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A COMPENDIUM OF PUBLICATIONS FROM INDIAN ZOOS

Vol - III, 2000
(Health & Disease Management)

Compilers

L.N. ACHARJYO
S.K. PATNAIK

INDIAN ZOO DIRECTORS' ASSOCIATION
&
CENTRAL ZOO AUTHORITY

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Published by :

INDIAN ZOO DIRECTORS' ASSOCIATION
National Zoological Park, Mathura Road
New Delhi - 110 003

With support from

CENTRAL ZOO AUTHORITY
Bikaner House, Annexe - IV
Shahajahan Road
New Delhi - 110 011

Printed at :

Reproprint
N-5/43, I.R.C. Village, Nayapalli
Bhubaneswar - 751 015
Ph. : 552066, 550642

PREFACE

Compendiums brought out in 1997 and in 1998 on 'Health and Disease Management' and 'Animal Biology and Conservation' were well received in all quarters and was vastly instrumental to inspire us to bring out further volumes in conformity with the ethos of Indian Zoos. This volume contains some more papers on 'Health and Disease Management' published in serveral journals by different authors and also articles on diseases occurring in free living wild species which could influence the zoo animal health. The present volume heavily draws from the issues of the 'Zoos' Print' and 'Zoos' Print journal' spanning over last one and a half decade. We are thankful to the contributors as well as Zoo Outreach Organisation, Coimbatore for their cooperation and to Dr. M.G. Ali Khan, Retd. Dy. Director of Nehru Zoological Park, Hyderabad for his efforts to collect papers published by different scientists on the animals of Nehru Zoological Park.

We are extremely grateful to Central Zoo Authority and particularly its Member Secretary Sri P.R. Sinha for their active support both in terms of finance and materials, which made publication of this volume possible. We are also thankful to the Indian Zoo Directors' Association for all the help rendered. Any suggestion for improvement of the future volumes is welcome.

COMPILERS

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* * *

Indian vet. J. 58 January, 1981 : 72-73

THEILERIASIS IN A GAUR CALF (*BOS GAURUS*)

Mir Gowher Ali Khan
Nehru Zoological Park, Hyderabad

Nehru Zoological Park, Hyderabad is rearing Gaur calves since 1967. The calves are caught by the villagers and sent to the Zoo for rearing. These calves are fed on buffalo-milk diluted with water for a week ; then whole milk is offered to them. When they attain the age of 1½-2 months, they nibble at the grass and take a few mouthfuls of concentrate.

Case History

A female gaur calf aged about 4 months, developed slight opacity of cornea of both the eyes on 29-5-69. The next morning she passed clay coloured stool, loose in consistency and was slightly off-feed. There was rise of temperature-105°F. Champing of jaws was seen. Opacity of corneas became more dense. Blood smears prepared from the tip of the ear were sent to the Veterinary Biological and Research Institute, Hyderabad for detecting protozoal or bacterial infections. The following treatment was administered.

30-5-1969
Body Temperature

Forenoon	Afternoon
105°F	105.2°F

1. Strinacin tablets (M & B) 2 tablets along with Pectokaoline, orally.
2. Terramycin eye ointment applied into both the eyes.

31-5-1969
Body Temperature

Forenoon	Afternoon
104.2°F	105°F

The calf passed loose stool once in the night. Champing of the jaws present. Appetite slighlty better.
After receiving the blood report from the Veterinary Biological Research Institute, Hyderabad which was positive for theileria species, the following treatment was administered :

3. Achromycin 300 mgm i/m
4. Glucose saline 200 ml s/c. Treatment No. 1 and 2 repeated.

1-6-1969
Body Temperature

Forenoon	Afternoon
102°F	101.8°F

The calf passed stool much better in consistency. Champing of the jaws stopped completely. Opacity of cornea persisted.
Treatment No. 1 to 4 was repeated.

From 2-6-1969 to 5-6-1969 treatment No. 1 and 2 i.e. antibiotic and eye ointment were repeated. During these days, temperature touched normal, both the corneas were cleared of the opaqueness and normal appetite was restored.

Discussion

It is interesting to note that Dr. Raj Shekhar Naidu, Regional Joint Director (Animal Husbandry), Cuddapah, A.P., in the Animal Husbandry Officers Conference held at Hyderabad on 7th and 8th May 1980 reported cases of theileriosis associated with haematuria and opacity of cornea in cross-bred cattle.

Summary

Successful treatment of a case of theileriosis in a gaur calf associated with opacity of both the corneas is reported.

Acknowledgement

The author is thankful to the Conservator of Forests, Wild Life Management, Hyderabad, A.P. for encouragement and permission for publishing this article.

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ORISSA VETERINARY JOURNAL
VOL. 4 NO. 1/4 DECEMBER 1969 : 52-53

BABESIOSIS IN A WHITE TIGER—A CASE REPORT

D. D. KHURANA,
VETERINARY OFFICER, DELHI ZOOLOGICAL PARK, NEW DELHI.

SUMMARY:- The treatment with Berenil against babesiosis in an eleven years old white tiger is described.

INTRODUCTION

Babesiosis in wild felines is not discussed in the veterinary text-books at hand. A clinical case of babesiosis in a white tiger and its treatment is hereunder recorded, with a view to help the Veterinarians for early diagnosis and control of this disease affecting the wild felines in captivity.

CASE REPORT

On 30-7-69, the eleven years old white tiger (Raja) of the Delhi Zoological park weighing 130 kg. refused usual meat ration and was found obviously lethargic and occasionally groaning while lying in the cell. He was shifted to the hospital on the same evening and put into the squeeze cage. Liquid paraffin 4 ounces in half litre of milk was given and the tiger lapped half the quantity during night.

In the morning he was found dull, lying in recumbent position, occasionally groaning and did not pass stool and urine. The body temperature was 104.6° F. Initially symptomatic treatment with Terramycin (Pfizer) 10 ml I/m and vitamin B-complex 10 ml I/M were given. In the afternoon dark coloured urine and foul smelling constipated yellow-brown faeces were voided by him.

Rise in temperature and dark colour of the urine lead to the suspicion of piroplasmosis. The urine was alkaline in reaction and contained blood cells, and the blood smear revealed haematozoa resembling piroplasms. The tiger showed no interest for meat soup also. Hence one litre of milk and plain water were given. Awaiting confirmation of the suspected haemoparasitic infection, normal saline 450 ml S/C and Styptobion (E. Mark) 5 ml I/M were adminstered.

The temperature was 103.8° F. in the morning and 105.2° F at noon on the subsequent day. He passed dark coloured urine and yellow loose stools. On receiving the confirmed diagnosis from the Zoonosis department of the National Institute of Communicable Diseases, New Delhi, as babesiosis, Berenil (4,4'-diamidino-diazoaminobenzene- Hoechst) 2 gms (i. e. two and half measures) dissolved in 13 mls of distilled water, was injected into the gluteal muscles. In the evening the temperature was 102.8° F, but passed large quantity of dark coloured urine. He took some meat soup and plain water. Subsequently after 15 minutes, the temperature became 101.9° F and started shivering with increased respiration rate. Immediately, Betnesol (Glaxo) 4 mls I/M and Redoxon (Roche) 10mls I/M were given. He passed loose stool and urine of somewhat lighter in colour.

In the subsequent morning, the temperature was 98.0° F; general look was better and passed lighter coloured urine and greenish coloured semisolid stool. Normal saline 450 ml S/C and Macrabin (Glaxo) 5 mls I/M were adminstered. In the evening, Betnesol 4 ml I/M and Redoxon 10 ml I/M were continued. The urine passed was yellow in colour. He took

some boiled meat with soup. On the subsequent day, although the urine and stools passed were apparently normal and temperature was 98.0° F, blood smears were still positive for the protozoan parasites but with reduced number in each field under the microscope. In the evening the temperature was 99.2° F. Macrabin 5 mls I/M and Betnesol 2 mls I/M were given.

On the next day, the temperature was 98.9° F and passed normal urine and stools. Betnesol one ml I/M and Redoxon 10 mls were continued. However, the blood smears were still positive with few parasites. On 5.8.69 at 9 a.m., improvement in general condition was marked (Temperature : 98.0° F, the urine and stool were normal). Vitamin B.complex 10 mls I/M was given and quantity of diet was increased. The blood smears showed the presence of few parasites.

On 6.8.69 at 9 a m, the temperature was 99.5° F. Urine and stool were of normal in colour and consistency. The blood smears became negative for protozoan parasites on the 6th day after Berenil adminstration.

Since then the tiger is in perfect health (Fig. No.1). His blood examined after one and half months was found to be free from any protozoa. It may be stated that no tick was found on the body of the tiger but nothing can be said about the grassy enclosure, in which the tiger is displayed, regarding the presence of ticks and the source of infection.

ACKNOWLEDGEMENT

Thanks are due to Dr. Satya Prakash, Deputy Director, (Zoonosis) who examined the blood smears and confirmed the babesiosis infection. The author is also greatful to Dr. S. D. Sharma (Hony. Vety. Adviser to this Zoological Park) for the useful suggestions during the course of the treatment.

BABESIOSIS IN A TIGRESS

K.P. Sinha, Mukti Sinha, N.K. Pankaj and V.K. Singh

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Babesiosis is a serious disease of domestic animals including dogs. Its incidence in wild animals is rarely recognised (Bourdeau, 1996). Tigress (Geeta) was brought to our notice for treatment by the Director of Bhagwan Birsa Jaivik Udyan, Ranchi on 13 November 1994. The tigress was off feed. A red trickle with urine was observed. After transfering the animal into a squeeze cage, her body temperature was recorded to be 105°F. Hyperpyrexia confirmed clinically a case of babesiosis.

The tigress was treated with Berenil (Diminazene aceturate, Hoechst) 1.5 g. dissolved in 15 ml. of water (Booth & Donald, 1988) and injected at two sites in equal halves, intramuscularly. Avil (10 ml.) and Belamy (1-10 ml.) was administered intramuscularly prior to the administration of Berenil. The animal returned back to feeding, and the colour of the urine became normal on the very next day.

Acknowledgement

The authors acknowledge the staff members of Birsa Jaivik Udyan, Ranchi for their help and pains taking venture.

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Received on 8 April 2000 *Accepted on 30 June 2000*

SUDDEN DEATH OF A LEOPARD (*PANTHERA PARDUS*) DUE TO BABESIOSIS

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Officer-in-charge, Maharajbag Zoo, College of Agriculture, Nagpur, Maharashtra, India.

A male Leopard (*Panthera pardus*) named Rahul aged about 15 years suddenly died on 18 March 1998. The animal did not show any signs of illness except anorexia on 17 March 1998. The carcass was sent for post-mortem examination to ascertain the cause of death.

The post-mortem examination revealed froth in trachea with edematous lungs, hypostatic congestion in left lung, icteric liver with haemorrhages and an enlarged spleen (3-4 times the normal) with cyanotic changes. The peripheral and heart blood smears revealed *Babesis* spp. infection.

Babesiosis is a tick-borne infectious haemoprotozoan disease caused by *Babesia* sp. and is clinically characterised by pyrexia, haemolytic anaemia, haemoglobinurea, jaundice and death (Arora, 1994).

Babesiosis in Leopard was reported by Shortt (1940) and in a white Tiger by Khurana (1969). The treatment of the disease with Diminazene aceturate @ 5-10 mg/kg or Imidocarb 0.5 to 1.0 mg/kg is reported to be highly effective (Arora, 1994). However, in the present case, the Leopard did not show the typical signs of babesiosis such as pyrexia, haemoglobinurea and jaundice. The jaundice, enlarged spleen and presence of *Babesia* protozoa in peripheral and heart smears could only be noticed after post-mortem examination. Hence treatment could not be prescribed.

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Received on 31 March 2000 *Accepted on 30 June 2000*

Indian J. Vet. Med. Vol. 10, No. 1, 1990. pp. 57-58

Anaplasmosis in a captive *Panthera leo*

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Maharashtra

Blood parasitic deseases pose a major threat to the development of wild livestock in the tropics. The present study records a clinical case of *Anaplasma marginale* infection in a 7 years old lioness of local Maharajbagh Zoo, Nagpur weighing about 150 kg. The animal showed anorexia, dullness, depresssion, polypnoea, staggering gait and mild muscle tremors. This was treated with sulpha and analgesic drug orally.

The lioness did not show any response to the treatment. Detailed clinical examination recorded pale conjunctiva, elevated body temperature (40.4° C), pronounced muscle trmors, complete anorexia and ataxia followed by lateral recumbency. There was increase in respiration rate (45/min) and heart rate (120/min).

Blood examination revealed apparent leukocytosis, decreased haemoglobin (8 gm/dl) and presence of *Anaplasma marginale* in blood smears. Faecal examination did not show the presence of any gastrointestinal parasite.

The animal was treated with oxytetracycline[1] @ 10 mg/kg b.w. in dextrose saline 500 ml iv and pheniramine maleate[2] 10 ml im. On 3rd day, the condition of the animal was reassessed which showed relative increase in body temperature, heart rate and respiration rate, gradual emaciation and weakness. However, blood smear revealed decreased parsitaemia. The treatment was continued on 4th and 5th day also. The blood smear examined on 5th day revealed absence of parasites and haemoglobin was raised to 9.5 gm/dl. Body temperature, heart and respiration rate reached to about normal range followed by partial improvement in appetite.

The supportive treatment in the form of liver tonics and iron tonic was given from 6th day to compensate the anaemia.

Present Address :
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** Ph.D. Scholar, Depu. of Surgery, Punjabrao Krishi Vidyapeeth, Akola-444 104 (M.S.)

[1]Marketed as Oxysteclin by M/s Sarabhai Chemicals, Baroda.
[2]Marketed as Avil by M/s Hoechst India Ltd., Bombay.

On 10th day, the haemoglobin of the animal was 12 gm/dl.

On 15th day the blood was free from any protozoa.

The main clinical findings observed in the present study have been reported by Rodriguez *et al.* (1977) in bovine anaplasmosis. Inappetance seen in lioness may be due to liver damage. Oxytetracycline was found to be effective against anaplasmosis (Blood *et al.*, 1983, Magonigle, 1975). The source of infection might have been the deers (Howarth, 1970) which were in close proximity to the lioness.

Acknowledgement

Authors are highly thankful to the Associate Dean and to the Professor of Parasitology and Pathology of Nagpur Veterinary College for providing necessary help.

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Received on : December 19, 1989
Accepted on : March 6, 1990

Reprint : Zoos' Print, 5 (2) : 8 & 3, February, 1990

ANAPLASMOSIS IN CAPTIVE PANTHERA LEO *(A Case Report)*

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D. B. Pawshe, Ph. D. Scholar in Vety. Surgery, P. K. V. Akola, Maharashtra

India has a rich heritage of wild life as well as long history and tradition of conservation. The spectrum of parasitic diseases in wild animals is of great importance both to human and veterinary medicine. Very little attention has been given to the study of extremely varied nature of many parasitic species in free and captive wild life. It is evident that blood parasitic diseases pose a major threat to the development of wild livestock in the tropics Large number of wild ruminants are susceptible to natural infection in Africa (Ristic, 1960). Deers in natural habitat becomes infected and acts as reservoirs for other animals (Peterson, 1974, Dalgliesh and Stewart, 1977).

The present study records a clinical case of Anaplasma marginale infection in a seven years lioness of local Maharajbagh zoo, Nagpur weighing about 150 kg showed clinical signs of anorexia, dullness, depression, polyphoea, staggering gait and mild muscle tremors, and hence subjected to the usual treatment comprised of sulpha and analgesic drugs orally presuming the possibility of some acute septicaemic infection.

On next day morning a lioness did not show any response to the treatment, on the contrary the condition appeared aggrevated and the clinical manifestations comprising of pale conjuctiva, elevated body temperature (104.8°F) pronounced muscle tremors, complete anorexia, ataxia followed by lateral recumbency. She was secured in a cage and subjected for haematological study thus found to be affected with parasitaemia (Anaplasma marginale) on examination of thin peripheral blood smears. Apparent leucocytosis and haemoglobin revealed 8 gm% Increased in respiration rate (45/min.), heart rate (120/min). Faecal examination was also done to find out the presence of any gastro-intestinal parasites.

On confirmation of report the lioness were subjected to the exhaustive treatment comprised of Inj. Oxytecline. 10 mg/kg b. w. with Dextrose saline 500 ml I/V through coccygeal vein and injection Avil 10 ml I/M by observing all aspectic precautions.

On 3rd day the condition was reassessed and observed that the vital reactions (temp. Heart rate and respiration) relatively elevated, physically looked weaker, evidence of gradual emaciation observed. However blood smear revealed presence of few parasites and haemoglobin 8 gm %. The same treatment were continued on 4th and 5th day also. The blood smear examined on 5th day revealed absence of parasites and haemoglobin raised to 9.5 gm %. The clinical findings comprising of rectal temperature, heart and respiration rate within normal range followed by partial improvement in appetite but interesting point of observation was that even at this state animal was still making efforts to be on her legs, but to no avail.

The supportive treatment comprised of injection Belamyl, Imferon and Liv 52 tablets orally was instituted on 6th day to compensate the anaemia and continued till complete recovery confirmed upon the status of haemoglobin which restored to 12 gm %, on 10th day of treatment with perfect health (Figure No. 2). Her blood examined on 15th day was found to be free from any protozoa. It may be stated that no ticks were apparently noticed on the body of lioness through out the period of illness.

Discussion

Anaplasmosis in wild felines is meagerly discussed in the available veterinary literature. However the present study records a clinical case of Anaplasma marginale infection and its chemotherapy with the practical aspect of such rare condition in Indian lioness under captivity at local Maharajbagh Zoo Nagpur. The main clinical findings comprising of pale mucous membrane, loss of condition, polypnoea, muscle tremors, motor incordination, tachycardia and inappetance observed in the present study were in confirmatory with the findings of Rodriguez *et al.* (1977) observed in bovine anaplasmosis. Inappetance seen in lioness was due to liver damage which was evidenced by pale mucous membrane. Hence the authors prompted to place on record the aforesaid case report which would help the veterinarian, zoo personals for the management of such rare condition affecting the wild felines in captivity.

In the present study the drug oxytetracycline found effective and are in agreement with Blood *et al.* (1979) and Magonigle (1975). The source of inection might have harboured from deer indicating a convincing evidence that the deer park is in close proximity of lioness cage and deer in their natural habital becomes infected and constitute persistance resistance of Anaplasmosis reported by Howarth (1970).

Acknowledgement

Authors are highly thankful to the Associate Dean of the College, Professor of Parasitology and Pathology, Veterinary College, Nagpur for providing necessary facilities.

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Reprint : Zoos' Print, 5 (10) : 13 - 15, October, 1990

ANAPLASMOSIS IN A CAPTIVE WHITE TIGER (*PANTHERA TIGRIS*)

BY

DR.Zaheer Ahmed *, Dr S. Ramanadhan ** and Dr Mir Gowher Ali Khan ***

Introduction

Anaplasmosis is a common intra-erythrocytic infection of captive and semi captive,domesticated,exotic and wild ruminants.

Cattle,zebus and buffaloes are naturally susceptible to inoculation. Calves are only mildly affected (Gaiger & davies - 1949) Anaplasma is less significant in camels (H.unger - 1982) *A. marginale* is the parasite involved in the disease of cattle known in africa as "Gall - sickness". (Richardson and Kendall - 1964) *Anaplasma marginale* considered by some to be a protozoan, has been reported in cape buffaloes, blesbok, duiker, mule deer, california black tailed deer, black wildebeest, pronghorn antelope, big horn sheep, American elk, white tailed deer, moose and Eland (wallach and Boevor - 1983)

Though *A. marginale* infection has been reported in many domesticated and wild ruminants, but occurance of this disease in wild felines in meagerly discussed in available veterniary medicine literature. Recently a case of *Anaplasma marginale* in a lioness is reported by Sarodhe D. B. and pawshe D. B. (1990). This papers presents another interesting report on the occurance of A. marginale infection in a white tiger (*Panthera tigris*)

Case History

The Nehru zoological park Hyderabad, received one male tiger, Govind aged about 10 years from Delhi zoological park on 26.4.1971. The animal was suffering from chronic superficial wounds of both temporal and hip regions, and a big hygroma with an open wound at the left knee. These wounds were treated regularly with antiseptic powders/cream. The general condition of the animal was unsatisfactory.

On 24.11.1971 in the morning when the animal was left in the open enclosure, it was found to be walking with stiff gait and moved about wobbly with both the limbs of the right side. The tiger was taken in the squeeze cage for detailed examination and investigations.

1. Body temerature -At the beginning below normal which went up to 105.2^0 F in the A. N.

2. General condition -Dull, depressed, off feed, visible mucous membranes pale, passing urine frequently

3. Investigation -Blood smears Examined the next day and were found to be positive for *Anaplasma marginale* like bodies.

Diferential count

Neutrophils	76%
Lymphocytes	19%
Eosinophils	3%
monocytes	2%
Urine	
Sp.gravity	10.20
sugar	0.5%
Albumen	Nil
Bile salts	Nil
Epithelial casts	Present
Epithelial cells	Negative

Treatment

24.11.71 to 26.11.71

Initially strepto-pencilline 3 gms 1/m was given daily along with Belamyl,B1, B6, B12 (alternately) Liv-52 was administered in milk

27.11.71 to 1.12.72

Still the body temperature remained high and hence streptopencilline was changed to Achromycine (Lederle) 500 mg 1/m along with rest of the medicines - mentioned above.

The general condition improved a bit, but the paralytic symptoms were aggravated involving the head which was titled to the right side. The animal was declared to be normal on 1.12.72 as all the symptoms disappeared except anaemia and slight muscular dystrophy after a period of 15 days.

Again On 9.3.72 severe relapse of Anaplasma infection was observed.The condition of the animal became worse with complete hemiplegia and total recumbancy.

Investigations were carried as follows Blood smears mild infections of A. marginale present

Differential count Neutrophils 63%
Lymphocytes 32%

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*** Retd.Dy. Director, Nehru Zoological Park, Hyderabad, A. P.

	Eosinophils 5% Hypochromic Anaemia present

Urine

Sp.gravity 10.30	10.30
Reaction	acidic
Sugar	Nil
Albumin	Nil
Bile salts	Nil
Eppithelial cells	present
Epithelial casts	Nil
Faeces	Negative for any helminthic ova

The maximum body temperature recorded was 107 °F. This time REVERIN (Hoechst- Rolytetracycline) was administered for a period of 5 days. The rest of the medicines were again repeated. on 30.3.72 the animal showed signs of improvement.

For the third time 29.4.1972 the tiger again had the same stroke and relapse of fever. The blood smear remained positive for mild infection of *A. marginale*. The animal did not respond much with above mentioned treatment of broad spectrum anti-biotic Nervine tonics and haemotinic drugs upto 28.6.1972. Govind's general condition remained unsatisfactory, apetite was depraved and the Bouts of parlytic stroke observed from time to time with sligght rise of body temperature. The animal was highly aneemic and little Icterus. Finally it died on 29.6.1972.

Discussion

As already mentioned anaplasmosis in felines that too in big wild cats is of very rare occurance. Literature on veterinary medicine which could referred locally has not revealed any single case except that of in a lionees reported by Sarodhe, D.B and Pawshe D.B 1990.

The anaplasma infection in a white tiger reported in this article is based on clinical symtoms exhibited by the animals and the findings of the *A. marginale* in the blood smear. The blood smears were examined at the following research institutes

1. Veterinary Biological Research Institute, Hyderabad, A. P.
2. Pathological laboratory of Delhi Zoological Park
3. The infection of *A.marginale* was confirmed by Dr. S. Alwar, Professor of parasitology Madras veterniary college, Tamil Nadu (Rtd.).

In the absence of estabilshed and confirmed symptoms of Anaplasmosis in a feline species, it will be of academic interest to compare it with those observed in bovine anaplasmosis. The descriptions of Richardson & Kendal (1964) are worth quoting and hence given below, where in we will find much similarity in most of the clinical signs exhibited by both the species. (Sarodhe and pawshe have aso mentioned similar symptoms in a lioness)

Bovine Anaplasmosis	Feline Anaplasmosis
1. The disease may be per acute, acute or chronic	The disease is of chronic nature
2. In the early stages of acute Anaplasmosis a fever of 103°F to 107°F. usually occurs. As the disease progresses the temperature may become normal or abnormal before the animal dies.	True in Feline anaplas - mosis also
3. Animal walk with a stiff unsteady gait urination is frequent but the urine is normal in colour.	Stiff gait and hemiplegia of the right side noted
4. With chronic case there is severe anaemia with very low red blood cells count with haemoglobin less than 10% of normal.	anaemia and icterous noticed

There is also marked similarity in few of the major post mortem findings in the white tiger under report, with those noted by Richardson and Kendall in bovine anaplasmosis.

P. M. findings in bovine anaplasmosis	P. M. Finding in a white tiger (under report)
1. Heart is enlarged and covered with petechial haemorrhages	Petechial haemorrhages seen above the auriculo ventricular groove.
2. The lungs are anaemic with some emphysema	Lungs are fluffy and emphysematous.
3. Gastro intestinal cattarh is usually present.	Intestines empty, bloated external surface having both reddish and greenish discolouration. Finally the animal died of coli septicaemia.
4. Blood thin and watery with all characteristics of an - extremely severe anaemia.	Anaemia due to anaplasmosis noticed.

SUMMARY

In this present study, the authors have placed on record a very rare case of Feline Anaplasmosis in a white tiger *(Panthera tigris)* This infection seems to be chronic in nature which resulted ultimately into severe anaemia Icterus and death due to coli sysiticaemia.

This report is presented for further research investigation and discussion.

Acknowledgement

1. The authors express their sincere thanks to Sri Mazheruddin Ahmed Retd. Ex. Offcio Director, and Sri Pushp kumar, IFS - the then curator of Nehru Zoological park,Hyderabad for their encouragement and facilities provided in the treatment.

2. The author are very thankful to Dr. D.D. Khorana, Retd. Veterinary officer, Delhi Zoological park for his visit to Hyderabad and to examine and suggest the line of treatment in the animal under report.

3. The author are also thankful to Dr. Datratri Rao, Asst. Director and Dr.Navin kumar, Vety. Officer of Nehru Zoo park for their tireless efforts to search for the treatment sheets of "Govind" from old record.

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Clinical Articles

OUTBREAK OF TRYPANOSOMIASIS EVANSI AMONGST TIGERS AND JAGUARS IN THE ZOOLOGICAL GARDEN, CALCUTTA

By

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and

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Trypanosoma evansi infection in cattle, buffalo, horse, camel and dog has been of common occurrence in various parts of India. Its rare incidence in wild animals like elephant, bear, deer, tapir and mongoose has been reviewed by Nair *et al.* (1965). Tigers have also been reported to harbour *T. evansi* infection occasionally (Alwar, 1953 and Nair *et al.*, *loc. cit*). In those reports only stray cases were observed. An outbreak of trypanosomiasis due to *Trypanosoma evansi* amongst the tigers and jaguars of the Zoological Garden, Calcutta is reported in this paper.

Case History

Case No. 1 : One adult female tiger, Sima by name, of Burdwan House, cage No. 4 died all on a sudden on November 11, 1967 without showing any symptom of illness. There was no other tiger in the same cage.

Case No. 2 : One adult male tiger, Lakahan by name, of Burdwan House, cage No. 5 was found dead in the morning of November 27, 1967. The animal was last seen in the previous evening without symptom of illness. This was the only occupant of the cage.

Case No. 3 : One adult female leopard, Rani by name, of Small Carnivore House, cage No. 9, died on November 29, 1967 without showing any symptom of illness. Of the two leopards in this cage, only one was affected during the outbreak.

Case No. 4 : One adult male jaguar of Small Carnivore House, cage No. 1 died suddenly on December 2, 1967 without showing any symptom of illness. There were 2 jaguars in the same cage but only one was affected in the outbreak.

Case No. 5 : One adult male tiger, Asoka by name, of Small Carnivore House, cage No. 11 was detected to be ill in the morning of

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December 16, 1967. It was dull and the food which was supplied on the previous evening was found untouched. It was, however, roaming about inside the enclosure. At about 1 a.m. the animal was found lying prostrate on the floor and appeared to be suffering from respiratory distress. The mouth was kept open with the tongue hanging out, indicating difficulty in breathing. The animal developed severe convulsions followed by death. In the same cage there was no other tiger.

Case No. 6 : One adult male tiger, Bharat by name, kept in open air enclosure was found to be dull and off feed on the morning of December 17, 1967 with running nose and respiratory distress. The animal died in the afternoon showing symptoms of dyspnoea with convulsive fits. This was one of the pair of tigers in the open air enclosure; the other was not affected during the outbreak.

Case No. 7 : One adult female jaguar of Burdwan House, cage No. 8 died in the early hours of December 19, 1967. The animal was found to be dull in the afternoon of December 18, 1967 and the symptoms before death constituted mainly laboured respiration and convulsion. There was no other jaguar in the cage.

Macroscopic Examination

The naked eye changes in the post-mortem examinations showed congestion in lung, kidney, liver, spleen and brain. In case Nos. 5, 6 and 7, spleen and liver were also enlarged and engorged with blood. The lungs were atelectatic with generalised petechiae and red hepatisation. Fine dark pigments were closely scattered in the tissue and they were also visible from the surface of the organ. Oedematous fluid was coming out from the organ on incision. Bronchi were full of dirty mucoid exudate with diptheretic deposits on the bronchial mucosa. Haemorrhagic spots were present in the medullary region of the kidney.

Clinical Examination

Blood smear : Heart blood smears from cases No. 1-4 which died suddenly without showing any symptoms proved negative for any bacteria and protozoa on examination after staining with Leishman's as well as with Gram's stain. Heart blood smears from cases No. 5, 6 and 7, however, proved to be positive for *Trypanosoma evansi*. The degree of infection in all the 3 cases, as indicated by the number of parasites present in the smears, was very heavy.

Urine examination : Urine samples from cases No. 1-5 were examined but no pathogenic organisms could be detected.

Cultural examination : Cultural test was done in all the cases from heart blood and cerebrospinal fluid to isolate any pathogenic bacteria responsible for the death of the tigers, but from none of them pathogenic organisms could be isolated.

Biological test :

Guineapigs, rabbits and mice were inoculated with heart blood for pathogenic bacteria; intestinal contents for toxins and urine sediments for Leptospira, but the findings were negative in all the cases.

In the first few cases pooled materials of liver, spleen, lung, kidney, intestinal contents and heart blood were filtered and inoculated in guineapigs and rabbits to eliminate the virus etiology. Cerebrospinal fluid also proved to be negative on animal inoculation.

Histopathology

Liver : Diffuse haemorrhage throughout the section ; hepatic cords almost without their entity and hepatic cells with extensive cloudy swelling separated from one another.

Kidney : Patches of haemorrhage here and there in the sections ; desquamated epithelium with hyperchromatic nuclei and very little cell membrane scattered as granular cytoplasmic masses filling up the lumen of the tubules. Most of the Bowman's capsules filled up with swollen glomerular tufts.

Spleen : Haemorrhage present in wide areas with marked increase in the lymphoid tissue.

Lung : Lung tissues with patches of haemorrhage and areas of atelectatic and emphysematous changes. Heavy infiltration of lymphocytes in general and dark green pigments scattered in masses; no exudate in alveolar spaces.

Brain : Congested with heavy lymphocytic infiltration all over the section.

Diagnosis and Treatment

As the smears from heart blood of cases No. 5, 6 and 7 were found to be positive to *Trypanosoma evansi*, the cause of death was ascribed to trypanosomiasis. Unfortunately the blood from the ailing animals was not available for animal inoculation because of the difficulty in collecting blood from them.

As soon as the diagnosis of the disease was established, immediate arrangement was made for administering Antrycide prosalt, 35 gm. dissolved in 150 ml. at the dose rate of 2·6 ml. / 100 kg. body weight ; as a prophylactic measure to all the lions, tigers, jaguars,

pumas, leopards and various types of lesser cats in the Zoological garden. One ailing tiger was cured with treatment with Antrycide prosalt though the blood could not be examined to confirm the suspicion. There was no recurrence of the disease in the Zoological garden after the mass prophylactic treatment.

Discussion

This appears to be the first report of occurrence of *Trypanosoma evansi* in tigers, jaguars and probably leopards in the form of an outbreak. Out of the total 7 cases, there were 4 cases amongst the tigers, 2 cases amongst the jaguars and 1 case in leopard. Only 2 tigers and 1 jaguar proved to be positive for *T. evansi* infection. In the beginning 4 animals (cases No. 1, 2, 3 and 4) died suddenly one after another without showing any symptom and gave no clue about the etiology. The first 2 cases were examined 10–12 hours after their death and cases No. 3 and 4 were examined 6–8 hours after death. It is possible that the parasites in the blood disintegrated by the time post-mortem was done. It is also possible that the animals died during the negative phase of the infection when the parasites were not detectable. Cases No. 5, 6 and 7 only proved to be positive for the blood parasite and these 3 cases suffered for sometime before they died. As no trypanosomes could be detected in the heart blood of the leopard it cannot be included in the list of hosts of *T. evansi* with certainty, though the circumstantial evidences point to that direction.

Strangely enough, in this outbreak *T. evansi* infection involved only tigers and jaguars and probably leopards. They were housed in small Carnivore House, Burdwan House and open air enclosure which were separated one from the other by not less than 300 meters. The infection spread from one house to another without affecting many known susceptible species of animals housed in cages situated in between. Probably the vector in this case was very specific about their host for sucking blood ; though the known vector of *T. evansi* *e. g.*, Tabanus, Naemotopota, Chrysops, Stomoxys etc. are not known to have such specificity. Whether or not these species suck blood of tigers, jaguars and leopards is also not definitely known. The possibility of the presence of carrier hosts amongst the known susceptible animals *e. g.* camel, pony, deer etc. in the same Zoological garden was looked into without any success. The source of infection was probably present in the cattle brought to the cattle market situated beyond the boundary wall of the Zoological Garden.

It has been observed that surra is more common in cattle and buffalo as natural infection, than in any other susceptible species of animals in West Bengal. Usually surra in cattle occurs in latent

form and for reasons not well understood, the infection flares up in some cases and causes death of the hosts; sometimes in the form of an outbreak. Deaths in tigers, jaguars and leopards in the Zoological Garden in the form of an outbreak may probably be a similar phenomenon as found in cattle, though dog, one of the known susceptible carnivores, does not show any latent infection of *T. evansi*.

The possibility of trypanosome gaining entrance in carnivores through ingestion of beef from infected cattle cannot be ruled out if the meat is fed immediately after slaughter. The infection may gain entrance through mouth and oesophagus. The meat supplied to carnivores of the Zoological Garden is from animals slaughtered 4-6 hours before it is fed and trypanosomes do not live long in clotted blood.

It is quite interesting to note that *T. evansi* infection in the affected animals proved to be extremely fatal. Majority died before the symptoms could be detected and others shortly after the detection of illness characterised by dyspnoea and convulsion. This may probably be due to the appearance of a very virulent strain of *T. evansi* to which only tigers, jaguars and probably leopards were very susceptible. It was noted with interest that pathological changes were more marked in cases No. 5, 6 and 7 in which death was not so sudden.

The absence of further cases of *T. evansi* infection in the Zoological Garden after the mass prophylactic treatment with Antrycide prosalt confirms trypanosomal etiology of the outbreak.

Summary

Trypanosomiasis evansi occurred in the form of an outbreak for the first time in tigers, jaguars and probably leopards, in the Zoological Garden, Calcutta. The strain was very pathogenic causing death of all the affected animals, altogether 7 in number.

Acknowledgment

The authors are thankful to Dr. D. P. Samanta and Dr. D. K. Roy, Veterinary Surgeons, Zoological Garden, Calcutta and to Shri R. K. Das Sharma, Head Laboratory Technical Officer, Bengal Veterinary College, Calcutta-3 for their assistance throughout the work.

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Indian vet. J. 52, May, 1975 : 406

AN OUTBREAK OF SURRA IN CIRCUS TIGERS

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The fact that tigers harbour *T. evansi* infection occasionally is established (Alwar, 1953). The disease in an out-break form is reported by Sinha *et al* (1971). Paucity of reports of the disease in an outbreak form prompted the authors to place on record an out-break of Surra in tigers of New Grand Circus stationed at Vijayawada and treatment adopted.

Case report : On 27-12-1973, Circus Company Management reported illness among six tigers with history of not taking feed and water since two days and refusing to respond to instructions.

Clinical examination : Temperature was recorded to be ranging between 106°F to 108°F. Microscopical examination of blood smears collected from all the sick animals, revealed *Trypanasoma evansi* infection. The animals showed only high rise of temperature; no other symptoms were observed.

Treatment and results: On establishing the disease, Berenil (Hoechst) was administered to four animals, intramuscularly at the rate of 0.8 gm/100 lb. body weight and the other two animals were given 500mg. of Antrycide prosalt (I.C.I) sub-cutaneously. All the animals received supportive therapy of B. complex vitamins and Tonophosphon (Hoechst) parenterally for five days. To avoid concurrent bacterial infection, antibiotic cover for five days was given with Omnamycin (Hoechst). Regular daily recording of temperature revealed that the temperature began to recede from the second day onward and reached normal by the third day. Little amounts of mutton soup and glucose water were allowed. The animals were maintained on the same liquid diet up to the seventh day, by which period, all the animals showed signs of complete recovery. Later, the liquid diet was replaced gradually by regular diet of beef by tenth day.

Blood smears were examined daily and no evidence of infection was seen from the 7th day onwards. However, on seventh day, a second dose of Antrycide prosalt and Beneril to the respective groups was administered, though the quantities were reduced to half the initial dose in each case. All the sick animals were under regular observation, with no untoward complications till the Circus Company left for next station.

Summary

Surra in circus tigers in the form of an outbreak and the successful treatment of the disease had been reported.

Acknowledgments

Authors thank Dr. K. Venkateswararao, Disease Investigation Officer, Animal Health Centre and Dr. N. Madhusdhanarao Superintendent, Veterinary Hospital, Vijayawada for the cooperation extended.

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Reprint : The Veterinarian - Journal of Students of College of Veterinary Science, Hyderabad (1980-82) Vol. XIX : 12 - 13

SURRA IN WILD CATS

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INTRODUCTION

It is not uncommon to find cases of Trypanosomiasis in domestic animals and also in wild animals. In Africa extensive outbreaks of Trypanosomiasis have been recorded in wild herbivours. However the incidence of Trypanosomiasis in wild carnivores including wild cats has been occasional. The transmission of this disease has been conclusively shown by Baker (1968) that Trypanosomiasis in carnivores in Africa is more due to eating injected flesh of herbivorous animals rather than through the bite of Tsetse flies. The present study is based on the cases of Trypanosomiasis recorded in the various species of wild cats at the Nehru Zoological Park, Hyderabad.

Materials and Methods

Surra was recorded and studied in the following number of cases indifferent wild cats of the Nehru Zoological park from August 1967 onwards.

1. Tigers — 8 cases
2. Puma — 5 cases
3. White tiger — 1 Case
4. Indian Lion — 1 Case

A total number of fifteen cases including re-injected animals were studied from close quarters. The animals were examined by controlling them in the squeeze case. Temperatures of all suspected cases were recorded regularly and blood smears were obtained from the tip of the tail. Blood sears negative for Trypanosomiasis were diagnosed on clinical signs. The animals were treated with Antrycide prosalt and Berenil. 5 animals were treated with Antrycide at the rate of 2 mg per pound body weight subcutaneosuly and 10 animals were treated with Berenil a therate of 0.8 Gram per 100 Kg. body weight subscutaneously.

Observations

Out of the fifteen cases 8 cases were positive for Trypanosoma evansi in the blood smear and the remaining 7 cases showed the clinical signs.

Tigers showed the symptoms of high temperature, between 104 to 106°F, dullness, complete off feed, in most of the cases opacity of the cornea. The opacity of the cornea was bilatered in one case. Enteritis was present in three cases while only dullness and off feed was noticed in two cases. In one case the appetite was also normal.

The pumas showed high fever (104°F) sluggishness and off feed.

Wite tiger showed high temperature (105°F) off feed and sluggishness.

Lion showed the symptoms of temperature (105°F) and off feed.

In all the above cases the interesting feature is the recurrence of the attack In male tiger the 1st recorded case was in August 1967. From 1967 onwards there

were subsequent attacks of Trypanosomiasis in 1973,74,75 and 76 even though the animals were treated previously, present observation has shown that the incidence of Surra is high in Tigers & Pumas and rate in Indian Lion (Only one case recorded). The disease was not seen in panthers, Black Panthers hunting cheetah, clouded leopard and African lion even though the animals were in close proximity.

All the animals responded very well with the treatment of Antrycide and Berenil. Inappetance, opacity of the cornea and other clinical signs disappeared after treatment.

Discussion

Fifteen cases of Surra were recorded in wild felines of Nehru Zoological Park. Out of the fiteen cases 8 were positive for Trypanosoma cvansi in the blood smear and 7 were showing typical clinical signs and were negative for Trypanosomes. All the animals responded for treatment and clinical signs disappeared. An interesting feature of this study was the recurrence of the disease even after previous treatment. The possible mode of infection and its trans-mission is through the biting flies and ingestion of injected meat. The later method of injection can not be ruled out due to presence of endemic areas of bovine surra and possibility of them being slaughtered and beef supplied for consumption of carnivores. This observation here has already been observed by Baker (1968) in African Trypanosomiasis.

Summary

Fifteen cases of Trypanosomiasis in wild cats of Nehru Zoological Park were studied. Out of fifteen cases, 8 cases were positive for parasites inthe blood smear. All the animals responded very well with the treatment by Antrycide and Berenil. An interesting observation is its recurrence and the mode of injection in Felines. It is possible that the animals may get injected by eating injected flesh. Further the disease was not seen in other felines namely Panthers; Black Panthers, Hunting Cheetah clouded Leopard and African Lions.

Acknowledgement

The authors are thankful to Shri Pushpa Kumar, I.F.S. conservator of Forests and Wild life management for his keen interest in the study.

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Reprint : Indian Zoo Bulletin, 2 (2-4) : 18 - 20, 1982

Trypanasomiasis in a Tigress 3:3

by

*Dr. A.V. Gopalakrishnan, B.V.Sc., F.Z.S.

Though many haemoprotozoan diseases were reported to occur in captive carnivorous animls of the zoological gardens, the disease caused by the 'Surra parasite' or Trypanasoma evansi' is of importance, since the disease caused by this parasite is of acute nature and has been responsible for the loss of many valuable carnivorous animals in captivity. The disease is comman in many domestic animals and camels in various parts of India. The incidence of this disease in wild animals in captivity, though rare, has been reported in tigers of the Madras, Mysore and Alipore Zoological Gardens.

In the Madras Zoo, the disease was recorded in one of the tigersses in 1965. The ten years old tigress 'Chitra' went off-feed during August 1965. On close examination the animal was found to be dull, lethargic and the respiration was rapid. The animals was trapped in a squeeze cage and the temperature was recorded. The temperature was 104.2°F. The animal was treated with streptopenicillin 2.5 gm intramuscularly. The animal was given milk and soup seperately. But the animal preferred only water and did not take either milk or soup. Temperature shot upto 105.6°F the next day and a blood smear taken from the tip of the tail revealed the presence of T. evansi The animal was administered one gram of 'Antrycide' (Quinapyramine sulphate) dissolved in 10 ml. of distilled water subcutaneously followed by 500 ml of 5% Dextrose intravenously. At about 4.30 P M. in the evening when the animal was grunting in pain, it was observed that the respiration was rapid and thoraco-abdominal and the temperature was 106°F. Ice was applied on head with an ice bag and the temperature came down to 103.4°F at 8.00 P.M. Though the temperature came to 96 6°F on the next day and maintained around that, thereon, the appetite of the animal was erratic. The animal took only about half-a-litre of milk with Liv. 52 drops and about two litres of water a day for about a week. A sample of urine was collected and the results are as follows :

1.	Animal/Sex	:	Tigress 'Chitra'/Female
2.	General Condition	:	Fair
3.	Age	:	About 10 years
4.	Temperature	:	103.4°F
5.	Nature of Material	:	Urine

	Physical		*Chemical*
Colour	: Highly coloured	Albumin	: Negative
Sediments	: Present	Sugar	: Traces present
Reaction	: Acidic	Acetone	: Negative
Specific Gravity	: 1045	Bill Salts	: Negative
		Bill pigments	: Positive
		Haemoglobin	: Negative

During this period the animal was given 300 ml of 5% Dextrose with 100 mg of "Redoxon" intravenously and 3 ml of 'Belamyl' intramuscularly. The two samples of blood smears taken at an interval of one week after the commencement of treatment revealed no blood parasites. The animal was nursed carefully for another fortnight by which time the animal became normal.

An analysis of the sample of urnine after the animal attained normalacy is as follows :

	Physical		*Chemical*
Colour	: Yellow	Albumin	: Absent
Sediment	: Present	Sugar	: Absent
Reaction	: Acidic	Acetone	: Absent
Specific gravity	: 1045	Bill Salts	: Absent
		Bill pigments	: Absent
		Haemoglobin	: Absent.

Though the traditional mode of transmission of haemoprotozoan parasites are through an invertebrate vector from one host to another, in the absence of a specific or a reservoir host, it has to be construed, that the infection in this case might have occured by way of ingestion. The posibility of the pathogenic organism gaining entry into the carnivorous animal through ingestion cannot be ruled out since these animals are fed with freshly slaughtered beef within two to three hours of slaughter.

The diagnosis and the successful treatment of trypanasomiasis has been made possible due to the timely detection of the parasite in the blood smear based on the principle that examination of blood smear should be made compulsory, in cases of hyper-pyrexia and persistant cases of pyrexia to eliminate infection due to haemoprotozoan parasites.

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Reprint : Veterinarian, 6(12):5, 1982

Trypanosomiasis in A White Tiger — A Case Report

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Trypanosoma evansi was first shown to be pathogenic for mammals and was identified by Griffths Evans a British Veterinarian. It causes Trypanosomiasis in almost all domestic animals including cat. In horses and camels the disease is known as 'SURRA' Besides domesticated animals and a few wild ungulates, *T. evansi* infection has been reported in Tiger, (*Panthera tigris*), Lion, (*Panthera leo*), Jaguar (*Panthera onca*), Striped Hyaena (*Hyaena hyaena*). In 1971 an outbreak of Trypanosomasis was observed in Alipur Zoological Gardens, Calcutta in Tigers, Jaguar and Leopards and in a circus Tiger in 1975. An outbreak in a Tiger has also been recorded in Mysore Zoo.

This article describes a case of trypanosomiasis in a white Tiger, the symptoms and its successful treatment.

Case Report : THINA : the White Tigress born to Ahsima and Hari of Delhi Zoological Park on 6-6-77 was sent to Nehru Zoological Park, Hyderabad in April, 1978 to be mated to a normal coloured wild caught tiger. She adopted pretty well to the new surroundings and climate of the Nehru Zoo Park for a few days. However from 18-6-80 onwards she was lethergic and was found to be sleeping for unusually long hours. Appetite was good and was passing stools of normal colour and consistency. She was kept under close observation for a week. On 26-6-80 she was found lying on the ground with lots of flies around her face and with both eyes sunken. Immediately she was taken into a squeeze cage and the temperature was recorded, which was 40.4°C, indicating high fever. Blood smears from the tip of the tail were taken and sent to Veterinary Biological and Research Institute, Hyderabad for investigation. The blood smears were found negative for any bacteria or blood protozoan parasite. The following treatment was administered : Tetracycline (Pfizer) 10 ml 1/m, Belamyl (Squib) 3 ml, 1/m. The evening temperature was found to be 39.8C and the appetite good. The above mentioned treatment was continued upto 30.6.80, but no progress was seen. The temperature throughout this period remained high i.e., between 39°C to 40°C. (The tigress consumed 8 kilos of beef daily inspite of high fever) without any digestive disturbances.

No treatment was given on 1.7.80 and 2.7.80. On 2.7.80 Blood smears were again prepared and sent to Veterinary Biological and Research Institute for Investigation. This time *T.evansi* was detected in the blood films and the following treatment was administered on 3.7.80. Dextrose solution 25% 100cc S/C, Berenil (Hoechst) 2.4 gms. (3-measures dissolved in 20 ml of distilled water was injected into the gluteal museles).

On 4.7.80 the temperature was normal i.e., 37.5°C. The Tiger received 3 ml of Belamyl intramuscularly on alternate days. Five such injections were given. The temperature remained normal during this period. On 13.7.80 she was declared to be successfully treated for Trypanosomiasis and was released back into her enclosure.

Reprint : Wildlife Health, 3 (1&2) : 1-2, 1985

Surra in a Jackal.

(A Case Report)

1. Dr. Mir Gowher Ali Khan, 2. Dr. Sabir Ali, and
3. Dr. Dattatri Rao.

Introduction :

Surra or Trypanosomiasis is the most common infection in quite a good number of species of large felids, kept in captivity in various Indian Zoos and Circuses, so far it is reported in Tiger (*Panthera tigrs*) including the white one, Indian Lion (*Panthera leo*) leopard (*Panthera pardus*) Puma (*Felis concolor*) and Jaguar (*Panthera onca*) It is also reported from striped Hyaena (*Hyaena hyaena*) Surra in wild canids such as Jackal, fox and wolf is uncommon as per the available literature. This article describes a case of surra in a captive Jackal. (*Canis aureus*) and its successful treatement with Antrycide prosalt.

Case Report :

Nehru Zoological Park, Hyderabad is exhibiting a family of Jackals consisting of 2 male and 4 females in a beautiful moated enclosure since April, 1981. The animals have settled down well and even started breeding. But in the month of October 1982 we lost a male and a female. The deaths were sudden without showing symptoms of illness. Postmortem conducted on the carcasses could not reveal any significant pathological changes in the internal organs.

On 13.12.1982 one of the Jackals was found dull. On close examination it revealed high fever, dullness and opacity of cornea of both the eyes. Pyrexia and opacity of cornea lead us to suspect Surra. Blood films prepared from the tips of the ear were examined at the Zoo Hospital and few were sent to the pathological section of College of Animal Husbandry and Veterinary Science, Rajendranagar and to the Veterinary Biological and Research Institute, Hyderabad. These films were found positive for T. *evansi* infection.

The treatment details and the observations are given below :-

1. Deputy Director (AH) (Retired) Nehru Zoological Park, Hyderabad, A.P.
2. Assistant Director (AH) Nehru Zoological Park, Hyderabad, A.P.
3. Veterinary Officer, Nehru Zoological Park, Hyderabad, A.P.

Date	Body Temperature	Treatment given	Observations
13.12.82	105°F.	Injected Antrycide prosalt 30 mg. S/C. @ 4 m grm per kilo B/Wt. Estimated Wt. 15 Kilos. (1/2 the dose was given)	High fever, dull. off feed, opacity of cornea.
14.12.82	104°F.	-do-	Fever persisting but appetite improving.
15.12.82	104°F.	No treatment was given.	Appetite almost normal. Opacity of cornea persisting.
16.12.82	104°F.	-do-	-do-
17.12.82	102°F.	-do-	No fever, appetite normal.
18.12.82 to 22.12.82	—	-do-	-do-
23.12.82	—	-do-	Opacity of both the eyes got cleared up.

PROPHYLACTIC TREATMENT : The remaining Jackals 1 Male, 2 Females were given prophylactic doses of Antrycide prosalt @ 2 mg. per kilo body weight i.e., 30 mg. S/C on 14.12.82 and they remained clean of infection during this out-break.

SUMMARY

One female Jackal was treated for surra successfully with Antrycide prosalt. The Jackals in contact were also given prophylactic does of Antrycide proslat. Antrycide prosalt has been found quite effective both as curative and prophylactive in case of surra in Jackals.

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Reprint : Zoos' Print, 1 (10) : 9 & 12., October, 1986

TRIPS FOR "TRYPS"

Memoirs of a Zoo Vet in India

By Mir Gower Ali Khan

Being a fresh Zoo Veterinarian I was like a fish, not exactly out-of-water but more like a fish thrown into a new pond. The environment of which was quite embarassing, in the sense that the Zoo inmates were not like domestic dogs and "Pussy Cats", nor did they look to me as familiar as my cows and buffaloes. Hence the simple act of sneezing of "MADHU" the male chimpanzee put me into fits of shivers and the regurgitation of undigested pieces of beef of my "RAMU" the Royal Bengal Tiger was as alarming as a child suffering from infectious gastro enteritis. Hence in this state of anxiety and tension the suggestion made by my colleagues working in different hospitals were warmly welcomed as there are no other Zoo Veterinarians in my State.

When one day I saw a tall thin man in his late forties introducing himself as a Zoo Vet I could not believe it and rubbed my eyes several times. But when I heard his deep voice I was sure of his presence and then jumped off my chair, rushed towards him, grasped his hand, made him sit by my side and showered upon him a volley of questions. Among his anectodes the infection of TRYPANOSOMIASIS in a tiger was the most valuable information. He told me that one of his tigers remained "off feed" with high fever for several days. He kept the tiger alive on glucose saline. One fine morning he could find TRYPS in the blood smears and then the wonder drug ANTRYCIDEPROSALT played the magic role and the tiger returned to its normal appetite and health, of course after a long period of convalescense. This was the first tale of a "Tailed Protozoa" carried to me by a Zoo Vet.

Trypanosomiasis (T. evansi) is the most common infection in my zoo felines, next to feline distemper. Tigers, Puma, Lions, Panthers and Jackals have suffered from Surra and have been treated successfully with Antrycideprosalt, with the addition of Belamyl, and Bigludox (in the intial stages). The symptoms are high fever, off-feed, dullness and shaggy coat. In one tiger and jackal there was opacity of cornea of both the eyes and the vision was impaired.

After one and a half decade, in the early seventies I had a sojourn in Bangalore City for a short period. My niece had invited me the "TASMIAQUANI" ceremony of hre first son. The journey was very tiresome. Huddling for sixteen hours in a bus made my knees more stiff and these were aching badly. When I got down at the bus station nobody was there to receive me. As I had her home address with me, to search for her palacious bungalow would not be a problem, I thought. After haviog a wash and a hot cup of "Mysore Coffee" I left the station. To my surprise right in front of me Bombay Circus was camping. Its dome shaped tent and the colourful buntings attracted me and I decided to call upon the manager whom I know very well. He was much pleased to see me and took me round the animals. When we were passing through the carnivorous section he took me to the two lions suffering from opacity of cornea. He complained, "Doctor, though the city Vets are attending the lions regularly and evincing great interest in the treatment, there is no response. The lions are still dull, lethargic and off feed". I handed over the prescription of Antrycideprosalt and asked him to tell the city Vets that a Zoo Vet. from Hyderabad had examined the lions and diagnosed the disease to be Surra and had requested them to inject this drug. Wishing him best of luck and hope to see his lions walking on the rope before the cheering crowd once again at Hyderabad I left the circus arena.

A few years later, it was a pleasant surprise to meet the same circus manager at the zoo dispensary. He dragged me to his camp, not to look at his big cats but to treat his pet dogs. Oh God, I have to look again into my old and worn out notes of "Canine diseases", most of which by this time might have been eaten away by the vermins. A Zoo Vet now has to undergo a "Metamorphosis" before he could attempt to treat a domestic animal, I thought.

At the camp I saw a dozen Boxers tied up neatly to a long chain. Seeing an intruder they started jumping howling and barking, except two which were lying down quitely on the ground. I approached the poor creatures nearer to have a close look. Ah ! the same Surra ! I was overjoyed.

Cont. on p. 12

Cont. from p. 9

There was no lustre and sparkling in those two pairs of beautiful eyes. Instead it looked as if four dirty white small pieces of marble have been studded in the eye sockets. Triumphantly after prescribing the same old drug I returned back to my zoo.

The author is one of the more dedicated and well-known zoo vets in India. He was vet at Hyderabad Zoo for years. Now he is editing Wildlife Health, the journal of the Association of Indian Zoo Veterinary Doctors.

Dr. Mir Gower Ali Khan

Indian vet. J. 63. June, 1986 ; 506-507

A CASE OF SUDDEN DEATH IN A MALE TIGER CUB (*PANTHERA TIGRIS*) WITH TRYPANASOMIASIS—A NOTE

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A male tiger cub, (*Panthera tigris*) 1½ years old, weighing approximately 150 kg, belonging to Nehru Zoo Park, Hyderabad and apparently in good condition, was found ill on 20-9 84 with high rise of temparature (104°C). The animal was dull, prostrate and unable to come to its enclosure. He was administered antipyretics (Novalgin) and antibiotics (Chloramphenicol), to bring down the temparature and to eliminate the bacterial infection. Without responding to treatment, the animal died on the same day four hours after the illness was observed. The blood smears could not be examined when the animal was alive.

A thorough autopsy examination was conducted. Diffuse congestion of internal organs was the predominant lesion, while the stomach evidenced greyish exudates on the mucosal surface intermixed with round worms and the small intestines also showed similar exudate on the mucosal surface. The heart muscle impression smears on microscopical examination revealed number of Trypanasomes in between the blood elements (Fig). The morphology of the Trypanasomes was akin to that described earlier for *Trypanasomn evansi* (Soulsby, 1968). The impression smears from other organs did not reveal any organisms of etiological significance. The round worms collected from the stomach were identified as *Toxocara leonina*.

It was established already that tigers harbour *T. evansi* infection (Alwar. 1953) and the infection was also known to occur in an outbreak form (Sinha *et al*, 1971 and Govinda Reddy *et al*, 1975). As the blood smears could not be examined when the animal was alive, the diagnosis of Trypanasomiasis could be arrived only after conducting postmortem and laboratory examination of impression smears from heart. The effect upon the host in acute cases of Trypanasomiasis is believed to be the result of hypoglycaemia (Smith *et al*, 1972) which might be the reason for the sudden death even in the present case. The presence of a few round worms was only coincidental observation and it was understood that these round worms might have ascended from the small intestine to the stomach after death.

Summary : A case of male tiger cub (*Panthera tigris*) belonging to Nehru Zoo Park, Hyderabad died with high fever. *Trypanasoma evansi* organisms were demonstrated in the heart impression smears.

Sincere thanks are due to Dr. G. Hanumantha Rao, Director of Animal Husbandry Department., Dr. Krishna Ashrit and Dr. S. Vasantha Rao, Joint Directors, for the facilities provided.

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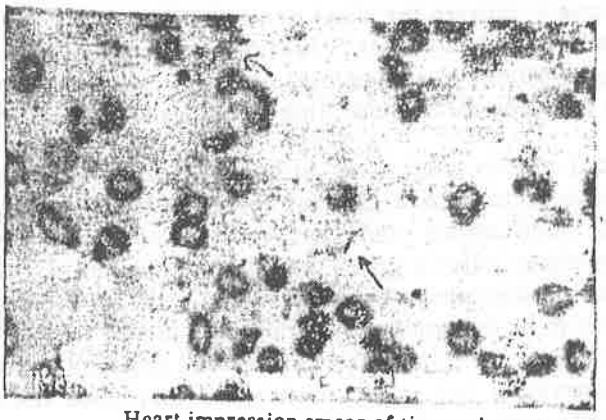
A case of sudden death in a male tiger cub (*Panthera tigeris*) with Trypanasomiasis–A note

Ch. Choudary, B. Narasimhaswamy, J. Hariramdas, P. Bhaskara Rao and M. R. Krishnamohan Rao



Heart impression smear of tiger cub
Note *Trypanasoma evansi* organisms (arrows).

Indian vet. J. 65. October, 1988 : 930

OCCURRENCE OF TRYPANOSOMIASIS IN SAMBARS (*RUSCA UNICOLOR*) (KERR)

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Trypanosomiasis is one of the commonest infections in Indian livestock. Alwar (1953) reported the occurrence of *Trypanosoma evansi* in several mammals and wild animals. Chen *et al.*, (1983) has also reported its occurrence in deer. The authors are therefore placing on record trypanosomiasis in two sambars.

History : Two male adult sambars belonging to the local deer park, of Maharashtra State Forest Department, were presented for necropsy in the Department of Pathology, Veterinary College, Nagpur at an interval of about 20 days with history of fighting amongst other male inmates. They were aiso reported to be going down in condition.

Necropsy findings : Carcasses were found to be emaciated and bloated and the pupils appeared dilated. Both were having injury over the thoracic region, probably due to blunt external violence. Coronary vessels were engorged and chicken fat clots were seen in both the ventricles. Hydroperitonium was also noticed in one of the animals. Lungs showed congestion and edema. In one animal there was froth in the trachea. Livers and spleens were congested. In both acule catarrhal enteritis was noticed. Examination of peripheral blood collected at the time of necropsy revealed a large number of trypanosomes morphologicaly indistinguishable from *T. evansi*.

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Reprint : Indian J. Wildlife Hlth. Manage, 1 (1) : 47, 1992

SHORT COMMUNICATION

TRYPANOSOMIASIS IN A WOLF AT MYSORE ZOO - A CASE REPORT.

K. Syed Ziauddin, K. Muralidharan and S.J. Seshadri

Trypanosomiasis due to Trypanosoma evansi has been reported in wolves under captivity (Sengupta, 1974). The present communication deals with the observation of T.evansi infection in a wolf of Mysore Zoo. A male wolf aged about 7 years looking anorectic and dull died after emesis. On postmortem the following lesions were recorded. Distension of pericardial sac with serosanguinous fluid, engorgement and congestion of superficial blood vessels of heart, lung and liver swollen oedomatous and congested. Gastric mucosa revealed patchy streaks of haemorrhages suggesting haemorrhagic gastritis. Stomach contained partially digested blood tinged ingesta. Intestines predominantly the duodenum and iliac portion showed lesions of haemorrhagic and catarrhal types of enteritis. Urinary bladder was distended with about 300 ml of urine which was positive for albumin. Faecal sample did not reveal any parasitic cysts or ova. Brain impression smears were negative for Negribodies. However, the impression smears from the affected organs such as heart, lung, liver and spleen revealed presence of T. evansi suggesting the possibility of death due to Trypanosomiasis, as earlier reported by Sengupta,(1974).

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Reprint : Indian J. Wildlife Hlth. Manage, 1 (1) : 38-39, 1992

SOME PATHOLOGICAL OBSERVATIONS ON TRYPANOSOMIASIS IN A TIGRESS AT MYSORE ZOO.

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Trypanosomiasis due to Trypanosoma evansi has been reported from Tigers of Indian Zoos, (Alwar, 1953; Nair et al., 1965; Sinha et al., 1971; Dasgupta et al., 1972; Dasgupta et al., 1979; Khan et al., 1982 and Seshadri et al., 1983). The present communication deals with the observation of T. evansi infection in an adult tigress which belonged to Sri Chamaraja Zoological Garden, Mysore.

Tigress (Ambika), 8 year old became ill, anoretic and showed rise of body temperature of 104°F in the morning. Giemsa stained blood smears exhibited parasites morphologically similar to T.evansi. The temperature reduced to 97°F in the evening and the tigress died the next morning despite of specific treatment. Urine samples was possitive for albumin (±±) and bile salt (±±±).

Autopsy was conducted immediately. The significant findings were as follows: Superficial blood vessels of heart were engorged and congested. Endocardial petechiae was observed in the right atrium and in the left ventricle. Both the lungs were congested and oedomatous and haemorrhagic pale necrotic areas were seen in some portions. On sectioning, the lung parenchyma revealed sero-sanguineous fluid. Mucosa of trachea & bronchioles was slightly congested. Liver was congested, mottled with rounded boarders. Biliary stasis was observed and gall bladder was distended with about 150 ml of viscous and dark green bile. Spleen was slightly enlarged haemorrhagic and pulpy. Kidneys were slightly enlarged and congested. Haemorrhagic spots were seen beneath the meninges. Impression smears from all the organs and cultural examination of pericardial fluid and heart did not reveal any specific bacteria of pathological importance. Congestion, hyperaemia or oedema of the important vital organs as noticed in the present study were also observed earlier by Sinha et al., 1971.

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As in the case of present study as well as our previous experiences, the sudden onset of trypanosomiasis and death of tigers before providing them specific treatment was reported by others (Dasgupta, 1979 and Sengupta, 1974), although successful treatment with Antrycide and Berenil has been reported (Dasgupta, 1979; Sengupta, 1974 and Khan, 1982). The failure of immediate specific treatment or the action of the specific drugs in many occasions was due to the reason that the time between the onset of visible symptoms, and death was very short - an observation noted by present authors in previous occasion as well as by other workers Seshadri et al., (1983). The ability to save some tigers and the death in other animals inspite of speedy diagnosis might be attributable to variation in pathogenicity of strains of T. evansi involved.

this study.

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Reprint : Zoos' Print, 8 (6) : 13, June, 1993

TIGER CUB CURED OF TRYPANOSOMIASIS IN MADHAV NATIONAL PARK

(As told to) Rajiv Saxena, AMC Student, Gwalior

The observations on the birth and behaviour of three tiger-cubs in tiger safari in Madhav National Park have been discussed elsewhere (Saxena, 1992; Saxena and Shrivastava, 1992) The male and two female cubs were named shiva, shivani and Bhawani respectively.

In the second week of February 1993 shivani stopped feeding and became idle. Her temperature rose to 101° F and the blood was spotted in the urine. She was about one year and six month old. On 25.2.93 Dr.V.S. Gautam, Sr. Vet. Officer of Gwalior zoo was consulted who started treatment initially giving the following medicines and recommending the blood test simultaneously : Gentamycin 120 mg, Decadron 2 ml Intra muscular, Vit. B. Complex 3 ml

As she was suspected to have Trypanosomiasis, samples of blood smears and citrated blood were sent for laboratory diagnosis to the Dy. Director (Disease Investigation Section) of Vet. Dept., Bhopal as well as to the Assistant Director (D.I.Section) Gwalior on the same date i.e.,25.2.93. The laboratory reports received on 27.2.93 from both the places confirmed Trypanosomiasis. A specific line of treatment was started on 28.2.93.

Three grams of Triquin was dissolved in 15ml of distilled water. The solution was again diluted by adding 2ml, distilled water to minimise irritation. Two ml out of this 17 ml solution was injected subcutaneously at two different places while 2 ml. Decadron was injected intra muscularly. Plenty of water with a lot of glucose was provided to her while the solid food of beef was held up for 24 hours.

On 29.2.93 Shivani responded to the medicines and started feeding as usual. Liver with meat was suggested. Now the cub is perfectly all right. The instructions to repeat Triquin dose after three months as a prophylactic measure have been issued to the safari management.

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Indian Vet. J. 72, November, 1995 : 1210 - 1211

SOME OBSERVATIONS ON AN OUTBREAK OF SURRA IN CIRCUS TIGERS

T. Bhaskara Rao[1], P. Balarama Raju[2], J. Hararama Das[3] and Md. Hafeez[4]

Trypanosoma evansi infection was earlier reported in tigers in Madras state (Alwar, 1953), in Kerala (Nair *et al.*, 1965), in the tigers of the zoological gardens in Calcutta (Sinha *et al.*, 1971), in circus tigers (Govinda Reddy *et al.*, 1975) and in a zoo tiger cub (Choudary *et al.*, 1986) in Andhra Pradesh. The present communication reports some observations on an outbreak of surra in tigers (Panthera tigris) belonging to the national circus organised at Kakinada (A.P.).

Five adult tigers and four tiger cubs which were showing dullness, disinterest in taking feed and water and not responding to the master's instructions were referred to the Veterinary Polyclinic, Kakinada on 13-7-1993 by the Circus management. Clinical examination revealed rapid pulse, rapid respirations and temperature ranging from 104°F to 106°F. Microscopical examination of Blood smears prepared from the sick animals revealed *T. evansi* infection while no parasitic ova could be detected in the faecal samples.

The ailing animals were immediately treated with 4, 4' - diamidine - diazoaminobenzene-diaceturate (Berenil, Hoechst, Bombay) at the rate of 1.6 gm/100kg body weight i.m. with 200 ml of Dextrose-20% (Max international infusions, narukur) i.v. and 5 ml of B.Complex with liver extract (Belamyl, Sarabhai, Bombay) i.m. injections. Berenil and Belamyl injections were repeated on 3rd day. Trimethoprim sulphadiazine (Biotrim, Ranbaxy, New Delhi) at the rate of 1 ml / 30 kg body weight i.m. was given for five days to avoid concurrent bacterial infection. Small quantities of mutton soup and glucose water were allowed for 5 days. By 5th day all the animals showed clinical recovery.

The Temperature records revealed that the temperature began to recede from 2nd day onwards and reached normal (100.2°F) by 3rd day. Blood smears were examined daily for 5 days and no evidence of infection was seen from 2nd day onwards. The results are in agreement with the observations of Govinda Reddy *et al.* (1975).

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Reprint : Zoos' Print, 12 (6) : 40-41, June, 1997

SICK LINE
Z.O.O. MONTHLY MEDICAL COLUMN

TRYPANOSOMOSIS (SURRIOSIS) IN TIGERESS A CASE REPORT - LUCKNOW ZOO

Ashok Singh*, Mahendra Singh** & Utkarsh Shukla***

On 6 April 1995 two tigers named Merry (female) and Vikram (male) were brought to Lucknow Zoo from Chandigarh in a healthy state. In July they mated and in about three months the tigress gave birth to three healthy cubs and raised them with no complications.

Suddenly on 17 December 1996 the tigress ate only 5-6 kg. of meat out of the 10 kg. given to her. The following day she was given 6 kg. of buffalo meat out of which she ate 5 kg. but appeared to be normal. Similarly, until the 26th, she ate less only occasionally but on 20 December she did not appear normal. On 25th December she ate only 3 kg. of buffalo meat out of the 7 kg. given to her. On 26th December until evening she did not eat anything.

On 28th December she was taken in the squeeze cage and her temperature was noted to be 102°F in the morning. She was given suitable antibiotics, B-complex and liver extracts. In the evening her temperature was noted to be 103°F and the treatment was repeated. On 29th December her temperature rose to 104°F in the evening. On 30th December '96 her temperature was 103°F in the morning and 104°F in the evening. Treatment was repeated until 1 January 1997 when the temperature was approximately 104°F.

During these days, she ate around 2-3 kg. meat everyday. The condition remained the same on 2nd January also. On 3rd January meat was not given because it was Friday. She was hospitalized on the 4th morning. She did not eat anything on 5th and was kept under observation the whole day. On 6th January her blood and stool samples were collected. The result of blood sampling is given in Table 1.

There was no ova and cysts but RBCs were present. On 7th January a blood sample was collected again and tryps were found after staining. (See Treatment Chart.)

On 8th Morning at 10.00 am, the tigress was given Berenil 0.8 g./ 100 lbs and supportive therapy. No abnormality was found. Temperature was 100°F at 3:00 pm but she was restless. She drank a lot of water and urinated at 4:00 pm. In evening 6:00 pm her temperature was 101.2°F. She consumed two chickens. On the 9th morning she ate 5 kg. buffalo meat ; her temperature was 100.4°F. In the evening the temperature was 101.8°F and supportive therapy was continued.

She was given supportive therapy again on 10th. By this time her temperature was normal and she ate 6 kg. buffalo meat. She was returned to her enclosure on 11th and for the next four days she ate 6-7 kg. meat per day and remained normal. On 15th half dose of the treatment was repeated. On 16th January blood sample was collected again and tryps were not found after staining.

Now the tigress again is normal and eating around 8-9 kg. meat per day.

Table 1
Blood Fixture (Before Treatment)

	Merry	Normal
W.B.C.	13000	10000-15000
Polymorph	77%	63%
Lymphocytes	23%	30%
Losinophils	nil	2%
Monocytes	nil	5%
Haemoglobin	8 gram %	0-14 gram %
Blood Protozoan	Trypanosoma	

Table 2
In Stools sample -- Stools examination

Colour	Dark Brown
Peaction (PH)	Acidic
Consistency	Soft
Mucous	Present
Frank Blood	Present
Ova	Absent
Cysts	Absent
Puscells	Absent
Red Blood Cell	Present

Treatment Chart of Tigress Merry

28.12.96	Antibiotic with supportive therapy
29.12.96	Treatement followed
30.12.96	Treatement followed
31.12.96	Treatement followed
01.01.97	Treatement followed
02.01.97	No treatment only liver extract,vitamins
03.01.97	Only liver extract and vitamins
04.01.97	No treatment
05.01.97	No treatment
06.01.97	No treatment
07.01.97	No treatment
08.01.97	Inj. Berenil 0.8 g./ 100 lbs deep i/m with supportive therapy
09.01.97	Supportive therapy
10.01.97	Supportive therapy
11.01.97	Supportive therapy
12.01.97	Supportive therapy
13.01.97	Supportive therapy
14.01.97	Supportive therapy
15.01.97	Second dose of Berenil

Note : See Observations - Summary Report on next page.

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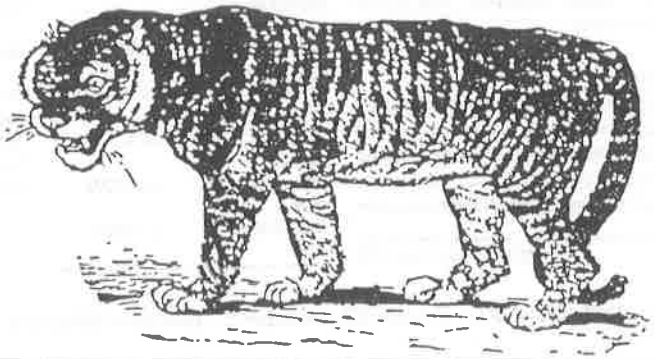
* Additional Principal Chief Wildlife Warden U.P. , Lucknow
Director, * Dy. Director, Lucknow Zoo.

Observations - Summary Report

Date	Feed(B.M.)	Temp.	Observation
17.12.96	10 kg.	-	Normal, but eaten only 5-6 kg. B.M.
18.12.96	6 kg.	-	Observed normal but eaten 5 kg. B.M..
19.12.96	4 kg.	-	Observed normal but eaten 4 kg. B.M.
20.12.96	Friday	-	Dull and depressed entire day.
21.12.96	6 kg.	-	Observed normal
22.12.96	8 kg.	-	Observed normal
23.12.96	8 kg.	-	Observed normal
24.12.96	8 kg.	-	Observed normal but taken only 5-6 kg. B.M.
25.12.96	6 kg.	-	Observed normal
26.12.96	6 kg.	-	Observed normal but eaten only 2-3 kg. B.M.
27.12.96	Friday	-	Observed normal but stool w. mucous & blood strain
28.12.96	5 kg.	102.4°-103°	Dull, depressed & recumbent entire day
29.12.96	6 kg.	102.4°-104°	Observed to be normal, but behaviour abnormal ; did not response the calls. Recumbent after few steps.
30.12.96	6 kg.	103°-104°	Observed normal in am; pm observed to be restless
31.12.96	7 kg.	102.°-103°	Observed normal
01.01.97	7 kg.	103°-106°	Observed estless but consumed 5 Kg. B.M.
02.01.97	6 kg.	102.1°-104.2°	Dull, depressed w. mucous & blood stain in stool
03.01.97	Friday	103°-104.6°	Observed as weak; consumed 4 Kg. B.C.
04.01.97	6 kg.	104.5°-105.2°	Dull & depressed, stool with excessive mucous & blood stain ; consumed 3 Kg. B.C.
05.01.97	6 kg.	103°-104°	Dull & depresssed, (Nictilaing memberanes) N.M. prominant of right eye / faeces with excessive mucous; complete anorexia
06.01.97	6 kg.	102.2°-104.2°	Dull, weak & depressed ; completely anorexia; N.M. prominant at both side, faces with excessive mucous and blood stain; consumed 2 Kg. B.C.
07.01.97	2 kg.	106°-100°	Dull, depressed, eaten broiler & B.C. after 5 hr. of treatment but observed to be very weak.
09.01.97	3 kg.	101°-102°	Normal
10.01.97	Friday	100°-102°	Normal
11.01.97	6 kg.	102.1°-102°	Released & returned to enclosure
12.01.97	6 kg.	-	Normal
13.01.97	6 kg.	-	Normal
14.01.97	6 kg.	-	Normal
15.01.97	6 kg.	102.2°-102.1°	Normal
16.01.97	6 kg.	-	Normal
17.01.97	Friday	-	Normal
18.01.97	8 kg.	-	Normal
19.01.97	8 kg.	-	Normal
20.01.97	9 kg.	-	Normal & returned to full diet



CERTAIN HAEMATOLOGICAL AND BIOCHEMICAL PROFILES OF A WHITE TIGERESS (*PANTHERA TIGRIS* LINNAEUS) SUFFERING FROM TRYPANOSOMIASIS

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Introduction

The incidence of trypanosomiasis in wild animals like tigers, leopards and jaguars has been reported (Alwar, 1953; Sinha *et al.*, 1971). Most of these reports contain information on clinical symptoms and post-mortem lesions (Sinha *et al.*, 1971). The information on circulating hematological and biochemical profiles of wild carnivores suffering from trypanosomiasis are meager to relate with clinical symptoms.

The present study includes a detailed observation on clinical symptoms as well as hemograms and blood chemistry profile of a white tigeress (Vaisali, 8 years old) maintained in captivity at the Sanjay Gandhi Zoological Park, Patna. The animal conceived when it was seven years of age but aborted at full term. Following abortion it developed health problems like reduced appetite, gradual emaciation, oedema in the abdominal region, slow and progressive dullness and depression. The body temperature recorded since the observation of clinical symtoms was normal (102°F). The fecal samples were negative of parasitic infestation. The animal was treated with supportive drug vitamin B Complex and liver extract during intial stages. During the course of the treatment the animal was also fed with protein-rich diet along with mineral mixture. The condition deteriorated gradually with exhibition of some more pronounced abnormal symptoms like staggering gait, weakness in hind quarters, muscular tremors, bilateral mucus discharge from eyes, circling movement, dashing against objects and frequent urination. The animal soon ended up in lateral recumbancy.

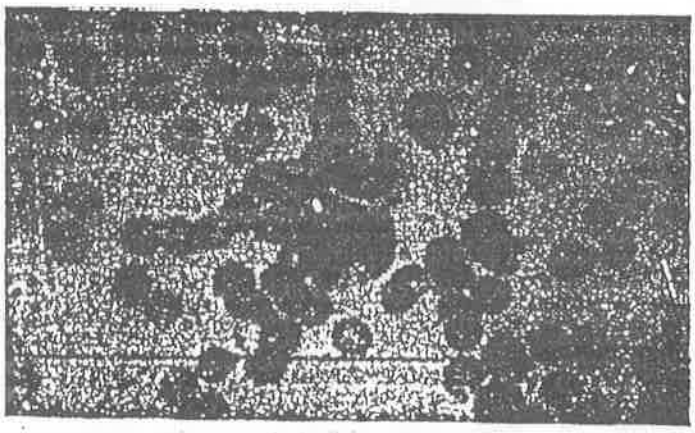
Materials and Methods

The animal was then secured in a squeeze cage and about 15 ml blood was collected (from the dorsal branch of median saphenous vein in the hind leg at about the level of the knee). Blood clotting time (BCT), total erythrocyte count (TEC), total leucocyte count (TLC), differential leucocyte count (DLC) were conducted using fresh blood, while packed cell volume (PCV) was estimated from heparinized blood as described by Schalm *et al.* (1975). Serum calcium and inorganic phosphorus, ESR and hemoglobin were estimated by the method described by Kolmer *et al.* (1969). The concentration of total serum protein, albumin and globulins were estimated as per the method discribed by Varley (1975). Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated by the formula as described by Swenson and Reece (1996). Blood smear was stained by Geimsa stain (Schalm *et al.*, 1975) for differential leukocytic count and examination of protozoal infection. The hematological and biochemical profiles recorded have been presented in Table 1.

Table 1. Hematological and biochemical profile of a white tigeress suffering from Trypanosomiasis.

Parameters	Value	Parameter	Value
Blood clotting time	9 minutes	Differencial leukocytic count	
Haemoglobin	10.5 g/dl	(i)Neutrophil	76%
Mean corpuscular haemoglobin	18.32 g	(ii)Lymphocyte	19%
Mean corpuscular haemoglobin concentration	32.81 g/dl	(iii)Monocyte	01%
		(iv)Eosinophil	04%
Mean corpuscular volume	55.84 u^3	Serum calcium	11.2 mg/dl
Erythrocyte sedimentation rate	76 mm/hr	Serum inorganic phosphorus	3.8 mg/dl
Packed cell volume	32%	Total protein	7.9 g/dl
		Serum albumin	3.1 g/dl
Total erytrocyte count	5.73x10^6/ul	Serum globulin	4.8 g/dl
Total leukocyte count	9.1x10^3/ul		

Received 30 June 1999; Accepted 2 November 1999



Results and Discussion

The examination of blood smear revealed heavy infection with trypanosomes (Figure 1). The species of trypanosoma could not be determined clearly because immunodiagnostic test was not conducted.

The examination of blood for different parameters indicated that the BCT, MCH, MCHC, TLC, DLC, serum calcium, serum inorganic phosphorus, total serum protein, serum albumin and serum globulin values recorded in this tigeress were similar to the values recorded for above parameters in healthy tigers and leopardess (Singh, 1998) and Asiatic lioness (Christi *et al.*, 1998). However, the Hb concentration, TEC, PCV and MCV were lower than the values of respective parameters recorded in healthy captive tigers (Singh, 1998) and Asiatic lioness (Christi *et al.*, 1998). The similar lower values of Hb, PCV, and TEC (Verma, 1973; Razzaque, 1976; Roy, 1987) and MCV (Razzaque, 1976; Roy, 1987) were reported in trypanosome infection in buffaloes. The reduced appetite, gradual emaciation, dullness and oedema of abdominal region observed in this animal agreed with similar clinical symptoms shown by buffaloes suffering from trypanosomiasis (Verma, 1973; Losos, 1980). Anaemia, ocular mucus discharge and weakness of hind quarter as observed in this animal has also been reported in acute as well as chronic form of trypanosomiasis in cattle (Losos, 1980). Other symptoms observed in this animal was also reported in cattle and buffaloes suffering from *Trypanosoma evansi* (Singh, 1977). However, the ESR value recorded in this animal was higher than the healthy tigers and leopards maintained in the Zoological Park (Singh, 1998).

The microcytic normochromic anaemia recorded in this animal was similar to the observation recorded in buffalo calves (Singh, 1983). The animal was treated with Berenil (Hoechst India Ltd.) and other supportive treatment just after the diagnosis of trypanosomiasis by blood smear but did not respond to the treatment and it died within 72 hours of the initiation of treatment. As the physical condition of this animal was deteriorating over two months, it could be assumed that this animal was having chronic case of trypanosomiasis.

The postmortem examination revealed no change in the size of liver, spleen and kidney. No peticheal haemorrhages were observed in liver, spleen and kidneys. Though such lesions were also not observed in one male tiger, one female leopard and one male leopard that died due to trypanosome infection showed peticheal hemorrhage of liver, spleen and kidney (Sinha *et al.*, 1971).

Acknowledgement

Authors are highly thankful to the Principal, Bihar Veterinary College, Patna, for providing facilities to carry out this investigation.

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TRYPANOSOMIASIS IN A TIGER (*PANTHERA TIGRIS*)

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Surra caused by *Trypanosoma evansi* is a common disease widely reported in domestic animals. However, because of its acute and fatal nature, the reports on Trypanosomiasis in wild animals are very few (Sinha *et al.*, 1971; Choudary *et al.*, 1986). The present communication reports a case of Trypanosomiasis in a Tiger and its successful treatment.

A male adult tiger *Chandu* aged 9 years at Maharajbag Zoo, Nagpur was observed ill for two days with symptoms of anorexia, constipation and lethargy. There was rapid respiration, panting and with the inclination to press the head on the bars of the cage. The Tiger had convulsions once in the early morning. The efforts to give antipyretic/analgesic drugs orally with food and water failed as the tiger did not show interest in the food. Then the Tiger was shifted into a squeeze cage for closer clinical examination. Pulse was rapid (80/min) and body temperature was (106.8°F). The blood smears were sent to a laboratory for examination. Meanwhile, injections of Diclofenac sodium (10 ml.) and B-complex (8 ml.) were administered to the Tiger intramuscularly. The blood smear was found positive for *Trypanosoma evansi* infection. Berenil (total dose of 3 g.) was immediately given intramuscularly on the same day. Since the Tiger was suspected to be hypoglycemic, an injection of Dextrose 10% 500 ml. was given intravenously. The injections of Diclofenac sodium and B-complex were repeated for one day and three days respectively. The tiger was kept under close observations for about a week.

The temperature recorded eight hours after treatment showed decline (103.8°F) and the animal gradually returned to normal on the second evening. The Tiger accepted some water on the same evening but did not show any interest in solid food. His appetite was fully restored on the fifth day after treatment with evidences of normal respiration and cessation of nasal discharge.

The head pressing or convulsions were not noticed after the beginning of the treatment. The Tiger showed complete recovery and was released in to the enclosure on the sixth day.

Received 31 March 2000 *Accepted 1 June 2000*

Sporadic cases as well as outbreaks of trypanosomiasis have been reported in tigers. Sinha *et al.* (1971) reported on outbreak of surra in four Tigers, two Jaguars and one Leopard. He reported sudden deaths in four animals without any signs of illness whereas three animals showed respiratory distress, running nose in one and convulsive fits in one animal. Reddy (1975) reported the successful treatment of an outbreak of surra in circus tigers. The major sign of the disease was pyrexia (106^0F - 108^0F). No other signs were noticed. Choudhary *et al.* (1986) reported a sporadic case of surra in a tiger which died suddenly with fever. He reported trypanosomes in the heart blood smear. In the present case, the Tiger suffered from the signs such as anorexia, pyrexia (106.8^0F), nasal discharge with respiratory distress and head pressing. The authors also observed convulsions only once but not after the administration of Berenil.

Prompt treatment with Berenil and B-complex (Livobex) was undertaken as suggested by Reddy (1975). Similarly, considering anorexia and possible hypoglycemia in surra, 10% Dextrose was also given to combat hypoglycemia. Laha *et al.* (1991) also reported hypoglycaemia in trypanosomiasis in buffalo calves. In his opinion hypoglycemia could be due to consumption of glucose by haemoprotozoa or disturbance in carbohydrate metabolism of the host. Only single injection of Berenil gave excellent result and the blood smear taken on 6^{th} post treatment day did not reveal the pathogens and hence no further treatment was thought necessary. The Tiger showed complete and uneventful recovery.

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Vol. VIII Issue IX Sept - 83

A Note on Amoebiasis in Non-Human Primates of Nehru Zoological Park, Hyderabad

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The Nehru Zoological Park, Hyderabad has about 25 species of non-human primates including Hoolock Gibbon and Chimpanzee from the APE group. Besides following helminthic infection:

1. Strongylosis.
2. Ascariasis.
3. Toxacara infection.
4. Trichuriasis.
5. Anchlostomiasis.; Protozoan infections as Bai antidiosis and Amemobic infections are also recorded in some of the species of non-human primates. The species in which Amoebic infection is recorded are listed as below :

1. Mandril. (Mandrillus sphinx)
2. Mona Monkey (Cynocephalum mona)
3. Oliva Baboon (Chaeropithecus spp)
4. Yellow Baboon (Papio cynocephalus)
5. Red crowned Mangaby Cercocebus torquatus)
6. Spider monkey (Atelas geoffroyi)
7. Chimpanzee (Pan troglodytes)

1, ENTAMOEBA HISTOLYTICA is the causal agent of amoebic dysentry of man. It has also been found in many species of monkeys. The parasites correspond to the small form of man and occur as commensale in the monkey gut. Infection being symptomless (Soulsby-1968) monkeys may harbour amoeba apparantly indistinguishable from those in man usually without displaying symptoms of dissease (Richardson and Kondall 1964).

The above opinions hold true with the first five species of the non-human primates (See Table no. 1) wherein the infection was symptomless i.e. no bloody diarrhoea was noticed and the monkeys remained healthy even though they were harbouring E. hystolytica cysta. But in chimpanzee and spider monkey amoebic infection was associated with fever anorescia and dysentry.

CASE HISTORY OF A CHIMPANZEE

On 30.8.81 in the early morning a female chimpanzee aged about 17 years weighing (by estimation) 70-80 Kilos was found dull and off feed. On close examination it was found that she had passed semi solid stools mixed with lot of mucos and blood at 5 different places on the floor of her "Animal house." The stool was examined under the microscope and was found to be positively for cysts of Entamoeba hystalytica.

The animal was treated orally with the combination of the following drugs.

1. Metrogyl syrup (Metronidazole) 15 ml. T.D.S.
2. Chlorostep suspension (Park & Davis) 15 ml. T.D.S.
3. Vitamin B. Complex syrup (Glxao) one table spoonful Bd.

The chimpanzee recovered fully on 6.9.81 after 6 days treatment. The stools examined on 12.9.81 remained negative for amoebic infection.

TABLE No. 1.

Details on faecal examination of (7) species of non-human primates of Nehru Zoological Park, Hyderabad for the detection of Helminthic Infection from 1.1.1972 to 1.8.1982.

Sl no.	Common name	Zoological Name	Frequency of stools examined microscopically from 1.1.72 to 1.8.1982.	No. of times found positive for Amoebic cysts.	Symptoms exhibited by the host	% of the Amoebic-infection.	Remarks
1.	Mandrill Monkey.	Mandrillus Sphinx	... 84 times.	once.	Symptomless infection.	1.3%	
2.	Mona Monkey	Cynocephalummona	... 65 ,,	once.	- do -	1.5%	
3.	Olive Baboon.	Chaeropithecus spp	... 41 ,,	once.	- do -	2.5%	
4.	Yellow baboon	Papio cynocephalus	.... 53 ,,	once.	Symptoms less	1.8%	
5.	Red crowned mangany	Cerocebus torquatus	... 65 ,,	once.	- do -	1.5%	
6.	Spider monkey	Atelas geoffroyi	... 10 ,,	twice.	Fever, of feed and Dysentry	20%	
7.	Chimpanzee	Pan troglodytes	.... 92 ,,	twice.	Fever, off feed and Dysentry	2.1%	

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INTESTINAL AMOEBIASIS IN A LIONNESS

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Intestinal amoebiasis due to *Entamoeba histolytica* is a serious malady in man and in domestic carnivores. Its incidence in wild is rarely recognised. A chronic case of amoebiasis in a lioness (Jyothi) was brought to our notice for treatment by the Director of Bhagwan Birsa Jaivik Udyan, Ranchi. The lioness was off feed, constipated, passing black coloured stools, sometimes with plenty of mucous. The animal was under treatment with Mortin D.S., Vitapepsin, Livogen, Tonomon, Neochlor and Kemicetin since 27.4.94 but showed no signs of improvement. The faecal sample when examined was found positive for cysts of *E. histolytica*. She was then treated with Metron syrup 20 ml (each 5 ml contains Metronidazole 200 mg) thrice daily for five days i.e. up to 10.v.94. The lioness appeared cheerful and showed considerable improvement in appetite. The above symptoms however reappeared on 16.v.94 and the animal was treated again with Metron syrup for two days. However, the treatment was not effective and the faecal sample still showed cysts of the protozoa.

The lionness was then treated with oral administration of Erythromycin esterate syrup 20 ml (each ml =125 mg) thrice daily, Tiniba 800 mg twice daily (Goodman & Gilman, 1996) and 10 ml Complex B syrup twice daily. The treatment schedule was continued for 12 days i.e. from 18.v.94 to 29.v.94. Chremafin suspension was also administered 10 ml twice daily orally for 4 days. After treatment constipation disappeared and the animal returned back to normal health.

An important lesson learnt from this case is that during the treatment of intestinal amoebiasis, it is essential to control the secondary bacterial infection also simultaneously (Soulsby, 1982). Oral administration of drugs is very difficult in wild animals. One has to make sure that any loss during administration is duly compensated. Drugs were administered by squeezing the animal and pushing the drug with a syringe with mouth open.

Acknowledgement

Thanks are due to Sri K.P. Sinha, Forester, Sri Brajendra Kumar Singh, Compounder and Sri Mahendra Singh, Pashu Palak of Bhagwan Birsa Jaivik Udyan, Ranchi for their co-operation and painstaking venture.

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Received 22 June 1999; Accepted 9 August, 1999

Vol. VI ISSUE VI June-81

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Balantidiosis in Monkeys of Nehru Zoological Park, Hyderabad

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The genus Balantidium belonging to the class Ciliata is a parasite of large intestines of cattle, man, pig and monkey. The organism also occurs in higher primates and it may be a troublesome infection in Zoological Gardens (Soulsby, E.J.L. 1968). And this infection in them in the Zoological Gardens is normally maintained by animals themselves. Numerous species of this genus have also been recorded from the alimentary canals of man, the chimpanzee and the orang-utan [McDonald (1920) Scott (1927) and Hegner (1934)].

PATHOGENESIS :

The genus Balantidium is not parasitic in the sense that they produce disease. Rather, they are concerned in digestive process but their exact role in this has yet to be determined. B. Coli is generally regarded as a commensal since under normal condition it is found in the lumen of the large intestine and is associated with no change in the mucosa. Sometimes these are associated with a mild to severe enteritis, depending upon mild to severe parasitism.

The Nehru Zoological Park, Hyderabad, has been exhibiting (26) species of monkeys for more than a decade. These monkeys are housed either in open enclosures or in cages with good ventilation. In order to keep them free, as far as possible, from helminthic infestation, the excreta of these monkeys is screened under the microscope (to note the severity of the worm load) and then vermicides are administered at regular intervals. The details of the faecal matter of various species of monkeys examined microscopically for the detection of Helminthic ova or cysts is listed in the Table.

Table shows that the helminthic infestation in the monkeys of Nehru Zoological Park, Hyderabad, ranges from Nil to 30%. The important finding is that the infestation of Balantidium

TABLE

Statement showing the details of the faecal matter of various species of monkeys of Nehru Zoological Park, Hyderabad, A.P., examined microscopically for the detection of ova of Helminthic parasite etc., from January, 1972 to August, 1979.

Sl No.	Common name	Zoological name	Monkeys housed in cages or in open enclosure	Frequency of the stools examined microscopically	Positive findings for ova/cyst of Helminthic parasites									
					Ascavis Spp.	Strongyle Spp.	Trichuris Spp.	B. Coli cyst.	Amoeba cyst.	Anchylostme Spp.	E histolytica Spp.	Toxacara Spp.	% of Helminthic infection
1.	2.	3	4	5	6	7	8	9	10	11	12	13	14
1.	Bonnet monkey	M. radiata	In both	16 times	—	—	—	—	—	—	—	—	Nil
2.	Chimpanzee	pan troglodytes	Open enclosure (O.E.)	35 ,,	—	2	—	one	—	—	—	—	8.5
3.	Chacma baboon	Papio ursinus	O.E.	23 ,,	—	—	2	—	—	—	—	—	8.6
4.	Capuchin monkey	Cebus capucinus	Cage	20 ,,	—	—	—	—	—	—	—	—	Nil
5.	Debrazzae monkey	Cercopithecus neglectus	Cage	32 ,,	—	—	—	—	—	—	—	—	Nil
6.	Drill	Mandrillus-leucohoeus	Cage	50 ,,	—	—	2	Two	—	—	—	—	8%
7.	Diana monkey	Cynocephalus cercopithercus	Cage	36 ,,	—	—	1	Two	—	—	—	—	8.3%
8.	Galada baboon	Theropithecus gelada	O.E.	23 ,,	—	1	—	—	—	1	—	—	8.6%

9. Hoolock gibbon	Hylobates hoolock	O.E.	4	,,	—	—	—	—	—	—	—	—	Nil
10. Lion tailed monkey	M. Silenus	Cage	31	,,	—	1	4	one	—	—	—	—	19.3%
11. Moustache guenon	Cercopithecus cephus	Cage	19	,,	1	1	—	—	—	—	—	—	1.5%
12. Mandrill	Mandrillus sphinx	Cage	53	,,	1	—	—	one	1	—	—	—	3.4%
13. Mona monkey	C. mona	,,	36	,,	—	2	—	two	1	—	—	—	13.8%
14. Olive baboon	Chaeropithecus spp	,,	20	,,	—	2	1	one	1	—	—	1	30%
15. Pig tailed monkey	Macaquanemestrina	,,	27	,,	—	—	1	—	—	—	—	—	3.7%
16. Red crowned mangaby	Cercocebus torquatus	,,	35	,,	—	1	—	one	—	—	—	—	5.7%
17. Rhesus monkey	Macaqua mullata	Both	36	,,	—	—	2	one	—	—	—	—	8.3%
18. Sooty mangaby	Cercocebus torquatus atys	Cage	26	,,	—	—	—	—	—	—	—	—	Nil
19. Sacred baboon	Papio hamadryas	Open enclosure	24	,,	—	2	3	—	—	—	—	—	20.8%
20. Stumped tailed monkey	Macaqua arctoides	Cage	41	,,	—	—	—	—	—	—	—	—	Nil
21. Spider monkey	Atelas geoffroyi	O.E.	10	,,	—	—	—	—	—	2	—	—	Female Died due to Heavy infestation of Ancylostomiasis.
22. Squirrel monkey	Saimiri sciureus	,,	6	,,	—	—	—	—	—	—	—	—	Nil
23. Sykes guenon	Cercopithecus spp	Cages	14	,,	—	—	—	—	—	—	—	—	Nil
24. Vervet monkey	C. aethiops pygerythrus	Cages	20	,,	—	—	—	—	—	—	—	—	Nil
25. Yellow baboon	Papio cynocephalus	Cage	26	,,	—	—	2	one	—	—	—	—	11.5%
26 Siamiang.	Symphalangus syndactylus	O.E.	—		—	—	—	—	—	—	—	—	—

coli is only in certain species of monkeys and apes, as follows :

1. Chimpanzee.
2. Drill.
3. Diana Monkey.
4. Lion-tailed Monkey.
5. Mandrill.
6. Mona Monkey.
7. Olive Baboon.
8. Red crowned Mangaby.
9. Rhesus Monkey.
10. Yellow Baboon.

The rest of the species are free from the B.Coli infestation. Keeping monkeys in small cages where they are huddled up, may be a predisposing cause for helminthic infestation. The monkeys which are housed in cages only are infested with B.Coli whereas those living in open enclosures are free of this infestation except for a single case of chimpanzee.

DISCUSSION

The B.Coli infestation is found in the monkeys housed in cages [exception of Chimpanzee] though the cages are thoroughly cleaned with phynyle solution every day whereas the monkeys housed in open enclosures i.e. in island with wet moat all round are found to be free of this infestation. There is no proper outlet for the moat water, but the water of the moat is treated with bleaching powder once in every month. Sometimes the monkeys are seen sipping the moat water, even though tap water is provided in water cisterns in the night houses.

The large floor space, direct sun ray and the heat may be responsible for keeping the monkeys in the open enclosures free from B.Coli infestation, and reinfestation. As open enclosures provide a good floor space, sun light and fresh air, there is little chance for the ova to live and propagate under the direct sun light and heat.

In 9 out of the 10 species listed above the B.Coli infestation is of no significance as no intestinal disturbances such as diarrhoea or dysentery were noticed. But once a chimpanzee female passed stool of normal consistency with mucous and blood on 6-9-79 and on microscopical examination it was found to be positive for B.Coli cysts.

TREATMENT

Nitrofurazolidone [NEFTIN] 200 mg. tablets 2 Bd. were administered along with B Complex tablets in small pieces of banana, on 8-9-1979. The stools became normal and there were no traces of blood and mucous. The treatment was given for 4 days.

The male chimpanzee which lives in close association with this female was free of Balantidiosis.

The stools of the female chimpanzee was again examined microscopically after a course of NEFTIN on (1) 24-10-79, (2) 20-12-79, (3, 25-1-80 and was found negative for B.Coli infestation.

ACKNOWLEDGEMENT

The authors wish to express their sincere gratitude to Dr. Vasanth Rao, Joint Director, Vety. Biological Research Institute, Hyd. Sri Pushp Kumar, I.F.S., Conservator of Forests, Wild Life Management, A.P. Hyderabad and Sri M. Kamal Naidu, I.F.S., Curator, Nehru Zoological Park Hyderabad for providing facilities and encouragement.

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LIVESTOCK ADVISER
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Vol IX Issue V May—1984

Balantidiosis in White Rhinos

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The Incidence of Balantidium coli in India among cattle and buffaloes has been reported from Assam, Orissa Madras and Pubjab (Biswas and Kannge, 1959; Patnaik, 1960) David, 1965, Gill and Kwatra, 1972) causing Balantidiosis with clinical symptoms of diarrhoea and dysentry (Patnaik, 1965 and David, 1967) It is also reported in monkeys (Kuowles, 1928, Ali Khan. M.G. et al 1981).

In the past various compounds like carborsone, Lucarsone, Deouinol, Flagyl, Entero Vioform, copper sulphate, stoversal, Neoviospt and hexachlorethane were used by various workers (Patnaik, 1960, David et al. 1966) with varied results.

The present investigation relates to the Occurrence of Balantidiosis among white Rhinos at Nehru Zoological park, Hyderabad, A.P. with some observations on the efficiency of certain drugs on the control of Balantidiosis.

CASE REPORT

A pair of white Rhinos native of Aftrica were brought to Nehru Zoological Park, Hyderabad. A.P. in the month of May, 1975. Both male and female Rhinos developed symptoms of diarhhoea and the faeces on examination was found to be positive for cysts as well as trophozotes of Balantidium coli. Clinically they showed the symptoms of foetid diarrhoea with mucus, loss of appetite, weakness and emaciation.

The following drugs were tried

1. Neftin 200 mg. tab. 30 tab. B D. for 2 days (without any Improvement).
2. Steclin boluses 8 B.D. along with guaxaline. 10 tab. B.D. for 10 days with no improvement.
3. Erythrocin 10 capsules plus sulphamezathene 5 g. tables, 3 tabs. B D. for 3 days gave some improvement In the condition but the faeces did show the presence of B. Coli cysts.

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TABLE-1 Showing the details of the stool tested microscopically antibiotics administered and details of Male White Rhinoceros

Sl. No.	Antibiotics administered in Feed/Jaggery balls.	Date of Administration	Date of Examining the stools M/C	Results of the stools tested	Consistancy of the stool	Apetitle of the Animal
I.	NEFTIN TABLETS 200 Mgs 30 Tabs. B.d.	27.8.75 to 28.7.75.	27. .75	-Ve for any helmithic ova	Loose watery	Poor.
II.	STECLIN BOLUS 8 B.D.	1.9.75 to	28.7.75	+ ve for strongle	-do-	Poor.
	QUZXALINE BOLUS. 10 B.D.	11.9.75	4-9-75	+ ve for B. Coli Cysts and Trophozoites	Loose and watery	Poor.
			8.9.75.	-ve.	Loose and watery	Poor.
			9-9-75	+ + + for B' Coli Cysts	-do-	Poor.
III.	ERYTHROMYGINE TABLETS 10 B.D.	12-9-75 to 14.9.75	15.9.75	+ ve for B Coli Cysts.	Slightly better	Appetite improving
	Sulphamezathine 5 gm. tab. 3 B.D.	14-9-75 to 16-9-75		-ve	Stool-loose again	-do-
			17-9-75	-ve for B. Coli Cyst.	-do-	-do-
IV.	DEQUINOL TAB 10 Tab daily	24.10.75 to 27.10.75	23.10.75	+ + for B. Coli Cyst and Trophozoites	Loose	Better
			30.10.75	+ ve -do-	consistandcy of the stool is much better	-do-
			6-11-75	- ve	Consistancy of stool returned to normal	Better

TABLE II Showing the details of stool tested microscopically, antibiotics administered and other details of Female White Rhinoceros

Sl. No.	Antibiotics Administered In Feed/Jaggery/Balls	Date of administration	Date of examining the stool M/S	Results of the stool tested	Consistancy of the stool	Appetite of the animal	Remarks
I.	STECLIN BOLUS 8 Bd + Quaxalive Bolus. 10 Bd.	6-9-75 to 9-9-75	4-9-75	+ve for B. Coli Stool Normal		Good	
			8-9-75	-ve for B. Coli Loose		Complete off feed from 6/9 to 8/9	
II.	ERYTHROMYCIN TABS 10 Bd	10-9-75 to 13-9-75	10-9-75	+ + + for B. Coli Loose Cyst., Trophozoits		Appetite Improving from 10/9	
	Sulphamezathine 5 gms. tab. 3 Bd		12-9-75	+ -do-		-do-	
III.	DEQUINOL TABS 10 Tabs daily	24-10-75 to 27-10-75	23-10-75	+ + + -do-	Loose watery	Appetite good	
			30-10-75	+ B. Coli	Consistancy normal	-do-	
			6-11-75.	-ve	-'-	-do-	

4. Dequinol 10 tablets daily for 4 days. It gave better results when compered to the above mentioned drugs as there was improvent in appetite, consistency of faeces beeing normal and the faeces was negative for the Balantidium coli cysts after one week of the administration of the above drug.

Although Balantidiosis is not so serious condition in animals, under certain conditions it may cause severe diarrhaea and dysentry. The disease may sometime be ove - shadowed by the usual conventional diseases which cause diarrhoea in animals. However, in the present study the white Rhinos showed symptoms of diarrhesa with clinical manifestation. Out of the several drugs tried, only Dequinol gave promising results. These Observations are in agreement with those of David and Mathew 1966.

SUMMARY

Several usually available drugs either singly or in combination were tried for the contol of Balantidiosis in white Rhinos. Dequinol was found to be more efficacious than other drugs.

Tables no. 1 and 2 show the details of the stool of the rhinos (male and female) examined and the antibiotics administered from time to time. The details of the consistency of the stool before and after administration of various drugs are also given.

From the above details, it is clear that the drug found effective was Dequinol only. Of course, Erythromycine + Smz has given satisfactory results but the stool examined on 23.10.75 i.e. after six days of administration of the above drug has again shown very heavy infection i.e. + + + and after use of Dequinol i.e. on 6.11.75 the stool for both the animals was found to be negative and the consistency of the stool remained normal for a long time.

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Reprinted from "Curr. Sci.", July 5, 1969, 38, No. 13, 316

ISOSPORA GYPSI N. SP. A NEW COCCIDIUM FROM THE INDIAN VULTURE (*GYPS BENGALENSIS*)

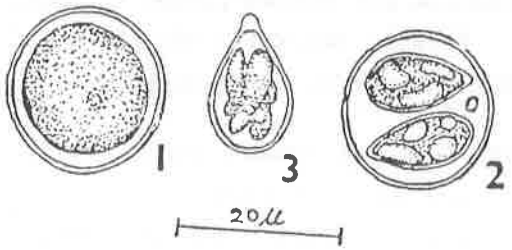
INDIAN vulture (*Gyps bengalensis*) does not seem to be a known host for coccidian parasites.[1-3] While conducting autopsy of a vulture to investigate into the chain toxic reaction of an insecticide, a few coccidian cysts in the fæcal sample were encountered. An attempt was made to study them from six more fæcal samples collected from another place and maintained in 2% potassium dichromate solution.

The coccidium was found to be a new species of the genus *Isospora* Schneider, 1881, and is designated *I. gypsi* after the generic name of the host.

Isospora gypsi N. SP.

(The measurement given are taken from 25 specimens)

The oocysts were smooth-walled, subspherical in shape and had no visible micropyle. They measured 17·5 to 22·4 μ (mean 20·2 μ) in length and 14 to 19·6 μ (mean 18 μ) in breadth with a shape index (Length/breadth) of 1·03 to 1·6 (mean 1·1). The sporont almost filled the inner space (Fig. 1).



FIGS. 1-3

They sporulated in about 18 to 20 hours into two pyriform tetrazoic sporoblasts leaving an irregular oocystic residuum of 2 μ diameter (Fig. 2). Each sporocyst measured 11·2 to 16·8 μ (mean 13·5 μ) in length and 8·4 to 9·8 μ (mean 8·9 μ) in breadth, had a refractile conical stidæ body at the narrow end and contained four sporozoites of 6 × 1·5 μ size and a granular sporocystic residuum (Fig. 3).

Remarks.—In the family Accipitirdiæ, only *I. buteonis* Henry, 1932 has so far been described from a falcon in America, and there is no other oriental report.[1] The coccidium under consideration is much larger than *I. buteonis* (16–19·2 μ × 12·8–16 μ) and resembles *I. zosteropis* Chakravarti and Kar[4] (17·6–22·2 × 13·2–19·8 μ) and *I. bengalensis* Mandal and Chakravarti[5] (18·7–23·3 μ). The latter has a micropyle. However, *I. gypsi* was distinct from them as it contained an oocystic residuum of significant size.

The authors are grateful to the Director of Animal Husbandry and Veterinary Services, Orissa, for the facilities afforded.

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Reprint : Zoos' Print, 12 (12) : 5, December, 1997

A NOTE ON ISOSPORA INFECTION IN A SOUTHERN REDWHISKERED BULBUL (*Pycnonotus jocosus fuscicaudatus*)

Bindhu Michael, M. Amrithraj and K. Madhavan Pillai

The Southern Redwhiskered Bulbuls are perky garden and shrubbery haunting birds found in moist deciduous and evergreen biotopes of the low country, both near and away from human habitations. Though a resident of Kerala, it ranges down the western side of peninsular India, Western Madhya Pradesh and South to Kanyakumari. The species in several races is found practically throughout India.

The authors had the opportunity to find an adult bird of the above species in a nest along with young ones in the gardens of Veterinary college hospital. The adult bird appeared dull and showed ruffled feathers. The nest was kept under careful observation and was examined when the bird flew off with the young ones. The droppings in the nest was found to be diarrhoeic and mixed with mucus. Hence it was collected and on microscopical examination, oocysts of coccidia could be detected in very large numbers.

The sample was centrifuged and kept in 2.5% potassium dichromate solution for sporulation of oocysts. The morphological details of both sporulated and nonsporulated oocysts were studied under oil immersion of a microscope. The oocysts were neraly spherical, double walled and measured 19.92 to 23.8 x 18.9 to 23.76 µ m in size and contained two sporocysts each with four sporozoites. Micropyle, polar cap and oocyst residum were absent. Majority of the oocysts had a single polar granule but some had two polar granules. The sporocysts had a plug like stieda body and measured 13.8 to 15.1 x 8.0 to 8.98 µm Sporocyst residuum as scattered granules was present and the sporozoites were elongate with a refractile globule at either end.

A perusal of the available literature did not reveal the occurrence of isosporan coccidia in Southern Redwhiskered Bulbul. Occurrence of *Isospora pycnonotae* and *I. pycnonotusi* were reported in Redwhiskered Bulbul (*Pycnonotus jocosus*) by Mandal (1971) and Bhatia *et al.* (1973) respectively. The specimens in the present study is closest to I. pycnonotusi in measurements and characters.

Hence, we report the occurrence of *I. pycnonotusi* in Southern Redwhiskered Bulbul (*Pycnonotus jocosus fuscicaudatus*) in Kerala. The sick nature of the adult bird and the diarrhoeic and mucous containing droppings might be due to the infection.

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Reprint : Zoos' Print, 11 (7) : 18, July, 1996

SARCOCYSTOSIS IN AN INDIAN GAUR (*Baus gaurus*)

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Sarcocystis is a protozoan parasite often encountered as an incidental microscopic finding in the cardiac and skeletal muscles of variety of mammals, birds and reptiles (Kalyukin and Zasukhin, 1975). During the months of June, July and August 1995, there were reports of sporadic death of Indian gaurs in Parambikkulam wildlife sanctuary, Kerala. A detailed postmortem examination was conducted on one of the gaurs found dead in the Parambikkulam wildlife sanctuary (Thunakkadavu area) on 27.7.1995. Subcutaneous absceses and maggot wounds were the postmortem findings in that particular case. During the course of the investigation, no specific aetiological agent could be identified for the sporadic deaths in gaurs. Histopathological examination of the tissues taken from the gaur revealed cysts of sarcocystis in the cardiac musculature (Fig.1).

There are reports of bovine calves (*Baus taurus*) and mule deer fawns expenmentally infected with *Sarcocystis fusiformis* and *Sarcocystis hemionilatrantis* showing clinical disease and subsequent death (Johnson *et al.* 1975 and Koller *et al.* 1977).

Koller *et al.* (1977) reported that fawns expenmentally infected with *Sarcocystis hemionilatrantis* showed clinical symptoms from 18th day post infection. They showed pyrexia, weight loss, reluctance and stiff movement and started dying from the [illegible]th day of infection onwards.

Sarcocystosis has been reported in Indian Gaur by Welch and Zimmer (1981). This report suggest that Indian gaurs are susceptible for sarcocystis infection. Other wild herbivores like sambar in Kerala forests have also been reported to get Sarcocystis infection (Gangadharan *et al.* 1992).

In the present case of Indian gaur, mature cysts of sarcocysts were recorded in the cardiac muscle. There was no cellular reaction around the cysts. The absence of cellular reaction around the cysts was responsible for neglecting its aetiological significance of this organism in causing clinical diseases in intermediate hosts like herbivores. However Johnson *et al.* (1975) and Koller *et al.* (1977) established that there are pathogenic species of sarcocystis like *S. fusiformis* and *S. hemionilatrantis* which can cause clinical disease and death in bovine calves and mule deer fawns respectively. Based on the above observations it can be surmised that wild ruminants like Sambar and gaur act as the intermediate hosts of sarcocystis and many species of wild carnivores may act as the final host to complete the life cycle of the two host parasite.

This observation warrants a detailed investigation to screen the carnivore population in the wildlife sanctuanes of Kerala and to isolate and characterise the species of sarcocysts involved and then elucidate the pathogenesis of the sarcocystis in wild ruminants.

Acknowledgement

The authors are thankful to Dr. A. Rajan, Dean, College of Veterinary and Animal Sciences, Mannuthy, Thrissur and Dr. K.M. Ramachandran, Professor and Head, Department of Pathology for the encouragement and facilities provided to undertake this study. The authors are also grateful to Dr. K.V. Valsala, Associate Professor, Centre of Excellence in Pathology, College of Veterinary and Animal Sciences for the help rendered in taking microphotographs.

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Fig. 1. Cyst of sarcocyst in the cardiac muscle

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Reprint : Zoos' Print, 7 (12) : 39, December, 1992

SIGNIFICANCE OF PARASITOLOGY TO WILDLIFE MANAGEMENT

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It is well known that parasitic diseases pose a major threat to wildlife management. In spite of this, parasitology has not received its due attention from wildlife professionals and scientists eventhough its importance has been recognised more in recent times.

Wildlife managers, biologists and veterinarians must know about wildlife parasites, their ecology, behaviour, population dynamics and their effect on wildlife populations in order to control parasitic diseases and to maintain a healthy wildlife stock. It should be emphasized that parasites and diseases not only affect wildlife but also humans and the domestic animals (Anderson, 1976). The early detection, prompt reporting, immediate diagnosis and prompt containment are essential for a successful disease control programme. The major drawbacks of data generated by wildlife disease studies seem to be failures (i) to assess the role of these parasites in the population dynamics of wildlife species and (ii) to transfer these data in formulation of effective control methods.

Rinderpest, one of the most dangerous diseases, wipedout a good population of gaur in Mudumalai and Bandipur in 1968 (Sinha, 1975) and Kaziranga National Park in 1982. Not only rinderpest but also foot and mouth disease, anthrax and haemorrhagic septicaemia had resulted in casualities among wildlife. Heavy mortalities of 2,269 Common langur *(Presbytes entellus)* and bonnet monkey *(Macaca radiata)* during 1957 to 1973 due to Kyasanur Forest Disease (KFD) have been reported by National Institute of Virology, Pune. Bhatt et al (1991) have highlighted the continuing epidemics of KFD and the threat to LTM *(Macaca silenus)* and Nilgiri langur *(Presbytes johnii)*. The Zoonotic diseases such as KFD, rabies and ornithosis are transmissible/communicable to man and therefore, are considered as serious public health hazards.

Parasitological studies by Sathyanarayana and Ayyadurai (1987) on the wildboar (Sus scrofa) by faecal sample analysis has revealed the presence of helminth parasites such as *Hymenolepis* spp. *Ascaris* spp. and *Trichuris* spp. This showed the gravity of the situation with reference to the health of our wildlife. Further, there is every chance that these parasites could be transmitted to man and to his domestic stock from wild boar. Noble and Noble (1964) have reported the transmission of *Fasciola hepatica* and *F. buski* from wild boar to man, cattle, sheep, deer, rabbits and other animals. Transmission of Ascaris lumbricoides to man from wild boar has also been reported by Huang et al 1977. Faecal samples of blackbuck (*Antilope cervicapra*) distributed in Point calimere, Tamil Nadu revealed the occurrence of *Trichostrongylus spp. Strongyloides spp. Ascaris spp.* and *Trichuris spp.* (Sathyanarayana and Balu, 1986).

One should bear in mind that these helminth parasites affect the behaviour, assimilation of nutrients and other aspects of the hosts and thereby contribute to the ill-health of wild animals. These effects may result in reducing the population of the host well below the carrying capacity of the range. The problem becomes more complicated as these nematode parasites are a group of very sucessful parasites and of a common and wide distribution. Mungall (1977) has also viewed the nematodes as the major parasites that potentially threaten wildlife management.

So, a successful management plan should aim at (i) reducing the probability of ingesting eggs which become contaminated in food, water and faeces, and the prevention of contact between the diseased animals and the other ungulates of the area.

Wildlife managers should concentrate on this aspect i.e., the parasitology as well in formulating their management plan. Of course, this needs further research and experiments.

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Reprint : Zoos' Print, 12 (4) : 14-16, April, 1997

ROLE OF WILDLIFE IN PARASITIC DISEASES OF MAN AND ANIMALS

Satyavir Singh and D.P. Banerjee

ABSTRACT

Wildlife has considerable values and usefulness to man. But, unfortunatery there are certain parasitic diseases which are either shared among man/ domestic and wild animals or may be transmitted among them when a definitive host ingests an intermediate host. Some of the important parasitic diseases namely, trichinellosis, hydatidosis, cysticercosis, giardiasis, toxoplasmosis, ancylostomiasis, toxocariasis, fascioliosis, sarcocystosis and their modes of transmission from wildlife to man and animals are discussed briefly.

INTRODUCTION

The values of wildlife are numerous such as commercial, recreational, biotic, scientific, environmental, educational, emotional and aesthetic. But, at the same time, there are a few negative values also, namely damage to crops, trees, seedlings, and other property or occasionally injury or death to livestock and man from their attack. Additionally, there are certain diseases which can take the shape of epizootics and are transmissible to man or his domestic stock. Wild animals may act as a source of disease agents or reservoirs of certain parasites communicable to man and/or livestock. Awareness about such parasites will help in preventing or reducing their incidence in man and domestic livestock. There are over 150 recognized zoonotic diseases representing all known classes of infectious agents (Acha and Szyfres, 1987) including viruses, bacteria, fungi and animal parasites (protozoa, helminths and arthropods). For the present purposes, the focus will be on parasitic diseases only. Parasites especially helminths (flukes, tapeworms and roundworm) may complete their life cycle in more than one species of animal hosts i.e. a definitive host and an intermediate host. Both vertebrates and invertebrates may serve as intermediate hosts. Transfer of a parasite may occur when a definitive host ingests or is bitten by an intermediate host. For example, *Trichinella spiralis* larvae remain encysted in the muscles of wild carnivores such as fox, jackal, wild boar, black bear, bush pig, walrus, etc. and man may become infected following the ingestion of meat of these animals. Another example may be *Taenia hydatigena*. It is a tapeworm whose immature stage *(Cysticercus tenuicollis)*, also called "bladder worm" occurs in the viscera and mesentery of domestic and wild ruminants which act as the intermediate hosts. The definitive hosts namely dog, wolf and other wild carnivores become infected when they eat the infected meat of domestic and wild ruminants and adult tapeworms develop in them.

SHARING OF PARASITES AMONG MAN, DOMESTIC AND WILD ANIMALS

There is another pattern of distribution of transmissible parasites that they may be shared between man or the domestic animals on one hand and their related wild fauna on the other. The parasitic diseases affecting non-human primates, namely apes, are almost similar to those of human beings like *Entamoeba histolytica, Balantidium coli*, trichomonads, *Giardia, Toxoplasma*, hookworms (*Ancylostoma*), round worms (*Ascaris lumbricoides*), *Cysticercus* and *Echinococcus*. Similarly, wild canids, felids and hyenas are affected by parasitic diseases of pet dogs and cats such as coccidiosis, ascariasis, hookworms, trichuriasis, lung worms, kidney worms, taeniasis and various types of mange. Zebra and wild ass are susceptible to almost all the parasitic diseases which affect horses like surra, ascariasis, strongylosis, *Strongyloides westeri*, *Trichostrongylus axei*, *Dictyocaulus arnfieldi* and

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Gastrodiscus sp. Arthropod infestations like *Gasterophilus* sp. and mange may also occasionally affect them. Deer (Singh and Pandey, 1963; Sadana *et al.*, 1980). Yak, wild buffalo and bison may suffer from some of the parasitic diseases which affect other domestic ruminants namely coccidiosis, babesiosis, dicrocoeliasis, paramphistomiasis, monieziasis, echinococcosis, taeniasis and various nematode infections as well as some arthropods. Animals unrelated to domestic livestock like bears suffer from coccidiosis, ascariasis, trichinellosis, trichuriasis, taeniasis and various types of mange. Elephants suffer from surra, paramphistomiasis, fascioliasis, ascariasis, ancylostomiasis, strongylosis and microfilariasis. The rodents are parasitized by coccidiosis, *Balantidium*, *Giardia*, *Toxoplasma*, *Strongyloides* sp., *Hymenolepis* sp. and lung worms. Birds suffer from protozoans like coccidia, *Trichomonas gallinae*, *Plasmodium* sp., *Leucocytozoon*, *Toxoplasma*; helminthic infections like *Capillaria*, *Ascaridia galli*, *A. columbae*, *Syngamus trachea*, *Heterakis gallinarum*, *Echinostoma* and certain arthropods like *Cnemidocoptes* sp. and *Dermanyssus gallinae*.

FACTORS RESPONSIBLE FOR TRANSMISSION

According to Filippov (1986), there are two prerequisites for transmission of natural nidal helminthiasis from wild animals to farm animals. Firstly, the presence of infected wild animals and secondly, the development of helminths in the environment i.e. the climate and geography of the area. The third prerequisite namely the presence of susceptible farm animals is largely determined by man through creating opportunities for interaction (interface).

The socio-economic factor and the standard of living has a direct relation with the transmission of parasitic diseases as in the rural areas of developing countries people commonly share their home environment with the variety of animal species under conditions of poor sanitation and hygiene which frequently leads to exposure of each other's pathogens. Also, compulsions of livelihood, often make man to intrude upon the territory of wild animals and limitations of grazing encourages tresspassing of game sanctuaries for his domestic stock. In developed countries certain delicacies/ dishes of raw meat may act as source of human infection from wildlife.

Some of the important parasitic diseases and their modes of transmission from wildlife to man and animals are discussed below.

1. Trichinellosis:

Independent sylvatic and synanthropic zoonotic cycles of infection occur. The sylvatic cycle involves wild carnivores such as fox, wild boar, black bear, bush pig, walrus and it is an exchange between the predator and prey. Man become infected by ingestion of bear meat and more rarely from other wild animal sources such as walrus and seal meat in arctic regions. The disease is common in Canada, erstwhile USSR, eastern and southern Africa, Bulgaria, Switzerland, India, Spain, Yugoslavia, Poland and Finland. The synanthropic zoonotic cycle occurs primarily in swines and rats, occasionally dog, cat and man may become infected.

2. Echinococcosis/ Hydatidosis:

Echinococcus granulosus, the cause of classic cystic hydatid disease is found in the small intestine of carnivores particularly dogs and larval stage (hydatid cyst) is found in a wide variety of ungulates, primates, marsupials, lagomorphs, artiodactyles and man. The parasite has a cosmopolitan distribution with highly endemic areas in the erstwhile USSR, the Mediterranean countries and areas of Africa, Latin America and Australia.

Apart from the strains of *E. granulosus* involving domestic animals, other strains exist with sylvatic cycles and these include moose/ wolf in North America, wallaby/ dingo in Australia, deer/ jackal in Sri Lanka, deer/ coyote in California, hare/ fox in Argentina, wolf/ elk or dog/ elk in erstwhile USSR and lion, cape hunting dog, jackal/ wild ungulates in southern Kenya. However, the confinement of the sylvatic strain to wild animal intermediate hosts limits the risk of human exposure. In arctic and sub-arctic regions on the other hand, where indigenous people subsist mainly by hunting wild reindeer, dogs kept as a means of transportation may be fed the lungs of infected deer, or if unrestrained may scavenge on the viscera left by the hunters (Rausch, 1986).

Echinococcus multilocularis is found in the northern hemisphere, central and eastern Europe apart from Canada and erstwhile USSR. Adults are smaller than *E. granulosus* and occur primarily in foxes. Alveolar hydatid cysts are found principally in microtine rodents. Growth of *E. multilocularis* is quite different from that of *E. granulosus* and the disease in human has similarities to malignant tumors in that it is an insidious and progressive growth with occasional metastasis to the lungs and brain. Man may become infected mainly by the sylvatic cycle involving foxes and criceted rodents.

3. Taeniasis/ Cysticercosis:

Taenia saginata has a cosmopolitan distribution with particular importance in Africa, South America and in some Mediterranean countries. The definitive host is man (in whose small intestine the adult parasite occurs) and the intermediate host is cattle and other ruminants. Its metacestode (*Cysticercus*) may also be found in llama, reindeer, giraffe, wild beast and antelope. Though these are not normally the intermediate hosts of this parasite; however, farming of game animals may change the situation.

Taenia solium occurs in the small intestine of man while the pig and wild boar are the main hosts of the metacestode. It is the intermediate stage or cysticerci which occasionally occur in man with serious consequences through nervous symptoms like paralysis and epilepsy (neurocysticercosis). The disease is found throughout the world, especially in pork eating countries with low socio-economic development like Latin America, southern Africa, south east Asia and the Indian subcontinent. *Taenia hydatigena* and *T. ovis* occur in the small intestine of dog, wolf and other wild carnivores. The intermediate hosts are domestic and wild ruminants, particularly sheep and goat. *Taenia pisiformis* occurs in the small intestine of dog, fox, several wild carnivores, cat and the intermediate hosts are rabbits, hares and rodents. The extent of transmission from wild animals to domestic animals and vice-versa depends upon the proximity of the two.

4. Giardiasis:
Giardia is a very common parasitic infection and its prevalence is increasing in the human population, particularly in the tropics. Transmission occurs by diverse modes, out of which faecal-oral and water-borne transmissions are most common. Humans and a variety of lower animals including wild ones naturally share this parasite. The symptoms include enteritis and mucus dysentery particularly in children.

5. Toxoplasmosis:
This is an important emerging zoonosis in which wild and domestic cats may be the source of infection for man through faecal contamination of environment and ingestion of the infective stage, cocyst. Wild felids like jaguar, ocelot, leopard, bobcat and lynx are the definitive hosts while all warm blooded animals including man act as intermediate hosts. The syndrome in human beings is characterized by lymphadenitis,chonoretinitis and abortions.

6. Ancylostomiasis:
Hookworms namely *Ancylostoma caninum, A. braziliense* and *A. ceylanicum* affect dog, fox, wolf cat and other wild carnivores and occasionally man. They are capable of producing cutaneous larva migrans syndrome in humans (Kalkofen, 1987). Ordinarily the lesions are self-limiting and the intense pruritis subsides in a few days or weeks. However, in some cases the larva may penetrate into deeper tissues and set up visceral larvae migrans with variable symptoms depending upon the organ involved. An additional source of infection to dogs and cats is rodents, the paratenic hosts.

7. Toxocariasis:
Larvae of ascarids of dogs and cats and occasionally those of wild canids and felids cause visceral larva migrans, especially in children who have the habit of dirt eating. In endemic areas the soil is heavily contaminated with *Toxocara* eggs. The disease is usually subclinical and self-limiting. Clinical features consist of pronounced and prolonged eosinophilia associated with hepatomegaly, fever and pulmonary symptoms. Ocular larva migrans with manifestation of endophthalmitis, retinal granuloma and chorioretinitis is another syndrome due to *Toxocara* larvae.

8. Fascioliosis:
Fasciola hepatica, the cause of liver fluke disease or liver rot in domestic ruminants is cosmopolitan in distribution and occasionally occurs in wild animals like hare, rabbit, beaver, coypu, elephant and kangaroo and also in man. The intermediate hosts are snails (*Lymnaea* sp.). Man is infected primarily by eating watercress contaminated with metacercariae. The symptoms in human beings are malaise, intermittent fever, weight loss, pain under the right costal margin and often pruritis with eosinophilia.

9. Sacrocystosis:
Certain species of *Sarcocystis* can cause abortion, reduced milk production, wool breakage, weight loss, lameness, retarded growth and even death in farm animals. In *S. cruzi* affecting cattle and bison, the infection is through ingestion of infective stage from the faeces of dogs, coyote, wolf, and fox. Similar is the case with *S. tenella* of sheep, *S. capracanis* of goat and *S. mieschenana* of pig. Occasionally man may be affected with nausea, stomach pains and diarrhoea through ingestion of *Sarcocystis* infected pork or beef (Dubey and Fayer, 1983).

Before concluding, it must be mentioned that literature on parasites of wildlife and zoo animals is scanty in India so far and published reports are extremely few and far between (Rajasekariah *et al.*, 1971; Chauhan *et al.*, 1973; Ray, 1988; Rao *et al.*, 1989). In view of the richness of wild fauna in this country, this is an anomalous situation. Because of increasing interaction the threat to the well being of human beings and domestic animals from the depradations of these parasites is real. Consequently, there is a need for stimulus to work on this fruitful, rewarding and as-yet virgin field of research.

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Reprint : Zoos' Print, 12 (4) : 8-11, April, 1997

SEASONAL EFFECT ON THE PREVALENCE OF PARASITIC ZOONOTIC DISEASES AMONG ZOO ANIMALS OF BIHAR

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ABSTRACT

Seasonal influence on the parasitic infection in both herbivorous and carnivorous animals showed that the maximun percentage of infection was observed in monsoon season and minimum in summer. Cent per cent parasitic infection was observed in elephant, capped langur, golden cat and wolf. All other zoo animals showed the infection rate varying from 12.5 to 75 %. The influence of seasonal prevalence was more pronounced in case of rhinoceros on spotted deer, golden langoor, monkey, tiger, clouded leopard, leopard cat and bear.

INTRODUCTION

The spectrum of parasitic diseases in wild animals is of great importance both to human and veterinary medicine. The wild animals and their domestic counterparts suffer from ill effects of a wide variety of helminths and protozoa. Under captivity the health status of the zoo animals varies on different factors such as management, feeding, sanitation and seasonal variation. A higher seasonal prevalence of various parasites during rainy and winter seasons has been reported by Chauhan *et al.* (1973).

The present study was an attempt to record the effect of different season on the prevalence of different endoparasites in Zoo animals of Bihar.

MATERIAL AND METHOD

Zoo animals (105 herbivores and 80 carnivores) belonging to Sanjay Gandhi Biological Park (SGBP), Patna and Jawahar Lal Nehru Biological Park (JNBP), Bokaro Steel City served as materials for this present investigation. The prevalence of parasitic infections recorded during various months of the year (1992-1993) has been pooled together for presentation into four seasons i.e. monsoon (August, September and October), winter (November, December and January), spring (February, March and April) and summer (May, June and July). As informed by zoo authorities, it is customary to do routine deworming.

The sample of each animal was collected from their individual cage. Fresh faecal samples were collected. Sufficient care was taken to have the middle portion of fresh faecal sample with the clean, sterile wooden stick into a clean, sterile small plastic vials to keep awary extraneous material from soil. The container was filled to its capacity and was tightened as close to the faeces to avoid the developing and hatching of eggs. The vials were properly labelled and brought to laboratory within an hour of collection. The examination of faecal samples were done for different helminthic ova and protozoal cysts by conventional methods. The prevalence of different parasitic infections among zoo animals were worked out and was statistically analysed.

RESULTS

The results revealed that 46.67 % of the herbivores to be positive for parasitic infection whereas 50 % carnivorous animals were found infected with parasitic diseases. The overall infection rate of parasites among zoo animals of Bihar was found to be 48.11 %.

The result of seasonal influence on the parasitic load in both herbivorous and carnivorous animals (Table 1) showed that maximum percentage of infection was observed during monsoon in both herbivores (46.59%) and carnivores (49.29%) and minimum in summer season (herbivores 41.93% and carnivores 33.33%).

The percentage occurrence of parasitic infection in different species of herbivorous animals at different seasons has been presented in Table 2. From this table, it appears that in all the season 100% infection was observed in all elephant and capped langur. Hippopotamus and gibbons were found negative for any parasitic infection during the whole year. Apart from this, the rhinoceros, mithun and golden langur as well as common langur showed the infecton rate above 50% in most part of the year. Surprisingly, the herbivorous animals i.e. nilgal, black buck and samoar maintained on range pastures, showed such less rate of infection as compared to other herbivorous animals. From the analysis of the results obtained, there appears to be no different pattern of the seasonal influence on parasitic infection in this group of animals (Table 2).

Table 1. Seasonal influence on the prevalence of parasitic infection of zoo animals of Bihar.

Group of animal	Season	No. of animal examined	No. of animal found +ve	% of infection	Value of X^2 3 d.f.
Herbivores	Monsoon	88	41	46.59	
	Winter	95	41	43.16	
	Spring	90	38	42.22	
	Summer	93	39	41.93	
		366	159	43.44	0.499
Carnivores	Monsoon	71	35	49.29	
	Winter	72	35	48.61	
	Spring	76	32	42.10	
	Summer	69	23	33.33	
		288	125	43.40	4.699

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The picture of parasitic infection in carnivorous animals (Table 3) showed that the single wolf and golden cat maintained at the zoo were found infected with parasitic worms. On the contrary, the jungle cat and khatas were found negative for any parasitic infection. All other categories of carnivorous animals showed infection rate varying from 20% (in case of hyaena) to 61.53 % (in clouded leopard). The seasonal prevalence were more pronounced in case of tiger, leopard, fishing cat and bear. However, lion, leopard cat and Indian fox showed 30.30, 40.74 and 36.36% infection respectively.

DISCUSSION

Many wildlife species are now known potential reservoirs of infectious and parasitic agents which are harmful to man and livestock (Zoonosis) (Pathak, 1991). On the basis of available literature it can also be judged that the parasitic infestation causes considerable losses of wildlife in this country (Srivastava and Pandey, 1965, Arora and Das, 1988, Dutta *et al.*, 1990) in the present investigation. The effect of season on the prevalence of parasitic Zoonosis occurring in a number of important wild animals maintained under captivity in India is scanty, however, the present observations will serve as an adjunct to the previous findings.

Seasonwise prevalence of parasitic infection in various species of herbivorous animals was higher in all the seasons i.e. monsoon, winter, spring and summer season as compared to carnivorous animals (Table 1). Statistical analysis revealed no significant effect of season on the prevalence of parasites both in herbivourous and carnivorous animal (X^2 = 0.499 and 4.699 at 3 d.f., respectively). A number of speceis e.g. elephant and capped langur maintained at the zoo showed 100% infection throughout the year (Table 2). In contrast to this, among the carnivorous animals 100% infection was found only in Golden Cat (Table 3). The infection rate was found to be constant throughout the year in both herbivorous and carnivorous animals (Tables 2&3). It is evident from Table-2 that statistically the season has no significant effect on the prevalence of parasitic infection. However, the highest percentage of infection in rhinoceros, mithun, black buck and spotted deer was found more in monsoon, whereas in sambar and golden langoor it was in winter and in monkey in summer. In nilgai in both spring and summer, infection rate was higher. Chauhan *et al.* (1973) observed higher prevalence of parasitic infection during rainy and winter season where as the peak figures for taenids occured in autumn and in non-taenids it was in winter (Coman, 1973).

No significant relation were found among different species of carnivores, maintained at the zoo, except that the infection was lowest during summer season in almost all the categories of wild animals (Table 3). Similar results were also reported by Gaur *et al.* (1979). Results presented in Table 1 to 3 indicates that there is no specific period during the year, when the infection rate of a particular species of wild animal becomes abnormally high. This may be due to the fact that most of the herbivorous and carnivorous wild animals maintained under captivity are stall fed and once they acquire infection through food and water they remain infected for most part of the year irrespective of seasonal variation. This factor might have been different in the same speceis of wild animals present in free forest and such comparative study could be carried out to establish the role of sesonal factors on the influence of parasitic worm load in wild animal. Srivastava *et al.* (1990) also found a lower incidence of parasitic infection during the winter season as compared to monsoon in a number of wild species. Similar observation has also been made by Horak (1979) and Schellner (1979). Srivastava *et al.* (1990) opined that the effect of seasonal incidence on parasitic infection may be dependent on the source of food and water supply throughout the year. This might be nearer the truth but can not be said definitely in absence of critical experimental study.

ACKNOWLEDGEMENTS:

The authors are thankful to the Director, Sanjay Gandhi Zoological Park, Patna and Jawaharlal Nehru Biological Park, Bokaro Steel City for providing necessary facilities.

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Table 2. Seasons influence on the prevalence of parasitic infection among herbivorous zoo animals of Bihar.

Animal	Seasons	Number of animals examined	Number of animal found positive	% of infection	Value of X^2, d.f.
Elephant *(Elephas maximus)*	Monsoon	3	3	100.00	
	Winter	3	3	100.00	
	Spring	3	3	100.00	
	Summer	3	3	100.00	
		12	12	100.00	0.000
Genda *(Rhinoceros unicornis)*	Monsoon	4	3	75.00	
	Winter	5	3	60.00	
	Spring	4	2	50.00	
	Summer	5	2	40.00	
		18	10	55.56	1.192
Mithun *(Bos gaurus frontalis)*	Monsoon	1	1	100.00	
	Winter	2	1	50.00	
	Spring	2	1	50.00	
	Summer	2	1	50.00	
		7	4	57.14	0.877
Nilgai *(Boselaphus tragocamelus)*	Monsoon	13	3	23.08	
	Winter	13	3	23.08	
	Spring	15	4	26.67	
	Summer	15	4	26.67	
		56	14	25.00	0.094
Black buck *(Antilope cervicapra)*	Monsoon	9	3	33.33	
	Winter	11	3	27.27	
	Spring	8	2	25.00	
	Summer	10	2	20.00	
		38	10	26.31	0.445
Sambar *(Cervus unicolor)*	Monsoon	16	5	31.25	
	Winter	18	6	33.33	
	Spring	16	4	25.00	
	Summer	17	4	23.53	
		67	19	28.36	0.568
Spotted deer *(Axix axis)*	Monsoon	18	10	55.55	
	Winter	18	8	44.44	
	Spring	16	6	37.50	
	Summer	17	6	33.29	
		69	30	43.48	1.770
Capped langoor *(Presbytis pileatus)*	Monsoon	4	4	100.00	
	Winter	5	5	100.00	
	Spring	4	4	100.00	
	Summer	5	5	100.00	
		18	18	100.00	0.000
Golder langoor *(Presbytis geei)*	Monsoon	4	2	50.00	
	Winter	3	3	100.00	
	Spring	4	3	75.00	
	Summer	4	3	75.00	
		15	11	73.33	2.214
Common langur *(Presbytis entellus)*	Monsoon	13	7	53.85	
	Winter	14	6	42.85	
	Spring	15	9	60.00	
	Summer	12	9	75.00	
		54	31	57.41	2.840

Table 3. Seasonal influence on the prevalence of parasitic infection among carnivorous zoo animals of Bihar.

Animal	Seasons	Number of animals examined	Number of animal found positive	% of infection	Value of X^2_3 d.f.
Lion (*Panthera leo*)	Monsoon	8	2	25.00	
	Winter	8	3	37.50	
	Spring	9	3	33.33	
	Summer	8	2	25.00	
		33	10	30.30	0.447
Tiger (*Panthera tigris*)	Monsoon	14	9	64.29	
	Winter	14	8	57.14	
	Spring	16	8	50.00	
	Summer	13	5	38.46	
		57	30	52.41	1.967
Leopard (*Panthera pardus*)	Monsoon	1	5	45.45	
	Winter	12	7	58.33	
	Spring	13	7	53.84	
	Summer	12	5	41.67	
		48	24	50.00	0.834
Clouded leopard (*Neofelis nebulosa*)	Monsoon	3	2	66.67	
	Winter	4	3	75.00	
	Spring	3	2	66.67	
	Summer	3	1	33.33	
		13	8	61.53	0.783
Golden cat (*Felis temmincki*)	Monsoon	1	1	100.00	
	Winter	1	1	100.00	
	Spring	1	1	100.00	
	Summer	1	1	100.00	
		4	4	100.00	0.000
Fishing cat (*Felis vivemna*)	Monsoon	2	1	50.00	
	Winter	2	1	50.00	
	Spring	2	1	50.00	
	Summer	2	1	50.00	
		8	4	50.00	0.000
Leopard cat (*Felis bengalensis*)	Monsoon	7	4	57.14	
	Winter	6	3	50.00	
	Spring	7	2	29.57	
	Summer	7	2	28.57	
		27	11	40.74	1.851
Indian fox (*Vulpes bengalensis*)	Monsoon	3	1	33.33	
	Winter	3	1	33.33	
	Spring	2	1	50.00	
	Summer	3	1	33.33	
		11	4	36.36	0.198
Wolf (*Canis lupus*)	Monsoon	1	1	100.00	
	Winter	1	1	100.00	
	Spring	1	1	100.00	
	Summer	1	1	100.00	
		4	4	100.00	0.000
Hyaena (*Hyaena striata*)	Monsoon	8	2	25.00	
	Winter	7	2	28.57	
	Spring	8	1	12.50	
	Summer	7	1	14.29	
		30	6	20.00	0.766
Bear (*Selenarctos* sp.)	Monsoon	10	7	70.00	
	Winter	9	5	55.56	
	Spring	10	5	50.00	
	Summer	9	3	37.50	
		37	20	54.05	1.980

PARASITES OF WILDLIFE - I

A PRELIMINARY INVESTIGATION ON THE PARASITES OF WILD ANIMALS AT THE ZOOLOGICAL GARDEN, THIRUVANANTHAPURAM, KERALA

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Abstract

A survey of parasites of wild mammals in the Zoological Garden, Thiruvananthapuram, based on faecal examination revealed that 74 per cent of the wild animals were harbouring helminthic infections including protozoan infections in 23 per cent of the cases. Strongyle, amphistome, *Strongyloides* and *Fasciola* in herbivores, *Ancylostoma*, *Toxascaris*, *Diphyllobothrium* and *Paragonimus* in carnivores and strongyle, *Strongyloides* and *Hymenolepis* in omnivores were the infections noted to be specifically present.

Introduction

Zoological gardens exhibit wild animals for aesthetic, educational and conservation purposes. Parasitic diseases constitute one of the major problems causing even mortality in wild animals in captivity (Rao & Acharjyo, 1984).

Inadequate information on diseases and parasites of zoo animals is a major limiting factor in zoological gardens (Rajasekhariah *et al.*, 1971). A regular programme of disease surveillance and control measures based on correct diagnosis, effective treatment and proper prophylaxis would certainly reverse the situation.

The present investigation has been undertaken as a pioneer study in this context at the Thiruvananthapuram Zoo. The Zoo maintains about 240 wild animals belonging to 35 species of mammals and are claimed to be maintained in good condition.

Material and Methods

One hundred and twenty seven fresh faecal samples were collected from the wild animals kept in individual enclosures and mixed species exhibits. The collected samples were immediately preserved in 2 per cent potassium dichromate and 5 per cent formaldehyde. Then the samples were processed with concentration method of centrifugation-cum-sedimentation technique and examined for parasitic infections. The results are presented in Table 1.

Received 24 February 1999; Accepted 9 November 1999

Results and Discussion

Out of the 127 samples examined, 97 samples (76%) were found positive for parasitic infections, of which 94 samples (97%) had helminthic infections and three samples (3%) had protozoan infections. Among helminth infections, 62 animals (66%) were found to have single or monoinfection with one species of the helminths (viz. trematode, cestode or nematode) and 32 animals (34%) were found positive for more than one species of parasite (multiple infections). Twenty-two samples had protozoan infections as well as helminthic infections. When compared to helminthic infections, the enteric protozoan infections were of lesser magnitude.

Of all the helminthic infections in herbivores, strongyle and amphistome infections were found to be higher in Bovidae and in certain species of Cervidae. Other infections observed in order of prevalence in a variety of herbivores were ascarid, *Strongyloides*, spirurid and *Fasciola*. Among carnivores, *Ancylostoma* and *Toxascaris* were the major infections found in lions, leopards, tigers and jackals. Heavy *Diphyllobothrium* and *Paragonimus* infections were also present in a male leopard. *Isospora* and *Balantidial* cysts were found along with helminthic infections in lions and leopards respectively. In the case of omnivores, strongyle, *Strongyloides*, spirurid, *Fasciola* and *Hymenolepis* were the major helminthic infections. Entamoebic and Balantidial cysts and coccidial oocysts were also observed.

Observations made in the present study based on faecal examinations were comparable with those of some of the recent similar surveys. Occurrence of ancylostome and ascarid infections in wild carnivores like lion, leopard, tiger and jackal have been reported by many workers (Gaur *et al.*, 1979; Chauhan *et al.*, 1973; Adkoli *et al.*, 1986; Muraleedharan *et al.*, 1990), an indication of the unhygienic conditions maintained in the

enclosures. The presence of *Paragonimus* infection in leopards has been reported by Pythal *et al.* (1993) during the postmortem of a wild Indian Leopard. This species could be an important natural reservoir host of *Paragonimus*, playing a significant role in the epidemiology of this major zoonotic parasite. Occurrence of strongyle, *Fasciola* as well as amphistome in herbivores like deers, Mithun, Hippopotamus, Nilgiri Tahr, Giraffe and also strongyle, *Strongyloides* and coccidial infections in omnivores like Wild Boar, porcupines, macaques and bears have also been reported in earlier surveys (Gupta, 1974; Tripathy *et al.*, 1971; Muraleedhran *et al.*, 1990; Reddy *et al.*, 1992).

The present study showed that the helminths and protozoans present in the wild animals examined were far less significant as manifesters of clinical disorders. However, Muraleedhran *et al.* (1990) have stated that helminthic or sub-clinical coccidial infections might not cause any immediate alarming signs of disease but in the long course, they might produce ill effects such as emaciation and general weakness which would in due course be responsible for inviting other pathogens. Although deworming is reportedly carried out at the Zoo twice annually, it was apparent from the results of the study that the efficacy of the same was not being ensured. Therefore, even low grade infections should not be neglected and conducting epizootiological surveys are necessary to study the prevalence of parasitic infections. The results of this study may invite a more comprehensive study into the epidemiology, pathogenesis, treatment and prophylaxis of parasite diseases in wild mammals.

Acknowledgement

The authors thank Dr. V. Ramesh, M.V. Sc. for his presence during the collection of samples; the Director, the Superintendant and the Veterinary Officer of the Zoological Garden, Thiruvananthapuram, for their help and also the Dean of the College of Veterinary and Animal Sciences, Mannuthy, for the facilities provided.

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Table 1. Prevalence of parasitic infections in the animals of the Zoological Garden, Thiruvananthapuram.

Hosts	No.of animals at zoo	No. of animals examined	Samples found positive for parasitic infection	Helmiathic infection: Samples showing single infection	Helmiathic infection: Samples showing mixed infection	Helmiathic infection: Type of infection **	Protozoan infection: No. having also helminth infection	Protozoan infection: No. having no helminth infection	Protozoan infection: Type of infection **
Herbivores									
Spotted Deer *Axis axis*	50*	23	18	9	9	Strongyle (6) Strongyloides(1) Amphistome (7) Spirurid (9) Ascarid (4)	3	-	Coccidia (3)
Sambar *Cervus unicolor*	36*	16	12	8	4	Strongyle (5) Strongyloides (1) Amphistome (5) Spirurid (3) Ascarid (2)	3	-	Coccidia (3)
Hog Deer *Axis porcinus*	19*	12	5	4	1	Strongyle (4) Capillaria (1) Spirurid (1)	-	-	-
Blackbuck *Antilope cervicapra*	13*	9	7	7	-	Strongyle (4) Strongyloides (1) Amphistome (2)	2	-	Coccidia (2)
Barking Deer *Muntiacus muntjak*	5*	2	2	2	1	Strongyle 2-types (2) Spirurid (1)	-	-	-
Nilgiri Tahr *Hemitragus hulocrius*	2	2	2	-	2	Strongyle (2) Spirurid (2)	-	-	-
Nilgai *Boselaphus tragocamelus*	6*	3	-	-	-	-	-	-	-

Hosts	No.of animals atzoo	No. of animals examined	Samples found positive for parasitic infection	Helminthic Infection: Samples showing single infection	Samples showing mixed infection	Type of infection **	Protozoan infection: No. having also helminth infection	No. having no helminth infection	Type of infection **
Cape Buffalo *Syncerus caffer*	2	2	2	1	1	Toxocara Amphistome (1) Strongyle (1)	-	-	-
Mithun *Bos sondaicus*	5	3	3	3	-	Amphistome (3)	1	-	Coccidia (1)
Giraffe *Giraffa camelopardalis*	1	1	1	-	1	Strongyle Spirurid (1)	-	-	-
Hippopotamus *Hippopotamus amphibius*	4	2	2	1	-	Stronglye (1)	1	1	Coccidia (2)
Indian Rhinoceros *Rhinoceros unicornis*	2	2	2	1	1	Fasciola Amphistome (1) Spirurid (2)	2	-	Coccidia (2)
Asian Elephant *Elephas maximus*	1	1	1	1	-	Strongyle (1)	1	-	Ciliates (1)
Hare *Lepus nigricollis*	1	1	1	1	-	Spirurid (1)	-	-	-
Omnivores									
Wild Boar *Sus scrofa*	19*	15	15	9	5	Fasciola (2) Strongyle (10) Strongyloides (5)	5	1	Entamoeba (3) Balantidium (3)
Palm Civet *Viverricula indica*	1*	1	1	1	-	Spirurid (1)	-	-	-
Hyaena *Hyaena hyaena*	2	2	2	2	-	Toxocara (1) Strongyle (1)	-	-	-

Hosts	No.of animals at zoo	No. of animals examined	Samples found positive for parasitic infection	Helminthic infection: Samples showing single infection	Helminthic infection: Samples showing mixed infection	Type of infection **	Protozoan infection: No. having also helminth infection	Protozoan infection: No. having no helminth infection	Type of infection **
Porcupine *Hystrix indica*	7*	5	5	2	3	Strongyloides (5) Strongyle (3) Hymenolepis (1)	2	-	Coccidia (2)
Rhesus Macaque *Macaca mulatta*	2	2	-	-	-	-	-	-	-
Bonnet Macaque *Macaca radiata*	9*	3	1	-	-	-	-	1	Coccidia (1)
Pig-tailed Macaque *Macaca nemestrina*	1	1	1	-	1	Strongyle Strongyloides Spirurid (1)	-	-	-
Sloth Bear *Melursus ursinus*	2	2	2	2	-	Strongyle (2)	-	-	-
Toddy Cat *Paradoxurus hermaphroditus*	2	2	2	2	-	Strongyle (2)	-	-	-
Carnivores									
Jungle Cat *Felis chaus*	1	1	1	1	-	Toxocara (1)	-	-	-
Jackal *Canis aureus*	6*	3	3	3	-	Ancylostoma (3)	-	-	-
Indian Fox *Vulpes vulpes*	1	1	-	-	-	-	-	-	-
Lion *Panthera leo*	15	5	2	2	-	Toxascaris (2)	1	-	Isospora (1)
Tiger *Panthera tigris*	5	2	2	-	2	Ancylostoma (2) Strongyloides(2) Toxocara (1)	1	-	Balantidium (1)

Hosts	No. of animals at zoo	No. of animals examined	Samples found positive for parasitic infection	Helminthic infection			Protozoan infection	
				Samples Showing single infection	Samples showing mixed	Type of infection **	No. having also helminth infection	No. having no helminth infection
Leopard *Panthera pardus*	2	2	2	1	1	Toxascaris (2), Diphyllbothrium Paragonimus (1)	-	-
Giant squirrel *Ratufa indica*	1	1	-	-	-	-	-	-
Total percentage in parentheses		127	97(76)	62(66)	32(34)		22(23)	3(3)

* Animals were maintained in groups

** Figures in parentheses indicate the number of animals infected.

A SURVEY OF GASTRO-INTESTINAL PARASITES OF WILD ANIMALS IN CAPTIVITY IN THE V.O.C. PARK AND MINI ZOO, COIMBATORE

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Abstract

Indian zoo animals are exposed to and susceptible to many parasitic diseases, a fact of much concern albeit few data from cursory examination and postmortem studies. A typical mini zoo in Coimbatore was surveyed for gastro-intestinal parasites of wild animals by examining 60 fecal samples. The examination revealed a high percentage (58%) of captive animals were positive specifically for helminth parasitic infections and some (6%) were positive for protozoan infections. *Strongyle*, *Trichuris*, *Strongyloides* as well as *Coccidia* were present in case of herbivores and *Toxocara*, *Ancylostoma* as well as *Artyfechinostomum* in case of carnivores.

Introduction

Zoo animals living under captivity are susceptible to almost all types of diseases, much so that parasitic diseases, particularly helminthic infections, can frequently be a major problem in zoo animals. Information on parasites of wild animals is meagre due to paucity of systematic investigation. The available data appear rather scanty and are based almost entirely on cursory examination and findings from autopsies. However, there is no dearth of reports of the existence of a number of helminthic and protozoan infections in zoo and wild animals in the Indian subcontinent. Adkoli *et al.* (1986), Gaur *et al.* (1979), Maske *et al.* (1990), Khan (1979) and Muraleedharan *et al.* (1990) conducted surveys of parasitic infestations based either on faecal or on post-mortem examinations of mammals, reptiles and birds of various Zoological Gardens, National Parks and Wildlife Sanctuaries in India.

The present paper deals with the prevalence of parasitic infections in the wild animals present in the V.O.C. Park and Mini Zoo, Coimbatore, maintained by the Corporation of Coimbatore.

Materials and Methods

Sixty fresh faecal samples were collected from the animals kept in separate enclosures, as well as from those kept in mixed species enclosures. The collected samples were immediately preserved with solution containing 5% formalin and 2% potassium dichromate. Then the samples were brought to the laboratory, processed using the concentration method of centrifugation-cum-sedimentation technique and examined for parasitic infections. The results are presented in Table 1.

Results and Discussion

The results of host-wise examination of the faecal samples are incorporated in Table 1. Out of the 60 animals examined 35 (58%) were found to be positive for parasitic infections, of which all 35 animals had helminth infection and three (6%) animals also had intestinal protozoan infection. Among helminthic infections, the prevalence of nematode infections was higher when compared to those of cestode and trematode infections.

Among the infected animals, herbivores showed multiple infections with more than one helminth parasite. *Strongyle* and *Trichuris* were the most commonly found parasite ova in the herbivores. Other infections observed in herbivores were ascarid, *Moniezia*, spirurid, *Strongyloides*, *Coccidia* and *Balantidium*. Among carnivores, *Toxocara* and *Ancylostoma* were the significant infections specifically present. Other infections such as spirurid, *Strongyloides* and *Artyfechinostomum* were also observed in carnivores.

The existing infections can be controlled by adopting suitable antihelmintic therapy and managemental procedures, but the possibility of recurrence is always there due to stress and also due to the closer proximity animals in a very small area. The possibility of transmission of zoonotic infections among the animals and the keepers also exist and requires investigation.

Acknowledgement

We thank Dr. Latha K. Shiva, M.V.Sc., for the valuable information, the Director and staff of the V.O.C. Park and Mini Zoo for the co-operation and help during the collection of materials, Dr. C. Pythal for the suggestions and the Dean for the facilities provided.

Received on 1 November 1999 *Accepted on 4 March 2000*

Table 1. Prevalence of parasites in the wild animals at the Coimbatore mini zoo

Host	No. of animals at the Zoo	No. of animals examined	No. of animals infected	Identification **
1 Spotted Deer	13*	7	4	*Strongyle* and *Trichuris* (1), *Strongyle* (1), Ascarid (1), *Coccidia* (1)
2 Sambar	7*	5	1	*Moniezia* (1)
3. Assamese Goat	12*	7	5	*Trichuris* (2), *Strongyle* (3)
4 Camel	2	2	2	*Trichuris*, Spirurid and *Coccidia* (1), *Strongyle*, Spirurid and Balantidial cysts (1)
5 Guinea Pig	32*	12	6	*Strongyle* (3), *Strongyloides* (2), Spirurid (1)
6 Tiger	1	1	-	-
7 Lion	3	2	2	*Toxocara* (2)
8 Sloth Bear	2	2	-	-
9 Hyaena	1	1	-	-
10. Porcupine	2	2	2	Spirurid (1) *Strongyloides* and *Coccidia* (1)
11 Bengal Fox	1	1	1	*Ancylostoma* (1)
12. Jackal	10*	5	5	*Ancylostoma* (5)
13 Jungle Cat	1	1	1	*Ancylostoma* and Spirurid (1)
14 Civet Cat	3	3	3	Spirurid and *Artyfechinostomum* (3)
15 Pig-tailed Monkey	1	1	-	-
16 Bonnet Monkey	10*	4	1	*Strongyle* and *Strongyloides* (1)
17 Rhesus Monkey	5*	3	2	*Strongyloides* (2)
18 Nilgiri Langur	1	1	-	-
Total (%)	107	60 (100)	35 (58)	

* Animals maintained in groups

** Figure in parentheses indicates the number of animals infected.

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Volume XV Number 6 June 2000

CASE REPORT ZOOS' PRINT JOURNAL 15(6): 279-280

A COPROLOGICAL SURVEY OF PARASITES OF SEVEN MAMMAL GROUPS AT SILENT VALLEY NATIONAL PARK, KERALA

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Abstract

During an ecological study in Silent Valley National Park, fecal samples of seven mammalian taxa were collected and analysed for parasites. The analysis revealed that Lion-tailed Macaques, Nilgiri Langur, Leopard, Porcupine, Small Indian Civet and Toddy Cat were hosts to nematodes, except Sloth Bear. Cestode infestation was recorded from Porcupine and Small Indian Civet and trematodes were found in the feces of Leopard and Toddy Cat.

Introduction

Silent Valley National Park is a rectangular table land in the southwestern corner of Nilgiris and is considered one of the most valuable gene reserves of the country. This 8,952 ha pristine forest of Kerala State lies between the latitudes of 10°15' and 11°25'N and the longitudes 76°21' and 76°33'E. The height varies from 658 to 2383 m. The average ambient temperature is 23.8°C and a rainfall above 3000 mm. Out of the 60 species of mammalian fauna in the forests of Kerala, around 40 species are among the better known large and medium sized ones (Balakrishnan & Xavier, 1995). The ecological insulation of this National Park provides abode to many a number of mammals that have become extinct elsewhere.

In conjunction with an ecological study in the Silent Valley National Park, fecal samples were collected from the Lion-tailed Macaque (*Macaca silenus*), Nilgiri Langur (*Trachypithecus johnii*), Sloth Bear (*Melursus ursinus*), Leopard (*Panthera pardus*), the Indian Porcupine (*Hystrix indica*), the Small Indian Civet (*Viverricula indica*), and the Common Palm Civet or Toddy Cat (*Paradoxurus hermaphroditus*) for a parasitological investigation.

Materials and Methods

As part of an ecological survey conducted in the Silent Valley National Park, between June 1994 and December 1994, forty five fresh fecal samples were collected along tracks, roads, trails and river sides. It was identified to be of seven different mammal groups. When defecation was not directly observed, samples were differentiated by their size, animal presence and presence of scraps associated with them (Rabinowitz & Walker, 1991). Samples preserved in 10% formalin, were examined for parasite eggs, larvae, cysts, and oocysts by centrifugal salt floatation and sedimentation techniques.

Results and Discussion

Analysis of the samples indicated that parasitism was highly prevalent among many of the mammal groups in this National Park. Forty two of the 45 samples were found to be positive for parasitism. The prevalance of various species of parasites and the probable identity of those parasites are presented in Table 1. Of the 45 samples examined 58 per cent were found positive for parasites.

All Lion-tailed Macaque fecal samples collected were infected with nematodes of *Trichuris* species and *Oesophagostomum* species. Presence of *Trichuris* species was more when compared to the *Oesophagostomum* species. The presence of the two nematode parasites may be related to the feeding habit of the Lion-tailed Macaques. They are arboreal and infected animals can contaminate all feeding material in the process of their defecation from the tree tops, as it gets scattered. The ingestion of food, contaminated with eggs of the parasite and their third stage larvae causes infection (Soubsby, 1982). The same parasites were identified in the fecal samples of Nilgiri Langur which also eats fruits, flowers, leaves, shoots and buds (Balakrishnan & Xavier, 1995).

Nematodes of *Ancylostoma* species and trematodes of *Paragonimus* species were identified from fecal samples of Leopards. These parasites have been commonly reported from wild felids (Patton *et al.*, 1994). Ancylostomes are reported to infect a host through different ways viz. oral, dermal, transcolostural and prenatal routes (Soulsby, 1982; Georgi & Georgi, 1990). The carnivorus feeding habit of Leopards make them susceptible to these parasites.

Porcupines which feed on roots, fruits, and bark are very common in the forests. Nematodes of *Trichuris* species and *Ascaris*

Received on 10 November 1999 *Accepted on 6 April 2000*

Table 1. Parasitic incidence in seven mammal groups of Silent Valley National Park.

Animal	Scientific Name	Sample Size	No. infested	Nematodes	%	Cestodes	%	Trematodes	%
Lion-tailed Macaque	*Macaca silenus*	3	3	*Trichuris* sp. *Oesophagostomum*	66.67 33.33	-	-	-	-
Nilgiri Langur	*Trachypithecus johni*	11	8	*Trichuris* sp. *Oesophagostomum*	87.5 75	-	-	-	-
Sloth Bear	*Melursus ursinus*	2	0	-	-	-	-	-	-
Leopard	*Panthera pardus*	4	3	*Ancylostoma* sp.	100	-	-	*Paragonimus* sp.	100
Porcupine	*Hystrix indica*	5	4	*Trichuris* sp. *Ascaris* sp.	50 50	*Hymenolep* sp.	25	-	-
Small Indian Civet	*Viverricula indica*	8	3	*Ascaris* sp.	66.67	*Diphylobothrium* sp.	33.33	-	-
Toddy Cat	*Paradoxurus hermaphroditus*	12	5	*Ancylostoma* sp.	100	-	-	*Paragonimus* sp.	20

species were identified in the fecal samples collected in the present survey. One sample was positive for *Ancylostoma* ova. Cestodes of *Hymenolepis* species were also identified in one sample.

Among the smaller mammals, Small Indian Civet scat samples contained nematode parasites of *Ascaris* species and cestode parasites of *Dipylobothrium* species. The samples from Toddy Cats had nematodes of *Ancylostoma* species and trematodes of *Paragonimus* species. The Sloth Bear was the only animal in which no parasites could be identified. Low sample size may be a reason for the absence of parasite ova in this animal.

Acknowledgement

The authors thank Dr. K. Madhavan Pillai, Professor and Head, Department of Parasitology, College of Veterinary and Animal Science, Mannuthy, for the help in the present survey.

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INCIDENCE OF GASTRO-INTESTINAL PARASITISM IN FREE LIVING, FERAL BONNET MACAQUE (*MACACA RADIATA* L.)

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Introduction

Among the Prosimians, the Cercopithecinae comprises of the Old World monkeys and their cousins. Primates, especially the members of the sub-family Cercopithecinae and particularly those of the common cercopithecines like the macaques, langurs, baboons etc. inhabit not only forests but also the suburbs of cities and townships. Thus the possibility of disease causing agents being carried by the latter group of inhabitants are of great veterinary as well as human public health importance. The Bonnet Macaque (*Macaca radiata*) is also an experimental model for several bio-medical studies, like cardio-pulmonary, leprotic, auto-immune deficiency, tuberculosis, filarial as well as ethological and other several human diseases.

Practically very little systematic work has been carried out on the prevalence and epizootiology of the disease agents encountable among the monkeys. Pythal (1970) had maintained a male and a female Bonnet Macaques for experimental purposes for 6 years and found these animals positive for *Strongyloides* sp., *Trichuris* sp., *Bertiella* sp., *Eimeria* sp. and a number of species of uncommensal ciliates, some of which were causing a decline in their health condition. It appears that the literature regarding parasites of monkeys are very much scanty and almost wholly unsystematic. A few authors (Adkoli *et al.*, 1986; Jayagobala Reddy *et al.*, 1992; Muraleedharan *et al.*, 1990) have reported parasites such as *Trichuris* sp., Ascarids., *Strongyloides* sp., Strongylids and *Eimeria* sp. among captive Bonnet Macaques in certain zoos but the infestation among free-living Bonnets and especially other free-living monkeys have not been studied systematically.

The present work has been carried out to gain a better understanding on the parasitic disease problems of feral Bonnet Macaques.

Materials and Methods

Free-living feral Bonnet Macaques numbering 32 frequenting the Anjaneyar (Hanuman) temple and sub-urban forests as well as agricultural holdings in Mettala Village of Rasipuram Taluk of Namakkal District of central Tamil Nadu were studied for this purpose. Fresh faecal samples were collected and immediately preserved with solution containing 2% potassium dichromate and 5% formaldehyde. The samples were then brought to the laboratory and screened by sedimentation techniques. The results are given below.

Result and Discussion

Out of 32 samples examined, 30 (90%) were found positive for parasitism and 29 (90%) Macaques had helminthic infections, 16 Macaques (50%) had mixed infections with more than one helminth and protozoan. Among helminths, Strongylids and *Strongyloides* sp. were present in 13 Macaques (40%). Next to these, Ascarids in 11 Macaques (34%), coccidial infections in nine Macaques (28%), Balantidial infections in three samples (6%) were also present. None of the trematode or cestode infections were found in these animals. This indicates that the Strongylids and *Strongyloides* sp. as well as coccidial infections are the major parasitic problems in this free-living feral Bonnets, possibly occurring as sub-clinical infections. All the Bonnet Macaques were active and none of the animals exhibited any obvious clinical illness.

Khera (1979) has stated that wildlife constitutes one of the important reservoirs of numerous infectious diseases for domestic livestock. Since these feral Bonnets come in frequent contact with wild animals in the sub-urban forests and also with the domestic animals in the nearby agricultural holdings, they may act as carriers of transmitting certain infectious diseases including parasitic diseases from wild animals to domestic livestock. However, information in this aspect is meagre and has to be investigated.

Acknowledgement

We thank Shri. S. Rajkumar, M.B.B.S. Student of Perundurai Medical College, Perundurai, Tamil Nadu for enduring help in collecting the materials.

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PINWORM INFECTION IN AN INDIAN PALM SQUIRREL (*FUNAMBULUS PALMARUM*), IN KERALA

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Introduction

Pinworms are very common nematodes infecting the large intestine of man and other animals. Species of the genera *Syphacia* and *Aspicularis* are pinworms of rodents. The present paper reports a very heavy infection of *Syphacia* sp. in an Indian Palm Squirrel. The squirrel found near the college premises appeared very weak, dehydrated and unable to move. It was taken to the laboratory with the intention of nursing but died within few minutes. On autopsy large number of small nematodes were found actually occluding the posterior part of intestine and the gut was practically empty. The worms were collected, washed in a saline solution and cleared in lactophenol to study the morphological characters.

Results and Discussion

The worms were small in size, with distinct lips, prominent posterior bulb for oesophagus and lateral alae. The males had single spicule with an accessory piece.

Male

Male worms were 1.7 to 1.82 mm long and 0.112 mm broad. Oesophagus including the bulb was 0.367 mm long with the bulb alone 0.073 mm in diameter. The spicule was 0.142 to 0.176 mm long and gubernaculum 0.053 mm. The tail was 0.264 mm long. Close to the cloacal aperture were three namelons.

Female

Female worms were larger, 3.66 to 4.1 mm long and 0.264 to 0.337 in breadth. Oesophagus including bulb was 0.396 to 0.47 mm long and the bulb alone 0.122 to 0.156 mm in diameter. Vulva measured 0.882 to 0.95 mm from anterior end and was located in a prominence. The tail measured 0.73 to 0.8 mm long and the eggs in uterus measured 0.078 x 0.025 mm on an average.

The species of *Syphacia* reported in squirrels are *S. thompsoni* (Price, 1928), *S. sciuri* (Mirza and Singh, 1934), *S. lahorea* (Akhtar, 1955), *S. funambuli* (Johnson, 1967) and *S. pennanti* (Parihar & Nama, 1978). The present species resembles *S. sciuri* though the measurements are higher than the original measurements given by the author. Gupta and Kazim (1980) have reported that this species has larger measurements especially the size of spicule when compared to the measurements recorded by Mirza and Singh (1934). Hence the present species is identified as *S. sciuri*.

Though pinworm infection is considered as nonpathogenic, Karpukhin and Kolevatova (1973) regarded *S. thompsoni* infection as a possible natural regulator of squirrel populations. In the present case there were no other lesions in the host except the unusually higher number of worms in the gut with little or no intestinal contents. There were about 30,000 worms and certainly this would have caused the death of the host. The gravid female worms lay eggs in the perianal region and this becomes a continual source of oral infection. The grooming activities of the rodents and the licking or biting of perianal region to relieve the irritation caused by egg laying could have caused the transfer of infective eggs to the mouth.

Acknowledgement

The authors are thankful to the Dean, College of Veterinary and Animal Sciences for the facilities provided for the study.

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Received 24 April 1999; Accepted 15 June 1999

Reprint : Zoos' Print, 3 (7) : 11-12, July, 1988

A Note on the Incidence & control of Microfilariasis in Nehru Zoo

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INTRODUCTION : The adult Filarial round worms occur mainly in the air sacs of thoracic and abdominal cavities of a wide Variety of birds. The larvae of many species known as mico FILARIAE occur in blood (ARNALL, K. KEYME, 1. F 1975) The intermediate hosts are blood sucking insects such as mideges (Culicoides) and black flies (Members of the family simulidae) known as buffalo gnats.

This disease is reported in Falconiforms birds such as Vultures, Secretary birds, Hawks, Falcons, Eagles; Psittaciforms, Eg.Parrots, Parakeets, Lorikeets, Cockatiels, Cookatoos, Budgerigars and a wide variety of passeriform birds. Microfilariasis is also recorded in Twelve (12) passerine birds of Nehru Zoological Park, Hyderabad and is presented in this article (See Table I)

The incidence of this disease is more in summer months, when compare to other seasons. (See Table II). This is mostly due to new arrivals in the month of March/April, from various bird markets of North and North eastern cities of the country The infected birds received at our end are the source of spreading this disease to other species of passerine birds of our zoo.

CASE REPORT :

Nehru Zoological Park. Hyderabad was declared open to the public in the Month of October 1964. At that time and up to February 1970 the following passeriform birds were on the exhibition.

1. BANK MYNA 2. HILL MYNA 3. JAVA SPARROW 4. WHITE ZEBRA FINCH 5. GREY ZEBRA FINCH 6. KOEL 7. BLUE MAGPIE.

In the month of March 1970, few other passerine birds were purchased from the bird markets of Calcutta, Kanpur, Banaras Patna and Lucknow. These birds were quaranteened for a period of seven days, and TERRAMYCINE, antigerm-77 was given to all the birds in drinking water as a prophylactic measure. On the eight day these were released in to large exhibition cages of the zoo but after a few days of release they started dying one after another Autopsies on all the birds were conducted at the Veterinary Biological and Research Institute, Hyderabad, and the heart blood films revealed the presence of numerous microfilae. There was not a single case of microfilariasis in the birds, of the Nehru zoo, Park right from the inception of the Zoo up to February 1970-It is recorded only after the introduction of few species of passeriform birds.

SYMPTOMS :

No specific symptoms except ruffling of the feathers could be detected in the group of birds. Dead birds were only found in the cages in the early morning. When ever a close approach was made to study the symptoms, the birds got alarmed and stated jumping up and down the branches of the shrubs or hopping on the ground. The disease is confirmed after autospy and microscopical examination of the heart blood smears.

TREATMENT AND CONTROL :

HETERAZONE (Diethyl carbamazine citrate) of cyanamide in syrup form gave very encouraging results. The syrup was dissolved in drinking water and was given to the apparently healthy birds, which were in direct contact with the diseased birds.

The dosage is as follows :-

1. **For Prophylactic Treatment**

1 M. L. (24 Mg) of Heterazone syrup in drinking water for 25 birds, for a period of 4 days.

2. **Curative treatment**

1-2- Drops Orally, daily for 3 days

CONTROL A prophylactic dose in drinking water for 4 days before the on set of summer months and at the time when new birds are purchased, has helped in controling the spread of disease to other various species of passeriform as well as psittaciform birds.

SUMMARY

The incidence of MICROFILARIASIS in twelve (12) species of passeriform birds of NEHRU ZOOLOGICAL PARK. HYDERABAD from 1970 to 1977, and its successful treatment with HETERAZONE syrup (Diethyl carbamazine citrate) is described. The disease in recorded only after the introduction of new birds purchased from Bird Markets of Calcutta, Patna, Banaras, Lucknow and Kanpur in March 1970

ACKNOWLEDGEMENT

The authors are thankful to the following Officers for their kind cooperation and encouragement.

1. Sri Pushp Kumar I.F.S. the then curator of the Nehru Zoological Park. Hyderabad.
2. Dr. Vasanth Rao, Joint Director, Vety. Biological and Research Institute Hyderabad.

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TABLE I Showing the details of casuallty in passarine birds due to MICROFILARIASIS spread over a period of Seven (7) Years from 1970—1977.

Sl. No.	Common Name	Scientific Name	No. of Birds Purchase during 1970—77	No. of Birds died (1970-77) due to Microfi-lariasis.	% of Mortality	Remarks
1.	The necklace Laugh -ing thrush.	Garrulax Moniligera	46	5	10.8 %	
2.	The White Crested thrush.	Garrulax Leucolophus	34	14	41.0 %	
3.	The White Throated Laughing Thrush.	Garrulax albogularis	30	5	16.6 %	
4.	The Straited Laughing Thrush.	Grammatoptila Straita.	12	6	50 %	
5.	Pied Myna.	Sturnus contra	7	1	14.2 %	
6.	Blue Magpie.	Cissa Flavirostris	16	4	25.0 %	
7.	Green Magpie.	Cissa Chinensis	6	3	50.0 %	
8.	The Himalayan Red Crownjay.	Garrulus Bispecularis	10	1	10.0 %	
9.	Blue Headed Himalayan Jay.	Garrulus lanceolatus	7	1	14.2 %	
10.	The Indian Rose finch.	Carpodacus erythrinus	9	1	11.1 %	
11.	Gold fronted Chloropsis	Chloropsis aurifrons.	5	1	20.0 %	
12.	The Black Headed 7 Sibia	Leioptila capi	6	1	16.6 %	

TABLE II Casualty due to Microfilariasis among the passerine birds of the Nehru Zoological Park Hyderabad.

SEASON WISE

Sl. No.	Total No. of Casualties From 1970-1977	Summer Season	Winter Season	Rainy Season	Remarks
1	2	3	4	5	6
1	43	39	3	1	

Indian Journal of Parasitology, 1982, **6**(1), 71—72

OPISTHORCHIS BRAHMINII N. SP. FROM BRAHMINI DUCK, *TADORAMA FERRUGINEA*

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(Received September 15, 1981 ; revised February 10, 1982)

During 1979-80 trematodes were collected from the liver of a wild brahmini duck (*Tadorama ferruginea*) kept in captivity in Gauhati. They exhibited the characters of the genus *Opisthorchis* Blanchard, 1895. The specimens were preserved in 10% formalin and the liver sections were cut at 6 μm and stained with haematoxylin and eosin. All measurements are given in mm unless otherwise mentioned.

Opisthorchis brahminii n. sp. (Fig. 1)

Body elongated, maintaining an almost uniform breadth throughout. It measures 19-27 long and 1.5-1.75 wide. Cuticle is smooth. oral sucker is terminal in position and measures 10.149-0.199 × 10.215-0.266. Ventral sucker is 0.185-0.199 × 0.199-0.219 The pharynx measures 0.183-0.215 × 0.182-0.265 and leads to the oesophagus measuring

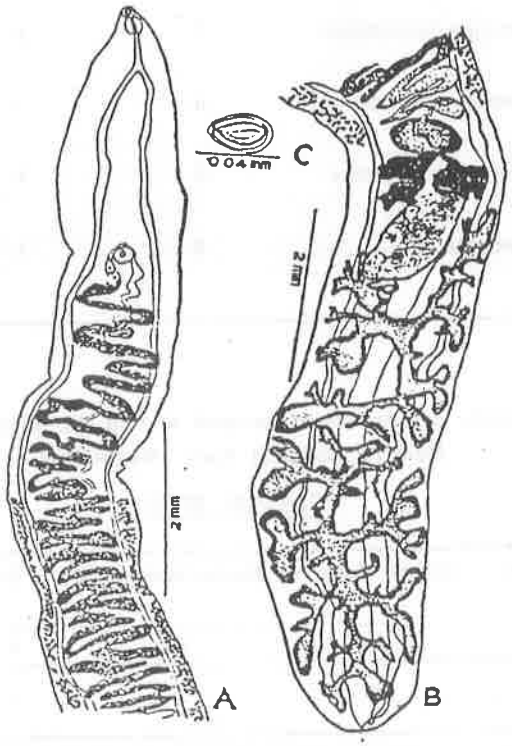

Fig. 1. *O. brahminii*. A—anterior end, B—posterior end and C—egg.

0.215-0.498 in length. Intestinal caeca simple and extended up to the posterior end. Excretory canal is Y shaped and passes dorsally to the testes.

Two testes, which occupy the entire posterior part of the body behind the ovary, are branched and show high polymorphism. Cirrus and cirrus sac are absent and small genital sinus opens immediately anterior to the acetabulum. Ovary lobed. Shell glands are diffuse and distinct. Receptaculum seminis is large and sac shaped. Uterus strongly developed and its convolutions with numerous eggs occupy the region between the ovary and the acetabulum and mostly confined between the intestinal caeca. The oval shaped eggs measure 0.026-0.028×0.016 and contain fully formed miracidium inside. Vitelline glands consist of 7-8 groups of acini, lie laterally on either side of intestinal caeca and begin at about the anterior third or middle of the length of the body to the front of the ovary.

So far eleven valid species of the genus *Opisthorchis* have been reported from birds. Of these, *O. dendriticus* Morgan, 1927 is the only species comparable with the present form in possessing a branched testes. But the testes of the present form show high polymorphism and excretory vesicle is not sigmoid as in *O. dendriticus*. The vitellaria of *O. brahminii*, which are divided up into acini and extend forward, are not present in *O. dendriticus*.

The present species can also be compared with *O. sinensis* (Cobbold, 1875), Loss, 1907, in having a branched testes, but *O. sinensis* is shorter (11.5-20.1) and much broader (2.8-4.6) in size. The vitelline glands in case of *O. sinensis* spread up to the level of the acetabulum and the ovary is not deeply lobed (see Bolding, 1965) as in *O. brahminii*.

The new species is named as *O. brahminii*, after the host.

Grossly small to fairly large areas of necrosis were seen scattered throughout the liver. When incised and cut surface was squeezed, such areas revealed part of the parasitic bodies. Stained sections revealed presence of several parasites in the bile ducts. The bile ducts were distended and the lining epithelial cells were flattened. Focal nodular type of necrotic areas were observed throughout the sections. In some foci, large numbers of ova were seen surrounding the parasites. Histopathological changes observed in the present study corroborate the findings of Ray, Mukherjee, Banerjee and Guha (1975) who reported similar type of changes in the liver of ducks infected with *Opithorchis* sp.

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SYMPTOMATOLOGY AND THERAPY OF ANCYLOSTOMIASIS IN LEOPARDS

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Abstract

A study of faecal samples of ten Leopards at the Nehru Zoological Park, Hyderabad revealed six of them to be positive for ancyclostome ova. Systematic treatment in the form of administering Ivermectin intramuscularly proved good treatment for the infected animals. This paper reports the diagnosis and treatment of the infection in Leopards.

Introduction

Non domestic felids like Leopards (*Panthera pardus*) are one of the more popular zoo exhibits. But captivity imposes a significant stress in these animals too, making them susceptible to various parasitic infections resulting in clinical illness. Hence work was taken up to screen the faecal samples of Leopards belonging to Nehru Zoological Park of Hyderabad and to institute treatment in the positive cases.

Methodology

Faeces from ten Leopards (weighing 30 to 100 kg.) at Nehru Zoological Park was initially screened for helminthic infection by concentration methods and subsequently EPG (eggs per gram of faeces) was calculated on the positive samples by Stoll's dilution method (Stoll, 1923). Clinical symptomatology was recorded in the affected Leopards and were treated with Ivermectin given intramuscularly with the help of blow pipe @ 200 µg/kg body weight. Clinical improvement along with EPG was monitored on days 3 and 7 after therapy and thereafter at weekly intervals for one month.

Results

Out of the ten Leopards examined, six (5 males and 1 female) were found to be positive for ancylostome ova. The animals also exhibited symptoms such as dyspepsia, lethargy, mild pot-bellied appearance, loss of hair (generalised but mild), rough hair coat and passage of blood-tinged slightly loose faeces. EPG in these animals ranged from 500 to 10,900 with a mean value of 4833.3 +/- 1404.8. Some improvement in general condition could be noticed three days following treatment, while the consistency of dung had changed to near normal with the disappearance of blood tinge. At this time the EPG ranged between 0 and 350 with a mean value of 166.67 +/- 47.72. On the seventh day of treatment the general condition of the Leopards improved markedly. The haircoat became almost normal with a smooth texture. Faeces was also totally normal in appearance and no helminthic ova could be detected.

Received on 1 May 2000 *Accepted on 1 July 2000*

Discussion

Based on faecal examination including EPG (4883.3 +/- 1404.8) and clinical symptoms as described previously, the Leopards were diagnosed to be suffering from ancylostomiasis. The clinical symptoms observed were similar to those described by Dakshinkar *et al.* (1994) in dogs. Ivermectin, a well established efficacious endectocide was used to treat the Leopards. Ramisz (1984) and Bagherwal (1992) reported the efficacy of ivermectin in ancylostome infections in domestic carnivores. Ivermectin acts by inducing tonic paralysis of musculature of many parasitic nematodes by modulating gamma aminobutyric acid mediated neurotransmission (Goodman & Gilman, 1996). The dose rate of ivermectin used in the present study (200 µg/kg body weight) was similar to that used in domestic animals. Fowler (1986) felt that as regards to organophosphorus anthelmintics, dosages recommended for the domestic dog and cat can be used even for non-domestic felids of up to 100 kg. body weight, but the total dosage divided and given on two consecutive days. Ivermectin proved quite efficacious in the present study as evident by a gradual but marked improvement in the clinical symptoms by the seventh day of initiation of treatment as well as faecal examination whose EPG was 166.67 +/- 47.72 and 0 (nil) on the third and seventh day respectively following therapy.

The Leopards continued to be in good health with a completely normal faeces containing no helminthic ova during the period of post therapeutic observation, i.e., upto a month.

Conclusion

The symptoms of ancylostomiasis in Leopards are similar to those observed in domestic carnivores and Ivermectin can safely be used to treat the infection @ 200 µg/kg body weight administered parenterally with the help of a blow pipe.

Acknowledgements

The authors are grateful to the Director of Nehru Zoological Park for allowing to undertake the work.

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Reprint : Zoos' Print Journal, 14 (4) : 6, April, 1999

CASE REPORT

ARTYFECHINOSTOMUM MALAYANUM (LEIPER, 1911) MENDHEIM, 1943 FROM A SMALL INDIAN CIVET (*VIVERRICULA INDICA*)

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Subsequent to the first report of *Artyfechinostomum sufrartyfex* by Lane, 1915 from an Assamese girl, several scientists have recorded this fluke not only from more humans but also many non-human animals such as pigs, white rats, honey badgers, dogs and cats (Reddy & Varma, 1950; Srivastava, 1964; Dubey, *et al.*, 1969; Mohandas, 1971; Agarwal & Pande, 1972; Premavati & Pande, 1974). Other species of the genus reported are *A. indicum* (Bhalerao, 1931) Mendheim, 1943 from *Uromastix hardwickii*, *A. mehrai* Jain, 1960 from rats (experimental) and human beings, *A. paradoxuri* Baugh, 1962 from palm civet, *A. varanum* Simha and Deshpande, 1964 from monitor lizard and *A. munshi* Deodhar *et al.*, 1967 from dogs. Leiper (1911) recorded *Echinostoma malayanum* from human beings. This species was later found to infect pigs, house shrews and experimentally white rats, white mice and hamsters (Liekian Joe, 1963). Padmavati and Pande (1974) stated that *E. malayanum* is to be renamed as *Artyfechinostomum malayanum* and be the type species of the genus *Artyfechinostomum*. They have aslo synonymised all the species of the genus including *A. sufrartyfex* with *A. malayanum*.

The present report deals with the finding of *A. malayanum* from a new host, the Small Indian Civet. The civet was under the custody of an animal Welfare activist who rescued it from another place because of inhuman treatment. Till then the animal was kept in his house at Trichur, Kerala for nearly five months. The animal was fed with banana, milk, cooked rice. It consumed food regularly until one day, when the animal became suddenly dull and showed anorexia. The civet died within few days. Postmortem examination revealed the presence of about 58 mature and nearly mature flukes in the intestine which showed severe enteritis. The flukes were processed and stained by acetic alum carmine to study the morphological features.

The flukes were elongated, slightly tapering anteriorly and possessed a head collar with 37-41 collar spines in two alternate rows of which 4-5 were corner spines on either side. The flukes measured 5.89-7.14 mm in length and 1.3-1.6 mm in width. Oral sucker 0.147-0.162 x 0.147-0.183 mm and the ventral sucker fairly large and 0.367-0.892 x 0.294-0.714 mm. Pharynx was almost equal in size to oral sucker and the oesophagus was 0.235 mm long. Testes were tandem and with 7-9 prominent lobes. Anterior one was 0.606-0.749 x 0.642-0.765 mm and posterior 0.749-0.911 x 0.612-0.711 mm. The cirrus sac was club shaped and located behind the ventral sucker. Ovary anterior to testes, nearly oval and 0.214-0.249 x 0.285-0.392 mm. Eggs on an average measured 0.147 x 0.073 mm. The vitelline glands were seen extending from middle region of ventral sucker to posterior extremity and the follicles united behind the testes.

Received on 26 February 1998; Accepted on 21 November 1998

The flukes were identified as *Artyfechinostomum malayanum* from the above features and based on the amended diagnosis furnished by Premavati and Pande, 1974. The Small Indian Civet (*Viverricula indica*) is reported as a new host for this trematode which is also of public health significance.

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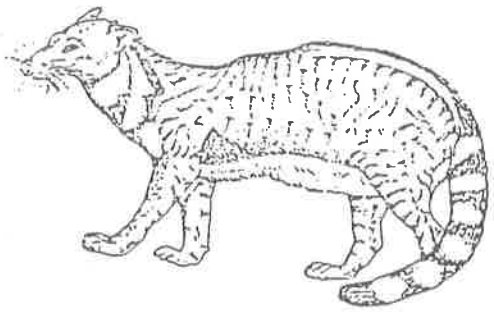

Reprint : Zoos' Print Journal, 14 (4) : 5, April, 1999

CASE REPORT

OCCURRENCE OF *ORNITHONYSSUS BACOTI* (HIRST, 1931) IN AN INDIAN GERBIL *TATERA INDICA*, IN KERALA

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Introduction

A fresh dead specimen of *Tatera indica* (Muridae, Rodentia) was obtained form Kerala Agricultural University main campus at Vellanikkara, Trichur District, Kerala on 20th May 1996. The cause of death may be due to poisoning, as no external injuries were found. On examination, five live ectoparasites could be collected-three from the basal region of the pinnae, one from the upper back and the other from the abdominal region Studies made on the identification of this ectoparasite is presented in this paper.

Results and Discussion

The parasites were identified as *Omithonyssus bacoti* belonging to the family Macronyssidae of the suborder Mesostigmata. The body has sclerotised shields or plates on the dorsal side. The dorsal plate is narrower and tapering gradually to a blunt point.

Numerous setae are present on this plate and they are of same size as those present on the nearby areas of the tegument. The sternal plate on ventral side has three pairs of setae. The anal opening is situated on the anterior half of the anal plate.

Mites of the genera *Laelaps*, *Androlaelaps*, *Trombicula*, *Cheyletus*, *Radfordia*, *Leptotrombidium*, *Listrophoroides* and *Odontocarus* have been reported in Indian Gerbils (Nadchatram & Traub, 1966; Alfred, 1969; Srivastava & Wattal, 1975; Kudryashova,1976; Kudryashova, *et.al.*, 1976; Sandhu & Kapoor, 1977; Fain & Hyland, 1980), but not *Omithonyssus bacoti*. This mite is called as ropical rat mite, but is cosmopolitan occurring in both tropical and temperate regions of the world infecting hamtsers, small marsupials (Kettle, 1990) and wild rodents, wild carnivores, domestu cat and man (Flynn, 1973; Soulsby, 1982).

Received on 13 November 1998; Accepted on 1 January 1999

Being haematophagus, high populations of this mite can cause death of their host by exsanguination (Kettle, 1990) *Ornithonyssus bacoti* is a vector of rickettsial organisms causing murine typhus, rickettsial pox and Q fever caused by *Coxiella bumeti*; it is also a vector of rodent filarial worms. It is also reported to cause severe dermatitis in man (Ram, *et al.*, 1986) and hence of public health importance.

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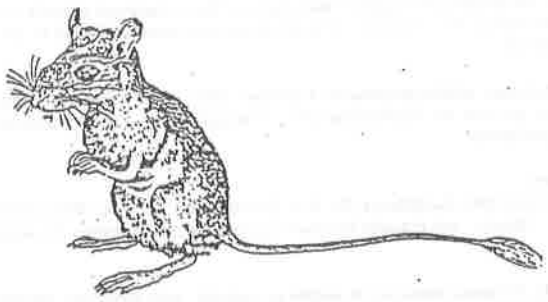

Reprint : Zoos' Print, 6 (5) : 16, May, 1991

PARAGONIMIASIS IN A TIGER

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Published report on the occurence of lung flukes (*Paragonimus*) in the tiger appears to be meagre. However, Paragonimiasis has been reported in cats and man (Chung Huel-len *et al.* 1965; Herman and Helland 1966), dog (Seed *et al.* 1966), cat (Renandao 1974), civet (Voelker *et al.* 1975) and pigs (Barush et al 1985). The present report is about the occurrence of the trematode of genus *Paragonimus* in the lungs of a tiger.

A grown up male tiger of 1.6 mts. length was trapped in an animal house in a nearby village of Katni in Madhya Pradesh. The animal was unusually lethargic. On the intimation from the villagers, the authorities of the national park, Kanha, caged the animal after tranquillisation. The animal, while struggling to come out of the cage, received many injuries. It also stopped eating and ultimately died after 32 days of captivity.

The post-mortem examination revealed presence of multiple cysts in the lungs of the animal. Microscopic examination of each of the freshly cut nodules revealed the presence of the trematode surrounded by red-coloured fluid within each cyst. The microscopic examination of the fluid indicated the presence of red blood corpuscles and the typical operculated eggs. The trematode measured ranged from 4 to 5 mm by 7 to 8 mm, the average being 4.6 mm by 7.4 mm. Similarly, micrometry of the eggs indicated their measurement as 74^ to 93^ by 40^ by 56^, the average being 52 ^ by 84 ^. The animal probably became dull and lethargic because of the lung damage due to extensive distribution of the cysts in the organ. This report appears to be probably the first report of respiratory trematode belonging to the genus *Paragonimus* in the lungs of a tiger. The infection usually is acquired by the host by eating raw crabs or other crustacean (which act as intermediate hosts for these trematodes) or drinking water containing the miracidium, of snail-infested ponds or lakes

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Reprint : Zoos' Print, 9 (11) : 22, November, 1994

NOTE ON INCIDENCE OF INTESTINAL HELMINTHIC INFECTION OF CHIMPANZEE.

Dr(s). A. K. Panda and D. Pal*

There is paucity of information on the incidence of parasitic infestation in zoo animals (Barua, 1983). The present study done to study the incidence of intestinal helminthic infection of chimpanzee in captivity.

Fecal samples for the present investigation was obtained from the three animals at monthly interval over the year from Alipore Zoo, Calcutta. The fecal samples were examined as per sedimentation and floatation technics.

The samples examined proved positive for 4 species. Out of 27 samples collected, 9 samples were found to be positive for *Entamoeba coli* 6 were positive for *Trichuris* and hook worm and 3 samples for *Troglodytella*.

Acknowledgement:
The Director and Veterinary Surgeon (s) Dr. B.D. Biswas and Dr. B.K. Mazumdar) of Zoological garden, Alipore, Calcutta, are thanked for their help in collecting samples for examination.

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* All India Institute of Hygiene and Public Health ,Calcutta

Reprint : Zoos' Print, 9 (11) : 20, November, 1994

A NOTE ON HOOKWORM INFESTATION OF A TIGER AT ZOOLOGICAL PARK, ITANAGAR

Dr. B. K. Gogoi *

Introduction :

The hookworm is an internal blood sucking parasite of animals. It belongs to the genus *Ancylostoma*. It can occur in domestic and wild animals as well as in human beings. Although the *Ancylostoma spp* is mainly found in domestic animals it can be readily transmitted to wild animals like tigers, etc., through ingestion of infected food materials, etc. The mode of transmission is direct which may occur through ingestion of infected larvae or through skin penetration. The larvae after ingestion or penetration usually settle in the small intestine and starts sucking blood and causes anaemia, general weakness, diarrhoea and dehydration in infected animals. Usually the young animals are more susceptible to a fatal clinical manifestation of this disease. It is estimated that an adult worm can suck upto 0.1 ml blood daily. So, a heavy infestation with this worm can be a serious problem. The presence of the worm can be determined by microscopical examination of the faecal matter.

Case history :

Itanagar Zoological Park acquired an adult male tiger (Vikram) in the year 1987. The animal was reported to be a man eater. It was caught alive by live baiting in an iron trap cage by the local villagers of Jumi of Kimin circle of Arunachal Pradesh. A female tiger was also brought to the zoo for pairing and they got themselves adjusted very nicely. In the course of time mating took place and the tigress soon became pregnant.

After some time the male tiger 'Vikram' was seen to be very lethargic and somewhat weak, his appetite was also not normal. He was treated for general weakness but his condition did not show much improvement and after a few days he started having diarrhoea. The faeces was very foul smelling and dark tarry coloured one. Faecal samples were collected and examined under microscope and hookworm eggs were detected. The animal was segregated and kept alone.

Treatment and care :

Since the animal was not having good appetite meat was boiled and the soup was provided. The treatment constituted the following.

1. Antacid gel
2. Electrolyte powder
3. Haemostatic tablets

Given in drinking water for 2-3 days.

Administration of these above were able to improve the condition of the animal. The appetite returned to normal and the feces also became normal. Afterwards the animal was treated with the following :

1. Fenbendazole tab @ 10-15 mg/kg body weight for 3 consecutive days.
2. Iron tonic mixed in the meat for two weeks.
3. Calcium tonic in drinking water or mixed in meat periodically.

The sleeping room of the animal was thoroughly cleaned with concentrated salt solution and the outdoor enclosure was also treated with salt solution and lime stone powder, so that the eggs and the larvae are destroyed. Thereafter the ground area of the outdoor enclosure was refilled with sand, etc. , As the main source of infection is the deposition of faecal matter, care was taken to dispose the faeces in a safe place by treating it with lime and salt solution. Fenbendazole tablets was given for 3 consecutive months to prevent re-infestation.

Control :

Strict hygiene is very important to control hookworm infestation. The faeces of infected animal should not be allowed to accumulate and it should be carefully disposed in a safe place and be treated with lime and salt solution. Enclosure should also be regularly cleaned with lime and salt solution.

Routine faecal examination is a must and necessary anthelminths be administered promptly. Since the hookworm eggs find conducive environment for hatching in moist places, the enclosure should have access to direct sunlight and the ground area should be kept dry as far as possible with good drainage, etc.

Conclusion :

The internal parasities play a major role in the health conditions of captive wild animals . The worms suck blood, protein and other micronutrients from the host and make them weak , unthrifty and susceptible to a lot a diseases. Therefore, to keep them healthy, parasitic control is a must. The animal may get infected by direct or indirect means. In our case it is suspected that the animal got infected through ingestion of meat of infected animals. The tiger when caught in the jungle was offered dog meat. The local villagers killed a stray dog and gave it to the tiger. As the dogs are common carriers of hookworms the tiger might have got infected from it. Various anthelminths like Fenebendazole, Albendazole, Mebendazole were tried and out of these Fenbendazole was found to be most effective. Treatment for hookworm should be long term, as reinfestation keeps occuring.

In this case segregation of the infected animal , strict hygiene and proper disposal of fecal matter greatly helped us in preventing occurence of the worm in other tigers.

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Arunachal Pradesh

Reprint : Zoos' Print, 9 (11) : 17-18, November, 1994

PATHOLOGY OF NATURALLY ACQUIRED *OESOPHAGOSTOMUM* INFECTION IN CAPTIVE HOOLOCK GIBBON (*Hylobates hoolock*) FROM ASSAM

S. Goswami*, S. Islam **, A. Mukit*

Abstract:
Pathology of naturally acquired Oesophagostomiosis in captive *Hylobates hoolock* has been described. The animal was anaemic and emaciated. Mucosal surface of the entire large intestine had necrotic nodules of 7-10 mm in size with 2-3 number of adult *Oesophagostomum spp.* In each nodule. Large number of adult parasites had penetrated serosal surface of the large intenstine. Necrotic mass lying inbetween sub-mucosa and sub-serosal layer of the large intestine contained larval stages of the parasite. While mild eosinophilic infiltration was seen around the larvae, the adult parasite was surrounded by neutrophils, a few mononuclear cells with necrotic cell debris. The results have been discussed and compared.

Introduction :
Hoolock gibbon *Hylobates hoolock* is a non-human primate of the South East Asian tropical rain forests. Though the state of Assam had a large number of free living *H. hoolock*, the number is fast dwindling due to different biotic factors. Zoo reaning of *H. hoolock* poses some medical problems mostly associated with gastro-intestinal helminthic infection (Fowler, 1978). Helminthic fauna of captive *H. Hoolock* have been previously reported from Indochina, Java, Borneo (Linstow, 1906), Delhi and Lucknow zoos (Chauhan *et al.*, 1973), London zoo (Yamaguti, 1961) and Assam State Zoo (Raquib *et al* .,1973). The occurrence of *Oesophagostomum spp*, on the large intestine of this species has been reported to be not uncommon (Linstow, 1906; Yamaguti, 1961). However, detailed pathological studies on the natural infection of *Oesophagostomum spp* has not been reported on earlier occasions. Present investigation deals with gross and histopathological changes in captive *H. hoolock* from the state of Assam.

Materials and methods :
Carcass of an adult male gibbon was sent to the department of Pathology, College of Veterinary Science by authority of the Assam State Zoo, Guwahati, for postmortem examination. According to history, the animal was weak, emaciated and remained off-feed for a few days before death. After postmortem examination, the adult parasites recovered from the carcass, were preserved in 10% formalin, for identification. Representative tissue samples from the lesions were preserved in 10% buffered neutral formalin, processed by routine paraffin embedding method and sectioned at 5 micron thickness. The sections were stained by routine Haematoxylin and Eosin stain (Luna, 1968).

Results :
Gross Pathology: The animal was anaemic and emaciated. When the carcass was opened, significantly large number of adult nematodes were protruding out from the serosal surface of the entire large intestine. Each mucosal surface of each of the large intestinal segment revealed necrotic nodules of 7-10 mm in size. Parts of adult parasites were seen on the surface of some nodules. When the nodules were incised, 2-3 numbers of adult parasites were found in each nodule. The nodules were composed of necrotic mass. Upper segment of small intestine was devoid of any such nodules but the lumen contained exudates.

Parasitology: All the adult parasites recovered from the gibbon belonged to the general *Oesophagostomum*.

Histopathology: Histological reaction of the large intestine containing grossly visible nodules showed cross section of both the adult (Fig.1) and larval (Fig.2) *Oesophagostomum* spp.

Fig.1. Cut section of adult *Oesophagostomum spp.* Inside the nodule in colon of a gibbon. The parasite is surrounded by necrotic mass. H.& E. 100X

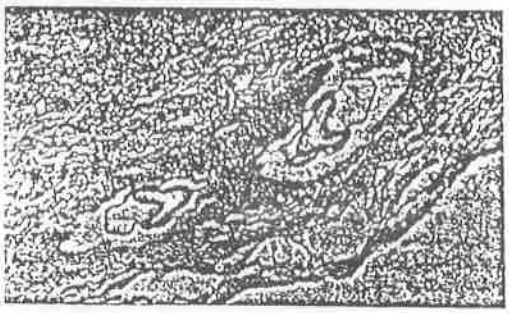

Fig.2. Section of larval *Oesophagostomum spp.* in colon of a gibbon. Note eosinophilic infiltration around the larva. H.& E. 100X.

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The adult parasites were surrounded by neutrophils, a few mononuclear cells and necrotic cell debris (Fig.1). The whole necrotic mass was found between the submucosa and subserosal layer separated by connective tissue capsule. The intestinal area devoid of any parasites also showed infiltration of mononuclear cells in the submucosa. The inflammatory reaction was very mild around the larval sections, with infiltration of eosinophil around the larvae.

Discussion :

Oesophagostomum infection in monkey have been extensively reviewed by Bourne (1971). The infection is also common in anthropoid apes (Benson *et al*.,1954, Fineg *et al*., 1961, Van Riper *et al*., 1966, Weinberg, 1908) including gibbon (loc.cit). Though five different *Oesophagostomum* species have been reported from Chimpanzees and gorillas (Yamachita, 1963) and two from *H. hoolock* (Yamaguti, 1961), taxonomic position of the present specimen upto species level has not been elucidated. This unknown species deserves detailed taxonomic description and its taxonomic status will appear in a separate publication. Marked weight loss due to Oesophagostomiosis is common in higher apes (Ruch, 1959). The present findings of emaciation, anaemia, culminating into death of the gibbon may be compared with the massive infection and high case fatality in chimpanzee (Hamerton, 1937) and man (Chandler, 1955). Though acute infection may occur in recently imported apes (Fineg *et al*., 1961; Van Riper *et al*., 1966) chronic form leading to nodular growth in large intonstine has been documented both in apes (Rousselot and Pellissier, 1952) and in domesticated animals (Michel, 1965). The massive nodular lesion in the entire large intestine of the gibbon with excessively high number of adult parasites may lead to rupture of intestinal wall, and subsequent pentonitis and septicaemia. Weinberg (1908) has also reported the death of a chimpanzee associated with Oesophagostomiosis and Septicaemia.

Characteristic gross and histopathological lesions of the present findings have similarities with those recorded in apes (Ruch, 1959, Habbesmann and Williams, 1958) and domesticated animals (Michel, 1965, Soulsby, 1982). The findings of the present investigation strongly recommends early veterinary care in enclosures and zoological gardens which keeps this highly endangered species.

Acknowledgements :

The senior author is thankful to the Dean, Faculty of Veterinary science, Assam Agricultural University, Khanapara, and the D.F.O., Assam State Zoo for the facilities provided during this study.

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Hoolock

Reprint : Zoos' Print, 11 (10) : 14, October, 1996

OCCURENCE OF *Melophagus ovinus* IN A WILD HOG DEER *(Cervus porcinus)* FROM THE KAZIRANGA NATIONAL PARK, ASSAM, INDIA.

Saidul Islam* and Bhupendra Chandra Lahkar**

INTRODUCTION

The genus *Melophagus* is a wingless fly (Order: Diptera) and belongs to the section Pupipara (Soulsby,1982). Though the species *M. ovinus* chiefly affects sheep (Soulsby,1982). They are not only occassionally found in goats (Sen and Fletcher, 1962) but also can be propagated in this host (Imes, 1932). This fly is a blood sucker and produces unthrifty condition in its host. Sen and Fletcher (1962) have reported 2 specimens of *M. ovinus* collected as early as 1912 in Mercara (Coorg). The species was also recorded from a sheep from Mukteswar, India. An unidentified species of *Melophagus* was collected from a wild panther from Madhya Pradesh (Sen and Fletcher, 1962).

There is no previous report of *Melophagus ovinus* from the state of Assam. Present communication describes, for the first time, the occurence of *Melophagus ovinus* in a wild hog deer *(Cervus porcinus)* from the Kaziranga National Park, Assam, India.

MATERIALS AND METHODS.

A wild adult male hog deer (*Cervus porcinus)* showing spontaneous symptoms of arched back and locked jaw in the Bagori range of Kaziranga National Park was rescued for the veterinary medical care. The animal survived only for 3 weeks in spite of treatment. Very fast moving, brown coloured and dorsoventrally flattened insects could be seen actively moving through the hairs, around the face and nostrils. The insects started to fall off the host half an hour after the animal was deceased.

A few of these insects moving on the face and those which fell off from the body were collected and preserved in 10% formol saline and brought to the laboratory for taxonomic identification.

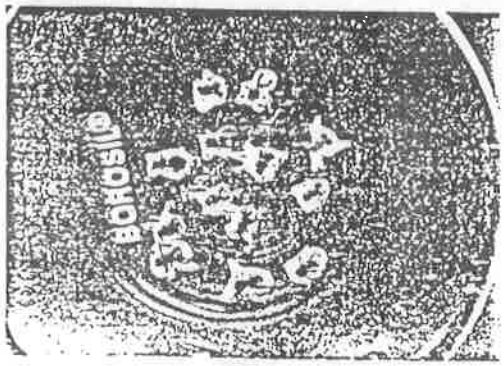

Fig. 1 Adult specimens of Melophagus ovinus *recovered from a wild hog deer* (Cervus porcinus).

RESULTS AND DISCUSSION

All the parasites were identified based on their morphological characteristics and were taxonomically assigned to the species *Melophagus ovinus*, Linn, 1758 (Fig.1).

Though the parasites are known to produce considerable economic loss to livestock (Immes, 1932; Soulsby, 1982), and carry the blood protozoa *Trypanosoma melophagium* in sheep, its exact significance in wildlife is not yet known. Previously *M. ovinus* has been recorded from a wild panther in Madhya Pradesh (Sen and Fletcher, 1962). The present study could be made only due to a chance observation. Probably these parasites share both the carnivore and herbivore hosts in the wild.

ACKNOWLEDGEMENT

The senior author is thankful to the D.F.O. (Eastern Assam Wildlife Division), Bokakhat, Assam and the Dean, Faculty of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati 781 022 for the necessary facilities.

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Reprint : Zoos' Print, 11 (3) : 3-5, March, 1996

A SURVEY OF GASTROINTESTINAL PARASITIC INFECTION IN SOME FREE LIVING HARBIVORES IN THE KAZIRANGA NATIONAL PARK

A. Chakraborty[1] and S. Islam[2]

ABSTRACT

A study on the prevalence of endoparasitic infection in free living mammalian species was conducted at the Kaziranga National Park, Assam. Species covered in this study included the hog deer (*Axis porcinus*), swamp deer (*Cervus duvauceli*), water buffalo (*Bubalus bubalis*) and elephant (*Elephas maximus*). A total of 171 samples were collected of which 40.35% was positive for infection with one parasite or the other. Species wise infection rate was found to be 22.85 per cent, 21.87 per cent, 49.31 per cent and 58.06 per cent in hog deer, swamp deer, water buffalo and elephant respectively. Helminth ova of *Paramphistomum*, *Fasciola*, *Strongyle*, *Trichuris*, *Oesophagostomum*, *Strongyloides*, *Ascaris* and cestodes could be recorded. Oocyst of Coccidia could be recorded in swamp deer and buffalo.

INTRODUCTION

Incidence of parasitic infection in zoo animals have been recorded (Tripathy and Acharjyo, 1971, Chauhan *et al.*, 1973; and Gaur *et al.*, 1979) but information on the same in free living wild animals are meagre. Helminth parasitic infection of free living rhinoceros in Kaziranga National Park have been reported (Chakraborty and Islam, 1993). The present investigation provides more informations regarding parasitic infection of some free living wild herbivores of the park.

MATERIALS AND METHODS

Fresh faecal samples of four herbivores viz. hog deer (*Axis porcinus*), swamp deer (*Cervus duvauceli*), water buffalo (*Bubalus bubalis*) and elephant (*Elephas maximus*) were collected at random from 13 different forest ranges in the core areas of the park (Table 1) during the month of January 1990 and 1991. The samples were brought to the temporary laboratory set up at Kaziranga and were examined for the presence of parasite ova by both sedimentation and floatation technique as per the standard procedure.

RESULTS AND DISCUSSION

In the study, altogether 171 dung samples were examined of which 69 were positive for different parasites. The percentage of infection being 40.35. The results of the study are presented in Table 2.

The different parasites recorded common to both the cervids were of the genera *Fasciola*, *Paramphistomum*, *Strongyle* and *Oesophagostomum*. While *Ascaris* and *Coccidia* were recorded in swamp deer, Strongyloides and Trichuris were found in hog deer. When compared with cervids, the buffalo showed more trematode infection. *Oesophagostomum* was the most commonly prevalent parasite in these three host species.

Prevalence of similar type of parasites in wild deer of Jim Corbett National Park has been documented by Gaur *et. al.* (1979) and Arora *et al.* (1985). A considerable number of faecal samples examined in this study were positive for *Oesophagostomum* sp. and *Strongyle* sp. It appears that these nematodes have adapted well to these hosts. The incidence of *Fasciola* infection is reported to be fairly high in wild deer by Gaur *et al.* (1979) and Arora *et al.* (1985). However, the infection was more in buffalos than in cervids in our study. In any case, the reservoir status of these wild animals for *Fasciola* infection appeared to be quite significant as it is an important parasite of domestic ruminants in the country.

Elephants showed the highest prevalence of parasitic infection (58%). *Fasciola* and *Strongyle* infection were noticed in fairly high proportion. The first author has conducted postmortem examination of 5 elephants in Assam State Zoo and Kaziranga National Park and found massive infection of *Fasciola jacksoni* in all the animals. In one occasion it was so severe that the whole bile duct was completely obstructed with *Fasciola jacksoni* and necrotic debrises, and the whole liver was cirrhotic (Chakraborty and Chaudhury, 1992). In an earlier study on camp elephants of Kaziranga National Park and Manas Tiger Project, Chakraborty *et al.* (1992) recorded 100 per cent and 88.88 per cent of parasitic infection respectively. Although similar parasites have been recorded in the present study also, the prevalence was comparatively lower, Arora *et al.* (1985) observed only nematode parasites in elephants of Jim Corbett National Park and in contrast the present study recorded more infection of trematodes. *Fasciola jacksoni* infection appears to plays a significant role as far as the diseases of elephants are concerned, particularly in North East India.

The dung samples examined from the different ranges of Kaziranga National Park were limited in number to derive any conclusion about the incidence of parasitic infection in different ranges of the park. However, it can be speculated that parasitic infection towards the western side was higher than the eastern side. The western part of the park being a low lying area, there is possibilities of snails and other intermediate hosts getting washed away from the eastern side to the western part.

Further long term extensive survey in different rangese of Kaziranga National park is essential to understand the implication of parasitism in free-living animals.

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Table 1. Faecal samples examined from different ranges of Kaziranga National Park

Forest ranges	Hog deer		Swamp deer		Buffalo		Elephant		Total Samples	
	Examined	Postive	Examined	Positive	Examined	Positive	Examined	Positive	Examined	Positive
Amkathoni	-	-	-	-	3	1	2	2	5	3
Bagori	-	-	-	-	6	3	3	3	9	6
Bimoli	-	-	-	-	5	3	4	2	9	5
Borbeel	-	-	-	-	4	2	1	1	5	3
Dallong beel	-	-	-	-	2	0	1	0	3	0
Digalinala	-	-	-	-	4	2	2	1	6	3
Diphalu	-	-	-	-	6	3	4	2	10	5
Dichuti camp	-	-	-	-	-	-	2	1	2	1
Kathpura	-	-	-	-	4	-	3	2	7	6
Mihimukh	32	7	35	8	26	12	3	2	96	29
Raumari tower	-	-	-	-	3	1	2	0	5	1
Sali beel	-	-	-	-	6	3	2	1	8	4
Tanti beel	-	-	-	-	4	2		1	6	3

Table 2. Prevalence of parasitic infection in some free living herbivores of Kaziranga National Park

Species	Number of samples		Percentage	Ova/ Oocyst recorded (No. of animals)	Severity of infection
	Examined	Positive			
Hog deer (*Axis porcinus*)	32	7	21.87	*Fasciola* (1) *Paramphistomum* (4) *Strongyle* (1) *Strongyloidas* (1) *Oesophagostomum* (3) *Trichuris*(3)	+ +to++ + + ++to+++ +
Swamp Deer (*Cervus duvauceli*)	35	8	22.85	*Fasciola* (1) *Paramphistomum* (1) *Ascaris* (1) *Strongyle* (2) *Oesophagostomum* (5) *Coccidia* (1)	+ + + +to++ +to++ +++
Buffalo (*Bubalus bubalis*)	73	36	49.31	*Paramphistomum* (16) *Fasciola* (7) *Strongyle* (3) *Oesophagostomum* (4) *Strongyloides* (1) *Trichuris* (1) *Coccidia* (3)	++to+++ +to++ +to++ +to++ + +
Elephant (*Elephas maximus*)	31	18	58.06	*Fasciola* (11) *Paramphistomum* (4) *Strongyle* (8) *Strongyloides* (1) *Cestode egg* (1)	+to+++ +to+++ + +to+++ ++ +

ACKNOWLEDGEMENT

The first author is grateful to CSIR, New Delhi for the financial assistance in the form of Senior Research Fellow. The authors are grateful to the Forest Officers and other field staff of Kaziranga National Park for their help in the collection of materials.

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Reprint : Zoos' Print, 6 (11) : 17, November, 1991

NOTE ON INCIDENCE OF INTESTINAL HELMINTHIC INFECTION OF DEER IN CAPTIVITY

Dr(s). G. C. Bordoloi, G. C. Dutta, I. Das, M. Pathak and A. Choudhury, Assam

Introduction:

Perusal of available literature revealed that limited study has been done on incidence of parasitic infestation in zoo animals (Barua, 1983). Hence, the present paper deals with incidence of Intestinal Helminthic Infection.

Material and Methods :

The faecal samples for the present investigation was obtained from the twenty-four animals from State Zoo, Guwahati, Assam. The faecal samples were examined as per sedimentations and floatation techniques.

Results and Discussion

Faecal sample examination proved positive for the following infection (shown in the table). It was found that 33.33 per cent of deer were infected by intestinal Helminth infection. The highest infection 50 per cent was recorded by Trichostrongides followed by 25 per cent (Bunostomum) and 25 per cent (Dicrocoelium), respectively. Our findings are coroborated with the findings of Barua (1983).

Table 1. Incidence and percentage of Helminth in Deer

Sl. No.	Helminth species	No. of animal	Percentage of infected animal	No. and % of infection
1	Bunostomum	2	8.33	(2)25
2	Trichostrongylus	4	16.67	(4)50
3	Dicrocoelium	2	8.33	(2)25

Acknowledgement : The Director, State Zoo, Guwahati, Assam for providing samples for examination.

Reference : Barua, M. (1983). Common diseases of Wildlife in captivity with particular reference to the North Eastern Region, Silver Jubilee Souvenir, Assam State Zoo-cum-Botanical Garden, Guwahati.

Reprint : Zoos' Print, 5 (10) : 4-5, October, 1990

PREVALENCE OF *MUELLERIUS CAPILLARIS* INFECTION IN FREE RANGING SPOTTED DEER (*AXIS AXIS*) IN INDIA

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ABSTRACT

During a survey to assess the parasitic load among spotted deer (*Axis axis*) in different National Parks in India,It was found that *Muellerius cappillaris* infection was widely prevalent in two(Dudwa and Corbett) out of three National Parks.There was an overall prevalence rate of 30.96%. Adult animals looked apparently healthy and probably serve as carriers for the infection.Land snails of the species *Macrochalmys sp.* could be infected under laboratory conditions with the first stage larvae of *Muellerius sp.* collected from the faecal pellets.When the third stage larva collected from these snails were fed to a goat *(Capra hircica)* the infection was established and adult worms could be recovered from the lungs 31 days post infection.

INTRODUCTION

Spotted deer(*Axis axis*) is the most widely distributed and abundant cervid species present in the different wild life sanctuaries and National parks in India. In most of these habitats they co-exist with other hervivores,sharing common grazing places.Therefore,there is a potential risk of cross- transmission of many parasitic agents between them.

No systematic study has been conducted so far to find out the prevalance of parasitic infection in free ranging cervids in India(Arora,1982). Hence, a detailed parasitological survey was conducted among cervid population of three geographically different National Parks Dudwa,Corbbett and Tadoba. Among the parasitic infections,lung worm infection due to *Muellerius sp.* was found common in *Axis axis* and the details of the findings are presented in the paper.

MATERIAL & METHODS.

Fresh faecal droppings of spotted deer (*Axis axis*) were collected from different localities of Dudwa,Corbett and Tadoba National Park (especially around grazing places and near water ponds) and examined by modified Baermann's techniques,Since the spotted deer remained mostly in herds,only one representative pooled sample was collected from one area representing one herd, to avoid any possible duplication.

Land snails were also collected from these areas to find out the presence of any larval stages of *Muellerius sp.* in them.The first stage larvae collected from the faecal pellets were pooled and exposed to clean land snails of the species **Macrochlamys sp.** at a concentration of 100 larvae snails.The snails were then dissected at one and two weeks post exposure to recover the larval stages.

RESULTS

The adult animals wherever observations could be made apparently looked fair in dondition and active without any visible symptoms of disease.

Out of 197 representatives samples examiined 61 (30.96%) had *Muellerius sp.* infection. Corbett National Park had the maximum percentage 30/106 of infection. Similarly Dudwa also had comparitively good infection rate(23/63), while at Tadoba the rate of infection was low (1/38).

Land snails collected from Dudwa and Corbett National Parks were found negative for *Muellerius sp.* infection.

Under laboratory conditions, developing second and third stage larvae of *Muellerius sp.* could be recovered from the land snails.Snails dissected after two weeks revealed only third stage larvae.Mostly each snail harboured only one or at the most two larvae. But rarely up to 5 larvae was also recovered.

DISCUSSION

The results show that lung worm infection due to *Muellerius sp.* is prevalent amoung free ranging (Axis axis) in all the three National Parks.There are two earlier records of the occurence of Muellerius sp. infection in sheep and goat in India (Dhar et al.,1979; Singh et al;1980). However, a perusal of the available literature do not reveal any published report on *Muellerius sp.* infection in *Axis axis.* Therefore, this appears to be first record where *Axis axis* is acting as host for this parasite.

The Observation that adult animals appeared apparent-

ly healthy even in the diseased state probably indicate that *Axis axis* may serve as a reservoir host for this parasite.

Muellerius capilliaris was found often associated withother pathogenic bacteria and fungi causing the lung worm pneumonia syndrome resulting in a heavy mortality in sheep and goat (DeMartini and Davies 1977, Aleutakaya et al.1980,Ogassawara et al 1982).Therefore, it is possible that this infection may cause morbidity-among Axis axis.

Due to marked prevalence rate of this disease in these National Parks, the chances of spill out of this disease to the adjacent grazing areas shared by both domesticated and wild reuminants can't be ruled out. Secondly the intermidiate molluscal hosts are widely prevalent in the domestic areas which alarms the potential risk of sheep and goat acquiring the infection. Our experimental study has proved that the *Macrochalamys sp.* of land snails could be easily infected with *Muellerius sp.* larvae collected from spotted deer and that the disease could be well established in goats, thus clearly indicating the chances of cross-transmission.

The longivity of the adult worms are over two years. Hence the disease may be carried from one season to the other.This coupled with the ubiquitous nature of the molluscan host helps, in the easy spread of parasite and makes the control of the disease very difficult.

Thus the present survey brings to light the potential risk of other herviborous animals acquiring the *Muellerius capillaris* infected from spotted deer. The findings also shows that probably spotted deer act as a reservoir host for this infection and that the Corbett and Dudwa National Parks are dendemic for this small lung worm infection.

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Reprint : Zoos' Print, 5 (5) : 14, May, 1990

INCIDENCE OF INTESTINAL HELMINTHIC INFECTION IN RHINOCEROS UNICORNIS IN CAPTIVITY

By Dr. G. C. Dutta, Dr. G. C. Bordoloi, M. Pathak and A. Choudhury, Assam

Introduction

The *Rhinoceros Unicornis* is a rare, valuable and second largest living animal of India. Its population in Assam is thirteen hundred including eleven number in captivity. Perusal of available literature revealed that limited study has been carried out regarding prevalence of intestinal helminthic infection of this valuable species (Deka *et. al.*, 1985). Hence, the present work is planned to study the incidence of intestinal helminthic infection in Rhinoceros in captivity.

Material and Methods

For the present investigation eleven numbers of individual samples were collected from the same number of Rhinoceros (*R. Unicornis*) at State Zoo cum Botanical Garden, Guwahati, Assam. The faecal samples were examined as per sedimentation and flotation technique.

Results and Discussion

Faecal sample examination proved positive for the following infection (Shown in the Table). It was observed that 55.55 per cent of *Rhinoceros unicornis* were infected by intestinal Helminthic infection. The highest infection 42.86 per cent was recorded followed by 28.57, 28.57, 14.29 per cent presented in the table. But 45.35 per cent showed negative to intestinal Helminth (normal). Our findings are Corroborated with the findings of Barua (1983), but the values are lower than the work done by Deka *et. al.* (1985). This might be due to regular deworming.

Table 1: INCIDENCE AND PERCENTAGE OF HELMINTH IN RHINOCEROS

Serial No.	Helminth species	No. of Animal	Percentage of infected Animal	No. and percentage of infection
1.	Fasciola	2	18.18	2) 28.57**
2.	Paramphitomum	2	18.18	2) 28.57**
3.	Ascaris	3	27.27	3) 42.86*
4.	Strongloides	1	9.09	1) 14.29***
5.	Normal	4	45.45	

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Reprint : Zoos' Print, 9 (9) : 6-7, September, 1994

GASTRO - INTESTINAL PARASITES IN FREE LIVING ONE HORNED INDIAN RHINOCEROSES (*RHINOCEROS UNICORNIS*) AT THE RAJIV GANDHI WILDLIFE SANCTUARY, ASSAM, INDIA

S. Islam *

Occurence of gastro-intestinal parasites in captive Rhinoceroses *(Rhinoceros unicornis)* have been reviewed by Silberman and Fulton (1979) and more recently by Miller (1992). Barring the work of Chakravorty and Islam (1993), there is no field survey report of gastro-intestinal helminths of free living one-horned Indian rhinoceros. Present study records some gastro-intestinal parasites of free living rhinoceroses at the Rajiv Gandhi Wildlife Sanctuary, Assam, India.

The study area was situated on the northern bank of the river Brahmaputra (Lat. 26°30' - 26°35'N, Long 92°15'- 92°22'E) which comprised a total area of 75 square kilometres (Map). The terrain is of alluvial flood plain of the river Brahmaputra containing deciduous forests, alluvival grass lands, and swampy areas with 97 rhinoceroses (Bankhowal, 1993). Since the Indian one-horned rhinoceros defecate in a well defined area within their territory, fresh faecal samples were easily collected at random from 40 individual dung heaps from different parts of the study area in 2 consecutive days during the month of December, 1993. The materials were processed (Soulsby, 1982) in the laboratory and examined under a light microscope.

All the 40 samples collected were found to be positive for parasitic infection (Table-1). The parasites recorded were paramphistome and *Strongyle* sps. In only one sample with moderate degree of coccidian oocyst could be encountered.

There is scanty report on the paramphistome infection in rhinoceros (Chakravorty, 1991; Chakravorty and Islam, 1993). However, *Strongyle* infection in rhinoceros have been reported by Silberman and Fulton (1979), Chakravorty (1991) and Chakravorty and Islam (1993). An unidentified coccidian oocyst has also been reported earlier (Chakravorty and Islam, 1993).

In the present study, samples were collected at random and all were positive for helminthic infection. The average load of infection was of moderate type except in a few cases where heavy infections were recorded. Therefore, it can be safely concluded that, the central area of the Rajiv Gandhi Wildlife Sanctuary is endemic for helminths parasitic on free living rhino. The numerous wet lands inside the sanctuary probably maintains an ecologically viable habitat for the propagation of necessary snail intermediate hosts of paramphistomes. The coprophagus habit of the Indian one-horned rhinoceros (Buechner and Mackley, 1975, Bhuyan, 1993) might play an important role in acquiring the strongyle infection (Islam, 1994). Field study of the terrian with satellite remote sensed data and ecology of the wet lands of the sanctuary is under investigation (Islam, 1994). This might bring into light some new informations on the parasitic infections of the mammals of this sanctuary.

ACKNOWLEDGEMENTS

The author is grateful to the DFO (Wildlife), Mangaldai, Assam, India, Dr(s). Paragjyoti Deka, Upen Bhuyan and all other forest personnels of the Rajiv Gandhi Wildlife Sanctuary who were involved in the present study. He is also thankful to the Dean, Faculty of Veterinary Science, Assam Agricultural University for providing necessary laboratory facilities.

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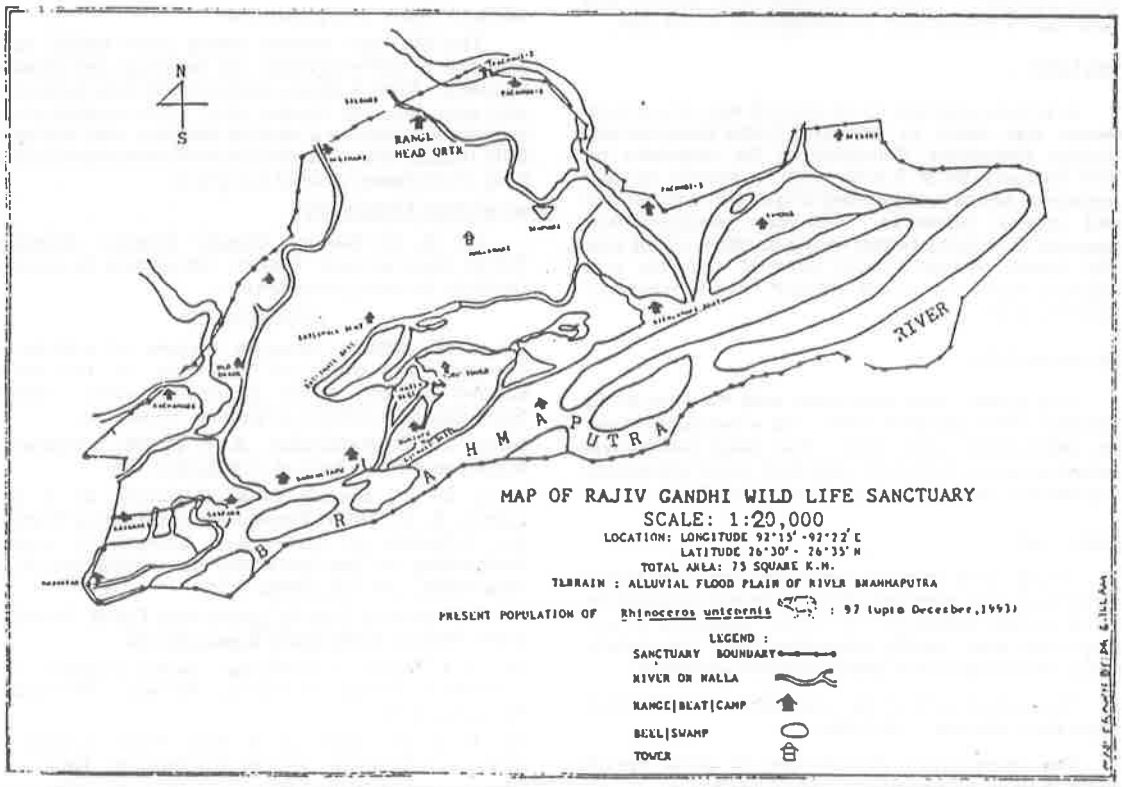
Table: I
Prevalence of gastro-intestinal parasites in free living Indian one-horned India rhinoceros at the
Rajiv Gandhi Wildlife Sanctuary, Assam, India

Collection sites	No. of dung samples	Ova/oocysts encountered	Load of infection
Near Satismalu	5	*Strongyle* Sps. Paramphistome	++ ++
Near Satismalu	15	*Strongyle* Sps. Paramphistome	++ +++
Nichlamari	10	*Strongyle* Sps. Paramphistome	++ ++
Near Orang (old)	10	*Strongyle* sps. Paramphistome Coccidian oocyst	 ++ +

Total : 40 (All samples were positive)
* + : light : ++ : moderate : +++ : heavy



Reprint : Zoos' Print, 3 (10) : 6, October, 1988

SICK LINE

Z.O.O. MONTHLY MEDICAL COLUMN

A Case of Distomiasis in Elephants and its Successful Treatment with Avlothans

by Dr. T. Borthakur, Dr. G. C. Dutta and Dr. B. K. Bhattacharyya (Assam)

INTRODUCTION :

The elephant is still used as the chief drought animal in hilly areas, particularly in Timber industry and contributing to the national economy. Approaches have been made to study the various diseases and infections of this useful animal along with remedial measures from time to time, however scientific data about the various disease and their specific drugs are still very meagre. Barua (1983) reported that the infection of fasciola, commonly, called the liver fluke is common in the captive elephants. Deka et al. (1985) after screening 14 (fourteen) drug samples from working elephants from Kazeronga National Park established the fasciola infection in these animals. They also reported that death occrued in 1984 in elephants both captive and wild due to fascioliasis, or distomiasis, in the park.

HISTORY :

A female elephant of 35 years of age, of a private owner was taken to Intensive Cattle Development Project, Khanapara, Guwahati-22 for treatment on 16th February '88 at 9 A.M. with a history of fed, dysponea, tympany, bubbling of gas through rectum and profuse diarrhoea. The cow elephant was engaged in logging timber in the outskirts of the city. The owner noticed in the morning that the cow elephant was lying in the ground, due to weakness and colic pain.

EXAMINATION :

The animal was restrained with the help of the "Mahut" (The elephant rider) and a thorough physical examination was done. The dung sample was collected as eptically and examined under compound microscope for detection of parasitic infection.

FINDINGS :

Along with general weakness and pale mucus membrane the elephant showed severe tympanities, trunk coiled, extension of limbs, dropping of ear, tears from eyes, frothy salivation from the mouth, loose stool with foetid smell, frequent urination.

The temperature of cow elephant was subnormal respiration shallow, fast pulse.

The microscopic examination of dung sample showed the presence of eggs of Fasciola.

TREATMENT PROCEDURE :

Belamyal (Sharabhai Chemicals) 20ml administered intermuscularly in alternate day. Dextrose Bex V 50% (Sterling Veterinary Product) 500ml x 6 bottle was administered intravenously in ear vein at 8 hours interval. Assam Batisa (B D. Chemical) + Sodibicarb 100 gm given orally twice daily. Avil (Hochaust 20ml administered daily. Repeated the same treatment for 5 days to tone up the animal.

On 10th day, Avlothane (ICI) 100 gm is given orally in two divided doses.

The elephant recovered by about 1 (one) month showing negative result to Fasciola when microscopic examination of dung was done on 25-3-88 and 25-4-88. Table - II.

RESULT AND DISCUSSION :

The elephant started taking plant leaves from 3rd day of administration on the drugs and showed recovery. After 4 (four) weeks it was fully recovered and sent back to normal duty. This distomiasis or fasciola infection in a captive elephant was successfully treated with a commonly available antehelmintic drug (Avlothane) in field condition.

ACKNOWLEDGEMENT :

Dr. K. N. Baruah, Deputy Director, Intensive Cattle Development Project, Khanapara for provide facilities for dung examination.

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Reprint : Zoos' Print, 4 (10) : 23, October, 1989

A Case of Ascariasis in Elephant and its Successful Treatment with Panacur

By Dr. P. Gogoi and Dr. G. C. Dutta, Assam

Introduction

The Elephant *(Elephus Maximum)* is known to all as a drought animal in Timber Industry contributing to the national economy. Various attempt have been made to study the various disease in elephant and its remady. Baruah (1983) reported the common disease of wild life in captivity. Deka *et al* (1985) reported the prevalence of intestinal helminthic infection of wild animals in Assam. Borthakur *et al* (1988) reported a successful treatment of distomiasis in elephant with avlothane. Dutta and Bordoloi (1989) reported the inceidence of intestinal helminthic infection in elephant in Tiger project, Manas, Assam.

History

A private owner from Mizra, 30 km from Guwahati reported on 24-5-89 that male elephant (Tusker) age of 25 years old was taking soil and was off feed from 2 days.

Clinical findings

The animal was restrained with the help of the "Mahut" (the elephant rider) and physical examination was done. The temperature, pulse and respiration were found normal. Diarrhoea with mucous was observed.

The faecal sample alongwith worms were identified as Ascaris spp on the basis of morphology of adult worm and ova. Faecal examination was done on 7th and 30th day post treatment using flotation method.

Diagnosis

The case was diagnosis as Ascariasis.

Treatment Procedure

On the first day, Sulfaguanidine, 6 boluses given orally with Banana ("Vim-Kal") daily twice. Pinkojet (Brihans laboratories) 10 ml was injected intramuscularly in alternate day for 5 days. On second day, sulfaguaridine + steclin bolus 6 gm. of each was given orally with Banana daily twice. (as diarrohea not stop 1st day). On third day, diarrhoea was stoped. That day, panacur (Hoechst) 30 gm was given orally in devided doses inside banana. On fourth day, mature ascarid worms were observed in dung. From 5th day, elephant was normal.

Results and Discussion

The elephant started taking plant leaves from 3rd day of administration on the drugs and stopped taking soil. After 3 weeks it was fully recovered and sent back to jungle for duties. On 7th day and 30th day post treatment, faecal sample examination revealed negative for ascarid worm. The Ascariasis or round worm infestation in a captive elephant was successfully treated with a commonly available anthelmintic drug Panacur (Fenbendazole) in field condition.

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Reprint : Zoos' Print, 4 (3) : 14 & 16, March, 1989

Prevalence of Intestinal Helminthic Infection in Elephant of Tiger Project of Manas, Assam

By Dr. G. C. Dutta and Dr. G. C. Bordoloi (Assam)

INTRODUCTION

The elephant plays a vital role in Timber Industry as a drought animal contributing to the economy of our Country. Various attempts have been made to study the various disease and infections of this useful animal from time to time. Barua (1983) reported that Fasciola infection is very common in elephant of captivity. Deka *et al*. (1985) reported about death of elephants both captive and wild due to Fasciola infection. Barthakur *et al*. (1988) reports the infection of Fasciola in elephant in captivity. But report on prevalence of Intestinal Helminthic infection in elephent of Tiger project Manas (Assam) was scanty. Therefore, the present work was planned to study the prevalence of Intestinal Helminthic infection in elephant of Tiger project of Manas, (Assam).

Material and Methods.

The faecal samples for the present investigation was obtained from the thirty number of elephants (*Elephus maximum*) at tiger project of Manas, which was 139 Km. away from Guwahati City. Assam. The faecal samples were examined as per sedimentation and flotation technique.

Results and Methods.

Faecal sample examination proved positive for the following infection. (Shown in the table). It was observed that 80 per cent of elephant (*Elephus maximum*) were infected by intestinal Helminth infection. The highest infection 29.17 per cent was recorded by Fasciola ❖ followed by 20.83 per cent (Fasciolo + Strongloides) ❖❖, 8.33 per cent (by Paramphistomum) ❖❖❖❖ and 4.17 per cent other parasites mentioned in the table. But 20 per cent was Normal (ie sample showed negative to in Intestinal Helminth). Our findings are co-rroborated with the findings of Barua (1983). But the values are lowered than the work done by Deka *et al*, (1985).

Conclusion

This is the report on prevalence of Helminth parasite in Elephant of Manas of which highly prevalent infestation is Fasciola (29.17 per cent).

Acknowledgement

Dr. S. K. Buragohain, Deputy Director, Animal Health Centre, A. H. & Vety. Department, Guwahati, Assam for providing facilities for examination.

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(Cont. on P. 16)

Table I INCIDENCE AND PERCENTAGE OF HELMINTH IN ELEPHANT

Sl. No.	Helminth species	No. of animal	Percentage of infected Animal	No and percentage of infection.
1)	Fasciola	7	23.33	7) 29.17 ❖
2)	Paramphistomum	2	6.67	2) 8.33 ❖❖❖❖
3)	Bunostomum	1	3.33	1) 4.17
4)	Ascaris	1	3.33	1) 4.17
5)	Strongloides	3	10.00	3) 12.5 ❖❖❖
6)	Cooperia	1	3.33	1) 4.17
7)	Fasciola + Strongloides	5	16.67	5) 20.83 ❖❖
8)	Fasciola + Oesophagstomum	1	3.33	1) 4.17
9)	Fasciola + Ascaris + Strongloides	1	3.33	1) 4.17
10)	Fasciola + Ascaris + Oesophagastomum	1	3.33	1) 4.17
11)	Strongloides + Oesophastomum.	1	3.33	1) 4.17
12)	Normal	6	—	—

Continued from Page No. 14

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Reprint : Zoos' Print, 5 (10) : 18, October, 1990

Application of Fenbendazole against *Strongylidae* worms in the Elephant.

By

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Gastrointestinal nematodes in elephants are not uncommon and in some instances have been responsible for disease problems (Ferrier 1947). Amongst nematodes,strongyles which are quite common,if present in everwhelming numbers,have been reported to cause signs similar to those seen in horses infected with these worms.The method of diagnosis and treatment for these worms in horses has been observed to be quite satisfactory for the elephants too (Blood and Henderson 1974).Quite a few drugs like thiabendazole,dichlorous and tetramisol have been used successfully in the treatment of internal parasites (Fowler 1978).The present paper describes the successful application of Fenbendazole against *Strongylidae* in elephants.

Faecal sample of one baby elephant of Bhandhavgarh National Park showing profuse diarrhoea was submitted for examination.It turned out to be highly positive for strongyle *(Strongylidae)*.Unfortunately,before any treatment could be offered the animal died. As the National Park had 12 more elephants staying in the same place it was decided to get the faecal samples of all the animals screened for gastrointestinal worms.Accordingly,the faecal samples of each of these remaining animals were obtained and were microscopically examined for the gastrointestinal worms, out of 12 animals,10 were significantly positive for strongyles.Depending on the body weight,Panacur** at the dose rate of 24 to 30 gms was administered orally mixed in wheat flour and jawagery.The faecal samples of each anomal was examined 7 days post-treatment.The faecal samples of each of the animal examined failed to show any parasitic eggs.

This indicated the drug to be effective against strongyles and because of ease in administration and safety of panacur,it could be used in elephants for the expulsion of gastroin-testinal nematodes. It is also felt that this drug could be used periodically in elephants of the zoo and National Parks for the prevention treatment of gastrointestinal nematodes.

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* Director, Bandhavgarh National Park,M.P.

** Hoechest harmaceuticals Ltd., Bombay (Fenbendazole 25%)

Reprint : Zoos' Print, 6 (11) : 10-11, November, 1991

HELMINTH INFECTION WITH REFERENCE TO THE CLINICAL AND HAEMATOLOGICAL OBSERVATIONS IN ELEPHANTS

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Introduction:

The elephant (*Elephus indicus*) plays a vital role in circuses and timber industry. The literature on helminth infections of elephant in India is meager. Barua (1983), Borthakur *et al* (1988) and Deka *et al* (1985) reported that fasciola infection is very common in elephant in captivity. Dutta and Bordoloi (1989) reported combined infection of fasciola and oesophago stomum in the elephants of Assam. The present work was planned to get the faecal samples screened for helminth infection along with clinical and haematological examinations in the elephants of Maharaja Circus at Nagpur in the month of February 1991.

Materials and Methods:

The faecal samples were collected directly from rectum of six elephants of varying age groups (Table I). At the same time blood samples also collected from ear vein in a clean sterile anticoagulant vial and haematological analysis were performed by using standard methods of Schalm et al. (1975). In view to rule out the possibility of any concurrent haemoprotozoan infection a think blood smear was prepared. Clinical examination comprised of body temperature, consistency of faeces, visible mucus membrane were undertaken with the help of Mahout.

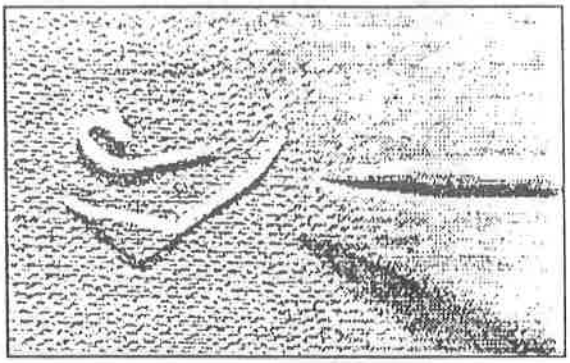
Results and Discussion :

The study indicated that the examination of faecal sample revealed the presence of worms and ova which were identified as oesophagostomum species on the basis of morphology of worms. It is interesting to note that all six animals were harbouring oesophagastomum spp. infection with lesser or greater intensity (Figure 1). Dutta and Bordoloi (1989) observed combined infection of fasciola and oesophagostomum in elephants. Body temperature revealed normal, conjunctiva pale and faeces showed semisolid consistency with adequate mucus.

The haematological analysis revealed decreased in total erythrocyte count (TEC), haemoglobin (Hb) and total leucocyte count (TLC). Thus, increase in eosinophil was observed in amongst all the elephants (Table I), when compared with normal values (Sastry, 1989). Blood smear examination did not show any protozoan infection. The infection oesophagostomum responsible for decreased in T.E.C. and haemoglobin concentration indicating the presence of anaemia as a result of blood loss in the intestine (Blood, et al. 1989), however decrease in T.L.C. could be due to lack of certain nutritional factors and eosinophilia observed attributed to reflection of hypersensitivity in helminth infection (Coles, 1986).

Conclusion:

The present communication places on record the haematological findings in oesophagostomum spp. affected Indian elephants.



Showing oesophagostomum spp worms passed by elephants. Photo by D. B. Sarodhe, et al.

Acknowledgements

Authors thank the Professor of Parasitology, Nagpur Veterinary College, Nagpur for necessary guidance.

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Table 1 : Haematological findings in oesophagostomum spp. affected elephants.

No.	Animal Name/Sex	Age (Yrs)	Haemoglobin (g/dl)	T.E.C. 10^6 cu mm	T.L.C. 10^3 cu mm	E.S.R. mm/hr	PCV %	Differential Leucocyte count N %	L %	M %	E %
I.	Seeta Female	32	7.0	1.6	5.1	44	24	24	46	1	30
2.	Shanti Female	29	8.6	2.7	5.8	42	35	20	68	1	12
3.	Chanchal Female	30	8.0	2.11	5.7	46	36	25	60	2	18
4.	Sagar Male	34	7.2	2.02	6.2	46	38	27	39	-	33
5.	Krishna Female	22	6.8	1.3	3.2	60	32	22	59	1	18
6.	Anarkali Female	21	7.0	1.79	5.05	66	28	25	53	1	21
1) Range		21-34	6.8-8.6	1.3-2.7	3.2-6.2	42-66	24-38	20-27	39-68	1-2	12-30
2) Averages		(28)	(7.4)	(1.91)	(5.17)	(50)	(32)	(23)	(54)	(1)	(22)

Reprint : Zoos' Print, 9 (9) : 10-11, September, 1994

OCCURRENCE OF *BIVITELLOBILHARZIA NAIRI* IN CAPTIVE ASIAN ELEPHANTS *(ELEPHAS MAXIMUS)* FROM KAZIRANGA NATIONAL PARK AND ASSAM STATE ZOO, GUWAHATI

S.Islam

Abstract

An occurrence of *Bivitellobilharzia nairi* in the captive Asian elephants (*Elephas maximus)* from the Kaziranga National Park and Assam State Zoo, Guwahati has been reported. Out of 44 elephants from Kaziranga National Park and Assam State Zoo, 7 were found to harbor natural B.nairi infection, respectively. The results have been compared and discussed.

Introduction

The occurrence of *Bivitellobilharzia nairi*, a schistosome parasite that dwells in the portal vessels of Indian elephants, has been documented by several authors (Vogel and Minnings. 1940; Mudaliar and Ramanujachari, 1945; Sundaram *et al.*, 1975) from Burma (Myanmar), Hamburg Zoo (Germany) and the Indian states of Tamil Nadu, Kerala and Mysore (Karnataka). Chakravorty *et al.* (1991) reported *Schistosoma* infection in a single Asian elephant from the Kaziranga National Park of Assam.

The finding of *Schistosoma* infection in elephant (Chakravorty *et al.* 1991) and the fact that captive elephants in Kaziranga are allowed to drink and graze within the park area (pers observation) suggest that schistosome infection cannot be an isolated or freak case. The vast amount of wetlands might act as a breeding ground for snail intermediate hosts of the parasite and serve as a nodal point of infection. Therefore, a thorough investigation was undertaken in the Kaziranga National Park and also at the Assam State Zoo, Guwahati to find out the occurence of this parasite in captive Asian elephants.

Materials and Methods

Collection of materials:

1. Faeces voided during the early morning hours measuring to an amount of 50 gms from each of the 30 adult elephant of both the sexes were collected in sterile polythene bags during the month of April, 1993, from the Kaziranga National Park. The bags were sealed and brought immediately to the park headquarter for analysis.

2. Faceal samples were also collected from the State Zoo, Assam during the month of February, 1994. A total of 14 dung samples was collected from the zoo and the materials were immediately brought to the laboratory of the Department of Parasitology, for analysis.

All the samples were processed according to the method of Soulsby (1982) and examined under a compound microscope.

Results and Discussion

The results of the present investigation have been summarised in the Table - 1.

Out of 44 samples examined, a total of 15.90% samples were found to be positive for *B.nairi* infection. All the positive samples encountered during the present investigation conforms to the faecal egg dimensions of Sundaram et al. (1972). Though Chakravorty *et al*, (1991) reported the occurrence of *Schistosoma* infection in a single captive elephant from KNP, the nomenclature of Chakravorty *et al.* (1991) is untenable because the nomenclature of *Schistosoma* spp. which occurs in Asian elephant has already been redescribed (Sundaram *et al.*, 1972)

Table - I:
Occurrence of *B. nairi* in captive Asian elephants in Kaziranga National Park and Assam State Zoo, Guwahati.

SL. No.	Collection source	No.of sample examined	No. positive	P.C. of infection
1.	Kaziranga Natl. Park	30	6	20.00
2.	Assam State Zoo,	14	1	7.14
	Total	44	7	15.90

The vast wetlands of the Kaziranga National Park might be maintaining the probable snail intermediate host for *B.nairi* survey of parasitic population in free living elephants within the park attention as the free living elephants may be the natural hosts for latent *B.nairi*

The zoo elephant which was found to harbor the natural *B.nairi* infection in the present investigation was carried down from some upland areas by the flood water of the river Brahmaputra during the year 1993. Subsequently, this animal was rescued by the forest personnel and rehabilitated at the Assam State Zoo, Guwahati. It is possible that, the elephant already had the infection when rescued. This also provides the evidence of the life cycle of *B.nairi* which is being maintained in the wild elephants and needs a careful and thorough investigation.

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Acknowledgements
The author is thankful to the D.F.O., Kaziranga National Park, the D.F.O., Assam State Zoo, Guwahati and the Dean, Faculty of Veterinary Science, Assam Agricultural University Khanapara, Guwahati for providing all the necessary facilities to carry out this study.

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Reprint : Zoos' Print, 11 (4) : 1-4, April, 1996

PARASITIC DISEASES IN INDIAN ELEPHANTS - REVIEW *Elephas maximus indicus*

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INTRODUCTION

Elephant is the largest of all living land mammals with an evolutionary background of more than 60 million years and has often been mentioned in the ancient Indian literature. For religious purposes, timber logging operation and forestry activities the elephants are still indispensable. In India the elephants are mostly seen along the foot of the Himalayas, tract of forest between Ganges and Krishna river and also in Western Ghats and in the hill forests of Karnataka, Kerala and Assam. So far, no census can say the exact number of elephants available in the country. Approximately about 7,000 elephants are found in India, of which approximately 43 per cent are seen in South India (Singh, 1994).

The elephants are invariably affected by many of parasitic diseases as like in other domestic animals. Reports of parasitic disease of elephants are very meagre. However, a few known parasitic diseases along with their treatment are reviewed in this manuscript.

I. TREMATODES

The occurrence of *Schistosome* in elephant liver was first reported by Mudaliar and Ramanujachari (1945) and they named it as *Schistosoma nairi*. The other flukes affecting the health of elephants are *Amphistomes* such as *Gastrodiscus secundus, Pseudodiscus collinsi, Pfendarius papillatus, Pfendarius birmanicus* and *Pseudodiscus hawkesii* (Bhalerao, 1935; Bapu; 1936; Huang, 1981; Dutta and Bordoloi, 1989).

The liver fluke is *Fasciola jacksoni* (Bapu, 1936; Huang 1981; Chakraborthy and Chaudhry, 1992; Borthakur *et al.*, 1993) and blood flukes are *Bivitellobilharzia nairi* (Sundaram *et al.*, 1972; Islam, 1994), *Ornithobilharzia nairi* (Rao and Hiregauder, 1953).

Among these, liver and blood flukes were the most pathogenic ones. They cause severe anaemia and cirrhosis of liver. The affected animal eats plenty of soil (about 10-20 kg) when let loose for grazing. The animal becomes dull, anorectic and the ears were cold to touch. The dung bolus is brown in colour and coated with mud. Foul smelling watery diarrohea is noticed 12-24 hours after eating the mud. (Bapu, 1936).

Rao and Hiregauder (1953) reported, the animals affected with blood fluke infection showed weakness, anorexia, difficulty in urination and tendency for vomiting. The mucous membrane was pale and diarrhoea followed by constipation.

In addition to the above symptoms Borthakur *et al.* (1993) observed symptoms of tympanitis, coiled trunk, extension of limb, dropped ear, conjunctivities, frothy salivation and frequent urination. But temperature was abnormal, respiration shallow and pulse rapid.

The liver fluke is sometimes found attached to the biliary epithelium and they are distorted by necrotic tissue which contain RBC's and ova of *Fasciola jacksoni* (Chakraborthy and Chaudhry, 1992).

Kalapsesi and Purohit (1957) found the *schistosome* eggs in liver and mesentric lymphnode. They could not identify eggs in faeces. But in histopathological section they revealed an adult worm with non tuberculate cuticle in mesentric vein.

The diarrohea is found in all trematode infection and lasts for 3 days and sometimes may extend for a week. Odematous swelling is noticed on the intermandibular region or on lower abdomen especially in rumen fluke infection (Chandrasekaran *et al.*, 1982). Singh *et al.* (1994) studied the pathology of *Fasciola jacksoni* in liver and found haemorrhagic tracts, thickening of bile ductules, cirrhotic changes and pseudolobulation. In lungs, the bronchial lumen contained desquamated cell mixed with fibrohaemorrhagic exudate.

Chandrasekaran *et al.*, (1982) suggested that the Hexachlorophene (Distodin) 8-10 mg/kg B.W. was 100 percent effective against Amphistomes. Drugs such as Nitroxynil (Trodax) 10 mg/kg/ SC and Rafoxanide (Ranide) - 2.5-5 mg/kg/ can also be tried.

Borthakur *et al.*, (1993) opined that an oral dose of 100g, Aviothane (ICI) in two divided dose has seen recovery from this infection with in a month.

Antimosan 200 ml/ animal, S/c, single injection for 3 weeks at weekly interval helped to treat the *Ornithobilharzia* infection was suggested by Rao and Hiregauder (1953).

II. CESTODES

The occurrence of cestode *Anoplocephala manubriata* was observed by Chandrasekharan *et al.* (1979) in Kerala. They revealed that affected animal became anorectic, deteriorates in condition, eats grit and mud apart from suffering from diarrhoea.

Oxyclozanide (Zanil ICI) @ 3.4 mg/kg B.W. orally was found to be effective against proglottids (Chandrasekharan *et al.*, 1979).

Other drugs that can be tried include (Panikar, 1992).

1. Niclosamide (Niclosan) @ 75 - 100 mg / kg B.W. Orally,
2. Haxachlorophene (Distodin) @ 10 mg / kg B.W. Orally,
3. Mansonil - 5 mg/Kg, Orally,
4. Praziquentel (Droncit) - 2.5 - 4 mg/kg, orally.

III NEMATODES

The species of nematode recorded from Indian elephants were *Amira pileata, Decruzia adilicta, Equinurbia siphunculiformis, Quilonia travencra, Q. rennie, Murshidia murshidia, M. falcifera, M. indica* (Sundaram *et al.*, 1971) and *Chomiangium epistomum* (Datta *et al.*, 1972). *Bathmostomum sangeri*

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(Sathianesan *et al.*, 1979; Adkoli *et al.*, 1986; Dutta and Bordoloi, 1989) *Parabronema indicum*, *P. smithi* (Panicker, 1992). The stomach worm *Haemonchous contortus* was first recorded by Rahman *et al.* (1970) on postmortem examination in an elephant of Mysore area.

The hook worm was first recorded by Bhalerao (1935) in India from bile duct of an elephant and he named them as *Grammocephalus elathratus* and *G. varedatus* a new species of strongyle was also recorded by Mudaliar and Alwar (1954). Rajasekharah *et al.* (1975) recovered both immature and adult worms of *G. hybridatus* from a nodule in the stomach and they reported it was a unusual site for this parasite. Subsequently Pillay *et al.* (1976) also reported *G. hybridatus* from the liver of an elephant.

Affected animals showed symptoms of drowsiness, inappettence and shivering. Rajamohanan (1970) observed acute enteritis in elephants with most of the nematode infection. During postmortem examination the following changes were noticed, such as liver was pale, enlarged and packed with nematodes. There was mild proliferation of connective tissue in portal tract, besides marked hyperplasia, hepatic and kuffer cell loaded with bile pigments, sinusoids showed slight to moderate engorgement and in focal areas revealed polymorphs and macrophages. (Pillay *et al.*, 1976).

Monning (1932) recorded the *Syngamus indicus* a new nematode from the lower portion of pharynx of an Indian elephant. Greve (1969) found Indian elephants infected with *Strongyloides elephantis* to be anaemic, depressed and in poor general condition. On postmortem examination, these animals had suppurative bronchopneumonia, enlarged mesentric lymphnode and emaciation. Datta *et al.*, (1972) reported animals irrespective of age, sex, body weight in *Chomiangium epistomum* infection showed emaciation, anaemia, exhausted even during light work, and coprophagia. Dung found to be loose, noxious smell, flatulence and sub normal temperature was observed.

Lakhar and Das (1988) reported the presence of Trichostrongyle infection in 6 elephants of both sexes from Khanapara, Assam. The animals showed symptoms of anorexia, diarrhoea and soil eating habit. Other ascarid, strongyle, *Strongyloides* species worms were also recovered from Indian elephants by Dutta and Bordoloi (1989).

Treatment for Gastro intestinal nematodes

The following drugs were tried by different research workers,

1. Tetramisole hydrochloride (Nilverm) 3-5 mg/kg B.w s/c (Sundaram et al., 1971; Datta *et al.*, (1972)

2. Thiabendazole (Panacur) - 40 mg/kg B.W. orally. (Chandrasekharan *et al.*, 1972)

3. Morantal tartrate (Banminth II) 2-5 mg/kg B.W. orally (Chandrasekharan *et al.*, 1973)

4. Thiophanate (NEMAFAX) - 14 mg/kg B.W. orally, against Strongylosis. (Chandrasekharan *et al.*, 1979)

5. Methyridine (Promintic) @ 50 mg/kg/ B.W. S/c, diluted with equal quantity of water effective against *G. varedatus* and *M. falcifera*. (Chandrasekharan *et al.*, 1979)

6. Oxybendazole (SKF) - 2.5 mg/kg orally against strongyle infection (Sathianesan *et al.*, 1979)

7. Mebendazole 3-4 mg/kg B.W

8. Levamisole 3 mg/kg B.W

9. Bephenium hydroxynapthoate - 25 mg /kg B.W

10. Diosophenol - 3 mg/kg. All these drugs (7 - 10) were tried against GI nematodes. (Chandrasekharan *et al.*, 1982).

11. Fenbendazole 25 % (Panacur Hoechst) 5 mg/kg. (Roy and Majumdar, 1988). Single dose, orally found effective against *Murshidia murshidia* infection.

12. Fenbebdazole (Panacur) - 24 to 30 g/animal orally was useful for treating nematode infection. (Rao *et al.*, 1990).

Cutaneous filariasis

Elephants also suffer from haemorrhagic filariasis or parasitic dermatorrhagia caused by *Indofilaria pattabiramani* and *I. elephantis* (Alwar *et al.*, 1959; and Chandrasekharan *et al.*, 1972) respectively. This parasite can affect all animals irrespective of age, sex and body weight.

A nodule appears on the skin at the sides underneath the abdomen and less frequently on the neck, chest, and outer aspect of thigh. Nodules are one cm thick, 1-2 cm in diameter. The nodules appear at a rate of 4-10 per day and up to 270 nodules has been reported during a penod of 6 weeks. About 5-10 ml of blood passes out from each nodule during hotter times of the day. The oozing blood contained large number of microfilaria. The disease is seen through out the year and mostly during months of October and April. (Alwar *et al.*, 1959)

Treatment

1. Arsenical preparation (Acetylarsan) 30-40ml, S/C five inj. should be given on alternate days. If treatment is further needed, should be continued after a week.

2. Anthiomaline - 50 ml / 2000 kg, s/c, 6-10 Inj (KAU, 1987)

3. By control of flies with insecticides, fly repellents and frequent application of neem oil around the haemorrhagic nodule helped to prevent the biting of flies. (KAU, 1987).

Stephanofilarial dermatitis

Stephanofilaria srivastavai was recorded for the first time in an Indian elephant by Bhattacharjee (1967). Subsequently, it had been also recorded by chatterjee *et al.* (1982) and Tripathy *et al.* (1989) in a female elephant. Affected animal had sores of 1 X 1/2 " in size, located on the left side of the back slightly ahead of shoulder blade, just in front of the saddle. The lesion was covered with crust and pus. They also recorded several female worms from the deep scrapings of the sore. The chronic dermatitic skin lesion was also observed by Chatterjee (1984) and Tripathy *et al.* (1989) in region of toes, heels of hind feet and right abdominal wall.

The line of treatment is similar to that of hemorrhagic dermatitis. The other drugs that can be tried was metrifonate 8% (Trichlorfon) in himaxbase will cure in 15 days, vaseline base will give cure after 22 days. (Tripathy et al., 1989).

IV ECTOPARASITES

The ectoparasites recorded from elephants were *Haematomyzus elephantis* (Raghavan *et al.*, 1968; Chandrasekharan *et al.*, 1972), *Cobboldia elephantis* (Datta *et al.*, 1972), *Tabanus sp.* and *Haematopoda sp.*, (Sundaram, 1966).

The bots are the larvae of *Cobboldia elephantis* flies, found more during rainy days, lay their eggs on hairs in various part of body and at the root of tusks in males. Animals irrespective of age, sex and body weight become highly emaciated, anaemic and gets exhausted even at light work. Body temperature is subnormal. (Datta *et al.*, 1972).

Haematomyzus elephantis was found mostly in the ear where the skin is thin, soft and easily penetrable, causing severe dermatitis, pruritis and dryness. There was scale formation on the neck, ears, abdomen and tail. (Raghavan *et al.*, 1968)

Treatment

1. Thorough dusting with Gammaxane (0.5%) all over the body.

2. Washing with sumathion 1% as a 1 in 100 solution

3. Raghavan et al. (1968) Suggested that application of sulphur in oil 10 per cent solution all over the body was effective in treating the louse infestation.

4. Nilverm (ICI) - 3 mg/kg B.W. single dose orally mixed with crushed grams. The animal recovered with in a period of 7 days in *C. elephantis* infection (Datta *et al.*, 1972).

Ticks

The ticks that had been recorded from wild elephants in Kerala were *Boophilus annulatus*, *Haemophysalis spinigera*, *Rhiphicephallus haemophysaloides*, *Ornithodorous savignyi* (Panicker, 1992).

V PROTOZOAN DISEASES

Babesiosis

The incidence of babesiosis in elephant is rare. The occurrence of piroplasmosis had only been described in elephants belonging to the Bareilly area in U.P. (Lingard and Jennings, 1904). Affected animals showed symptoms of anorexia, constipation, dark coloured urine, high temperature, iectenc mucous membrane of conjunctiva, dullness and weakness. (Mcgaughey, 1961).

Babesan or Berenil may be tried as a treatment

Surra

In elephants surra is caused by *Trypanosoma evansi* (Mcgaughey, 1961), transmitted by species of *Tabanus* and *Stomoxys* flies. The disease is most prevalent during rainy season when the fly population is more.

Affected animals appears dull, restless, sleepy, quite disinclined to move, eyes protruding, frothy discharge from eyes and nostrils, mucous membrane were pale, odematous swelling on the dependent part, throat, abdomen and along the sheath. Skin is dry, harsh, urine scanty, turbid and often greenish in colour. Mucous membranes of proboscis and eyelids loose their pink colour and become dirty white. There is intermittent rise of temperature and lacrimation (Panicker, 1992).

Treatment

1. Berenil - 5 to 8 mg/kg, I/M. (Panicker, 1992)

2. Antricide methyl sulphate - 24 ml of 10% solution/animal, S/C. (KAU, 1987).

3. Neganol - one ounce dissolved in 5 ounce of water, I/V.

4. Tryparsamide - Initial dose 20 gm in 20 ml water I/V, gradually increased to 40-50 gms at weekly interval until a total dose of 500 gm is reached.

5. Antricide prosalt - 7gm in 30 ml dis water S/C.

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Reprint : Zoos' Print, 11 (4) : 10, April, 1996

FENBENDAZOLE * - AN USEFUL DEWORMER FOR ELEPHANTS

S.P. Tiwari and K.N.P. Rao

Bendazole group of drugs being broad spectrum and effective anthelmintics are quite safe. Now a days they have a wide application for routine deworming in domestic animals. These are being marketed in different forms such as powders, boli and suspensions. When used orally in doses of 5-15 mg/Kg. body weight, are quite effective in controlling majority of the internal parasites in the domestic animals. It is further claimed that these drugs act on all the stages of the internal parasites.

Trematodes have been reported to cause disease in elephants. Severe infections of Fasciolíasis have been responsible for ill health and death in Asiatic elephants. Various drugs have been tried with varying success (Fowler 1978). The present communication deals with the therapeutic application use of fenbendazole in elephants for the removal and prevention of trematodes in elephants of Bandhavgarh, National Park in Madhya Pradesh.

The present observation communicates the use of fenbendazole (Panacur) in elephants of Bandhavgarh National Park showing the symptoms of parasitic infection, such as eating of earth, passage of worms in their faeces, loss of body weight and death of two elephants due to perhaps heavy parasitism.

Out of 14 elephants belonging to the National Park of Bhandavgarh, faecal samples of 4 elephants were found positive for the presence of *Paramphistoma* eggs. Microscopic finding and history of earlier deaths in this group lead to the suspicion of focus of this infection in the National Park. These findings necessitated a routine deworming of all the elephants which were kept in semi captive environment.

Panacur brand of fenbendazole was used and given orally @ 5 mg./Kg. body wt. in bolus (1.5 gm.) form which constituted a total dose of 10-15 boli for each elephant weighing around 3000 - 4500 Kg. Single dose treatment was given to 14 elephants of various ages and body weights. The second dose was repeated after 3 weeks and then regular deworming every 3-6 months was practiced between 1993-1995. Their faecal samples were examined microscopically after 7-8 days of 2nd dosing which did not reveal any thing specific.

These elephants were regularly dewormed every 3-6 months using Panacur brand of fenbandzole from Hoechst India Ltd. Bombay, in the same doses without any side effects. Since then there is no serious sickness reported from the National park and the elephants are in good health as observed in recent visit by one of the authors. The drug was found acceptable and equally effective in all age group of animals.

* **Panacur bolus from Hoechst India Ltd, Bombay.**

ACKNOWLEDGEMENT

The authors are thankful to the Dean, College of Veterinary Science and A.H., Jabalpur (M.P) and the Director of Bandhavgarh project for providing all necessary facilities for visiting the National Park.

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Reprint : Zoos' Print, 11 (4) : 11, April, 1996

STUDIES ON SOME ASPECTS OF FASCIOLIASIS IN ASIAN ELEPHANTS (*Elephas maximus*)

Saidul Islam*

ABSTRACT

Epidemiology of fascioliasis in free living and captive Asian elephant (*Elephas maximus*) of Kaziranga National Park, Rajiv Gandhi Wildlife Sanctuary and Assam State Zoo-cum-Botanical Garden was studied. A vegetation cover type-cum- wetland map of the Kaziranga National Park was prepared through visual interpretation of LANDSAT 5TM (FCC) remote sensing satellite data. Altogether four main land cover classes could be identified in addition to sandy and agricultural lands. The moist deciduous forest, grass-land, waterlogged (perennial)/ beels, swampy/ marshy areas, sandy areas and agricultural lands occupied 29.13, 51.91, 7.62, 6.67, 3.95 and 0.60 percent of the total park area (430 sq. km) respectively. Limnological studies conducted during the month of December, 1993 at 3 selected wetland sites of the park revealed water temperature to be 25°C; the range of pH, total alkalinity, dissolved oxygen, total hardness and free carbondioxide varied from 7.4-8.0, 70.90 mg/1, 7.6-8.9 mg/1, 28-35 mg/1 and 0-3 ppm respectively. Malacological studies conducted at 3 wet-land sites of the park showed prevalence of 7 different aquatic snail species viz. *Bithynia sps.* (6%), *Gyraulus convexiusculus* (16%), *Indoplanorbis exustus* (20%), *Lymnea luteola* (8%), *L.auricularia var rufescens* (22%), *Thiara (Melanoides) tuberculata* (8%) and *Vivipara sps.* (20%). A total of 14 different aquatic weed species under 11 families could be identified in three ranges of the park. Free living Asian elephant in the park showed 33.78 percent infection rate with *Fasciola jacksoni*. Highest infection (50.00%) was found at the Kohora range of the park. Captive elephants reared at the Kaziranga National Park, Rajiv Gandhi Wildlife Sanctuary and Assam State Zoo - Cum -Botanical Garden showed highest infection with *F. jacksoni* which was 42.50, 62.28 and 18.18 percent during the year 1994, 1994 and 1993-94 respectively.

Studies conducted with LM and SEM showed the size of *F. jacksoni* eggs to be 127.14 +/- 5.26 µ (116.10- 147.20 µ) x 65.36+/- 0.86 µ (64.50 - 68.80 µ) and 145.06 +/- 9.49 µ (105.87 - 166.50 µ) x 75.43 +/- 5.12 µ (54.11 - 88.24) respectively. The egg shape was elliptically oval with deep yellow coloured shell.

Complete miracidial development of *F. jacksoni* eggs was attained at 28 - 33°C on 12th day in wet cultures. Developed miracidia remained alive for 7 months in permanently moist faeces at a temperature of 21 - 35°C.

The dimension of *F. jacksoni* miracidia measured under SEM was 103.75 x 26.00 µ. Tegument showed numerous cilia, an apical protrusible papilla and a pair of lateral papillae at the juncture of first and second tier of epithelial cells.

The adult parasites were 14.94-15.12 mm x 9.95 - 10.42 mm. Numerous sharp edged spines covered the entire tegument of the parasites which varied in size and density along the different parts of the body. Oral sucker showed numerous radially oriented papillae. Intestinal caeca were highly branched in the middle and posterior third than in the anterior third.

Average diurnal fluctuation of *F. jacksoni* egg count in naturally infected *E. maximus* was 4.89, 2.47 and 2.76 during the morning, noon and evening hours of the day respectively. Highly aged animals had less daily average egg output than the younger animals.

Younger animals with *F. jacksoni* infection showed the clinical signs of anorexia, constipation, often passed out odorous stool, dehydration, anaemia and icterus. They took black earth while grazing. There were deaths in progressive stage of the disease with distinct clinical manifestations. Many aged animals survived the disease without apparent clinical signs.

In liver of elephant, *F. jacksoni* produced well defined necrotic cavities which contained dark red coloured homogenous masses, dead parasites and trapped eggs. There were periportal necrosis, hepatic fibrosis, individualization of hepatocytes, syncytia formation with enlarged hepatic nuclei, hydropic changes, leukocytic infiltration and tracts of hemosiderin deposits. Adult *F. jacksoni* produced emboli in a superficial epicardial vessel. In a pericardial vessel immature *F. jacksoni* could be observed at different stages of immune attack from host.

Triclabendazole @ 9 mg/kg (not exceeding a total dose of 7200 mg/animal) and oxyclozanide @ 7.5 mg/kg (total dose not exceeding 6.8 gm/animal) was found to be 100 and 72.16 percent effective respectively till 21st day post-treatment in clinical fascioliasis in elephant based on faecal egg count. Post-treatment hormotologic and serum biochemical values did not reveal any significant difference statistically. No signs of toxicity could be noticed in the treated elephants till 21st day post-treatment.

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Indian J.Vet.Med. Vol. 17. No. 1 & 2, 1997 PP. 48-49

Use of fenbendazole against murshidiasis in a zoo elephant

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Nematode infection, especially with Murshidia spp. has been reported in India (Singh, 1998). Varieties of anthelmintics have been tried successfully in the treatment of Murshidia infection in elephants. The present paper deals with treatment of a chronic case of murshidiasis in a zoo elephant by use of fenbendazole.

A she elephant (Vasanti) aged about 21 years was brought to the State Biological Park, Nanadankanan, Orissa on 13.10.85 from the Forest Department, Tamilnadu. She had given birth to a male calf on 12.05.86 and was keeping fit excepting apearing a bit weak externally which was due to suckling of young calf. She had been dewormed with phenothiazine @ 300g orally on 3.7.87, 8.8.87and 4.11.88 along with Livol @ 100g daily orally for 15 days before and after use of phenothiazine. Mineral and Vitamin powder were being given regularly for most of the period. Inspite of all these treatments the animal was getting weaker and weaker though she was consuming food as usual.

On 12.12.88 a thorough investigation was done to find out the cause of the debility.

At the time of examination the elephant appeared to be dull and cachectic. The feed consumption had been reduced by 25%. The water consumption and urination appeared normal. The faecal material was semisolid in nature. Slight oedematous swelling appeared around face, submandibular space, knee joints of fore limbs and brisket area. Examination of faeces revealed Murshidia eggs. The e.p.g. of faeces was 4200 (counted by Mc Masters counting chamber). There were no abnormalities in urine. Examination of blood revealed packed cell volume (35%) and heamoglobin (13.6g%) to be within normal range as reported by Simon (1960). The differential count of blood was L:63%, N:27%, E:7% and B:1% indicating presence of lymphocytosis and neutropenia. Basing on all these findings and clinical signs it was diagnosed to be a case of chronic infection of Murshidia spp. of nematode.

The elephant was treated with 50g of Panacur (Hoechst) (25% fenbendazole)

orally which was repeated after 30 days alongwith Neurobion (E.Merch) 30 ml. i.m. every 3rd day for 5 injections, Minamil (Brihans) @ 50g once daily for a month and Livol (Indian Herbs) @ 100g daily for 15 days.

Gradual improvement was noticed in the body condition and the oedematous swellings were absent after about 2 months of starting of treatment. The elephant appeared quite normal 4 months post treatment. Excretion of eggs reduced by 70% and 100% when faeces was examined 5th and 20th day after first deworming respectively. The body weight showed improvement 2 months post treatment and subsequently. The body weight of the elephant at the time of treatment was 2120 kg. After 6 months of post treatment, the body weight increased to 2865 kg. an increase of 745 kg.

Panacur (Hoechst) has been used successfully @ 5 mg per kg. body weight for the treatment of 3 elephants having M.*murshidia* infection (Ray and Muzumdar. 1988) and in 10 elephants @ 24-30 g per animal (Rao et al., 1990). In the present study 50g of Panacur (with body weight of about 2050 kg) was given to elephant twice at an interval of one month where increase in body weight, absence of strongyle ova in faeces and improvement in body condition were used as the criteria for evaluation. The present finding confirms the finding of previous reports.

A chronic case of murshidiasis was recorded in a she elephant aged about 24 years. Reduction in feed intake, oedematous swelling on dependant parts of body, debility and chachectic condition were the major clinical signs. Examination of the faeces revealed presence of Murshidia sp. eggs (e.p.g. 4200) and differential count of blood revealed lymphocytosis (63%) and neutropenia (27%). Panacur (25% fenbendazole) was administered oraly 50g repeated after a month along with Neurobion, Minamil and Livol as a measure of treatment. Significant improvement in body condition was noticed with absence of clinical signs 2 months after initiation of treatment. The gain in body weight was highly significant after the treatment.

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Received on : January 25, 1996
Accepted on : December 9, 1997

Reprint from THE INDIAN VETERINARY JOURNAL
Vol. 47, No. 3, March 1970

SOME OBSERVATIONS ON TRICHOMONIASIS OF THE UPPER DIGESTIVE TRACT OF LOVE BIRDS (BUDGERIGARS) IN HYDERABAD, ANDHRA PRADESH

By

ZAHEER AHMED[1], A. PANDURANG[2], R. S. ACHARYA[3]
and
GOUHER ALI[4]

Trichomoniasis of the upper digestive tract of birds has been reported in pigeons, wild mourning doves, turkeys and chickens (Lund and Farr, 1965). In our country, Mohteda (1946) recorded its incidence in pigeons. The present report deals with the occurrence of Trichomoniasis of the upper digestive tract in love birds (budgerigars).

Observations

In May and June, 1958, there were outbreaks of disease among love birds with heavy mortality. The birds died within 3 to 4 days after showing symptoms of dullness, off feed, ruffled feather, loss of weight, dyspnoea and dysphagia (Fig. 1). On examination, a hard mass was felt in the region of the throat. In three different flocks having a strength of 84, 65 and 245 birds, there was a mortality of 32·2%, 36·9% and 40·8% respectively. Few birds that were purchased from the market were in contact with pigeons. These birds

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might have probably caught the infection from the pigeons. Birds of 3-5 months age were affected. The mortality in the females was more than in the males. The disease made its appearance in summer and subsided during rainy season.

Laboratory Findings

Post-mortem examination of ten carcases from the three outbreaks revealed gross discernable lesions in the upper digestive tract only. The oesophageal mucosa just anterior to the crop was covered with a yellow caseous mass, which partially occluded the lumen of the oesophagus. In some cases, the occlusion was almost complete. *Trichomonas sp.*, in teeming numbers could be demonstrated on microscopic examination of both the wet and dry smears (stained with Giemsa stain) from the affected region of the upper digestive tract. No organisms of aetiological significance could be detected in the tissue smears of liver, heart, spleen and lower digestive tract of birds.

Material from the lesions was sown in broth, nutrient agar and MacConkey's medium. Gram positive cocci and Gram negative rods (lactose fermenters) could be isolated.

Treatment

Metronidazole (1-beta-hydroxyethyl 2-methyl 5 nitroimidzole) was administred at the rate of 5 mgm /100 gm. body weight for five consecutive days. Mortality in the birds was controlled and fresh cases were not observed after medication. No *Trichomonas sp.* could be detected in the treated birds.

Description of the Parasite

Forty parasites were measured. The parasites were pear or round shaped, measured about 7·9 microns to 13 microns in length and 4·1 microns to 9·2 microns in breadth with an average length of 10·1 microns and breadth of 7·2 microns. There were four anterior flagella and an undulating membrane running up to two thirds the length of the parasite. An exostyle ran along the long axis of the parasite. The nucleus was placed anteriorly with the blepheroplast placed anterior to the nucleus (Fig. 2). The morphological studies indicated that the *Trichomonas* from these love birds had morphological resemblance to *Trichomonas gallinae*.

Transmission Experiment

Material from the upper digestive tract of love birds containing *Trichomonas sp.*, on oral administration in fifteen day-old chicks was found to be avirulent.

Some observations on Trichomoniasis of the upper digestive tracts of love birds (Budgerigars) in Hyderabad, A.P.

By ZAHEER AHMED, A. PANDURANG, R. S. ACHARYA and GOUHER ALI

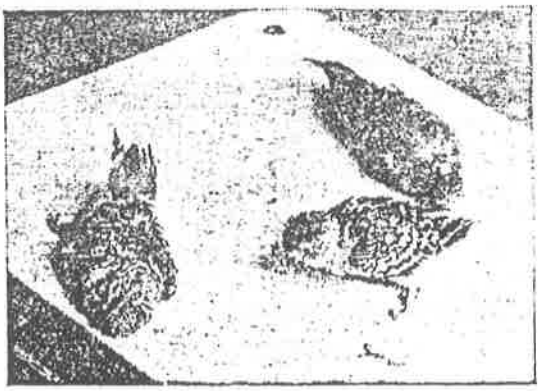

Fig. 1. Ailing and dead Budgerigars.

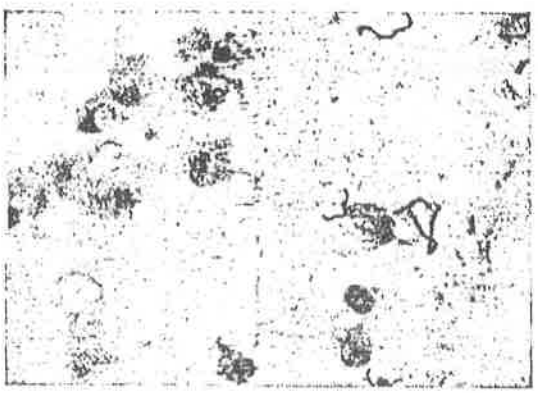

Fig. 2. Showing Trichomonas sp. from the oesophageal lesions.

| *To face page 210* |

Discussion and Conclusion

The history of outbreaks, the post-mortem findings, demonstration of *Trichomonas sp.* in teeming numbers from the lesions, failure to control the mortality by the administration of broad-spectrum antibiotics, sulpha drugs and Bifuran and response to treatment with Metronidazole which is almost specific for trichomoniasis of pigeons point trichomoniasis as the main cause of mortality among the love birds.

Summary

Trichomoniasis of the upper digestive tract of love birds has been recorded in Andhra Pradesh. The flagellates recovered from the lesions of these birds have morphological resemblance to *Trichomonas gallinae*. Metronidazole was found to be effective in controlling mortality among the affected birds.

Acknowledgment

The authors are grateful to Dr. C. Krishna Rao, the then Director of Animal Husbandry, Andhra Pradesh for encouragement in publishing this article. The cooperation extended by Sri Mohd. Ali, Love Bird fancier is also recorded.

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Reprint : Zoos' Print, 11 (4) : 12, April, 1996

A NEW ELEPHANT HOST RECORD OF EYE WORM THELAZIA WITH SOME CLINICAL OBSERVATIONS

S. Islam and B.C. Lahkar

Common eye worm belonging to the genera *Thelazia* (Soulsby, 1982) has been recorded from different domesticated animals. The subject has been widely reviewed by Weinmann (1982). However, there is no previous record of the occurrence of this general in Asian elephant (*Elephas maximus*) (Fowler, 1978;1991Pers. comm.). Present communication deals with the occurrence of Thelazia in an Asian elephant with some clinical conditions and its correction.

A 20 year old adult male elephant was reported to be constantly weeping from its right eye with irritation. Most of the time the animal kept close its eyelid. The mahout treated the eye with common salt in mustard oil. However, the clinical condition was not ameliorated.

On examination of the affected eye, four live creamy-white colored nematodes could be seen under the nictitating membrane in the medial canthus of the eye. The worms were collected in physiological saline solution and brought to the laboratory for taxonomic study.

Removal of the worms were followed by washing off the eye with 1% borozinc lotion three times a day. From the second day of treatment, a 1% aqueous solution of tetramisole was used alternatively for 5 days along with borozinc lotion. On the third, gentamicin eyedrops were used topically three times a day which was continued for 7 days. Fifteen days after this treatment, all the clinical condition of the affected eye became normal.

Based on the morphological criteria (Soulsby, 1982, Weinmann, 1982) of the worms recovered, it was found that the worms belonged to the genera *Thelazia* Bosc, 1819. Scanning electron microscopic studies on the tegumental morphology of the worm revealed transverse striations on the entire body surface. The striations were more sharp in the first quarter of the body (Fig 1) than the other quarters (Fig.2,3 and 4). Moreover, the striations located in the posterior two quarters were incomplete at some places (Fig.3 and 4). Findings of the detail light microscopic studies on the morphology of the specimen will be separately communicated.

There is little practical work on the host specificity of thelazia species. Probably, the host feeding preference by vector species might be playing a role in establishing the infection in a new host. Further observation in this regard is necessary.

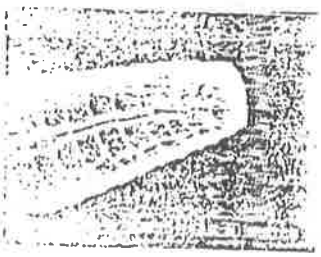

Fig.1. Scanning electron microscopic (SEM) photograph of the Thelazia specimen showing the anterior quarter of the body. Note the sharp tegumental striations. Scale bar = 10 micron Magnification = X600

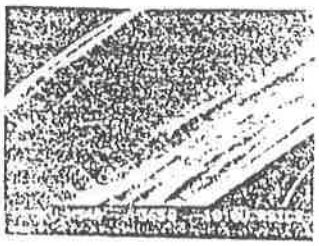

Fig.2. SEM photograph of the worm showing the transverse tegumental striations at the second quarter of the body. Scale bar = 10 micron Magnification - X540

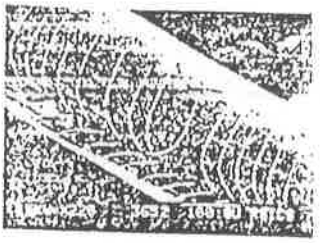

Fig.3. SEM photograph of the worm at the third quarter showing the transverse tegumental striations. Note the striations are not complete. Scale bar = 100 micron Magnification = X220

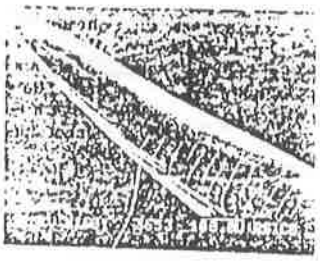

Fig.4. SEM photograph of the worm showing the hind quarter with incomplete transverse tegumental striations. Scale bar = 100 micron Magnification = X160

ACKNOWLEDGEMENT

Senior author is thankful to the Head, Regional Sophisticated Instrumentation Centre (RSIC), Shillong, Meghalaya, for the scanning electron microscopic facilities.

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Reprint : Zoos' Print, 11 (10) : 16 & 18, October, 1996

A NOTE ON *Grammocephalus varedatus* INFECTION IN AN AFRICAN ELEPHANT *(Loxodonta africana)* AT THE ASSAM STATE ZOO, GUWAHATI.

S. Islam, S. Goswami*, and G.K. Baruah*

ABSTRACT

Grammocephalosis due to *Grammocephalus varedatus* Lane, 1921 in an African elephant *(Loxodonta africana)* at the Assam State Zoo, Guwahati has been described. Grossly, there were petechial haemorrhages and small white necrotic spots on the liver surface. Bile ducts had thickened mucous layer. Numerous adult *G. varedatus* specimens of both the sexes could be recovered from the bile duct. Histopathologically, there were haemorrhages with congested sinusoids. Hepatocytes showed degenarative changes. There were necrosis, focal fibrosis and cellular infiltration. Results have been compared and discussed.

INTRODUCTION

Unlike other hookworms the species of the genus *Grammocephalus* are exceptional in that they occur in the liver. Occurrence of this parasite in Indian elephant has been recorded earlier by several workers (Bhalerao, 1935; Baylis, 1936, Ramanujachari and Alwar, 1954; Sukumara Pillay *et al.*, 1976). Karim (1989) reported the gross pathology of *G.varedatus* infection in a male wild Asian elephant *(Elephas maximus)* from the state of Assam. This communication deals with pathology of *G. varedatus* in a male African elephant *(Loxodonta africana)* from the Assam State Zoo, Guwahati.

MATERIALS AND METHODS

An adult male African elephant came into musth at the Assam State Zoo, Guwahati, in the year 1994. While attempts were made to control musth by chemical sedatives, it died of strangulation during the anaesthetic period.

Gross observation of liver and bile duct of the animal was noted at post-mortem. Parasites were collected in 10% formalin. Representatives samples from liver were collected in 10% formol saline and processed by routine histopathological procedure (Luna, 1968).

RESULTS

On post-mortem, the enlarged liver showed petechial haemorrhages and small white necrotic foci on the surface. On incision, numerous round worms could be seen in the lumen of the bile duct. Bile ducts had thickened mucous layer. The worms were identified as *Grammocephalus varedatus*, Lane, 1921, based on their morphology (Fig.1).

Histopathologically, there were haemorrhages throughout the section with congested sinusoides. Hepatocytes had undergone degenerative changes and at some places they were completely necrosed (Fig.2). Focal areas showed fibrosis with mild infiltration of mononuclear cells. Mild fibroblastic proliferation were also found in the interlobular areas (Fig.3).

DISCUSSION

G. hybridatus (Sukumara Pillay *et al.*, 1976) and *G. varedatus* (Karim, 1989) are known to produce hepatomegaly and fibrosis in *E. maximus*, were also found in the present study. The thick mucous layer in the bile duct might be attributed to the presence of parasites leading to catarrhal inflammation of the duct.

The cause of petechial haemorrhage have been assumed to be an affect of chemical sedatives used to control the animal. Portal tracts of *E. maximus* with mild proliferation of connective tissues, biliary hyperplasia, slight to moderate engorgement of sinusoids, focal infiltration of polymorphs and macrophages have been associated with acute grammocephalosis due to *G. hybridatus* (Sukumar Pillay *et al.*, 1976). Comparable histopathological changes were also observed in the present study with *G. varedatus* in *L. africana*. It appears that *G. varedatus* is a common parasite of wild Asian elephant (Karim, 1989) and zoo reared African elephant in Assam. An early diagnosis and proper treatment of captive elephants in this region is suggested to evade the pathological implications of this parasite.

ACKNOWLEDGEMENT

Authors are thankful to the F.V.O., the pathologist the D.F.O. of the Assam State Zoo-cum- Botanical Garden, Guwahati and the Dean, Faculty of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati for the facilities.

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and pain at the site of crushing due to inflammation were the probable reasons for the animals to go off-feed on the day of castration. The abnormal posture during standing and walking might also be due to pain in the scrotum. As the inflammation decreased gradually, those postural abnormalities disappeared simultaneously.

The present study indicates that Burdizzo's method of castration is ideal for castration of barking deer. The goat is reported to be susceptible to shock during open method of castration which might be true in case of barking deer too. Open method of castration necessitates repeated capturing for regular dressing and administration of antibiotic. These problems can be avoided with the Burdizzo's method.

The testicles atrophied gradually and completely disappeared in the course of 3 to 4 months and in bovine, it happens within 2 to 3 months (O'Connor, 1980).

There was no remarkable fattening of the castrates during the three years of post-castration period. General health condition remained as before. The aggressive male behaviour disappeared temporarily for 18 days which might be due to stress during capture and castration. Castration failed to control the aggressive male behaviour permanently. Similar report is also available in horse and the persistance of masculine behaviour may be attributable to the production of androgens by the adrenal glands and accessory adrenal cortical tissues (Vaughan, *et al.*, 1988). Further, inappropriate ratio of male and female in the herd might be another cause. The castrated deer even attacked the attendents occasionally. Hence, the primary objective of castration was not achieved in the present study.

ACKNOWLEDGEMENT:

We thank Dr. S.C. Pathak and Dr. S.N. Gogoi (Department of Surgery & Radiology, College of Veterinary Science, AAU, Khanapara, Guwahati) for their technical advice on the day of castration. We are also thankful to the staff of the Zoo Veterinary Hospital, Assam State Zoo, Guwahati for their cooperation during the 3 years of observation period.

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continued from page 16..... (G. varedatus infection...)

Fig. 1. Anterior end of Grammocephalus varedatus *recovered from the bile duct of a* Loxodonta africana

Fig. 2. Photomicrograph showing haemorrhage and degeneration of pericentral hepatocytes of an African elephant (Loxodonta african). *H&E X200*

Fig. 3. Photomicrograph showing focal fibrosis with mild mononuclear cell infiltration. H&E X200

Reprint : Zoos' Print, 12 (9) : 27, September, 1997

AMPHISTONE INFECTION IN SWAMP DEER (*Cervus duvauceli branderi*)

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Amongst the parasitic diseases of trematode origin in domestic ruminants like sheep, goat, cattle and buffalo, amphistomiasis is a common and important infection. The disease is caused by flukes commonly known as amphistomes. The flukes are present in the rumen and reticulum of their respective hosts. Adult flukes are not harmful but the immature forms are very harmful producing a condition known as immature amphistomiasis. The disease is very common in young animals in almost all parts of the country. Developing flukes cause haemorrhagic diarrhoea, oedema, anaemia and at times death. Disease occurs in the form of outbreaks after rainy season and in early winter.

Cotylophoron cotylophorum, *Parmphistomum cervi* and *Gastrothylax crumennifer* have been commonly reported from sambar, nilgai, black buck and barking deer have been reported by Patnaik and Acharjyo (1970). *Gastrotylax* spp. have also been reported in barasingha, gaur, black buck and sambar (Schaller, 1967; Verma *et al.*, 1993; Acora *et al.*, 1985).

Post-mortem examination of a herd of swamp deer in Kanha National Park (Madhya Pradesh) revealed the presence of several amphistomes from the rumen. The amphistomes collected were identified as *Gastrothylax crumenifer* and *G. glandiformis*. Both of these species of amphistomes are parasites of sheep, goat, cattle and buffalo. Their occurrence in this wild host suggest that swamp deer can play a role of potential host for amphistomes.

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Reprint : Proceedings of the Workshop on Wildlife Health for Veterinarians, 22-26 April, 1985, Wildlife Institute of India, Dehra Dun, PP. 64-65

V. Case Reports

PATHOLOGY OF THE PANCREAS OF A HOG BADGAR CAUSED BY ACHEILOSTOMA COLLARIS

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Assam Agricultural University
Khanapara, Guwahati, Assam.

A carcass of an adult Hog badger (*Arctonyx collaris*) was received by the department of Pathology, College of Veterinary Science, Khanapara for postmortem diagnosis from the Assam State Zoo, Guwahati. This report communicates the pathological finding caused by *Acheilostoma collaris* reported to be new species of the genus *Acheilostoma*, localised in the pancreas of hog badger (Gogoi, 1985).

The female hog badger was of 5 years old. The general appearance of the carcass was much debilitated and has only the history of off-feed for few days prior to its death. The carcass was critically examined and on post mortem examination no visible gross changes were noticed except general emaciation and a wallnut sized circumscribed, hard swelling near the ventral end of the pancreas. Heart blood samples were subjected to bacteriological examination and was found negative.

The pancreas was of 11 cm in length and on incision of the bulged part, a large number of nematodes were found forming a cavity in the centre. On careful examination the nematodes were seen throughout the pancreatic duct. The parasites were identified as a new species of the genus *Acheilostoma* and called as *Acheilostoma collaris* by the department of Parasitology, College of Vety. Science, Assam Agricultural University, Khanapara.

Histopathological examination of the enlarged and hard part of the pancreas revealed marked fibrosis, around cross sections of parasites surrounded by inflammatory reaction. The predominatng inflammatory cells were mononuclear cells. Macrophages and plasma cells were also abundant along with few giant cells. Fibrous tissue proliferation in the area was so marked that the architecture of the pancreatic cells could be seen in the area. In some part the histological picture was so changed by proliferated fibrous tissue that has resembled the fibroma. In some area the fibrotic cores were also noticed those generally seen in fibromas. Small red flukes *Erytremo pancreatium* were recorded by Jones and Hunt (1983) in pancreatic ductal system of cattle, buffalo and sheep causing chronic fibrosis but no records of nematodes in pancreas could be traced out in available literature.

The few pancreatic acinii found near the parasites also showed the tendency to transform to necplastic growth.

Acknowledgement

The authors gratefully acknowledge the help rendered by Dr. M.C. Baruah, Veterinary Officer, Assam State Zoo, for supplying the carcass and to Dr. A.R. Gogoi, Associate Professor, Department of Parasitology, College of Veterinary Science, Khanapara for identifying the parasite.

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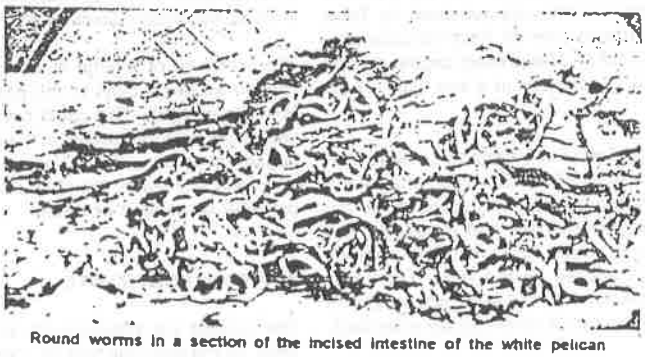
Reprint : Zoos' Print, 9 (11) : 21, November, 1994

WORM INFECTION IN A MIGRATORY WHITE PELICAN - A CASE REPORT

Dr. M. G. Maradia *



Round worms in a section of the incised intestine of the white pelican

A young (approximately one year old) migratory bird (White Pelican) was reported with the history of having fallen from its flock during flight. This happened at Jilaria Village 40 km. away from Rajkot. The bird had a leg band inscribing "MOSKWA K.K. 3439" indicating its Russian origin. This information was sent to Bombay Natural History Society for further investigation. White Pelican is a winter migrant to Saurashtra coastal region hailing from Hungary and Central Asia during the months of October to April every year.

The bird was unable to fly but could swim well. When examined for evidence of any disease signs, dullness, depression and debility were evident. Though it did not consume any fish in the begining, feeding picked up gradually from 5th day onwards. However, the bird died on 12.3.1993 inspite of our best efforts to save it.

A necropsy was conducted to asertain the cause of death. On postmortuem examination, except proventriculus which was full of round worms, other organs were normal.

The round worm was confirmed as *Contracaecum spiculegerum* (Ascarials) by the Department of Veterinary Parasitology, Gujarat College of Veterinary Science and Animal Husbandry, Anand. Occurance of such infections in duck, geese and other birds have been reported.

Such worms are also seen in fish musculature. The bird, being a resident of costal area; might have acquired this round worm infection while feeding on infected fish.

Acknowledgement :

The author is thankful to the Principal and Head of the Department of Parasitology, Gujarat Veterinary College, Anand for his help during the study.

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Reprint : Zoos' Print, 11 (3) : 5, March, 1996

HELMINTHIASIS IN A FREE-FLYING BLUEROCK PIGEON (*Columba livia*)

C. Venkatesan, A Jayasudha and K. Senthilvel

Ascaridiasis is one of the major parasitic problems in the domestic and wild pigeon (Deo, 1964). A six-year-old pigeon which died of dyspnea and anemia was autopsied by Takei and Sakurai (1976) and a large number of *Ascaridia columbae* were found in the small intestine. The present papaer reports a case of Ascaridiasis and Cestodiasis in a wild bluerock pigeon.

An adult female pigeon was found in Veterinary College Premises at Mannuthy, unable to fly. On examination, the pigeon was found weak, dull and depressed. The conjunctival mucous membrane was pale and the bird had dyspnea. The crop was distended and light green fluid oozed out from the mouth when pressure was applied on the crop. Droppings were greenish, watery in consistency and foul smelling. Cravid segments of tapeworms were found when closely examined.

Examination of the faecal sample revealed the presence of large number of Ascarid eggs. Blood smear examination was negative for protozoan infection. The bird died before the onset of treatment.

On postmortem examination, the carcass was found emaciated, pale and anemic. The crop contained fluid and semi-solid food. A large, hard, greenish mass of food was found impacted in the gizzard. Worms had balled up causing obstruction of the lumen of the anterior segment of the duodenum. The entire lumen of the small intestine was packed with worms. There were no marked changes in the other internal organs. Twenty six nematodes and three tapeworms were collected from the small intestine. The nematodes were identified as *Ascaridia columbae* and the cestodes as *Cotugnia* sp.

The presence of a large number of Ascarid worms probably cansed an obstruction to the passage of solid food material from the gizzard. This could have lead to the stagnation and impaction of food material in the gizzard and subsequent enlargement of crop. As a consequence, the bird was unable to take food and water, the obstruction caused by the helminths probably resulted in its death.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. K. Madhavan Pillai Professor, Dept. of Parasitology and Dr. Jacob V. Cheeran, Department of Pharmacology, for the help rendered by them.

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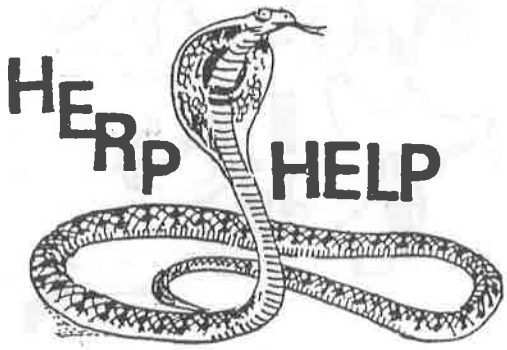
Reprint : Zoos' Print, 3 (10) : 7-8, October, 1988



A Note on Successful Treatment of Ascaris Spp and Spirometra monsonoides Infection in Indian Python (Python morulus) with Analgon (Albendazole)

Paper presented in VIII th National congress of Parasitology, held at Calcutta 10-12th February, 1988.

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Introduction:

Nematodes and cestodes are the major causes of loss in Zoo animals as well as Livestock. Most frequently the problem is one of the subclinical helminthiasis in which there is relatively light infection of several species which prevent the achievement of normal growth and productivity but exert no other clinical by significant effects.

The way in which this takes place, is complex and depends on many factors including the species present, their numbers and relative proportions to each others and the animals plane of nutrition. This has been reviewed by Soulsby (1967).

The most satisfactory method of controlling parasitism is to practice a system of husbandry where the contact between young animals and infective stages on pasture is minimized. It is frequently necessary, therefore to combact helminthiasis by utilizing the best husbandry system appropriate to the circumstances in conjection with the use of suitable anethelmintics. There are many anthelmintic compounds available in the market. The modern ones generally have relatively high potency for example Febendazole, Thiabendazole, Mebandazole, Livamisol etc;

The properties of a new broad spectrum anethelmintic Albendazole have been summerized by Theodories **et. al.**, 1976, 1977.

The present paper deals with information on the efficacy of the drug against **Ascaris** and **Spirometra** which is not reported earlier.

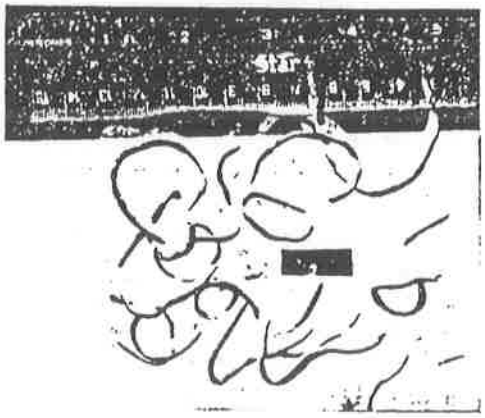
Material and Methods:

One female python having 18 Kg. body weight, kept at Sakkarbag Zoo at Junagadh, has mixed infection of round worms and tapeworms. This was detected by the veterinarian as the snake was passing the worms in the faeces at intervals, The symptoms observed include dull appearance, anorexia, loss of body weight etc.,

The faecal sample along with the worms were sent to Department of Parasitology, College of Veterinary Science & Animal Husbandry, Sardar Krushinagar for diagnosis. They were identified as Ascaris spp. and Spirometra monsonoides on the basis of morphology of the adult worm and the ova. For the treatment, the python was kept without food for seven days and on the Eight day, one young rabbit which had been dressed with 18 ml of Analgon (Albendazole) Wackhardt (at the dose rate of 25 mg/ Kg body weight of python) was fed to the python. Faecal examination of the python was carried out on 7th and 30th day post treatment. The examination was done by flotation method in Zinc Sulphate 32.5% concentration.

Results:

After 24 hours of medication, the python passed a large number of worms, tape worm segments and the ova. On 7th day and 30th day following medication, faecal sample examination proved negative



Showing Ascaris spp worms passed by the python

for any infection and the python in subsequent months gained about 450gm in its body weight. This proves that the drug is highly effective against **Ascaris** and **Spirometra** infection in Reptiles.

The results of present study are the first to be reported for python helminthiasis. The trial with albendazole for the treatment of Ascaris and Spirometra, is quite encouraging, hence this drug can be suggested for routine treatment of Zoo animals without any adverse effects.

Discussions:

Romaniuk (1984) reported that Albendazole (Valbazen) at the dose rate of 5mg / Kg body weight in sheep it is highly effective against **Moniezia expansa**, gastro intestinal nematodes and pulmonary nematodes, Genchi et al (1986) found strong ovicidal activity of albendazole against **Ostertagia, Cooperia, Trichostrongyles, Nematodirus** and **Oosophagostomum** in cattle, where Dzukula, et al (1985) have reported that albendazole highly against **Ostertagia, Cooperia, Tricho - strongylus**, in cattle and **Haemonchus, Nematodirus** and **Strongyoides** in sheep,

In conclusion, this is the first report on albendazole which is highly effective against **Ascaris** and **Spirometra** at dose rate mentioned in the text.

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Reprint : Zoos' Print, 5 (10) : 20-24, October, 1990

PARASITES OF REPTILES

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Wild and captive reptiles are infected and infested with a great variety of parasites. Numerous parasites are responsible for illness and death in captive reptiles. The difference in the host parasite relationship between captive and wild reptiles must be considered. Although reptiles in the wild are not without stresses, they obviously do not undergo the stresses of captivity. In captivity, we confine the reptiles in most cases, to relatively small areas thus contributing to the increased parasite load, especially of those parasites with direct life cycles. We feed reptiles a diet convenient for us to provide. Perhas, the variation in the diet of wild reptiles is also advantageous.

The reptiles may harbour parasites for considerable lengths of time before showing signs of illness, clinical disease may be seen later, when predisposing factors compromise the host immunologically and allow the development of evident infection.

The most clinically significant parasitic diseases of reptiles are discussed here.

(A) PROTOZOA :

a)Amoeba

The most common amoebic pathogen is *Entamoeba invadens* reported in captive snakes, crocodilians, chelonians, and tortoises.

Diffuse, severe necrotizing enterohepatitis is commonly seen in reptiles suffering from amabiasis. The microorganisms is commonly associated with amoebic infections. There are no clinical signs of illness pathognomonic for amebiasis. Affected animals may be listless and anorexic and may pass a mucoid bloody faeces.

Diagnosis can be made by examination of sedimented faecal samples. The infective stage for *E.invadens*, the quadrinucleate cyst is shed in the faeces. Cysts may persist in the environment for considerable periods of time. Hence contaminated cages should be steame-cleaned and disinfected with a three precent sodium hypochloride solution before the introduction of new animals.Control measures for preventing an epizootic incidence should include isolation of sick animals and disinfection of contaminated cases as above. The most effective and clinically safe drug is metronidazole (flagyl), administered as a single dose @ of 40 to 250 mg/kg body weight and is repeated i two weeks.

Since amebiasis is often associated with gram negative microbial infections, treatment should include the parenteral or oral administration of a broadspectrum antibiotic such as chloramphenicol 50 mg/kg body weight twice daily for two weeks) or gentamicin (2.2 to 4.4 mg/kg body weight every 72 hours for five treatments)

b) Flagellates

The most important genera of flagellates in reptiles are -

I) Trypanosoma
II) Leishmania
III) Hexamita
IV) Trichomonas
V) Tritrichomonas
VI) Monocercomomas

Flagellates are usually found in the intestinal lumen of most clinically healthy reptiles, and thus it is often difficult to attribute the diseases of sick reptile to the presence of flagellates in faecal samples. Few reports of pathological conditions are associated with flagellate infections in reptiles.

It has been suggested that reptiles may serve as reservoirs for *Leishania* that infects humans. Nine Species of *Leishmania* have been described from lizard Of these *L.adleri* produces infections in both lizards and mammals.

Hexamitiasis of chelonians (tortoise) is caused by *Hexamita parvs*. The parasite has six flagella, two of which are caudal. Clinical signs of illness are nonspecific and include loss of weight and progressive lethargy Diagnosis of Hexamita infection can be made by examining excreta for characteristic organisms. These organisms are easy to detect in wet mounts, and Giemsa stained smears.

There are serveral reports of Monocercomonas as a Pathogen of reptiles. The affected repitles show chronic regurgitation, anorexia, reduced activity and in some cases diarrhoea develops.

Control measures and treatment of flagellates is similar to Amoebiasis.

C)Sporozoa

1) Coccidia :

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The clinically significant genera of *Coccidia* infecting reptiles are -

I) Eimeria III) Caryospora

II) Isospora IV)Cryptosporidia

Eimeria is found in the gall bladder, bile ducts, and intestinal epithelium of snakes, lizards and crocodilians.*Eimeria* was found to produce intense catarrhal and diptheroid inflammation, necrotizing lesions of the small and large intestine of various reptiles.

Isospora is confined to the intestine. In most of the cases, clinical signs of illness are nonspecific and include lethargy, anorexia, and in severe cases, bloody diarrhoea.

Caryospora cheloniae causes major intestinal lesions involving the posterior small intestine and the colon of turtles. The infection causes loss of mucosal epithelium and the necrotic cellular debris and blood that fills the lumen.

Cryptosporidium has been associated with gastritis in various species of snakes. Snakes with severe cryptosporidiasis have palpably firm stomach that may cause the surrounding body wall to bulge. Affected snakes will often regurgitate within several days of feeding.

Sarcocystis have been reported in turtles, lizards and snakes. The cysts have been found in skeletal muscle.

Diagnosis of coccidiosis depends upon the demonstration of characteristic sporulated oocysts in the faeces of infected reptiles or organisms in tissue sections.Sporulated cocysts of *Eimeria* have four sporocysts, each containing two sporozoites. Sporulated oocysts of Isospora have two sporocysts, each containing four sporozites,sporulated ooxysts of *Caryospora* have one sporocyst,are octozoic, sporulated oocysts of *cryptosporidium* have no sporocysts and four sporozoites. Sporulation of above coccidial oocysts is possible by keeping the faecal samples in 2.5 per cent potassium dichromate solution for five to seven days.Cryptosporidium, oocysts were best demonstrated by the Giemsa method and oocysts are of smallest in size.

Preventive measurments are same as that for amoeba. Use of coccidiostat like sulpha drug is giving good resluts for the treatment of above coocidial infections. Sulhamethoxine at 90 mg/kg body weight on first day followed by 45 mg/kg body weight daily for five days can be given orally.

2) Haemosporidia :

The most important genera of this group are -

i) Haemogregarina iv) Schellakia

ii) Hepatozoon v) Lainsona.

iii) Karyolysus

These parasites are transmitted by either an arthropod or an annelid vectors. *Haemogregarine* and *Hepatozzon* are the most common intracrythrocytic parasites seen in snakes. One or two banana shaped organisms may be seen within a single red blood cell. Which is often varies in size and shape. Severe infections are associated with anaemia and dehaemoglobinization. No chemotherapeutic substances have been reported to effective against haemogregarines.Antimalarial and anticoccidial drugs may be effective.

3) Plasmodium :

Sixty species of *Plasmodium* are described in reptiles, most has been reported from lizards and some in snakes. Few reports associate pathological states with *plasmodium* infections in reptiles. The schizogony and gametogony occurs in erythrocyte of reptile host and sporogony occurs in an insect vector. For treatment quinine have been used with limited success.

4) Haemoproteus :

Haemoproteus have been reported from turtles, lizards and snakes. There is no pathological condition associated with *Haemoproteus* infection in reptiles. The continuing destruction of red blood cells that occurs with *Plasmodium* infection is not seen in infections with *Haemoproteus*. No information is available on treating Haemoproteus infection in reptiles. Antimalarial drugs may prove effective.

(B) TREMATODES :

1) Renifers :

This group of digenetic trematodes is common in snakes. Adult parasites are usually seen within the oral cavity. Adult renifers migrate from oral cavity to lungs and air sacs. These Parasites considered to be pathogens. Often secondary bacterial infection has been found associated with this infection.

Diagnosis is based upon identification of adult parasites in the gastrointestinal system, oral cavity and respiratory system. On examination, of faecal sediment or lung washings eggs yellow- orange in colour and have a faint polar cap are seen.

There is no safe treatment against renifers infection. Adult parasites can be manually removed from the oral cavity.

2) Styphylodora :

The adult of this digenetic trematode inhabits the urinary system of snakes. Lesions have been found incollecting tubules and ureters. In most cases , Infection is of little clinical importance.

Diagnosis depends upon identification of eggs in urine. Eggs are yellow in colour. There is no treatment known to be effective against this trematode.

3) Spirorchids :

Adult parasites inhabits the circulatory system of susceptible reptiles mainly turtles. These parasites are generally found within the heart chambers or its vessels. The most significant clinical lesions resulting from the release of eggs within the vascular compartment and trapped within terminal vessels anywhere in the host body and from severe granulomatous lesions. As a result of vescular occlusion, turtles may develop edema of the limbs. Turtles with severe granulomatous lung lesions may exhibits flotation abnormalities.

Diagnosis is generally made at necropsy or uon identification of eggs within tissue section.

Control of these parasites is through elimination of snail int- host. Although no chemotherapeutic drugs have been effective, but those used for *Schistosoma* infection in human may be useful.

(C) CESTODES :

Pseudophylliadas :

The genus of this order ***Bothridium*** and ***Bothriocephalus*** are mainly parasites of snakes. There are very few reports of pathological states like edema and haemorrhage of the intestinal mucosa at the site of attachment.

Spirometra is a scudophyllidean cestode that is widely distributed in different species of snakes, which serve as intermediate or paratenic hosts. The egg of this worm release a larva: (coracidium) which, when ingested by a copepod, develops into a procercoid. Ingestion of this procercoid stage by a second intermediate host (reptile), procercoids develop into plerocercoids which are known as spargana and they are present in skeletal muscles. When spargana present subcoutaneously, spargana may result in soft swellings of the body.The oedema and haemorrhage of soft tissues may be found associated with this stage. The definitive host is generally a mammalian carnivore, although reptiles and birds may also serve as final hosts. In some part of the world, human sparganosis is a common disease, and some cases result from the consumption of raw snake meat.

Diagnosis of pseudophyllidean infections is based upon the identification of the Spirometra larvae or the identification of eggs in the faeces of animals infected with- ***Bothridium*** and ***Bothriocephalus***. These parasites have operculated eggs that are similar to trematode eggs.

Niclosamide at 150 to 300 mg/kg body weight given orally as a single dose have been found effective against ***Bothridium***. No drugs are known to be effective against larval pseudophyllideans.

2) Mescocestodies :

Mescocestoides parasitizes lizards and snakes. The larval stage that infect reptiles is called the tetrathyridium and develops in reptiles after they ingest the first intermediate host i.e. mite. A carnivorous mammal serves as the final host.

Tetrathyridite may be found within the intestines or extraintestinal sites of reptiles. The mechanical damage to organs due to this parasities is significant.

Diagnosis of Mescocestoides is generally made upon histological examination of tissues. No treatment has been found affective against this parasite.

3) Proteocephalidea :

This order include the major genus, *Ophiotaenia*. Adult parasites are found within the intestinal tract of reptiles. The life cycle includes copepod as an intermediate host. Tadpoles, frogs and fishes may serve as paratenic host.

Mostly the infections in reptiles are subclinical. Severe burdens may result in mechanical obstruction of the gastrointestinal tract.

Diagnosis is based upon demonstration of adult parasites at P.M./ ON identification of eggs in faecal sample.

Niclosamide at 150 to 300 mg/kg body weight as a single oral dose is the drug of choice.

(D) NEMATODES :

1) Ascaridae :

Most of the worms of this group are large and located in gastrointestinal tract. The life cycle of these worm are either direct or indirect. For indirect life cycle they require an amphibian or rodent as intermediate host.

Ascarid larvae cause pathogenic changes during their migration through visceral organs or as adults they are embedded within the gastrointestinal mucosa. Infected reptiles may show anorexia and progressive lose weight. Snakes may regurgitate partially digested food after feeding.

Diagnosis of Ascarid infection depends on identification of adult parasites in regurgitated food or, on post mortem examination or identification of typically thick-shelled eggs in a faecal examination.

Following drugs are useful to treat the case of Ascarid worm infection.

i) Mebendazole 20-25 mg/kg. or

ii) Thiabendazole 50 mg/kg or

iii) Fenbendazole 50 to 100 mg/kg

as a single dose and repeated in two weeks.

2) Strongylidae :

Kalicephalus is clinically the most important stronylid of snakes. This is small parasite (up to 1.5 cm long) The life cycle is direct and transmission occurs through con-

taminated food or water. Snakes with heavy infections may exhibit nonspecific sins of lethargy, debility, and anorexia and during severe infection, may pass bloody faeces.

Diagnosis is mainly upon demonstration of adult parasites or eggs in faeces. Here the eggs are thin walled and contain larval stage by the time the faeces is passed.

Treatment of this worm infection is simillar to Ascarid worm infection.

3) Rhabditida :

Rhabdias and *Strongyloides* are the clinically important genera belonging to this order found in snakes.

These parasites are having a free living or a parasitic, parthenogenetic phase. The parasitic phase is associated with adult nematodes in the lungs (Rhabdias) or intestinal tract (Strongyloides). Infective larvae penetrate through the skin or ingested through contaminated food or water. When larvae penetrate through oral mucosa enter in circulatory system and ultimately enter the lungs.

Clinical signs may include respiratory disease, when adult *Rhabdies* are in the lungs or when larvae of *Strongyloides* migrate through this organ. Snakes may exhibit open-mouth breathing and an extended glottis. Clinical signs of Strongyloides infection are nonspecific and include anorexia, weight lose, and lethargy. Infected snakes may develop diarrhoea.

Diagnosis of *Rhabdias* infection depends upon demonstration of embryonated eggs in a lung washing.Larvated eggs within a faecal flotation. These must be distinguished from larvated *Kalicephalus* eggs which are larger.It is impossible to distinguish between larvated eggs of *Strongyloides* and *Rhabdias*.

Following drugs are very useful for treatment:

1.Levamisol hydrochloride Intraperitoneally 10 mg/kg body weight is the drug of choice for *Rhabdias*.

2 Thiabendazola at 50 t0 100 mg/kg in single oral dose for *strongyloides*.

Both drugs should be repeated in two weeks.

4) Oxyurids :

Oxyurides are common nematodes as colonic parasites of turtles and lizards.Eggs are large,and often have a flattenened site.These parasites have a direct life cycle,and show a high degree of host specificity.

5).Spirurida :

The order *spirurida* consists of several suborders known to infect reptiles.*Important genera* to which the filarial nematodes belong are *Oswaldofilaria*,*Foleyella*,and *Macdonaldius*.Adults of all above members are found at extra intestinal sites(lungs,circulatory system,subcutaneous tissues).These nematodes are either ovoviviparous or viviparous.Microfilaria are released into the circulatory system and transmission is achieved through blood-sucking arthropods usually ticks and mosquitoes.

No clinical signs and gross lesions are associated with this infection.Several pythons developed cutaneous lesions.

Diagnosis depends on demonstration of adult parasites commonly in the portal vein at necropsy or identification of microfilariae in a blood samples.

No suitable treatment is available.

6) Oxyurids :

Oxyurids are commonly eencountered as colonic parasites of turtles and lizards. Only under unusual circumstances, such as the fatal impaction, they found to be pathogenic. The eggs are large, and often have one side flatened. These parasites have a direct life cycle and show a high degree of host specificity.

(E) ACANTHOCEPHALANS :

They are spiny-headed worms. In reptiles adult parasites are generally found in the intestinal tract, whereas immature forms may migrate throughout serosal surfaces of the gastrointestinal tract and attache to the capsule of visceral organs. An invertebrate serves as an esstential intermediate host, although in many cases, a reptile may act as paratenic host.

Adult acanthocephalan infections are gernerally diagnosed by identifying characteristic multi-enveloped oval eggs in a faecal sample. No safe drug has been found effective against these infections in reptiles.

(F) PENTASTOMIDS :

These parasites are placed in their own phylum. The adults are wormlike and segmented, they are up to 12 cm long. All require intermediate host for completion of their life cycle, and although most adults are parasites of reptiles. Mammals serve as intermediate hosts. The deaths of several captive snakes have been attributed to pentastomids occluding the uppor respiratory system. Parasites distributed in subcutneous sites may cause bulging of the overlying skin.

Diagnosis depends upon identification of eggs in a lung washing. The eggs have a distended,thinly walled capsule.There are no safe parasiticides reported effective against pentastomids.

(G) ANNELIDS :

Leeches :

These ectoparasites are encountered in aquatic reptiles., especially turtles and crocodilians. In severe cases, anaemia and traumatic damage to tissues have been seen. Leeches may serve as vectors for blood protozoans such as *Haemogregarins* and *Trypanosoma* In most situations leeches can be manually removed. Fresh water species can be killed by exposure to hypertonic salt solution.

(H) ACARIDS :

1) Mites :

Most free-ranging reptiles are infested with mites. The most commonly reported mite of reptiles is *Ophionyssus natricis* in snake. Severe infestation of this mites may result in a debilitated, anaemic snakes. Coating the snake with olive oil is the safe treatment, which occluded the respiratory system of the mite. The most effective treatment involves the suspension of dichlorodivinyl phosphonate, dichlrovos (DDVP) pest strips in or adjecent to the cage for 2 to 5 days.

2) Ticks :

Reptiles and several marine species are commonly infested with ticks. The important hard ticks infesting reptiles are *Amblyoma, Aponomma and hyalomma* genera. The most important soft bodied tick is *Ornithodoros.* They cause anaemia by sucking blood and transmit various pathogens. Ticks can either be removed manually or by using DDVP strips.

(I) DIPTERA :

Numerous species of diptera are known to feed upon reptiles and many are responsible for transmitting infections agents. Several species of flies are known to parasitize reptiles directly in the larval (maggot) stages and cause myiasis.

The most effective way to treat infected reptiles is to surgically remove the maggots. when it is light burden, the topical application of other or turpentine may be sufficient to irritate the maggots to leave the wound.

Reprint : Zoos' Print, 6 (5) : 18, May, 1991

PARASITIC PROBLEMS IN REPTILES AT NANDANKANAN BIOLOGICAL PARK

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A survey of parasitic fauna in reptiles at Nandankanan was carried out during routine clinical and postmortem examination during 1967-1987. A check list of parasites hitherto encountered has been furnished (Table). However, pathological lesions were observed only in the intestinal tract of an Indian python which was heavily invaded by *Ophidascans algaris*. Tufts of coiled worms numbering more than 30 at one place were seen piercing deeply through the intestinal wall. Microscopically, the anterior portion of the parasites has been embedded deeply into the mucosa and submucosa causing chronic enteritis. The reactionary cells consisted of lymphocytes, plasma cells, and macrophages particularly in perivascular areas in well-developed granulation tissue. In some areas, the parasites had incited granulomatous response with central caseation necrosis surrounded by macrophages and foreign body giant cells. Cross section of parasites were also seen in the serous coat.

This study indicated that the parasites particularly helminths play an important role in captive reptiles. Though some of the parasites do not cause heavy mortality their vitality is never-the-less very much reduced which in turn is reflected in their physical appearance. Though on many occasions heavy parasitic infestation has been detected during routine necropsy/faecal sample examination neither clinical signs nor any significant pathological changes were observed. It is a common theme that parasites in reptiles are to so perfectly adapted to their host that under natural conditions th.,' would not cause disease.

Table: Check list of parasites in reptiles

Reptile		Helminth	Ectoparasites
1. Water monitor		*Duthiersia fimbriata*	-
2. Land monitor	1.	- do -	-
	2.	*Hastospiculum macrophallos*	*Amblyomma helvolum*
3. Indian python		*Bothridium pythonis* *Ophidascans filaria* *Ophidascaris algais*	
4. Russel's viper		*Polydelphis attenuata* *Kalicephalus welleyi*	
5. King cobra		-	*Amblyomma helvolum*

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2. Senior Veterinary Officer, Nandankanan, Baranga, Cuttack, Orissa

Reprint : Zoos' Print, 6 (11) : 18, November, 1991

INFECTION OF "*OPHIDASCARIS AJGARIS*" IN AN INDIAN PYTHON (*Python molurus molurus*)

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Introduction

Parasites particularly helminths plays an important role in captive reptiles. They may not cause heavy mortality but the vitality is very much reduced which is later on reflected in their physical health. Heavy parasitic invasion results in severe damage to the intestinal wall, ending in death.. (Rao and Acharjyo, 1981).

The present communication deals with the information of round worm identified as "*Ophidascaris ajgaris* " in an Indian a python at Nawegaonbandh National Park, Maharastra.

Materials and Methods

One female python maintained at National Park, Nawegaon Bandh was passing tufts of coiled worm in faeces and vomitus. The authorities of the park requested us to perform the clinical check up of animals maintained in captivity of the park. In the course of clinical check-up it was observed that a tuft of coiled live worms numbering more than 50 at one place were seen voided in vomitus by the Python. The symptoms noted included dull appearance, pronounced anorexia and poor general health. The collected worms were sent to the department of parasitology, Nagpur Veterinary College and a few of them were sent to the Veterinary College, Bhubaneswar (Orissa) for diagnosis.

Results and discussion

The tufts of coiled worm passed by the python were identified as "*Ophidascaris ajgaris* " on the basis of morphology of worm (Figure). The wild and captive reptiles are commonly infested with great variety of parasites facilitated heavy losses in captive reptiles. Obviously, the reptiles in captivity were under stresses, thus contributing to the increased parasite load especially of those with direct life cycle and another factor was a diet offered to the reptiles as per the availability and convenience.

Reptiles may harbour parasites for considerable length of time before showing any signs of illness. Clinical symptoms may be seen later, when predisposing factors supervenes thereby allowing the development of evident infection. (Soulsby 1982). The symptoms observed in the python could be due to the heavy infection of *Ophidascaris ajgaris* causing damage to the internal system of the body. Rao and Acharjyo (1981) observed heavy parasitic invasion caused severe damage the intestinal wall in an Indian Python.

The authors place on record the round worm infection identified as "*Ophidascaris ajgaris* " in an Indian python.

Acknowledgement

Acknowledgement are given to the staff of Parasitology Department, Nagpur Veterinary College and Dr. P. K. Das, Orissa Veterinary College, Bhubaneswar for identification of parasite

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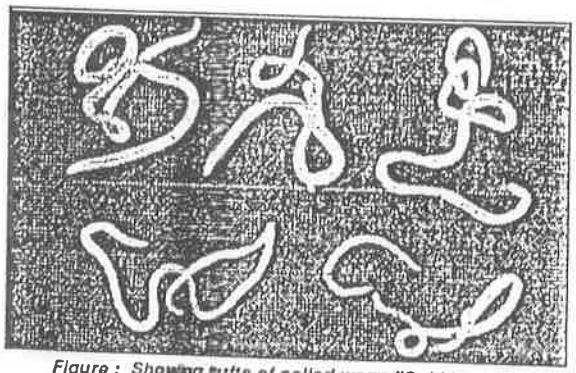

Figure : Showing tufts of coiled worm "Ophidascaris ajgaris" passed by the pyhon.

Reprint : Zoos' Print, 6 (11) : 16, November, 1991

PARASITIC OCCLUSION OF GASTRO-INTESTINAL (G.I.) TRACT IN A PYTHON (*Python molurus molurus*) - A CASE REPORT

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Introduction :

Incidence of parasitic occlusion in gastrointestinal tract of python has been found in Miao Mini Zoo, Arunachal Pradesh, during the month of December 1990. Another female python was captured from the wild and kept in this zoo for display. After its capture, it laid about 65 eggs during the first week of July 1990. After the last egg was laid it stopped taking food and gradually its movement was observed to have reduced considerably. All efforts to revitalise it failed and finally it died on 3 January 1991 at 11.30 am. The following are the observations of detailed postmortem (PM) examination of the python.

Observations:

No visible injury or lesion was observed externally. The G. I. tract was thoroughly examined for the presence of any foreign object causing obstruction. A compact lump was detected in the intestine which on further careful incision showed the presence of a large mass of two types of helminthic parasite-round worm (*Ascarid spp*) and tapeworm (*Cestode spp*). (Fig. 1).

Death due to chronic enteritis caused by helminthic parasite *Ophidascaris ajgaris* in captive Indian python has been reported by Rao et al (1991).

Heavy mixed helminthic infestation possibly picked up in the humid natural habitat from prey species reduced the vitality and finally caused death in the above case.

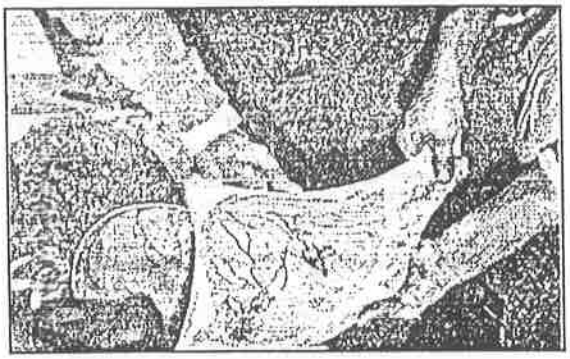

Figure 1 : Large mass of two types of helminthic parasit es -- round worm and tape worm.

It seems to be of importance in the management of python in captivity that, the live animal food supplied to them should be healthy and routinely dewormed. It is also necessary to study the zoonotic importance of these parasites from public health point of view.

Acknowledgement: The authors are thankful to Sri B.C. Bhagwati, Vety. Field Asstt. and the attending staff of Miao Mini Zoo for their assistance in the above study.

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Reprint : Zoos' Print, 7 (12) : 40-41, December, 1992

HELEMINTHIC INFECTION IN INDIAN PYTHON *(Python molurus molurus)* AT SAKKAR BAUG ZOO, JUNAGADH.

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INTRODUCTION

Reptiles harbor a variety of helminth - Parasites. The parasitic burden is often heavy, and every body surface and organ may be invaded by some kind of larval or adult parasites. Indeed, parasitism is so common that it is often difficult to determine its clinical significance.

In zoo, captivity caused stress and this may change the host parasite relationship and results in a disease. The parasitic diseases of reptiles have been reviewed by Momin et al. (1990)

METHODS AND OBSERVATION :

Incidence of parasitic gastroenteritis of pythons have been studied in Sakkar Baug Zoo, Junagadh (Gujarat). Faecal samples were collected from eight pythons kept at the zoo and processeed for presence of helminth eggs. Post-mortem of one python was also performed that died at the zoo. Observations of faecal sample examination are given below:

Sr.No\Results of faecal samples

1. Eggs of *Capillaria* spp. and one male and two female worms of Capillarria spp.
2. Eggs of Pseudophyllidean cestode and *Ascaris* spp.
3. Egg of *Ascaris* spp.
4. Eggs of Pseudophyllidean cestode and *Ascaris* spp.
5. Eggs of *Ascaris* spp.
6. Eggs of *Ascaris* spp.
7. Eggs of Pentastomida
8. Eggs of Pseudophyllidean cestode and *Ascaris* spp.

Out of eight pythons no. 8 one died and post mortem was performed.

Small intestine revealed large numbers of round and tapeworms. Tumour like growths involving intestine at many places where intestine had became very hard thick with tumorous growth involving entire intestinal wall was seen. The oesophagous and stomach revealed many round worms and two large tapeworms. They where deeply embeded into the submucosa of oesophagus, stomach and small intestine and at some places mucosal and muscularis layer of intestines was separated. Intestinal surface at many places was having severe haemorrhages and necrosis with irosions. Some immature round worms were also embeded in lung tissues/paranchyma. After microscopic examinations of worms and examinations of crushed female adult round worm and grevid segments of the tape worm for examination of eggs. These were identified as *Ascaris* spp. and Pseudophyllidean cestodes. Gram negative micro-organisms also found in gastrointestinal lesion. This might be the common sequels of the gastrointestinal lesion.

DISCUSSION :

The more important members of Ascaridae group infecting reptiles like python include the genera Ophidascaria, Polydelphis and Hexametra. Some species have direct life cycle and others require an intermediate hosts, may be an amphibian or rodent. Ascarids may cause lesions eitherr due to larval migration through the Visceral structures or as adults embedded within the gastrointestinal mucosa. The migration pattern of larvae may depend upon the amount of time spent in intermediate host in indirect life cycle as older larvae infecting a susceptible reptile will complete the life cycle in the stomach (Sprent, 1963). Generally, adult Ophidascaris are encounterred within the caudal oesophagus and stomach, where they often get embeded deeply in the lumen or may be found free within the intestinal lumen. In the present investigation adult Ascaris spp. worms were found deeply embeded in the oesophagus and stomach and also free in the intestinal lumen. The presence of adult Ascaris spp. worms in the oesophagus and stomach indicates that they belong to Ophidascaris spp. undergoing indirect life cycle in which amphibians or rodents probably act as their intermediate hosts. Death due to chronic enteritis caused by helminth parasite Ophidascaris algaris in captive Indian python has been reported by Rao et al. (1991) and due to occlusion of gastrointestinal tract by round worms (Ascaris spp.) and tapeworms (Cestodes spp.) was recorded by Dehingia and Choudhury (1991).

Pseudophyllidea order includes the genera Duthiersis, Bothridium, Bothriocephalus, Schohocephalus and Solrometra. A severe oedema and haemorrhage of the intestinal mucosa at the site of attachment of Bothrium pithonis had been reported in python by Wiesenhutter (1964). A mild chronic enteritis due to Bothridium in two pythons have been reported by Toft and Schnidt (1975). In the present investigation the intestine with severe haemorrhages, necrosis and erossions, might be due to the combined effects of Ophidascaris spp. and Bothridium species. Heavy mixed helminthic infection picked up in this case from prey species reduced vitality and caused death.

Capillaria spp. infection is much common in birds and mammals. A C. hepatica is mainly a parasite of wild rodents, but occurs occasionally in the dog, cat and man. The predilection site is the liver and the eggs are laid in the parenchyma from which there is no natural access to th exterior. The infection is acquired by ingestion of either the liver, following predation, cannibalism or carrion feeding, or eggs on the ground which have been found by decomposition of the host. The presence of eggs and worms of Capillaria hepatica in faecal sample of one python in the present study. Indicates that this might be due to predation only. This species may be responsible for parasitic gastroenteritis in python.

The great majority of pentastomes are found as adults in reptiles. During this study, one faecal sample revealed typical Pentastomids eggs. The eggs had a distended, this wall and larvae which contained hooklets, inside. The normal site for development of adult worms is either in the lung and air sac or in subcuttaneous tissues. Mammals (rodents and primates) serve as intermediate hosts. Antemortem diagnosis depends upon identification of eggs in a lung washing. In this case eggs were found in faeces, may be due to swallowing of eggs through trachea and passing of eggs in faeces.

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ACKNOWLEDGEMENT

Authors are thankful to Professor and Head, Department of veterinary Microbiology for Microbiological Examination.

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Reprint : Zoos' Print, 9 (9) : 17, September, 1994

A COMPARISON OF EFFICACY OF FENBENDAZOLE AND MEBENDAZOLE AGAINST *KALICEPHALUS* SPP. IN RAT SNAKES *(PTYAS MUCOSUS)*

R. Thiruthalinathan [1], N. Pannerselvam [1], M. D. Yuvaraj an [2] & D. Swaminathan [3]

Ippen (1971) reported fourty percent mortality rate in reptiles due to parasitism. Heavy Kalicephalus spp. infestation recorded in free living snakes (Cooper, 1973). In reptiles, mebendazole at the rate of 20mg/kg. body weight found effective against intestinal nematodes (Marcus, 1981). So as attempt has been made to compare the efficacy of Fenbendazole (FBZ) and Mebendazole (MBZ) against Kalicephalus spp. in rat snakes *(Ptyas mucosus)*. The salient feature of the study are presented in this paper.

MATERIALS AND METHODS:

Nine Rat snakes naturally infected with Kelicephalus spp. were selected for this experiment and they were divided into three groups of three snakes each.

Group - I was treated with FBZ (Panacur) at the rate of 50mg/kg body weight single dose orally.
Group - II was treated with MBZ (Mebex supension) at the rate of 25 mg/kg body weight single dose orally
Group - III Infected but untreated control.

The eggs per gram of faeces (EPG) were counted in each snake of the three groups before giving treatment (Stoll,, 1923). Subsequent EPG counts were made on 6th and 10th day after treatment to assess the parasitic load. The efficacy of the drug was evaluated on the basis of absence of eggs in the faeces (or) decrease in the number by the 10th day after treatment.

RESULTS AND DISCUSSION

The eggs were indentified as *Kalicephalus* spp. by their morphology shape and size (i.e. thin, oval, transparent eggs which sometimes contains first stage larva inside the eggs)

The results of comparative efficacy of FBZ and MBZ against *Kalicephalus* spp. along with control are given in the table.

Group	No.of snakes	Drug and Dosage	Mean of EPG Before treatment	After treatment 6th day	10th day	Efficiency (%)
I	3	FBZ 50mg/kg b.wt.	22000	4000	800	96.36
II.	3	MBZ 25mg/kg b.wt.	10300	2300	300	97.1
III	3	control	15500	17200	19800	-

EPG - Eggs per gram of faeces.

Fowler (1986) recommended FBZ at the rate of 50-100 mg/kg. bt. weight (or) MBZ at the rate of 20-25 mg/kg. bt.wt. and Heinzgeorz klos et al (1976) used MBZ at the rate of 100 mg/kg.b.wt. against *Kalicephalus* spp. In this experiment, we tried with FBZ and MBZ against Kalicephalus spp. at this specified dosage. No side effects has been observed by the administration of FBZ and MBZ in Rat snakes.

ACKNOWLEDGEMENT :

We thank Mr. R. SUNDARARAJU, I.F.S., Director, Arignar Anna Zoological Park, Vandalur for his kind co-operation, Professor R. Anandan and P.G. Students of Department of. Parasitology, Madras Veterinary College, Madras - 7 for their assistance in doing this work.

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Reprint : Zoos' Print, 10 (7) : 47, July, 1995

A CASE REPORT ON *Ophidascaris spp.* INFESTATION AND ITS TREATMENT IN RAT SNAKES (*Ptyas mucosus*)

R. Thiruthalinathan [1], N. Pannerselvam [1], M. D. Yuvarajan [1] and D. Swaminathan [2]

CASE HISTORY

Three rat snakes each No.1, No.2, No.3, weighing 850 gm; 600 gm; and 700 gm; respectively had shown anorexia, loss of weight, diarrhoea, dullness and dull coat. Since the snakes were having poor appetite, faecal samples were collected and examined under microscope. Faecal examination revealed considerable degree of *Ophidascans* spp infestation which was identified by elliptical eggs of size 80 X 72 microns with thick finely punctuate shells. To determine the parasitic load, Egg count Per Gram of Faeces (EPG) was done using Stolls dilution method.

TREATMENT

Snakes were treated with Fenbendazole (FBZ - (Panacur suspension 2.5%) at a dose rate of 50 mg/kg. body weight as a single dose orally using a stomach tube attached to a 5 ml. disposable sterile syringe. Faecal samples were collected at 6th and 10th day of post treatment and EPG was done to assess the efficacy of FBZ.

RESULTS

Egg counts and efficacy of FBZ

Snake No.	Drug & Dosage	Egg count per gram & faeces			efficacy
		Before Treatment	After Tretatment		
			6th day	10th day	
1.	FBZ 50mg/kg	1800	1300	200	88.89%
2.	FBZ 50mg/kg	3600	1700	500	86.11%
3.	FBZ 50mg/kg	2400	1400	300	87.5%
					Average 87.5%

$$\text{Efficacy} = \frac{\text{EPG before treatment - EPG after treatment}}{\text{EPG before treatment}} \times 100$$

After treatment the snakes showed complete recovery with restoration of appetite, active behaviour, bright skin, normal faeces and weight gains.

DISCUSSION

Since very little information is available about anthelmintics usage in reptiles we have treated the snakes with FBZ with approximate dosage and concentration which is used for carnivores. This trial revealed that efficacy of FBZ is 87.5% against *Ophidascans* spp. at 50 mg/kg body.

ACKNOWLEDGEMENT

We thank Mr. R. Sundararaju, I.F.S., Director of Arignar Anna Zoological Park for his kind co-operation and Dr. R. Anandan, Professor Department of Parasitology, Madras University College for his assistance in doing the work.

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Reprint : Zoos' Print, 11 (5) : 30-33, May, 1996

STRUCTURAL FEATURES OF HELMINTH PARASITES OF AMPHIBIANS

M. C. Sathyanarayana and K. Sampath

It is well known that amphibians form the major nutritional source for different species of reptiles, birds and mammals (Prokopic and Krivanec, 1975). Also it is known that amphibians serve as intermediate, complementary or reservoir hosts for some of the helminths infecting domestic and wild animals (Prokopic and Krivance, 1975). The parasite community forms in general an integral part of an ecosystem. It is superimposed upon free living communities which form intermediate and definitive hosts (Kennedy 1975). In nature several species of parasites infect invariably every amphibian species, thereby, bringing a stress on the population of the latter. Such a stress necessitates one to analyse the composition of the helminth fauna infecting the amphibian species.

It is felt that this paper will help the biologists especially the Amphibian Special Interest Group to identify and to study the endoparasites of amphibians.

DIGENETIC TREMATODES

Pleurogenoides gastroporus (Fig. 1)

Occurs in the fore-and mid-gut of *Rana tigerina* and *R. cyanophlyctis*. Body oval in shape; oral sucker moderately large; acetabulum small and found near mid body; pharynx small; oesophagus short; caeca terminating anterior to acetabulum; testes symmetrical and situated postcaecal in acetabular zone; cirrus pouch club shaped; seminal vesicle tubular; prostatic complex well developed; ovary preacetabular; viteliaria forming grape-like bunches in the neck region; uterus winding chiefly in hind body; genital pore on the left body margin; excretory vesicle 'v' shaped.

Tremiorchis ranarum (Fig.2)

Occurs in the fore-and midgut of *R. tigerina* and *R. cyanophlyctis*. Body elongate and spinose anteriorly; oral sucker subterminal; acetabulum small, situated posterior to intestinal bifurcatin; prepharynx present, oesophagus short; caeca terminating posteriorly; testes oblique and pre equatorial; cirrus pouch elongate; ovary posterolateral to acetabulum; uterus not extending backward beyond caecal ends; vitellaria extra caecal; genital pore median; excretory vesicle 'Y' shaped.

Caneo tigrinum (Fig.3)

Occurs in the midgut of *R. tigerina* and *R. cyanophlyctis*. Body tongue shaped, spinulate; oral sucker small; acetabulum small in mid region of the body; oesophagus bifurcating about half way between two suckers; caeca long terminating some distance short of posterior extremity; testes symmetrical found at the anterior intercaecal field; cirrus pouch poorly developed; ovary posterior to acetabulum; uterine coils in hind body; vitellaria extending backwards along caeca; genital pore marginal in level with oesophagus.

Diplodiscus amphichrus (Fig. 4)

Occurs in the hindgut of *R. tigerina* and *R. cyanophlyctis*. Body more or less conical; oral sucker with paired diverticula; acetabulum ventroterminal and sucker like in appearance; caeca long; testes single; cirrus pouch small, ovary submedian and post testicular; vitellaria extending along caeca; uterine coils intercaecal; genital pore median, usually postbifurcal; excretory pore anterior to acetabulum.

CESTODE

Nematotaenia dispar (Fig. 5)

Found in the intestine of *Bufo melanostictus*. Scolex with four typical suckers; neck present; strobila gradually attenuated towards posterior end, where the gravid proglottids appear longer than wide; testes two nearly symmetrical in dorsal medulla; cirrus pouch may reach to muscle sheath or further in wards; vas deferens long coiled; ovary median, posterior in ventral medulla; vitellaria dorsal or dorsolateral to ovary, between testes and ovary; egg capsules arranged in two parallel rows throughout proglotus, but later scattered throughout parenchyma; excretory system situated in muscle sheaths and ventral to testes.

Nematodes

Rhabdias bufonis (Fig.6)

Occurs in the lungs of *Bufo melanostictus*. Mouth surrounded by six insignificant lips; a short cup shaped swelling posteriorly; tail conical; vulva near middle of body; ovanes reflexed; uteri opposed; eggs are thin shelled and contain each a fully developed larva.

Cosmocerca longicauda (Fig.7)

Occurs in the hind gut of *R. tigerina*, *R. cyanophlyctis*, *Bufo melanostictus*, *Microhyla ornata* and *Polypedatus maculatus*. Mouth with three small lips; oesophagus followed by small pharynx with a very slight prebulbar swelling and a posterior bulb; lateralalae well developed, extending backward beyond anus in female; Male: posterior extremity bend ventrally and has a long spine, numerous small pre-anal and postanal papillae with slender peduncles are present on the ventral surface of the preanal region two longitudinal comb like structures are present; gubernaculum chitinized. Female: posterior extremity terminating in a long delicate process which ends in three spines; vulva in front of middle body.

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Cosmocerca ornata (Fig. 8)

Occurs in the hind gut of *R. tigerina, R. cyanophlyctis, Bufo melanostictus* and *Microhyla ornata*. It resembles *C. longicauda* in most of the characters but differs in having a small spine in the posterior extremity.

Oswaldocruzia filiformis (Fig. 9)

Occurs in the anterior intestine of *R. tigerina, R. cyanophlyctis, Bufo melanostictus* and *Microhyla ornata*. Head with cuticular vesicles; cuticle with transverse striations and longitudinal ridges; mouth with indistinct lips, buccal cavity small without chitinous wall. Male: Bursa symmetrical; dorsal lobe triangular; ventral rays continuous, equal and reaching bursal margin; spicules complex with 4 or 5 terminal processes united by hyaline membrane; gubernaculum absent. Female: Tail tapering to a spike; vulva in posterior half of body.

Gnathostomum spinigerum (Fig. 10)

Occurs in the stomach of *Bufo melanostictus*. Parasites of cats and other mammals; they live in the stomach tumors. They possess distinct enlarged spiny head; spines continue down one half of the body; the eggs pass out along with faeces and hatch into free swimming larvae; then they are eaten by cyclops, the primary host; the definitive host is cat by taking the amphibians as food.

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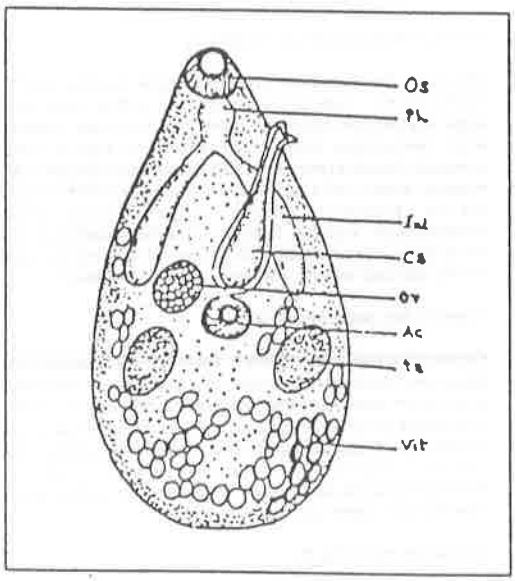

Fig. 1. Pleurogenoides gastroporus

Figs. 1 -4.

Ac.	Acetabulum	Ov.	Ovary
Cs.	Cirrus sac	Ph.	Pharynx
Os.	Oesophagus	Sp.	Spine
Int.	Intestine	ts.	testes
Os.	Oral sucker	ut.	uterus
vit.	vitellana		

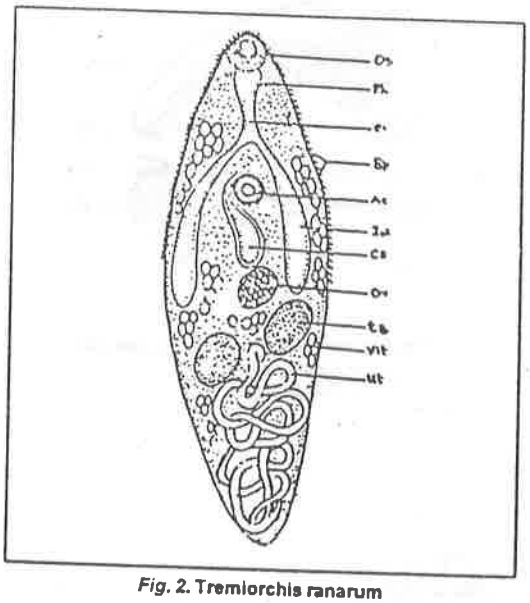

Fig. 2. Tremiorchis ranarum

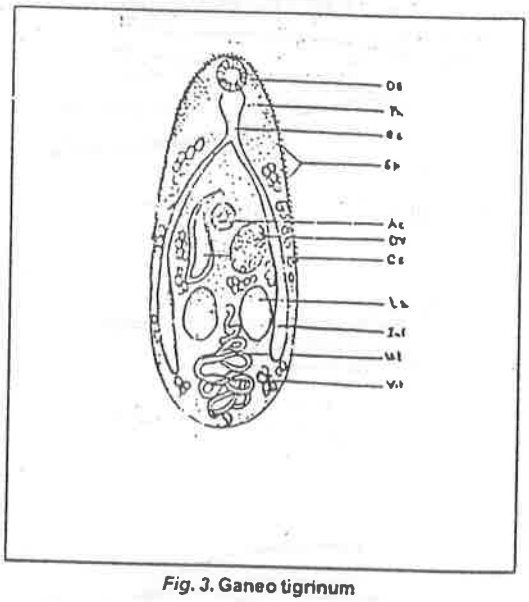

Fig. 3. Ganeo tigrinum

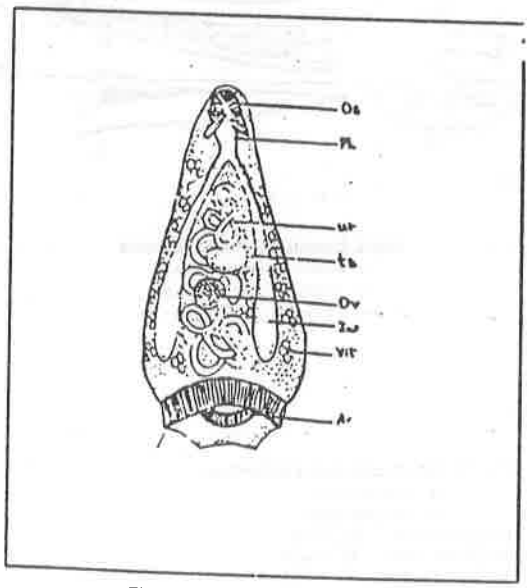

Fig. 4. Diplodiscus amphichrus

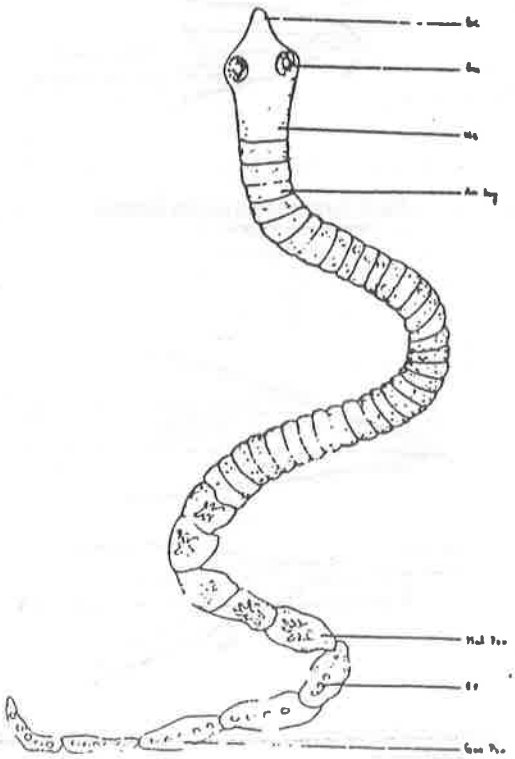

Fig. 5. Nematotaenia dispar

An. Sag.	Anterior Segment	Ne.	Neck
Mat. Pro.	Mature proglottid	Sc.	Soolex
Es.	Eggs	Su.	Sucker
Gra. Pro.	Gravid proglottid		

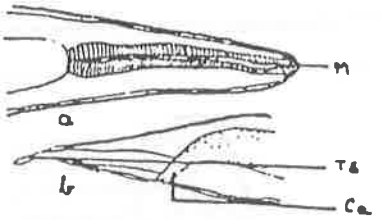

Fig. 6. **Rhabdias bufonis** *(Female)*
a. Anterior part
b. Terminal part

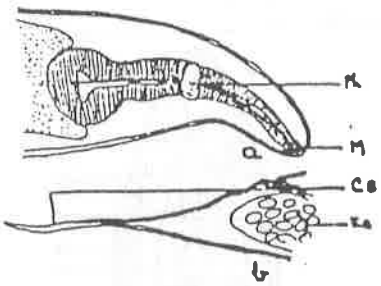

Fig. 7. **Cosmocerca longicauda** *(female)*
a. Anterior part
b. Terminal part

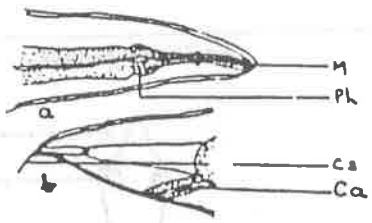

Fig. 8. **Cosmocerca ornata** *(female)*
a. Anterior part
b. Terminal part

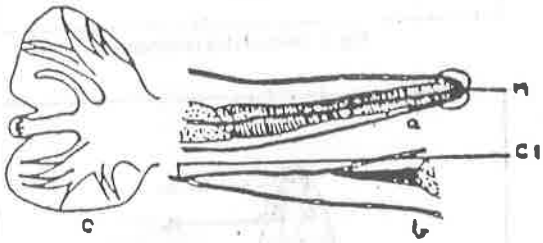

Fig. 9. **Oswaldocruzia filiformis**
a. Anterior part (female)
b. Terminal part (female)
c. Terminal part (male)

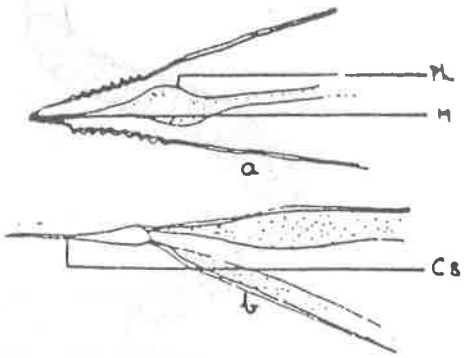

Fig. 10. *Gnathostomum spinigerum*
a. Anterior part
b. Terminal part

Ca. Caudal alae Es. Eggs
Cs. Caudal spike M. Mouth
Ts. Terminal spike. Ph. Pharynx

NATURAL INFECTION OF SPARGANUM IN FROGS IN NAGALAND (NORTHEASTERN INDIA) - AN AMPHIBIA-BORNE ZOONOSIS?

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Abstract

Several species of anuran Amphibia in Nagaland (northeastern India) were found to harbour Plerocercoid (=Sparganum) larvae of *Sprirometra* species of Cestodes in their muscle tissue the adults of which occur as intestinal parasites in felids and canids. In view of their use in traditional medicine and local cuisine among the native tribals, these frog species may possibly be involved as paratenic hosts in dissemination of sparganosis as a zoonosis among human hosts in the region.

Key words

Spargamum, zoonosis, paratenic hosts, amphibians

Introduction

Associations of amphibians with several zoonotic infections have been frequently reported, particularly in southeast and far eastern countries where eating of frogs and treatment of wounds with raw flesh of frogs is customary (Hoeden, 1964; Suzuki *et al.*, 1982; Shen, 1988; Arora, 1994; Bodri, 1994; Mastura *et al.*, 1995a,b). Amphibians are implicated as one of many paratenic hosts for the pseudophyllidean tapeworm of the genus *Spirometra*, adults of which are common mammalian parasites, particularly in cats and dogs (Miyazaki, 1991). According to the same authority, only one species of *Spirometra* is represented in Asia: *S. erinacei* (= *mansoni*). This cestode is of medical importance as its larval stage, the plerocercoid (= sparganum), causes sparganosis in humans (Huang & Kirk, 1962; Tansurat, 1966; Kittiponghansa *et al.*, 1988). Spirometra involves two intermediate hosts in its life cycle; the first is a copepod (*Cyclops*) in which the Procercoid larval stage develops and the second may be either frog, snake, bird or mammal in which spargana are found in the muscle tissue (Kobayashi, 1931; Mueller, 1938; Iwata, 1972). Humans become infected by three possible routes -through copepod-contaminated drinking water, by ingestion of raw or partially cooked frog or snake-flesh contaning spargana (which migrate through the intestinal wall and encyst in the subcutaneous tissue) and through direct contact by application of frog/snake flesh poultice on open wounds.

Received 26 October 1998; Accepted 1 March 1999

Material and Methods

Study area

The study area comprises three major localities in the state of Nagaland, northeastern India, which offer varied climatic conditions which are expected to have an impact on the abundance of both amphibian hosts and their parasitic fauna. Of the localities under survey (Fig. 1), Kohima (which is the state capital, district headquarters and the abode of Angami tribe) lies at the foot hill of Japhu Peak, the secound highest peak in Nagaland, covering an altitude range of 1444.12 - 1590 +/ - 5 m., has high rainfall, mild temperature in summer ranging from 12 - 21°C and cold in winter with average temperture ranging from 1 - 6°C. Mokokchung, situated to the Northeast of Kohima, is another district headquarters and the abode of the Ao tribe; its altitude ranges from 1000 - 1400 m.; the rainfall is high and the temperature is mild to cold through the year, ranging from 8.6 - 25°C and most of the time it is misty and cloudy; the rainy season starts from the month of May and lasts till October (some times until December). Dimapur, another district headquarters and a fast growing commercial town, is identical to any of the tropical plains with an altitude ranging between 195 - 260 m. and has a hot and humid climate for most part of the year.

Hosts collected/surveyed

The anuran hosts collected and examined for plerocercoid infection included in all 13 species under six genera representing 3 families (identified following Dutta, 1997). These included *Euphlyctis cyanophlyctis, Limnonectes limnocharis, L. mawphlangensis, Rana khare, R. liebigii, Rana* sp.,

Hoplobatrachus tigerinus, *Scutiger*(?) sp., *Rhacophorus reinwardtii*, *R. nigropalmatus*, *Polypedates leucomystax*, *Hyla annectens* and *Amolops afghanus*. Collections were carried out in different spots in the main localities mostly by day or at nightfall, either with a net or hands following the croaking sounds of the males or by locating the nest constructed by the female in a few species.

Methodology

In captivity, anurans do not feed and tend to get rid of their worm burden (Smyth & Smyth, 1980). Therefore, immediately after capture, they were narcotised, dissected or autopsied after returning to the laboratory. Muscles of the limbs, peritoneal cavity and its wall and abdomen of the host were examined. For whole mount preparation, parasites were first stretched in warm water, flattened and fixed in 70% alcohol, stained with borax carmine, followed by dehydration in ascending gradean of alcohol, followed by clearing in methyl benzoate and mounting in canada balsam.

For scanning electron microscopy, live specimens recovered were fixed in 4% cold neutral phosphate buffered formalin, dehydrated in ascending grades of acetone and treated with tetramethylsilane following Roy and Tandon (1991), metal coated in a fine coat ion sputter JFC-1100 (JEOL) and observed under a scanning electron microscope JSM 35CF (JEOL) under an electron accelerating voltage ranging between 10 and 20 kV.

Observations

Numerous specimens of a plerocercoid larval form were recovered during the study period from all the three major localities of Nagaland surveyed. The maximum number of parasites in an infected host was 18. Of the host species surveyed, the plerocercoid infection was found to occur only in six. The prevalence and intensity of plerocercoid infection is depicted in Table 1. The parasite measured 50.2 - 75.1mm in length. In slightly contracted form, its apical end showed the presence of a frontal pit. Under scanning electron microscope its body surface is revealed to have numerous transverse folds or wrinkles giving it a pseudosegmented appearance, with slight suggestion of the beginning of proglottidization. Under higher resolution the whole tegumental surface is shown to have dense covering of microtriches. The latter did not show any regional differentiation of their shape and density (Figs. 2-6).

Discussion

Plerocercoid larvae have earlier been reported from several amphibian hosts, such as, *Euphlyctis cyanophlyctis*, *Hoplobatrachus tigerinus*, *Limnonectes limnocharis* and *Rhacophorus nigropalmatus* from Meghalaya in northeastern India (Diengdoh, 1989). The present report forms a new locality report with *Rana* sp. from Dimapur, *Rhacophorus reinwardtii* from Kohima and *Polypedatus leucomystax* from Mokokchung and Dimapur as new host host records. *Polypedatus leucomystax* was always found to be the most heavily infected of all the host species checked for infection.

The plerocercoid larvae, studied herein, showed a similarity in morphology to *Spirometra erinacei* plerocercoids fixed directly in glutaraldehyde; the latter have a shrunken and wrinked appearance with a frontal pit at the apical end (Hatsushika & Okino, 1987). The present study recorded considerably high prevalence of plerocercoid larvae in as many as six anuran species, all of which have use in traditional medicine or local cuisine among the natives of Nagaland. Highly endemic foci of amphibian borne zoonoses, sparganosis in particular, are known to occur among populations in the neighbouring southeastern and eastern countries where similar practices are prevalent (Mastura *et al.*, 1995a,b). Tropical and oriental forms of sparganа occur in frogs (Bonne,1942; Huang & Kirk, 1962). Dissemination of this zoonotic infection among the native population of Nagaland, therefore, needs to be ascertained.

Acknowledgements

This study was supported by the Departmental Research Support Program of the University Grants Commission to the Department of Zoology, North Eastern Hill University. Financial support to RI from the State Government of Nagaland is thankfully acknowledged. The SEM facility was kindly made available by the Head, Regional Sophisticated Instrumentation Center at NEHU.

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Table 1. Prevalence and intensity of plerocercoid larvae in anuran hosts in Nagaland

Host Species	No. examined (infected)	Prevalence % (M, F)	No. of parasites recovered	Range	Intensity	Mean intensity
Dimapur						
Rana sp.	43 (7)	16.27 (71.4, 28.5)	10	1 - 2	1.42	0.23
Hoplobatrachus tigerinus	23 (13)	12.03 (58.8, 46.1)	20	2 - 6	1.53	0.18
Euphlyctis cyanophlyctis	108 (8)	7.40 (37.5, 62.5)	11	1 - 3	1.25	0.1
Polypedatus leucomystax	25 (12)	48 (75, 25)	19	1 - 7	1.5	0.17
Kohima						
Euphlyctis cyanophlyctis	60 (5)	8.3 (20, 80)	8	1 - 4	1.6	0.13
Rhacophorus reinwardtii	8 (1)	12.5 (100, 0)	1	–	1	0.12
Mokokchung						
Euphlyctis cyanophlyctis	50 (3)	6 (0, 100)	7	2 - 3	2.3	0.04
Rhacophorus nigropalmatus	40 (3)	7.5 (66.6, 33.3)	11	2 - 6	3.66	0.27
Polypedatus leucomystax	47 (23)	48.93 (56.5, 43.4)	89	2 - 18	3.88	1.89

M = Male; F = Female
Intensity = Number of individuals of a parasite species in each infected host in a sample
Mean intensity = Mean number of individuals of a particular parasite species per host examined in a sample.

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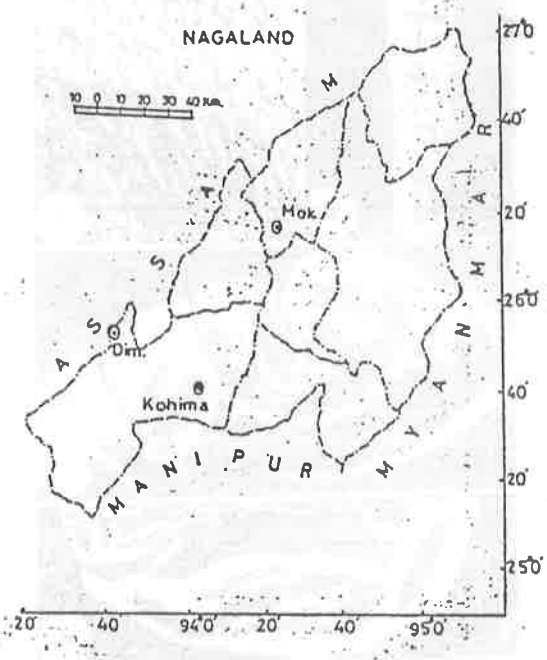

Figure 1. Localities of collection in Nagaland State

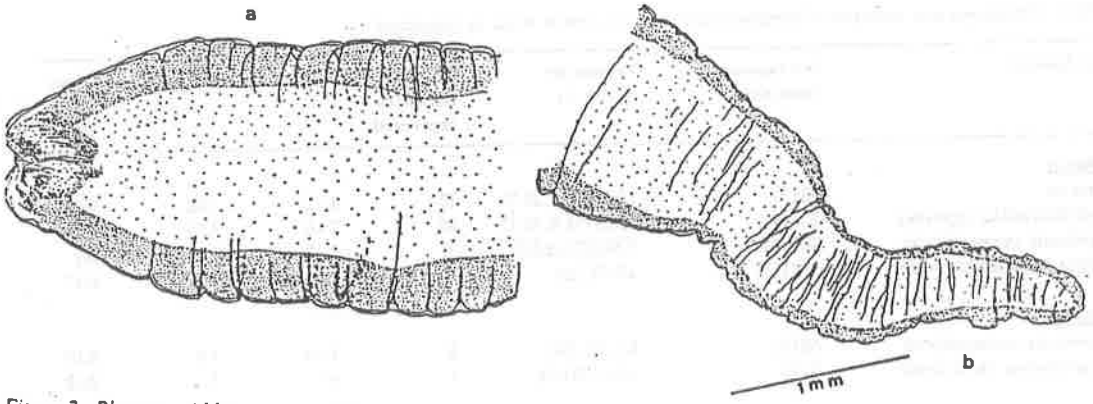

Figure 2. Plerocercoid larva. a. Anterior region b. Posterior region.

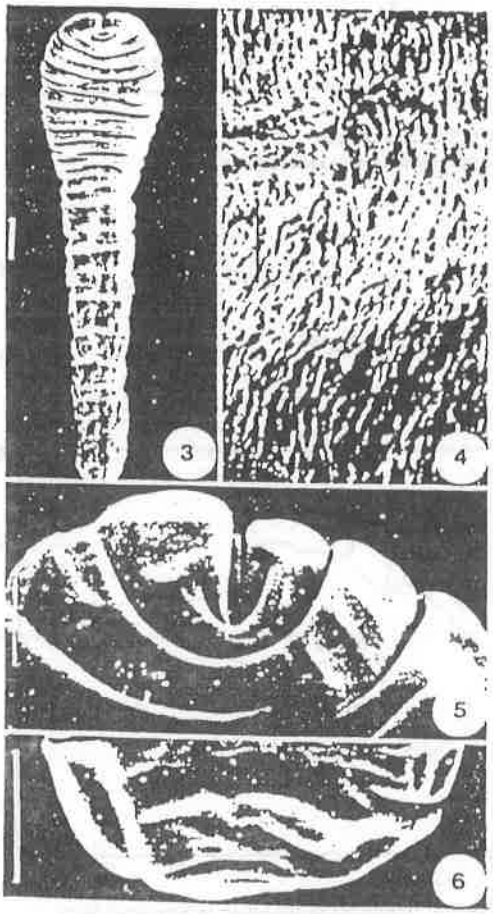

Figure 3-6. Plerocercoid larva- scanning electron micrographs.
3. Full worm (scale bar = 100 µm).
4. Body tegument under higher resoluation, showing microtriches (scale bar = 10 µm).
5. Magnified view of the apical end, showing the frontal pit and tegumental foldings (scale bar = 100 µm).
6. The posterior blunt end (scale bar = 100 µm).

PAPER

ZOOS' PRINT JOURNAL 15(4): 233-238

A QUANTITATIVE ANALYSIS OF GASTRO-INTESTINAL HELMINTHS (TREMATODA: DIGENEA) INFECTION IN RANID FROGS IN JAMMU

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Abstract

Trematodiasis due to a number of flukes is a serious malady in amphibians. The incidence of trematode infection in ranid frogs in Jammu, Jammu and Kashmir State at an elevation of 300m. above sea level has been reported before by earlier workers, which contains information on the taxonomy, morphometrical description and seasonal incidence of worms. This paper complements the earlier works in describing the the parasitic burden on two ranid hosts, *Hoplobatrachus tigerinus* and *Euphlyctis cyanophlyctis* inhabiting Jammu waters. The study revealed that more than 70 per cent of frog specimens were found infected with seven entric trematode species. The quantitative description of the worms has been described and the data statistically analysed.

Keywords

Gastro-intesunal trematodes, *Hoplobatrachus tigerinus*, *Euphlyctis cyanophlyctis*, parasitic helmunths

Introduction

Hoplobatrachus tigerinus (Daudin) and *Euphlyctis cyanophlyctis* (Schneider) are two important ranid frog species known to inhabit the low lying areas especially the irrigated fields, ponds, pools and ditches in Jammu (Verma *et al.*, 1995). These amphibians not only constitute an important trophic link in the environment wherein they live but also help in maintaining the ecological balance. Their role in pest control is well known; frogs being instrumental in insect vector control to some extent. Also it is known that amphibians serve as intermediate, complementary or reservoir hosts for some of the helminths infecting domestic and wild animals (Prokopic & Knivance, 1975) besides harbouring the adult digenetic trematodes, *Pleurogenoides*, *Tremiorchis*, *Ganeo*, *Diplodiscus*; nematodes, *Cosmocerca*, *Rhabdias*; and the cestode, *Nematotaenia* (Sathyanarayana & Sampath, 1996).

It has been found that amphibians, particularly anurans in Jammu province of the state, harbour a number of digenetic trematodes namely *Diplodiscus*, *Haematolechus*, *Plagiorchis*, *Ganeo*, *Loxogenes*, *Phyllodistomum*, *Astiotrema* and *Mehraorchis* involving gastropods as the intermediate hosts in the completion of their life-cycles (Duda & Verma, 1996).

Received 19 March 1999; *Accepted 20 January 2000*

The parasite community forms an integral part of an ecosystem and is superimposed upon free-living communities which form intermediate and definitive hosts (Volnna, 1974). In nature, several species of parasites infect invariably every amphibian species, thereby bringing a stress on the population of the latter (Duda & Verma, 1996; Sathyanarayana & Sampath, 1996; Yamaguti, 1975) such a stress necessitates analysis of the composition of the helminth fauna infecting the amphibians.

A perusal of available literature reveals that a lot more attention has been paid to the taxonomic studies of these worms. Very little effort has been made to ascertain the extent of damage and losses incurred due to helminths on the herpetofauna; and, the present knowledge of parasitic helminths from Jammu amphibians and reptiles is spotty (Soodan, 1978; Khar & Duda 1980; Verma, 1988; Verma & Duda 1988; Duda & Verma, 1996; Singh, 1993; Duda *et al.*, 1999). The present study was, therefore, undertaken to assess the prevalence and intensity of gastro-intestinal digeneans collected from ranid hosts in Jammu, Jammu and Kashmir State.

Materials and methods

The collections of helminths and their hosts has been described in detail elsewhere (Singh, 1993; see Table 1 for a list of the host collected). Collection for ecological analysis of the enteric

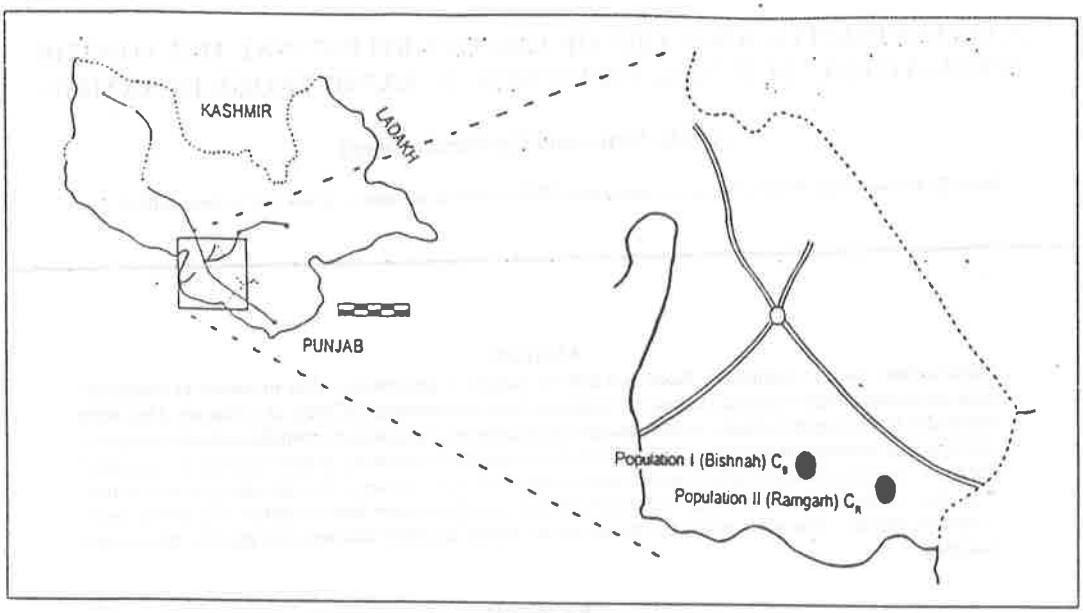

Figure 1. Map of Jammu District showing collection sites

helminths were made over a short period, from April to August 1998, in order to minimize the effect of seasonal variations on the helminth infra-community structure existing within these frog hosts.

The present data is based on 3,266 individual worms recovered from 283 frogs of the two species, *Hoplobatrachus tigerinus* and *Euphlyctis cyanophlyctis* out of a total 395 host individuals collected and screened for infection from two populations, Bishnah Population - C_B (Station-I) and Ramgarh Population - C_R (Station-II), two well defined and discrete sites lying about 25km. apart (Fig. 1). The terminology used is after Margolis and Arther (1979) and significance taken at $P < 0.05$ unless noted otherwise.

Prevalence is the percentage of infected frogs of each species; mean intensity is the number of worms per infected frog and the values expressed as mean S.D./S.E.; species-richness is the number of helminth species per frog.

Table 1. Overall collection data of the two hosts from two populations.

Host species	Bishnah population C_B (Station-I)			Ramgarh Population C_R (Station-II)		
	Sex	No.	Total	Sex	No.	Total
Hoplobatrachus tigerinus	M	68		M	61	
	F	57	125	F	70	131
Euphlyctis cyanophlyctis	M	138		M	108	
	F	168	306	F	134	242
Total number of hosts collected *			431			373

* Of the total sample sizes from the two populations of the host from the two sites, only 125 hosts of *H. tigerinus* and 270 of *E. cyanophlyctis* from the two populations were included for the analysis.

Table 2. Intestinal trematode species found parasitising the frogs, Euphlyctis cyanophlyctis *and* Hoplobatrachus tigerinus *in two populations.*

Trematode species	C_B Population				C_R Population			
	E. cyanophlyctis		*H. tigerinus*		*E. cyanophlyctis*		*H. tigerinus*	
	Male	Female	Male	Female	Male	Female	Male	Female
Diplodiscus mehrai	+	+	+	+	+	+	+	+
Ganeo tigrinus	+	+	+	+	+	+	+	+
Gorgoderina elliptica	+	+	-	-	+	+	-	-
Indopleurogenes yamaguti	+	+	-	-	+	+	-	-
Loxogenes jammuensis	-	+	-	-	+	-	-	-
Mehraorchis ranarum	+	+	-	-	-	-	+	-
Prosotocus himalayai	-	+	+	+	-	+	+	+

Chi-square (X^2) analysis for two sample comparison was used to determine significant differences in the prevalence and intensity, respectively, of the dominant helminth species across nested variables of the host sex and maturity status.

Chi-square (X^2) was estimated according to the formula

$$\frac{[(Fo - Fe) - 0.5]^2}{Fe}$$

Where, Fo is the observed frequency, Fe is the expected frequency and 0.5 is the Yates correction for continuity.

Chi-square test was also used for studying association between presence and absence of various pairs of helminth species.

Results and Discussion

One hundred and eighty-nine frogs of *Euphlyctis cyanophlyctis* (70% of the total number of the frog examined) and 94 frogs of *Hoplobatrachus tigerinus* (75.2% of the total number examined) from the two populations (C_B and C_R) were found infected with one or more of the seven intestinal fluke species (Table 2). While *E. cyanophlyctis* was found infected with all the seven trematode species, *H. tigerinus* was found infected by only four, which therefore constituted the shared species. However, all the species of the trematodes described herein were never found simultaneously infecting the same host individual. Only about 1 to 5 different species were, if ever found parasitizing the same individual.

In all 3,266 gastro-intestinal flukes were recovered from 283 infected frogs, of which 1,141 (about 35%) were recovered in the two hosts from C_R populations at an overall relative intensity (RI) of 8.5 and the remaining 2,125 (about 65%) in the two host species from C_B population (Table 3) at an overall relative intensity of 14.24. The helminths recovered from the two ranid species in C_R population were less evenly distributed (Table 4) in their host

Table 3. Sex-wise data on the number of intestinal flukes obtained from the two populations of the ranid hosts along with relative intensity (RI) of the flukes in each host.

Host	C_R Population			C_B Population				
	Sex (n)	Worms recovered	Relative Intensity	Sex (n)	Worms recovered	Relative Intensity	Total worms recovered	Overall Intensity
Euphlyctis cyanophlyctis	M (39)	188	4.82	M (36)	183	5.0	371 (n=75)	4.90
	F (46)	318	6.9	F (68)	839	12.3	1157 (n=114)	10.1
Hoplobatrachus tigerinus	M (23)	390	16.9	M (23)	832	36.1	1222 (n=46)	26.3
	F (26)	245	9.4	F (22)	271	12.3	516 (n=48)	10.75
Total	134	1141	8.5	149	2125	14.24	3266 (n=283)	11.54

Table 4. Overall distribution pattern of worm load in the two ranid hosts from two populations

Hosts	CR population (n=134)		CB population (n=149)		Total		
	Worm load (%)	n	Worm load (%)	n	Worm load (%)	n	Absolute Intensity
Euphlyctis cyanophlyctis	506 (44.34)	85	1020 (48.00)	104	1526 (46.80)	189	8.08
Hoplobatrachus tigerinus	635 (55.66)	49	1103 (51.98)	45	1738 (53.30)	94	18.49

(44.3% in *E. cyanophlyctis* and 55.6% in *H. tigerinus*) than those in the two ranids of the C_B population (48.02% in *E. cyanophlyctis* and nearly 52% in *H. tigerinus*), although in either populations, *H. tigerinus* was found to show a relatively higher intensity than the other host species. Of the total 385 frogs examined from the two populations, 283 (71.65%) were found infected with gastro-intestinal flukes.

Of the seven enteric trematode species found in frogs in the two stations, only four species namely *Diplodiscus mehrai*, *Ganeo tigrinus*, *Prosotocus himalayai* and *Mehraorchis ranarum* were recovered from the two populations of *H. tigerinus*. Of these *M. ranarum* was obtained only once during the study period from a single male *H. tigerinus*, whereas the remaining species infected both sexes of this frog in C_B and C_R populations.

Of the seven species of enteric trematodes in the two frog species in C_B and C_R population, only four were found infecting both sexes in both population of *E. cyanophlyctis*; these were, *Diplodiscus mehrai*, *Ganeo tigrinus*, *Indopleurogenes yamaguti* and *Gorgoderina elleptica*, where as *Mehraorchis ranarum* was found infecting both the sexes of *E. cyanophlyctis* only in C_B population. This worm was not recovered in this frog host species in C_R population. The infection pattern of *Loxogenes jammuensis* was also ecologically bizzare in infecting only one male and one female frog from the two populations.

While *Prosotocus himalayai* was found as a parasite equally compatible in the intestines of both sexes of *H. tigerinus* in the two populations, this worm was recovered only in the female of *E. cyanophlyctis* in either population and never from its male members. *I. yamaguti* and *G. elliptica*, likewise, were found parasitising only *E. cyanophlyctis* but never *H. tigerinus* in either population despite their sympatry.

Prevalence of Infection

One thousand five hundred and twenty eight worms belonging to the trematode genera *Diplodiscus*, *Ganeo*, *Gorgoderina*, *Indopleurogenes*, *Loxogenes*, *Mehraorchis* and *Prosotocus* constituting 46.73 per cent of the total number of worms were found parasitic in the intestines of 189 specimens of *E. cyanophlyctis* in the two populations of the host. One thousand seven hundred and thirty eight trematode worms belonging to *Diplodiscus*, *Ganeo*, *Loxogenes* and *Mehraorchis* constituted 53. 27 per cent of the total number of trematodes obtained from the intestine of only 94 frogs of the other ranid host *H. tigerinus* drawn from similar habitats (C_B and C_R) during this study (Table 5).

Obviously, of the two host species, *E. cyanophlyctis* hosted a comparatively broader variety of trematode taxa (species richness) in its intestine in comparison to *H. tigerinus*, although both are sympatric and, therefore, equally exposed to similar set of factors and infections. However, the latter host species showed a relatively higher abundance (Table 5) and a higher mean intensity of worms (Table 6). Against 18.5 enteric worms infecting a frog of *H. tigerinus*, only 8.07 worms were found infecting an individual of *E. cyanophlyctis*; the difference of these mean intensities of the trematodes in the two host species from the two populations was found to be statistically significant (X^2 cal. = 4.3; X^2 tab. = 3.84 at $P < 0.05$).

While the male *E. cyanophlyctis* in the two host populations (C_B and C_R) shared an overall mean intensity of 4.94 at a more or less comparable intensity of 4.82 in the C_R population and 5.08 in the C_B population, the overall mean intensity of the intestinal

Table 5. Combined data on overall prevalence and abundance of infection in the two ranid hosts in two populations.

Host	Number examined	Number infected	Prevalence (%)	Number of worms	Abundance
Euphlyctis cyanophlyctis	270	189	70.0	1528	5.66
Hoplobatrachus tigerinus	125	94	75.2	1738	13.90

Table 6. Data on intensity and prevalence of enteric trematode infection in the two ranid host populations

Host (No. examined)	Sex	Ramgarh population (C_R) *E. cyanophlyctis* (85) *H. tigerinus* (49)			Bishnah population (C_B) *E. cyanophlyctis* (104) *H. tigerinus* (45)			Overall		Combined percentage	
		Intensity	Host infected	Prevalence (%)	Intensity	Host infected	Prevalence (%)	Mean Intensity	Mean Prevalence	Intensity	Prevalence
E. cyanophlyctis (n=270)	M	4.82	39	20.6	05.08	36	19.00	4.94	26.5	8.07*	66.78
	F	6.9	46	24.33	12.3	68	35.97	10.15	40.28		
H. tigerinus (n=125)	M	16.9	23	24.46	36.1	23	24.66	26.56	16.25	18.5*	33.22
	F	9.4	26	27.65	12.30	22	23.4	10.75	16.96		
Total (n=395)		8.51	134	47.34	14.24	149	52.65	11.53	100	11.53	100

(* =calculated = 4.3; tabulated = 3.84 at P < .05)

trematodes (Table 6) in the females of this host in the two populations was nearly twice as much (=10.15). Moreover, at population level, the mean intensity of infection in female *E. cyanophlyctis* from C_B population was significantly higher (Table 6) than that observed in the male in the same population.

Quite a reverse of such a situation regarding the intensity of infection was observed in *H. tigerinus* in the two populations. An overall intensity of only 10.75 was recorded in female hosts in the two populations which is favourably comparable to the overall intensity of infection in female of the other host species *E. cyanophlyctis*. In male *H. tigerinus*, on the other hand the overall mean intensity of infection was significantly higher being of the order of 26.56 (Table 6).

The higher intensity of infection in males than in females of *H. tigerinus* was recorded even separately for the host in the two populations. Against a mean intensity of 9.4 worms in female *H. tigerinus* in C_R population, the mean intensity of infection was found to be 12.3 (Table 6) in C_B population. On the contrary, the difference in the mean intensities of infection in male and female *H. tigerinus* was wider and statistically significant. Table 6 reveals that against a mean intensity of 12.3 in female *H. tigerinus* in C_B population, an intensity of 36.1 was recorded for the male of this ranid host species in the same population.

No significant sex-related difference was found in the prevalence of *D. mehrai*, *G. tigrinus* and *P. himalayai* between the male and female *H. tigerinus* from C_B population. In sympatric *E. cyanophlyctis* population, no gender related significant difference in the prevalence of *D. mehrai* and *G. elliptica* was found. However, the prevalence of *G. tigrinus* and *I. yamaguti* was significantly higher in female host of *E. cyanophlyctis* than in its males in C_B population.

In C_R population no significant difference was found in the prevalence of *D. mehrai* and *P. himalayai* between the infected female and male hosts of *H. tigerinus*. Although seemingly the prevalence of *G. tigrinus* was markedly higher in females than in males of *H. tigerinus*, yet the difference in the prevalence in the two sexes of the host in this population did not turn out to be statistically significant.

In *E. cyanophlyctis* in this population (C_R), no significant difference in the prevalence of *G. tigrinus* and *I. yamaguti* was found between the infected males and females of the host. Likewise, the prevalence of *D. mehrai*, though markedly higher, was not statistically significant in males than females of the host, whereas statistically significant gender related prevalence (73.4%) of *G. elliptica* infection was recorded in the females than in males of *E. cyanophlyctis*.

Combes (1972) has attributed the diversity of parasitic community structure to difference in the behaviour of the sexes of the hosts. While higher prevalence, intensity and abundance of dominant helminth species in specific sex of the host, (*Gorgoderina elliptica* in this case) could be attributed to behavioural differences between the male and female members of the host (Bush & Holmes, 1986a,b), immunological difference between the two sexes of the hosts cannot be excluded (Wassom *et al.*, 1973; 1986).

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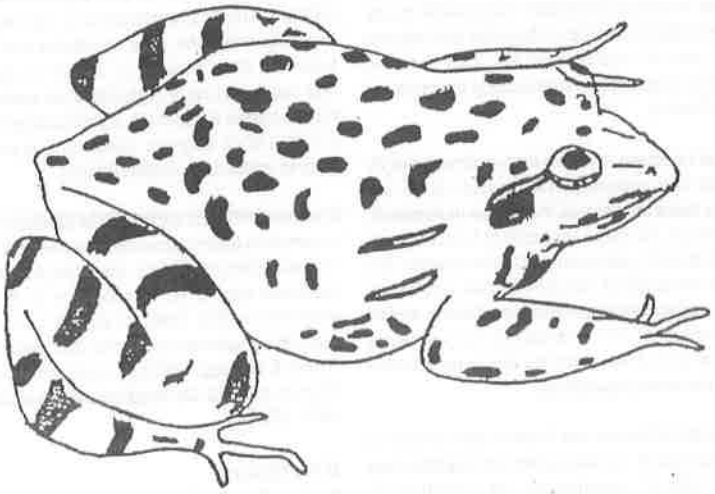

Indian vet. J. 64. August, 1987 : 713 - 714

HYDATIDOSIS IN LUNGS AND LIVER OF AN AMERICAN BISON (*BISON BISON*)

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One female American bison (*Bison bison*) aged 18 years belonging to Nehru Zoo park, Hyderabad died without exhibiting any earlier symptoms of illness. The history was that the animal had been receiving anthelminthic treatment against amphistomiasis periodically. The animal was imported when she was 2½ years old and had calved once.

Autopsy examination revealed emaciation with 3-4 litres of straw coloured fluid in the abdominal cavity and ½ litre in the thoracic cavity. The lungs showed tennis ball size cysts-two each on the diaphragmatic lobes and one each on the apical lobes. The cysts on incision exuded plenty of watery fluid with plenty of daughter cysts. The liver was enlarged to a size greater than the size of a foot ball and was tense on palpation. More than 2/3 of the liver was occupied with big and small hydatid cysts, which contained lots of watery fluid and daughter cysts. The adjacent liver parenchyma was atrophied. The gall bladder contained a few amphistomes. The mucosa of abomasum was congested with number of amphistomes in the abomassal contents. Spleen had a few infarcts. Kidneys were congested. Heart showed diffuse haemorrhages over the epicardium. On histopathological examination, lungs and liver showed fibrous capsule and cellular infiltration around the hydatid cysts. Heart muscle showed mild congestion and plenty of sarcocysts. The hydatid cysts both in lungs and liver were found to be fertile and belonged to the metacestodes of *Echinococcus granulosus* morphologically. The amphistomes collected from the abomasum and gall bladder were found to be *Gastrothylax cruminifer* and *Gigantocotyle explanatum* respectively.

Hydatids have been recorded in elephants (Southwell, 1930)., liver of a lion, lungs of a giraffe (Ramanujachari and Alwar, 1954 and 1955)., spleen and lungs of a monkey (Alwar and Lalitha, 1961)., lungs of a great Indian squirrel (Reddy and Alkhan, 1970) and lungsof a giant flying squirrel, spotted deer and Indian Pangolin (Rao *et al*, 1972).

Acknowledgement : Sincere thanks are due to Dr C. Hanumantha Rao, Director of Animal Husbandry and Dr. Krishna Ashrit and Dr. S. Vasantha Rao, Joint Directors for the facilities provided. Thanks are also due to Zoo authorities for presenting the animal for autopsy examination.

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Reprint from THE INDIAN VETERINARY JOURNAL

Vol. 47, No. 11, November 1970

Correspondence

Sir

Sub : *Hydatidosis in a great Indian squirrel (Ratafa indica maxima).*

The great Indian squirrel from Malabar region is as large as a small cat with glossy black, buff and chestnut coloration. It arrived at Nehru Zoological Park, Hyderabed on 15-7-66 and died suddenly on 14-12-68.

On post-mortem, two cysts were found on the internal lobes of the right and left lungs; the right cyst was found ruptured. The cysts were confirmed as hydatid. Both the cysts were found to be fertile. They were about 1-1½" in diameter and were just attached to the lung tissue. Rest of the organs were normal.

To the authors' knowledge there has been no prior record of the incidence of hydatid cyst in the lungs of great Indian squirrel. It is felt that the squirrel might have died of shock due to the rupture of the hydatid cyst.

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Vol. 48, No. 12, December 1971.

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Sir,

Sub : *Occurrence of the nymphal stages of Linguatula serrata in a Kashmiri goat.*

History : A Kashmiri buck (Gaddi breed) aged about one year belonging to the Nehru Zoological Park, Hyderabad was found sick on 18-8-69 with high temperature - 104–105°F, with accelerated respiration and heart beat and slight shivering. It was treated with 400 mg Achromycin i/m. Blood smears and faecal samples were collected for laboratory examination ; faeces was positive for oocysts of coccidia and ova of strongyles and Strongyloides sp ; blood smears revealed no organism. On 19-8-69, the condition of the animal showed no improvement. It was completely off feed with temp. 103·8°F and signs of dyspnoea. Achromycin was repeated with 2 c.c. of vit. B Complex i/m. The goat continued to show the same symptoms of dyspnoea on 20-8-69 with severe fits. Achromycin 400 mg, i/m, glucose saline 100 ml, i/v and Berin 2 c.c, i/m were administered ; but no improvement was observed. It showed slow heart beats and was given Coramine 1 c.c., i/m at 8-30 p.m. followed with an injection of Novalgin 3 c.c., i/m. The animal showed no improvement, continued to exhibit symptoms of dyspnoea and died at 7-30 a.m. on 22-8-69. Post-mortem was conducted at the college of Veterinary Science, Hyderabad at 11 a.m.

Post-mortem report : The condition of the animal was fairly good. On opening the abdomen, peritoneal cavity was found to contain about 2 gallons of turbid fluid. A large number of whitish bodies about 1 cm in length were moving all over the internal organs like leeches. Some of them were found attached to the intestines. They were identified as nymphal stages of *Linguatula serrata*. Under the microscope, the hooks were seen moving and sac containing pale yellowish fluid was visible at the posterior part of the nymph.

Perforations ranging from pin point to 2·5 cm. diameter were noticed in the small intestines and caecum. At the perforated areas there was gelatinous substance oozing and the whole intestines were found to be empty. Mesenteric lymph nodes were not visible; lot of fat was attached to the mesentery; the mesenteric region looked like T.B. lesions; the fat was crumpled in appearence like cauliflower of various sizes. Many nymphs were noticed at this region. The cause of death was peritonitis.

The nymphs measured 6 mm x 1 mm with 90-92 annulations. At each annulation there were small spines. They survived in normal saline at laboratory temperature (28°C) for four days. More than 2000 nymphs were collected.

Discussion

Leese (1911) described a case of peritonitis due to Linguatula larva in a camel. Sysak and Bykow (1930) recorded severe pathological changes such as cachexia and asphyxia in a goat due to occurrence of the parasites in msenteric lymph nodes of various organs, such as omentum, liver, lungs, ventricle of heart, pericardial sac, spleen and cortex of kidney. Schmitt and Pohlmann (1935) ercorded a fatal case of peritonitis in a goat.

To the author's knowledge, nymphal forms of linguatulid infection was not recorded so far in this area. Due to the presence of strong hooks and sharp backward directed spines and migratory habits, the nymphs might have caused considerable damage to the affected organs and a very heavy infection might have caused considerable damage to the affected organs and a very heavy infection might have caused the death of the host as reported by different authors. Sections of the intestines revealed mononuclear infiltration in the lamina propria and desquamation of epithelium.

Summary

A case of nymphal linguatulosis in a goat is reported.

The clinical symptoms shown by the animal and perforation of the small intestine and caecum noticed on post-mortem are described.

The recovery of more than 2000 nymphs of *Linguatula serrata* from the peritoneal cavity is recorded.

Acknowledgment

The authors wish to express their thanks to Dr. V. N. Pargaonkar, Principal, College of Veterinary Science, Hyderabad for his encouragement.

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Indian vet. J. 67. December, 1990 : 1171

OCCURRENCE OF BOTS IN A WILD ASS (*Equinus hemionus pollas*)

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Larvae of Gastrophilus flies inhabit the upper digestive tract of equines. This infestation was reported from horses, asses and zebras causing damage in the stomach and duodenum resulting in digestive disorders leading to fatal cachexia in young animals. (Klos and Lang, 1982 and Soulsby, 1982). The authors encountered gastric bots in wild ass (*Equinus hemionus pollas*) stationed at Nehru zoological park, Hyderabad, during autopsy.

Case Report : The wild ass was reported to be preferring to stay back in stable than moving about as it normally does. Later it was not taking feed and was going down in condition. Clinical examination and laboratory examination of blood and faeces did not reveal anything significant. After a protracted course of illness, the animal died.

On postmortem examination, the presence of bots in the stomach of this wild ass was the only significant lesion detected. About 36 larvae were found attached to the cardiac portion of the stomach (Fig.) and another 26 were found free in the stomach. The interior of the stomach was showing multiple ulcers with punched-in appearance. There were no haemarrhagic spots. The bots were red in colour and measured 18-20mm in length and 8 mm width. On examination, the larvae were found to be possessing two rows of spines upto the tenth segment. Spines of the first row are larger than the spines of the second row. These are therefore referrable to be the larvae of *Gasterophilus intestinalis*. On histopathological examination of the stomach, connective tissue proliferation of subserous layer with moderate congestion underneath was detected. The death of the animal was attributed to debility induced as a result of hypersensitivity to the excretions of the larvae.

Acknowledgement : The authors are thankful to the curator, Nehru zoological park, Hyderabad, for encouragement, and to the Director of Animal Husbandry, Andhra Pradesh, Hyderabad and to the Joint Directors of Veterinary Biological and Research Institute, Hyderabad for the facilities provided.

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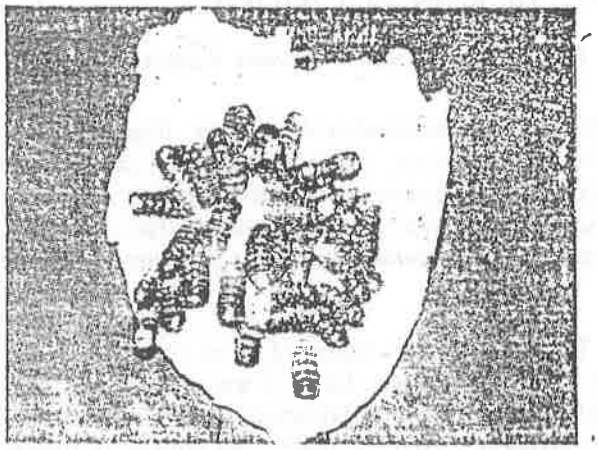
Occurrence of bots in a wild ass (*Equinus hemionus pollas*) —P. Bhaskara Rao *et al*



Cadiac portion of stomach of wild ass affected with bots

Reprint : Zoos' Print, 13 (3) : 16, March, 1998

FLEA INFESTATION IN A LEOPARD (*Panthera pardus*)

M.G. Jayathangaraj[1], Latha[2] & Mathew C. John[3]

Wild felids are susceptible to a wide variety of external parasites which also affect the domestic cats (Wallach and Boever, 1983). Documentations of such infectation are, however, remote. The occurrence of flea infestation in a leopard is discussed in this article.

Materials and Methods

The wild animal under study was a captive leopard (*Panthera pardus*) in the mini zoo, located at the Amirdhi forest of North Arcot - Ambedkar district. A panther was reported to be having occasional pruritus. The animal was restrained physically. Close clinical examination revealed heavy infestation of black coloured fleas. Few were preserved in 10% formalin and brought for examination at the Department of Parasitology, Madras Veterinary College.

Results and Discussion

The flea was identified as *Ctenocephalides felis*. Bowman and Lynn (1995) stated that only a few fleas are required to cause a great misery, especially in sensitive animals. Fowler (1986) stated that *Ctenocephalides* species, *Pulex* species and *Echidnophaga gallinacea* are fleas that affect wild felids; and most of the parasites of felids are shared with other species in the order carnivora. Kirk (1975) also noted that flea infestation is the most common form of external parasitism in exotic felids.

It has been stated that fleas are the main cause of parasitic skin diseases in cats (Thoday, 1981). *Ctenocephalides felis*, being facultative parasites, spend much of their life cycle away from the host, in baskets or corners of rooms (Thoday, 1981). The clinical signs of infestation vary between individuals, the marked signs in some being due to the irritant reactions or the hypersensitivity to components of flea saliva (Thoday, 1981). Griffin et al (1983) stated that the adult flea stage has been estimated to represent only 1% of the flea population, with the rest consisting of fleas in pre-adult form. Pyrethrum compounds are recommended as effective parasiticides for topical application and dichlorvos for cage enclosure application (Thoday, 1981).

Bowman and Lynn (1995) suggested that the bottom of the cage could be kept elevated at least 33 cm above the floor to keep away the jumping *Ctenocephalides felis*. This space will enable a vacuum cleaner reduce the number of eggs, larvae, pupae and unfed fleas in the environment.

Acknowledgement

The facilities rendered by the attending Veterinary Assistant Surgeon and forest officials of the zoo are greatly acknowledged.

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EFFICACY OF DORAMECTIN, CLOSANTEL AND IVERMECTIN IN THE TREATMENT OF TICK INFESTATION AMONG ZOO ANIMALS

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Introduction

In wild animal practice tick infestation is not as commonly encountered as internal parasitism. Ticks transmit several infectious diseases, suck blood and cause discomfort. In old, debilitated and very young animals, severe tick infestation may cause anemia, paralysis and even death. For treating tick infestation in wildlife, the same drugs that are used for domestic animals are of value. This report describes successful treatment of a few clinical cases of tick infestation of varied severity in wild carnivores using endectocides like Doramectin, Closantel and Ivermectin.

History and Observations

In S.V. Zoological Park, Tirupati, two Wolves (1 male, 1 female, 8-10 yrs, body weight 20kg.) three male Wolf cubs (2 months, body weight 2.5 kg.) three Dholes (2 females, 1 male, 3-4 yrs, body weight 20kg.) and four Leopards (2 males, 2 females, 4-10 yrs, body weight 50-100kg) were reported to be infested with ticks. Clinical examination of Wolf cubs revealed severe infestation with ticks which were in bunches around the eyes and margin and opening of the ear canal and the interdigital space. The other parts of the body which were also affected in decreasing order of severity were groin, tail, neck and back. The cubs were very dull, weak, anaemic, unable to move and were lying down lethargically even after being approached. The Wolves had a moderate infestation and were weak while the Dholes and Leopards were affected mildly without any apparent clinical symptoms.

Results

The Wolves and their cubs were given a single injection of a new endectocide i.e. Doramectin (Dectomax, M/S Pfizer Animal Health) @ 200µg/kg body weight intramuscularly. Besides in such areas as pinnae of ears and interdigital space, where ticks were in layers one over the other, manual removal of some was carried out after applying dilute deltamethrin solution. The kennels and night house were exposed to blow lamp and the entire enclosure area including the pasture was set on fire. It was observed that after 24 hours of administration of Doramectin almost all the ticks died and dropped on the floor while very few paralysed ticks were still on the body which were shed off by the second day. The Wolves were free from ticks during the period of 14 days of confinement in the kennels. But upon their release into the enclosures, they were reinfested with very few ticks after four days. The burrows were filled tightly with mud and reinforced with heavy stones to prevent the wolves from digging them again. Subsequently even the reinfested ticks shed off in two days without any further treatment. The wolf cubs were also given two doses of parenteral iron dextran at weekly intervals.

Dholes were given closantel orally along with meat @ 1ml/15 kg.body weight and the Leopards were given invermectin @ 200µg/kg body weight, subcutaneously, keeping them in a squeeze cage. A single administration of both these drugs brought complete relief by the second day of administration.

Discussion

Doramectin, a recently introduced endectocide has been successfully used in the control of ectoparasitic infestation in pet dogs (Jagannath & Yathiraj, 1999) but there is no report on its use in wild carnivores. Hence this drug was tried and found to be quite effective and safe as no adverse reaction was noticed even in weak and young Wolf cubs. Doramectin derived from *Streptomyces avermitilis* inhibts the electrical activity of nerve cells and causes paralysis and death of parasites (Turner & Schaeffer, 1990) as has been recorded in this study. But the Wolves developed mild tick reinfestation as the burrows of the enclosure in which they took shelter were found to be intensely infested with ticks which could not be cleared by external fire. However, maintenance of higher plasma Doramectin level for 38-45 days (Jones *et al.*, 1993) might have made the Wolves to completely recover from the mild reinfestation.

Closantel (Exi not, M/s Cadia Pharmaceuticals, Vet. Div.), a new oral endectocide has been tried in domestic animals earlier and was found to be effective and safe in Dholes. It can be used as a routine dewormer which may also get rid of the ectoparasitic infestation. Ivermectin (Ivomec, M/s Dynamic Pharmaceuticals) a widely used drug proved to be efficaceous in Leopards. Chakravarthy and Malhotra (1975) reported tick infestation in a Lesser Panda and Jaguar and their treatment with malathion

Received 21 June 1999; Accepted 25 August 1999

spray.

Acknowledgements

The authors are thankful to Dr. K.V. Ramana, in-charge Veterinarian and Sri. Parthasarathi, Assistant Curator of S.V. Zoological Park, Tirupati for their cooperation.

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Reprint : Zoos' Print, 5 (10) : 5, October, 1990

WOLF TICK IDENTIFIED.

BY

Dr.P.Chakravarthy,B.V.Sc.
Veterinary Officer.

Dr.D.Rajasubramanian,B.V.Sc.
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Dr.Ravishankar, B.V.Sc.
Veterinary Asst.Surgeon.

Arignar Anna Zoological Park,Madras-48.

TICKS were collected from the body of a wolf (Female) stationed in Arignar Anna Zoological Park,Vandalur,Madras-48 in November 1989 and submitted to Professor and Head Of the Department of Parasitology,Madras Veterinary College for detailed identification of TICK.

Professor and Head ,Department of Parasitology,Madras Veterinary College,Madras-7 identified the Tick as *Rhiphicephalus Sanguinas* and communicated the same to Veterinary Unit vide their lab Lr.No. 1167.

Acknowledgement:

The Authors are thank to the Director,Arignar Anna Zoological Park,Madras-48 for providing necessary facilities and also the Professor and Head,Department of Parasitology,Madras Veterinary College,Madras-7 for indentifying the Wolf tick.

October 1990

Reprint : The Indian Veterinary Journal, Vol. 45, No. 8, August 1968, PP.700-701

Letter to the Editor

Sir,

Sub :Dermatitis in Elephants caused by the louse *Haematomyzus elephantis* (Piagot 1869)

Haematomyzus elephantis, the elephant louse has been recorded in many parts of the world. The lice are mostly found at the ear where the softer and thinner skin is more easily penetrable. The present note is on the incidence of extensive infestation by this louse in elephants belonging to the Nehru Zoological Park, Hyderabad, causing dermatitis.

Of the three elephants in the Zoo, one was showing signs of dermatitis, having severe pruritis with dryness of the skin and scale formation on the neck, ears, portions of the abdomen and other regions near the tail etc. There was history of inappetence. On clinical observation it was noticed that the elephant was uneasy frequently scratching the abdomen, neck and vigoursly moving the ears. The animal was in a state of nervousness. On close examination a large number of lice were detected all over the body, mostly at the ears. The other two elephants also showed milder infestation with the lice at the ears and on other regions of the body. Some of the lice were found inserted with their proboscis so firmly in the skin, that it broke during the process of extraction.

The elephants were given a thorough dusting of Gammexene all over the body which destroyed all the lice. They were bathed next day. After bath, sulphur in oil 10% solution was applied all over the body. The sulphur in oil dressing was continued for 15 days. Gammexene was repeated after a week from the first application. Bathing was repeated once in three days. Dematitis and itching subsided after a period of a week. Complete recovery took place in a fortnight.

Acknowledgement

The authors wish to express their thanks to Dr. V.N. Pargaonkar, Principal, Veterinary College for his guidance and encouragement.

R.S. Raghavan and
K. Radhakrishna Reddy,
Veterinary College, Hyderabad
and
Mir Gowher Ali Khan
Veterinary Officer, Zoo, Hyderabad.

Hyderabad,
10-2-68

Reprint : Zoos' Print, 6 (11) : 25-26, November, 1991

PSOROPTIC MANGE IN GREY GIANT RABBITS

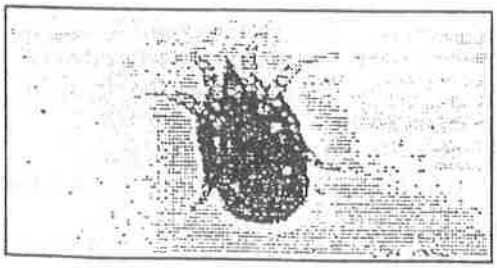
R. Somvanshi and J. C. Biswas, Indian Veterinary Research Institute, Mukteswar 263 138 U P

Psoroptic diseases of external ear canal are frequent in laboratory rabbits although often they are a partial phenomenon of specific diseases of nose and mouth. Mange caused by different mites are of outstanding importance in rabbits since the disease comes as epidemics and death often follows quickly (Benjamin, 1929; Kelemen and Kircher, 1978). Such information are infrequent in meat rabbits in this country.

In the present communication, morbidity, clinical features, haematological changes and pathological lesions of ear mange alone or associated with other diseases are reported in Grey Giant rabbits acclimatised to the medium altitude of Mukteswar.

Grey Giant, a strain of broiler rabbit was obtained from the Regional Research Station, C.S.W.R.I., Garsa, Himachal Pradesh in 1989 and multiplied at Muketeswar campus of this Institute. The animals were maintained in cages and provided with 50 g concentrate feed mixture and 300 g green grasses/vegetables per day per animal. Appropriate preventive and curative health care was provided. During April, 1990 to March, 1991 an outbreak of mange occurred in these animals. Mange mites were identified from ear scrapings. Blood was collected from infected as well as control rabbits for haematological study. Out of 31 animals which died, 10 rabbits were due to mange or mange with other associated diseases. They were necropsied and when required materials were collected in 10% formalin for histopathological examination. Efforts were made to manage the ailment by therapeutic measures.

Clinically, approximately 60% rabbits were affected with mange. Varying degree of disease was seen in all age groups irrespective of sex. In adult rabbits mange was generalized and general debility was frequently associated. In severely affected rabbits masses of crust reached a thickness of one cm, grey-yellowish in colour, spreading over entire ear and was painful. The infection was noticed in middle ear (Fig. 1). In generalized cases infection was seen over the entire head and grey, granular exudate was seen on hairs. In head, thickening of lips, nose, skin around eyes and base of ear was seen. Fore and hind legs, areas around testes and infrequently abdomen and tail were affected.



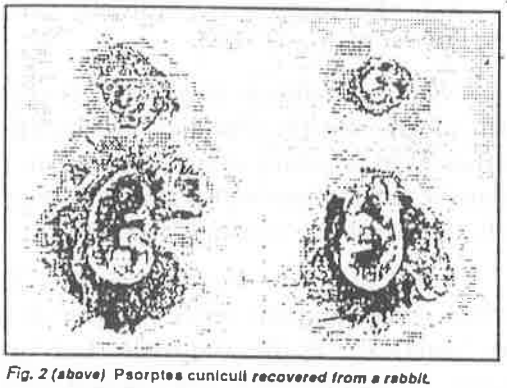


Fig. 2 (above) Psorptes cuniculi *recovered from a rabbit.*

Fig. 1 (adjacent column, below) Ceruminous deposits in mange affected middle ear

In severely affected animals innumerable mange mite *Psoroptes cuniculus* were demonstrated (Fig.2). However, in early cases fewer mange mites were observed.

Mean haematological values (Table 1) [next page] showed slightly lower RBC, Hb,PCV and WBC values in mange-affected rabbits. Differential counts showed heterophilia and relative lymphopaenia as compared to controls.

The data on the suceeding page clearly indicated that in 50% dead rabbits mange was associated with general debility. In all these cases disease was generalized while in the remaining rabbits it was associated with hepatic and intestinal *coccidiosis, enteritis* and pulmonary congestion. These factors were contributory in causation of death. Pulmonary congestion was due to exposure of the ailing rabbits to extreme chilly winter of Mukteswar having minimum temperature range from -7.4 to +8 o C.

The clinical features of mange in Grey Giant rabbits were similar to an earlier report (Kelemen and Kircher, 1978). Keeping in view the generalizaed lesions on head, neck, extremities, inguinal areas etc. along with presence of numerous mange mites and relatively high morrtality, the disease may be graded as highly infectious and pathogenic similar to those observed in Italy and France (Seifried, 1937). The hepatic coccidiosis and pulmonary congestion could, however, be the other contributing factors for higher mortality. The infection was therapeutically managed by use of Ivermectin as reported by earlier workers (Pathak and Kapoor, 1990).

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Table 1. Haemogram in mange-affected rabbits

Rabbits Groups	n	RBC	Hb	PCV	TLC	N	L	M	E	B
						----------%----------				
Controls	8	6.25	11.51	47.12	8,331	40.75	48.25	5.63	4.00	1.37
Mange*	8	5.24	10.25	42.25	7,603	46.57	41.71	5.58	4.28	1.86

Note: *Four of these animals died.

Necropsy examination showed that ear mange was associated with diseases as below:

Mange/General debility	- 4
Mange/Hepatic coccidiosis	- 2
Mange/Pulmonary congestion	- 2
Mange/Intestinal coccidiosis	- 1
Mange/Enteritis	- 1
Total	-10

Reprint : Zoos' Print, 1 (11) : 3-5, November, 1986

Modern Birth Control Measures Undertaken At Lion Safari Park, Borivli

By N. B. Bhure
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Dr. K. D. Bhatwe
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Borivli, Bombay

There are many methods of controlling big cat population in captivity as practised in the Western countries.

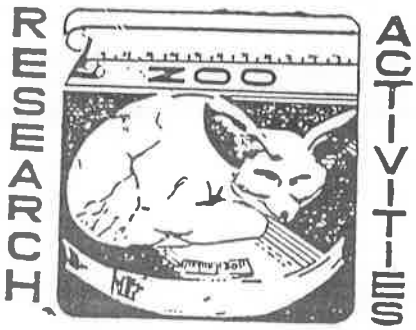
1) Euthanasia i.e. mercy killing is routinely used with dying or diseased animals or even for population control. but this concept is not acceptable to the society and it is just unthinkable in our conditions.

2) There are some managerial techniques such as separation of animals at appropriate period of their reproductive cycle. But such isolation is difficult in lions as it is noticed that they also helped in giving wide publicity to this problem in the press. Thus with combined efforts, 35 surplus animals were supplied to other needy zoos and circuses within a couple of months, and now the park has 15 animals. There are some demands still in hand. Every demand case was scrutinised by the Chief Wildlife Warden of the Maharashtra State and after getting his permission the animals were supplied to secure places like Safari Park, zoos and circuses.

Birth Control for Remaining Lions

The latest birth control measures were adopted for the remaining animals. The dominant male lion Shankar was vasectomised on 3/5/86 with the help of Veterinary Surgeons of Veterinary College, Parel, Bombay. Similarly five lionesses of the park were implanted with hormonal contraceptives, especially brought from U. S. A. for the first time in India.

By adopting all possible measures in this behalf as illustrated above, the animals are now in optimum number which can be managed easily by the administration.



the breeding amongst felines is throughout the year and moreover, this is not possible in case of Safari, where proper animal display values are more. Such mechanical methods are also not feasible frequently due to space restriction and exhibit needs and social behaviour of animals.

Vasectomy Operation of Lion "Shankar"

Sterilization has proved to be the superior method of curbing cat population in states though it is irreversible and permanently removes the animal from the gene-pool. Moreover it involves a

surgical procedure which interferes with internal body working. Vasectomy is a good method for animals like lions of mixed strain and of inbreeding. It may be a routine surgery in the developed countries, but in Indian condition it is difficult because of non-availability of drugs for anesthetizing large animals. The vascular system of lions is very complex and hence an expert doctor is needed to locate the sperm duct (Vas deferens).

With the help of Melghat Tiger Project, Paratwada we could procure the drugs required for chemical immobilization of the animals. The veterinary experts from Veterinary College, Bombay together with Dr. Batwe of Sanjay Gandhi National Park, Borivli could successfully vasectomise the lion "Shankar" on 3/5/86 at the veterinary college Bombay.

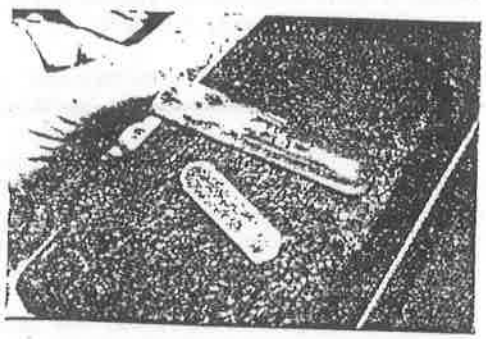
Site of vasectomy operation showing line of sutures. Photo by Staff photographer

The animal kept in the treatment cage, was chemically immobilized by injecting chemical drugs Ketamine and Rampun. The space selected for operation was at the base of scrotum on its anterior aspect. A small incision of about one half inch was made after sterilizing the area. The Vas deferens was identified, and a small portion of it was taken out and both the cut ends are ligated with silk thread. The procedure was repeated on the other side also. After the operation, the wound was treated with antibiotic powder, and was sutured with no. 1 size cat-gut. During the immobilised stage of the animal the complete physical examination of the animal was taken and necessary required treatment was given. After a few days stay in the veterinary hospital Bombay, "Shankar" was taken back to Lion house in Safari Park, Borivli. Shankar has now completely recovered and selected Chanda lioness in estrus, a queen of his choice from the harem of seven lioness and was seen happily mating with her.

Contraceptive Implants–first time in India

Many compounds in western countries are developed as suitable contraceptives and agents for supression of heat or synchronization of estrus in domestic livestock. These include preparations for regulation of both male and female fertility. Many of these compounds have been tested in domestic animals as well as in laboratory species so that data on primates, rodents, carnivores and ungulates are available. Dr. U. S Seal and others after studies on lions had successful results with medroxyprogesterone acetate (MPA.) and melengestrol acetate (M. G. A.)) in silicon rubber implants placed sub-cutaneously. The implants last upto three years and can be removed when the zoo wants the animal to breed. As per the New-York Times news (Chicago Aug., 12, 1984), Dr. Seal said, 50 zoos in the States have used the implants mainly on their large cats.

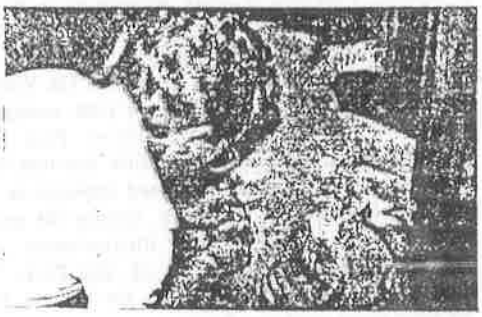
Mr. J. C. Daniel, Curator, Bombay Natural History Society Bombay entered into correspondence with U.S. Fish and Wildlife Services U. S. A. and could succeed in getting these implants through Paul Joslin, Assistant Director, Brookfield Zoo and Dr. Ulyssess Seal of U. S. A. The Wildlife Institute of India, Dehradun was kind enough to bring the implants to the Borivli Park and Dr. Bhattacharjee from the Wildlife Institute came to Safari Park, Borivli and fixed implants in five selected lionesses of the park during the period 6/8/1986 to 10/8/86. Dr. Bhattacharjee was assisted by Dr. Batwe, V. O. of this Park. The lionesses of the Safari Park were the first in India to have these implants fixed.



Hormonal contraceptives in the form of silicone rubber implant containing varying quantities of MGA or MPA Photo by N. B. Bhure

Sr. No.	Name	Age	Tatoo mark	Implant No.	Wt. of the Compound
1.	Sarika	10 years	5	1450	3.41 gm.
2.	Mohini	3½	easily identified	1455	3. 08 gm.
3.	Jamuna	6½	red tag No. 384 on ear.	1453	3 45 gm.
4.	Parvati	4½	8	1449	5.34 gm.
5.	Chanda	3½	9	1454	4.95 gm.

The implants are simple Silicon subber rods of hardly 2" length containing either the compound MPA or MGA,with quantities of different wt. Hence while implanting the number and wt.of the implant has to be recorded. The fixing of implants is a very simple procedure. The females attaining sexual maturity were first selected, and accordingly out of the seven females in the park the lionesses in the table above were selected.



Implant is placed subcutaneously near the base of the ear. Photo by N B Bhure

The animal was taken in the treatment cage and by squeezing the animal slightly, the Rompun and Ketaset mixture was directly injected in the body. Once the animal was completely immobolized the place on the neck just 3" to 4" below the base of the ear was selected. The skin was cleaned and Lignocaine injection was given as a local an aesthesia.Holding the skin in hand incision of 1" was given with sharp surgical blade. The wound was cleaned and the implant was inserted below the skin and the cut was neatly sutured with nylon thread. The wound was properly dressed with antibiotics.

A complete physical body inspection was done. Any other injuries noticed were properly treated. The body measurements were noted down, the blood samples were collected and body temperatures were also recorded. The tatoo mark with permanent ink was given near the base of the tail, though the selected animals are easily identified by the animal keepers. It was observed that the animal could completely recover within 3½ to 4½ hours after injection of drugs and actual implanting work could last for 15 minutes.

Presently the Safari Park has only 15 animals, 2 male lions Raj and Gurudutta are old, one dominant male Shankar has been vasectomised, five lionesses have been implanted.one lioness Rani is too old and rest of the animals are too young and can work as control animals. Thus the control measures for leonine population have been undertaken and now the animals are displayed properly and are accomodated comfortably in hygienic conditions.

(For hormonal contraception in captive lions reference is taken from study-note prepared by Dr. U. S. Seal and others).

Sri N. B. BHURE. is the Asst. Manager (h.q) Thane region Thane F. D. C. M. Ltd.

Sri Dr. K D. BATIVE is the Veterinary Officer Sanjay Gandhi National Park, Borivli, Bombay.

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Reprint : Zoos' Print, 5 (5) : 27-28, May, 1990

VASECTOMY OF LEOPARD

*By Dr. K. D. Batwe**

In October 89, sally Walker, chairperson of Z. O. O. wrote me a letter requesting me to visit Dr. Prakash Amte's "Tribal Zoo cum orphanage", Hemalkasa, for performing vasectomy of his leopard. This communication prompted me to contact Dr. Amte for further programme. The Hemalkasa is situated amidst the dense, green and silent forest, where borders of Maharashtra, Madhya Pradesh and Andhra Pradesh are very close to each other.

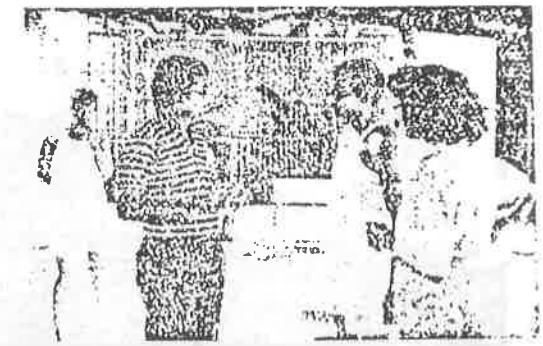
To reach Hemalkasa, we travelled for more than thousand Kilometers from Bombay. While reaching Hemalkasa we were literally spellbound by tall green dense forest which is abounds in wild animals. The area is also having a large population of tribals, the Madia Gonds. Baba's Son, Dr. Prakash Amte set up a "Lok Biradari Project" which provides medical and educational facilities to the Madia Gond Tribal people. Hemalkasa is base camp with several subcentres in the Gadchiroli district each manned by training volunteers.

The tribal patients of the Amtes, presented him these animals as a token of their gratitude and sometimes for curing these wild beasts of therr ailments. Most of the time animals offered at very yound or suckling age. Dr. Amte provided best possible medical-aid with love and tenderness such type of gifts obviously resulted in a "Animal Orphanage cum tribal Zoo.

In this Zoo, Dr. Amte is having a pair of leopard namely Raja (male) and Negali (female). The compatibility of this pair resulted in a four litters with seven cubs during 1985 to 89. However then it becomes a great problem to dispose off these cubs and also there was another problem from lone lion in the same cage, who was showing great interest towards Negali caused fear of probable interspecies breeding, which is against the recent trend as well as Zoo ethics. That was the reason why Sally Walker requested me to visit Hemalkasa to perform sterilization of lion and leopard. As the Raja was full grown adult I have selected him first to perform vasectomy however, operation of Lion was post-poned till he attains maturity.

While we were deciding to perform operation of Raja in October 89, the question of availability of anaesthetic drug-Rompum was solved by Dr. Jacob Cheeran, Professor, College of Veterinary Science Kerala. He was also kind enough to give us few good tips & precautions to be taken during anaesthesia.

While all this correspondence was in progress, I talked to one of my local Veterinary collegue-Dr. Sarita Kelkar, (Practicing Veterinary gynaecologist in Bombay, she with all enthusiasm promised me to associate me in this operation. Infact, her immence help in this operation helped me to achieve this success.



Dr. Batwe while planning with Dr. Amte and Dr. Sarita Kelkar about anaesthesia.

We reached Hemalkasa on odd hours of 11th February 90. Even on that odd hours, Dr. Amte was enthusiastic to introduce us to various animals. We were specially interested in Raja for operation and hence kept him under observation and been instructed to fast him till next day.

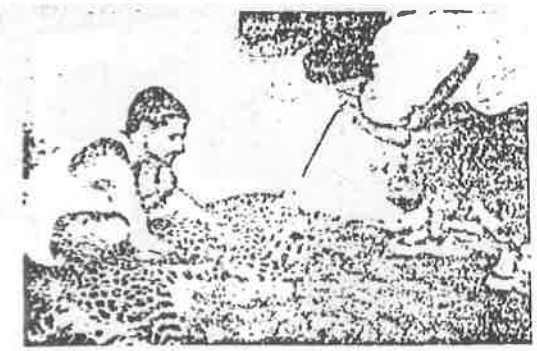
On 12th February, after observing Raja for few hours we were satisfied about his health.

Prior to anesthesia, we had a discussion with Dr. Amte about tranquillizing Raja with blow pipe, however, immediately he ruled out this procedure and asked me to give syringe filled with anaesthetic drugs. He assured me that injection will be given without any problem. As usual Dr. Amte entered in the cage of Raja without any fear, patted him and started combing with hair comb, inturn leopard started licking him, while he distracting leopard's mind in combing he was given the first short of tranquilizing drug with hypodermic needle.

The first shot of above mentioned anaesthetic drug "Rampun' (150 mg) was given around 9.45 a. m. A twenty minutes later another anaesthesia-"Ketamine" (150 mg) was given intramascularly.

* Dr. Batwe, presently working at Veterinary Dispensary Uran, Raigad as a Livestock Development Officer

Soonafter, first dose of Rampun he sat quietly which helped in taking his body temperature which was shot up to 105°F. The rate of respiration was ten per minute and heart rate was sixty per minute, after another twenty minutes time. After some time Raja attempted to vomit stomach contents though he was fasted almost for 24 hours prior to anaesthesia. The Inj. Atropine sulphate was given to counteract this vomiting. After ten minutes of giving Ketamine he was sleeping quietly. While doing so we have also checked his body reflexes - like palpebral, auditory and pedal reflexes. Even after 15 minutes of anaesthesia slight pedal and palpebral reflexes were present however rest other reflexes were abscent. The chlormycetin eye ointment was applied to open eyes to protect them from sunrays.



Dr. Amte checking heart rate and Dr. Kelkar Auditory reflexes after anaesthesia.

The operation was started around 10.30 a. m. The area of operation selected was at the base scrotum on its anterior aspect. The area was shaved, cleaned with spirit and disinfected with "Povidone iodine".

After securing testicles in hand, a midline incision of 1" was given, the underlying tissues were bluntly dissected to bring left spermatic cord in right. A membranous layer of tunica vaginalis was cut by scissor and approach was made to vas deferens. After differentiating vas which is glistening white in colour, a peace of 1" length of vas deferens was removed and both the cut ends of vas were ligated with silk threads.

The same procedure was applied on vas deferens of right side.

The pieces of vas deferens collected during operation were preserved in 10% formalin to confirm its anatomical nature by histopathological examination.

After ligating the vas deferens the underlying subcutaneous tissue and skin were sutured together with chromic catgut, so that there should not be any problem of removing these sutures afterwards. The operation was finished around 1200 hours.

Team of doctors performing vasectomy of leopard.

Soon after operation Raja was given the injection "Penidure LA-24 lakhs" intramascularly and around the site of operation. A oil of eucalyptus was applied around the site of operation to keeps files away and povidone iodine applied along the line of suture. The injection Hostacycline-H was also given to counteract swelling around right side of scrotum.

After operation animal showed slight leg movements on 12.30 hours started growling after 1300 hours and sat at 1430 hours. He recovered from anaesthesia on 1600 hours, although drowsiness continued till late in the night. He also showed slight depression even on next day. Otherwise he was showing normal physiological behaviour. Fortunately, there was no post operative complications were seen as per the letter from Dr. Amte.

The pieces of vas deferens collected for histopathology were examined at the pathology department of Bombay veterinary college confirmed its anatomical resemblance.

Photos : Dr. Henriette Syatauw, The Netherlands

Reprint : Zoos' Print, 9 (1&2) : 24-34, Jan./Feb. 1994

REPORT ON THE CAPSULE VETERINARY WORKSHOPS ON SPECIAL TECHNIQUES IN FELID REPRODUCTION AND GENETICS

Dr. N. V. K. Ashraf, Veterinary Officer, Coimbatore Zoological Park and Conservation Centre

Workshop training team and participants monitoring vital signs of an anesthetized jungle cat. From left to right: Dr. B. M. Arora, then Director, National Zoological Park, New Delhi, Dr. Budhan Pukazhenthi, Research Fellow, National Zoological Park, Washington, D. C.; Dr. Lindsay Phillips, Professor, U.C. Davis, California; Shri Raju Vyas, Zoo Inspector, Baroda Zoo.

Introduction

A series of four one-day capsule veterinary workshops were held at four zoos in India, during the month of October, 1993. These were held on alternate days, immediately following the Asiatic Lion PHVA at Baroda. A team of six US scientists from Smithsonian Institution and NOAHS centre (New Opportunities in Animal Health Sciences) of National Zoological Park conducted these workshops. The group included one reproductive biologist, two veterinarians, one geneticist, one reproductive physiologist and a research scholar working on the techniques of animal reproduction. Their names and designations are Dr David Wildt, Reproductive Biologist; Dr. Mitchel Bush, Assistant director, Animal Health, Dr. Terri Roth, Reproductive physiologist; Dr. Budhan Pukazhenthi, Research scholar, -- all from the National Zoological Park, Washington, D. C. and Dr. Lindsay Phillips, Professor, University of California, Davis, California as well as Ms. Janice Martenson, Laboratory of Viral Carcinogenesis, National Cancer Institute, Frederick, Maryland

These workshops were initiated by Zoo Outreach Organization and hosted by the respective zoos. These zoos were invited to host these workshops on the basis of their proximity to a veterinary college and their relationship and record of cooperation between the same. They were Municipal Corporation Zoo, Baroda, Kamala Nehru Zoo, Ahmedabad, Veermata Jeejabhai Bhosle Udhyan, Bombay and Sanjay Gandhi Biological Park, Patna. The workshops were held at these centres on 22nd, 24th, 26th and 28th respectively.

One of the major objectives of the team's visit to India was to establish the purity of the Asiatic lion subspecies maintained in these Indian zoos. The group was also interested to study the seminal characteristics of exotic felids that have the history of inbreeding in zoos and to demonstrate these techniques to Indian veterinarians, reproductive physiologists and geneticists working in zoos and universities. While doing so, the team also demonstrated the use of transponders for animal identification, technique of collecting skin biopsies and the procedure of performing vasectomy as a method to control breeding in zoos. This report, accordingly, deals with the following topics....

1. Anaesthetic procedures
2. Electroejaculation & Cryopreservation
3. Genetic tests for recognizing hybrid lions
4. Reproductive control methods-Vasectomy
5. Transponder telemetry
6. Diseases of potential threat to lions

The number of participants at each centre varied from 15 to 30; almost all of them were veterinarians. Most of them were from local universities and veterinary colleges. All participants were given a briefing book and a workshop training manual.

For conducting studies on genetics and reproductive biology, it is obvious that two types of biological materials are essential: blood samples for genetic studies and semen samples for reproductive assessment. For conducting these procedures, anaesthesia is the only choice of restraining wild felids, particularly for electroejaculation.

Participants at the Ahmedabad Workshop.

A. Anaesthetic procedures

Since almost all the participants were veterinarians, a considerable amount of interest was evident during drug-immobilization operations. In fact the success of the whole workshop was dependent on the successful handling of the anaesthetized animals. Therefore, all workshops started with briefing on darting techniques with emphasis on drugs and delivery systems used.

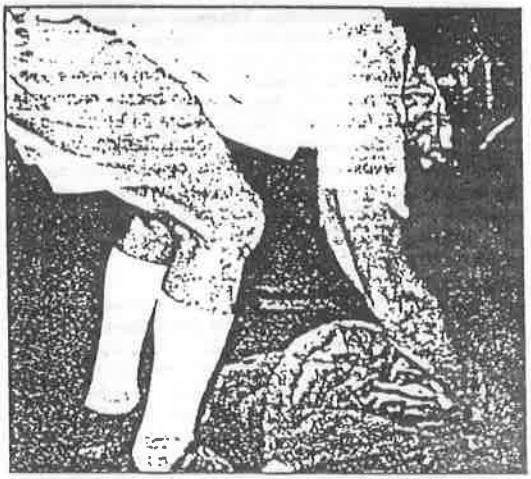
As many as 25 individuals of 6 species of cats were subjected to drug immobilization. These were, lions *(Panthera leo)*, leopards *(P. pardus)*, tigers *(P. tigris)*, clouded leopards *(Neofelis nebulosa)*, jungle cats *(Felis chaus)* and leopard cats *(Felis bengalensis)*. Multiple samples of blood and semen were collected from most of these animals for performing various laboratory procedures. Skin biopsy samples were also collected from jungle cats, leopard cats and leopards for taxonomic studies.

Drug delivery systems used: Either Blow pipe or Pole Syringe (Jab-stick) were used, depending on the species and the type of enclosures they were in. For all big cats in large enclosures, darts were delivered using blow pipes. Occasionally a pole syringe was used for individuals in confined areas (e.g. squeeze cage). Most of the jungle cats were drugged using a pole synnge and almost all the leopard cats were net-caught and later subjected to drug immobilization. Mini-ject syringes with plastic stabilizers were used in blow-pipes made of aluminium alloy. The advantage of using plastic stabillzers over the conventional woolen stabilizers is that the plastic ones are reportedly more accurate in striking the target. The blow pipe was made of 3 pipes of about 1 metre length.

Drugs used: Telazol was the drug used for most individuals for anaesthesia. Telazol is a 1:1 combination of Tiletamine (a dissociative anaesthetic like Ketamine) and Zolazepam (a sedative like Diazepam). Other drugs used were Ketamine and Xylazine hydrochlorides.

The advantage of Telazol over others is that it is available in a powder form and can, therefore, be made into a high concentration preparation. In fact, the whole 500 mg vial (Tiletamine and Zolazepam: 250 mg each) can be diluted in 1.2 ml of distilled water. This is considerably advantageous because 1-1.2 ml of this preparation would be sufficient to bring down a captive adult lion. Conversely Ketamine, which is the other drug of choice, comes as 100 mg/ml preparation and thus demands a higher volume of drug (say more than 4 ml for an adult lion) even if administered along with 50-100 mg of Xylazine. This means using 2 darts of 3 ml volume; and when animals are to be tranquilized with two darts, there is no guarantee that the interval between these two successive injections would be minimal. During the course of the workshop, some of the other advantages of Telazol also became apparent. Whenever Telazol was used, induction was rapid, anesthesia was profound, and the total duration of anaethesia was considerably longer. Like Ketamine, Tiletamine also has a wide safety margin and other properties of Ketamine like maintaining swallowing reflex. However, in spite of all these advantages, the long period taken for recovery should be considered a drawback. Animals immobilized with Telazol often hardly showed any sign of recovery from anaesthesia even after 2 hours.

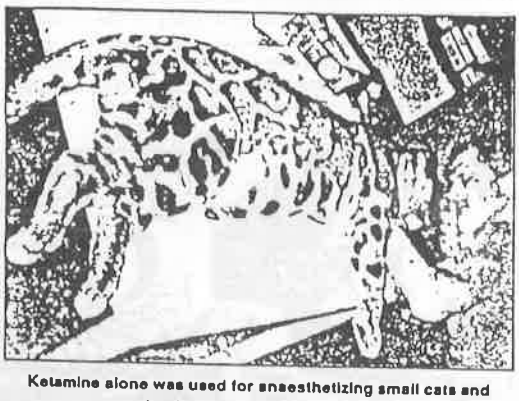
Demonstrating the use of blow pipe at Baroda Zoo.



Leopard Cats at Patna Zoo were caught in gunny-bag nets and later anaesthetized

Telazol was not used for tigers for its alleged side effects in this particular species (readers can refer to page 2 in the 19 90 January issue of ZOOS' PRINT.) Tigers immobilized with Telazol have been reported to develop symptoms of CNS disease including limb ataxia, disorientation, hyperactivity, muscle tremors and petitmal seizures after 3-4 days of recovery from anaesthesia. Because of these reasons, a combination of Ketamine and Xylazine was used for anaesthetizing tigers. Whenever xylazine was used, its effects were reversed by administering Yohimbine hydrochloride. However, Dr. Mitch Bush, the National Zoo Veterinarian, was of the opinion that only 7-10% of the tigers immobilized with Telazol exhibit such side effects, particularly those tigers anaesthetized after repeated drug administration.

Only Ketamine was used for anaesthetizing small cats (including *Neofelis*) except on 2 occasions when Telazol was used in jungle cats. Since Ketamine has a tendency to cause convulsive seizures, diazepam was given intravenously. However, as most of this Ketamine induced seizures are self limiting, animals were monitored for 1-2 seizures to complete before deciding administering this anticonvulsive drug.

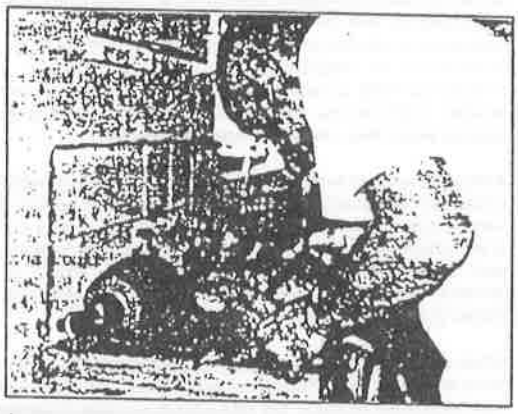


Ketamine alone was used for anaesthetizing small cats and clouded leopards at Patna Zoo.

Precautions before drug-immobilization: From animal's point of view, several precautions were taken before darting. In almost all cases, food was withheld before 24 hours and no water was provided for 6-12 hours before darting. Very old animals were avoided as they were considered weak to withstand the drug effect. It was advised against anaesthetizing animals enclosures with water pools so as to avoid drowning.

Darting procedure: Whenever blowpipe was used, darting distance varied from less than 1 meter to as far as 7 metres. Darting procedures were always systematic. The importance of keeping accurate records of drug-immobilization was stressed every time. The data sheet used can vary in its format from place to place, but should include all the information during anaesthetization including the mistakes made during every operation. Such records are useful at later dates to refer back to the mistakes

Monitoring the animal: Table 1 shows the details of the dosage used, induction time, revival time (whenever recorded), etc. Like Ketamine, animals anaesthetized with Telazol also kept their eyes open and maintained corneal, palpebral, pinnal, pharyngeal and laryngeal reflexes. Soon after induction, reflexes were examined, particularly jaw control using long probes like iron rods. After complete anaesthesia, vital physiological parameters were recorded. These included, body temperature, respiratory rate, pulse, blood pressure, oxygen concentration in blood and heart rate. Various types of equipments were used for monitoring all these vital parameters. While blood pressure was recorded using a standard human sphygmomanometer, blood oxygen saturation & pulse rate were recorded using a special 'pulse oximeter'. This equipment is particularly used in monitoring physiological events during human anaesthesia and has been adapted recently for use in wildlife species. This technique depends upon a sensor which transmits a beam of light through a pulsative capillary bed. This beam of light reads it straightaway and shows the pulse rate and oxygen saturation on the monitor. The sensor has been modified to clip on areas such as lips, tongue, nasal septum, ear and prepuce of animals.



After complete anaesthesia, vital physiological parameters were monitored. Here Dr. Bush is examining a jungle cat at Baroda Zoo

Collecting biological materials: Once completely anaesthetized, blood samples were collected in Venoject plain vacuum tubes as well as in vacuum tubes with additives (EDTA and/or Sodium Heparin). The site of blood collection was jugular vein in small cats & clouded leopards, and caudal or femoral veins in big cats. Simultaneously, semen samples were also collected using electroejaculation. This has been dealt in the next section on electroejaculation and cryopreservation.

Recovery from anaesthesia: As 3-6 animals were immobilized per day, it was not possible to record the total duration of anaesthesia and the recovery time (the time from induction to getting up) for most cases, particularly those animals anaesthetized with Telazol. Often, big cats administered with Telazol remained in lateral recumbency for more than 3-4 hours after induction. As said earlier, this should be considered as an operational disadvantage while using Telazol. On the contrary, animals anaesthetized with Ketamine (or Ketamine-Xylazine combination) showed signs of recovery after 40-50 minutes of induction.

B. Electroejaculation and cryopreservation

Why should one try artificial insemination (AI) techniques in wild animals? There are many reasons. The ultimate measure of an animal population condition is its reproductive success. The success of any conservation effort, be it captive breeding or habitat protection, lies on the species' ability to reproduce and propagate its numbers successfully. In this respect, reproductive biologists play an important role in conservation biology. Their role becomes more important in the management of captive populations which are more vulnerable to inbreeding and subsequently loss of genetic diversity.

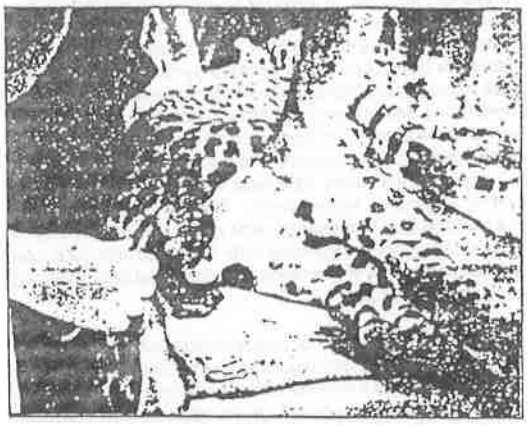
According to Dr David E.Wildt, Reproductive biotechnology using frozen gametes and embryos, has made great strides in recent years, and artificial breeding will find its own management application atleast in some wildlife species in the next decade. For examp'e, there are many species like the cheetah, which do not readily breed in captivity. It has been proven that ejaculates from this species contains mostly dead and deformed sperms. In such problem animals, in-vitro fertilization is the only option. Another reason for developing AI techniques in wild animals is that zoos cannot afford to maintain lot of animals to maintain genetic diversity. By AI, the diversity can be maintained in separate populations of a species scattered across several zoos. AI methods are also excellent tools for the propagation of critically endangered species which may not readily breed in captivity.

Almost all the 25 anaesthetized males were subjected to rectal probe electroejaculation. Depending on the species, probes of varying length and diameter were used. For lions, probes with 2 inch diameter, for leopard cats probes with 1 cm diameter and for clouded leopards & leopards, probes with 2 cm diameter were used. The probes contain 3 longitudinal electrodes at the terminal end.

Once anaesthetized, the morphomry (length and breadth) of each testicle was taken using vernier calipers. This procedure has been done to study the relationship between testicular size and semen quality. In animal husbandry practice, it is an established fact that testicular size in bull is positively correlated to seminal quality/volume.

On most occasions of electroejaculation, the electrical stimulation consisted of 3-5 series with 4-6 minutes of rest in between. Each series consisted 10 electrical stimull or pulses. The voltage used ranged from 1 to 5 volts depending on the species.

Ejaculation procedure: Prior to every ejaculation operation, the prepucial sheath and the penis are cleaned, to avoid contamination of the ejaculate. Lubricated rectal probe is inserted into the rectum by gentle pressure. The electrodes are positioned ventrally, i.e. over the underlying accessory sex organs. Penis is projected out of the sheath and a sterile collection vial is kept over the penis for collection. During electrical stimulation (which is done using an electroejaculator which converts the 240 volts electricity to only 1-7 volts; this can be read on the voltmeter), constant pressure is applied over the accessory sex organs by gently pressing the electrodes in the probe. The electroejaculator is switched off after completion of every ejaculation.



Electroejaculation in a leopard

The total volume of the ejaculate is measured and maintained at room temperature. One or two drops of the sample is mounted for microscopic evaluation of its quality. This quality evaluation involves assessing percent sperm motility (marked as 0 to 100%) and rating forward progressive motility (in a scale ranging from 0 to 5.... 5 indicating the best).

All the semen samples were evaluated for quality

Three to five microlitres of the ejaculate is fixed in 100 microlitre of 0.3% glutaraldehydein for analysing morphology. From samples thus fixed, sperm concentration and sperm motility are determined using the conventional methods followed in the animal husbandry departments for evaluating bull semen.

During the four workshops, ejaculates from as many as 25 individuals of 6 species were examined for motility (see table 1 for number of individuals in each species). Broadly speaking, most of the lesser cat samples were of good quality. The sperm concentration and motility in big cats varied according to species. The variability in lions was very noticeable, with some semen samples being poor. In a study conducted by Dr Steve O'Brien (USA), it has been established that the spermatozoa in Asiatic lions show extreme degree of morphological abnormalities. About 79% of the spermatozoa in each ejaculate was

found to be morphologically abnormal. This has been attributed to the result of genetic bottle-neck that the Gir lions underwent during the early part of this century when their numbers were reportedly reduced to less than 20. The quality of semen in tigers and leopards were generally good. All the three clouded leopards of Patna zoo failed to show any live sperms in their ejaculates. One interesting observation could be made on the quality of ejaculates from leopard cats of Patna zoo, apparently bred from a single breeding pair. Ejaculates from 4 males were examined and 2 of them were good with high concentration of progressively moving sperms. Two of them either failed to ejaculate or their scanty ejaculate contained only dead sperms.

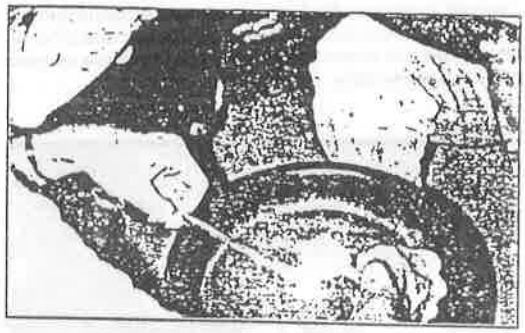
Freezing method: Bull semen, as we all know, is frozen in straws that enable easy handling and administration using an appropriate inseminating gun. Apart from this well known method of straw-freezing, there is an old Japanese technique of pellet-freezing. Professional dog breeders in US had apparently failed to get good results in trying to freeze dog sperm in straws until they rediscovered the old forgotten Japanese method of pellet freezing. Cat sperms like dog sperms, for reasons unknown, freeze well while pelleting. The process of cryopreserving felid sperms was demonstrated to the participants during the workshops.

As the sperm concentration is generally low in felids, the ejaculate is centrifuged to get a high concentration of sperms. The supernatant is removed and the sediment is suspended in the cryodiluent (PPV-62) with the cryoprotectant added to it. The sperm-sample is then maintained at 4°C in the refrigerator for 20-30 minutes. It is also advised to refrigerate the sterile pipettes, that will be used for pipetting while pelleting, for the same period. The sperm sample is first pelleted on dry ice before transferring into liquid nitrogen. Multiple pits or impressions of 3 mm deep are made on a flat block of dry ice, using a nail-board.

Dr. David Wildt demonstrating the procedure of making multiple pits on dry ice using a nail-board.

Pipetting drops of diluted and reconstituted sample on dry ice for pellet freezing

Drops of the diluted sample are pipetted into these depressions using the precooled pipettes. After freezing these multiple pellets in these depressions, the dry ice block is inverted over a bucket of liquid nitrogen. The pellets automatically fall into the liquid nitrogen and sink. Later the pellets are scooped into cryovials using a spoon or by any other suitable equipment. The vial is always kept under the liquid nitrogen during the time of transferring the pellets. The vial is then transferred from the bucket to the liquid nitrogen storage container. One can make upto 2-4 pellets from a good quality semen of a lesser cat.



Scooping pellets into cryovials using spoon

Thawing and Intra-uterine (IU) insemination: The procedures of thawing and insemination were also dealt during the workshops, though not demonstrated practically. For thawing, 1-4 pellets are transferred into a tube containing Hams F10 (containing 5% fetal calf serum) maintained at 37°. The sperm motility is evaluated immediately. Unlike in cattle, where the whole semen sample in the straw is inseminated along with the cryodiluent, the sample of felids is centrifuged to separate the medium. This is done by discarding the supernatant by aspiration. This has to

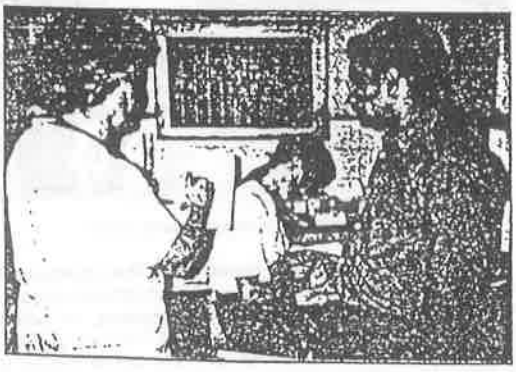
be done because the uterus of felids are apparently more prone to get metritis. The pellets are resuspended in 100-200 microlitre of fresh Ham's F10 (containing foetal calf serum).

In the case of pellets made from a good quality semen sample, 1 or 2 pellets are reportedly sufficient for Intra-Uterine insemination. In bovids, the frozen semen is deposited in the body of cervix from where the sperms progress to the point of fertilization. Cats, for that matter all carnivores, apparently do not conceive when inseminated cervically. Therefore the commonest method practiced is intra-unterine (IU) insemination. Cats are induced ovulators like many species of mustelids like ferrets. However, ovulation can be induced by the administration of gonadotropins. This stimulates follicular development and ovulation. A fibre-optic laparoscope is used for assisting insemination. The site of incision is near the umbilicus. So far successful offsprings have been produced by IU AI using frozen-thawed sperm in 19 species of wild mammals which include bovids, cervids, canids, felids, mustelids, primates and giant panda.

C. Genetic test for detecting hybrid lions

Being an endangered subspecies, maintaining pure Asiatic lions has conservation value because of prospects of reintroduction. Hybrid lions on the other hand, occupy valuable zoo space and cut into zoo budgets. According to Dr. Wildt, hybrid lions do have some value, particularly in future. They can act as foster mothers for embryo transfer programmes and also as experimental animals for various surgical and diagnostic procedures.

The Asiatic lion differs from the African lion in few morphological features. The prominent belly fold of skin and the less fuller mane in the Asiatic subspecies are considered as diagnostic. Apart from this, the difference in the infraorbital foramen in the skull is also taken into consideration. These differences are marked as long as the 2 populations are separate and not interbred. The problem has been to differentiate and separate the Asiatic and African lion hybrids based on these morphological features alone.



Jan Martenson showing the results of the gel-electrophoresis test to Shri S. K. Nanda, Municiple Commissioner of Baroda

One of the major objectives of conducting these workshops was to genetically test some of the suspected hybrid lions for purity. The procedure was demonstrated to the participants at Baroda workshop using a newly developed portable laboratory kit. It has been established by this method that the Asiatic lions are genetically monomorphic when compared to African lions which are polymorphic. The presence of any polymorphic isozyme allele denotes that the individual is a hybrid.

Heparinized blood samples are collected either after chemical restraint (using Telazol) of physical restraint (using squeeze cage). Whole blood is centrifuged to separate plasma, erythrocytes and leukocytes. Isozyme extracts are prepared and then subjected to gel electrophoresis, followed by histochemical isozyme development.

What is a hybrid? One of the participants in the Bombay Zoo workshop raised an important question about the definition of HYBRID. He was of the opinion that the word HYBRID has been confusingly used to describe offsprings born to two different species/subspecies of wild animals. Being a veterinarian, his contention was that hybridization is an accepted event in livestock breeding programmes where cross breeding is done between two breeds of cattle or birds and, therefore, is proper to term them hybrid. Even though there was some disagreement with the various explanation given to this question, it logical to say that HYBRIDIZATION can occur between any group of animals whenever it is biologically feasible. Consequently, a hybrid can be between two species (eg. mule), between two subspecies (eg. African and Asiatic lion hybrid), between two breeds of livestock (eg. jersey and zebu hybrid) and so on.

Besides the use of genetic studies in determining hybridization, they can also be used in defining the phylogeny of closely related species. For this, skin biopsies were taken from leopard cats, leopards and jungle cats for cryopreservation. Such preserved tissue samples can serve as a source of DNA and protein products for such studies in taxonomy/phylogeny.

All the biopsy samples were collected from the inner thigh region. A 5X5 cm area of the skin was prepared by shaving off the hairs and cleaning with betadine solution and later with alcohol to remove excess betadine. A piece of skin of approximate 1 cm^2 was then removed using a sterile scalpel/scissors. The skin was lifted using a forceps to facilitate easy cutting. The area was then left unsutured after applying local antiseptics. All biopsy samples were stored in a tube of biopsy transport medium. Samples can be preserved for 1-2 days in this medium. For cryopreserving biopsy samples, the sample was removed from the transport tube into a petridish and cut into minute pieces. A cryotube containing freeze medium was used for cryopreservation.

D. Reproductive control methods-Vasectomy

While special efforts like electroejaculation, cryopreservation, artificial insemination and embryo-transfer are required to make some of the endangered species breed, others have been breeding prolifically necessitating a special effort to control reproduction. Overabundance is a problem not only in the wild but also in captivity. Many zoos in India have hybrid lions

and they now realize the need to maintaining pure Asiatic lions. Euthanasia of wild animals is not an accepted practice in India. Controlling the reproduction of such unwanted animals is often the only solution available.

Reproductive control methods can be broadly classified into reversible and non-reversible methods. Use of contraceptive hormonal implants in females belong to the former category. Though animals return to normal oestrus cycle once the implants are removed, there is always a risk of developing cancer in the urogenital organs. Surgical operations like castration and vasectomy in males and ovariohysterectomy & oviductomy in females belong to the category of non-reversible methods. Methods like castration totally eliminates gonadal sex hormones which are essential for the growth and maintenance of secondary sexual characteristics like mane in lions. One acceptable alternative is vasectomy.

Vasectomy of male lions has been recognized as an acceptable practice of reproductive control. ZOOS' PRINT on two different occasions had published articles on vasectomy. One was on a leopard in India (May 1990 issue) and the other one recently on lions in Sri lanka (June 1993 issue). Most veterinarians probably have some idea about this simple surgical procedure. But the method followed during the workshop was slightly different from those reported by Dr Batwe and Dr Jayanthi in zoos. Such variations in this surgical procedure is due to the fact that the Vas Deferens, the subject of surgical intervention in this procedure, can be severed at any place during its course before it disappears into the abdominal cavity through the inguinal canal.

Anaesthesia: During this workshop, vasectomy was demonstrated on a lion in Ahmedabad zoo. Anaesthetic used was Telazol (450 mg for the adult lion), administered using a blow pipe. During vasectomy operations published earlier in ZOOS' PRINT (May 1990 & June 1993 issues), the leopard was anaesthetized with Xylazine and Ketamine, 150 mg each. In the second case in Sri Lanka, Ketamine alone was used at the rate of 150 mg/kg BW for the lion. This amounts to almost 2,000 mg of Ketamine (20 ml of a 100 mg/ml solution) for an adult male lion weighing 130 kg!

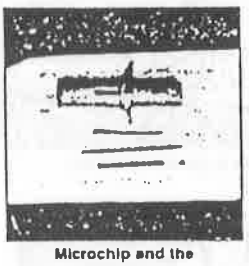
Site of incision: After induction of anaesthesia, the animal was positioned laterally on the right side. The left leg was lifted by tieing to a rope, to expose the penneal region. The choice of incision site and the number of incisions seems to be dependent on the operator's choice. Scrotal neck (base of the scrotum on the anterior side) was the site chosen for the incision in the reports published in ZOOS' PRINT. While a single mid-line incision was done in the case of the leopard, two parallel incisions were done in the case of the lion in Sri Lanka. In this workshop, the incision site was different. After preparing the penile and scrotal area aseptically, local anaesthetic was administered subcutaneously. An one inch long incision was made first on the left of the anterior part of the penis, all along the chord line.

Ligating the Vas Deferens: After incising the skin, the spermatic chord was exposed by blunt dissection of the subcutaneous tissue. In animals with considerable amount of subcutaneous fat, there can be some difficulty in finding the chord, as happened during the demonstration at Ahmedabad. One can feel the movement of the chord in this area by pulling the testicles posteriorly. After locating the chord, it was pulled out and held firmly over a forceps. The Vas Deferens was uncovered by cutting through the tunica vaginalis using a forceps and scissor. The Vas can be easily differentiated from others by its white colour and firm consistency. The Vas was then ligated in 2 places 2 cm apart using a 3.0 chromic catgut. The mid portion was excised and preserved in 10% formalin for a later histological confirmation. The spermatic chord was then released into its original position. Later the subcutaneous tissue and skin were sutured using a 2.0 chromic catgut, with continuous and simple interrupted sutures respectively. The same procedure was done on the right side also. An antibiotic injection of long acting penicillin was administered subcutaneously after dressing the wound.

E. Transponder telemetry

Transponder telemetry is the latest technique now available for identifying individual animals. The transponder system consists of 3 components:

(i) A 4 mm long microchip which is injected into the animal
(ii) An applicator for injecting the microchip and
(iii) A scanner/reader for reading the identification number of the injected microchip



Microchip and the applicator

Reader/Scanner for reading the number

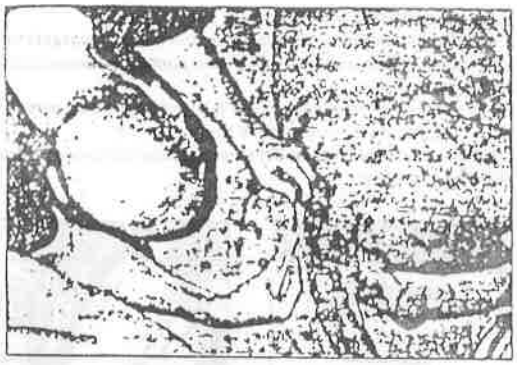
Advantages & disadvantages: Using transponders for animal identification has its own advantages. It is permanent and remains life long inside the animal, demanding no further application unlike ear tags and tattooing. Being a non-radio active material, it does not cause any ill effects. This marking system is very useful for animal identification during transport as it is not subjected to damage during transport unlike the conventional type of ear tags and tattoos.

Transponders have their own disadvantages also. As they cannot be seen externally, and have a short reading distance, animals have to be restrained every time for reading the identification number. Group living animals like primates & ungulates with transponders, therefore, cannot be subjected to behavioral studies like focal animal sampling. Moreover, transponders being more sophisticated, are also costlier than the conventional ones.

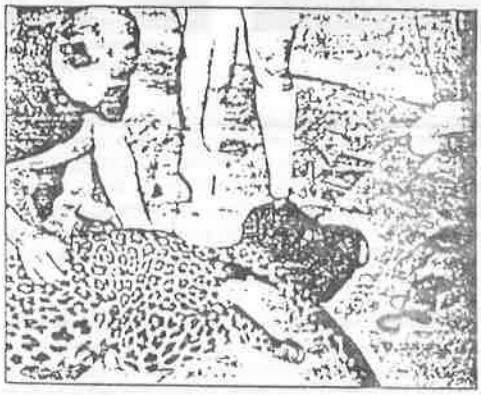
Implantation procedure: The recommended site of implantation of the microchip is the dorsal aspect of the tail base. This has

been chosen because it is safer to place the reader at the rear side of wild animals, particularly carnivores. Locations like shoulder, neck etc. are closer to an animal's head and thus invariably require drug-immobilization for implantation as well as reading. Whenever tail base is chosen, the implantation can be done simply be restraining carnivores in squeeze cages.

The selected area is clean shaven and prepared surgically using antiseptic lotions like Betadine solution and alcohol. The 4 mm long microchip that comes within a 16 gauge disposable needle is attached to the special syringe that functions almost like the customary Artificial Insemination gun (meant for frozen semen). The identification number of the microchip can be seen on its pack. The microchip is implanted subcutaneously like giving a subcutaneous injection. Before releasing the animal, the number is read on the reader for confirmation.



Implanting the Microchip at the base of the tail

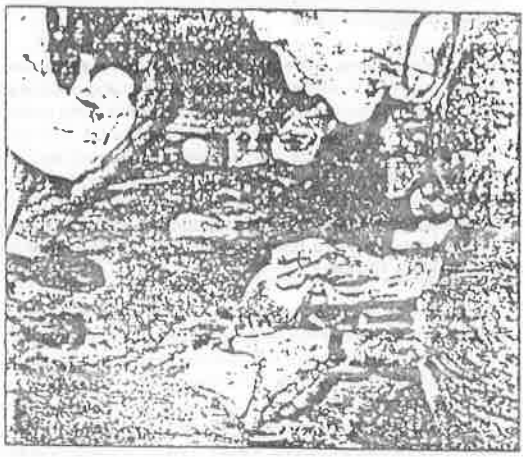


Scanning the microchip number using the reader

F. Diseases of potential threat to lions

The disease working group in the PHVA on Asiatic lion, held at Baroda during Oct 18-21 1993, inferred that two incidents of disease in Asiatic lions need special attention. One was the frequent reports of maggot wounds and the other the incidence of viral papilloma. Most of the zoo veterinarians during the veterinary capsule workshops agreed that the Asiatic lions and their hybrids are more prone to get their wounds infested with maggots. In fact two of the seven lions anaesthetized during these workshops had maggot wounds. Both animals were treated with subcutaneous injections of Ivermectin at the rate of 200 microgram/kg body weight.

During the 1992 collaboration with US scientists and the forest department of Gujarat, lions from the Sakkarbaug Zoo were examined for disease prevalence. Papillomatous lesions were detected on the anterior part of the ventral surface of tongue. When subjected to histopathological and virological diagnostic tests, a papilloma virus was found to be the cause. Interestingly, it is the same viral papilloma that has been found to affect bob cats, Florida panther and snow leopards. This condition has not been found in African lions so far. During these workshops, two of the seven lions examined had viral papillomas on their tongue. Samples of the lesions were collected & frozen and some preserved in formalin. Determining the prevalence of this suspected pathological condition in Asiatic lion was one of the objectives of the US team's visit to India. Even though, only a limited number of Asiatic lions have been subjected to any such systematic investigation, Dr. Bush & Dr Philip were of the view that about 25% of all the pure Asiatic lions have viral papilloma. It is not known whether this virus can cause any disease to these wild felids.



All the anaesthetized lions were examined for viral papilloma

Another virus that has disease causing potential is the Feline Immunodeficiency Virus (FIV). FIV is a recently identified lentivirus that can cause depletion of T-lymphocytes in domestic cats. FIV is closely related to HIV (the Human Immunodeficiency Virus), the cause of AIDS in humans. Exposure to FIV has been detected in African lions, bobcats, leopards, snow leopards and jaguars. Like the Papilloma virus, there has been so far no evidence of FIV causing any disease in these species, however.

So far the Asiatic lions in Sakkarbaugh zoo and Gir forests have proved to be negative to this virus presence. In fact FIV has not been detected from any of the felid species including domestic cats in India. However, one must admit that only few limited samples have been subjected to the diagnostic procedure. A simple diagnostic kit for diagnosing FIV and FeLV (Feline Leukaemia Virus) was demonstrated to the author by Ms Janice Martenson at Patna Zoo. This so called CITE Combo FeLV Ag/FIV Ab Test, has been designed to diagnose infection by one or both of these viruses in a single test procedure. It is an enzyme linked immuno-absorbent assay (ELISA) for detecting FIV antigen and antibody to FIV. As both these viruses cause immunosuppression, it is difficult to differentiate them based on clinical symptoms alone. Using this kit, the test can be performed with whole blood, serum or plasma. Even hemolyzed samples can be used.

None of the blood samples collected during the workshops were positive for FIV and FeLV. The Coimbatore Zoological Park & Conservation Centre has plans to conduct a prevalence survey of FIV and FeLV in domestic cats after obtaining the diagnostic kit from US.

Table 1. Details of anaesthesia (all are adult animals).

NO.	SPECIES	ZOO	B[1]	DRUG(S)	TD[2]	ADDITIONAL DOSE	IT[3]	RT[4]
1	Tiger	Baroda	NR[5]	Ketamine Xylazine	NR	—	NR	NR
2	Lion	Baroda	-	Telazol	NR	—	NR	NR
3	Lion	Baroda	-	Telazol	NR	—	NR	NR
4	Lion	Baroda	-	Telazol	500	Not required	NR	Prolonged
5	Leopard	Baroda	-	Telazol	400	Not required	NR	Prolonged
6	Jungle cat[6]	Baroda	-	Telazol	30	"	NR	Prolonged
7	Jungle cat[6]	Baroda	-	Telazol	30	"	NR	Prolonged
8	Tiger	Ahmedabad	130	Ketamine Xylazine	450 24	" (Yohimbine HCl given after 40 mt)	14	Recovery was evident by 35 minute
9	Leopard	Ahmedabad	-	Telazol	250	Not required	5.5	4 hours
10	Tiger	Ahmedabad	140	Ketamine Xylazine	450 30	Ketamine at 14th & 55th min. At 45 th min;7.5 mg Diazepam to control seizures	27	Yohimbine given after 1 hour & 40 minutes
11	Jungle cat	Ahmedabad	-	Ketamine	40	40 mg given after 10 mts	17	NR
12	Lion	Ahmedabad	-	Telazol	425	Not required	6	NR
13	Lion (for vasectomy)	Ahmedabad	-	Telazol	450	50 mg had to be given twice as it started growling	6.5	NR
14	Lion	Bombay	-	Telazol	450	Not required	7.5	NR
15	Leopard	Bombay	-	Telazol	250	Not required	8	NR
16	Asiatic lion	Bombay	-	Telazol	400	Not required	7.5	NR
17	Leopard	Bombay	-	Telazol	180	100 mg Ketamine after 17 mts	15	NR
18	Cloudod leop.	Patna	-	Ketamine	250	Not required	7.5	53
19	Clouded leop.	Patna	30	Ketamine	250	Not required	8	42
20	Clouded leop.	Patna	-	Ketamine	275	50 mg more after 11 mts	16	36
21	Leopard cat[7]	Patna	-	Ketamine	50	40 mg after 10 mt 25 mg after 20 mt	-	NR
22	Leopard cat	Patna	-	Ketamine	100	Not required	8	NR
23	Leopard	Patna	-	Telazol	250	Not required	7	NR
24	Leopard cat	Patna	-	Ketamine	100	Not required	4.5	NR
25	Leopard cat	Patna	-	Ketamine	100	Not required	5	NR

[1]Estimated body weight before darting
[2]Total dose in mg.
[3]Induction time in minutes
[4]Revival time in minutes (from induction to getting up)
[5]Not recorded
[6]In these two cases, apnoea developed after 10 minutes. Endo tracheal tubes were inserted using a laryngoscope and artificial respiration provided using a manual resuscitator.
[7]As the animal got over-excited prior to drug administration, subsequent administrations were required. Hyperthermia developed after 15 minutes (up to 108°C). Libral spraying of water brought down body temperature to 105°C in 20-30 minutes

Collected Biomaterials from Collaborative Project Between Zoos in Baroda, Ahmedabad, Bombay, Patna (India), Zoo Outreach Organisation and the National Cancer Institute/National Zoological Park (U.S.A.)

Purposes for collecting each biomaterial:

#1. **For blood.** To be used to measure genetic variation within an animal compared to others in the population. This will be an index of genetic health indicating if the animal originates from an inbred or outbred population. Inbreeding jeopardizes the entire population. The information gained can be used to reorganize management strategies to avoid inbreeding and keep the population reproducing and viable.

#2. **For blood (LIONS ONLY).** To be used in molecular testing to determine if an animal is a 'pure' individual of the designated Asiatic subspecies Panthera leo persica or a 'hybrid' (resulting from cross-breeding between P. l. persica and P. l. leo, African lion). This especially is important for diagnosing the status of Asiatic lions in Indian zoos. Without proper analysis of captive lions, managers risk continued propagation of useless hybrids which waste valuable resources and put the few remaining pure lions at risk for extinction.

During the workshop held in Baroda 22 October the analysis technique was taught to Dr. V.K. Sharma of the Chatbir Zoo in Chandigarh. Some of the reagents and equipment needed for the analysis were left with him (value = US$2000, donated by the National Cancer Institute). For the sake of continuity and quality control it was decided that each of the samples collected during this trip would be tested independently by both Dr. Sharma and by Mrs. Martenson back in the U.S. and the results compared. This is to ensure that the analysis systems are working as they should. Dr. Sharma was able to take with him half of each of the lion samples collected in Baroda and 3 of the samples collected in Ahmedabad. The remaining samples collected by Mrs. Martenson were divided into 2 portions for future division between her and Dr. Sharma.

#3. **For blood.** To be used to measure circulating hormone concentrations as a measure of reproductive status. For example, measuring testosterone in the male and relating it to ejaculate quality provides an index of the fertility level of the male. Many animals fail to reproduce in zoos and analysis of hormone concentrations is one approach for beginning to identify the cause. Once the cause is determined, managers can better understand which animals to pair to sustain a healthy population.

#4. **For blood.** To determine normal blood components as an index of clinical health. Normal blood chemistry values for animals maintained in Indian zoos are unknown, but these values are crucial for determining which animals are healthy and which are sick. Results can be used not only for allowing immediate treatment of illness or parasites, but for developing (for the first time) large-scale preventative medical programs to vastly improve overall health of captive animals held in Indian zoos.

These samples also will be analyzed for antibodies to viral agents including feline leukemia virus and feline immunodeficiency virus, which have not yet been detected in any Indian felids.

#5. **For skin.** To be used as a back-up resource useful for future genetic studies. Skin biopsies are frozen and stored without charge for Indian zoos, and can be used later to establish tissue culture cell lines. This biomaterial is a permanent source of DNA and proteins and serves as an insurance repository of genetic material.

#6. **For frozen sperm.** Reproduction is essential to species survival. Males are producing excess germ plasm (sperm). As insurance, it only is logical to begin cryopreserving (freezing) sperm from valuable animals living in Indian zoos. This biomaterial can be used at a later date for artificial insemination to infuse new genes into the population. Particularly valuable from an animal welfare perspective is that no longer would animals have to be stressed by moving them from zoo-to-zoo for breeding. Rather, only the sperm would be transported and then artificially inseminated into the appropriate female. These sperm samples would be stored without charge for the Indian government until needed for research or conservation purposes.

SUMMARY OF ANIMALS, PRODUCTS COLLECTED AND UTILITY

BARODA ZOO

Tiger #1 (Dora; male). Collected blood and sperm for purposes #1, 3, 4 and 6.

Lion #1 (Ramu; male; 00000DF45F transponder). Collected blood and sperm for purposes #1, 2, 3, 4 and 6.

Lion #2 (Janak; male; 0000D8264 transponder). Collected blood and sperm for purposes #1, 2, 3, 4 and 6.

Lion #3 (Janki; female; 00004D042C transponder). Collected blood for purposes #1 and 2.

Lion #4 (Jahanvi; female; 00000F02E7 transponder). Collected blood for purposes #1 and 2.

Lion #5 (Rama; female; 00000D0CE8 transponder). Collected blood for purposes #1 and 2.

Lion #6 (Malika; female). Collected blood for purposes #1 and 2.

Lion #7 (Balram; male; 00004F01ED transponder). Collected blood and sperm for purposes #1, 2, 3, 4 and 6.
Leopard #1 (Shembhu; male). Collected blood and sperm for purposes #1, 3, 4 and 6.

Jungle cat #1 (no name; male). Collected blood and skin for purposes #1, 3, 4 and 5.

Jungle cat #2 (no name; female). Collected blood and skin for purposes #1, 3, 4 and 5.

AHMEDABAD

Tiger #2 (Nanda; male). Collected blood for purposes #1, 3 and 4.

Leopard #2 (Dhaval; male). Collected blood and skin for purposes #1, 3, 4 and 5.

Tiger #3 (Vijay; male). Collected blood for purposes #1, 3 and 4.

Jungle cat #3 (no name; male). Collected blood, sperm and skin for purposes #1, 3, 4, 5 and 6.

Lion #8 (Tony; male; 00004DA3134 transponder; studbook 301). Collected blood and sperm for purposes #1, 2, 3, 4 and 6.

Lion #9 (Shankar; male; vasectomized). Collected blood for purposes #1, 2, 3 and 4.

Leopard #3 (Raja; male). Collected blood and skin for purposes #1, 3, 4 and 5.

Lion #10 (Govind; male). Collected blood for purposes #1 and 2.

Lion #11 (Parvati; female). Collected blood for purposes #1 and 2.

Lion #12 (Radha; female). Collected blood for purposes #1 and 2.

BOMBAY

Lion #13. (Samar; male; 00004D0802 transponder). Collected blood for purposes #1, 2, 3 and 4.

Leopard #4 (Ashok; male). Collected blood, sperm and skin for purposes #1, 3, 4, 5 and 6.

Lion #14 (Sham; male; transponder). Collected blood for purposes #1, 2, 3 and 4.

Lion #15 (Ram; male; transponder). Collected blood for purposes #1, 2, 3 and 4.

Lion #16 (Navin; male; 00000DEE71 transponder). Collected blood and sperm for purposes #1, 2, 3, 4 and 5.
Leopard #5 (Kishor; male). Collected blood, sperm and skin for purposes #1, 3, 4, 5 and 6.

PATNA

Clouded leopard #1 (Hero; male; 00000D14F7 transponder). Collected blood for purposes #1, 3 and 4.
Clouded leopard #2 (Jamuna; male; 00001EFCCC transponder). Collected blood for purposes #1, 3 and 4.

Clouded leopard #3 (Monu; male; 00004E11A3 transponder). Collected blood for purposes #1, 3 and 4.

Leopard cat #1 (no name; male). Collected blood and sperm for purposes #1, 3, 4 and 6.

Leopard cat #2 (no name; male founder). Collected blood, skin and sperm for purposes #1, 3, 4, 5 and 6.

Lion #17 (Raju; male; 00000F0432 transponder). Collected blood for purposes #1, 2, 3, and 4.

Lion #18 (Ramu; male; 00004EFA2C transponder). Collected blood for
purposes #1, 2, 3, and 4.

Lion #19 (Kamu; male; 00000D016F transponder). Collected blood for purposes #1, 2, 3, and 4.

Lion #20 (Jyothi; female; 00004F0355 transponder). Collected blood for purposes #1, 2, 3, and 4.

Lion #21 (Durga; female; 00000D0FBE transponder). Collected bood for purposes #1, 2, 3, and 4.

Leopard #6 (no name; male). Collected blood for purposes #1, 3, and 4.

Leopard cat #3 (no name; male). Collected blood and sperm for purposes #3, 4 and 6.

Leopard cat #4 (no name; male). Collected blood and sperm for purposes #3, 4 and 6.

Leopard cat #5 (no name; male). Collected blood for purposes #3 and 4.

Leopard cat #6 (no name; male). Collected blood for purposes #3 and 4.

SANJAY GANDI NATIONAL PARK (BORIVILLI)
(samples collected Dr. R.P. Barhate, Vet at Park, and brought to Bombay during workshop 26 October)

Lion #22 (Suraj; male). Collected blood for purposes #1 and 2.

Lion #23 (Moti; male). Collected blood for purposes #1 and 2.

Lion #24 (Shankar; male). Collected blood for purposes #1 and #2.

Indian vet. J. 54, December, 1977 : 1036-1037

A NOTE ON NORMAL PARTURITION IN A GIRAFFE

D. Bhim Reddy, G. P. Sharma, V. Subhas Chandra Reddy,

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A report on the normal parturition in a giraffe is presented here. Hediger (1955) and Lee (1965) have observed a delivery period of 6 hours in the giraffe. In both singlets were born and they weighed 68 lbs. and 100 lbs. with a height of 4 feet and 5 feet 7 inches respectively. Maurice Burton (1962) gave a gestation period of 420-468 days and reported the birth of a singlet calf. The present case is reported in order to throw more light on the process of parturition in the giraffe.

Case History : The giraffe in question was crossed on 1[illegible]-12-72. It started showing signs of pregnancy like abdominal enlargement after a couple of months. During the last week of February, 1974 it began showing the signs of approaching parturition which included sinking of the pelvic ligaments, vulvar swelling, prominent teats etc. The above signs became more prominent when observed on the 2nd of March, 1974 and it finally gave birth to a female calf on the night of March 3rd, 1974. The details are listed hereunder.

The animal started showing signs of parturition at 2 p.m. on 3-3-1974. To begin with, she was only showing some degree of discomfort like passing one or two dung pellets every 3 minutes, walking around the pen etc. At 4.10 p.m., the first water bag (allanto-chorion) ruptured followed by the appearance of one foreleg enclosed in the second water bag within a few minutes. The second foreleg also appeared within 2 to 3 minutes after the first and soon after the second water bag ruptured. After this there was a pause upto 4.30 p.m. Thereafter the animal started straining and was walking listlessly. At this stage the forelimbs were one and half feet outside the animal body.

The animal was restless and wandered aimlessly till 6. p.m. She was making futile efforts to deliver the fetus. At about 7 p.m. she showed continuous straining every 2 minutes and at about 7.15 p.m. the animal squatted down on its hind legs and the head of the calf was visible from outside. Then the dam got up at 7.20 p.m and the young one was dropped on the ground. The new born was motionless for two minutes and after that there was a slight movement of the legs and head. Soon the mother began to lick the face of the young one. The young one was struggling to get up and was finally able to stand on its feet at 7.55 p.m. The young one then started moving around and tried to locate the udder and located the same at 9.05 p.m. and started suckling. The placenta was expelled at about 11 p.m.

* Present address : Veterinary Officer, Nehru Zoological Park, Hyderabad

The other observations made on the above case are as listed below :

1. Gestation period : 447 days (about 15 months)
2. Delivery time : 5 hours 20 minutes
3. Pregnancy : Right cornua (based on the examination of placenta)
4. Time taken to expel the placenta after delivery of the fetus : 3 hours 40 minutes
5. Weight of the placenta : 4 kg.
6. Sex of the baby : Female
7. Weight of the baby : 100 lbs.
8. Height of the baby : 6 feet
9. Shape and appearance of fetal cotyledons : The cotyledons were found to be circular, convex (smooth), spongy and chorionic villi not distinct. The cotyledons were arranged in two rows.
10. Other particulars of placenta and cotyledons.

Particulars	Right cornual placenta (gravid)	Left cornual placenta non-gravid)
Length --	4 feet	3.5 feet
Breadth at		
(a) Base --	1 foot	4.5 inches
(b) Middle --	2 feet	6.0 inches
(c) Apex --	6 inches	1.5 inches
Number of cotyledons (fetal) -	60	63
Average diameter of cotyledons at :		
(a) Base --	3 inches	1.5 inches
(b) Middle --	2.5 inches	2.4 inches
(c) Apex --	2.1 inches	2.0 inches

Acknowledgment : The authors are thankful to Sri Pushpa Kumar, I.F.S., Curator, Nehru Zoological Parks, Hyderabad, A.P. for helping them to record the case.

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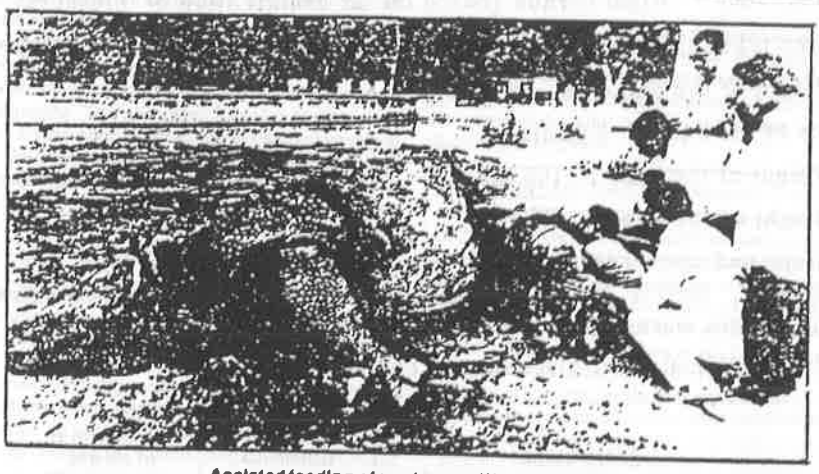
Reprint : Zoos' Print, 9 (9) : 1-2, September, 1994

MANUAL DELIVERY OF A CAPTIVE INDIAN RHINOCEROS CALF *(RHINOCEROS UNICORNIS)* AT SANJAY GANDHI BIOLOGICAL PARK, PATNA

P.C. Mishra*



Assisted feeding of newborn calf by proud staff

A female rhinoceros "Hartali" (ISB # 159), was born in our park on 8 July 1988 (father Raju ISB # 157, mother Kanchi ISB # 155 both of wild origin from Assam). The animal came to oestrus for the first time on 28 August 1991, just after completing three years. She was not allowed to mate straightaway because of her extreme youth. It was also feared that her strength would not be sufficient to interact with the powerful males in the park. Therefore mating was avoided until the following year.

On 16 June 1992 ,the male "Kanchha" (ISB # 156), a male of wild origin (ISB # 156) was allowed to enter the enclosure of Hartali. Hartali was receptive but Kanchha did not sustain a complete erection and, as a result, could not copulate. They were left together the entire day without result. At the next oestrus period, (18 October 1992), Kanchha was kept in Hartali's enclosure again for 24 hours with nil result.

On the next oestrus, (14 January 1993), Kanchha was released into Hartali's enclosure for three hours but when the same failure was observed, Kanchha was removed and the father of Hartali, Raju, was introduced. Copulation took place in the early morning of the following day at 0100 hrs. Later it was confirmed that Hartali was pregnant.

On 26 July 1994 Hartali exhibited signs of impending partuition at 1000 hrs. Chhetki, her younger sibling, who occupies the same enclosure, was removed from the enclosure on the 24 July.

Close attention was desirable as it was the first delivery for Hartali. The Director, Veterinary Officer and keepers kept watch from 11 a.m. of that day. Labor pains gradually increased and at 1215 hrs the amniotic sac appeared. At 1218 hrs. the hoofs of the hind legs could be observed along with the amniotic sac. At 1222 hrs the hind knee joint was visible. The animal was producing grunting sounds presumably due to excessive labour pain. She layed down and got up alternatively at intervals of about four minutes for about one hour. Whenever the animal exerted pressure while in sternal and lateral recumbencies, the hind legs of the call were visible but retracted when Hartali relaxed.

At this stage it was decided to assist Hartali manually manupulating the call. The animal had been extremely adverse to any human being entering her enclosure just before delivery. The value of the animals had to be weighed against the lives of zoo personnel and we decided to take the risk, scaling the chain mesh to enter so as to avoid sound of the gate. First, the Director and one keeper approached the rhino

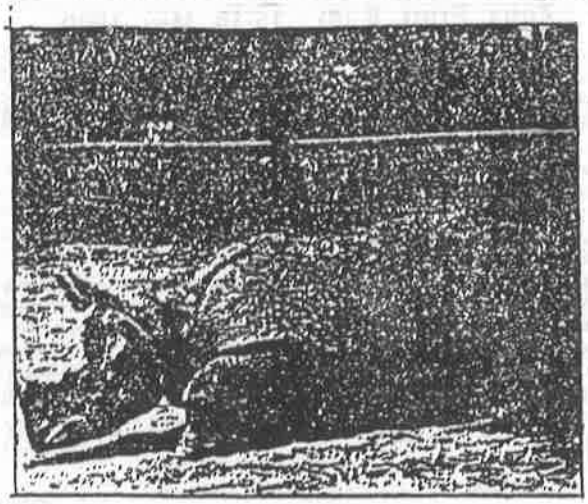
from behind and touched the calf's feet experimentally. The mother fortunately did not react. When two persons tried to remove the calf, their efforts were not sufficient. The Director then requested the other two zookeepers to assist and they tugged at the calf with full force four times in a down-ward direction.

The mother got up immediately after delivery and turned towards the zoo persons who moved hastily away. After three minutes, the calf raised its head. The mother left the calf and went to one corner of the enclosure. After some time the zoo staff persons approached the calf and lifted it, thereby subtly luring the mother to come to it which she did after about 20 minutes. The calf attempted to stand after about 30 minutes. There was apprehension about the condition of the hind legs since strong pressure had been applied to them to remove the calf.

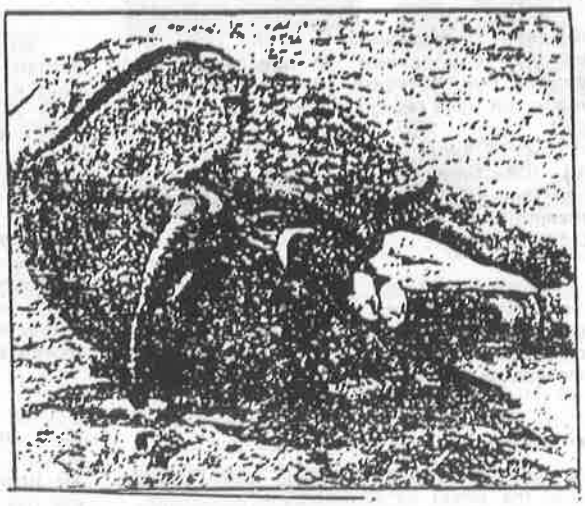
After 70 minutes the calf stood up and collapsed several times before standing sucessfully. The mother, lying laterally, lifted her leg so that the calf could reach her teats. The keepers squeezed the teats and forcibly put the calf at the teat. A small amount of honey was also put into the calf's mouth. The calf began to suckle by itself after about three hours and is in good condition after one month.

After delivery, the mother was given warm liquid of flour (2 kg), gruel (3 kg, and tumenc powder (2 kg.) to drink. Zoo veterinary officer prescribed Ostacalcium 500 ml. daily and Vimeral 20 ml. daily to the mother. For proper milk secretion Leptaden tablet (20 tabs twice daily) and Vitablend A,D3 (25 gm daily) were given with gramflour and gruel for 20 days. The calf, which is a female, was named "Rani". The number of rhinos in the Sanjay Gandhi Biological Park is now 2.4.

I. F.S., Director
Sanjay Gandhi Biological Park, Patna, Bihar



Mother straining in delivery pain; amniotic sac out



Amniotic sac has burst and feet of calf have emerged

Reprint : Zoos' Print, 5 (5) : 15-16, May, 1990

Dystocia in a Cow Elephant *(Elephas maximus)*[1]

By P. O. George[2], V. K. Ramakrishna Pillai[3] and Kuriachen Thomas[4]

'Lakshmi', a cow elephant, aged about 26 years, belonging to the Department of Forests, Kodanad Range, Kerala, was roported to be showing symptoms of parturition, since early morning, at about 2 a. m. Soon the water bag was presented. Bouts of straining were seen at intervals of half an hour. The local veterinary surgeon had administered 80 mg stilboestrol, intramuscularly. Since parturition did not take place, the authors were consulted.

History

This cow elephant had accidentally fallen into one of the pits which was previously used for capturing elephants by the pit method, four months back Later, it was enkraaled. Training in the kraal[5] had made her docile, but she had not been taken out of the kraal.

At the time of enkraalment, all the signs of pregnancy viz. enlargement of the abdomen, hypertrophy of the mammary glands and foetal movements in the flank region, were evident.

There was a sinus wound over the left hip region at the time of enkraalment. Routine dressing of the wound had been done. Later, a counteropening was provided. Subsequently, the wound had healed up.

The elephant never lay down to sleep,[6] but used to lean on to one of the pillars of the kraal and sleep. since enkraalment. This was attributed to the disability of the limb due to the wound. She was otherwise normal in habits.

Observations

When the animal was examined after about 20 hours of the onset of symptoms of parturition, it was off feed. Urination was frequent, but the quantity of urine voided at a time was less. The frequency of straining was prolonged, a bout of straining in an hour or so. No bulge could be detected at the perineal region.

Per vaginal examination was resorted to, retaining the elephant in the standing position. The hind limbs were secured by means of chains and the tail was held secure. The hand, after lubrication, was introduced into the vagina, while standing close to and just in front of the hind limb, since the vulva is in the inguinal region. No foetal extrimity could be palpated. Uterine contractions were not appreciable.

Pituitrin 20 ml was administered intramuscularly. Straining commenced 15 minutes after the injection. To begin with, the straining was at intervals of five to eight minutes and each bout persisted for about two minutes, straining four or five times, during each bout. Later, the bouts of straining became more frequent. The effect of Pituitrin injection persisted for 40 minutes and waned away gradually.

While straining, the body was crouched, back arched, the forelimbs were kept steady and upright, hind limbs kept apart, with the hocks flexed, tail held raised and the position of the vulva being about 30 cm, from the ground. While straining, the vulval opening appeared posteriorly because of the foreward placement of the hind limbs.

When the straining subsided, the elephant was led out of the kraal. She lay down of her own, just outside the krall. When she lay down, a bulge could be noticed at the perineal region, about 50 cm. below the anus. On palpation, this bulge appeared to contain a hard mass within.

On per vaginal examination, one of the foot pads could be felt, about 60 cm. anterior to the vulva. The amniotic bag was incised and about 10 litres of clear fluid drained out. The animal did not resent to per vaginal examination. Foetal movements could not be felt. It was not possible to apply traction on to the foetus in that position. Hence, it was decided to incise the perineal region so as to expose the foetal extrimities, to enable traction.

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4. Veterinary Officer, Department of Animal Husbandry, Kerala
5. A wooden shelter, strong enough to lodge wild elephants immediately after their capture. Regular training is given to these elephants, in the kraal itself. They are taken out of kraal when they become tame.
6. Elephants are capable of sleeping while standing. An elephant in good health, lies down to sleep, for about three hours during the night.

Surgical Management

Under aseptic precautions, 50 ml procaine hydrochloride four per cent solution, was infiltrated in the perineal region over the bulge. An incision, 40 cm. long was made over the bulge, dividing the skin, subcutis and the vaginal wall, thus exposing the extrimity of the foetus. Foot pads of the limbs were then visible. By applying traction it could be exposed to a length of 10 cm. It was not possible to identify, whether the exteriorised foot pads were of the fore or hind limbs of the foetus.

A running noose with strong cotton rope was made and slipped over the foot pad. The noose was tightened by pulling the free end of the rope, thus securing the limb for traction. Similarly, the other limb was also secured. To facilitate traction, the incision was further extended anteriorly and posteriorly, to a length of 10 cm more. Traction was applied to each of the ropes, separately, simultaneously and in different directions, engaging six to ten men on each rope. This trial lasted for about 45 minutes. The extrimities of the limb could be exposed to a length of 30 cm. only.

A tame tusker was then brought down, to aid traction. The ropes tied on to the foetal extrimities were held by the tusker in between its teeth and pulled according to the directions given. The hind quarters of the foetus could be fully exteriorised on traction by the tusker. When the tusker pulled more forcibly, the dam also was drawn along with the foetus.

When these efforts failed to deliver the foetus, evisceration of the foetus was resorted to. To provide more space, perineal wound was extended laterally, to a length of 15 cm. on either side. The abdomen of the foetus was incised and the contents were removed. Few ribs could be cut and removed. The foetal lungs also were removed. When the volume of the foetus was thus reduced, traction by the tusker was tried again. The foetus could be exteriorised still further, but the shoulder region got locked at the maternal pelvis.

By then, the efforts of delivering the foetus had been a continuous attempt for six hours, till 4 a. m. the next day. The dam had become very weak and almost in a stage of shock. Hence it was decided that further manipulations might be stopped, the animal given rest and dextrose saline administered before embryotomy was resorted to. But the elephant died by 8.30 a. m. while dextrose was being administered.

Autopsy Findings

1. The wound over the hip region, on excision, revealed large quantity of pus. There was a sinus tract, communicating up to the external angle of the ileum.
2. The foetus was emphysematous and shoulder lock was noticed.
3. Liver, heart, kidneys and lungs showed toxaemic changes.

Intrauterine death of foetus followed by emphysema and shoulder lock might be the cause for dystocia. The death of the dam might be due to shock resulting from severe straining, exhaustion and toxaemia.

Anatomy of the genital tract of a cow elephant

"The uterus can be subdivided into three regions, one in which two horns are distinct, another in which they fuse externally, but retain separate lumina, and a third with a single (unilocular) cavity. The external os of the uterus is a thick and rigid muscular ring with a very irregular free margin which projects for some distance into the much thinner and distensible vagina.

The vagina is a simple, capacious tube which measures nearly 50 cm. in length and is more or less constricted by a transversely placed hymen. Beyond the hymen the vagina is continued into the curved urogenital canal. This measures about 90 cm and so is approximately as long as the rest of reproductive tract. The great length of this canal is the most outstanding feature of the female reproductive tract of the elephant, and is responsible for the unusually foreward position of the vulva, which is very similar to that of the preputial orifice in the male. The urogenital canal is relatively thin and extensible like the vagina. Near its lower end, the urethra opens into the ventral wall through a round, thick-lipped aperture two cm. in diameter. The vulva measures about 22 x 15 cm. and lies immediately behind the umbilicus, at a distance of some 60 cm. from the anus, projecting slightly from the bodywall."

Acknowledgement

The authors are thankful to the Dean, College of Veterinary and Animal Sciences and Director of Animal Husbandry, for according permission to publish this paper. The authors are grateful to Shri Paul, Forest Range Officer, Kodanad, for all the help rendered.

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Reprint : Zoos' Print, 11 (3) : 24, March, 1996

DYSTOCIA IN A GIRAFFE (*Giraffa camelopardalis*) AT THE ZOOLOGICAL GARDEN, ALIPORE.

G.R. Saha, S.K. Sur, D.D. Chatterjee, S. Bhattacharyya, B.D. Biswas, S. Paul Chodhury and A.K. Das.

INTRODUCTION

Dystocia in giraffe has been described by Gijzen (1958) and Grunert *et al* (1988) for different abnormal presentations. Calcutta Zoo had to face this obstetrical problem in one of the giraffes. It was her fourth pregnancy and was the first time veterinary care was necessary for the expulsion of a full grown dead male foetus.

OBSERVATIONS

Signs of parturition was evident on 9.7.94 at about 13.00 hours. The giraffe, named "Uttara", was instantly attended for necessary veterinary care. Following the rupture of the water bag, the forelimb hoof became visible. She was left undisturbed from the visitors and a close vigil was maintained for the smooth progress of delivery. Abdominal movement was suggestive to rhythmic uterine contractions. Assuming it to be a case of "Rigid Cervix", Valethamate bromide (Inj. Epidosin-5 ml. - a ITK product) was administered *im* using blow-pipe at 9-15 p.m. to initiate cervical dilatation. Since there was no further improvement in the situation, a second dose of Inj. Epidosin 5 ml. was administered at 23-00 hours. At about 02-00 hours of 10.7.94, pastern joint of the protruded limb was noticed. By 06-30 hours in the morning, a portion of the other forelimb also came out. To avoid possibilities internal infection, antibiotic (Inj. Mikacin - Amikacine sulfate 10 ml.) was administered using dart-gun at about 07-30 hours. At the same time, traction by fixing nooses of rope to the protruded portion of each of the forelimbs were applied through physical manipulation. The tail end of the ropes were pulled by sixteen keepers in a rhythmic interval consistent with that of the abdominal contractions. Finding very little progress, the head of the foetus was searched using a bamboo pole. Since the foetres was in vertex posture, the head was pushed upwards and by simultaneous pull of the traction ropes, a dead foetus came out. It was a full grown male foetus of about two metre tall.

While lateral presentation (Gijzen, 1958) and right fetlock flexion (Grunert *et al*, 1988) have been reported as the cause of dystocia in giraffes, this is probably the first time "Vertex Presentation" is being noticed.

It took only 30 minute for fixing the traction ropes, correcting the Vertex posture and pulling the foetus out. However, the total operation took about twenty hours from the start of parturition process. Maximum period required for a successful normal delivery in giraffes is reported to be three and half hours (Backhaus, 1961).

The course of antibiotic was continued for another four days twice daily against secondary bacterial infection.

ACKNOWLEDGEMENT

The authors acknowledge Sri Subimal Roy, I.F.S., Chief Wildlife Warden, Government of West Bengal for his kind visit to the garden at the time of the operation. The expert suggestion offered by Dr. B.N. Dey, Director of Veterinary Services, West Bengal and Dr. P.K. Bose, Prof. of Surgery, B.C.K.V. during the operation is also acknowledged. The services of Sri Shewpujan Ram, zoo hospital were immensely useful during traction.

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Reprint : Zoos' Print, 5 (5) : 10-11, May, 1990

TENDONECTOMY OF MUSCLE PECTORALIS MAJOR, A MODIFIED TECHNIQUE TO RENDER A BIRD FLIGHTLESS

By M. K. Mondal[1] and C. K. Mondal[2]

In modern zoological parks the large birds are prefered to be exhibited in a big open enclosure or near a lake for the sake of attractive and impressive display. In order to prevent them from flying away from the enclosure these birds are penioned by amputating the metacarpus from any one of the wings. This method consists of following disadvantages, - after the operation the wing looses its original size and shape, moreover the penioned wing presents an awkward look when the bird opens its wings apart. For the purpose of restricting high-flying and at the same time retaining the anatomical integrity of the wing and the beautiful look of the bird with its wings fully spreaded out, a tendonectomy operation of the muscle pectoralis major has been done successfully on a few birds in National Zoological Park, New Delhi.

Concept of the operation

During flight, in birds, several types of wing-movement, like elevation and depression of wing, extension, flexion, rotation, protraction, retraction of the wing, are involved All the muscles of the forearm, neck, shoulder and breast play their respective roles to bring about these wing-movements. Out of these movements depression or downstroke of the wings is the most important part of the flight, because it elevates the body of the bird upward. The downstroke of the wing in flight is brought about almost exclusively by the m. pectoralis (King A. S. & Mc Lelland, 1985). Pettingill Jr, & Olin Sewal (1985) state that m. supracoracoid and m. pectoralis together play principal role in elevating and depressing the wing. The massive muscle pectoralis, the largest muscle of the bird originates mainly from the ventral surface of the sternum; some of its fibres also originate from the ribs, clavicle and coracoid. While forming the major breast portion of the birds body, the m pectoralis moves upwards and inserts on the pectoral crest at the proximal end of the humerus. When this m. pectoraiis contracts it gives a pull on the humerus and by the lever-action the forearm is drawn downwardly. The wings by their vigorous downward strokes, serves to raise the bird's body in the ait (Storer T. I. & Usinger R. L. 1957). In the light of the above phenomena the present method of operation is designed to nullify the strength of the m. pectoralis, by cutting the tendon of this muscle near its insertion on the humerus. This musculo-tendinous part is conveniently selected for operation, because lesser amount of tissue is damaged in this area with lesser chance of haemorrhage.

Material and method

8 numbers of adult painted storks (Ibis leucocephalus) belonging to National Zoological Park, New Delhi were admitted in the zoo hospital on April 24, 1989 for the purpose of penioning. These birds were operated upon one after another in the method mentioned below.

Operation

The bird is laid on the right side and properly secured. The left wing is flexed and slightly rotated outward to approach the shoulder joint at the ventral side. After cleaning the feathers from the site of the coraco-humeral joint, the tendon of m. pectoralis major is felt immediately before its insertion at the pectoralis crest, as a small notch.

i) The area is antiseptically cleaned.

ii) Local anaesthetic is injected along a transverse line about ½" to 1" before the insertion of the m. pectoralis.

iii) A longitudinal incision on the skin over this site is given.

iv) The skin is flapped and windowed with the help of Allis tissue forceps.

v) The musculo-tendinous part of the m. pectoralis, near its insertion, rear to the head of the humerus is felt and exposed, through the window.

vi) Fine dissection done to lift the tendon of m. pectoralis near its insertion, taking every haemostatic precaution.

vii) The tendon is clamped by two curved artery forceps placed about ½" apart from each other.

viii) The tendon is incised transversely between the clamps.

ix) Stay-suture, with the help of cat gut, is applied at the two cut ends of the tendon keeping the forceps in situ.

x) Antiseptic dressing is applied and the skin is closed by silk.

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Parental tetracycline is used as a precautionary measure against any septic complication. Skin suture is removed after ten days, when the healing is seen to be perfect.

Rest for some days was allowed to the bird for getting the site of operation free from post operative pain. After about a month the bird was released outside for a trial-flight after tying a rope in one of its legs. The bird hopped, beat the wings and could "jump" upto a height of about 2'-3' only, that too when provoked. The bird tried to fly but it could not do that, although it could spread its wings to full span for sun basking etc.

Following this successful trial, the same operation was done on the rest of the birds with satisfactory result. The storks are now released and living in an open enclosure near a swamp feeding and behaving normally as good as other birds who visit the zoo freely from outside.

Acknowledgement

The authors convey their grateful thanks to Kamal Naidu, S. S. Bisht and I. H. Khan, the Ex. Director and Joint Director respectively, of National Zoological Park, New Delhi, for their kind approval and generous encouragement for carrying out this experimental operation on these zoo birds. Nevertheless the authors are thankful to the staff of the zoo veterinary hospital for their untiring cooperation during this experiment.

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Reprint : Zoos' Print, 5 (10) : 25, October, 1990

Treatment of wounds in a hyperglycaemic elephant (*Elephas maximus*) A case report.

By

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On 12--9--1987, the author was called upon to treat a tusker 'Damodaran' aged 60 years, belonging to Kizhakkeveetil Madhavi Amma Trust, Trichur. It had two sinus wounds on either side of the withers, 18 inches deep and extending downwards upto the shoulder. Extensive ulcerations of the skin at the back, extending upto the occipital area were noticed. These ulcers were deep, with lot of pus and debris. The animal was reported to be ailing since five years. It was reported that this elephant had to immobilised using "capchur gun" and that this ailment had set in after the immobilisation, and hence, it was attributed to be on account of the reaction of the drugs used for immobilisation. The animal had been under treatment since then, but the wounds were refractory. An abscess had developed on the right forelimb, above the elbow joint, which had burst, discharging foul smelling pus.

To drain away the pus, the opening of the abcess was widened. Cultural examination of the pus revealed the prescence of Staphylococcal organisms, sensitive to amoxycilin, cephalaxin and oxytetracyclin.

Haematological examination was also carried out:

Haemoglobin	10.4 g%
Erythrocyte sedimentation rate	50 mm/hr.
Total leucocyte count	10500 / cu mm
Blood sugar	.109 mg%

The wounds were cleaned with hydrogen peroxide and the sinuses packed with gauze dipped in cusol lotion. The ulcers were dressed with a paste made of furazolidone and urea (Furea - Eskeylab LTD., Bangalore), boric acid, acriflavin and glycerin. Long acting oxytetracyclin (Oxyvet LA -Sarabhai Chemicals, Baroda) 30 ml was injected intramuscularly, and repeated thrice, on every fourth day. Daonil (Hoechst India LTD ., Bombay) 10 tablets twice daily and Silicea 200th (a hamoepathic drug used in suppurative processes) 15 drops daily and fenugreek 500 g cooked along with rice, were also given, for 15 days.

When the blood sugar was estimated on 29--9--1987, it was found to be 90 mg%. The quantity of pus had reduced. Healthy granulations appeared in the ulcers.Dressing of the wounds and sinuses was continued. For the next two weeks, administration of the antibiotic and Daonil and Silicea was discontinued, but fenugreek, at the rate of one kilogram was continued.

When the blood sugar was established on 14--10--1987, it was 54 mg% (almost normal). Thereafter, fenugreek at the rate of 750 g was given daily. Dressing of the wounds was continued.

On 31--10--1987, the blood sugar was 56 mg%. The wounds had almost healed up. However, dressing of the wounds was adviced , till, the wounds had healed up completely. Fenugreek, at the rate of 500 g was adviced daily. Periodic checking of the blood sugar level at intervals of two weeks was also adviced. The general condition of the animal had improved and it was fit enough to be taken for temple processions.

On 10--12--1987, blood sugar was 88 mg%. On enquiry, it was understood that the mahouts, had not been giving fenugreek, for some days, when the animal was engaged in temple processions. Fenugreek was given at the rate of one kilogram daily. On 30-- 12--1987, the blood sugar level came down to 60 mg%. Thereafter, administration of fenugreek was adviced at the rate of 750 g daily.

Discussion

Wounds in diabetic human patients, heal up only when the blood sugar level is brought down to normal level.On screening the available literature, reports on cases of diabetes in elephants could not be found. In the present case, the wounds were not amenable to treatment, which could be attributed to the very high blood sugar level. It is interesting to note that the wounds, though long standing for years, showed the tendency to heal only when the blood sugar level was reduced, and the wounds healed up completely when the blood sugar level reached near normal value.

Administration of Daonil (a drug often recommended for diabetes in human beings) was discontinued after two weeks and thereafter, fenugreek was the only treatment given. Periodic checking of the blood sugar level is of very much importance to assess the quantity of fenugreek to be administrated to the individual patient. It could be observed that, when the administration of fenugreek was discontinued, the blood sugar level which was 56 mg% on 31--10--1987, increased to 88 mg% on 10--12--1987. When the administration of fenugreek was resumed, the blood sugar level was reduced to 66 mg% on 30--12--1987.From this, it could be inferred that oral administration of fenugreek, is beneficial in bringing down the blood sugar level. However, more clinical trials are necessary for recommending it for general adoption. Estimation of blood sugar level in elephants appears to be a necessary clinical investigation while treating wounds which are refractory nature.

Summary

Successful treatment of long standing wounds in a hyperglycaemic tusker is reported.

Acknowledgement

The author is grateful to Dr.P.O.George, Professor & Head, Department of Surgery, College of Veterinary & Animal Sciences, Mannuthy, for help in treating this case.

Reprint : Zoos' Print, 5 (10) : 27, October, 1990

A wound on the trunk of a male elephant *(Elephas maximus)* - A case report.

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Injuries on the trunk of elephants are common, which might often be due to the accidental fall of a log or penetration of sharp objects. Nair *et al*(1979) had reported the successful treatment of a punctured wound on the trunk, after anaesthetising the elephant with Flaxedil and Intraval Sodium. George *et al* (1989) had reported the treatment of a wound on the trunk of a male elephant, using Gallamine triethiodide and Trifluprornazine for premedication and Thiopentone Sodium for gerneral anaesthesia. In the present report, treatment of a lacerated wound on the trunk of a male elephant empolying xylazine hydrochloride and acepromazine hydrochloride for inducing general anaesthesia is placed on record.

History

On 10-11-1989, it was reported that a male elephant, *(Elephas maximus)*, had sustained a wound on the trunk the previous day, due to the accidental fall of a log, while loading them into a lorry. The animal was about 25 years of age and weighing approximately two and a half tons. The wound was 7 cm long, situated transversely on the dorsal aspect and 30 cm from the tip of the trunk. The wound was deep enough to divide the septum as well. The animal could convey food, but while conveying water, it escaped through the wound.

Anaesthesia and surgical management

The elephant was administered 250 mg xylazine hydrochloride (Rompun-Bayer, Leverkusen, Germany) and 80 mg acepromazine hydrochloride (Acetylpromazine - The Boots Company LTD England) intramuscularly. Drooling of the saliva was noticed by the 10th minute. The animal was immobilised by the 20th minute and snoring (a feature of xylazing sleep) by the 28th minute. In addition, local infiltration of lidocaine hydrochloride (Gesicain - SG Pharmaceuticals, Baroda) 2 percent solution 30 ml was also resorted to. The penis was not seen protruded from the sheath.

The edges of the wound were scarified and freshened. Synthetic suture material (Prolene) was used for apposing the septum and the muscular layer, by inserting continuous sutures in two layers, Black braided silk was used for suturing the skin by unserting interrupted sutures.

The wound was dressed with Tr.Benzoin. Benzathine pencillin 120 lakhs (Penidure LA 24-Geoffrey Manners & Co.LTD, Bombay) and tetanus toxoid 5 ml were administered intramuscularly. Thereafter, the wound was daily dressed with nitrofurazone ointment (Furacin-Vet-Smith Kline and French, Bangalore). Injection of benzathine pencillin was repeated on the fifth day. After a week, the animal had removed the skin sutures by rubbing the region. The dressing of the wound was continued and in about three weeks, the wound had healed up.

Discussion

When xylazine is administered, relaxation and protrusion of the penis is one of the indications to ascertain the depth of anaesthesia. In the experience of the second author who had anaesthetised/immobilised more than 100 tuskers using xylazine, this had been the solitary incidence, where protrusion of the penis was not observed.

Acknowedgement

The authors are thankful to the Dean, college of Veterinary and Animal Sciences, Mannuthy and the Director of Animal Husbandry Kerala, for according permission to publish this paper.

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Reprint : Zoos' Print, 6 (5) : 10, May, 1991

TUSK ROOT INFECTION IN AN INDIAN ELEPHANT

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ABSTRACT

The present communication places on record successful treatment of tusk root infection in an Indian elephant.

Cast history and laboratory findings:

An Indian tusker, Hira Mal (Case No. 4-8857) was brought to the Veterinary Clinics of the College of Veterinary Sciences, Haryana Agricultural Univeristy, Hisar for treatment of chronic discharge from the tusk root. The relevant history of the case revealed that for the purpose of obtaining ivory, the Mahout had sawed the tusk proximal to the recommended site resulting in the exposure of the pulp. This resulted in pulpitis, presumably anacho.etic effect of secondary bacterial infection resulting in softening of the pulp and ultimately infection of the tusk root and accumulation of pus within the alveilar process. It was also reported that the case had been treated earlier at some other veterinary hospital but without any appreciable response.

Aseptically collected pus swab from the wound site was cultured on blood agar and Maconkey's agar plates. The plates were incubated at 37°C for 24 - 48 hours. The resultant growth from respective media plates was identified as *Pseudomonas aeruginosa* and *Escherichia coli* following standard procedures. Aeruginocine typing of *Ps. aeruginosa* revealed that it belonged to Wahbha's type A. *E. coli* was found to belong to 0-serotype 020. In vitro drug sensitivity of the isolates against 20 antimicrobials revealed that they were resistant to most of them, except for a few, such as gentamycin, polymyxin B and neomycin.

Line of treatment :

With the help of the Mahout, the elephant was made to lie down on its right and the pulp cavity was probed for its potency and size. During this process, the material was collected for cultural examination. The tissue debris and the necrosed pulp was removed and the pulp cavity was insuflated with 3:1 mixture of Copper Sulphate and Potassium Permangnate. Subsequently necrosed pulp was removed. About 7" length of the stump of tusk was further removed to drain out as much of the purulent material as possible. After this Magnesium Sulphate and glycerine was instilled into the cavity and for proper spreading, the head was lifted and tilted sideways and the cavity was packed with sterilized gause. This procedure was continued for 3 days.

The cavity was treated with BIPP for 15 days. The wound dried up and drainage of pus stopped. The case was discharged and the Mahout was instructed to keep in touch with the hospital for any complication.

Generally, such-like tusk root infections involving alveolar process are not likely to heal and the ultimate treatment would end up in the extraction of the tusk.

Acknowledgements:

Thanks are due to the Director, National Salmonella and Escherichia Centre, Kasauli, Himachal Pradesh for kindly doing the serotyping of *E. coli.*

Reprint : Zoos' Print, 11 (4) : 20, April, 1996

A NOTE ON THE TREATMENT OF AN INJURED WILD TUSKER AT THE AGASTHYAVANAM BIOLOGICAL PARK, KERALA.

C. Venkatesan*, Jacob V. Cheeran**, K. Chandrasekharan**, K. Radhakrishnana** and A. Jayasudha*.

An injured wild tusker sighted by the forest officers at the Agasthyavanam Biological Park, Trivandrum, Kerala required immobilization to assess the severity of injuries and to carry out the necessary treatment. The elephant was reported to be frequently habitating the area close to the Peppara lake. The only possible approach to the animal was through the lake. A motor boat was used to scan the area for the elephant. The boat cruised a distance of 5 km from the starting point at Peppara dam and it was 5 hours before the elephant could be spotted at the lakeside. The boat was stopped at approximately 10 meters from the elephant and the animal was tranquilized from the boat with Immobilon1 (3 ml) to hit its right shoulder region using Cap-chur gun. Darting the elephant from the boat and a watch at the lakeside removed the risks associated with immobilizing animals getting into water-holes.

The elephant wandered to a distance of 100 mts and lied down within 5 minutes of the dart. The animal was examined soon after.

Multiple, deep, punctured wounds and lacerations were seen at the regions of the trunk, rump and perineum. A fistula, 45 cm long was seen at the base of the trunk. A 20 cm deep wound was seen in the region of the left rump.

The wounds were cleaned with Savlon solution. Pus and debris were removed by irrigating the wounds with hydrogen peroxide solution. The wounds were dressed with Charmil ointment and the animal was adminstered Benzathine Pencillin G3 6/6 lac units intramuscularly. The entire operation lasted for thirty minutes, after which the elephant was administered t antidote Revivon4 (4 ml) intravenously. After 30 minutes, further dose of Revivon (2 ml) had to be given to hasten covery. The elephant made an uneventful recovery and start grazing four hours later.

Some observations after immobilization

Prolapse of the penis was seen in the recumbent animal. T pluse rate (per minute) and respiratory rate (per minute) a 25 minutes of anesthesia were 67 (normal -34 to 46) an (normal 5 to 8 in lateral recumbency) respectively.

The first sign 3 minutes after the injection of Revivon was mo ment of the tail. Penis was retracted at 17 minutes and animal was able to move its trunk at 19 minutes. Movemen the ears was noticed 4 minutes after the second injectio Revivon. The respiratory rate (per minute) was 9 at 6 min after the second injection. However, the animal continue be in lateral recumbency, for about four hours.

1. C-Vet Ltd.
2. Dabour Chemicals Ltd.
3. John Wyeth and Bros Ltd
4. C-Vet. Ltd.

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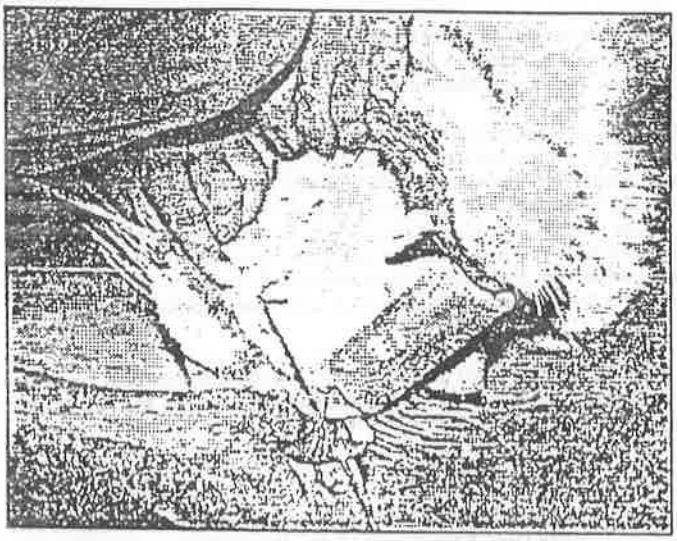
Reprint : Zoos' Print, 6 (11) : 35, November, 1991

ROOT CANAL TREATMENT IN WHITE TIGER : A CASE REPORT

Dr. V. S. Gorhe, M.V.Sc. (Medicine), Peshwe Park Zoo, Pune



Oral opening of the oronasal fistula

A white tiger brought to Peshwe Park Zoo was suffering from a non-healing wound on the left side of the nose. Initially it was thought to be due to trauma while shifting him from his enclosure to the transport cage. Later on it developed into oronasal fistula.

The wound did not respond to any antibiotic treatment and hence it was thought to carry out X-ray examination and contrast radiography. X-ray examination revealed the fistulous tract. Owing to the limitations while taking the X-ray a clear radiograph was not obtained. Once incisor was found to be caried and upper left canine was found to be attrieded. It was decided to operate on the tiger, carry out curatage of the fistulous tract surgicall and close the oral opening with advancement flap from lip. It was also decided to remove the caried incisor and give root canal treatment to the attrieded canine.

Anaesthesia was brought about using 750 mg. Ketamine hydrocholorde and 100 mg. Xylazine. The effect of the anaesthetic started at 10 mts. and this dosage brought about satisfactory anaesthesia for nearly four hours. Total recovery took seven hours.

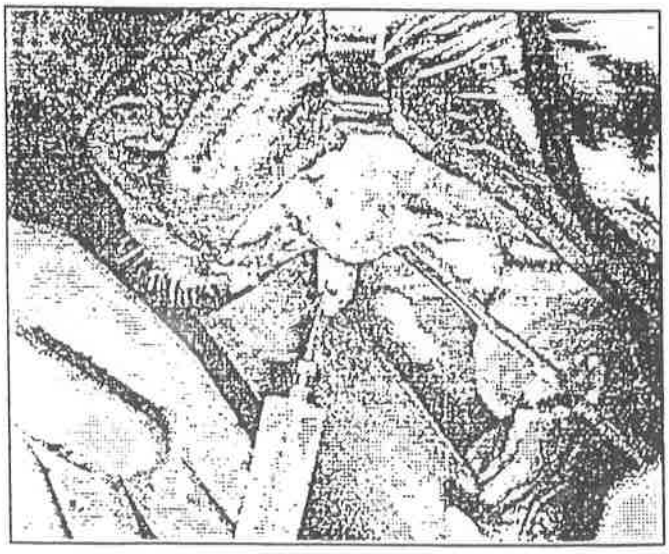
During surgey a supernumerary (additional) tooth was found within the fistulous tract and it was also surgically removed.

Root canal treatment was carried out on the left upper canine and the Root canal was filled with a mixture of eugenol, formocresol and zinc oxide. The opening was sealed with silve amalgum.

Impression were taken for preparation of procelain fused to metal crown for the canine. The crown was prepared and fixed on the canine using glass ionomer on the 3rd day after surgery.

The intra oral wound took nearly 14 days for complete healing. Food consumption was normal on the 3rd day after surgery and the recovery was uneventful. The tiger was released in the special enclosure 20 days after the surgery and is in perfect condition now.

Human maxillofacial surgeon Dr. Kiran Gadre, M.D.S. was specially invited to perform this operation as root canal treatment is not a routine procedure in veterinary surgery. Other members of the surgical team were Dr. Wakankar and Dr. Kudale from Bombay Veterinary College. Dr. Nargide from Veterinary Hospital, Pune. The porcelain fused to metal crown was prepared by a human dentist, Dr. M. M. Raikar. We are grateful and indebted to the immense help rendered by various people within Peshwe Park and Pune Municipal Corporation.



Root canal treatment in progress

Reprint : Zoos' Print, 11 (7) : 22, July, 1996

CLIPPING OF CLAW IN BENGAL TIGRESS IN MYSORE ZOO - A CASE REPORT

S.C. Valandikar[1] and R. Raju[2]

Reena the Bengal tigress, aged 10 years had developed excess growth (overgrowth) of right claw and was puncturing its paw since 8-9 months, leading to injury, pain and lameness, which was noticed during its walking. When examined, the claw was found flattened and curved sharp atbthe free end causing damage to the paw.

It was decided to cut the overgrown claw under combination of Xylase + Ketamin anaesthesia. A dose of 200 mg of Xylase and 100 mg of Ketamain was used together and fired. Within 15 to 20 minutes the tigress slept and there were no reflexes of eye or tail. She was secured for extra security with rope tied to the fore- and hindlimbs and the mouth was taped. The hair around the claw was clipped with scissors. With the support of a wooden plank under the right leg, the excess growth (about 3 inches) was clipped with chisel and hammer. The wound was cleaned with spirit, iodine and Neosporin powder was applied and bandaged, since there was little bleeding. As a precautionary measure to tetanus, Tetvac 1ml was injected subcutaneasly, Dicrysticin, large dose 1 vial injected i/m and terramycin 10 ml i/m. Daily dressing was continued for a week with application of Neosporin powder.

Remarks: The tigress was anaesthesized on 25.7.94 at 12.40 pm and after 20 minutes operation was conducted which took 30 minutes to complete. The tigress recovered at 5.30 pm with a sudden roar. She had recovered in the morning but drowsiness persisted for the full day of 26th. The wound healed completely in a week's time.afterwords.

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Reprint : Zoos' Print, 6 (11) : 26, November, 1991

COLONIC OBSTIPATION IN A CIRCUS CUB

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[1] Asst. Prof. of Surgery, [2] Prof. of Surgery; [3] Vety. Officer, Dispensary, Dhanera

A four months old lion cub, belonging to Golden Circus at Dhanera (Gujarat) was referred with the complaint of inappetance and frequent efforts to defecate since last three days. As reported by the owner, the cub was given paraffine liquid, 100 ml mixed with milk, but could not pass faeces. Upon clinical examination, the animal was depressed, dull and lying down in the cage; while straining only thick sanguineous mucus discharge was passed; temperature was subnormal (98.0 o F) but all other signs of progressive toxaemia could be observed. Further on inquiring about the feeding schedule, it was revealed that the symptoms were shown following the ingestion of chevon with bones.

For controlling the animal, only physical restraint in the cage was made as it was already dull. During controlling, the animal passed foul smelling liquid forcefully in the form of jet spray. This led us to examine the rectum which was difficult by hand. As the fluid passed with forceful spray, the presence of some obstacle was suspected inside the rectum. by introducing the whelping forcep inside the rectum, its tip struck a hard mass. The hard mass was removed by forcep with great difficulty. It turned out to be a bone. Immediately after the removal of the bone, a large quantity of dark, foul-smelling semiliquid faeces was passed.

The animal was given the following treatment - Inj. Dextrose - 5%, 450 ml, I/V; Inj. Normal Saline - 450 ml, I/V; Inj. Campicillin* - 500 mg. I/m and Inj. Dexona* - 8 mg, I/V. Pesuline syrup* - 100 ml was prescribed to be given 4 +. S.P. twice daily.

On the next day, Inj. Normal Saline - 450 ml, I/V; Inj. Dexona - 8 mg, I/m and Inj. Campicillin - 250 mg, I/m was given. While on third day only Inj. Campicillin - 250 mg. I/m was given.

On the fourth day the animal started feeding normally and made an uneventful recovery.

Colonic obstipation is fairly common in dogs and it is generally observed following the ingestion of unusual quantities of bones (Larsen, 1965). The same may hold good in the present case also.

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* Cadila Laboratories, Pvt. Ltd., Ahmedabad

Reprint : Zoos' Print, 9 (9) : 11, September, 1994

SCROTAL HERNIA IN STUMP TAILED MACAQUE (*MACACA ARCTOIDES*) AT THE NEHRU ZOOLOGICAL PARK, HYDERBAD.

Dr. M. D. Nissar Hussain * · Dr. Dattatri Rao **and Dr. M. Navin Kumar ***

Case History

A male Stump-tailed Macaque *(Macaca arctoides)*, belonging to the Nehru Zoological Park, Hyderabad, was sent to newly established animal park at Horsely hills in Chittoor district of Andhra Pradesh. The Macaque was brought back because of complaint of inactivity and loss of appetite.

Observations

When examined closely, the scrotal region was found to the swollen. Rectal temperature was 102° F.

The macaque was tranquilized with 0.5 ml. of Ketamin Hydrochloride (50mg I/m). A detailed examination was taken up once induction was achieved in 5 minutes. There was no external injury to the testicles or scrotum. A distinct hernial ring could be noticed on palpation and it was suspected as a case of hernia. The macaque was taken to the inpatient ward and kept for observation. Terramycin was given intra-muscularly in order to prevent any type of secondary infections.

When examined the next day there was no change in the swelling of the scrotum. The macaque was tranquilised and shifted to a portable cage and immediately taken to the surgical ward at the college of Veterinary Sciences for expert opinion.

Surgery

The macaque was thoroughly examined by the head of the department of Surgery Dr.M.N.Rao and Dr. Jhoshi. They confirmed it as a case of hernia and decided to operate immediately. The macaque was given 0.5 ml. ketamin Hydrochloride and was brought on to the operation table. The hair portion at the site of incision was completely shaved off and cleaned. A longitudinal incision of 2 inch size was made at the site of the Inguinal ring. The contents of the abdomen were pushed inside and sutures were put to the inguinal ring, using cat gut. The site of the incision was sutured with nylon thread. A long acting antibiotic was given. Lorexane cream was applied over the sutures. Xylocaine cream was applied to avoid irritation, and subsequent scratching and removal of sutures.

Scrotal hernia is confined to the male sex in all animals. scrotal hernia may be congenital or acquired. Congenital form is most common in young animals and it results through some failures in the inguinal canal through which the testicles descend,. Acquired forms are common in adults and it results from accidents such as a slipping sideways traumatic injurues to the abdomenal dilatation of the inguinal canal during very vigorous copulation etc.

Acknowledgements:

The authors are thankful to Dr. M.N.Rao, Head of the Department of Surgery, College of Veterinary Science, Hyderabad and Dr. Joshi. Associate Professor of Surgery for performing the operation. The authors also express sincere gratitude to the Principle Chief Conservator of Forests, A.P. Hyderabad, the Conservator of Forests (Wildlife Management) and the Curator, Nehru Zoological Park, Hyderabad for their encouragement and help.

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Reprint : Zoos' Print, 9 (9) : 23, September, 1994

PYLORIC OBSTRUCTION IN A BEAR - A CASE REPORT

R. Sridhar, M. Thanikachalam, N. Thilagaran and A. Sundararaj*

Diseases in captive bears are not usually common (Weilenman, 1992). However gastric diseases are quite often observed because of the animals' voracious appetite and willingness to eat anything (Wallach and Boever, 1983). Even food with big pieces of meat had caused obstruction of oesophagus leading to death in two bears (Goltenboth, 1982). Strangulation of the tongue by a ring-like foreign body has also been reported in bears.

Here we report a case of pyloric obstruction due to a foreign body in a bear. A five year old male Himalayan bear of the Vandalur Zoological Park, Madras, was found to be dull, and off-feed. Vomition was frequent and diarrhoea was observed for three days. Subsequently it collapsed and was necropsied (A. No.239/91).

Upon post-mortem, Oesophagus was found severely congested, with thick adherent mucus. Stomach was empty but contained almost a litre of mucus rich turbid fluid. Gastric mucosa was severely congested. Two large flat plastic pieces with irregular borders measuring 4x4 cm. in size and 0.3 cm. in thickness was seen lodged in the pyloric sphincter. Mucosa at this area was markedly odematous and haemorrhagic. Catarrhal changes were seen in the intestinal mucosa which was almost empty.

Concurrent changes were diffuse haemorrhages in the subcutis, costal pleura, heart and lungs. There was mild enlargement of liver with centrilobular pale areas.

Histologically, haemorrhages and oedema in the mucosa of stomach along with mononuclear cell infiltration were the main features. Central necrosis and Venous Stasis were noticed in the liver.

Detailed examination of bears can be made only when they are chemically restrained. Palpation and auscultation of pulmonary and cardiac areas are ruled out because of the dense hair coat. Diseases related to them are generally diagnosed best at autopsies (Weilenman, 1982). Bears in captivity are generally maintained on available commercial diet or a diet supplemented with bread, vegetables, fish and meat products. Because of their gluttonous eating habits, they are know n to eat garbage, foreign bodies, sand, dirt and garden chemicals leading to simple gastritis (Wallach and Boever, 1983). However the bear in this case might have eaten the two big plastic pieces accidently resulting in obstruction, toxaemia and death.

Acknowledgement

The authors thank the Dean, Madras Veterinary College, Madras for the facilities provided.

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Reprint : Zoos' Print, 11 (10) : 17, October, 1996

CASTRATION OF BARKING DEER *(Muntiacus muntjac)*

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ABSTRACT

Four adult barking deer *(Muntiacus muntjac)* were castrated with Burdizzo's castrator. The testicles atrophied within 3 to 4 months of castration and no complication were observed during 3 years post castration. However the males aggressive behaviour did not disappear upto 3 years of post-castration.

INTRODUCTION

Castration of dometic animals is a routine veterinary practice in India. Castration of surplus male domestic animals has long been practiced to make them more manageable (Dyce, *et al.*, 1987; Giles, 1978), to obtain more control over a mischievous or wicked animal, to prevent wandering and fighting, to fatten better and to improve the quality of the flesh (O'Connor, 1980). Besides, sex ratio of wildlife can be manipulated by castration of male animals (Giles, 1978 and Giles, 1981).

Castration can be performed by different techniques in different species of animals (O'Connor, 1980). The size, shape and location of the scrotum and testicles and the nature of skin of an animal mostly determines the suitability of one specific method (O'Connor, 1980). This report describes the efficacy of one closed method of castration in four barking deer (*Muntiacus muntjac*).

MATERIALS AND METHOD

Twelve male barking deer in a herd of twenty two kept inside a closed area of about one acre land in the Assam State Zoo, Guwahati, frequently exhibited aggressive behaviour. Considering the overpopulation of males, the zoo authority decided to have four adult healthy male deer castrated. Castration was performed on the 10th Jan, 1992, forenoon by the Burdizzo's method using a smaller sized Burdizzo's castrator. No food was provided 18 hours prior to castration. Two deer were castrated under Ketamine hydrochloride anaesthesia @ 20 mg per kg body weight i.m. Since induction and recovery periods of anaesthesia were associated with violent struggling and paddling of limbs, two deer were castrated by manually restraining them in lateral recumbancies.

The advantages and disadvantages of Burdizzo's method of castration experienced at the time of castration of anaesthetised and unanaesthetised deer were recorded. Observation on feeding, drinking, walking, running, fighting, chasing the female etc. were made for ten post-castration days. The scrotum and testicles were examined daily for 10 days for possible complications. Long term effects of castration on the size of the scrotum and testicle, general appearence, masculine behaviour viz, fighting, chasing the females, mounting, attacking the attendents, etc. were recorded upto three years. The size of scrotum and testicles were noted from a distance of about 5-6 feet to avoid repeated capture. As a result measurement of those organs at different intervals was not taken.

RESULTS

Castration of the anaesthetised deer could be performed without any difficulty within a minute. The unanaesthetised deer struggled vigorously during crushing the cord and the attendents had to struggle hard to control them. Castration in these cases was completed in two minutes. No visible open wound developed at the site of crushing in all cases.

All the castrated deer did not eat and drink on the day of castration. The animals appeared dull and lethargic upto the third day. On the day of castration, they stood with a slightly arched back and moved cautiously for short distances with their hind legs well apart. They ate and drank normally from the second day. The difficulties during walking and running disappeared gradually.

The castrated deer did not exhibit the aggresive male behaviour upto the 18th day of castration. No complication of scrotum and testicles occured after castration. The testicles atrophied gradually and were almost untraceable in the course of 3-4 months. Simultaneously, the size of the scrotum also diminished.

No detectable change in general appearance and health could be detected during the three years period after castration.

The behavioural problems did not disappear permanently after castration. Two castrated deer fought on the 18th day of castration. Fighting between two castrated deer or between one castrated and one uncastrated deer was noted on many occasions. Sometimes the castrated deer chased one female and injured her with sharp teeth. They also mounted on females occasionally. The habit of attacking the attendents was also seen during the three years post-castration period.

DISCUSSION

Castration of the anaesthetised deer could be performed quickly and safely than unanaesthetised deer. The unanaesthetised deer struggled due to pain during crushing the spermatic cords. As ketamine hydrochlonde is reported to produce profound analgesia in sheep and goats (Hall, 1983), the present study indicates a similar analgesic effect of ketamine in barking deer also. In the present study, the induction and recovery periods were associated with struggling. The use of ketamine in sheep and goats is also reported to have an excitatory effect (Hall, *et al.*, 1983).

The fear psychosis developed during the whole procedure

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Reprint : Zoos' Print, 4 (12) : 18, December, 1989

HAEMANGIOPERICYTOMA IN A PIGEON

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Haemangiopericytoma in pigeon appears to be either a rare tumour or a rarely documented one. While Moulton (1961) cited its occurence in dogs as the most common, Jones and Hunt (1983) observed it as a rare tumour in other species. Young and Lee (1987), however, reported one case of haemangiopericytoma in pigeon from their survey of 1982-1986 conducted in Taiwan.

In the present case, the growth, showing a obulated, cauliflower-like structure, about the ize of a small marble ball, was situated just below he left lower eye-lid (Fig. 1). The eye-lid was nverted thus closing the eye partially. There was constant lachrymation.

Initially, the condition was treated clinically vith Oxytetracycline 25 mg (0.5 ml) given ntramuscularly for 5 days, without any apparent mprovement. Surgical removal of the growth was esorted to.

A pre-anaesthetic, chloropromazine hydro-hloride 5 mg was given intramuscularly before nducing the local anaesthesia. The site was naesthetized by infiltrating with 2% Xylocaine. wo drops of Xylocaine 1% was instilled into the ye.

After sterilizing the site, 1 cm incision was nade horizontally. The incised skin was reflected bluntly to avoid haemorrhage and to expose the growth. The tumour was then removed from its cutaneous attachments. After giving antiseptic dressings, the incision was closed with fine nylon thread in a single interrupted pattern. The bird was treated with streptomycin 50 mg plus 25000 IU of Penicillin intramuscularly daily for 5 days. The wound was dressed daily with a nitrofurazone ointment for 7 days. The nylon suture was removed on the 7th day. The recovery was uneventful and the normal movements of the eye-lid was restored. Grossly, the tumour, covered with intact skin, was located subcutaneously. It weighed 3.5 gm, and the diameter of the growth was 1 cm. It was cool and firm to tough and lobulated.

Microscopically, the growth was situated below the epidermal layers. The tumour cells, known as pericytes, were noticeable abundantly in whorls or as finger prints at different sites. The cells were spindle-shaped and arranged rather concentrically around the cutanous capillaries (Fig. 2). These capillaries were either patent or in occult forms and these were innumerable, sprouting up everywhere, showing an unlimited proliferation.

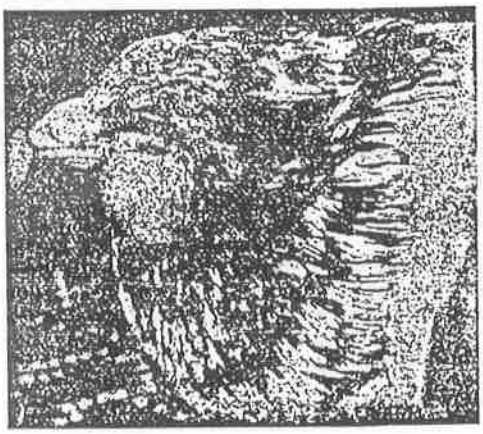

Fig. 1: The Jumour (Haemangiopericytoma) below the left lower eye-lid.

Note: Fig. 2 and Fig. 3 were not sufficiently clear to reproduce

The spindle shaped pericytes had elongated to avoid nuclei with considerable cytoplasm. These cells took dark stains (H & E) but mitotic figures were not discernible. These cells, in places, were batched in pink fluid and separated in groups but mostly they were of compact mass. The pericytes were pleomorphic and anaplastic in their growth pattern. There was, however, no report by the owner of its recurrence following the surgical removal.

Summary

A case of haemangiopericytoma in a pigeon and its treatment is reported.

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Reprint : Zoos' Print, 6 (5) : 14, May, 1991

A CASE OF "FIBROSARCOMA" IN A PANTHER (PANTHERA PARDUS)

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Fibrosarcoma is a malignant tumour arising from the fibrous connective tissue. Though malignant, metastasis to distant organs is not a feature, however, it will recur with greater speed after removal. The portion affected will be hard and bulging. The animal may develop uneasiness and disfunction of the affected part.

Case Report :

A male panther, adult, aged about 6 years received at Arignar Anna Zoological Park, Vandalur, Madras 48 from Salem Park had a serious malignant growth and specialist from the surgery department of Madras Veterinary College suggested extirpation of growth on 24.10.89.

Conservation and Treatment :

The left eye of the panther exhibited a growth which was noticed in the eyeball partially affected the vision in that eye with the tendency to bleed at regular intervals. Purulent discharge was also noticed.

Suspecting it to be a malignant tumour extirpation of the affected eyeball was conducted on 24.10.89 at zoo premises.

Operation Proceedure :

The animal was prepared for operation. Vetamin I.5 gms and Dexona 4 m. were given parenterally four days prior to surgical intervention. To control salivation 4 ml. (2.6 mg) of atropine sulphate injection was given and it was followed by 'ketalar' (ketamin) 1000 mg. on the day of the surgery. Complete immobilisation was noted after 15 minutes.

Observing all the aseptic precautions, the left affected eyeball was extirpated with growth. The lips of the wound were sutured after instilling antibiotics, leaving a narrow gap at one end of the wound to facilitate drainage, etc. The whole operation lasted one hour. 'Keflong' I gm and dexamethasone 320 mgs. were given parenterally to control infection. The animal recovered fully after four hours from the effects of ketalar.

Result and discussion :

Detailed histopathological examination revealed that it was a case of 'fibrosarcoma'. The animal was comfortable with one eye. The operation was successful, the wound healed and the animal free from pain and irritation.

After 3 months the tumour started growing again and the animal expresses uneasiness due to this growth. The place where the tumour was removed started bulging again causing pain and irritation. A second operation was conducted on 5.6.90 at the zoo premises.

II. Operation Procedure

The animal was prepared for operation. The first dose of tranquilizing drug 'rompum' - 1 ml (100 mg.) and ketamine - 2 ml (200 mg) was given at 9.58 a.m. by telinject system. The animal became restless, laid down and became somewhat docile with rapid breathing, nausea and vomition. Panther vomited 8 minutes after administration of tranquillizer. A second dose was given after 9 minutes i.m.e., 3 ml. ketamine. The induction time was 14 minutes. During this period the head came down, the eyes started closing and there was salivation.

The operation began at 10.30 a.m. During the operation the animal showed slight movements so the third dose of 2 ml. (200 mg) ketamine was given 65 minutes after the first dose. A fourth dose of 2 ml. (200 mg) ketamine was subsequently given after five minutes.

The operation lasted for 75 minutes and the wound was sutured. Gentamycin 10 ml injection was given intramuscularly. Another dose of 200 mg. ketamine was given 8 minutes after the previous dose.

The animal was taken to the squeeze cage and 200 mg ketamine was given one hour after the previous administration. The animal recovered from the effects of Rompun and ketamine uneventfully.

Results and Discussion

Histopathological examination was done. Fibrosarcoma does not have a permanent cure. It will recur after a certain period.

Summary

A case of 'fibrosarcoma' was recorded and operated in a male panther for temporary relief for the animal.

Note: Temperature of Panther during tranquilisation : 105.2°F, 104° F.

Respiration : 19, 18, 22 per minute

Pulse rate : 40, 44 per minute.

The authors convey their thanks to Thiru Gautam Dey, I.F.S., Director, Arignar Anna Zoological Park, Madras for permission and facilities given to carry out the operation and full interest shown in the case throughout.

Reprint : Zoos' Print, 11 (4) : 9, April, 1996

FIBRO - LIPOMA IN AN ASIAN ELEPHANT (*Elephas maximus*)

B. Gangadharan[1], K.N. Muralidharan Nair[2], K. Chandrasekharan[3], and T. Leenadevi[4]

SUMMARY

A fibro - lipoma observed in a female Asian elephant was placed on record.

INTRODUCTION

Neoplasms are rare in elephants. Perusal of the available literature revealed only a report of fibro - papilloma in the vagina of a female Asian elephant (Robinson and Meire 1977). Hence a tumour, Fibro - lipoma encountered in an Asian Elephant is placed on record.

CASE HISTORY

A female elephant aged about 45 years belonging to a private individual had a nodular growth under the skin in the thigh region since the last eight years and the growth showed progress increase in size and reached the size of an inflated football. Surgical intervention was indicated and the growth was removed under general anaesthesia with Xylazine hydrochloride (350 mg i/m). The weight of the animal was estimated as 3500 kg and the animal attained anasthesia within 45 minutes and the operation lasted for 90 minutes. The tumour mass weighed 2.5kg and the wound was sutured with synthetic sutures in mattress pattern. The healing of the surgical wound was uneventful.

GROSS AND HISTOPATHOLOGY

The tumour mass was off white in colour and it was hard in consistency. Representative sample of the tissue was fixed in 10% neutral buffered formalin and sections were cut at 5-6 Micron thickness and sttained with haematoxylin and eosin. Microscopically the tumour mass revealed mainly two types of cells. Islands of round to oval cells with spherical nucleus and cytoplasm with fat globules. In certain cells the nucleus was marginated to the periphery. The other type of cells were spindle shaped with fibroblastic morphology. Bundles of such cells were seen penetrating the lipomatous collection of cells, as well as neoplastic fibroblastic cells were seen encircling groups of lipomatous cells. Based on the gross and histopathological features, the tumour was diagnosed as fibro-lipoma.

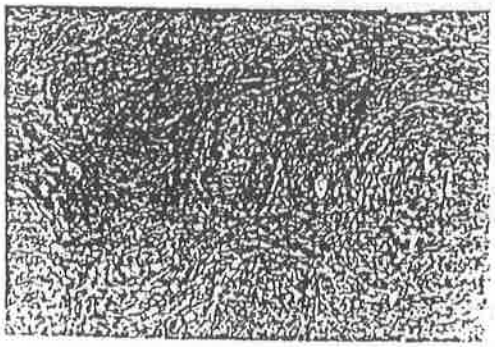

fig.1 Fibro -lipoma - Islands of Round to oval cells encircled and penetrated by spindle shaped cells

DISCUSSION

As tumours are rare in elephants, this report of fibro - lipoma in an asian elephant is placed on record. It is also interesting to note that, record of fibro - papilloma in an asian elephant was also from a female elephant.

The fibroblastic tissue in the present lesion might have resulted from the adipose tissue cells, that have lost their fat (Ewing 1940) or more likely it had developed independently from the mesenchymal cells, as an intrinsic component of the lipomatous tumour. Such two fold differentiation is not surprising, because both fat cells and fibroblasts arise from the same prototype cell (Clark and Clark 1940)

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ACKNOWLEDGEMENTS

The senior author wish to acknowledge the help rendered by Dr. A. Rajan, Dean College of Vetennary and Animal Sciences, Mannuthy, Thrissur in confirming the diagnosis and Dr. K.M. Ramachandran, Professor and Head, Department of Pathology for the facilities provided. The authors are also grateful to Dr. K.V. Valsala, Associate Professor, Centre of Excellence in pathology for the help rendered in taking microphotograph.

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SURGICAL EXCISION OF GRANULOMA IN AN INDIAN STAR TORTOISE (*GEOCHELONE ELEGANS*)

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Tumour removal, laceration repairs, abscess excision and hernia repair are all performed in reptiles in the same manner as in mammals (Jacobson, 1981).

A 26 years old female Indian Star Tortoise (Case No. 4905/454, Dt. 26.ii.1999) weighing 3.5 kg. and kept as an exotic pet was referred to the University College Hospital for tumorous growth in the neck. After clinical examination, it was decided to go for excision of the tumour. Accordingly, the turtle was sedated with Ketamine at 44 mg/kg. administered intramuscularly and the site was prepared for aseptic surgery. The tumour (Arecanut size) was excised by giving two elliptical incisions. Bleeders were clamped and ligated with #2/0 chromic cat gut. Skin sutures were taken with cotton thread using horizontal mattress suture pattern. Post-operatively, gentamicin at 10 mg/kg. was given intra muscularly for three days. The suture line was dressed daily with povidone-iodine spray. On 15th post-operative day sutures were removed. Histopathological findings revealed focal necrosis and granulomatous lesion.

Abscess occur frequently in turtles especially on the neck. The sharp defects of the free edge of the carapace may lead to trauma of the skin of the legs and to abscesses. A provisional therapy of gentamicin at 10 mg/kg. every 48 hours is advised for chelonians. Chronic granulomatous lesions of fungal origin are reported in chelonians (Zwart, 1986).

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Received 28 July 1999 *Accepted 10 February 2000*

Reprint : Zoos' Print, 4 (6) : 12-14, June, 1989

REPAIR OF COMPOUND FRACTURE OF TIBOTARSUS IN A BAR-HEADED GOOSE: A CASE REPORT

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Avian orthopaedic surgery is not commonly in vogue, however, it is warranted under special circumstances. The sole aim of such surgical manoeuvres is to conserve the rare bird species. Birds are much prone to the leg injuries and fractures. Randal *et al* (1984) observed nine lame turkey poults out of a flock of 400, the cause was fracture of the proximal tibiotarsus, usually bilateral. The present report validates the surgical treatment in a clinical case of compound comminuted fracture of left tibiotarsal bone in a rare exotic goose.

Case history and clinical findings:

A one year old Bar Headed exotic female Goose of Wild Life Protection department of J & K, State, suffering from a compound, comminuted fracture of left tibiotarsus was presented for treatment. The history revealed that the bird entangled its left leg in some marshy land and while struggling for its release suffered the fracture near distal extremity of the bone. On manipulation it was observed that the distal sharp edge of proximal fragment had disaligned and pierced its way through the medical aspect of the leg, creating the wound (Fig-1). The wound was fresh but lacerated; however the condition of the bird was quite satisfactory.

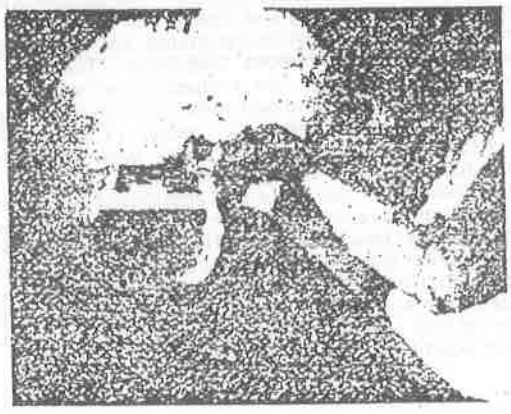

Fig. 1

Treatment / Surgical Technique:

The bird was held and secured by the attendent. The feathers were carefully plucked from the area and the site was antiseptically washed and cleaned and then painted with weak iodine solution. Anaesthesia of the leg was achieved by injection of 1 ml of 2% Lignocaine Hcl, along the site of incision was also worked out. A longitudinal incision along the length of the bone was given, the haemorrhage was controlled by torniquate and vessel ligation. The bone chips were removed and one hole was drilled through each of the broken ends of the bone.

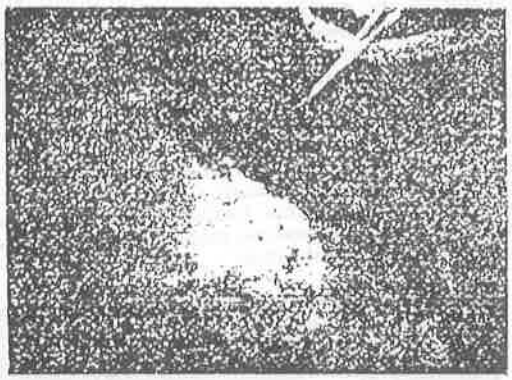

Fig. 2

The ends of stainless steel wire were threaded through the two drilled holes and then they were held and tied together to bring and keep the fractured ends in close apposition. (Fig-2). The wound was closed with continuous sutures using No. 1 silk thread. The leg was then bandaged and immobilized using the hard card board splints within the bandage (Fig-3) Streptopenicillin 0.05 gm and Dexamethasone 0.12 ml were injected parentrally for five consecutive days.

The bird was brought again after 10 days as the alignments of the fracture was lost. The site was prepared again and then reopened. The wire suture had broken due to splitting of the fragments at the site where holes were drilled. The wire and the bone pieces were removed and the fragments were brought in apposition by stretching and closely approximating the muscle of the limb. The wound was closed and immobilization done using only card board splints. Post-operative care and treatment was done previously. Follow up after 4 weeks revealed complete union of the fragments, however arthrodesis of tarsal joint also took place. Further due to the contraction of the wound, the bird could not move its leg forward at the hip joint (Fig-4), however it could move on one leg and balance with another, and swim properly and effectively (Fig. 5 and 6).

Discusssions

Besides, ethical consideration, endangered status of rare bird species necessitates that these avian patients receive state of the art surgical care. In order to protect and preserve the rare aquatic game bird species, the surgery was mandatary in the present case. The avian fracture does present some problems not encountered in mammals. First, avian bone is more brittle owing to a higher calcium content (Bush, 1986) and it tends to shatter or crack more easily. Secondly, birds have pneumatic bones with large intramedullary spaces and these complicate the attainment of adequate stabilization with intramedullary pins. In birds the endosteal callus contribute greatly to the healing process (Bush *et al.* 1976), therefore the intramedullary pinning is not desirable as the pin employed in the procedure completely prevents the endosteal callus formation (Trah, 1976) and the inability to fill the large medullary space properly leads to torsion and instability at the fracture site. Bone plates and screws are rarely used in birds probably because of the brittleness of the bone and its tendency to splinter (Bush, 1986). Bush (1977) suggested that external fixation splint are the best repair method as it provides stability without disruption of the endosteal callus.

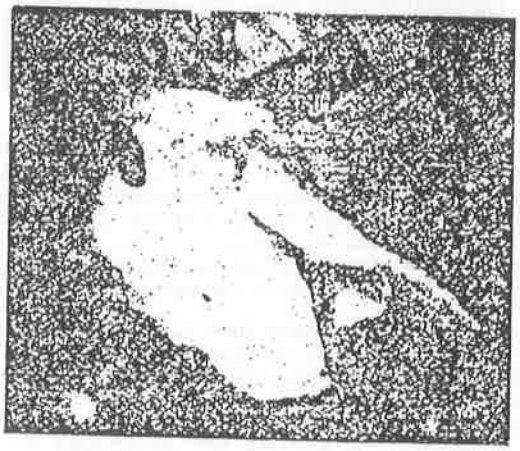

Fig. 3

Satisfactory anaesthesia is mandatory to any surgery. To avoid the risk of the anaesthetic emergencies, the surgery was performed under the local anaesthesia using 2% lignoceine hydrochloride. The leg got desensitised within two minutes, after administration of the anaesthetic agent. The anaesthesia was graded good as it also provided satisfactory muscle relaxation, facilitated aggressive surgical prodedure. Mouli (1987) has used 5 ml of 0.5% lignocaine HCl for the correction of eviscerated cranial larynx in an Aseel cock.

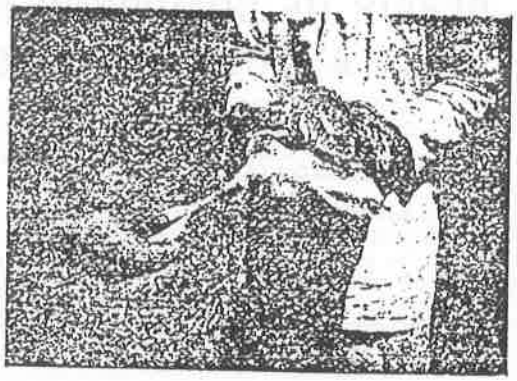

Fig. 4

The basic factor considered for the surgical treatment was that of maintaining functional leg for courtship and copulation, so as to conserve and protect this rare aquatic game bird from extinction In the present case considering the nature of the fracture, the brittleness of the bone and least damage to the endosteal tissue, bone wires were used internally along-with the external splints. However, stainless steel wire sutures did not prove successful in the present case owing to brittleness of the bone. The bird was brought back after 10 days, as the alignment of the fracture was lost. The treatment was modified as was necessary to achieve optimal results. The modifications of repair techniques used in mammals may be adopted for satisfactory results in avian orthopedics (Bush, 1977; Newton and Zeitlin, 1977) The stainless steel wire sutures and broken edges of the bones were removed. The sutures were applied after stretching and closely approximating the muscles of the limb which facilitated the apposition and alignmant of two bone fragments. The splints were well provided. The antibiotics and corticosteroids were repeated and oral administration of glucose solution to meet metabolic needs (5 ml of 25% dextrose solution) after the repair was indicated. Besides, a bandage was used to secure the limb to the body in a nearly normal anatomical alignment. The splints were removed after 4 weeks, and it had allowed the bones to heal The physical theraphy, both during immobilization and after the splints were removed, helped the goose to regain the functional use of the leg, with of course some impairment. The life of this valuable rare bird was saved and the bird was fit enough for breeding.

Fig. 5

Summary

A bar headed female goose of rare species was presented for treatment for the left broken limb. It was a case of compound comminuted fracture. The surgical treatment was rendered by setting the fracture and suturing the two ends of the opposing bones by stainless steel wire loop. However, it did not prove successful due to brittleness of the bone.

The technique employed was modified and the broken edges were brought in apposition and aligned by stretching and closely approximating the muscles of the limb. The splints were put and the limb was secured by bandage against the body. After 4 week splints were removed, the fracture had healed; however, orthrodesis of the tarsal joint had also occured. Still the bird could walk and swim properly.

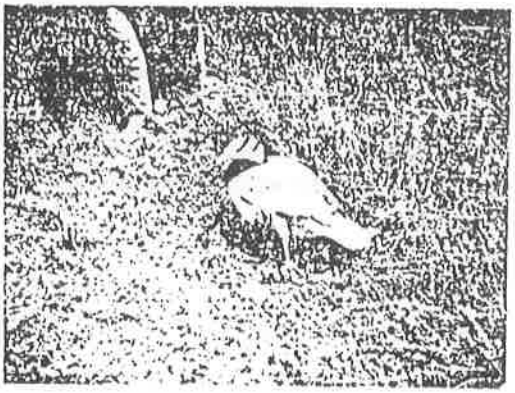

Fig. 6

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Acknowledgement

The author thanks Mr. Mohd Amin for assisting during the study.

Reprint : Zoos' Print, 5 (2) : 3, February, 1990

REPAIR OF SHELL FRACTURE IN A GIANT TORTOISE; A CASE REPORT

A giant tortoise (Testudo galapagos) from Peshwe Park Zoo had a shell fracture. It was reported by the concerned zoo keeper. The crack in the shell was examined and it was decided to repair it using dental cold cure acrylic, Polydent Co. U. S. A.

The dental cold cure acrylic is commonly used in dental practice. Basically it is methyl methacrylate, mixture of Polymer & Monomer.

The crack was thoroughly cleaned with Savlon (germicidal & disinfectant), denatured spirit & was thoroughly dried. Cold cure acrylic was subsequently applied to the crack.

The repair of shell fracture was braught about satisfactorily using this material.

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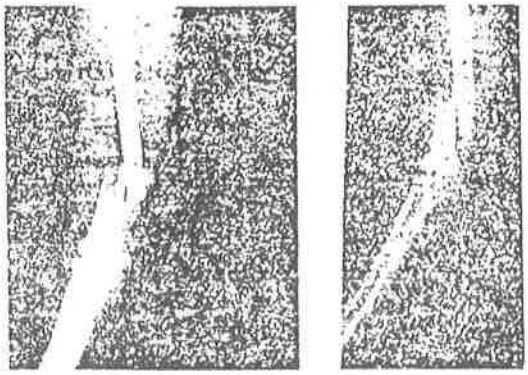
Reprint : Zoos' Print, 5 (5) : 29-30, May, 1990

SURGERY OF A RARE KIND

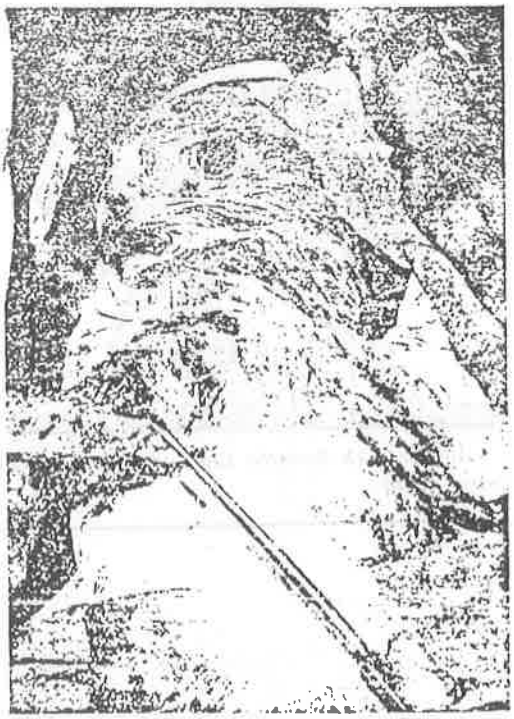
By Dr. Sattyasheel Naik, President. Indian Nature Society

On 11th March 1990 two young Bonelli's eagle were found at Galavde wadi near Indapur. One of the young Bonelli's Eagle had a fracture of its left leg. Most probably this could have been due to the injury sustained to the bird when their nest was destroyed by local people. X-ray was taken and it was found that the leg bone tibiotarsus was fractured and there was one centimeter of overriding. If only a plaster would have been given the eagle would be left with a shortened and weak leg. As eagles kill their prey with their talons and strong legs it was absolutely necessary to restore normal anatomy. Hence it was decided to operate on the Eagle's leg. The eagle was operated under local anesthesia as this was found to be the safest. A lateral approach was taken and the bones were reduced and fixed with a plate and four screws. An intra medullary rod was put as an additional support. The screws and plate used are made of special American steel which does not give any reactions and they are the ones used in human finger operations.

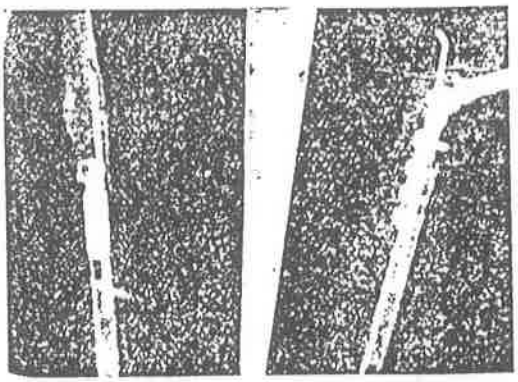


X-Ray showing fractured bone Tibio tarsus of Bonellis Eagle

Special observations were that the Tibiotarsus of the leg bones of a bird has a thin cortex. This is because the bones should be light in weight to facilitate flight. The medullary cavity is very broad. The bone is flat anterioposteriorly.



Bonellis Eagle during surgery Plate being fixed on leg bone Tibio Tarsus



Bonellis Eagle X-Ray showing Plate and Rod fixed in leg bone Tibia Tarsus

Author with Bonellis Eagle after surgery and plaster given

The other observation was the muscles of the leg are extremely strong and are grouped in anterior and posterior groups to enable the bird to give a push in flight and buffer the shock while landing.

The leg of birds especially in eagle is covered with feathers and one has to carefully trim them with scissors.

The healing of such a fracture in human being would take 3 months. In a bird it has to be observed as to how many days it would take for the fracture to heal. The healing would be accessed by subsequent X-rays.

As absolute anatomy has been restored it is expected that the eagle would recover to normal and could be released back in its environment subsequently. The eagle is kept for nursing care under the care of Mr. Neelamkumar Khaire at the Snake Park Office.

This operation was done by Dr. Sattyasheel Naik and assisted by Dr. Sunil Jakar and Mr. Atul Varekar and Mr. Jayant Deshpande.

This is the first kind of surgery done on a bird like Bonelli's Eagle by the members of Indian Nature Society which aims at protecting Nature for a Bright Future.

Reprint : Zoos' Print, 6 (5) : 4-5, May, 1991

TIBIAL FRACTURE AND ITS TREATMENT IN KASHMIR STAG (*Cervus elaphus hangul*)

1) Dr. Mir Mansoor, Veterinary Officer, 2) A. R. Wani, Chief Wildlife Warden,
J & K State Wildlife Protection Department, Srinagar

Wild animals are not more exempt from accidents than domestic animals are. Road collisions, falls, drowning, fires and the like can all cause death. Accidents are more commonly small, but a constant decimating factor. As populations increase in size, safe shelter is more difficult to find, with the result chances of accidents increase. Where wild life managers have introduced many modifications of the habitat — fences, buildings, roads, powerline, etc. increase the hazards for wildlife. Most frequently, young ones and subadults, inexperienced members of a population are the victims.

The present study reports, the "Tibial fracture and its treatment" in a Kashmir stag or hangul (as it is locally called).

PRESENT AND PAST STATUS OF ANIMAL

Kashmir stag (*Cervus elaphus hanglu*) a subspecies of the European Red Deer is one of the most endangered deer species in the world. Dachigam National Park in J & K State is now the only place in the world which holds a viable hangul population.

A census carried out by J & K State Wildlife Protection Department in 1983 enumerated about 500 individuals, in addition to about 60 individuals in the areas outside the reach of Dachigam National Park against the estimated number of 300 animals in 1954.

As per latest Census, carried out by J & K State Wildlife Protection Department in 1988 the number has been estimated to be around 800 animals in the National Park. In all there are about 1000 heads in the Valley of Kashmir and Dachan-Wardwan, Kishtwar belt of Chenab Valley.

CASE HISTORY :

A male Kashmir stag about two years old was found in complete recumbancy just about 100 yards distance from the main road on the left side within the lower area of Dachigam National Park. On approaching the animal closely, the animal struggled hard to stand and to flee, but could not. On close observation it was found that the right hindleg of the animal was in a stretched position. Simple manipulations revealed that there was a complete closed fracture of tibia (in shaft region). Symptoms observed were: pain, functional derangement, disfiguring of injured segments, motility of the bone outside the joint and bone crepitation.

PROBABLE CAUSE OF FRACTURE:

As the rutting season was on, a majority of the Hangul population had descended from high pasture lands of upper Dachigam into the lower Dachigam area, although the movement is a temporary one. The dominant male animals in the population defend their territories very strongly during the rutting season. Each dominant male collects a harem which comprises of 5 - 15 females (hinds). Hence, it appeared that the victim (a subadult male) was driven off by some dominant male and during the course of chasing by the latter, the animal slipped off from the nearby slope which was evident by the signs on the ground. Also it was observed that the wounded animal had tried to move from that place, but only had been able to move about ten metres.

Although animals with bone fractures are very rarely noticed in the wild either because of the fact that only a negligible portion of the populations suffer from such accidents, or predators take full advantage of such occasions before human eyes strike on the subject.

TREATMENT AND MANAGEMENT :

The animal was heavily panting with salivation. Also it was noted that the foretrunk was sweating profusely. Hence to restore the water-loss, the animal was given fresh drinking water in which glucose powder and a little common salt was added.

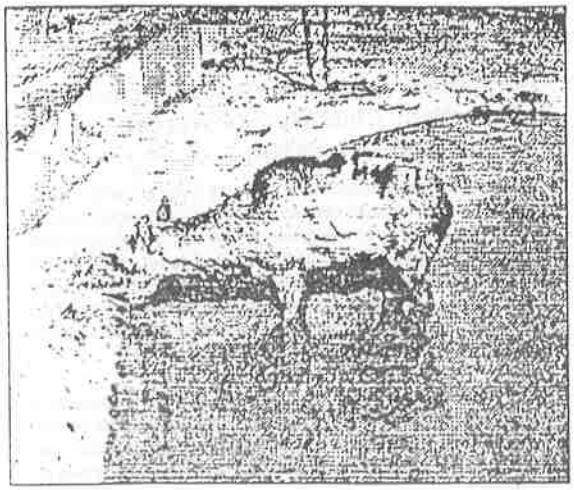
Considering the fact that post-treatment management was not possible in field conditions that too in a forest, it was necessary to shift the animal to a recovery enclosure located in the city forest. For this purpose 100 mg of Chlorpromazine hydrochloride (Largactil) was given I/m (*1 mg/kg B.Wt) to the animal then a provisional immobilising dressing was applied to the fractured leg to prevent further displacement of fragments and other possible complications. Then the animal was transported to a recovery enclosure with all possible precautions and where the following line of treatment was taken:

1. After casting the animal properly, the fractured leg was washed thoroughly with clean water and antiseptic solution.

2. As there was a marked displacement and overriding of fragments of fractured bone, it was necessary to use local anaesthetic for reduction of fracture. For this 15 ml of Lignocaine hydrochloride (1% soln.) was injected into the haematoma near the two fragments of the fractured bone. Local anaesthetic injection was given after about 70 minutes of Largectil injection given earlier as a sedative.

3. Ten minutes after lignocain hydrocholoride injection, reduction of the fractured limb was carried out through extension, counter-extension and local manipulation.

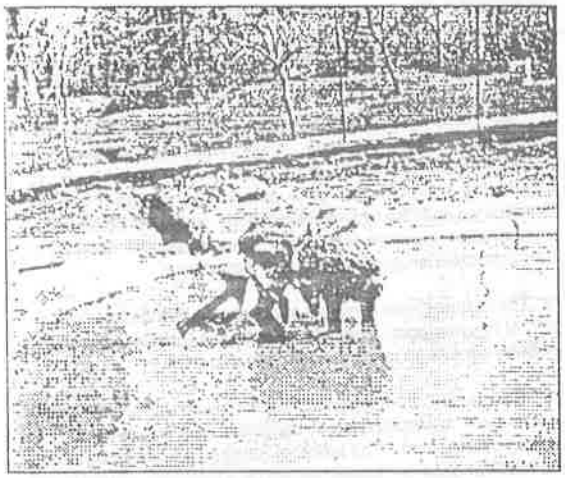
4. Splints cut from plywood, padded with cotton wool were applied for immobilization of fractured tibia including corresponding hock joint. The splints were kept in position by strong canvas bandage reinforced outside by a thin rope wound round the limb.



Kashmir stag enjoying fresh drinking water from tap after removal of immobilizing bandage from its fractured leg. Photos by Mir Mansoor.

The animal was then given following supportive treatment :

1. Welicyclin injection. 4 ml x 5 days i/m
2. Dexona vet injection. 5 ml i/m
3. Livogen injection. 10 ml x 3 days i/m
4. Vitatone. 5 ml daily in drinking water.
5. Ossopen vet. granules. 30 gms daily with concentrate feed.



Kashmir stag in water pond. Arrow indicates fractured leg.

RESULTS AND DISCUSSION :

Repair of the bone after fracture is by callus formation. The bone tissue regeneration has its major source from internal layer of periosteum, endosteum, bone marrow, endothelium, vessels of haversian canals, young connective tissue. As in cattle, sheep and pigs it has been seen that injured limb is guarded only during the first 3 to 5 days (M. V. Plakhotin) but the subject animal (Kashmir stag) guarded the limb for about the first 20 days. Subsequently slight functional load was given to the limb. It was observed that inflamatory oedema was a localised one and symptoms of proliferation at the site of trauma manifested at 15 - 20 days after fracture in comparison to cattle, sheep and pigs, where the symptoms are exhibited at 8 - 10 days after fracture. (M. V. Plakhotin). The proliferation was presented as a solid extensive overgrowth of the connective tissue by which two fragments of the fractured bone are well-fixed. The animal started using the leg after about 3 weeks from the date of fracture.

Immobilising bandage was removed on 40th day of application after ensuring supporting function of injured limb. It was observed that muscles of the limb were wasted and hock joint was stiff. Slight lameness was also persisting. The anima was then set free within the city forest for about two weeks which resulted in disappearance of muscles atrophy and join stiffness due to natural exercise. Also this helped the animal ir regaining its natural postures and reflexes which were de pressed but not lost during treatment and recovery phase inside the recovery enclosure.

SUMMARY :

The caseoif tibial fracture in Kashmir stag (Hangul) is treated successfully and case report recorded accordingly. The animal responded very well to the treatment given and now restoration of the animal in its natural habitat is under active consideration.

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print : Zoos' Print, 7 (12) : 41, December, 1992

AMPUTATION OF TAIL (DOCKING) OF THREE LIONS

(Drs) B.Sarma[1], B.Dutta[2], D.Kalita[3], S.C.Pathak[4], K.K.Sarma[5*]

Three lions, all suffering from a chronic disease of the tail were brought to the clinics, Department of Surgery. These lions were owned by the Moonlight circus, Assam. The animals were examined after restraining in a squeeze cage. It was found that they were suffering from gangrene of tail.

Surgical procedure : Initially one lion was controlled inside the squeeze cage and about 3-4 cms above the gangrenous part was prepared for aseptic surgery. Analgesia of the tail was carried out with posterior epidural injection of lignocain6 hydrochloride (2%). One tourniquet was applied at the base of the tail to control haemorrhage. The tail was amputated following the standard flap method, by applying an 'U' shaped incision both on the dorsal and ventral surfaces of the tail. The vessels causing haemorrhage was ligated with 2/0 catgut. The skin was then sutured with a monofilament nylon and wound was sealed with Tincture benz. Co. Similar methods of docking was practised for the remaining two lions. Post operatively, a course of cephaloridine7 (1 G, 1/mly, daily,) and pheneramine maleate8 (5ml, 1/mly, daily) were injected for 5 days.

The suture was removed on the 6th day of operation. The wound healed without any complication, and the lions were discharged from the departmental clinics.

Discussion: Anaesthesia of Feline is generally performed under ketamine hydrochloride (Hime 1974). Amputation of tail under xylazine has been reported by George et al(1984). In this case, as the lions were properly restrained inside the squeeze cage, posterior however, epidural anlgesia was sufficient for docking. Similar methods of restraint & anlgesia was practised by Singh et al (1992).

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Reprint : Zoos' Print, 11 (3) : 22, March, 1996

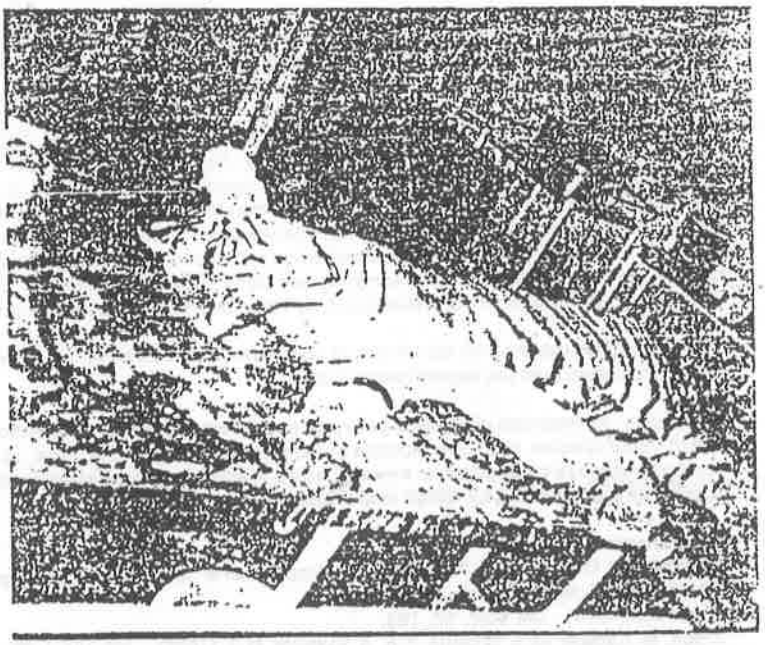
RADIUS AND ULNAR FRACTURE IN A TIGER CUB (*Panthera tigris*).

N. Panner Selvam, R. Thiruthalinathan, and D. Swaminathan.

A female tiger cub(*Panthera tigris*) aged about seven months was noticed limping. On close observation, the problem was found to be with its left forelimb.

Assuming its bodyweight as 30 kg, 2.5 mg/ kg of ketamine hydrochloride and 0.8mg/ kg of xylazine hydrochloride were given intramuscularly for immobilization. After an induction period of 7 minutes, the cub was transferred to the veterinary hospital. As the cub showed signs of recovery after one hour, an additonal dose of 25mg of ketamine hydrochloride and 15mg of xylazine hydrochloride were given intramuscularly.

Radiographs were taken at various angles to demonstrate the site of fracture. Radiographic findings revealed simple, complete fracture of left radius and ulna at their distal end.



The anaesthetized tiger cub with p.o.p. bandage

The cub was placed on the operation table and the fractured limb was washed throughly with clean water and antiseptic solution. Reduction was facilitated by accentuating the fractured angle and apposing the fractured ends. This was done to avoid possibilities of medial/lateral angulation that could result in secondary arthritis from abnormal weight bearing. The reduced fracture was stabilised with external coaptation in the form of plaster of paris (p.o.p) splint. Bamboo splints padded with cotton wool were kept in position by strong canvas bandage over which p.o.p bandage was applied. The whole operation was over within 20 minutes. The animal showed signs of recovery from anaesthesia after 3 hours. Analgin, Chloril and Prepalin were given as supportive treatment for three days.

The cub's diet was supplemented with calcium and vitamin D-3 (Caldivet) and also with multi vitamin and multi mineral tablets daily. The cub was placed in a squeeze cage to restrict the movement of the animal. The p.o.p bandage was kept dry and monitored daily for swelling and abrasions for 30 days. The animal began bearing its weight on the fractured leg after about 15 days from the date of fracture. The p.o.p. bandage was removed 30 days later after ensuring the supporting function of the injured limb. Later the animal was transferred to its enclosure under mild sedation.

ACKNOWLEDGEMENT:

Authors are thankful to Mr. R. Sundraraju, I.F.S. Director, Mr. M. Jaganatha Rao, I.F.S. Deputy director, Arignar Anna Zoological Park, Madras - 48. for their encouragement. We also thank the professor and staffs of Radiology unit, Madras Veterinary College, Madras for their assistance in doing this work.

Veterinarians, Arignar Anna Zoological Park, Vandalur, Madras.

Reprint : Zoos' Print, 11 (7) : 19-20, July, 1996

RADIOLOGICAL DIAGNOSIS OF CERTAIN ORTHOPAEDIC CONDITIONS IN CAPTIVE WILD ANIMALS

D. Swaminathan[1] and R. Thiruthalinathan[2]

Radiology plays a major role in the confirmatory diagnosis of various surgical conditions both in domestic and wild animals. Due to the importance of radiology and high value of captive wild animals, a radiology unit was started at Zoo Veterinary Hospital, Arignar Anna Zoological Park by purchasing a portable X-Ray machine (Stallion-60, Wipro GE Medical Systems Limited) having the capacity of 100 KV and 60 MA. In addition to the radiological parameters like KV, MA, exposure time and FFD, proper positioning of the animal is essential for the production of diagnostic radiograph. Various physical and chemical restraint methods can be used for proper positioning of the captive wild animals. Chemical restraint is more preferble than physical restraint to avoid the formation of undesirable shadows. For chemical restraint, combination of Ketamine HCL and Xylazine HCL have been commonly used at various dosages depending upon the Species. From 1.6.94 to 30.8.95, among the 20 cases examined, seven orthopaedic cases have been diagonosed in various wild mammals and birds. The details of KV, MA and exposure time used were given in Table-I. The case history and radiological intrepretation of above cases were reported here under.

Table-I. The radiological details of captive wild animals.

Animal	Part Examined	Part thickness (inches)	KV	MA	Sec.
Tiger cub	Tibia and fibula (Lt)	3.	55	40	0.1
Tiger cub	Radius and Ulna (Lt)	2.5	50	20	0.2
Wild dog	Radius and Ulna (Rt)	1.5	50	40	0.1
Tiger cub	Tibia and Fibula (Rt)	3	55	20	0.2
Common Langur	Femur (Lt)	2.5	55	40	0.1
White Pealowl	Tibio-Tarsal joint (Rt)	1.5	45	40	0.08
White Ibis	Tibia (Lt)	1	45	20	0.1

Case - I:

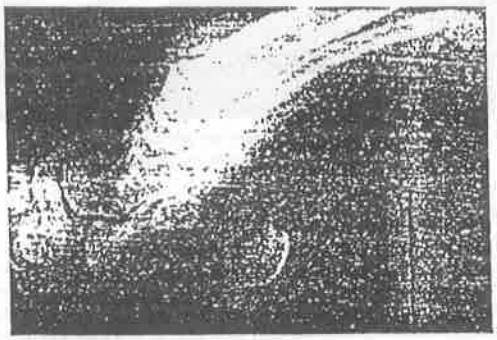
Tigercub, Male, 6 months old. The animal showed lameness of left hind limb and not able to stand and walk. The animal had a history of falling down from the wall while physical restraint.

Clinical examination :

Severe pain evinced on palpation of the left tibia and fibula.

Radiological diagnosis:

Complete fracture of tibia and incomplete fracture of fibula.



Case I. Lateral radiograph of left hind limb of tiger cub demonstrating complete fracture of tibia and incomplete fracture of fibula

Case - II:

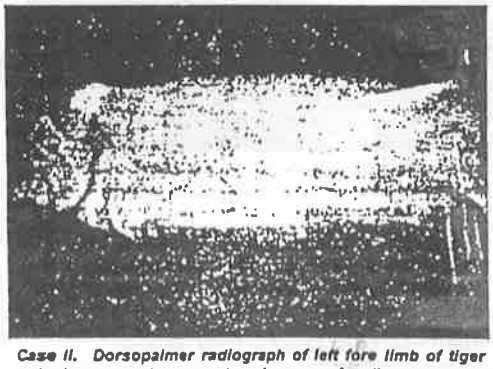
Tigercub, female, 7 months old. The animal showed lameness of its left fore limb following the struggling in squeeze cage and unable to bear weight on the affected limb.

Clinical examination:

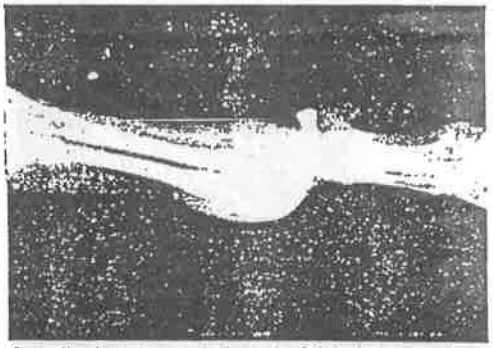
Diffuse swelling in the distal part of the left radius and ulna. Palpation of the inflammed area revealed crepitus and severe pain.

Radiological diagnosis :

Complete fracture of radius and ulna.



Case II. Dorsopalmer radiograph of left fore limb of tiger cub demonstrating complete fracture of radius and ulna.

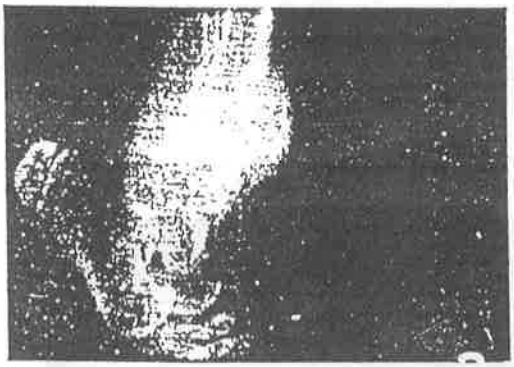


Case III. Dorsopalmer radiograph of right fore limb of wild dog demonstrating old fracture of radius and ulna.

1.Veterinarians, Arignar Anna Zool. Park, Madras - 48
2. Presently working as Veterinary Assistant Surgeon at Veterinary dispensary, Agaramthen.

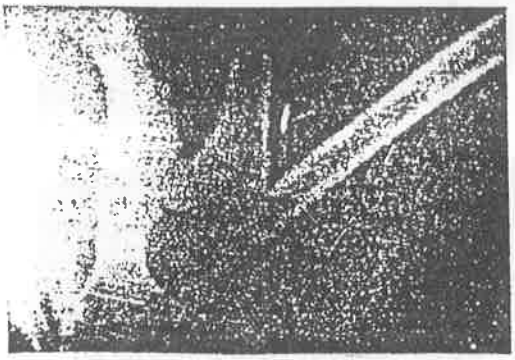
Case - III:
Wilddog, female, 7 months old. The animal showed progressive lameness of right forelimb.
Clinical examination:
Hard swelling in the distal part of the right radius and ulna.
Radiological diagnosis:
Old fracture of radius and ulan.

Case - IV:
Tigercub, Male 6 months old. The animal showed lameness of right hind limb and unable to bear weight on the affected limb.
Clinical examination:
Pain evinced on palpation of the right tibia and fibula.
Radiological diagnosis:
Incomplete fracture of tibia.



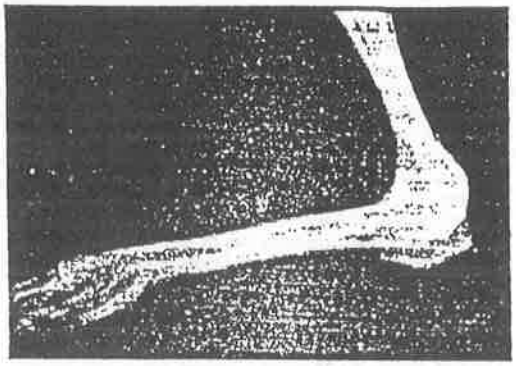
Case IV. Lateral radiograph of right hind limb of tiger cub demonstrating complete fracture of tibia.

Case- V:
Common Langur, Male, 4 years old. The animal showed lameness of left hind limb and inflammation of the affected limb noticed.
Clinical examination:
Severe pain evinced on palpation of the left femur.
Radiological diagnosis:
Complete fracture of femur.



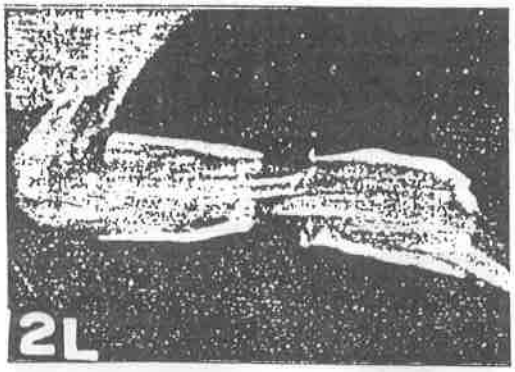
Case V. Ventro dorsal radiograph of hip and left hind limb of common Langur demonstrating complete fracture of femur at its shaft.

Case - VI:
Whitepeafowl, Female, 4 years old. The bird showed chronic lameness of both the limbs in progressive condition.
Clinical examination :
Painful swelling at the right tibio-tarsal joint.
Radiological diagnosis:
Articular gout - Tibiotarsal joint.



Case VI. Lateral radiograph of right limb of white peafowl demonstrating articular gout on tibio-tarsal joint.

Case - VII:
White Ibis, Female, 5 months old.
The bird was unable to stand following the blunt trauma on it's left limb.
Clinical examination:
Palpation of left tibia revealed crepitus and pain.
Radiological diagnosis:
Complete fracture of tibia.



Case VII. Lateral radiograph of left limb of white Ibis demonstrating complete fracture of tibia at its shaft.

Acknowledgements:
Authors thank The Director, Deputy Director and Veterinary Officer, Arignar Anna Zoological Park for the facilities provided. Authors also thank Dr. N.N. Balasubramanian, Professor and Head, Dr. Archibald David, Professor Dr. T.N. Ganesh, Associate Professor, Department of Surgery, Madras Veterinary College for their assistance in radiological interpretation and confirmation of the results.

MANAGEMENT OF SINUS DUE TO NECROSIS OF RIGHT TRANSVERSE PROCESS OF SECOND LUMBAR VERTEBRA IN AN ELEPHANT

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Even though domestication of elephants for private or community use was in vogue since early days, incidences of fractures and fracture-related complications in elephants were not well documented (Schmidt, 1978). This note reports a case of a sinus due to fracture of right transverse process of second lumbar vertebra.

A male elephant aged about 15 years (height: 8' 6") had a history of swelling and subsequent drainage of pus from the lumbar area whenever the howdah was seated for a long time. However, the discharge decreased or even disappeared whenever the animal was given rest and the howdah was removed. Clinical examination revealed cicatrised spots and probing indicated the depth of sinus to be nearly 10 cm. The discharge was foetid and sanguinous (Fig. 1). It was decided to open the sinus to remove the necrotic tissues and provide free drainage.

The animal was given 300 mg. of xylazine intramuscularly and it went to lateral recumbency after 15 minutes. The area extending from last thoracic to 4th lumbar vertebra was then cleaned with soap and water and Tr. Iodine was applied. A 12 cm. long fish head probe was introduced through the opening and directed downwards and forwards to reach the depth of the sinus. The sinus was then opened to its entire length and depth with the help of a knife. The entire sinus tract was filled with reddish exudate containing necrotic tissue. Exploration of the base of sinus cavity indicated the involvement of right transverse process of second lumbar vertebra towards its summit. The necrosed part of transverse process was then removed.

A 12 cm. long longitudinal incision was made dividing the longismus dorsi muscle on the right side and exposing the vertebrae. The affected transverse process was made free from the surrounding tissues and an embryotomy wire was passed beneath it. The necrosed part of transverse process was separated including a portion of normal bone by moving the wire in sawing motion. The debridgement was done with the help of scissors to make the area free from necrosed tissues. The wound was then cleaned with 4% Chlorhexidine solution and painted with Providone iodine solution. Tetracycline (30 ml i/m.) was given for eight days. Cleaning of wound with Chlorhexidine and painting with Providone iodine was continued. It took nearly three months for the wound to heal. The animal was put to work after four months from the date of operation. Reappearance was not reported even after six months of regular service.

The deprivation of blood supply to a portion of bone can result in loss of vitality of the affected part. Subsequent bacterial infection can lead to suppuration and drainage from the affected part. In the present case it seems that the second lumbar vertebra might have been under pressure due to the faulty fitting of the howdah. This in turn might have resulted in excessive pressure on the right side, specifically on the lumbar vertebrae, leading to interference in the blood supply and subsequent pressure necrosis.

The entrance of alien organisms apparently caused sepsis. The removal of necrosed bone, effective surgical drainage and antibacterial therapy proved effective in treating the sinus.

Reference

Schmidt, M. (1978). *Zoo and Wild Animal Medicine*. W.B. Saunders Co. Philadelphia. London.

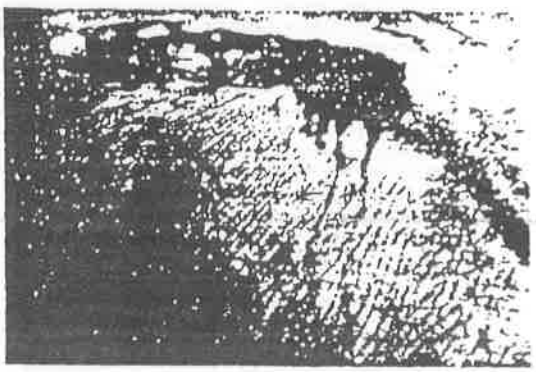

Figure 1. Draining sinus due to fracture of transverse process of lumbar vertebrae in an elephant.

Received 16 March 2000 *Accepted 12 July 2000*

Reprint : Zoos' Print, 12 (2) : 12, February, 1997

AMPUTATION OF HIND LIMB IN CHINKARA (*Gazella benneti*) UNDER DIAZEPAM AND KETAMINE ANAESTHESIA

Makena Sreenu*, K.V. Rao**, B. Venkanna*** and K. Suresh Babu***

A male chinkara aged 9 months was received in the Surgery ward with a history of sudden fall and inability to bear the weight on left leg. On clinical examination there was a swelling, crepitus and pain on palpation of the distal third of the tibia suggested as a fracture. The animal was active and showed pulse, respiratory rate and rectal temperature with in the physiological limits. Radiographic examination of left leg revealed multiple fracture of irreducible type on the distal third of the tibia (Fig.1). In the interest of saving the animal, it was decided to amputate the limb at proximal third of the tibia. Moreover, amputation is indicated in cases of irreduceable fracture (Oheme and Prier, 1980; Quessada,1993).

After 12 hours of fasting the animal was prepared for aseptic surgery controlled on lateral recumbency and premedicated with diazepam[1] @ 0.25 mg/kg body weight intramuscularly. After 15 minutes of premedication, Ketamine hydrochloride[2] @ 3.5 mg/kg body weight was administered intramuscularly.

These anaesthetic agents produced surgical anaesthesia for 30 minutes with a recovery time of 80 minutes with good muscle relaxation. Premedication with diazepam is reported to increase the length of action of the anaesthetic agent and also reduce the hallucinations which seem to occur with dissociative anaesthetic agents like Ketamine Hydrochloride (Hall and Clarke, 1991). Tourniquet was applied below the stifle joint. A circumscribed incision was made at the level of proximal third of tibia, reflecting the skin and muscles; bone was exposed, transected and removed. The muscles were sutured with No.1 chromic catgut in a crossed manner to cover the bony stump. Bleeding points were checked by removing tourniquet. The skin was closed in a horizontal mattress pattern using braided silk.

Post operatively, the animal was given streptopencillin[3] 2.5 G intramuscularly for 5 days. The wound was cleaned with normal saline and covered with Nitrofrazone[4] ointment daily. The skin sutures were removed on the 12th day of operation when the skin wound showed normal healing. The animal showed no difficulty in walking on three limbs (Fig.2) and made a complete recovery.

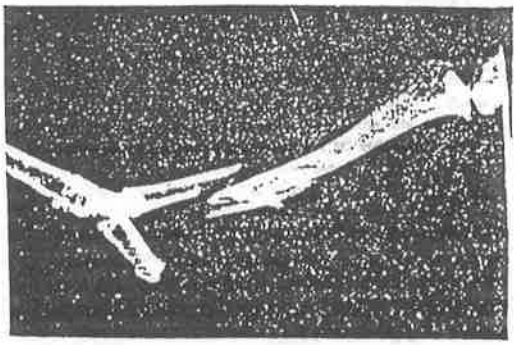

Fig 1. Sklagram showing multiple fracture of the distal tibia.

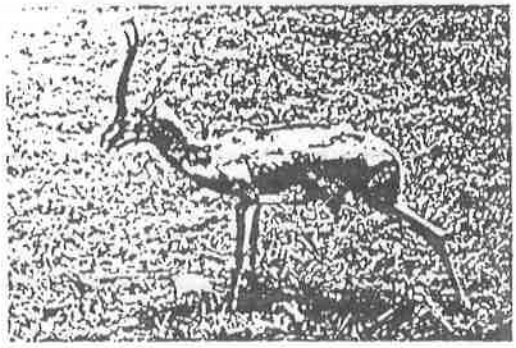

Fig 2. Animal after surgery.

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A.P. Agricultural University, College of Veterinary Science, Tirupati 517 502.

[1] Calmpose, Ranbaxy Laboratories Ltd., Thane
[2] Ketamil, Helpro Health Products and Services, New Delhi
[3] Dicrysticin, Sarabhai Chemicals, Baroda
[4] Furacin, Smithkline Beecham Pharmaceuticals, Bangalore

Acknowledgements

The authors are very much thankful to Dr. O. Ramakrishna, Professor of Surgery, College of Veterinary Science and the authorities of the S. V. Zoological Park, Tirupati for their cooperation and suggestions.

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Reprint : Zoos' Print, 4 (3) : 15-16, March, 1989

Operation Inmobilization Translocation of Lion

By Dr. R. H. Sabapara. Sakkarbagh Zoo, Junagadh

Gir Forest in Gujarat is the origin and natural habitat for Asiatic Lions. The population of Lion in Gir Forest has increased from 25 according to 1930's census to 239 according to 1985 census due to protection of these animals by the Government. The major portion of the feed of these carnivores comprises of domesticated animals like cattle, buffaloes, goats, sheep etc., which are easily available and easy to capture. But since last year the natural feed had been scarce and so they have been driven out of the jungle area.

Lions are scared of tall grass, flies and insects. All these factors make them move towards plains. This happens particularly in the rainy season.

There was a group of six Lionesses which were reported to have killed a few cattle, buffalo and a young boy of about 17 years of age, after entering into nearby villages of Devalia Range.

Now it was a group of only Lionesses and that's why it was possible for them to shift into another territory; if there had been any lion along with them then it would not have been possible because of the tendency of the male to fight with males, of other territory for territorial rights and females.

The actual operation was started on 9th October 1988 with the help of our devoted officers and hunters of Sasan forest; first, all sizes of Lionesses were driven in to an enclosure about 25 x 25 ft.

Driving these animals from an open jungle to a small enclosure was a very exciting and skillfull operation. Our hunters are trained and highly experienced. They kept a prey with them. Making a very peculier kind of noise (Kukavo) and showing the prey, they attracted the Lionesses and slowly moved towards the enclosure. They kept a watchful eye over lionesses which came behind the prey and in this way all six Lionessess were coaxed into a small enclosure.

These animals had to be shifted to another enclosure, about 40 - 50 km away and for that it was essential to put all animals in small cages and for doing so, the only convenient way was to tranquilize the Lionesses.

It was very late that evening and to carry out immobilization procecure during night hours was difficult.

So on 10th Oct 1988 early in the morning tranquilization was carried out.

Ketamini Hydrochloride and Rompun were used as immobilization agents and for darting Dist. inject M-60 mode gun & pistol were used.

Five animals were given 1000 mg of pure Ketamine and one animal was given 500mg Ketamine and also injections clinically. Two animals were given an additional dose of Ketamine plus Rompun.

These animals were given Ketamine only as an additional dose.

They were shifted to three different cages in group of two animals. Our aim was to release all these animals at Bhavathirth which is a place 40-50 km away from Devalia Range. It is away from human and domesticated animal population; so that animals can not invade villages. Bhavathirth is a place full of natural resources suitable for Lion habitat viz; adequate herbivorous population, dense jungle with patches of plains, adequate water faciiities etc., It took about 7 hrs to cover those 40-50 km because of the bad condition of roads after rain.

Befor releasing, each animal was treated for wounds and other injuries and were given Ampicillin 1500 mg. Five of the six animals were released that evening which were normal in health and condition. Sixth one we could release only the next morning because it was vomiting due to previous days over feeding and tranquilization effect. Next day she was completely normal and was released after symptomatic treatment.

Four of the six animals were tagged before releasing to identify that group in the future.

At regular intervals we are getting reports of the whereabouts of those animals and according to that all animals have settled in the new area nicely-one which was released later is still alone but in good health.

Now villages of Devalia Range have got rid of danger from Lionesses.

This way our operation was completed satisfactorily in in all aspects.

Detailed information about the drug used and its effect on those animals is given in the following page :

* This paper was presented at the All India Zoo vets Symposium held at Chandighar December, 1888.

Detailed Information Regarding Tranguilization of Lionesses

SR No.	Observation	Lioness-1	Lioness-2	Lioness-3	Lioness-4	Lioness-5	Lioness-6
1	First Dose Drug.	Ketaset	Ketaset	Ketaset	Ketaset	Ketaset	Ketaset
	Dose	500 M. g.	1000 M. g.	1000 M. g.	1000 M. g.	1000 M. g.	1000 M. g.
	Time	8-00	8-10	8-17	8-21	8-27	8-32
2	Imbalance Time	8-05	8-11	8-22	8-24	8-30	8-37
3	Completely Unconcious	8-08	8-20	8-27	8-32	8-39	8-45
4	Addl. Dose Drug.	Ketaset	Rompum & Ketaset	Ketaset	—	Ketaset + Rompum	Ketaset
	Dose	300 M. g.	300 + 200 M. g.	200 Mg.	—	200 + 200 M. g.	200 M. g.
	Time	8-39	9-00	9-05	—	9-15	9-10
5	Recovery Time	11-15	9-45	10-00	12-45	9-50	11-30
6	Tag No.	04598	—	04061	04570	—	04563
7	Time of Release	17-30	17-42	17-50	7-45	17-46	17-47

Reprint : Zoos' Print, 6 (5) : 8, May, 1991

CHEMICAL IMMOBILISATION OF HYENA *(HYAENA HYAENA)*

Rajesh Gopal, Director, O. P. Uchadiya, Asst. Director, Sumukh Joshi, Range Officer
Bandhavgarh National Park.

ABSTRACT

This paper discusses the chemical immobilisation of a severely wounded hyena (*Hyaena hyaena*, Linnaeus). Hellabrunn mixture (HBM) was used for the tranquilisation and observations were recorded until complete recovery.

General: Chemical restraint of many wild animals has been done successfully in our country using the Hellabrunn mixture. This mixture, when used intramuscularly, produces the proportionate effects of Ketamine and xylazine within 15 to 20 minutes.

Study Area: Chemical immobilisation of the hyena was done at Tala (Bandhavgarh National Park). The animal was brought in a severely wounded condition from the Karkeli range of Umaria forest division (Shahdol district) and was immobilised for medical treatment.

Material and Method: Rifle type 'dist-inject' projector was used for immobilisation along with a 5 ml. dart and an appropriate activating charge.

Immobilisation and Observations: The animal was tranquilised on 25.7.90 and 29.7.90 for medical treatment. The hyaena was weak with multiple maggot-ridden wounds on the face, earlobes, lower jaw, chin and back. The left foreleg appeared fractured and the animal was moving with a limping gait.

On both days, four ml. of Hellabrunn mixture was prepared by mixing 4 ml. of Ketamine (100 mg/.ml) in a vial containing 500 mg. of xylazine Hcl (Rompun) dry substance. The observations are as below : -

25 July 1990

1. 1 ml of freshly prepared HBM (125 mg xylazine and 100 mg ketamine) was injected at 3.50 p.m. The animal was moving inside the enclosure after receiving the dart.

2. Reflexes appeared normal even after 10 minutes and the animal limped around in small circles with its tongue protruded out.

3. The movement of the thoracic cage was faster after the 12th minute.

4. After 15 minutes, the animal was seen licking some spilled over water inside the enclosure and showed no signs of immobilisation.

5. At 4.30 p.m. 1 ml. of HBM was again darted.

6. Within four minutes, the animal sat down with a staggering gait.

7. After the sixth minute complete tranquilisation was achieved to facilitate medical treatment. Reaction to sound was seen as slight movement of ear lobes which persisted up to twenty minutes after the second darting.

8. Regurgitation was seen once; however urination, defecation or post capture complication of any sort was not observed.

9. At 6.10 p.m. the animal fully recovered and started moving.

29 August 1990

1. 2 ml. of freshly prepared HBM was darted at 2.10 p.m.

2. The animal started panting soon after receiving the dart and started moving in small circles with a limping gait.

3. At 2.16 p.m. the animal staggered and sat down and within a minute was immobilised completely to facilitate surgical dressing of wounds.

4. The animal recovered at 9.30 p.m.

Discussion:

Hellabrunn mixture has been successfully used in our country for the chemical immobilisation of cheetal *(Axis axis)* barasingha (*Cervus duvauceli branderi*), tiger (*Panthera tigris*), panther (*Panthera pardus*) and Wild buffalo (*Bubalus bubalis*) (Kotwal, P.C.). For wild dog and wolf, a dosage of 1 to 1.5 ml. of HBM has been recommended.

Since the animal was weak, the dosage was initially kept as 1 ml. which however proved ineffective. Complete tranquilisation was achieved in a short span of 6 minutes with 2 ml. of HBM which produced no remarkable post-capture complication. Thus a dosage of 2 ml. of freshly prepared HBM is effective and convenient for the tranquilisation of the genus Hyaena.

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Reprint : Zoos' Print, 5 (10) : 24, October, 1990

Translocation of a striped hyaena (*Hyaena hyaena*) at Trichur Zoo

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Translocation of animals is often a necessity in any zoo. Chemical immobilisation is one of the methods employed for their safe transfer. In the present paper, translocation of an aggressive hyaena by chemical immobilisation is reported.

The hyaea *(Hyaena hyaena)*, male, weighing about 40 kg, very aggressive and not tractable, was controlled by noosing with a nylon rope, around the body, just behind the shoulders. It was brought close to the bars of the cage and secured. By hand injection, 3 ml droperidol-fentanyl mixture (Innovar Vet - Pitman Moore, Inc.,Washington Crossing, USA 1 ml containing 20 mg droperidol and 0.4 mg fentanyl citrate) was administered intramuscular. By the third minute after the injection, the animal became unsteady. It assumed the position of sternal recumbency by the eighth minute. It got up immediately and started walking, though with an unsteady gait. By the 21st minute, a second injection of 1.5 ml of the mixture was administered. Three minutes after the second injection, the animal assumed the position of sternal recumbency, immediately followed by lateral recumbency and was fully under anaesthesia.

The hynena was taken out of the cage and transferred to the other cage.It was kept in the position of lateral recumbency. After about four hours, muscular twitching was observed. Pentozocine lactate (Fortwin - Ranbaxy, Delhi) 60 mg was administered intramuscular. It could not stand up and continued to be in the lateral recumbency on the second day also. Pentozocine 60 mg was repeated. On the third day, it got up itself and was normal in habits thereafter.

Discussion

This had been the first attempt by the authors, to anaesthetise a hyaena. The dose recommended for dogs i.e. 0.12 to .016 ml/kg bodyweight (Cheeran *et al*, under publication)was administered. Since the effect was not satisfactory, half the dose was repeated. With this dose, the animal was under, but remained to be on a position of lateral recumbency for a prolonged period. However, no untoward effect could be noticed and recovery was uneventful.

Summary

A report on the translocation of a striped hyaena, at Trichur Zoo, using droperidol-fentanyl mixture, is placed on record.

Acknowledgement

The authors are grateful to the Dean, college of Veterinary and Animal Sciences, Mannuthy, for permitting to publish this paper, and to the Superintendent, Trichur Zoo, for the facilities provided.

Reprint : Zoos' Print, 6 (11) : 56, November, 1991

PROFORMA FOR MEASUREMENTS AND OTHER INFORMATION DURING OPPORTUNISTIC IMMOBILIZATION OF ELEPHANT (Elephas maximus)

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SUGGESTED PROFORMA -- Sample Data Sheet from actual immobilisation

1. **Date :** *19.06.91*

2. **Domestic or wild:** *Wild*

3. **Sex:** *Female*

4. **Age:** *20 - 22 years*

5. **Locality:**

   State: *Tamil Nadu*

   Circle: *Wildlife Western Circle*

   Division: *Mudumalai WLSanctuary*

   Range: *Masinagudi*

   Beat/Block: *Moyar, Compartment 12*

6. **Purpose of operation** *For Radio collaring*

7. **In herd or alone:** *Herd (24+ elephants)*

8. **Ambient temperature at the time of darting** *31.0 °C /87.8 F*

9. **Nature of terrain:** *Undulating*

10. **Physical condition of : the animal darted (observational)** *Good*

11. **Name of the Drug or Drug combination used** *Immobilon*

12. **Dosage:**

The animal had to be darted twice. On the first attempt, the dart bounced off rib on striking the animal. Most of the drug was injected but a part of it was spilled out. The animal went down but was conscious and recovered and moved off before an additional dose could be administered. It was darted again after a chase. The second daring was done from a very close range. This time the cannula got detached from the needle and most of the drug spilled out, but the little that got injected was sufficient to tranquillise the animal. The exact dose could not thus be calculated. But the first dose of 2.75 ml. Immobilon, had brought the animal down even with spillage. This would have been sufficient if the dart had not bounced off, spilling a part of the drug.

13. **Weapon used** *Palmer's Capchur gun*

14. **Syringe Caliber:** *5 ml.*

15. **Cartridges used:**

1) Red (High) but did not discharge properly. Dart went low and allowed animal movement even at that short range to shift strike area from shoulder to rib cage.

2) Green (low) - This cartridge also did not discharge properly, the dart barely falling out of the barrel.

3) Green (low) — worked well

16. **Time of Darting:**

First darting: *13:33:13 hr.*
Second darting: *not recorded*

17. **Darted from:**

First darting: *on foot*
Second darting: *Elephant back*

18. **Darting range:**

First darting: *25 metres*
Second darting: *5 metres*

19. **Induction time:**

First darting: *13:47 hr. (14 minutes)*
Second darting : *Not Recorded*

20. **Body physiological condition and visual symptoms observed after immobilization (Vital signs).**

a) **Temperature:** *Not recorded*

b) **Pulse:** *36 per minute*

c) **Respiration:** *Deep and regular; 8 per minute*

d) **Recumbence:**

The animal went down in a nulla with dense vegetation. Though it was in a lateral recumbancy (left) position, the neck was in an awkward position as the animal was in a nulla. Kumki elephants were used to shift it into a sternal recumbancy position first and then into partial lateral recumbancy (right) position.

e) **Visible mucous membrane** *Healthy pink*

f) Ocular reflexes: *Not present*

g) Skin reflexes: *None*

h) Secretions/excretions: *No discharges observed*

21. Body measurements

a) Height (at shoulder): *7'6" to 7'10"*

b) Neck girth: *Not recorded*

c) Circumference front foot: Left: Right:

d) Head and Body length: *Not recorded*

e) Tail length: *-do-*

f) Length of Body (PS - PH):

g) Ear (L/R)

Length:
Width:
Fold:

h) Number of Nails: Left: Right:

22. Tushes measurements: Left: Right:

a) Length outer curve: *Not recorded*

b) Length inner curve:

c) Basal circumference

d) Mid-girth:

e) Width between tushes:

At Base:

Middle:

Tips:

f) Conformation:

23. Colour of eye: *Light grey*

24. Other particulars: *General condition good*

25. Supportive therapy given with results: *N.A.*

26. Time taken for

a) Collaring: *14:29:47 hr. to 14:37:09 hr. (7 min.22 sec.)*

b) Surgery if any: *N.A.*

c) For roping if captured: *N.A.*

d) For initial roping, loading, unloading, etc. during translocation: *N.A.*

27. Drug used for Reversal (Antidote): Revivion

28. Dose

1) 2 ml
2) 3 ml
3) 3 ml

29. Time of injection and route:

1) 1431 hr : I/M
2) 1436 hr: I/V
3) 1441 hr: I/V

30. Time when the animal recovered: *14:44:52 hr*

31. Observation during recovering process:
Started feeding immediately after getting up.

32. Total time animal was immobilized:
14:20(approx) to 14:44:52 2/5 minutes

33. In case of translocation: *N.A.*

Drugs used for sedation: *N.A.*

Total period under sedation: N.A.

Distance translocated: *N.A.*

Mode of translocation: *N.A.*

34. Darts missed or drug loss

a) Drug Name:

b) Quantity

c) Reasons for fault:

35. Any other comments :

Because of the awkward position in which the animal was lying, and the fact that an unknown quantity of drug (immobilon) had been injected, no measurements were recorded and the dense vegetation did not permit any supportive treatment. The collaring was done even as the antidote was being administered and the animal was showing signs of recovery.

36. Veterinary Doctors present:

a) Dr. V. Krishnamurthy (B.N.H.S.)
b) Dr. Jacob V. Cheeran (K.A.U.)
c) Dr. Md. Zachariah (FVO, TNFD)

37. Darting done by: Ajay A. Desai(B.N.H.S.)

38. Remarks: Transmitter frequency - 165.228

39. Data recorded by: M. Balasubramanian (B.N.H.S.)

Reprint : Zoos' Print, 6 (11) : 32, November, 1991

IMMOBILISATION OF FREE-RANGING TIGRESS USING HBM - FOR MEDICATION AND TREATMENT IN KANHA NATIONAL PARK

P.C. Kotwal, Research Officer, Project Tiger (Kanha) Mandla, M. P.

Kanha National Park (also Tiger Reserve) is famous for its scenic wilderness, variety and abundance of wildlife and excellent management. Out of many interesting things, tiger tracking by elephants is of prime importance.

One day (on 19-3-88) a young tigress of Chuhari area in Kanha was seen by elephant trackers having a wound in the neck on the right side. This information reached Mandla town (Headquarters of the Tiger Reserve, 70 km.) through the wireless message system operative in the tiger reserve. Immediately a veterinary doctor was called along with wound dressing equipments and medicines to attend the emergency. In the meantime, another wireless message reached Mandla that the tigress has run away in the forest. This caused a serious concern to the officials. All efforts were made to re-track the tigress so that it could be properly treated. As a result of this the tigress could be again tracked four days later on 23 March 1988 at about 5 p.m. Then it's wound was about one inch in diameter and watery secretion was oozing out showing signs of infection. The tigress was not able to lick the wound directly due to its lateral position on the neck. In order to retain the tigress, a live goat bait was given which she killed in a normal way. During this time, it was noted that the tigress was frequently shaking its head/neck due to pain of the wound and to keep flies away. After making thorough observations, it was decided to immobilise the tigress next day morning for dressing the wound.

Next day on 24 March 1988, the tigress was again tracked from elephant back after about three hours of tracking. Then it was darted using a blow pipe, because the Tel-Inject rifles did not retain the air pressure and thus, became non-functional. It was not thought proper to use the Dist-Inject rifle because of fear of sustaining another wound due to heavy impact of the dart. So, in such a situation it was thought correct to use the blow pipe, although little risk was involved in this. The wounded tigress would have to be approached very close for darting by blow pipe. This is perhaps the first case of darting a free-ranging tiger by blow pipe. The details of daring, wound dressing, respiration, etc. are given below:

9.25 am – Darted 3 ml. drug mixture (HBM) containing 250 mg. xylazine and 300 mg. Ketamine by blow pipe using plastic dart of 3 ml. capacity. The tigress was sitting on a rock which was higher in elevation than the elephant. As the dart hit, the tigress quickly came down the rock and moved aobut 50 - 60 steps.

9.40 am -- Again darted 300 mg. Ketamine by blow pipe similarly when the tigress was still ambulatory.

10.00 am -- The tigress sat down and seemed to be under the drug effect. We came down from the elephant and touched the tigress. It raised its head. Again 200 mg. ketamine was injected by hand syringe.

10.10 am to 10.45 – The tigress was totally immobilised. Thereafter given the following medicines - effortil, penicillin and analgin.

The wound was oozing and there was swelling around it. Although there were no maggots but the wound was severely infected. It was thoroughly cleaned and dressed. Applied Soframycine ointment, Furacine powder and sealed by Helax spray. There was another small wound on the right shoulder having pus. It was also cleaned and dressed.

10.50 am -- Again given effortil and another dose penicillin. The tigress was 253 cm. in length. Temperature was 104 o F. Respiration 16/ minute. The tigress was lifted and kept in nearby shade. Then we got up on the elephant back to watch the tigress for some more time.

11 am -- Respiration 24/ minute.

11.15 am -- Movement of head. By this time, the sun became quite hot. Water was sprayed on the tigress from bamboo containers and syringe to keep it cool.

11.40 am -- Respiration 44/ minute.

11.50 am -- Respiration 57/ minute

12.00 am -- The tigress tried to get up on spray of water.

12.07 pm -- Another attempt to get up; she moved a little.

12.16 pm -- - do -

12.30 pm -- The tigress walked a few steps slowly and sat down

1.00 pm -- The tigress gradually started walking at intervals and taking rest. She reached near a small water hole in the nullah and sat down in the shade. Thus, the tigress was almost recovered from the effect of anesthetic drugs. Thereafter a close watch was kept on the tigress and the wound was regularly monitored..

Three days later on 27 March 1988, the tigress was tracked in the afternoon. By this time the wound had recovered considerably. Given one vial of 6 lakh units long acting penicilline by blow pipe for quick healing of the wound. On 5 April 1988 the tigress was again tracked. By this time its wound had almost healed.

Thus the wounded tigress had been successfully treated in time using the modern techniques of capture, dressing and healing the wound. The cause of the wound could not be ascertained. However it seems that she might have sustained the injury while preying upon a male chital or a wild boar. Photographs of this operation could not be taken because camera was not available in Kanha proper on that day.

Reprint : Zoos' Print, 6 (11) : 33-34, November, 1991

IMMOBILISATION AND RADIO-COLLARING OF GOLDEN JACKAL (*Canis aureus* Linn.)

P. C. Kotwal, Research Officer, Kanha, B. C. Sharma, Dy. Director, Kanha,
D. K. Pandey, Research Scholar, Kanha

INTRODUCTION

The jackal is one of the most enterprising animals. It has wide distribution on account of its indiscriminate habits (food/breeding) and habitat requirements (forest, grasslands, around human habitation). It has been considered as vermin on account of its scavenging habits and common occurrence. Therefore this animal has been least attended for either any special management or study purpose in India. However it has been relatively better studied in other parts of the world, particularly in the African subcontinent (Hugo and Jan Van Lawick - Goodal 1970).

In recent times it has been illicitely hunted extensively to quench the thirst of its pelt-lovers as is evident from the seisure of large hawls. It's pelt is much liked in making fanciful and utility items. As a result of long-term cumulative effect of these activities and other ravaging habitat factors, its population has been seriously depleted in the recent past all over the country.

However trade of its pelt has been banned along with other animals and their products, under the international convention of trade in endangered species of flora and fauna (CITES) of which India is one of the eighteen signatories along with several countries of the world. Legal protection is also being provided by elevating its status under the provisions of Wildlife (Protection) Act 1972. Thus, the importance of this animal has been realised which was much overdue.

Jackal commands an important "niche" in the ecosystem food-web by its peculiar food habits. It is a daring scavenger and normally feeds on the carcasses left by predators such as tiger and leopard. It also feeds on insects, crabs, frogs, etc. The herbaceous diet comes from the fruits of Amaltas (*Cassia fistula*), Ber (*Zizyphus jujuba*), Jamun (*Syzigium cumini*) . Around human habitation, it feeds on kitchen wastes. Sometimes it also preys on domestic chickens.

In Kanha National Park it has adapted to habitatual depredation on ungulate fawns. The jackals form small packs of 2 - 4 and venture to chase and kill the fawns of chital (*Axis axis*) black buck (Antelope cervicapra) and also of barasingha (*Cervus duvaucelli branderi*). It has been attributed to be one of the reasons of dwindling the population of black buck and barasingha. It frequently attacks on chital fawns due to common chance encounter but because of their high population the effect is not clearly visualised. The habit depredation is in a particular set of conditions such as open area with scattered small bushes having high density of ungulates. Their predatory instinct is also noticed in other parts of the country such as in West Bengal (Chattopachyay).

Thus, considering the importance of the jackal, systematic and detailed observation of this species in Kanha were planned.

Material and Methods:

The animals are uniform in colouration and as such it is difficult to differentiate the individuals. However, sex, body size, natural marks such as cut ear pinnae, peculiarity in tail, legs, spots on body, peculiar behaviour of animals do permit individual identification. Still, identification of some individuals is difficult. Therefore it was planned to capture a few animals and radio-collar or label them suitably. Accordingly a female jackal was radio-collared in the neck, so that its range of movements, social, hunting, and scavenging activities could be studied. By nature jackal is extremely suspicious for anything that may pose least danger to it and without loss of time intelligently avoids such things. therefore it is very difficult to capture this animal without injury either by trapping, snaring or by darting.

Attempts were made to capture the jackal without sustaining any injury. Trap cages were kept near the kill on which four jackals were feeding, after keeping the kill in the trap cage, but in vain. The jackals dig out the sandy soil about 1.05 m deep near the bait end of the cage overturning it but did not venture to enter through the open gate of the cage. This was repeated time and time again and each time the jackal did come near the cage but did not enter. Free-ranging jackals seldom come in darting range for chemical immobilisation.

This time the jackals were allured on a dead chital and managed to enter in a carnivore-proof enclosure (28 ha) where 27 black bucks and 13 chitals were kept. The trap cage was kept in the hole (through which jackals had entered), and then the jackals were systematically driven towards the hole. Thus one female entered into the cage and still managed to escape. The jackal in the cage was injected with 0.75 ml. of BBM (Hellabrum mixture - ketamine : xylazine in ratio of 100 : 125 mg). After three minutes of drug injection, the animal became immobile.

Results and discussion:

The body weight and measurements were taken as follows:

Weight	7.5 kg.
Length from nose to tail end	113 cm.
Tail	30 cm.
Height at shoulder	30 cm
Girth- neck	25 cm
chest	40 cm
belly	50 cm.
Number of nails in forepaw	5 each
hind paw	4 each
Mammae	6 (3:3)

The blood haemoglobin content, as measured on the spot by A.O. Haemoglobinometer was 10.5%. The body temperature was 37% C. some ectoparasites, as ticks were collected from the body. A radio-collar weighing 373.4 gm (frequency 151.225) was tied to the neck. The animal did not vomit or defaecate during the operation. It produced foul smell by secretion of some glands, perhaps as a sort of automatic defensive mechanism as was in case of wild dog immobilisation (Kotwal 1981).

One ml. of Effortil was injected after 35 minutes of darting and five minutes later to this, the animal become mobile and gradually moved away. The rate of breathing before immobilisation was 44/minute, during drug effect it reduced to 20/minute and later 24/minute. One ear tag was also given but the animal somehow dropped it three days later.

The anesthesia was given to the animal to keep it immobile during the process of above mentioned operation. The condition of the animal was very good under the drug effect as was evident from normal temperature and breathing rate. No after-effect of the drug was noticed in the animal after several days of immobilisation as the animal was being regularly radio-monitored.

The monitoring of radio-collared jackal revealed that it moved in a limited area in Kanha meadows from lower Cabin to barasingha fencing, Niran chhaper area and Menha nullah. The behaviour with conspecific was frightening *(sic)* as a result it moved all alone. In about a month, the radio-collar stopped functioning. Thereafter the animal was monitored by merely seeing the radio collar in the neck. After rainy season the animal was not traceablo in the area.

The habit of depredation of hunting ungulate fawns is a significant adaptation causing depletion of the ungulate fawns, particularly endangered species like black buck and barasingha, thus adversely affecting their population. The home range and denning sites of jackals are in the same area where these ungulates mostly live throughout the year. This increases chance encounter with ungulate fawns.

=Although jackal occupy an important "niche" in the ecosystem yet its leaving the scavenging habits and partially predating on the fawns of ungulates particularly the endemic endangered species like barasingha should not be taken lightly.

Hence manouverial management practices should be considered as a solution to the problem without affecting either population. Induced concentration of jackals in prime barasingha area has to be lowered because jackals can exist in either area as well but the barasingha being an exacting species can live only in selected areas where its habitat requirements are fulfilled (such as swamps, ponds, tall grasses like Saccharum spontenceum).

Except for such specific situation, the jackal deserves to be looked upon as an important animal contrary to the present day vermin position. Failing which this handsome scavenger animal occupying an important "niche" in the ecosystem food-web may also meet with total extinction.

References:

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Abstract:

The jackal has been considered as vermin on account of its common occurence and scavenging habits. It has been least attended for either any management or study purpose in India. But as a scavenger it occupies an important "niche" in the ecosystem "food-web". Therefore systematic studies were planned. Data pertaining to first time chemical immobilisation, radio-collaring and some biological aspects have been detailed in the paper. The animal also exhibits predatory instinct on ungulate fawns. This has also been highlighted in the paper.

Reprint : Zoos' Print, 7 (6) : 3-7, June, 1992

Chemical Immobilisation of Indian Mammals in Captivity

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Editor's Note: This is a paper written for the Post-graduate course in Wildlife diseases and management, Zoological Society of London. The paper was to be a written essay on an aspect of wildlife disease or capture relative to the trainee's own country. Navin Kumar has selected Chemical Immobilisation of Indian Mammal as his topic. We are proud to publish this excellent paper and feel that it will be of use to veterinarians in India.

Abstract:

During the last two decades a number of drugs have become available which, when used separately or when combined with another, have facilitated the handling and movement of nervous and aggressive animals. These drugs are usually grouped according to their principal properties into Narcotics such as Etorphine and Fentanyl and sedatives such as Azaperone and Xylazine and anaesthetics such as Phencyclidine and Alphaxalone.

Knowledge of the clinical pathology of these drugs and of the different responses found amongst the various mammals is necessary if the effect required is to be accurately and safely obtained. Narcotics, for instance, are contraindicated in the felidae on account of their severe excitatory side effects but in some carnivorous families the milder side effects can be overcome by combining the narcotics with a sedative.

This paper sets out to describe these different effects and to show that an understanding of them is important when selecting the appropriate drug for a particular case.

Introduction

Veterinarians working in zoos are becoming more involved in the care of wild animals kept in the zoos and wild parks. The concept of this paper is to share the experience with Veterinarians working in various zoos in India. A decade back there was no captive equipment and drugs hence various physical restraints were adopted, in the process a few animals died due to capture stress, injuries, fractures and so forth. The safest means of capture is to immobilise chemically which facilitates the veterinarians to attend to clinical diagnosis, surgery and translocation of captive animals. In recent years immobilising agents were developed.

Drugs used to tranquilise and immobilise wild animals vary from species to species. These drugs and their combinations act at various sites within the brain to produce tranquillisation, sedation, analgesia, anaesthesia. The chemical immobilisation may vary depending on factors such as drug molecular size, pH and ionic change, route of administration, tissue change and leakage, amount of drug per body weight (dosage) and other variables such as species of animal, age, sex, season, time of day, animal behaviour and pathologic condition.

The most useful and safe dosage is that which rapidly immobilses an animal without causing adverse side effects. The immobilising agent should preferably be reversible and rapidly eliminated.

During the course of the study at Whipsnade Wild Animal Park during 1991-92 a few immobilisations were done with immobilisation drugs and in combinations on a few species. The most common drugs used were Immobilon, Etorphine, Xylazine, Ketamine, Telezol, Medetomidine. Data listed in the table are based on practical experience during the course study of Wildlife Diseases and Management offered by the Zoological Society of London to veterinarians during 1991-92. The animals listed are limited to common species in Indian zoos.

Etorphine hydrochloride (M-99):

Pharmacology: Etorphine hydrochloride was described as a synthetic morphine-related derivative. Etorphine can shortly be described as a potent analgesic and narcotic. In ungulates it produces excitation followed by analgesia, alleviation of the feeling of fear, loss of aggressiveness, depression of respiration, stiffness of the muscles of neck and limbs, inhibition of gastrointestinal and ruminal motility and lowering of the body temperature. At low doses animals will remain on their feet but ataxia and a certain amount of excitement will dominate the condition. Injected animals walk away with a typical mincing gait. At higher doses the animals will stop in a cataleptic state or lay down in sternal recumbancy. Excitement is covered by deep analgesia and areflexia. The consciousness is depressed but not totally lost.

Following intramuscular injection the first signs of action are seen after 4-5 minutes and the duration is a few hours. The action of Etorphine may be reversed through competitive antagonism by the morphine antagonists Diprenorphine (Revivon) M-50.

In elephants, rhinoceros and wild horses and wild ass, Etorphine also produces a tranquilising effect and Etorphine given alone usually at very low dosage gives sufficient immobilisation. In most other ungulates, especially in nervous species in the wild, the excitement may cause injuries to the animals. Higher doses of Etorphine will immobilise even these animals after an initial state of excitement, but muscle relaxation is poor. Etorphine mixed with a suitable tranquillizer may completely eliminate the excitement and potentiate the effect of Etorphine thus allowing the dose of Etorphine to be lowered. Etorphine is commercially available as Immobilon and contains 2.45mg/ml Etorphine hydrochloride and 10mg/ml

Acepromazine. It is also available as Etorphine hydrochloride alone.

Antagonist
Diprenorphine (M-50) is a specific antidote developed for Etorphine. When given intra-venously it displaces Etorphine from the brain in from 30 seconds to 2 minutes. During that time the animal will awake and be capable of full defences. Etorphine and Diprenorphine are the bare derivatives and chemically related to morphine.

Pharmacology of M-50
Diprenorphine is a narcotic antagonist used to reverse the effects of Etorphine (M-99).

Indications
Diprenorphine acts as a depressant on the central nervous system and if used in excessive dosage may complicate recovery.

Administration
Diprenorphine is injected I/v, if possible, otherwise I/m. The recommended dose is twice the milligrams of the injected dose of Etorphine. When injected I/v reversal usually occurs in 1-4 minutes. I/m injection requires 15-25 minutes for reversal effect.

Side-Effects
No side effects should be noticed unless an overdose is given. An overdose will cause narcosis similiar to low doses of Etorphine.

Xylazine (Rompun) - Pharmacology
Xylazine is a non-narcotic sedative, analgesic and muscle relaxant. It acts in the central nervous system, stimulating norepinephrine release at Alpha-2 adrenergic receptor sites causing animals to appear sleepy. Stimulation during the induction stage may prevent optimum sedation. When approached suddenly a sedated animal may rouse explosively with reflexive defense mechanisms like kicking, biting may not be abolished.

Indications
Xylazine is used as a mild sedative and at higher doses for immobilisation. It can be used singly or in combination with other drugs for a wide variety of species. The primary role in wildlife immobilisation is in combination with narcotic and dissociative agents where it markedly enhances their effect and can improve reversibility of the condition. It is very effective in captive or tame animals rather than in excited or free-ranging wildlife. Xylzine has been used alone to capture various species of deer, but prolonged induction times and other side effects severely limit situations in which it is a drug of choice. Xylazine may be given intravenously or intramuscularly. There is a wide species variation in the optimum dosage. Immobilisation occurs within 3-5 minutes following I/v or 15-30 minutes after I/m. Analgesia lasts from 15-30 minutes by sleep like state is maintained for 1-2 hours. Duration of action may be quite long, often in excess of 5 hours.

Side-Effects and Precautions
Occasionally muscle tremors, bradycardia and partial A-V block occur with normal doses. Atorphine should be given if necessary to prevent cardiac effect. Xylazine also causes relaxation of the distal oesophagus, rumen and intestinal stasis, which can result in reflex or regurgitation and aspiration or rumen contents, bloat and other gastro-intestinal problems. Xylazine produces an additive effect when combined with tranquilizers and barbituates. The analgesic effect is variable. The depth of analgesia should be ascertained before clinical diagnosis or surgical procedures are begun.

Antidote
Yohimbine hydrochloride (Antagonil): Yohimbine hydrochloride causes rapid and often complete recovery from xylazine sedation. Other reversal agents are available for Rompun: Antisedan, RXB2002A, Colx.

Ketamine hydrochloride - Pharmacology
Ketamine is a non-barbituate dissociative anaesthetic agent. The animal usually retains normal pharyngeal-laryngeal reflexes. This desirable effect minimizes inhalation of ingesta near the glotis. Ketamine does not produce skeletal muscle relaxation. Nystagmus may be noted during induction. Profound analgesia is rapidly produced. Excessive salivation can be alleviated with Atrophine. Ketamine is detoxified in the liver. Metabolites are excreted via the urine. Ketamine produces a fixed expression in the eyes. The eyelids are dilated and stay open yet the cornea usually remain moist. Peripheral reflexes persist. Because swallowing reflexes are usually unaffected, excessive saliva is swallowed as usual. Induction is characterised by ataxia. This ataxia can be a problem in some species if no tranquilizer administered concurrently. The animal lies down. The animal becomes insensitive to external stimulation. Lateral nystagmus appear, then disappear with increased depth of anaesthesia. Ketamine may be safely and effectively used for anaesthesia of numerous other species of wild animals. It is particularly effective in wild carnivores, reptiles and birds but not suitable for most ungulates with the addition of a sedative or tranquilizer. The duration of effect varies with the species and dosage administered. Recovery is usually smooth in carnivores and furbearers. In ungulates, recovery may be stormy so Ketamine is usually combined with a tranquilizer to balance its anaesthetic effects, allow lower doses of Ketamine, smooth recovery and improve the recovery time.

Side-Effects and Precautions
Ketamine causes tonic clonic convulsions in few wild felids. Other carnivores are similiarly affected. Primates are less commonly effected. Convulsive effects can be obviated by administering Diazepam with a Ketamine antidote. There is no known clinical antidote for Ketamine.

Medetomidine - Pharmacology
This is a potent sedative and specific full agonist of both pre- and postsynaptic Alpha-2-adrenoceptors. The Alpha-2/Alpha selectivity ratio of Medetomidine is 1620 as compared with 160 for Xylazine. Medetomidine is a racemic mixture, the active isomer is predominantly the D-enanticimer (discamedetamidine). Medetomidine acts by modulating noradrenaline release

on adrenalinergic nerve terminals and is devoid of affinity for beta-1, beta-2, H1, H2, 5-HT, 5HT2 muscarine, dopamine, tryptamine, GABA, my- and delta-type opiate and benzodiazepine receptors. Characteristic effects of medetomidine in animals include sedation, analgesia, relief of anxiety, bradycardia, hypotension and hypothermia. At high doses medetomidine has hypnotic or anaesthetic effects. Medetomidine is metabolised in liver and metabolites are excreted mainly in the urine.

Antidote: Atipamezole is a reversal agent for medetomidine (and xylazine).

Tiletamine hydrochloride and Zolazepam hydrochloride (Telazol) - Pharmacology: Tiletamine hydrochloride is a cyclohexanone dissociative agent related to Ketamine hydrochloride and Phencyclidine hydrochloride. Zolazepam hydrochloride is a non-phenothiarzine pyrazalodiazepinone tranquilizer. Zolazepam effects include sedation, muscle relaxation, but no bradycardia. The combination capitalizes on the desirable characteristics of each while minimizing the side effects. Combined Tiletamine hydrochloride-Zolazepam hydrochloride is used for chemical immobilization and surgical anaesthesia in a wide variety of carnivores, artidactylids, birds, reptiles and amphibians. Onset occurs within 5-12 minutes after intramuscular injection. Recovery is prolonged.

Antidote
There is no specific antidote for Telazal. There is no a reversal agent called Benzodiazipinis sychas zylazepam.

Acepromazine Maleate - Pharmacology: Acepromazine maleate is a phenothiazine derivative and has been used in veterinary practice in most countries for a long time. Acepromazine is a nervous system depressant which, used on its own, produces sedation in most animals at low dosage. It will trigger anticonvulsant, hypotensive and weak analgesic action and potentiate the effect of analgesics and barbituates. As other phenothiozine derivatives it is an adrenalytic and should not be used on exhausted and excited animals. Disturbances of the heat regulatory mechanism in shade-loving antelopes has been observed under field condition. This can be quite significant.

Indications
Acepromazine is rarely used alone for immobilisation purposes but rather in combination with Etorphine, Ketamine. Its muscle relaxation characteristic is of particular value when used with Ketamine and Phencyclidine.

Side-Effects
Acepromazine In combination with other hypotensive agents occasionally , instead of producing central nervous system depression, acts as a stimulant and hyper-excitability ensues.

Drug Combinations

"Hellabrunn" Mix
The mix is prepared by dissolving 500mg Xylazine dry powder in 4ml of 100mg/ml Ketamine solution. The combination has a 45-60 minute duration of action and can be used in a wide variety of mammals, birds and reptiles. To increase the duration of effect, Ketamine should be given i/v or i/m. The mix gives good muscle relaxation in mammals, birds and reptiles unlike Ketamine alone, which produces muscle rigidity and tremors. Due to the high level of Xylazine in the mix, if ruminants are not fasted for 24 hours there is a risk of ruminal tympanic developing. In antelope, relaxation of the tongue and pharynx leads to a risk of asphyxiation in these species, therefore it becomes necessary to intubate antelope by giving Hellabrunn mix and place them in sternal recumbency for the duration of the immobilisation. The mix has a very slimey emetic effect in all carnivores, particularly big cats which can be prevented with administration of 1-2mg Atrophine prior to the mix. Elephants are also sensitive; 1-3ml is adequate for elephants for minor procedure.

Combination of Etorphine and Xylazine
Etophine alone produces muscle tremors which are abolished if combined with Xylazine. The duration of action of the combination is approximately 45 minutes (though can be much longer) and has the advantages of being reversible with the use of Revivon. The authors recommend Revivon should be administered at twice the Immobilon dose. The animal should be observed for 10 hours after immobilisation due to the risk of renarcotisation. Side-effects, especially in equids, include tachycardia and sweating.

In antelope and horses, disturbances of blood pressure may also be seen and occasionally these may lead to spontaneous heart failure. The combination if contraindicated in cats and primate and as such is extremely dangerous to the operator and reversal agents should be on hand in the event of accidental injury. Literature review and field trial at Whipsnade with this combination has recorded that time to onset of immobilisation was shorter than with use of Etorphine alone. Excellent muscle relaxation for almost any surgical procedure; no problems with reversal of effect using anatagonist, M50 and Yohimbine. This combination offers the advantage of excellent muscle relaxation and opportunity for rapid reversal of drug action.

Combination of Xylazine and Ketamine
In ruminants this combination provided quick immobilising action and good muscle relaxation. Because Ketamine is metabolised more rapidly than Xylazine, recovery is more rapid than when anaesthesia is induced with Xylazine alone.

Combination of Medetomidine and Ketamine
This combination can be used to induce complete immobilisation. In trials on captive leopards, Medetomidine has been found to have a potency up to 30 times that of Xylazine, allowing a 3/4 reduction in Ketamine doses required for immobilisation, a reduction time to onset of deep sedation, improved myorelaxation during immobilisation and an improved reversal with a reduction in the degree and duration. These effects are entirely due to the increased Alpha-2 effect. The same would be seen if more Xylazine were used though the volume would be increased. The combination of Medetomidine and Ketamine provides good immobilisation for a

variety of minor surgical procedures in exotic felid and canines. The recommended dosages: 233mg/kg Medetomidine; 2.33mg/kg Ketamine - though it is preferred to use less Medetomidine and more Ketamine because of the cardiac depression of Medetomidine.

Discussion

Quite a lot of mammalian species were immobilised during the course study of Wildlife Diseases and Management offered by the Zoological Society of London at Whipsnade Wild Animal Park, out of which a few Indian mammals immobilised can be of great interest for vets working in captive conditions where they can adapt the procedures of immobilisation with confidence. These animals were immobilised for various reasons like clinical, surgical, haematology and translocations. The dosages of immobilising drugs best suited is given in table 3 and in all care was taken especially in herbivores to see that there was no regurgitation. Monitoring the depth of immobilisation like respiration, pulse, temperature right from induction time to recovery is very important with regular intervals of 5-10 minutes. This helps to know the depth of anaesthesia. One of the most recent developments noticed was dependent upon the type of operational procedures required on the animal.

It was interesting to observe that endotracheal tube and inhalation anaesthesia were applied. Augumented anaesthesia or increasing the depth of anaesthesia was used in animals previously immobilised by injectable agents. They are the major general anaesthetic agents in balanced techniques because they can be quickly installed or removed from animals through the respiratory system and the depth of anaesthesia can be precisely controlled during the cause of a prolonged surgical procedure. One advantage in placing an endotracheal tube in an animal is the availability of a means for support of pulmonary ventilation. Intubation facilitates treatment of atelectasis with palitive premire and prevention or treatment of abnormalities in arterial carbondioscids by increasing or decreasing minute volume.

It is an advantage to be able to supply increased concentrations of oxygen to the alveoli and in a limited way to provide a potential means for evaluating the health of respiratory function. This is accomplished with an anaesthetic machine that can run in a closed configuration. For all species inhalation anaesthesia follows the quantal dose response concept, which states that the incidence of effect increases as the dose increases, that is, inhalation agents are predictable which is not true with injectable agents which tend to be unpredictable and idiosyncratic from one animal to the next and from one species to another. Some of the effective inhalation anaesthetics used were Halothane, Isoflane. The combination of immobilising drugs in practice at Whipsnade Wild Animal Park also did give good response and excellent results especially the combination of Immobilon and Xylazine.

Conclusion

Ketamine hydrochloride on primates in recommended doses is a good immobilising drug, has good induction, sedation and restraint, fair muscle relaxation. It is good for short procedures such as translocation, TB testing, blood collection and radiography but causes slight salivation. In ruminants the combination of Etorphine and Xylazine gave a shorter time to onset of immobilisation than with the use of Etorphine alone. Excellent muscle relaxation is produced for almost any surgical procedure and there are no problems with reversal of effect using antagonist.

The combination of M50 and Yohimibine offers the advantages of excellent muscle relaxation and opportunity for rapid reversal of drug action.

The combination of Xylazine and Ketamine in ruminants provides quick immobilisation action and good muscle relaxation. Because Ketamine is metabolised more rapidly than Xylazine, recovery is more rapid than when anaesthesia is induced with Xylazine alone. This combination in Felidae is best for immobilisation, good analgesia, good muscle relaxation, good safety margin, and the best oral anaesthetic for wild carnivores.

Ketamine alone is a good analgesic and gives good immobilisation for surgery with some muscle twitching. In Canidae, Ketamine alone is a good analgesic and gives good immobilisation but with convulsions and seizures. Combination with Xylazine is the best immobilisation, good analgesia, good muscle relaxation, good safety margin and is the best overall general anaesthetic for wild canines.

Miscellaneous Considerations

Immobilising drugs are potent and dangerous. In India except for Ketamine hydrochloride, none are available. Xylazine is now being imported and marketed by one or two firms and is very expensive. Since Etorphine is a narcotic, so far no clearance has been given by the Drug Enforcement Department hence import of Etorphine into the country needs lots of excise and formalities to be cleared. Drug companies are unable to justify the expense in importing and carry out extensive testing necessary to licence a drug for use in wild animals. However, immobilising agents must be used by the zoo veterinarians if proper health care is to be given. There is a decided advantage in using combinations that allow dosage reduction. Skill and experience are prerequisites to the successful combination of immobilising agents.

Acknowledgments

I am most grateful to the Zoological Society of London for offering this course in Wildlife Diseases and Management during July-December 1991. We are indebted to Barkley Hastings, Course Director, who was instrumental and initiated support and guidance during immobilisations at Whipsnade Wild Animal Park. Thanks to Richard Kock, Curator Veterinary Office, Whipsnade Wild Animal Park, for having us with him in immobilisations for translocations and re-introductions. Thanks to James Bonnet, Veterinarian, Whipsnade Wild Animal Park, who was at all the immobilisations carried out at Whipsnade.

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Table 1.
List of Common Immobilising Drugs

Name	Trade-Name	Class of Agent
Etorphine	M-99	Narcotic
Ketamine-Hydrochloride	Vetar/Ketar	Cyclohexamine (Dissociative)
Xylazine	Rompun	Sedative/Tranquillizer
Tiletamine- Zolazepam	Telazol	Cyclohexamine (Dissociative)
Meditomidine	Dormitor	Alpha2 Antagonist

Table 2
Drugs Used to Modify Effects of Immobilising Agent

Name	Trade-Name	Class of Agent
Diprenorphine	M-50	Narcotic Antagonist
Diazepam	Valium	Benzodiazepine
Yohimbine-Hydrochloride	Antogonil	Xylazine Antagonist
Acepromazine-Maleate	Acepromazine	Phenothiszine Tranquillizer
Atropine-Sulphate	Atropine	Parasympatholytic
Atipamezole HCL	Antisedon	–
RX821002A	–	Alpha2 Antagonsist

Table 3
Recommended Immobilising Drugs and Dosages

Species	Drug 1	Dosage (mg/kg)	Drug 2	Dosage (mg/kg)	Drug 3	Dosage (mg/kg)
Primates	Ketamine	8-10				
	Telazol	2-6				
Cervidae	M99		Xylazine	Tilazol		
Hog Deer	M99	1.5-3mg	Xylazine	3-4mg/kg		
Barasinga	M99	3-5mg				
Axis Deer	M99	3-6mg	Xylazine	3-4mg/kg		
Sika Deer	M99	2-4mg	Xylazine	3-4mg/kg	Tilazol	4.5-5mg/kg
Bovidae			Xylzine		Tilazol	
Nilgai	M99	4-6mg	Xylazine	3mg/kg	Tilazol	6-8mg/kg
Yak	M99	3-8mg	Xylazine	0.6-1mg/kg		
Gazelle	M99	2-3mg			Tilazol	2.5-15mg/kg
Black Buck	M99	2-3mg	Xylazine	3mg/kg	Tilazol	4.5-10mg/kg
4-horned Antelope	M99	2-3mg	Xylazine	3mg/kg		
Mouflon	M99	1-2mg				
Gaur	M99	5mg				
Felidae	Ketamine	5-10mg/kg				
	Telazol	1.5-5mg/kg				
	Ketamine & Xylazine	10mg/kg of Ketamine & 2mg/kg Xylazine				
Canidae	Ketamine & Xylazine	10mg/kg Ketamine & 2mg/kg Xylazine				

Reprint : Zoos' Print, 7 (8) : 18, August, 1992

RECORD OF BEHAVIOUR OF ASIATIC LION ON BEING IMMOBILISED AT NEHRU ZOOLOGICAL PARK, HYDERABAD

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A twenty-three month old Asiatic lion had been suffering with swelling paws of left hind limb and right fore limb. On 20 February 1992 at 12:20 p.m., 200mg Ketamine Hcl and 40 mg Xylazine was given to the animal using Dist.Inject Pistol (30). The syringe hit the hind portion of the thigh and fell down after two minutes. The animal displayed fearful and furious behaviour in the beginning and became even more furious on being hit with the syringe, roaring, charging, and defecating.

At the sixth minute the animal began to stagger in the hind limbs and two minutes later in the forelimbs also. After ten minutes the animal lost control of his hind portion and lost balance. At thirteen minutes the growling sound was reduced. At seventeen minutes when the doctor approached, the animal charged him giving a loud roar as the sedative had not completely taken effect.

At eighteen minutes the animal was taken to the adjoining cage so that the empty syringe could be collected to ascertain if the sedative had gone into the system. It could be ascertained that the entire quantity of sedative had been injected. The animal entered the adjoining cage with staggering gait.

At twenty minutes when the lion was still growling, the doctor decided to administer an additional 200 mg of Ketamin Hcl. At twenty-five minutes the dose was administered by hand syringe. At twenty-six minutes the animal gave a big roar at the approaching attendant. At the twenty-eighth minute the animal rested in sternal recumbent position with its chin on the ground. The animal exhibited fast breathing due to the effect of the drug.

At twenty- ninth minute it growled sitting in the same posture. At the thirty-fourth minute the animal gave a powerful growl when purposely disturbed. At the thirty-seventh minute the eyes were still blinking. At the fortieth minute the animal was totally down with suppressed growl but would lift the head when incited.

At the forty-third minute the animal was pushed with improvised implement to a convenient position for examining the paws. The animal was still emitting a low growl. At the forty-fifth minute there was no blink of the eye. The doctor examined the hind limb left paw for any mark of thorn prick or wound but nothing could be observed.

The animal was turned for examining the forelimb right paw. Still he was emitting a low grow. At the fifty-fifth minute thrombophob was applied to the swollen paws. The animal was not under complete sedation but it was given treatment nontheless. The eyes were blinking.

At the sixty-seventh minute the respiratory rate was relaxed. The iris of the eye was reflecting light with greenish blue tint. At the seventy-second minute, the head and eyes reponded to stimuli. The iris contracted; there was periodic blinking of eyelids. The breath of the animal was not deep at this stage. At the seventy-fourth minute the animal moved its head in response to a call. At the 82nd minute the animal lifted its head and again rested it on the ground. From the eighty-second minute to the ninety-fourth minute the animal periodically lifted the head, gazed around and snarled at any disturbance. At the ninty-fifth minute it tried to stand and sat upon its hind part.

At the ninty-sixth minute the animal stood up but fell immediately. At the ninty-seventh minute the animal assumed the sternal recumbent position and looked around with swinging head and body. At the ninety-eighth minute the animal stood up at the sound of Axis deer call, although it could not stand long. It sat on the hind part with straight forelimbs, looking around with swinging body. Then it slowly rested in lateral recumbent \position with head still up but swinging and casting wary looks all around.

At the one hundred and fifth minute the animal walked with staggering gait and sat on his hind portion. At one-hundred and seventh minute, the animal covered a few steps with staggering gait before falling on its left flank. It again struggled to get up. At this stage the rate of respiration was increased and the animal took occasional deep breaths.

Reprint : Zoos' Print, 8 (4) : 11, April, 1993

Xylazine-Ketamine anaesthesia *** in a Red Panda (*Ailurus fulgens*)

Dr. G. Chakraborty, A.D.V.D. Padmajanaidu Himalayan Zoological Park

Red Panda is an endangered species and declared as a Schedule I animal under Wildlife Protection Act, 1972. A female adult Red panda weighing about 5-6 Kg showed an open wound on the neck region. It was decided to tranquilize the animal for treatment. A combination of xylazine and ketamine ** was used. The drug combinaton was taken together in a plastic projectile syringe and administered in the neck region with a blowpipe. Xylazine (0.5ml) and ketaset (0.5ml) were used. The approximate dose of xylazine and ketamine was 2mg/kg and 10mg/kg body wt. respectively.

The induction time was around 7 minutes. Temperature and respiration remained normal. Eyes remained open and salivation was scanty. Within 10 minutes necessary clinical procedures were completed. The animal took about 3 hrs for full recovery from anaesthesia.

The best chemical agents for immobilizing the procyonidae is a combination of ketamine and xylazine (Wallach & Boever,1985). The present study revealed that xylazine-ketamine anaesthesia is well tolerated by the Red Pandas. The sedative, analgesic and muscle relaxation properties of xylazine is useful for combination with ketamine without any ill effects.

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* xylazine-Farvet Lab. Holland.
** Ketaset - Fort Doge Lab, U.S.A.

Reprint : Zoos' Print, 8 (6) : 12, June, 1993

TRANQUILISING THE COMMON LANGUR IN THE SRI VENKATESWARA ZOOLOGICAL PARK, TIRUPATI

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Scientific name : *(Presbytis entellus)*

Sri Venkateswara Zoological Park, Sprawling over 5,500 Ac is in the developmental stages. Few moats and enclosures are completed for primates, Herbivores and lesser Carnivores with a future plan for various safaries in the first phase. Two aviaries are constructed for Parakeets, Munias and Weaver birds. Animals and birds are released as and when the moats or enclosures are completed. The animal keepers are in the process of training in rearing, feeding and capturing the animals.

On 23-3-1992 two (1+1) Common langurs were left in the wet moat. The width of the moat is 7 mts, and depth 2.4mts. The Central island is turfed green and there are few branched dry logs fixed in the soil as perches. The male was showing agressive behaviour and frequently attacked the female.

Since it is a wet moat , water is pumped out periodically for the purpose of cleaning. On 3-6-92 when the water was being pumped out, the frantic female jumped out of the moat taking the back of cleaning person as a spring board. The animal, however, was caught physically by the Zoo Staff, and was put back in the moat. The first escape, though was not a great escape, boosted its confidence and on 5-6-92, the female again jumped out of the moat, holding support of the dangling water pipe on the front side of the moat, meant for drawing out the moat water. So under forced conditions the animal could clear 7 mts. This time, again the animal was cornered and caught by the Zoo-Staff with little more difficulty and caged. The erratic behaviour of lone alfa male has made weeding, cleaning etc., of the island of the moat impossible, as none of the keepers dared to enter in. So it became inevitable to tranquilise and remove the animal from the moat.

On 24-1-93, at 11.30 A.M. the animal was tranquilised with Ketamine Hydrochloride. The dosage was just sufficient to impart sedation with decreased muscle tone. The syringe was darted from a blowpipe, the air pressure was given with a foot pump. The syringe was blown towards the target from a distance of 7mts. The first syringe missed the target. The second syringe hit the right hip. The animal took an immediate 180° counter clock -wise turn, pulled out the syringe and threw it away. The animal again picked up the syringe, broke and crushed it with its teeth, inspite of our efforts, to keep the animal away from the syringe, fearing that the needle may pierce through its mouth. By 5th minute the animal evinced staggering gait. It did not prefer to walk. By 7th minute the animal started slipping while walking. By 8th minute the animal sat looking towards us. The animal stopped grinding its teeth, what otherwise was its regular habit. Blinking of the eyes was normal.

Now the range officer was allowed to enter the moat from the backside. The animal charged a little at the sight of the approaching person, but started walking slowly and sat again. Finally the animal was covered with a sack from behind and was held with a tight grip on the backside of the neck, with fore limbs, held back. When it was caged, it lay flat on the abdomen. After 10 minutes, the animal could get up and sit. After 1 1/2 hours it drank water. When the animal was provided with fruits and bread at 4 p.m. it did not eat. The animal was normal but drowsy. The next morning the animal took its normal food and exhibited normal behaviour.

Reprint : Zoos' Print, 9 (9) : 13, September, 1994

SHIFTING AFROASIATIC LION BY CHEMICAL IMMOBIZATION IN ASSAM STATE ZOO, GUWAHATI

B. S. Bonal [1], Dr. T. Barthakur [2], Dr. D. B. Thakuria [3], Dr. K. K. Sarmah [4], and M. Baruah [5].

The present stock of lions (5:3) at Assam State zoo are all inbred and " Afroasiatic" individuals. In the past few years, certain suspected adverse effects of inbreeding were observed in juveniles in the form of some peculiar nervous disorders which sometimes did not respond to any treatment and ultimately leading to death.

As per the guidelines of the Central Zoo Authority of India it was decided to stop further breeding of these hybred lions. This paper outlines the methods adopted to separate the breeding pair. The operation was conducted Friday 3rd June, 1994 which was the wee ly off - day for the zoo. The weather was little cloudy (Ambient temperature : Maximum 28.3°C and minimum 23°C) and humid.

The two lions were confined to their respective feeding cubicles and kept starved on the previous night. The operation was started at 8 A.M. A darting pistol (Dist. inject Pistol, Model - 30) was used with blue cartridge. A 5ml metallic syringe (dart) with a barbed needle was filled with 3 ml Ketamin Hcl (Ketamil injection Troy Laboratory Private, Limited, Australia) (100 mg/ml) and 2 ml Xylazine (Xylazil - 100) (100mg/ml).

The lion, Mohan was first targeted from a distance of about 5 metres and shot on the right buttock. Induction was evident after 15 minutes and the animal vomited a little. At 8.30 A.M., he was completely immobilized and was found with dilated pupils and slow respiration. He was taken out of the cubicle on a stretcher and shifted to a large iron cage. At 8.45 A. M., 5ml of Curadex (Concept) , was injected intramuscularly to avoid any possible shock. Later 3 ml Yohimbine Hcl (Antagozil injection - Troy Laboratory Private Limited, Australia) was injected intravenously. After 3 minutes, the animal started lifting his head and looked around. At 9 A.M., he had recovered completely and started walking inside his new home.

The second operation was performed on the lioness, Kasturi at 9 A. M. under the same procedure (above mentioned) and was shifted to another iron cage. Both the animals were partially anorectic on the following day but regained their appetite within 2-3 days.

The shifting operation was performed very smoothly with the procedure followed. The drug delivery through Dist. inject pistol was perfect and did not cause any tissue injury. The Ketamin-Xylazine combination was selected considering its high potency, safety, and low volume requirement. (Pade, 1974; England and Kock ,1988). The Xylazine induced sedation and relaxation was reversed within 4-5 minutes by i/v administration of Yohimbine. Dexamethasone was administered i/m to prevent any eventualities like shock as the weather was hot and humid.

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Reprint : Zoos' Print, 11 (3) : 1-2, March, 1996

CHEMICAL CAPTURE OF ESCAPED WILD PIGS (*Sus scrofa cristatus*) USING IMMOBILON

B.M. Arora

Majority of the published reports on chemical immobilization/ restraint in wild ungulates refer to the use of Ketamine HCl, Xylazine HCl and Immobilon (Etorphine 2.25 mg/ml base plus Acepromazine 10 mg/ ml). More often, these chemical restraints have been done in combination of two drugs, usually Ketamine and Xylajine. These reports have helped to improve our knowledge about these drugs facilitating their proper usage in routine health management and shipment practices for the commonly exhibited species in zoological gardens. This report details our experience with immobilon used in capturing a herd of wild pigs (*Sus scrofa cristatus*) that escaped from an exhibit at National Zoological Park, New Delhi.

CASE REPORT

On the 23rd April, 1991, 8 adult and 2 very young wild pigs had escaped through a worn-out chain-link fence of their exhibit. Apparently, a male tusker had shown the way for others to follow suit. On the morning of 24th April, the escaped tusker along with 3 females were located hidden in the nearby vegetation. Our initial attempts to immobilize them with a 3 ml mixture of xylazine HCl and Ketamine HCL (each in concentration of 100 mg/ ml and in the ratio of 1:1 filled in the dart and shot from a distance by long range tranquilizing gun) met with little success. As a result of this operation, the animals left the area and sneaked into the other parts of zoo. The capture operation was postponed. Meanwhile strict surveillance was kept to prevent their escape out of the zoo premises. All the boars, remained hidden amongst the vegetation during the day in different parts of the zoo. On several occasions, they were observed to visit their enclosures during twilight hours. All efforts to trap them, however, met with failure.

Eventually we resorted to immobilize the pigs with Immobilon (containing Etorphine HCL 2.45 mg/ml and Acepromazine 10 mg/per ml.) using a total dose of 0.25 ml to 0.5 ml per young (aged about 1 year) and 0.8 ml to 1.2 ml per adult. The darts were shot through a long range tranquilizing gun. The immobilized animal was shifted to an exhibit of beat no.6 within half an hour. There it was revived by parenteral administration of diprenorphine HCl (m 50-50). Effortil (1 ml 1/M) was also administered before the animal was set free in the enclosure. Unfortunately, one of the four pigs captured and confined in the exhibit died on May, 3, 1994 due to traumatic injuries caused by her companions. Later, one boar died due to hyperthermia developed after 15 minutes of darting with dose of 1.2 ml immobilon. Also on 11th, June one sow managed to escape from the exhibit and ventured into an underdeveloped area lying between the old Fort and zoo boundary on the north-east side of the main gate of the zoo. Due to difficult terrain and dense vegetation, she could not be retrieved till 12 July 1991. The capture operation continued and by 12th July 1991 all the 6 pigs from different areas of the park were immobilized and captured safely.

For rehabilitation of all the 8 pigs kept confined in beat No.6, two new enclosures were constructed on priority basis in a remote corner of the zoo by 15th July, 1991. In the next two days, using a total dose of 0.5 ml of immobilon per sub-adult and 0.8 ml per adult, all these pigs were immobilized and transported by truck to the new enclosures. Later, they were revived with a double dose of M 50-50 administered intravenously and/ or intramuscularly.

RESULTS AND DISCUSSION

The results of immobilization of ten escaped wild pigs with immobilon and their revival with M50-50 have been summarized in the table. Because of the species' nocturnal habits, the capture-operation had to be conducted at odd hours.

Owing to the constraint of locating the darted animal (not necessarily immediately after the drug had produced its effect), the induction time was recorded as the interval between the time of darting to the time when the animal was observed immobilized or in the state of getting immobilized. This interval ranged from 7 to 16 minutes. Dosages of immobilon 0.5 ml per sub adult (about 1 year) and 0.8 ml to 1.2 ml per adult were found almost optimal for immobilization of escaped pigs. Boever (1986) advocated the use of immobilon 0.02 mg to 0.04 mg per kg. body weight for wild pigs. The succumbed boar, which weighed around 60 kg, received more than the prescribed maximum dosage of 0.04 mg/ kg body weight. The experience helped in fixing the dosages of immobilon for translocating these animals again. On both the occasions (i.e. for capturing the escaped pigs and later for translocation), the use of diprenorphine HCl (M 50-50) was found quite effective in alleviating the central nervous depression caused by immobilon. Remobilization usually occurred within 2 minutes when administered I/V and/or within 5 to 10 minutes when administered I/V and or I/M. Effortil was found effective in hastening the recovery.

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Table : Results of chemical capture of escaped wild pigs (Sus scrofa) using Immobilon

Animal's description	No.	Date	Immobilon dosage	Induction time	Remarks
1. Female (young adults)	3	(30 April, 1st & 2nd May, 1991)	1.0 ml	10-16 minutes	The animals reclined on their rear legs, went down on lateral recumbency and became completely unconscious. Soon shifted to an exhibit, revived with M 50- 50 (and also administered Effortil 1 ml, I/M).
2. Female (young adult)	2	(11 & 22 June, 1991)	0.8 ml	7-8 minutes	Immobilized. Shifted to the exhibit, revived with M 50-50 (and also administered Effortil 1 ml, I/M).
3. Female (1 year old)	1	(2nd May, 1995)	0.25 ml	15 minutes	Sedated only. Retrained manually, shifted to the exhibit and then revived with M 50- 50 instantaneously to avoid chances of capture myopathy.
4. Male (young adult)	2	(10th & 30th May, 91)	1.0 ml	8-16 minutes	The animals reclined on their rear legs, went down on lateral recumbency and became completely unconscious. Shifted to the exhibit, revived with M 50-50 (and also administered Effortil 1 ml, I/M).
5. Male (Oldest in the herd)	1	(16th May, 1991)	1.2 ml		After extensive shivering, hyperthermia set in and the animal collapsed in about 15 minutes.
6. Male (1 year old)	1	(27th June, 1991)	0.5 ml	15 minutes	Got immobilized but required extra manual restraint during shifting. Administered 0.5 ml xylazine HCl, I/M, with M 50-50 and then set free.

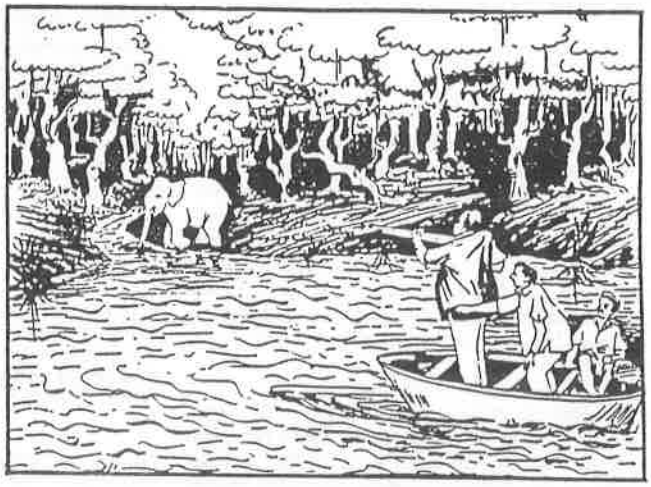
Reprint : Zoos' Print, 11 (4) : 27-28, April, 1996

CHEMICAL IMMOBILIZATION OF AN INJURED WILD TUSKER FROM A MOTOR BOAT

C. Venkatesan*, Jacob V. Cheeran**, K. Chandrasekharan**, K. Radhakrishnan** and A. Jayasudha*

INTRODUCTION

Immobilization of elephants is required for various reasons, including clinical examination and treatment, minor surgery, for research purposes and biological investigation (Kock *et al.* 1993). Etorphine hydrochloride in combination with Acepromazine maleate and its antidote Diprenorphine have been used successfully for immobilization of both domestic and wild elephants (Sale *et al.* 1986). This drug combination was used to immobilize a wild adult tusker in order to assess seventy of injuries and to carry out the necessary treatment. To our knowledge this is the first time an elephant has been immobilized from a motor boat. Hence, we considered this report a worthwhile contribution to drug immobilization of wild elephants.



HISTORY

The forest officers at the Agasthyavanam biological park, Trivandrum, Kerala reported an injured wild tusker to be frequently habiting the area close to the Peppara lake. People had expressed fear at the possibility of contamination of the waters in case the animal died at the water side. The authorities requested immobilization, examination and treatment of the elephant and if possible, translocation.

METHODOLOGY

The only safe approach to the animal was through the lake. A motor boat was used to scan the area of the lake bordering the forest, since the animal used to frequent the lake. The boat cruised a distance of 5 km from the starting point at Peppara dam and the elephant could be spotted at the lakeside after 5 hours of search. The body weight of the animal was estimated to be 3500 kg. Etorphine hydrochloride was calculated at the dose of 1 mg/450 kg body weight. The boat was stationed approximately 10 meters away from the elephant and the animal was darted from the boat with Immobilon1 3 ml (Etorphine hydrochloride 7.35 mg and Acepromazine maleate 30 mg) to hit its right shoulder region using locally made syringe projector and cap-chur gun syringe. The elephant wandered for a distance of 100 meters and fell into lateral recumbency in a down time of 5 minutes. The animal was examined soon after.

CLINICAL FINDINGS AND TREATMENT

Multiple, deep, punctured wounds and lacerations were seen on the trunk and at the region of the rump and perineum. The wounds appeared to have resulted from fight with another tusker. A fistula 45 cm long was seen above the commissure of the lower lips and trunk on the left side. Injury occurring at this site was probably due to the fact that the elephant lacked a tusk on its left side. A 20 cm deep wound was seen in the region of the left rump. The wounds were cleaned with Savlon solution. Pus and debris were removed by irrigating the wounds with hydrogen peroxide solution. The wounds were dressed with Charmil ointment2 and the animal was administered Benzathine Penicillin G3 576 lac units intramuscular. The entire operation lasted for thirty minutes, after which the elephant was administered the antidote Revivon4 (4 ml) intravenously. After 30 minutes, a further dose of Revivon (2 ml) had to be given to hasten recovery. The elephant made an uneventful recovery and started grazing four hours later.

SOME OBSERVATIONS AFTER IMMOBILIZATION

Prolapse of the penis, a common feature associated with drug immobilization operations in elephants was seen in the recumbent animal. The pulse rate and respiratory rate after 25 minutes of anesthesia were 67

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(normal - 34 to 46) and 6 (normal 5 to 8 in lateral recumbency) per minute respectively.

The first sign of revival noticed after the first injection of Revivon was movement of the tail. Penis was retracted at 17 minutes.

Movement of the ears was noticed 4 minutes after the second injection of revivon. The respiratory rate (per minute) was 9 at 6 minutes after the second injection. However the animal continued to be in lateral recumbency for about 4 hours.

DISCUSSION

The method of approach to target animals depends on the combination of many factors including the flight distance of the species, the type of country and vegetation cover, the size of the animal and its reaction to disturbance. (Harthoon, 1976). In this case it was risky to approach the animal from land because of the potential danger of the elephant entering water after being darted (see fig.). Darting the elephant from the boat and a watch at the lakeside removed the risks associated with immobilizing animals near water - holes.

The pulse rate after 25 minutes anesthesia was 67 / min. Elephants are unusual in having a greater heart rate lying down than when standing (Benedict F. C. 1936). Following I/V injection of the antidote Revivon, Recovery usually occurs within 2 to 15 minutes. (Fowler, 1978). Recovery reflexes noticed after I/V injection of revivon are movements of eyelids, trunk and head, followed by movement of limbs and tail (Appaya and Khadri, 1992). But in this case, the first recovery reflex noticed after the injection of Revivon was movement of the tail at 3 minutes, followed by movement of the trunk at 19 minutes. Although the elephant showed recovery reflexes 3 minutes after the injection of Revivon, a further dose of Revivon had to be given to hasten recovery. But prolonged recovery time was observed even after an additional dose of Revivon was administered. The fact that the animal was exhausted and weak at the time of immobilization probably resulted in a prolonged recovery time. Revivon neutralises the effect of etorphine hydrochloride, leaving behind the action of acepromazine to continue (Appayya and Khadri 1992). Delay in recovery has also been attributed to individual differences in tranquilizing effects of acepromazine. Appaya and Khadri (1992) reported that residual effects of etorphine due to recycling of the drug by enterohepatic circulation should be carefully observed and reversed by giving additional dose of the antidote, if necessary.

Literature citation indicate that the elephant cannot lie for a prolonged period on its side or on the sternum. However there are reports of elephants remaining in lateral recumbency for as long as 3 1/2 hours without showing ill-effects (Fowler 1978). In this case, the elephant was apparently normal even after 4 hours of lateral recumbeny. Lack of an ideal infrastructure ruled out the possibility of translocation of the elephant.

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Reprint : Zoos' Print, 12 (1) : 29, January, 1997

CHEMICAL IMMOBILIZATION OF BLUE BULL (*Boselaphus tragocamelus*) WITH KETAMINE - XYLAZINE MIXTURE AND ITS REVERSAL WITH YOHIMBINE HYDROCHLORIDE

K.K. Sharma[1], T. Barthakur[2], D. Thakuria[3], B.S. Bonal[4] and M. Barua[5]

The Assam State Zoo has a stock of Nilgai (*Boselaphus tragocamelus*) since 1961. They have been successfully bred and presently their number has increased to 15. As it has become difficult to retain the entire herd in the original enclosure (about 100 sq.m.), particularly in the face of two adult males fighting each other, it was decided to transfer a unit of two females and one male to another enclosure which is located about 200 meters away.

The translocation operation was planned on a Friday during November. The month is moderately cool with high relative humidity in Guwahati. Friday was selected as the zoo remains closed for the visitors. No food was offered to the herd since the previous evening. Out of the two adult males, the younger (approx. body wt. 200 kg) was selected for transfer and was darted on the quadriceps using a 3 ml. metal dart from a distance of about 7 meters. Xylazine[a] (100 mg/ml) - 2 ml. and Ketamine[b] (100 mg/ml) - 1 ml was filled in the dart which was projected through a Dist Inject Pistol[c] using a blue cartridge (art-2012) and an appropriate syringe charge (art - 2006).

The animal jumped and then galloped across the barn nervously on receipt of the dart. The first sign of sedation with lowering of the head and slight staggering, was evident after 5-6 minutes of darting. As sedation became stronger, the animal knelt down, head balanced against the ground, saliva drooling and the tongue protruded to one side. The darted animal would jump up and gallop again whenever disturbed by its curious companion. Whenever this happened the animal would stop quickly and go to sternal recumbency with hind quarters raised. Lateral recumbency was achieved after 23 minutes of darting. The animal was left undisturbed for 30 minutes and then examined for the depth of sedation by throwing a small dart. Subsequently on close examination, the animal was found deeply sedated. The limbs were tied with ropes and the animal was lifted over a gunny bag and brought out of the barn. The herd galloped nervously as the team worked inside and care had to be taken to avoid any accident

The animal was transferred to a hand puller and rushed to the new enclosure. The animal was unloaded under the shade of a tree and examined for vital signs. A remarkable respiratory depression and hyperthermia was recorded, but the cardiac functions remained within normal limits. The palpebral reflex was lost and the tongue was found dirty with soil

Cool water was sprayed over the body and the tongue was washed with clean water. Xylazine antagonist Yohimbine Hydrochloride[d] (10 mg/ml) - 3 ml was injected into the saphenous vein within 2 - 2.5 minutes, the animal jumped up to its feet and ran away to the opposite side but stopped under the shade of another tree, where it lied down again. When examined for the post reversal sedation, the animal jumped up and ran away.

Two females were also transferred into the new enclosure in similar way. For darting, apparently healthy and non-pregnant females were chosen and same amount of drugs were used with satisfactory results. The transfer procedure did not appear to have caused any physical and psychological distress to the animals which were observed closely for several weeks after the transfer.

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[a] Sedazine™- Forte Dodge, IOWA 50501, USA.
[b] Ketamine, Laboratories Cheminova International, SA.
[c] Mod - 30, Peter Ott Co. CH- 4007, Basel, Switzerland.
[d] Antagozil, Troy Laboratories Pvt. Limited, NSW 2164 Australia

Reprint : Zoos' Print, 12 (6) : 36-37, June, 1997

Combination of Chemical and Physical Restraint to treat an injured Rhinocerosus in the Kaziranga National Park

K. K. Sarma[1], B. Dutta[2] and S. Bonal[3]

Kaziranga National Park (KNP), with its marshy alluvial expanse, shelters about 1200 Great Indian rhinos (*Rhinoceros unicornis*) which is the world's largest population in a single place. This population accounts for about two thirds of the world's population of this highly endangered species. It is a challenging task for the wildlife department to keep poachers at bay for the horn of rhino brings a high price on the international market. Even some of the rhinos which escape with gunshot injuries may eventually succumb to injuries if not spotted and treated in time.

The rescue and treatment of these injured animals presents great difficulties due to the limited resources available to the state wildlife department. Furthermore, an animal immobilized with strong narcotics like immobilon can easily drown in the marshy habitat. Sedating the animals with milder tranquilizers which permit them to retain the use of some reflexes and then the judicious use o physical restraint with trained camp elephants is a safer option.

On 16th Sept. 1996, an adult rhino was spotted near the Chagalibeel in the Burapahar (Ghoraman) range of the western boundary of the KNP. The rhino was limping as the result of a gunshot wound (1.5 cm in diameter) over the shoulder. The injury might have been inflicted by a poacher during the recent flood when many of the rhinos stray into the nearby Karbi-Anglong Hills, crossing the National Highway or the nearby paddy fields. The injured rhino was guarded by the forest department personnel until veterinary aid could reach him.

On 18th September 1996, our veterinary team reached the site in two canoes. The rhino was spotted at the bank of the marsh below a high tension electric tower. The area was under about 5 feet of deep water and the nearest bank was about 50 meters away. The bank was muddy and uneven caused by the foot marks of rhinos and elephants.

The rhino was approached by two large, well-trained camp elephants, Joyraj a tusker, and Devilal a makhna, both very robust and courageous. Initially, the injured rhino attempted to charge. On close observation, the rhino was found to be in distress and there was growth of blue-green algae on its back indicating that the rhino was constantly in the water for several days. The rhino apparently preferred to remain in the swamp due to difficulty in bearing its body weight on land.

With the level of resources and preparedness, the prognosis was considered to be unfavorable. Under the circumstances, the objective of the treatment was to dress the wound and remove the bullet if possible and subsequently inject long acting antibiotic and supportive drugs.

Though Immobilon has proved to be a safe, efficient and versatile immobilizing agent for rhinoceros, the authors decided against its use because of (i) the proximity to waterbodies, (ii) poor physical condition of the animal, and (iii) because surgical anaesthesia was felt unnecessary for achieving these minor objectives.

With the help of these trained elephants, the rhino was driven out of the deep waters to the muddy bank. A total of 1500 mg of Xylazine (15 ml, 100 mg/ml) was administered using projectile syringe in a Distinject system in two shots (10 ml in the brachiocephalicus muscle over the neck and 5 ml in the quadriceps femoris muscle in the hind quarters). The rhino, lame as it was, responded with a jerk but did not run away. After 7-8 minutes, the head dropped, the animal emitted an audible snore and salivated. Trembling of the body and drop in the respiratory rate were also noticeable. After 14 minutes, the animal was lying on the ground in a lateral position. The animal was approached and examined after 20-25 minutes of darting and was found to respond to nociceptive stimuli.

Both the elephants were used to hold the rhino in that position on the ground. The tusker had the added advantage of his tusks with which he maintained moderate pressure over the back of the rhino and did not allow him to move.

The high velocity bullet had fractured the neck of the scapula with possible damage to the radial nerve, leading to extensor paralysis. The wound was oozing offensive smelling sanguinous pus. The wound was drained, dressed properly with Tincture of iodine. However, the bullet could not be located on exploration. Probably the bullet has pierced through the neck of the scapula and entered the thoracic cavity. Now a long acting antibiotic (Oxytetracycline LA, 12000mg) - 60ml and concentrated B-complex (Conciplex-30ml) was injected intramuscularly.

The treatment procedure took about 40 minutes and on completion, the elephants released their hold on the rhino. A team of forest guards were placed near the rhino to protect it from predators and poachers.

Xylzine is not the drug of choice for immobilizing rhinoceros as it causes inadequate levels of sedation. Increasing dose only prolongs the duration of sedation and not the degree of sedation (Keep, 1973). Etorphine (M99), Etorphine plus acepromazine (Immobilon) and Carfentanil etc. have been used by various workers (Jenkins, 1978; Keep, 1981; Sale and Woodford, 1981; Allen et al. 1991). However, these drugs and their combinations cause complete immobilization of the rhinos, and if used in this case, could have led to accidental drowning. Therefore, a combination of Xylazine sedation coupled with the physical restraint provided by trained elephants allowed safe handling of the injured rhino.

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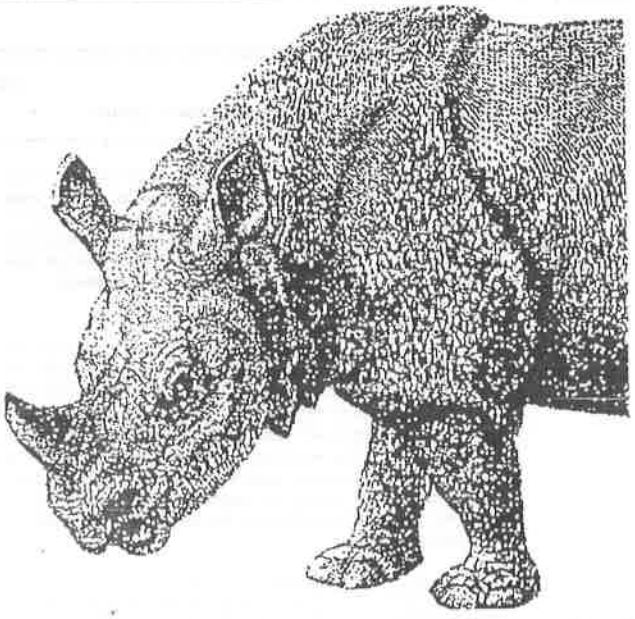

Reprint : Zoos' Print, 12 (7) : 24, July, 1997

Immobilization of Captive Budgerigars

M. G. Jayathangaraj* and Mathew C. John**

Restraint induced excitements are more significant in small cage birds. Selecting budgerigars as a case, a study was conducted to evolve a suitable method of short-time immobilization of small birds so that close medical examinations can be performed and biological sample can be collected without causing undue hardship to them.

Material and Methods

A batch of six numbers of adult budgerigars from a private aviary formed the study materials. Ether soaked in cotton and kept in polythene bags of double-lock type (size 26.2 x 21.2 cms), was used at the rate of 6 ml. per bird. Each bird was transferred from a wire basket cage. The reflexes and duration of anaesthesia were recorded. The same batch of birds were later administered with ketamine orally but at the i/m dose rate of 30 mg./kg. as suggested by Marx and Roston (1996). The drug was squirted into the buccal cavity using a tuberculin syringe.

Results and Discussion

The application of ketamine solution on the buccal surface failed to make any immobilization effect in these budgerigars. However, ether soaked in cotton effected immediate anaesthesia in them.

Ketamine has been recommended for immobilizing birds, both by parental administration (Beynon & Cooper, 1991) and oral administration (Fowler, 1995). Oral application has often been preferred to reduce stress and anxiety caused during injections.

Failure of immobilization after using the oral application of ketamine might be attributed to the high basal metabolic rate in this small sized birds. Furthermore, effects of ketamine are known to vary with species and individual (Bennett, 1991). During ether inhalation, the state of anaesthesia was assessed as informed by Price (1992). Though the loss of righting reflex is taken as the criteria to assess the state of anaesthesia, respiratory rate was considered important to assess the anaesthetic effects in these budgerigars.

The respiratory rate during general anaesthesia should be deep and regular and the rate should not be less than half that of the normal respiration in conscious birds (Price, 1992). The mean respiratory rate in this study was 71.7 per minute before ether administration and it was reduced to 45 per minute soon after anaesthesia was achieved.

Bennett (1991) recommended that short procedures could be performed on ether immobilized birds with less metabolic consequences and stress to the patient. Monitoring the respiratory rate in field conditions becomes more vital considering the difficulty in gauging the amount of ether inhaled by the birds.

The induction and recovery were faster in all the budgerigars and the main duration of anaesthesia was 4.3 minutes. Being a small sized bird (body weight ranged from 30-38 gms), the increased BMR may be attributed to this rapid recovery. Though usage of popular anaesthetics like halothane in birds is more advantageous (Beunon and Cooper 1991), ether has been chosen in this study because it is cheap, easily available and easily portable despite its highly inflammable property.

Acknowledgment

The facilities rendered by Dean, Basic Sciences, MVC and the cooperation rendered by private aviary owner are greatly acknowledged herewith.

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Reprint : Zoos' Print, 13 (3) : 23, March, 1998

CHANCE IMMOBILIZATION WITH HIGH DOSAGES OF XYLAZINE PLUS KETAMINE IN CAPTIVE WILD MAMMALS

B. M. Arora*

Chemical immobilization has become a routine operation carried out by zoo veterinarians. Though some level of expertise has been gained in drug immobilization and translocation procedures, the procedure is still fraught with potential dangers like mechanical injuries to the animal. However, veterinarians have often been blamed for any capture related deaths. Overdosage has often been sighted as reason in such eventualities. Narrated below are incidence of accidental overdosage while immobilizing animals with Xylazine and Ketamine.

During chemical capture operations, darts intended for a large animal might accidentally hit a much smaller individual. The Table furnishes the results of the effects of Xylazine & Ketamine (1:1 ration mixture) administered in high dosages than what is normally ascribed (Wiesner, H-Table 1).

The below dosages are not the recommended ones rather accidentally administered. In other words, administration of little high dosages of xylazine and ketamine mixture are not fatal provided proper care is taken in positioning the animals during the different planes of anaesthesia.

A little higher dosage may be required when Xylazine HCl preparation of 10% w/v solution is used in the mixture, instead of the dry powder, for mixing with the 10% w/v Ketamine HCl.

On many occasions, death is often on account of the animal either falling in inebriated state into moat trench or dashing against the fencing. This can cause cerebral concussion, broken neck, internal haemorrahage or asphyxia. Cardiac dysrhythmias are rarely encountered with Xylazine administration.

Table: 1 Chance immobilization of wild mammals in captivity

Species	(a) Recommended dosages of X+K in 1.25:1	(b) Chance dosage of X+K (in 1:1) injected	Fate in case of (b)
Chital (*A. axis*)	1.3 ml.	3.5 ml in one male frequenting in herd VPU Izatnagar.	Recovered after 1 hr.
Barasingha (*C. d. duvaucelli*)	2 ml.	4.0 ml in 8 yrs old male-VPU, Izatnagar.	Recovered after 1.30 hrs. Antidote+ & respiratory stimulant given.
Sambar (*C. unicolor*)	Variable.	7 ml* in two females & 6 ml* in one male. Restrain and crating from FTC Haldwani. (UP).	Recovered after 1 hr. without antidote and animal released safely.
Black buck (*A. cervicapra*)	0.3 ml.	2.75 ml adult female untargeted, in herd of chitals.	Antidote + adm. Animal recovered after 1 hr. Fig. 2(a,b).
Nilgai (*B. tragocamelus*)	**	4.5 to 5.0 ml in 2 adult animals. Translocation.	Recovered after about 2 hrs.
Lion (*P. leo*)	3 ml + 1.0 K	12 ml to capture 7 yrs old hybrid lion that escaped on 12th June '93 NZP New Delhi Fig.3(a,b).	Frequent vomitions as animal had its meal about 5 hrs before. Antidote + but given animal recovered after three hrs.

* In two divided dosages.

** Only Xylazine Hcl @ 3 mg per kg recommended (Boever W. T. 1986). However, I often used 3-4 ml of xylazine + ketamine mixture for restraining adult individual.

(a) Dr. H. Wiesner, Director Munich Zoo, Federal Republic of Germany recommended preparation of 500 mg Xylazine + 400 ml Ketamine (10% w/v) i.e. concentration of mixture 125 mg Xylazine + 100 mg Ketamine per ml to be used.

+ Antidote = Yohimbine Hcl (Conc. 10 mg/ml) dose 0.25 ml per 10 kg body weight.

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Reprint : Zoos' Print, 14 (4) : 6, April, 1999

Immobilisation of Wild Elephant (Tusker)

M. Navin Kumar

1. Species - Asian Elephant (*Elephus maximus*)
2. Date - 11-10-1998
3. Free ranging/Domesticated - Free ranging
4. Sex - Adult Bull (Tusker)
5. Age - About 32 to 35 Years
6. Locality - Pullimadugu Tanda
   Division - Chittur West
   Range - Kuppam
   Circle - WLM, Circle, Ananthapur
   Beat/block - Ramakuppam, Poolakunta
7. In herd or alone - Alone
8. Purpose of capture - The animal might have strayed out of the herd, reported raiding of Sugar cane, Ragi, Paddy crops, killed one women on 16 Aug 1998, injured one person. Regular crops destructor hence captured
9. Ambient temperature at the time of darting - Raining/ cool weather
10. Nature of terrain - Undulated terrain with dense vegetation, shrub forest
11. Physical condition of animal - Good
12. Date and Time of darting - 12.20 a. (midnight) 11.10.98
13. Name of drug combination - Immobilon (Etorphine with acepromozine)
14. Dosage - 4 ml. of (Containing 2.25 mg. of Etorphine HCL and 10 mg. of Acepromozine per ml.)
15. Darting range, whether done on foot or using a Kunky, vehicle or from machan - From a vehicle the animal was sited at a distance of 25 m. The animal was darted getting down from the vehicle and going by foot towards animal about 5 m.
16. Weapon, syringe calibre, cartridges used - 5 ml. dart using collared needle. 1-5 ml. charge for syringe / orange cartridge for propelling syringe observation
17. A) Search recovery time - After darting the animal was followed.
    B) Induction time - Could not be ascertained as it was pitch dark, the animal was found lying about 200 m. away from the darting site. The time was 12.50 A.M.
18. A) Vital signs (Body physiological condition and visual symptoms observed after immobilisation)
    a) Temperature -could not be recorded
    b) Pulse - 44/minute
    c) Respiration -12/minute.
    d) Recumbency - Left lateral recumbency
    e) Visible mucus membrane - Normal
    f) Oscular reflexes - Absent
    g) Skin reflexes - Tail/Ear Present
    h) Secretion/excretion - None
19. Body measurements
    a) Height - 9 ft. 8 inches
    b) Neck girth -269 cm.
    c) Colour of Eyes - Honey
    d) Circumference of the right front foot -139 cm.
20. Tusk - Assymetrical

	Right Tusk	Left Tusk
Outer length	108 cm.	93 cm.
Inner length	91 cm.	83 cm.
Mid girth	28 cm.	36 cm.
Tip girth	10 cm.	11 cm.

21. Ears - Right ear fold 2 cm., Right ear width 80 cm., Right ear length 59 cm.
22. Nails - Fore legs. 4+4, Hind legs. 5+5.
23. Other particulars - Middle aged tusker fit for domestication.
24. Supportive therapy given with results - Oxytetracycline/30 ml. I/M.
25. Time taken for roping after capturing - 1 hr. 10 min.
26. Drug use for reversal (Antidote) - Rivivon I/V Route
27. Dose - 8 ml. I/V
28. Time of injection and route - 2 A.M. dt. 12-10-98
29. Time when the animal recovered - 2.05 A.M.
30. Observation during recovery - Recovered with out any difficulty and stood

The tusker was trying to butt the kunky elephants and trying to break the chains and ropeneck. Hence the animal was sedated with Xylazine HCL and Acepromozine 3 ml. + 1 ml. with dart gun.

It was decided to tow the animal to the kraal at Naniyal camp office in the morning as the approach road was damaged due to heavy rains, and also due to darkness.

At 6.30 A.M. the animal started breaking the neckrope and tried to pull the chains and in the process they were loosened.

At 6.50 A.M. the tusker was again subjected to immobilisation by darting with Immobilon 3.5 ml. and 1.5 ml. of Acepromozine.

At 7.00 A.M. the animal went down on right lateral recumbency. The chains and ropes were tightened and again the animal was revived by giving Rivivon 7 ml. at 7.40 A.M. in the ear vein.

The animal stood up immediately within 3 minutes.

At 8.00 A.M. the animal was sedated with 500 mg. of Xylazine.

At 8.30 A.M. Dt. 12/10/1998 the animal was shifted to Naniyal base camp reaching at 1.25 P.M. Antibiotic, Oxytetracycline 30 ml. I/M was administered.

At 2.00 P.M. the animal was enkraaled. The effect of the sedative lasted till midnight. The animal started hitting the cross bars. In the moring again the animal was sedated with Xylazine and the kraal was strengthened.

The animal was darted by Sri. Mani, Live stock Inspector, Mudumalai, Tamil Nadu. The capture operation and veterinary help was conducted by Dr. M. Navin Kumar Asst. Director, Nehru Zoological Park, Hyderabad.

The capture operation started on 11.9.98 and exactly on 11.10.98 the animal was captured.

Asst. Director (AH), Nehru Zoological Park, Hyderabad

ZOOS' PRINT, Volume XIV, Number 4, APRIL 1999

CHEMICAL IMMOBILIZATION AND HAEMATOLOGICAL SAMPLING IN AN INDIAN FLAPSHELL TURTLE (*LISSEMYS PUNCTATA*)

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Introduction

In zoological medicine, there is a lack of documentation especially with regard to chemical immobilization in small reptile like turtles, tortoises, iguana, lizards etc. Chemical immobilization details along with sampling techniques is discussed in this paper.

Materials and Methods

Indian Flapshell Turtle found abandoned was brought to the Department of Wildlife Science, Madras Veterinary College and attempts were made to collect blood sample from this conscious animal. All attempts including the manipulation of hind limbs, mild stimulation at fore limb region failed to extend the head and finally, it was decided to immobilize the turtle chemically. The body weight of the study animal was 330 g. and Ketamine was used in the forequarters at a dosage of 139 per kg body weight on adjusted weight basis, using tuberculin syringe and 23G needle. The effects were noticed and blood sample was finally collected using orbital-sinus collection technique by means of a capillary tube. After the sampling, warm water bath was given to this animal and the reptile recovered completely, uneventfully. In order to avoid the probability of infection due to the adaptation of orbital-sinus collection technique, benzathine penicillin was given once at the rate of 50,000 I.U. per kg body weight by deep intra-muscular route at the fore quarters.

Results and Discussion

The effects of chemical immobilization in the study animal is shown in Table 1.

In turtles and tortoises, one should not expect the stress respones as noticed frequently in larger mammals and hence, it becomes necessary to reduce stress factors during the manipulation procedures for sampling purposes, biopsy purposes etc. by application of suitable immobilization techniques. Throughout the course of immobilization, the turtle was kept ina tray filled with water, the level of which was kept just below the relaxed head of the turtle and luke warm water bath was done for this animal after the sampling procedures were completed. Usage of ketamine in turtles, comparatively the long time taken for the induction of immobilization and recovery from immobilization effects with luke warm water bath, as done in this case was supported by the reports of Fowler (1986); Wallach and Boever (1983) quoted that the chemical anaesthesia of reptiles and amphibians is difficult and the induction, duration and recovery time periods in reptilian and amphibian anaesthesia are longer than in mammalian anaesthesia and ketamine was recommended for immobilization of turtles (Bennett, 1994). Usage of immobilization drug based on an adjusted weight by excluding 50 per cent of body weight as shell weight, as carried out in this case was in agreement with the reports given by Frye (1976). Though the immobilization for sampling purpose may be achieved by using ketamine in turtles like the present case, it should be remembered that ketamine must not be used in debilitatedreptiles and those with any liver diseases because the ketamine reduces the liver enzymes (Beynon & Cooper, 1991); Rosenthal (1997) too recommended usage of ketamine hydrochloride in reptiles and amphibians and quoted that muscle analgesia may be marginal but recovery is slow with high doses.

The site of choice for blood sampling in chelonians is the dorsal tail vein which lies very superficial exactly in the midline (Beynon & Cooper, 1991) and occipital plexus was the site used in tortoises (Raphael *et al.*, 1994); but, this aquatic animal had a small tail and the head could not be retracted by any type of gentle physical restraint measures and even in the extended head, the fixation of jugular vein for the sampling purpose was very difficult and hence, blood sampling was done from orbital sinus using blunt end of the capillary tube and was found to be one of the fast and easy method of collection of blood samples in an adequate volume required for the examinations in a well restrained turtle. Sampling of blood from orbital sinus as done in this aquatic animals is supported by the reports given by Warwick *et al.* (1995) who stated that blood can be sampled for clinical or research purposes from veins or various sinuses which are accessible by needle as in case of usage of orbital sinuses in lizards. However, the one of the minus point the zoo veterinarian could anticipate during this sampling technique in turtle is the probable damage to the corneal region and subsequent infections at the ocular regions if care is not taken. By experience and administration of antibiotic, these problems may well be overcome and the study did not show any evidence of ocular

Received 20 March 1998 *Accepted 3 May 1999*

Table 1. Effects of chemical immobilization in Indian Flapshell Turtle

Significant immobilization effects	Time of witnessing the change
Voluntary extending of head was noticed but still the animal was able to retract the head forcefully when touched.	22 minutes after immobilization
Partial relaxation of limbs which could not be achieved by all means earlier was achieved, along with the extension of head after immobilization with ketamine; but the animal was still able to retract the head fully and the limbs partially when the concerned regions were touched.	40 minutes after immobilization
Absence of response of the limbs when the extended head grasped.	53 minutes after immobilization
Satisfactory extension of both the limbs and the head was noticed and the stage was adequate for the manipulation of procedures required for the collection of blood from orbital sinus.	58 minutes after immobilization
Animal regained its routine activities completely.	130 minutes after immobilization

infections and benzathine penicillin administered however might have helped as a prophylactic measure in this case. Orbital sinus based sampling method might be considered as better than the cardiac puncture technique as there is always an immence risk of demage to the cardiac regions and compared to the nail clipping based sampling , the volume of sample is also reasonably more in case of orbital sinus sampling technique.

Acknowledgement

The facilities rendered by Dean, Faculty of Basic Sciences, Madras Veterinary College are greatly acknowledged.

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Reprint : Zoos' Print, 6 (5) : 21, May, 1991

RESTRAINING OF GHARIALS (*Gavialis gangeticus*)

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The Gharials (measuring about 3 meters in length) in captivity at Arignar Anna Zoological Park, Vandalur, are to be exported. Prior to that certain formalities have to be completed so that necessary health screening certificates can be issued. For this purpose we had to collect blood from the crocodiles for performing certain haematological and serological tests. Before the blood collection was carried out, the first and foremost difficulty was the restrainment of crocodiles.

Restrainment of crocodiles is not that easy, as it has powerful lashing of tail. We have to plan the method of executing the work. Eight animal attendants were involved in the capture and immobilization work. The crocodiles are powerful in water. Any attempt to disturb its normal state, it automatically retorts, becomes furious and behaves in an aggressive manner. It slaps with its powerful tough scaly tail and at the same time it tries to snap with the sharp teeth present in the long jaw. The technique of restraining crocodiles though looks very simple, it has to be executed very neatly and without exciting the animal.

Method

In order to bring the animal to land from water, long, strong, broad, and blunt hook was applied to its abdomen by 2 men and gently pulled out of water. As soon as the animal was on the surface, it was allowed to settle down. The crocodile after an aggressive mood became submissive after a little while. A big gunny sack well soaked in water was applied over the head and long snout region.

The large gunny bag weighing 60 gms. when fully soaked in water weighed 3.1 kgs. The soaked sacks not only acted as a protective hood for the head but also due to the hydrated condition, it weighed additional 2.5 kgs more per bag and acted as a weight barrier on the head which made the animal still without lifting the head. The wet gunny bag made the head cool as well as made blind in the eyes.

When the crocodile was quiet, again an additional two wet gunny bags were gently dropped over the same region. Slowly and steadily three men approached the crocodile cautiously and with a sudden swift action the attendants captured the long powerful jaw and head along with the sacks. At the same time three men held the tail simultaneously so strong that the animal was not allowed to move. Meanwhile one man held the two forelimbs and another the hind limbs. Once the animal was immobilised, it became quiet and calm. It became so docile that any kind examination could be carried out. The procedure is simple but needs careful and swift execution after studying the crocodile's movements.

Reprint : Zoos' Print, 11 (1) : 17-18, January, 1996

"BUILT IN SQUEEZE CAGE" - A MANAGEMENT TOOL FOR RESTRAINING WILD ANIMALS IN CAPTIVITY.

M. Jagannadha Rao[1] and A. Manimozhi[2]

INTRODUCTION

Restraint of wild animals in zoos involving capture and confinement may be necessary for measuring the animals, marking, veterinary care and transfer of animals.

Prior to the installation of the squeeze cage in the animal house, whenever any close examination or restraint of the animal was necessary either the animal had to be trapped by mechanical means into a cage and transferred to the hospital where there is a facility for restraining, or the animal had to be immobilized chemically by darting. Trapping the animal inside a cage involves placing the cage inside the enclosure, baiting and trapping with a remotely controlled device. It also takes lot of time, sometimes up to a week and at times results in injuries to the animal while trapping or transportation. Moreover the animal, when trapped in a cage alien to its familiar surroundings/ territory and transported to a new environment, experiences a lot of excitement and anxiety and resists capture in all possible ways resulting in considerable stress to the animals.

Chemical capture operation may be stressful or even fatal to some individuals. This requires the development/application of new capture techniques, including the use of new drug-animal combination. There are numerous records of animals being killed by inexperienced veterinarians/ biologists administrating wrong dosages or using equipment inadequately (Riney, 1982).

In order to overcome these difficulties, "built-in cages" have been introduced in Arignar Anna Zoological Park in the year 1993 for large carnivores like lion (*Panthera leo persica*), Tiger (*Panthera tigris*), Panther (*Panthera pardus*) and Jaguar (*Panthera onca*).

DESIGN

The design of the squeeze cage fixed at the Panther house is given in the Figs. 1 & 2.

The animal house consists of 4 individual chambers to serve as night shelter and feeding cells for each animal. Movement of animal from one chamber to another is possible through the sliding doors available to each chamber. Squeeze cage is fixed in one of the chambers. The shift door can be moved back and forth with the help of a hand operated gear and chain system. For easy and smooth movement of the shift door it is hung over two rails with the help of wheels fitted with ball bearings. By rotating the handle in a clockwise or anti-clock wise direction the animal can be easily restrained by a single person. Some feed may be given to distract the attention of the animal while squeezing.

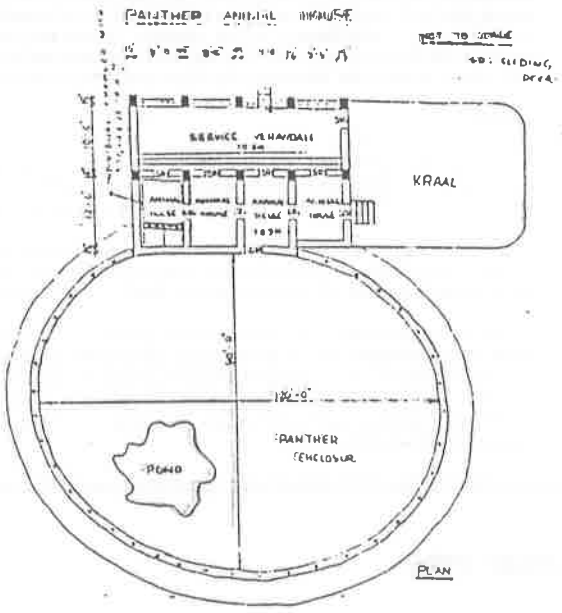

Fig. 1. Panther Animal House

RESULTS AND DISCUSSION

After fixing the squeeze cages and habituating the animals to that individual chamber, restraining the animals becomes a quick and harmless operation. They are being frequently put to use for periodical vaccination, booster administration, health checkup, treating small wounds and for transfering the animal to another enclosure or to the Veterinary Hospital for prolonged treatment. The trapping of animal for transfer to another place has become

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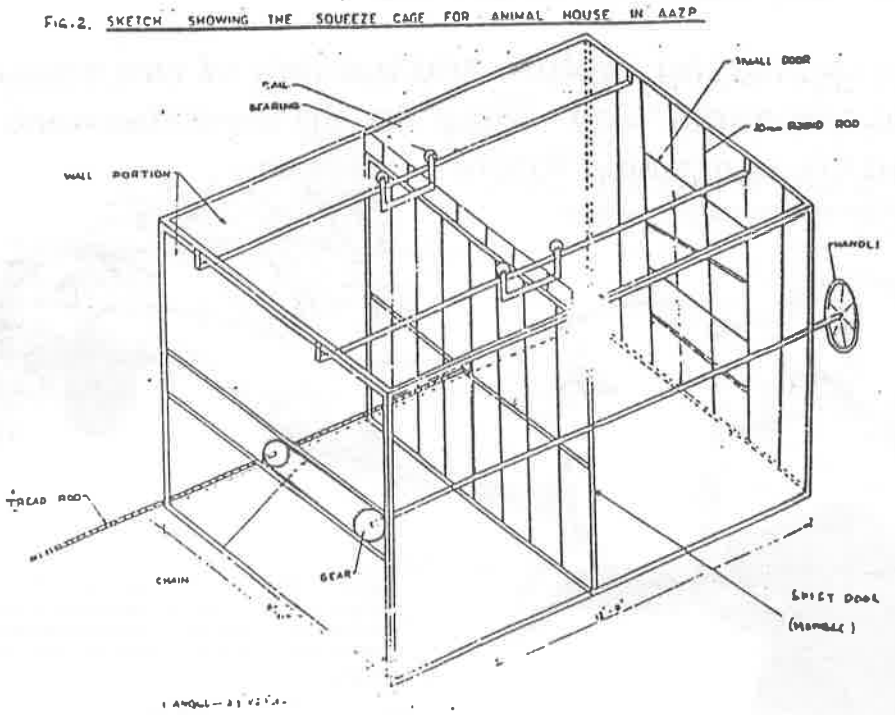

Fig. 2. Sketch Showing the Squeeze Cage for Animal House in AAZP

especially easy and less time consuming as the transport cage can be placed opposite to the squeeze cage door and the animal can be pushed inside the transport cage by moving the shift door towards the transport cage entrance.

A built-in-squeeze cage inside the cubbing den is used in the Berlin Zoo carnivore house, according to George Klos and Lang (1982). One wall of the squeeze cage is moved by means of an electric motor in the above zoo. Fowler (1986) also mentions that squeeze cages are extremely valuable tools for restraining wild animal in captivity.

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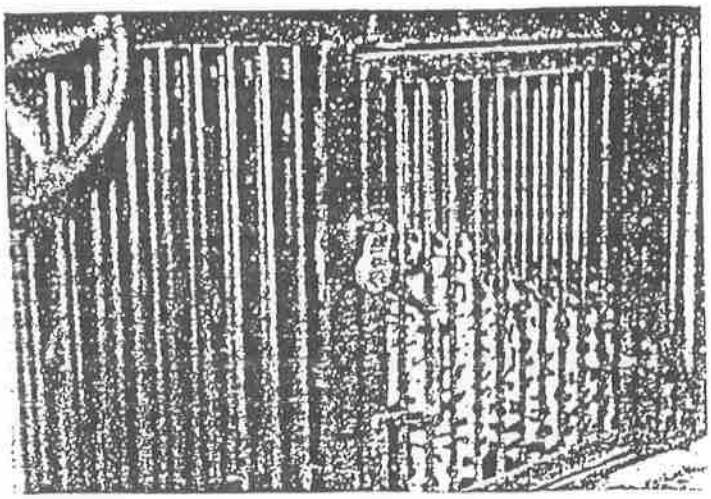


Fig. 3. Panther in a squeeze cage at AAZP.

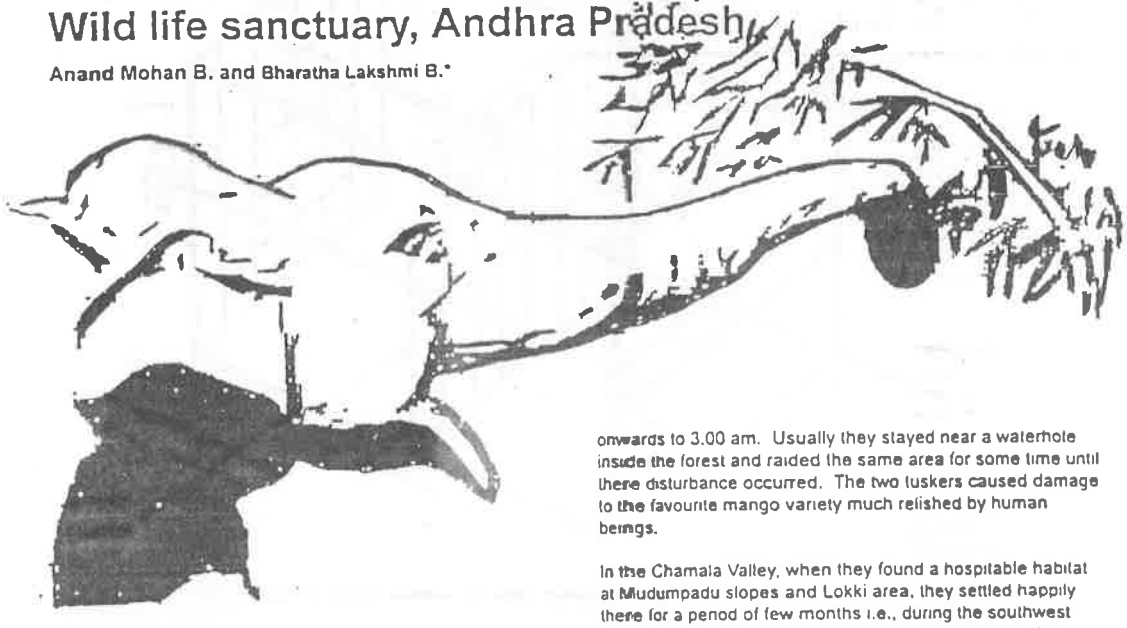
ACKNOWLEDGEMENT

The authors are thankful to Thiru Arul Prakasam, IFS, Chief Conservator of Forests (WL) and to Thiru R. Sunderaraju, IFS, Director, Arignar Anna Zoological Park, Vandalur, Madras for their guidance and encouragement.

Reprint :.Zoos' Print, 14 (4) : 1-5, April, 1999

The successful capture and training of two strayed wild elephants "Jay - Vijay" in Sri Venkateswara Wild life sanctuary, Andhra Pradesh

Anand Mohan B. and Bharatha Lakshmi B.*



After a long gap of more than four years from 1994 to 1999 when the elephants Jay and Vijay were seen recently in captivity in Sri Venkateswara Zoological Park, I recollected their capture operation and subsequent training. Though the entire episode was never reported to my wildlife friends till now, I thought it is better to scribble the episode from my field book before I forget my memories with the elephants Jay and Vijay.

Report of Elephants in Chamala Valley of Sri Venkateswara Wildlife Sanctuary

A few elephants from Karnataka and Tamil Nadu entered into Kuppam forest area on 4-3-1984 and in the year 1990, Koundinya Sanctuary was notified. Two wild elephants got separated from their main herd at Koundinya Wildlife Sanctuary and migrated to the Chamala Valley of Sri Venkateswara Wildlife Sanctuary on 8th, April 1993, thus travelling a distance of 90 km. For one year and two months, these two elephants moved near Bhakarapet, Taakona, Kotakadapalli village and in the Reserve Forests of Santpaya, Kodur, Rajampet and Balapalli Ranges.

A gradual change of behaviour

In the initial period of the entry the two pachyderms avoided human interference and started moving into deep forest. When they found inhospitable terrain, they started moving along the forest periphery which is a degraded forest. Usually they stayed quietly in the day time and began raiding crops like mango, paddy, groundnut, sugar cane etc., from 9.00 pm onwards to 3.00 am. Usually they stayed near a waterhole inside the forest and raided the same area for some time until there disturbance occurred. The two tuskers caused damage to the favourite mango variety much relished by human beings.

In the Chamala Valley, when they found a hospitable habitat at Mudumpadu slopes and Lokki area, they settled happily there for a period of few months i.e., during the southwest monsoon to the end of north-east monsoon season when human interference is very least in the area. When human interference occurred however and forest fires began to break out, they moved out from the area. Again they resorted to the habit of crop raiding in the fragmented habitat and started moving from one area to the other. Their movement ranged from 10 km to 60 km/day, from dusk to dawn time preferably.

The start of problems with the Wild elephants

In the month of march 1994 the two wild elephants had gone up to Venkatagiri and Dekkali area of Nellore District. A human injury as a result of elephant encounter was reported in Veerakumara Yachasamudram village in Nellore District. A hue and cry in the press and resistance from the local people against the presence of these two Elephants reached a peak with this incident. Right from their entry into the Chamala Forest, constant monitoring was carried out by the Sri Venkateswara National Park Management. Steps were taken to awaken the public, about precautionary measures to be taken against the elephant problem. These efforts yielded certain results. But constant raiding of Mango orchards from March 1994 in and around Kodur area, particularly in Settigunta village caused much inconvenience to the people. Vested interests, against wildlife conservation started all sorts of propaganda against the presence of wild elephants, to malign the forest officials who were taking responsibility for

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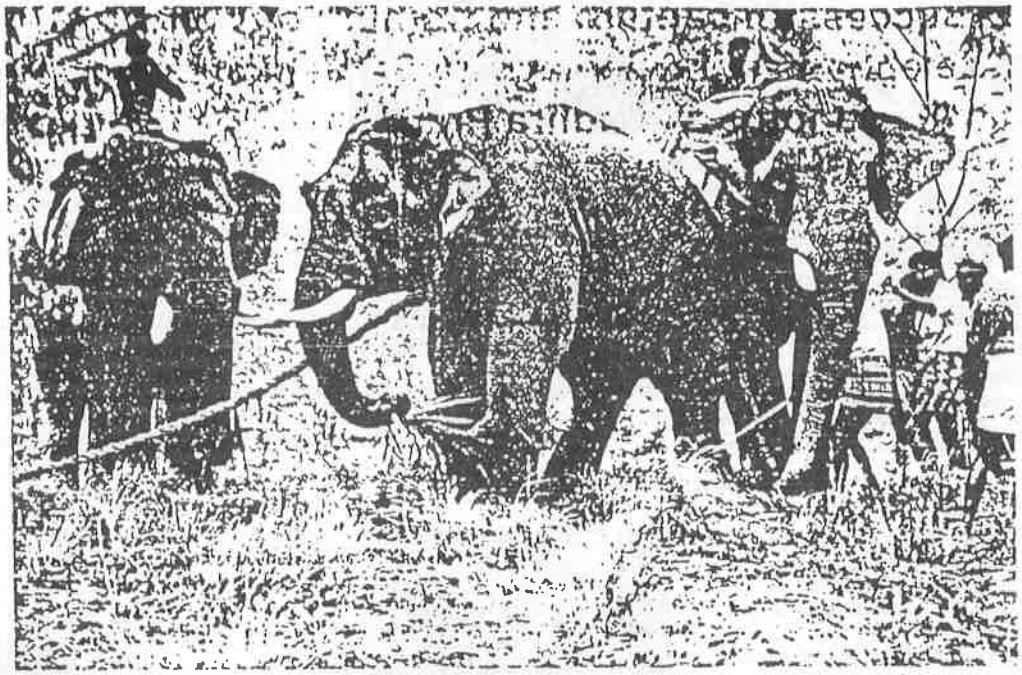


Fig. 2. Capture of elder tusker 'Jay' at Tirumala

the cause of wildlife conservation. The local villagers were instigated and press was utilised as a propaganda medium. No doubt, damage to commercial crop like mango, will cause much heartache to the poor farmer, but many misleading things also were brought into the picture. By that time already twelve elephants had registered their causality in a population of 40 numbers in Koundinya Sanctuary over a period of 7 years due to man-elephant conflict. So the park management took all preventive steps. The villagers were told about the provisions relating to compensation payment and the department's precautionary and preventive steps against elephant damage to crops and to human injury.

When the elephants were constantly raiding the mango orchards at Settigunta village near Balapally it was decided to drive the elephants into Sri Venkateswara National Park area by mechanical driving method, but the efforts in this direction had not resulted in solving the problem. It was suggested also to tranquillize and translocate the animals to their original place, but – due to their crop raiding behaviour and because of their constant presence away from their herd – it was opined that translocating the animals to their original place is not a viable option. The crop raiding habit may continue and they would not be acceptable to their original herd. The tuskers were also likely to reach their maturity in a few years. At this stage expert opinion was sought and accordingly it was decided to tranquillise and train the animals for future use by the department. Interestingly, it was near Balapally, where the French traveller and Jewel merchant Jean Baptist Travenier recorded on 27-8-1652, about the pit method capture of elephants by Mir Jumla's army.

The Tamil Nadu State Forest Department was contacted for expertise and Kumkies, to capture of the two wild tuskers. Since it was peak summer period in the month of May, it was contemplated to tranquillise the Elephants when the temperature gets down from 41° to 36C. So regular monitoring of these two wild elephants was carried out continuously till the completion of their capture.

In the first week of June, the two wild elephants travelled from Settigunta to Kukaladoddi, Anjaneyapuram, Jeevakona to Avachari Kona in the Tirumala enclosure area. When the elephants are migrating in a totally different direction because of their disorientation, the work on capturing operation was speeded up. On 8th June, two kumkies "Pallavan" and "Dev" reached Tirupathi from Pollachi, for capturing the two wild elephants roaming in the area. A kraal was constructed by using local Toddy palm trees (*Borasus flabellifer*) and both the Kumkies helped a lot in transportation and erection of the kraal. The kumkies were transported to Tirumala by 14-6-1994 for attending the capture operation.

Meanwhile the location where the Elephants were moving was thoroughly scrutinized for organising the capture operation and the behaviour of these two wild elephants was studied well. A constant watch and ward day and night was kept by the field staff of Sri Venkateswara National Park Division. The Tamil Nadu Forest Department deputed a team of officers which included a Veterinary Surgeon, Livestock Inspector, one forest range officer and one forester, in addition to the elephant capture expert Sri V. Krishnamurthy, Retd. Veterinary surgeon, Tamil Nadu Forest Department. Dr. V.

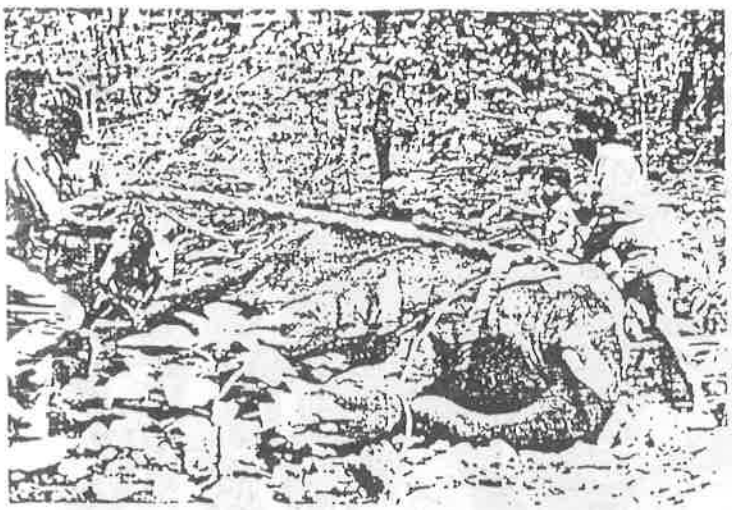


Fig. 3. The younger tusker 'Vijay' when tranquilised

Krishnamurthy's expertise was necessary to guide in the capturing operation and subsequent training programme to these Two Wild Elephants. The location, as well as the terrain was shown to the team members. A few points were fixed on ground to station the field staff for the capturing operation and the same was shown to the team members. The measures to be taken up at the time of capture operation was also discussed and the strategy was finalised (Fig 1).

Operation Capture - Jay and Vijay

On 15-6-1994 it was tried to guide the elephants to a certain point for attending the tranquillisation but at one point of time the animals went in another direction. So it was decided to drive the Elephant to Mokallamitta area. On 16-6-1994 the elephants were driven, but this also did not yield any results for the tranquillisation operation. Darting is very difficult because of the heavy bush growth. On 17-6-1994 the same driving operation was tried again but of no use. So it was decided to erect a machan near the water hole where the elephants were seen constantly. To lure the elephants sugar cane and jack fruit was kept near the machan side and in the adjoining track. But on 18-6-1994 these elephants were not seen in the area and thorough search was made in Jeevakona and Karakambadi tracks, and finally they were again noticed in Avachari Kona area only. On 19-6-1994 night a party was stationed atop the Machan.

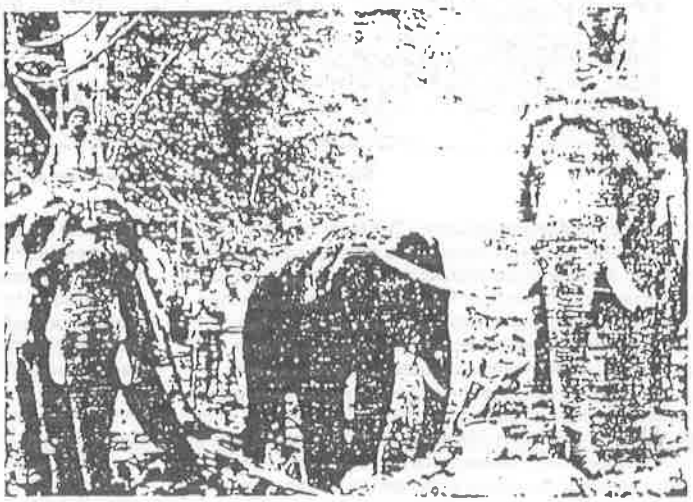


Fig. 4. Capture of "Vijay' at Avachari Kona

On 20-6-1994 early morning the big elephant was darted from the machan but the dart bounced off. Due to the constant disturbance the animals started leaving the location. So it was decided to dart the animal even in the night time if necessary.

Darting of 'Jay - the elder one

The two elephants were moving frequently very close to the Tirumala foot path in the night. Any human casualty may have lead to greater problems in the Temple town of Tirumala. So it was decided to dart the animal in the plain area near the Sanctuary line, when the animals visit this area. Two generators, search lights and labour were kept ready for search operation after darting in the night. On 20-6-1994 around 11.05 PM the first one 'Jay' was darted. But even with intensive search till 4.00 AM of 21-6-1994, we could not to locate the darted animal and all the party left to Tirupathi. A lesson was learnt, that tranquillising at night time was a mistake. But worried about the fate of the elephant, as it may die if it slips from the escarpment, I stayed back alone along with one Mr. Gangadhar, Forest guard and continued our search for tracing the darted animal. Then the forest guard was sent to one direction and I continued my search in another direction. After the anxious search in the morning twilight, the blood stains on a rock gave me the clue which indicated success. I was very happy when I traced the darted elephant and located him finally at 6.30 am. Then all the team members were called back to Tirumala and they successfully attended the capture operation. Jay was marched down to Tirupathi on 22-6-1994, and enkraaled in Sri Venkateswara Zoological Park in Tirupati (Fig. 2).

Important statistics of Jay

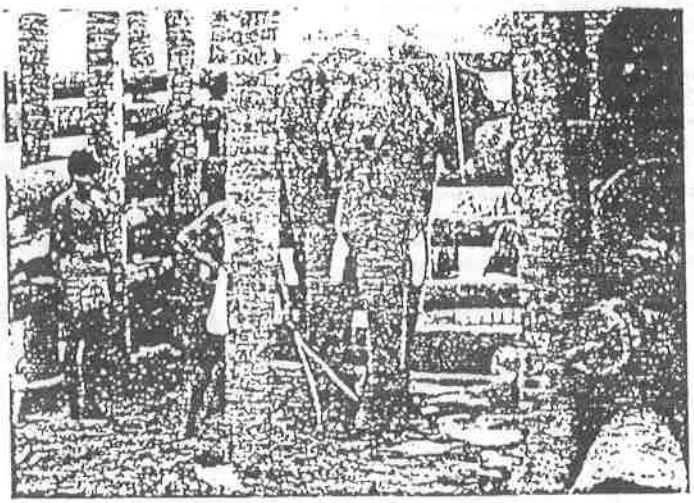


Fig. 5. Release of "Jay' from the kraal after training

Age: 18 years
Height: 8'4"
Physical condition : good
Date and time of darting: 21-6-1994 at 11.05 PM in a cool weather condition.
Place: Between 12th and 13th km of Tirumala Tirupathi one way ghat road, at a rocky undulating terrain.
Drug and Dosage: Driving in a jeep 3.5 ml immobilon used in a 5ml dart with dist inject gun from 20 mt. distance which was hit near the temporal region. Traced the animal almost in revived condition at 6.30 am on 22-6-1994.
Body temperature: 97.6° F (36.5°C)
Pulse: 38 to 44/minute
Respiration: 15/minute
Abnormalities observed: none
Eyes: Honey brown.
Supportive therapy: Tetracycline 30ml I/m Vebalan 20 ml I/m; Xylazine-1015 hrs-300mg. 1300 hrs-300 mg;1915 hrs-2ml xylazine w/ 10 mg acepromazine.
T.T - 10,000 IV, Neurovet - 20 ml
Long action penicillin : 36 lakh units in 20 ml dist. water I/m.
Antidote : Revivon 10.00 - 2 ml I/m
12.55am - 2 ml I/m
Animal recovered by 10.15 am.

Darting of 'Vijay' - the younger one

For tracking the second Elephant 'Vijay' the same tracking party was kept at Tirumala on 22nd and 23rd June, 1994 and it was noticed upto June 24th morning and the elephant was lured to stay in the same place by keeping sugarcane and jack fruit. Significantly on 24-6-1994, when the party sat on the Machan for tranquillisation, the movement of the second elephant was not noticed, however. On 25th also the animal movement was not traced correctly and parties were despatched to Jeevakona and Karakambadi for locating 'Vijay'. On 26-6-1994 and 27-6-1994 also thorough search was made with the field staff. At this point of time, it was decided to keep the kumky elephants upto 2-7-1994 only, as the services of the kumky elephants are required by the Tamil Nadu Forest Department. So it was decided to utilise the services of all the forest staff available at Tirupathi for search operation on 29-06-1994.

On 29th afternoon 'Vijay' was traced in the Avachari Kona down below 6 Km away from the usual site observed for the last 15 days. Immediately arrangements were made for capturing the second one, there at the site itself and the kumkies were marched to Anjaneyapuram for ready availability after darting. Field arrangements were made accordingly. On 30th June early hours proceeded to Avachari Kona to track the second elephant 'Vijay' and finally by 8.15 AM it was tracked. Because of the constant disturbance by human activity 'Vijay' started charging right from 8.15 AM to 3.00 PM. So it was decided to dart the animal by sitting on a tree and the Elephant was driven to that side. By 4.45 PM it was darted and 4.55 PM the animal was found and by 5.30 PM noosing and tying to the tree was completed and the animal was revived. Message was flashed for bringing the Kumkies to the capture site. The Kumky party reached on 1-7-1994 by 6.00 AM and again by 9.00 AM the Kumkies along with the new capture started to Anjaneyapuram. After giving some rest, again the Kumkies along with the new capture was marched to Sri Venkateswara Zoological Park, and 'Vijay' was enkraaled by 10.30 AM on 2-7-1994 (Figs. 3 and 4).

Important recordings of Vijay

Age: 15 years;
Height: 7'5", with 18 toe nails;
Estimated weight: 2 tonnes.
Date, time and place of darting: 30-6-1994, 4.45 pm at Avacharikona valley, in the stream bed.
Drug and dosage: 2.6 ml immobilon used in a 5ml dart with dist inject gun from 25 m. distance which hit on the bump. Unconscious after 8 minutes, secured with Vakkai ropes and administered the following drugs.
Antidote: Revivon 3.5 ml given at 5.15 pm and revived in 5 minutes.
Sedative: 2ml Xylazine.
1-7-1994 Xylazine - 300 mg.
Tetracycline 30 ml I/m
Marched to Anjaneyapuram, which is 15 km away from the spot.
200 mg Xylazine for sedation in the night.

Again from 11.30 pm of 1-7-1994 marched to Tirupathi and reached Tirupathi zoo by 6.00 am of 2-7-1994.
Xylazine - 200mg TT - 6000 IV, 48 Lakh units long acting penicillin was administered and successfully enkraaled the animal.

Thus ended the successful capture of two wild elephants 'Jay and Vijay' which joined the company of Venkanna, the other elephant captured in the year 1989 in the coastal belt of Nellore District.

After the successful capture - what next?

'Jay and Vijay' were given two months training inside the kraal and afterwards ten months they were given training outside the kraal for utilising them in the field. The total cost of operation until the end of training inside the kraal was nearly Rs. 2.50 lakh, which included the expertise charges, transport of kumkies,

construction of kraal, payment to trackers, elephant feed, watch and ward, etc.

The following is the feed schedule provided to the animal during their period of stay in the kraal.

Items	Jay quantity	Vijay quantity
Horse gram cooked)	3kg	2kg
Ragi (cooked)	14kg	10kg
Salt	100gms	100gms
Jaggery	200gms	200gms
Sugar cane	6 numbers	6 numbers
Green fodder	200kgs	150kgs

Training was given to the two elephants as per daily training schedule recommended by Dr. Krishnamurthy. The two elephants were taken out of the kraal on 7-9-1994 without the help of kumkies (Fig 5.)

In addition to the above diet schedule two coconuts and 100 ml, gingely oil were given to the two animals. On 8-9-1994 Jay and Vijay were vaccinated against anthrax. Both the elephants responded well with the initial training in the kraal.

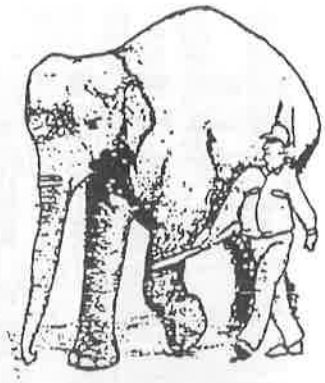
Even though the operation capture has caused much inconvenience, the capture of the two crop raiders and the efforts of the department were thoroughly understood by the public.

The entire operation was successful and the two pachyderms in their initial travel never troubled any one, except for one person who was injured, and during their training also responded very positively. The recent stories of human kill by strayed elephants, and the death of captured elephant in Andhra Pradesh made me to remember again the capture of in Jay and Vijay and their subsequent training.

Thus, came an end to my flash back memories of Jay and Vijay elephant capture operation.

Acknowledgements

For guidance in tranquillising operation and for providing valuable information, I thank Dr. V. Krishnamurthy, elephant expert, Principal Chief Conservator of Forest A.P.F.D., Chief Wildlife Warden A.P. Forest Dept and Sri A. V. Joseph, Conservator of Forests (Wildlife) Tirupathi and all the field staff and veterinary staff of Tamil Nadu Forest Department and AP Forest Department who participated in the above tranquillising operation.
I whole heartedly thank the tracking party and the training party who did an excellent job. Finally I thank my wife Mrs. Radha Mohan and my kids Amulya and Aditya for their continuous support during the period of tracking and tranquillising the two wild tuskers.



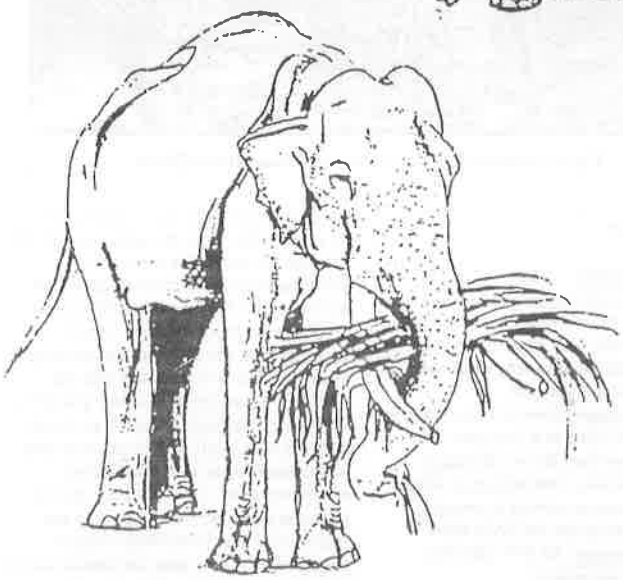


Fig 1. Map of Chittoor District (A.P.) - Showing Elephant Migration

Reprint : Zoos' Print, 14 (4) : 11-14, April, 1999

Transportation of Giraffe by road Arignar Anna Zoological Park Experience

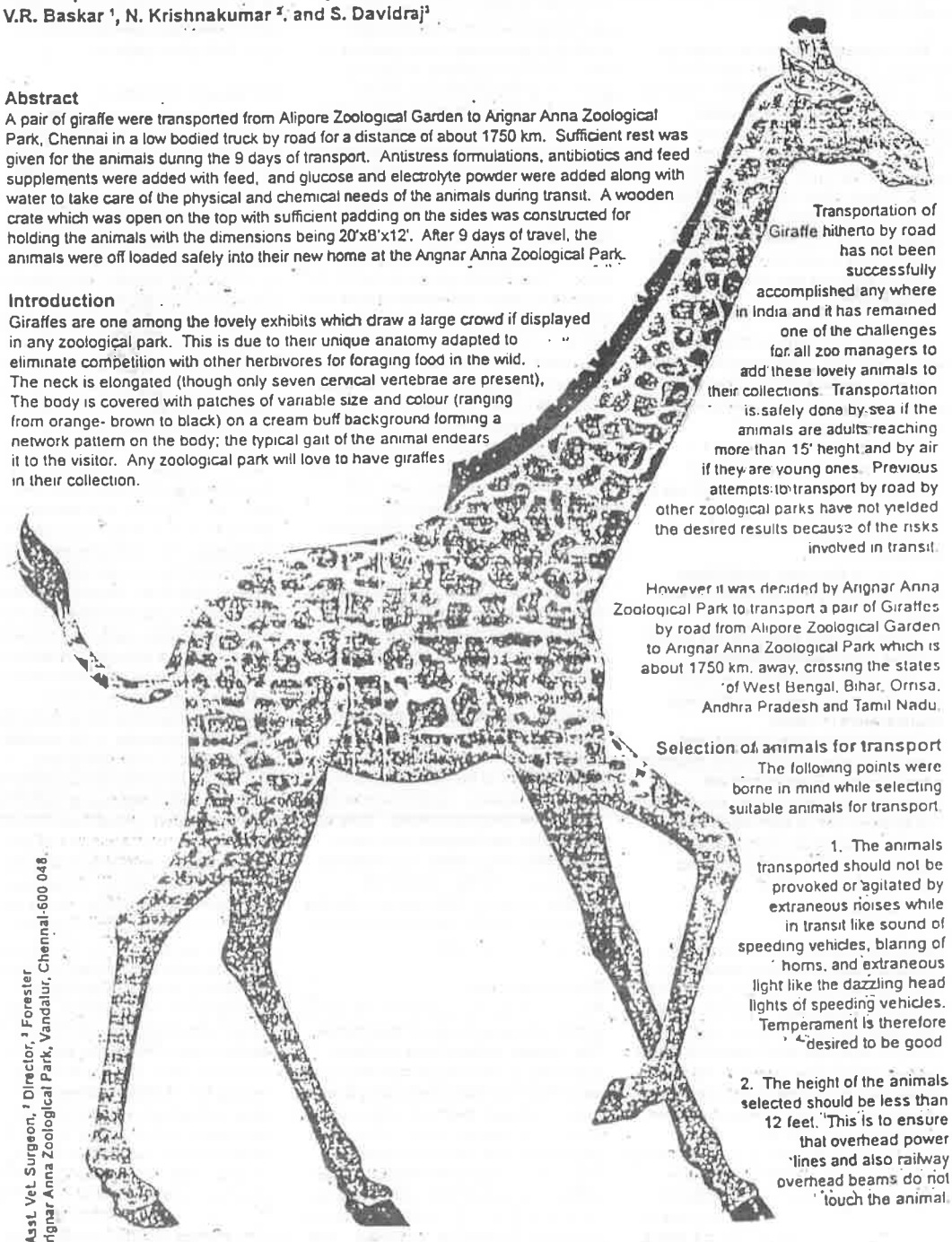
V.R. Baskar [1], N. Krishnakumar [2], and S. Davidraj [3]

Abstract

A pair of giraffe were transported from Alipore Zoological Garden to Arignar Anna Zoological Park, Chennai in a low bodied truck by road for a distance of about 1750 km. Sufficient rest was given for the animals during the 9 days of transport. Antistress formulations, antibiotics and feed supplements were added with feed, and glucose and electrolyte powder were added along with water to take care of the physical and chemical needs of the animals during transit. A wooden crate which was open on the top with sufficient padding on the sides was constructed for holding the animals with the dimensions being 20'x8'x12'. After 9 days of travel, the animals were off loaded safely into their new home at the Arignar Anna Zoological Park.

Introduction

Giraffes are one among the lovely exhibits which draw a large crowd if displayed in any zoological park. This is due to their unique anatomy adapted to eliminate competition with other herbivores for foraging food in the wild. The neck is elongated (though only seven cervical vertebrae are present), The body is covered with patches of variable size and colour (ranging from orange- brown to black) on a cream buff background forming a network pattern on the body; the typical gait of the animal endears it to the visitor. Any zoological park will love to have giraffes in their collection.



Transportation of Giraffe hitherto by road has not been successfully accomplished any where in India and it has remained one of the challenges for all zoo managers to add these lovely animals to their collections. Transportation is safely done by sea if the animals are adults reaching more than 15' height and by air if they are young ones. Previous attempts to transport by road by other zoological parks have not yielded the desired results because of the risks involved in transit.

However it was decided by Arignar Anna Zoological Park to transport a pair of Giraffes by road from Alipore Zoological Garden to Arignar Anna Zoological Park which is about 1750 km. away, crossing the states of West Bengal, Bihar, Orrisa, Andhra Pradesh and Tamil Nadu.

Selection of animals for transport

The following points were borne in mind while selecting suitable animals for transport.

1. The animals transported should not be provoked or agitated by extraneous noises while in transit like sound of speeding vehicles, blaring of horns, and extraneous light like the dazzling head lights of speeding vehicles. Temperament is therefore desired to be good

2. The height of the animals selected should be less than 12 feet. This is to ensure that overhead power lines and also railway overhead beams do not touch the animal.

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This height of 12 ft. is selected so that an allowance of 1 foot is given for the animal in case it stretches its neck. In India, over head power lines and railway beams are at 15ft. height.

3. The animals so selected should be compatible, with the presence of one animal reassuring for the other. Giraffes may be aggressive towards other giraffes (Mckenzi, 1993). But the mother - calf relationship, previously believed to be weak (Dagg & Forester, 1976; Foster, 1966; Innis 1958; Walker, 1968) is in fact strong and complex (Langman 1977, Nowak & Paradisio, 1983, Pratt & Anderson, 1979). Hence a mother with calf was selected for transportation.

In our case, the height of the female was 12 feet and of the male was 8 feet. The temperament of both were good, and they were used to visitors noises and disturbances.

Design of crate for transport

The crate designed for transport had the following essential pre requisites.

1. It did not block the vision of both animals.
2. It did not have any sharp edges.
3. It was strong enough to withstand road jerks.
4. It had sufficient space for the animal to move freely and comfortably.
5. It had soft padding on the inside walls to avoid bruises or cuts or any injuries while in transit.
6. It had provision for feeding and watering placed at convenient height for both animals. Exact height will obviously vary according to the height of the giraffes and so both water and feeder was kept at a height of 0.5 m. below the eye level of the smallest animal (Wallach, 1974).
7. The floor was soft.

In this case, a wooden crate with the dimension 20'x8'x8' was made with 5 runners each weighing around 200 kg. along the length and 4 runners along the width on the floor and 8 wooden pillars 8 feet high each along the length were used as side supports. Above the 8 feet height, another 4 feet chicken mesh was provided on wooden frame for ventilation. The frames were propped up with iron plates as additional reinforcement with the gap between each iron plate being 4' top to bottom on both sides. A feeder made of wood with dimensions 2 1/2' x1 1/2' x1 1/2' and a waterer to hold 20 liters water were fixed at 7 feet height because the male was 8 feet tall. Bedding material was provided with chopped paddy straw. The side walls were padded with high quality polythene on which layers of paddy straw and gunny bags were stitched so that sufficient cushioning effect was given. A small window was left to facilitate feeding and the crate was left open on top, so that the animals do not feel cramped, considering the height of the animal. Some bending of the neck is acceptable on short trips but not on long journey (Mckenzi, 1993). The crate was placed in the enclosure and feed and water were provided inside the crate. The animals got habituated to the crate after initial apprehension and after 10 days the gate of the crate was locked with the animals inside (10 to 14 -12-98). Four days were allowed for the animals to get used to the limited space inside the crate. They were able to see their counterparts nearby. The animals slowly started settling down. They were monitored continuously by keepers sent for the purpose. Animals were observed for feeding, perambulation, micturition, defecation and abnormalities if any.

The transport vehicle was a 26 feet long low bodied trailer with ten wheels with the rear wheels being smaller than the front ones which gives additional height for manouvering.

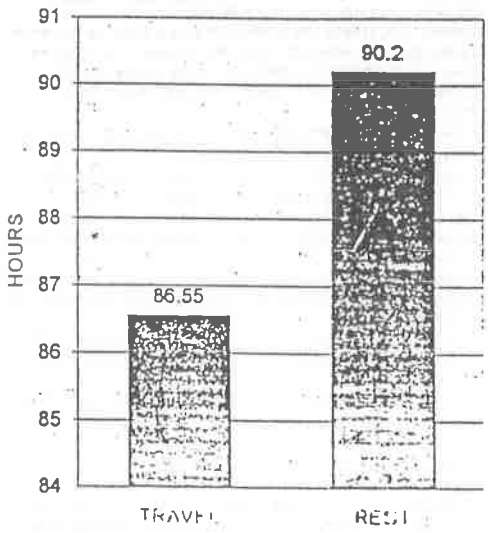
The crate was loaded with the help of a crane (10 tons capacity) with the animals behaving excellently. The temperament of the animals comes into play while loading. Giraffes are rarely aggressive towards humans. They can normaly be easily loaded and transported (Mckenzi, 1993). The keepers kept reassuring the animals with plentiful supply of bananas and calmed the animals down, while the crate was loaded on to the trailer.

Transportation

For successful transportation the speed of the vehicle is of utmost importance. The animals hitherto have not been subjected to any transportion and so it is very important that unnecessary braking and jolting and swerving have to be avoided as this may trigger off a series of physical and chemical reactions in the animals making the transportation difficult. A skillful driver will be able to take care of it if he is briefed thoroughly regarding the load he is carrying. The most crucial period for the animals are the first two days of travel when the animal tries to balance itself while in transit and getting used to the constant jolting and noises from other speeding vehicles and sudden flashes of the head lights from other vehicles.

Behaviour in transit

It is important to give sufficient rests for the animals. In our case we stared at 1.00 P.M. on 14-12-98 and drove till 12.45 A.M. and halted for the night. The animals were initially excited and they kept on perambulating till night halt. At 1.30 A.M. both were seen ruminating which was a good sign. At 4.00 A.M. on 15-12-98 both animals were standing, active and alert browsing the ficus leaves which were offered. (Sufficient moonlight was available and the animals could be seen). At 6.15 A.M on 15-12-98 the journey started again and they were fed at 7.15 A.M. Both animals started feeding almost immediately with the female guiding the male. Fresh ficus was given. The animals were monitored once every hour. At 11.15 A.M. both animals were sitting down with their necks upright and ruminating. The vehicle was stopped to give rest to the animals from 12.05 Noon to 3.45 P.M. Fresh feed and water given and the journey started at 4.00 P.M. Due to bad roads for a distance of about 4 km., to minimize the effect if constant jolting on bad roads through rest was given for the animals. Monitoring was done once every hour to ensure the condition of the animals. At 6.05 P.M. both were sitting and ruminating and this was observed till 7.45 P.M. Both were up at 8.00 P.M. active and alert. Again from 9.25 P.M. to 11.45 P.M. both sat down as they were probably tired after a long day. During this rest period, dinner was had and the vehicles parked. It was decided to make use of excellent weather conditions prevailing during nights as it was cool with night temperatures not exceeding 18 degree centigrade throughout in West Bengal, Orissa and Andhra Pradesh and comfortable for the animals giving sufficient rest 1 -1.5 hours for every 3 hours of driving. After resting for 2 hours, journey was resumed and after 3 hours it was decided to halt at 3.00 A.M. On 16-12-98 the vehicle halted till 6.00 A.M. The animals were fed again at 6.30 A.M. and journey started and went on till 11.45 A.M. with rests of 1 hour in between. The animals looked tired as it was mid-



Total Travel Time - 177.15 Hrs

day Temperature was around 28° C in West Bengal, Orissa and Andhra Pradesh. Rest was given for the animals till 4.00 P.M and the animals were lying down ruminating and perambulating. The same pattern of journey was adopted with afternoon halts from 11.00 A.M. to 4.00 P.M. and night halts from 1.00 A.M. TO 5.00 A.M. After every 3 hours of driving 1 - 1.5 hours rest was given for the animals and the journey continued. The speed of the vehicle did not exceed 25 km/hour.

The places of rest for the animals were chosen keeping the following in mind.

1. It should be away from a town / village to minimize stress by gazing public and other noises.
2. It should provide adequate shade for the animal both during forenoon and afternoon.
3. It should be next to a restaurant / motel for the crew to have lunch / dinner and rest.
4. It should be accessible to nearby market to buy feed items for the animals.

For the rest of the days, the same pattern was followed with the behaviour of the animals being more or less stereotyped with minor variations in between. The animals were comfortable through out the journey.

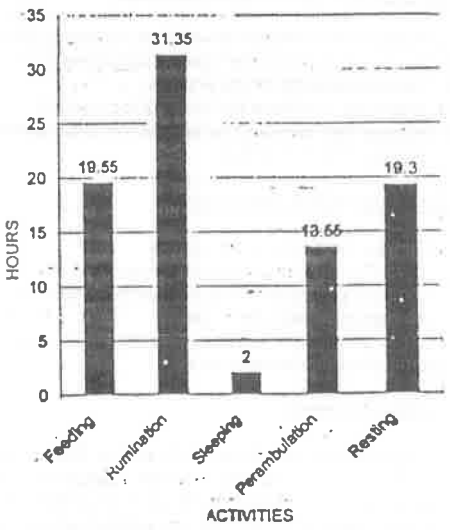
Feed Additives

Sufficient precautions were taken to minimize stress by providing feed additives like vitamin, mineral, combinations (Supplevit-m-sarabhai), Vitamin-E and Calcium along with the feed and antibiotic like tetracycline to take care of any bacterial complications like transit pneumonia. Electrolytes and Glucose-D were added along with water to correct electrolytic imbalances if any.

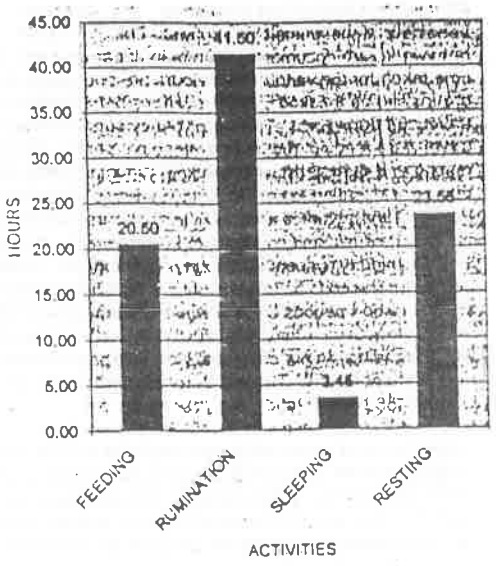
Hourly monitoring was done to ensure the health and behaviour of the animals throughout. The observed behaviours are documented with help of bar diagram. The time taken for the various behaviours are pooled into two groups like as the time spent on various behaviours during travel and during rest. The major behaviours observed during travel were feeding, rumination, sleeping, perambulating and resting and during rest were feeding, rumination, sleeping and resting. According to Leuthold (1978), Moss (1989) and Pellew (1984), giraffes are active in the hours following dawn and before dusk; and spend 16 to 20 hours a day feeding. The hot midday is spent ruminating and resting. Nocturnal behaviour depends on the amount of moon light. Giraffes sleep for short periods only, sit with their head resting on the rump. More usually they rest with their head up and often whilst standing. In our case, more or less the above said facts were observed. The respiratory rates during hot midday was 45 - 55 per min. and during cooler parts of the day around 40 - 44 per min.

After 9 days of travel, the journey ended at Arignar Anna Zoological Park at 7.15 A.M. on 22-12-98 with the animals weak and tired but active and alert. The enclosure was ready and the crate was off-loaded with a crane and the animals were released the next day on 23-12-98 into the enclosure.

They are now used to the new enclosure and their activity pattern is more or less the same as it was in transit excepting for the fact that they curiously gaze at the Zebras which are their neighbors at Arignar Anna Zoological Park.



Time spent for various activities during travel



Time spent for various activities during rest

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(A) The following documents are of utmost importance with respect to animals during transportation.

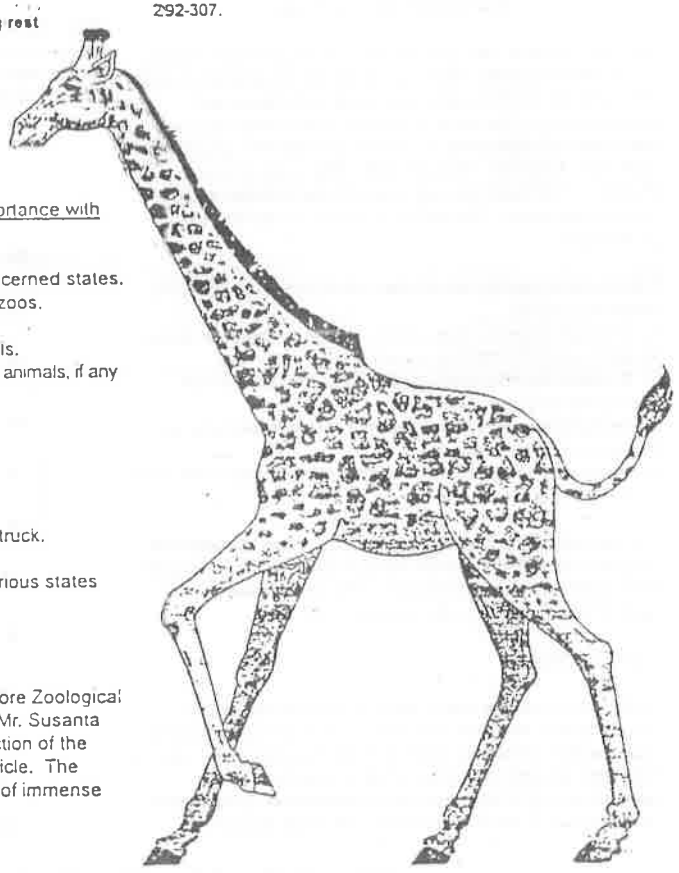
1. Permit from chief wildlife wardens of the concerned states.
2. No objection certificate from the concerned zoos.
3. Transit insurance for the animals.
4. Veterinary certificate for fitness of the animals.
5. History sheet / previous treatment records of the animals, if any
6. Diet chart for the animals.

(B) With respect to transporters

1. Fitness certificate for the vehicle
2. Lorry receipt and consignment note.
3. Letter of agreement from the owners of the truck.
4. All document regarding vehicle
5. Motor vehicle entry permits for entry into various states through which the vehicle passes.

Acknowledgements

The authors are thankful to the Director of Alipore Zoological Garden, Mr. A.K. Das, and Assistant Director Mr. Susanta Bhattacharya for the help rendered in construction of the transport crate and arranging for transport vehicle. The authors wish to thank Dr. T. Rajaram who was of immense help in the preparation of this article.



USE OF DIAZEPAM FOR TRANSPORTATION OF HIMALAYAN BLACK BEAR (*SELENARCTOS THIBETINUS*)

Nawab Nashiruddullah[1] and Saidul Islam[2]

[1]*Department of Pathology,* [2]*Department of Parasitology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam 781022, India.*

Abstract

A male wild Himalayan Black Bear (*Selenarctos thibetinus*) was chemically restrained with diazepam, dose rate of 2 mg/kg body weight intramuscularly in divided doses for translocation. Mild tranquillization was achieved without sedation. However, the animal showed moderate analgesia, muscle relaxation and listlessness. No side effects were exhibited. The animal could be translocated safely and it could fully recover after three hours of drug induction.

Introduction

Diazepam, a benzodiazepine compound has been used as a feed additive in domestic animals for its tranquillizing, antistress and growth stimulating effects. This group of drugs show dose related tranquilizing, sedative and hypnotic properties. This report discusses the various tranquilizing stages of diazepam in a young male wild Himalayan Black Bear (*Selenarctos thibetinus*) during its translocation.

Materials and Methods

A young male wild Himalayan Black Bear had to be tranquilized for translocation from the site of temporary rehabilitation and to its new destination site located 68 km away.

Diazepam (Calmpose inj.*) was selected as the drug of choice at a dose rate of 1 mg/kg body weight initially, with a total dose of 25 mg., intramuscularly. The animal calmed with no sedation and was boarded on a jeep inside a temporary wooden cage. The dimension of the cage was enough to allow the animal to move, the roof touching its back. The ambient temperature was 34°C.

The animal initially responded with grunts on starting the vehicle. After about 10 minutes of journey, the animal became increasingly excited and hard to control, gnawing at the thinner planks. Diazepam 10 mg. was again injected intramuscularly. After 10 minutes, the journey was resumed. The bear got excited intermittently, thereafter with heavy panting due to heat, congestion and probably constant movement of the vehicle.

After 10 minutes of the administration of the second dose, the animal became increasingly restless and broke one side of the cage with frantic effort to come out. Diazepam 15 mg. was injected again intramuscularly to complete a dose regime of 2 mg/kg body weight. After 15 minutes of administering the third dose the bear calmed down. The animal lay on its belly with relatively moderate muscle relaxation and analgesia but with complete listlessness. Transportation resumed soon after repairing the cage.

On arrival, the bear was allowed to creep out of the cage. The animal recovered fully an hour thereafter. Emesis or other complications were not exhibited.

Results and Discussion

Diazepam is described as a suitable drug for restraining wild animals (Fowler, 1978). The dosage varies from 1 to 3.5 mg/kg (0.5 to 2 mg/lb), depending on the species and the degree of excitement at the time of injection. Onset of induction is reported to be within 1 to 2 minutes when given intravenously. If given intramuscularly, it takes effect within 15 to 30 minutes, depending on the dose. Diazepam is metabolized slowly. Clinical effects usually disappear within 60 to 90 minutes (Fowler, 1978).

In the present study, diazepam at the dose rate of 1 mg/kg body weight was not found to be sufficient, but responded well at the dose rate of 2 mg/kg body weight. However, a higher dose rate may be necessary for bigger and more agile and excited bears.

The present dose was found to be completely safe with no visible clinical side effects or toxicity. Similar findings have been reported when large doses of diazepam was given to dogs for prolonged periods (Hall & Clarke, 1983).

Acknowledgement

NN acknowledges the kind help rendered by the D.F.O., Western Assam Wildlife Division, Mangaldai, Assam, India. He is also grateful to all his well-wishers for their help and advice during clinical monitoring and health recovery of the bear at its temporary rehabilitation site.

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* Diazepam 10mg. per 2ml, Ranbaxy India, Bombay

Received 22 October 1998; *Accepted 6 December 1999*

Reprint : Zoos' Print, 5 (5) : 13, May, 1990

General Anaesthesia in a Lion Tailed Monkey (*Macaca silenus*) using Droperidol-Fentanyl Mixture (Innovar-Vet).

By P. O. George, K. Rajankutty and Jacob V. Cheeran
College of Veterinary and Animal Sciences, Mannuthy, Kerala

For successful general anaesthesia of a bonnet monkey (*Macaca radiata*). George *et. al* (1987) had used xylazineketamine combination. In the present report, the authors place on record, the use of droperidol-fentanyl mixture for anaesthetising a lion tailed monkey for surgical manipulations.

A lion tailed monkey (*Macaca silenus*) weighing about 10 kg and belonging to the Trichur Zoo, was reported to be lame, due to the injuries sustained on the left hindlimb. For the treatment of the wounds and to ascertain whether there was any fracture, it was decided to anaesthetise the animal.

After trapping the animal within its cage, 1.50 ml droperidol-fentanyl mixture (Innovar-Vet, Pitman-Moore, U. S. A. 1 ml containing 20 mg droperidol and 0.40 mg fentanyl citrate), followed by 0.30 mg atropine sulphate were administered intramuscularly. The animal became unsteady in gait by two minutes. By the third minute, it assumed the position of sternal recumbency, with the head kept lowered and touching the ground. It assumed the position of lateral recumbency, by the fourth minute and by the fifth minute it was under surgical plane of anaesthesia. The eyelids remained open.

On examination of the affected limb, there were deep lacerated wounds on the metatarsal region and the footpads. No fracture was evident. The wounds were scarified and sutured using chromic catgut. The wounds were dressed with Tr. Benzoin. Benzathine penicillin (Penidure LA-6, Geoffrey Manners & Co LTD, Bombay) was administered intramuscularly. Surgical manipulations took about 10 minutes. The anaesthetic effect waned away by the 25th minute. Recovery from anaesthesia was smooth and uneventful. The wounds healed up by about 10 days.

From the present report, it could be seen that, for bringing about surgical plane of general anaesthesia, in a lion tailed monkey, weighing about 10 kg, 1.50 ml droperidol-fentanyl mixture was necessary. Field *et. al.* (1966), had recommended the use of droperidol-fentanyl mixture, in primates, at varying dose levels ranging from 1.0 ml/4.5 kg. to 1.0 ml/36.0 kg. bodyweight, for producing central nervous system depression and analgesia.

Acknowledgement

The authors are thankful to the Dean, College of Veterinary and Animal Sciences, Mannuthy, for according permission to publish this paper and to the Superintendent, Trichur Zoo, for facilities provided.

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Reprint : Zoos' Print, 3 (8) : 7-11, August, 1988

Gross Anatomical Studies on the Visceral Organs of the Musk deer (Moschus Moschiferus)

By 1. Tahseen Lone, 2. Massarat Khan 3. Mushtak 4. Mansoor A. Mir 5. A. Baba

CLASSIFICATION AND DISTRIBUTION:-

Order Artiodactyla has a World wide distribution. All the deer species come under two families, cervidae and Moschidae (Green, 1986). Three sub-species have been distinguished (Flerov, 1952) under the species moschiferus and genus Moschus which are :

1) MOSCHUS MOSCHIFERUS. 2) MOSCHUS SIBIRICUS and 3) MOSCHUS BEREZOVESKII.

Earlier Himalayan musk deer was widespread in Pakistan, Nepal, Bhutan, North Burma and extended into parts of Tibet and North West China. At present it is localised in isolated pockets in Kashmir, Himachal, Uttar Pradesh and Nepal. This species is near extermination in India (Jumwal 1972).

HABITAT :

Himalayan musk deer is commonly found at the height of 2400 - 4300 meters in different forests. They are nocturnal and solitary animals.

SPECIAL FEATURES :

Himalayan musk deer is distinguished from other deers in the following special features:-

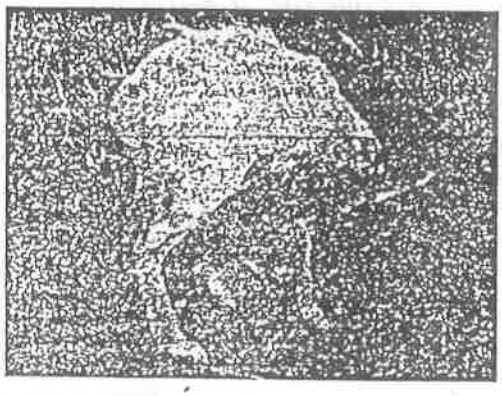
a) They are antlerless (also, chinese water deer HYDROPTES INERNIS).

b) Presence of an elongated upper canine tooth in males.

c) Presence of gall bladder and caudal gland.

d) Absence of tarsal, metatarsal and suborbital glands.

e) Presence of single pair mammae in females.



Musk deer with fawn.

IMPORTANCE:-

The most valuable product is musk, a strong smelling perfume obtained from males. The musk is used in oriental medicines and to some extent by perfume industry.

Keeping in view the importance of this species, gross anatomical studies of their visceral organs will be dealt with, as there is scanty information available in this aspect. The present study was conducted on a liver of 3 months old musk deer brought from Salim Ali National Park at Srinagar.

DESCRIPTION:-

Liver was situated on the abdominal surface of the diaphragm on the right side, the long axis being directed obliquely downwards and forwards. It was roughly rectangular in SHAPE AND WAS REDDISH BROWN in colour. It weighed about 120 gms and was 5 inches long from middle of right border to the middle of left border, and 3 inches broad at the middle of dorsal and ventral borders. It presented three well marked lobes; a large lobe, a caudate lobe and a papillary lobe. The large lobe (Fig. 1) consisted of two surfaces, four borders and four angles (Habel '77).

PARIETAL SURFACE:-

This surface was smooth and convex (Fig. 1). A blunt oblique line divided the surface into external and internal areas. External area was regularly curved from above downwards, whereas the internal area was slightly flattened. Falciform ligament was attached to this surface from the oesophageal notch to the umbilical fissure. A narrow portion of the internal area (area nuda), on its dorsomedial aspect was without a serous covering and was attached to the diaphragm.

VISCERAL SURFACE:

It is concave, irregular (Fig. 2) and related to omasum, abomasum, duodenum and pancreas. This surface presented the following features :

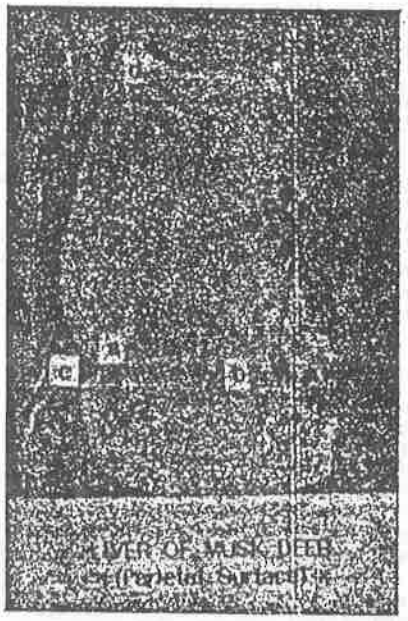
1) THE PORTAL FISSURE (porta hepatis) An elongated depression lying above the middle of the visceral surface, beneath the papillary lobe. (Portal vein and hepatic artery enter the liver, whereas, the hepatic duct and lymphatics also leave it at this portal fissure). The pancreas was attached on the right lateral part of the fissure.

2) OMASAL IMPRESSION:- A shallow cavity above the papillary lobe.

3) RETICULAR IMPRESSION:- An indistinct marginal area below the omasal impression.

4) ABOMASAL IMPRESSION:- Present below the reticular impression.

5) DUODENAL IMPRESSION :- A deep, concave depression lying ventral and to the right of the portal area.



Liver of musk deer, parietal view.
a. Notch for round ligament b. Falciform ligament c. Gall bladder d. Caudatelobe.

6) FOSSA OF GALL BLADDER:- A distict impression just inside the umbilical notch.

Right border (Fig. 2) was short, thick and presented a caudate lobe and a deep renal impression for the right kidney.

Left border (Fig. 1) was thin, convex and continuous with the dorsal and the ventral borders. It presented a thin flap like structure on its visceral surface. (Fig. 2).

Dorsal border (Fig 1) was straight and thick with a shallow oesophageal notch at about its middle. The posterior vena cava lay partly embedded in the right half of the dorsal border.

Ventral border (Fig. 1 & 2) was convex, thin, marked by deep and wide umbilical notch. The notch divided the border into two parts Gall bladder was embedded with in the notch and did not extend beyond the ventral border of the liver.

The angles were right dorsal, right ventral, left dorsal and left ventral (Fig. 1). All the angles were having rounded margins,

Papillary lobe (Fig. 2) was prominent having rounded margins. It was situated just below the dorsal border overlying the portal fissure.

Caudate lobe (Fig. 1&2) was situated towards the right border and was sickle shaped, with its tip extending well beyond the renal impression. It projected about an inch beyond the right ventral border of the main lobe.

Gall bladder (vesica fellae) was more or less pear shaped (Fig. 2) and 1½ inches in length. It was having a bluntly rounded fundus, a body and abruptly narrowing neck. The neck continued into a cystic duct which ran beneath the hepatic duct. It joined shortly with the hepatic duct by taking a short course, after which they continued as common bile duct.

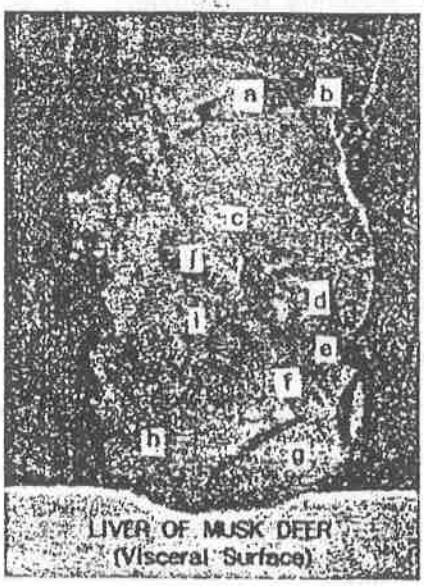


Figure 2. Liver of musk deer, visceral view.
a. Renal impresion b. Caudate process
c. Cystic duct d. Gall bladder
e. Notch for round ligament
f. Abomasal impression g. Left border, flap
h. Reticular impression i. Hepatic artery
j. Papillary lobe.

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Reprint : Zoos' Print, 4 (6) : 19, June, 1989

MORPHOLOGICAL STUDY OF BRAHMINI RIVER TURTLE

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Introduction :

Smith M. A. (1933) quotes that the length of Hardella thurgi attains 500mm and Prichard (1979) states that the species reaches at least 533mm. Indra Neil Das (1984) saw a large female which had a carapace length of 24 inches (610mm). The author dissected the Hardella thurgi on 24-11-86 and observed that the animal had a carapace length of 46cm, a plastron length of 39cm and a carapace width of 41cm. The shell height was 18cm; shell weight 9.4 kg The tail length was 6 5cm. It had 10 ovarian follicles of diameter 1 74cm. to 2.70cm.

Not much research work has been done on the Hardella thurji species. The morphological characters as studied by the author are given below. Hardella thurji is found in Gomti river.

Materials and methods :

Measurements of morphological feature have been made by use of Freemans stap, salter Balance and Vernier callipers.

Observations :

The carapace : The mean carapace length was 29.9cm to 49.0cm. The carapace was black in colour with 22 marginal scutes excluding 2 supra caudals and 1 nuchal segment. 5 median segments were present between the right and left 4th mediolateral segments. All the 8 mediolateral segments were deep black in colour. Out of the 9 animals examined, in one animal, the left supracaudal slightly overlapped the right supracaudal segment of the carapace. The carapace showed slightly wavy edges with a median keel.

The Plastron : The plastron was segmental and pale yellow in colour. Large black blotches were observed on each bridge as well as on the midline of the plastron near the front. On each abdominal scute also large black blotches were present, with smaller extensions on the posterior part of the pectorals. There were black pigmentation around the interfemoral and inter-anal seams. The mean plastron length measured in 9 Hardella was 34.41cm and the average plastron length was 27.4 to 40.8cm. The mean girth of the caudal was 4.24cm. and the average was 2.80 to 7.2cm.

Weight : The mean weight of the 9 Hardella species examined was 6.466 kg and the average was 3.30 - 12.20 kg.

Shell Height : The average shell height in the 9 Hardella thurji was 11.5 to 18.0cm. The mean shell height was 14.188cm.

Head : The head was dark black in colour and the snout projected some what beyond the upper jaw. A thick yellow strip extended from the nostril on each side passing above each eye and then curved sharply downward along the side of the head and neck. Another elongated yellow blotch was situated just below the nostrils. The lower jaw was pale yellow in colour. There was a short diagonal yellow bar just below each eye.

Girth of Head cavity : The mean of head cavity girth in the 8 Hardella examined was 5.2625 cm and the average was 4.6 cm to 7.9 cm.

The Tail length : In large animals (C. L. 49 cm) the tail length was 6 cm; in animals measuring CL 37.2, the tail length was 4.1 cm; in CL 42.2 cm, the tail length was 5.5 cm in CL 31.4 cm, the tail length was 3.0 cm and in CL 40 cm, the tail length was 6 cm.

External apertures : In the 9 Hardella species examined, the cloacal aperture was found above the end of the carapace in 6 animals and in the other 3, the cloacal aperture was found after the carapace end. A pointed penis was found inside the cloaca in the males.

Comments :

It was observed from a study of the 9 Hardella species that the carapace and plastron length increase with the size of the animal. The shell height increased as the carapace length increased. The head cavity increases in relation to carapace length and the caudal in the plastron increased as the size of the animal increased.

Hardella thurji is a black turtle with yellow stripe on the head, a yellow line on the bridge of costal and marginal segments.

Acknowledgments :

The author is greateful to Mr. R. S. Bhaduriah C. F. (Forest Corporation U. P.); Mr. Ashok Pai, Deputy C. T. V. P.; Ms. Sally Walker, Editor, Zoo's Print; Mr & Mrs. Whitaker; Dr. L. A. K Singh, Research Officer, Tiger Project; Dr. R. J. Rao, Senior Research Fellow, W. I. India; Mr. P. M. Gaur, Director General Navy; Dr. R. M. Gupta, Vice Chancellor Poorvanchal University, U. P.; Mr. Ajit Pratap Singh, Forest Minister, U. P.; Mr. R. P Singh, Special Secretary, Forest, U. P.; Mr. Niranjan Singh, Freedom Fighter on India; fer their encouragement in his research study of aquatic reptiles.

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Reprint : Zoos' Print, 5 (3) : 40-42, March, 1990

Bone Age Assessment of Various Skull Bones and Teeth of the Gir Lion *(Panthera leo persica)*

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Introduction

For understanding of the population structure and dynamics the knowledge of sex and age classes of the population is very important for a wildlife investigator and manager as well. However, determining age in mammals is somewhat less precise because there appears to be more variation between individual mammals (Taber, 1971).

The variations are also registered between left and right sides of the same skull probably because of asymmetrical loading during mastication (Greaves, 1985).

The methods used to estimate the age in mammals include the tooth development, maturation of long bones, changes in baculum (or penis), growth of horns, weights, and the weight of the lens of the eye (Table, 1971). Mills (1982) has determined age of the brown hyaena on incremental growth lines in the teeth.

Primarily, present work was planned to carry out the studies on the variations in the skulls of Gir Lions present at Sakkarbaug, Junagadh. Attempts have been obtained by measurements of various parameters of skulls with the chronological age estimated by the Sakkarbaug Zoo staff. Lack of material on this particular aspect has always hampered the useful efforts in this direction; as in case of Pocock (1930, 1935) and Todd. This work is no exception. In spite of the poor number of skulls, the efforts to estimate the chronological age came to reliable approximations.

Material and Methods

Nine skulls of Asiatic Lion *(Panthera leo)* were collected from Sakkarbaug, Junagadh. Livestock register number, sex, whether zoo born or wild caught, date of death and approximate age of individual skull were collected from the zoo register. Out of 9 skulls studied, 3 skulls were of male and 6 of female.

The skulls were divided into age groups on the basis of their chronological age. For example, 'age 10 years' comprised the skulls aged from 9.5 to 10.5 years. The chronological age data were taken from the zoo register, in cases where the date of birth of an animal was available the age was calculated.

All measurements have been taken to the nearest millimeter and measured with the help of a pair of divider wherever necessary.

Measurements were taken as follows:

1) *Palatal length:* Length from anterior end of premaxillary to anterior end of posterior nasal opening.

2) *Palatal width:* Width between inner roots of superior carnassials.

3) *Intraorbital width:* Least width between superior border of orbits.

4) *Incisor Molar length:* Length of line connecting posterior most margins of alveoli of upper incisors with posteriormost margin of molariform toothraw occlusal surface, (such measure gives an idea of overall length of 'masticating area' of mouth).

5) *Width across molariform toothraw:* Length of straight line connecting right and left labial margins of toothraw at their mid-points. (This character gives an idea of mouth width).

6) *Length of Molar toothraw:* Length of occlusal surface of molariform teeth from anteriormost to posteriormost points.

7) Height and Width of incisors, canine, premolars and molar teeth were also taken.

Height: Height from the base of the crown, which is well defined by a line of constriction at the point of union with the roots, to the occlusal surface.

Width: Greatest width across a tooth.

Other than these, other measurements like condylobasal length, muzzle width, postorbital construction, zygomatic width, mastoid width and condyle width were also taken. But after analysis it was found that they were insignificant.

Results

Age and various skull elements :

A) Palatal length (Table II, fig. 1): Palatal length was found to increase sharply upto ten years, afterwards the growth was very slow.

B) Palatal width (Table II, fig. 1): shows sharp increase in the width upto 14 years of age, however, the growth was steady after 14 years.

C) Width across molariform toothraw (Fig. II, Table-I): Width across molariform toothraw was found to be increased sharply upto 18 years.

$r = 0.75$ Regression Equation: $Y = 64.63 + 0.43x$

D) Length of Molar toothraw: Fig 2, table II, shows sharp increase in length of molar toothraw was found to increase sharply upto 18 years.

$r = 0.62$ Regression Equation: $Y = 64.63 + 0.43x$

E) Intraorbital width (Fig. 3, table-II): shows sharp increase upto 10 years, afterwards the growth was slow.

F) Incisor Molar length (Fig. 3, table-II): shows sharp increase in incisor molar length upto 10 years, then growth stabilizes in case of female whereas in case of male it increases up to 18 years in a curvilinear fashion.

G) Incisor height, premolar height (upper-jaw) was found to increase sharply upto 10 years afterwards decreases due to aging.

H) Canine height: However, canine height was found to increase upto 18 years.

I) Incisor height, canine height, premolar height, molar height of lower-jaw was found to increase upto 10 years afterwards it got reduced.

J) Incisor width, premolar width, and molar width was found to be increased up to 10 years afterwards it got reduced due to wear and tear.

Discussion

Here an attempt has been made to assess the bone age using various skull bones and teeth by regression equation using the chronological age as independent variable. Although the method of estimating the chronological age by zoo seems arbitrary, deviation of some of the age data from the regression line also suggests the factual mistakes in chronological age assessment and the real age can be estimated from the graph or the equation.

Although lack of the material is a weakness of this work, it suggests that the growth in skull bones becomes slow after ten years of age and after 14 years wear and tear becomes predominnnt especially in the teeth.

Sources of discrepancy between bone age and the chronological age is largely attributed to 1) arbitary method of age estimation in zoo; 2) natural variation in individuals: and 3) probably asymmetrical loading during mastication.

To assess the age of animals in wild the live animals can be immobilized, and dead can be examined by post-mortem.

The mass, total length, shoulder height were proved quite effective in assessing the chronological age in brown hyaenas (Mills, 1982), such parameters also can be checked with Gir lions upto the age of 14.

TABLE - I. Details of the Asiatic Lion skulls of Sakkarbaug, Junagadh according to Zoo's register.

S. No.	Livestock Register Number	Sex	Arrival at zoo By birth/W. c. *	Date of arrival at zoo	Date of Death	Approximate Age (year)
1.	66	Male	W. c.	14— 6—86	6— 9—86	18
2.	61	Male	W. c.	15—11—85	15—11—85	10
3.	22	Male	Zoo born	26—11--81	28— 2--88	6
4.	15.	Female	Zoo born	20— 2--80	23—10—89	10
5.	84	Female	Zoo born	24— 1—78	17— 4—88	10
6.	72	Female	W. c.	3— 8—86	18— 8—86	4
7.	30	Female	W. c.	2— 4—82	28— 5—82	14
8.	8	Female	W. c.	23— 7—78	30—11—82	12
9.	54	Female	W. c.	28— 4—75	21— 7—85	10

* W. c. = Wild caught.

TABLE - II. Measurements of various skull elements of Asiatic Lion of Sakkarbaug Zoo.

S. No.	Sex	Approximate Age (year)	Palatal length (mm)	Palatal width (mm)	Intraorbital width (mm)	Incisor-Molar length (mm)	Width across Molariform toothraw (mm)	Length of Molar tooth-raw (mm)
1.	Male	18	135.0	82.5	77.0	128.0	97.0	75.0
2.	Male	10	132.0	80.0	73.0	111.0	90.0	68.0
3.	Male	6	125.0	79.0	67.0	106.0	89.0	69.0
4.	Female	10	122.0	67.0	60.0	111.0	75.0	63.0
5.	Female	10	122.0	67 0	60.0	110.0	74.5	63.0
6.	Female	4	102.5	55.5	48.0	77.0	65.0	50.0
7.	Female	14	121.0	75.0	63.0	102.0	86.0	67.0
8.	Female	12	126.0	78.0	67.0	110.0	93.0	74.0
9.	Female	10	127.0	77.0	70.0	110.0	90.0	70.0

Acknowledgements

One of us (K. G.) is thankful to Mr. Anil Joshi, Miss Seema Sharma Miss Bindu Shah, Miss Sholly, Mr. Gachin, Mr. James and Mr. Katan for encouragement.

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Questions, Comments, Discussion

Kapasi: A good attempt has been made to collect some data which has been based on nine skulls. The effort needs to be continued so that guidelines can be set to assess the age of lions. If anyone has done any similar work on any other animal also, they can respond.

We have a number of zoo directors here and we can request them to send skulls of dead animals here to Saurastra University so that some more work can be done. The scientists can give a list of the parts of animal which they require to make some useful study and then the zoos can send such materials to you for the benefit of scientific study. It will be useful for coming to some conclusions. Let there be a checklist, including height, etc. of what kinds of materials and information is needed by the University. A good beginning has been made so let us all cooperate to forward this kind of study.

Editor's Note: Tables III-VI giving detail of height and width of teeth have not been included due to constraint of space and time.

Reprint : Zoos' Print, 6 (5) : 17, May, 1991

MORPHOLOGICAL OBSERVATIONS ON INDIAN CIVET

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The Indian Civet lives in bushy jungles near human habitations and feeds mainly on rodents, thereby helping to keep the rodent population under control. The numbers of the beneficial wild animal is fast on the decline, however, and it has not received proper attention. This communication is to put on record some morphological observations on the Indian civet.

Observation:

On 3rd March 1990 at 9:30 a.m., a carcass of Indian Civet was referred for conducting post-mortem examination to Margherita Block Veterinary dispensary, District: Tinsukia, Assam by the Ranger, Margherita West Forest Range. Before conducting post mortem examination, the observations recorded are as follows:

The carcass was carefully placed flat on an even ground surface with legs stretched apart and abdomen touching the ground. Body length was measured with the help of a measuring tape from the point of the nose to the last sacral vertebra (point of hip). It was found to be 70 cms. The tail length was 45 cms measured from tip of tail to the first coceygeal vertebra. The head was elongated with pointed mouth, small blackish nose and small round, dark-coloured eyes. Three pairs of long and tough whiskers were found.

The teeth were small, white and looked razor-sharp. The number of teeth could not be counted as the jaws were locked due to rigor-mortis. Ears were found to be small in comparison to the head.

The whole of the body was covered with coarse thick coat of grey colour containing black-coloured longitudinal stripes running from head to hip excepting the abdomen. The tail was spindle shaped and covered with two types of hairs, one elongated and coarse over a fine and short type. The carcass was turned to place in supine position. A circular anal opening below the root of tail and a vaginal slit just one inch below the anal opening was observed. The coat was thoroughly examined and no external parasites like ticks or lice were observed.

Reprint : Zoos' Print, 6 (11) : 22, November, 1991

COMPARATIVE DIMENSIONAL CHARACTERISTICS OF SPERMATOZOA OF SIX ZOO ANIMALS

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Introduction

The dimensional characteristics of spermatozoa differ within and between species. They are very valuable for characterizing the normal morphology of spermatozoa of a species. The literature on morphology of spermatozoa of zoo animal is very scanty. This might be due to difficulties in obtaining semen. However a few reports are available on the dimensional characteristics of spermatozoa of zoo animals (Merilan, et. al., 1982 and Petterson et.al., 1985). The present study was undertaken to record the dimensional characteristics of six zoo animals.

Materials and Methods

Spermatozoa were collected from the cauda epididymis just after the death of the animals. A fine drop of sperm was mixed with eosin-nigrosin stain (Hancock, 1951) and a smear was made on a microscope slide. For each animal 15 morphologically normal sperm with clear outline of head were selected at random in the semen smear and measurements of head length, head width and tail length of sperm were made at a magnification of 1000 X using an ocular micrometer which has been calibrated with stage micrometer. The head length and head width of sperm included the maximum length and width of sperm head as described by Mukherjee and Bhattacharya (1949).

Result and Discussion

The mean head length, head width and tail length of sperm of six zoo animals are presented in Table 1.

Among the six animals studied, the size of sperm head (length and width) was largest in Spotted deer and smallest in bear. The tail of sperm was observed to be longest in bear and shortest in Slow loris. The dimensional characterisitics of sperm of Spotted deer, Slow loris and Black buck were comparable with the dimensional characterisitcs of sperm of sheep, goat, and Mithun (Deka and Rao, 1980, 1987 and Nath et. al., 1985). The head length (8.7 +/- 0.3/u and 8.9 +/ 0l.4/u) and total length (64.8 +/- 0.8/u) and 66.2 +/- 1.1 /u) of Formosan Sika deer and Axis deer (Patterson et. al., 1985) were well comparable with spotted deer under study. A comparison of all the findings could not be done due to lack of available literature.

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Table 1 Spermatazoan dimensions

Parameters	Barking deer *Muntiacus muntijak*	Sambar *Cervus unicolor nigar*	Spotted deer *Axis axis*	Slow loris *Nycticebus coucang*	Black buck *Antilope cervicapra*	Bear *Melursus ursinus*
Head						
Length (/u)	7.03+/-0.06	6.9 +/- 0.04	8.53+/-0.07	8.44+/- 0.11	8.08+/-0.04	5.5+/-0.13
Width (/u)	3.7+/-0.06	4.75+/-0.05	5.15+/-0.07	4.91+/-0.05	4.95+/-0.03	2.8+/-0.11
length: width	1:0.53	1:0.69	1:0.60	1.0.58	1:0:61	1:0.51
Tail length (/u)	54.85+/-0.47	48.1+/-0.50	56.8+/-0.26	47.25+/-0.41	58.6+/-0.31	60.44+/-0.44
Total length (/u)	61.88+/-0.44	55+/-0.50	65.33+/-0.29	55.69 +/-0.43	66.65 +/-0.31	65.9+/-0.46

1. Mean of 15 observations.

Reprint : Zoos' Print, 6 (11) : 29, November, 1991

NOTES ON THE ANATOMY OF THE HEAD OF A WILDCAT

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An adult wild cat which died in a road accident was brought to the department. It had an injury on the head and a fractured hind leg. Considering its importance in wildlife, close lineage with the domestic cat (Table I) and paucity of information on its anatomy, a detailed dissection was carried out on it. Certain interesting points regarding its head and mouth are being reported in this note.

Table I

Position of the wildcat and domestic cat in the Animal Kingdom (Adapted from Crouch 1969)

Phylum - Chordata - Craniata
Subphylum - Gnathostomata - Tetrapoda
Class - Mammalia - Eutheria - Placentalia
Order - Carnivora - fissipedia
Family - Felidae
Genus - Felis
Species - Felis chaus
Felis chaus = wild cat
Felis domesticus = common cat
(a cross between European and African wild cat)

The wild cat had a wider head than its length with thin and short, triangular ears placed on its either side. The face was covered with the regular black grey haired skin with certain black stripes over the crania. The facial region was lighter in colour. The round eyes were placed in front. The nose was short with well built nostrils. The T-shaped planum nasale (Height 1.2 cm and width 0.7 cm) was a distinctly horny, non-hairy, red area placed between the nostrils and the upper lip, cut by a distinct philtrum. The facial length was 9.5 cm and width 10 cm. The distance between the two medial canthi (interorbital distance) was 2.8 cm. The cephalic index was more than 100 and the craniofacial index was 10 : 4 putting it into extreme brachicephalic group.

Both the lips were thin at their free borders. They united at the commissures opposite the molar teeth on either side (Rima oris - 9.5 cm). They were quite mobile and free from the frenulum. The cutaneous surface of the upper lip bore long, mostly non-pigmented tactile hairs in three rows placed among the ordinary hairs. Tactile hairs were absent on the lower lip.

The mucous membrane of the whole mouth cavity was pink. The dental formula was 2 (I 3/3 C 1/1 M 1/1)= 30 which corresponds with that of the domestic cat (Taylor and Weber 1951, St. Clair 1975). The crowns of teeth were sharp but canines were much sharper and pointed curved caudal. The palate was more than twice longer (3 cm) than the soft palate (1.2 cm). Soft and hard palate ratio thus was 1 : 2.5. The palatal index was 71.42. The hard palate widened gradually from craniad (2cm at 1st ruga) to caudad (3 cm at M 1). The raphe palati was indistinct. There were 7 rugae palatinae arching more acutely caudad. Ellenport (1975) observed horny papillae between the rugae of domestic cat. The crescentric papilla incisiva guarded by a horny mucous membrane lay between the central incisors and the first ruga. In domestic cat it is round (Crouch 1969) or triangular (Ellenport 1975).

The tongue was soft, protractile and broad anteriorly. the mucous membrane of the free dorsal surface was studded with filiform papillae throughout, which became conical type caudally. The fungiform papillae were present anteriorly and laterally only. The circumvallate papillae occurred on either side in front of the root. The foliate papillae were not clearly discernible. Ellenport (1975) and Crouch (1969) have reported 2 - 3 vallate papillae in the domestic cat. The latter authors reported some rudimentary foliate papillae also.

A very big rima oris, tactile hairs on the upper lip and a wide tongue with mechanical and gustatory papillae help the wild cat to select and consume its predatory feed, whereas a wide head with eyes placed in front help it to concentrate on its prey, in accordance with its carnivorous nature.

Acknowledgement

Authors appreciate the keen interest shown by Archana in research by providing wild cat to the department.

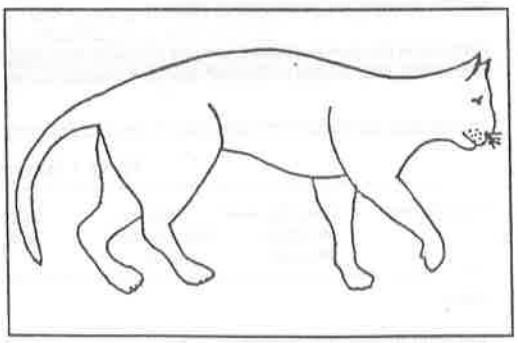

Illustration of wild cat by the authors.

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Reprint : Zoos' Print, 6 (11) : 30, November, 1991

A NOTE ON THE ANATOMY OF THE DIAPHRAGM OF A WILD CAT (Felis chaus) WITH SPECIAL REFERENCE TO ITS NERVE SUPPLY

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An adult wild cat died accidentally on the road and was brought to the department. It had a fractured skull and hind leg. A detailed dissection was carried out. Certain interesting points on the diaphragm of the animal are being reported in this note.

Like other domestic animals, the diaphragm of the wild cat was also musculotendinous in structure. The muscular part was extensive (114 cm^2) whereas the tendinous part was very small (4 cm^2). The diaphragm attached ventrally to xiphoid cartilage, laterally from the 9th costal cartilage and then to the ventral end of the 10th to 12th ribs, and dorsally to the ventral spine of 3rd and 5th lumbar vertebrae on left and right sides respectively, by means of its tendinous crurae. The left tendinous crus was smaller (2 cm) than the right (5 cm) one. The central tendon of a domestic cat is stated to be thin and irregularly crescent shaped, with its convexity ventrally and horns ending on two sides of the spinal column (Crouch, 1969). In wild cat it was clearly "V" shaped structure placed centrally (Fig. 1). The limbs of "V" extended in either hemidiaphragm 3.5 cm from the respective thoracic wall while its ventral point was 3.5 cm dorsal to the sternum. The foramen venae cavae lay in its concavity 4.5 cm dorsal to the sternum. The hiatus oesophageus lay 1.2 cm dorsal to the foramen venae cavae slightly to the right of median plane (5 cm from the right and 6 cm from the left thoracic wall). Crouch (1969) has also described the hiatus oesophageous of domestic cat in the right crus.

The right phrenic nerve which formed by the union of fibers from ventral branches of C_5 and C_6 as in domestic cat (Crouch, 1969) entered the thorax, crossed the heart at the level of atrioventricular junction included into the ventral accessory fold of the vena cava reached the diaphragm at the right musculotendinous junction and divided into three branches (Fig. 1). The dorsal (thickest) branch was distributed into the right dorsal musculature. The lateral branch (medium) after a short course split into 2 and supplied the lateral fleshy part. The ventral branch (thinnest) after a short distance divided into three and supplied the ventral musculature of the right hemidiaphragm. The left phrenic nerve after being formed as above crossed the atrium and reached the left musculotendinous junction and divided into dorsal and ventral branches. The dorsal branch (thick) divided into 2, the lateral and medial. The latter split off into 4 and the former into 2 radicles again and supplied the left dorsal hemidiaphragm.

The ventral branch was comparatively thin and split into 2 to supply the ventral part of left hemidiaphragm.

Acknowledgement

Authors appreciate the keen interest shown by Archana in research by providing the wild cat to the department.

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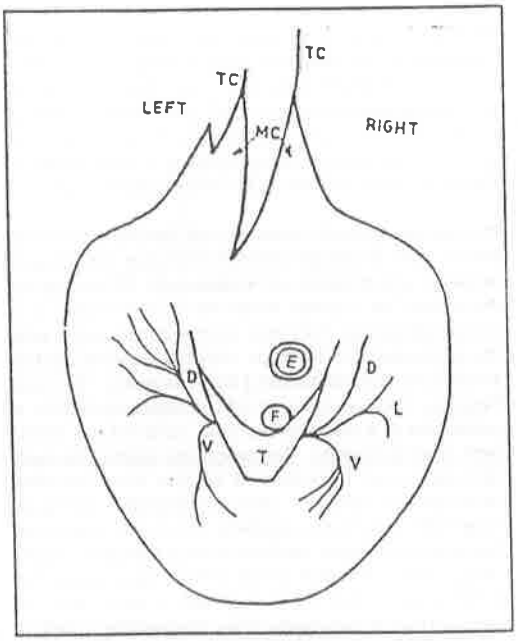

Figure 1

Diagrammatic sketch of the diaphragm of wild cat.
D, dorsal branch of phrenic nerve;
E, hiatus oesophageous;
F, foramen venae cavae;
L, lateral branch of phrenic nerve;
MC, muscular part of crurae;
T, Central tendon;
C, tendinous part of crurae.

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Reprint : Zoos' Print, 10 (5) : 27-28, May, 1995

ANATOMICAL STUDY OF GULAR POUCH IN GREATER ADJUTANT STORK

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Greater Adjutant stork *Leptoptilos dubius* (Gmelin) is one of the most endangered species of Ciconidae in the world. It may infact be the stork species most endangered with extinction, and deserves special attention (Luthin, 1987). Only a small viable population is struggling for its existence in the Brahmaputra valley of Assam, India. Recent records of breeding of the Greater Adjutant Stork (GAS) is known only in Assam (Kahl, 1970; Saikia and Bhattachanee 1990). It has also been reported that the isolated populations in Assam are mainly sedentary.

Till 1989, very little attention has been given on the conservation and intensive study of GAS. Since 1987, Saikia and Bhattachanee have been trying their best to conserve the species under a WWF-India project. Recently Centre of Wildlife and Ornithology of Aligarh Muslim University has also launched a project to study storks in India with special reference to the endangered species.

Here we are highlighting the fact that, despite continuous effort to save this huge bird from extinction, some major problems are resisting our endeavours. Without going into details, we explain about the incident of killing of GAS by poisoning. We have been informed earlier also that pesticides of dangerous implications were used to kill the GAS, but did not get a direct evidence. On 22nd February 1995, we discovered two bodies of GAS in a paddy field at a place called Barni, about 40 km. north-west from Guwahati. We caught the killer of the bird, who is a farmer. He informed us that four days back he mixed one pesticide called "DEMICRON" with fishes to be fed by the unfortunate GAS. When they consumed the poisonous fishes, became drowsy and could not fly away. Then the farmer along with his sons beated the birds to death. We were surprised to know from the accused that he has been doing this practice for last 15 years and on an average, five birds were killed every year by the accused. The accused kills the bird because GAS feed fishes from the three percolation tanks within his paddy field.

In another case, at Singimari Alikash, about 13 km north from Guwahati, two juveniles of GAS were found dead on the nest, on 24th February 1995. However, Forensic examination reveals that this was not a case of food poisoning. This is for the first time, we found that the juveniles about to fledge died for some unknown reason in the nest.

MARVEL OF THE GULAR POUCH

We dissected one dead adult and one juvenile GAS. They were almost in the rotten state and so we could not do much with the viscera. However we managed to cut open the pouch. Same kind of pouch are also found in the Marabou Stork, which is thought as an enlargement of the lower part of the oesophagus. Some experts believe that this may have sexual significance, others feel that it has some connection with the respiratory system (Anon, 1994). Some feels that the gular sac of *Leptoptilos dubius* functions primarily during social displays and possibly in thermo-regulation (Hancock *et al*, 1992). Our observation is that the pouch has neither linked with the respiratory trachea nor connected with the oesophagus; rather it is an extra skin beneath the neck. In the adult bird, we measured the pouch, which was 23 cm in lenght. Another orange coloured air sac situated near the base of the neck on the dorsal side is also isolated from the gular pouch. However, at present, we are not able to say what is the actual function of the gular pouch. The vital statistics of the adult and Juvenile GAS are summarized in Table-1.

Table1 . Showing various measurement of the body of GAS.

Parameters	Adult (cm.)	Juvenile (cm.)
Length of the body (from tip of the bill to tip of the tail).	137	118.7
Wing span	303	290
Bill Lenght	31.2	19.8
Maximum expansion of the bill	28	16.5
Length of neck	32	29.5
Length of pouch	23	7
Circumference around the body	60.5	50.4
Length of Tibia	36.8	36.5
Length of Tursus	30	28.5
Circumference of Head	32	29.5

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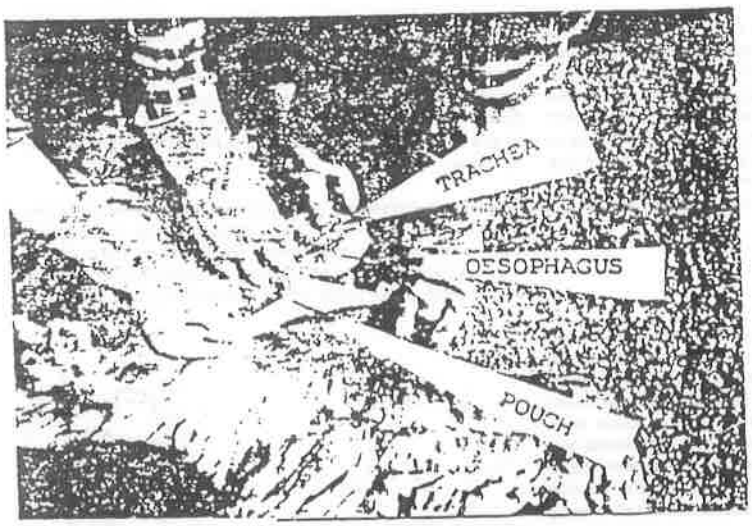

Fig. 1. Dissection of gular pouch in Greater adjutant stork, showing oesophagus and trachea having no connection with the pouch. Photo: B.K. Talukdar

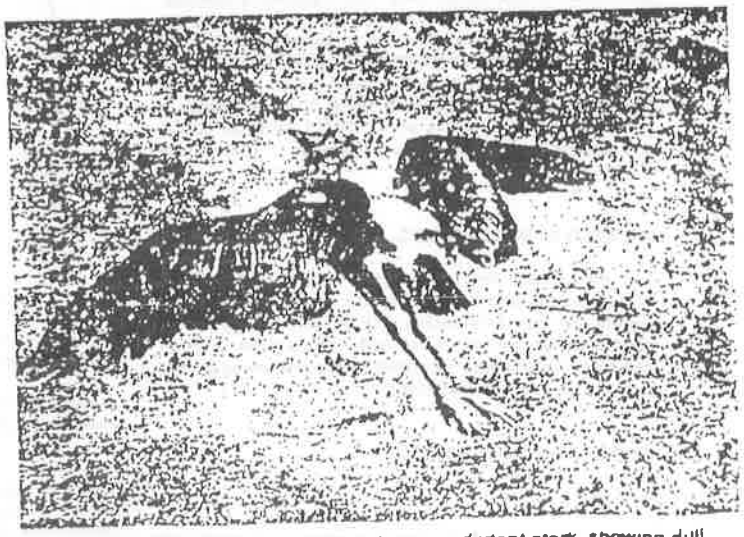

Fig. 2. Dead body of the juvenile Greater adjutant stork, showing dull greyish secondary coverts and hairy head. Photo: B.K. Talukdar

Reprint : Zoos' Print, 11 (3) : 18-20, March, 1996

GROSS OBSERVATIONS ON THE SPLEEN AND TONGUE OF A LION (*Panthera leo*)

K.R. Harshan[1], N. Ashok[1] and P.O. George[2]

ABSTRACT

Spleen and tongue were collected from a lion that died at the Trichur zoo for a detailed examination of their anatomical features. The gross features, relationship and colour of the spleen showed certain similarities to the equine spleen. However, there were definite distinguishing features for the lion's spleen. The dorsum of the tongue showed sharp filiform papillae specially designed to lick out flesh from the prey. Four pairs of circumvallate papillae were seen. Fungiform and foliate papillae resembled those of the domestic carnivores.

INTRODUCTION

Apart from general descriptions given by taxonomists and comparative anatomists, anatomical features of visceral organs of wild animals are rarely described in detail. Apart from a few publications on jungle cat (Sharma *et al.* 1991; Bhardwaj and Sharma, 1991) and musk deer (Lone *et al*, 1988), not much was been written on the anatomical features in wild animals. The authors had the opportunity of closely examining the carcase of lion which died in Thrissur Zoo. Spleen and tongue were subjected into detailed study for their anatomical peculiarities.

Spleen is the largest lymphoid organ in the body and it performs a variety of functions. The size, shape and attachments of the spleen vary from species to species. But in all the animals this organ is situated towards the left side of the abdominal cavity, in contact with the abdominal wall. Morphology of the tongue varies slightly amongst species. The dorsal surface of the tongue presents various types of papillae. Most of them perform a mechanical function, while some others serve as gustatory organs by virtue of the presence of taste buds (Ellenport, 1975).

MATERIALS AND METHODS

The animal from which the organs were collected was a 19 year old lion which died in the zoo. The position of these organs and their relationship with others were noted before removing them from the body. Their gross features and morphometry were recorded before preserving in 10% formalin for further investigation.

RESULTS AND DISCUSSION

Spleen

The spleen was located in the abdominal cavity on the left side. It was loosely attached to the wall of the stomach by a gastro-splenic fold. A similar type of attachment has been reported for the spleen in most of the simple stomached animals (Sisson and Grossman, 1953). It was dark purple in colour and roughly sickle shaped as described for the spleen of most of the domestic animals (Snook, 1950; Evans and Christensen, 1979; Nickel *et al.*, 1979). The shape of the present material is comparable to the spleen of horse.

The spleen presented two surfaces, two borders and two extremities (Figs: 1&2). The parietal or outer surface was slightly convex and presented irregular lines. Inner or visceral surface was divided into two unequal parts by a prominent longitudinal ridge which presented the hilus at its

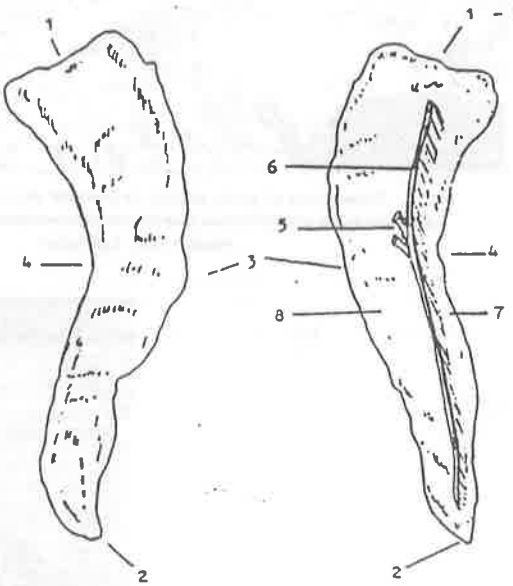

Fig.1. Spleen of lion- parietal surface

Fig.2 Spleen of lion- visceral surface

1 dorsal extremity; 2. ventral extremity; 3 caudal border; 4 cranial border; 5 hilus; 6 ridge on the visceral surface. 7 gastric surface; 8 intestinal surface

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middle. The gastro-splenic fold was attached to this ridge. The narrow portion on this surface was located cranially in contact with the stomach wall and therefore could be described as the gastric surface. The wider portion was in contact with the intestine thus forming the intestinal surface. The cranial border was sharply concave dorsally and slightly convex ventrally. The caudal border was convex and irregular in its entire length showing small notches and depressions. The dorsal extremity was narrow and somewhat pointed. From the dorsal to the ventral end, the organ measured 31.0 cm. In general the features are comparable to the spleen of horse, except for some of the distinguishing features. It is relatively longer and less massive. The hilus is located at the centre of the ridge. The caudal border presented a number of notches which are absent in the spleen of other animals. One or two notches may be present on the spleen of the dog.

Tongue

The tongue measured 34 cm in length from the base of the epiglottis to the apex. Width at the central part was 7.5 cm. Ventrally it was attached to the floor of the mouth cavity by a double fold of mucous membrane, the frenulum. In the fresh state, the organ was bright pink in colour without any pigmentation. The same appearance has been reported for the other carnivores (Sisson and Grossman, 1953). The apex of the tongue was thin and spatula shaped. Towards the body and root, the thickness increased. The lateral borders were relatively thick.

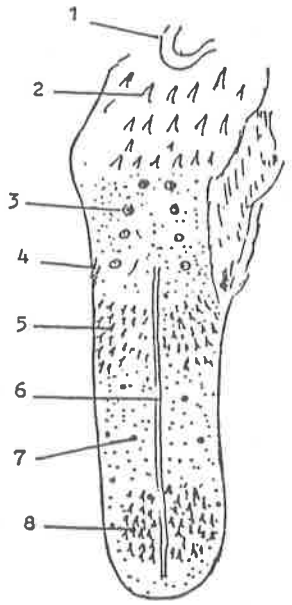

Fig. 3. Dorsum of the tongue of lion showing the distribution of various types of papillae.

1 epiglottis; 2 smooth papillae of the root; 3 vallate papillae; 4 foliate papillae; 5 cornified papillae of the body; 6 median sulcus lingua; 7 fungiform papilla; scornified papillae of the apex region.

On the dorsal surface, there was a central groove (the median sulcus lingua) which was 20 cm long, extending from the tip to the caudal part. In the cat and dog, a similar groove has been reported by many authors (Crouch, 1969; Gregory and Chibuzo, 1979). The caudal part near the root was slightly elevated.

The dorsum was covered by various types of papillae , which in general resembled those of the domestic animals, but their distribution, number and the degree of cornification differed. Figure 3 shows the distribution of papillae on the tongue of lion. Throughout the dorsum, small filiform papillae were present, but very well developed and highly cornified filiform papillae were present on the cranial part 1.5 cm away from the tip. They were distributed over an area of about 5.0 cm. These papillae would probably help to lick out flesh from the kill. Towards the caudal part of the body of the tongue, similar papillae were present and they were concentrated towards the lateral part. On the root of the tongue, large smooth conical papillae were noticed. Their number decreased but the size increased towards the base of the epiglottis. Similar papillae has been reported in the cat, dog and pig (Nickel et al., 1979) with slight differences in the distribution.

Fungiform papillae were few in number, scattered among the other types of papillae on the dorsum. They were absent on the root. A unique feature was the presence of eight circumvallate papillae on the lion's tongue. In the cat and dog, only two to four circumvallate papillae are present. The most cranial pair was located just behind the termination of the median sulcus. The members of this pair were placed wide apart and the caudal pairs were seen close together. Immediately in front of the cranial pair of circumvallate papillae, on each side of the tongue, a row of foliate papillae were also noticed. The lyssa, a thickening on the ventral surface of the tip of the tongue as seen in the dogs and cats, was absent in the lion.

ACKNOWLEDGEMENTS

The Authors wish to express their gratitude to the Superintendent of the Trichur zoo for providing the materials for the study.

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THE ULTRASTRUCTURE OF THE CIVET GLAND IN SMALL INDIAN CIVET (*VIVERRICULA INDICA*)

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Abstract

The modified skin gland of Small Indian Civet (*Viverricula indica*) located at the perineal region has been studied for its ultrastructure. The 'civet gland' found in both the sexes secrete the prized item 'civet' which has a wide use in indigenous medicines and oriental perfumes. In this preliminary study of the gland, holocrine mode of secretion is established. Large lipid droplets were found filling the cells which were disintegrating holocrine secretory cells. A centrally placed nucleus and nucleolus could be located in developing cells. Smooth endoplasmic reticulum whirls were also observed. The secretion of this gland plays an important role in the chemical communication system of this small mammal.

Key Words

Civet gland, ultrastructure, perineal gland, Small Indian Civet

Introduction

Chemical communication plays an important role in the biology of mammals (Gorman, 1990). The dazzling array of odoriferous skin glands in mammals are utilized in transmission of information and mammals are often profligate in their use of social odours. Many mammalian species own complex glandular organs exclusively developed for secretion of chemical components which are either chemical signals themselves or are transformed into such signals by microbial activity (Schliemann *et al.*, 1985). Information on the structure perineal gland of Small Indian Civet is scanty although its secretion is used from very early times in indigenous medicines and in oriental perfumes (Kingston, 1964; Xavier. 1993a,b; Xavier & Balakrishnan, 1993a,b). Small Indian Civets have conspicuous glandular organs lying between the anus and the opening of the excretory and reproductive organs. Only some baseline information on the functional significance of their gland are available (Xavier 1993a,b; 1994; Xavier & Balakrishnan, 1993a,b,c). The secretion 'civet', which is obtained from males and females, is widely used in our country. Considering the wide use of the secretion and the role of civets as a sustainable wildlife resource, a preliminary study on the ultrastructure of this largest developed skin gland of Small Indian Civets was taken up.

Received 15 April 1999; Accepted 21 September 1999

Materials and Methods

Perineal glands from 10 male and 10 female Small Indian Civets kept in captivity were utilized for the present study.

The animals were kept under 'Ketamine-Xylazine' anaesthesia. The perineal gland region was shaved and cleaned with a mild antiseptic lotion. Vertical and horizontal incisions were made to expose the glandular tissue. Tissue samples of approximately 10 x 10 mm. were collected. The incision was closed by surgical suture. All the animals underwent an uneventful recovery.

The tissue samples were sliced into very small pieces and fixed in 2.5 per cent gluteraldehyde in 0.1 M sodium cacodylate buffer (pH 7.2) at room temperature. This was post-fixed in one per cent osmium tetroxide in the same buffer. The tissue samples were then processed for electron microscopy. It was dehydrated in acetone series and embedded in 'araldite 502'. Ultra thin sections were cut using a 'LKB ultramicrotome'. Sections were stained with uranyl acetate and lead citrate and observed under a 'Philipps EM 400' electron microscope.

Results and Discussion

The perineal gland of Small Indian Civet is distinctly visible between the anus and the opening of the reproductive organs of both males and females. This conspicuous glandular organ is covered by hair and has two bulging halves with a central cleft. Each half can be seen as a round intact mass when incised.

Figure 1. Electron micrograph of a secretory cell with lipid droplets in the perineal gland of Small Indian Civet. Large secretaory droplets of 2-5 µm. in diameter are filling the mature cell. Note the absence of the nucleus.

The incised perineal gland revealed the appearance of honeycomb like construction. The interspace was filled with yellowish oily secretory material and it oozed out as soon as each glandular tissue mass was cut.

Simple histological sections revealed a conglomeration of secretory mass separated by connective tissue. Holocrine secretory units formed this secretory mass (Xavier, 1994). Electron micrograph of the secretory cells revealed large lipoid secretory droplets of about 2 to 5 µm. in diameter filling the cells (Figure 1). Similar large cells filled with lipid droplets formed the central part of the alveoli. These were the disintegrating holocrine secretory cells. The developing cells, i.e. the basal layer of thin flat epithelial cells lining the periphery, showed secretory droplets of about 0.2 µm. in size. These cells have a centrally placed round nucleus and the nucleolus is also visible (Figure 2). Smooth endoplasmic reticulum whirls are found in these cells (Figure 3).

The prominent and specialized integumentary gland located in the perineal region of the Small Indian Civet is almost similar to the cutaneous scent glands described in other mammalian species like African civets, Chinese civets (Jacob & Schliemann, 1983, 1986) and Indian Musk Shrew (Balakrishnan, 1987). The present observation of large secretory droplets in the mature cells, is in agreement with the reports of Dellman (1993) that the sebaceous glands are simple branched or compound alveolar glands that release their secretory products by holocrine mode. In mature cells, the lipid droplets fill the entire cell to such an extent that other cell structures either become invisible or move to the periphery of the cells. The entire cells in the holocrine mode of secretion disintegrates and the contents are extruded into the duct.

Conclusion

Although the secretion from the perineal gland of male and female civets are used in indigenous medicine and oriental perfumes from very early times, elaborate studies on this gland and its structure are meagre. In the present preliminary study on the ultrastructure of this modified perineal gland, holocrine mode of secretion is establised. Secretory droplets of about 2 to 5 µm. in diameter filling the mature cells prove that the civet gland is a modified holocrine skin gland. The basal layer of thin flat epithelial cells lining the periphery showed smaller secretory drop-

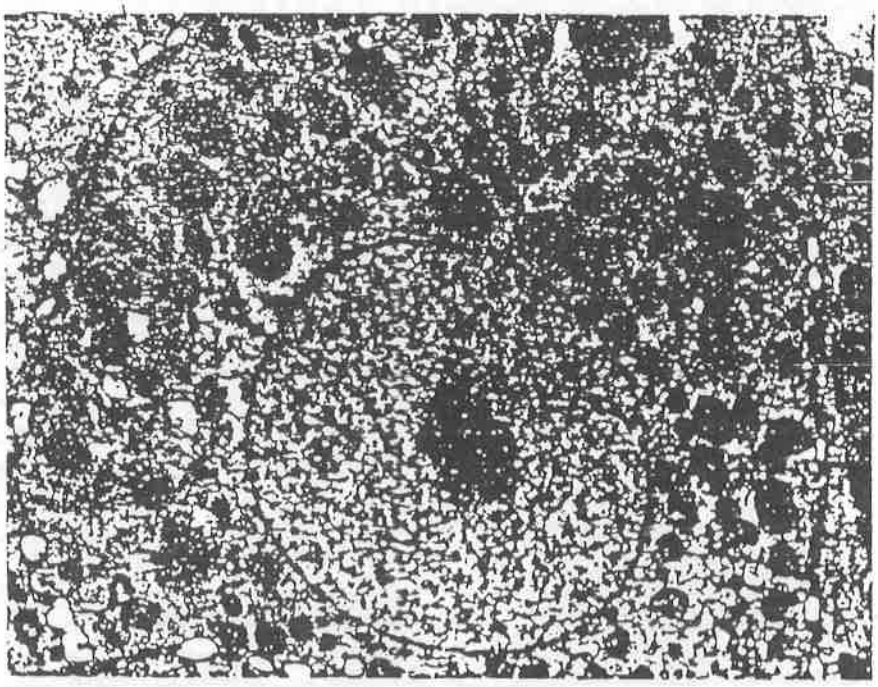

Figure 2. Electron micrograph of a basal cell with small secretory droplets of 0.2 µm. in size distributed around the nucleus. The nucleus with a central nucleolus may be noted in the centre of this cell.

lets of about 0.2 µm. in size with a centrally placed nucleus and nucleolus. There was no sexual dimorphism as far as the ultrastructure of the gland is concerned.

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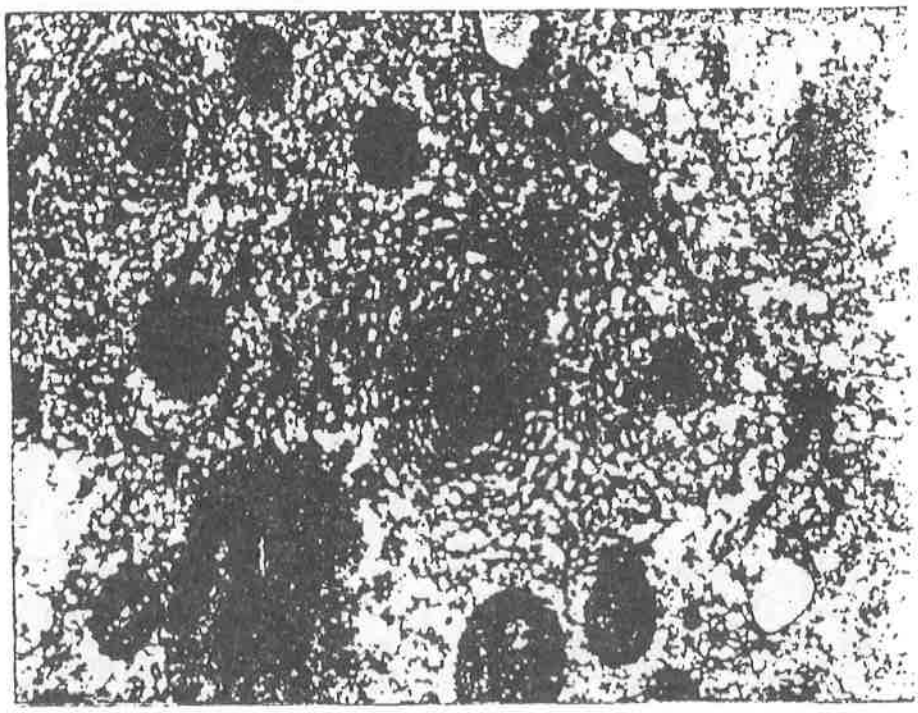

Figure 3. The secretory cell from the perineal gland of Small Indian Civet with smooth endoplasmic reticulum whirls and lipid droplets.

Reprint : Zoos' Print, 4 (2) : 15-16, February, 1989

Certain Physiological and Anatomical Features of a Camel

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CLASSIFICATION

Family	*Camelidae*
Order	*Artiodactyla*
Sub order	*Tylopoda*
Species	*(i) Camelus bactrians*
	(ii) Camelus dromedarius

DISTRIBUTION:- The Bactrian camel is found from China to Turkestan, while a few of their wild herds are still existing in Gobi desert. Camels are the important animals of the arid regions and the bactrians camel is built to withstand the cold climate of its range in central Asia.

NOMENCLATURE: The adults of South American Camelids (SAC) are appropriately termed as males and females and as infant from birth to weaning is a 'baby', while 'Juvenile' is the term for animal between weaning and adulthood. The old world camelids (OWC) are called a bull, cow and calf respectively. A castrated male is called a gelding. A group of camelids is called a herd but the term flock is also used for llamas (a smaller, humpless and wooly-haired animal related to camel).

EXTERNAL FEATURES: These are large ruminants which are closely related to the llamas and alpaca. Head and neck are elongated and the upper lip is clefted. The humps are made of fatty tissue and their number may be one or two. Humps are utilized as food reserve. Bacterian camel is stronger and more heavily built than the dromedary and is more suitable as pack animal. It has long, shaggy hair which protects it from cold climate. It is two humped, with one over shoulders and other atop the hind quarters. Shoulder height without hump is 6 ft.

Arabian camel is taller and single humped. This species has two varieties. One is baggage camel called the beast of burden which covers 40 miles a day with 400 lbs. of load, Other is slightly smaller and and is used as a racing camel. This travels up to 100 miles/day with light load. Arabian camels have broad feet, adapted to walking on sand and well suited to the desert life. It has ability to close its nostrils completely and has double row of interlocking eyelashes. These features make it very adaptable to the sand storms of the desert. Camels have long and slender legs. Anatomy of camelids foot is unique which terminate into two cushhioned toes. The foot has two digits. The plantar surface is covered with soft, cornified layer of epithelium similar to the digital cushion of the horse. The foot contains digits with 2nd and third phalanx which lie in a hori zontal position. The nail or claw is small and does not bear weight.

ADAPTATIONS: The two species of the camels are able to interbreed. The most imqortant physiological adaptation of the camels is their ability to conserve water. This is helped by the body fur and has a temperature of over 12°F before it perspires sufficiently to prevent further rise. Morning temperature of body is 93°F and rises to 106° during day times activity before water is expanded in any appreciable quantity. The camel can lose over 40% of its body water and does not fear dehydration. It survives without water but can drink 15 gallons of water when available. The camel can control the water content of the feaces and concentration of the urine. This adaptation consumes excretion of the vital fluids during heat stress. Camel does not store more water than any other species but can sustain for any considerable period without drinking. Even after severe dehydration the camel is able to drink sufficient water at one session to make up the delecit. Dromedary is able to endure a diurinal fluctuation of body temperature from 36.5 to 42°C (97.7 to 107°F). The body acts as a heat sink during hot times of the day. This conserves vital water that would otherwise be lost through evaporation. During the cool night of the desert the body heat is dissipated by conduction. This physiological mechanism makes the evaluation of fevered state difficult in dromedary.

Normal weight ranges (Kgs)

Common Name	Maie	Female
Bactrian Camel	500-690	450-550
Dromedary Camel	500-750	400-550
Llama	162-243	108-189

Some normal physiological values :

	Llama	Dromedary
Respiration rate/min	10-30	5-12
Heart rate/min	60/90 (resting)	40-50
Rectal temp	101/8°F (Adult) 102.2°F (Infant)	97.5-107.6°F.

Dental Anatomy of camelids is unusual.
Dental formula of camel:-

Permanent teeth I 1/3, C i/1, PM 3/3, M 3/3 36 Total

Deciduous teeth I i/3, C 1/1, PM 3/2

Certain Anatomical and Physiological features:-

The Anatomy of the stomach of camelids differs from that of the true ruminants. The stomach has three compartments. The lining epithelium of first

compartment is stratifled squamous but changes to glandular epithelium in saccules. Second compartment is also glandular over greater curvature with stratified squamous lining on the lesser curvature. Function of first two compartments is fermentation at PH.6.4-7-0 and its major contractions are 3 to 8 per minute. The third compartment is glandular with PH 3.0 It secretes digestive juices that continue the digestive process.

Motility of the camelid stomach differs from that of rumen, but is likely to be similar to that of alpaca and llama. At resting state the gastric motility is irregular with 5 to 8 contractions within a minute. After feed, the rate of contractions increases and pause disappears. If the camel is on low protein diet it recycles urea which is utilized by gastric micro organisms to produce more proteins. The motility pattern begins with a rapid contraction of the second compartment, followed by contractions of the caudal sac of the first compartment in cranial direction. Next, the cranial sac contracts in caudal direction. The saccules evert their contents into the lumen during contractions.

The liver is entirely on the right side and caudal borders are fimbriated. Gall bladder is absent. Kidney of this animal is capable of concentrating urine to diminish water loss. Urine color varies from clear and colourless to yellowish.

The moisture content of camel feaces depends on the type of food consumed. Camels have the capacity to pass desiccated feaces on restricted intake of water. In the Arbian desert during the summer, freshly passed feaces can be used for fuel. South American camelids use a dung heap for defecation.

The penis is situated in the ventral pelvic area and has sigmoid flexure. The prepuce is directed caudally in the unaroused male. Preputial orifice is under the control of at least two sets of muscles; i. e. protractors and retractors, which pull the prepuce cranially and candally respectively. When urinating, the male either sprays on its legs or squats to spread the rear limbs. Accessory sex glands include one prostate and pair of bulbourethral glands. Seminal vesicle is absent.

All camelids have 37 pair of chromosomes. The gestation period is for about one year and female breeds every second year giving one young called a colt. The mammary gland of all camelids have four nipples. The placenta is diffused and epithliochorial type and resembles that of mare. Pregnancy diagnosis is done by rectal palpation, ultrasound and by hormonal analysis of blood serum or milk. Dystokia is rear but the malpositions prevelent in cattle and sheep are possible. The most common malposition is the head turned back. Because of long neck of camels and less working space it becomes difficult to correct it.

Dromedary has a fold of tissue arising from the soft palate called gula. Male dromedary is able to inflate it which makes it protude like a bladder as large as 15 cm in diameter. A gargling roar is produced by the malo which is done to threaten or or intimidate other males.

CLINICAL ANATOMY :

Superficial veins of camelids are not readily accessible for venipuncture. The jugular vein lies slightly medial and ventral to transverse process of the cervical vertebra, while carotid artery and vagosympathetic trunk lies in a single sheath.

Jugular vein courses caudally between the sternomandibularis muscle ventrally and brachlocephalicus muscle dorsally. Medially the omohyoideus muscle separates the jugular vein from the deeper carotid artery. Jugular vein can be felt superficially for 8 cms from its origin then it divides between the muscles of the neck to meet the carotid artery and vagosympathetic trunk. At thoracic inlet the skin overlying this area is 5 to 10-15 mm thick which diminishes the clinicians ability to palpate the distended vein. This is the point of penetrating the vein.

HAIR: Protective hair covering the camel is non conductor of both heat and cold and is water repellent. In spring the years growth of hair hangs from the camel in matted strands and tufts, which falls in clumps. This growth and the hair shed throughout the year is the chief source of supply. The under hair of the camel is plucked. Camels hair fabrics are ideal for comfort particularly for over coating as they are very warm and light in weight. Hair is characterized by strength, luster and smoothness. Fine hair is the form of high quality coat fabrics which is expensive. This is obtained from two humped bactrian camel native to all parts of Asia. Camels hair is mixed with wool to improve its quality.

In textile Industry the camels hair has 3 gradings. Grade I is soft, silky obtained from light tan underhair. Thus choices and quality has short staple or of 1-5 inches. This was taken as only true camels nair for the manufacture of apparel. Grade 2 is the intermediate growth consisting partly of short hairs. and partly of coarse outer hairs-Grade 3 consists entirly of coarese outer hairs measuring up to 15 inches in length and varying in colour from brownish black to reddish brown. This grade has no value for manufacture and Is suitable for cordage and for low quality rugs. Hair of this animal is woven into a thick, warm light weight and a long piled textile material. Imitation of this fabric is camels hair, camel hair brush and artists paint brush which is made of squirrel hair.

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SHORT COMMUNICATIONS

Indian Journal of Veternary Anatomy 3 *(1) 99-100, December, 1991*

Histology Of The Uterus Of Orangutan (*Pango pygmaeus*)

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ABSTRACT

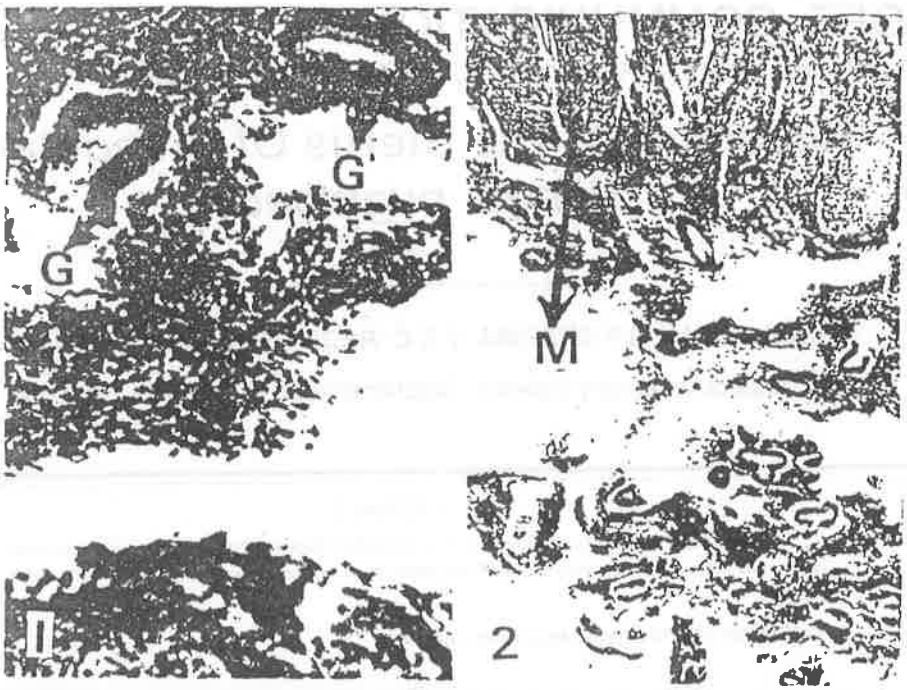
Histological studies on the uterus of orangutan showed that it is very close to that of human uterus which confirms that orangutan is a closely related animal to the human being.

Key words : histology, orangutoan, uterus

The uterus of orangutan was collected soon after its death from Nehru Zoological Park, Hyderabad, Andhra Pradesh. The uterus was cut and the pieces were fixed in 10% buffered formalin. 5-6 micron thick paraffin sections were stained with Haematoylin and Eosin and Van Geison's stain.

The body of the uterus consisted of endometrium, myometrium and perimetrium. The endometrium was about 2 mm. thick and was lined by ciliated columnar epithelium. In sow and ruminants, the surface epithelium is stratified (Trautmann and Febiger, 1959),while in woman the surface epithelium is simple columnar with patches of ciliated columnar cells (Bloom and Fawcett, 1968). The uterine glands were simple tubular (100-200 microns) running perpendicular to the surface (Fig.1). most of which had a small lumen Nearly similar findings are reported in woman (Bloom and Fawcett, 1968). Branching and coiling of glands occurs in carnivores (Trautmann and Febiger, 1959). The stroma of the endometrium was composed of closely packed round or oval cells and their nuclei were large, occupying greater part of the cells. A very thin rim of cytoplasm was present around them. Spiral arterioles were present in deeper parts. The superficial part was relatively less vascularised.

The myometrium measuring about 1.0 to 1.5 cm in thick consisted of smooth muscles interlaced with bundles of fibrous tissue ness. The outer thin longitudinally oriented smooth muscle fibres were of 0.5 to 1.0 micron thickness. The middle thick vascular layer had smooth muscle bundles forming interlocking arrangements with fibrous tissue and the inner and outer smooth muscle coats. Around the blood vessels they were very closely arranged. Myometriums formed the main bulk of the wall of the uterus (Fig. 2). A thin circular layer of smooth muscle was present below the endometrium.



Figs. 1-2 1, Endometrium of orangutan showing simple tubular glands (G) with tall ciliated columnar epithelial lining. H. E. X 250, 2, Endometrium and myometrium of orangutan showing smooth muscles (M) interlaced with bundles of fibrous tissue. H. E X 63.

The perimetrium was thin layer of smooth muscles, vascular and continuous with the outer longitudinal muscle coat.

ACKNOWLEDGEMENT

The authors wish to thank the authorities of the Nehru Zoological Park, Hyderabad and the Principal, College of Veterinary Science, Rajendranagar, Hyderabad, for providing the necessary facilities.

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Indian Journal of Animal Sciences 62 (10): 950-951, October 1992

Glans penis of the Indian one-horned rhinoceros (*Rhinoceros unicornis*)

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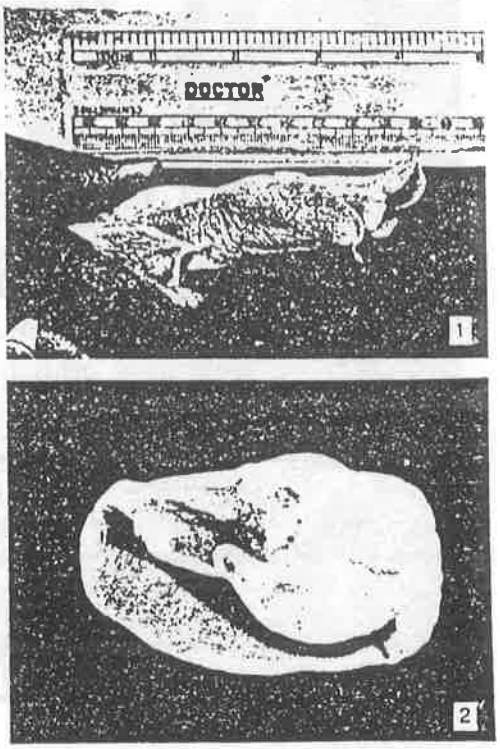
Received: 19 February 1992

This study was conducted to elucidate the glans penis of Indian one-horned rhinoceros.

The glans penis of 2 adult Indian one-horned rhinoceros was collected from the Assam State Zoo after death. Gross anatomical characteristics of the glans were noted immediately after collection. Small pieces of tissues were collected in 10% formolsaline solution, processed for routine paraffin sectioning, and stained by haematoxylin and eosin and Mallory's method (Luna 1968). Electron microscopy method for scanning (SEM) of the organ was done (Igaku *et al.* 1975) and observed by 'Jeol' SEM.

The prepuce on the glans extended at the dorsal border for adult 9 cm and at the ventral for 3.2 cm. The length of the glans penis was 13 cm from the attached portion of prepuce to free extremity of the glans, and transverse diameter at the widest free part was 2.5 cm. The free extremity of the glans of rhinoceros was like a half-bloomed bud (Fig. 1) as reported earlier (Kakati and Rajkonwar 1972). The height of the free extremity of the glans was 3.2 cm and width at the widest part was 1.3 cm. The external urethral orifice was located little below the central midline of the free extremity without any distinct groove (Fig. 2). However, a little darker area encircled the orifice from which a distinct groove extended till the ventral tip. The diameter of the external urethral orifice at the point of termination was 0.1 cm and at the middle of



Figs 1-2. 1. Photograph showing the half-bloomed free end of glans penis of rhinoceros. 2. Photograph showing the location of external urethral orifice at the anterior free extremity of the glans penis.

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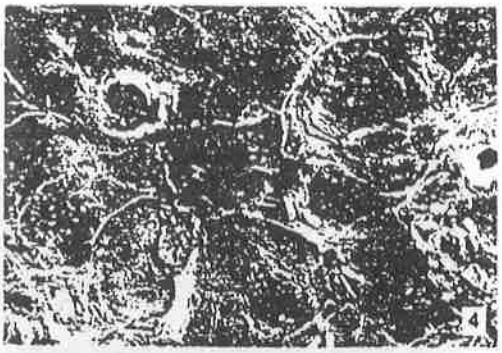

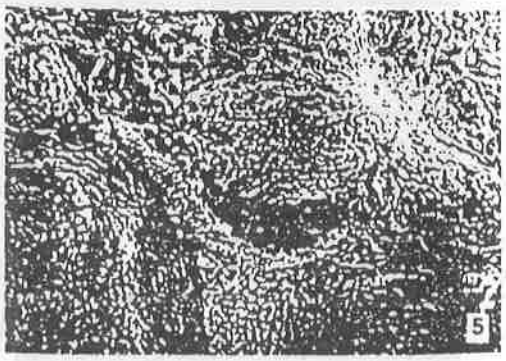

the glans penis was 0.4 cm. The ventral median raphe of the glans was distinct. The corpus cavernosus penis extended in the glans penis excepting for the last 5 cm of the glans, and may have a relation with specific sexual behaviour of the rhinoceros.

No cartilagenous structure was seen in the glans penis. The corpus cavernosus urethrae at the glans part of rhinoceros was lined by a stratified squamous epithelium underneath which was highly vascularised connective tissue consisting of mostly collagenous fibres (Fig. 3).

Scanning electron microscopy on urethral surface showed flat polygonal areas (Fig. 4). Polygonal areas could also be seen on the penile surface which were relatively much larger and had numerous minute processes that could not be marked on urethral surface (Fig. 5).

ACKNOWLEDGEMENTS

We are grateful to the Veterinary Officer and DFO, Assam State Zoo, for their help in getting the material for the study. The second author is grateful to CSIR for the financial assistance in the form of SRF for the study.

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Figs 3-5. 3. Photomicrograph showing vascularised connective tissue of corpus spongiosum consisting of mostly collagenous fibres. Mallory's method. 400x. 4. Scanning electron micrograph of rhinoceros glans penis showing polygonal areas on the urethral surface. x 1,000. 5. Scanning electron micrograph of rhinoceros glans penis showing polygonal areas on the penile surface studded with minute processes. x 3,200.

A NOTE ON THE LIVER OF INDIAN ONE HORNED RHINOCEROS (*RHINOCEROS UNICORNIS*)

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Studies on the liver of the domestic animals including the Indian elephant were conducted by Marippa (1958), Sisson and Grossman (1959), Nickel *et al.* (1973) and Prasad and Sinha (1982) but the study on the liver of Indian one horned rhinoceros is yet to be taken up. Hence, the present communication deals with the morphological characteristics of the liver of rhinoceros, the unique wild animal found in Assam.

The liver of a 47-years old male rhinoceros and the liver of a full term aborted foetus of rhinoceros, collected from the state zoo of Assam, constituted the material for the present study. The morphological features of the liver were recorded immediately. The pieces of liver tissues were preserved in 10 per cent neutral buffered formalin; processed for paraffin sectioning and the 5 to 6 μm thick sections were stained by routine haematoxylin and eosin stain and Mallory's triple method (Luna, 1968).

The liver of both adult and foetus was more extensive, thick at the centre and was gradually thinner towards the periphery. The weight of the liver of the adult rhinoceros was 12 kg, which seems to be higher than that of ox and horse as described by Nickel *et al.* (*loc. cit.*) being in the range of 3 to 10 kg and 2.5 to 7 kg respectively. The weight of the liver of the aborted foetus was 1.2 kg which was lesser than that of an Indian elephant foetus as recorded by Mariappa (*loc. cit.*) to be 2.17 kg.

Like the other mammals, the liver of rhinoceros presented parietal and visceral surface and dorsal, ventral, right and left borders. The parietal surface was convex and was marked by costal impressions. The visceral surface was irregularly concave which possessed impressions meant for attachment with other different visceral organs. The portal fissure was located at the visceral surface near the dorsal border of the liver through which portal vein, hepatic artery and nerves enter or pass out of the organ. The portal fissure did not lodge the bile duct as the gall bladder was absent. The gall bladder is present in all domestic animals except in horse (Sisson and Grossman, *loc. cit.*) and in Indian elephant (Mariappa, *loc. cit.*). However, the hepatic duct was found to emerge out of the portal fissure.

The oesophageal notch in rhinoceros was not so prominent and the renal impression in caudate lobe was indistinct. However, oesophageal notch and renal impression in different domestic animals including Indian buffalo and elephant were distinct and prominent (Mariappa, *loc. cit.*; Sisson and Grossman, *loc. cit.*; Prasad and Sinha, *loc. cit.*).

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The present study revealed that the liver of rhinoceros was divided at the ventral border into 5 lobes by means of prominent interlobular fissures *viz.* right lobe, quadrate lobe, caudate lobe, left medial lobe and left lateral lobe out of which the right lobe was the largest (Fig. 1). Mariappa (*loc. cit.*) recorded that the liver of Indian elephant consisted of a larger right lobe and a smaller left lobe while in horse the ventral border was thin and was marked by three deep interlobar incisures which partially divided the liver into four lobes *viz.* right, caudate, quadrate and left lobe (Sisson and Grossman, *loc. cit.*).

Histological sections of rhinoceros liver showed that the liver may be termed as muralium simplex as in other mammals (Elias, 1963). In addition, the interlobular connective tissue pattern around the hepatic lobules resembled other domestic animals (Fig.2), but not as adult pig where the same was described to be very thick (Kiernan, 1933). The interlobular connective tissue in main trabeculae of liver of rhinoceros consisted of mostly collagenous fibers (Fig. 3).

Acknowledgement : The authors are grateful to the Veterinary Officer and the D.F.O. of State Zoo of Assam, for providing the facilities to collect the materials.

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Fig. 1. Liver, visceral surface showing 1. Right lobe, 2. Quadrate lobe, 3. Caudate lobe, 4. Left median lobe and 5. Left lateral lobe

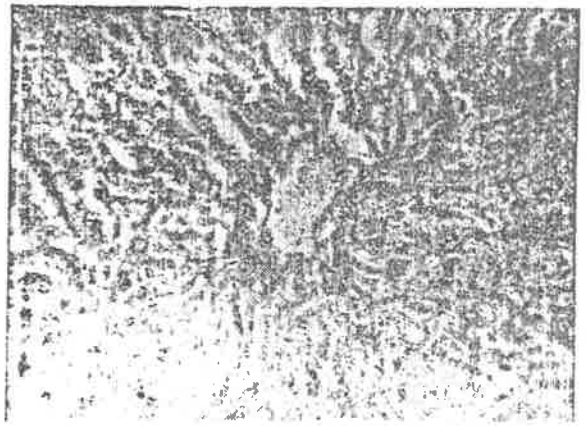


Fig. 2. Photomicrograph of liver showing muralium simplex. (H & E)

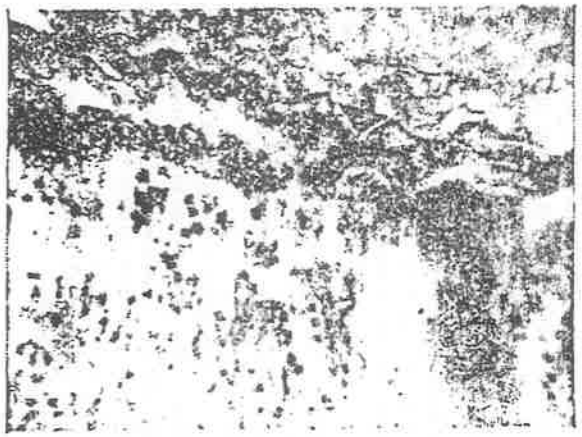


Fig. 3 Liver showing collagenous fibers in a Mallory's trabecula

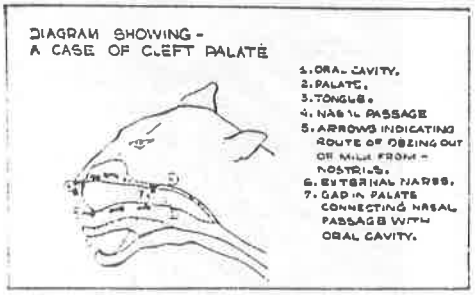
Reprint : Zoos' Print, 1 (12) : 20, December, 1986

A CASE OF "CLEFT PALATE" IN CUB AND ABNORMAL BEHAVIOUR OF ITS MOTHER

The lioness Jamuna, of the Lion Safari Park of Sanjay Gandhi National Park, Borivli, Bombay, gave birth to two healthy cubs on 27th Dec., 1985. One of the male cub was a case of "Cleft Palate" i.e. The hereditory defect of the roof of mouth generally seen in inbred animals. It consist of a gap in the structure forming the palate, often so extensive as to allow of communication between mouth and nasal passage. The milk started oozing out from the nostrils of the cub soon after sucking. The case was also associated with harelip or split lip.

Perhaps due to the abnormality in cub, the lioness-Jamuna started behaving abnormally i.e. lifting her cub and throwing her forcefully on the ground and also neglected the usual nursing of her cubs.

Subsequently the cub died on 2nd January, 1986. The postmortem examination was conducted by Dr. Jalnapurkar, Dept. of Pathology, Bombay Veterinary College. He confirmed that it was a case of Cleft Palate. The cause of death of the cub was intracranial haemorrhage due to traumatic injury.



The past history of the lioness Jamuna suggests that she was a very excellent nursing mother and no deformity in her cubs was noticed prior to this litter.

By N. B. Bhure
Asst. Manager (H.Q.) Thane
F.D.C.M. Ltd.
and Dr. K.D. Batwe
Veterinary Officer
S.G.N.P. Borivli

Indian Journal of Animal Sciences 62 (4): 322-323, April 1992

Histoenzymic study on the liver of rhino (*Rhinoceros unicornis*)

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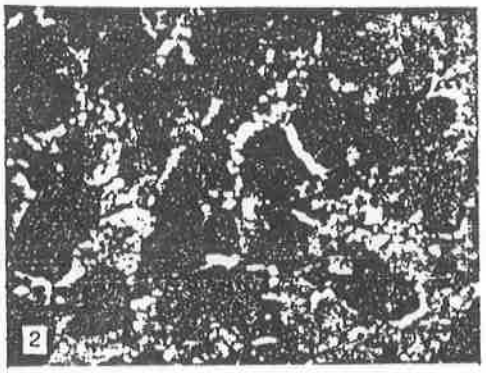
Received : 4 April 1991

The present study is an attempt to elucidate the histoenzymic distribution of certain enzymes in the liver of one-horned rhinoceros.

Pieces of liver tissues from 2 adult one-horned rhinos belonging to the State Zoo, Guwahati, were utilized in the present study. The tissues were collected within 2 hr after the death of the animals. Cryostat sections, 10 µm thick, of these tissues were later treated by standard procedures for adenosine-triphosphatase (ATPase) (Chayen *et al.* 1973) and glucose-6-phosphate-(G-6-PD), malate-(MDH), lactate-(LDH) dehydrogenases (Pearse 1980).

The histoenzymic reaction appeared more evident in the hepatocytes and Kupffer cells within hepatic lobule, and interlobular branches of bile-duct, portal vein and hepatic artery in the portal area. Vascular ATPase reaction was most conspicuous in the endothelium of portal vein and hepatic artery which showed intense ATPase reaction (Fig. 1). This definitely indicated higher ATPase content of rhino liver at α-ketoglutarate level, i. e. at the transition step from protidic to glucidic metabolism. In addition to blood vessels, biliary epithelium also showed strong reaction for ATPase. Dehydrogenases like G-6-PD, MDH and LDH exhibited almost similar reaction in the different structures of rhino liver (Fig. 2). However, there was no specific zonation of reaction for these enzymes in the hepatocytes of rhino liver. Kupffer cells in the sinusoids showed relatively less stronger reaction for dehydrogenases.



Figs 1-2. 1. Section of rhino liver showing ATPase reaction in blood vessels of portal area. Method of Chayen *et al.* (1973). ×280. **2.** Section of rhino liver showing perinuclear granular MDH reaction in hepatocyte. Nitro BT Method × 400.

In the portal area, biliary epithelial and vascular endothelial cells showed moderate granular reaction for the dehydrogenases under study. However, total content of oxidative enzymes belonging to different metabolic pathways in rhino liver showed approximate

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intensities in order being LDH> MDH> G-6PD.

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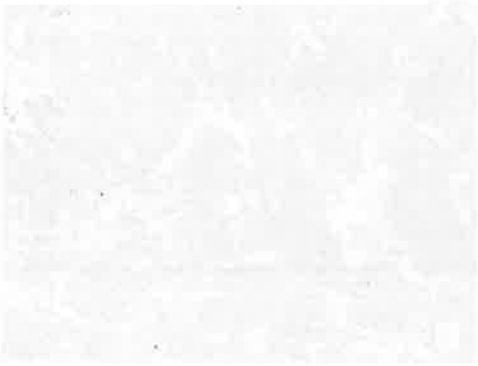

Indian Journal of Animal Sciences 63(1): 42-43, January 1993

Gastric mucous membrane of the one-horned Indian rhinoceros (*Rhinoceros unicornis*)

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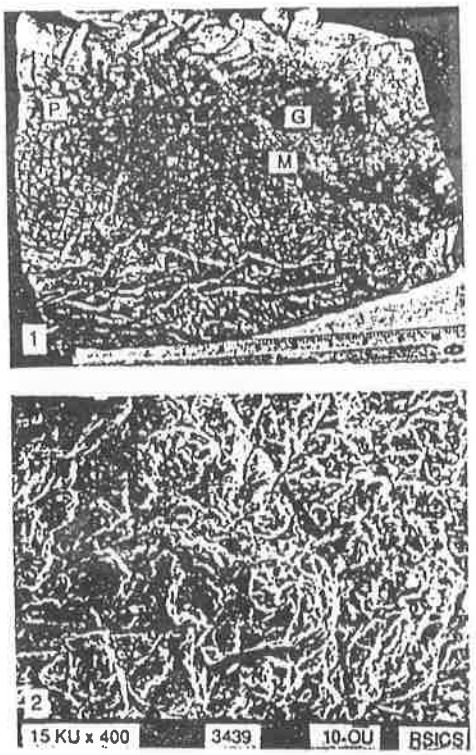
Received: 14 August 1992

The present study was undertaken to elucidate the gastric mucous membrane of One-horned rhinoceros to reveal the species-specific peculiarity of this simple stomach animal.

Stomach samples of 2 one-horned rhinoceroses belonging to State Zoo of Assam were collected immediately after death. The stomach was opened out, cleaned and gross characteristics of its mucous membrane studied. Pieces of tissues from stomach were fixed in 10% formol-saline solution and processed for routine haematoxylin and eosin staining. Subsequently, pieces of tissues from the stomach, were fixed in 5% glutaraldehyde in 0.1M cacodylate buffer at pH 7.2, processed for scanning electron microscopy (SEM) according to Dey *et al.* (1989), and observed by a scanning electron microscope (JEOL).

The mucous membrane linning of the stomach of rhinoceros was divided into two parts depending upon its surface characteristics (Fig. 1). The part which was the continuation of the oesophageal mucous membrane was termed as proventricular or oesophageal part. It was brownish and certain longitudinal folds were marked at the cardiac orifice. This part was lined by stratified squamous epithelium and lacked gastric glands. The proventricular part was separated from the glandular part by an irregular ridge termed as margo plicatus. The glandular part was yellowish grey. The surface of the glandular part was smooth. However, SEM study revealed the groups of



Figs. 1-2. 1. Photograph showing gastric mucous membrane of rhinoceros. P proventricular Part; M margo-plicatus; G glandular part. 2. Scanning electron micrograph shwoing the fundic stomach. x 400.

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epithelial cells of animals cells being separated by gastric pits (Fig. 2).

The gastric mucous membrane of the rhinoceros as detailed in the present study resembled that of horse (Sisson 1975). This structural similarity to gastric mucous membrane of these two different species of animals indicated their resemblance in feeding habit and life style.

ACKNOWLEDGEMENTS

We are grateful to DFO, State Zoo, Assam, Guwahati, for the material, and to Dr Sudip Dey, RSIC, Shillong, for his help in SEM study.

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Reprint : Zoos' Print, 8 (8) : 18-19, August, 1993

SERUM PROTEIN PATTERN OF CAPTIVE INDIAN ELEPHANT (Elephas maximus)

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Abstract

Blood samples collected from 8 adult male captive Indian elephant *(Elephas maximus)* were analysed to study serum protein pattern. The average total serum protein, albumin, globulin content in g/dl and albumin/globulin ratio were found as 8.08, 3.02, 4.99 and 0.60 respectively. Polyacrylamide gel (7%, pH8.6) electrophoretic pattern revealed that all the 6 major electrophoretic components of serum proteins viz. albumin, alpha1 globulin, alpha2 globulin, Beta1 globulin, Beta2 globulin and gamma globulin were distinctly separated and their content in percentage of total protein were found as 36.81, 8.18, 9.20, 14.97, 16.99 and 14.86 respectively.

Introduction

Investigations of plasma protein in veterinary diagnosis are not as advanced as other branches of animal clinical biochemistry (Eckersall, 1988). Determination of total serum protein, albumin and albumin/globulin ratio are very useful analytes for first approximation in the classification of protein dyscrasia which may result from many diseases and nutritional imbalances (Eckersall, 1988; kaneko, 1988; kaneko, 1989). Serum protein electrophoresis has evolved into an extremely useful technique because aberrations are observed in so many disease states (Kaneko, 1989). In this present communication serum protein pattern of adult male captive Indian elephants are presented.

Materials and Methods

Morning blood samples were collected from 8 number of physically healthy adult male (35 to 40 yrs of age) captive Indian elephants from Manas Sanctuary, Manas, Assam in the month of June '90. The sanctuary is located at the foothill of eastern Himalaya, altitude 300-400 m, covering an area of 2840 sq.km. with core care 391 sq.km. The elephants were used for antipoaching purposes and also for the tourists to visit the sanctuary. The

elephants were under ad-libitum natural feeding regime.

The total serum protein (Biuret method) and serum albumin (Dye binding method) were estimated as described by Gowenlock (1988). Differences of total serum protein and albumin was considered as globulin. Polyacrylamide gel (7%) electrophoresis of serum protein in tube (10 x 0.5 cm) was performed using Tris (hydroxymethyl) methylamine glycine buffer (0.04M, pH 8.6) as described by Gowenlock (1988). Serum protein 200 ug was applied for electrophoresis. Electrophoresis was performed at a constant current of 1 mA gel tube for 15 min. and then increased to 3 mA/gel tube (200-250 V) for 2 hours till tracking dye (bromophenol blue, 0.05%) reached the lower end of the gel. The gels were stained with 1% amido black in 7% acetic acid. Destaining was done by several changes of 7% acetic acid. The different protein bands were identified according to Gowenlock (1988) and Kaneko (1989). The destained gels were scanned at 580 nm in densitometer for determining the relative proportion of different protein fractions.

Result and Discussion

The total serum protein, albumin, globulin content and albumin/globulin ratio of adult male captive Indian elephants are presented in Table 1. Nirmalan and Nair (1971) reported the total plasma protein, albumin, globulin in g/dl and albumin/globulin ratio to adult male Indian elephant as 7.49, 2.36, 5.56 and 0.46 respectively. The discrepancy observed in protein content and albumin/globulin ratio of present study with the earlier report (Nirmalan and Nair, 1971) can be attributed to the difference of nutritional status of the animals. Nutrition influences albumin content of blood and thereby changes the total protein and albumin content (Gowenlock, 1988; Kaneko, 1989).

The polyacrylamide gel electrophoretic pattern of serum protein of adult male captive Indian elephants revealed that all the 6 major electrophoretic components of serum protein viz. albumin alpha$_1$ globulin, alpha$_2$ globulin, Beta$_1$ globulin, Beta$_2$ globulin and gamma globulin were distinctly separated (Fig.1). The percentage of different electrophoretic serum protein fractions are presented in Table 1. The polyacrylamide gel electrophoretic pattern observed in the present study was comparable to that of the cellulose acetate electrophoresis of Kaneko (1989) where a single band in alpha1 region was reported. On the contrary, the present study revealed 3 bands in the above region. This might be due to the difference in supporting media used. In polyacrylamide gel electrophoresis used in the present study serum proteins were separated by the combining effect of both electrical charge and molecular seiving, hence the high resolution could be achieved. The use of polyacrylamide gel as supporting media has largely superseded low voltage thin sheet electrophoresis system like paper, cellulose acetate etc. for the separation of high molecular weight substances such as protein and nucleic acids because of improved resolution obtained. This is due to physical properties of gels which are

water insoluble, hyderophilic, semi-solid colloids and forms interwined molecular chains, throughout the gel result in a sieve like structure. The molecular sieving property of the semi-rigid gel helps to separate large ionic compound such as proteins which have similar charge properties but which differ in size and shape (Davis, 1987).

Acknowledgement
Authors thank to the Dean, Faculty of Veterinary Science, Khanapara, Guwahati-22, for providing necessary facilities.

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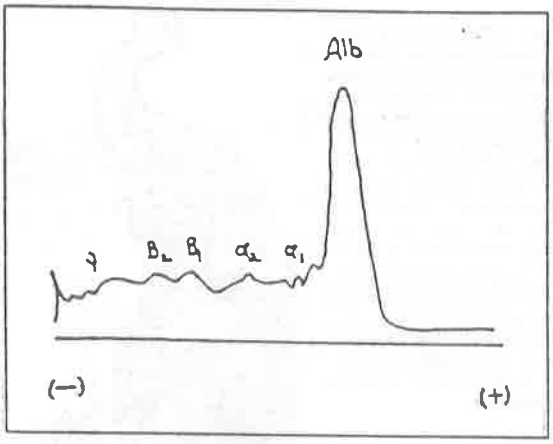

Fig. 1. Polyacrylamide gel (7%, pH 8.6) electrophoretogram of serum protein of adult male captive Indian elephant.

Table 1.
Serum protein content of adult male captive Indian elephant

Analytes	Range	Mean+/- S.E.
Total serum protein (g/dl)	7.63-8.69	8.08+/-0.16
Albumin (g/dl)	2.81-3.28	3.02+/-0.08
Globulin (g/dl)	4.79-5.37	4.99+/-0.12
A/G ratio	0.54-0.68	0.60+/-0.02
	Percentage of total protein	
Albumin	36.81+/-0.40	
Alpha$_1$ globulin	8.18+/-0.32	
Alpha$_2$ globulin	9.20+/-1.34	
Beta$_1$ globulin	14.97+/-0.57	
Beta$_2$ globulin	16.99+/-0.11	
Gamma globulin	14.86+/-0.95	

Number of animals = 8

Reprint : Zoos' Print, 5 (10) : 17, October, 1990

Haematology of a Palm Civet (Paradoxirus hermaphroditus).

By

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Toddy Cat, also popularly known as Palm Civet *(paradoxirus musange)*, is a common inhabitant amongst the wild life in Madhya Pradesh (Finn 1929).One such adult male cat was found by the villagers on the outskirts of Jabalpur, with signs of external injuries on its head region showing swellings and exudations.The lenghth of its body proper was 20 inches which was covered with fur,grey and black mixed.Its tail length too was about 20 inches and the end white-tipped.

Indian Civet Cat
(Paradoxirus hermaphroditus)

Upon being brought to the Department, the animal was given treatment for its injuries.The animal was put in a cage and was given raw meat,but he refused to eat anything or even drink milk or water.About 2 ml of blood was drawn aseptically by cardiac puncture for heamatological studies and to screen for possible haemoprotozoan or bacterial infection.Accordingly,total erythrocytic counts (TEC), total leucocytic counts (TLC), haemoglobin per cent (Hb.g/dl), differential leucocytic counts (DLC),packed cell volume (PCV%) and direct blood smears (BS) stained by Gram's Leighman and Wright's methods were studied.The results of haematology are summerised in table 1.

The TLC, TEC and PCV were considerably high compared to their normal average (Makey and Seal 1974). High values were possibly the manifestation of dehydration and haemoconcentration for its refusal to eat and drink.A rather low haemoglobin level and high neutrophilic counts with immature cells could be linked with injury, inflammation and local infection.The animal died on the 3rd day.

Haematological investigations in a wild Palm Civet *(Paradoxirus hermaphroditus*

TEC (xcmm)	Haemoglobin	PCV(%)	TLC (1000/cmm)	DLC(%) N	L	B	F	M
18.51	10.0	52	10.70	74	21	0	2	3

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Reprint : Zoos' Print, 9 (9) : 5, September, 1994

LIPID & CHOLESTEROL CONTENT IN CEREBELLUM & CEREBRAL HEMISPHERE OF INDIAN RHINOCEROS *(RHINOCEROS UNICORNIS)*

N.C. Nath

ABSTRACT

The brain of the 21/2 yrs old male Indian rhinoceros *(Rhinoceros unicornis)* was oval in shape. The maximum length and breadth were 15 cm and 13 cm respectively. The weight of the brain with meninges was 775 gm, while the weight of the meninges was 100 gm. The water (%), total lipid (gm % DM basis) and cholesterol (% of total lipid) content in cerebellum and cerebral hemisphere were 49.45 , 77.52 and 54.50 and 32.96, 26.40,20.40 respectively.

INTRODUCTION

Scientific information on physicochemical aspects of Indian rhinoceros *(Rhinoceros unicornis)* is scanty. The author got a chance to collect the brain from a male Indian rhinoceros calf at about 2 1/2 years of age and an attempt was made to communicate a report on lipid and cholesterol content in the brain.

MATERIALS AND METHODS

An Indian rhinoceros calf was found injured with a sharp weapon by poacher(s) at the upper part of the right forelimb at the Manas Sanctuary, Assam. The animal was transferred by the authorities to the State Zoo cum Botanical Garden, Guwahati, Assam for treatment where it succumbed to injury. Postmortem examination was carried out immediately and the brain was collected. After recording weight and measurements, the brain was transferred into a precnilled polythene bag and kept in ice cold condition. Random triplicate samples were taken from cerebellum and cerebral hemisphere. The samples were analysed for water, total lipid ,(either extract) as per-AOAC (1970). From the extracted lipid cholesterol level was estimated by the method of Pearson *et al* (1953).

RESULTS AND DISCUSSION

The brain was oval in shape and closely attached to the cranium. The maximum length and breadth of the brain was found to be 15 cm and 13 cm respectively. The weight of the brain with Intact meninges was 775 gm and the weight of the meninges was 100 gm. The results show that the cerebellum contained more solid matter, lipid and cholesterol than that of cerebal hemisphere. The chemical composition of different parts of the brain varies widely; the high solid containing part of the brain is rich in lipid and chief lipid of the brain is cholesterol (West *et al*, 1966).

Table :1.
Water, total lipid and cholesterol content in brain of Indian rhinoceros *(Rhinoceros unicornis)**

Brain tissue	Moisture % Mear +/- S.E.	Fat gm/100 gm dry tissue Mean +/-S.E.	Cholesterol % of total lipid Mean +/-S.E
Cerebellum	49.45+/-1.54	54.50+/ - 1.39	26.40+/-0.6
Cerebral hemisphere	77.52 +/-1.41	32.96+/-1.50	20.40+1.12

* Result are on triplicate samples of single rhinoceros

ACKNOWLEDGEMENT

The author is grateful to Dr. M.C. Baruah, Ex-Veterinary Officer, State Zoo cum Botanical Garden, Guwahati, Assam allowing to collect the brain.

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Reprint : Zoos' Print, 9 (9) : 14-16, September, 1994

COMPARATIVE STUDIES ON SERUM PROTEIN PATTERN OF CAPTIVE MITHUN *(BOS FRONTALIS)* WITH ZEBU *(BOS INDICUS)*

N. C. Nath *, N.D. Verma **, A. Das ** and C. Rajkhowa **

ABSTRACT

Comparative studies on serum protein pattern of 3 (2 bull calves and 1 heifer) captive mithun (*Bos frontalis)* and 3 zebu bull calves *(Bos indicus)* of 3 to 3.5 yrs of age were done. The average total serum protein, albumin, globulin content in g/dl and albumin/globulin ratio were found as 6.32, 3.26, 3.05 and 1.07 respectively. The values were not significantly different from that of zebu. Polyacrylamide gel (7%), electrophoresis (pH8.6) of mithun serum resolved albumin, alpha1 globulin, alpha2 globulin, beta globulin and gamma globulin fractions distinctly with relative electrophoretic mobilites (Rm) were 0.70, 0.63, 0.53, 0.39 and 0.19 respectively. The above serum protein attributes expressed as percentage of total serum protein were 51.00, 6.00, 2.03, 12.83 and 28.09 respectively. The serum electrophoretic pattern and Rm of different serum protein fractions of mithun and zebu were found similar. Though the relative proportion of most of the serum protein fractions of mithun and zebu were similar, the alpha globulin fraction was significantly ($p \leq 0.01$) lower in the former.

INTRODUCTION

The mithun (*Bos frontalis)* or gayal is a semi-wild ruminant which is unique to Arunachal Pradesh, Nagaland, Manipur, Mizoram and Tripura - the hill regions of the northeast India at elevations from 600 to 2700 m (NRC, 1983; Simoons, 1984). Though it was reported to be a hybrid between bull gaur *(Bos gaurus)* and zebu cow (*Bos indicus)* by many (Prater, 1971) it is more likely that it is originated as semi-domesticated form of gaur (NRC, 1983; Simoons, 1984; Winter, 1984). With its massive and muscular body, the mithun is very popular for its meat and has been considered as one of the most prestigious assets for the hill tribes of northeast India.

Under usual management practices the mithun are freed in the jungle and visited periodically only to provide salt. In a hopeful development, the government of India has recently set up National Centres for mithun study in northeast India to rear these animals in captivity in order to upgrade the production potential. There appears to be an urgent need for fundamental studies on biochemical aspects of these animals. In every facet of veterinary medicine, normal biochemical data are pre-requisite for diagnosis and treatment of ailments. Determination of total serum protein, albumin and albumin/globulin ratio are very useful analytes for first approximation in the classification of protein dyscrasia which may result from many diseases and nutritional imbalances (Gowenlock, 1988; Kaneko, 1989). Serum protein electrophoresis has evolved into extremely useful technique because aberrations are observed in so many disease states (Gowenlock, 1988; Kaneko, 1989).

Serum protein electrophoresis also provides the rationale for further in-depth studies like interspecies relationship (Kaneko, 1989; Wallis, 1975). Age and sex related variation of total serum protein of mithun is known (Nath *et al.*, 1983). Present communication deals with electrophoretic profile, mobility and relative proportions of serum proteins of mithun from a comparative point of view.

MATERIALS AND METHODS

Morning blood samples were collected through jugular venipuncture from 3 numbers (2 bull calves and 1 heifer) of physically healthy captive mithuns, 3 to 3.5 yrs of age from National Research Centre on Mithun, ICAR Complex, Barapani, Meghalaya (altitude 960 m, latitude 25.39 N, longitude 91.54) in the first week of October, 1993. In the month of September 1993, the average maximum temp, minimum temp, relative humidity at 08.30 hrs and rainfall were 26.7°C, 17.7°C, 82% and 263.6 mm respectively. The body coat of all the mithuns were black in colour with white stocking at four legs. Characteristics high dorsal ridge on the crest of the shoulder, a small but distinct dewlap, flat forehead, blunt straight horns with enormous base covering top of the skull were prominent in all the mithuns. Blood samples from 3 zebu bull calves were also collected. All the animals were under *ad libutum* natural feeding regime.

The total serum protein (Biuret method) and serum albumin (Dye binding method) were estimated as described by Gowenlock (1988). Differences of total serum protein and albumin was considered as globulin. Polyacrylamide gel (7%) electrophoresis of serum protein in tube (10 x 0.5 cm) was performed using Tris (hydroxymethyl) methylamine glycine buffer (0.04 M, pH 8.6) as described by Gowenlock (1988). Twenty microlitre of diluted serum (1:4) was applied for electrophoresis. Electrophoresis was performed at a constant current of 1 mA/gel tube for 15 min and then increased to 3mA/gel tube (200-250 V) for 2 hrs till tracking dye (bromophenol blue, 0.05%) reached the lower end of the gel. The gels were stained with 0.05% coomassie brilliant blue R in 7% acetic acid containing 50% methanol. Destaining was done by several changes of 7% acetic acid. The different protein bands were identified according to Gowenlock (1988) and Kaneko (1989). Relative mobilities (Rm) of different serum protein fractions were determined using following equation:

$$Rm = \frac{\text{Distance of protein migration after destaining}}{\text{Distance of dye migration after destaining}}$$

Relative proportion of different serum protein fractions were determined by dye elution technique (Fenner *et al*, 1975). The stained gels were sliced, eluted in 25% pyridine and absorbance recorded at 625 mμ. Significant differences between mean values were tested by 't' test according to Snedecor and Cochran (1967).

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RESULT AND DISCUSSION

The total serum protein, albumin, globulin content and albumin / globulin ratio of captive mithun and zebu are presented in Table 1. The total serum protein concentration of the mithun of present study is found to be similar with the reported values (Nath *et al*, 1983) on mithun bull calves (6.94 + 0.51%) and heifer (6.90 + 0.68%). The little discrepancy observed with the reported values might be due to the difference of nutritional status of animals. Nutrition influences the total serum protein content (Gowenlock, 1988, Kaneko, 1989). The total serum protein, albumin, globulin content and albumin/globulin ratio of the zebu bull calves of the present study was found similar with the earlier report (Kaneko, 1989). In the present study , though albumin and mithun was little higher , no significant differences were observed in the total serum protein, albumin, globulin content, and albumin/globulin ratio between mithun and zebu.

The polyacrylamide gel electrophoresis of mithun serum protein resolved albumin, alpha (alpha 1 and alpha 2) globulin, beta globulin and gamma globulin fractions distinctly (Fig .1). The serum electrophoretic pattern of mithun was found similar with the zebu and the patterns were found similar with the cellulose acetate electrophoretic pattern of bovine (Kaneko, 1989). Ruminants such as the cow, the normal serum protein electrophoretic pattern exhibits as albumin, one alpha globulin, one beta globulin and one gamma globulin fraction (Kaneko, 1989). The relative electrophoretic mobilities (Rm) of the different serum protein fractions (Fig.1) i.e. albumin, alpha 1, globulin, alpha 2, globulin, beta globulin, and gamma globulin of mithun and zebu were found to be similar and the values were 0.70, 0.63, 0.53, 0.39 and 0.19 respectively. This can be attributed to structural similarity (amino acid composition) of different serum protein fractions of mithun Because the electrophoretic mobility of protein at alkaline PH was shown to be inversely related to pI value which is determined by amino acid composition of protein (Davis, 1987, Wallis, 1973). The relative proportion of albumin, beta globulin and gamma globulin fractions of mithun and zebu were found similar but the alpha 1 globulin fraction of mithun was significantly ($p < or = 0.01$) lower than that of zebu. Though the alpha 2 globulin fraction of mithun was higher (not significantly), but the alpha globulin fraction as a whole was significantly ($P < or = 0,01$) lower than that of zebu. The proteins of an individuals or of a species are synthesized under genetic control and thus it would be expected that variations in proteins would occur between individual and between species. These variations are reflected in the species differences of the normal serum protein electrophoretic pattern (Kaneko, 1989; Wallis, 1975).

Fig1: Polyacrylamide gel (7%) electrophoretic (pH 8.6) pattern of serum. M, mithun; Z, zebu.

Table 1.
Comparative serum protein pattern of mithun (*Bos frontalis*) and zebu (*Bos Indicus*)

Analytes	Mithun	Zebu	't' test
Total serum protein(g/dl)	6.32+/-0.10	6.34+/-0.11	NS
Albumin (g/dl)	3.26+/-0.13	3.12+/-0.08	NS
Globulin (g/dl)	3.06+/-0.05	3.22+/-0.03	NS
Albumin/globulin ratio	1.07+/-0.05	0.97+/-0.02	NS
Serum protein fractions (% of total serum protein)			
Albumin	51.00+/-0.58	49.33+/-0.88	NS
Alpha globulin	8.03+/-0.14	10.00+/-0.12	**
Alpha 1 globulin	6.00+/-0.00	8.66+/-0.33	**
Alpha 2 globulin	2.03+/-0.14	1.34+/-0.24	NS
Beta globulin	12.83+/-0.4	12.68+/-0.20	NS
Gamma globulin	28.09+/-0.9	27.37+/-0.38	NS

Values are mean +/- SE of 3 number of animals, ** $p < or = 0.01$, NS = Not significant.

ACKNOWLEDGMENT

Authors thank to Okela, the mithun attendant, National Research Centre on Mithun, I.C.A.R. Complex, Barapani, Meghalaya for his help.

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Reprint : Zoos' Print, 10 (6) : 14, June, 1995

AN OBSERVATION ON HAEMATOLOGICAL PARAMETERS OF DRY-GROUND BARASINGHA *(Cervus duvauceli branderi)*

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Barasingha *(Cervus duvauceli branderi)* is a hard ground swamp deer. It is an endangered Cervid, one of three subspecies which is found only in Kanha National Park, Madhya Pradesh, India. The animals are living in their natural habitat. An observation on haematological parameters was made here. The authors are unaware of any previous report on haematological studies in free living Barasingha.

The animal was tranquillized with mixture of Rampum and Ketamine, by Teleinject pressure gun. The blood was collected from an apparently healthy adult female from the jugular vein, and EDTA was used as anticoagulant. The whole blood was studied for haematological studies by standard techniques (Jain et.al. 1986) and blood protozoan infections. The results are presented as follows :-

Parameters	Results
1. Total erythrocyte count	5.4 million/ul
2. Total leucocyte count	3.25 thousand/ul
3. Haemoglobin concentration	9.5 gm/dl
4. Packed cell volume	34%
5. Total plasma protein	8.2 gm/dl
6. Fibrinogen concentration	0.6 mg/dl
7. Erythrocyte sedimentation rate	41 mm in 1 hr
8. DLC	Neutrophil 41%, Lymphocyte 40%, Eosinophil 13%, Monocyte 6%, Basophil 0%
9. Erythrocytic indices	MCV - 62.96 fl, MCH - 17.59 pg, MCHC - 27.94%
10. Erythrocytic morphology	Smear prepared immediately after the collection of blood - about 5% sickled (Fig. 1). Smear prepared/4 hrs after the collection of blood - about 50% sickled.
11. Blood protozoan infection	Negative

There is no systemic haematological observations of Barasingha. In general, haematological values obtained in the present investigation compare favourably with the values of white tailed deer, except for higher ESR and eosinophils. Interestingly about 5% erythrocyte showed sickling in fresh blood smear. Sickling was enhanced as the sample stands at refrigeration for 4 hrs. Kitchen *et. al.* (1964) also reported sickling phenomena in white tailed deer, and this may be due to the presence of several haemoglobin with different electrophoretic properties in the blood.

Acknowledgement

The authors are thankful to Mr. Jagdish Chandra, Assistant Director and the staff of the Kanha National Park for their active cooperation in tranquillization and capture of the wild animal.

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Fig. 1. Blood smear showing sickling of erythrocytes in fresh blood of Barasingha

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Reprint : Zoos' Print, 10 (7) : 44-45, July, 1995

EFFECT OF STARVATION ON THE TISSUE CHEMISTRY OF FRESH WATER TURTLE *Melanochelys trijuga trijuga* OF TAMIL NADU, INDIA.

G. Premkishore and M. R. Chandran

ABSTRACT

Many species of freshwater turtles are reported to become inactive and stop feeding for long periods of time for no apparent reason despite good climatic conditions and plenty of food. This was observed to occur in the freshwater turtle *Melanochelys trijuga trijuga* also which is found in the water bodies of Tamil Nadu. Hence the present study was aimed at analysing the changes in the tissue chemistry between the normal and the starved turtles. Results indicate that protein, carbohydrate, lipid and amino acids were decreased in the tissues of liver, muscle and heart of starved turtles with the maximum decrement occurring in the liver tissues. Hence it is suggested that the energy stored in the liver is utilised first followed by the muscle. Peptide pattern also revealed maximum changes in the liver tissue. It is presumed that the high molecular weight peptides are broken down to low molecular weight peptides and the energy released is utilised by the animal to overcome the stress caused by the starvation effect.

INTRODUCTION

Most species of freshwater turtles show marked changes in the intensity and periodicity of reproductive, feeding and other daily behaviour related to seasonal shifts in environmental conditions (Bury, 1979). Cagle (1946) reported that feeding activity apparently decreases with falling temperatures while Boyer (1965) reported that when conditions were favourable, large number of freshwater turtles were observed basking and feeding while during a cold period, few turtles appeared. However, Auffenberg and Iverson (1979) found that although many individuals feed regularly every day during the part of the year when they are active, some become inactive for no apparent reason and may go for fairly long periods of time without food despite good climatic conditions and plentiful food. This habit was also observed to occur in the emydid turtle *Melanochelys trijuga trijuga* an inhabitant of the freshwater bodies of Tamil Nadu and hence it was thought worth while to study the changes in the tissue chemistry brought about by the effect of starvation.

MATERIALS AND METHODS

Five healthy adult specimen of *Melanochelys trijuga trijuga* that became inactive for no apparent reason were chosen for the present investigation. Each animal was kept separately in aquarium tanks (200 l capacity) containing no food and water but filled with sand as all these turtles were found to bury immediately into them. Each tank was then covered with a wire net and left undisturbed for a period of 6 months.

After this period, all the turtles were dug out and sacrificed, body cut open and tissues like muscle, liver and heart dissected out and electropherograms run to study their effect on peptide patterns. In addition healthy turtles which had fed regularly were also sacrificed and various tissues dissected for making a comparison. Similar tissues of the starved and healthy turtles were pooled together separately, homogenised and then estimated for their biochemical contents.

Total protein was estimated by following the method of Lowry *et al.* (1951) while lipids were analysed by adopting the procedure of Barnes and Blackstock (1973), carbohydrates by the method of Roe (1955) and amino acids after Yemm and Cocking (1955). Electrophoretic studies of the tissues were done by following the method of Studier (1973) in 10% SDS PAGE.

RESULTS

The biochemical composition of the normal and starved tissues are presented in Table 1. A comparison among the various tissues of the control reveals that liver seems to be the site of concentration of proteins, carbohydrates and lipids followed by the muscle and heart respectively.

The starved tissues when compared with that of the control appeared to show a drastic reduction in the levels of protein, carbohydrate and lipid in all the 3 tissues. Among the tissues examined, liver seemed to be the most affected as evident by the maximum reduction in the levels of protein, carbohydrate, lipid and amino acid content. Electropherograms run for tissues of liver, heart and muscle showed a range of peptides that could be resolved in 17-180 KDa.

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Table 1. Showing the changes in the tissue chemistry of normal and starved tissues of Melanochelys trijuga trijuga (mg/g)

Sl. No	Tissue	Protein		Carbohydrate		Lipid		Amino Acids	
		Normal	Starved	Normal	Starved	Normal	Starved	Normal	Starved
1.	Muscle	20.55	15.66	18.52	12.61	0.72	0.032	0.0038	0.0032
2.	Liver	30.18	17.81	23.50	12.18	1.10	0.020	0.0070	0.0052
3.	Heart	23.61	17.93	13.15	11.50	1.02	0.064	0.0070	0.0066

In the normal muscle tissue, the prominent peptides were at 180 KDa and 43 KDa with a number of minor peptides ranging from 63-180 KDa. In the starved muscle tissue there was no significant variation in the peptide pattern. While the intensity of the 180 KDa peptide was considerably reduced, it further showed degradation.

In the normal heart tissue the prominent peptides were at a range of 43 and 180 KDa. In the starved heart tissue again there was no significant change in the peptide pattern and all peptides as found in normal tissue were also seen in the starved tissue.

Normal liver tissue also showed prominent peptides in a range of 43 and 180 KDa and a number of small peptides ranging from 17-180 KDa. In the starved tissues however there was a significant change in the peptide pattern. The high molecular proteins seem to have been completely degraded while some low molecular weight peptides were generated.

DISCUSSION

A comparison of the protein, carbohydrate, lipid and amino acid content between the normal and the starved tissues showed marked changes in their biochemical composition with the starved tissues showing a drastic reduction in the protein, carbohydrate and lipid levels. Among the tissues, the worst affected appeared to be the liver which showed a reduction of 41% in protein, 48% in carbohydrate, 98% in lipid and 26% in amino acid content respectively when compared to the control. Thus it is apparent that the energy stored in the liver was utilized first and when its level came down the energy in the muscle was utilized followed by the heart tissue respectively.

A persual of literature shows that Woo and Cheung (1980) while studying the metabolic effects of starvation found a rapid decrease in protein concentration in the starved *Ophiocephalus maculatus* during the initial 33 days. Morala (1982) while studying the enzyme activities during starvation in *Salmo gairdneri* found an increase in the activity of alanine amino transferase, aspartite amino transferse and LDh in liver for the first 30 days. After 60 days of activity, phosphophenol pyruvate, carboxylase, glucose 6 phosphatase and fructose diphosphotase increased.

In the present study, there was complete disappearence of certain bands, increase in the intensities of some other bands while at the same time generation of low molecular peptides possibly from the high molecular bands which were absent in the control tissues. As to the question of why there are changes in the peptide bands, it is thought that it may be a phenomenon of compensatory acclimation as has been reported earlier by Prosser (1969). Muralitharan (1987) reported that the decrement of protein despite its synthesis may suggest its high rate of utilization while Neame (1968) observed that amino acids in brain are known to be involved in a number of metabolic processes and hence the demand of amino acids may possibly induce the breakdown of proteins and this could have enabled the animal to withstand the stress caused due to starvation by performing normal neurochemical functions. The same appears to hold good in the present study also.

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Reprint : Zoos' Print, 13 (3) : 13-14, March, 1998

CIRCULATING LEUKOCYTIC CONCENTRATION OF TIGERS (*Panthera tigris tigris*), LEOPARDS (*Panthera pardus*) AND CLOUDED LEOPARDS (*Neofelis Nebulosa*) KEPT UNDER CAPTIVITY

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Introduction

The hematological values are useful for understanding the state of animal health. Hematological values of domesticated and pet animals vary according to age, state of health, environment, nutrition and management. However, the information on these values among wild animals are not sufficient to establish the relation of age, nutrition, management and environment with general health condition and reproductive stage. The main objective of this study was to find out the circulating level of leukocytes in tigers, leopards and clouded leopards managed under captivity in tropical India.

Materials and Methods

Three male tigers (3-5 to 9 year), six female tigers (4-5 to 14 years), six female leopards (4 to 11 years), one male clouded leopard (one year) and one female clouded leopard (11 years) maintained in Sanjay Gandhi Biological Park, Patna, India, were considered for this study. There were no previous reports of ailment in these animals. Stool examination of all animals done on three consecutive days were found negative for parasitic infestation.

Blood samples from each animal was collected between 09.00 and 10.00 A.M. by restraining them in a squeeze cage using sterile disposable syringe (20 ml) and needle (20 gauge) by venipuncture either from dorsal branch of medial saphenous vein in the hind leg at about the level of knee or from recurrent tarsal vein in the hind leg at the upper portion of the paw from the tigers. Blood samples from leopardess and clouded leopards were collected from medial saphenous vein. The total and differential (using Giemsa stain) leukocytic count was done by the method as described by Schalm *et al* (1975). Data were analysed for averages and standard error and analysis of variance for comparison between groups (Snedecor and Cocharan, 1967).

Results and Discussion

The total and differential (Mean +/- SE) leukocytic count of tigers, tigress, leopardess and clouded leopards have been presented in Table 1. The total leukocyte in tigers, tigeress, and leopardess varied from. 10350/ul to 13650/ul, 10050/ul to 16550/ul and 101001/ul to 14700/ul respectively. The concentration of neutrophils, lymphocytes, Eosinophils and monocytes also varied in all these species.

The values of total leukocytes, neutrophil, lymphocyte, eosinophil and monocyte of above three groups were however, not statistically different.

The total and differential leukocytic count of tigers, tigeress, leopardess and clouded leopards (male & female) recorded in our experiment were similar to the leukocytic count reported in lion, tiger, leopard, jaguar and cheeta (Soifer and Bernstein 1974; Christoph and Mehlhorn, 1960).

The historical record and the physical appearance of our experimental animals showed that all the animals under experimentation were apparently healthy. One tigress during the period of study developed high temperature (106° F) even though her leukocytic count during pyrexia was similar to the healthy animals of the group and comparable to the other healthy felids reported earlier. Her hemograms (blood clotting time, total hemoglobin, total erythrocyte count, packed cell volume, mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration) recorded during pyrexia was also unaltered. The alteration was noticed only in respect of erythrocyte sedimentation rate which was higher during pyrexia and came down to the levels of other healthy animals 48 hours after animal recovered in response to the treatment with sulphadimidin (Singh *et al* 1979 a). The leukocytic picture of this healthy animal revealed that the leukocyte count within twelve to twenty four hours of developing febrile condition does not cause the alteration in leukocyte count in the circulating blood. However, it has been established that variability of white cell count is pronounced in domestic animals and is caused by certain physiological, pathological and psychological factors (Swenson and Reece 1996). The blood picture recorded in this experiment led us to conclude that the leukocyte picture in wild animals kept in captivity is less influenced by sex, species and acute abnormal physical condition, although the other paramenters like ESR is highly variable in various conditions as stated earlier (Singh *et al* 1997b). The reasons for this is not clearly known and a more systematic and close observations are needed to reach any conclusion on the activity of the hematopoietic system of wild felids.

Acknowledgement

Authors are highly thankful to the Associate Dean-Cum-Principal, Bihar Veterinary College, Patna and to Dr. P.C. Mishra, Director, Sanjay Gandhi Biological Park, Patna for the facilities made available to conduct this experiment.

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Table 1 The leukocytes in circulating blood of Tiger, Leopard and clouded Leopards

Animals	Total leukocytes count (X 103/ul (Mean +/- SE)	Neutrophil (%)	Differential Lymphocyte(%	Leukocyto counts Eosinophil(%)	(Mean +/- SE) Monocyte(%)	Basophil(%)
Male tiger (3)	11.75 +/- 0.81	65.67 +/- 2.33	29.00 +/- 2.45	2.67 +/- 0.72	2.67 +/- 0.54	00.00
Female tiger (6)	11.66 +/- 0.90	69.33 +/- 1.85	24.83 +/- 1.50	3.50 +/- 0.57	2.33 +/- 0.45	00.00
Female leopards (6)	12.78 +/- 0.62	66.33 +/- 1.84	26.83 +/- 1.32	4.67 +/- 0.77	2.17 +/- 0.44	00.00
Male clouded Leopard (1)	21.85	56.00	38.00	3.00	3.00	00.00
Female clouded leopard (1)	12.85	62.00	32.00	4.00	2.00	00.00

Reprint : Zoos' Print, 13 (3) : 17-19, March, 1998

CERTAIN HAEMATLOGICAL AND BIOCHEMICAL PROFILES IN ASIATIC LIONESS (*Panthera leo persica*)

K.S. Christi[1], R.H. Sabapara[2] and V.P. Vadodaria[3]

Introduction

The single wild population of Asiatic lion (*Panthera leo persica*) remaining today occupies a 1,400 square kilometers area including the Gir Forest Sanctuary and the surrounding forest in Gujarat state. The perpetuation of any species also depends on the maintenance of adequate numbers and survival of a species requires adaptation to its environment. Isolated reports on African lion (Theobald, 1978; Jain, 1986) and on Asiatic lion (John *et al.*, 1995) have been available.

Physiological and biochemical norms are very much useful to know about the adaptation and health status of such species of animal like other domesticated animals. An attempt therefore, has been made to study the haematological and blood biochemical profiles of Asiatic lioness of Gir forest, Gujarat state.

Materials and Methods

Eight Asian lionesses maintained in captivity were included in the present study. Of these, four lionesses were captured from the Gir forest and four were captive born at Sakkarbaugh Zoo, Junagadh. The average body weight of these lionesses were within the range of 100 to 125 kg. The lionesses were restrained in a squeeze cage and blood samples were collected from the caudal vein. Whole blood was collected in a vial containing citraye fluonde mixture anticoagulant. Blood smears were prepared for different leucocyte count (DLC). Serum samples harvested were kept on ice, transported and preserved in the laboratory till analyses.

Haemoglobin (Hb), packed cell volume (PCV), erythrocyte sedimentation rate (ESR), red blood cell count (RBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH), white blood cell count (WBC), DLC and absolute values (AB) were measured by standard haematological methods (Jain, 1986). Blood glucose, blood urea, serum calcium, inorganic phosphorous (Pi), magnesium, cholesterol, total proteins (TP), alkaline phosphatase (AKP), acid phosphatase (ACP), aspartate amino-transferase (AST or SGOT) and alanine amino-transferase (ALT or SGPT) were determined by standard biochemical techniques (Wootton, 1964). Mean standard error as well as the regression and correlation coefficient of these parameters with overall body weight were worked out (Snedecor and Cochran, 1964).

Results and Discussion

The mean and standard error as well as correlation and regression on body weight for haematological and blood biochemical parameters from eight Asiatic lioness are presented in Table 1 and 2, respectively. No comparative data on Asiatic lioness is available on similar aspects. However, the reported values of lionesses were in agreement to the values reported for lions given by John, et al. (1995). Looking to the individual parameters for all lionesses, the levels were more or less uniform, except significant negative correlation coefficient for neutrophils and Ca:Pi and regression coefficient for MCHC with overall body weight. Significant positive regression for Hb, RBC, MCV, monocyte, total proteins (TP) and AST:ALT and negative for AKP and Ca:Pi were recorded with overall body weight. This indicated that this group of lionesses form a complete homogeneous population. In view of limited number of animals studied, above statistics should be viewed as a broad outline for direction of possible correlation and regression between overall body weight and blood parameters. The population of Asiatic lion that survive in the Gir Forest Sanctuary is genertically monomorphic at each of 46 allozyme loci (O'Brien *et al.*, 1987). The Gir population may thus represent an example of severely endangered species that suffered a population bottleneck or a series of bottlenecks followed by inbreeding in their recent history. The present data will be a guideline to normal values and will be useful to find out the existence of pathological conditions.

Acknowledgement

The authors are thankful to C.S.I.R., New Delhi for providing financial support in the form of Senior Research Fellowship which has helped to carryout the present investigation. Thanks are also due to help and facilities rendered by Sakkarbaugh Zoo authorities as well as in statistical analysis by department of Animal Genetics and Breeding.

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Table 1 *Average (X+/-S.E.) haematological profiles of Asiatic lioness and their correlation and regression values with body weight.*

Parameters	Mean +/- S.E.			With body weight (Overall).	
	Captive born n=4	Captured n=4	Overall n=8	r+/-S.E. n=8	b_{y_x} +/-S.E. n=8
Hb (g%)	17.20 +/- 0.53	16.35 +/- 0.80	16.77 +/- 0.47	0.164 +/- 0.397	0.025* +/- 0.098
PCV (%)	42.50 +/- 1.26	42.75 +/- 4.77	42.62 +/- 2.28	0.174 +/- 0.396	0.127 +/- 0.106
RBC (10 /cmm)	6.19 +/- 0.41	6.06 +/- 0.38	6.12 +/- 0.26	0.022 +/- 0.001	0.015* +/- 0.005
ESR (mm/hr)	4.75 +/- 1.88	3.00 +/- 0.71	3.87 +/- 0.99	0.003 +/-0.408	0.006 +/- 0.010
MCH (pg)	2.83 +/- 0.27	2.71 +/- 0.17	2.77 +/- 0.15	0.270 +/- 0.970	0.013** +/- 0.002
MCHC (g%)	0.41 +/- 0.01	0.39 +/- 0.03	0.41 +/- 0.02	-0.309 +/- 0.960	-0.002** +/- 0.000
MCV (fl)	6.99 +/- 0.67	7.00 +/- 0.46	6.99 +/- 0.38	0.001 +/- 0.408	0.040** +/- 0.010
WBC (10 /cmm)	2.07 +/- 0.28	1.19 +/- 0.16	1.63 +/- 0.22	-16.380 +/-109.170	-0.500 +/- 37.440
Neutrophil (%)	69.75 +/- 2.28	69.50 +/- 0.64	69.62 +/- 1.10	-0.315 +/- 0.956	-0.111 +/- 0.045
Lymphocyte (%)	26.25 +/- 1.75	24.25 +/- 1.49	25.25 +/- 1.13	0.044 +/- 0.407	0.016 +/- 0.019
Eosinophil (%)	2.50 +/- 0.29	4.75 +/- 1.11	3.62 +/- 0.68	0.205 +/- 0.391	0.044 +/- 0.019
Monocyte (%)	1.50 +/- 0.50	1.50 +/- 0.50	1.50 +/- 0.46	0.479 +/- 0.314	0.050** +/- 0.009
Neutrophil (Asolute)	14.41 +/- 2.00	8.23 +/- 1.03	11.32 +/- 1.57	-0.735* +/- 0.779	-368.226 +/- 3926.79
Lymphocyte (Absolute)	5.44 +/- 0.88	2.89 +/- 0.48	4.17 +/- 0.67	-0.001 +/- 0.999	-127.624 +/- 70.001
Eosinophil (Absolute)	0.51 +/- 0.07	0.56 +/- 0.15	0.53 +/- 0.08	-0.119 +/- 0.994	-7.701 +/- 28.260
Monocyte	0.29	0.20	0.24	0.016	2.413

Table 2 Average (X+/-S.E.) blood and serum biochemical profiles of Asiatic lioness and their correlation and regression values with body weight

Parameters	Mean +/- S.E.			With body weight (Overall)	
	Captive born n=4	Captured n=4	Overall n=8	r+/-S.E. n=8	$b_{y.x}$ +/- S.E. n-8
Blood Estimates:					
Glucose (mg%)	102.64 +/- 3.26	106.09 +/- 4.13	104.37 +/- 2.52	0.382 +/- 0.367	0.023 +/- 0.049
Urea nitrogen (mg%)	21.73 +/- 1.67	25.29 +/- 1.30	23.51 +/- 1.19	0.038 +/- 0.408	0.014 +/- 2.620
Serum Estimates:					
Cholesterol (mg%)	152.58 +/- 3.26	161.52 +/- 5.50	157.20 +/- 3.79	-0.126 +/- 0.402	-0.136 +/- 0.163
TP (g%)	7.77 +/- 0.18	7.54 +/- 0.46	7.66 +/- 0.23	-0.153 +/- 0.396	-0.011* +/- 0.003
Calcium (mg%)	7.64 +/- 0.47	7.16 +/- 0.34	7.40 +/- 0.28	-0.666 +/- 0.227	0.060 +/- 0.033
PI (mg%)	3.60 +/- 0.27	4.27 +/- 0.43	3.93 +/- 0.27	0.518 +/- 298	0.045 +/- 0.007
Ca:PI	2.15 +/- 0.21	1.72 +/- 0.17	1.98 +/- 0.15	-0.798* +/- 0.138	-0.038** +/- 0.004
Magnesium (mg%)	2.25 +/- 0.21	2.52 +/- 0.17	2.38 +/- 0.13	-0.252 +/- 0.382	-0.011 +/- 0.036
AKP (BLU/ml)	5.72 +/- 0.57	4.47 +/- 0.69	5.10 +/- 0.48	-0.243 +/- 0.384	-0.038* +/- 0.012
ACP (BLU/ml)	2.11 +/- 0.14	2.11 +/- 0.52	2.11 +/- 0.24	-0.057 +/- 0.407	-0.004 +/- 0.002
AKP: ACP	2.78 +/- 0.36	2.88 +/- 0.64	3.01 +/- 1.35	0.039 +/- 0.407	0.008 +/- 0.074
AST (U/ml)	22.24 +/- 1.78	20.64 +/-2.54	21.44 +/- 1.46	0.021 +/- 0.408	0.010 +/- 0.019
ALT (U/ml)	14.13 +/- 1.91	12.82 +/-1.41	13.47 +/- 1.13	-0.391 +/- 0.346	-0.140 +/- 0.060
AST: ALT	1.62 +/- 0.15	1.61 +/- 0.90	1.62 +/- 0.07	0.617 +/- 0.156	0.016** +/- 0.001

n = Number of animals, r = regression coefficient, * - Significant at 5%, ** - Significant at 1%, b_{yx} = Correlation coefficient

Reprint : Zoos' Print Journal, 14 (4) : 7-8, April, 1999

CASE REPORT

HEMATOLOGY OF TIGERS (*PANTHERA TIGRIS TIGRIS*), LEOPARDS (*PANTHERA PARDUS*) AND CLOUDED LEOPARDS (*NEOFELIS NEBULOSA*) IN CAPTIVITY.

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Introduction

The determination of hematological values are useful for understanding the state of animal health. The normal blood values in different classes of domestic and pet animals are adequately available (Schalm, *et al.*, 1975; Swenson & Reece, 1996). However, the information on these values is very limited in few feline species maintained in tropical gegion (Christi, *et al.*, 1998) and not sufficient to establish the relation of age nutrition, management and environment with general health of these animals. The main objective of this study is to have a base line data to provide a basic information on normal hematological values in tropical climate for identifying abonormalities in blood of sick Tigers (*Panthera tigris*), Leopards (*Panthera pardus*) and Clouded Leopards (*Neofelis nebulosa*) kept under captivity in tropical region

Methodology

Three male Tigers, six female Tigers, ~~six~~ female Leopards, one male Clouded Leopard and one female Clouded Leopard of 3.5 to 9 Year, 4.5 to 14 Years, 4 to 11 years, one year and 11 years of age respectively, maintained in Sanjay Gandhi Biological Park, India, were included for this study. There was no previous reports for ailment in these animals. Stool examination of all animals done on three consequitive days were found negative for parasitic infestation.

Blood samples from each animal were collected between 09.00 and 10.00 am. during fully conscious state in squeeze cage. To minimise the excitement and to get rid of physiological stress to the animals durnng blood collection all animals were made accustomed to stand in the squeeze cage prior to the initiation of expenment. On the day of blood collection animals were brought into squeeze cage and were left in the cage for one hour. Thereafter the animals were further squeezed mildly and again left for 30 minutes. Finally the animals were squeezed properly and blood samples were collected using disposable syringe (20 ml) and stenle needle (20 gauge) by venipuncture either from dorsal branch of medial saphenous vein in the hind leg at about knee level or from recurrent tarsal vein in the hind leg at the uper portion of the paw from the tigers. Blood samples from leopardess and clouded leopards were collected from medial saphenous vein. Blood clotting time (BCT), Total erythrocyte count (TEC) (Schalm, *et al.*, 1975) and hemoglobin (Hb) was estimated by Sahli's Hemometer (Kolmer *et al.* 1969) in freshly collected blood. Packed cell volume (PCV) was measured (Schalm, *et al.*, 1975) from heparinized blood within two hours of blood collection. Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated using Swenson and Reece (1996) equation.

Received on 16 March 1998; Accepted on 4 March 1999.

Results and Discussion

The data was analysed for averages and standard error and analysis of vanence for comparison of various traits between groups was done by the method as described by Snedecor and Cocharan (1967).

The values of BCT, Hb, PCV, TEC, MCV, MCH, and MCHC in Tigers, Tigeress, Leopardess and Clouded Leopards have been presented in Table.1.

The singnificantly ($P<0.01$) lower BCT in Leopardess than the BCT of Tigers and Tigeress was recorded in our expenment. Maintenance of optimum concentration of Hb and TEC in Tigers, and Leopardess of different age groups recorded during present study might be due to the fact that all animals had achieved age of puberty (Fowler, 1978) as the concentration of Hb achieves its maximum level when the animals reach puberty and sexual maturity (Swenson & Reece, 1996; Safi *et al.* 1987). Slight lower Hb in Lion, Tigers, Leopards, Jaguar and Cheetah (Soifer & Bernstein, 1974) and higher Hb values in Mountain Lion (Currier & Russel, 1982) has been reported. This might be due to the variation in physiologycal status, ambient temperature, agroclimatic condition, feeding and management of the expenmental animals as variation in any of the above factors causes fluctuation in hemoglobin concentration (Safi, *et al.*, 1987). However, the Hb concentration estimated in Tigers, Tigeress, Leopardess, Clouded Leopard and Clouded Leopardess were comparable to the value recorded earlier in Puma, Lion, Tiger, Leopard, Jaguar and Cheetah (Hawkey & Hart, 1986) in Cheetah, Lynx, Puma, Jaguar, and lion (Pospisil, *et al.*, 1987) and in captive born as well as in captured Asiatic Lioness (Christi, *et al.*, 1998).

The TEC values recorded in these species durnng present study are identical to the values reported in Tigers, Leopards, Jaguar, Cheetah, Cougar, Ocelot and Margay (Howkey & Hart, 1986; Soifer & Bernstein, 1974; Fowler, 1978), Asiatic Lioness (Christi, *et al.*, 1998). However, a higher value of TEC in Lynx, Puma, Lion and Jaguar (Pospisil, *et al.*, 1987) and in Mountain Lion (Currier & Russel, 1982) than the TEC values recorded in present experiment has been reported. The value of PCV in animals of our experiment was higher than domestic cat (Schalm, *et al.*, 1975). However, the PCV value reported in Lion Cheetah, Ocelot, Margay (Soifer & Bernstein, 1974), captive and wild Mountain Lion (Currior & Russel, 1982), captive Lioness (Christi, *et al.*, 1998), Lynx, Puma, Jaguar, Lion, Cheetah (Hawkey & Hart, 1986; Pospisil, *et al.*, 1987) were comparable.to the values recorded in present experiment.The value of MCV, MCH and MCHC recorded in our experimental animals was comparable to the respective values reported in cats of different ages (Schalm, *et al.*, 1975; Coffin, 1953), captive born and captured Lioness (Christi, *et al.*, 1998), Puma, Lion,

Table 1. Hemograms of Tigers, Leopardess and Clouded Leopards

Animals	Male Tigers	Female Tigers	Female Leopards	Male Clouded Leopard	Female Clouded Leopard
BCT(min)	8.25+- 0.20 (7.45- 8.50)	8.50+- 0.38 (7.00- 10.00)	5.29+- 0.20 (4.25-5.75)		
Hb(g/dl)	15.75+- 1.40 (15.40-16.00)	15.03+- 0.47 (13.60-17.00)	14.83+- 0.46 (13.00-16.00)	15.80	15.00
PCV(%)	45.67+- 2.42 (40.00-50.00)	43.33+-0.93 (41.00-48.00)	42.83+-1.06 (39.00-47.00)	48.00	46.00
TEC(X10⁶/ul)	7.17+-0.33 (6.36-7.69)	7.05+-0.12 (6.60 - 7.43)	6.95+-0.16 (6.48-7.67)	7.96	7.17
MCV(u³)	63.70+- 1.45 (61.11-67.11)	61.46+- 0.91 (59.21- 63.63)	61.62+- 1.34 (58.69-67.13)	60.30	64.15
MCH (pg)	22.07 +- 0.90 (20.54-24.21)	21.15+- 0.82 (18.32-23.02)	21.39+- 0.80 (18.25-24.24)	19.84	20.92
MCHC(%)	34.70+-1.60 (32.00-38.50) (3)	34.72+-0.71 (32.81-38.09) (6)	34.66+- 0.87 (31.11-37.20) (6)	32.91 (1)	32.60 (1)

BCT- Blood clotting time, Hb- Hemoglobin, PCV- Packed cell volume, TEC- Total erythrocyte count, MCV- Mean corpuscular volume, MCH- Mean corpuscular hemoglobin, MCHC- Mean corpuscular hemoglobin concentration.

Tigers, Jaguar and Cheetah (Hawkey & Hart, 1986).

The values of above parameters reveal that the mean values of Hb, PCV, TEC, MCV, MCH and MCHC were quite similar in Tigers, Tigeress, Leopardess and Clouded Leopards. Though the Hb concentration of three Tigeress and three Leopardess were lower than the Hb values of PCV, TEC and MCV of Tigers, Tigeress and Leopardess were similar. These values indicated that in the wild felides in which the Hb concentration was lower the cells size and the number of erythrocytes were not affected. However, the MCH and MCHC values of three Tigeress and three Leopardess having lower hemoglobin concentration were lower than the MCH and MCHC values recorded in other animals having higher Hb concentration. This indicates that the process of erythropoisis and Hb synthesis is similar to the domestic animals (Swenson & Reece, 1996).

Acknowledgement

The authors would like to thank Associate Dean-cum-Principal, Bihar Veterinary College, Patna for providing adequate facilities.

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HAEMATOLOGY AND SERUM CHEMISTRY OF INDIAN WOLF (*CANIS LUPUS PALLIPUS*)

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Introduction

According to the Conservation Assessment, the Indian Wolf (*Canis lupus pallipus*) is a near threatened subspecies. The Sakkarbaug Zoo has established a captive-breeding programme since last few years. Successful breeding of this species in captivity at the zoo is reflected by the many births. At present, the zoo has 14 individuals, which might be one of the largest captive populations of this subspecies in the world. Biological parameters are considered useful aids in clinical diagnosis and there is paucity of such information. Therefore, the study was undertaken to estimate the normal ranges of a variety of haematological and serum chemistry values in healthy individuals of this species.

Materials and Methods

Fourteen apparently healthy Indian Wolves housed at Sakkarbaug Zoo, Junagadh, Gujarat were utilised for this study. Of these animals, five were pups (3 males and 2 females) about five months of age and nine were adults (5 males and 4 females). Except for one male, which was acquired from the wild, the rest were born in captivity.

These animals were housed in three groups. Group one composed of a breeding pair with five pups. Group two composed of four adult animals (3 males and 1 female) and group three composed of three adult animals (1 male and 2 females). Each group was housed in separate enclosures having an outdoor area of about 300 ft², covered from all four sides with a chain linked fence. Additionally, every enclosure had an area of about 200 ft² as night house or feeding house. These animals were maintained on a natural light and dark cycle and fed with buffalo meat comprising soft bones (15%). Food was supplemented adequately with necessary vitamins and minerals. Water was made available to all animals round the clock. Animals were physically examined to determine their health condition. Approximately 10 ml of blood was obtained from femoral vein with a sterilised 20-gauge needle after restraining the animal in squeeze cage. Two millilitre of blood was deposited into a sterile tube containing di-potassium ethylenediamine tetra acetate (EDTA) and rest was transferred to centrifuge tube for serum separation. The EDTA tubes were agitated for 15-20 seconds. Haematological evaluations were performed on whole blood. Serum was separated within 30 minutes of sample collection by centrifugation, and serum chemistry evaluations were performed within six hours of sample collection. Blood smears were stained with field A and B stain and differential counts (based on count of 100 cells) were made manually under microscope. Haemoglobin estimation was done by Sahils acid hematin method

Received 3 April 1999; Accepted 20 May 1999

Table 1. Haematological data for 14 Indian Wolves

Blood measure	Mean	SD	Range
Haemoglobin (g/dl)	13.51	1.23	10.5-15
ESR mm/hr	2.86	1.06	1-5
Leukocytes (WBC) (10^3/ul)	14028	17775	10200-18200
Neutrophils (10^3/ul)% of WBC	63.14	3.85	58-71
Lymphocytes (10^3/ul)% of WBC	33.71	3.22	28-39
Monocytes (10^3/ul)% of WBC	1.07	0.5	0-2
Eosinophils (10^3/ul)% of WBC	2.07	0.79	0-4
Basophils (10^3/ul)% of WBC	0	0	0

Table 2. Serum chemistry values for 14 Indian Wolves

Serum measure	Mean	SD	Range
Calcium (mg/dl)	6.533	0.647	5.58-7.94
Phosphorus (mg/dl)	4.86	0.357	4-5.32
Glucose (mg/dl)	71.44	9.398	58.2-91
BUN (mg/dl)	28.19	7.966	16-41
Cholesterol (mg/dl)	173.44	16.45	138-198
Total protein (g/dl)	6.01	0.394	5.07-6.49
Albumin (g/dl)	3.287	0.18	2.92-3.53
Globulin (g/dl)	2.724	0.406	2.03-3.16
SGPT (mg/dl)	40.29	11.34	24-64

as described by Wintrobe (1967). White blood cell counts were performed using a standard hemocytometer method as described by Schalm (1967). Erythrocyte sedimentation rate was determined using Westergreen method. Total Protein (Buiret & Dumas method), Albumin-Globulin (Buiret and Dumas method), Urea (Dam method), Glucose (God/pod method), Cholestrol (Wybenga and Pileggi method), Serum Glutamate Transminase (Reitman and Frankel method), Calcium (O.C.P.C. method), Phosphorus (Gommorri's method) and Blood Urea Nitrogen (Dam method) were determined using photoelectric colorimeter (Systronics, Ahmedabad) using diagnostic kits supplied by M/s Span Diagnostics Limited, Surat. Mean sample standard deviations, and ranges were calculated for all haematological and serum chemistry parameters.

Results and Discussion

The general haematological and serum chemistry mean value of healthy Indian Wolves regardless of their sex and age are presented in the tables 1 and 2. The haematological values (Table 1) observed in the Indian Wolf were consistent with those published previously for dogs by Sharma *et al.* (1996) and Kirk and Bistner (1995).

Similarly majority of serum chemistry values (Table 2) in the Indian wolf were within the range as previously reported by Sharma *et. al.* (1996) and Kirk and Bistner (1995). Serum chemistry value for calcium was slightly lower than what is reported in dogs. The ratio of calcium to phosphorous should be between 1:1 to 2:1 and it was within the ranges in these animals.

Acknowledgement

Authors are grateful to Mr. R.D. Katara, Zoo Officer, Sakkarbaug Zoo for help and support during this study.

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SERUM CALCIUM AND INORGANIC PHOSPHORUS IN TIGERS (*PANTHERA TIGRIS*) AND LEOPARD (*PANTHERA PARDUS*) KEPT IN CAPTIVITY

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The study was conducted on adult, captive Tigers (*Panthera tigris*) and Leopard (*Panthera pardus*) of Sanjay Gandhi Zoological Park, Patna. They were fed once daily for six days a week. The quantity of feed provided to the animals and feeding schedule is presented in Table 1. Regular deworming was done with broad spectrum anthelmintics. The faecal samples of each animal were examined on three consecutive days and were found negative for parasitic infestation.

Single blood samples from each three male tigers (tigers), six female tigers (tigeress) and six female leopards (leopardess) were collected in winter season by restraining them is squeeze cage. Blood was collected either from dorsal branch of the medial saphenous vein in the hind leg at about the level of knee or from the recurrent tarsal vein in the hind leg. The serum calcium was estimated by the Clark and Collip method, while serum inorganic phosphorus was estimated by Fiske and Subbarow method as described by Kolmer *et al* (1969). The data were analysed for averages, standard error and analysis of variance as described by Snedecor and Cochran (1967).

The value of serum calcium and inorganic phosphorus have been presented in Table 2. Nearly similar level of serum calcium and inorganic phosphorus was estimated among individual tigers, tigeress and leopardess. The calcium to phosphorus ratio in tigers, tigeress and leopardess was 2.91:1, 2.96:1 and 3.02:1 respectively.

The serum calcium value determined in tigers and leopardess was higher than the serum calcium reported in tigers, leopards and cheetah (Wallach & Boever, 1983). In most of the mammals studied so far, the circulatory levels of calcium stands around 10 mg/dl (Mc Donald, 1989). The level of serum calcium of tigers and leopardess of present experiment fall within the recommended range. Moreover, the serum calcium values of the experimental animals are comparable to the value recorded in male and female tigers and lion (Seal & Makey, 1975), wild and captive mountain lion (Currier & Russel, 1982).

The values of serum phosphorus in animals of our experiment was lower than the previous reports on tigers and lions (Seal & Makey, 1975), wild and captive mountain lion (Currier & Russel, 1982) Cheetah, Leopard, Bengal Tigers, African Lion and domestic cat (Wallach & Boever, 1983). A lower value of serum calcium level than the value of serum calcium recorded in our experiment has also been reported in Bengal Tiger, Leopard and Cheetah (Wallach & Boever, 1983). The serum calcium level in most of the species studied so far ranged between 8 and 13 mg/dl. The calcium homeostasis is controlled by the intrinsic endocrine activity which mobilise the calcium from the G.I. tract whenever the calcium level in the circulation goes below the threshold value. At the same time, the intrinsic mechanism of the body remove the excess calcium from circulation and deposit it in the bones. In most of the mammals studied, the circulatory level of calcium stands around 10 mg/dl. The persistant elevation of calcium above 12 mg/dl is considered as hypercalcaemia (Mc Donald, 1989). The level of serum calcium of the tigers and leopards of our experiment fall within the recommended range but towards higher value. The serum calcium of normal animal is near 10 mg/dl with some variation depending upon the analytical method employed as well as the age and diet of the animal. The serum calcium value of leopardess in our experiment is comparable to the value recorded in Cheetah, Leopard, Bengal Tiger, African Lion (Wallach & Boever, 1983), male and female tiger, lion (Seal & Makey, 1975) wild and captive mountain lion (Currier & Russel, 1982), equine (Coles, 1974), dog (Kirk, 1989) and human being (Harper, 1975).

The serum phosphorus levels estimated in male and female tigers and leopardess of this experiment seems to be quiet identical. However, the value of serum phosphorus level in our experiment proved to be lower than the previous reports on Tigers and Lions (Seal & Makey, 1975), wild and captive Mountain Lion (Currier & Russel, 1982), Cheetah, Leopard, Bengal Tiger, African Lion and domestic cat (Wallach & Boever, 1983). The higher value of calcium associated with slightly lower value of phosphorus in our experiment in comparision to the value of calcium and phosphorus recorded earlier on wild felids might be due to the differences in dietary composition in respect of calcium and phosphorus content made available to the animals on different experimental regimen. Besides the higher value of calcium (within the range) associated with lower serum phosphorus level may be due to consistently higher activity of intrinsic endocrine factor responsible for elevation of calcium level and decline of serum phosphorus level under certain managemental condition, that might have caused such condition of higher Ca:P (2.91:1 to 3.02:1) ratio in our experimental animal.

Received 2 June 1999; Accepted 30 September 1999

in captivity. As it has been well documented that at the event of maintenance of serum calcium level towards 10 mg/dl or above and the blood phosphorus 4 mg/dl or in the lower normal range is due to maintenance of calcium at the higher level and inhibition of renal tubular reabsorption of phosphorus by the slightly elevated release of endocrine factor mainly parathormone by the parathyroid gland (Mc Donald, 1989). This intrinsic mechanism for the control of calcium and phosphorus level in circulation might be operating in our experimental wild felids kept in captivity which led to keep the serum calcium at a little higher but within the range by shifting the threshold of calcium towards higher value for the operation of internal endocrine factors responsible for calcium homeostasis.

It has been reported that the higher value of total protein in circulating blood is associated with elevated level (towards higher normal range) of calcium in circulation (Coles, 1974). In our experiment the total serum protein is higher than the total serum protein value of most of the felids which accounts for the higher physiological level of calcium in the circulation and agree well with the earlier statement (Coles, 1974). However, the calcium-phosphorus ratio of the individual animal (2.47:1 to 3.22:1) as well as mean value (2.91:1 to 3.02:1) is lower than the calcium phosphorus ratio (4.5:1) in equine (Coles, 1974) and similar to the values obtained in dog (Kirk, 1989; 2.2:1 to 3.4:1) and human being (Harper, 1975; 2.4:1 to 3:1).

Acknowledgement

Authors are thankful to the Dean-Cum-Principal, Bihar Veterinary College, Patna, for providing facilities for the study.

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Table 1. Prescribed carnivore diets provided to the animals during two different seasons

Season	Feed	Tiger Male	Female	Leopard Female
Winter	Beef	12 Kg	10 Kg	4.5 Kg
	Egg	02	02	02
	Milk	1 litre	1/2 litre	1/4 litre
	Water	Ad. lib	Ad. lib	Ad. lib
Summer	Beef	8 Kg	6 Kg	2.5 Kg
	Milk	1 litre	1/2 litre	1/4 litre
	Water	Ad. lib	Ad. lib	Ad. lib

Table 2. Serum calcium and inorganic phosphorus of tigers, and leopardess

	Male Tigers	Female Tigers	Leopardess
Serum calcium (mg/dl)	10.57+-0.07 (10.40-10.70)	10.87+-0.09 (10.20-11.20)	10.97+-0.49 (8.40-11.80)
Serum inorganic phosphorus (mg/dl)	3.63+-0.03 (3.60-3.70) (3)	3.67+-0.05 (3.50-3.30) (6)	3.63+-0.06 (3.40-3.80) (6)

Figures in parenthesis shows no of animals.

Reprint : Zoos' Print, 5 (10) : 16-17, October, 1990

NEOPLASMS IN CAPTIVE WILD MAMMALS- CASE REPORTS

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The general impression is that neoplasms are not common in wild mammals, though there is no premise or veracity in this statement. Different types of tumours have been reported in a variety of wild mammals in the country (Sivadas *et al.*, 1969; Arora, 1982). The present paper reports further cases of neoplasms encountered in various species of wild mammals during our wildlife health monitoring and disease surveillance persuits.

CASE-I On 18-6-1979 a male tiger (*Panthera tigris*) died at National Zoological Park, New Delhi. History indicated that the beast had at times bleeding from mouth due to some problem in its oral cavity. Its Physical condition progressively deteriorated and eventually the animal died. Zoo veterinarian, on necropsy examination, found enlarged and swollen reddish posterior part of tongue and preceived it to be the main cause of its death. Pieces of the tissue from swollen part of tongue fixed in 10% formalin examined histopathologically. The finding revealed it to be a case of squamous cell carcinoma. This neoplasm has been reported from the oral activity in bear *(selenarctos thiobetamus)* (Rajan *et al.*,1973) and lynx *(Felis lynx canadensis)* (Effron *et al.*, 1977).

CASE-II. A 17-year-old lioness (*Panthera leo*) at Prince of Wales Zoological Garden, Lucknow fell sick and died. The clinical manifestations included anorexia, anaemia and ascites. Necropsy examination revealed thick growths attached to peritoneum and omentum. The ascitic fluid in the abdominal cavity was blood- tinged and slightly viscous. Histological findings on the growths revealed them be a case of malignant mesothelioma. Such a tumour has been recorded in one, 5 year old female nilgai (*Boselaphus tragocamelus*) died at Nandan Kanan Zoo, Orissa (Rao *et al.*, 1981).

CASE-III. Tumorous enlargements of lymph glands in one 15 years old gnu (*Gonnochaetus taurinus*) which died of bronchopneumonia at National Zoological Park, Hydreabad were found to be due to histiocytic cell sarcoma.Report of histiocytic cell sarcoma in this species was not traceable in the available literature.

CASE-IV. The animal under study was a female rhinoceros (*Rhinoceros unicornis)* that died at the age of about 50 years at National Zoological Park, Delhi. Based on the signs of senility and history of a relatively long period of captivity, death was attributed to its old age. Earlier the maximum life span of 47 years of a rhino died at Zoological Garden, Calcutta had been recorded from by Sanyal (1892).The hard tissue mass of about 2 kg recovered from the uterus of this animal was diagnosed to be a fibroma. Occurrence of fibromas in captive wild mammals is rather uncommon.

CASE-V. An adult female hog deer (*Axis poroinus*) with comlaint of persistent vaginal bleeding died at Prince of Wales Zoological Garden, Lucknow. Necropsy examination revealed a mass weighing about 544 g attached to the uterus and encompassing the oviduct. It was pulpy (necrotic) in the centre and little gritty at places indicating calcification. Both these facts were borne out on histopathological examination. It was diagnosed as a case of adenocarcinoma suggestive of uterine origin and hydrosalpinx.

Adenocarcinoma of uterus and its metastasis to peritoneum, liver and lungs in a fallow deer (*Duma duma*) have been described (Appleby, 1969).

CASE-VI. In kanpur Zoological Park during 1988-89 an adult male solth bear (Melursus ursinus) started losing condition. There were in termittent episodes of anorexia and indefinite digestive disturbances. Despite paliative treatment, weakness continued and clinically the case was diagnosed for tuberculosis. It was treated with a course of streptomycin and isnox forte. The animal died on 20.5.1989. Necropsy examination revealed serosanguineons fluid in the abdominal cavity, thickening of intestine, hard and enlarged liver and nodular lesions in lungs. The microscopic examination revealed the gross changes to be due to adenocarnomatous lesions affecting the itestine and apparently spreading to the liver and lungs. During 1983 a female Himalayan bear (*Selenarctos thiabetanus*), which had died in this very zoo, had evidenceed tumorous growths in the stomach and its metastases to other Visceral organs.

Acknowledgement

Authors thank Director of the Institute for providing facilities for the work and zoo verterinarias for supplying the investigational material.

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Reprint : Zoos' Print, 5 (10) : 11, October, 1990

AMYLOIDOSIS IN A BLACK SWAN (CHENOPIS ATRATAS)

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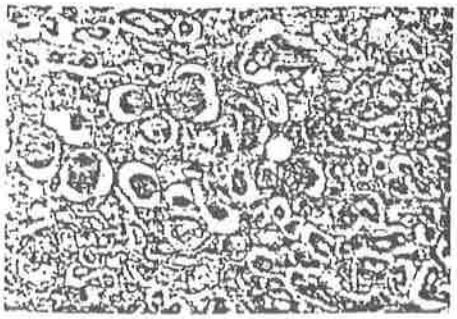

Section of kidney showing amyloid in glomeruli.H& E

Amyloidosis is usually ascribed to long continued suppuration,chronic infection or tissue destructive process.Fox (1923) recorded 8 cases of amyloidosis from Philadelphia zoological gardens,four in pesseres, one each in Columbae and 9 in Punnes and in two Anseres.According to him the liver was more prone to show amyloid deposition.In this study three cases were associated with chronic infectious diseases and two with nematode parasitism.The remaining three were classified as primary being not related to any disease process.Brassard (1965) stated that the percentage of deaths due to tuberculosis,renal diseases,hepatitis and infections accompanied by amyloidosis increased significantly in ducks,geese and swans at Philadelphia zoo during 1945-1962.Secondary amyloidosis accounted for 71.4% of the cases and the rest were classified as doubtfully primary.Cowan (1968) and Karstad (1972) reported amyloidosis in a number of zoo birds particularly water fowl.Richards *et al.*(1976) while studying tuberculosis in 127 captive exotic birds during 1969-1975 reported amyloidosis in 20% of the tuberculosis affected birds-Damodaran *et al.* (1977) recorded a case of amyloidosis in a sarus crane.

In course of routine necropsy and histopathological examination conducted on over 1600 captive birds of different species maintained at Nandankanan Biological Park during 1967-1987, a single case of amyloidosis in a female black swan has been encountered and reported in this communication.

At necropsy, no specific gross lesions were observed except moderate enlargement of kidneys and thyroid and congestion of liver and intestinal mucosa.Histologically, a number of glomeruli in both the kidneys revealed homogenious translucent acidophilic materials replacing whole or part of glomeruli.Duplicate sections when stained with congo red revealed pink coloured masses in glomeruli indicating amyloid The interstitinal tissue revealed fibroplasia associated with infiltration of lymphocytes,monocytes and plasma cells.The epithelial cells lining the proximal convulated tubules revealed necrobiotic changes and the debris was seen in tubular lumens.The dilated distal convoluted tubules revealed albuminoid materials.

Sections of liver revealed similar amyloid deposits in the sinusoids involving most of the parenchyma as a result the adjoining hepatic cells revealed pressure atrophy.The sinusoids and central veins were markedly congested.The enlargement of thyroid was due to amyloid deposition in the markedly widened interfollicular tissue as a resultmajority of the follicles were atrophied.Intestines showed congestion of muscosa while lungs and heart had normal histology.

Since the present findings are without adequate accompanying pathology other than amyloidosis in the organs studied,it is plausible to term this condition as primary amyloidosis.This study indicated that amyloidosis does not seem to be an important disease in wildlife as suggested by Cosgrove and Satterfield (1982).

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Reprint : Zoos' Print, 5 (10) : 6, October, 1990

IMPACTION OF PROVENTRICULUS AND GIZZARD IN A COMMON GOOSE.

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Fox (1923) observed impaction of proventriculus and gizzard at Philadelphia Zoological Gardens on 34 occasions and the sole cause of death due to impaction was observed on 8 occasions.The anserine birds and parrots are most often affected by this form of obstruction.Impaction of crop is of common occurence in birds which eat omnivorous diet including hard shelled seeds and occasionally in carnivorous birds (Arnall and Keymer, 1975). Petrak (1982) stated that impaction of proventriculus and gizzard with vegetation and mud or fine grit was common in debilitated water fowl.According to Jarvis(1982) impaction of crop and oesophagus is one of the most common causes of death in geese and mallards.Impaction of crop in domestic birds is usually associated with greedy eating/ingestion of large quantity of fibrous materials.This paper reports impaction of proventriculus and gizzard of an adult female common domestic goose weighing about 3.5 kg.

The bird in question was found to be dull and depressed on 22nd April, 1989, anorexic and reluctant to walk.It was found dead on 23rd April,1989.At necropsy,the whole proventriculus,gizzard and anterior one fourth of duodenum were overdistended (about 5 times the original volume) and packed with dry sand . These organs occupied major part of abdominal cavity. The intestines posterior to impaction were empty.The liver and spleen were very much atrophied.

The wall of proventriculus became very thin and translucent.The proventriculus and gizzards became flaccid due to impaction resulting in loss of tone and contractility of their musculature and consequent paralysis,leading to stasis of sand and obstruction of their lumens.Death occured within 24 hours of appearance of clinical signs which is attributed to acute impaction of those organs apparently resulting from shock.

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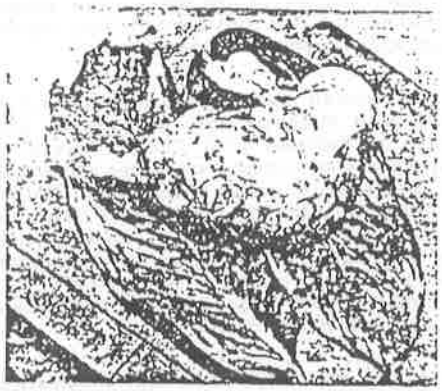

Impaction of proventriculus and gizzard-Common goose

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Reprint : Zoos' Print, 5 (10) : 6, October, 1990

Short Communication.

IMPACTION OF OVIDUCT IN A REEVES PHEASANT

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Impaction of oviduct by masses of yolk, coagulated albumen,shell membranes,broken eggs and in some instances fully formed eggs is common in domestic birds. But this condition is rare in captive birds.A rare case of impaction of oviduct in an adult female Reeves pheasant which has died on July 10, 1988 at Nandankanan aviary has been reported in this paper.

The bird with pendulous abdomen was found to be dull,depressed, anorexic and unable to walk and fly 3 days prior to death.On opening the carcase, major portion of the abdominal cavity was occupied by oviduct which was overdistennded and occlude by hard ball of egg material.The distened oviduct measured 12x10x6 cm in size and weighed about 500 gms.Large masses of yolk like material was found in the oviduct and upon transection these masses had the appearance of concentric rings. The crop and intenses were empty while the liver and spleen were very much atrophied.

Any factors such as poor nutrition/chilling/atony of oviduct may affect the normal functioning of oviduct resulting in spasms/cramps of oviduct. Once the Spasms/cramps of oviduct has set in, the normal progress of the ovum down the oviduct becomes slow, as a result exessive amount of albumen is deposited in the oviduct and water from albumen may be absorbed leaving behind a hard ball of egg material.The cause of impaction in this case could not be determined.

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Reprint : Zoos' Print, 5 (5) : 12, May, 1990

INTUSSUSCEPTION IN A CAPTIVE HOOLOCK GIBBON (*Hylobates hoolock*) : CASE REPORT

By L. N. Acharjyo,[1] S. B. Tripathy,[2] and G. C. Sahoo[3]

An adult male Hoolock Gibbon (*Hylobates hoolock*), the only variety ape found in India, had been on exhibition in the Gibbon Island of Nandan Kanan Biological Park, Orissa since April 5, 1981. Because of its agility, acrobatic performances, man-like erect walking and repeated peculiar loud calls "whoko whoko", it was attracting much attention from visitors of the park. The animal was maintained on a diet consisting of milk, boiled egg, bread, apple, orange and ripe banana.

The ape showed signs of frequent vomition of undigested food materials, loss of appetite, and inactiveness on February 27th, 1988. Instead of usual playfulness of climbing on to tree and house tops, he preferred to remain inside the retreating chamber either on sitting posture or lying down on the floor often pressing the belly. A small amount of faeces was beind voided each time it attempted for defaecation but urination was normal. Its familiar musical loud voice was no more heard from the very first day of illness.

The ape was promptly treated with antiemetics, digestive enzme and antacid preparations orally. Subsequently, the colour of the vomitus appeared dark black and without any improvement in the condition.

Dicrysticin - S small dose was injected intramuscularly from 3rd day onward daily for 5 days along with oral administration of electral powder without any marked improvement. From 7th day onwards Livogen liquid, Glucon - D and sugar cane juice were also given orally. During this time, the animal appeared to be dull and the quantity of vomitus was less but had more froth & mucous.

Two weeks after the onset of illness, the Gibbon started taking small quantities of different food items giving some hope of its survival but suddenly died 3 days later. It had been in captivity for about 7 years. Post-mortem examination revealed death to be due to intussusception involving 10 cm of the jejunum.

Fowler (1986) has stated occurrence of intussusception and vulvulus in non-human primates and has suggested immediate surgical intervention to prevent death. Jones and Hunt (1983) and Blood *et al*. (1983) have suggested excessive peristaltic movement as the cause of intussusception. Increased peristalsis due to gastritis was probably the cause of intussusception in the present case. Mohnot and Roonwal (1977) have stated that this species of ape could become good pet because of its mild and docile habits but does not thrive well in captivity.

Summary

Intussusception as a sequel to gastritis wa found to be the cause of death of a male Hooloc Gibbon (*Hylobetes hoolock*) maintained at th Nandan Kanan Biological Park Orissa. Vomitior lithargy. loss of appetite and voidance of scant faeces were the initial clinical signs followed b extreme dullness, hidebound conditions, anorexi and absence of faeces towards the later part. Th animal died about 2 weeks after the onset of illness Treatment with antibiotics, antiemetics, antacid digestive enzyme, liver tonic dextrose and electrolyt preparations did not have any therapeutic effect.

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Reprint : Zoos' Print, 4 (12) : 17, December, 1989

A Case of Capture Myopathy in a Hog Deer (Axis Porcinus)

By Dr. Ravishankar, B. V. Sc., Veterian Ry Asst. Surgeon, Arignar Anna Zoological Park, Madras-48

Capture Myopathy affects numerous species of Birds and Mammals and developed within a few hours and upto 14 days after capture. It occurs with either physical and chemical restraint. Capture Myopathy is accompanied by degeneration and necrosis of striated and cardic muscles. This is a muscle disease associated with stress of capture, restraint, and transportation. Predisposing factors includes fear, anxiety, over exertion repeated handling and failure to allow the exhausted animal to rest before transportation. Animal may develop local muscular Anoxia and necrosis. Lactic Acid, builds up more rapidly than it can be metabolised, producing a marked local as well as systemic acidosis. (Willion J. BOEVIER, 1986).

Case Report

A she Hog Deer, adult, was admitted to Veterinary Hospital, Arignar Anna Zoological Park, Madras in serious condition with the history of physical capture for transportation to other station on 11-5-1989.

Conservation and Treatment

This Hog Deer exhibited serious respiratory distress (dysponea), painfull stiff gait (Hindlimbs), dullness, weakness (unable to stand and walk), depression. Muscles of back and upper leg are swollen and hard. Head lateraly deviated.

Shifted the animal first to a well ventilated room in the Veterinary Hospital wherein fresh air is available. Applied warm water packs on the body, head and hind legs.

The Hog Deer was then treated with Avil (2 ml.) i/m and after 30 minutes with Hortacortin-H (2 ml.) i/m. Electrol powder was rubbed gently on the tongue and animal duly responded. Tongue movements noticed. After 45 minutes the animal was given 150 ml. of Dextroce S/C and Analgin 2 ml. i/m. Application of Hot warm water packs to the body, thigh and head muscles continued. In the evening of 11-5-'89 Livogen 2 ml. i/m was given. Recovery symptoms noticed after an hour in the form of alertness etc., Eagerly sipped glucose water when supplied.

The next day, the animal was active, passed hard dry pellets and slightly coffee coloured urine. Took water containing electrical forte. Orally given Sodibicarb powder, mixed in the water using a ink filler. Animal made attempts to get up and stood up for 10 minutes without any help. Supplied wheat bran mixed with soaked bengal gram as diet.

On the 3rd day, this animal was given Oxysteclin (5 ml.) i/m. and Neurobin (3 ml.) i/m. Animal took green grass, carrot, cabbage and also wheat bran mixed with soaked bengal gram.

On the 5th day the animal was well on the way to recovery, able to stand and bear weight on all four legs. On the 6th day, the animal was discharged to its original enclosure after complete recovery.

Results & Discussion

After intensive care and treatment the animal markedly improved in its condition. No abnormal clinical symptoms were noticed except weakness. It was given additional feed additives like supplivet. M. 50 gm. daily for the next fortnight.

Since the animal was captured physically, muscles and circulation would have been over loaded with lactic acid and this in turn would have depressed the cardiac out put and lowered the systemic blood pressure. Acid in the muscles tend to make the animal stiff so that they could not rise and reluctant to move (Harthroorn 1976). To control circulatory failure and respiratory dysfunction Hostacortin and antihistaminic drugs were tried and found effective. Metabolic Acidosis was alleviated by oral administration of Sodium biconbonate.

Summary

A case of capture Myopathy in a she Hog Deer is recorded and treated successfully. Animal responded well and discharged to its enclosure after recovery.

Acknowledgement

I wish to thank, the Director and the Veterinary Officer, Arignar Anna Zoological Park for providing inspiration in carrying out the treatment successfully and for the facilities provided and guidance given.

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Reprint : Zoos' Print, 4 (5) : 23-24, May, 1989

METASTATIC SUPPURATIVE PNEUMONIA IN A WILD BUFFALO-BULL

By A. B. Srinivastava, A. K. Katiyar, R. P. Awadhiya, U. K. Garg and N. K. Jain
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Synopsis

Necropsy of wild buffalo-bull which had a gun-shot chronic suppurating wound on its left fore shank revealed suppurative pneumonia possibly as a result of metastasis from the primary abscess of the shank.

With growing awareness of the importance of wild life for its conservation, efforts are being made to know the occurrence of various diseases and pathological conditions in wild animals. Keeping this im view a case of metastatic suppurative pneumonia im a wild buffalo (*Bubaline bubalus*) is described.

History

A wild buffalo-bull, on its admission to the College Hospital, had an old, gun-shot punctured, suppurating wound in the middle of its left fore-limb (Fig. 1). The animal was emaciated and possessed a rough coat. Besides lameness, it showed fever and servere dyspnoea. Symptomatic treatment was given but the condition of the animal detrioratated and it died on 28th day of hospitalisation.

Necropsy findings

Necropsy was conducted soon after death. large abscess was present subscutaneously on the le fore-shank. It contained grey inspissated pus with a tough fibrous capsule. A callus in the metacarp was also present. Left prescapular lymphnode w congested. oedematous and presented many absce ses.

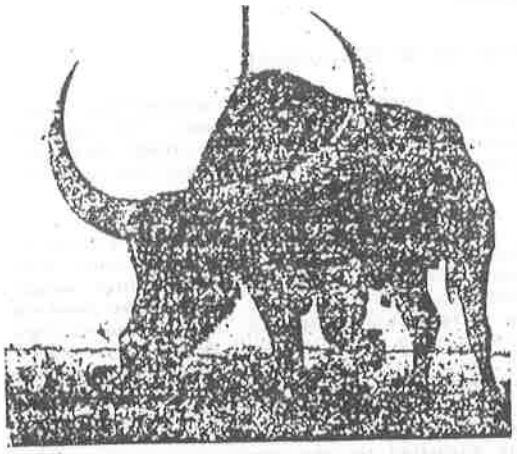

Figure 1 Wild Buffalo with wound in left Fore-limbs

Both the lungs were pneumonic and were studded with a large number of abscesses of various size and duration (Fig. 2). Whereas old abscesses were encapsulated, the fresh abscesses were surrounded with hyperaemic zone. The diaphragmatic lobes were more severely affected. The pleura was adherent to the thoracic wall by fibrinous exudate at many places. Histopathological examination of the lung revealed hyperaemia and oedema. The exudate contained many degenerating neutrophils, a few macrophages, some fibrin and bacterial clumps.

Bronchial lymph nodes were swollen, congested and oedematous. Heart revealed hypertrophy of the left ventricular wall. Liver showed chronic cholangitis with mild fascioliasis.

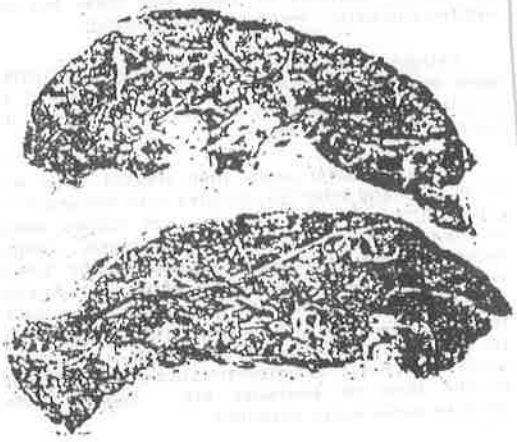

Figure 2 Lungs

Discussion

A wound on being contaminated with microorganisms may lead to many complications. In the present case, the gun-shot wound infected with pyogenic organisms resulted into the development of metastatic suppurative pneumonia.

The abscesses were distributed uniformly in the lung parenchyma. Haematogenous metastatic abscesses have uniformity of distribution which is not seen in other pulmonary inflammation (Jubb and Kennedy, 1970).

Despite uniformity of distribution, the abscesses were not of the same age. This may possibly be the result of periodic spread of pyogenic organisms from the primary abscess to the lung patenchyma.

Metastatic abscesses are the integral part of some specific diseases like easeous lymphadenitis and melioidosis (Jubb and Kennedy, 1970). However, the present animal was apparently free from any of these diseases.

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Figures

Fig. 1 : Lame wild buffalo - bull having a large abscess on left fore-limb.

Fig. 2 : Cut surface of the lung from the animal of Fig. 1 showing numerous abscesses distributed uniformly.

Reprint : Zoos' Print, 3 (12) : 16, December, 1988

AN INDIAN ZOO TRAGEDY

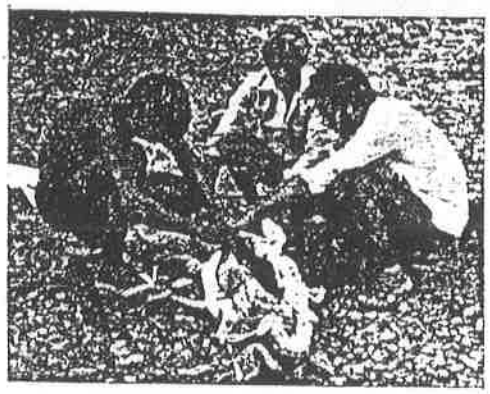
REPEATED TIME AND TIME AGAIN

Death by impacted intestinal tract due to ingestion of plastic bags. Prev visitors from this dirty habit by using every ruse available: paper popcorn c tainers, warning signs; pleading signs; refusal of admission to persons carry plastic bags; installation of attractive trash containers; Fines; arrest. (Photo court of C. B. Varma, Former Director Prince of Wales Zoo, Lucknow. Barking deer died Polybag Consumption June 1987).

Reprint : Zoos' Print, 3 (12) : 9 & 6, December, 1988

A Case of "Eggbound" followed by Abnormal Behaviour in Marsh Crocodile

By S. D. Sathe, Director, Sanjay Gandhi National Park and Dr. K. D. Batwe, Veterinary Officer



Post-mortem examination of Marsh Crocodile

On 25th April, a Marsh Crocodile (Crocodylus alustris) laid her first egg for the first time here in a tcher-shaped hole dug in earth, though enough nd cushion was available around the crocodile ond. This hole was almost 3 meters away from ond. Soon after the laying the hole was opened confirm the egg laying, without disturbing the osition of egg.

Subsequent egg laying occured in water on 8th April, 1988 and 1st May, 1988. As we have ot heard of egg laying in water by Crocodile, we ought that this strange behaviour is due to disturbnce to the egg laying site.

No more egg laying was observed after 1st May, 1988. It was thought that this size of ciutch . e. 3 eggs may be the normal as it has some reference to the citings made by J. C. Danial where in he has said that mugger crocodile lays 3 to 40 or more number of eggs in a clutch. Where as Anton De Vos has said that the clutch size is around 20 to 70 eggs per clutch.

Later, on 29th May, 1988 this Crocodile died suddenly without showing any apparent symptoms except off-feed condition and passing of white coloured liquid stools. She was treated accordingly or these ailments.

On post-mortem examination it was revealed hat the oviduct of deceased crocodile was completely filled and blocked with 15 number of eggs, and ne of the egg was broken, setting infection around ie cloaca and also caused peritonitis.

On studying this case in depth we came across a report of egg bound in turtles. Accorcing to Leonard C. Marcus such case shows the symptoms such as tenesmus, cloacal prolapse or a mass in cloacal region or lower abdmen (2). The treatment suggested for such cases is aspiration of contents of egg or administration of a hormones "Oxytocin" intramuscularly which helps in easing the dystokia caused by inadequate contraction of oviduct. If all these methods fail surgical removal of eggs may be necessary.

This case of egg-bound probably might have occured due to lack of "Oxytocin" hormone in the body and may not be on account of calcium deficiency because this crocodile was regularly fed with beef by adding 'Ostocalcium B 12' to the beef as the beef is deficient of calcium.

It is felt that to avoid such egg-bound condition the crododiles may be fed with whole or live fish, which will take care of mineral requirements naturally than by adding them artificially with beef.

More observations are required to be made on this particular aspect. Any suggestions would be welcome.

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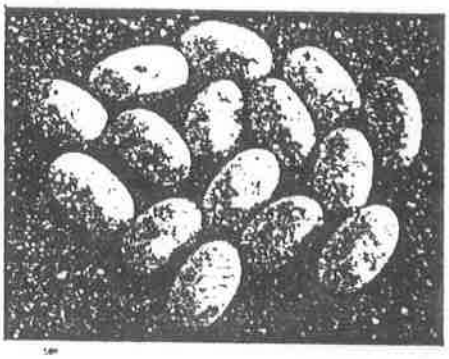

Marsh Crocodile Eggs

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Indian J. Vet. Path. 1981, 5, 53

LEUKOSIS IN ZOO BIRDS

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In domestic poultry, tumours of lymphoid tissue are more common, whereas in wildlife only stray cases are encountered. In India, Sah *et al.* (1973) reported two cases affecting a Peahen and a male Pied mynah during examination of 250 pathological specimens of various species of zoo birds. In the present report, leukosis affecting one female necklace laughing bird (*Turdus eriectorum*), two female magpie birds (*Pica pica*), one American rhea bird (*Rhea americana*) and one pheasant (*Phasianus*) are reported.

During the past three years (1977–79), carcases of five birds received from Zoo Park, Hyderabad, with histories of sudden death, were autopsied. Tissues showing gross lesions were collected in 10% formalin. Formalin fixed tissues were processed by routine histological technique. Paraffin sections were stained by haematoxlin and eosin.

Grossly, heart, liver, lungs, spleen and kidneys of all five birds showed greyish areas in the form of either discrete foci or diffuse patches distributed on the outer and cut surfaces. The American rhea bird showed thickened and raised ulcers on the intestinal mucosa and many rounded growths measuring 5–8 cm in diameter on the serosa (Fig. 1). Microscopically, all the involved organs revealed either focal or diffuse infiltration of lymphoblastic cells replacing the normal architecture. The cells were undifferentiated blast type with vesicular nuclei. All the birds in the present study were females supporting the view (Burmester, 1945) that females were more susceptible than males.

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A Case Of Fibroma In The Cervix Of A Monkey

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Fibroma in the cervix is recorded by Kodagali and Kerur (1968) and Dewivedi and Singh (1978) in buffaloes, but the incidence of this neoplasm in primates appears to be rare from the available literatures. The present communication wants to put a record of a fibroma in the cervix of a monkey rared in captivity.

During the routine post-mortem examination in the Department of Pathology, Assam Agricultural University; a monkey of Assam state zoo aged about 11 years revealed a tumourous growth in the cervix. The tumour was round, greyish white in colour, hard to feel and measuring about 2.5 cm in diameter. The tumour was attached with the wall of the cervix and caused occ lusion of the cervical cannal. On incission the c surface of the tumour showed whitish fibrous tiss bundles in a defenite arrangement having a capsu Microscopically, the bundles of irregular small fusifor cells were noticed (Fig.) having abundant intercellul substances interlacing with collagen fibers. Hence, t tomour was diagnosed as a fibroma. Both the ovari were seems to be small and smooth indicating t inactive condition. The occulution of the cervi cannal by the tumour mass made the ani sterile.

Acknowledgement

The authors are grateful to Dr. M.C. Baruh, Veterinary Officer, Assam state zoo for his he

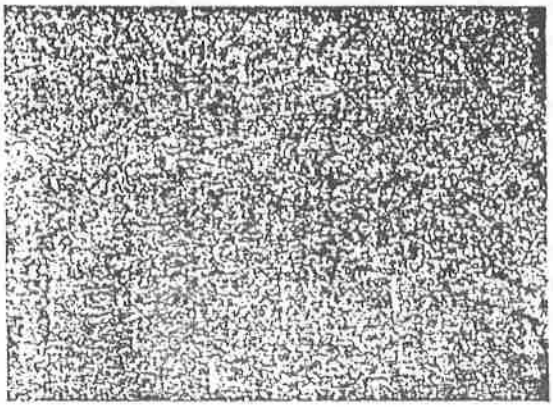

Fig. Note the arrangement of the fusiform cells in bundles. H & E × 70.

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Indian Vet. J. 74, August, 1997 : 645 - 647

NEOPLASMS IN NON-HUMAN PRIMATES IN ASSAM STATE ZOO

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Spontaneously occurring neoplasms in nonhuman primates have been reported (Parihar *et al.* 1976, Chakraborty and Datta, 1981, Depaoli and McClure, 1982 and Wadsworth *et al.*, 1985). The present investigation reports the neoplasms of nonhuman primates of Assam State Zoo during a study of mortality in view of paucity of literature.

Materials and Methods

In an eight year study from 1985 to 1992 the pathological conditions in 85 animals of 10 different species of captive nonhuman primates were studied (Table). Four neoplasms were recorded in four different species of animals. The gross lesions were recorded and tissue samples fixed in 10% formol-saline solution were processed and stained by routine haemotoxylin and eosin.

Results

Out of the total 85 necropsied 4 (4.70%) animals showed neoplastic growths of which two (2.35%) were malignant tumours viz. adenocarcinoma and bronchogenic carcinoma while the other two were adenoma and seminoma.

Fig. 1. Adenocarcinoma in the stomach of a capped langur. Note the raised button like ulcerated nodules in linear pattern.

Adenocarcinoma : One adult male capped langur showed multiple nodular growths in the stomach in linear patttern along the folds on the mucosal surface. The superficial part of the growths were ulcerated with raised edges and there was sharp demarcation between the ulcers and normal mucosa (Fig.1). The raised button like nodules measured about 1-1.5 cm in diameter. The liver had several whitish firm nodules of about 5 mm to 1 cm. in diameter over the viscereal surface and the regional lymph nodes were enlarged.

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Table : Showing different species and number of animals of the study and occurrence of neoplasms

	Common name (Zoological name0	Total animals studied	Neoplasms recorded
1.	Gibbon (*Hylobates hoolock*)	18	
2.	Capped langur (*Presbytis pileatus*)	10	Adenocarcinoma (1)
3.	Golden langur (*Presbytis geei*)	20	
4.	Common langur (*Presbytis entellus*)	3	Bronchogenic carcinoma (1)
5.	Nilgiri langur (*Presbytis johnii*)	2	
6.	Phayres leaf monkey (*Presbytis phaurei*)	2	
7.	Lion-tailed monkey (*Macaca silenus*)	2	Seminoma (1)
8.	Bonnet monkey (*Macaca radiata*)	1	Adenoma (1)
9.	Assamese macaca (*Macaca assamensis*)	7	
10.	Slow loris (*Nycticebus counang*)	20	
	Total	85	

Based on histopathology the case was diagnosed as adenocarcinoma with metastatic lesions in the liver and kidney.

Bronchogenic carcinoma : In one adult female common langur the diaphragmatic lobe of the lung showed multiple nodular growth measuring about 2-5 mm in diameter with interspersed areas of consolidation. At some places the small nodules coalesce to form irregular nodules. Fibrinous deposition over the surface of the lung was also noticed. Microscopically, the neoplasm was diagnosed as bronchogenic carcinoma.

Seminoma : In an old lioned-tailed monkey, the left testis was enlarged to about 4 cm in diameter while the right testis wa

normal. On incision, the enlarged testis revealed to be soft in consistency, creamy in colour and bulging out over the adjacent tissue.

Adenoma : In one old bonnet monkey, on the floor of the anterior vagina a cauliflower like growth of about 1.5 cm in diameter was recorded. On incision, thick mucous could be seen in it the tumour was diagnosed as adenoma, microscopically.

Discussion

In this study of four neoplasma (4.70%), two malignant tumours with metastatic lesions in other organs, in langurs and two tumours of reproductive organs, in old macacas have been recorded. Occurrence of neoplasms in nonhuman primates, although scanty, were reported by Chakraborty and Datta (loc.cit), Depaoli and McClure (loc.cit), Chalifoux *et al.* (1983) and John *et al.* (1984). Incidence of adenocarcinoma was reported by earlier workers (Parihar *et al.*, loc.cit., Depaoli and McClure, loc. cit. and John *et al.*, loc.cit) whereas, bronchogenic carcinoma in nonhuman primates has not been reported so far. The occurrence of adenoma in reproductive organs has been recorded by Chalifoux *et al.* (loc.cit) and Wadsworth *et al.* (loc.cit). Chakraborty and Datta (loc.cit) recorded a fibroma in the cervix of a monkey and opined that benign neoplasms of the reproductive organs in old ages were frequently seen. The findings of two such tumours in the present study endorse their views. Ewing (1942) was of the opinion that severe trauma is one of the etiological factors for testicular neoplasms in human. In the present case also possibility of getting traumatic injury in the genitalia within the enclosure cannot be ruled out.

Summary

In eight years (1985-92) study on the mortality of non-human primates of Assam State Zoo, 85 animals were necropsied and four neoplasms were recorded. Two malignant neoplasms viz., adenocarcinoma and bronchogenic carcinoma and two adenoma and seminoma in reproductive organ have been recorded. The gross and histopathology of all the tumour were described and disscussed.

Acknowledgement

The authors are grateful to the Zoo Authority, Govt. of Assam for the materials and to the Head, Department of Pathology, College of Veterinary Science, Khanapara for providing the facilities.

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Reprint : Zoos' Print, 6 (5) : 1-3, May, 1991

DISEASES OF CHIR PHEASANTS *(Catreus wallachii)* IN CAPTIVITY UNDER TEMPERATE ENVIRONMENT

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Chir pheasants (*Catreus wallachii*) are denizens of Chir (pine) forests of Kumaon hills. These pheasants are listed under endangered species of birds. They are semi-wild and difficult -to-handle. Indian Veterinary Research Institute, Mukteswar Campus maintained a small flock of pheasants under captive condition for multiplication of this valuable germplasm. Much information is not available on general diseases of pheasants. Swarbrick (1985) reviewed various aspects of associated husbandry and disease problems in pheasant rearing. Subsequently Arora (1981 and 1983) reviewed diseases of these birds.

During 1985-90 an attempt was made to investigate the prevalence of diseases causing morbidity and mortality under temperate climatic conditions of medium altitude (2350 m). The results are reported in this communication.

MATERIALS AND METHODS

The materials from 81 pheasants (44 chicks and 37 adults), died during 1985-90, were utilized for the present study. The dead birds were necropsied and appropriate materials for bacteriological and histopathological examination were collected. Tissues were processed and paraffin blocks were prepared. Five micron sections were cut and stained with H & E for pathoanatomical studies.

RESULTS AND DISCUSSION

Important clinical conditions included injuries/trauma on head due to fighting of cocks during breeding season and foot-injuries followed by bumble foot. Few cases of kerato-conjunctivitis were recorded. The disease conditions diagnosed have been presented in Table I. Mortality was comparatively higher in new born chicks than adults.

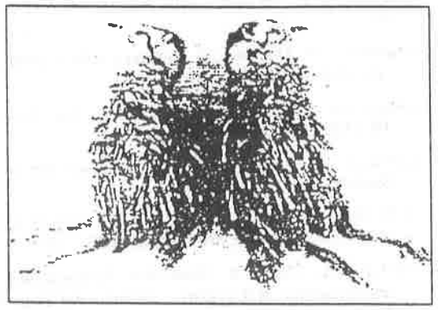

Figure 1. Pheasant chicks died due to coli septicaemia. Photo by R. Somvanshi

Coli-septicaemia was the most important infectious bacteria disease of young chicks causing highest (28.41 %) death (Fig. 1). In the present study the finding of out-break of coli-septicaemia is similar to that of poultry chicks (Gross, 1972, Swarbrick, 1985). The infected sheds were possibly the source of infection for the neonate pheasant chicks. *E. coli* was isolated from lesions of dead chicks. Pulmonary congestion was another major cause of death in young chicks (12.35%). Attempt to isolate bacterial organisms from heart blood failed. Histopathological examination evidenced atelectasis, hyperaemia and haemorrhage. Most of these young chicks (1 - 4 weeks old) were exposed to rains in mid-June and early July. The average environmental temperature during this period remained 20-22 C° during day time while nights were cooler. Therefore, effect of wet condition cannot be ruled out in causation of pulmonary congestion and death of chicks.

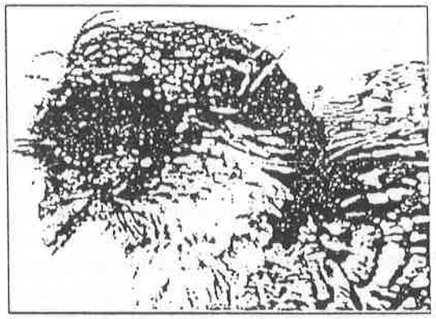

Figure 2. Trauma and haemorrhage in head of a pheasant cock. Photo by R. Somvanshi

Three chicks and 5 adult birds were predated by a free living leopard during night in 1987. Remnants of the killed pheasants in and around the pheasant house with pug marks of leopard clearly indicated predation. Although pheasants are not the natural food of felines, when food is not available, a leopard can kill any living object and eat its flesh.

Pheasants were again predated by yellow-throated pine marten *(C.flavigula)* locally known as Chitrola on two occasions once in the first week and subsequently in the last week of August, 1990. Pine marten could find its way into the pheasant house through small holes in shed walls. The main necropsy findings consisted of broken neck at atlanto-occipital joint, rupture of jugular vein and haemorrhages. Sharp teeth marks and haemorrhages on neck, breast, shoulder and back muscles were also observed. Wing and back muscles had sharp marks of nails of pine marten. Only in 3 - 4 birds part of muscles of breast or other regions was eaten away. Martens are known

TABLE DISEASE PATTERN IN CHIR PHEASANTS

Disease conditions	Number	(Percentage)
Chicks :		
Coli-septicaemia	23	28.41
Pulmonary congestion	10	12.35
Non-specific	4	4.94
Predation by leopard	3	3.70
Omphalitis	1	1.23
Chilling	1	1.23
Cannibalism	1	1.23
Mineral deficiency	1	1.23
Total	44	54.32
Adults		
Predation by pine marten	13	16.05
Predation by leopard	5	6.17
Trauma on head/pulmonary t.b.	2	2.47
Trauma on head/Asphyxia	2	2.47
Enteritis	2	2.47
Egg bound condition	2	2.47
Trauma on head/bumble-foot	1	1.23
Septicaemia/bumble-foot	1	1.23
Kerato-conjunctivitis/bumble-foot	1	1.23
Siliceous pneumo-coniosis	1	1.23
Shock of handling stress	1	1.23
Internal haemorrhage	1	1.23
Pneumo-enteritis	1	1.23
Rupture of liver	1	1.23
Pulmonary congestion	1	1.23
Non-specific	2	2.47
Total	37	45.64

to be blood-thirsty and raptous, feeding on small mammals, birds and occasionally bird eggs. They live in dense forest of Mukteswar, especially in rocky areas, and climb trees very easily. Occasionally they are reported to kill birds/rodents kept in sheds.

Tuberculosis in captive birds is not uncommon (Arora, 1981). Gross and pathological features of tuberculosis in pheasants are reported and discussed separately (Somvanshi et al., 1990). Poor husbandry, over crowdedness and sub-standard nutrition increase susceptibility and prevalence of tuberculosis in captivity. However, in the present investigation pneumoconiosis seemed predisposing factor for pulmonary tuberculosis in pheasants.

Deaths due to trauma on head in pheasant cocks occurred during breeding period. The condition was also diagnosed in pheasant hens. The condition was characterized by injuries/trauma on head and upper part of neck (Fig. 2). Subcutaneous haemorrhages, brain haemorrhages and/or presence of rope-like clot in trachea (Fig. 3) were the post mortem and histopathological findings. Asphyxia, shock and stress were the causes of death in these birds. Physical handling is severe stressor in semi-wild bird like pheasants (Swarbirck, 1985). As soon as some stranger enters in sheds, the birds are frightened and start flying against roof or walls of sheds resulting in trauma on head and neck. Cocks fight violently during breeding season and produce serious head injuries leading to death. Such losses may be prevented by better management.

Bumble-foot was caused by repeated injuries on foot-pad from wire nettings of paddock of pheasant house. Staphylococcus aureus was isolated from foot lesions (Fig. 4). Birds showed lameness. Occasionally, the disease was associated with some other conditions. These findings are similar to those reported in poultry (Gross, 1972) and pheasants (Swarbrick, 1985).

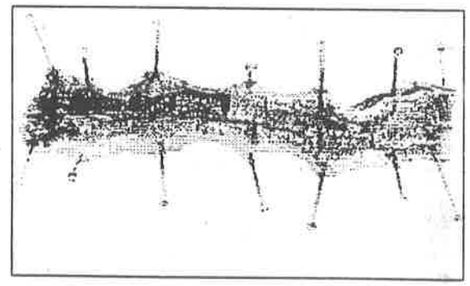

Fig. 3. Rope-like blood clot in the trachea of a pheasant which died of fighting with a fellow cock. Photo by R. Somvanshi.

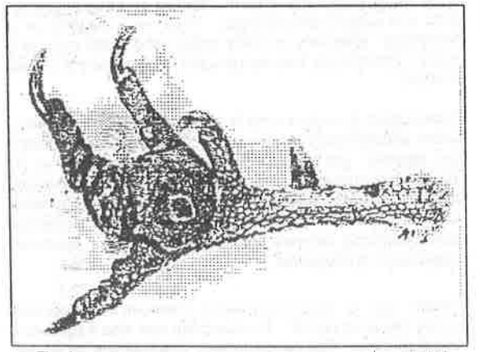

Fig. 4. Bumblefoot in a pheasant. Photo by R. Somvanshi

To sum-up, most of the diseases observed in chir pheasants were borne from captivity conditions and efforts to multiply these valuable germplasm were hindered due to mortality in chicks and predation by wild animals.

SUMMARY

Diseases of Chir pheasants (*Catreus wallachii)* in captivity under temperate climatic condition were investigated during 1985-90 which revealed mortality among 1 - 4 weeks old chicks. Major causes of deaths in chicks were due to colisepticaemia (28.41%), pulmonary congestion (12.35%) and predation (3.70%). Adult birds died due to predation by pine marten (16.05%), predation by leopard (6.17%), trauma on head/pulmonary tuberculosis (2.47%), trauma on head/asphyxia (2.47%), enteritis (2.47%), egg-bound condition (2.47%), and bumble-foot and associated diseases. Pneumoconiosis, shock due to handling stress, pulmonary congestion, pneumo-enteritis, internal haemorrhages, rupture of liver, kerato-conjunctivitis and septicaemia were infrequently found as cause of death.

ACKNOWLEDGEMENTS

Thanks are due to Director, IVRI, Izatnagar for providing necessary facilities; Station In-charge, IVRI, Mukteswar for management of Chir Pheasants House and staff of Veterinary Medicine Section and Pathology Laboratory, IVRI, Mukteswar for assistance.

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Reprint : Zoos' Print, 6 (5) : 9, May, 1991

ADVERSE EFFECTS OF HUMAN INTERFERENCE ON WILDLIFE

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Introduction

Sambar (*Cervus unicolour*) is not only the largest deer of Southern Asia, but also the most wide-spread in distribution. There are sixteen subspecies that have been distinguished, found in dry thorny forest of Western India to tropical rain forest of Thailand, Burma, Malaysia Indonesia, Phillipines and India. The size varies from 200 - 300 kgs in males and 150 - 200 kgs in females (DNPGO Records)

History :

An adult male sambar was reported to be stuck up in a swamp at Kakanakote Reserve Forest (Nagarhole Game Sanctuary). With the help of Koomkie elepnants the above-said Sambar was dragged from the swamp and thoroughly cleaned.

The adult Sambar was a male of about seven years and weighing about one hundred and fifty kgs. The animal was highly debilitated, with a wound on the left fetlock joint. The Sambar survived for about an hour after it was brought out from the swamp.

Post-mortem findings :

The Sambar was very weak, showing prominent bony extremities with a rough hair coat, sunken eyeballs and very pale mucous membrane. Practically all the fat deposit of the body was depleted as the animal had been off-feed for a very long time. Intestines were ballooned and practically devoid of any cud (injesta) suggesting starvation from quite some time.

The right hock joint was slightly inflamed due to struggling in the marsh and left hock had a circular deep incised wound at the coronet (above the hooves) joint. On probing the wound all the musculature above and below the wound were necrosed and hooves were turned at an acute angle due to disuse of that limb. Pus could be seen extending to the whole length of the limb. The bones were intact. On deeper probing it could be seen that the skin along with musculature and associated tendons and ligaments had necrosed. A plastic rope of one-half inch diameter was seen embedded deep inside the wound encircling the bone. The above-said rope is the kind used by fishermen to secure their fishing nets all along the border. Other than this, no other major post-mortem findings were present.

Conclusion :

Man-made hazards such as the one above can cause tremendous damage if left unchecked. Many such cases may go unnoticed since carnivorous animals are likely to eat the carcass of such animals before they can be discovered.

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Reprint : Zoos' Print, 6 (5) : 13, May, 1991

A CASE OF HEAT STROKE IN PAINTED STORK

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2) Selvi P. Vaheth Menon, 3) Selvi K. Razeena, Students, Madras Veterinary College.

On 22.4.90 approximately at 4.00 p.m. one aged Painted stork was found dead in the yard and brought to the Zoo Veterinary Hospital for post-mortem examination.

Detailed post-mortem examination revealed the following:

1) Flesh presented cited appearance 2) Visceral organs hyperaemic and somewhat greasy 3) In the brain, meningeal vessels were bulging and more prominent with blood splashes or clot in the upper 1/3 of the brain.

Etiological diagnosis: - Heat stroke.

Oppressive heat wave prevailed in this area during the previous two days, coupled with humidity and steep rise in environmental temperature on the day (22.4.90) affected this aged bird fatally.

Reprint : Zoos' Print, 6 (11) : 12, November, 1991

SUPPREATIVE PERICARDITIS IN CAPUCHIN MONKEY *(Cebus spp.)*

A. T. Rao 1 and L. N. Acharjyo 2

Primary suppurative pericarditis is extremely rare in domestic animals, wild animals in general and monkeys in particular. This communication reports a rare care of such a condition in a Capuchin monkey. The animal in question is an adult female which has been brought from Texas, U.S.A. on exchange basis and had been maintained at Nandankanan Biological Park since 29 November 1987. The animal died suddenly on 20 September, 1988 after showing clinical signs of convulsions.

At necropsy, there was about 5 ml of straw coloured fluid in thoracic cavity. The heart was mishaped and rounded due to hypertrophy of right ventricle. The pericardium was distended with creamy coloured pus. There was fibrinous pleuritis and lungs of both the sides showed emphasema with alternate areas of stelectasis and congestion. Catarrhal gastroenteritis and congestion of liver were also seen. Impression smears from pus of pericardial sac revealed gram positive coccobacillary bodies along with dead and degenerating neutrophils. Corynebacterium spp. isolated in pure cultures from pus.

Histological examination of heart revealed acute pericarditis characterised by thickening of pericardium due to congestion, oedema, haemorrhages and polymorphonuclear cell infiltration. The underlying myocardium showed marked congestion of capillaries and granular degeneration of myocardial fibres. Sections of liver and kidneys revealed changes associated with toxic hepatitis and nephrosis, respectively, with congestion of their parenchyma. Spleen and lungs were also congested. Death was attributed to cardiac insufficiency resulting from suppurative pericarditis.

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Reprint : Zoos' Print, 6 (11) : 9-10, November, 1991

INTUSSUSCEPTION AND TIBIA FRACTURE IN ELEPHANTS - NECROPSY FINDINGS OF TWO CASES

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Case Study 1

An elephant of Manas Tiger Project showed gradual decline of health and hence for proper treatment it was transferred to the State Zoo with a history of heavy infection of strongyle, Hookworm, Fasciola and Paramphistomum and moderate degree of pus cells and epithelial cells in the urine. In the course of investigation in the State Zoo after 9 days of its arrival, the animal died. It was reported that the animal had loss of appetite, abdominal pain and discomfort and absence of faeces for two days.

Postmortem examination was conducted 10 hours after death and revealed -

1. The anterior part of the small intestine about 80 - 90 cm was telescopically invaginated into the posterior part of the intestine along with mesentary (Fig - 1). The serosal surface of the invaginated part showed necrosis and deposition of fibrinous flakes over it.

2. High degree of edema was noticed throughout the intestine.

3. Large number of *Choniangium epistomum*, *C. megastomum*, *Cammocephalus hybridatus*, *Pseudodiscus collinsi*, *Plenderius papillatus* were seen in the intestine

4. The liver showed severe infestation of *Fasciolo jacksoni* along with the *Grammocopnalus hybridatus* and developed cirrhosis.

5. Excessive amount of blood tinged fluid in the thoracic cavity.

6. The lung was congested and pneumonic with larva of *cobbaldia elephantis* and few *Grammocephalus hybridatus*.

7. Pericardial sac revealed about 500 ml. of watery fluid.

8. The kidney was hard to touch and the capsule was firmly adhered.

Based on the lesions the diagnosis was made that the animal died due to intussusception. Intussusception is believed to occur due to excessive peristolsis and possibly in this case heavy infection with parasites may lead to this condition. Schmidt (1986) stated that Intussusception has been recorded as a cause of death in a number of elephants, yet from the available literature the incidence could not be traced out.

Case study 2.

A young elephant of State Zoo was in ailing condition for four months after injury inflicted by an African male elephant. The

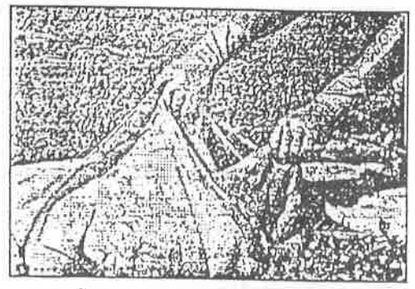

Figure 1. Intussusception in Elephant
Photo by H. P Phukan, Director, Assam State Zoo

animal had pot-bellied condition and swelling in the left hind leg with lameness. Gradually the lameness increased such that the animal was unable to move and ultimately the animal laid on the ground and died 28 days after falling.

On postmortem examination the animal showed:

1. About five liters of sero-sanginous fluid in the abdominal cavity.

2. Thoracic cavity was filled with straw coloured fluid and bloatchy haemorrhages in the heart.

3. Both the diaphragmatic lobes and the apical lobe of the lung were hepatised.

4. The liver was slightly enlarged and pale.

5. An oblique fracture at the anterior part of the tibia was seen on the left side. The bone was soft and easily breakable. The muscle became edematous and gangrenous and *E. coli* and *Bacillus* species could be isolated from the exudate. Heart blood also showed *E. coli* infection. The intestine showed necratic enteritis and culturally *E. coli* and *Aspergillus fumigatus* could be recorded however, in the tissue section the fungus could not be recorded. *Gammocephalus hybridatus* and *Brumptica bicaudata* could be recorded in the intestine.

Schmidt (1986) stated that fracture in elephants are associated with poor prognosis, although, Dosterpuis and Nelson (1981) reported a recovery of an African adult elephant, after 15 weeks with proper treatment and good management.

In this case the fracture of tibia could not be diagnosed in living condition and hence no proper treatment could be resorted. The animal died due to toxemia and septicemia resulting from the gangrenous fracture.

Acknowledgement

The authors are grateful to Council of Scientific and Industrial Research for financial assistance in the form of Senior Research Fellowship to the Senior author, to Mr. H. P. Phukan, D.F.O. State Zoo, for the photograph and to Dr. K. C. Panicker, Professor Parasitology, Kerala Veterinary College for getting the parasites identified.

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Reprint : Zoos' Print, 6 (11) : 24, November, 1991

TRAUMATIC PERICARDITIS IN A SIKA DEER (*Cervus nippon*)

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Dr. L. N. Acharjyo, Sr. Veterinary Officer, Nandankanan Biological Park, Baranga, Cuttack, Orissa

Perforation of pericardial sac by sharp foreign bodies such as nails, wires, etc. originating in reticulum causing traumatic pericarditis is ordinarily a disease of domestic bovine animals.

A zoo-born male sika deer aged 4 years and 4 months was found to be sick on 17 September 1990. Initially the animal exhibited partial anorexia, disinclination to be moved followed by profound depression and dyspnoea. The animal died on 25 September, 1990 in spite of treatment with 1 synthocillin intramuscular (I/M) injection (inj) at 1 gm, 2 Betnasol I/M inj. at 1 ml and 3 Livogen I/M Inj. at 1 ml once daily for three consecutive days. Three to four days prior to death, the animal frequently raised its head giving a star gazing posture and the brisket was swollen due to oedema.

At necropsy, about 3 litres of purulant dirty coloured liquid admixed with blood was seen in thoracic cavity. The pericardial sac was distended with foul smelling greyish fluid containing fibrin and pus. The heart presented a typical shaggy heart with bread and butter-like appearance. The left venticle was hypertrophied. A metalic wire measuring about 10 cm in length had penetrated through pericardium into left ventricle. The heart was adhered to both the lungs. The liver had a nutmeg-like appearance due to marked venous congestion. Both the kidneys were congested. The omental fat was necrosed and had a chalky white appearance. Death was attributed to cardiac failure resulting from purulent pericarditis.

The clinical signs exhibited by the animal in early part of the disease were not adequate to suspect for traumatic reticulopericarditis. Therefore, surgical intervention was not thought of. Moreover, the animal died with a brief period of illness. Hence the disease could be diagnosed only at necropsy with characteristic fibrinopurulent pericarditis associated with the presence of metalic wire perforating through the myocardium. The animal must have picked up this foreign body accidently while grazing. 1. Synthocillin - ampicillin. Mfg. Pharmaceutical and Chemical Industries, Bombay; 2. Betnasol: each m. contains Betamethasol Sodiumphosphate 4 mg; 3. Livogen: Liver extract with B Complex vitamin. Mfg. Glaxo. Lab, Bombay.

Reprint : Zoos' Print, 8 (8) : 1-2, August, 1993

CHEERAN'S ZOO MED -- A ZOO MED-U-CATION COLUMN -- PART I

POST MORTEM EXAMINATION OF BIRDS AS AN AID TO DISEASE DIAGNOSIS

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Post mortem examination of birds is often neglected compared to the postmortem (P.M.) of mammals despite the fact that it is not difficult to conduct P.M. in birds whether it is in the zoo, or in the field. Although P.M. of birds in the zoo is more or less routinely conducted, it is not usually considered to be very important in the field. Since conducting postmortem examination is an important tool for disease diagnosis, it is worth knowing a few details of P.M. in birds.

In an ideal situation, the following items are required for a bird P.M. (1) P.M. tray/board (2) A pair of gloves (3) Antiseptic lotion (4) Scissors, forceps, bone cutterss, scalpel, necropsy knife etc. (5) Sterile vials, test tubes and petri-dishes (6) 2-3 wide mouthed bottles containing 10% formalin. (7) Syringe and needles, preferably disposible. Postmortem should be conducted only in bright day light. In the case of the zoo, try to procure history sheet/case sheet, if available. This will help to look for details depending on the symptom/history.

Unfortunately, symptoms noticed in birds for various diseases may be similar and hence to diagnose a disease from the symptoms is difficult. This being the condition in captive birds, the significance of P.M. in birds in wild conditions can very well be guessed.

Postmortem examination helps us to examine each system and observe the lesions produced in each organ. This will help us to arrive at a tentative diagnosis. Further confirmation can be done by subjecting the collected samples for histopathological, serological and microbiological tests. Postmortem diagnosis is thus easy and quick.

To pin-point the diagnosis, as many number of birds as possible must be subjected to Postmortem examination. If there is large scale mortality, 6-8 birds of different age groups may be selected. Again, if ailing or moribund birds are available, they can also be subjected to autopsy.

History sheet or case sheet should record as much information as possible. Information on the nature of disease (acute or chronic), number or percentage of birds affected, period of illness, mortality rate, rate of recovery if any, whether all species of birds are affected, change in feed, climate etc., would be gathered.

Collection of blood:
Blood is usually collected in birds from the wing vein using a syringe and needle. It is convenient to use a sterile disposible syringe. Blood can also be collected directly from the heart. For the collection of serum, 3 ML of blood can be collected in a test tube and kept in a slanting position. If whole blood is to be collected anticoagulants like sodium citrate (1.5 ML of a 2% solution for 10 ML of fresh blood) or heparin (20 IU/ML of blood) can be added and thoroughly mixed.

Killing of live birds:
Any of the following methods can be used:
(1) Disarticulate the head and the atlanto-occipital joint.
(2) Sever the cervical spinal cord - using emasculotome, Burdizo forceps, large scissors or even by fingers in small birds.
(3) In small birds, the neck can be even broken by pressing it against a sharp table edge.
(4) Inject 10-25 ml of air directly into the heart (air emboli) using an 18 gauge 1 1/2 needle inserted through the thoracic inlet.
(5) Euthanasia with pentobarbitone I/V or inhalants like ether.

External examination:
Look for the presence of external parasites like lice, mites etc. If the animal is dead for a long time, these parasites are likely to crawl away.

If the bird is alive, look for the following symptoms incoordination, tremor, paralysis, paresis, blindness, respiratory signs etc.

Also some of the sick animals may be nursed to health, if possible for further studies.

External examination will also help to detect the presence of tumor, skin diseases, evidence of cannibalism, beak abnormalities, presence of diarrhoea, leather and comb abnormalities, nasal discharge, conjunctival exudate, dehydration, body flesh conditions etc. Feel for the keel bone. This should give an indication about the body flesh condition. Examine the face, eyes, comb and wattle, limbs for fracture and dislocation etc.

Internal examination:
Soak the feathers in a detergent cum antiseptic solution (eg.Savlon). If the case is suspected for diseases like Psittacosis or Ornithosis, soak the bird in 5% lysol solution.

To open and examine the mouth, cut the lateral commissure of the mouth and inspect the oral cavity. Cut down along the commissure through the skin along the neck till the thoracic inlet. Open and reflect the skin sideways to see the vagus of both sides and note the nerves, cut along the oesophagus through the crop and look for the contents and odour. Similarly examine the Larynx and tracheea after incising lonitudinally, to examine the nasal cavity and sinuses (infraorbital) cut the upper beak at the level of eye, removing the upper beak cut through the wall of each sinus by inserting one blade of scissors into the infraorbital sinus.

Disarticulate the hip joint by incising the loose skin on the median side of the thigh and abdomen. The skin on the median side of each leg is incised to examine the muscles and stifle joint.

Join the lateral incisions with a transverse skin incision at the level of abdomen. Pull the skin of the breast forward and of the abdomen downwards. Dissect the skin cutting the tissues at the top of the breast bone. Cut through the rib on each side. For this, one blade (blunt) of scissors can be inserted through the top of the breast bone. Lift the breast bone upward using a bone cutter. Also examine the condition of breast musculature carefully.

Examine the air sacs and visceral organs withought touching by hand. Remove any organ or take swabs using sterile instruments for microbiological culture. Expose the spleen by freeing it from the left margin of gizzard. Examine the liver, spleen and reproductive system. In female birds remove the ovary & slit open the oviduct longitudinally. Examine the ureters and kidneys in situ. Look for crystals, congestion etc.

Examine the heart, by taking it out from the thoracic cavity. Examine the lungs by reflecting them medially from between the ribs. Incise proventriculus longitudinally using sissors. Also open small intenstine, caeca, colon and cloaca. Enteritis, coccidiosis, cyanosis, parasites etc. can be noticed. Open up the gizzard and look for errosion, crop mycosis etc.

Bracheal plexus (anterior to first rib) and sciatic nerves are to be examined. Remove the kidneys by blunt dissection and examine the pelvic cavity. Split the femur with an osteome and examine the bone marrow. A greenish colour indicates anaemia.

To examine the brain, following procedure can be followed. Remove the skin and disarticulate the head. Using a bone shear, nip just through the bone to the cranial cavity on both sides of the cranium, beginning at the occipital foramen laterally to the mid point at the anterior edge of the cranial cavity. Lift off the cut portion of the bone. This will expose the entire brain.

Collect the organs or parts of organs showing pathological changes in 10% formalin for histopathology. Samples for cultural examinations are collected using sterile precautions as mentioned previously.

Editors Note: **We are very fortunate to have Dr. Jacob V. Cheeran to take up our invitation to contribute a regular column on practical zoo and wildlife medicine to ZOOS' PRINT.**

Dr. Cheeran is well known for his expertise in tranquillisation of large mammals, particularly elephants, as well as his overall wildlife knowledge. He is Professor at the College of Veterinary and Animal Sciences, Trichur, Kerala. He is also a Member of the Central Zoo Authority. He has been active in animal welfare and education as well as medical aspects of wildlife. He is also— we are very proud to say — a member of the Committee of Management of Zoo Outreach Organisation. He has promised to make this a regular column.

Sample of a P.M. Report

Owner/Source

Species (Common name/ Scientific name)

P. M. Time General condition

I. External Examination:
Oral cavity/skin/presence of parasites, wound etc.

II. Internal Examination:
a) sub-cutis Muscle Skeleton
b) viscera Air-sacs Peritonium

1. Digestive tract:
   Oesophagus Crop Gizzard Intestine
   Cloaca Liver
2. Reproductive tract:-
   Ovary Oviduct, Presence of egg - State of ovary
3. Respiratory and Cardiovascular System:
   Lungs Heart & Blood Vessels
   Lymphoid Organs (Bursa, Spleen, Thymus)
4. Endocrine:
   Thyroid, Adrenal
5. Sense organs:
   Eye Ear Nose
6. Bone marrow
7. Sciatic plexus
8. Provisional Diagnosis

Reprint : Zoos' Print, 10 (1) : 40, January, 1995

DEATH DUE TO RETAINED FOETUS IN A STRIPED HYAENA (*Hyaena hyaena*) IN CAPTIVITY IN ASSAM STATE ZOO, GUWAHATI

Dr. D.B. Thakuria [1], Dr.T.Barthakur [2], And a batch of six Internees [3]

Five of the six hyenas (*Hyaena hyaena*) in Assam state zoo are males. This female hyaena was born in the Zoo on 22nd May,1989. The gestation period in this species has been recorded at this zoo as 80-90 days.

A still born male hyaena cub was born to a 5 year old female at Assam state zoo on the 5th of October, 1995. The placenta was expelled instantly. On 10th of October, the keeper reported that the animal is off-feed, showing lameness and lethargy. A prominent bulge was noted at the posterior of the animal and the posterior part of the animal was bulging out. The main cause of lameness, was considered as a result of infighting. The animal was treated with antibiotic (Tetracycline), cortisone, (Dexamethasone) & supportive drugs (B-complex) and this was continued for 5 days. Though the animal evinced slight recovery, oliguria was evident.

On the 20th, the keeper reported symptoms of vomitting. In spite of veterinary case, the animal died on the 22nd of October, 1994. The carcass when examined externally, had no signs of any injury. The abdomen was distended. Foetid smelling pus was seen oozing from the vaginal passage.

Internally, there was an offensive odour as the peritoneal cavity was opened. The fluid was dull red in colour and had a very offensive smell. The internal organs were floating over the peritoneal fluid that was collected. The right uterine horn was found ruptured with a foetus inside. It was in posterior longitudinal presentation. The head was adhered to the wall of the horn like a pouch which apparently looked like a cyst. Urinary Baldder was contracted. Kidney was swollen and pulpy and liver was slightly enlarged with round edges.

The normal litter size of Hyaena is 1-3. As no post parturition anomalies were observed till the 3rd day, the male was let into the cage on the 4th day. The retained fetus, strangled in the right uterine horn caused the death of the female as a consequence of resulting from the failure of kidney leading to oliguria and liver dysfunction. The ruptured and putrefied uterus also added to the toxaemic condition.

This incident strongly argues the need to examine all animals post-parturient, under chemical restraint. This also necessitates the need to conduct a caesarian section if there is a suspicion of retained foetus.

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Reprint : Zoos' Print, 11 (3) : 25-26, March, 1996

PNEUMOCONIOSIS IN WILD MAMMALS OF NATIONAL ZOO, DELHI

B.M. Arora[1] and N.S. Parihar[2]

Pneumoconiosis occurs when fine particulate matters of any kind and nature are inhaled causing accumulations/ deposits with or without inciting pathological lesions in the lungs. The chief types are anthracosis (coal dust), siderosis (iron dust), silicosis (stone dust) and asbestosis (asbestos dust). The condition is often encountered in animals inhabiting polluted environs. The fine inhaled particles of matter reaching the alveolar and bronchiolar lining are usually engulfed by phagocytes, carried by the lymph-stream and deposited in the lung stroma and lymphatic tissues with or without inciting inflammatory changes. The presence of these particles may give rise to mild and chronic interstitial changes. In the recent past, developments in and around the cities and large scale decimation of forests for agriculture and farming operations have vitiated the global environment due to release of various pollutants into the atmosphere. The wildlife, being maintained in captive and natural habitats, have not escaped from these effects. This paper presents the information on the occurrence of atmospheric pollution and its impact on wildlife particularly on those maintained in the National Zoological Park, Delhi.

MATERIALS AND METHODS

The lung specimens along with other visceral organs preserved in 10 percent formalin from certain native and exotive mammals which succumbed to various ailments in the National Zoological Park, New Delhi, between Feb., 1990 to Jan., 1995, were received for histopathological diagnosis at the Institute. Whenever lung specimens were fund to be discoloured (blackish-grey), the tissues were specially observed for pneumoconiosis. The results to these histopathological findings have been shown in the accompanying table.

The incidence of pneumoconiosis was found to be 11.1 % (5.45) in artiodactylids, 84.2 % (16.19) in carnivorese and 77.2 % (17.22) in non-human primates. Artiodactylids in general were found less affected/exposed than carniovres and primates. Histological picture showed the occurrence of pigmentation as sparse or moderate deposits of brownish black/ black amorphous particulate of granular matter or in aggregates in the alveolar walls and in the spaces in the around bronchiolese and blood vessels. These were often present within the macrophages but without inciting any important pathological lesions therein.

Pneumoconiosis has been recorded in other Zoological Parks. Ten out of the 13 bears, which died between 1980 - 88 in Nehru Zoological Park, Hyderabad, Andhra Pradesh, were found affected with anthracosis (Mohan Rao *et al*, 1989). Earlier Choudary *et al.*, (1986) reported the same condition in a lioness and monkey. We have also encountered this condition in artiodactylids (chital, swamp deer, black buck), carnivores (lion, leopard, red panda) and primates (common langur) which died in Lucknow Zoological Garden, and in carnivores (lion, leopard, clouded leopard) and primates (golden langur) which died in Kanpur Zoo. Studies to dermine the impact of pneumoconiosis on the degree of pulmonary gaseous exchange are certainly warranted. They are likely to act as predisposing factors for respiratory infections. The epidemiological explanation for the occurrence of pneumoconiosis in wild animals in Zoological Parks/ Gardens could be explicited as under.

Besides the inhalation of dust, dirt and various emissions raised by movements of people and vehicles, particles from drying polluted water moats, dumped heaps of garbage and sewer effluents in the zoo become added sources of pollution in the atmosphere already laden with fly ash and carbon particles emanated from various sources together with silica/sand/stone particulate matter from quarries, masonary works, etc. All these sources continue to be the cause of pneumoconiosis, more frequently in animals whose confinement in the same environment is almost lifelong.

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Table.1 Pneumoconiosis recorded in captive wild mammals between February, 1990 to January, 1995 at National Zoological Park, New Delhi

(A) Artiodactylids			(B) Carnivores			(C) Non human primates		
Animals	# Specimens Positive/ Examined	Major diagnosis	Animal	# Specimens Positive/ Examined	Major diagnosis	Animal	# Specimens Positive/ Examined	Major diagnosis
Chital (*A. axis*)	*1/9	Nothing Specific	Cheetah (*A. jubatus*)	*2/3	Salmonelloses Nephritis	Bonnet Monkey (*M. radiata*)	**2:2	Hepatitis
Sangal (*C. eldi eldi*)	*1/4	-do-	Tiger (*P. tigris*)	*3/3	Nephritis Rabies Nothing Specific	Rh. Monkey (*M. mulatta*)	*4:5	NS(2) Hepatitis (1) Fatty Liver (1)
Barking deer (*M. muntjak*)	-/1	-do-	Lion hybrid (*P. leo*)	*1/1	Trichobezoars	Langur (*P. entellus*)	**3:5	Hepatitis, Enteritis Fatty Liver one each
Sika deer (*C. nippon*)	-/2	-do-	Leopard (*P. pardus*)	*2/2	Pneumonia & Nephritis Hepatic Cyst	Nilgiri Langur (*P. johni*)	**1:2	TB
Chousingha (*T. quadricornis*)	-/1	-do-	Malayan bear (*H. malayanus*)	*1/1	Nehpritis	Capped langur (*P. pileatus*)	**1/1	Nothing Specific
Chinkara (*G. gazella*)	*1/3	-do-	Binturong (*A. binturong*)	*1/1	Pneumonia	Stump tailed (*M. arctoides*)	**1/1	Nothing Specific
Nilgai (*B. tragocamelus*)	-/10	-do-	Jackal (*C. aureus*)	**2/2	Pulmonary Ossification Enteritis	Lion tailed (*M. silenus*)	*2:3	Pneumonia Nephritis
Black buck (*A. cervicapra*)	*1/4	-do-	Small civet (*V. indica*)	*1/1	Rabies	Spot Monkey (*A. geoffroy*)	*1/1	Pneumonia
Cape buffalo (*S. caffer*)	*1/2	Pulmonary Mycosis	Palm civet (*P. hermaphroditus*)	*3/3	Pneumonia Alveolar cell carcinoma	Olive baboon (*P. papio*)	*1/1	Nephritis
Eland (*T. oryx*)	*1/3	Nothing Specific	Red fox (*V. vulpes*)	-/2	Nothing Specific	H. Baboon (*C. hamadryas*)	*1/1	Asphyxia
Lechwe (*K. leche*)	*1/1	Aspiration Pneumonia & Impaction of Abomasum	Common fox (*V. bengalensis*)	-/2				
Water buck (*Kobus Sp.*)	-/3							Note : * Mild to moderate pigmentation ** Heavy pigmentation
Tahr (*Hemitragus Sp.*)	-/2							

Reprint : Zoos' Print, 11 (4) : 5-7, April, 1996

PATHOLOGY OF NEPHROPATHIES IN TWO ELEPHANTS

Saidul Islam[1], Taibur Rahman[2], Abdul Mukit[3], Bhupendra Chandra Lahkar[4]

ABSTRACT

Pathology of nephropathies in two elephants have been described. In one African elephant (*Loxodonta africana*), there were greyish-white lesions on the cortical surface of kidneys. There were atrophy of tubular epithelium with deposition of calcium oxalate crystals. At some places, there were fibrosis with cellular infiltration of lymphocytes and macrophages indicating lesions of chronic interstitial nephritis. In an another case of Asian elephant (*Elephas maximus*), there were marked nephrotic changes throughout the kidney sections. Lining epithelium had undergone coagulative necrosis. Bowman's space of several glomeruli contained fibrinous caste. Result have been compared and discussed.

INTRODUCTION

A number of plant species and chemicals are responsible for oxalate poisoning in animals. Calcium oxalate is precipitated in renal tubules durnng the process of elimination and subsequently responsible for various nephropathies in the renal tubules (Dickie *et al.*, 1978; Lincoln and Black, 1980 and Cho and Lee,(1986). Presence of calcium oxalate in the urine samples of 4 captive Asian elephants were also detected in the Kaziranga National Park and Manas Tiger Project of Assam (Chakraborty *et al.*, 1990). Owing to paucity of information on the details of nephropathies in elephants, two case studies have been presented in this communication which records the spontaneous nephropathy due to calcium oxalate and possible toxin(s) in an African and an Asian elephant, respectively.

MATERIALS AND METHODS

Case No. 1

An African female elephant (*Loxodonta africana*) of about 22 years of age died of chronic ailments in the Assam State Zoo - cum - Botanical Garden. Pieces of kidney tissues were collected at postmortem and preserved in 10% formol saline. The tissues were then processed through conventional paraffin embedding technique and sections of 4-6 thickness were cut and stained by routine haematoxylin and eosin method (Luna, 1968).

Case No. 2

A 30 year old male captive Asian elephant (*Elephas maximus*) reared in the Kaziranga National Park, Assam, showed clinical signs of passing out yellowish red coloured urine from two days before death. The animal was subjected to post-mortem examination and representative tissue samples from the affected portions of the kidneys were collected and processed for histo-pathological studies as in Case No.1.

RESULTS

Case No. 1

Grossly, there were greyish-white lesions of vanable size on the cortical surface of both the kidneys.

Microscopically, many renal tubules were filled with compact mass of refractile nature or light yellowish brown to dirty yellow crystals led to the atrophy of the surrounding tubular epithelium. The crystals were present in rosette-like arrangement or sometimes clusters of prisms or rhomboidal structures in the proximal convoluted tubules and occasionally in the interstitial tissues. Some of the tubules had undergone cystic dilatation (Fig.1 and 2). At places showed areas of fibrosis with cellular infiltration of lymphocytes and macrophages indicating lesions of chronic interstitial nephritis. The renal capsule was thickened and hyalinised. Considering the mrophological characteristics, the crystals were identified as calcium oxalate.

Fig. 1. Rosette-like arrangement of crystals in the tubules, free crystals in the interstitial space and cystic dilatation with fibrosis., H&E. X100.

Case No. 2

Grossly, kidney surfaces did not show any noticeable changes. When the kidneys were incised, yellowish coloured urine could be noticed. Slight haemorrhagic areas at the corticomedullary juncture of both the kidneys could be observed (Fig.3). No grossly visible changes could be detected in pelvis.

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Histopathologically, there were marked nephrotic changes throughout the sections. The lining epithelium of several tubules had undergone coagulative necrosis and necrotic debrises were seen in the lumen. Some of the tubules showed complete disappearance of the epithelial lining(Fig.4). The Bowman's space of several glomeruli contained fibrinous casts (Fig.5). Focal interstitial and tubular haemorrhages were also seen. Some of the glomeruli showed reduction in the size of glomerular tuft and increased glomerular space.

DISCUSSION

Case No. 1

Oxalate combines with calcium after absorption to form insoluble calcium oxalate and deposited in the renal tubules causing tubular obstruction and acute renal failure (Jubb *et al.*, 1985). The presence of closely packed crystals within the tubular lumina and interstitium with definite shape and arrangement indicating crystals of calcium oxalates are in conformity with the earlier reports (Andrews, 1971; Dickie *et al.*, 1978; Jones and Hunt, 1983 and Jubb *et al.*, 1985). The obstruction in the renal tubules are responsible for cystic dilatation of the functional tubules and pressure from the crystals within the tubular lumina are sufficient to cause pressure atrophy of the tubular epithelium as observed in the present study. Interstitial nephritis is the consequence of irritation caused by the crystals with subsequent proliferation of fibrous tissues. Although the exact cause in this case could not be ascertained, it is presumed that the supply of sugar beet to the elephant for consumption might have led to the deposition of the crystals in the kidneys (Jubb *et al.*, 1985).

Fig. 2. Higher magnification of Fig.1. H&E X200.

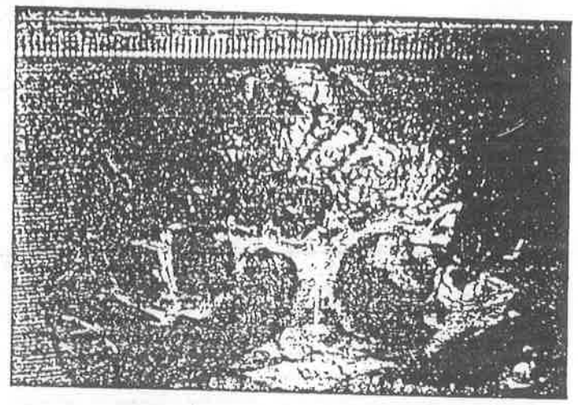

Fig.3. Kidney of an Asian elephant showing light haemorrhagic areas at the corticomedullary junction. (Each small division = 1mm)

Case No. 2

Similar histopathological alterations in kidneys were also reported in other domesticated animals (Jones and Hunt, 1983; Thomson, 1988). Extensive necrosis and detachment of renal tubular epithelium blocking the lumen of tubules (Boyd, 1987), marked hypocellular tubules containing detritus and casts (Thomson, 1988) are characteristics of toxic nephrosis. In swine and cattle, toxic nephrosis of mycotic origin (Ochratoxin, citrinin) could be associated with maize, wheat and barley. In experimental rats, mice, and dogs, the latter toxins produced similar changes as was seen in natural cases of swine and cattle (Jones and Hunt, 1983). Nephrotoxic tubular changes may be precipitated by naturally occurring or synthetic compounds (Brown and Engelhardt, 1987) and heavy metals (Thomson, 1988).

The present finding of toxic nephrosis might be either micotoxic or exogenous synthetic drug origin. All the captive elephants of Kaziranga National Park were partially fed with gram without any preconsideration to its possible relationship with mycotoxin. If the grams contain any potent mycotoxin, such regular feeding practice of gram might involve a cumulative deposition of potent mycotoxins leading to serious renal involvement as was seen in the present investigation. The liver of the elephant

was extensively damaged due to chronic fascioliasis (*Fasciola jacksoni*) for which o toxic pathological changes could be seen. Moreover, the use of amphotericin based synthetic compounds like gentamiin might also injure the renal tubules and glomerulus when it crossed the required therapeutic level. The gentamicin related neprotoxicity cannot be ruled out as this drug was mostly used in this animal for the treatment of clinical renal conditions. However, the histopathological changes of the present study indicates senousness of the field problem and speculates more similar undercurrent cases. Moreover, to draw a final conclusion, the possible causes of present toxic nephrosis as discussed above requires an immediate and thorough study to conserve these pachyderms.

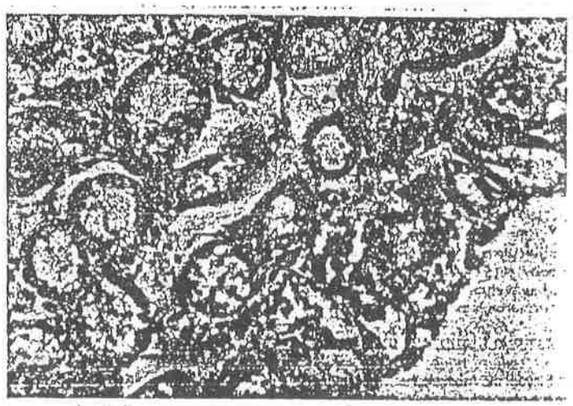

Fig.4. Photomicrograph showing nephrotic changes in the renal tubules. H&E. X200

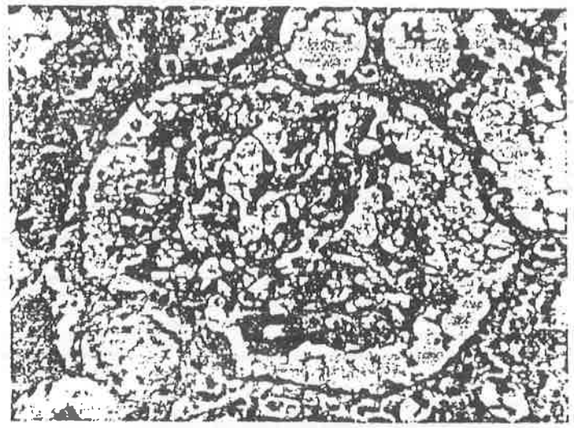

Fig.5. Coagulative necrosis of the lining epithelium of renal tubules. Note the presence of fibrinous deposits in the Bowman's space. H&E. X200

ACKNOWLEDGEMENT

Authors are thankful to the D.F.O., Assam State Zoo-Cum-Botanical Gardens, D.F.O. Eastern Assam Wild Life Division, Bokakhat and dean, faculty of veterinary science, Assam Agricultural University, Khanapara, Guwahati 781 022 for all the necessary facilities to carry out this investigation.

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Reprint : Zoos' Print, 11 (10) : 10, October, 1996

STUDIES ON PREVALENCE OF PATHOLOGICAL CONDITIONS OF CAPTIVE NON-HUMAN PRIMATES*

P.K. Goswami [1] and A. Chakraborty [2]

ABSTRACT

In comparison to the amount of research done in non-human primates, a systematic study on prevalence of pathological conditions of captive non-human primate in our country is yet to be undertaken. Keeping in view the lacuna in our knowledge, the present investigation was planned to study the pathological conditions as well as the causes of mortality of captive non-human primates of Assam State Zoo.

During the present investigation altogether 85 carcases of captive non-human primates of Assam state zoo were examined. Out of these, 23 carcases were collected during the period of 1991-92 and the rest were collected by the Department of Pathology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati from the said zoo during 1985-1990. The diagnosis of the causes of death were based on the history of the cases and in gross and histopathological study. Bactericlogical examination was undertaken when warranted, of the materials collected during the period 1991-92. Spontaneously occuring aortic lesions in the aortas of 25 adult animals were examined. A study on the parasites found at post-mortem examinations of these animals were also carried out. Faecal samples of 36 captive non-human primates were examined to assess the status of parasitic infection and 12 rectal swabs were collected to know the prevalence of bacteria of public health importance.

On the basis of diagnosis the following conditions were recorded - pneumonia (24.70%), enteritis (16.47%), tuberculosis (12.94%), traumatic injury (11.76%), mycotic infection (4.70%), gastric ulcer (3.52%), malignant neoplasm (2.35%), gastric dilation (1.17%), poisoning (1.17%), neonatal mortality (8.23%), stress (9.41%), dystokia (1.17%) and senility (2.35%).

Respiratory and alimentary disease complex claimed the highest number of deaths of captive non-human primates. Pneumonia was recorded in 21 animals, in which one case of giant cell pneumonia was noticed in a macaque. *Pasteurella* and *Streptococci* were associated in few cases.

Out of 14 cases (16.47%) of enteritis, 4 cases were due to *Oesophagostomum aculeatum* infection. The bacteria isolated from the remaining cases were *E.coli* and *Citrobacter* spp. from the intestine. Three cases of gastric ulcers and one case of gastric dilatation were also noticed in the study.

Tuberculosis was recorded in 11 animals and most of the cases were pulmonary tuberculosis, although desiminated lesions were also recorded in few occasions.

Traumatic injury was found to be another common cause of death among non-human primates under captivity. Ten deaths were recorded due to traumatic injury. The injuries were classified as (i) caged injury, (ii) infighting between inter- and intra-species, and (iii) capture injury.

Pulmonary mycotic infections were recorded in 4 animals. Coccidioidomycosis infection was noticed in 3 occasions while a case of blastomycosis infection was recorded which is worth mentioning.

Two cases of malignant neoplasm, adenocarcinoma in the stomach and bronchogenic carcinoma were documented in the study. Two benign tumours of genital organs namely adenoma in the vagina and an unilateral seminoma in the testis were also noticed.

Isolated cases of organophosphorus compound poisoning and dystokia were found in the study. Neonatal mortality was seen in 8 animals where the deaths were due to agalactia and still birth. Two cases of senility and death associated with stress were noticed in 8 animals.

Aortas of 25 adult captive non-human primates were collected and examined for the presence of spontaneously occuring atherosclerotic lesions. The only lesion recorded in the study was the deposition of lipid in the form of fatty streaks in 9 animals.

Thirty six number of faecal samples were examined and the ova of parasites recorded were - *Ascaris, Enterobius, Ancylostoma, Trichuris, Strongyloides, Entamoeba, Girdia* and *Balantidium*. The parasites recorded in the postmortem examinations were *Oesophagostomum aculeatum, Trichuris trichunna, Enterobius vermicularis, Dirofilaria* spp. and filarial parasites. *Fasiola gigantica*, Cestode and Cysticercus were also recorded. Rectal swabs of 12 captive non-human primates were examined and no significant bacteria of public health importance could be isolated.

* Abstract of Dissertation of the same title in the Master's Programme

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Reprint : Zoos' Print, 12 (2) : 7, February, 1997

OCCURRENCE OF A FAECOLITH IN A LITIGON IN CALCUTTA ZOO

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An intestinal obstruction may either be obvious and easily diagnosed or obscure and difficult to identify (Buckner, 1979). Pyloric obstruction in a tiger-cub due to foreign body has been reported by Joshi (1991). The present report deals with a case of intestinal obstruction by a large herd faecolith of an adult litigon, named "Piali". This litigon was born on 22nd March, 1982 by hybridization of a male Indian Lion "Debabrata" with a female tigon "Rudrani" who was a hybrid of a Bengal Tiger and African Lioness.

The predominant signs observed were occasional vomition followed by gradual loss of appetite, dehydration, emaciation and restlessness. Superficial wounds had developed on the body surface, markedly on the paws due to self inflicted injuries. The animal started to pass reduced quantity of stools gradually from 28th October, 1993. Symptom of tenesmus was there for a few days and the animal ultimately stopped passing stools. The animal become totally anorectic at the latter part of illness. Symptomatic treatment was undertaken with antacid, liver extract and vitamin B-complex, along with a course of antibiotics, time to time, in therapeutic doses. Palatable diet like dove and fowl were provided but it yielded no satisfactory improvement of appetite. Parenteral dextrose with normal saline therapy was extended for a couple of days but the animal ultimately died on 4th December, 1993 without giving any opportunity for surgical intervention. At the same time her age of eleven years eight months was also a factor of hindrance towards surgical approach. It is also reported that longer a patient lives with intestinal obstruction prior to surgical intervention, sooner the death occurs afterwards (Rawlings, *et al.*, 1981).

On post mortem examination, a large hard bullet shaped faecolith, tappering at one end (length 11.6 cm., circumference length at its maximum point 15.2 cm., weight 156 g.) was found at the junction of caecum and colon. A moderate intestinal tympanic condition with submucosal haemorrhage was noticed in different sites of intestinal loop. Liver and spleen were found congested. No other gross pathological changes were observed on necropsy. Similar case of faecolith in a Siberian Tiger was also reported by Chakraborty and Das (1991).

Acknowledgement

The authors are thankful to Sri. A.K. Das, Director and Sri. S. Bhattacharyya, Assistant Director, Alipore Zoological Garden for their kind help and necessary advice for preparing this note. The authors are also thankful to Mr. R.P. Banerjee, Member, Managing Committee of the Zoological Garden, Alipore for his continuous encouragement in writing this paper. Advice and suggestion received from Dr. D. Chattopadhya, Ex-parasitic disease control officer of Veterinary Services, West Bengal towards the write up of the article is also acknowledged.

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Editors' Note : *There was disagreement among the various editors as to whether to publish this article. Scientific editor questioned publications on hybrids. Associate editor questioned whether the fact of hybridisation really mattered since the point of the article concerned physiology and may be of interest to veterinarians. Editor has decided to publish it on the strength of the latter argument but with this Note that we do not, in Zoo Outreach Organisation or ZOOS' PRINT, encourage zoos to hybridise wild animals. Publication of an article about a physical condition of a hybrid is entirely different; it may or may not be of value.*

The authors' included a genealogical chart of tigon and litigon which we have not included as it is probably not relevant to the fact of the faecolith.

Fascination with freakish animals has been one of the irritants confronting persons with a modern approach to zoo management in India. Hybridising of wild animals, breeding for unusual characteristics such as double recessive mutation, albinism, etc. is very much discouraged by the international zoo conservation community. Some reasons are :

Zoo space and resources: In zoos there is a limited amount of space as well as personal and financial resource which needs to be devoted in full to research and propagation of animals which would enhance the conservation effort. Hybrids and other freaks do not contribute to conservation in any measure that we have come across.

Wrong education. Visitors get a wrong impression of wildlife by seeing such animals exhibited and even highlighted in zoos. They get a clear but erroneous message these animals are the most important animals in the zoo. Exhibition of freaks encourages all the wrong inclinations in visitors. We want to discourage fascination with oddities and encourage study of the even more fascinating natural world.

In the Calcutta Zoo where these animals are exhibited, the most colourful signboards in the zoo were about the tigon and the litigon while important animals such as sangai were identified by small, drab signs. This in itself creates a wrong impression of the importance the zoo gives these species.

Reprint : Zoos' Print Journal, 15 (2) : 216, February, 2000

NOTE ZOOS' PRINT JOURNAL 15(2): 216

A CASE OF OBSTRUCTIVE ASPHYXIA IN PYTHON (*PYTHON MOLURUS*)

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The Apex Centre, Jaipur received a carcass of python in the month of January 1998 from the Zoological Park, Jaipur. With the animal going off-feed during the winter months on account of hibernation, the zoo authorities apparently could not note of the deteriorating health condition of the snake. The general body condition of the carcass was good and the animal measured about 8 feet 6 inch in length. The carcass had no external marks of injury.

All the visceral organs presented white foci of variable size on the exposed surfaces. The gastro-intestinal tract when opened for examination, was found to be totally empty except for the presence of thick mucigenous mass in the posterior part of the intestine. The anterior part of small intestine had numerous round worms attached to the mucosa of the lumen. However, no pathognomonic lesions could be detected in the gastrointestinal tract.

The respiratory tract was explored from mouth to lung through trachea. About 6 inches posterior to mouth the lumen of trachea was found completely occluded with a mass of growth (more than 2 inches long). An incision on the mass revealed the presence of thick pus. Abscesses of variable sizes were found scattered throughout the trachea and in the lung. The lung was found to be totally collapsed. Heart was found empty.

The pus samples along with piece of lung and mucus from intestine were collected for further laboratory investigation. Gram's stained smears of the pus and impression smear of lung revealed the presence of Gram negative non-sporulated rods.

The pus sample was inoculated in blood agar medium. The bacterial growth appearing after incubation at 37°C for 24-36 hours was subjected to purification by subculturing and generic identification tests as per usual microbiological techniques of identification (Carter, 1967). The bacterial isolate recovered from pus sample was identified as *Corynibacterium* (*Actinomyces*) *pyogenes*.

The mucus sample was inoculated in Mac Conkey and S S agar media. The bacterial growth appearing on the media were identified as *Esteurichia coli*, *Proteus* sp. and *Salmonella* sp.

The clinical history, post morten examinations and laboratory investigation were suggestive of obstructive asphyxia as the cause of death in the Python. Rao *et al.* (1980) reported concomitant occurrence of *Corynibacterum pyogenes* and *Pseudomonas aruginosa* in mouth lesions of cobra. Kaura *et al.* (1972), Sethi *et al.* (1980a&b) and, Mishra and Verma (1981) have also reported the presence of enteric bacteria in python and other snakes.

Received 22 July 1999; *Accepted 3 December 1999*

Acknowledgement

The authors are thankful to Director Research (Veterinary and Animal Science), Rajasthan Agricultural University, Bikaner and Deputy Chief Wildlife Warden, Zoo, Jaipur for providing facilities.

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BEZOAR IN A SPOTTED DEER (*AXIS AXIS*)

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An adult female Spotted Deer (*Axis axis*), which was maintained in the college livestock farm died suddenly and was presented for post mortem examination. The deer, originally located at the premises of a hotel at Pondicherry was handed over to the college by the forest department approximately six months prior to its death.

Blood smear examination did not reveal any organism of pathological significance. On necropsy, the rumen and reticulum were moderately impacted and among the contents was found a bezoar with knotted appearance (Fig. 1). It was 40 cm. in length and 400 g. in weight. The bezoar consisted of several entangled polythene bags, ingesta and mineral deposits. The omasum and abomasum contained moderately digested ingesta. Intestines showed mild enteritis. Other postmortem findings included hydrothorax, pulmonary edema, ecchymosis on epicardium and a focal necrotic calcified lesion on the parietal surface of the liver.

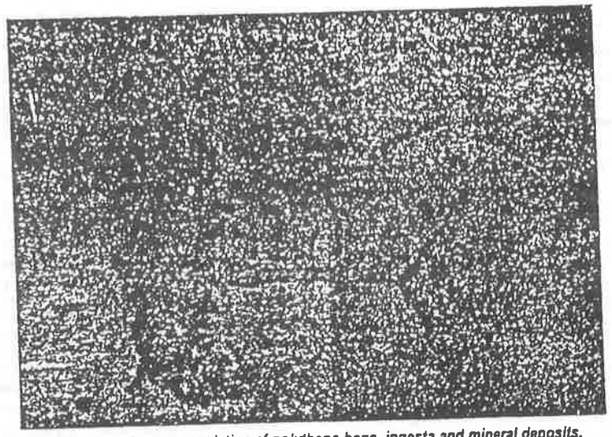

Figure 1. Bezoar consisting of polythene bags, ingesta and mineral deposits.

Received 8 October 1999; Accepted 10 December 1999

Presence of foreign bodies in the fore stomach of deer is not uncommon (Rao & Acharyjo, 1995). Sharma and Chauhan (1997) reported the occurrence of phytobezoar in the reticulum of a Barking Deer in Nainital Zoo. The polythene bags left over by the visitors to the zoo was postulated to be the source of the bezoar. The occurrence of bezoar in the present case may be due to the fact that the animal had access to unwanted materials in the hotel premises.

Although this bezoar was found to be the cause of impaction, the cause of death in this case could be attributed to acute pulmonary edema.

The observation made in this case once again highlights the potential health hazard to wild and domestic animals as a result of improper disposal of plastic materials.

Acknowledgement
The authors are thankful to the Dean, Rajiv Gandhi College of Veterinary and Animal Sciences, Pondicherry for providing the facilities. Thanks are due to the staff members, Department of Animal Husbandry Extension for their help in photography.

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Reprint : Zoos' Print, 1 (3) : 8-11, March, 1986

Zoo Mortalities-Causes And Control

(Report from Kanpur Zoological Park) By Dr. H. K. Gairola

Captivity of wild animals in Zoological Parks has long been a controversial issue among conservationists. Their viewpoint is often that Zoos are mere institutions of recreation and entertainment for humans with no redeeming features. High rate of deaths in Zoos on account of various diseases and vicissitudes of captivity has been cited as being anti-conservation.

But it has been well understood now particularly as clarified by Gerald Durrell, the well known naturalist, that animals in wild state also endure many stresses. They have to search for food, safeguard from predation, protect from enemies, look for shelter in bad weather conditions and fight diseases occuring in nature. In captivity, although they may be under stress of new surroundings just after capture but are well adjusted soon and all the natural problcoms of food, predation and shelter are reduced. Their greatest enemy (man) acts as a friend to them in captivity. The impact of diseases in free living wild life has also been well known and documented. The effects of disease are incidental at individual level but may turn epizootic occasionaly.[3] In 1969, Dr. C. M. Herman[3] in his paper entitled "The impact of disease on wild life population" stated that :–

"While there is limited documentation that disease, as an individual factor, can drastically affect population fluctuation, it is certainly evident that acting with other ecological phenomena, disease can have extensive impact in free living wild life."

Populations are often resilient and can compensate for losses of individuals and attain some balance with disease agents. Density, nutrition, climate and predation interact with disease within populations and it is not easy to asses their relative importance. Sick animals under natural conditions are frequently predated or they die in obscure places where they are not easily found. Even when they are found, the cause of death often cannot be determined with certainity because of post-mortem changes and activities of scavengers. Thus the quality of population might be maintained if predation and other pressures are adequate to cull the populations of the most seriously diseased animals. In other situations when illness does not directly kill the host and predation and climatic conditions are absent or minimal in their effects, it may affect the quality of the populations and consequently may result in its low levels.

Thus the role of disease in free living wild life although of a complex nature, cannot be overruled. Blaming captivity for high mortalities as compared to free living is not fully justified. Moreover captivity, by way of captive breeding propagation and rehabilitation has long aided in conservation programmes of many endangered species of animals and birds all over the world In our Zoological Parks too, most of the endangered species have been conserved and propagated. The Manipur Brow-antelered deer (almost extinct in wild state) have been bred in various Zoological collections. In a recent survey as reported in Zoo School chapter of Vol. III issue IX of Zoo Letter bulletin of Mysore Zoo, they are less than 14 in wild state while their number is more than 100 in various Zoos of the country. It is because of these facts that the concept of Zoological Parks has changed altogether. Zoos are now considered not only for amusement but in addition to wild life education and conservation media, are regarded as nature education institutions. They affect public attitude and awareness of naturalistic environments exhibiting animals, natural patterns of behaviour and place in nature. People are far more likely to take interest in their preservation if they are familiar with living examples. Zoological Parks further aid in scientific research to obtain the requirements, behaviour and disease understanding of wild life living in free state.

Mortality

Mortalities in Zoological Parks have always been great source of propaganda and publicity in press. Perhaps it is for this reason that many Zoos all over the world have been reluctant to admit and expose their losses in general.[4] In fact mortality in a collection is directly related with life span of the species present and their feeding standard, management practices, disease control

and curative measures. Veterinarians are entrusted with health care, disease control and treatment programmes of animals in Zoos. It is their interest, efficiency and devotion that is reflected as low mortality rates in Zoological Parks. Even with all the possible measures some natural mortality is bound to occur. There cannot be a standard measure of normal mortality for a Zoological Park due to diversities of species and their life spans in various collections. But if a uniform method of calculating annual mortality rates is adopted by all the Zoos and an average of last 4-5 years of each is compiled and analysed, a normal standard annual mortality rate applicable to all Zoological Parks having mixed types of collections, can be formulated. Deviation from this standard could give some indication of normal and abnormal deaths. Such figures could be helpful to the Zoos to control the mortalities and rectify and analyse their adopted measures. Figures of well established Zoos will however be more reliable and definite.

Preliminary effrots have been made at Kanpur Zoological Park in the past few years to calculate annual mortality rate in three groups of animals as Reptiles, Mammals and Birds, separately and ever-all, It has been calculated as percentage of total deaths in the year, over the balance strength of the year. The balance strength of each year is calculated by adding all the arrivals in the year including births, to the strength in the begining of the year and sub-stracting from it all the departures in the year except deaths as illustrated in Table I

Kanpur Zoological Park is quite a new Zoo. Its construction was taken up by the State Government through State Forest Department in the year 1968. With completion of enclosures and establishment of most of the animals it was opened for the public in February 1974. There was no proper recording of data in the beginning for want of staff and lack of experience. It was since the year 1980 that proper records were maintained. Let this Zoo be perhaps the first to admit and expose these bare facts of its past mortalities in general. Study of the table reveals that overall mortality rate as high as 18.1% in the year 1981-82 has gradually come down to 10.96% in the year 84-85. Highest mortality in birds as 21.2% noted in year 81-83 is due to unpredicted heavy rainfall and lake flood. In mammals highest mortality as 17.4% in the year 83-84 is due to losses in Rinderpest outbreak. The average of all the four years annual mortality percentage is 10.00% for reptiles, 12.7% for mammals, 13.6% for birds and 13.36% overall.

Although these figures cannot be considered a standard for all the Zoos, as a first step, if all such groupwise figures of various Zoo collections (especially those which are well established) are analysed a common figure applicable to all Zoos can be formulated. In the second step however specieswise mortality rates from all Zoos will be helpful in the long run to formulate and reach a standard annual mortality rate for each species.

Causes

In a Zoo the animals are in a semicaptive state. However natural the environment which is provided their limited movement and proximity to human and domestic life cannot be comparable to free state. New entrants of Zoo are much prone to diseases, firstly due to stress of change of environment and secondly because of proximity to infections for which they are not immunized. Bounded and limited space also stimulates fighting and injuries. Sometimes fighting is provoked due to sexual rivalry. Mortalities are high during the establishment phase of a Zoo but once it is well established the mortalities normalise and have a regular trend.

Broadly the causes fo death can be divided as due to non-infectious ailments and infectious diseases. Among non-infectious ailments main causes of death are malnutrition, stress, injuries, cold and heat strokes, verminous bites and accidents like heavy rains, flood, etc. Causes of deaths due to infections include effects of bacteria, viruses and parasites. Numerous books and literature are available on various ailments and diseases which may cause mortalities in Zoo animals. Unlike free living wild life however, captive wild animals in Zoos are under regular watch and veterinary supervision. Unfortunately, most of the times the animal is found dead without any visible symptom of ailment and opportunity of curative measure to be applied. It has been found in Kanpur Zoological Park that out of total casualities of 390 in last three years, only 93 or about 24% deaths were such when opportunity of treatment was available, the remaining 76% deaths were sudden. On groupwise analysis 50% deaths in mammals and 92% deaths in birds were sudden without any history or symptom of ailments,

Post mortem examination with history and symptoms of ailment are the main tools to reach a diagnosis of cause of death The Zoo Veterinarian acts as practicing pathologist at the spot and interprets probable cause of death from the available tools. The experimental pathologists of well established laboratories help him to reach a final conclusion.[7] A diagnosis of the cause may be morphological (naming the lesion), etiological (naming the cause) or definitive (naming the specific disease entity involved).[8] It is often not possible to determine the etiology or the specific disease entity so the practicing pathologist records and describes the morphological lesions and then gives his interpretation of what had happened to reach at right conclusions. Insight, Imagination, originality, persistence, mental acuity, sound education and experienced background are the basic qualifications and mere opening the areas for autopsy is no solution to it.[9]

Deaths at Kanpur Zoological Park in past few years when etiological and definitive diagnosis could be possible are reported as following :

1. **Tuberculosis** Prevalence of tuberculosis is a most common feature in many Indian Zoos. In Kanpur Zoo 27 mammals and 14 birds have been diagnosed as having died of tuberculosis in the past three years. The diagnosis is based on morphological lesions in post mortem examinations with confirmation of laboratory test and histopathology in a few. Among mammals 7 primates, 9 bovids, 4 deert, 7 others and in birds 5 ducks, 7 fowls and pheasants and 2 storks have died of this Many of the deaths were sudden with this disease, more so in birds.

2. **Rabies :-** This disease caused by virus has also been reported to occur in wild animals in captivity in Zoos. Kanpur Zoo lost two Jaguars in October and November 1981 and one blue bull in March 85 on account of this disease. Laboratory test sought in one Jaguar confirmed the presence. Two deaths due to rabies in Indian rhinoceros have also been reported from Lucknow Zoological garden in the years 83 and 84.

3. **Enterotoxaemia :** due to clostridium perfringens type D in one male giraffe in February 1981 have been diagnosed and confirmed by laboratory test at Kanpur Zoological Park. This is perhaps the first ever reported death in giraffe with this disease.

4. **Rinderpest :** It is also caused by virus, and the outbreaks have been reported in the past from many Zoos.[7] Kanpur Zoo has also been unfortunate to have an outbreak of this disease in November 83 in which 4 gnus, 2 gayals and 1 deer were lost. Prophylactic vaccination with tissue culture rinderpest vaccine responded to prevent further spread of the disease to other enclosures of bovids and deer.

As a routine, post mortem examination of every death is performed at Kanpur Zoological Park and materials for laboratory tests of few is sent to Indian Veterinary Research Institute, Izatnagar to reach a conclusion of cause of deaths. Total of 390 deaths comprising of 3 reptiles, 149 mammals and 238 birds were recorded in last three year in this Zoo. During analysis of their morphological causes it has been found that highest incidence as 21.5 of deaths in mammals and about 32% of deaths in birds recorded due to external injuries as shown in table 2. These injuries generally occurred in fights among males, mostly in ungulates and birds. Next highest incidence 16.8% deaths in mammals and 31.5% deaths in birds are due to gastro-intestinal affections. More worth mentioning are 18.12% deaths in mammals due to tuberculosis and 9.24% deaths in birds due to drowning in rain or flood water. Remaining about 42.0% deaths in mammals and 23.5% deaths in birds cover all other affections as detailed in the table.

Control

Mere curative measures cannot be banked upon for preventing mortalities in Zoo animals. As seen in proceeding paras that out of a total 390 deaths in three years it was only in 93 or 24% deaths that opportunity of treatment was available. These 24% deaths are about 14% of total cases treated in the same period. It was in remaining 76% deaths that treatment was of no avail. Thus, preventive measures are of utmost importance in control of abnormal mortalities in a Zoological Park. Kanpur Zoological Park had been in its phases of establishment in past years and various preventive measures were attempted and adopted to check the abnormal mortalities as summarised below :

1. It was seen that certain species especially that of birds were not thriving well in the Zoo most probably due to environmental and climatic

conditions. Keeping of such species before suitable conditions can be provided is discouraged.

2. Quantity and variety of Food of all animals and birds are revaluated and efforts to balance and supplement them with vitamins and minerals are made keeping in view their taste, liking and requirement.

3. Measures of sanitation and cleanliness of enclosures are strictly observed. All food materials received daily such as fruits, vegetables and meat, are examined thoroughly for quality and freshness and distributed after proper antiseptic treatment and supplementation.

4. Quarantine measures are strictly followed and new arrivals are seperoted until fully ensured as free from internal parasites and diseases. Segregation of diseased animal and restriction of entry of all types of domestic animals is observed. Street dog menace is checked by obstructing their entry and at times removed by driving, capturing or destroying.

5. A deworming schedule for all the animals and birds is chalked out after analysis of stool examinations of past years and regular deworming of each and every animal is ensured. In positive cases found during regular stool examinations, deworming of whole of the flock is undertaken irrespective of schedule with the effective anthelmintic. No new arrival is declared free from parasites until found negative in three fecal samples at intervals of 72 hours.

6. In the prevalence of any infectious disease in domestic animals and birds of surrounding area vaccination programme of the suceptible species of Zoo is also carried out. All clinically suspected cases of tuberculosis in primates, bovids and deer are immediately segregated at Zoo hospital for treatment and if possible never mixed again with their fellow animals.

7. Overcrowding in enclosures is avoided and efforts are made to enlarge and extend many enclosures like that of tiger and rhinoceros. Surplus males of each herd separated and exhibited either singly or with males of other compatible species to avoid male fightings commonly seen in presence of females most probably due to male dominance or sex rivalry.

8. To check the accidental deaths like that of cold and heat strokes suitable provisions are arranged in extreme climate months. To avoid drowning deaths in birds in rainy season, water birds are shifted to a safer place during lake flood period and suitable shades and places are provided for others in heavy rains.

9. Daily reports of each and every behaviour of animals is taken from each keeper and all the animals are closely observed and watched at feeding times. Suspects showing abnormal behaviour and any type of ailment are thoroughly examined at once and if necessary are treated at Zoo veterinary hospital.

10. To aid diagnosis, preliminary laboratory examination of stool and blood is undertaken at Zoo hospital laboratory and at times help is sought from experts of Indian Veterinary Research Institute, Izatnagar or local Medical colleges.

Note : Dr. Gairola is the veterinary doctor at Kanpur Zoological Park. Mr. G. C. Mishra IFS, Director was instrumental in the writing of this paper and Dr. Gairola wishes to acknowledge his help.

Charts and reference list were not published due to lack of space, those who have a particular interest in this may write to Z.O.O. for a copy.

REPRINT: Global Trends in Wildlife Management, Ed. B. Bobek, K. Perzanowski & W.L. Regelin (1991): 18th International Union of Game Biologists Congress, Jagiellonian University, Krakow-Warszawa, Poland.

CAUSES OF MORTALITY WITH SPECIAL REFERENCE TO HISTOPATHOLOGICAL DIAGNOSIS IN SOME CAPTIVE INDIAN PRIMATES

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The greatest concentration of primate species of the world lies in Indian region. The large scale destruction of their habitats mainly forests coupled with hazardous diseases, natural calamities and their explicit use in the biomedical research resulted in depletion of the population and even extinction. The worst affected species threatened with extinction are rhesus monkey and slender loris. Information on diseases and causes of mortality in Indian primates is scanty (Raghavan and Khan, 1968 ; Basak et al., 1976 ; Parihar, 1978-79 ; Khera, 1979 ; Rathore and Khera, 1981 ; Baruah, 1983 ; Khan et al. 1983 ; Arora and Goyal, 1984 among others). The purpose of this communication is to highlight the common disease conditions encountered in different species of monkeys and the possible causes of their death at Nandankanan Zoo. It is envisaged that this study will throw considerable light in respect of disease status which in turn will have a tremendous impact on the conservation of some of the species particularly of the endangered ones.

MATERIALS AND METHODS

Epidemiological data pertaining to date of arrival/birth/death, sex, age and history of different types of primates maintained at Nandankanan Zoo were collected from 1967-1985. During this period, a total of 100 deaths were recorded in 13 species of primates. The cause specific mortality was determined on the basis of history, pathoanatomical changes observed at necropsy and histopathological examination, whenever found necessary.

RESULTS AND DISCUSSION

The recorded causes of death are given in the Table. Deaths due to traumatic injuries occurred in rhesus, liontailed, bonnet and stumptailed monkeys and whitebrowed gibbon constituting 14% of the total deaths. More than 50% of the deaths in rhesus monkeys were due to injuries. The causes of such injuries could be faulty managemental practices and social behaviour as suggested by Rathore and Khera (1981) who also reported more or less the same percentage of deaths due to injuries in different zoos of the country. Nonspecific pneumonia and gastroenteritis were found to be the common

maladies in most of the monkey species under study. According to Khera (1979), enteric infections such as shigellosis, salmonellosis, colibacillosis have been found to be the leading causes of mortality in recent years in India. Parihar (1978-79), Rathore and Khera (1981) and Baruah (1983) also considered pneumonia and enteritis as the prime causes of death in Indian captive primates. Capped langur has been found to be very susceptible to transport and heat stress. It has been found difficult to maintain slow loris, capped langur and whitebrowed gibbon under captive conditions.

Intussusception of ileum involving about 15 cm length resulting in gangrene was observed in an adult female common langur. Prior to death, the animal was found struggling in the cage for about a fortnight. In a female adult slow loris, the small intestine about 5 cm away from the ileocaecal valve showed intussusception associated with marked congestion. This condition was attributed to heavy hook worm infestation whereas in another slow loris, the intussusception involving jejunum was associated with severe catarrhal enteritis. There has been no reports of intussusception in primates except for a solitary report on ileum invaginating into the colon (Fox, 1923).

Tuberculosis was seen in 3 stumptailed macaques and 2 Assamese monkeys. Lungs which were affected in all the cases showed multiple, creamy white nodules throughout the surface and substance. Microscopically the nodule consisted of either epithelioid granulomas or caseous and calcified areas surrounded by epithelioid cells and Langhan's giant cells and fibrous tissue encapsulation. Spleen and bronchial lymph nodes also showed similar caseous lesions in the former species. Zheil-Neelsen's stained duplicate sections showed acid-fast organisms morphologically indistinguishable from *Mycobacterium tuberculosis*. Tuberculosis has been found to be one of the most important causes of death in Indian captive monkeys (Liston and Soparkar, 1924 ; Rathore & Khera, 1981 and Baruah, 1983). Basak *et al.*, (1976) isolated bovine type of tuberculous organisms from 2 species of monkeys while Rahaman *et al.* (1981) reported tuberculosis associated with human type in golden langur and pigtailed monkey.

An emaciated female Assamese monkey had a large spherical abscess measuring 5-6 cm in diameter on parietal surface of liver which on incision yielded yellow caeous pus associated with gram-positive diptheroids. A 5-year old whitebrowed gibbon which was anorectic and week prior to death had diarrhoea and showed purulent rhinitis and multiple discrete encapsulated caseous foci measuring 2-3 mm in diameter on liver and portal lymph nodes. No bacteria was isolated from the pus. Sections of kidneys revealed necrobiotic changes in the lining epithelial cells of proximal convoluted tubules, congestion of interstitial capillaries and hypertrophy and hyperplasia of the lining epithelial cells of Bowman's capsule. Necrotic hepatitis associated with infiltration of lymphocytes and plasma cells and biliary hyperplasia in portal areas has been encountered in a young male Nilgiri langur. According to Fox (1923), acute hepatitis is a rare condition in mammals except when it is combined with septicaemia or severe enteritis. In his study, abscesses in 3 monkeys were seen of which one was due to trichocephalus infestation, second to amoebiasis and third was associated with ulcerative enterocolitis of unknown cause.

Pyelonephritis was seen in an aged female langur which died after showing signs of uterine bleeding. At necropsy both the kidneys showed numerous pale areas and

the uterine wall showed several haematomas. Microscopically, the cortex of the kidney showed numerous pyaemic foci of varying sizes. Majority of the glomeruli were ischaemic and showed disruption and degeneration associated with periglomerular infiltration of neutrophils and lymphocytes. The cortical and medullary tubules were not only dilated due to accumulation of lymphocytes and polymorphs but also widely separated by these cells. The endometrium of the uterus was fibrosed while the submucosa showed cystic dilatation of uterine glands and infiltration of lymphocytes and monocytes. The serosa was oedematous while the myometrium showed haematomas.

A 12-year old male pigtailed macaque which died suddenly without showing any clinical signs showed pale liver and kidneys. The former showed extensive fatty changes while the latter showed massive accumulation of polymorphs in the dilated medullary tubules associated with periglomerular fibrosis. Many of the glomeruli were distorted and degenerated while the lining epithelial cells of the proximal and distal convoluted tubules showed severe retrogressive changes. A 7-year old rhesus monkey which was affected with dermatitis, rhinitis and oedema of scrotum and eyelids became anorectic 10 days prior to death. The kidneys had rough granular surface and the capsule was adherent to parenchyma. Microscopically, most of the kidney parenchyma was replaced by fibrous connective tissue. The glomeruli were much reduced in number, distorted and/or atrophied. Some of them were hyalinised or fibrosed. Death in the above two animals was attributed to renal insufficiency resulting from chronic glomerulonephritis.

Interstitial pneumonia was seen in a young male gibbon and a 12-year old female stumptailed macaque. In both, the lungs showed thickening of inter alveolar septa due to infiltration of mononuclear cells. The alveolar and bronchial lumens were free from exudates while the lining cells of the alveoli were hypertrophied. In addition, in the stumptailed macaque, the lining epithelial cells of the renal tubules showed severe retrogressive changes while the hepatic cells showed extensive fatty changes. An adult male common langur showed numerous ulcers on the mucosa of stomach and small intestines. Microscopically, the gastric and intestinal submucosa were markedly thickened due to infiltration of lymphocytes and plasma cells. The mucosa showed desquamation and degeneration of the lining epithelial cells asociated with infiltration of mononuclear cells. There was hyperplasia of the lymphoid follicles in the submucosa.

A female capped langur showed a firm pea-sized greyish-white spherical nodule measuring 3 cm in diameter projecting from the surface of spleen. Microscopicaly, the nodule consisted of numerous reticuloendothelial cells replacing the white pulp. Duplicate sections when stained for reticulum showed marked hyperplasia of reticulin fibres. The condition was diagnosed as nodular hyperplasia. According to Jubb and Kennedy (1970) nodular hyperplasia has been frequently observed in spleens of old dogs and occasionally in old bulls and rarely in other species.

ABSTRACT

This paper presents data in relation to the mortality of 100 primates of 13 species maintained at Nandankanan Biological Park Orissa, India. For this study epidemiological data pertaining to date of arrival/birth/death, sex, age and history of different types of

Indian primates from 1967-1985 were collected, The cause specific mortality was determined on the basis of history, pathoanatomical changes observed at necropsy and histopathological examination whenever found necessary. The important causes of mortality in decreasing order of frequency were pneumonia (19%), gastroenteritis (15%), traumatic injuries (14%), transport and heat stress (13%), tuberculosis and suppurative hepatitis (7%) each, debility (6%), pericarditis (4%), intussusception of intestine (3%) and other miscellaneous conditions. Histopathological confirmation was done on tuberculosis and suppurative hepatitis. In addition, pyelonephritis associated with uterine bleeding, renal failure resulting from chronic glomerulonephritis, nodular hyperplasia of spleen and interstitial pneumonia of unknown etiology were diagnosed.

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Table : Recorded causes of death in Primates

Sl. No.	Cause of death	Rhesus monkey	Assamese monkey	Lion - tailed monkey	Bonnet monkey	Stump-tailed monkey	Pigtailed monkey	Cappad langur	Nilgiri langur	Common langur	Golden langur	White-browed gibbon	Slow loris	Slender loris
1.	Traumatic injuries	9	-	2	1	1	-	-	-	-	-	1	-	-
2.	Pneumonia	3	-	1	-	-	-	3	-	-	1	2	8	1
3.	Gastroenteritis	1	-	-	-	-	-	3	1	4	2	2	2	-
4.	Transport stress	-	-	-	-	-	-	4	-	-	-	-	1	3
5.	Debility	2	-	-	1	-	-	-	1	-	-	1	1	-
6.	Tuberculosis	-	4	-	-	3	-	-	-	-	-	-	-	-
7.	Suppurative hepatitis	1	1	-	-	1	-	-	1	-	-	1	2	-
8	Pericarditis	-	-	-	-	-	-	-	-	-	-	-	4	-
9.	Nephritis	-	-	-	-	-	1	-	-	1	-	-	-	-
10.	Intussusception intestine	-	-	-	-	-	-	-	-	1	-	-	2	-
11.	Heat stress	-	-	-	-	-	-	2	-	-	-	-	3	-
12.	Round worms	-	-	-	-	-	-	-	-	-	-	-	3	-
13.	Senility	1	-	-	1	-	-	-	-	1	-	-	-	-
14.	Drowning	-	-	-	-	-	-	-	-	-	-	1	-	-
15.	Canibalism	-	-	-	-	-	-	-	-	-	-	-	1	-
16.	Born dead	1	-	-	-	-	-	-	-	-	-	-	-	-
17.	Tetanus	1	-	-	-	-	-	-	-	-	-	-	-	-

Reprint : Zoos' Print, 6 (11) : 15-16, November, 1991

INCIDENCE AND ETIOPATHOLOGY ON THE MORTALITY OF CAPTIVE WILD HERBIVORES IN ASSAM

Apurba Chakraborty

ABSTRACT

In comparison to the plethora of research done in wildlife studies, a systemic study on the incidence and etiopathology on the mortality of captive wild herbivores in our country has yet to be undertaken. Keeping in view the gap in our knowledge, the present investigation was planned to study the incidence of diseases and causes of mortality of captive wild herbivores of the Assam State Zoo.

Altogether, 214 carcasses of captive wild herbivores of the Assam State Zoo, from 1985 to 1989, were subjected to post-mortem examination to determine the cause of death. The diagnosis of the causes of death were based on history of the case, gross and histopathology, bacteriological and mycological examination and other tests, if felt necessary. Scanning Electron Microscopy (SEM), Energy Dispersive X-ray microanalysis (EDAX), and histochemical analysis were also undertaken in some cases to know the detail of the cellular damage caused by the etiological agent. A study on the parasites found in these animals and an attempt to study the spontaneously occuring aortic lesions in some of the cases were undertaken. Besides examining the faecal samples of 84 captive herbivores of the State Zoo, 214 faecal samples from the free living herbivores of the Kaziranga National Park were also examined to know the status of parasitic infection in free-living wild animals so as to assess a comparison of parasitic infection in captive wild as well as in free-living wild animals.

On the basis of diagnosis, the following conditions were recorded: traumatic injury with complications (34.11%), tuberculosis (19.62%), pneumonia (10.28%), neonatal mortality (7.47%), capture myopathy (6.54%), colibacillosis (5.14%), bloat (2.33%), senility (1.86%), mixed infection of Fasciola and Amphistomes (1.40%) and intussusception and volvulus (1.40%). Candidiasis, haemonchosis, cestodiasis, and metritis and pentonitis were recorded in 2 (0.93%) cases each, while pseudotuberculosis, necrobacillosis, botryomycosis, peracute mortality, cirrhosis, shock, traumatic reticulo-pericarditis, hernia, dystocia, and organophosphorus poisoning were recorded in 1 (0.46%) cases each.

Death due to traumatic injury and complications therewith was observed in 73 animals, which was found to be the highest of all deaths found in this study. The injury from inter and intra species fighting, fighting during rutting season and in some animals, injury resulting from capture operation for translocation and treatment.

Tuberculosis was seen in 42 animals of 7 different species. Pulmonary as well as generalised form of tuberculosis were noted, from which both bovine and human strain were isolated. A tuberculous bacillus was scanned under SEM and, on EDAX study of a tuberculous lung of a spotted deer, the elements like sulphur, chloride, potassium and calcium were seen to be higher than normal. Pneumonia was recorded in 22 cases in which *Streptococci* could be isolated in majority cases. Besides bacterial pneumonia, parainfluenza-3 infection in 2 spotted deer, zygomycosis in a sambar and aspiratory pneumonia in a barking deer were also noted.

Neonatal mortality was seen in 16 calves, which include agalactia and still birth. In majority of the cases, deprivation of milk and rejection by mother were the common causes of death. Fourteen cases of capture myopathy were recorded, which included 4 cases of each species of spotted deer, barking deer and mouse deer, and another 2 cases of rhinoceros. On histochemical study, increased activity of LDH was appreciated both in cardiac and skeletal muscle tissue. However, MDH, SDH and m-ATPase did not show significant changes in the affected tissues. EDAX study also showed remarkable differences in regard to distribution of elements in normal and affected cardiac muscle.

Colibacillosis was detected in 11 animals, affecting different species of deer, rhinoceros and elephant. Of these, *E.coli* with different serotype could be isolated in 7 cases. One rhinoceros had mixed infection of *E. coli* and *Candida* and the case was further studied by SEM and EDAX. On SEM, the arrangements of intestinal villi were found to be disrupted and distorted, and, on EDAX, the significant change of elements concentration like phosphorus, sulphur, iron and zinc were noticed. Five cases of bloat were recorded in the study and the condition was seen to be associated with ruminal impaction in three cases. One giraffe, one zebra and two rhinoceros were found to have died of senility and all showed a number of other associated lesions. The maximum life spans of rhinoceros found in the study are 52 years and 59 years, which are higher than the earlier reports.

Intestinal candidiasis in a black buck and in a sambar were seen in the study. Intussusception was the cause of death of an elephant and a nilgai. Volvulus was also recorded in another nilgai. In addition, hernia and cirrhosis of liver in a nilgai, dystocia in a sambar, shock in a barking deer, traumatic reticulopericarditis in a serow, metritis and pentonitis in a spotted deer and a white fallow deer were observed. Peracute mortality of a giraffe and organophosphorus poisoning of a zebra were also recorded in the investigation. The cases worth mentioning, which have been recorded in the study, are pseudo-tuberculosis in a blackbuck, necrobacillosis in a sambar and botryomycosis in a zebra. These three cases have been recorded for the first time in captive animals.

Death due to parasites were noticed in 7 animals in which mixed infection of Fasciola and Amphistomes in 3 animals, Haemonchosis and cestotodiasis in 2 animals each were recorded. The important finding in mithun was the presence of amphistomes in the oesophagus and trachea. The EDAX study of the bile concretions found in fasciola infection in mithun revealed

calcium, phosphorus and sulphur as the chemical constituents of the concretions.

In the present study, five types of neoplasms were found, of which only one was malignant in nature. The tumours recorded were fibroma, leiomyoma, adenoma, osteochrondroma and adenocarcinoma.

Out of 68 aortas studied for the presence of aortic lesions, 39 (57.35%) were found to be affected. The lesions observed were fatty streaks, fibrous plaque, calcification, aneurysm, parasitic infection and other miscellaneous conditions. In one sambar and in one giraffe, metaplastic changes were noticed in the atrio-vetricular septum and, on EDAX study, it was found to be composed of calcium, sulphur and phosphorus. SEM study of the parasitic lesions of aorta showed marked disruption and distortion of the endothelial surface.

During necropsy, the different parasites were identified as *Fasciola, Paramphistomum, Fischoederius, Gastrothylax, Cotylophoron, Homologaster, Haemonchus, Trichuris, Ascaris, Gongylonema, Moniezia, Cysticercus, Hydatid cyst,* and *Sarcocystis* in artiodactylids; *Kililuma, Bunostomum, Necator, Chabertia, Anoplocephala and Balantidium coli in rhinoceros; Habronema* and *Dictyocaulus* in zebra, and *Fasciola, Grammocehalus, Choniagium, Pseudodiscus* in elephant. The SEM study of a few parasites, viz. *Trichuris, Gongylonema* and *Anoplocephala* were undertaken along with the affected tissues to study the detailed cellular damages caused by them.

Faecal samples of 84 captive herbivores of the State Zoo and 47 tamed elephant of the Kaziranga National Park and the Manas Tiger Project were examined along with 214 faecal samples of free living wild herbivores of the Kaziranga National Park. Similar kinds of parasitic infection were noticed in both captive and free-living animals. The ova of parasites recorded were of *Fasciola, Paramphistomum, Strongyle, Strongyloides, Trichuris* and *Coccidia*. *Oesophagastomum* was recorded only in free-living animals.

It was seen from the study that the captive animals suffered from a wide variety of diseases, some of which are rare in occurance and now recorded for the first time in this study.

Reprint : Zoos' Print, 11 (10) : 11-12, October, 1996

INCIDENCE AND CAUSES OF MORTALITY IN CAPTIVE WILD HERBIVORES OF ASSAM STATE ZOO, INDIA:1985-1989.

A. Chakraborty * and B. Chaudhury

ABSTRACT

Incidence and causes of mortality of 214 captive wild herbivores of Assam State Zoo for a period of 5 years has been studied. The diagnosis of the causes of death was based on history of the case, gross and histopathology, bacteriological and mycological examination and other tests, as necessary. Of these 214 animals, 126 animals were adults, 55 were calves and 33 were subadults. Of these 125 were males and 89 were females. On the basis of diagnosis, the following conditions were recorded in decreasing frequency: traumatic injury with complications (34.11%), tuberculosis (19.62%), pneumonia (10.28%), neonatal mortality (7.47%), capture myopathy (6.54%), colibacillosis (5.14%), bloat (2.33%), senility (1.86%), mixed infections of *Fasciola* and amphistomes (1.40%) and intussusception and volvulus (1.40%). Candidiasis, haemonchosis, cestodiasis and metritis and peritonitis were recorded in 2 (0.93%) cases each, while pseudotuberculosis, necrobacillosis, botryomycosis, cirrhosis, shock, traumatic reticulo-pericarditis, hernia, dystokia and organophosphorus poisoning were recorded in 1 (0.46%) case each.

It was found in this study that the captive herbivores suffered from a wide variety of diseases, some of which are rare in occurence and have been recorded for the first time in this study.

INTRODUCTION

A systematic study of the incidence and etiopathology of mortality of captive wild animals is yet to be undertaken in our country. However, some preliminary studies have been carried out (Acharjyo and Rao, 1987a; Khan, 1979; Rao and Acharjyo, 1984 and Rathore and Khera, 1982). The present investigation was planned to study the incidence and cause of mortality of different captive wild herbivores of Assam State Zoo for a period of five years, 1985-1989.

MATERIALS AND METHODS

A total of 214 carcasses of 18 different species of herbivorous mammals of the State Zoo of Assam from 1985 to 1989 comprises the material for the present study. The different animals studied were of the order - Artiodactyla 195; Perissodactyla 16 and Proboscidea 3. Animals were arbitrarily divided into different age-classes: calf, subadult and adult. In the case of Artiodactylids, animals with 0-2 years of age were considered as calves, 3-5 years as subadults and those above 5 years as adults. In Perissodactylids it was 0-2 years, 3-10 years and above 10 years. In Proboscidea, it was 0-5 years for calves, 5-20 years for subadults and above 20 years for adults. The seasons were divided into premonsoon (March, April, May), monsoon (June, July, August, September), post-monsoon (October, November) and winter (December, January, Februrary) as per India Meterological data, Guwahati Airport.

RESULTS AND DISCUSSION

Altogether, 214 carcasses of captive wild herbivores from 1985 to 1989 were necropsied and diagnosis of causes of death were made on the basis of history of the case, gross and histopathological examination, microbiological, parasitological and chemical analysis of the tissue when warranted. The causes of death of the animals are presented in Table 1. The incidences of mortality in different species of animals in relation to age and sex are presented in Table 2. The highest mortality was recorded in adults (126) followed by calves (55) and subadults (33). Of these, 125 were males and 85 were females. The number of deaths in different months and years are presented in Figure 1 and 2 respectively. The highest mortality was observed in monsoon season and the lowest in the post-monsoon season.(Fig.3).

Cervids were the most commonly affected particularly Sambar deer. This might be due to the larger number of animals of this family kept at the Zoo. While this study recorded the highest mortality in adult animals, others have reported high mortality during the first year of life (Acharjyo and Rao, 1987b and Krikwood *et al.*, 1987). The high incidence of mortality in adults (58.87%) recorded in this study was due to tuberculosis and traumatic injuries. Incidence of mortality in relation to month and year did not show any significant variation. The effect of season was found to be statistically insignificant and similar findings have also been reported by Acharjyo and Rao (1987a). However, high mortality in the monsoon season was noticed in the years 1987, 1988 and 1989. High temperature and humidity during the monsoon season might be the factors responsible for high mortality during monsoon.

ACKNOWLEDGEMENT

The authors are grateful to the Forest Depatment, Government of Assam for their help and the first author expresses his gratitude to Council of Scientific and Industrial Research, New Delhi for the financial assistance in the form of Senior Research Fellowship.

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Table 1. Causes of mortality among animals of different families at Assam state zoo.

Causes of mortality	Artiodactyla					Perissodactyla		Proboscidae	Total Number
	Cervidae	Tragulidae	Bovidae	Giraffidae	Hippopotamidae	Equidae	Rhinocerotidae	Elephantidae	
Tuberculosis	32	-	8	2	-	-	-	-	42
Pseudotuberculosis	-	-	1	-	-	-	-	-	1
Necrobacillosis	1	-	-	-	-	-	-	-	1
Botryomycosis	-	-	-	-	-	1	-	-	1
Colibacillosis	3	1	4	-	-	-	2	1	11
Pneumonia :									
i) Bacterial	11	-	6	-	-	-	-	-	17
ii) Viral	2	-	-	-	-	-	-	-	2
iii) Mycotic	2	-	-	-	-	-	-	-	2
iv) Aspiratory	1	-	-	-	-	-	-	-	1
Candidiasis	1	-	1	-	-	-	-	-	2
Fascioliasisand Amphistomiasis	1	-	2	-	-	-	-	-	3
Haemonchosis	-	-	2	-	-	-	-	-	2
Cestodiosis	-	-	2	-	-	-	-	-	2
Traumatic injury	34	-	7	-	1	1	-	-	43
Complications due to injury	22	-	3	-	-	-	4	1	30

Table 2. Incidence of mortality in different species in relation to age and sex

Order	Family	Species	Total Nos.	Adult	Sub-adult	Calf	Male	Female
Artiodactyla	Cervidae (132)	Spotted deer	33	26	5	2	19	14
		Barking deer	41	22	7	12	24	17
		Sambar	42	28	6	8	25	17
		Hog deer	11	8	1	2	8	3
		Thamin deer	2	1	1	-	-	2
		White fallow deer	3	3	-	-	1	2
	Tragulidae (6)	Mouse deer	6	5	-	1	3	3
	Bovidae (49)	Nilgai	17	8	3	6	12	5
		Black buck	12	3	2	7	6	6
		Serow	12	3	2	7	6	6
		Ladakhi goat	3	1	1	1	2	1
		Mithun	4	2	-	2	2	2
		Water buffalo	1	1	-	-	-	1
	Giraffidae (5)	Giraffe	5	3	1	1	2	3
Perissodactyla	Hippopotamidae (3)	Hippopotamus	3	-	-	3	2	1
	Rhinocerodae (12)	Rhinoceros	12	4	2	6	9	3
	Equidae (4)	Zebra	4	3	1	-	1	3
Proboscidea	Elephantidae (3)	Asian Elephant	3	-	1	2	2	1
		Total	214	126	33	55	125	89

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Reprint : Zoos' Print, 7 (12) : 37-38, December, 1992 Nainital, U.P

DISEASES ENCOUNTERED IN WILD MAMMALS AND BIRDS IN TRIPURA.

Dr. S.K. Mitra and Dr. (Mrs.) N. Debnath

The Forest Department authorities of the Sepahijala Wildlife sanctuary used to send carcasses of wild animals and birds various diagnostic materials for laboratory examination to the Disease Investigation Laboratory, Abhoynagar, Agartala of Animal Husbandry Department., Government of Tripura. In this article, the diseases encountered in wild animals during our routine laboratory investigations during 1989 to 1991 are detailed. This information might be of help to those who are concerned about the disease pattern/ problem in wild animals.

Anthrax was found as the cause of death in Mithun *(Bos frontalis)*, Nilgai *(Boselaphus tragocamelus)* and Black buck *(Antilope cervicapra)*. All the animals reportedly to died suddenly with signs of profuse frothy discharge from the nostril. A Golden langur died of Colibacillosis. The isolate, which was recovered from the Golden langur, was characterised by the C.R.I., Govt. of India, Kasuali, Himachal Pradesh as *E. Coli*, 0141. Postmortem examination of one each of Chinkara *(Gazella bennetti)*, a leopard cat *(Felis bengalensis)*, a flamingo and three Golden langurs revealed major changes in the lungs only. Pneumonia was ascribed as the cause of death in animals. Enteritis was the cause of death in one Leopard, one Clouded Leopard, one migratory bird *(Dendrocona javanica)* and two Demoiselle cranes *(Anthropoides virgo)*. Intestinal mucosae of one Spectacled monkey *(Presbytis phayrei)* showed a characteristic nodulation. Faecal sample of this animal was found positive for the ova of Oesophagostomum spp., suggesting the presence of Oesophagostomiasis or "pimply gut."

Severe infection with Strongyloides spp. was attributed as the cause of death in one Black buck, Hoolock Gibbon *(Hylobates hoolock)* and an Indian Giant Squirrel *(Ratufa indica)*. One each of Golden langur, Demoiselle crane and Barheaded ghoose *(Anser indicus)* were found to be suffering from capillariosis tapeworm infection was noted in one Burmese peacock *(Polyplectron bicalcaratum)*. coccidiosis was the cause of death in a Chinkara, partrige *(Arborophila sp.)* and Chuckor *(Alextrosi chukor)*.

Routine examination of faecal samples of different wild animals and birds showed the following parasitic infection. The table shows that the wild animals and birds of this region mostly suffer from parasites of Nematode group.

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INCIDENCE OF PARASITIC INFECTIONS IN WILD MAMMALS AND BIRDS OF SEPAHIJALÁ WILDLIFE SANCTUARY (ZOO COMPLEX), AGARTALA DURING 1989-1991

Sl.No. Species	Nos of faecal samples examined	Positive samples	Negative samples	Name of the parasites Strongyle	Strogyloides	Trichuris	Roundworm	Lungfluke	Capillaria.
1. Hoolock Gibbon *(Hylobates hoolock)*	16	10	6	6	2	2	-	-	-
2. Golden cat *(Felis temminckl)*	8	2	6	-	-	-	1	1	-
3. Golden langur *(Presbytis geei)*	12	5	7	-	2	3	-	-	-
4. Mithun *(Bos frontalis)*	2	-	2	-	-	-	-	-	-
5. Leopard *(Panthera pardus)*	27	8	19	-	2	-	4	2	-
6. Lion *(Panthera leo)*	34	17	17	2	-	1	8	6	-
7. Royal Bengal tiger *(Panthera tigris)*	1	0	1	-	-	-	-	-	-
8. Spectacled monkey *(P. Phayrei)*	6	3	3	-	-	3	-	-	-
9. Saras *(Grus antigoue)*	2	1	1	-	-	1	-	-	-
10. Black necked stork *(Ephippiorhynchus asiaticus)*	2	0	2	-	-	-	-	-	-
11. Hawk eagle *(Spiactus arrhatus)*	1	0	1	-	-	-	-	-	-
12. Peacock *(Pavo cristatus)*	4	3	1	-	-	-	1	-	2
13. Emerald Dove *(Chalcophaps indica)*	2	1	1	-	-	-	1	-	-
14. Indian Giant Squirrel *(Ratufa indica)*	4	4	0	4	-	-	-	-	-
TOTAL	121	54	67	12	6	10	15	9	2

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MORTALITY IN GHARIAL (*GAVIALIS GANGETICUS*) HATCHLINGS AT JAIPUR ZOO

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Male and female gharials are being kept together in water pond at Jaipur Zoo. During the period of two years, i.e., 1997-98 and 1998-99 from July to November, mortality in gharial hatchlings was recorded. There was history of sudden death in the age groups about 10 days to four months. The animals failed to show any significant symptom before death. Following hatching the animals were kept separately in small cages measuring about 2x2 ft., made up of wood with sand bedding. The hatchlings had free access to water.

Post-mortem examination of hatchling carcases showed congestion and haemorrhages at umbilical region in very young animals. There was marked deposition of yolk also. Yolk deposits were absent in one-and-half month olds. All vital organs showed severe congestion and patichial haemorrhages. Out of 17 carcasses examined, about six revealed the accumulation of foul smelling fluid in abdominal cavity. All animals were being fed with small fresh water fishes manually. The impression smears of freshly cut edges of different visceral organs were stained with gram's stain, methylene blue stain and giemsa's stain to record the presence of bacteria. Simultaneously, with the help of sterile swabs, biological samples were collected from freshly cut edges of vital organs and from abdominal fluid for bacterial cultural examination. All samples were streaked on Nutrient agar, McConkey agar and Sabouraud agar media. The inoculated plates were incubated at 37°C and the bacterial growth so obtained was subjected to generic and species identification tests as per standard microbiological procedures. The pure culture isolates were also subjected to determination of antibiotic sensitivity pattern against a set of 10 antibiotics and chemotherapeutic agents.

Table 1. Number of bacterial isolates recovered from postmortem examination of 17 gharial hatchlings.

Bacterial genera	Viscera (17)*	Water (6)*	Soil (6)*
Staphylococcus sp.	3	-	-
E. coli	17	6	6
Pseudomonas aeruginosa	11	6	6
Corynebacterium sp.	8	2	3
Bacillus sp.	14	6	5
Mycotic agent (Fungus)	6	6	6

* Number of samples examined.

Bacteriological cultural examination resulted in the isolation of a multitude of organisms indicating septicaemia. The numbers of samples examined and number of bacterial isolates identified along with the demonstration of mycotic agents are given in Table 1. The antibiotic sensitivity pattern and number of isolates resistant are given in Table 2.

Apart from isolation and identification of bacterial and mycotic causal agents from the carasses, attempts were also made to screen soil and water samples for demonstration of the presence of similar bacterial agents in soil and water as source of infection.

Table 2. Antibiotic sensitivity pattern of bacterial isolates recovered from carcasses of gharial hatchlings

Antibiotics	*E. coli* (20)*	*Pseudomonas* sp. (10)*	*Coryne-bacterium* sp. (10)*	*Bacillus* sp. (10)*	*Staphylococcus* (3)*
Ciprofloxacin	4	5	1	5	0
Norflox	7	5	1	5	0
Cloxacillin	10	4	3	4	1
Chloramphenial	4	4	4	4	0
Trimethoprim	12	7	3	7	1
Oxyetracycline	12	9	4	7	1
Nitrofurantoin	9	4	3	4	0

* Number of repeats.

Received 4 August 1999 *Accepted 2 February 2000*

Saprophytic soil and water bacteria were commonly encountered in carasses of gharial hatchlings along with human and animal gutflora. *Escherichia coli* (17), *Pseudomonas aeruginosa* (11), *Corynebacterium* sp. (8), *Bacillus* sp. (14) and *Staphylococcus* sp. (3) were isolated and identified as major causes of septicaemia. On Sabauraud agar medium only six samples yielded mycotic growth. Similar bacterial and mycotic causal agents could also be recovered from water and soil samples suggestive of the source of infection.

Similar observations have been made by Arora and Kumar (1985-89) who isolated *Corynebacterium bovis*, *Pseudomonas aeruginosa* and *E. coli* from digestive contents of dead gharial (*Gavialis gangeticus*) hatchlings kept at Crocodile Rehabilitation Centre, Kukrail (UP).

The bacterial isolates from carasses, soil and water were found to be highly susceptibile to commonly used antibiotics like ciprofloxacin, norflox, and chloramphenicol in comparison to oxytetracycline, cotrimizole, cloxacillin and nitrofurantoin.

The present incidence of mortality due to septicaemia in gharial hatchlings, suggests that the gharials need fresh running water as opposed to the present stagnant pond system.

Acknowledgement

The authors are grateful to the Director Research (Veterinary and Animal Science), Rajasthan Agricultural University, Bikaner and Incharge Jaipur Zoo for providing facilities to carry out the work.

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Reprint : Zoos' Print, 8 (11) : 26-27, November, 1993

CONTROLLING MUSTH ELEPHANTS BY TRANQUILIZATION: TWO CONTRASTING CASES

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Asian elephant cows are comperatively more docile than the bulls. As bulls become aggressive and restless during musth, they become unreliable to work with. We present two contrasting cases of elephant musth. In both the cases, the bulls had gone out of control of their Mahouts. Three days of strenuous efforts to capture and chain the animals was all in vain. As a last resort, both the elephants had to be chemically immobilized and captured, to prevent possible threat to human lives and their properties.

First Case :

During July'91 an elephant with it's Mahout was proceeding from Ahmedabad to Indore. The animal was normal and was under control of it's Mahout till they covered about 100 km from Ahmedabad. The elephant started showing signs of restlessness, aggression and was reluctant to obey the Mahout. The elephant started running in every direction with his Mahout on it's back trying to control the animal with oral commands and ankush. After about 2 hours the Mahout managed to get down and run away from the elephant. Many attempts were made to control the animal, but in vain. Every approach was countered with fierce charging. The animal has been purchased hardly two months before the incident took place. The animal had behaved normally with it's new owner. It all started when the new Mahout removed all chains that were tied to the legs of the elephant. The Mahout reported the incident to the Godhara Police station and also contacted the Divisional Forest Officer of Godhara and Wildlife Conservator of Baroda and requested them to shoot the elephant for public safety. Wildlife conservator Mr. K. R. Ladwa phoned to Junagadh Sakkarbaugh Zoo and asked for help. Meanwhile experts from Baroda Zoo and Ahmedabad Zoo were also called to tackle the situation.

When we arrived at the place, the animal was standing and grazing in a field, away from human habitations. According to the Mahout, the elephant had damaged a small hut. The elephant kept charging at those who attempted to go near.

After assessing the situation, it was decided to immobilise the animal. At 9.45 hr. the animal was given 3ml. of Immobilon (containing 2.45 mg atropine hydrochloride & 10 mg Acepromazine hydrochloride) with Dist. Inject pistol in a 3ml. aluminium dart. But the dart bounced off the body. When the animal did not show any sign of drug effect, a second dose of 3ml. Immobilon was given at 10.15 A.M. The animal moved about 150 metres from the darted site started showing signs of loss of muscular coordination after 20 minutes. He kept his hind legs apart, trunk relaxed and sat down taking a hunch back position. The animal was fully anaesthesized. Ocular and auditory reflexes were poor. No pedal or caudae reflexes were noticed. The animal was chained properly and tied to a nearby tree. At 10.45 hrs. 225mg. Xylazine was given I/m to prolong the period of tranquillisation after recovery from immobilon. Subsequently 3 ml and 6ml of Revivon was administered I/m & I/v respectively. After 1 minute, the animal started showing signs of recovery and on the 3rd minute, it was standing on its legs. The animal was observed for about three hours after recovery, for any possible complication.

Second Case:

During May '93, we came across a similar kind of incident when an elephant bull went out of control. This animal also had an history of Musth. When we reached the place the elephant was standing on a field and a big crowd had gathered watching the animal from a distance. It was a 35 year old bull in Musth. In this case also, the incident started when the Mahout, decided to unchain the animal after elephant had moved about 100km. from a place. Immediately after being freed, the elephant escaped and started running.

It was decided to tranquilize the animal, as other means of restraint did not prove to be fruitful.

A three ml aluminium dart was prepared with Immobilon and a Dist-Inject pistol was used for darting. First two darts failed to hit the target properly as they bounced off. A third dart was prepared and fired at 7.45 hr. This dart properly injected the drug on the rump. The animal started showing signs of loss of coordination after three minutes of injection and at the 15th minute, it was on lateral recumbency. The animal was properly secured by chaining all four legs to a nearby tree. After 15 minutes of anaesthesia, 600 mg of Xylazine hydrochloride was administered I/m. Later Revivon was given I/m & I/v respectively. The animal did not show any sign of recovery. Further administration of 3 ml Revivon I/v after 10 ml also failed to revive the animals. Again 2 ml. Revivon was given I/v after 20 minutes. The animal did not show any signs of recovery even after 3 hours. As a supportive therapy injections Dexamethazone and Dextrose 5% with Normal saline were given I/v. After about four hours of anaesthesia the animal started showing some reflexes of the eye, ear and tail. After five hours it was moving all four legs and was trying to obey oral commands, but could not raise the head. After this, recovery was extremely slow. Though the elephant showed signs of recovery, it went back to the state of deep sleep with no response to external stimuli. Durng the entire course of anaesthesia, the elephant was having fairly constant rectal temparature (98°F), respiration (9 to 10 minute) and heart rate (48 to 50 minute). By 18.30 Hrs. all signs of recovery were seen.

The animal was found opening its eyes, flapping its ears & moving its trunk. Though signs of dragging the legs was evident, the animal again went to sleep and did not show

much improvement. On the next morning, all reflexes were more prominent. We thought that the elephant may stand up if given some support. At 11.30 hrs, the head was tied to a tractor and with the additional help of villagers, attempts were made to raise the head, but in vain. On the second day evening at 17.00 hrs, the elephant raised the head 2 feet above the ground and made all efforts to get up. It ate 5kg of Jaggery with some rotis. After 19.30 hrs, the elephant made many attempts to raise its head and could manage to lift its head about 3 feet above the ground. Though leg movements were evident, the animal was recumbent throughout the night.

On the third day morning the animal was looking more active and strong. A 10 x 10 x 2 cubic feet pit was prepared. The hind portion of the animal was shifted in the pit, so as to raise the fore legs and head, with the help of more than 25 villagers and oral commands by mahouts, It was possible to make the animal stand on it's feet at 9.00 hrs.

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The elephant was standing, obeying all commands, further feeding and taking water. The elephant was closely observed for a further 10 hours and was found to be slowly getting stronger and more active. The elephant looked completely normal by the evening.

It took about 50 hours for the second animal to be able to stand up. A supportive therapy of 15 litres of I/v fluid with 70 ml of Dexamethazone and 150 ml of Terramycin injections were given. The animal had to be kept completely wet with a large amount of water to keep it cool during the very hot summer. More than two litres of secretion could have oozed out of the musth gland of the second elephant on third day. Moreover, there was continuous urination for more than 40 hours after anaesthesia. We were able to save the second animal only with the help of villagers. About 100 women worked for 5 to 6 hours for two days just to spray water on the animal so as to maintain temperature of the animal.

If tranquillization method was not carried out, the animal would have been shot for public safety in both the cases. Timely action taken by zoo personnels saved the life of both the animals. We were told by the owner of the elephant ("Sadhus") that shooting was the usual practice to deal with musth elephants.

Reprint : Zoos' Print, 9 (9) : 12, September, 1994

MANAGEMENT OF MUSTH IN A MALE AFRICAN ELEPHANT BY CHEMICAL SEDATIVES IN THE ASSAM STATE ZOO, GUWAHATI

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INTRODUCTION

A pair of African elephants were brought to the Assam State Zoo, Guwahati on 5.10.74 from the Southwich Birds and Animals Inc., Blackstone, U.S.A. Both were about three years old. The male was named Lakhiprasad and the female as Rupa.

The two African elephants lived together till 7.2.93 until the female died of Lymphosarcoma on that date. Though they lived together for such a long period of time (about 19 years), they never tried to mate. Every day they were taken out from their enclosure into the remote jungle within the zoo area for grazing, exercise and for bathing in a pond. Though they seemed to indulge in sexual foreplays, they never attempted to mate. The female never showed any sign of heat which may have been due to her chronic illness.

Suddenly on the of 25th of November 1992, the elephant bull started showing certain behaviour with a little agressiveness and not intending to obey his master. He was chained immediately on the neck and forelegs. He started micturating frequently and protruded an erect penis for a long time, striking on his belly.

There was a prominent bulge in the perineal region and a fishy smelling oily secretion was seen coming out of the temporal glands. Frequent dribbling of urine was also observed. Gradually the animal became more violent, on trying to attack people.

These external manifestation were sufficient to indicate that the elephant is in musth. Unlike Asian elephant, both male and female African elephants come to musth after sexual maturity. Once the female African elephant was also passing through the stages of musth but in a much milder form. As she was under the treatment of her illness, sedatives were not given and within 3 days she became normal.

MEASURES ADOPTED

Immediately the female was separated to avoid any unwanted injuries caused by the male. The wooden bridge over the dry moat was removed so that the male could not come out of the enclosure even if his chains. Concentrate fed to him was reduced to half of its normal quantity. Water was sprayed over his body from a distance. Since the elephant was properly chained and secured and as he was not refusing to take food, the idea of darting him with tranquilizing drugs was dropped. We decided to keep the elephant under mild sedation by administring drugs orally till the animal reverted to normal.

Initially, Diazepam (Valium 10 - Roche Product Ltd. Bombay) (Dose: 400 mg in the morning and 200 mg in the evening i.e. 600 mg/day) was used for inducing sedation. Tablets were put inside Athia bananas and were placed at a distance from the elephant.

Diazepam 600 mg/day was continued for 5 days. As the animal was getting increasingly quiet, the dose was tappered down to 100 mg/day and continued for another 5 days. In the mean time, the bulk of concentrates were gradually increased. Later, the dose of Diazepam was further reduced to 100 mg/day and this was continued for another 10 days. Meanwhile the concentrate was also increased.

On the 20th day of treatment, drug administration was completely stopped and the usual diet scale of the elephant was resumed. This experience showed us that Diazepam can be used to control musth in male African elephant within a span of 20 days.

SECOND OCCURRENCE

The same male African elephant started showing similar musth behaviour after about 10 months i.e. on 29th September 1993. This time instead of Diazepam, it was decided to use another sedative, Lorazepam (Calmese 2 Themis Chemical Ltd. Gujarat) (Dose : 40 mg in the morning and 40 mg in evening i.e. 80 mg/day). After 3 days of Lorazepam treatment, the animal was found 50% stable. Then the dose was reduced to 40 mg/day and was continued for another 3 days, followed by 10 mg/ day for 4 days. On the next 10th day of treatment with Lorazepam, the animal was found to be normal.

SUBSEQUENT OCCURRENCES

Lakhiprasad started showing similar musth behaviour again on 5-1-94 and on 6-4-94 but in a milder form. Unlike last time, it was decided to use Lorazepam instead of Diazepam. In these two last occasions, Lorazepam was administered in a dose of 20 mg/day for 5 days. The mode of administration of drugs as well as other measures adopted were the same as done in the previous occurrences. The dose of Lorazepam was reduced to 10 mg/day for the next 5 days. After 10 days of treatment, the animal was seen normal.

CONCLUSION

In the first occasion, a total dose of 600 mg of Diazepam was administered for a period of 20 days to control musth. But in the second occasion, a total dose of 400 mg of Lorazepam was given for a period of 10 days. Again in the third and fourth occasions, the dose of Lorazepam was reduced upto 150 mg for a span of 10 days as the last two occurrences were milder. The amount of secretion coming out of the temporal glands was much less in the last two stages than that of the first two occasions. It could be observed from the above experience that Lorazepam has high potency & safety and also demands low volume and takes less time for controlling musth in African elephants.

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Reprint : Zoos' Print, 11 (4) : 21-22, April, 1996

MUSTH AND ITS MANAGEMENT IN ASIAN ELEPHANT: A DISCUSSION BASED ON FOUR CLINICAL CASES

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CASE NO. 1

Manik, a 28 years old robust working tusker of Arunachal Pradesh stayed idle for about a fortnight but enjoyed full ration and free grazing. One fine morning in mid January, 1994; the handler got the shock of his life, when the mammoth pachyderm charged him showing all the signs of a killer. He merely escaped by climbing a nearby tree, and from the tree-top he could see the temporal secretions in full flow. Fortunately, a chained female elephant from the viscinity kept Manik fondling her and away from the human habitations. As the cow elephant was not in season, mating was not allowed, but Manik would leave her company 5 - 6 times a day only to take bath in the ice cool water of a nearby hill stream. It was interesting to note that the same elephant was very reluctant to take bath in that water in normal conditions and took bath only once a day.

On 27th January, 5 mg of etorphine was injected through a projectile syringe from a tree -top; the canula stuck the elephant by the side of the back region and the charging tusker was immobilized within 3-4 minutes. The trunk, penis and tail became relaxed and profuse salivation occurred. As the tethering operation started, the elephant floundered badly and apprehending a violent fall, 5 mg of Diprenorphine was injected i/v/ at the 9th minute, and hurriedly chained him to a nearby tree. The reversal was remarkable with 2-3 minutes and again xylazine 200 mg was injected by the projectile syringe to keep the animal in sedation. Next morning, 400 mg xylazine was administered similarly and chaining was completed to perfection. From third day onwards, Diazepam 1500 mg was given orally in water or food reducing the dose at the rate of 100 mg daily and withdrawn after a fortnight. During this entire period of rehabilitation, the food was restricted but abundant intake of water was allowed. Cold water was also sprayed over the body 4-5 times daily. The handlers stayed with him all the time, and the rogue regained his normal temperament in 20 days.

CASE NO. 2

Exactly after a month, another bull of 30 years of age in the North Cachar Hills, called by the same name (Manik) developed musth and played a havoc in several villages. He destroyed quite a number of huts, a P.W.D. bungalow, a truck and a Vinear Mill. One "Phundi" (elephant capturer) was brutally killed when he tried to put traps around the neck of the elephant. He also enjoyed full ration and free grazing for a fortnight without any work. Though both his forelimbs were loosely chained, the devilish giant could move in an unbelievable speed. He also took the company of a female elephant (9-10 years of age) and both of them roamed about in the dense jungle in a very steep hillside of about twelve sq. km. area. Worse than that was the presence of 5 wild and 4 other domestic elephants at the same jungle. Only after 36 hours of search the animals were located resting some 20 meters below us. The hill was not very steep in that site but a shallow gorge separated us from the courting couple. Although no suitable tree could be found to climb, yet 6 mg of etorphine was loaded in the synnge fitted to the projector and triggered. Unfortunately the synnge got diverted due to the hanging branch of a tree that came in between. On hearing the sound the elephant raised his head, lifted his trunk and violently charged by trumpetting thunderously. Immediately the second rifle loaded with 500 mg xylazine was fired and the syringe hit the triceps and stuck firmly. The rogue suddenly came to a halt, went back for few steps and shook his whole body, particularly the head but stopped charging. The female company, half his size, stayed close to him. Within, 13 minutes, the sings of relaxation appeared, penis protruded out slowly with reduced tail and trunk movements. In about 25 minutes, all these organs appeared limping, head lowered, with profuse salivation and eyes appeared sleepy. When the female was held and separated by expert handlers, she offered considerable resistance, and on examination she was found in season (pregnancy was confirmed one year later). The rogue was chained and rehabilitated similar to case no. 2 and he became normal within 20 days.

CASE NO. 3

In the first week of April, 1994, 'Madan' a bull from Sonapur area near Guwahati exhibited musth (under similar conditions like rest, full ration, prime age) with full flow of ruttish waters from both the temples. He got hooked to a female elephant that was chained loosely to a tree in a highland encircled by cluster of villages. The female was in season and the villagers saw the rare scene of 5 bouts of sexual congress within 2 hours in the morning before the authors reached the site. The area was an open space except a small extension of a bamboo grove 30 meters away from the courting couple. An elephant handler mounted on another male was asked to appear before the rogue. As expected, the musth bull came charging violently and once he came within close range, we fired at the triceps which hit the target and stuck firmly. This time 500 mg of xylazine was used. The elephant took few steps back, turned round and walked slowly on the opposite direction. The animal was immobilized in 25 minutes similar to case no. 2. Usual rehabilitating procedures controlled the musth within 20 days time.

CASE NO. 4

A vigorous male in his thirties near Haflong (N.C. Hills) developed musth in August, 1994. He was in company of two females but both were out of season. He was darted with 500 mg xylazine following which he walked 100 meters away before being immobilized. Rehabilitation was achieved as in Case No.2.

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DISCUSSION

Drugs

High dose of xylazine was found suitable to immobilize 'musth' elephants, as the elephants retain the standing posture enabling satisfactory chaining operation. With etorphine, immobilization was perfect, but apt to go down to recumbency where chaining would make standing difficult if not impossible after reversal. In case no. 1 the elephant almost fell down during the chaining period, which could have caused accidental injury to the elephant or crushing of personnel. However, relatively longer induction time with xylazine could also cause danger if he continues to charge or move away to a very steep site, from where he could roll down as sedation supervenes. Therefore, in the selection of immobilizing agents, the topography of the area and personnel safety should also be considered. In case nos. 2,3 and 4, the elephants went back after being hit by the projectile syringe and stopped charging after receiving high doses of xylazine. The darting equipments should be fresh and reliable.

Age and sex

All the six 'musth' elephants were male and in their prime ages. This observation supports the statements of Jainudeen *et al.* (1972a), Schmidt (1978) and Stracey (1991). However, in rare occasions musth was also observed in female elephants (Pathak, 1991). According to Jainudeen *et al.* (1972b) the phenomenon of musth is related to the level of testosterone in blood plasma which increases from 0.2 - 1.4 ng/ml during the non-musth phase to 29.6 - 65.4 ng/ml during the full musth phase.

Season

Generally winter season has been found to be the period of development of musth. Similar observation was made by Cheeran *et al.* (1991). Stracey (1991) also mentioned about a great tusker in Nepal 'Hanprasad' that exhibited musth in every rainy season. Sabapara and Raval (1993) also observed musth during the summer months.

Rehabilitation

Restriction of food, and gradually lowering doses of diazepam after initial use of xylazine for tethering that was followed in these cases was found suitable. No lasting adverse effects of such medications could be noticed. Constant assurance and nursing during the rehabilitation period from the handler might also have contributed to early psychological rehabilitation of the musth elephants.

Conditions common as observed in all these cases that have led to the development of musth were-

1. Prime age (Young adult)
2. Period of rest (10-15 days)
3. Full ration.

Signs showed by the musth bulls as observed by the authors

1. Putting on weight.
2. Tar coloured pungent smelling secretions from both the temporal glands which were greatly enlarged.
3. Frequent erection of penis.
4. Marked swelling of the perineal region.
5. Frequent micturation of low volume of urine.

Behavioural changes

1. Frequent bath and spraying of cool water onto the body.
2. Craze for female company and highly remarkable libido, attacking and injuring non-cooperative females.
3. Contrary to their affinity towards females, the musth bulls were violent towards other males (Case no. 3). Normal male, irrespective of his size or strength, trembled and ran away at the sight of a musth bull. Such observation was also made by Williams (1950).
4. Human and their voice put musth elephant into violent temper. It was interesting to note, however, that even at the height of the musth phase, the elephants responded to many verbal commands of their mahouts.

Flower (1973) reported euthenesia of dangerous Asian bulls when they attain puberty (probably musth) and became violent. Stracey (1991) reported numerous incidence of such killings. The present approach of the authors could safely restrain and rehabilitate such bulls and avoid the merciless slaughters.

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Reprint : Zoos' Print, 11 (4) : 23-24, April, 1996

MANAGEMENT OF MUSTH IN INDIAN ELEPHANT IN MYSORE ZOO - A case study

S.C. Valandikar* and R. Raju**

Musth is a regular physiological and behavioural phenomenon of bull in Asian elephants. The typical picture of musth in a bull elephant includes some or all of the following: significantly elevated serum testosterone level, aggresive behaviour, drainage of fluid from the temporal glands on the sides of the head between ear and eye; dribbling of urine from the prepuce, somnolense, anorexia, dehydration and unusual vocalizations (eg, groaning) (Fowler, 1992). Bull elephants are difficult to control and may be dangerous to manage during musth and may attack fellow animals and human beings and kill them.

CASE HISTORY

We noticed an unusually a long period of musth (5 months) in our Indian elephant, named Ganesha, aged 66 years of age. He was aggresive in nature, ferocious in the behaviour. We noticed oozing of oily fluid from the temporal gland on, 1.12.1993. the elephant was restrained, all his four legs on the platform, where he was standing and taking rest. Oozing of fluid increased after one month (1.1.1994). He was found very much aggresive and uncooperative and frenzy in behaviour. The secretion of fluid found still more comparatively on 1.1.1994. He was found to be problematic and cunning. He even managed to break down the metal chain, and started damaging the surrounding trees and plants. He attacked and crushed the bullock cart, which came for unloading the grass to feed him and the bullock escaped narrowly from the enclosures. Somehow, he was again on the platform with the help of Zoo-Workers.

MANAGEMENT

To control his unruly aggresive behaviour, tranquilizers were used. Xylase (Parnoli Lab.Aust. 100 mg/ml. of Xylazine HCl) 150 mg injected IMLY and he was calmed down within 30-40 minutes. This was continued daily but the elephant remained in musth till (22.4.1994) Dr. Cherian, of Veterinary College, Trichur, (Kerala) visited this Zoo and advised the following line of treatment, besides Xylazine HCl, 100 mg daily. (a). Haloperidol, (Ethnor, 10 mg/tablet) 40 mg each time orally 12 hourly, morning and evening for a week. (b). Lasix (Hoechst, India, Ltd, Frusemide 10 mg/tab. 40 mg (4 tablets) 20 tablets each time orally morning and evening for first 4 days and 10 tablets the remaining 4 days was given.

During the period of musth, following diet was given, which is said to be calming effect on the body. (a) Boiled rice = 5kgs, (b) Soaked green gram = 2 kgs, (c) onion = 2 kgs and (d) curds = 3 liters. All this mixed together, twice a day, in addition to normal food of leaves and raw rice. The elephant was kept on this special diet for nearly three months. In addition, (e) Ragi balls in curds or butter-milk, was fed.

RESULTS AND DISCUSSION

The above medicines and diet, when given to the elephant helped us a lot to bring down the musth. The fluid oozing from the temporal gland was diminished. He was found normal in behaviour and obeying the orders of the Mahout. The embeded chain was removed from the hind limb on 20.5.1994 and subsequently he was released. The elephant was kept on the special diet for nearly three months, after which the normal diet was given.

We could notice that there was considerable change in the behaviour of our Indian, (white) elephant, due to administration of Xylazine HCl, Haloperidol, and Lasix as guided by Dr. Cheeran and the elephant could be controlled out of the musth, which was lasted unusually long for a period of five months. Fowler has recorded an elephant in musth even for a year. We used Xylazine HCl alone (100 mg) and gave good results in tranquilising the animal, which acts on CNS. The Xylazine HCl usually can be used in combination with Ketamine HCl, depending upon different situations, like anaesthesia, for close observations, operations and surgical intervention. Fowler (1992) suggested use of Xylazine HCl in combination with Ketamine HCl in affective monitoring of elephant, and the authors agree with this view, but we practiced Xylazine HCl, 150 mg and subsequently 100mg, alone in management of musth and could not notice any bad effect, except standing, which may be he could not sit due to hobbling of his fore and hind limbs. The use of sedatives like ketamine HCl are worth to practice along with Xylazine HCl. He further recommended that, the sedatives (like Ketamine HCl) not to be used in the field immobilization of elephants, unless they are required to be transported or closely monitored under controllable conditions. The use of Haloperidol gradually helped to modify his aggressive behaviour. It is said to be sedative and psychotrophic effect on CNS but this has not been evaluated fully. The continuous use of Lasix in high doses (besides diuretic) said to be diminishing effect on testosterone level of serum. It causes impotency on prolonged use in human beings and it may be the same effect here also on Indian elephant. Fowler (1992) mentioned successful use of drug Lupron (Takedda, Abbott) in controlling the musth. It has been demonstrated that 45 mg of Lupron i.m. can reduce the elevated serum level of testosterone to the castration level in three weeks, but we have not tried. The effect of spraying water on the body of elephant, in the hot summer of April and May, helped us to recover the animal faster from the restlessness and it is nothing to do with the temperature of the body. Musth usually occur at about the same time of the year for each individual bull, beginning at the age of 10-15 years but in case of Ganesha, we observed the above same pattern. He again

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came in Musth as usual during 1994 and 1995 and the musth disappeared on the same pattern of last year. It was very much surprising to note, the occurrence of musth at the ripe age of 64-66, that too in high intensity and for a prolonged penod of 5 months at regular interval. We agree with the view of Fowler (1992) on the musth periods which is longer in elephants kept in captivity and the same holds good with our Indian elephant in Mysore Zoo. The musth become more severe as the bull reaches his prime. Typically, musth lasts for 6 to 12 weeks, but year-long-musth have been observed, as in case of Indian elephant. Bulls in depths of musth are often anorexic by choice, and we found this to be true.

SUMMARY

A successful management of musth in Indian white elephant, in Mysore Zoo, by use of Xylase, Haloperidol and Lasix along with special diet has been recorded during the year 1994 and 1995. This is the first time, that Haloperidol and Lasix have been used to control musth.

ACKNOWLEDGEMENT

Thanks are due to Dr. J.V. Cherian, Professor of Pharmacology, Veterinary College, Trichur, Mannuthy, Kerala for his guidance and timely help.

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Reprint : Zoos' Print, 11 (4) : 25-26, April, 1996

USE OF ANTIANDROGEN IN CONTROLLING MUSTH IN CAPTIVE ELEPHANTS

K. Chandrasekharan and Jacob V.Cheeran

Adult male Asian elephants and both sexes of African elephants manifest annually a physiological and behavioural phenomenon known as musth. This condition is charactensed by enlargement of temporal glands with copious flow of secretion and aggressive episodes. The main manifestations are spreading of ears, alertness, fully opened oging eyes with roving eye balls, stiff and tense body, extended blowing trunk and a charging or destructing tendency towards human beings especially mahouts. This condition is mostly seen during winter season and the elephant is to be tethered safely by putting chains on both front and hind legs. The symptoms and behavioural changes of musth usually last for one to three months or some time up to five months and their intensity varies in pre-musth, violent musth and post-musth phases. (Jainudeen *et al*, 1971 and Chandrasekharan *et al*, 1989). The androgen level in the blood usually increases considerably during the period of musth and it is stated to be the reason for the increased aggressive behaviour in musth elephants (Jainudeen *et al*, 1972; Rasmussen *et al*, 1984; Cooper *et al*, 1990 and Niemuller and Liptrap, 1991). Where as Flanagan and Flanagan (1983) observed reduction in aggressiveness in castrated bull elephant. Based on these hypotheses, a trial with the oral administration of an antiandrogen, a sedative and diuretic was undertaken in elephants under pre-musth and in the last phase of violent musth in order to make them more tractable and can be put to use and the results are furnished in this paper.

MATERIALS AND METHOD

During the present study 22 captive elephants showing different phases of musth, maintained by private individuals and Devaswoms in different parts of Kerala were selected. The age of the elephants varied from 25 to 65 years. Nineteen elephants were in the pre-musth phase showing reluctance to obey the commands of mahouts, slight engorgement of temporal glands with small quantity of discharge at the temporal opening, enlargement at the phase of violent musth showed slight regression of the temporal glands with flowing discharge, dribling urination and charging tendency against mahouts. Flutamide (Drogenil 250mg tab, Fulford (India) Ltd., Bombay) is a potent non-steroidal antiandrogen, haloperidol (Serenace 10mg tab, Searle (India) Ltd., Bombay) a sedative and potassium iodide a diuretic were powdered, concealed with in jaggery bolus and administered orally to each elephant. Flutamide @ 2500 mg., 5000mg and 7500mg was administered to five, ten and four elephants respectively during their pre-musth phase and @ 5000mg to three elephants in the last phase of musth once daily for continously three days. Haloperidol @ 100mg and Pot. iodide @ 20gm per animal per day were also administered to all the 22elephants.

The change in the behaviour and other symptoms of musth were observed for a period of two months and all the elephants were fed with sufficient quantity of palm leaves and water. The elephants in pre-musth phase were engaged for usual work but the elephants in the last phase of musth were under full restrainments with chain on both hind and front legs.

RESULTS AND DISCUSSION

Elphants in pre-musth :

The enlargement of temporal glands, tendency to masturbate, swelling at the base of the penis have reduced considerably in two elephants from three days onwards following administration of flutamide @ 2500 mg/animal. All these two elephants came into musth after 30 days and lasted for three months but with reduced aggressiveness. Other three elephants started showing musth symptoms on the 15th, 20th and 25th day following the treatment with all its charactenstic musth symptoms.

Out of the ten elephants received flutamide @ 5000mg, seven elephants showed reduced musth symptoms from the second day onwards and came into musth after 45 to 60 days and lasted for two to three months with less agressiveness. Other three elephants in the group failed to show musth symptoms during the stipulated period but came into musth as usual during subsequent season.

All the four elephants dosed with flutamide @ 7500mg did not show musth symptoms in the stipulated time and were normal in behaviour. They came into musth in next season as usual.

Elephants in the last phase of musth :

All the three elephants, administered flutamide @ 5000mg started to show reduction of all the musth symptoms from the second day onwards and became normal in behaviour and activities. They were released from the tethering site on the 5th, 7th and 10th day and were used for routine festival parade and work.

Flutamide was absorbed rapidly after administration and gets converted into 2-hydroxy flutamide before action (Neri, 1976). It was found to cause regression of androgen target tissues such as prostate and seminal-vesicle in rats (Marchetti and Labne, 1988 and Chandolia *et al*, 1991) and improvement in clinical symptoms in prostate cancer patients (Aso *et al*., 1993) by binding the androgen receptors and thereby blocking the androgenic action (Sogani *et al*, 1975 and Beland *et al*, 1990).

During the present study the reduction in the aggressive behaviour and other musth symptoms observed in the treated elephants may be due to the reduction in the concentration of testosternone level in the blood. This also supports the observations of Jainudeen *et al*, (1972), Rasmussen *et al*. (1984), Cooper *et al*, (1990) and Niemuller and Liptrap (1991) in respect of the aggressiveness and high level of testosterone during musth in elephants. It also confirms the finding of Flanagan and Flanagan (1983) of reduced aggressiveness observed in a castrated bull elephant. The intial daily dose of flutamide @ 2500mg/elephant is not found to be sufficient to

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reduce aggressive behaviour in pre-musth phase. The drug is well tolerated and does not prevent the occurrence of musth during the subsequent seasons.

SUMMARY

A combination of flutamide @ 5000mg and 7500mg, haloperidole @ 100mg and Potassium iodide @ 20 gm per elephant administered orally once in daily for a continuous period of three days is found to be very effective in controlling aggressive behaviour and other musth symptoms in captive elephants during their premusth and in the last phase of violent musth. The drugs are well tolearted.

ACKNOWLEDGEMENT

The authors wish to express their gratitude to the Dean, college of Veterinary and Animal Sciences, Mannuthy for giving permission to publish this paper and to the elephant owners and mahouts for providing necessary facilities and co-operations to conduct the study. We are indebted to M/s Fulford (India) Ltd. Bombay for the free supply of Flutamide.

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Reprint : Zoos' Print, 11 (6) : 26-27, June, 1996

MUSTH : OBSERVATIONS BASED ON STUDIES ON 140 ELEPHANTS IN KERALA OVER 10 YEARS

Dr. R. Kaimal

A study was conducted on 140 elephants over a period of 10 years to understand musth in elephants. It was observed that musth occured mostly in well nourishd elephants, between the age group of 21-80 years. "Moda" or juvenile Musth was observed in 11 elephants of age group 15-20 yrs. The duration was usually 3 months but there was an exceptional case of 5 months duration in one male. Musth occurs mostly in the cold season, the month of December. Based on behavioural manifestations, the Musth period is divided into three phases; Pre-Musth, Violent Musth and Post-Musth.

Some behavioural patterns and precautionary measures:

– A cruel look appears on the elephant's face, with the eyeballs rolling when somebody approaches it. The body becomes taut and tightly stretched and the trunk is extended forwards. There is a tendency to attack strangers and mahouts.

– They pull at their chains and fiddle around with it as if trying to remove them. Hence the chains must be stonger and old ones must be replaced with good and strong ones. An ideal distance of 2 feet must exist between the tree the elephant is tethered to and its chains.

– Some elephants exhibit a tendency to fiddle with a particular loop. The mahouts must anticipate and know before-hand and have spare chains in hand. Usually a circular loop called the '*Thirukenni*' is found on the chain which allows the chain to twist without being broken. This must be checked for damage.

– During musth, elephants are chained to the same spot until the intensity of the phase subsides and they become approachable. During such times it is likely that the elephant may get chain sores. To prevent this one must use a long stick and try and hold up the chains or shift their position from a distance at regular intervals.

– It is always wise to double check on the chains and prepare in advance for Musth.

I. Symptoms of Pre-musth:

– Engorgement of temporal glands.

– Discharge observed at the temporal gland openings. This initial discharge is not the actual musth fluid and is a dirty brown coloured, viscous fluid with a strong smell. Sometimes this fluid itself may block the opening due to its viscous nature or the opening may be too small and the flow is obstructed. This is very uncomfortable to the elephant and it starts to scratch the area with its trunk using twigs and other sharp objects. They may hurt this area and cause abscess. This is a very serious condition and the area might stop secreting the fluid and may have to be operated upon. To prevent this condition one may aid the flow as soon as one notices the symptoms by squeezing out the fluid.

– The perineal region, below the tail and anus enlarges. This is an important symptom. This is the area where the testes of the elephant are located.

– The penis will enlarge and the elephant will exhibit tendency to masturbate. The penis strikes against the stomach of the elephant giving immense pleasure and the elephant may ejaculate. Sometimes the penis becomes so big that it trails on the ground. The mahouts then hold it up with a cloth or prop.

– There is a tendency to gore. The third mahout must be warned by the senior mahout of the danger of this condition and must be careful while approaching the elephant.

– There is an intense feeling of vengeance towards mahouts.

II. Violent Musth:
Initial phase of Violent Musth

– The secretion of the temporal fluid is slow and is more viscous.

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– Penis is partially relaxed. Semen discharge is less or nil.

– Behaviour is unruly and it does not obey commands. Will react violently to even to the voice of the mahout.

– The body is stretched and taut and stiff. The trunk is extended forwards as if reaching out for something. The ears are spread out as if listening intently to sounds.

Middle phase of Violent Musth:

– The temporal fluid flows very fast (like tear drops) and has a pungent odour like that of gun powder and can be felt long distances away.

– Some elephants may have a red mark around the temporal region.

– The behaviour is more aggressive and the trunk is beaten on the ground as a n indication of discontent and anger.

– Tendency to pull more violently at chains and tethers.

–No desire to eat or drink ; i.e., a lack of appetite. Some owners try to offer it more palatable food like banana and curd rice during these times.

Final phase of Violent Musth: This phase may last for a month.

–The glands reduce in size thus subsiding the flow of liquid

–starts urinating normally, by erecting penis.

–the nature of the animals becomes less aggressive and violent. It may even start obeying commands.

III. Post Musth: This is the final stage of Musth

– The gland is completly deflated and flow stops completely

– Urination is normal

– The behaviour reverts to normal.

– Yet one must be careful and the elephant must always have some sort of restraining chain around one of the legs while being moved around.

The Musth can begin manifesting in a male any time after 15 years of age ie. after it has attained puberty.

Reprint : Zoos' Print, 12 (4) : 12, April, 1997

CAPTURING MUSTH ELEPHANT (A CASE REPORT)

B. Dutta * and S.C. Pathak **

A middle aged tusker about eight feet in height, in good health became violent and disobedient to the mahout all of a sudden near Haflong town in Karbi Anglong district. With chained forelimbs the animal escaped to the nearby deep forest. Nearby police station and the forest officials were kept informed for public safety. Further, to prevent the animal to come to the nearby village, a female elephant was released near the tusker.

We arrived the camp in the hilly terrain next day. A dozen of us were in alertness expecting arrival of the tusker any moment. We were told that the elephant kept charging at those who attempted to go near and was in company with the female within a distance of $1^1/_2$ to 2 km.

We had taken with us a Distinject syringe projector (Model 60 N) and 5 ml aluminium dart, a 30 ml vial of Xylazil (Xylazine 100 mg/ml), 50 ml vial of Ketamil (Ketamine Hcl 100 mg/ml) and Antagozil (Yohimbine HCl 20 mg/ml) since we had no M99, etc.

Jainuddin (1970) successfully immobilized a domestic male Asian elephant in 'Musth' with 8 mg of etorphine hydrochloride; ataxia developed 5 minutes post injection, and within 12 minutes collapsed into lateral recumbency. During this period all the legs were chained.

The action was reversed with 25 mg of i.v. cyprenorphine hydrochloride. Jainuddin *et al.* (1971) also immobilized 4 Asiatic elephants (3 of them in musth) with etorphine (5-8 mg) and reversed the effect with cyprenorphine (15-25 mg) i/vly. These drugs have also been reported to be successfully used for immobilizing elephants for various purpose (Pienaar *et al.*, 1966, Wallach and Anderson, 1968). Thakuna and Borthakur (1994) controlled a captive African male coming into musth in three occasion using Diazepam (400 mg and 200 mg) orally in the morning and evening for first 5 days then reducing the dose to 100 mg/day till 20th day. On subsequent development of 'Musth' they used Lorazepam (400 mg for 10 days, then 150 mg/day for another 10 days). The authors concluded that Lorazepam was found better in controlling musth. Sabapara and Raval (1993) captured two aggressive musth elephants with immobilon which was reversed later with Revivon. Xylazine was used to prolong the period of tranquilization.

As we had no alternative, after assessing the situation we decided to use 500 mg of Xylazine, correlating with the height the body weight was assumed to be approximates 3+ ton. If we take the weight as 3 ton, then the dose will come to 167 mg/ton. Further, we had no scope to increase this dose as we had only 5 ml dart. We planned that both of us shall stay in the camp. Three persons including a shooter will go. The latter with one man will be on a tree top. The mahout will be on the ground away from tree. The tree will be selected after seeing the elephant. The mahout will call the elephant by name and provoke charging. When the elephant charges the mahout, the latter will run towards and below the particular tree. The shooter will shoot from the nearest possible distance, should the elephant pass below the tree. Only after a successful shooting someone of them will shout so as to send signal to the camp. The plan was detailed to them several times. The shooter was told not to shoot unless the elephant was within the targetted range. Both of us with nine others were waiting anxiously to hear the signal which could be heard after 2 hours and 10 minutes from the time, the three persons left the camp. Leaving one all left the camp including both of us. On our way we had to cross a river with waist deep water to enter the hill. The mahout came forward to receive us and pointed towards the elephant standing quietly about 100 meters away in a thick bamboo forest. All of us approached the elephant from the rear side. The ears were raised, trunk, relaxed, penis fully erected. After 27 minutes of shooting (the time between shooting and our arrival), 200 mg of Xylazine was injected i/m as the animal was not fully sedated. In the meantime, person accompanying us started chaining all the four legs to nearby trees and bamboos. After issuing necessary instructions and observing the animal for one hour we left for the camp leaving 2 persons by the side of the elephant. We appreciated the confidence of the shooter, who said that the elephant ran about 200 meters from the darted site and had he not been chained (fore legs) he would have gone still further, he added.

All the worker immobilized the aggressive musth elephants either with etorphine or immbilon while Thakuna and Barthakur (*loc.cit*) only managed a chained 'musth' elephant with Diazepam and Lorazepam where chemical immobilization was not required.

None of the above workers used Xylazine for immobilizing 'musth' elephants. Xylazine has been in use fro several decades because of its potent sedative and relaxant properties in elephants for various purposes by various workers including the writers. This drug has been used for controlling and management of musth after immobilizing with M99 or immobilon. Xylazine is not a drug of choice for immobilization, but procuring a narcotic drug like Xylazine where action is almost similar except the introduction time was tried under the prevailing circumstances to capture a musth elephant successfully.

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MUSTH IN ELEPHANTS

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Abstract

Musth is recognized as physiological phenomenon characterised by aggressive behaviour, engorgement and secretion from temporal gland and associated behavioral changes. Men living in very close association with domesticated elephants over the ages have acquired an extensive knowledge regarding musth, but much of this information remains unrecorded in scientific literature.

Introduction

In antiquity the elephant species originated in Africa in the Miocene era, dating back to seven million years. Even though the genera Loxodonta and Elephas diverged five million years ago, recent genetic studies have demonstrated that modern day Asian elephants (*Elephas maximus*) and African elephants (*Loxodonta africana*) (Paenungulates) belong to similar clade, one of the super order clades of endemic African mammals (Stanhope *et al.*, 1998). During Miocene, Pliocene, Pleistocene and Holocene periods, climatic changes of great magnitude occurred on the African continent (Shoshani & Tassy, 1996). Elephas and Mammoths rapidly radiated into northern climates during the Plio-Pleistocene periods (Maglio, 1973), and later with climatic changes Elephas disappeared from Africa and Europe migrating towards south. They adapted themselves by formation of complex dentitions, as their diet changed to long coarse grasses and shrubs and their skin became thicker, with enlarged ears to have more surface area, thick fat, selective hair loss and hair related glands modified themselves to specialized glands for dispersing chemical signals. One of these methods was modification of a facial apocrine sweat gland to the specialized temporal gland. The gland is located on each side of the head in the temporal fossa about midway between the eye and ear and opens to the surface by a duct near the centre of its lower border.

Paleolithic engravings showed that Mammoths have had a larger temporal gland (Pocock, 1916), suggesting the temporal glands might have been a major vehicle for chemical signals during synchronous herd like reproduction. Male Wooly Mammoths were presumed to undergo seasonal rut and temporal gland presumably, sent signals broadcasting male conditions and reproductive fitness to females and the dominance positions to males. By evolution, the social structure of the herd has been changed and major chemical signals are being released through urine. Thus a functional atrophy could be attributed to be reduced size of the gland in the present day males, although present day females often check the temporal gland of males before mating.

Received 24 December 1999 *Accepted 30 January 2000*

Incidence

Musth is noticed in adult male Asian Elephants between the age of 15 to 60 years and is usually seen once in a year and in some cases twice in a year. In a work conducted in Sri Lanka drawn from case history of 80 males and 52 females of domesticated elephants from the age of three onwards showed a distribution of 15 per cent under 20 years of age, 62 per cent and 75 per cent between the age group of 21 to 25 and 26 to 30 and almost all males experience atleast one musth period by the time they reached 30 years of age. (Jainudeen *et al.*, 1972b)

The animals in Kerala usually develop musth during winter/rainy season but in a small percentage of animals it may be seen in summer. It recurs almost at the same time during next year. The duration of musth ranges between two weeks to five months. Musth is seen in both sexes in case of African elephants.

Signs

The main manifestations are spreading of ears, alertness, fully opened ogling eyes with roving eye balls, stiff and tense body, extended blowing trunk and a charging/destructive tendency towards human beings, especially mahouts. (Chandrasekharan *et al.*, 1989).

Juvenile musth

This is seen in adolescent males between 15 to 20 years. There will be enlargement of the temporal glands and animal is easily irritable, mischievous and some times aggressive and do not obey the mahouts and may show tendency to run away from tethering place. A brown coloured, foul smelling paste-like secretion escapes through the opening of semi-engorged tem-

poral gland when massaged. Frequent striking of erect penis on lower abdomen is also noticed in some elephants. Manifestations normally last for 15 to 20 days.

Psychology and symptoms of musth in adults

The manifestations of musth vary from 15 to 90 days which may be classified as pre musth, musth and post musth (Chandrasekharan *et al.*, 1989).

Pre musth

Initial period of musth lasts for 10 to 15 days. Here, the temporal gland become enlarged and the animal may rub the region with the tip of the trunk or on wall or on trees. They become excited and easily irritable. A hard swelling may be noticed in the perineal region. There will be frequent erection of penis and attempts of masturbation accompanied with seminal discharge. The stance would be particular with glans striking the abdomen. A viscous, brown foul smelling discharge from temporal gland oozes and which mainly consist of a type of compound containing 2-butanones, informing both males and females of impending musth. (Rassmussen *et al.*, 1997). The animal would be aggressive and would show reluctance to obey commands. Attacks on other elephants appear to occur most frequently during this period (Jainudeen *et al.*, 1972b)

Musth

This period lasts for 30 to 45 days. During musth discharge from the gland gradually increases, becomes watery and flows over the cheek, secreting and releasing compounds that have demonstrated bioactivity.

Diminished importance of rut is a result of reduced competition for food and probably reduced seasonal male-male competition. As male-male encounters are usually with one or two males, individual information and the recognition of the exact stage of musth of a particular male is essential. The degree of musth, of a potential competitor is a necessary information in determining whether to challenge or retreat. This information is mostly relayed in volatile form through the emissions from temporal gland (Rasmussen *et al.*, 1990).

During musth, a multilevel chemical messages of medium duration released through urine, temporal gland and of short duration through breath are evident. The unique temporal gland and its released substances serve as a specific example of an emission releasing a variety of chemical compounds, apparently sending differentially directed messages (toward specific groups of conspecifics) of varying durations. The secretions from the temporal gland of the Asian elephant carry specific messages, that is an "in musth" signal which Asian male secrete only during musth. These messages may have differential time components. Released lighter volatile compounds may gain ready access to olfactory system, and if requirements for cofactors are met, may function in male self-awareness; less volatile compounds may reinforce this message through the vomeronasal organ system via flehmen. Males flehmen to their own urine almost exclusively during musth (Rassmussen *et al.*, 1984). The compounds emitted include a wide spectrum of chemical types, such as proteins, steroids and volatiles. Examination of temporal gland secretion on gas chromatography showed mainly five volatiles namely phenol, 4-methyl phenol farnesol, farnesol-monohydrate and dihydrate. This was detected both in Asian and African species and in both sexes of African elephant (Rassmussen *et al.*, 1997). Some signal messages may be single compounds such as cyclohexanone, a compound with a boiling point of 161°C, producing a longer period of signal and produces flehmen responses in sub dominant females irrespective of their period of cycle and not in males (Perrin & Rassmussen, 1994). It also elicits a behaviour for cluster formation making females with offsprings form a protective circle around the young. Frontalin mixture (a chemical signal of long duration), though its specific action is not known, produces retreat of subdominant male young bulls and non cycling females.

Behavioural patterns change and dominance-ranking interchange can occur. Investigations by Jainudeen *et al.* (1972a), showed that musth in the domestic Asian elephant is characterised by increased level of testosterone both in plasma and temporal gland secretions (TGS) which appear to be responsible for aggressive behaviour. In the African elephant, testicular testosterone levels show no relation either to season or to behavioral status of the animal (Short *et al.*, 1967) and no discharge is seen from male or female during mating but the peak activity of gland occur at the time of the year when sexual activity is maximum (Perry, 1954). High testosterone level in TGS (between 13.6 and 2781.3 ng/ml in musth as against 1 ng/ml during non musth conditions not only affect behaviour but also the type and the quantity of emitted compounds functioning as chemical signals (Rassmussen *et al.*, 1984; 1990; 1996; 1999). Self induced reduced food in take some times to the point of starvation also alters metabolism such as increased catabolism of lipids with high serum lipase level and internal physiochemical factors such as electrolyte levels and pH affect the chemistry and potential bioactivity of released compounds. High urine protein and low serum magnesium level during musth is a reason for persistent and improved transport and reception of messages created by more volatile, less water soluble signals.

Behaviour patterns would be more excitement with spread out ears, by driving away people and animals by hurling the feed, in particular palm logs and also by attacking inanimate objects. The animal spends most of its time in apparently aimless rhythmic oscillations of head and neck with trunk raised high (Jainudeen *et al.* 1972b) The eyes become glary and it

becomes violent and urinates with out protrusion of penis. Progressively the temporal glands get reduced in size and the animal gradually comes to the stage of normalcy.

Post Musth

At this stage the dribbling of urine would end and it is possible to handle most of the animals irrespective of whether or not the temporal glands are secreting (Jainudeen *et al.* 1972a). The secretions become more pungent and contain a compound, 2-nonanone. There will be varying periods of recovery from the state of excitement to that of normalcy.

Management and Control of Musth

As musth is a physiological condition, there is no particular pattern of treatment. The general management include securing the animal properly and feeding with soft lush food like plantain, cucumber and curd rice. Indigenous ayurvedic medicines like *shatawar* (*Asparagus racemosus*) winter cherry (*Withania somnifera*) *Aswaganda rasayanam* and *Kalyanagulam*, sugar and milk can be given during this period. The animal loses a lot of weight and condition. Being tied through out the period, the hind limbs are the major site of wound infection and necrosis of skin at the site of restraint are frequent.

Homeopathic drugs, Zincummet 200, Belladonna, Gelsimium, Chamomilla, Sabal serulata, Orchitinum, Ferrum picricum, Agaricus muscaricus, Stamonium are reported to be effective in controlling the aggressiveness.

Flanagan and Flanagan (1983) observed a reduction in aggressiveness in castrated bull elephant. Cooper *et al.* (1990), Niemuller and Liptrap (1991) had stated that increased aggressive nature in musth is due to increased androgen level. Work done by Chandrasekharan and Cheeran (1996) showed treatment with antiandrogen namely Flutamide @ 5000 mg and 7500mg, haloperidole @ 100mg and potassium iodide @ 20gm per elephant administered orally once daily for a continuous period of three days, was very effective in controlling aggressive behaviour and other musth symptoms in captive elephants during their pre musth and last phase of violent musth.

Report from Assam State Zoo (Thakuria & Barthakur, 1994) shows that they could control male African elephant in musth by chemical sedatives such as Diazepam 400mg morning and 200mg evening for five days followed by tapering the dosage for five days to 100mg per day and dosage @ 100mg per day for ten days and by twentieth day the animal was normal. After ten months, the rut recurred and at that time it was given lorazepam 40mg morning and evening for three days and reduced to half the dosage on the next day and tapered to 10mg for four days; the animal was normal since then.

The effective control of a violent animal can be obtained by tranquilisation. The common drug used is xylazine @ 0.11-0.12mg per kg and is administered using capture gun. Xylazine can be used along with acepromazine or ketamine. Etorphine @ 1 mg per tonne body weight can be administered using capture gun.

Oral dosing with chlorpromazine at the dose of 6-8 g. combined with phenobarbitone sodium 4-6 g. to an adult elephant may give a reasonable degree of sedation but baiting even with extreme care would cause suspicion leading to rejection of bait. Research is being carried out at various levels so as to control the animal as well as reduce the period of musth and to prolong inter musth periods.

Acknowledgement

The author wishes to express her gratitude Dr. K. Chandrasekharan Retd. Professor and Head of Department of Parasitology, College of Veterinary and Animal Sciences, Mannuthy for his guidance and help in preparing this paper.

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Reprint : Zoos' Print, 11 (1) : 13-14, January, 1996

COMMON HEALTH PROBLEMS IN THE ZOO

Jacob Cheeran

Health Problems can be listed as follows

1) Nutrition
2) Housing and sanitation
3) Quarentine
4) Breeding problem
5) Behavioural Problem
6) Disease

1. NUTRITION

Animals in captivity are fed with artificial food like concentrates, cut fodder etc.

Herbivores: The feeding pattern of herbivores is varied and seasonal. It will vary with season, and phenology. Feeding habits may vary from grazing, browsing and even bark-eating. Feeding habit of herbivores has to be varied since plants differ much in their nutritional quality. This is unlike meat which is almost complete; there is, then, not much difference in the nutritional quality of various types of meat. Cut fodder that is fed to animals in captivity will often be of the same plant and plant material almost all the year round. This can lead to various nutritional deficiencies.

Even in carnivores the lack of opportunity to consume visceral organs, to bite and chew bones will also lead to health problems.

Birds are another group with varied type of feeding habits. It may vary from carrion eaters (vultures) to herbivorous type (grouse). Their nutritional requirement and digestion tracts are also designed/ adapted accordingly and if feed does not meet these requirement it is likely to lead to digestive and nutritional disturbances.

Hence feed supplements containing minerals, vitamins, proteins, energy are to be fed depending upon the requirement and availability.

2. HOUSING AND SANITATION

Often the zoo managers will be forced to house an animal in enclosures which are not suitable for the type of animal. Many an occasion the enclosures are divided and subdivided when the animals increase in numbers. This is more a problem in the case of old zoos. This will eventually lead to poor sanitary condition and health problem. A master plan with major housing designs and location should be prepared to avoid this situation.

3. QUARANTINE

Quarantine provision is mandatory in the current zoo rules, but the facilities are meagre in many zoos. The quarantine has to be in an isolated corner, without being detrimental to the health of the animals in the zoo. In many zoos, however, the quarantine facility is provided in the zoo hospital. The hospital is often situated in the zoo with easy accessibility to enclosures, a practice which is to be discouraged.

Quarantine has to be strictly adhered to, especially if new species of animals that too from a new area are to be introduced. The introduction of South African horse sickness to India and the efforts we have had to take to contain it is worth remembering.

4. BREEDING PROBLEM

(i) Often nutritional deficiencies especially minerals will affect the breeding efficiency of the animals. It is worth remembering that reproduction is first to be affected and the last to recover. As mentioned earlier, appropriate feed supplements are useful in restoring the reproductive health of the animals.

(ii) Another problem that is affecting the breeding efficiency is inbreeding. Continuous inbreeding in a limited population has resulted in poor gamete production and defective germ plasm.

(iii) Animals kept in agroclimatic region which is quite different from its natural habitat will show breeding problem. Considering this factor CZA has planned captive breeding of endangered animals in zoos where the agroclimatic condition are similar to their natural habitat.

(iv) Biological group. Many animals need the normal biological groups like herd etc. for proper breeding. Captive condition which is quiet different from the natural biological group may adversely affect the breeding.

(v) Male sterility or infertility. Female infertility or sterility is often observed easily. But deficiencies in male with regard to reproductive success is difficult to notice.

(vi) Favouritism. All breeding pairs may not mate and reproduce successfully. This is often seen in flocks of birds. A bull elephant which shows least interest in a cow may readily mate with another female. Hence changing the mate may be tried if a pair does not show any inclination to mate.

5. BEHAVIOURAL PROBLEM

Till recently, the concept of enclosures covered only what is necessary to meet the biological needs of animals. Relatively intelligent and social animals, however, require environmental enrichment to avoid boredom and associated development of vices.

Carnivores require environmental enrichment more than herbivores. It is noticed that carnivorous bears (e.g. polar bear) need more enrichment than other bears. Naturally primates and elephants will also will benefit from environmental enrichment.

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6. DISEASE

Problem associated with disease are preventive, diagnostic and therapeutic.

(1) Vaccination. On the preventive side, the vaccination is the most important. Although vaccination is not practiced as a rule in India, not much of a problem has been encountered by this. The greatest problem is tuberculosis and unfortunately there is no effective vaccine available for the same. Administration of a vaccine that is ordinarly given S.C. if given I.V. is not likely to cause any problem except regarding the volume. Alternate sites can be selected if volume has to be large.

(2) Diagnosis. The difficulty of physical examination and lack of clinical laboratory facilities are other problems. Even if a developed clinical lab is not available in the zoo, clinical lab (often private) available locally can be made use of. However they should be told about the nature of sample. Otherwise they may confuse with value which is quiet different from their regular samples - human sample and may try to correct.

(3) Administration of drugs. Administration of drugs for wild animals has always been a problem. Dart gun and blow pipes are easy to apply but they are not cost effective. Extensive use of squeeze cages and pole syringes which can make use of disposable syringe should be used. Although pole syringe is a simple device and easy to use, this device is not very popular in our country.

(4) Parasitic burden. Closed environment and limited area will often lead to reinfection/ reinfestation of parasites. Hence periodical inspection of animal and faecal examination should be conducted and a deworming schedule and chart to the effect has to be drawn. Modern broad spectrum anthelmintics and parentral endectocides are really a boon to the zoo veterinarian. The margin of safety of modern deworming drugs is also another advantage.

Editor's Note : Dr. Jacob Cheeran has been associated with Zoo Outreach Organisation for many years. He has served as Special Editor for several veterinary issues. He is a member of the Managing Committee. He has and is associating with us on several cooperative projects.

Reprint : Zoos' Print, 11 (6) : 25, June, 1996

SIGNS OF HEALTH

Dr. Jacob V. Cheeran

Being healthy does not mean a state of not having diseases or sickness but a state where the normal activity and nature of the elephant is not affected. Some symptoms of ill health are discussed below. A mahout must be able to read these symptoms and call a doctor for immediate medical attention in case he notices anything wrong.

– The tip of the trunk will always be moist with saliva. If this place is dry or cracked then it is obvious the elephant lacks water in its body.

– There are some very obvious factors like wounds, rashes and swellings which should be considered for immediate medical attention.

– The insides of the mouth must be rosy pink in colour. This indicates if there is enough blood circulation and if the animal is anaemic or not. Usually in other animals and humans the eye is tested but with an elephant this is not possible because it closes its eyes and it is not possible to force it open.

– The eyes must be moist all the time. An elephant is different from other animals on this aspect. No other animal's eyes are wet all the time like the elephant's.

– Whitish layers inside the eyes are bad signs. This whitish layer appears either on the cornea or the lens. If it appear on the lens it is called cataract, and appears when the elephant is old.

–The ear should have a lot of veins running across it. Also any scratches or bruises here should be treated immediately.

–Elephants generally are susceptible to sinus infections. Discharge is seen running out through the trunk.

–The briskette region is where the temperature of the elephant is taken. This region if cold will indicate the elephant is sick.

– Swellings may occur on various parts of the elephant's body due to various reasons. The swellings are usually found on the lower parts of the body such as the feet, the chest (the briskette), etc. These swellings occur due to wounds or injuries. Usually in such cases, the area will swell up, will cause pain and will be hot. If the swelling is watery and not hard then the region will not be warm. The swelling has to be rubbed upwards according to modern medicine to reduce it, and not downwards as traditionally practised.

– The nails of the elephant have to be trimmed often, especially the sides. One should be careful while washing the nails as to not scrub the nails with a hard surface like stone, etc. This will remove the waxy coating over the nail. There must also be plenty of sweat around the nails of the elephant.

– The elephant's skin has several wrinkles and folds. This is to regulate heat of the body. The wrinkles increase when the elephant is tired or dehydrated. The skin can be pinched and released. If the skin feels elastic and resilient then the elephant is getting sufficient water. If the skin stays firm and tight if pinched, one can assume that the elephant is not being given enough water.

– The pulse of the elephant is taken below its chin.

– Foot diseases are common in elephants. The skin around the nails and feet start rusting. This occurs due to unclean tethering area of the elephant. If elephants use the tethering area of other elephants this disease will be communicated to the new one. To prevent this the mahout must regularly clean the tethering area.

– Also some elephants have multiple hairs coming out of single pores. It is said that if the elephant is weak then these hairs will fall off if tugged at.

–The dung and the urine of the elephant also give away some facts about its health condition.

–Other general indicators are change in the quantity of food and water taken. A mahout who is observant and aware of his elephant's habits and activities will easily be able to say if his elephant is feeling well or not.

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Reprint : Zoos' Print, 11 (6) : 21-23, June, 1996

SICK AND INJURED ELEPHANTS: CARE AND CURE

Parbati Barua

1. INTRODUCTION

A working elephant may be exposed to many kinds of injuries and ailments. With the development of veterinary science,treatment of sick and injured elephants is not a problem. But in remote areas, experienced veterinary doctors and required medicines are not easily available, and the mahout may be required to provide first aid or primary treatment before the services of a veterinarian are available. There are some traditional herbal-based medicines in different regions of India, which provide effective treatment against some common ailments of elephants. In the wild, elephants are known to use different types of herbs, climbers, leaves, etc to treat themselves in case of sickness. Use of herbal medicines should, therefore, be preferred to other kinds of medicines as far as practicable.

2. PREVENTIVE MEASURES

The saying that "PREVENTION IS BETTER THAN CURE" applies to elephants in the same way as to human beings. Captive elephants are subject to injury or sickness more due to the negligence of their keepers than to other reasons. The other thing that needs to be remembered is that elephant is a very costly animal and one can not afford to lose it permanently or even temporarily due to injuries or sickness. Hence, elephants should be kept or used with great care. Some important precautions to be observed are discussed below.

2.1 HYGIENE

Experience shows that some of the common ailments of captive elephants relating to eye, feet and skin are because of filthy and unhygienic conditions of the pilkhana (stable). Therefore, the pilkhana must be kept clean and well drained. All the leftover fodder and dung should be removed to a distance and burnt periodically. The urine-drenched floor should be covered with sand and periodically treated with a disinfectant. The feet of the elephant may be washed with a solution of Potassium permangnate at least once a week to guard against fungal attack. Elephants should be given a regular bath and their toe-nails and tusks (if any) should be trimmed periodically. Cattle and other livestock should be kept away from the pilkhana. As a rule, captive elephants should not be made to share their grazing ground and source of drinking water with other livestock to avoid infection and contagious diseases.

2.2 FEEDING

An ill-fed elephant is quite prone to diseases. Hence, the elephant should be fed properly and timely. The food of the elephant should not be monotonous and a variety should be maintained to the extent possible. Extra diet (fodder and ration) should be provided to the elephants engaged in logging operation or working overtime. It is believed that regular feeding of the elephant with leaves and branches of *ficus* species in dry months may cause eye problems. Similarly, an elephant having problems of digestion or worms in the intestine or which has recently taken earth,should not be fed on banana stems or any other fodder with high water content. The elephant should also be kept off water for at least three days in such cases. In case of elephant calves which have recently started grazing, a careful watch should be maintained so that they do not take any poisonous plant.

2.3 WORKING OF ELEPHANTS

Working elephants are usually observed to suffer from back sores or spinal injuries. The reason is either overloading or uneven loading on either sides of the elephant back. An elephant may also get back- injuries if its gadela (mattress) is not of proper specification or not suitably tied. An elephant may also get injuries on its legs if the knot of the rope with which the legs are tied is not correct or its hobbles are not of proper size or if some link of its chain is pointed and sharp. Gear of the logging elephants needs careful designing to avoid injuries.

Captive elephants should not be over worked and should be given proper rest. They should not be exposed for long duration to direct sun,chilly winds,rains and hailstorms. They should not be made to march over rocky areas, marshy land or quicksand after a long march or heavy spell of duty, an elephant should not be immediately taken for bath or provided with drinking water.

* Mahout and elephant trainer, Assam

2.4 PROTECTION AGAINST WILD ELEPHANTS

Sometimes wild elephant visit a pilkhana and attack captive elephant who, being tied, cannot protect themselves. Mahouts should be alert and must chase away wild elephant using crackers. Elephant-proof trench or electric fencing around pilkhana may also be useful.

2.5 PROPHYLACTIC ACTION

Periodic deworming of captive elephants under the care of a veterinarian is very important. It is also necessary to inoculate the elephants against such contagious cattle-borne diseases as foot and mouth disease (FMD), anthrax, haemorrhagic septicaemia (HS) etc. A routine pathological test of elephant dung may help in timely detection of many diseases.

2.6 USE OF INTOXICANTS

It is a common habit (rather a vice) among most of the mahouts to use opium or any other intoxicant to "treat" a sick elephant. Such intoxicants may suppress the symptoms of sickness in the elephant or may even cure the elephant for the time being, but these are very harmful to the elephant in the long run. These intoxicants, besides addicting the animal, also weaken the immune system of the elephant and make it susceptible to many diseases. Therefore, use of intoxicants for treating the elephants should be strictly prohibited.

3. SYMPTOMS OF AN AILING ELEPHANT

Like an infant, an elephant also can not express its pain and problems through speech. But like a good mother who can feel any thing going wrong with her baby, the mahout should also be able to detect any unusual behaviour in his elephant. A mahout should observe his elephant very carefully every now and then and should be able to tell what is normal for it and what is not. Reasons for any abnormal behaviour must be investigated and immediately reported to the superior authorities and the veterinary doctor. Some useful tips for the mahout are given below:

3.1 The mahut must often visit the pilkhana in the early hours of the morning to see whether the elephant is lying down to sleep. Sleeplessness for many days at a stretch may be the signs of an ailment.

3.2 The mahut must keep watch over the feeding of his elephant. Lesser than the usual intake of food should be viewed with concern.

3.3 He should examine the dung of the elephant carefully. Presence of worms, earth or unusually large quantity of undigested food in the dung is indicative of ill health.

3.4 Eating of earth by the elephant also suggests presence of worms in its stomach or digestive problems or any other ailment.

3.5 A healthy elephant is always active and apparently restless, constantly moving its trunk, tail and legs, flapping its ears, always chewing something. Its eyes are also bright. A dull looking and inactive elephant suggests sickness.

3.6 The gait of the elephant should also be observed carefully. An uneven movement or dragging of feet may be on account of injury,muscular pain,thorn,foot rot etc.

3.7 Appearance of ribs on the body or forehead of elephant is a definite indication of sickness or weakness.

3.8 The bathing time of the elephant is also the proper time for physical examination of the elephant. All parts of the elephant's body should be carefully examined to detect injury,thorns,sores, boils or signs of rot.Different parts of the elephant should be pressed with hand and the reaction of the elephant should be noted to see whether it feels any pain.

3.9 Periodic measurements of weight and girth of the elephant also helps in monitoring its health. For example, loss of weight in any elephant shows bad health. Unusual increase in the girth of an adult cow elephant within a short span of time may be on account of its pregnancy. A regular record of the history of musth in a bull elephant may help in determining whether or not the unusual behaviour of the elephant is indicative of the approaching bout of musth.

4. TREATMENT OF COMMON INJURIES AND AILMENTS

Given below are some local cures for common injuries and ailments of elephants as practiced in N.E. india. Some of the cures may not look sophisticated or even scientific, but they are time tested and the ingredients involved are within the reach of a mahout.

4.1 EYE TROUBLES – Constant watering from the eyes of the elephant may be due to infection, injury to the eye ball, cataract or excessive internal body heat. Eyes of the animal may be washed 3-4 times daily with a weak solution of alum. Water soaked overnight with tobacco leaves is also used for this purpose.

4.2 BODY-ACHE – Elephant may be given a bath with tolerably hot water. Water is poured gently on the ridge of elephant's back and the body is given a massage with hands or sometimes with legs.

4.3 BACK-ACHE – A hot compress may be given with the help of a gunny bag soaked in hot water. A little common salt may be added to the water.

4.4 SWELLING IN THE NAVAL – Raw jaggery may be melted and applied over the naval.

4.5 WOUND – An elephant may get a wound due to injury or on being hit by the ankush (driving hook) or ballam (spear).The wound should be washed with clean water and dry turmeric powder should be sprinkled over it.When the wound starts drying up ,an admixture of turpentine oil,coconut oil and carbolic acid in suitable proportions should be applied on it.

4.6 INJURY DUE TO ROPES – In case of a domestic elephant, wound caused by a rope may be treated in the manner explained above. In case of a recently captured wild elephant, the wound should be washed with clean water and sprinkled with wood ash. After repeating it for 2-3 days, the wound should be thoroughly cleaned and a special ointment should be applied on it. This ointment is prepared by collecting earth from a termite mound, boiling it in water and mixing up with turpentine oil. This ointment is also believed to be a painkiller.

4.7 SORE-BACKS AND ABSCESSES – An abscess without pus inside, may be treated with hot water compression. In N.E.India, mahuts also use elephant dung or the root of a wild variety of a plant called "Kochu"(Harum) for giving hot compression. In case of an abscess with pus inside, a paste of red chilly is first applied to draw the pus to the surface. Next day , the abscess is washed thoroughly and allowed to dry up. A slight layer of mustard oil may be applied to sooth the pain.T he pus may come out on its own within a day or two. Otherwise, it may be drained out by making an incision into the abscess using a sharp disinfected dao (a cutting knife). The wound is then sprinkled with the dust of the dry bark of pipul tree *(Ficus religiosa)* to help quick- healing and to prevent re-formation of pus.

Treatment of back-sore takes a long time with a working elephant.It is necessary that the elephant is kept off heavy duty or specially designed gears are used so as to avoid pressure on the affected part of the elephant's body. The sore should be washed and wiped dry. A thin layer of coconut oil should be applied on it followed by sprinkling of dusted bark of pipul tree.

4.8 INSECT BITE – Painful swelling may be caused on elephant's body due to bites by wasps, hornets or other insects. A specially prepared ointment is applied on the affected area to give relief to the animal. The ointment is prepared by boiling buffalo dung and earth from a termite mound together in water and adding turpentine oil when the solution is luke warm.

4.9 ECZEMA – The affected part is washed with hot water mixed with boric powder and wiped dry with a clean piece of cloth. It is, then "burnt" with pure carbolic acid. An admixture of turpentine oil, coconut oil and carbolic acid is then applied daily on the wound.

4.10 FOOT-ROT – Fungal infection on the heel (called "Chhajan") or soles and toes (called"Karrhi") of an elephant are invariably due to unhygienic conditions of the pilkhana and cause tremendous pain to the animal. In N.E. India, the tissues affected with fungus are burnt with the help of a red hot iron rod. For the next three days, the tissues are also treated with boiling mustard oil mixed with crushed nuts of Bhela (Washerman's nut i.e., *Semecarpus anacardium*) and a little blue vitroil (Copper Sulphate). Elephant is not allowed to get the affected feet wet. The treatment is repeated if some fungal affected tissues are still left. Otherwise,the wound is treated with the admixture of turpentine oil, coconut oil and carbolic acid till it completely heals up.

5. CONCLUSION – As stated earlier, proper food and working conditions coupled with suitable preventive measures would keep an elephant in healthy condition.However, a mahout should be able to deal with unforeseen situations.He should keep at hand medicines,materials and equipments needed to provide first aid and primary medication to the elephant. Last but not the least, he should be able to narrate the complete case history of his elephant to the veterinary doctor. This will help the doctor in making the correct diagnosis of the ailment and prescribe proper course of treatment for the elephant.

Reprint : Zoos' Print, 10 (4) : 7-8, April, 1995

AN APPROACH TO WILDLIFE MEDICINE

Dr. Goutam Chakraborty*

Wildlife Medicine is that branch of Veterinary Medicine which deals with the diagnosis, treatment, prevention and general study of the diseases of wild animals both captive as well as free living. For the practice of wildlife medicine, a wildlife clinician /Zoo Veterinarian has to acquire knowledge of Anatomy, Physiology, Parasitology, Pathology, Pharmacology and Microbiology of wild animals of this vast kingdom. Apart from this he should acquire sufficient knowledge on the behaviour of wild animals (Ethology) to differentiate easily a diseased case from a healthy one. Wild animals natural habitats should also be well known to a clinician.

For making a diagnosis of wildlife diseases, a zoo vetetrinarian has to face a number of hurdles.

(a) In Wildlife Medicine subjective symptoms (feelings expressed by the patient) amounts to nil. In human medicine this has a high relevance.

(b) A zoo veterinarian has to depend on only objective symptoms (feelings observed by the clinician) through various methods of examination. Still, for getting the objective symptoms, the animal patient does not co-operate with him during examination. Wild animals show fear/aggression and try to make away from examination and thus makes the diagnosis a difficult task, hence becoming a stress by itself. So, minimum restraining devices should be done to derive maximum output of examination as restrainment is likely to alter the behaviour of the animal. While taking the objective symptoms of sensitive and aggressive wild animals, a clinician has to consider the comfort of the animal, security and safety of the staff.

(c) The wide variations in normal anatomy and physiology in different species of wild animals with a vast variation in their behaviours makes the task of a diagnosis a more troublesome process.

Disease indicates deviation from normal physical, physiological and mental well-being of an individual. Disease processess are informed to the zoo veterinarian through the complaint from the zoo keeper. History is one of the most important facet to diagnose a disease. The following things are to be obtained.

(i) Immediate/present history
(ii) Past/previous history
(iii) History of Management
(iv) History of environment

Immediately after obtaining the history, the clinician proceed towards examination of the patient. The involvement of a particular system is categorized and the organ concerned of that particular system is examined during preliminary general examination. The clinician is dependent for his good sense, sight, touch, hearing & smell for collecting useful information during physical examination. Abnormalities of the following actions are noted during visual examination.

(I) Appearance
(II) Body condition
(iii) Condition of skin coat
(iv) Gait
(v) Posture
(vi) Response to stimull
(vii) Behaviour
(viii) Abnormalities in respiration
(ix) Visible mucous membrane
(x) Act of eating
(xi) Act of defaecation
(xii) Act of urination
(xiii) Condition of the abdomen
(xiv) Condition of the ear
(xv) Condition of the nose
(xvi) Condition of the external genitalia
(xvii) Discharge from natural orifices

Specific examinations are also to be done as and when required.

(i) Microscopic examination of blood, urine, stool, sputum, C.S.F., skin scraping etc.
(ii) Bio-chemical Analysis of blood, urine etc.
(iii) Culture & Antibiotic sensitivity test
(iv) Serological test
(v) Allergic test
(vi) Biological test
(vii) Radiological exam.
(viii) Histopathological examination of tissues.

Help and contact with the nearby laboratories is highly essential for prompt diagnosis and treatment. Involvement of advice and help from nearby veterinary colleges as well as of Indian Veterinary Research Institute, Izatnagar (U.P.) in difficult cases is to be sought.

w3eeeeeUse of squeeze cage is also done for examination of animals. For close examination and treatment of wild animals a combination of tranquilizer and general anaesthetics are used.

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In Wildlife Practise, a Zoo Vet gets the advantage that the economic aspect of treatment is not a factor of hinderance to his line of treatment. The effective and prompt treatment of animals is important in the zoo without consideration of cost. Promptness of treatment urged as the animal may take the medicine orally in the diet itself before going to off-fed condition. But if it becomes late, injectable form of the same medicine will be required. Medication (particularly oral medication) to wild animals requires skill and manipulation over animals. Once the wild animal gets the smell/taste of medicines they reject it outright. Oral medicines are given by hiding it inside the diet. Treatment depends to a great extent on general care and nursing. General and specific treatment are given as and when required.

It is essential to leave diseased zoo animals within its familiar environment except in a few cases to prevent adverse effects in a new environment. The regulation of temperature, humidity and ventilation of the animal houses is essential for maintaining good health in captive animals.

As prevention is better than cure, prophylactic measures is given importance to reduce the incidence of diseases. A vaccination schedule is to be followed to keep animals free from infectious diseases. The animals fare kept free from parasitic diseases and a regular de-worming schedule is followed throughout the year. Optional nutrition is the best prophylaxis against diseases in captive animals. Balanced and wholesome diet should be provided. Care is to be taken to control the pre-disposing factors for occurrence of diseases. Daily maintenance of hygienic conditions to be strictly followed. The newly arrived animals are to be kept in quarantine under observation for at least 4 weeks before mixing with other zoo animals. Protection from disease introduced by visitors, keepers and intruding stray birds, foxes, dogs and cats are to be done. Disease outbreaks in zoos can frequently be traced to domestic animals. A buffer zone of 1 - 2 km. is to be made around the periphery of zoo to prevent introduction of diseases from domestic animals. Disinfectant foot mats should be provided at the entrance of all enclosures. Regular cleaning and disinfection is to be done in animal houses. -Feeding/drinking pots are to be cleaned daily and clean drinking water provided. Control measures are to be taken against nuisance of mice, rats, small carnivores and insects. Personal hygiene of zoo keepers is to be maintained. Health status of zoo keepers is to be monitored and a periodic X-ray examination and other medical examinations should be mandatory. A keeper with tuberculosis or salmonellosis will introduce the disease in zoo animals within a short period of time.

For proper approach to wildlife medicine the zoo veterinarian largely relies on zoo keepers, whose dedicated cooperation and observation is required. Proper training of zoo keepers is highly essential. They should be trained with knowledge of zoology, basic veterinary science, animal husbandry, ethology and the fundamental understanding of diseases of wild animals. The importance of maintaining personal hygiene should be known to them. They are to be educated in the principles of disinfection for hygienic condition of animal houses. Principle of cleanliness of feeding/drinking utensils, etc. should be well known to them. But above all they should be a true animal lover.

Considerable progress has been achieved in the field of wildlife medicine with the introduction of modern equipments and facilities in capture and restraint and embryo transfer in wild animals. Within our present knowledge it is possible to produce sedation and anaesthesia in virtually every captive wild animal. Still there is lot of scope for the proper development of veterinary facilities in our zoos in conservation of wildlife.

Reprint : Zoos' Print, 11 (6) : 19, June, 1996

COMMON AILMENTS

Dr. Jacob Cheeran*

A healthy elephant will not remain still and will constantly preoccupy itself with any activity moving various part of its body. Listed below are some common ailments that affect the elephants.

1. **Impaction:** Constipation leading to impaction is the most common and serious condition seen in captive elephants in Kerala. Expert veterinary aid which consists of fluids and parental feeding are important.
2. **Worm infestation:** Very common both in captive and wild. Periodical deworming is a must.
3. **Foot rot:** Common in rainy season. Tethering site should be clean and should have provision for drainage.
4. **Surra:** A protozoan disease. A debilitating condition which can effectively be treated.
5. **Lice:** Seen at earfolds, inner aspects of limbs and tail switch. Easily treated with insecticides.
6. **Tuberculosis:** Often contracted from the affected mahout. Difficult to institute protracted treatment.
7. **Tetanus:** Often results in death caused by punctured and contaminated injuries. Patient will present a very pathetic sight.
8. **Rabies:** Commonly caused by dog bite. Post bite vaccination is effective.
9. **Injuries to the eye:** Often caused by improper use of the stick by the mahout causing permanent eye damage or blindness.
10. **Arthritis:** Common in old animals. Total cure is difficult. Palliative measures are possible.

Often diseases like Anthrax, Pasturellosis, Foot and Mouth disease and Salmonellosis have been reported to occur.

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SOME BASIC SYMPTOMS OF INTERNAL AILMENTS

Dr. K. C. Panicker * and Shri Maheshwaran Namboothiri **

Some reasons why stomach ailments occur are impaction, outgrowth in the stomach area, worms and ingestion of mud.

When elephants are feeling sick inside some external manifestations which indicate the condition are :

- the elephant droops on its legs and will not stand erect.
- the elephant won't move its ears or trunk.
- the elephant loose interested in food and water.
- the elephant will twist and turn its body around periodically.
- If the pain or ailment is very severe it will lie down and then stand up again.
- the body temperature of i.e elephant will be low. (The chest portion of the animal's body is where the temperature is noted)
- if the illness is a case of impaction, the elephant will try to lay dung.

Elephants eat mud when they are sick, but if they eat too much mud it is not good for them. It is possible to determine from the dung if the elephant has been eating mud.

There are several Ayurvedic and traditional preparations for stomach ailments. (Some of them have been discussed in chapters elsewhere in this issue)

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Reprint : Zoos' Print, 14 (1) : 32-33, January, 1999

THE ROLE OF MODERN HEALTHCARE FACILITIES IN THE ZOO

Dr. Abdul Samad and S. Jagadish

Editor's note :
All of us do appreciate that in spite of providing all the possible care and facilities, the animals kept in the zoo are in an unnatural environment and, hence, under some degree of stress and health-related problems. It is therefore essential that holistic, comprehensive, state-of-art facilities are provided for their health care. At the outset we will consider the existing problems faced by zoo animals and the constraints under which the facilities will have to be provided.

The major constraints when we deal with the health problems of the captive animals kept in zoos are:

1. The diseases of zoo animals may not be obvious as clinical signs or the signs of illness are expressed very late in the course of the disease and at this stage no treatment is fruitful.

2. The clinical signs often are vague and detailed physical examination is not possible due to problems of handling and restraints.

3. Many modern diagnostic investigations may be difficult to carry out or interpret since handling may alter the physiochemical responses of the animals.

4. The treatment often is non-specific and hence expensive and a number of times not effective. Administration of drugs to animals is also another constraint.

Comprehensive preventive medical programmes:
Thus, the zoo management has to be geared up for providing comprehensive preventive medical programmes. Such programmes in domestic animals and people has been found to be beneficial and cost-effective, but their role in zoo practice needs to be evaluated on a long-term basis.

The modern concept of disease causation has undergone tremendous changes. The earlier Koch-Henle postule of disease causation has been found to be inadequate to explain the disease causation in many non-infectious as well as infectious diseases. This postulate in fact led to narrowing of the concept of disease causation since it gave more emphasis to the single causal theory. But, now it has been recognized that most of the diseases in animals or human are caused due to multiple factors. For example, in Marsupials and Monotremes, it has been found that mere presence of Bacillus necrophoros is not sufficient to cause Necrobacillosis. The disease is produced only when factors such as, overcrowding and feeding of soft diets are present. Thus, although the bacillus is the cause of Necrobacillosis, this by itself is not sufficient to cause the disease. Hence such causal factors are now called necessary causal factor, whereas the causal cycle is completed only when there is overcrowding and feeding of soft feed. These two causes are therefore called component causes. This new theory of causal mechanisms, also called Evans Hypothesis or canons, have revolutionized the concept of preventive medicine. Thus, looking at the sufficient causal models, it will be easier to devise preventive strategies. For example, in the Necrobacillosis model, if overcrowding of soft feed is avoided, even if the organisms are present, the disease will not occur. As is evident, such strategies are not only rational but are also pragmatic for implementation as these are cost-effective.

Now it is well known that nutrition, environment, husbandry practices, sanitation, genetics, etc., are important determinants of the diseases in domestic and zoo animals. There is however a need to understand the interactions of these factors with different diseases under our zoo conditions. If the zoo veterinarian is a vigilant and keen observer with simple mathematical calculations, the presence and impact of these factors on disease causation can be established. The zoo veterinarians should therefore be trained in this modern clinico-epidemiological concepts.

The above holistic approach has been incorporated into preventive medical programmes. For zoo animals the preventive medical programme consists of following basic practices.

a. Quarantine
b. Nutrition and feeding
c. Proper caging
d. Routine surveillance and prophylactic medication
e. Proper disposal of dead animals and disinfection
f. Sanitation
g. Animal care personnel

For implementing preventive medical programme the following issues should be addressed.

a. Establishment of a health monitoring laboratory: A modest laboratory for routine laboratory procedures should serve the purpose. The laboratory should be equipped to carry out routine blood, smears, urine and faeces examination. For other works however, the services of either a regional district laboratory or college laboratories should be availed. It will also be prudent if the college laboratories have technical personnel, material resources and facilities specifically earmarked for wild life-related investigations.

b. Establishment of Diagnostic facilities at zoos: Although human and pet animal practice have witnessed dramatic improvement in availability of the diagnostic facilities, which has also changed the approach to therapeutics, such facilities may not prove that useful for zoo animals, since there are constraints of cost, sustainability or maintenance cost, restraints and problems with interpretation of the results. At least for the time being, Indian zoo veterinarians will have to depend on their own clinical acumen.

c. Reorienting the zoo veterinarians in modern art of diagnosis: The art of diagnosis of the diseases based on symptoms and physical examination has also become rational since now there are ways to calculate the strength of these signs in predicting a correct diagnosis. For example, if the lion is showing signs of diarrhoea which is greenish in colour, based on the predictive value of the one or a collection of signs, the disease can be diagnosed with a reasonable

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confidence. At present the zoo veterinarians have to rely only on the clinical presentation to diagnose the diseases but they are not reasonably sure about the diagnosis. By following a dichotomous approach, certain indices, such as, predictive value, likelihood ratios, gain in certainty, etc., can be calculated. If these values for different clinical signs in various diseases are available, an algorithm path can be drawn which will help in diagnosis.

For doing this some planned initiatives and efforts will have to be undertaken by all the zoo veterinarians and the nodal veterinary college experts in science of clinical epidemiology. The nodal agency then can compile the data and calculate the predictive indices for each clinical sign and a spectrum of diseases. In human beings this approach has rationalized the art of diagnosis, and resulted in development of soft-wares to aid the clinicians in diagnosis. In addition, the algorithm paths drawn for each set of diagnostic and prognostic sign would also guide the clinicians in deciding on a particular therapeutic or preventive strategy. The details of organising such studies can be obtained from any standard text book of clinical epidemiology.

Summary:

The modern zoo animal healthcare facility should constitute following components:

1. Properly oriented zoo veterinarian(s) trained in basic concepts of clinical epidemiology, preventive medical health programmes and zoo animal behaviour.

2. Vigilant support animal care staff trained in personal hygiene, animal behaviour, basics of nutrition, food hygeine, environment, sanitation, mode of transmission of infections role played by management, husbandry and other factors.

3. Modest diagnostic laboratory for routine investigation work.

4. An elaborate zoo record maintenance and database facility.

5. Zoo to zoo linkages for rapid exchange of information specially via internet or if not feasible at least by way of bulletins, news letter, etc., which are specially based towards zoo animal health management problems.

6. Linkages with regional state-level diagnostic laboratories, regional stations of national laboratories, veterinary colleges, and national laboratories.

7. Establishment of a national nodal agency to enforce, monitor and evaluate preventive health programmes in zoos and establishment of functional linkages throughout the country, if possible via internet or website.

8. A policy decision to expedite the relocation of excess animals in order to keep the population density at optimum level.

Reprint : Zoos' Print, 15 (2) : 8, February, 2000

Health care and treatment of zoo animals

Dr. M. V. Wani*

Wild animals in zoos are prone to various health problems. These might be physical, mental, or behavioural diseases, both infectious and non-infectious.

Broadly animal health care can be classified in two major groups. 1. Prophylactic measures i.e. preventive treatment and 2. Therapeutic measures i.e. Curative treatment

I. Prophylactic measures:-

1. Maintenance of good hygiene in and around cages

2. Proper and timely disposal of waste, left over food, animal excreta, effective sanitation.

3. Cleaning, washing the food places with proper disinfectants, periodical fumigation of enclosure and paddocks.

4. Regular supply of clean, potable water for drinking purpose

5. Timely supply of wholesome food with sufficient quantity as per the requirements of the individual animals.

6. Checking of parasitic load by regular stool examinations and giving required treatment to the infected ones - preparation and implementation of deworming schedule is important. It is also important that a particular wormicide is not used repeatedly as the repeated and continuous use of the same drug develops immunity in the parasites and the same dung is found ineffective.

7. Birds particularly need more precautionary and prophylactic measures to protect them from getting infections.

8. Regular vaccination programme for birds is essential and also for animals where ever it is feasible to vaccinate the animals in small groups or pairs. Vaccination of deer in herds is a difficult task.

II. Therapeutic treatment:-

In captive wild life management, in zoos we encounter various health problems which can be classified as - a) Symptomatic or b) Infectious.

a) Symptomatic:- In these conditions the lesions are visible. Accidential fractures, trauma, injuries in fight or due to sharp objects, abscess and various skin diseases. These visible elements can be treated immediately by using appropriate medicines as well as preventive medicines to avoid secondary complications.

Wild animals do not co-operate while rendering the requisite treatments. They become frightened and go into stress and shock. As such it is very important to handle the animals with due comfort, reduce the stress, reassuring the animals by friendly patting and tones. The concerned caretaker of the particular animal needs to be present to calm the animal by making his usual sound/call to the animal.

b) Infectious diseases:- In spite of taking various precautionary measures it is exprienced that zoo animals are prone to various infections through air, water, food and other sources. There are also certain predisposing factors which reduce the immunity, resistance power of animals like stress, excitement, parasitic load, pollution, authracosis etc. These factors create favourable conditions for propagation/ multiplication of causative organisms viz bacteria and viruses.

Mostly in zoos outbreaks of epidomic/endemic diseases are rarely recorded. However incidences of pasteurellosis are more common among the bacterial diseases the incidences of tuberculosis, pasteurellosis, salmonellosis, enterobacterial infections, aspergillosis in birds are more common. However, it is noticed that during the initial phase of infection the animals appear apparently normal in paracute and acute forms of infections. The symptoms are noticed when the disease goes in septicaomic form when animal is either in the last stage or do not respond to treatment. It is also observed that in certain paracute forms of infections, even though the requisite antibiotics are immediately administered, the bacterias in the blood circulation are killed but the toxins liberated by them are lethal to the patient, ultimately resulting in the death of the animal.

In the chronic forms of diseases there is time to get the detailed clinical examinations. In many cases we come across such cases where there is such poor response to the treatment that even higher doses of antibiotics do not show fruitful results. In such cases one has to go for sensitivity tests, which clearly indicates that the invaded bacteria are sensitive to particular antibiotics only. Accordingly proper antibiotics can be selected.

Today, an important aspect of infectious disease is that the resistance power of animal is reduced due to various predisposing factors. Instead of one specific infectious organism invading the system, it is more likely that multiple forms of infectious organisms can invade and propogate in the animal body system. During the chronic form of such diseases, the sensitivity test is the proper guide for effective line of treatment.

In many zoos in India it is oberved that the keeper attending the particular animal enclosure is the key person to be closely attached to the animals in his charge. As such, he is the only person who can note any change in the day to day behaviour of animals and differentiate and identify the changes in normal behaviour and health of the animal. Unfortunately, however, a majority of the keeper staff in zoos in India are not vigilant to the required extent with the result that those slight but significant changes in behaviour, food intake, stool, urine consistancy are not noted by the keeper staff resulting in advanced stages of infections and diseases in animals. It is, therefore, essential to have a daily health monitoring programme for zoo inmates to enable to render immediate treatment to the sick animals.

One must appreciate that the veterinarians in zoos in India are doing their best inspite of various odds and lack of facilities compared to zoos abroad.

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Reprint : Zoos' Print, 1 (8) : 9-20, August, 1986

SOME HEALTH PROBLEMS ENCOUNTERED IN CAPTIVE AND SEMI-CAPTIVE RHINOCEROS

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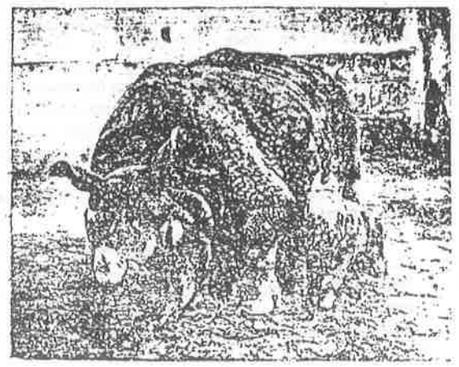
Lecture Presented at Wildlife Summer Institute, I.V.R.I., Izatnagar. May 86

A perusal of the available literature reveals that losses among great Indian one horned rhinoceros *(Rhinoceros unicornis)* by catastrophies like diseases and injuries have occasionally been encountered in captive and free life. The infrequent reporting perhaps may be due to their 1) extremely low population as compared to other wild herbivores and 2) peculiar habit of remaining in irregular and discontinuous contact with other wild animals and with their own kind.

The present paper describes some of the fatal conditions recorded during our regular consultancy offered to various national wildlife reserves in the matter of health care, management and disease investigation.

Materials and Methods

This study accounts for mortality in 8 rhinos. These included 6 rhinos on display in captivity (zoos) and 2 out of 5 rhinos transported from the wildlife sanctuary, Assam to Dudwa National Park, Uttar Pradesh, under the reintroduction scheme of the Government. Cases have been described in respect to their clinical history and subsequent observations.



A Female Indian Rhino after giving birth

History and Observations

Case Study I :—During August, 1983, at Nehru Zoological Park, Hyderabad three rhinos fell sick and died after ailing for a period of 8-10 days. The clinical signs were weakness of hind limbs, shivering, grinding of teeth, nasal and occular discharges, anorexia followed by recumbency. During the illness body temperature ranged between 36.5°C and respiration rate 17 to 50 per minute. Dehydration was obvious in the terminal stages.

Animals were administered broad spectrum antibiotics, vitamins, corticosteroids, electrolytes and saline both orally and peritonialy but to no avail. Clinically the disease was suspected to be viral in nature. The postmortem examination was conducted. The small intestines showed marked haemorrhages and a great many tapeworms. A small abscess in the lung was present in a male rhino. Studies on virological isolation, pathological and blood examinations were carried out at IVRI, Izatnagar. The specimens were also processed simultaneously by Veterinary Biological Research Institute (VBRI) and Veterinary College Hyderabad.

Case Study II :—The Prince of Wales Zoological Garden, Lucknow maintained a pair of rhinos (7 year old male and 8 year old female). The female rhino fell sick on 13th December, 1983 and died after an illness of 6 days. The clinical signs were anorexia, restlessness, frothy salivation, tendency to bite her mate and other objects, staggering gait, paralysis of lower jaw and dashing of head against enclosure. On the morning of the 19th she was found dead. Clinically the case was diagnosed as rabies. Except for frothy exudate in the trachea and bronchi and severe congestion of meninges no other gross pathological changes were recorded. Brain specimens were collected in 50% buffered glycerine saline solution

for biological tests (mice inoculation) and in 10% formalin for histopathological examination. Soon after the death of the female, the remaining male rhino was immunized against rabies with 14 × 30 ml. dose of B. P. L. inactivated anti-rabic vaccine. But after about 1 year, the animal developed clinical manifestations similar to its female partner and met the same fate. The course of illness in this case was however, about 3 days. Clinically rabies was suspected. Only brain specimens were collected and processed for rabies diagnosis.

Case Study III :—On 31st March 1984, five rhinos were reintroduced to Dudwa National Park. They were kept in temporary stockades in the park. One of the females soon after arrival had a miscarriage. The animal had developed deep wounds and abscesses on many parts of the body, due to injuries. Later on the vagina was found swollen with putrid discharge. The animal went off feed, became dull and depressed. Her body temperature ranged between 96.2 to 100°F. Pulse and respiration rates were 40 and 10 per minute respectively. The animal did not respond to treatment and died on 12th April, 1984. The necropsy was performed 24 hours later. The gross pathological changes were recorded and specimens submitted for laboratory investigations. The remaining 4 rhinos were released into different areas of the park.

Case Study IV :—On 6th May, 1984, a female out of 4 rhinos released at Dudwa, National Park, was found limping on its forelimb. A deep wound on its croup infested with maggots was being picked by crows. For thorough clinical examination and treatment, she was tranquillized using M-99 (immobilon) on 7th May, 1984. After the needful drug was administered [fevivon (M 50-50)] the cow got up and walked a few steps but fell down on her right side. Repeated efforts to stand were not successful. It was noticed that right forelimb was unable to support weight and was being held in flexion, though the initial trouble was limping on left forelimb. It appeared that the animal had sustained contusion of shoulder joint and/or radial nerve compression and was treated. All the vital reactions of the animal, however, remained normal.

Some improvement was seen on the second day of treatment. The animal frequently tried to get up and at times attempted to step forward by the 5th day of treatment, but further improvement did not take place and subsequently she preferred to remain recumbent. The animal maintained her appetite. She ate food and drank water normally. The possibility of fracture in the limbs, however, was ruled out. Occasional passive extension and flexion of the limbs were advised, besides the symptomatic treatment.

On 26th May, 1984 besides the problem in right limb, a diffuse swelling on antero-lateral aspect of the left carpal joint developed. It was explored on 28th May. The exploratory puncture revealed only fresh blood. It was topically dressed with iodine solution. Prolonged recumbency led to development of bed sores on prominences which were treated. An interesting point of observation was that even in this state the animal was still making efforts to be on her legs, but to no avail.

An expert attributed the ailment due to deep injury (internal), fracture or nerve paralysis. However, prior to these suggestions, the animal was already under our treatment for radial nerve compression and/or paralysis.

The animal's condition was reassessed on 18th June. Although the vital reactions of the animal (temperature, pulse and respiration) were found to be within normal range, she still appeared to be weaker physically. There was evidence of gradual emaciation, reduction in size and atrophy of the affected right forelimb. She was reluctant to rise even on being provoked. The left forelimb revealed hard swellings covering the forearm and the knee joint. The movement of the joint was found to be restricted. About 60–70 ml. of blood ringed synovial fluid was drawn for culture. In the absence of visible improvement in the condition, the administration of life supporting drugs was advised. Re-examination in July showed that the animal's condition had further deteriorated and progonosie appeared to be grave. She died on 31-7-84, following an illness of 85 days. The complete right forelimb was cut and removed from the body and the left forelimb was sawed from just above the carpal joint. On the medial aspect of right scapula a large blackish coagulated necrotic mass around the auxiliary nerve was observed. Both the legs were X-rayed and then dissected to find out involvement of any bone or joint.

Case Study V :—A female rhino of about 50 years being maintained at National Zoological Park, Delhi died on 10th November 1984. There was no medical complaint except that the cow was physically weak, disprited and less vigorous. Signs of

senility such as wearing of teeth, skin discolouration and thinning of tubercles, folds and leg musculatures, etc., were obvious. She was maintaining interest in taking food and water. To prolong her life, tonics were being administered orally till death. A necropsy was conducted. Except a tumorous mass of about 2 Kg in the uterus, no other abnormality was recorded. A piece from the mass was cut and subjected to histopathological study. Blood smears were also prepared and stained with Giemsa and Gram's methods.

Results and Discussion

Case Study I : Viral infection could not be detected in any of the three rhinos which died at Hyderabad Zoo. A massive load of *Anoplocephala* tapeworms was encountered in two cases. This infection is commonly recorded in captive as well as in free rhinos (Jones, 1979).

A pulmonary abscess noticed in one male rhino was found to be tuberculous in nature. Hycobacterium acid-fast organisms have been demonstrated from pulmonary and pleural abscesses in rhinoceroses (Keep and Basson, 1973). The present cases yielded *Salmonella sp.* from intestinal contents (Sabir Ali, per. comm). According to the available literature, *Salmonella* infections have been reported on a number of occasions in both non-fatal (Williamson *et al.*, 1973 ; Jones, 1979 ; Clausen and Ashford, 1980) and fatal cases (Silberman and Fultan, 1979 ; Windsor and Ashford, 1972 ; Shmidt and Hartfiel, 1976). The isolation of *Salmonella* coupled with the occurrence of acute haemorragic enteritis indicated that the animals might have succumbed to this infection.

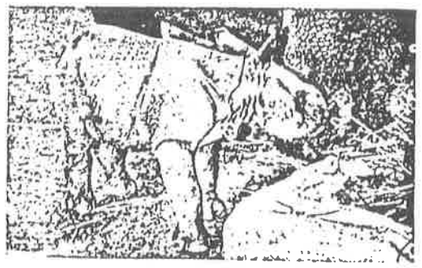
Case Study II : The presence of Negri bodies mostly in the Purkinje cells of cerebellum were detected in this female animal that died at Lucknow Zoo. Mice inoculated intracerebally with brain suspension started succumbing from 5th day post inoculation showing typical paralytic symptoms and the impression smears from their brain stained with Seller's stain revealed the presence of Negri bodies. The clinical symptoms, pathological and biological findings proved it to be a typical case of rabies. The epidemiological investigation carried out pointed to the possibility of the animal having been infected through contact with a rabid dog (Mukherjee *et al.*, 1984). Purkinje cells of the cerebellum and neurons of cerebrum and medulla showed marked degeneration. Mild perivascular cuffing was noticed in the sections of spinal cord but the biological test proved to be negative in case of male rhino.

Case Study III : The aborted cow developed septicmetritis and died due to pyaemic toxaemia. The cause of miscarriage apparently was prolonged transportation stress.

Case Study IV : Animal revealed fracture of the 8th right rib and atrophy of the muscles of the right limb. The muscular atrophy resulted due to radial paralysis following trauma at the axilla and damage to the nerve fibres. Cases of transient and permanent radial paralysis in black rhinoceroses immobilized and down on one side for 5.8 to 17.6 hours have beed recorded by King (1965). The present case essentially met the same fate after being tranquillized using M 99. Skin of the elbow of this limb had a hard mass of tissue at the base of decubitus ulcers. Medical aspects of radius showed small area of bone erosion. *Staphylococcus aureus* was isolated from the synovial fluid of the left carpal joint. Osteoarthritis on X-ray examination and fracture of the radial and intermediate carpal bones of this joint were noticed, which have occurred as a result of some trauma (Hamerton, 1939).

Case Study V : The animal under study died at the age of about 50 years. Based on the signs of senility and history of a relatively long period of captivity, death was attributed to its old age. Earlier the maximum life span of 47 years in a rhino at Zoological Garden, Calcutta has been recorded (Sanyal, 1892). The hard tissue mass in the uterus was diagnosed to be fibroma.

(References p. 20)



A Captive born Indian Rhino calf

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Reprint : Zoos' Print, 2 (10) : 15-16, October, 1987

A PAT FOR ME

By Dr. MIR GOWER ALI KHAN
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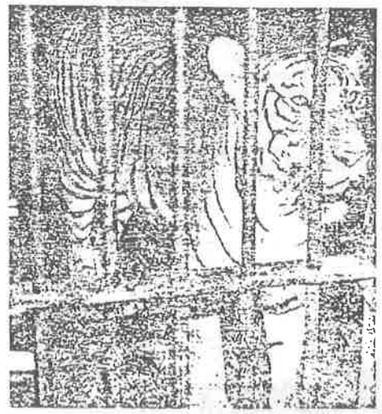


The Heat - struck tigress.

Summer of 1973 was very servere and challenging to the Zoo authorities. On 3rd May one of the female Tigresses, which was left in the open yard for the morning stroll, straight away went into the moat and had a dip in the cool and refreshing water. She did not enjoy a long bath, as after a few minutes she restlessly came out of the water and vomited pieces of bones and undigested beef. A little later she fell on to the ground, vomited again, and was so weak she could hardly stand up and walk. She staggered and with great difficulty could pull herself up to the squeeze case, when forced. She was then taken into it and was examined closely for diagnosis and treatment.

The Tigress was panting badly with the tongue protruded out of the mouth and cyanosed. Pupils of both the eyes were dilated to the full extent with no eye reflex. She was completely unconscious. The body temperature was 102°F which later rose to 104°F. Broad spectrum antibiotics, Belamyl and Glucose saline were injected thinking the case to be of "Feline Distemper", as vomition and extreme dehydration are the very important symptoms of this viral disease.

It is my day-to-day experience in the Zoo management, that whenever an important animal falls sick, the whole machinery rises to the occasion and there is a real life in the campus. The officials get on coming and going. The Jeep moves briskly on its four wheels, delivering the stock of medicines, equipn ent and food, and transporting the Vets, from Zoo Hospital to Vety, college and from therain to vety. Research Institute. Or the vehicle will be hovering over all the city Medical Stores for the search of particular brand of medicine. So this also was one of such occassions. I was attending the animal when the news of the arrival of the Zoo Director was conveyed to me.

He arrived a robust person, white in colour with light pink cheeks, bent a little forward gracefully, a pipe in his mouth and one of his hands in his pocket. He became alarmed when saw the unconscious tigeress with the cyanosed tongue out of the mouth.

"OH! Hopeless case! She cannot survive. Much delay has been done in finding out the animal to be really Sick". "No Sir, fortunately the squeeze cage is here only. We left no time in attending it",

"Difficult to believe man".

His face turned red with anger and left the place with slow and short steps.

After his departure I diverted my full attention once again towards my patient. I thought over and over how to justify the symptoms of cyanosed tongue and the continuous panting in feline distemper. This is something else. I injected again 200 cc of saline and went back to the chair under the shed to relax a little. One of the attendants came with a glass of ice cold water. "Sir, it is very hot today". "OH God, how on earth could I forget this: it is a typical case of heat stroke!" Immediately a large piece of ice was brought and in no time the whole body of the tigress was sponged with ice cold water. I sat at the perteriers of the patient with enema can in my hand holding the rubber tubing, half of it deep into the tigress' rectum. A bucket full of ice cold water was injected in this way. A shot of Aminophyline was given to relieve the panting. After ½ an hour the animal got up and assumed a natural sitting posture. Saline was repeated and a second dose of Aminophyline was given.

In the late Afternoon we offered her every thing, right from mutton soup to a well dressed chicken but nothing was touched by the sick animal. She sat there with all royalty without showing any signs of discomfort. With content hearts we left the place giving detailed instructions to the zoo attendant on night duty.

After a week the Zoo was busy in celebrating its annual function, "Vanya Prani Sabtaha," (Wild Life week) with all the grandeur. A colourful shamiana erected in the eastern corner of the "Formal garden". The dias was covered with a spotless white long cloth. A large table was placed in the centre of the dias and high-backed wooden chairs beautifully carved were arranged to one side. The right side was reserved for the press with a placard " FOR PRESS" fixed in the ground; the left was earmarked for the Prize winners. The multi. coloured buntings were fluttering all round.

As the time for inaguration was approachiug near the V·I.Ps. attired in their best, started getting down from their cars. The Host and the guests were busy. " Hello" "How do you do".

" Thank you ".

" Oh marvellous, The place is very well decorated",

" Thank you ".

The Zoo Director was in a dark grey suit with a crimson red tie. He was in a cheerful mood; welcoming the visitors, shaking, hands; laughing and cutting jokes. Among such gestures his eyes caught me. He looked deep into my face, and with a smile signed me to come near. When I approached him closer, he patted me on my back with the same pleasing face, A reward for the attention I paid towards my sick Tigress, I thought.

The author, Dr. Mir Gower Ali Khan.

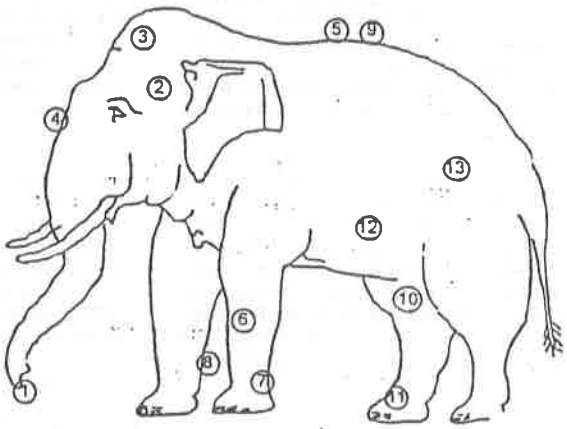
Reprint : Zoos' Print, 11 (6) : 24, June, 1996

IMPORTANT MARMMAMS ON THE ELEPHANT'S BODY

Shri Ponnapan* and Shri Radhakrishnan**

'Marmmam' is a Malayalam word meaning the sensitive points on the elephant's body which may cause excessive damage to the elephant's body and health, if abused. Tradition says that there are at least 101 such areas on the elephant's body. The places where the artery and veins cross over the bones i.e. right below the skin is very sensitive. If a lot of pressure is exerted in these areas it is dangerous for the elephant. A typical example of such an area is the elbow in humans.

Listed below are Marmmams on the elephant's body and also the side effects caused due to abuse of this area. It is important for a mahout to know these so that when he has to use his stick or *Thotti* on the elephant he can avoid these areas. Any slight damage to these places will be prove detrimental to the health and well being of the elephant.



1. The tip of the trunk or the *'Thunikkai'*

2. *'Kannakuzhi'* (the temporal region): any damage to this area (by using the stick or *Thotti-ankus*) will cause blindness eventually.

3. Head: damage to the brain, internal swelling and pus.

4. *'Vayukumbham'* (shoulder) and sorrounding area: swelling and pus. The pus may flow out of the nose.

5. *Irikkasthanam'* (the mahout's seat): This place is so sensitive that it is said that even breaking wind will cause damage.

6. *'Vakkathazhambu'*: The ridge or thickening caused due to pulling the Vakka or the rope while hauling timber.

7. *'Thavalakuzhi'* (this is a depression found behind the legs near the feet). The mahouts sometimes use their stick on the legs while the elephant is walking and if it hits this region then the elephant may fall on its face on the ground.

8. The knee portion above the *'thavalkuzhi'*: Abuse of this area will cause the *'Nada'* or the front feet to turn inwards.

9. The backbone.

10. Penis: Sometimes the penis protrudes prominently in some males and hangs out. In such conditions one has to be careful not to use the stick on the hindleg region. Also the elephant must be made to walk slowly or the penis might get injured due to abrasions.

11. The region on the feet where the chains lie and the area above it. Likelihood of instantaneous swelling in case of abuse with sticks or stones.

12. The belly: Use of stick will cause swelling.

13. The skin on certain parts of the elephant's body harden due to constant abrasion or use. One such region on the side of the elephant's body is the *'kidakkathazhambu'*. Any wound due to abuse will take a long time to dry.

14. Similiarly wounds on the area near the body chain and the temporal region will take along time to dry up.

It is dangerous to beat a tired and hungry elephant on its ear with a stick. The mahouts use the *thotti* while seated on top, on the depression around the pupil. There is loose skin in that area and also the area where the chain lies on the body, the feet etc. All these should be used only as a last resort to restrain the elephant and require years of practise to wield the *thotti* without seriously harming the elephant. The mahout can use the stick on the *'Peela'* or the *'Koottellu'* as these wounds will dry up quickly.

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Reprint : Zoos' Print, 5 (5) : 7-9, May, 1990

PUBLIC HEALTH ASPECT OF SOME WILDLIFE DISEASES IN INDIA

By A. T. Rao[1] and L. N. Acharjyo[2]

Wild mammals and birds, like their domestic counterparts, suffer from various diseases in a free-living state as well as in captivity. Many of people such as conservationists, pet lovers, hunters, poachers, taxidermists, veterinarians and workers in Zoological Gardens/Sanctuaries/National parks come in direct or indirect contact with living or dead wildlife. It is also well-known that the meat of many wild animals and birds are considered delicacies in most parts of our country. Investigations have demonstrated the important role of wildlife in the epidemiology of some diseases affecting man. The role of wildlife in this connection is established the world over and India is no exception. It is a strange paradox that the public health aspects of wildlife diseases have received scant attention. In this paper, the authors' own observations accompanied with a brief review of commonly occurring diseases of wild animals and birds which have public health significance have been incorporated.

Among the viral diseases, rabies appears to be one of the important wildlife diseases of zoonotic significance. A World Health Organisation report (1967) indicated that rabies is enzootic in every continent except Australia and has been reported from 63 countries (Sikes Sr. 1970). In India, it is countrywide in distribution and jackal, fox and mongoose are the vectors of rabies virus. Ratels, Civets, badgers, baboons, hyenas, squirrels, wild cats, coyotes, wolves, vampire bats etc. (McDiarmid, 1962) acts as the carriers of the virus. The infection can be contacted in human beings through bite or contact with infected saliva. Two outbreaks of rabies among jackals of Nilgiri district in 1943 and 1956 were responsible for decline in their population (Report, 1957). Evidence of natural disease in tigers is available in India (Burton, 1950 and Rao and Nayak, *pers. com.*). The famous domesticated tigress "Khairi" which was bitten by a stray dog, died after showing typical signs of rabies. The disease was diagnosed on the basis of histopathology and fluorescent antibody technic. Rao *et al.* (1980) reported an outbreak of rabies in lions at Nandankanan Biological park. The affected lions showed typical clinical signs of rabies. One lioness died within 2 days of showing clinical signs and bitten two other lions in the same enclosure. The second and third lions, respectively, exhibited clinical signs 15 and 42 days post bite, and died within 5 days of sickness. Mongoose was attributed to be the source of infection.

Foot-and-mouth disease (FMD) is an important disease of wild ungulates in free-living state and in captivity. The disease is countrywide in distribution. Gaur appears to be the worst affected species in India. Outbreaks of FMD among captive wild animals have been reported in Nilgai (Mukhopadhaya *et al.* 1975). gaur, sambar and spotted deer (Khan *et al.* 1983) and deer, mithun and gaur (Baruah, 1983). An out-break of FMD was recorded in sambar, spotted deer and blackbuck at Nandankanan Biological Park (Kar *et al.* 1983). The incidence and case fatality rates were 22.10 per cent and 20 per cent, respectively. 'O' type of virus was isolated from the affected animals. These animals had contacted the disease from the neighbouring village cattle epidemic. A mild form of FMD is known to affect human beings (Bisseru, 1967) after consuming the infected meat/through close contact with the infected animal.

Reports of human beings getting cowpox smallpox and measles from wild animals are on record. The primates are susceptible for smallpox infection (Bisseru, 1967). Smallpox like disease has been described in a chimpanzee (Raghavan and Khan, 1968). An outbreak of cowpox virus infection killing two out of three cheetahs has been described (Baxbay *et al.* 1982). Kuntze *et al.* (1982) reported two outbreaks of pox in a troupe of circus elephants. They observed that the pock lesions produced in chick embryos by the vaccinia virus and the virus isolated from these outbreaks were identical. Macarthur (1979) was of opinion that the human measles virus had a close similarity with virus isolated from an outbreak of measles in rhesus monkeys. The public health significance of new castle disease virus is well known. Similarly other virus diseases like Kyasanur forest disease, herpes B virus disease and yellow fever being transmitted from non human primates to human beings is well understood. But unfortunately no much information is available on these diseases in Indian wildlife.

Among the bacterial diseases, tuberculosis (TB) is one of the most common diseases of wildlife particularly in captivity. Bovine, human and avian strains of *Mycobacterium tuberculosis* which have got a wide host range can cause the disease in man and wild animals and birds. The disease has been reported in a wide varieties of animals and birds from different zoos of the country (Liston and Soparkar, 1924; Sengupta; 1974; Parihar, 1978-79; Rathore and Khera, 1982 and Baruah, 1983).

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Most of the avian species can be infected by the avian strain but the human and bovine strains can also infect parrots and parrot like birds (Gale, 1971). Human type of *Mycobacterium tuberculosis* was associated with giraffel (Rai and Chandrasekharan, 1958) and golden langur and pig tailed monkey (Rehman *et al*. 1981). Basak *et al* (1975, 1976) isolated bovine type from spotted and hog deer, common langur, stump-tailed monkey and porcupine.

During the course of histopathological investigation of wildlife diseases of Nandankanan zoo, 5 cases of TB in stump tailed monkey, lesser whistling teal, silver pheasant and pigeons during 1968-69, 29 cases affecting spotted deer, wild pigs, monkeys, four-horned antelopes and barking deer, white cockato and grey java sparrow during 1976-80 and 8 cases affecting sambar, gaur, barking deer and spotted deer were encountered during 1980-83 (Rao and Acharjyo, 1969, b ; c Rao and Acharjyo 1975 and Rao *et al*. 1982). Proportionate mortality rate, age, sex and organ involvement were discussed. Lungs were primarily involved in mammals and liver in birds. Tuberculous mastitis and myositis were also detected.

Anthrax, another zoonotic disease of importance is endemic in India and the organism has a wide host range including wild animals. The disease has been reported in the Indian Civet (Sastri, 1964), rhinoceros (Choudhury, 1965) and Kangaroo (Sengupta, 1974). Severe outbreaks of this disease among free-living gaur, chital, hog deer, barking deer, sambar, elephant and wild pigs have been reported (Sinha, 1976) Rathore and Khera (1983) mentioned the incidence of the disease among primates, deer, antelopes, wild boar and fox. The other bacterical diseases like brucellosis, clostridial infections, pasteurellosis, leptospirosis, colibacillosis, listeriosis, salmonellosis etc. affecting wildlife also have public health significance. However, no much information on these diseases is available in India.

Among mycotic diseases, aspergillosis affects a wide varieties of birds. According to Bisseru (1967), the floor of the birds' cage containing droppings and bird seeds forms an ideal culture medium for the growth of Aspergillus, the spores of which cause allergic disease in sensitised human beings. During the course of our investigation pulmonary aspergillosis was encountered in striated laughing thrush, white-eyed buzzard, rosy pelican, racket-tailed drongo, hill myna, paddy bird, wild duck, spurwinged plover, goose, pea-fowl and koel.

Mocardiosis caused by *Nacardia asteroides* causes chronic granulomatous disease of subcutaneous tissue, lymph nodes, bone, lungs, feet, pleura and meninges in man (Bisseru, 1967). A case of systemic nocardiosis in a hill myna involving lungs kidneys, proventriculus, masentary and muscles of the eye ball was reported (Iyer *et al*. 1972). The normal parenchyma in these organs was replaced by caseation necrosis/granulomas. Loupal *et al*. (1982) described nocardiosis in a red fox and small mongoose causing severe exudative pleurisy.

A number of parasites of zoonotic significance recorded in various species of animals during the course of ivestigation (Rao and Acharjyo, 1969 a, Patnaik and Acharjyo, 1970, Rao and Acharjyo, 1971, Rao *et al*., 1972 and Rao *et al*., 1973) at Nandankanan zoo have been appended below.

Name of the parasites	*Animal hosts*
1. Dirofilaria immitis	Tiger, panther, Golden cat, Indian fox and Jackal
2. Dirofilaria repens	Indian fox
3. Echinoccus granulosus	Wolf
4. Mesocestoides lineatus	Indian fox and leopard
5. Dipylidium caninum	Indian fox
6. Uncinaria stenocephala	Indian fox
7. Toxocara cati	Jungle cat and golden cat
8. Ancytostoma braziliense	Leopard cat
9. Toxocara laonina	Fishing cat
10. Taenia taeniaeformis	Colouded leopard
11. Trichuris trichura	Golden langur
12. Oesophagostomum aculeatum	Golden langur
13. Fasciola gigantica	Spotted deer and blackbuck
14. Fasciolopsis buski	Wild boar
15. Opisthorchis novorca	Wild boar
16. Echinostoma ravolutum	Pigeon
17. Paragoninus westermani	Mongoose and tiger

Conclusion

An attempt has been made to focus some of the wildlife diseases of zoonotic significance which were encountered during routine investigation of diseases at Nandankanan Biological Park during past 17 years. Though some of the diseases are of great concern to public health, it was not possible to establish their actual role in human health. Therefore, it is suggested that an intensive surveillance of diseases affecting wildlife both in captivity and in free-living state should be carried out. Periodical testing of people associated with all wildlife activities will establish their possible correlation with human health. To avoid any possible health hazards, people in general and those working in close proximity with wildlife in particular, should be educated on the possible role of wildlife diseases in human health. It is hoped that the present account will provoke scientists to further investigation on this aspect.

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Reprint : Zoos' Print, 5 (5) : 23-24, May, 1990

HOMOEOPATHY FOR ANIMALS

By Dr. R. P. Barahate, Veterinary Officer, Sanjay Gandhi National Park, Borivalli

Homoeopathy is a system of curing all curable diseases whether in man or animals by small doses of those medicines which are capable of producing in the healthy body symptoms similar to those produced by the disease in the sick body.

A distinguished Veterinary Surgeon, Dr. Haycock says of Homoeopathy "It cures disease more quickly; it does so without leaving any injurious effects upon the constitutional powers. It saves more lives and it costs less". It cannot be contended that the subjects of the curative powers of Homoeopathy here referred to Horses, Cattle, Sheep etc. are influenced in their recovery either by faith or imagination.

Homoeopathy is the discovery of the German Physician Dr. Samuel Hahnemann, who was born on 10th April, 1753, in Germany. Though he was Allopath (M. D.), he was not satisfied with the medical science and its methods of treatment "Like cures like" or *similia similibus curenter* is the basic principle of Homoeopathy. A medicine in minimum doses cures all such symptoms or diseases which it is capable of producing in a healthy person when taken in large doses.

In 1810, Hahnemann published his "Organon of medicine which is termed as the Bible of Homoeopathy clearly and logically explains the principle like cures like" "Minima Minimus" the second principle of Homoeopathy is to minimise the dose Dr. Hahnemann mixed the medicine with alcohol, distilled water or sugar of milk. By a special procedure dose was minimised and dynamised. The molecules of the medicines were divided and subdivided to increase their curative power, which were named as potencies. Potencies are prepared by mixing well one part of the original medicine with 9 parts of the alcohol or distilled water or sugar of milk. The potencies are 3, 6, 30, 300, 1000 or (1^M) 10,000 (10^M) 1,00,000 as CM. The original medicine is called mother tincture indicated by Q. Solid mother drugs are mixed with sugar of milk and ground well in pestle and mortor. This procedure of grinding is called triturating of the powder potencies are called triturations e. g. calc phos 12X trit.

The Materia Medics of Homoeopathy is nothing but the proving of the medicines on healthy bodies i. e. the symptoms which a medicine produced in a healthy body when taken in physiological doses. Therefore in Homoeopathy the name of a disease is not at all necessary to select the right medicine. "Homoeopathy treats the patient not the disease" Whereas in other systems of medicine diseases are treated. Therefore, to select the right remedy in Homoeopathy, the location of the disease, the sensations aggravation and amelioration of the troubles are the guiding symptoms.

In Homoeopathy dosage are Acute or Chronic. Acute diseases e. g. fever are short and sharp. In Acute diseases symptoms appear increase and either end in cure or death within days or weeks. In such diseases medicines are given frequently even at intervals of 5, 10, 15 minutes according to the severity of symptoms. In chronic diseases the body's vital force gets disturbed to their depths and the diseases keeps recurring. Chronic disease duration extends to months and years e. g. Cancer, T. B. In such disease the Homoeopathic medicines are repeated weekly, or monthly or even at longer intervals.

Homoeopathy does not prescribe for disease or a single symptom but one single medicine for the totality of the symptoms are physical as well as mental. Physical symptoms include temperature variations in behaviour, excretions from the body i. e. stools, urine etc. The time when the disease is aggrevated or ameliorated and its exact location on the body should be noted in as much detail as possible. Mental symptoms include appetite, anger feeling. Compare these symptoms with characteristics of medicines and select whichever is closest Thus in Homoeopathy every patient is treated individually according to the symptoms of his ailments and if carefully selected remedies are administered in the initial stages. Many chronic and serious diseases can be avoided. The selected remedies act upon the vital force and the vital force eradicates morbid symptoms in totality and restores the patient to the normal health.

Homoeopathic medicines are available in four forms ...

1) Mother tinctures.
2) Pillules.
3) Globules.
4) Triturations (Powder)

Mother tinctures are extracts of original remedies prepared mostly in alcohol. Pillules are made of cane sugar which are then absorbed with a few drops of liquid medicine. Globules are smaller than pillules where as triturations are in the form of powder or tablets made from powder which contains the medicine triturated with sugar of milk. Pillules and Globules may be given on dry tongue or sucked but should not be allowed to swallow. This could also be dissolved in pure water.

The dose is repeated according to the severity of the disease. In ordinary cases, doses may be repeated 4 to 6 hours intervals and in chronic cases, medicines are given once a week or month. There are no prescribed rules for selection of potencies, ordinarily low potencies 3X, 6, 6X or 30 are used in acute cases and in chronic cases, high potencies such as 200, 1^M, 10^M, 50^M, CM are used at long intervals. In all cases when practicable, the medicines should be given to animals when they have been without food for some time, say 15 to 30 minutes before they are fed. As a general rule for cattle, horses, ten drops of tincture on two grains of the trituration may be given and for small animals like dog, sheep 2 - 5 drops or one grain of trituration may be given. It is often said that there is no surgery in Homoeopathy and without it, it cannot be called a complete science. This is a great misunderstanding. Homoeopathy is a thereapeutic science or the art of healing the diseases of human beings as well as animals by using medicinal substances. Surgery is a technique, a method of removing certain impediments in the way of curing a disease. Such as removing a foreign body from foot or setting up a dislocated bone.

There is difference of opinion regarding where surgery would be essential and where it could be avoided we are of the opinion that in 50% of the cases where surgery is practised it can safely be avoided e. g. tonsillitis and appendix in human, Dystokia, iiletiecis, (SIC) and vaxeination (SIC), temporary lamness in animals can be cured by oral medicines without surgery. I am of the opinion from my own experience suggest to try Homoeopathic medicines before surgery as Homoeopathy can successfully treat and cure all chronic cases.

It should be again underlined that Homoeopathy does not treat diseases as they are classified in other systems of medicine but the symptoms that occur in various diseases. In single disease there may be a large variety of cases with altogether different symptoms. So in Homoeopathy one medicine is used in many diseases.

Reprint : Zoos' Print, 5 (5) : 21-22, May, 1990

VETERINARY HOMOEOPATHY

The use of Homoeopathy in treatment of Captive Wildlife

By Dr. Samai Ram Saini

Introduction

This is in continuation of articles written earlier on the treatment of captive wildlife by the Homoeopathy system. The earlier results of treatment by this system was published in Zoo's Print March, 1988. The following captive animals were treated by Homoeopathic medicines successfully in the National Zoological Park, New Delhi and else where. Since March 1988.

Case No. 7 loss of appetite: Kinkajous

A young kinkajou of 24 days old was dull and was not taking food for the last two days. As requested by the Director, I examined the young kinkajou and recorded that the kinkajou was very weak, dull and suffering from bad effect of dry wind; it had lost its appetite. No allopathic medicines were given to this animal. I started treatment with a dose of Nux-Vom in glucose water pouring in the mouth by syringe at 6.00 p. m. on first day and a dose of Aconite at 8.00 p. m. on the 2nd day, the 7th of April, 1988.

On 8th April, 1988 at about 6.00 a. m. I visited the enclosure and observed that young kinkajou was little active, sitting under the breast of its mother. Another two doses of Aconite glucose water were repeated at 8.00 a. m. and 7.00 p. m.

On 9th April, 1988 I again examined the kinkajou and noticed that the young one had moved from one spot to other along with mother and become active. To improve the appetite a dose of Chelidonium at 7.00 a. m. and 6.00 p. m. in glucose water was given for 3 days. Thereafter young kinkajou has been eating ration regularly.

Case No. 8 Fright and Stress : The Swamp Deer

On 23rd March, 1988, a male and two female Swamp Deer were received from Lucknow Zoo. They were badly scratched all over body and being volatile they were also in a state of fright and stress due to the change of habitat. I was given the task to treat these animals.

I immediately gave a dose of Aconite in half bucket of water at 5.00 p. m. which was drunk by these animals and repeated another dose at 7.00 p. m.

On 24th March, 1988 I visited the enclosure and observed that the animals were free from fright and stress. At 10.00 a. m. a dose of Hypericum was given to prevent tetanus for internal healing of the wounds and repeated another dose of the same at 4.00 p. m.

On 25th March, 1988 I repeated the last dose of Hypericum at 10.00 a. m. and thereafter the Zoo Vet had sprayed balm on the wounds to prevent infection till they healed.

Case No. 9 Right leg fracture: Chinkara female

A female Chinkara's hind right leg was fractured due to fight in the enclosure. Allopathic treatment given earlier proved to be of no use and was given up on 8th Sept. 1988. I examined them and recorded that the female chinkara had swelling on the hind right leg, unable to touch her leg on the ground, right hoof bent backward and was eating less.

I started treatment with a dose of Nux-Vom at 11.00 a. m. and repeated a dose of Nux-Vom at 4.00 p. m. On 9th Sept. 1988, a dose of Hypericum was also given at 10.00 a. m. and another dose of Hypericum repeated at 4.00 p. m. to prevent tetanus, reduce pain and promote internal healing. I repeated Hypericum at 10.00 a. m. and 4.00 p. m. till 11th September 1988. On 12th September 1988 I visited the enclosure and observed that she had touched her hind right leg on the ground and swelling on the right leg also reduced. I started further treatment with a dose of Ledum at 10.00 a. m. and a dose of Arnica at 4.00 p. m. daily for internal healing and reunion of fractured bones of right hind leg till 10th October 1988. During the course of treatment I daily used to notice some improvement on the right hind leg. The female Chinkara was kept in the cell for further safety of the leg till 27th October 1988. Later on she was released in the open enclosure.

Case No. 10 Conception of female blackbuck

In the first week of February 89. Mr. Arun Bhatia of Bhatia Potteries requested me to treat his female blackbuck which was unable to conceive for a long time. I examined the case carefully and reached the conclusion that pair of Blackbuck was suffering from deficient sex drive due to lack of privacy in the enclosure. Workers were too close as the enclosure was very small and the Bucks

were disturbed every now and then. The enclosure was converted into natural habitat with some hides for the animals. Lycopodium 20 drops in a small bucket-full of water was kept to drink twice a day for a week in the enclosure.

In the second week of February 89, the female blackbuck was crossed by the male blackbuck, which ultimately resulted in the birth of a female black buck.

On 5th July, 89, I observed that mammary glands of the female blackbuck were developed. On 13th August 89 about 4.00 p. m. the female blackbuck delivered. This was the result of Homoeopathic medicines in the Bhatia Potteries.

Case No. 11 Paralysis: Male peafowl

In the month of April 89, Mr. Arun Bhatia of Bhatia Potteries requested me to treat his Peafowl whose left leg and neck were paralysed. He had tried allopathic medicines for a month but could not get any result. I examined the cage carefully and I started treatment with a dose of Nux-Vom thrice a day for 2 days followed by Kali Phos 4 globules in the morning and evening and Rhus Tox 4 globules in the noon and night regularly for a month. In the month of May, 1989 a report was received that there was much improvement in the left leg and neck movement. I repeated the same treatment in the month of May, 1989.

In the first week of June 1989, Mr. Arun Bhatia visited Zoo and informed me that the peafowl started moving its leg and neck very well and there is no limping at all. However, I gave Mag. Rhos 4 globules twice a day in the morning and evening regularly for a month. Now peafowl has recovered and is roaming about.

Case No. 12 A case of stomach disorder, Domestic male goat

On 20th April, 1986 a case of illness in a male goat was reported to me by the Zoo Keeper Sh. Girdhari of National Zoological Park. On physical examination, I recorded the following symptoms:

1. The Goat was apathetic 2. Rectum of goat was moving in and out, 3. Stomach was filled with gas, 4. Rumbling sound was heard, 5. stomach was distended 6. On touching the stomach and shaking the sound of water in stomach could be heard.

On enquiring about the diet given, it was stated that 1 kg. of wet atta was given. The following Homoeopathic medicines were given Nux-Vom a dose in small piece of jaggery at 7.00 p. m. and three doses of Opium at intervals of 1 hour each, that is from 8.00 to 10.00 p. m. At 10.30 p. m. I again enquired the goats health and was told that the goat has passed liquid stool with rumbling sound and goats stomach became soft. The goat began moving her tail, ear, and other limbs with relief. No further medicine was given to the goat and goat was cured.

Case No. 13 Acute tonsilities-Fever: Dog (Deepak)

On 12th December 89 Mr. Kamal Naidu I. F. S. DIG requested me to treat his dog (Deepak) who was suffering from acute tonsilities and fever. I examined the dog and found that throat of the dog was blocked by enlarged tonsils. The dog was very dull and was not taking anything. A dose of Byco-10 (combination of Calc. Phos-6x F. Phos-6x, and Kali Mur-6x) 4 globules thrice a day was given for 5 days.

On 15th December 1989, the dog was fully cured.

I recommend some of the following treatment for the captive wild animals.

Preparation of dose

A dose may be prepared in 40 Nos. of globules or in water as per the eating habit of the wild animals.

Dose: Small animals - 2 drops of tincture in water or 5 globules.

Big animals: 4 drops of tincture in water or 10 globules.

Treatment: Shock-Aconite, Arnica,

Injury with fright: Aconite

Brushing: Arnica Ledium,

Injury at joints / fibre tissues: Rhus Tox, Hypericum.

Soreness around wound: Rhus Tox

Vomiting: Ipecac, Nux-Vom.

Rheumatism: Rhus Tox

Diarrahoa: Cham, Nux-Vom

Tetanus: Hypericum, Ledium.

Heat stroke: Bella-donna, Selsemium.

The success of Homoeopathy in the treatment of wild animals can open a new chapter in Veterinary Science.

Reprint : Zoos' Print, 6 (11) : 13-14, November, 1991

COMPARISON OF CHEMICAL COMPOSITION OF MIXED HERBAGES AND FAECES OF SOME DEER SPECIES OF DUDHWA NATIONAL PARK, INDIA

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ABSTRACT

Average chemical composition of mixed herbages collected after 6 - 8 weeks of pasture burning and faecal pellets of swamp deer (*Cervus duvauceli*), spotted deer (*Axis axis*) and Hog deer (*Axis porcinus*) was compared from the natural habitat of Dudhwa National Park during the month of June. Crude protein percentage in the dried faeces of swamp deer was comparable to mixed herbage, but it was higher in the faeces of spotted deer and hog ceer.

Mean weight of dried faecal pellets was related with the body size of deer species. It was maximum (839.3 +/- 15.93 mg per pellet) in swamp deer followed by 538.0 +/- 4.16 mg in spotted deer and 205.3 +/- 2.91 mg in hog deer. The body size of swamp deer was largest and that of hog ceer smallest.

The chemical composition of faeces depends on the type of herbages consumed in natural habitat and size of faecal pellets is often characteristic in different species (Bennet et al. 1949, Coe and Car, 1983 and Pathak *et al.* 1988). In this study chemical composition of mixed herbages found to be eaten by swamp deer (*Cervus duvauceli*) spotted deer (*Axis axis*) and hog deer (*Axis porcinus*) and their faecal pellets has been compared from the natural habitat of Dudhwa National Park, India. Average weight of over-dried faecal pellets of these deer species was also recorded.

MATERIALS AND METHODS

The site of study, Dudhwa National Park is one of the tiger reserves in the sub-himalayan forests of India. Three habitats of mixed deer species were located in different parts of the park during June, 1986. As far as possible representative samples of herbages grazed by deer species and feacal samples were collected and analysed for chemical composition as per AOAC (1980). Fifty faecal pellets of each species from different locations were dried in hot air oven over night at 100 +/- 1 °C for determining dry weight of pellets.

RESULTS AND DISCUSSION

Average chemical composition of mixed herbages and faeces of deer species is presented in Table 1. The percentages of crude protein (CP), ether extract (EE) and ash is mixed herbages were in the range of preflowering grasses (Sen et al. 1978). Mean CP content in faeces of swamp deer was similar to herbages but it was higher in the faeces of spotted and hog deer which may be due to selective feeding of tender grass blades containing higher crude protein. Ether extract in faeces was much higher in comparison to herbages except in spotted deer, but a very high standard error in EE content of faeces of spotted deer changed the picture. Very high increase in ash content of faeces may be due to high digestibility of organic constituents of herbages coupled with soil consumption for minerals supppiy. An increase in faecal CP in comparison to fodder CP has been also observed in roe deer (*Capreolus capreolus*) by Papageorgiou *et al.* (1981).

Mean weight of faecal pellets was related with the body weight of deer being largest in swamp and smallest in hog deer. This was in line with the observation of Coe and Carr (1983). Mean weight of faecal pellets of wild hog deer was similar to captive hog deer fed a ration of concentrate and fodders (Pathak et al. 1988).

The observations of the present study revealed a close relationship between the body weight of the deer species and the weight of their dried faecal pellets, which may be used for the location of different species of deer in a forest and also the composition of mixed herds. The mean CP content of faecal pellets on dry matter basis was found to be satisfactory indicator of the CP content of herbages usually consumed by the deer species.

Tables on following page.

ACKNOWLEDGEMENTS

Thanks to Director, Indian Veterinary Research Institute, Izatnagar and Director, Dudhwa National Park for providing necessary facilities.

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Table I.
Chemical composition of mixed herbage and faecal pellets of deer on dry matter basis (%)

Nutrients	Mixed herbage	Faecal pellets		
		Swamp deer	Spotted deer	Hog deer
Crude protein	8.55+/- 0.23	8.49+/- 0.13	9.11+/- 0.08	9.01+/- 0.12
Ether extract	3.19+/- 0.14	5.73+/- 0.23	3.14+/- 0.88	5.21+/- 0.16
Carbohydrates	83.10+/- 0.31	68.57+/- 1.54	68.37+/- 0.44	68.80+/- 0.14
Organic matter	94.84+/- 0.37	82.79+/- 1.18	82.44+/- 0.92	82.88+/- 0.30
Total ash	5.16+/- 0.37	17.21+/- 1.18	17.56+/- 0.92	16.98+/- 0.17

Table 2
Average weight of oven-dried faecal pellets of deer

Deer species	Weight of 100 pellets(g)	Weight of one pellet (mg)
Swamp deer *Cervus duvauceli*	83.93+/-1.59	839+/-15.93
Spotted deer *Axis axis*	53.80+/-0.42	538+/-4.16
Hog deer - *Axis porcinus*	20.53+/-0.29	205+/-2.91

Reprint : Zoos' Print, 6 (5) : 6-7, May, 1991

FEED INTAKE, DRY MATTER DIGESTIBILITY AND DEFAECATION RATE IN CAPTIVE HOGDEER (*Axis Porcinus*).

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Abstract

Voluntary feed intake, dry matter digestibility, daily defaecation rate and pellet weight of two adult Hog deer (*Axis porcinus*) of 33 kg. average body weight was observed in captivity. Deer were offered 500 g concentrate mixture for cattle and *ad libitum* green maize chaff. Average dry matter digestibility was 76.51 % and DM intake and DDM intake per 100 kg body weight was 2.52 and 1.94 kg respectively or 60.62 and 46.58 g/kg $^{W^{0.75}}$. Average defaecation rate was 15.92 per day (range, 10-24). Number of pellets per defaecation varied from 43 to 70 with an average of 61.3 pellets, and mean weight of an oven dried pellet was 203.6 mg.

Introduction

The defaecation rate and shape and size of pellets of wild ruminants have been used for the estimation of population, herd composition, habitat and migration pattern of animals [1,2,3]. Chemical composition and weight of oven dried pellets of swamp deer (*Cervus duvaucell duvaucell*), spotted deer (*Axis axis*) and hog deer (*Axis porcinus*) of Dudhwa National Park, India have been reported earlier [4]. This study was conducted to record the defaecation rate and pellet size of captive hog deer during digestibility studies for further use in population estimation and benavioural studies of hog deer in natural habitats.

Materials and Methods

Two adult captive hog deer (Axis porcinus) of about 3 and 14 years of age kept in the Institute's experimental zoological park were used in this study. Wire gauze pens of about 10m X 12m size were erected in the vicinity of the park to provide near natural habitat.

The animals were housed individually and fed 500 concentrate mixture used by cattle, feeding along with *ad libitum* green maize chaff. Drinking water was freely accessable. After an adjustment period of one month on same feeding, a digestion trial of 6 days by manual collection was conducted. Daily records of feed offered, residue left and faeces voided were maintained. The number of pellet groups and total number of pellets voided were counted. The representative samples of feeds, residue and faeces were oven-dried at 100 +/- 1° C overnight for the estimation of dry matter content.

Results and Discussion

Dry matter intake : The large difference in dry matter intake between the deer may be due to great difference in their age and longer stay of older deer in natural habitat where concentrate feeding is not practiced (Table 1). The dry matter digestibility of ration was very high and difference between the animals was due to difference in concentrate : roughage ratio.

A large variation was observed in defaecation rate within and between the two deer. Average daily defaecation rate 15.92 was lower than the 20.3 pellet groups (range 16-24) in captive hog deer reported earlier [5]. In penned white-tailed deer (Odocoileus virginiasus) daily defaecation rate ranged from 11 to 14 times [6]. The number of pellets per pellet group was within the range reported in hog deer [5].

There was little difference in the dry matter content of pellets of two hog deer, and pellet weight was comparable with the pellets of wild hog deer of Dudhwa National Park [4]. Dry matter content per 100 pellets of Steinbok (*Raphicerus campestris*), Springbuck (*Antidorcas marsupialis*) and Impala (*Aepyceros melampus*) has been reported to be 10.5, 16.5, and 26.5 g for 15, 26 and 32 kg. body weight respectively 7 . Although the body weight of adult hog deer was similar to impala but dry matter content in faecal pellets of former was much less than the later species of wild ruminant.

TABLE 1. VOLUNTARY DRY MATTER INTAKE IN HOG DEER

Particulars	*Deer 1*	*Deer 2*	*Average*
Body-weight (kg)	35	31	33
$W^{.75}$ (kg)	14.39	13.14	13.76
D M. Intake (g/day)			
Concentrate mixture	445	177.8	293.5
Green maize chaff	593	467.5	560.5
Total	1038	645.3	841.7
Conc. : roughage ratio	43:57	28:72	37:63
D M digestibility (%)	78.22	74.80	76.51
DMI/100 kg W(kg)	2.97	2.08	2.52
DMI/kg $w^{0.75}$ (g)	72.13	49.11	60.62
DDMI/100 kg W(kg)	2.32	1.56	1.94
DDMI/kg $W^{0.75}$ (g)	56.43	36.73	46.58

TABLE 2. DEFAECATION RATE AND WEIGHT OF OVEN-DRIED PELLET.

Details	Deer 1	Deer 2	Average
Pellet groups/day, Range	12-24	10-18	10-24
Average	17.67	14.17	15.92
Pellets/group, Range	43-70	56-66	43-70
Average	61.9	60.7	61.3
DM/100 pellets (g)	20.66	20.07	20.36
DM/pellet (mg)	206.6	200.7	203.6

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Reprint : Zoos' Print, 1 (10) : 7-8, October, 1986

TUBERCULOSIS IN A WILD CHITAL AT RANTHAMBORE NATIONAL PARK, RAJASTHAN

By W. A. Rodgers and K. K. Bhattacharjee

Introduction :

Tuberculosis is considered as a serious clinical condition in captive cervids (Mammalia *fam. cervidae)* in India, and all over the world (Arora 1980. Basak et al 1976, Jones, 1976, Winkler and Gale 1970). While tuberculosis (TB) in wild cervids has been documented elsewhere we do not know of any published report from the Indian sub-continent (Arora pers. comm. 1980). Hence this findings of TB in a free ranging chital (*Axis a × is*) from Ranthambore National Park, Rajasthan in November 1985 is of both veterinary and practical wildlife management interest.

Field Observation :

In the late afternoon of 17-11-85 some 3 km from the entrance gate to Ranthambore National Park (26 deg N. 76 deg. 30 min. E) we noticed an adult female chital lying down with recumbant neck and head. The animal was listless, with a rough coat and general body condition was poor. The next evening the same animal was found dead with mild rigor mortis already set in. On close observation no signs of external injury could be seen. No exudate of any pathological significance was detected in natural orifices. Subcutaneous swellings in the thoracic region were noticed. The carcass was taken for immediate post mortem.

Post mortem findings :

The carcass was emaciated with no perinephric, pericardiac or mesenteric fat. Femur marrow was colourless, transparent and of a soft jelly like texture. The animal was pregnant with a near to full term embryo. The rumen was full with a mixture of grass and browse species. The rumen had an estimated infestation of 150–200 adult *Paramphistomum* sp. flukes. Some ten *Taenia sp*. Cysts were seen in the intestinal mesenteries.

The thoracic cavity showed severe pulmonary infection of TB in multiple lesions in the lung parenchyma. Over 90% of the lung tissue was estimated to be affected by soft cheesy pus deposits in discrete nodules. Lymphatic tissue draining the respiratory and alimentary tract (Tracheobronchial and mediastinal lymph nodes) also showed typical tubercular lesions. Superficial lymph nodes were enlarged and on opening found to be tubercular. The cause of death was determined as Tuberculosis.

Chital in Zoo

Discussion :

Tuberculosis outbreaks are less frequent and of reduced morbidity and mortality among free living animals than captive or domestic animals which live at higher artificial densities and are in more intimate contact with man (Winkler and Gale, 1970). Griffith (1928) in describing the epidemiology of TB divided wildlife into three categories :

(a) Those kept in captivity-highly susceptible to TB.

(b) Those that are free living but in higher than normal densities, as in intensively managed park tourist zones etc -TB is not uncommon.

(c) Those that are free living with little contact with man or his livestock—TB is seldom, if ever reported.

We believe our case to be from a situation midway between 'b' and 'c'. Chital in Ranthambore have in the past been in contact with very large livestock populations sharing the same water sources. A major death of ungulates in 1980 was attributed to excessive *Paramphistomum* infestation, perhaps due to such shared water holes (Ranthambore Park Administration, pers; comm)

The fatality we observed came at a time of diminishing nutrients in cold dry season forage, and at a time of rapidly increasing demands of late pregnancy.

The question park management must ask now is to what extent is TB present in this population ? There are an estimated 3500 chital in the park and densities in the tourist zone exceed 40/sq. km. If one animal of this highly gregarious population died of the disease, it is probable that other individuals are also infected. Management should try and ascertain the extent of the disease. This could be done by culling and examining apparently diseased individuals, or by tuberculin testing a captured sample;

The problem of what steps management should take if TB is found to be extensive is beyond the scope of this paper. It is important to stress that no action should be contemplated before the problem has been fully investigated.

Acknowledgements :

We thank the Field Director, Project Tiger, Ranthambore for assistance and discussion.

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Reprint : Zoos' Print, 5 (10) : 12, October, 1990

TUBERCULOSIS IN A WHITE SPOTTED DEER (*Axis axis*)

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The prevalence of tuberculosis in both captive and free living deer family is not uncommon in India and abroad (Mc Diarmid, 1960, Belli,1962, Jones et al., 1976,Arora 1980,Rathore and Kher,1982,Rodger and Bhattacharjee 1986 and Shah et al., 1987).The present communication refers to a spontaneous case of tuberculosis in a deer at Kamla Nehru Park,Indore (M.P.)

Photograph showing tuberculosis nodule attached to the perital surface of the pleura

A carcase of white spotted deer (*Axis axis)* aged about 2 years was received in a department with a history of sudden death.The external appearance of the animal was fairly normal and did not show the usual signs of a chronic wasting disease.On the post mortem examination the thoracic wall revealed caseocalcarious nodules distributed irregularly and attached to the pleural surface.These nodules were greyish white in colour ,round or elongated in shape and were up to the size of a pea.Some of the nodules were pedunculated and appeared like clusters of grapes attached to the perital surface of pleura.On incisions the nodules revealed central areas of calcifications and caseation.A large solitary caseacalcarious nodule was observed in the diaphragmatic lobe of the right lung.The affected lung also revealed focal areas of pneumonic patches characterized by congestion and consolidation.Nodules similar to those observed in the lungs were also found in the spleen and peritoneum.

On histopathological examination the tubercule showed central areas of caseation with calcification and zone of infiltration by lymphocytes,epitheloid cells with foamy cytoplasm and formation of few Langhan's type giant cells.The nodules were found to be encapsulated by proliferating fibroblasts.The pneumonic areas were characterized by hpermia of blood vessels,serofibrinous exudate in the alveoli and infiltration of neutrophils and few lymphocytes.When smears from the caseonecrotic material obtained from the tuberculous lesions were stained with Ziehl Neelson's method acidfast organisms could be observed either phagocytized in the macrophages or free in the necrotic tissue.

Tuberculosis in deer is not uncommon and it appears that they get infected through the respiratory route from the persons involved in the zoo management or visitors (Rathore and Kher 1982; Upadhyaya *et al.* 1986; and Shah *et al.*1986). The spread of lesions from the respiratory tree of the thoracic wall might have been due to the direct extension of the lung lesions or through lymphogenous route.The chronic proliferative splenic and peritoneal lesions might have resulted from the hematogenous dissemination.

It is further suggested that due precautions should be taken to prevent the transmission of infection from man to zoo animals an visaversa.

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Reprint : Zoos' Print, 8 (6) : 15, June, 1993

TUBERCULOSIS IN SIKA DEER (CERVUS NIPPON)

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Plate 1 : Mandible region and the knee joints showing swelling due to tuberculosis

Tuberculosis is not uncommon in the capative wild animals. Reports of this disease in the members of deer family kept in captivity are on record (Dodd 1984; Shan and Dholakia 1986 and Sood et al. 1986). The present paper deals with a case of tuberculosis in a four year old female Sika deer. The animal had swelling in the knee joints. The joints had become stiff and had resulted in lameness. Initially the animal was treated for rhumatic arthritis without any appreciable response. After about two weeks a similar type of hard swelling developed in the mandible (plate 1). At this stage the knee joints got dislocated resulting in lot of pain and discomfort to the animal so much so that it resulted in its immobilization (Plate 2). Test puncture of the swelling resulted in thick cheesy exudate which on bacteriological examination revealed Mycobacterium tuberculosis. However it could not be worked out as to which strain the organism belonged. The animal was positive to single intradermal tuberculin test with mammalian tuberculin.

Subsequently, the animal was kept under isolation and treated with Rifampicin Sugar coated tablets of 450 mg marked by Hindustan Ciba-Geigy 450 mg and Isonex Forte Isoniazid tablets of 300 mg marketed by plizer Limited 300 mg daily. The animal started showing some improvement when suddenly on fourth day post treatment it died. Postmortem examination revealed pulmonary tuberculosis with accumulation of blood in the thoracic cavity. This had occured because of rupture of one of the nodules. The knee joints had arthritis with accumulation of cheesy mass in the joint capsule. The mandible had typical ramification. The cervical as well as prescapular nodes were enlarged and had become soft. Microscopic examination of the smears from the exudate of the lesions stained by Zeil-Nelson method revealed acid fast bacilli typical of M.tuberculosis.

This wasting disease,apart from being infectious,has zoonotic importance. It is,therefore,suggested that a regular tuberculin testing of zoo animals should be done. Amongst the captive wild animals the members of deer family being more susceptible to tuberculosis (McDiarmid 1960) needs a particular attention. For the prevention of spread of the disease the planning of the Zoo should be done in such a way to keep this species away from other animals. Further for an early detection of the cases tuberculin testing of the animals should be done and for treatment as suggested by Quinn and Tower (1963) and Tower (1968), Isoniazid in combination with suitable antibiotic supported by good feeding and management of at least six months duration should be undertaken.

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Plate 2 : Swelling and enlargement of the knee joints resulting in its immobilization

Reprint : Zoos' Print, 11 (1) : 15-16, January, 1996

TUBERCULOSIS IN PRIMATES

K. Mukunda

Tuberculosis is an ancient disease, evidence of spinal tuberculosis having been discovered in Egyptian Mummies and lung tissue of Peru. Mummies showed lesions of modern TB. Tuberculosis in animals appears to be equally ancient. Iyer (1937) reports evidence in early Hindu literature. Tuberculosis was common in elephants as early as 2000 B.C. Robert Koch in 1889 isolated the mammalian tubercule bacilli and proved its causative role in tuberculosis. Tuberculosis in mammals, and birds was subsequently shown to be caused by the Hominis, Bovis and Avium designated *Mycobacterium tuberculosis hominii, M. bovis* and *M. avium*. Two other types of tubercle bacilli were also recognised - the Murine type (*M. marcroti*) from voles and cold blooded type (*M. piscium, M. marinum, M. ranae* and others) from fishes, lizards, snakes, frogs and other cold blooded animals. Johne (1895) described *M. para* tuberculosis, the agent causing chronic specific enteritis in cattle.

In 1895 Strauss reported that 43% of monkeys that died at London Zoological Gardens had tuberculosis lesions, as did 20% of monkeys that died at two French Zoological Gardens. In 1906 Rabin Witsch isolated human, bovine, and avian tuberculosis from a group of 33 infected monkeys at the Zoological Gardens of Berlin. In 1908 the Bombay Zoological Gardens experienced a prolonged outbreak of tuberculosis which infected many species including lions, antelopes, tapirs, monkeys and birds. In 1984 a male orangutan aged 11 years and in 1985 a female chimpanzee aged 16 years died at Sri. Chamarajendra Zoological Gardens. These were suspected to be having tuberculosis.

Tuberculosis in primates is caused by 3 major types of Myco bacteria. They are *M. hominis, M. bovis* and *M. avium*. Data collected from various sources suggest that 60% of tuberculosis cases were caused by Hominis type: 20% was caused by Bovis type: 5% was caused by Avium type: 15% by unidentified type.

Mycobactena virtually spares no organs. Predominately they are known to affect the lungs, and intestines, more or less in equal proportions. Other organs which are involved are meninges, spleen, liver, kidneys, bladder, and skin. They are also known to cause TB metritles, mastitis, orchitis, potts spine and cold abscess.

Clinical signs are often rarely found in acute cases. It usually depends on the strain of the infecting organism, the mode of infection, the method of dissemination within the host, the stage of infection and the species of the host animal involved.

Pulmonary infection which is less frequent is manifested with respiratory distress of varying severity with chronic cough and dyspnea often leading to fatal respiratory distress and death. Alimentary involvement which is usually caused by *M. tuberculosis bovis* and *M. hominis* enters the system usually through milk, and swallowed sputum, which is manifested by enlarged abdominal lymph glands, pharyngeal obstruction, difficulty in swallowing and diarrhoea in most of the cases.

In chronic cases tuberculosis is usually manifested with painless swelling of superfical lymph node, inappentence fibrile fluctuation, progressive cacheia, loss of hair texture, abnormal hair growth, Alopecia and skin ulceration and lethargy.

LABORATORY DIAGNOSIS

1. Demonstrating tubercle bacilli from sputum, body lesions, faeces and specimens from urogenital system under microscope.

2. Culture of concentrated materials on specific medias which are very sentitive for detecting tubercule bacilli

3. Transmitting infection into experimental animals like guinea pigs by using concentrated material.

4. Chest x-ray is of diagnostic value for detecting advanced tuberculosis in primates that may be occasionally negative to tubeculin test.

5. Proving positive tuberculin test cases by adopting standard intra-dermal palpabral test for primates recommended by the Institute of Laboratory animal resources in 1967.

PREVENTION

1. Proper planning of primate enclosures can help prevent tuberculosis. The enclosure should be spacious with sufficent sunlight. Display animals should be kept at a distance from visitors so that infection from humans through sputum can be prevented.

2. Before importing of new animals, tuberculin test should be done to rule out tuberculosis and a proper certificate should be provided with it.

3. Quarantine screening of new arrivals by subjecting the animal to various laboratory diagnosis for various infectious diseases.

4. To avoid overcrowding in enclosure by keeping too many specimens.

5. Proper cleaning and disinfecting facilities should be provided to maintain healthy environment.

6. Screening of attendants at regular intervals to rule out tuberculosis.

7. Active immunization of primates by BCG (Bacilli Calmette-Guerin) vaccine.

8. Adequate nutrition should be provided.

Farmhouse, Panchavati, Bodyguard, Mysore.

9. Milk used should be pasturized to prevent Bovine type of tuberculosis.

TREATMENT

Anti-tuberculosis treatment is inadvisable in most cases. In case where extremely valuable and endangered primates are involved, they do require treatment. Confirmed cases of tuberculosis should be isolated.

The following regimes is recommended.

a) 12 months regime

(I) INH+S+T/E —— 2 months
with INH+T/E —— 10 months

(ii) INH+S —— 1 months

b) 8 months regime

(i) INH+R+PZA+T —— 2 months
with INH+T —— 6 months

c) 6 months regime:-
i) INH+R+PZA+S/E —— 2 months
with INH + T —— 4 months

The above regimes should be supplimented with pyridoxine to counter adverse reaction.

DOSAGE

ISONICOTINIC ACID HYDERAZIDE (INH)	3-5 mg/kg body wt.
STERPTOMYCIN (S)	10 mg/kg "
THIACETAZONE (T)	2 mg/kg "
ETHAMBUTOL (E)	15-20 mg/kg "
RIFAMPICIN (K)	10 mg/kg "
PYRAZINAMIDE (PZA)	20-30 mg/kg "

ACKNOWLEDGEMENT

I am thankful to Pundarika Rao, Warden and S. Shivanna, Manager and the zoo, personnel of Sri Chamarajendra Zoological Gardens, Mysore for their assistance and encouragement.

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Reprint : Zoos' Print, 12 (9) : 33-34, September, 1997

TUBERCULOSIS IN MONKEYS: A ZOO PROBLEM

Rishendra Verma *

Non-human primates (monkeys) have long been recognised as an appropriate model for the study of human biology and behaviour (Goodwin and Angistine, 1975). Among disease in monkeys, tuberculosis in North Indian brown monkey *(Macaca mulatta)* commonly known as rhesus monkey has been reported in natural habitat (Jaswant *et al.*, 1951). Tuberculosis constitutes a major hazard to primate colony in captivity and the percentage of infected monkeys go on increasing when the animals are kept in captivity possibly by the infection of the normal animals kept side by side with the infected monkeys (Kennel, 1941). Tuberculosis of monkey is caused by humans, *(M. tuberculosis)*, bovine *(M. bovis)* and (rarely) avian *(M. avium)* tubercle bacilli. Mycobacteria other than *M. tuberculosis* of *M. bovis* have also been reported as causing disease in non-human primates (Keys *et al.*, 1973).

Susceptibility

The susceptibility of primates to tuberculosis varies; New world monkeys resistant than old world monkeys.

Tuberculosis of the monkeys is caused by human, bovine and rarely swain tubercle bonili.

Monkeys seem to be less susceptibile to infection with avian bacilli than to infection with human and bovine types (Francis, 1958).

Macaca mulatta can be infected by as few as 1 -10 viable organisms of M. tuberculosis or M. bovis.

In all monkeys, the establishment of infection as shown by a positive reaction to tuberculin can be detected within 3 weeks of exposure of an infecuve dose.

M. africanu an intermediate strain between M. bovis and *M. tuberculosis* has also been isolated from Chimpanzee.

Predisposing Factors

Lung diseases are activated and precipitated under captivity by environmental pollution, congestion, droplet infection and restricted movement (indoor housing).

Symptoms

Less playful, move less, take less interest in the environment when the disease is advanced, the monkey sits crouched, is dull and indifferent, they may cough, loss of weight, loss of appetite, enlargement of liver and spleen.

Transmission

May be through the alimentary tract of aerosol; monkey to monkey contact; primate workers to monkey and vice-versa.

At least one monkey out of every ten monkeys caught in the neighbouring big cities suffer from Tuberculosis (Nair and Ray, 1954).

Pathology

Tuberculosis of varying sizes on different visceral organs enlargement of the liver and spleen, miliacy form of tuberculosis involving all organs, mesentry have been seen (Rishendra Varma, pers. observation).

Microscopically, tuberculosis lungs showed multiple granulosus with central area of causative necrosis and surrounded by epitheloid cells and lymphocytes, stray number of acid-fast bacilli (Varma et al., 1994). Calcification has not been seen in old world monkeys but has been found in new world monkeys.

The same Mycobacteria can elicit a different response in different species. *M. tuberculosis* and *M. bovis* produce tubercules formation with necrosis in any species e.g. cattle, swine, monkeys, dogs man but the lesions are more diffuse in horse. *M. avium* produce discrete tubercles with caeseation in most mammals and birds but in monkeys the lesions are diffuse with saprophytic mycobacteria like *M. ovium* complex, *M. fortuitun* acid-fast bacilli occur single or completely fill the cytoplasm of epitheloid cells in the mucosa of intestine just resembling paratuberculosis of cattle caused by *M. paratuberculosis*. No necrosis, calcification, fibrosis or organisation of tubercles in such cases.

Diagnosis

(1) Periodic tubrculosis testing
(2) Chest X-ray
(3) Additional tests like CFT, IRA, ELISA, SAFA etc
(4) Autopsy

(1) Tuberculin testing

Each monkey should be tuberculin tested with 0.1 ml of Koch's old tuberculin or PPO given intracutaneously on the upper eye lid at 1:10 1C diltuin containing 15 COTU. The test is read at 24, 48 and 72 hours and the reactions can be recorded as per Malik (1966-67). Some workers recommend the skin of the arm (Trolldenier *et al.*, 1966) or the abdomen (Schmidt, 1956). Intrapalperbral injection in upper eyelid of monkey was found suitable and easy to read and involve least handling of the animal.

These consecutive tests at an interval of 30 days may be done.

(2) Chest X-ray

Primary complex in primates is seldom detected. Chest X-ray helps in identifying other abnormalities too in addition to advanced lesions of tuberculosis.

(3) Additional tests

Elisa, Safa, Pcr may be adopted for diagnosis of tuberculosis as adjunct to the conventional tuberculin test. Lysozyme, a non specific factor, has resulted in the increase in tuberculous monkeys (Verma et al., 1994).

(4) Autopsy

Regular autopsy of any dead monkey must be conducted to monitor the health and to detect pathological lesions.

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Treatment

Briefly the following antituberculous drugs act in the following manner:

Isuniazid: Inhibits DNA synthesis and decreases lipid and carbohydrate content of the cell wall.

Rifampicin: Inhibits DNA dependent RNA polymerase

Ethambutol: Inhibits incorporation of mycolic acid into the cell wall and induces lethal imbalance in lipid synthesis.

Isoniazid
or streptomycin modifies course of disease

Treated animals may show negative Tuberculin Test, thus interfere in diagnosis

Varying Results of therapy

In view of the above facts, treatment offers little value in control of primate tuberculosis.

Control

- Detection of Infected animals.
- Destruction of Infected animals.
- Continued intense monitoring of contact animals
- BCG Vaccination- no Absolute immunity
- Periodic Tuberculin testing

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Mortality in zoo due to Tuberculosis in monkeys

Place	Species	Reference
Zoological Garden Calcutta	Rhesus	(10/57) Mitter, 1910
Zoological Garden Bombay.	Bonnet	Liston and Poparkar, 1924
Zoological Garden	*Presbytis entellus*	Basak et al., 1976 (Langur)
All India Instt. of Hyg. & Public Health Calcutta	Rhesus	Krishna , 1936
Circus	Baboons	Iyer, 1940
Circus	Spider monkey	Arora & Parihar, 1982
National Zool. Park, Delhi	Nilgiri Langur	Arora, 1994
Madras Vet. College	Pig tailed macaque	Chandrasekaran & Krishnamurthi, 1951
Malaria Instt. Del.	Rhesus	Singh et al., 1951
Zoological Park Kanpur	Orang Utan Lion-tailed macaque	Sabharwal, D. N. Pers. Comm.
Zool. Park Bombay	Lion-tailed macaque	Karawale, Pers.Comm.

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Vol XI Issue VI June-1984

Tuberculosis in a Monkey

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In this country, deaths due to tuberculosis were recorded only in 6 monkeys of various species kept at various zoo parks (Rathore and Khera, (1982). The present paper reports on a case of generalised tuberculosis in a male monkey (Cercocebus torquatus atys) kept in captivity at Nehru Zoo park, Hyderabad.

CASE HISTORY:

One male monkey (Cercocebus torquatus atys) aged eleven years kept in captivity at Nehru Zoological Park. Hyderabad fell ill on 24. 2. 79 with symptoms of dullness, pyrexia (38.6°c) and, loose motions. Faecal smears and blood smears examination did not reveal any significant finding. Nasal discharges collected did not reveal any organisms on impression smear examination and also on cultural examination. As the disease was not diagnosed as T.B before the death of the animal, no specific tuberculostatic drugs were used except symptomatic treatment and supportive therapy. The monkey died on 28. 3. 79.

Autopsy examination was conducted. The carcase was found emaciated indicating the cause of death due to a chronic wasting disease. Representative tissue pieces showing gross lesions were collected in 10% formalin. These sections were examined microscopically The impression smears were collected and stained with Ziehl-Neelsen's method.

RESULTS AND DISCUSSION :

Grossly, both the lungs, kidneys and spleen evidenced greyis h millary nodules distributed all over the surface. No gross lesions could be evidenced in the

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Lung-Monkey. Showing caseation and cellular infiltration.

gastrointestinal tract. Microscopically, lungs showed necrosis and infiltration of epitheloid cells, lymphocytes and few plasma cells (Fig). Langhan's giant cells were seen very rarely. Calcification and encapsulation was absent. Liver had large caseonecrotic nodules with caseation and calcification, encapsulation and also miliary tubercles. The adjacent parenchyma evidenced cirrhosis. Spleen and kidneys showed miliary tubercles. Acid fact bacilli were demonstrated in all the tissue sections and impression smears, the morphology of which was indistinguishable from Mycobacterium tuberculosis.

Infection of tuberculosis in monkeys is generally through respiratory tract (Hobel, 1947). In the present case, the lesions were observed in lung, liver, spleen and kidneys suggesting the route of entry by both respiratory and alimentary tracts or the infection might have generalised from a primary focus.

SUMMARY :

A case of generalised tuberculosis in a male monkey, (Cercocebus torquatus atys) aged eleven years kept in captivity at Nehru Zoo park, Hyderabad has been recorded.

ACKNOWLEDGEMENTS .

Sincere thanks are due to Dr.V. Narayana Rao, Director of Animal Husbandry, Dr. Zaheer Ahmed., Dr. S Vasantha Rao: Joint Directors and Dr. D. Narayana, Deputy Director for the facilities provided.

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TUBERCULOSIS IN AN EMU (*DROMICEIUS NOVOEHOLANDIES*)

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Tuberculosis is found to be a fairly common disease in birds kept under captivity (Francis 1958). However, the occurrence of the disease in emu birds is not reported, though incidence of the disease in wild birds is reviewed (Feldman, 1938). Hence, a case of tuberculosis in an emu (*Dromiceius novoeholandies*) is placed on record.

Gross appearances : Spleen showed many grayish nodules on the surface and also in the parenchyma. Nodules on the surface were raised and granular. Liver was enlarged and the borders were rounded, grayish in colour. The cut surface and surface of the liver showed discrete foci. Irregularly grayish nodules of varying sizes were seen on the walls of the intestines. Lung also showed discrete foci on the surface. Cut section and surface of ovary showed brown foci

Microscopic appearance : In spleen, numerous nodules, varying from small miliary tubercles to large caseonecrotic ones were seen (Fig. 1). In liver, intestines and lung, caseonecrotic nodules were present. In ovary, melanoma was evidenced which was characterised by the presence of polyhedral cells, mostly fusiform in shape, filled with brown pigments (Fig. 2).

Miliary tubercles consisted of collection of endothelial cells. Large caseonecrotic nodules consisted of necrotic centre surrounded by endothelial cells, lymphocytes and stray foreign body giant cells and were encapsulated by a thin fibrous capsule. Smears and paraffin sections from all the tissues except ovary revealed numerous acid fast bacilli, indistinguishable from *Mycobacterium avium*. Lessions were seen in spleen, liver, intestine and lung. Infection in the present case had evidently taken place by way of digestive tract which is the usual site of infection in birds (Francis *loc. cit*) and bacillemia had resulted the involvement of other organs (Feldman *loc. cit*). Calcification was not observed which is a feature of avian tuberculosis due to failure of accumulation of mineral salts. Melanoma observed in ovary is found to be commonly associated with this organ in avian species (McGowan 1928).

Summary : A case of generalised tuberculosis in an emu (*Dromiceius novoeholandies*) is reported with description of gross and histopathological features. Melanoma is evidenced in ovary.

Acknowledgments : Authors wish to thank the Veterinary Officer, Zoo Park, Hyderabad for providing material and to Drs. M. Madhava Krishna Reddy, Joint Director and Zaheer Ahmed, Deputy Director, Veterinary Biological and Research Institute, for encouragement given.

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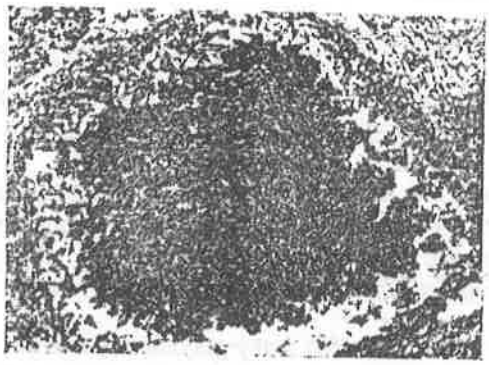

Fig. 1. Spleen showing large caseonecrotic nodule with fibrous capsule.

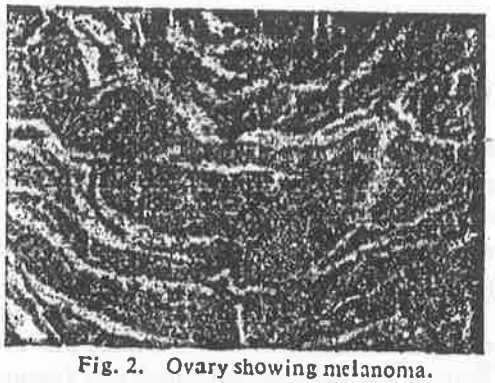

Fig. 2. Ovary showing melanoma.

TUBERCULOSIS IN SLOTH BEAR AT JAIPUR ZOO

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Tuberculosis a chronic infectious disease of domestic animals, is of great public health and economic significance. The causal agent *Mycobacterium spp.* invariably infects man and animal hosts without manifesting clinically but during conditions of stress, the infection gets manifested as disease. It has been observed that the incidences of this chronic disease is comparatively higher in captivity than in free living animals. Close confinement, overcrowding, hot and humid living conditions enhance the possibility of infection.

Occasionally, animals suffering from tuberculosis infection fail to show clinical symptoms. Such cases pose more threat to public health. In recent past the apex centre received two carcasses of Sloth Bear. One animal was old, aging more than 16 years and another was young, aging about 8-10 years. Both animals were under treatment in Jaipur Zoo for respiratory infections, with symptoms of high fever, nasal discharge and coughing. Due to progressive secondary infections, the health condition of both animals deteriorated and death occurred due to possible secondary bacterial infections. Postmortem examination revealed generalized lesions characterized by the presence of micro and macro abscesses throughout the viscera. Midline incision revealed the presence of white patches of variable size throughout the visceral organs predominantly in spleen, liver, kidney, intestinal wall and genital organs. There was accumulation of white turbid fluid, about 250 ml in case I and 400 ml in case II in thoracic cavity. There were patchy circular lesions throughout the lung. Lungs were hard, shrunkened and showed compensatory enlargement in apparently healthy part in both cases.

The impression smears from white patches (Micro and macro abscessess) prepared from different organs revealed the presence of Gram +ve rods, non sporulated, comma shaped with pallisade arrangement. Simultaneously, smears were also stained by Ziehl-Neelsons (ZN) staining method to demonstrate the presence of acid fast organisms.

The microscopic examination of these smears revealed the presence of abundant small stumpy acid fast rods embeded in pus cells and debris. No attempts were made to culture the acid fast Mycobacteria, whereas the pus samples were also inoculated in blood agar medium for isolation of aerobic bacteria. The bacterial growth so obtained following incubation and purification was identified as *Corynebacterium pyogens* as per Carter's (1967) technique.

Looking at the symptoms, lesions and laboratory findings, it was concluded that both animals initially suffered from tuberculosis. Sreenivas Gowda *et al.* (1983) also reported tuberculosis in Sloth Bear with similar lesions on various visceral organs. Low body resistance might have lead to secondary bacterial (*C. pyogens*) infection which ultimately proved fatal. A regular thorough physical and laboratory examination of suspected individuals is essential for early diagnosis and isolation. The lesions found in various organs as identified in postmortems in sloth bear as suggestive of the fact that the death occurred due to mixed infection of Mycobacteria and *Corynebacterium pyogens*.

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Received 22 March 1999; *Accepted 16 June 1999*

Reprint : Zoos' Print, 11 (3) : 16-17, March, 1996

PULMONARY TUBERCULOSIS IN BLACK RHINOCEROS (*Diceros bicornis*) IN MYSORE ZOO

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ABSTRACT

Mysore Zoo lost two of its rhinos due to pulmonary tuberculosis 1992 and 94. Symptoms of coughing, sneezing and nasal discharge were evident only during the terminal phase of the disease. Postmortem examination revealed multiple tuberculosis nodules in the lung and in one case also in the liver. Mycobacterium tuberculosis, isolated from cultures, was found to be highly resistant to INH and Rifampicin. These incidences of tuberculosis in rhinos and earlier reports of this disease in Thamin deer suggest that tuberculosis is a major problem to be tackled with.

INTRODUCTION

Tuberculosis has been recognized as a serious disease in zoo animals (Theon and Himes, 1982). Though the disease has been nearly eradicated from domestic animals and humans in many developed countries, outbreaks of this zoontic disease continue to be reported in captive exotic species (Theon, 1993). In India, the disease is endemic, causing widespread outbreaks in humans, livestock and zoo animals.

Tuberculosis has been reported in many species of wild mammals and birds in captivity (Rathore and Khera, 1982). As far as rhinos are concerned, there are numerous reports of this disease from abroad as well as from India (Arora, 1986; Mann, 1982; Barbiers, 1994). In the Mysore Zoo, occurrence of pulmonary tuberculosis due to *Mycobacterium tuberculosis*, has been noticed in black rhinos during 1992-94, causing two deaths in a total population of 9 rhinos (one Indian, two white and six black rhinos). The details of these two incidents are described here.

CASE HISTORIES

A female African black rhinoceros named "Gowri", aged 13 years, born on 14-3-97 in Mysore Zoo, was found ill on 23-8-92. Symptoms were cough, nasal discharge, respiratory distress and fever. Suspecting some bacterial infection, treatment began with boluses of Terramycin (Tetracycline HCL) and Oriprim (Trimethoprim and Sulphamethoxazole). This was continued for 5 days. Soon she developed epistaxis and dyspnoea a with persistent cough. Medication with antibiotics, antihistaminics and antiinflammatory drugs including cortisones for the next 3 days failed to control epistaxis and other signs. On 10-9-92, she developed sneezing with yellowish mucopurulent discharge. The animal died on 11-9-92 without showing any sign of improvement. Postmortem findings (see below) confirmed the death due to tuberculosis.

Following the death of the female, the male African black rhinoceros named "Gunda" aged about 22 years, born on 1-10-72 and brought up in Mysore Zoo, was suspected to be suffering from tuberculosis. Treatment began with Tibicin (Rifampicin) (22 capsules of 450 gm per day) and vitamin B-Complex (10 capsules per day). This was continued for a month. When he dit not take any food on 19-1-94, he was treated with Digestone (100 gm orally), Terramycin (10 tablets of 500 mg per day) along with supportive therapy. This treatment continued for a week. In spite of this and subsequent treatment programmes, the animal became week and collapsed on 28-5-94. The animal died the following day. Symptoms of sneezing, nasal discharge and shivering were observed during the last two days before death.

POSTMORTEM AND LABORATORY FINDINGS

In the first case, the lungs were found enlarged, edematous and cyanotic. Intralobular septa were thickened with multiple nodules and absesses found on the entire surface of the lungs. About 1.5 litres of pus could be removed when the lobes were incised. The mesentery was congested and the glands were suppurated. The nasal discharge and portions of all major internal organs were sent to IAH and VB, Bangalore for diagnosis. Presence of acid fast organisms morphologically similar to *Mycobacterium* spp were noticed by direct microscopic examination of impression smear of lung tissue.

In the second case, the lungs had multiple nodules which when cut produced cheesy like pus. The necrosed and shrunken liver also had multiple nodules. The spleen was found pale, anemic and shrunken. Other organs like kidney, ileum, heart and intestines showed generalized congestion. All major internal organs were sent to IAH & VB, Bangalore for histopathological and microbiological studies. The direct microscopic examination of impression semears of lung tissue showed the presence of acid-fast bacilli morphologically similar to *Mycobacterium tuberculosis*. Cultural and sensitivity tests done at the National Institute of Tuberculosis, Bangalore not only confirmed this identification but also found the organisms to be resistant to Isonicotinic acid hydrazide (INH) and Rifampicin.

DISCUSSION

The first incidence of tuberculosis in Mysore Zoo was recorded in Thamin deer (Unpublised). The deaths of two rhinos within a span of 2 years indicate an increasing and alarming trend. The problem of tuberculosis in not unique to Mysore Zoo. The

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disease has been reported from zoos in Darjeeling, Delhi, Bombay, Kanpur, Shillong, Hyderabad, Bhilai (Rathore and Khera, 1982), Calcutta (Basak, *et al.*, 1975), Junagadh (Shah, *et al.*, 1992), Indore (Garg, *et al.*, 1990) and possibly from many other zoos. Though *M. bovis* has also been reported to be the cause of tuberculosis in these reports, *M. tuberculosis* appears to be the cause in most of the cases. On an average 5,000 to 10,000 visitors throng Mysore Zoo everyday and the situation warrants attendtion on the possibility of humans or zoo animals as a source of infections to each other.

Treatment of mycobacterial infections in captive wildlife is controversial because of the difficulty in making a definitive diagnosis and the unknown efficacy of antimicrobial drugs in species like rhinos (Ramsay and Zainuddin, 1993). Though Rifampicin and Isoniazid have been suggested and used in rhinos, these drugs have often failed to eliminate mycobaterical lesions (Mann, *et al.*, 1981; Barbiers, 1994).

Detection of active tuberculosis cases by observing the symptoms like cough, purulent nasal discharge and respiratory distress like dyspnoea is nearly impossible in zoos. Very often, animals remain asymptomatic until few days or few hours before death (Barbiers, 1994). A productive cough and dyspnoea may appear only shortly before death (Ramsay and Zainuddin, 1993). Various tests like, tuberculin testing with mammalian old tuberculin (PPD-B) and microscopic examination of purulent nasal discharge for acid fast bacilli are useful to detect tuberculosis cases in zoo animals. Apart from these, evaluation of dealyed hypersensitivity reaction, Enzyme linked Immunosorbent Assay (ELISA) and lymphocytic migration have been used on a limited basis in large zoo animals. Of all these tests, because of vague clinical signs and equivocal skin testing, ELISA has been used with some promise in zoo species (Mann, *et al.*, 1981; Ramsay and Zainuddin, 1993).

Both *M. tuberculosis* and *M. bovis* have been attributed to be the cause of tuberculosis in rhinos. Mann, *et al.* (1981) reported tuberculosis in a black rhinoceros. *Mycobacterium* of human type was found to be the cause in rhinos of Mysore Zoo. Since zoo is a place where thousands of public visit to see the large collection of exotic species maintained in a limited space of 100 odd acres, there is every possibility to contract the disease either by man or animals. Therefore, it is essential to maintain the zoo premises clean with regular disinfection of the moats, holding cages, exhibit furnitures and barns. Whenever possible, all these facilities should have access to direct sunlight. It also becomes imperative to screen and treat workers who are infected.

ACKNOWLEDGEMENT

The authors are thankful to the Director, IAH and VB, Bangalore 24 and Director, N.I.T., Bangalore for thier help in diagnosis, culture and guidance.

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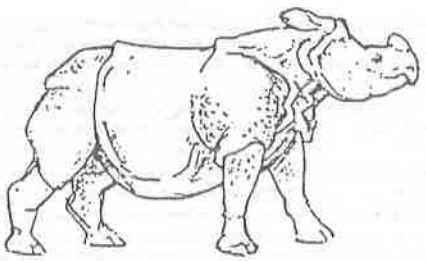

Reprint : Zoos' Print, 11 (4) : 8, April, 1996

PULMONARY TUBERCULOSIS IN AN ASIAN ELEPHANT (*Elephas maximumus*)

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SUMMARY

Pulmonary tuberculosis encountered in an Asian elephant is placed on record.

INTRODUCTION

Tuberculosis is rare in Asian elephants (Narayanan, 1925; Seneviratna et al. 1966 and Hutler, 1981). Hence a case of pulmonary tuberculosis noticed in an elephant during post mortem examination is placed on record.

MATERIALS AND METHODS

A 52 year old Asian elephant succumbed to the punctured wound in the abdominal region due to attack by another elephant during temple festival procession was subjected to detailed post mortem examination on 23.2.1995. The lesions observed in the lung were suggestive of tuberculosis. Representative samples were from the lung and it constituted the material for the study.

RESULTS AND DISCUSSION

Grossly the apical lobes of the lungs showed numerous yellowish white nodular areas of 5-10 mm diameter. Incision of the nodular growth revealed thick caseated material. Smear was prepared from this material and it was stained by Ziehl Neelson's technique and it revealed numerous acid fast organisms. Histopathological examination revealed numerous circumscribed granulomatous lesions (fig.1). The centre of the granuloma was filled with caseous material and it was encircled by fibrous tissue capsule (fig.2). Lymphocytes and macrophages were seen the periphery. Giant cells were not seen and the efforts to demonstrate acid fast organisms in the sections were also not successful.

Since we could demonstrate acid fast organisms in the pus material and considering the gross and histopathological features, the condition was diagnosed as tuberculosis. In the earlier reports on tuberculosis in elephants, the gross lesions appeared like caseating abscesses rather than granulomas (Wallach and Boever 1983). The district histopathological feature waslack of calcification and poor cellular response. The strain of Mycobacterium involved in this case could not be characterised. The most possible source of infection would be form mahouts, however this could not be confirmed. Whether there is any variation in the strain of organism causing tuberculosis in elephants is to be probed further. Motomura (1961) has identified a species of Mycobacterium called *Mycobatenum elephantis* which used to differ from the classical species of Mycobacterium which causes tuberculosis in human beings and other domestic animals. This species or strain variation may be responsible for the peculiar gross and histopathological lesions encountered in elephants. This aspects needs further elucidation. Domestic elephants are usually grouped in elephant camps and festival processions, there is a possibility of spreading the infection to other non infected healthy elephants in the group. the observation made points out

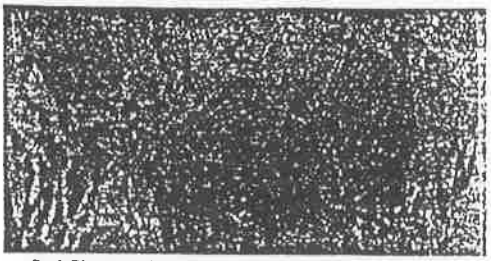

fig.1 Circumscribed granulomatous lesions in the lung

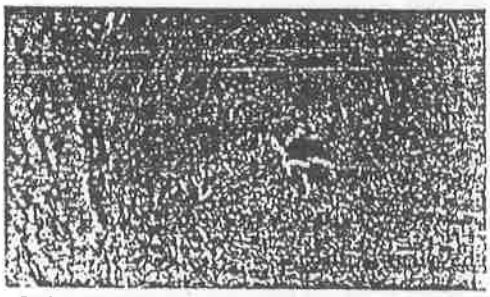

fig. 2 A granulomatous central caseous material, Peripheral lymphocytes and macrophages, encircled by fibrous capsule

the need for regular screening of elephants for tuberculosis and isolating the positive animals form the remaining herd.

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ACKNOWLEDGEMENTS

The senior author wish to acknowledge the help rendered by Dr. A. Rajan, Dean, College of Veterinary and Animal Sciences Mannuthy and Dr. K.M. Ramachandran, Professor and Head, Department of Pathology during the study. The authors are thankful to Dr. K.V. Valsala, Associate Professor, Centre of Excellence in pathology for the help rendered in taking microphotographs.

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Reprint : Zoos' Print, 9 (9) : 19-21, September, 1994

USE OF ANTI-TUBERCULOUS DRUGS IN ZOO ANIMALS FOR CONTROLLING INCIDENCES OF TUBERCULOSIS

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INTRODUCTION

Mycobacterium tuberculosis infection in captive wild animals of Zoological Gardens, Deer parks, Sanctuaries etc. is common. This has profound implications as it is not only a fatal disease but also a disease of zoonotic importance.

Fowler (1978) reported that administration of streptomycin and isoniazid therapy to control the disease in artiodactyla positive reactors became non-reactors. When treatment was stopped, however, animals often became to positive reactors. The problems of isoniazid therapy have also been recorded by him.

Davis *et al* (1981) in USA isolated the three strains of *Mycobacterium* from wild mammals maintained in captivity :

1. *Mycobacterium bovis*:- Out of 261 tissues suspected of having tuberculous lesion on necropsy, they isolated 74 cases of *M. bovis* which was accounted for the greatest number of isolations. Twenty six . *M. bovis* isolates were from monkeys, 13 from deer, 12 from Kudus, 8 from Llama, 5 from antelopes , 3 from Bisons, 2 from Baboon, 2 from Situtinga and one each from an Elk, and Eland and a Tapir.

2. ***M. tuberculosis*:-** The human strain of tubercle bacilli were isolated from 28 animals in 9 states of USA. 21 isolates were from monkeys, 4 from Oryx, 2 from Addax and 1 from an Elephant.

3. ***M. avium*:-** The avian tubercle bacillus was isolated from 54 exotic mammals of which 46 were isolated from monkeys in primate Colonies and Zoos and 5 from hooled animals.

Rathore *et al* (1982) conducted a countrywide survey on the prevalence of tuberculosis in wild life. Information was collected from 15 zoological parks, 2 National Parks and 8 sanctuaries in reserve forests of 5 states of India. A total of 56 cases of tuberculosis was recorded in wild mammals and birds. None of these cases were from free living wild animals. This disease was responsible for the death of 16 spotted deer, 10 Primates belonging to 6 species, 5 Tigers, 4 Bears, 1 Wolf, 5 Black buck, 6 Tragopan Pheasants, 1 Peacock, 1 Brahminy duck, 1 Demoiselle Crane and 1 Emu in different Zoological Parks.

In a survey conducted from July, 1984 to October, 1985, Wu (1986) of the Department of Veterinary Medicines, NAT Institute, Pingtung, Taiwan conducted tuberculin test on 129 deer of various species of 19 deer farms and 2 Zoological Parks. Using PPD (Bovine tuberculin) he found that 27 deer (20.9%) which include 21 Sambar (*Cervus unicolor*) 5 Fallow deer (23.8%) and 1 Sika deer (3.3%) were positive reactors. post-mortem examination on Sambars showed tubercle formation in different organs which were similar to histopathological changes in typical tuberculous lesion except the formation of Lanqerhan's giant cell. The organs affected were mainly lungs, upper trachea, larynx, lymphnodes, tonsils, colon, caeca,liver,pleura and skin.

MATERIALS AND METHODS

Reports of deaths of animals and birds from tuberculosis at Alipore Zoo over a period of 23 years i.e. from 1970 to 1992 have been collected, classified and given in the Table.

Application of different tests and techniques like examination of blood, sputum, skiagram, allergy test for the clinical diagnosis of tuberculous infection in wild captive animals are almost impossible. Even tuberculin tests on deer, antelope, monkeys etc. involves risk both for the operators and the animals.

Retarded growth, emaciation in certain cases and anorexia were the symptoms which arouse suspicious for TB infection. Confirmation was made by finding out the P.M. lesions and subsequent detection of organism by Ziehl-Neelson test.

During early part of 1960, deaths of some valuable animals in Alipore Zoo particularly, primates and deer aroused commotion amongst the city dwellers through the press. As it is related with the public health hazard, a committee was formed in August, 1960 under the Chairmanship of Dr. A.C. Ukil, M.B. MSPE (Paris) FCCP (USA) FNI, FAS, FSMFB, a noted TB Specialist for fact finding and also to make recommodation for controlling the incidence of T.B. in Zoo animals. One of the recommendations of the committee was that "Watenever several cases of T.B. occur in an enclosure or an animal house, chemoprophylactic treatment with I.N.H. may be applied to all animals exhibited there". Accordingly isoniazid, an antituberculous drug was given to deer, antelope and primates at the rate of 4-5 mg/kg bodyweight daily once with the feed as a chemotherapeutic agent. In case of deer and antelope, medicine was administered in the form of powder mixed with concentrate feed. In case of primates, the powdered medicine was mixed with rose syrup and offered to the animals after spreading the same over the sliced bread. A gap of three months was given after three months of daily administration of the medicine and this procedure was continued throughout the year.

Due to non availability of the medicine at the open market administration of this chemotherapeutic drugs became irregular during the period from 1972 to 1975. Again due to

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controversy over the use of antituberculer drug as a prophylactic measure, administration of the said drug was kept suspended during the period from 1979 to 1982. Since 1961, the antituberculer drug "Delon" (M/S. Dey's Medical stores) was in use . This drug was discontinued after 1971 but resumed again from 1976 - 1978. From 1983 onward Isonex of (M/s. Pfizer Ltd.) was used. At present Isokin of (M/s. Park-Davis) is being used as an antituberculer drug.

OBSERVATION AND DISCUSSION

Prolong and continuous use of antituberculous drug to the hooted animals and primates did not show any serious adverse reaction. Only the animals belonging to the deer family were found to suffer from patchy alopecia occassionally. The incidence of alopecia was more prominent in spotted deer, brow-antlered deer and sambar It was never observed in barking deer. Whenever the incidence of severe alopecia was noticed in a herd, the administration of the drug was discontinued. Hairs started to grow after the withdrawal of the drug.

Use of antituberculous drug reduced their incidences of death from tuberculosis considerably(Table).

In the year 1990, a 8 months old Giraffe calf died suddenly after a short illness at the zoo. Clinical symptoms were anoreaxia, dyspnea and loss of body condition. On postmortem examination, it was found that the animal died of miliary tuberculosis affecting both the lungs ,kidneys, Liver and spleen. Incidentally it may be mentioned here that the said Giraffe calf including its parents were not treated with antituberculer drug before. It was suspected that this type of generalised tuberculosis in an young Giraffe calf might be due to transmission of the disease from the other apparently healthy stock which were kept together. Preventive treatment of the apparently healthy animals started forthwith by using a combined oral therapy (R-cinex and combunex).

The chances of rendering individual treatment to a captvie wild animal is remote as diagnosis and segregation of affected animals are very difficult. Preventive measures by using anti-tubercular drugs preferably the "Combined therapy" may reduce the incidences of T.B. Care must be taken to control the side effects which can be averted by discontinuing the medicine for a few months along with enrichment of food by adding sufficient quantity of vitamins and minerals.

CONCLUSION

In Zoos, sanctuaries, deer parks etc. where clinical detection, segregation and rendering individual treatment is not possible, specially to those animals which are in a herd, chemotherapeutic agents preferably in combination may be used to reduce the incidences of the disease in a particular population.

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Key to Annexure I on next page.

Primates include:- Rhesus (35), Common Langur (32), Bonnet (26), Hamadryas Baboon (14), Crabeating(10), Stumptailed (8), Anubis Baboon (6), Assamese (6), Japanese (5) Liontail (4), Nilgiri Langur (4), Pigtail Monkey(4), Gibbon (2), White handed Gibbon (2) Mandril(2), Capped langur (1), Chimpanzee (1) and sooty Mangabey(1).

Deer include:- Spotted Deer(32), Brow-antlered deer(19), Hog Deer (16), Swamp Deer (3), Mouse Deer (1), Barking Deer(1) and Fallow Deer(1).

Antelopes include:- Indian antelope(12), Eland(5), Nilgai(5), Chinkara(3), Four horned antelope (3) and Beisa Oryx(1).

Birds include:- Purple Moorhen(3), Malayan Fireback Pheasant(2), Cotton Teal(2), Pintail Duck(2), Mandanne Duck(1), Hill Partridge(1), Lesser Whistling Teal(1), Indian Tree Pie(1), Rosefaced Love Bird(1), Garganey Teal (1) Indian Peafowl(1), Palwan Peacock Pheasant(1) and Booted Bantam(1).

Others include:- Bengal Porcupine(5), Common Otter(4), Bennett's Wallaby(4), Barbari Wild Sheep(2), Gayal(20), Llama (2), Dama Wallaby(2), Prma Wallaby (1), Quokka (1), Kangaroo (1), Giraffe(1), Malayan Giant Squirrel(10) , Red panda(1), Sloth Bear(10), Malayan Sunbear(1), Camel(1) and Warthog(1).

(The figure mentioned against each species with in the parenthesis denotes the number of deaths due to T.B. during the period from 1970 to 1992 i.e .23 years.)

TABLE

Species wise list of animal that died of tuberculous at Allpore Zoo.

Year	Primates	Deer	Antelopes	Birds	Others	Total	
1970	5	2	2	Nil	1	10	
1971	2	5	Nil	Nil	Nil	7	*
1972	7	3	2	Nil	6	18	
1973	3	2	1	Nil	3	9	
1974	7	8	6	1	1	23	
1975	12	2	1	2	3	20	
1976	9	1	1	1	1	13	
1977	3	1	2	Nil	1	7	
1978	5	1	2	2	1	11	
1979	18	Nil	Nil	1	2	21	**
1980	16	5	Nil	1	3	25	
1981	8	12	Nil	4	1	25	
1982	13	10	Nil	Nil	1	24	
1983	5	2	1	5	1	14	
1984	11	4	1	1	Nil	17	
1985	7	3	Nil	1	Nil	11	
1986	6	4	2	Nil	Nil	12	
1987	8	1	5	1	1	16	*
1988	3	2	1	Nil	Nil	6	
1989	10	2	Nil	Nil	Nil	12	
1990	4	3	1	Nil	3	11	***
1991	3	Nil	1	1	1	6	
1992	2	Nil	Nil	Nil	1	3	
Total:	**167**	**73**	**29**	**21**	**31**	**321**	

* Irregular use of antitubercular drugs.
** Withdrawal of administration of anti-tuercular drugs
*** Regular and uninterrupted use of antitubercular drugs

Reprint : Zoos' Print, 11 (3) : 6-15, March, 1996

PREVALENCE, TRANSMISSION, DIAGNOSIS AND CONTROL OF TUBERCULOSIS IN ASSAM STATE ZOO : A REVIEW

D. Thakuria

SUMMARY

Prevalence of tuberculosis in Assam State Zoo during the period of 1984-93 was studied. The causes were recorded mainly based on post mortem finding. Selected samples from different species of captives were examined at the laboratory for confirmation by histopathological study as well as by isolation and characterization of the pathogens.

Pulmonary tuberculosis was identified as the major cause of death of sambar deer and giraffe. Miliary Tuberculosis was also recorded in magpie, cassowary and white turkey.

Mycobacterium of both bovine and human type were isolated from different species of captives died of tuberculosis. However, Mycobacterium of avian type could not be isolated from any of the samples studied.

INTRODUCTION

Tuberculosis has become a common disease of wild animals, particularly those closely associated with man and his environment. Its outbreaks are usually less severe among free living wild animals than among captive animals which are in more intimate contact with man (Winkler and Gale, 1970).

Tuberculosis is one of the major infectious zoonotic diseases which is still a global problem to be concerned. The disease may be acute or chronic, general or local. Tuberculosis in both captive and free-living deer family is not uncommon in India and abroad (Mc Diarmid, 1960; Belli, 1962; Jones *et al*, 1976; Arora, 1980; Rathor and Kher, 1982; Rodgers and Bhattacharjee, 1986; Shah *et al*., 1986). Tuberculosis in captive animals was recorded as early as 1892 by Sanyal and thereafter many workers have reported tuberculosis in captive deers from time to time (Basak *et al*; 1975; Sing *et al*., 1981).

Most early reports on prevalence of tuberculosis in wild animals show the disease as found in different Zoological Gardens. Tuberculosis has long been recognised as one of the most important disease entities in non human primates. In 1895, Strauss reported that 43% of monkeys that died at the London Zoological Gardens, 20% and 22% of monkeys that died at two French Zoological Gardens had tuberculosis. In 1906, Rabinowitsch reported human bovine and avian tuberculosis from 33 monkeys at the Zoological Gardens of Berlin. In 1924 Liston and Soparker reported that early in 1908 the Bombay Zoological Garden experienced a prolonged outbreak of tuberculosis in some species of captives early in 1908.

Rathore and Kher (1982) conducted a countrywide survey on the prevalence of tuberculosis in wildlife. Information was collected from 15 Zoological Parks, 2 National Parks and 8 Sanctuaries in reserve forests of 5 states of India. A total of 56 cases of tuberculosis was recorded in wild mammals and birds. None of these cases were from free-living wild animals. This disease was responsible for the death of 16 Spotted deer, 10 Primates belonging to 6 species, 5 Tigers, 4 Bears, 1 Wolf, 5 Black bucks, 6 Tragopan pheasants, 1 Peacock, 1 Brahminii duck, 1 Demoiselle crane and 1 Emu in different Zoological Parks.

The Assam State Zoo was established in 1958. It is situated at 26.11°N Latitude and 91.45°E Longitude. The total area of the Zoo is 130 hectares which falls in the Hengerabari Reserve Forest. The average annual rainfall is 136.43 cm and the temperature varies from 11°C to 38°C. The relative humidity varies from 60 to 70% throughout the year.

Tuberculosis among some of the wild captives mainly deer families except Sangai, the Brow antlered deer (*Cervus eldi eldi*) as well as some non human primates including hoolock gibbon (*Hylobates hoolock*) was first identified in the Assam State Zoo during the period of 1965 as per records available. But sporadic outbreak of this infection among the wild captives took place since 1982 in interrupted phases.

The prevalence of different diseases with special reference to tuberculosis at the Assam State Zoo during the period of 1984-93 were the materials of the present study.

MODE OF TRANSMISSION

Tuberculosis in deer is not uncommon and it appears that they get infected through respiratory route from persons involved in Zoo management or visitors (Rathore and Kher, 1982, Upadhyaya *et al*., 1986; and Shah *et al*., 1986).

During the early period of the establishment of the Zoo, naturally accumulated water areas were treated as resources. Accordingly some deer enclosures were constructed in these selected areas. Different species of deer brought from different sources, were kept in these enclosures for display without performing any tuberculin test or quarantine. These animals were one of the major routes of entry of tuberculosis to the zoo.

As the population increased, healthy animals were infected through feed and water contaminated with urine, fecal material or exudates from diseased animals shedding tubercle bacilli.

The elimination of tuberculosis in wild animals is hampered by the lack of suitable regulations limiting the movement of infected or exposed animals. The problem is further magnified

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by the inability to detect tuberculous animals early in the course of disease, because clinical signs may not be present until progressive pulmonary disease develops (Thoen and Himes, 1981).

Crowding in deer families appears to be an important factor in the transmission and spread of tuberculosis in the Zoo. Fomites, such as cages and containers for feed and water are also possible source for spread of the infection in the zoo.

In domestic animals, tuberculosis is most common in animals kept in close contact in pens. The survey conducted by the Animal Health Centre, under the Animal Husbandry and Veterinary Department, Assam, reveals that 5% of the livestock population is attacked by tuberculosis.

Although the location of the Assam State Zoo is within the city covering an area of 130 hectares, it is still in the adjacent area of some hilly forests which was once home for many wild mammals, birds and reptiles. Presently, only rhesus monkeys (*Macaca mulatta*) have managed to survive and increased their population. Ultimately these stray monkeys have created an added problem for the management of the Zoo. It is inpractical to present entry of these stray monkeys into the open-air enclosures and stealing and sharing the feeds of the Zoo captives. The post-mortem examination findings as well as laboratory examination of the lesions found in naturally died or trapped stray monkeys have confirmed the presence of tubercle bacilli (both human and bovine type). This is one of the established routes of entry of tuberculosis from wild into the captives of the Zoo.

The authority has to stand helplessly against the monkey menace inside the zoo because the stray monkeys cannot be destroyed nor can be driven out since they are protected under the Wildlife (Protection)Act 1972 and Prevention of Cruelty to Animals Act 1960. Also it is not possible for the management to capture all the apparently healthy stray monkeys and to go for rehabilitation/reintroduction into other reserve forest areas.

The man and animal association of the Assam State Zoo is another problem as the zoo is accommodating the staff colony inside the campus itself. Among the Zoo workers, who are closely in contact with the captives (the animal attendants, sweepers, food handlers etc), some of them are diagnosed tuberculous positive which is also an inevitable factor for transmission of the infection to the captive wild population. Of course the authority has already adopted some measures to screen out the infected persons for proper treatment periodic health check-up and for improving the living conditions of the workers in a phase manner.

MODE OF DIAGNOSIS

Application of different tests and techniques like examination of blood, sputum, skiagram and allergy test for the clinical diagnosis of tuberculous infection in wild captive animals are almost impossible. Even tuberculin test on deer, antelope, monkeys etc. involves risk both for the operators and the animals (Das, *et al.* 1994).

The standard national and international test used for screening humans and animals is the tuberculin skin test (ST) which measures delayed type hypersensitivity to a protein derivative (tuberculin) prepared from *M.bovis*, *M. avium* and *M. tuberculosis* (Angus, 1978; Thoen, 1990).

In a survey conducted from July, 1984 to October, 1985, Wu (1986) of the Department of Veterinary medicines. NAT Institute, Pingtung, Taiwan, conducted tuberculin test on 129 deer of various species of 19 deer farms and 2 Zoological Parks. Using PPD (Bovine tuberculin) he found that 27 deer (20.9%) which included 21 Sambar (cervus unicolor), 5 Fallow deer (23.8%) and 1 Sika deer (3.3%) were positive.

(a) Tuberculin test: Any captive animal which shows progressive debility in spite of regular intake of was monitored very carefully. If the herd was already infected, then it was presumed that the animal might have been attacked by the TB infection. The suspected one was isolated and screened for tuberculin (PPD; IVRI, Izatnagar) skin test.

The animals selected for testing were caged and physically restrained in a proper manner without using sedative or tranquilizing drugs. The site for inoculating PPD was chosen as the ventral aspect of the forelimb in primates and the neck region in deer.

Before inoculation, the site was shaved and the measurement of the skin fold was recorded. The test was performed by inoculating 0.1 ml of PPD intradermally into the site with a tuberculin syringe and needle. Appearance of a pea-like nodule was noticed at the site of inoculation.

The thickness of the skin-fold was measured after 48 and 72 hours of injection with the help of a slide caliper and the skin reactions at the site of inoculation were recorded.

Out of 20 captive wild animals tested 13 (7 primates and 6 deer) were found positive reactors in the tuberculin skin test with evidence of mild erythema at the site of inoculation (Table1).

The thickness of the skin fold was not much remarkable in case of primates when reading were taken after 48 and 72 hours (Table 1).

The monkeys received isoniazid (INH) therapy for a protracted period of time. Since INH is reported to be immunosuppressive, the use of tuberculin test is of limited value in animals undergoing INH therapy (Thoen and Himes, 1981). Therefore, the results of tuberculin skin test could not be interpreted as negative as two of the tested monkeys showing skin thickness of 3.0 mm at 72 hours of inoculation died after a couple of days of the test due to some other causes, showed progressive pulmonary lesions which was found in the post-mortem examination. Moreover, some of the monkeys tested were in the advanced stages of the infection which was confirmed during the post-mortem examination. Therefore, there is a need for development of a better and reliable diagnostic test for tuberculosis.

(b) Post-mortem examination: The post-mortem examinations performed on the clinically suspected cases of tuberculosis during 1984-93 have revealed 119 nos of positive cases of

pulmonary/non-pulmonary tuberculous infection out of 577 i.e 20.6% of the captive animals and birds have died of TB in the last decade (Table 2A).

Mycobacterium infection has been recorded in deer, kudu, giraffe, elephants, monkeys, llamas, antelope, bison, baboons elk, elands, tapirs etc. Prevalence of TB is a common feature in many Indian Zoos. In Kanpur Zoo, 27 mammals (7 primates, 9 bovides, 4 deer, 7 others) and 14 birds (5 ducks, 7 fowl pheasants, 2 storks) died of TB in 3 years (Jhala *et al.* 1990) .

Species wise prevalence in Assam Zoo shows that TB was the major disease of antelopes, giraffes, deer and primates, followed by carnivores and birds. Highest incidence was recorded in giraffe (60%) black buck (58%) chital and sambar (43-49%) and macaques (50%). Table 2(B) shows the year wise incidence of tuberculosis in Assam Zoo.

(c) Laboratory Investigation: Selected samples from the wild captives of different species died due to clinically suspected tuberculosis were collected for laboratory investigation as well as to find out the types of tubercle bacilli. The samples for isolation of *Mycobacterium* were examined during 1984-93. Standard techniques were followed for isolation and identification of the organism.

A total of 47 samples of 9 different species which were found positive for tuberculosis in post-mortem examination were used for isolation and identification of the tubercle bacilli (Table 3).

All the 47 animals exhibited characteristic tuberculosis lesions in the lungs; therefore, lung pieces were collected aseptically from each of the animals. Besides lung samples, lymph nodes were also collected from Golden langur, Axis deer, Black buck, Hog deer and Sambar deer.

All the samples used for isolation of *Mycobacterium* were found positive and *Mycobacterium* of both bovine and human type could be identified in different species of non human primates (Assamese macaque, Golden langur and Capped langur) and deer families (Axis deer, Barking deer, Blackbuck, Giraffe, Hog deer and Sambar deer).

Mycobacteriur · bovis was found in all the samples taken from giraffe whereas *Mycobacterium tuberculosis* and *M. bovis* were found in all other species. However, *Mycobacterium* of avian type could not be isolated from any of the 47 samples.

CONTROL MEASURES

Eradication of bovine tuberculosis has been achieved in many countries. The methods used have depended on a number of factors but ultimately the test and slaughter policy has been the only one by which effective eradication has been achieved (Blood and Henderson, 1968).

Eradicating tuberculosis in exotic species by testing and slaughtering can not be carried out in India due to the Wildlife (Protection) Act 1972 and the Prevention of Cruelty to Animal Act 1960. A news item SORROWFUL SLAUGHTER Montreal, Dec 11 (AP), published in a daily (Sentinel, 12th December, 1993) reported that a Canadian Zoo was forced to slaughter 447 nos. of animals in an effort to keep the deadly disease (Tuberculosis) under control. The order was to destroy all the animals except some endangered species. The slaughtered animals included some valuable animals like zebras, yaks, ibex, bison, exotic big-horned cattle, gnus, fallow deer and other antelopes.

Since we can not go for destroying the positive reactors as done in some Zoological gardens of other countries, the option is to go for adopting testing, treatment and control measures.

THERAPEUTIC APPROACH

Earlier in this zoo, either Rifampicin or Isoniazid was used against tuberculosis as chemotheraphy for the clinically diagnosed captive wild animals for a considerable period of time. This possibly resulted in resistance and turned some of the open cases into carriers. That was confirmed in case of two giraffes which later on showed clinical symptoms indicating recurrence of the infection.

After careful observation and study on the above facts, the following new regimen of combined therapy was adopted since 1993 considering certain salient factors.

The combination chemotherapy was classified into two groups.

(A) Bactericidal drugs

These are the most important drugs as their action is most marked on rapidly multiplying bacilli. They can easily penetrate the cell membrane and are thus active against both intracellular and extracellular bacilli. Also these drugs are free from toxicity Under this category. Isoniazid was selected.

Isoniazid was also a recommendation of the committee (1960) under the chairmanship of Dr. A.C. Ukil, M.B. MSEP (Paris) FCCP (USA) FNI, FAS, FSMFB, a noted TB specialist for controlling the incidence of TB in Zoo animals of the Alipore Zoo, Calcutta (Cited by Das *et al.*, 1994).

Rifampicin is also another choice under the category of bactericidal drugs. It is powerful and equally effective against the intracellular as well as the extracellular bacilli. It has got one advantage over Isoniazid, that its action on slowly multiplying bacilli is more marked than that of Isoniazid. Also, Rifampicin is of special value when the bacilli resist other anti-tuberculous drugs.

To this category, one more drug has been selected, that is, Pyrazinamide has been selected. Its action is more marked on slowly multiplying bacilli than on rapidly multiplying bacilli. In other words, it acts better when drugs like Isoniazid and Rifampicin have eliminated the rapidly growing bacilli.

(B) Bacteriostatic drugs

These drugs usually stop the multiplication of bacilli and thereafter it is the immunity mechanism of the host that annihilates these bacilli in due course. For elimination of the tuberculous

bacilli, of course, bacteriostatic drugs take somewhat longer time than bactericidal drugs. Considering the above facts and the efficacy, the current regimen has been selected as a combination of drugs from each group. Ethambutol belongs to this category.

To eliminate any probable adverse effect on the lives during the chemotherapy with anti tuberculous drugs, the feeds of the captives under treatment were fortified with vitamins of B complex group. This supportive therapy was continued for a couple of months even after withdrawal of the drugs.

Enrichment of feed has been regarded as one of the major factors to be concerned for the animals and birds undergoing chemotherapy with anti-tuberculous drugs. Extra addition of vegetable protein containing mainly Vit-A and Vit-C into the feeds has been practiced for a considerable period of time even after withdrawal of the drugs.

Supplementation of mineral mixture into the feed of the captives under treatment has also been practiced during and after the chemotherapy.

MODE OF TREATMENT

The first batch the captives (41 nos.) selected for treatment against tuberculosis were Golden langur 5, Capped langur 4, Common langur 3, Nilgiri langur 1, Bonnet monkey 2, Pig-tailed monkey 7, Lion-tailed macaque 1, Assamese macaque 4, Rhesus monkey 2, Stump tailed monkey 1, Giraffe 2, Nilgai 4, Hog deer 2, White Fallow deer 2, and Serow 1. These animals were treated with the following new regimen of anti-tuberculous drugs.

REGIMEN OF DRUGS (These drug schedules must be presented as in the manuscript of the author)

FIRST TRIMESTER

TIBINEX 450
(Themis chemicals * 2
Rifampicin 450 mg
Isoniazid 300 mg tabs)
+ BECOSULES
(Pfizer +3
Vit B1-10 mg
Vit B2-10mg
Vit B6-3mg
Vit B12-5 mg.
Niacinamide-50 mg
Cal. pantoth-12.5 mg
Folic acid-1 mg
VitC - 150 mg caps)

DOSE :

For large animals	TIBINEX 450 tab 2 +BECOSULES cap 2 daily for 90 days
For small animals	TIBINEX 450 tab 1+ BECOSULES cap 1 daily for 90 days.
For non human primates	TIBINEX 450 tab 1/2 + BECOSULES cap 1/2 daily for 90 days.

SECOND TRIMESTER

INABUTOL FORTE
(Themis chemicals
Isoniazid 300 mg
Ethambutol hcl 800 mg tabs) +
BECOSULES.

DOSE

For large animals	INABUTOL FORTE tab 2 + BECOSULES cap 2 daily for 90 days.
For small animals	INABUTOL FORTE tab 1 + BECOSULES cap 1 daily for 90 days.
For non human primates	INABUTOL tab 1/2 + BECOSULES cap 1/2 daily for 90 days.

THIRD TRIMESTER

THEMIBUTOL
(Themis chemicals
Ethambutol hcl 200 mg 400mg,
600 mg, 800 mg, 1000 mg tab) +
BECOSULES.

DOSE

For all animals	THEMIBUTOL 15 mg/kg body wt. + BECOSULES caps (as before) daily for 90 days.

In case of deer, the anti-tuberculous drugs were given once daily and administered in the form of powder mixed with concentrate feeds.

In case of primates, the powdered drugs were mixed with honey and offered to the animals spreading them over sliced breads.

The above regimen was strictly followed without keeping any gap in between the trimesters. After the chemotherapy with anti-tuberculous drugs for three consecutive trimesters ie. 270 days, the captives were administered with vitamins and mineral mixtures for another 30 days.

In the second batch, 4 nos. of Hog deer were selected for TB treatment with another following regimen of combined therapy with Three-in-one drugs.

TRICOX FORTE
(Themis chemicals
Rifampicin 225 mg
Isoniazid 150 mg
Pyrazinamide 500
mg tab) + BECOSULES.

DOSE

TRICOX FORTE tab 2 + BECOSULES cap 2 daily for 180 days.

The above combination chemotherapy against tuberculosis in case of human being has become popular all over the world 'Sentinel' a Washington daily (9th June, 1994) 'Three-in-one tablet' (ANI): 'The US Food and Drugs Administration (FDA) has finally approved the use of Rifater, a drug made up of Rifampicin, isoniazid and Pyrazinamide-used throughout the world to treat tuberculosis (TB).'

Presently in the third batch, one adult male Mithun has been selected for TB treatment with another new regimen of combined therapy with Four-in-one anti-tuberculous drugs ie.

TRICOX
(Themis chemicals Rifampicin 150 mg Isoniazid 100 mg, Pyrazinamide 350 mg tab) + THEMIBUTOL 1000 (Themis chemicals Ethambutol HCL 1000 mg tab) + BECOSULES.

DOSE

TRICOX tab 4 + THEMIBUTOL tab 4 + BECOSULES cap 4 daily for 120 days.

The mode of administration of the drugs are same as above.

Anti-TB treatment for captive wild birds

Eight clinically detected TB positive of birds ie six cassowaries and two emus were treated with the following drug.

TIBICIN SUSPENSION
(Themis Chemicals Rifampicin 100 mg/5 ml suspension).

DOSE

TIBICIN SUSPENSION 15 mg/kg Body Wt. + Vitamin (Liquid) daily for 180 days.

The drugs were mixed with feed and offered to the birds.

RESULTS AND OBSERVATION

Prolonged and continuous administration of anti-tuberculous drugs with the newly adopted regimen of 'Combined therapy' to the captive wild population of deer families, non human primates and birds, did not produce any serious adverse reaction. Only in the beginning some of the captives showed little reluctance for accepting the drugs.

It was observed that, enrichment of feed along with supplementation of sufficient vitamins and minerals enhanced the process of recovery from the infection.

The rate of recovery was found quite satisfactory in the first batch where treatment was given for three consecutive trimesters (270 days). The captives under treatment were observed gaining body weight with proper intake of feed supplied to them. The body coat of animals started regaining its normal glossy colour from a dull appearance.

In the first batch, just after completion of the 2nd trimester, one male hog deer which was under the treatment had a fatal infighting injury with another male hog deer resulting the death of the previous one. In the post-mortem examination it was found that more than 75% of its pulmonary tuberculous lesions were cured. The finding had proved that the anti-tuberculous treatment given was quite an effective one.

In the second batch, where 4 hog deer were treated with the combined therapy with 'Three-in-one' anti-tuberculous drugs for a period of 6 months, one male hog deer was killed due to infighting during rut. In the post-mortem examination, not a single tuberculous lesion was found in any of the vital organs of the victim. That animal had completed the full course (6 months) of above treatment which proved the very efficacy of the drugs used.

In the third batch, where one adult male Mithun was treated with 'Four-in-one' anti-tuberculous drugs, the animal showed a remarkable recovery from the infection.

The result of the treatment in case of the captive wild birds (cassowary 6 and emu 2) was quite encouraging. Treatment of tuberculosis is seldom attempted in avian species because of the uncertainty of gaining a curative outcome (Snyder and Richard, 1994). The birds responded well to the treatment and gradually returned to normalcy following the course.

But a tuberculin positive reactor African elephant did not show any improvement after a prolonged and continuous treatment with anti-tuberculous drugs. When the animal died, post-mortem and histopathological examinations confirmed that the animal was suffering from chronic Lymphosarcoma. In this case, the false interpretation of the test might be due to the fact that false positive result of tuberculin test (Schmidt, 1986).

DISCUSSION

It is difficult to give the exact status of tuberculosis among the captive wild population of the Assam State Zoo as it is not practically possible to test every individual animal. However, based on clinical observation and diagnosis, it could be observed that the cervids and primates have a higher incidence of tuberculosis than other species. Since, slaughter of the infected and clinically suspected captives are not possible to carry out, the therapeutic approach with anti-tuberculous drugs along with supportive therapy such as vitamins and minerals supplement to the clinically suspected captives has been practiced. At present, 62 nos. of wild captives are under the treatment with anti-tuberculous drugs and most of them are in the stage of recovery.

The animals which were treated with different regimens of anti-tuberculous drugs in three separate batches were monitored carefully. After completion of the courses, it was observed

that all the captives had responded well to the treatment showing a satisfactory result in the recovery from infection. The efficacy of the drugs used were established mainly on the basis of clinical observations and post-mortem examination not on the basis of sputum smear test or skiagram which were practically not always possible.

The evolution of the combined therapy with anti tuberculous drugs to the wild captives in the first batch with Rifampicin + Isoniazid + Ethambutol HCl for 270 days, in the second batch with Rifampicin + Isoniazid + Pyrazinamide for 180 days and in the third batch with Rifampicin + Isoniazid + Pyrazinamide + Ethambutol HCl for 120 days were observed equally effective against the infection. But the quantum of drugs used as well as the period of time needed for the course was considerably less in the third batch than that of the other two batches.

Identification of both Mycobacterium of bovine and human type has not only created a problem for the zoo captives, but also for the zoo animal attendants, veterinarians, sweepers and the persons who are always involved in direct contact with the captives.

Since it is not practically feasible to reduce the infectivity and prevent the transmission of tuberculosis in free-living wild animals, the therapeutic approach to eliminate the infection has been adopted for species in laboratory for farms and zoos.

Although, efforts were made to offer anti-tuberculous drugs among the clinically suspected zoo captives, there are problems. The major problems are the difficulty in detecting the different species of zoo captives which may have tuberculosis, the expensive treatment where 3 to 3.5 lakhs of rupees are required to carry out the therapeutic as well as prophylactic schedule for all the apparently healthy captives and lastly the regular entry of large number of stray monkeys and other animals from outside the zoo campus.

The prevalence of tuberculosis however can be reduced by treating the clinically positive captives, supplying more nutritious food to the animals and birds, minimising the number of animals specially the cervids, controlling the easy trespass of stray monkeys and other animals from outside the zoo. Separating the human habitation from the zoo campus, regular periodical health screening of the persons who are always in close contact with animals, keeping single species of animals in one enclosure, adopting strict hygiene and sanitation measures in and around the enclosures, improving the architecture of the old enclosures to more scientific one, improving the veterinary facilities including the Pathology laboratory and conducting awareness education programmes for the animal attendants as well as the visitors regarding the importance of zonotic diseases are some of options for control.

ACKNOWLEDGEMENT

The author is thankful to Mr. B.S. Bonal IFS, DFO, Assam State Zoo, Guwahati, for his best wishes and kind permission for undertaking the study. The author is grateful to Dr. T. Barthakur FVO; Ms. R. Sarmah WLR & EO; Assam State Zoo, Guwahati and Dr. D.K. Sarmah Virologist, Department of Microbiology, College of Veterinary Sciences, Guwahati, for their sincere help and cooperation in undertaking the study. Special thanks are due to Mr. H.K. Tiwary, Internee, College of Veterinary Science, Guwahati-22, for his help in this work.

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Table 1. Results of Tuberculin testing in non-human primates and deer families of Assam State Zoo, Guwahati.

SPECIES OF ANIMALS AND SEX	SKINTHICKNESS AT HOURS POST INOCULATION IN MM.			SKIN REACTION	RESULTS
	0	48	72		
1. Golden langur (M) (*Presbytis geei*)	15	20	30	Slight erythema	+ve
2. Golden langur (M)	15	20	30	Slight erythema	+ve
3. Golden langur (F)	15	20	25	Nil	-ve
4. Golden langur (F)	15	20	30	Slight erythema	+ve
5. Nilgiri langur (F) (*Presbytis johni*)	15	20	25	Nil	-ve
6. Capped langur (M) (*Presbytis pileatus*)	15	20	30	Slight erythema	+ve
7. Capped langur (F)	15	30	30	Slight eythema	+ve
8. Capped langur (F)	15	30	30	Slight erythema	+ve
9. Capped langur (F)	20	22	22	Nil	-ve
10. Lion-tailed macaque (F) (*Macaca silenus*)	15	20	25	Slight erythema	-ve
11. Bonnet monkey (M) (*Macaca radiata*)	15	20	30	Slight erythema	+ve
12. Bonnet monkey (F)	15	20	25	Nil	-ve
13. Barking deer (M) (*Muntiacus muntjak*)	30	45	55	Slight erythema	+ve
14. Barking deer (F)	30	45	60	Slight erythema	+ve
15. Barking deer (F)	35	45	65	Slight erythema	+ve
16. Barking deer (F)	30	35	40	Nil	-ve
17. Hog deer (M) (*Axis porcinus*)	30	45	55	Slight erythema	+ve
18. Hog deer (M)	30	45	60	Slight erythema	+ve
19. Hog deer. (F)	30	45	55	Slight erythema	+ve
20. Hog deer (F)	30	40	40	Nil	-ve

Table 2(a). Incidence of Tuberculosis confirmed by post-mortem examination during 1984-93

SPECIES OF ANIMALS & BIRDS	NO. EXAMINED	NO. AND % POSITIVE FOR TB
1. Giraffe (*Giraffa camelopardalis*)	5	3
2. Sambar deer (*Cervus unicolor*)	81	40(49.38%)
3. Mithun (*Bos frontalis*)	4	1
4. Nilgai (*Boselaphus tragocamelus*)	20	2(10%)
5. Leopard (*Panthera pardus*)	26	3(11.3%)
6. White Fallow deer (*Dama dama*)	16	1(6.25%)
7. Blackbuck (*Antelope cervicapra*)	12	7(58.33%)
8. Axis deer (*Axis axis*)	48	21(43.75%)
9. Hyaena (*Hyaena hyaena*)	3	1
10. Hog deer (*Axis porcinus*)	18	5(27.7%)
11. Ladakhi goat (*Capra hircus*)	6	1
12. Otter (*Lutra lutra*)	8	1
13. Common civet cat (*Viverricula Indica*)	9	1
14. Barking deer (*Muntiacus muntjak*)	86	5(5.8%)
15. Assamese macaque (*Macaca assamensis*)	10	5(50%)
16. Lion-tailed macaque (*Macaca silenus*)	2	1
17. Golden langur (*Presbytis geei*)	33	8(24.24%)
18. Capped langur (*Presbytis pileatus*)	17	4(23.52%)
19. Common langur (*Presbytis entellus*)	9	2
20. Nilgiri langur (*Presbytis johnii*)	7	1
21. Guineapig (*Cavia porcellus*)	209	1(0.0047%)
22. Cassowary (*Cassowary cassowary*)	2	1
23. White turkey (*Numida meleagris*)	5	1
24. Blue magpie (*Cissa erythororyncha*)	9	1
25. White goose (*Anser anser*)	15	1(6.6%)
26. White ibis (*Threskiomis aethopica*)	17	1(5.88%)
Total	577	119(20.6%)

Table 2(b). Yearwise Incidence of Tuberculosis in wild captives during 1984-93 at Assam State Zoo, Guwahati.

SPECIES OF ANIMALS & BIRDS	Years										
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	Total
1. Giraffe	-	-	1	2	-	-	-	-	-	-	3
2. Sambar deer	-	1	-	2	1	3	6	12	3	12	40
3. Mithun	-	-	-	-	-	-	-	1	-	-	1
4. Nilgai	-	-	-	-	-	-	-	1	1	-	2
5. Leopard	1	1	1	-	-	-	-	-	-	-	3
6. White Fallow deer	-	-	-	-	-	-	1	-	-	-	1
7. Black buck	-	2	2	2	-	1	-	-	-	-	7
8. Axis deer	-	1	-	-	2	6	-	5	4	3	21
9. Hyaena	-	-	-	-	-	-	-	-	1	-	1
10. Hog deer	2	1	1	-	-	-	-	-	-	1	5
11. Ladakhi goat	-	-	-	-	-	-	-	-	-	1	1
12. Otter	-	-	-	-	-	-	-	-	-	1	1
13. Common civet cat	-	-	-	-	-	1	-	-	-	-	1
14. Barking deer	-	2	1	-	-	-	-	-	1	1	5
15. Assamese macaque	2	-	-	1	1	-	-	-	-	1	5
16. Lion tailed macaque	-	-	-	-	-	-	1	-	-	-	1
17. Golden langur	-	-	-	1	-	1	2	2	2	-	8
18. Capped langur	-	1	-	-	-	-	-	3	-	-	4
19. Common langur	1	-	-	-	1	-	-	-	-	-	2
20. Nilgiri langur	-	-	-	-	-	-	-	-	-1	-	1
21. Guinea pig	-	-	-	-	-	-	1	-	-	-	1
22. Cassowary	-	-	-	-	-	-	-	-	1	-	1
23. White turkey	-	-	-	1	-	-	-	-	-	-	1
24. Blue magpie	-	-	-	-	-	-	-	-	1	-	1
25. White goose	-	-	-	-	-	-	-	-	-	1	1
26. White biis	-	-	-	-	-	-	1	-	-	-	1
Total	6	9	6	9	5	12	12	24	15	21	119

Table 3. Isolation of Mycobacterium tuberculosis *in different specimens of non-human primates and deer familes in Assam State Zoo, Guwahati*

SPECIES OF ANIMALS	NO. OF SAMPLES EXAMINED	NATURE OF SAMPLES USED FOR ISOLATION OF *MYCOBACTERIUM*	TYPES OF *MICOBACTERIUM* ISOLATED
1. Assamese macaque (*Macaca assamensis*)	3	Lung	*M. bovis* (1) *M. tuberculosis* (2)
2. Golden Langur (*Presbytis geei*)	5	Lung, lymph node	*M.bovis* (3) *M. tuberculosis* (2)
3. Capped langur (*Presbytis pileatus*)	4	Lung	*M.bovis* (1) *M. tuberculois* (3)
4. Axis deer (*Axis axis*)	6	Lung, lymph node	*M.bovis* (4) *M. tuberculosis* (2)
5. Barking deer (*Muntiacus muntjak*)	8	Lung	*M.bovis* (6) *M. tuberculois* (2)
6. Black buck (*Antelope cervicapra*)	3	Lung, lymph node	*M.bovis* (1) *M. tuberculosis* (2)
7. Giraffe (*Giraffa camelopardalis*)	2	Lung	*M. bovis* (2)
8. Hog deer (*Axis porcinus*)	7	Lung, lymph node	*M.bovis* (2) *M. tuberculosis* (5)
9. Sambar (*Cervus unicolor*)	9	Lung, lymph node	*M. bovis* (6) *M. tuberculosis* (3)

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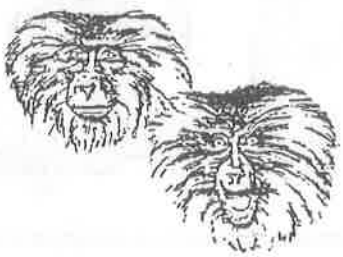

Reprint :-Zoos' Print, 11 (10) : 1-5, October, 1996

SOME OBSERVATIONS ON THE MANAGEMENT OF TUBERCULOSIS IN ZOO ANIMALS

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Tuberculosis is an age old disease of mammals. In recent years, its occurance in zoo or captive animals has assumed significant importance (Shah *et al.* 1986; Sood *et al.* 1989; Abdul Haye 1992). The situation is posing problems to the animals of endangered species kept in captivity. Apart from this, as the zoo is visited by human beings of all age groups, there is every likelihood of it assuming a zoonotic importance. The management of affected animals at Maitri Bag Zoo, Bhilai to contain this disease are being discussed.

The Zoo had 450 animals of different species of which 136 animals belonged to deer family. Some of these animals started showing dullness and were lethargic. The food intake got reduced and after about 2 weeks a noticeable loss in body weight was noticed. One of such animals died after one month of suffering. The animal had pulmonary tuberculosis. Acid fast organisus could be demonstrated in the exudate of freshly opened pulmonary lesions. During a period of 3 months, 5 deer died with similar lesions.

As daily parentral administration of drugs to individual animal was not practically possible, an alternate oral treatment regimen consisting of Isonex[1] 300 mg and Rifampicin[2] 450 mg per animal as suggested by Emanuel (1980) was adopted. The medicines were given with the mash. The medicated mash was kept at many places in the enclosure. Care was taken to keep the mash sufficient for 3-4 animals at one place in the enclosure. This procedure enabled the drugging of more or less each animal. Apart from this treatment, the new borns were vaccinated with BEG (Merck 1979). This combined treatment was carried over for 90 days and for another 60 days only Isonex was given.

All animals were observed for their activities as well as feed intake. Subsequent to the treatment no deaths were recorded. At 20 days post treatment a marginal progress in their exercise and feed intake was noticed. However, no noticable change in their physical appearance could be observed at this stage. However, at 60 days post treatment a noticeable improvement in their physical appearance, feed intake and exercise was seen. This progress continued and by 90 days post treatment the ribs prominance disappeared and they had started taking normal feed and an all round improvement was noticed.

It is felt that tuberclosis being a zoonotic disease should receive utmost attention in zoo animals. The members of the deer family being more susceptible should be closely observed and animals showing wasting, if diagnosed for tuberculosis, could be treated successfully with the suggested treatment regimen consisting of Rifampicin and Isonex for 60-90 days. Though this is quite costly the method could be adopted at least for treating endangered species. This treatment should also be accompanied by proper designing of moats so that the water from one animal house does not flow to the other. This would prevent the infection from the infected area going to the other susceptible animals. Simultaneously the disease in new borns could be contained by use of BCG vaccination.

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[1] Isonex marketed by Pfizer Limited, Bombay.

[2] Rimphapicin market by Hindustan Ciba Geigy, Bombay.

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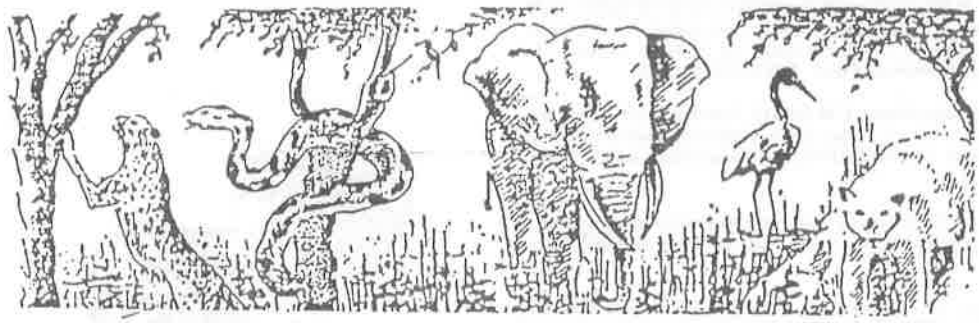

Reprint : Zoos' Print, 9 (9) : 22, September, 1994

TUBERCULIN TESTING IN NONHUMAN PRIMATES

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Tuberculosis is a disease of zoonotic importance. It causes very high losses and poses a great public health hazard. All the new arrivals in a zoo should be subjected to tuberculin testing. Also all the existing zoo animals should be subjected to annual tuberculin testing for the monitoring of health status. It is a reliable test in primates.

After restraining, an intrapalpebral injection of 0.1 ml of 1% solution of Old Tuberculin Kotch is given (in the middle portion of the upper eye lid). Old Tuberculin Kotch is more sensitive than Purified Protein Derivative (PPD). For administrating of tuberculin, a 12mm long needle of 25-28 gauge should be used. Correctly administered test produces a bleb at the site.The test can be repeated on the other eye lid after 14 days but it is better to avoid injection at the same location in less than 30 days as it may cause local reaction.

Reading is taken at 24, 48 and 72 hours post injection. Positive reaction is recognised by a readily apparent oedema, swelling,pain and redness of the tested lid. Localised necrotic lesions at the site of injection can occasionally occur within 20-72 hours of testing. Complete closure of the eye with purulent discharge can also occur. Sometimes the reaction may continue to increase and peak reaction may be observed at 96 hours post-injection.

The test may be conducted at other sites also eg. skin of the abdomen/upperarm/lower arm. The injection is given intradermally. The test conducted on the upper or lower arm is comparatively more reliable. But test conducted on the eyelid has the distinct advantage in recognizing positive reaction without recapturing the animal.

Gastric lavage, faeces, sputum and tracheo-bronchial mucus should be tested bacteriologically to confirm doubtful or positive reactors . Serological tests can be used to diagnose extrapulmonary organic tuberculosis.

INTERPRETATION OF RESULTS

1) As reactors have been found even after five negative tests, at least six negative tuberculing tests are desirable before mixing a newly arrived animal with existing animals.

2) Observations of the repeat eyelid test should also be made between 2-8 hours after the tuberculing injection, as well as daily, since animals which are allergic may show a 'flash' reaction which subsides quickly.

3) Animals immunized with BCG vaccine show positive tuberculin reaction starting from 6 weeks to 5-7 years post vaccination (while the actual immunity may be provided for a period of 3-4 years or even less).

4) Test should be standardized in different species because there may be variation in sensitivity of skin in various wild animals to tuberculin.

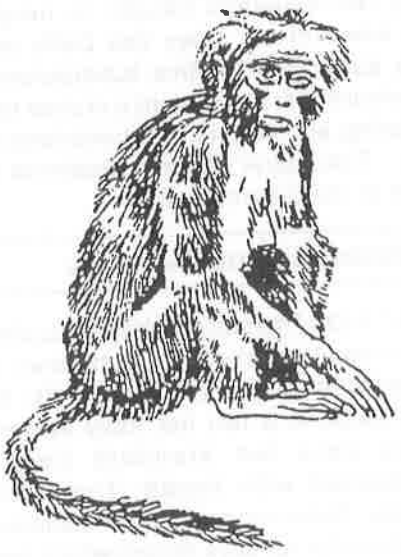
5) If the result is negative, it meanseither the animal is free from disease or the animal has become allergic because of highly advanced stage of the disease.

6) X-ray examination may aid in the diagnosis in doubtful reactors.

7) Animals which have been administered antituberculous drugs like Isoniazid, streptomycin, PAS and Rifampicin will show false negative tuberculin test. A negative reaction may also be seen in animals given corticosteroids or immunization or those suffering from viral infection like measles or any debilitating illness.

8) An animal showing two consecutive doubtful reactions should be isolated and considered as tuberculous.

9) If one animal in an enclosure is found positive then all its inhabitants should be considered potentially infected and testing schedule must be begun for all.



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Indian Vet. J., November, 1999 ; 76 : 962 - 964

OBSERVATIONS ON TUBERCULIN TESTING IN MONKEYS (MACACA MULATTA)

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Monkeys are important research models to study various biological processes. Tuberculosis in monkeys has been reported in India (Iyer, 1940; Sen Gupta, 1974; Verma and Bhardwaj, 1992). Rhesus monkey (Macaca mulatta) has been reported to be highly susceptible for both human and bovine type of tubercle bacilli (Dhanda and Lall, 1963). Nair and Ray (1954) opined that atleast one monkey out of every ten monkeys caught in neighbouring areas of big cities like Delhi and Mathura suffer from active tuberculosis. The tuberculin test has played a crucial role in monitoring and control of tuberculosis in animals. The paper reports response of monkeys to the tuberculin test.

Materials and Methods

In all, 1039 Rhesus monkeys supplied by the animal supplier, were housed in individual steel cages (62 x 76 x 76 cm squeeze back) in a two tier trolly system. Monkeys were fed standard pellets supplemented with bread, fruits and vegetables. These monkeys were subjected to quarantine for 45 days during which time each monkey is tattooed a number on its chest for permanent identification. Each monkey was tuberculin tested with 0.1 ml (1:10 dilution of 1500 TU) of mammalian purified protein derivative (PPD) (manufactured at Indian Veterinary Research Institute, Izatnagar, UP, India) given intrapalpebrally in alternating upper eyelid. Monkeys negative to atleast three tests which are done 15 days apart are transferred to experimental work.

Results and Discussion

Out of 1039 monkeys tested by the tuberculin test, over a period of two years (1987-1989), 163 (16%) were positive. Intrapalpebral injection in the upper eyelid of monkey was found suitable and easy to read as has also been reported by others because of convenience of post injection observation (Keeling *et al.*, 1969).

Saibaba and Bhardwaj (1984) reported that out of 233 monkeys 20 (9%) were found positive to tuberculin test, of these 8 showed lesions on radiograph and were also confirmed for tuberculosis on culture and histopathological examination. It has been reported that lung diseases are activated

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and percipitated under captivity by enviornmental pollution, congestion, droplet infection, index, housing and restricted movement (Bhargava *et al.*, 1970).In this study, tuberculin positive monkeys which were clinically positive on chest radiograph (Verma and Bhardwaj, 1992) showed advanced lesions on autopsy. Lesions of tuberculosis were not seen in tuberculin negative monkeys (Verma and Bharadwaj, *loc cit.* Verma *et al.*, 1998)

These findings contradict views of other workers (Legg and Maunder, 1977, Lepper *et al.*, 1977) that animals with advanced tuberculous lesions become anergic to the tuberculin test and do not respond to the test. Anergy to tuberculin is defined as the failure of an animal with evidence of tuberculosis to show a palpable cutaneous hypersensitivity reaction to tuberculin at the time when the test is read. Various factors like early infection (Kerr *et al.*, 1946), the healing of lesions or immunipathological changes in advanced cases of disease (Legg and Maunder *locit*), parturition (Kerr *et al.*,*loc cit*), malnutrition, exhaustion and transport (Kleeberg, 1960) have been attributed.

Although the tuberculin response is classically a delayed type reaction maximal at 48-72 h careful observation has shown that a mijority of subjects may show an intermediate reaction or an erythematous reaction at the inoculation site of tuberculin is probably manifested by an intense neutrophilic infiltration as seen at 24 h post-inoculation. Neutrophils have been reported to play role in killing both avirulent and virulent variants of M.*tuberculosis* (Brown *et al.*, 1987).

Our findings suggest that advanced lesions of tuberculosis in monkeys have little effect on the outcome of tuberculin response. One of the explanations to support our views may probably be the availability of sensitized lymphocytes which may be responsible for giving an intense response to the tuberculin. Secondly, delayed type hypersensitivity (DTH) response and tuberculous immune response are complex interlinked phenomenon which need further immunological investigation that may vary in different species of animals.

Summary

Out of 1039 monkeys tuberculin tested over a period of two years (1987 - 1989) with injection of 0.1 ml of mammalian PPD (1:10 dilution of 1500 TU), 163 (16%) monkeys were found positive. Monkeys with advanced lesion did not become anergic to tuberculin test.

Acknowledgement

The author is thankful to Dr. K.R. Bhardwaj, Deputy Director and Head, National Laboratory Animal Centre, Central Drug Research Institute, Lucknow, for providing necessary facilities. Assistance of Mr.B. Maity in the collection of biopsy tissue is thankfully acknowledged. Histopathological interpretations provided by Dr.R.Somvanshi, National Fellow (ICAR) and Dr. A.K. Sharma, Senior Scientist, Division of Pathology, Indian Veterinary Research Institute, are gratefully acknowledged.

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SCREENING OF CAPTIVE WILD ANIMALS FOR TUBERCULOSIS

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Tuberculosis is an important infectious disease of zoo animals especially in elephants, deer herds and primate colonies. Few reports are available on the incidence of tuberculosis in various wild animals in India including deer, primates and elephants (Narayanan, 1925; Bopayya, 1928 - 29; Basak *et al.* 1975; Singh *et al.* 1991; Chandrasekaran, 1992 and Krishnamurthy, 1994).

However, most of the cases of tuberculosis in wild animals were diagnosed at necropsy. Few attempts were made to diagnose tuberculosis in captive wild animals using tuberculin test (Francis, 1958; Ruch, 1959; Jones and Manton, 1976;Saunders, 1983 and Thoen *et al*, 1977).

A study was undertaken to evaluate the efficacy of intradermal tuberculin test and passive haemagglutination (PHA)test in elepahants, spotted deer,black bucks and monkeys.

Materials and Methods

109 captive elephants of different camps of Karnataka and Tamil Nadu were tested for tuberculosis by PHA test. Four spotted deers four black bucks and four common langurs from different zoological gardens of Tamil Nadu were tested for tuberculosis by PHA test.51 out of 109 elephants and four common langurs were subjected to tuberculin test. All the elephants, spotted deer and black bucks were apparently healthy. Two of the four common langurs were also subjected to tuberculin test.All the elephants, spotted deer and black bucks were apparently healthy. Two of the four common langurs from Arignar Anna Zoological Park, Vandaloor, Chennai had persistent cough and general debility indicating possibility of tuberculosis.

Tuberculin testing : Purified protein derivative (PPD) tuberculin (Mammalian) obtained from Indian Veterinary Research Institute, Izathnagar, UP was used in the study. 0.1 ml tuberculin was injected intrader-mally at the base of the ear on the dorsal surface in elephants and on the ventral abdomen in common langurs using Mclintosh automatic syringe. Skin fold measurements were recorded before and 72 hours after injection. Spotted deer and black bucks could not be subjected to tuberculin test.

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Passive haemagglutination test : Dry BCG (60 mg) obatined from BCG laboratory, Madras was used to prepare antigen. BCG was added to one ml of normal saline (0.85% NaCl), sonicated at 80 W in IMECO sonicator, certifuged in a refrigerated centrifuge (REMI) at 6000 rpm for 30 min. The supernatant was stored in aliquots at- 20°C and was used an antigen.

Tuberculosis positive sera were collected from cattle confirmed positive for tuberculosis. Positive serum to mycobacterium antigen was raised in rabbits against BCG antigen (Gunaseelan *et al.*, 1991).Pooled serum from the same rabbits collected before injecting the antigen served as the negative control. PHA test was performed for detection of tuberculosis antibodies in the serum as described by Gunaseelan *et al.* (1991)

Results and Discussion

The results of PHA test are given in table 1 and tuberculin test in table 2. Sera of one elephant and one common langur showed a positive titer of 1:32. Also sera of three elephants and one spotted deer and one common langur had a PHA titer of 1:16 (Table 1). However, all elephants and spotted deer which had a PHA titer of 1 : 16 and above were apparently healthy. One of the common langurs which had a PHA titer of 1:16 and above was apparently healthy and the other had symptoms suggestive to tuberculosis.As far as tuberculin test was concerned, there were four reactors among elephants and no reactors among common langurs (Table 2). Further, the elephants which reacted to tuberculin test had no significant PHA titers didn't react to tuberculin.

Francis (1958) and Saunders (1983) considered elephants as weak responders to intradermal tuberculin test.Jones and Manton (1976) used comparative intradermal tuberculin test in four deers using avian and mammalian tuberculin and found that it gives false positive and false negative reactions. Ruch (1959) and Thoen *et al.* (1977) found that intradermal skin testing with PPD is not effective for screening lower primates because of false positive and false positive and false negative reactors.

The present study also supports the observation made by above mentioned authors. It was found that the procedures and the regents adopted for intradermal test and PHA test on domestic animals are not reliable to test wild animals. However, the efficacy of other tests like ELISA, Lymphocyte transformation test and detection of interferon can be evaluated in

Table.1. Results of PHA test for tuberculin antibodies in wild animals

Animals	No.tested	PHA titre 1:32	1:16	<1:16
Elephants	109	1	3	105
Spotted deer	4	Nil	1	3
Black buck	4	Nil	Nil	4
Common langur	4	1	1	2

Table 2. Results of tuberculin test in elephants and common langurs

Animals	No.tested	No.positive
Elephants	51	4
Common Langur	4	Nil

diagnosing tuberculosis among wild animals.

Summary

The efficacy of tuberculin test and passive haemagglutination test (PHA) were studied in the diagnosis of tuberculosis in elephants, spotted deer, blackbucks and common langurs. It was found that the procedures and the regents adopted for intradermal test and PHA test on domestic animals are not reliable to test wild animals.

Acknowledgement

We thank the Chief Conservator of Forests, Tamil Nadu and Karnataka for permitting them to carryout the study on wild animals. We also thank all the Veterinarians and officials of the forest department of Karnataka, Tamilnadu and Andaman Nicobar Islands for the corperation given during the study.

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Pathology of tuberculosis in a silver pheasant (*Gennaeus nycthemerus*)

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Received : March, 25, 1969

ABSTRACT

For the first time tuberculosis was recorded in a silver pheasant. The bird was from Zoological Garden, Nandankanan. The lung was found involved along with liver and spleen. The normal lung tissue was largely destroyed and replaced by numerous coalesced tubercles. One peculiarity was that the syncitial cells, which were irregular in shape with pale eosinophilic cytoplasm, were more frequently seen in the lungs. The nodules were more sharply defined due to epithelioid granulation tissue laid around them.

In liver the fat globules were apparent in the centre of the tubercle. Giant cells were fewer in number. The tubercles were often noticed in the immediate neighbourhood of the blood vessels, an indication regarding the spread of the disease. The histopathology was very similar to those seen in the poultry.

There seems to be no record in India as to the occurrence of tuberculosis in a silver pheasant. One of the several cases sent to the State Veterinary Laboratory from the Zoological Garden, Nandankanan, a silver pheasant was found affected with tuberculosis. The same is described in this paper. It was received at the State Veterinary Laboratory, Bhubaneswar, on November 22, 1968, for autopsy. The bird was suffering from some respiratory disease since 6 to 7 months with symptoms of gaping and respiratory distress, and showed signs of recovery when treated with Omnamycin and vitamins and fish-oil capsules. This bird was purchased from Calcutta. The general picture of the bird showed signs of wasting disease.

Pathoanatomy

On necropsy the bird was found to be devoid of subcutaneous fat and reduced in bulk. The liver was of normal size. Several grayish white spots of 0·5 to 2 mm diameter were found scattered on the liver surface and parenchyma. The right lung was largely destroyed by conglomerated multiple tubercles, which were slightly indurated and hard to touch. Miniature form of grape-like clusters were seen in the lungs. Pleurisy with adhesions of lungs to the thoracic wall and involvement of serous membranes and air-sacs was apparent. The left lung was partially involved. The small intestine was slightly indurated at places. The spleen was slightly enlarged and the surface presented minute necrotic points.

Representative pieces from the lungs, liver, small intestine, spleen and kidney were fixed in 10 per cent formol saline and preserved. Paraffin sections 5 to 6 μ thick were cut and stained by haematoxylin and eosin, Periodic Acid Schiff and Ziehl-Neelsen stain to study the histopathology.

Microscopic anatomy

The normal lung tissue was largely destroyed and replaced by numerous coalesced tubercles (Fig. 1). A typical tubercle consisted of centrally located acidophilic caseous mass surrounded by gaint cells. Rarely forms akin to Langhan's giant cells measuring between 40 and 50 μ were observed in the epithelioid zone. These syncitial cells were irregular in shape with pale eosinophilic cytoplasm and a number of round nuclei arranged like a wreath. The nodules were more sharply defined due to epithelioid

granulation tissue laid around them. Clusters of acid-alcohol-fast organisms morphologically similar to *Mycobacterium tuberculosis* were seen in the central caseous mass. Secondary tubercles were not seen frequently. The spread of the lesion was along the bronchioles and small bronchi. Moderate degree of congestion, influx of plasma cells and lymphocytes, pneumonic changes and accumulation of heterophils were apparent elsewhere.

Liver: The liver presented the usual picture of concentric zones around a necrotic eosinophilic mass of debris derived from the destruction of the host tissue cells. Fat globules were apparent in the centre of the tubercle. Giant cells were few in number. Surrounding the giant cells was a layer of epithelioid cells undergoing different degree of necro-biotic changes. Vacuolation of cells in this zone was apparent. Infiltration of plasma cells and lymphocytes along with histiocytes and fibroblasts were observed in the periphery. A fibrocytic layer of variable depth—an evidence to limit the reaction and spread of infection—was noticed. In some tubercles encapsulation was incomplete owing to the formation of daughter or secondary tubercles in the epithelioid zone (Fig. 2). The tubercles were often noticed in the immediate neighbourhood of the blood vessels, an indication regarding the spread of the disease. Marked fatty degeneration of liver parenchyma was also noticed.

Spleen: Several points of focal necrosis with a few giant cells were observed in the spleenic pulp. Number of macrophages were seen around the necrosed area.

Kidney: The histologic picture of the kidney was apparently normal.

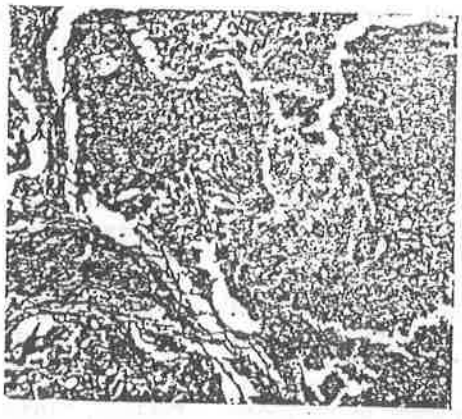
Intestine: The villi of the intestine were congested and in between them and muscularis mucosa there were masses of reticulo-endothelial cells and heterophils, which suggested the earliest stage of the disease. However, no acid-alcohol-fast organism could be detected.

DISCUSSION

It was concluded from the foregoing description and demonstration of acid-alcohol-fast tubercle bacilli inside the nodules that the silver pheasant was suffering from an acute and generalized form of avian tuberculosis. The histological picture was typically tuberculous and very much similar to those seen in the domestic fowl (Feldman, 1959). One peculiarity was that the syncitial cells were more frequently seen in the lungs. It also confirms the earlier observation that captive birds may be attacked by tuberculosis. In poultry affected with avian tuberculosis, involvement of lungs, air-sacs and serous membranes has been less frequently observed (Hutyra and Marek, 1926; Feldman, 1959). Gorden *et al.* (1941) found more frequent involvement of lungs and serous membranes in an extensive outbreak of tuberculosis in ducks. Graini (1944) observed avian tuberculosis in liver, spleen, lungs and right femur in a capercailzie. Rao and Acharjyo (1968; personal communication) recorded tuberculosis in a whistling teal duck at Nandankanan and that lungs, liver and spleen were involved. There exists, however, no statistics to show the order and frequency of involvement of different organs in captive or wild birds in such infection. It is difficult to assume that the involvement of lungs and serous membranes would be regular feature in captive or wild birds.

The silver pheasant studied perhaps did not have the chance to come in contact with a tuberculous flock and the source of contagion, therefore, could not be precisely determined. It is interesting to note that the bird was purchased from Calcutta. Therefore, a pertinent question arises if avian tuberculosis was prevalent in Calcutta zoo amongst captive birds, or some other vector such as a crow or a rat was responsible in spreading the infection. It may be possible that such a living carrier host might be responsible in introducing avian tuberculosis into non-infected premises.

Presently it is suggested that the portal of entry is the small intestine due to involvement of liver and spleen and to the remnant lesions in the intestine. The infection has later on spread by the way of blood. The tubercles found in close



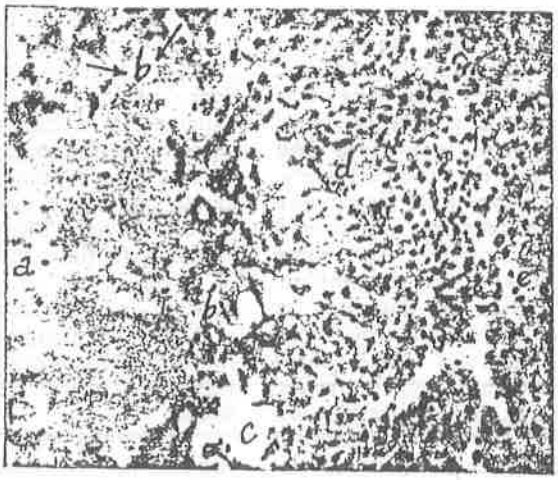


Fig. 1. Section of lung. Note replacement and destruction of normal lung tissue by numerous coalesced tubercles. Haematoxylin and eosin. × 60

Fig. 2. Section of a tubercle in the liver. H. & E. × 270.
a, central necrotic eosinophilic mass of debris; b, giant cells; c, fat globules; d, normal liver parenchyma around the tubercle.

proximity of the blood vessels in the liver confirms the above view.

ACKNOWLEDGEMENTS

The authors are grateful to the Director of Animal Husbandry and Veterinary Services, Orissa, and Dean of Faculty, Orissa Veterinary College, Bhubaneswar, for the facilities afforded. Thanks are also due to their colleague Dr L. N. Acharjyo for the material, and to the staff of Pathology Section of the College.

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BACTERIOLOGICAL STUDY ASSOCIATED WITH MORTALITY IN CAPTIVE WILDLIFE

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Information available on infectious causes of mortality in zoo is very scanty and scattered. This paper presents the results of a study which was undertaken to isolate the bacterial agents associated with mortality in wild captive animals and birds from Sakkarbaug Zoo, Junagadh.

Materials and Methods

A total of 32 deaths during the year 1990-91 were investigated. Information such as history, clinical signs and gross postmortem lesions were noted. At the time of postmortem samples like pieces of lung, liver, heart, kidney, spleen, intestine etc., were collected aseptically in sterilized 50% glycerine saline and brought to the laboratory. Isolation of organisms was carried out as per Cruickshank et al. (1975). Identification was done on colony morphology and Gram's staining of culture smear. The isolates were subjected to antibiotic sensitivity test as per the method recommended by Bauer et al. (1966).

Results and Discussion

The details of bacterial isolation, antibiotic sensitivity, clinical symptioms and postmortem findings of various species of mammals and birds are presented in Table 1.

In the present study *Pseudomonea aeruginosa* has been isolated from 2 out of 3 pythons. *Paeruginosa* has been frequently isolated from pythons (Mayer and Frank, 1975 and Soveri, 1984).

Pasteurellosis has been reported in domestic and wild ducks, geese, wild fowls and pheasants by Merchant and Packer (1983). In the present study *Pasteurella multocida* is isolated from a Nicobar pigeon.

Prevalence of Tuberculosis is a most common feature in many Indian Zoos (Gairola, 1986). T.B. in black buck and white-coloured spotted deer was reported in India (Shah et al., 1986 and Sood et al., 1989). In the present study acid fast bacilli morphologically indistinguishable from *Mycobacterium tuberculosis* were observed in lung impression smear of a spotted deer.

Out of four lions, in two, *Staph. aureus* and in one case, Gram negative bacilli were isolated from liver, lung, spleen and heart. Streptococci were isolated from amniotic fluid of a blue bull which was pregnant and weak and died without any significant symptoms. In the rest of the cases Gram positive cocci and Gram negative bacilli have been isolated from various organs of the dead animals. These organisms might be contributing towards the cause of death in these animals.

Antibiogram of the isolated, revealed that Gentamicin, Streptomycin, Furazolidone, Chloramphenicol and Cotrimoxazole were effective on the isolates while the organisms were completely resistant to Ampicillin, Tetracycline and Penicillin calling for judicious and discriminate use of antibiotics for therapeutic purpose in the wildlife.

Summary

Various species of wild captive animals and birds like, Blue bull, Spotted deer, Samoar, Antelope, Crocodile, Python, Parrot, Nicobar pigeon, Hornbill, etc. died in Sakkarbaug Zoo, Junagadh during the period of study were investigated. Bacterial organisms viz. *Staph. aureus*, *Streptococci*, *Ps. aeruginosa*, *Proteus Sp.* other gram negative bacilli and acid fast bacilli were obtained from these cases. Streptomycin and Gentamicin were found effective on bacterial isolates which can be used for therapeutic purpose in wild animals.

Acknowledgement

The authors are grateful to the Dean, Veterinary Science College, Sardar Krushinagar for providing the facilities and to Shri K. A. Ghoya and Miss Sangeeta Vyas for help in laboratory work.

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Table 1 : Details of bacterial isolation from captive wild life

Spp. of animal	No. of animals, from which samples collected	No. of samples positive for bacteria	Types of bacteria observed	Antibiotic sensitivity organisms Sensitive/Resistant to	to	History and clinical symptoms	Postmortem findings
1	2	3	4	5	6	7	8
Lion	4	3	Staph. aurous, Gram negative bacilli	S,G,FU	T,P A,C,BA	Weakness,debility with rough coat, dehydration, pale mucous membranes and anorexia.	White necrotic foci on liver, lung and spleen, lungs were pneumonic with petachial haemorrhages
Nilgai	1	1	Streptococci	nil	S,G,A FU,P,C,BA	Pregnant, unable to stand, lateral recumbancy	2 dead kids in womb, Amniotic fluid collected, other organs were normal
Chital	2	1	Lungs Improsn. revealed Acid - fast bacilli	nil	nil	Weakness, rough body coat debility, diarrhoea and pale mucous membranes	Haemorrhagic spots on spleen and stomach mucosa. Lungs congested with caseation
Black buck (White)	3	1	Staphylocci, Gram negative bacilli	nil	nil	Weak, unthrifty with normal appetite. One was pregnant	Lungs pneumonic and partly fibrosed; one lung adhered with ribs.
Sambar	1	1	Gram negative bacilli	C,S	BA,T,FU,P, A,C	Weakness, debility and of hind quarters	Necrotic foci and haemorrhages on lungs, liver and spleen and intestine.
Antelope	1	1	Gram negative bacilli	nil	nil	Apparently healthy, not showing any clinical symptoms	Lungs, liver, spleen and kidneys were congested
Civet	1	-		nil	nil	Debilitated, rough coat and dull	Liver, lungs, spleen and kidneys were congested

Crocodile 9		3	Streptococcus sp. and Proteus	S,G, BA	A,T,P, FU,C	Unable to move due to paralysis of vertebral column, gingivitis with pus, conjunctivitis, pustular lesions in buccal cavity and twitching of thigh and shoulder muscles	Lungs and heart severely congested liver with white spots, trachea filled with mucus, meninges congested
Python 3		2	Ps. aeruginosa	G.S	P.FU.BA	Chronic weakness	Nodules on lung with congestion trachea filled with mucus and necrotic foci on right lung
Banded Racer Snake	1	-	nil	nil	nil	Convulsions and tremors from head to tail	Internal organis were normal
Rat Snake	1	-	nil	nil	nil	Convulsions and tremors Apparently normal	Internal organis were normal
Parrot	2	1	Gram negative bacilli seen in lungs Impression smears	nil	nil	Apparently normal ; not showing any clinical symptoms	Lungs pneumonic, trachea congested
Nicobar Pigeon	1	1	Bipolar organisms in trachea and lung tissue	C,G,S, FU	BA,A,P	Dyspnoea, nostrils were filled with mucus	Lungs were congested trachea was filled with mucus
Silver pheasant	1	-	nil	nil	nil	Gasping	Haemorrhagic spots were seen on the inner wall of gizard
Hornbill	1	1	Gram negative coccobacilli	nil	nil	Sudden death without any clinical symptoms.	Deposition of white material on spleen liver, heart and intestine

G = Gentamicin; S = Streptomycin; C = Chloramphenicol; P = Penicillin; FU Furazolidone; A = Amphicillin; BA = Cotrimoxazole; T = Tetracycline

Indian J. Comp. Microbiol. Immunol. Infect. Dis.
Vol. 18, No. 2 (July-Dec.), 1997 : 147-152

ISOLATION OF BACTERIA FROM CAPTIVE HERBIVORES

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(Received for publication on 10.6.97)

Isolation of bacteria from 120 clinical samples collected from 68 herbivorous animals having pathological conditions and belonging to 14 different species of the Assam State Zoo was made. The common pathological conditions of the animals were tuberculosis, pneumonia, enteritis and wound infections. Of the 120 samples, 94 yielded *Mycobacterium tuberculosis* both bovine and human types, *Escherichia coli*, *Staphylococcus aureus*, *Streptococcus pyogenes* and *Actinomyces pyogenes*, *Pasteurella multocida*, *Pasteurella haemolytica*, *Pseudomonas aeruginosa*, *Corynebacterium ovis*, *Proteus mirabilis* and *Bacillus* spp.

The etiopathology of mortality of captive wild animals in different zoological parks of the country has been investigated by different workers (Khan, 1979; Acharjyo and Rao, 1987; Arora and Goyal, 1987) but no systematic approach has been made. Considering the importance of infectious agents in different pathological conditions, an attempt was made to isolate bacteria from samples collected at postmortem of the captive herbivores with different pathological conditions.

MATERIALS AND METHODS

A total of 68 herbivore carcasses with different pathological conditions and belonging to 14 different species of the Assam State Zoo were examined at postmortem and 120 samples were collected aseptically for isolation of bacteria (Table).

The isolation and identification of the bacteria were carried out as per the methods of Cruickshank *et al.* (1975) and Carter (1986). The serotyping of the isolated *Escherichia coli* strains were done at the National Salmonella and Escherichia Centre, Kasauli, Himachal Pradesh, India.

RESULTS AND DISCUSSION

The types of bacteria isolated from the various species of captive herbivores having different pathological conditions

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Table. Isolation of bacteria from different species of herbivores with different pathological conditions

Pathological condition at postmortem	Species of animals	Nature of samples	Bacteria isolated
Cirumscribed raised whitish nodular lesions	Spotted deer (5) Barking deer (4) Hog deer (3) Sambar (2) Black buck (5) Giraffae (2) Rhinoceros (1)	Lung, Liver lymph node, spleen. udder uterus, joint capsule.	*Mycobacterium tuberculosis* : bovine type (09) human type (10)
Pneumonia	Spotted deer (4) Barking deer (1) Sambar (1) White fellow deer (1) Mouse deer (4) Black buck (3) Serow (2) Nilgai (1) Mithun (1) Rhinoceros (2)	Lung and exudate	*Pateurella multocida*, Streptococci (haemolytic type), Staphylococci, *E. coli*, *Streptococci pyogenes*, *Pasteurella haemolytica*, *Actinymyces ovis*, *Klebsiella* sp.
Focal nodules with abscess in the lung	Sambar (2)	Lung and pus	Actinomyces pyogenes
Enteritis catarrhal to haemorrhagic type	Spotted deer (1) Barking deer (2) Sambar (2) Mouse deer (2) Serow (1) Nilgai (1) Zebra (1) Rhinoceros (1) Elephant (1)	Intestine	E. coli serotypes 09, 097, 060, 05 074, 04, 037, 0154 017, 07, 0133, 08 0163, 043, 0156 Untypable (6) Rough strain (3)
Necrotic ulcerative colonitis	Zebra (1) Rhinoceros (2)	Colon	*Actinomyces* sp, *E. coli* (untypable)
Abscess in the liver	Spotted deer (1) Mithun (1)	Liver and pus	Streptococcus pyogenes, Pseudomonas aeruginosa

contd.

Peritonitis	Spotted deer (1) Sambar (1)	Peritoneal fluid	*Pseudomonas aerugenosa*, *Proteus mirabilis*
Wound in different areas of the body	Sambar (3) Black buck (1) Rhinoceros (2)	Swab or exudate and necrosed muscle	*Staphylococcus aureus*, *E. coli*, *Bacillus sp.*, *Actinomyces pyogenes*,
Suppurative orchitis	Black buck (1) Zebra (1)	Testicle, pus and lymph node	*Corynebacterium ovis*, *Staphylococcus aureus*
Metritis	Spotted deer (1)	Uterus and pus	*Pseudomonas aeruginosa*
Pus in the prepuce	Sambhar (1)	Prepucial swab	*Proteus mirabilis*
Epi-and endocardial haemorrhage	Mouse deer (1)	Heart blood	*Streptococcus pyogenes*
Hydropericardium	Sambar (1)	Pericardial fluid	*Proteus mirabilis*
Duodenal ulcer	Black buck (1)	Affected deodenum	*E. coli*
Stress condition	Rhinoceros (1)	Heart blood	*Streptococcus pyogenes*
No lesion but with a history of two consecutive abortions	Mithun (1)	Amniotic fluid and placenta	*Pseudomonas seruginosa*
Non specific	Barking deer (2) Giraffe (1)	Heart blood	*E. coli*

Figures in parentheses indicate the number of animals.

are presented in the Table. Out of the 120 samples processed for the isolation of bacteria, 94 samples were positive for different types of bacteria.

Mycobacterium tuberculosis both human and bovine-types were the important isolates from the animals having tuberculous lesions. Samples from 22 animals of 7 different species having tuberculous like lesions were examined for isolation of the mycobacteria and the bacteria could be recovered from the samples of 19 amimals. *M. tuberculosis* human and bovine-types were respectively detected in 10 and 9 animals. Number of other workers (Basak *et al.*, 1975; Rathore and Khera, 1982; Shah *et al.*, 1986; Singh *et al.*, 1986; Upadhyaya *et al.*, 1986) have reported that the tuberculosis is relatively a common disease in captive deer. In the present study out of the 22 animals having tuberculosis, 14 animals were deer of four different species. The other species of animals from where the mycobacteria could be isolated in the present study were black buck, giraffe and rhinoceros. Tuberculosis in giraffe and black buck has been reported by Rai and Chandrasekharan (1958), Pathak *et al.* (1987) and Shah *et al.* (1986), but the occurrence of tuberculosis in rhinoceros has not been reported. Lung and pulmonary lymph nodes were commonly affected in most of the tuberculous animals, while the liver of the rhinoceros showed nodular lesions and bovine type of mycobacteria could be isolated from the lesion.

Isolation of human type of mycobacteria suggests that the infection might have entered through the animal attendants and disseminated through monkey as large number of monkeys from nearby jungle are reported to enter into the zoo and take the feed supplied to the zoo animals. The bovine type of mycobacteria might have spread from the reservoir animals through contaminated feed and water.

The samples examined from the animals having pneumonic lesions were positive for various types of bacteria such as *Pasterurella multocida, Pasteurella haemolyica, Streptococcus pyogenes, Escherichia coli* and *Klebsiella* spp. Isolation of most of these bacteria from the cases of pneumonia of captive wild animals has been reported by number of other workers (Freeman, 1979; Ramachandran *et al.*, 1983 and Srinivasan *et al.*, 1977). *Pasteurella multocida* infection has also been reported in a wide variety of wild animals in captivity (Rosen, 1981; George, 1985). Death of 15 rhinoceros due to haemorrhagic septicaemia caused by the bacteria in the Kaziranga National Park, Assam has also been reviewed by Laurie *et al.* (1983).

The bacteria isolated from the cases of enteritis of the animals were mostly the *Escherichia coli*. The important *Escherichia* coli serotypes identified were 037, 08, 0133, 0154, 0163, 09, 097, 060, 074, 04, 043 and 0156. Isolation of some of these *Escherichia coli* serotypes in cases of diarrhoea and

gastroenteritis in lambs, kids and calves has been reported by other workers (Sarma and Boro, 1983; Smith and Halls, 1967).

The bacterial species such as *Staphylococcus aureus, Streptococcus pyogenes* and *Actinomyces pyogenes* were mostly isolated from the animals having abscesses in liver and lung and peritonitis etc.

Another important microorganism isolated in the present study was *Corynebacterium ovis* from testicle, lung, lymph node and kidney of a black buck which showed suppurative orchitis and pneumonia at postmortem. The exact route of *C. ovis* infection was not clear, but it is assumed that the infection might have entered through scrotal injury and then spread to other organs. Similar view in sheep has been suggested by Lalkrishna *et al.* (1977).

Isolation of wide variety and some of the important species of bacteria from the captive herbivores of the zoo suggests the possible role of the bacteria in the disease processes of the animals, however, detailed epidemiological studies are needed to identify the sources of the bacterial infection, so as to adopt necessary preventive measures.

ACKNOWLEDGEMENTS

The first author is grateful to CSIR, New Delhi for the financial assistance in the form of Senior Research Fellowship. Authors are also grateful to the Zoo Authority, Govt. of Assam for the materials. Thanks are also due to the Director, National Salmonella and Escherichia Centre, Kasauli for serotyping the *Escherichia coli*

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Reprint : Zoos' Print, 6 (5) : 19-21, May, 1991

BACTERIAL DISEASE OF WILD ANIMALS

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The impact of bacterial disease in wildlife has been well known and documented. Many of the bacterial disease have been studied in different wild animals. Certain bacterial diseases are described in brief as under:

PASTEURELLOSIS :

This is an infectious bacterial disease of wild and domestic animals caused by *Pasteurella multocida*. Epizootics of pasteurellosis occasionally reported among wild mammals like bighorn sheep, bison, black-tailed deer, elephant, elk, kangaroo, wild swine, etc. It is gram negative coccobacillus and transmitted through droplet or by ingestion of contaminated food and water. It affects respiratory systems and pathogenesis depends upon many predisposing factors like stress, parasitic infection (especially lung worms), poor nutrition, crowding, etc. A definite diagnosis can be made on the pathologic findings together with isolation of bacteria and its identification through biochemical tests. Treatment and immunization of free roaming wildlife are impractical. For controlling of pasteurellosis in wild mammals, other livestock or resevoirs must be thoroughly checked and immunized for pasteurellosis.

TUBERCULOSIS :

For more than a century tuberculosis has been recognized as a serious clinical entity in wild mammals. Tuberculosis has not been commonly reported in wild animals except where they have exposure to infected domestic animals or human beings. Mycobacterium infection has been reported in deer, kudu, giraffe, elephant, monkeys, antilope, bison, baboons, elk, eland, tapir, etc. Although data on the frequency of mycobacterial isolations is limited, but available information indicates that many of the species are susceptible to *M. bovis, M. tuberculosis and M. avium*. It is transmitted by aerosols or droplets containing tubercule bacilli.

In the zoo the animals are mainly infected through feed and water contaminated with urine or faecal material. M. avium can be transmitted by ingestion of uncooked meat of diseased chickens. The development of the disease or recovery depends on the microbicidal activities of the ingesting macrophages to destroy the tubercle bacilli. Organisms multiply in the cell and leads to the death of the host cell resulting in microscopic tubercle. As the lesion develops, necrosis occurs and Langhan's giant cells appear in the lesions. Lastly, caseation and mineralization may occur. In pulmonary tuberculosis the animal may exhibit cough and show some evidence of dyspnea. In generalised tuberculosis, spleen, liver, kidney and regional lymph nodes are also affected. Clinical signs are of limited value of diagnosis. The tuberculin skin testing has been the key to reducing the incidence of tuberculosis in man and cattle. But, in wild animals its application is limited. For confirmatory diagnosis histopathologic examinations of tissues collected at necropsy or biopsy are most useful.

JOHNE'S DISEASE (Paratuberculosis) :

This disease is caused by *Mycobacterium paratuberculosis* which results in high morbidity and mortality in a variety of wild mammals. Johne's disease has been reported in wild big horn sheep, deer, moufion, antelope and moose, etc. Definite information regarding transmission is not available. It is characterised by chronic diarrhoea in cattle, sheep and other domestic animals that persists for months. In wild mammals, clinical signs are variable. So it requires further laboratory isolation for confirmation. Microscopic examination of impression smears from ileum or mesenteric lymph nodes of affected wild animals reveals the presence of acid fast organisms. For the diagnosis of Johne's disease in wild animals faecal culture technique is not useful. Lymphocyte immunostimulation test is more reliable than other tests. Measure for controlling and eliminating Johne's disease in wild animals should be based on the diagnosis and elimination of infected animals shedding the organisms in faeces and avoid the introduction of animals without knowledge of their status of infection with *M. paratuberculosis*.

BRUCELLOSIS :

This is a highly contageous infection of many animals including man caused by the organism of the genus Brucella. It has been reported in bison, elk, moose, Dall sheep, caribou, reindeer, and several species of deer, etc. For causing brucellosis in wild animals *B. neotomae* has shown similar susceptibility like *B. abortus, B. suis* and *B. melitensis*. It is transmitted by oral exposure, wounds, contamination of eyes and genital tract transmission is also equally important during breeding season from infected males. Usually this infection begins as bacteria, during which blood sucking parasites can serve as vectors. Infected edible tissues can also spread the disease. Certain animals like wolf, coyote and fox act as mechanical carriers. While significant signs have not been reported in deer and moose, bison and elk show similar symptoms as cattle. For diagnosis of brucellosis in wild animals, the most common tests are plate and tube serum agglutination tests. Other tests, like CFT, FAT and G. pig inoculation, are the standard one. Regular testing of suspected wild mammals helps in controlling the infection.

ANTHRAX :

Anthrax is an infectious, febrile disease caused by Bacillus anthracis characterised by sudden onset which leads to fatal course. It has been recorded in zebra, springbok, baboon, cheetah, leopard, honeybadger, elephant, hippopotamus, giraffe, antelope and deer, etc. It is highly virulent, when it gains access to the animal body, it multiplies rapidly, producing septicaemia. In herbivores, anthrax is essentially a soil borne infection. Soil (and water) contamination is often caused by carcasses of infected animals died of anthrax.

Certain scavengers such as jackals, coyotes, foxes and vultures, etc. are highly resistant and play an important role as disseminators of the disease. The occurrence of anthrax is largely influenced by its spores which can survive for many years in soil. The developing *B. anthracis* produces a toxin which favours the bacilli for free multiplication. Blood smears on clean slides and blood samples from fresh cadavers are adequate for laboratory diagnosis. Bacilli should also be examined, in the tissue sections. To distinguish them from anthracoid, it is necessary to see the pathogenecity in laboratory animals. Certain antibiotics can be used with good response in early stage of the disease. Spore vaccine can be used for immunization.

ERYSIPELOTHRIX INFECTION :

E rhusiopathiae affects a wide variety of domestic and wild animals. It has been reported in white-tailed deer, fox and many free living as well as captive animals. Transmission is not fully known but insects may play a role in the transmission of the disease among wild animals. Diagnosis depends on isolation of *E. rhusiopathiae*. Penicillin can be used for treatment and for control, strict attention must be given to sanitation of food and quarters and protect the animals from insects and unconfined rodents.

LISTERIOSIS:

This is a febrile, infectious, endemic disease of man, domestic as well as wild animals, caused by *Listeria monocytogenes*. It has been reported in leopard, mink, paca, several chinchilla, cameroen goat, deer, moose and skunk, etc. It is transmitted either by eating infected animals or by contact with diseased animals. Arthropods and ectoparasites are also reported for the transmission. Listeriosis can be diagnosed by the isolation of organisms and confirmation by biochemical tests. Broad spectrum antibiotics are helpful if used in time for therapy.

ENTEROBACTERIAL DISEASES :

These pathogens are characterized by destruction of the gastrointestinal lining, producing gastroenteritis, although vomition and dehydration may be found in acute case. Mortality is generally limited to the neonatal mammal, older individuals being more resistant to infection. Salmonella, Escherichia, Proteus, Klebsiella and Arizona are important for causing gastrointestinal disturbances in wild animals. Cultural confirmation is required for a definitive diagnosis. Rectal swabs are useful for screening in living case and most reliable sources of cultural material on necropsy specimens is the mesenteric lymph nodes, which yield the most consistent results. For the treatment, dehydration must be controlled by giving the electrolytes and oral antibiotic therapy often aggravates the condition by reducing normal intestinal flora.

LEPTOSPIROSIS :

Leptospirosis is a group of infectious diseases of man and animals, caused by antigenically distinct members of the genus, Leptospira. Leptospiral infections in wild animals are important as a source of infection for other species and for domestic animals and humans. It has been reported from opossums, bob cat, mongoose, deer, mice, etc. Infective urine constitutes the major source of infection for susceptible wild mammals. House mice are the resevoir for L. ballum. In some wild mammals it causes nephritis and abortion. Symptoms of Leptospirosis in wildlife is not fully known. FAT is very useful for the demonstration of leptospires in urine and tissues of infected animals. A number of antibiotics, namely, streptomycin, penicillin and tetracycline and recommended for the treatment. The application of sanitary practices will reduce the spread of leptospirosis.

NECROBACILLOSIS :

This is an infectious disease of wild ruminants and domestic animals caused by *Fusobacterium necrophorum*. It has been reported in caribou, black-tailed deer, deer, elk, white-tailed deer, etc. Epizootics of necrobacillosis seem to occur when wildlife are crowded. Although, this organism does not invade tissue, they await opportunity that follows injury and then multiply which leads to arthritis with ankylosis in chronic form. For the treatment wounds must be treated with antibiotics and in chronic cases surgical treatment is useful. Natural recovery is much lower in wild animals. Sanitation and disinfection of premises is useful for its control. Over-crowding must be checked by providing sufficient water facilities.

Q. FEVER :

Q. fever is a generalised rickettsial infection which is characterised by pneumonitis. It is caused by Coxiella burnetii. Organisms are Gram positive and requires living media for cultivation. They remain viable for many years in dried tick faeces. It affects the range of species of wild mammals. It has been reported in deer, coyote, mouse deer, opossum, antelope, etc. Arthropods play an important role in spreading the infection. Natural infection of Q. fever in wild animals is not known but the frequent occurrence of anitbodies in many wild species indicates that recovery is common. Certain factors like pregnancy

stress, cortisone therapy predispose the animal to Q. fever. Serological tests are very useful for the diagnosis.

VIBRIOSIS :

It is an infectious disease of the genital tract of domestic animals. It is caused by Campylobacter fetus. It is transmitted by ingestion of infected material and through coitus in cattle. It causes abortion in late gestation or an increased neonatal mortality in antelope. Diagnosis is dependent on clinical signs and isolation and identification of causative organisms.

ACTENOMYCOSIS (Lumpy jaw) :

This is an infectious disease of an insidious nature characterised by suppurative granulomatous lesions occurring commonly in the mandibular region of deer, moose, pronghorn antelope, mountain sheep, etc. It is caused by *Actenomyces bovis*. It affects bony tissues like maxilla, turbinate and mendible. It is recognised by clinical signs like stertorous breathing, difficult prehension and mastication due to mechanical interference from swellings in jaw and sulphur granules are found in the lesions.

Early cases can be treated by surgical extripation and drainage of bone lesions. Potassium iodide given orally or sodium iodide given introvenously is effective treatment. Application of liquor iodine pack in the wound is also useful.

CONTROL MEASURES :

Many diseases in wild animals are sometimes not manifested by obvious clinical signs until quite advanced and in advanced cases therapy may not give successful repsonse. Preventive measures are of utmost importance in control of the infectious diseases. The following control measures are advocated.

1. Measures of proper housing, sanitation and cleanliness of habitat should be provided.

2. Quarantine should be strictly followed because it is very important component of the preventive medicine programme. So, quarantine must be adopted for all new animals before allowing them with other animals at the zoo.

3. Strict restriction of entry of all types of domestic animal, street dog, etc. should be observed.

4. Diseased animals should be segregated.

5. In case of outbreak of any infectious disease in domestic animals or birds of surrounding area, vaccination of susceptible wild animals should be carried out.

6. Animal keepers must be regularly checked for zoonotic diseases.

7. All the staff attached with wild animals must be educated/ trained regarding hygiene, management and disease transmission, etc.

MULTIPLE INFECTION IN A RUSTY-SPOTTED CAT (*PRIONAILURUS RUBIGINOSUS*)

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Introduction

The Rusty-spotted Cat (*Prionailurus rubiginosus*) is one of the smallest cats of the world. It is listed under Schedule I of the Indian Wildlife Protection Act. The distribution range of this species include southern India, Jammu and Kashmir, Gujarat Dangs and Sri Lanka (Prater 1980). In the Gir Lion Sanctuary, this species was recorded for the first time in the year 1991. Subsequently some more sightings and photographic evidence of this species in the Gir and Girnar range of forests have been made available. The specimen discussed here is the first recorded evidence of this species in the Girnar Mountain.

In India this species is found in moist and dry deciduous forests, scrub forest, grasslands and arid lands. There is a great paucity on the information about the ecology of this species in the wild. The captive population of this cat is about 12 closely related individuals located in some zoos of the world (Merehurst, 1993). The species is not found in any Indian zoo.

Materials and Methods

A kitten thought to be a panther cub was rescued and brought to the zoo. It had four distinct dark black lines running from eyes to forehead. It had spots all over the body with paler under parts. From the external features, it was assumed to be a Rusty Spotted Cat. Later, a photograph was sent to experts of the Bombay Natural History Society, confirmed our identification. The following table shows the comparison between some of the physical parameters of an adult specimen of this species described by Merehurst (1993).

Physical Parameters	Unit	Kitten	Adult
1. Body weight	gram	325	1000
2. Head and body length	cm	37	35-48
3. Tail length	cm	7	15-25
4. Heart girth	cm	12.5	-
5. Shoulder height	cm	5.5	-
6. Front foot pad length	mm	8.61	-
7. Front foot pad width	mm	10.89	-
8. Hind foot pad length	mm	5.89	-
9. Hind foot pad width	mm	10.59	-

Received 3 April 1999; Accepted 28 May 1999

The kitten was fed with pasteurized luke-warm milk in a sterile feeding bottle. Milk was given every two hours during daytime and every four hours during the night (2000 to 0600). It was housed under hygienic conditions. Though it was doing fair, the overall progress was not satisfactory possibly due to the new environment and diet. After about 20 days in captivity, the animal looked slightly weak. No stones were left unturned to save the kitten, but it did not respond to any of the treatment and died after 3 days.

Upon external examination, the cheeks, eyes and surrounding tissues were found to be swollen. Upon postmortem examination, the lungs were collapsed, whereas the liver and the spleen were slightly congested. Some round worms were found in the stomach and intestines. The intestinal mucosa was severely congested and some patticheal haemorrhages were also observed. Different biological samples were collected from the dead kitten and were examined thoroughly at the zoo laboratory.

About 5g of fecal matter obtained from the rectum of the kitten was thoroughly crushed and mixed with water. After 20 minutes, the supernatant was discarded and the sediment was examined under microscope, which revealed large number of *Toxoscaris leonini*, *Trichuris* and *Anchylostoma* species ova.

Representative samples of the vital organs like lungs, liver, spleen, kidneys and lymph nodes were inoculated on nutrient agar medium and were incubated at 37°C for 24 hours. The media containing kidneys and lymph nodes did not show the growth of any bacteria, whereas those of liver, spleen and lungs revealed *Pseudomonas* organism.

No previous records are available regarding the occurrence of these parasites in this species. Severe congestion and some haemorrhages observed in the intestines of the kitten could be due to the heavy worm infection.

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Salmonellosis in Adult Indian Rhinoceroses (*Rhinoceroses unicornis*)

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Introduction

Zoo animals are known to suffer from salmonella infection in many parts of the world. Literature pertaining to the incidence of salmonellosis in rhinoceroses in India is scant. As such, there is no record of the infection due to S. *typhimurium* and S. *enteritidis* in rhinoceroses causing fatalities. This is a report on the mortality of three adult Indian rhinoceroses stationed at Nehru Zoological Park, Hyderabad, Anahra Pradesh State, as a result of salmonella infection.

Clinical History : In August, 1983, three adult Indian rhinoceroses, two males aged 12 and 25 years and one female aged 20 years, died after an illness of 8-10 days duration, within a span of 15 days, one after the other.

Early clinical signs noticed were dragging of both hind limbs, shivering of body and forelimbs with intermittent convulsions, and recumbency which lasted till death. Grinding of the teeth and increased rate of respiration were observed. Petechiae of the visible mucous membranes, mucoid lacrimation and nasal discharges was noticed. A few days before death, the animals became weak as a result of diarrhea and dehydration. On the day of death, hematuria and yellowish discoloration of the body coat was observed.

Treatment included tetracycline, antibiotics, vitamins, corticosteroids, electrolytes and saline, which were given both orally and parenterally. Despite continued therapy, the animals died without showing any response to treatment.

Necropsy Findings : Extensive submucosal and subserosal petechial hemorrhages were noticed. The heart and spleen were congested and edematous. The liver was enlarged and congested. Hemorrhagic enteritis was seen and the entire lumen of the small intestine was packed with a heavy infestation of tapeworms. Mesenteric lymph nodes were swollen, edematous and congested. All three rhinoceroses revealed the same type of lesions except one, the lungs of which showed multiple abscesses of varying sizes from 1.6 cm, with considerable amounts of blood tinged exudation from cut surfaces. In the other two, the lungs were consolidated with pleural adhesions showing pneumonic lesions. In the female, amphistomes were observed in the stomach. The uterus was gravid with an 8-month

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fetus. In general, all the organs were severely congested indicating septicemic infection.

Histopathology Examination : In the intestines, congestion of blood vessels in the lamina propria and submucosa was seen. At some foci, there were hemorrhages in the lamina propria and a few of the macrophages were laden with golden yellow hemosiderin pigment. Infiltrations of mononuclear cells, mainly lymphocytes and macrophages were evident.

In the heart, mild congestion of blood vessels was observed in the musculature, subepicardium and between myofibrils. There was severe congestion of blood vessels in the interstitial spaces of the kidneys. The lungs of one rhinoceros had granulomatious foci with Langhan's giant cells and acid fast organisms. The liver and spleen were congested.

Laboratory Investigations : Lung abscesses of the male rhinoceros contained acid fast organisams morphologically indistinguishable from *Mycobacterium tuberculosis* on Ziehl-Neelsens method of staining.

The tapeworms which were found fully packed and interwoven throughout the lumen of the small intestines of all three animals were identified as *Anaplocephala species*. Amphistomes found in the stomach of the female rhinoceros were identified as *Cotylophoron* species.

Heart blood, liver and intestinal contents of the three animals were subjected to detailed bacteriological examination. Based on biochemical and sugar fermentation tests, the organisms isolated were identified as *Salmonella* species[1]. These isolates, sent to National Salmonella and Escherichia Centre, Kasauli, were identified as *S. typhimurium* and *S. enteritidis*, with antigenic formulae 1,4,5,12:i:1,2 and 1,9,12: g.m, respectively.

In vitro, antibiotic sensitivity tests for the isolates were conducted by conventional paper disc diffusion method as described by Cruickshank[2], using discs supplied by Span Diagnostics, Surat. *S. typhimunium* and *S. enteritidis*, were both found to be sensitive to gentamicin, neomycin followed by furadantin, and Chloramphenicol. Complete resistance was encountered with oxytetracycline, chlorotetracycline, streptomycin, ampicillin, erythromycin and pencillin.

Materials from all three animals sent to the Indian Veterinary Research Institute, Mukteswar, for investigation of probable viral infestions, were found to be negative for viral agents.

Discussion : From the available literature and statistical data, enteric infections in man and animals are most frequently caused by infection with the salmonella group of organisms. There is not an abudance of literature on salmonellosis in zoo animals and rhinoceroses. Salmonellae have been reported in young rhinoceroses[4], although not as the cause of fatalities. Schmidt and Hartfiel[3] attributed the death of an infant rhinoceros born at San Antonio zoo to acute salmonellosis, though no salmonella organisms were isolated.

In the present investigation, *S. typhimurium* and *S. enteritidis* were isolated form all three adult rhinoceroses which died showing septicemic lesions. One male rhinoceros had extensive localised tuberculous lesions in the lungs, and a pregnant female had amphistomes (*Cotylophoron* sp) in the stomach. Further, all three animals had heavy infestation of tapeworms (*Anaplaocephala sp.*). The multiplicity and chronicity of these disease entities may probably have lowered the vitality of the animals, allowing the salmonella organisms present in the intestines to proliferate causing mortality among these animals.

The rhinoceroses were located in an area with a pond of stagnant water. There is a possibility for rodents, mongoose and bandicoots, which act as carrirs of salmonella organisms, to move freely in the premises. Human infection may pose a threat to the captive animals. Though the source of the salmonella infection was not established in this study, the authors are of the opinion that poor environmental sanitation and other factors might have contributed to the deaths of the three adult Indian rhinoceroses from salmonella infection.

Summary :

Mortality of three adult Indian rhinoceroses, *S. typhimurium* and *S. enteritidis* infection is reported.

Acknowledgements :

The authors express their gratitude to Dr. C. Rajal Rao, Director of Animal Husbandry, Andhra Pradesh state; Dr. W.P. Heuschele, Head, Microbiology/Virology Research Department, San Diego Zoo, California; the veterinarians of the Nehru Zoological Park, Hyderabad, for their cooperation and help in this investigation.

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Vol VI Issue XII Dec-1981

SALMONELLOSIS IN AN OSTRICH (STRUTHIO CAMELUS)

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Salmonellosis is the term applied to infections caused by a group of microbes of the germs salmonella. The organism usually produces an intestial infection. These are gram negative, aerobic, non-spore forming rods.

Salmonella are known to inhabit many animals and birds, majority of isolates are from domestic avian species. Few isolates have also been made from wild birds, some are listed below:

1. Chukor Partridge (Alectoris graeca)
2. Seal Gull. [Larus fascus] — Different species.
3. Pheasants. (Phasianidae).. -do
4. Gold Finch (Carduelis carduelis)
5. Wood Pigeon. (Columba palumbus)
6. Coot. (Fullca americana)
7. Magpie. (Pica pica.)
8. Razor Bill. (Alca torda)
9. Gannary. (Serinus cnarius)
10. Mullard. (Anas platyrhynchos.)
11. Mute Swan. (Cygnus olor)
12. Starling. (Sturnus vulgaris)
13. Twany Owl. (Strix aluco)
14. Tuffied Duck (Aythya fuligula)

This is also reported from different species of Heron, Doves, Quails, Parrots and Budgerigars. Here a case of Salmonellosis in an Ostrich female is described.

BACTERIAL ENTERIS caused by Salmonella species or Escherichia-Coli are common in RATTEES i.e. Ostrich, Encu, Cassowaries and Rhea [Amond.W.B] et al.

A female Ostrich of Nehru Zoological Park, Hyderabad, became sick with poor appetite on 18 6-1973. As it was difficult to catch and examine it carefully medicines were given in feed and drinking water as follows:

1. Terramycine capsules 250 Gms. [2] Capsules B.D.
3. Vitamin "C" mg. One tab. B.D [500 mg]
4. Hostacycline soluble powder in drinking water.

No. 1 and 2 medicines were given in small pieces of banana. This treatment was given for a period of three days, but the appetite of the bird did not improve. She was pecking few pieces of bread and banana only. Hence it was decided to capture it and examine thoroughly. The Ostrich was secured manually the body temperature was reeorded and the medicines were administered parentally as follows:

Body temperature 101°F.

1. Injected Procain Pencillin 12 lakhs 1.U1/m.
2. Injected multivitamins 2. M.1 1/m.
3. Injected Vitamin "C" 1 gm. 1/m.

This treatment was continued for 4 days with no improvement. On the fifth day the body temperature rose to 103°F. and the giant bird was found in a very bad shape with dried beak, anxious expressions and accelerated breathing. Hence the broader spectrum antibiotic was changed from Terramycine to Achoromycine 500 mg. 1/m twice in a day. Even this line of treatment was not effective. By this time the bird had started passing loose greenish white stools. Hence it was decided to screen the bird for salmonellosis.

AGGLUTINATION TEST

The Ostrich was caught and secured manually. Fresh blood samples were collected from the vein under the wing, and whole blood rapid agglutination test was conducted with coloured antigen. Immediately agglutination was formed to the extent of plus four (+ + + +).

TREATMENT:

The positive result led us to suspect salmonellosis. In response to the laboratory findings of Salmonellosis a course of Nitrofurazone (in the form of NEEFTIN 200 Mgs. Tablets) was given such (5) tablet i.e. 1 gm. daily divided into two one morning and one in the afternoon was administered orally to the bird Multivitamins and BELAMYL [Squibb] injections were also given at alternate days. The bird responded very well to this treatment by improving its appetite and general condition. The stools consistency also returned to normalcy. This treatment was continued for 5 days.

SUMMARY

A case of Salmonellosis and its successful treatmant with Nitroferazone, in a captive female Ostrich is described. On the basis of whole blood rapid agglutination test with coloured pullorum antigen.

ACKNOWLEDGEMENT

The authors express their gratitutde to Dr. Vasanth Rao, Joint Director [Animal Husbandry] Vety. Biological and Research Institute, Hyderabad and Mr. Pushp Kumar, I.F.S., Conservator of Forests, Wiid Life Management, Hyderabad A.P. for their encouragement and guidance.

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Reprint : Zoos' Print, 6 (5) : 12, May, 1991

ISOLATION, CHARACTERIZATION AND ANTIBIOTIC SENSITIVITY OF *PSEUDOMONAS AERUGINOSA* FROM PYTHON.

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The ubiquitous existence and the pathogenic role of *Pseudomonas aeruginosa* as opportunists in many localised and few generalised infactions of man and animals, combined with its resistance to many antibiotics have drawn the attention of clinician and epidemiologists. There is paucity of literature regarding causes of mortality in pythons. The present communication is to report the isolation and identification of Pseudomonas infection from python.

A python, showing the symptoms of weakness since one month, died in Sakkarbaug zoo, Junagadh (Gujarat). On post mortem examination, lungs were found congested with some nodules on posterior region and liver was having many white necrotic focci. Heart and kidneys were found normal without having any gross lesions. On parasitological examination, three worms and large numbers of eggs belonging to genus *Capillaria* were found in the intestinal content of the python. Pieces of lung, liver, heart and kidneys were collected aseptically for microbiological investigations. The organisms were isolated on nutrient agar medium producing large, irregular, translucent, spreading and bluish green, water soluble, pigmented colonies. The isolates were identified as *Pseudomonas aeruginosa* by smear examination, colony characters and biochemical reactions (Cowan and Steel, 1970).

Marcus (1971) isolated *Pseudomonas, Aeromonas, Proteus, Klebsiella and Citrobacter* species more frequently from infections in reptiles. Mayer and Frank (1975) considered Pseudomonas as Pathogenic for reptiles after bacteriological study of organs from 148 reptiles from zoo or private owners. Soveri (1984) found *Pseudomonas aeruginosa* associated with stomatitis, bronchopneumonia and abscess in 10 pythons with gentamicin and neomycin as effective antibiotics.

The result of the in vitro antibiotic sensitivity test of the isolate in the present study indicated that the organisms were sensitive to gentamicin and streptomycin only while resistant to septran, furazolidone, Chloramphenicol, tetracycline, penicillin and nitrofurazone. Dholakia, *et. al* (1985) observed similar result of antibiotic sensitivity of 25 isolates of *Pseudomonas aeruginosa* obtained from animals and poultry.

The present study has revealed the resistance of *Pseudomonas* organisms to most of the commonly used antibiotics necessitating the selection of proper drug for treatment.

Acknowledgements

Authors are thankful to Dr. D. K. Pethkar, Professor and Head, Department of Veterinary Parasitology for Parasitological Examination and to Dr. K. N. Vyas, Dean, Veterinary College, Sardarkrushinagar for facilities provided.

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print : Zoos' Print, 5 (10) : 15, October, 1990

ISOLATION OF CERTAIN ENTEROBACTERIAL ORGANISMS FROM LESSER WHISTLING TEALS (TREE DUCKS)

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Lesser whistling teal or tree duck which comes under the family Anatidae is a migrant bird that breed in one part of this subcontinent and move to other parts within the country in a different season. They make nest on ground or in holes or hollows in tree trunks.

One adult teal and nine nestlings were caught from Paramukku near Trichur, Kerala and was kept under observation in the Laborotary. In a weeks time all the nestlings died of diarrhoea and emaciation. Bacterial isolations were tried from the dead birds. Heart blood was inoculated onto tryptic soy agar and the intestine into tryptic soy agar and selenite broth. All the inoculated plates and tubes were incubated at 37^0 C overnight. Subculture on to Mac Conkeyos agar was done at 24 hr. and 48 hrs intervals and isolated colonies were selected for further study. The isolates were studied in detail and typed as per the procedures given in 'Manual for the Identification of Medical Bacteria' (Cowan, 1974 . The isolates from the heart blood were *Escherichia coli* and *Klebsiella edwardsii* and that from the intestine were *E.coli*, *K.edwardsii* and *Enterobacter cloacae*.

All these organisms might be normal inhabitants of the intestine of these birds. Since these birds were kept in the laboratory the unnatural condition, the stress might have caused the normal flora to produce ailment and death. The adult bird was unaffected and was perfectly healthy during the period of three months.

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Reprint : Zoos' Print, 10 (7) : 43, July, 1995

GASTRO - ENTERITIS AND IT'S TREATMENT IN SALTWATER CROCODILES (*Crocodilus porosus*).

N. Paneer Selvam, R. Thiruthalinathan, D. Swaminathan and G. Prabhakar.

ABSTRACT

The Present communication places a record on successful treatment of gastro-enteritis due to *Eschenchia coli* in Salt-water crocodiles.

CASE HISTORY

Three salt water crocodiles were off-feed, lethargic and passing diarrhoea and the condition persisted. The crocodiles were placed in separate, clean, hygienic moats for further examination and treatment.

OBSERVATION AND TREATMENT

The affected crocodiles were dull, anorectic and passing whitish diarrhoea 3-4 times daily While they were handled for examination they passed a small quantity of whitish watery faeces which was collected in a test tube for parasitological examination. Faecal examination revealed no helminthic eggs. Initially they were treated with Neblon (Antidiarrhoel, Indian Herbs) 25 gms orally for 3 days. As there was no response to this treatment, the conditions were suspected of bacterial origin. As there is a great deal of misinformation appearing in the veterinary and herpetological literatures regarding the use of antibiotics in reptile diseases, cloacal swabs were taken from all the three corocodiles using sterile, cotton swabs after physical restraint and sent for bactenological typing and antibiotic sensitivity. Before getting the results of antibiogram, they were temporarily treated with combination of Sulfaguanidine and Sulfadimidine 10 gms orally without any success. Bactenological culture and sensitivity revealed *Escherichia coli* organisms which were sensitive to Neomycin and Furozolidone but resistant to Penicillin, Streptomycin, Gentamycin, Chloramphencol and Trimethoprim. Hence they were treated with Neomycin 0.5 gms, orally daily for 5 days. They responded to this treatment - diarrhoea stopped on 2nd day and started taking feed on 3rd day onwards. Vitamin B Complex supplementation (Becosules - 2 capsules/animal) was given orally throughout the oral antibiotic therapy to support the digestive process.

RESULTS AND DISCUSSION

There is paucity of literature regarding the causes of mortality in crocodiles. But most of them in captivity showed mortality due to parasitic and bacterial infections. Upto 75% of mortalities in reptiles may be ceused by bacterial infections (Ippen and Schroder 1977).

Among the bactena, *Eschenchia spp.*, *Aeromonas spp.* and *Pseudomonas spp.*, are common isolates in cloacitis (Cooper 1973). Though the above organisms are normal inhabitants of the intestinal flora, they are opportunistic and play their pathogenic role whenever the host is suffering from any stress. These organisms are also resistent to most of the commonly used antibiotics which necessitates culture and antibiogram for proper selection of the drug for treatment of bacterial diesases in reptiles. Since *E. coli* is common inhabitant of soil and water, infected soil in the enclosure was replaced, water tank was cleaned and disinfected, care was taken while feeding, to avoid contamination of feed with faecal matter, to prevent further transmission of the oganisms from soil and water.

ACKNOWLEDGEMENT

Authors are thankful to the Director Mr. R. Sundara Raju, I.F.S. Deputy Director Mr. M. Jagannadha Rao, I.F.S., for providing all the necessary facilities and Animal Keepers for their whole hearted co-operation in restraining the reptiles.

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Reprint : Zoos' Print, 10 (1) : 39, January, 1995

ESCHERICHIA COLI AS DISEASE CAUSING ORGANISM IN SALTWATER CROCODILES *(Crocodilus porosus)*

N. Paneer Selvam*, R. Thiruthalinathan*, D. Swaminathan* and G. Prabhakar*

Three Salt water crocodiles were found to be off-feed and lethargic. Persistant whitish diarrhoea was evident in all three animals. These crocodiles were kept in separate, clean, hygienic moats for further examination and treatment.

A small quantity of this whitish watery faeces was collected in a test tube for parasitological examination. Faecal examination revealed no helminthic eggs. Initially they were treated with Neblon (Antidiarrhoeal, Indian Herbs) 25 gms orally for 3 days. As there was no response, the condition was suspected to be of bacterial origin. Cloacal swabs were taken from all the three individuals using sterile, cotton swabs for bacteriological typing and antibiotic sensitivity. Before getting the results of antibiogram, they were temporarily treated with a combination of sulfaguanidine and sulfadimidine 10 gms orally without any success. Bacteriological culture and sensitivity revealed *Escherichia coli* organisms which were sensitive to neomycin and furozolidone but resistent to penicillin, streptomycin, gentamycin, chloramphenicol and trimethoprim. Consequently, medication with neomycin (0.5 gms, orally) was administered daily for 5 days. There was a positive response and diarrhoea stopped on the 2nd day following treatment. Vitamin B Complex (Becosules -2 capsules/animal) was given orally as supplement throughout the oral antibiotic therapy.

There is paucity of literature regarding the causes of mortality in crocodiles. Upto 75% of mortalities in reptiles may be caused by bacterial infections (Ippen and Schroder 1977). Among the bacteria, *Escherichia spp.*, *Aeromonas spp.*, and *Pseudomonas spp.*, are common isolates in cloacitis (Cooper, 1973). Though the above organisms are normal inhabitants of the intestines they perhaps turn opportunistic whenever the host is subjected to stress. These organisms are also resistant to most of the commonly used antibiotics which necessitates culturing and antibiogram tests. Since *E. coli* is a common inhabitant of soil and water, infected soil in the enclosure was replaced, water tank was cleaned and disinfected. Care was also taken to avoid contamination of food with faecal matter, to prevent further transmission of the organisms from soil and water.

Acknowledgement

Authors are thankful to the Director Mr. R. Sunderaraju, IFS, Dy. Director Mr. M. Jagannatha Rao, IFS for providing all the necessary facilities and to the animal keepers for their whole hearted cooperation in restraining the reptiles.

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Indian vet. J. 63: August, 1986 :

PREVALENCE OF *ESCHERICHIA COLI* SEROTYPES IN CAPTIVE WILD ANIMALS AND BIRDS

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Escherichia coli is a normal inhabitant of the intestinal tract of different species of animals and man, besides being incriminated as the etiological agent of several well-defined disease entities. In India, several workers (D' Souza *et al* 1961; Satyanarayana, 1962; Khera and Dhanda, 1963; Ahuja and Khera, 1971; Verma and Adlakha, 1971; Srinivasan *et al.*, 1979; Srivastava and Arya, 1979; Sarma *et al.* 1981; Parmeshwar Rao and Lakshmana Char, 1983) have reported the isolation of *E. coli* serogroups from different sources. From a perusal of available literature, it is found that the isolation of *E. coli* from stool specimens of healthy captive wild animals and birds is very scanty.

The present study was undertaken to provide information regarding the prevalence of *E. coli* serotypes as normal inhabitants in stool specimens of captive wild animals and birds. Isolation of zoonotic significance strains of *E. coli* from stool specimens of healthy zoo animals and birds is reported in this paper.

Materials and Methods

The rectal swabs and the samples of fresh droppings from the healthy captive animals and birds of Nehru Zoological Park, Hyderabad, were collected and processed on MacConkey's bile salt medium and Eosin methylene blue agar for the isolation of *E. coli* organisms. Isolation and identification of the *E. coli* organisms was done according to Edward and Ewing (1972).

The serotypes of all the *E. coli* strains was done at National Salmonella and Escherichia Centre, Kasauli.

Results and Discussion

Systemic bacterialogical examination of 800 stool specimens of zoo animals and birds resulted in the isolation of 308 strains of *E. coli*. Serotypes of *E. coli* recorded are furnished in Table 1. Category-wise enteropathogenic strains of *E. coli* isolated are depicted in Table-2.

As seen from these tables, the serogroup 01 ranked highest over all the serotypes, and isolated particularly in large number from the captive birds. This serotype was reported by Shah et al (1980) in stools of human patients suffering from gastrointestinal disorders. Savov (1965) ascribed that this particular serotype is highly virulent and invasive in nature and isolated 25 strains from a total of 130 cultures from fowls examined.

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E. coli serotypes in captive wild animals and birds

Out of 308 strains of *E. coli* isolated from all the captive wild animals and birds, 154 (50.00%) were found to be enteropathogenic strains. Serotypes 02, 018, and 045 (Parmas *et al.*, 1950), 020, 026 (Pesti, 1960). 0119 (Rees, 1959), 0111, 086 (Dunne and Bennet, (1970), 824 (Mohan and Srivastava. 1969). 055 044. 0127, 0128, (Om Prakash, 1962), 08 045, 010, 035, 064 0108, 0138 (Sojka, 1971) are the established enteropathogenic strains of *E. coli* isolated very frequently from infantile diarrhoea among neonats and children and also adult human patients suffering from gastroenteritis. All these strains have been recorded in large numbers in this study.

The analysis of various serogroups of *E. coli* recovered as normal inhabitants of intestinal tract revealed harbouring enteropathogenic strains, 18 (5.84%) in herbivores, 10 (3.25%) in carnivores, 44(14.29%) in non-human primates and 82 (26.62%) in avians.

Table 1—*Serotypes of E. coli Isolated from captive wild animals and birds*

S. No.	Species of animal with zoological name	Number of *E. coli* strains isolated	Serotypes recorded
	Herbeveres		
1	Sambar (*Cervus unicolor*)	5	020. 02, 01, U/T (2)
2	Bison (*Bos gaurus*)	3	01, R/S (1), U/T (1)
3	Spotted deer (*Axis axis*)	3	056, 055, 064
4	Thamin deer (*Cetvus eldi*)	2	01, U/T (1)
5	Fallow deer (*Dama dama*)	1	055
6	Musk deer (*Moschus moschiferus*)	1	045
7	Barking deer (*Muntiacus muntjak*)	1	038
8	Hog deer (*Axis porcinus*)	3	035, 0125. 0128
9	Neelgai (*Boseiaphus tragocamatus*)	3	018, 026. 0156
10	Girafee (*Giraffa camelopardalis*)	2	02, 0127
11	Wild ass *Equus hemionus*)	1	U/T (1)
12	Water buck (*Kodus defassa*)	1	02
13	Black buck (*Antilope cervicapra*	1	018
14	Gnu (*Connochaetes taurinus*)	1	024
15	Sloth bear (*Melursus ursinus*)	2	082, 0163
16	Himalayan black bear (*Selenascos thibetanus*)	2	0105. U/T (1)
		32	
	Carnivores		
1	Puma (*Felis cancolor*)	3	01, 02, U/T (1)
2	Cheeta (*Acinonyx jubatus*)	2	01, 07
3	Tiger (*Pauthera tigeres*)	10	03. 020. 023, 026, 088 0157, U.T (4)
4	Lion (*Panthera leo*)	7	056, 082, 0156. U/T (4)
5	Fox (*Vulpus fulva*)	7	020, 023. R.S (2). U/T (3)
6	Panther (*Panthera pardosa*)	4	025, 026, 055, 0133
7	Leopard cats (*Felis bengalensis*)	7	07. 026, 045, 049. R/S (3)
		40	

S. No	Species of animal with zoological name	Number of *E. coli* strains isolated	Serotypes recorded
	Non-human Primates		
1	Slender laris (*Loris tardigradus*)	3	0111, 0128, U/T (1)
2	Slow iaris (*Nycticebus coucang*)	3	018, 055, R/S (1)
3	Rhesus monkey (*Macaca mulata*)	2	024, 055
4	Lion tailed monkey (*M. silenus*)	4	024, 0127, U/T (2)
5	Stump tailed monkey (*M. speciosa*)	2	045, 056
6	Pig tailed monkey (*M. nemestrina*)	3	01, 03, 026
7	Vervet monkey (*cercopithecus pygerythrus*)	4	01, 049, 063, 0128
8	Mona monkey (*C. mona*)	4	02, 05, 055, 0105
9	Debrazza's monkey (*C. neglectus*)	2	018, 088
10	Mustache monkey (*C. cephus*)	3	020, 055, 086
11	Diana monkey (*C. diana*)	3	020, 0103, 0128
12	Mangabey monkey (*C. cebus*)	5	055(3) 086, 093
13	Spider,monkey (*Ateles species*)	5	0156, R/S(2), U/T (2)
14	Yellow baboon (*Papio cynocephalus*)	2	08, 018
15	Gelada baboon (*Theropithecus gelada*)	3	01, 02, 056
16	Secerest baboan (*Papio hamadryas*)	2	U/T (2)
17	Chakma baboon (*Papio ursinus*)	2	01, 0156
18	Golden languar (*Presbytis entellus*)	3	0127, U/T (2)
19	Common languar (*Presbytis species*)	4	0111, R/S (1), U/T (2)
20	Capped languar (*P. pileatus*)	2	08, 0128
21	Mandrill (*Mandrillus species*)	5	01, 02, 024, 086, 0111
22	Hoolock gibbon (*Hynlobates hoolock*)	4	01, 018, 0127, 0163
23	Black saki (*Chiroptes satanus*)	2	01, 08
		72	
	Avians		
1	Flaminga (*Phenocapteris ruber*)	4	07, 08, 023, 0156
2	Magpie (*Pica pica*)	4	025, 035, 061, 0111
3	Pheasants (*Pheseanus species*)	14	018, 024, 055, R/S (3) U/T (8)
4	Love birds (*Agabornif species*)	38	01(6), 03, 08, 015, 017, 020, 025, 026, 045, 049, 055, 082, 0100, 0105, 0108, 0111, 0127, 0128, 0163(2), R/S (5), U/T(8)
5	Turkey fowl (*Melcagris gallopava*)	7	01(4), 010, 018, 049,
6	American Rhea (*Rhea americanus*)	3	01, 02, 082
7	Pigeons (*Columba livia*)	22	018, 020, 024, 044, 051, 055(3), 085, 0111, 0112, 0128, 0138, 0145, 0149
8	Parrots (*Psittacifarmus species*)	28	01 6), 02, 007, 018, 035, 045, 055, 0105, 0111, 0163, R/S(4), U/E(8)
9	Indian Pea Fowl (*Pavo cristatus*)	4	01, 024, 086, 093
10	Owl (*Tyto alba*)	1	08
11	Pelicans (*Pelicanus species*)	4	01, 05, 026, 086
12	Geese (*Branta domesticus*)	3	07, 08, 093
13	Parakiies (*Psittocular species*)	5	050, 063, 090, 0108, 0138
14	Stork (*Ciconida* species)	9	01(3), U/T (6)
15	Fowls	18	01 (3), 02 (2), 023, 024, 044, 045, 082, 086, 093, 0119, 0138, 0156, R/S (3)
		164	

R/S = Rough Strains U/T = Untypables
Parentheses indicate number of strains.

E. coli serotypes in captive wild animals and birds

Serological studies have shown that there are in nature several serotypes of *E. coli* pathogenic to one or several species of animals, while many are non-pathogenic (non-toxic), the significance of which as carried by these animals and birds in captivity is little understood.

Table 2 – *Enteropathogenic strains of E.coli isolated from zoo animals and birds*

S.No.	Category	Number of entero-pathogenic strains of *E. coli* isolated	Serotypes recorded
1.	Herbivores	18	01 (2), 02 (3), 018 (2), 020, 024; 026, 035, 045, 055 (2), 064, 0125, 0127 0128
2.	Carnivores	10	01 (2), 020 (2), 026 (3), 045, 055, 02
3.	Non-human primates	44	01 (7), 02 (2), 08 (3), 018 (4), 020 (2), 024 (3), 055 (7), 026, 045, 086 (3), 0108, 0111 (3), 0127 (3), 0128 (4)
4.	Avians	82	01 (33), 02 (4), 08 (4) 010, 018, (4), 020 (2), 024 (4), 026 (2), 035 (2), 044 (2), 045 (3), 055 (6), 064, 086 (3), 0108 (2), 0111 (4), 0119, 0127, 0128 (2), 0138
		154	

(Parentheses ind-cate number of strains)

In zoo animals, the signs of illness or the infection may go unnoticed. When the infection occurs there exists a serious threat to the health of other animals, keepers and general public. Similarly, human infection also may pose a threat to captive wild animals and birds. In captivity, the wild birds exhibited enteropathogenic strains more in number than other wild animals and indicates the magnitude of severity of spreading the infection in free living stage.

This study throws light on the role played by the wild animals and birds as reservoir hosts for the *E. coli* strains and their potential danger in the dessemination of these entero-pathogenic organisms to other animals as well as human beings and *vice versa*. Further, this investigation enforces the contention that even where the best available procedures are maintained, constant dedication must be given to proper cleaning the premises and hygienic measures, food preparation and quality, rodent and insect control, early recognition of illness and the isolation of suspected eases.

Summary

Normal inhabitants of *E. coli* serotypes in stool specimens of healthy captive wild animals and birds belonging to Nehru Zoological park, Hyderabad are reported. Potential enteropathogenic zoonotic significant strains of *E. coli* isolated in these animals and birds are detailed.

Acknowledgements

The authors wish to acknowledge Dr. S. Vasantha Rao and Dr. Krishna Ashrit, Joint Directors, Veterinary Biological and Research Institute, Hyderabad, for their keen interest in this investigation.

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Vol. 4, No. (4), Dec. 1983.

Reprint

COLIBACILLOSIS IN CAPTIVE WILD BIRDS

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Escherichia coli (*E. coli*) is known to be incriminated with a number of definite disease conditions in different species of animals and poultry. Studies on the incidence of *E. coli* in captive wild birds is very scanty (Hungerford. 1969 and Satyanarayana Rao *et al.*, 1981). *E. coli* infection in captive wild birds belonging to Nehru Zoological Park, Hyderabad is reported in this communication.

Fresh carcasses of captive wild birds from the zoo park were brought to the Veterinary Biological and Research Institute, Hyderabad, for the isolation of the causative agents. These birds were identified as Blue magpie, Black neck swan, Serum crane, White laughing threshold, Roller bird, Silver pheasant, green pigeon, red breasted pankite, parrots and love birds. No symptoms in the birds were reported as they could not be properly noticed. On postmortem examination, the birds showed pneumonia, enteritis, necrotic patches on the surface of the liver and congestion of all the organs. Heart blood, lungs, liver, intestinal contents were collected aseptically and inoculated on blood agar, macConkey's bile salt medium and Eosin methylene blue agar for isolation of the organisms. After 24 hours incubation at 37°C, small pink colonies were seen on MacConkey's medium while colonies with clear metallic sheen were observed on EMB agar. The isolates showed beta-haemolysis on blood agar. The organisms were non-motile and capsulated and were identified as *E. coli* on biochemical and sugar fermentation tests (Breed, Murray and Smith, 1957).

All the isolates were found pathogenic to Swiss albino mice and *E. coli* was isolated from the visceral of these experimental animals in pure form.

Davis *et al.* (1973) ascribed that pathogenic strains of *E. coli* elaborates a potential thermolabile toxin *in vivo* causing toxic effects and shock which may be fatal to the host. It is probable that although *E. coli* is a normal inhabitant of the intestinal tract of the birds, the onset of colibacillosis under adverse conditions of husbandry may result from the inhalation of these organisms from an unusually heavily contaminated atmosphere.

Acknowledgements

The authors express their thanks to the Joint Directors, Dr. S. Vasantha Rao and Dr. Zaheer Ahmed, Veterinary Biological and Research Institute, Hyderabad for their keen interest in this study.

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Indian J. Comp. Microbiol. Immunol. Infect. Dis. Vol. 7 No. 4 Dec. 1986

Colisepticaemia in a Gnu (*Connochaetes taurinus*)

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A male Gnu belonging to order Artiodactyla and family Bovidae, aged about 15 years, stationed at Nehru Zoological Park, Hyderabad. died suddenly without showing any symptoms. The animal was reported to have been ruminating till the previous day of death. The carcass was brought to the Veterinary Biological and Research Institute, Hyderabad, for the isolalation of causative agent. The body of the carcass was in good condition and no external injuries were noticed. On postmortem examination, diffused congestion of all the internal organs was noticed, indicating general septicaemia. Heart, lungs, liver and kidney showed savere congestion. Patechial haemorrhages were noticed on the cut surface of the myocardium. Apical lobes of the lungs were also consolidated.

Histopathological examination of all the organs in general, indicated severe congestion. The lymph glands revealed diffuse fibrosis extending into the lymph follicles with depletion of lymphocytes and cellular infiltration and myomatus changes in the fibrous tissue was indicated. Heart blood, liver and intestinal contents were collected aseptically and streaked on blood agar, Mac Conke's bile salt medium, Eosin methylene blue agar and nutrient agar for the isolation of the causative organisms.

After 24 hours incubation at 37°C. small pink coloured mucoid colonies were seen on Mac Conkey's bile salt medium while colonies with blackish centre with metallic sheen were observed on EMB agar. The isolates produced Beta haemolysis on blood agar. The organisms were found to be motile and identified as *E. Coli* on biochemical and sugar fermentation tests (Edward and Ewing, 1972). The organisms proved pathogenic to Swiss albino mice on inoculation of 0.2 ml. of 6 hours broth culture by iutra-peritoneal route. All the mice died within 18 hours post inoculation. The isolates sent to Central Research Institute, Kasauli, for serotyping was reported as belonging to O 17 group. Thus the strain of E.Coli O 17 isolated in this study was found to be highly virulent, a septicaemic type in nature resulting in the death of the Gnu The authors express their gratitude to Dr. S. Vasantha Rao, Joint Director, Veteinary Biological and Research Institute, Hyderabad and thanks to the Veterinary Staff of Nehru Zoological Park, Hyderabad for their help extended.

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Reprint : Zoos' Print, 11 (3) : 21, March, 1996

A REPORT ON PASTEURELLOSIS IN HIPPOPOTOMUS (*Hippopotomus amphibius*).

R. Thiruthalinathan, N. Pannerselvam, D. Swaminathan and M.D. Yuvarajan.

Pasteurellosis is a common infectious disease of domestic ruminants and wild animals caused by gram negative bacteria *Pasteurella multocida*. In domestic ruminants, the customary clinical manifestations include septicemia, pneumonia and bronchitis. Though its occurrence is infrequent in wild animals, epizootics can occur from domestic to wild animals and among wild animals. The disease has been reported in cervids (Damodaran et al 1977), carnivores (Arora, 1988; De Sankar, 1989), elephants (De Alwis and Thambithurai, 1965) and many other groups of mammals.

On the 11th of November 1992, a 21 month old male hippopotamus was found dead in its enclosure. As with most diseases in wildlife, particularly those of a acute or peracute nature, the animal didn't show any symptom of illness prior to death. When the peripheral blood smear examination revealed no evidence of anthrax infection, a detailed postmortem examination was carried out. The lungs were bluish black in colour, liver was enlarged and the intestines had signs of congestion and haemorrhage throughout its course.

Microscopical examination of heart blood smears stained with Gram's and Leishman's stain revealed the presence of bipolar stained short gram negative rods indistinguishable from *Pasteurella* organisms. On culturing the heart blood swab, similar organisms were isolated. Biological test carried out on white mice using the culture also proved positive for pasteurellosis. This is probably the first report of Pasteurella infection in a hippopotamus in India.

Pasteurella multocida is an opportunistically or facultatively pathogenic bacterium with an extensive mammalian and avian host range (Quan *et al* 1986; Rosen, 1981)). Many of these hosts many act as carriers, shedding the organism through their nasal, oral or anal discharges, without showing obvious clinical signs. Pasteurellosis could be an example of an harmless infection that turns into a disease under conditions of stress due to malnutrition, crowding, shipping, pneumonia or other predisposing factors like viral infections.

ACKNOWLEDGEMENTS

Authors are thankful to Mr. R. Sundararaju, I.F.S. Director, Arignar Anna Zoological Park, Vandalur for the facilities provided. The Dean, Professor, Department of Pathology and Professor, Department of Microbiology, Madras Veterinary College, Madras are also thanked for providing the necessary facilities for conducting postmortem and confirmation of this disease.

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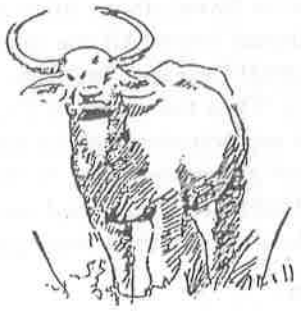

A CASE OF PASTEURELLOSIS IN MALE SLOTH BEAR AT JAIPUR ZOO

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Pasteurellosis is a common bacterial disease encountered in domestic and wild animals. This infection occurs in two forms: as localized pneumonic and generalized septicaemic forms. In both conditions high morbidity with varying degrees of mortality has been recorded. Predisposing factors like weather or environmental stress, humidity, transportation stress etc. play an important role in establishing the infection caused by *Pasteurella multocida* and *Pasteurella haemolytica*. These organisms are normal inhabitants of upper and lower respiratory tract of animals.

A male Sloth Bear, aged 17 years kept at Jaipur Zoo, was found dead in the wee hours and this sudden death was reported without any history of prior serious illness. The animal was dull the last two days, with lacrimation and nasal discharge being the only symptoms. The animal weighed about 170 kg and the general health condition was apparently very good. But for the pot belly, external examination failed to reveal any evidence of injury. Pinkish fluid was found oozing out from the mouth and nostril. A midline incision at ventral aspect of the carcass showed the presence of thick adipose tissue layer, but haemolyzed bloody fluid dribbled out following incision of musculature. About three litres of bloody fluid accumulated in the abdominal cavity was found to be the cause of the pot belly.

All abdominal musculature and subcutaneous tissues showed severe congestion and petechial haemorrhages. Liver was shrunk and nonfriable suggestive of cirrhosis and fibrosis. The extremities of the liver was pale and congested centrally. In between liver lobes, near the gall bladder, a muscular sac was found, about eight inches in length and four inches in width, filled with clear fluid possessing liver flukes. The liver lobes were found engauged with haemolyzed blood and this became evident when the lobes were incised.

Spleen was found to be pale at extremities, congested centrally and hard in consistancy. Kidneys showed congestion. Stomach was totally empty and pale except for a few patches of congestion. The pyloric end of the stomach had mature worms. The intestines were severely congested, empty and balooned due to accumulation of gases. Following incision, the intestines also revealed congestion and petechial haemorrhages and found to possess adult worms.

The thoracic cavity had about 1000 ml of haemolyzed bloody fluid. Lung lobes showed variable pathogenic lesions including areas of consolidation, haemorrhages, congestion and compensatory emphysma. The heart was covered with a thick layer of adipose tissue and abnormally thick pericardial layer. When incised no pericardial fluid could be found. Heart muscles showed signs of congestion and petechial haemorrhages. Heart cavities were totally empty with no clots or blood.

Trachea and bronchi were congested and had a lining of pinkish fluid. Oesophagus was empty and thoroughly searched for the presence of any choke. The regional lymph glands were found swollen and congested.

The genetalia and urinary tract, along with urinary bladder failed to present any significant pathological lesion except for slight congestion.

The microscopic examination of impression smears from lung, liver, spleen, kidneys, abdominal fluid, thoracic fluid, tracheal fluids, following Giemsa's staining showed the presence of bacterial rods with bipolar statining characters indistinguishable from pasteurellae. Infiltration of neutrophils, mononuclear cells and macrophages were suggestive of the host's response to bacterial invasion. The haemolyzed blood samples, lung tissues and liver fluids were subjected to cultural examination in nutrient agar and blood agar culture media. The bacterial growths so obtained following incubation of culture plates were purified and subjected to identification as per standard bacterial identification tests. *Pasteurella multocida* and *P. haemolytica* were identified and were supposed to be the cause of a paracute form of haemorrhagic septicaemia resulting in the sudden death of the Sloth Bear. Pasteurellosis has also been reported by George (1985) in deer, Nayak *et al.* (1988) and Sarkar *et al.* (1989) in Panda, Arora and Kumar (1988) in tiger, Chakraborty and Maity (1993) in wolves, and by Sen Gupta (1974) in monkeys.

Received 3 March 1999; Accepted 15 June 1999

Acknowledgement

The authors are grateful to the Director, Research (Veterinary and Animal Science), Rajasthan Agricultural University, Bikaner and Incharge Jaipur Zoo for providing the facilities to carry out the work.

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Reprint : Zoos' Print, 6 (5) : 15, May, 1991

A NOTE ON PASTEURELLOSIS IN NICOBAR PIGEON

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Pasteurellosis is an important disease affecting a large number of different animals and birds. In addition to chicken, the disease has been reported in domestic and wild ducks, geese, wild fowls and pheasants (Merchant and Packer, 1983), crows and owls (Taylor and Pence, 1981) and Rosy-billed Pochard in a Zoo in Japan (Fujihara et al. 1986). The present communication delineates an incidence of Pasteurellosis in Nicobar Pigeon from Sakkarbaug Zoo, Junagadh.

The case history indicated that the pigeon died shortly after showing the symptoms of dyspnoea and profuse mucous secretion. At necropsy, the gross lesions observed were small nodules like despositions in oral cavity, haemorrhagic spots on tracheal mucosa and necrotic focci on liver. The trachea was filled with mucus.

On laboratory examinations, blood smear and tracheal impression smear, stained with Leishman's stain, revealed distinctly bipolar organisms morphologically indistinguishable from *pasteurella multocida*. A pure culture of Gram negative coccoid organisms was obtained by inoculating tracheal content on blood agar medium which was further identified as Pasteurella multocida by biochemical reactions (Cowan and Steel, 1970)

The pure bacterial suspension (2.1 X 10 9/ml) was innoculated intraperitonially, 0.2 ml in mouse and 0.5 ml in rabbit but it did not produce death of experimental animals. However, blood smears from these animals, 48 hrs post innoculation, revealed bipolar organisms and *Pasteurella multocida* organisms were isolated from blood of experimental animals.

In vitro antibiotic sensitivity test revealed that the organisms were sensitive to chloramphenicol, gentamicin, furazolidone, streptomycin and tetracycline and resistant to Septran, ampicillin and penicillin.

This appears to be the first report of pasteurellosis in captive zoo bird in Gujarat.

Acknowledgement : Authors are thankful to Dr. K. N. Vyas, Dean, College of Veterinary Science and Animal Husbandry, Gujarat Agricultural University, Sardarkrushinagar for the facilities provided.

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Indian Journal of Veterinary Pathology 17(2) : 142-143 December, 1993

Short communication

NECROBACILLOSIS IN A SAMBAR (*CERVUS UNICOLAR*)

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Necrobacillosis has been reported in wild artiodactylids from abroad[1,4,5] but not yet from India. The present communication puts on record a case in sambar.

In a five year study on mortality pattern of captive wild herbivores of Assam State Zoo, Guwahati out of 195 artiodactylids, one case of necrobacillosis has been recorded. The affected animal was a three and half yrs old female sambar (*Cervus unicolor*). On post mortem examination, liver showed greyish well defined areas over its surfaces (Fig. 1), with hydropericardium and hydroperitonium. The cut surfaces revealed greyish dry granular areas surrounded by a zone of hyperemia (Fig. 2). Patchy consolidation in lungs, subscapular haemorrhage in kidneys and excessive mucus in intestine were also noted. Three small caseated foci were seen on the serosal surface of rumen. The rumen was distended with dry ingesta causing impaction.

Microscopically, the hepatic lesion showed foci of coagulative necrosis surrounded by a hyperemic zone with leucocytic infiltration.

On Brown and Brenn stain, a large number of gram negative filamentous organisms

Fig. 1. Liver : white necrotic areas

Fig. 2. Liver : cut surface showing irregular white necrotic areas.

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were noticed in the necrotic area, indistinguishable from *Fusobacterium*. On Scanning Electron Microscopic (SEM) study, the affected part revealed clumping of the hepatic cells, forming a homogeneous mass and filamentous organisms (Fig. 3). Based on these observations the condition was diagnosed to be a case of necrobacillosis.

In order to study the difference in the content of elements present in the necrotic part as well as in normal liver tissue of the same animal, Energy Despersive x-ray microanalysis (EDAX) was adopted. The result of the study has been presented in Table.

Table : Result of EDAX study.

Elements	Elements percentage	
	Non-necrosed part	Necrosed part
Silicon	6.7	5.1
Phosphorus	3.5	9.2
Sulphur	11.5	18.3
Calcium	3.5	4.6
Iron	3.4	-
Copper	41.1	34.0
Zinc	30.3	27.3
Potassium	-	1.4

Ulceration of foot and rumen are reported to be invariably associated with necrobacillosis[3], however, in the present case, foot lesions could not be seen, though serosal surface of rumen exhibited caseated mass supporting earlier findings[5]. Haematogenous route might have operated in this case causing toxaemia as commented by Blood *et al.*[2]

Fig. 3. Liver : clumping of hepatic cells and the filamentous organism (arrow) x 2000.

ACKNOWLEDGEMENTS

The first author is grateful to CSIR, New Delhi for the financial assistance. The authors are grateful to the Zoo Authority, Govt. of Assam for the materials and to Dr. S.C. Dey, RSIC, Shillong for his help in SEM and EDAX study.

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CLOSTRIDIAL INFECTION IN A BROWN BEAR (*Ursus arctos*)

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Bears belonging to *Urisidae* family are natural clowns. Various disease conditions of bears and other zoo animals are sometimes not manifested by obvious clinical signs until quite advanced. in which case therapy may be too late to be successful. Clostridial infections have been reported in the grizzly bear, black bear and Kodiak bear (Murray, 1978). Death of a crown bear due to clostridial infection is reported in this communication.

One female brown bear aged 19 years belonging to Nehru zoological park, Hyderabad, was found sick on 6-12-83 with depreesion, anorexia and sinusitis with bilateral nasal bleeding and severe dyspnoea. The animal was found dead on 7-12-83. The carcass was brought to the Veterinary Biological and Research Institute, Hyderabad. for detailed investigation.

On post-mortem examination it was found that the facial muscles were darkened with open wound at the mandibular region. The muscles were browny to dark, crepitant and covered with dark red layer of skin liquefied with necrosis. Blood stained serous exudate emerged when pressed. Heart showed petechial haemorrhages with epicardium and endocardium severely congested. Liver revealed necrotic patches with 7.5 cm diameter circular haemangioma. Lungs, spleen, and kidney were highly congested. Stomach mucosa revealed ulcers. Intestinal mucosa was congested with ulcers throughout its length.

On histopathological examination, the myofibrils of heart showed degenerative changes and extravasation of red blood corpuscles and polymorphs in the interstitial spaces. Kidney, liver, stomach and lungs showed congestion.

Impression smears prepared from the muscle piece and serous exudate of the face, stained by Gram's method of staining, revealed large numbers of Gram positive rods arranged singly and in pairs with distinct capsule surrounding the bacilii. A few spores seen were large and oval with slightly flattened ends located subterminally.

A piece of facial muscle piece was inoculated into Robertsen's cooked meat medium, which was heated previously in a water bath at 100°C to reduce free oxygen and then cooled to 37°C. Bubbles of gas from the base of the cooked meat medium was detected after an incubation of 18 hours. A loopful of this medium was shown on blood agar plate and incubated at 40°C anaerobically in McIntosh and Filde's jar for 48 hours Pure culture showing smooth, round, convex, opaque and 2 to 3 mm diameter colonies with narrow zone of complete haemolysis and wider zone of partial haemolysis were seen. Cultural smears indicated Gram positive rods indistinguishable from Clostridial organisms and were found to be non-motile on motility test.

The culture was inoculated into guinea pigs intra-muscularly with 0.5 per cent calcium chloride. The organisms were found to be highly invasive and virulent and the guinea pigs died within 18 hours of inoculation. with a large crepitant swelling at the site of inoculation. The oganisms were reisolated from the muscle piece and the exudate of the experimental animal. The culture sent to Indian Veterinary Research Institute, Izatnagar was confirmed as *Clostridium perfringens* type C which produces acute toxaemia.

The brown bear showed symptoms only a day before its death and no treatment was given as the disease entity was not diagnosed. As the Clostridial organisms are ubiquitous in nature, the brown bear might have picked up the infection due to a prick from a sharp object in the premises, as a wound was observed on the face of the animal

Acknowledgements The authors express their gratitude to Dr. S. Vasantha Rao and Dr. Krishna Ashrit, Joint Directors, Veterinary Biological and Research Institute, Hyderabad, for the facilities provided.

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Reprint : Zoos' Print, 12 (12) : 6, December, 1997

HEMATURIA IN A WOLF (*Canis lupus*) ASSOCIATED WITH *Neisseria canis* INFECTION

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Abstract

Hematuria in a wolf has been detected with the clinical manifestations of restlessness, anorexia, painful micturition and blood mixed urine. On cultural examination of urine sample, Gram negative, bean shaped, arranged in pairs and bacteria simulating *Neisseria sp.* was isolated. On the basis of cultural, staining and biochemical characteristics the isolate was tentatively designated as *Neisseria canis*.

Introduction

Wolves (*Canis lupus*) are widely distributed throughtout the world including Europe, North America and Asia. In India, wolves are seen in all parts except deserts and high mountains (Arora, 1994). The Indianwolf appear to be an adaptable species with its ability to survive in marginally distrubed areas by man. Wolves are also kept in captivity in zoos. The present paper describes a case of hematuna in a wolf kept in Nainital zoo.

Materials and Methods

A case of hematuria was roported in a wolf of about 10 years of age. In Nainital zoo, this lovely wolf was transferred from Lucknow zoo in mid 1996. The wolf was on boilded buffalo meat diet and was given 2.0 to 2.5 kg meat daily along with liver tonics. In the month of Feb. 1997, the wolf became sick with clinical signs of hematuria. The animal was given anesthesia for x-ray examination in order to see the presence of concretions in urinary tract. Urine was collected in sterile vials for cultural examination and antibacterial sensitivity tests (Chauhan, 1995).

Results and Discussion

Clinical examination of the affected wolf revealed fever, restlessness and pain. The wolf became weak, docile and frequently exhibited sigus dysuria. On radiological examination, there was no indication of the presence of calculi in urinary tract. However, the evidence of constipation were recorded in the radiograph. Physical and microscopic examination of urine revealed the presence of turbidity, red blood cells, leucocytes and some epithelial cells. On cultural examination, small, pin point watery colonies were observed with similar size and shape. Gram's staining revealed the presence of Gram negative cocci, bean shaped and arranged in pairs, which belongs to *Neisseria sp.* Further biochemical tests were employed. These included fermentation of sugars (glucose, maltose, sucrose, fructose, mannose, lactose) and oxidase test, the results of which were suggestive of Neisseria canis organism (Hold et al. 1994). This organism was found to be sensitive to ampicillin, ciprofloxacin, gentamicin and norfloxacin antibiotics.

The animal recovered in a week following treatment with cezolin/ampicillin, cystone, belamyl and neurobion. Carboz et al. (1993) reported local and systemic infections due to Neisseria sp. in canines and felines but there seems to be no report in the literature regarding association of Neisseria canis with hematuria in wolves. Plowan et al. (1987) isolated Neisseria sp from speticemic and chronic abscess in zoo animals. The isolation of Neisseria canis from a wolf with hematuria seems to be the first report of its kind.

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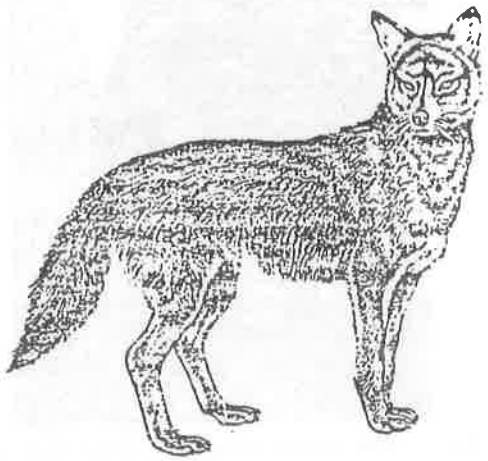

Indian Journal of Veterinary Pathology 17(2) :144-145 December, 1993

Short Communication

BOTRYOMYCOSIS IN A ZEBRA (*EQUUS ZEBRA*)

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Botryomycosis is known to occur in horses[2] but its occurrence does not seem to has been recorded in Zebra so far. Present communication puts on record a case of botryomycosis in a Zebra.

In a five year study on mortality pattern of wild herbivores (1985-89) at Assam State Zoo, Guwahati one adult male Zebra had a fistula in the left testicle. The enlargement of left testicle was noted 6-7 months back and subsequently drainage of pus through the fistula for the last two months prior to its death. On post mortem examination, the lesions recorded were enlargement of the left testicle with pus, while the right one remained unaffected (Fig. 1). All the underlying structures of scrotum adhered to each other. The enlarged suppurated testicle measured 16 x 29 cm in size and about 2.5 kg. in weight. Cut surface bulged out when incised. The mesenteric lymph nodes were enlarged. One such lymph node was so much enlarged that it miniked 'heart' (Fig. 2) and was filled with thick pus. The pus from the testis and the lymph node contained some greyish white granules.

Fig. 1 : Enlargement of mesenteric lymph node, one which is minicing heart (arrow).

In addition, the animal had considerable number of *Dictyocaulus arnfieldi* in the bronchi, with patchy consolidation of lungs and few necrotic foci in the liver. The urinary bladder was distended with thick turbid urine. Other parasites recorded were *Habronema* sp. in the intestine and *Gasterophilus intestinalis* in stomach with mild inflammatory changes.

The microscopic lesions comprised of pyogranulomatous dermatitis and orchitis. The predominating infiltrating cells were neutrophils and macrophages with lymphocytes and plasma cells. Affected testicle showed foci of degeneration and caseative necrosis at various places. Perivascular and peritubular (seminiferous) fibrosis was the

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most striking features. The mesenteric lymph node also showed similar changes. Gram positive bacterial colonies, indistinguishable from *Staphylococcus,* could be demonstrated on Brown and Brenn stain in the tunica vaginalis, testis and lymph nodes.

Cultural examination showed the presence to *Staphylococcus aureus* from the lesions of testis, lymph node and urine retained in urinary bladder.

Botryomycosis occurs in horses mainly as an infection of skin wound. Lymphogenous spread leading to the development of new foci may produce metastasis in lymph nodes[2] and in present case also it would have followed similar route. Further, in horses botryomycosis is stated to be common on the neck and pectoral region[1].

ACKNOWLEDGEMENTS

The first author is grateful to CSIR, New Delhi for the financial assistance. The authors are grateful to the Zoo Authority, Govt. of Assam for the materials.

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Reprint : Zoos' Print, 6 (11) : 7-8, November, 1991

A NOTE ON CLINICAL EXAMINATION OF ELEPHANTS IN MANAS TIGER PROJECT AND KAZIRANGA NATIONAL PARK IN ASSAM

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The diseases of elephants have been recorded by Steel (1885) and Evans (1910) and till then many works have done on elephants. Compared to the extent of work done in other states of our country, very little investigation seems to have been done in Assam. The present communication relates the report of investigation carried out in the domesticated elephants of Manas Tiger Project and Kaziranga National Park in Assam.

Materials and Methods

The dung and the urine samples were examined as per conventional methods. All the elephants were examined for physical condition and for other abnormalities if any. The feet and body lesions were washed thoroughly with 90% alcohol and materials were collected aseptically which include skin scraping, sterile swabs, impression smear and blood smear. Bacteriological and mycological studies were done as per Cruickshank (1965) and Ajello *et al.* (1963) respetively. The impression smear were stained with methylene blue and blood smear were by wrights stain. The skin scraping were digested in 10 per cent potassium hydroxide solution and examined for the presence of any parasite.

Results

The results of the dung examination at Manas Tiger Project and at Kaziranga National Park were presented in Table I and the result of urine analysis was presented in Table II. The Table III showed the results of bacteriological, mycological and scraping for parasites from the skin lesions.

Discussion

The parasitic infection of the elephants of Manas Tiger Project had nematode 58.6 per cent and trematode 93.1 per cent and the elephants examined in Kaziranga National Park it was 72.2 and 61.1 per cent respectively. The difference of parasitic infection might be due to the seasonal deworming done in Kaziranga National Park. Schistosoma egg could be recorded in only one elephant of Kaziranga National Park indicating the prevalence of Schistosoma infection.

The pH value of urine of majority of cases were alkaline and crystals like calcium carbonate and amorphous phosphate were readily seen. Acidic urine showed calcium carbonate crystals. Schmidt (1984) had also reported similar findings. In the study it was recorded that bile pigments and albumin invariably present in the elephants having fasciola infection.

Though, Schmidt (1984) stated that mycotic infection was rarely recorded in elephant, few fungus like *Aspergillus neiger, Tricophyton terrestre* and yeast were isolated from feet and body lesions. One fungus isolated from foot lesion could not be identified and sent for identification. Chatterjee (1984) have also recorded fungus from the foot lesions. The bacteriological findings of the present study supports the record of Chatterjee (1984). Bhattacharjee (1967) and Chatterjee (1984) recorded staphanofilaria associated with the lesions but no parasite could be recorded in the study.

Acknowledgement

The authors are grateful to the Council of Scientific and Industrial Research for the financial assistance in the form of Senior Research Fellowship to the senior author, and to the Chief Conservator of Forest and Conservator of Forest (Wildlife), Govt. of Assam, Ex-Director, Manas Tiger Project, Director, Kaziranga National Park and the Forest Officers for their help in this investigation.

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See charts on next page

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TABLE I.
RESULT OF DUNG ANALYSIS

Place	Number of animals examined	Parasites recorded	Parasitic Infection	
			Nematode	Trematode
Manas Tiger Project	29	29	Strongyle(19)	Paramphistomum(27)* Fasciola (14)
Kaziranga National Park	18	16	Strongyle(13)	Paramphistomum(6) Fasciola(6) Schistosoma(1)

TABLE II.
RESULT OF URINE ANALYSIS

Number of animals examined	pH value	Albumin	Sugar	Bile salt	Bile pigment	Microscopic Examination
23	Alkaline(16)	Trace(3)	nil	'+'in(1)	Trace in(6) + in (9).	Calcium carbonate (5)
	Acidic(7)					Calcium oxalate-(4) Amorphous phosphate-(4). Cystin-(2). Hiphuric acid-(1). Pus cells-(2). Epithelial cast-(3)

* Parenthesis indicates number of animals

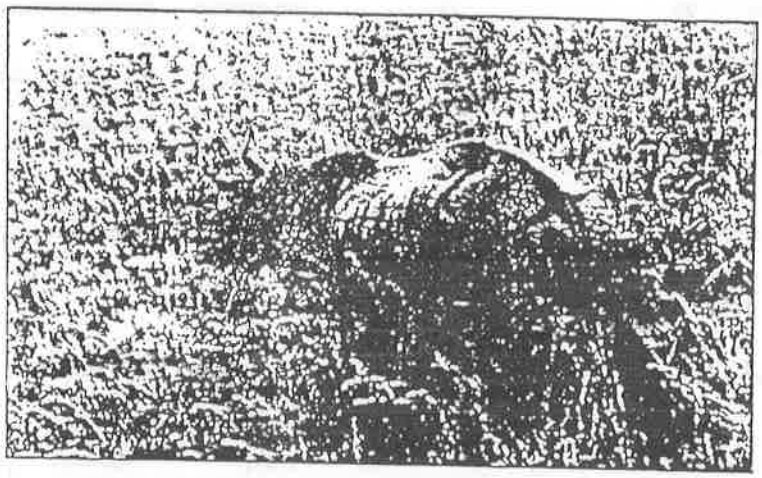
TABLE III.
RESULT OF BACTERIOLOGICAL, MYCOLOGICAL AND SKIN SCRAPING EXAMINATION

Elephant	Bacteria	Fungus	Parasite
Foot lesion			
1. Dayangkanya	Streptococci pyogenes	Unidentified fungus	No parasite
2. Jograj	Staphylococci aureus	Yeast	-do-
Body lesion			
1. Siva Prasad	No growth	Trycophyton terrestre	-do-
2. Jaymala	Bacillus species	Aspergillus niger	-do-
3. Parbati	No growth	Yeast	-do-
4. Sadhani	Staphylococci aureus.	No growth	-do-

Reprint : Zoos' Print, 9 (9) : 3-4, September, 1994

VACCINATING WILD RHINOS *(RHINOCEROS UNICORNIS)* AGAINST ANTHRAX AT JALDAPARA WILD LIFE SANCTUARY

P. K. Pandit, W. B. F. S. *



An Adult rhino at Jaldapara Wildlife Sanctuary

INTRODUCTION

Jaldapara Wild Life Sanctuary is well known for the presence of the Great Indian One-Horned Rhinoceros *(Rhinoceros unicornis)*. The sanctuary is located in the flood plains of the river Torsa and other smaller rivers, which have created large tracts of grasslands sustaining a small population of one horned rhinos. This population is the largest any where outside Assam and Nepal. The Rhino population in Jaldapara sanctuary is a remmant of the erstwhile population inhabiting Indo-gangetic plains.

Jaldapara sanctuary is situated within the district of Jalpaiguri of West Bengal which is situated between the latitude of 25°58' to 57°45' in the North and the longitude of 89°08' to 89°55' in the east. Total area of the sanctuary is 216.51 Sq.Km. which has been divided into 46 Compartments for administrative purpose.

DETECTION OF ANTHRAX

Wild elephant herds frequently visit Jaldapara for food and cover. During the last part of January-February (1994), three wild tuskers died of Anthrax. The river Torsa, passing through Jaldapara sanctuary, was flooded during the end of July, 1993. All the carcases were detected in the Torsa 2 & 3 Compartments of Bengdaki Beat of Jaldapara West Range. The first carcase was detected on 29.1.1994 at Torsa-II Compartment, the second was found on 3.2.1994 at Torsa-III Compartment and the third on 4.2.1994 at Torsa-II Compartment. Blood sample slides taken to District Veterinary Laboratory, Jalpaiguri were confirmed for Anthrax*. The presence of broken branches, boli of dung and disturbed ground indicated that the elephants had undergone considerable pain before death. These areas were cleaned and burnt.

All the dead tuskers were burried just after postmortem on the same spot, where they were detected. Six 12 X 12 X 12 feet pits were dug for burying. All the carcases were cut into pieces and buried after adding lime, salt and bleaching powder. Later these areas were again burnt to destroy any remaining Anthrax spores. The area was with barbed wire fenced properly to check the entry of other animals.

VACCINATION OPERATION

Vaccination of all the captive elephants (20 adults and 9 Calves) of Jaldapara Sanctuary was started on the 5th of February. Doses were 3 ml for adults and 1 ml for calves. One female with advanced pregnancy (Damayanti) and other two small calves were not vaccinated.

The rhino vaccination programme started on the 10th of February, 94 under the guidance of Chief Wild Life Warden, West Bengal.

It was decided to cover all animals, compartment wise. Calves below 2 years age and females in advanced stage of

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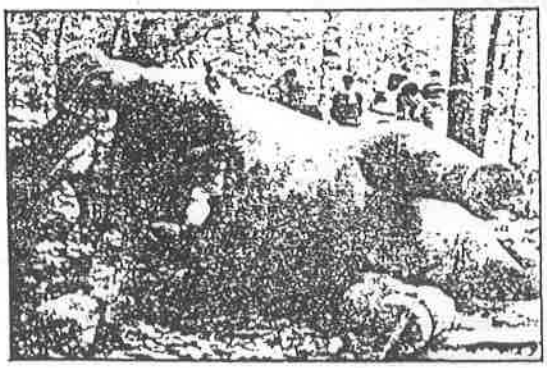

Carcase of an elephant which died of anthrax.

pregnancy were avoided. Three or four elephants were used per drive. Each elephant carried two persons (one for darting and the other for locating rhinos). The supervisor ensured that no rhino was darted twice. For this purpose each rhino, after being sighted, was closely observed to establish identity by sex, age (approx), distinguishing characteristics of cut marks, injury, shape and size of horn, age of accompanying calf, etc. A register was maintained to describe each rhino that had been darted, mentioning location, time and date of darting, distinguishing characteristics etc.

Vaccination dose was 1.5 ml per rhino. A suitable Rhino was located for darting in areas where vegetation is not too dense. Darts were prepared with Anthrax spore vaccine and kept ready before locating the animal. An extra dart was always loaded with the drug and kept ready in case the shot missed the target. All darts were fired fairly high in the hind quarters from a distance of 30-35 m ensuring that the target area is perpendicular to the line of flight of the dart.

It is the first incidence of Anthrax at Jaldapara Sanctuary and Rhino vaccination is also the first time in wild at Jaldapara.

Out of the total 35 rhinos present in Jaldapara, 24 were vaccinated. Remaining 8 were calves, 1 was in advanced stage of pregnancy, two were located but could not be vaccinated. (Table -1).

Out of total 24 animals vaccinated, 11 were males, 12 were females and one was unidentified. Eight of the nine calves identified during the operation were not vaccinated. One female in an advanced stage of pregnancy was not vaccinated.

All the captive elephants except pregnant females, mothers and suckling calf were vaccinated with anthrax spore vaccine. Cattle of nearby fringe villages were also vaccinated with anthrax spore vaccine.

Table - 1

Age and sex classes of Rhinos vaccinated at Jaldapara Wild Life Sanctuary with Anthrax spore vaccine

Age Class (Year)	Total Number	No. of Males.	No. of Females.	Sex Identified
0-5	9	1	-	8 *
5-10	1	1	-	-
10-15	3	1	1	1
15-20	2	-	2	-
20-25	4	1	3	-
25-30	5	3	2	-
30-35	3	-	3	-
35-40	3	3	-	-
40-45	2	2	-	-
45-50	-	-	-	-
TOTAL	32	12	11	9

* not vaccinated as they are young.

Reprint from THE INDIAN VETERINARY JOURNAL
Vol. 45, No. 1, January 1968 : 75-76

AN OUTBREAK OF POX IN CHIMPANZEES

By

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and

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It is not uncommon to find lesions of pox in all the domesticated animals. The incidence of pox in wild life has not been reported extensively.

Case Report

A chimpanzee belonging to the Gemeni Circus, camping in Hyderabad was brought to the hospital on 14-8-1967 with high temperature of 103°F and complete inappetance. There were small patches of erythema on the face, inside the ears, palms and sole of

the foot. The animal was given symptomatic treatment. After 3 days when the animal was again examined in the circus premises, it showed typical vesicular lesions on the face, ears, hands and f . The lesions were extensive on the face. (Fig). The vesicles presented the typical appearance of smallpox vesicles. They were loculated and depressed in the centre giving an umbilicated appearance. The animal showed symptoms of bronchitis. Pox lesions underwent the usual course of pustulation on the seventh and eighth day. Desiccation started commencing from the 9th to 10th day. Scab formation was complete in 15 to 16 days. Complete healing took place after 22 days. During this period another chimpanzee also contacted infection and showed typical lesions. The lesions underwent a similar course.

Treatment

The chimps were given the following treatment up to 11th day :—

1. Chloromycetin palmitate syrup 100 mg. BD.
2. Vitamin C 500 mg. (Roche) one tablet BD.
3. Syrup Vitamin B complex 4cc. - twice daily (Lederplex).
4. Phosphomin (Squibbs) 4cc. – twice daily.

Chloromycetin was discontinued beginning from 12th day when the animal began showing normal temperature and appetite. The rest of the treatment was administered till recovery. During scab formation the animal was dusted with borated talcum powder.

Discussion

The incidence of pox in chimpanzee is rare. It is not known whether it is due to small pox virus or any other pox virus of animal origin. Thorough investigations were made by questioning the owners, trainers and attenders of the animals for an attack of small-pox or recent vaccination agaist small-pox. Outbreak of small-pox in the vicinity and also in the previous camp of the circus *i.e.* at Warangal was also eliminated. The present case under discussion appears to be of a sporadic origin and the source of infection is unknown. Material has been sent for typing. The result is awaited.

Summary

A case report of chimpanzee pox has been described. The lesions had the regular course of pox lesions.

Acknowledgment

The authors are highly thankful to Dr. V. N. Pargaonker, Principal, Veterinary College, Hyderabad for his constant guidance and keen interest in the treatment of the case.

An outbreak of pox in chimpanzees

By

R. S. RAGHAVAN and GOHAR ALI KHAN

Showing typical pox lesions in the chimpanzees.

[*To face page 75*]

Livestock Adviser Vol. XIII Issue IV 1988 : 37-40

OCCURANCE OF FOOT AND MOUTH DISEASE IN CAPTIVE GAURS (BOS GAURUS)

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INTRODUCTION

The Foot & Mouth disease is a contagious viral disease of cloven footed domestic and wild animals. It is the most frequently occuring disease among hoofed animals in Zoological Garden (Jarofke - D-1976).

Among the wild bovidae the following are the host of Foot and Mouth Disease (ANON '63).

1. European Bison (Bison bonasus)
2. American Buffaloe (Bos americanus)
3. Indo China Buffaloe (Bos bubalis)
4. African Buffaloe (Bos cafferananus)
5. Gayal (Bos frontalis)
6. Gaur (Bos gaurus)
7. Yak (Pophagus grunniers)

(Urbain et al., 1938) and (Prasad et al 1978)

In the past, Foot & Mouth disease has been reported in wild bovine from the following Zoological Parks (A.L. Fletch-1970)

1. BERNE ZOO IN SWITZERLAND

A severe out break was described in eleven bisons (Hediger - 1940) (Bison bonasus)

2. BUENOS AIRES ZOO IN ARGENTINA

Foot & Mouth was recorded in cattle and American Bison. No laboratory confirmation was done (Grosso-1957)

3. PARIS ZOO

32 out of 250 susceptible animals contacted the Foot & Mouth disease. This includes one gaur, one buffaloe one bison.

4. Urbain et al (1938) and Prasad et al, (1978) received reports of Foot & Mouth disease in wild animals including yak.

5. Nandan Kanan Biological Park, Orissa has recorded an out break of Foot and Mouth disease in December 1978. In this out break Sameer deer, Spotted deer and Black Buck were affected but one gaur remain un-affected.

6. Young et al, reported the infection of 8 out of 9 young buffaloes held coptive in the Khuger National Park.

7. It is reported from Poland that Wisnets (Bison bonasus) and Bison bison are more susceptible to Foot & Mouth disease than all other Artiodactyles kept there During an epizootic in 1953/54 in Poland two Wisnet sancturies lost all animals while

* Veterinary Officer

in the third, the mortality was 64% (Jarofke D 1982)

Foot and Mouth disease is fairly wide spread in India, but reports of natural out break in wild especially in gaur (Bos gaurus) is rare. M. Krishnan has reported an out break of Foot & Mouth disease in Madumalai sanctuary in 1966 " I saw the corpses of gaur that had apparently died of -some epedimic in the Madumalai area of the Madumalai sanctuary. Foot and Mouth disease has spread from cattle to Samber and Gaur in that year in the sanctuary and I saw an old Buffaloe badly tricken by infection".

This communication reports an outbreak of Foot and Mouth disease among the gaurs and American Bison (Bison (Rison bison) of the Nehru Zoological Park, Hyderabad. It was first detected on 17-3-1972 in an adult female over 2/12 years old. The other two female gaurs of the same age group got the infection on 18-3-72. The disease was localised to these three animals for a few days But from 13-4-72 onwards the rest of the guars i.e 3 males and 1 female also got affected. One male and one female Bison (Bison bison) kept in between the gaur enclosures developed a mild attack. The following ungulates housed adjacent to the gaurs did not show any signs of Foot and Mouth disease.

1. Guanaco llama guanaco) 1, ,1,2
2. Beisa Oryx (oryx) 1
3. Eland (Taurotrogus oryx) 1,2,3
4. Gnu (Connochaetes taurinus) 1,1,2
5. Water Buck (Kobus lechee) 2,0,2
6. Samber Deer (Ceruvs unicolor) (23)

The other unaffected species of the wild ungulates maintained in the park away from thesick animals were as follows:

1. Giraffe (Giraffa camelopardalis) 1,1,2
2. Chinkara (gazella gazella) 3,0,3
3. Thompson Gazella 1,2,3
4. Fallow Deer (Dama dama) 2 0,2
5. Mouflon (Ovis musimom) 1,3,4
6. Black Buck (Antilope cervicepra) 11 Nos.
7. Four horned antelope (Tetracerus quadricornis)
8. Hog Deer (Axis parcinus) 16 Nos.
9. Spotted deer (Axis axis) 44 Nos
10. Nilgai (Boselaphus trago camelus) 25 Nos.
11. Rhinoceros (Rhinocerus unicornis) 2,1,3
12. Hippopotamus (Hippopotamus aimphibius) 1,0,1
13. Elephants (Elephas maximus) 1,45-
14. Camel (Camelus dromedarius) 1,1,2
15. Mouse deer (Tragulus meminna) 6 Nos.

SOURCE OF INFECTION :

The source of infection was an out break of Foot and Mouth disease among the dairy cattle of Hyderabad. And the disease possibly transmitted to the wild ungulates through the zoo keepers who invariably are the residents of the city.

TYPE OF INFECTION :

The material from the lesions on the tongue, other mouth parts and feet was collected by the Deputy Director (AH) of All India Coordinated Project for Epidemiological studies on Foot and Mouth disease, Vety. Biological and Research Institute, Hyderabad, A.P., and the findings communicated were those of isolation Type 'C' virus from the lesions.

SYMPTOMS AND LESIONS :

Early signs seen in gaurs were anorexia dullness moderate salivation from the mouth, lameness due to tenderness of the hooves and high fever (107° F). After a period of 2 3 days when ulcers appeared in the mouth and feet, pronounced and thick salivation was seen hanging from the mouth and nostrils. The lesions observed were as those seen usually in the domestic cattle. Ulcers were seen on the oral mucous membrane of tongue, lips and hard palate, and in between the interdigital space. No lesions were seen on udder and teats.

TREATMENT :

The affected cases were treated as follows

Daily injection of Terramycine (Pfizer) 20 Ml 1/m / Achromycine (cyanamide) 1 gm 1/m for three days.

Terramycine A.F soluble powder 8-12 spoonfull or Hostacycline (Hoechst) 6-8 spoon full in drinking water.

Aureomycine (cyanamide) Tablets 2 nos in jaggery morning and after-noon.

Washing of mouth lesions with light pottasium permanganese solution and application of Boroglycerine / Aureomycine ointment.

Spray of 4% solution of Sodium carbonate to the feet lesions. Later on Lazin was applied to the healing lesions.

All the cases except one male gaur responded well to the above treatment within a period of 4-6 days. The feet lesions took a longer time for complete healing. One male adult gaur became sick on 13-4-72 and died on 15-4-72.

Clinical signs observed in Bison (Bison bison) were moderate. Both the animals were seen limping and frothy salivation was seen dribbling from mouth and nostrils. They remained dull and off feed for 2 days. The animals could no be secured for close observation and treatment. Hence medication was given through oral route, in food and drinking water. Sodium carbonate solution was sprayed on the feet from a pump spray.

PREVENTIVE MEASURES

A) Isolation of Sick Animals: This could not be done due to management difficulties. Hence all the affected animals were kept and treated in their respective animal houses.

B. Isolation of Attendents: Separate attendants were posted for sick animals. A strict watch was kept on the movements of the attendants, especially those looking after the sick animals and they were not allowed to move freely in the zoo campus.

C. Foot Baths: Foot baths 3'x1'x1 1/2' were made into all the enclosures of the ungulates and was filled with solution of sodium carbonate. The animals were driven into these Foot Baths in the morning and in the after-noon, so as to dip their feet into the antiseptic solution.

D. Antibiotics were administered in feed and drinking water to the unaffected animals in houses close to the gaurs and Bisons.

E. Preventive vaccination was given to an eight months old gaur calf, using Foot & Mouth Vaccine manufactured by Indian Veterinary Research Institue, Izathnagar, U P. India.

MORBIDITY & MORTALITY

Out of 8 gaurs of different age groups seven got infected, six recovered and one died.

Morbidity - 87.4%
Mortality - 14 2%

In case of Bisons, the morbidity was cent percent and mortality nil. The date of first and last attack was 17.3.1972 and 13.4. 1972.

SUMMARY

An cut break of Foot and Mouth disease in gaurs (Bos gaurus) and American Bison (Bison bison) is described. 8 gaurs and Bisons got affected. One male gaur succumbed to the infection and the rest recovered.

Broader spectrum antibiotics were used for treatment. One gaur calf was successfully vaccinated against the disease from spreading to other ungulates of the Zoological Park.

ACKNOWLEDGEMENT

The authors acknowledge their sincere thanks to

Dr. Raja Ram Mohan Roy, Deputy Director of All India Co-ordinated Project for Epidimiology Studies on Foot and Mouth disease.

Dr. Somasundram Rao Vety. Biological and Research Institute, Hyderabad, A.P. Sri Pushpa Kumar, IFS the then Curator of Nehru Zoological Park.

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Reprint : Zoos' Print, 12 (1) : 10, January, 1997

RABIES IN A CAPTIVE INDIAN WILD ASS (*Equus hemionus khur*)

B.M. Arora[1], M. Bhardwaj[2], N.S. Parihar[3] and A.A. Kumar[4]

ABSTRACT

A 3-year old female wild ass *(Equus hemionus khur)*, after eight days of clinical course died in the National Zoological Park, New Delhi. Positive immunofluorescent test, biological test and histopathological demonstration of perivascular mononuclear cell reaction (perivascular cuffing) and intracytoplasmic eosinophilic inclusions resembling Negri bodies in the neurons proved it to be a case of rabies.

Engorgement of blood vessels in various organs and acute haemorrhagic intestinal lesions were seen. The lesions in the intestines could have been caused by *Clostridium perfringens* type "D" which was isolated from intestinal contents. The diagnosis of rabies in wild ass appears to be the first case report.

Key words: Wild ass, *Equus hemionus khur*, rabies, FAT, Negri bodies, *Clostridium perfringens* type D.

INTRODUCTION

There appears to be no report of rabies in Asiatic wild ass *(Equus hemionus khur)*, listed highly endangered in the Red Data Book of IUCN (1990). The present report is to place on record a case of rabies in a 3 year old female wild ass at National Zoological Park, New Delhi, Ministry of Environment and Forests, Government of India.

On the 24th of February, 1995, the animal was found to be restless. Continuous salivation led to the suspicion of possible stomatitis. The next day frothy discharge and staggering gait were conspicuously observed. A long-acting antibiotic was administered. In the subsequent days clinical manifestations included occasional biting, circling, falling and rising and rubbing against the enclosure structures.

The zoo authorities sought advice from the local veterinary doctors on 27th February 1995. The animal had 103° F rectal temperature. Surra was suspected but blood smears did not indicate any haemoprotozoan infection.

The animal was treated with a single dose of Berenil 2.5 grams (i.m.) and daily glucose saline 2 liters (i.v.), vitamins and long acting antibiotics. Despite all possible health care measures taken, there was no sign of improvement.

The animal became laterally recumbent on the 28th and subsequently on second March became comatose with subnormal body temperature ranging from 95° to 96° F. The animal died at 9 P.M. on the 3rd after 8 days of clinical sickness.

Necropsy revealed cherry red haemorrhagic lesions in the small intestines and stomach. Severe congestion was noticed in the lungs, liver, spleen and brain. Ventricles contained unclotted blood. Yellowish turbid fluid and a small quantity of food contents were present in the intestines and stomach. Tissues of visceral organs for histopathological, intestinal contents for bacterial culture and brain specimens for diagnosis of rabies were collected for specific laboratory tests.

Laboratory Diagnosis

(a) Fluorescent antibody test (FAT): The brain specimen submitted to the reference laboratory of National Institute of Communicable Diseases, New Delhi was subjected to immunofluoresent test and was found positive for rabies.

(b) Histopathology: Small intestines and stomach specimens showed engorgement of blood vessels both in the mucosa and submucosa. A few intestinal glands revealed presence of bacilli in their lumen. Red pulp in spleen was engorged with blood. Pulmonary blood vessels were engorged and alveolar walls severely congested with extravasation of RBCs in alveolar spaces. Autolysed debris was seen in a few bronchioles containing fungal and bacterial elements.

Brain revealed distinct perivascular mononuclear cell reaction. Satellitosis was not prominent though a few neurons revealed distinct intracytoplasmic eosinophilic inclusions indistinguishable from Negri bodies.

(c) Bacteriology: Intestinal contents evidenced *Clostridium perfringens* type D infection based on cultural characters, biochemical tests and toxin-antitoxin neutralization.

(d) Biological test: Mice inoculated intracerebrally with brain suspension started dying from the eighth day post-inoculation showing typical paralytic symptoms. Brain impression smears stained with Seller's stain revealed presence of Negri bodies and presence of rabies antigen by FAT.

DISCUSSION

Based on the immunofluorescent test, biological test and histopathological findings of typical Negri bodies in neurons in the brain, the death of wild ass was attributed to be due to rabies. *Clostridium perfringens* type D isolated from the intestional contents could have caused the local lesions. Paralysis of lower jaw, profusion of tongue and hydrophobia were absent. The clinical course of the sickness lasted for 8 days. In domestic equines rabies has clinical course of 5 to 8 days. The present observation alluded a little longer clinical course of the disease in wild ass.

Rabies does not seem to have ever been recorded earlier in the wild equidae. All the staff (including first author of this paper) who attended the case got post exposure immunization after the confirmation of rabies in wild ass.

ACKNOWLEDGEMENTS

Authors are thankful to Director, NICD, Delhi for the necessary help.

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Reprint : Zoos' Print, 9 (9) : 18, September, 1994

MALIGNANT CATARRHAL FEVER LIKE DISEASE IN A CAPTIVE FEMALE HANGUL *(CERVUS ELAPHUS HANGUL)* – A CASE REPORT

Dr. Mir M. Mansoor *

INTRODUCTION

Malignant Catarrhal Fever (MCF) or Gangrenous Coryza is an acute, generalised, fatal, infectious disease of viral origin in farmed deer, cattle and buffaloes. The disease is most common in Africa, where the virus responsible for the disease is alcelaphine herpesvirus-1 and is carried by wildbeast (Buxton *et al* 1979). The other form of virus responsible for this disease in farmed deer is called "sheep-associated" agent. This form occurs worldwide but cause no disease in sheep (Buxton *et al* 1984). The morbidity rate varies. In most instances the disease occurs as an isolated case in individual herds but a high morbidity (upto 50% in a herd) occurs occassionally (Stenius 1952).

The current report delineates an incidence of possible Malignant Catarrhal Fever (MCF) in a captive female hangul from Salim Ali National Park, Srinagar, Kashmir. This disease is being reported for the first time among captive hangul from J&K State.

HISTORY OF THE ANIMAL

Among other animals, this female hangul was also acquired as parent stock from Dachigam National Park in August 1986, for initiating a Captive Breeding Programme for Hangul in the newly established City Forest National Park (now renamed as Salim Ali National Park). The animal was about 3 years old at the time of acquisition and was given a code No. HF2. Since then the animal actively contributed to the Captive Breeding Programme by giving birth to five young ones. Only the last year did the animal fail to conceive because of some unknown reasons.

CASE HISTORY

On 21st October 1992, at 9.30 AM, during the routine examination of Captive animals, a female hangul was found isolated from the group, lethergic and anorectic. The animal was immediately put in a separate closure. On medical examination, it was found to be febrile (106°F) with increased pulse rate (110/minute), slightly dysentnc and there was also watery nasal discharge. Erosions were very much visible on oral mucosa and mouth was frothy. The animal was immediately put on oral sulfonamide therapy with a 20 gms of Bactrisol powder and parenteral antibiotic therapy with 15 ml terramycin injectable solution.

On 22nd October 1992, the animal was found markedly emaciated and had developed corneal opacity. The surface lymph-nodes were enlarged. The watery nasal discharge observed on the previous day had now changed completely to serosanguinous fluid and was discharged ocularly as well. All other symptoms remained the same as noted on the 1st day of observation. These symptoms were suggestive of a possible Malignant Catarrhal Fever attack. Treatment with sulfonmides and antibiotics was continued to control secondary bacterial infections. In addition oral fluid therapy was also adopted.

On 23rd October 1992, the animal was found not responding at all to the treatment given and that its condition had worsened instead. Corneal opacity had increased and muscle wasting was predominant. Body temperature showed an increase from 106°to 107°F.

The condition of the animal remained as such until early hours of 26th October 1992 except for the nervous signs like excitibility, hyperaesthesia and muscle tremors that had developed later. The animal died at about 10.15 AM.

POSTMORTERM FINDINGS

Lesions in the form of discrete erosions were found through out the internal surface of the gastro-intestinal tract and lumen of the upper respiratory tract. The liver and lymph-nodes were swollen. Petechial haemorrhages were observed in the brain.

LABORATORY FINDINGS

Materials could not be sent for histological examination due to unavoidable circumstances. Nevertheless the clinical symptoms and gross lesions observed during necropsy suggested that animal was suffenng from a possible Malignant Catarrhal Fever.

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Reprint : Zoos' Print, 6 (11) : 23-24, November, 1991

ISOLATION OF NEWCASTLE DISEASE VIRUS from LESSER WHISTLING TEALS (*Dendrocygna javanica*)

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Introduction :

Lesser whistling teals or tree ducks popularly known as 'Yerrundi' in Kerala are migrant birds that breed in one part of the subcontinent in one season and move to other parts within the country in a different season. They are usually seen in Kerala during the sowing season of paddy particularly in the Kole lands of Trissur and Puncha fields of Kuttanad. They come in large numbers, remain here for a couple of days and cause heavy loss to the farmers by pecking seeds from the paddy fields. Rare they remain here for breeding. Being a migrant bird and belonging to the family Anatidae; members of which are generally considered resistant to Newcastle disease (ND), but capable of acting as a carrier for this virus (Pearson and McCann, 1975; Lancaster, 1977), it was felt worthwhile to screen them for the presence of both orthomyxo and paramyxo viruses. The results obtained are presented in this paper.

Materials and Methods:

One adult female bird caught from the adjacent areas of Kole land of Trissur was brought to the laboratory for collection of throat and cloacal swabs and for close observation for any clincial manifestations. Throat and cloacal swabs were collected from this bird at weekly intervals for a period of 8 weeks when it escaped while collecting the sample. The swabs were soaked in tryptose phosphate broth (pH 7.4) containing 800 micrograms of streptomycin and 800 IU of penicillin/ml. These swabs were processed and inoculated into the allantoic cavity of a 9-day embryonated chicken eggs as per the proceedures given by Sulochana *et al* (1981).

The innoculated eggs were incubated at 37o C and candled daily for embryo mortality. The embryos died after 24 hours were chilled at 4 o C overnight to avoid red cell contamination while harvesting the allantoic fluid. The allantoic fluid from dead embryos were tested for *haemagglutinating* activity using chicken red cells. The specificity of the isolate was studied by haemagglutination inhibition test using antisera prepared in chicken against NDV. The biological characteristics of the isolate was studied according to the techniques described by Hanson (1980).

Experimental infection studies:

a). Chicken: sixteen, eight-week old chicks were divided into three groups; group A and B consisting of six chicks each and group C four, Group A and B received the virus isolate at the rate of 0.1 ml. subcutaneously and intranasally respectively. The third group which served as the control received the same amount of allantoic fluid from uninfected embryos by subcutaneous route. The three groups were kept in separate cages and closely watched daily for the development of any clinical symptoms/death.

b). Pigeons: Since pigeons have the habit of visiting paddy fields in groups the pathogenity of the isolate to this species was investigated. Six pigeons purchased from a local pet bird breeder, pre-tested for the presence of anitbodies/virus were used for this purpose. Four of them were innoculated at the rate of 0.5 ml. of the infected allantoic fluid into the breast muscles while the remaining two received same quantity of uninfected allantoic fluid to serve as controls. The control and experimental birds were kept seperately and examined for the development of clinical symptoms/death.

Tissues collected from the dead birds were used for virus isolation.

Results and Discussion

A haemagglutinating virus was isolated from the cloacal swab. the EA property of the isolate was inhibited by specific antiserum to NDV. This virus could be isolated from all the eight cloacal swabs collected at weekly intervals. The bird was apparently normal without showing any clinical symptoms during the observation period of two months. Yerrundi is a semimigratory water fowl. Water fowls in general are considered to be resistant to NDV infection, but at the same time are considered potential carriers of the virus over long distances (Pearson and McCann, 1975). The migratory and forraging pattern exposes this bird to a variety of infections either by contact or by consumption of contaminated food and water. This also provides ideal conditions for transmission of viruses from them to domestic and other free flying birds.

The biological characteristics of the virus isolate are given in a tabular form below.

Characteristics	Results
ELD50/0.2ml	$10^{-8.0}$
Mean death time	49 hours
Intra cerebral pathogenicity index	1.9
Intravenous pathogenicity index	2.1
Pattern of elution	rapid
Stability at 56 o C in 30 minutes	
a). Haemagglutination	lost
b). Infectivity	lost
Haemagglutination of mammalian erythrocytes	
a). equine	negative
b). bovine	positive

All the eight-week old chicks that received the virus either by subcutaneous or intranasal route died by day five after showing clinical symptoms such as depression, prostration and diarrhoea. The lesions in these birds were typical of velogenic form of the disease, mainly petechiae in the proventriculus

and caecal tonsils and haemorrhagic enteritis. The virus was isolated from the liver and spleen of these birds.

One of the four experimentally infected pigeons became sick and paralytic on the 4th day of infection and died by day five. There was no specific lesions except moderate enteritis. the second bird started showing symptoms of paralysis of the wings and greenish diarrhoea and was unable to peck grains from the floor from the 7th day onwards. This bird continued to be sick and died of severe emaciation by 15th day. The remaining two infected pigeons were normal till the 20th day and died 10 days later showing the same type of clincial manifestations as the second one.

The results of experimental infection studies of chicken and pigeon and the biological characteristics show that the virus isolate from Yerrundi is a highly virulent strain pathogenic for both chicken and pigeon. Sulochana and Mathew (1991) also reported that pigeons will manifest mainly nervous symptoms after a long incubation period unlike chicken, even with highly virulent strains of NDV.

Continuous excretion of the virus as indicated by virus isolation at weekly intervals for a period of two months without manifesting any clinical symptoms clearly indicate that this species can act as a silent carrier of the virus and thus could be one of the sources of infection. Lancaster (1977) during his study on the epizootiology of ND observed that the infection persisted longer in the intestine than in other organs and wildlife, particularly waterfowl are indispensable in the spread of the disease and play a very important role in the transmission of virulent virus to poultry. These facts and the migratory and foraging habit of Yerrundi and virus excretion mainly through cloaca increases the possibility of dissemination of the virus by this species.

Summary:

A velogenic strain of Newcastle disease virus was isolated from the cloacal swabs collected at weekly intervals for a period of eight weeks from a Lesser Whistling teal (*Dendrocygna javanica*), known as Yerrundi in Kerala. The importance of this isolation is briefly discussed.

Acknowledgement:

The author wishes to express her deep gratitude to the Manager, Trichur Zoo for arranging transfer of the bird for investigation and to the Dean, Faculty of Veterinary and Animal Sciences for granting permission to publish this paper.

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Reprint : Zoos' Print. 5 (3) : 42-43, March, 1990

A Study of Feline Leukemia Virus (FELV and FIP) in Asiatic Lion

By P. N. Bhatia, Conservator of Forests and Dr. R. H. Sabapara, Vetny. Officer

There are many viral diseases found in the feline population. Some directly attack the host animal and cause pathogenic lesions in many organs, due to which many animals suffer from illnesses and may die. A variety of other viral diseases cause immunosuppression with other opportunistic organisms invading the host animal which suffers a lot.

Feline Leukemia virus (FeLV), Feline T-Lymphotronic Lentivirus are two distinct sub-families of retrovirus that produce immunosuppression. It is difficult therefore to diagnose on clinical symptoms alone. FeLV infected animals are susceptible to a variety of secondary and opportunistic infections. In addition, a variety of neoplastic and non-neoplastic disease results from FeLV infection, including Lymphosarcomo Myleogenous Leukemia, thymin degenerative disease, pan leukopenia like disease and non-regenerative anaemias.

Infection with FTLV may lead to immunosuppression. Typical clinical symptoms include chronic rhinitis, gengevitis and periodontitis, anaemia, diarrhoea, pustular dermatitis and generalized Lymphadenopathy. Symptoms vary from animal to animal and may persist for several years.

All eight serum samples were tested at Sakkarbaugh Zoo, Junagadh for Feline Leukemia virus and Feline T-Lymphotropic Lentivirus using Feline Leukemia virus Antigen/Feline T Symphotropic Lentivirus Antibody Test Kit (CITE COMBO DEVICE).

The CITE COMBO FeLV Ag/FTLV Ab assay utilizes monoclonal antibodies to p. 27, inactivated FTLV antigen. The conjugate mixture of the kit contains horse raddish paroxidase (HRPO) conjugated monoclonal antibody to p. 27 and HRPO conjungated FTLV antigen. Upon mixing the conjugate and test sample conjugated monoclonal antibody will bind to p 27 antigen and conjugated FTLV antibody will bind to FTLV antibody if present. This entire mixture is applied to CITE device and subsequent colour development in FeLV sample spot and FTLV sample spot will decide the presence or absence of FeLV and FTLV infection. The colour development was not found in either FeLV sample spot or FTLV sample spot which was suggestive that all serum samples tested were not infected with either FeLV or FTLV.

Same serum samples were sent to Zurich Veterinary University (Switzerland) with Dr. Hans Lutz and the samples were tested there for corona virus by Antigen antibody technique. The results were negative for Feline infectious peritinitis infection.

Feline infectious peritonitis (FIP) is also a viral disease found in felines. It is caused by corona virus. FIP is a chronic disease of felids that is frequently seen in association with feline leukemia. Length of incubation is highly variable. In acute form there may be depression, anorexia, fever, weight loss and abdominal distention. Sometimes however, abdominal distention is not found for many weeks. In exudative form of the disease there is accumulation of fluid in abdominal and thoracic cavities. In non-exudative form there may be involvement of liver, lungs, eyes, kidneys, brain and spinal cord.

Material and Method

EDTA added blood was collected from seven lionesses (Panthera leo persica) and one male lion. Samples were collected aseptically from caudal vein after restraining the animal in a squeeze cage. Serum was separated from each blood sample by centrifuge machine.

The detection of the FeLV group specific viral antigen (p 27) is diagnostic for FeLV infection and the measurement of specific antibody titre to FTLV indicates that the animal has been exposed to FTLV and may be chronically and persistently infected.

AUTHORS' NOTE : We are grateful to Dr. Hans Lutz, Department of Medicine, Veterinary Faculty, University of Zurich, Switzerland for his kind assistance in donating the testing kit for FeLV and FTLT and for testing samples for FIP at Zurich Veterinary University (Switzerland).

Reprint : Zoos' Print, 5 (10) : 26-27, October, 1990

INFECTIOUS FELINE ENTERITIS IN TIGER CUBS *(Felis Tigris)* AT TRICHUR ZOO.

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On 24--3--1989, the Superintendent,Trichur Zoo, reported that one female tiger cub aged five months, was dull and off feed, all of a sudden since that morning. It was one of the three cubs, born at the zoo, on 25--9-1989, out of a pair of tigers brought down from the Mysore Zoo. These cubs were routinely dewormed and were healthy.

On examination, the cub was found to be dull, off feed, and had not consumed milk, egg or meat. It was weak, reluctant to move about in the cage,keeping the head lowered and pressing the abdomen on the floor. It had passed slightly loose faeces. The other two litter lates were apparently aormal and active. The following medicines were administrated:

Analgin [1] 2 ml
Betamethazone[2] 4 mg intramuscularly in the morning.

There was no improvement intramuscularly in the morning in the condition, and it appeared to be weaker by the evening and the following medicines were administrated:

Dextrose 10% --50 ml
Calcium gluconate 10%-10ml
Betamethazone 4 mg

intravenously in the evening.

After the medication, the cub did not show any appreciable improvement, except that it could keep the head slightly raised. The cub died the next morning. On autopsy, lesions of acute gastroenteritis could be noticed.

On 28--2--1989, the other female cub of the same litter, was reported to be ill. It was off feed and was passing loose blood tinged faeces with detached shreds of mucous membrane. Temperature was 104 F. However, it was moving about in the cage but with a staggering gait. On examination of the faecal sample, no ova of parasites could be detached.

The faecal samples from the two cubs and their dam were collected, processed and tested for parvovirus by haemagglutination test using piglet blood cells at 4°C. All the three samples revealed haemagglutinating agents. The titres were 1 in 40 for the two cubs and 1 in 160 for the dam.

The cub was administrated the following:

Dextrose 25%-25ml Of this, only 35 ml could
Calcium gluconate 10% 10ml be administrated intravenously.
Distilled water 20 ml
Diasyn [3] 2 ml intramuscularly
Levamisol [4] 30 mg

The cub died the next day.

Autopsy findings:

Heart- Rounded off with necrotic foci at the apex. Haemorrhage in the myocardium.

Lungs- Hypostatic congestion

Liver- Edges rounded off with focal necrosis.

Kidneys- Infarct

Stomach and Intestines -Pealing off of the mucosa through out with congestion upto the caecum. Intestines distended with gas. Contents were rosy pink, Pasty and loose. Serosa with patchy areas of congestion.

The tissues were examined for any specific bacterial organisms by cultural studies. None of them revealed any pathogenic bacteria.

The same day (1--3--1989), the remaining male cub of the same litter was found to be dull, off feed and passing loose blood tinged foul smelling faeces. The animal was administrated the following:

Analgin 2 ml
Dextrose 25% 25 mm Intravenously
Calcium gluconate 10% 10 ml
Distilled water 20 ml
Levamisol water 30 mg intramucularly.

The next day, the cub appeared better, started licking milk and consumed a small quantity of minced meat. It was more active and moving about in the cage. Faeces was loose, but not blood tinged.The medicines as on the previous day were repeated.

On the third day, the cub had consumed a small quantity of milk and minced meat. It was much better, more active and running about in the cage. Faeces had become semi-solid. The cub was administrated the following:

Dextrose 25% 25 ml
Calcium gluconate 10% 20 ml intravenously
Distilled water 20 ml
Furazolidone [5] 200 mg- one tab twice daily and yeast 1/2 teaspoon twice daily, for three days consecutively.

Thereafter, the animal showed steady progress. The faeces became well formed. It resumed its normal feeding habits by the fifth day.

1.Novalgin-Hoechst India LTD, Bombay
2.Betnasol-Glaxo Laboratories (India) LTD, Bombay
3.Diasyn- J.& J.DeChane, Hyderabad
4Lemasol- Ranbaxy Laboratories LTD, New Delhi
5.Neftin- Eskaylab LTD., Bangalore.

Discussion

The clinical symptoms manifested by the animals, failure to isolate any specific bacterial pathogens from the faecal samples of the affected animals and tissues of the dead ones and positive haemagglutination test with the extract of the faecal samples of these animals with titres 1 in 40 and above strongly suggest the possibility of parve virus infection. The specific identity of the haemagglutinating virus could not be made as the specific antisera was not available. The abscence of earlier manifestation of the clinical symptoms might be due to the prescence of maternal antibodies. The positive haemogglutination reaction with the dam's faeces indicate the sources of infection to the cubs, and carrier status of the older animals. The level of haemagglutination inhibition antibodies in the dam and the cubs could not be estimated due to the difficulty in collecting blood from these animals subsequently. The faecal samples were screened for the haemagglutinating virus after six months, but were negative.

Treatment adopted in these cases were only symptomatic. Of the three cubs affected, only one recovered. The cub that recovered, is healthy and had grown up well for its age.

Summary

An outbreak of infectious feline enteritis in the tiger cubs at Trichur Zoo, the clinical symptoms, treatment adopted, autopsy findings of the dead ones and the diagnostic investigations undertaken, are reported.

Acknowledgement

The authors are thankful to the Dean, College of Veterinary and Animal Sciences, Mannuthy for according permission to publish this paper. The authors are grateful to the Superintendent, Trichur Zoo, for the facilities provided.

Reprint : Zoos' Print, 5 (3) : 36-39, March, 1990

Infectious Diseases Transmitted between Wild and Domestic Animals

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The impact of disease in free living wild life has been well known and documented. The effects of disease are incidental at individual level but may turn epizootic occasionally. Dr. C. M. Herman (1969) in his paper entitled "The impact of disease on wild life population" stated that "while there is limited documentation that disease, as an individual factor, can drastically affect population fluctuation, it is certainly evident that acting with other ecological phenomena, disease can have extensive impact in free living wild life"

The role of disease in free living wild life although of a complex nature, can not be overruled. Blaming captivity for high mortality as compared to free living is not fully justified.

Many of the infectious diseases have high degree of communicability and pathogenicity and they may infect various species of wild animals as well as domestic animals. Some wild animal species are particularly notorious as reservoirs of certain specific diseases.

Viral Infections

Rinderpest: A viral contagion of the cloven hoofed artiodactyles characterised by fever, erosive stomatitis and gastroenteritis. It commonly attacks domestic cattle and buffaloes. On occassion wild life suffers. In India it is reported from deer, wild buffaloes, wild boars, bison and free living blue bulls. Transmission is by close contact between

healthy and infected animals. Pigs may become infected through eating infected carcasses. Lipzootics in African wild life is largely blamed on buffaloes. Rinderpest was reported by Gujarat Vety. College from eland in Baroda Zoo.

Foot and Mouth Disease: It is an acute, febrile, highly contagious viral disease of ruminants and pigs. Numerous wild species including wild buffaloes, deer, antelope, peccaries and european hedgehogs are susceptible. In domestic animals, the disease is a problem of world wide concern.

In Europe, it was reported in free living fallow deer during an epizootic in cattle in the same area. In Great Britain, infected hedgehogs *(Erinaceus europaeus)* were found in the vicinity of outbreaks in cattle. Outbreaks of FMD are reported from Zoological gardens. In Africa, where in many territories, FFT is endemic and wild animals of many species share their habitat with domestic animals, there has long been interest in role played by wild animals in perpetuation & spread of FMD.

Rabies: It is an acute viral infection generally persist in nature as salivary gland infection of carnivores. It is usually transmitted from animal to animal and animal to men by biting. All warm blooded animals are susceptible. Epizootics of rabies in domestic dogs and such wild animals as foxes, skunks, coyotes, jackals and wolves occur when the population of such susceptible animals become dense enough to ensure easy animal to animal transmission of infection where rabies is present. Vampire bat act as asymptomatic carrier.

Rabies is reported in Jaguars, blue bulls in Kanpur Zoo in 1985 and in Indian Rhino in Lucknow Zoological Park in 1983 - 84.

Blue Tongue: The infection is found in sheep. Cattle are recognized long term carriers. Virus is transmitted by insect vectors. It affects wild ruminents and has been isolated from gazelle, kudu, bighorn sheep, deer, elk, antelope etc.

Distemper: It affects many species of carnivora. The main host is dog. The wild animals reported to be susceptible are wolf, Jackal, Coyote, Australian Dingo, Wild dogs, hyena, mink, ferrets, racoon, lessar panda, etc. It is transmitted by aerosol, direct contact or fomites.

Pseudorabies: Domestic swine are considered to be the principal reservoir of the disease. Infected swine may act as symptomless carriers, transmitting it to susceptible individuals of variety of species. Racoons, skunks, foxes, dogs are readily infected by ingestion of carcasses.

Bovine viral diarrhoea-mucosal disease It is a viral infection of cattle. It is also reported from white tailed deer, mule deer, antelope, eland, giraffe, gazelles etc.

Infectious Bovine Rhinotracheitis: It is caused by Bovine herpes virus in cattle. It also produces abortion in swine. Infection was frequently recorded from buffalo, eland, water buck, reed buck, kob and hippopotamus in form of pustular vulvovaginitis.

Parainfluenza - 3: It is widespread in many species of wild animals, by itself it is not a serious pathogen but together with other agents it may contribute to disease of respiratory tract.

Feline panleukopenia: It is an acute viral infection affecting most members of the family Felidae. It is highly infectious in susceptible cat population. It has been described in cheeta leopard, bobcat, tiger, jaguar, lion, wild cat etc. The most common route of infection is by inhalation or ingestion of virus from infected feces, urine or salvia by direct or indirect contact.

Contagious ecthyma: The infective agent is pox virus which affects mainly sheep and goats. It is transmitted by contact exposure from infected sheep or goat. It has been reported from wild life viz , bighorn sheep, chamois, tahr, mountain goats and musk oxen.

Bacterial Rickettsial and Mycotic Infections

Tuberculosis: For more than a century Tuberculosis has been recognised as a serious clinical entity in wild animals kept in captivity. TB has not been commonly reported in wild animals except where they have exposure to domestic animals or human being. Mycobacterium infection has been reported in deer, kudu, giraffe, elephants, monkey, llamas, antelope, bison, baboons, elk, eland, tapirs etc. Prevalence of TB is a most common feature in many Indian Zoos. In Kanpur Zoo, 27 mammals (7 primates, 9 bovides, 4 deer, 7 others) and 14 birds (5 duck, 7 fowl peasant, 2 stork) died due to TB in 3 years. Shah *et al* (1986) reported incidence of tuberculosis in black buck and white spotted deer in Gujarat. Tuberculosis in spotted deer is reported by Sood *et al.* (1989).

Paratuberculosis: Caused by *Myco paratuberculosis* resulting in high morbidity and mortality in variety of wild animals. It has been observed in deer, big horn sheep, antelope, mountain goats. The problem of this infection is magnified by lack of suitable procedure for control and elimination of disease from captive and wild species.

Brucellosis: It has been reported through out the world and has long been considered an important disease in human, cattle goat and swine. The infection has been reported in bison; elk, moose, Dall sheep, Caribou, reindeer, antelope, spotted, hyena, wild dogs, jackal, grizzly bears etc. Jhala (1971) reported brucellosis in Nilgai and Spotted deer in Gir forest.

Pasteurellosis: It is an infection of domestic and wild animals caused by *Pasteurella multocida*. Episzootics of this infection occasionally reported among wild mammals like bighorn sheep, bison, black tailed deer, elephant, elk, kangaroo, wild swine etc.

Anthrax : It is acute infection having sudden onset and rapidly fatal course characterised by exudation of tarry blood from body orifices, enlargement of spleen and gelatinous infiltration of subcuteneous tissue. It has been reported from wide variety of wild mammals like zebra, spring bok, baboons, carnivores, hippopotamus, lions, leopards, cheetah, elephants, hyena giraffe, impala etc. In Australia anthrax is prevalent amongst the kangaroos. The anthrax was reported with high mortality in kangaroos of Trivandrum Zoo.

Salmonellosis : It is common in wild animals of all species. Mortality in free living wild animals goes unnoticed because of acute course of disease. Enteric infections are exceedingly common in wild animals trapped and moved into captivity.

Heart water : It is a septicaemic; rickettsial disease of ruminants. It may cause an inapparent, transient reaction in some wild animals and be responsible for clinical disease and mortalities in others. It has been reported from eland, nilgai, blackbuck, Indian buffalo, Barbary sheep as well as domestic cattle, sheep and goats.

Eperythrozoonosis : It is non - contagious infectious disease of rodents, ruminants, swine. Also reported in blesbuck, deer, elk, muledeer etc.

Dermatophilosis : It is an exudative dermatitis of wild and domesticated animals caused by *Dermatophilus congolensis*. There have been several reports of occurrence of this infection in eland, giraffe, gazelle, deer, zebra, kudu, fox, monkey, antelope etc.

Histoplasmosis : It is a mycotic infection caused by *Histoplasma capsulatum*. Wild and domestic animals as well as humans are susceptible to this infection.

The other mycotic infections reported are Coccidioidomycosis, Adiaspiromycosis etc.

Control Measures

Preventive measures are of utmost importance in control of the infectious diseases. The following control measures are advocated.

1) Measures of proper housing, sanitation and cleanliness of the habitat should be provided.

2) Quarantine measures should be strictly followed.

3) Strict restriction of entry of all types of domestic animal / street dog should be observed.

4) The diseased animal should be segregated.

5) In case of outbreaks of any infectious disease in domestic mammals or birds of surrounding area, vaccination of susceptible wild animals should be carried out.

TABLE - 1 Infectious Disease of Animals

1) Wild Ruminants

1) *Bacterial Infections*:

Anthrax, Black Quarter, Enterotoxemia, Malignant edema, Erysepalas, Listeriosis, Streptococcosis, CBPP, Vibriosis, Salmonellosis, Brucellosis, Pasteurellosis, Actinomycosis, Actinobacillosis, Tuberculosis, Paratuberculosis, Leptospirosis

2) *Viral Infections*:

Rinderpest, Foot and Mouth Disease, Blue tongue, Vasicular Staomatitis, Mucosal disease, Infectious Bovine Rhinotracheitis, Parainfluenza, Hog Cholera, African Swine Fever, Contagious ecthyma, Maligment Cattarhal Fever, Rabies Virus, Pseudorabies

3) *Rickettsial infection*

Q fever, Tick borne fever, Anaplasmosis, Eperythrozoonosis

2) Equine

African horse sickness, Glanders, Borna disease

3) Felide

Salmonella, Anthrax, Tuberculosis, Feline Pan Lukopenia

4) Elephant

Anthrax, Salmonellosis, Tuberculosis, Pasteurellosis Clostridium, Colibacillosis, Diphtheria, Mycoplasma, Tetanus, Poxvirus, Herpesvirus

Haemoprotozoan Diseases of Wild Animals

Haemoprotozoan parasites occurring in wild animals are of two types. Those specific to the host either benign or pathogenic and those that utilise the wild animals as reservoir hosts and exhibit pathogenicity on transmission to man and his live-stock. The important protozoan diseases are: Leishmaniasis, Trypanosomiasis, Malaria, Babesiasis, Theileriasis, Toxoplasmosis, Anaplasmosis etc.

Occurrence of Haemoprotozoan Parasites in wild animals

Leishamaniasis: It is primarily, a disease of Man and dog. *L. donovani* is the causative agent of visceral leshamaniasis and *L. toopica* is responsible for cutaneous form. Both types are seen in Desert rodents, gerbil, ground squirrels. The third form: mucocuatneous due to *L. brazilienses* in S. America. An American rodent, Agouti, is incriminated as the reservoir.

Trypanosomiasis: Trypanosomes are universally distributed haemoprotozoans of vertebrates: Pisces, amphibians, reptiles and mammals. In wild animals it is usually benign form but pathogenic to man and his live-stock.

Antelopes carry African trypanosomes which are responsible for sleeping disease in man and nagana in livestock. These species are responsible for morbidity and mortality in Gazella, elephant, hynaena. The giraffe is also carrier of *T. vivax* and *T. congolense.*

T. evansi a causative agent of "SURRA" in live stock is also pathogenic to Elephants, tigers and mongoose. Deaths have been reported in tigers and jaguars in zoos.

The wild reservoir hosts of *T. cruzi* (Chaga's disease) in children include armadillo, opossum, ant-eaters, raccoon, wood-cat fox and ferret.

Malaria: Four species are responsible for human malaria. But number of species are found in animals: monkey, artiodactyles, rodents, bats and birds. Man is suceptible for some of these species, odf simian plasmodium.

Haemoproteus and *Leucocytozoon* spp. occur in variety of birds. Similarly, Haepatozoon canis is reported from jackal, hyaena, palmcat and musang.

Babesia parasites: Babesia parasites as such are host specific. *B. hippotragi* and *B. stordi* and few more have been reported from antilopes. Deer act as latent carrier of *B. bigemina, B. divergens* of cattle. Similarly, *B. canis* and *B. gibsoni* have been reported from wolf, jackal, fox etc. *B. felis* which is found in cat is reported from tiger, lion, puma, leopard and wild-cats.

There are reports of babesia parasites from African and Indian elephant, rhinocerus, giraffe, Rodents do have this species.

Theileriasis: A vary large numbers of Theileria spp. have been reported from artiodactyles (antilopes, deer giraffe), primates (monkeys) edentates (opossum), tubulidentates (African sloth, ant-bear). African buffalo is a natural host of *T. parava, Tlawrenci* and *T. mutans* of cattle. Theileria schizogony has been described in three species of antelopes (kudu, duikar & eland)

Toxoplasma: *T. gondii* first recorded from north african rodent: *(Ctenodactylus gondii)* had since been found in large number of species of mammals and birds. The disease may vary from acutely to a chronic form which is asymptomatic. Mortalities have been reported from in leopards, kangaroos and monkeys in zoos. Asymptomatic toxoplasmosis in an unlimited variety of animals is a public health hazard as it is of zoonotic importance.

Anaplasmosis: *A. marginale* is the cause of gall sickness in cattle has been reported from antelopes and other animals which act as carriers of the infection. Haemobartonellosis and epierythrozoonosisnow classified as rickettsial diseases affect a number of wild animals.

Questions, Comments, Discussion

Kapasi: Very little is known about the diseases that are spread in the wild and no concentrated efforts are being made in this direction. Whatever is known has been gathered from the zoo data, so it is very essential that more work is done in this area. For example, when an animal is found dead, we send it for post mortem more for the legal requirement than for any scientific opportunity. We should examine the body carefully from every viewpoint for furthering the knowledge in this subject.

Regarding prophilactic measures, I have noticed that during summer, when water supply is scarce and all the animals come to particular spots to drink, can we not mix broad spectrum medicine in the water as a preventative measure for certain general diseases. Has anyone done any work in this?

(Audience) It has been done in some places for preventing a variety of diseases, even t. b., helmenthic animals, etc.

Reprint : Zoos' Print, 12 (9) : 18, September, 1997

REPORT ON ISOLATION OF SOME Microsporum SP. FROM LION (*Panthera leo persica*) AND ITS PUBLIC HEALTH IMPORTANCE

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Introduction

Animals and their products of hair, feather and skin like keratinaceous substances are known to be the reservoirs of fungi causing mycoses and dermatomycoses (White *et al*; 1950 and Griffin, (1959).

Georg (1960) emphasized the role of animals as vectors in human and animal ringworm and its public health significance. Unfortunately the literature presents little information on the prevalence of different dermatophytes in wild animals. The present investigation is, therefore, an attempt to isolate some dermatophytic fungi from lions *(Panthera leo persica)*.

Materials and Methods

Hair samples were collected from lions of Sanjay Gandhi Biological Park, Patna. Samples were taken directly from its body using sterilized gloves, forceps and hard brush. Collected hair samples were kept directly in moist chamber adopting conventional blotter technique. Overall, 20 hair samples were placed in a sterilized petridish having three layers of blotting sheets of the same size moistened with sterilized distilled water. The plate was incubated at 25°C+1°C. Each plate was examined for any growth on hair periodically and no plate was declared negative until four weeks of incubation. The growth when obtained was subcultured on Sabouraud's dextrose agar (SDA) containing Chloromycetin (0.05 mg/ml) and Cycloheximide (0.5 mg/ml). The final identification was made on the basis of macroscopic and microscopic examination of the isolates as described by Ajello *et al* (1966).

Results and Discussion

The intimate relation between man and animals renders them completely exposed to a wide range of reservoirs of dermatophytes with far reaching epidemiological implications. Indisputable evidence for the direct transmission of fungus infection from animals to man, however, could be obtained only from skin and hair infection. In the present investigation *Microsporum gypseum* and *M. nanum* were isolated.

Microsporum gypseum, a geophilic fungus is a component of the mycoflora of soil serving as the common source of infection for most animals and human (Ajello, 1953). Nannizzia (1927) demonstrated the presence of *M. gypseum* in soil contaminated with keratinized materials like hair and feathers etc. Under certain conditions *M. gypseum* is capable of assuming a parasitic existence and producing alternations in the invaded animal and human tissues. *M. gypseum* has been reported in laboratory-bred rabbits (Dey and Kakoti, 1955) and in pet rabbits (Sinha *et al*, 1982). Dermatophytes in different pet animals due to *M. gypseum* has also been reported by various workers (Kaplan *et al*, 1957; Chatterjee and Sengupta, 1979 and Gupta *et al*, 1970). Though infection in man by M. gypseum is relatively rare, this fungus has been found to be associated in several surveys of human dermatophytoses (Swartz *et al*, 1949 Goncalves, 1953).

Isolation of *M. nanum* from the body surface of lion seems to be the first report from Bihar though Gupta *et al*, (1968) had reported for the first time from India from pigs. Isolation of various dermatophytes from different aberrant hosts has shattered the concept of host specificity. As the fungal nature of the disease is not always evident in the form of eczematous lesions, a regular survey is essential to detect the presence of different dermatophytes on the body surface of zoo animals.

Acknowledgements

The authors are grateful to the Director, Sanjay Gandhi Biological Parks, Patna for providing facilities.

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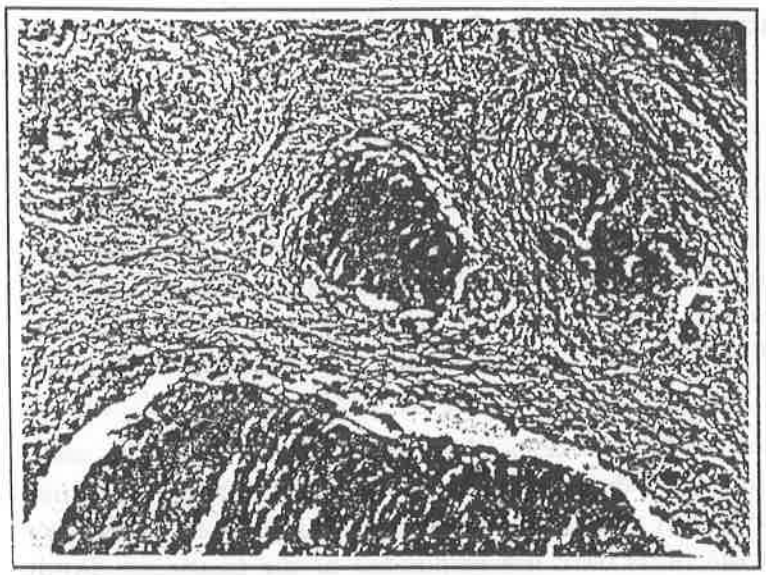
Reprint : PASHUDHAN, Volume 9, Issue 6, June 94 : 2



←Cutaneous aspergillosis in a black tailed bantem

A.T. Rao[1] and
L.N. Acharjyo[2]

An adult female black tailed bantem showed numerous spherical tumour - like growths over the skin of the right wing, breast, neck and back. Biopsy materials were collected after surgical operation of most of the growths and preserved in 10% formal saline solution for histopathological diagnosis.

Sections revealed hyperkeratosis of epidermis associated with numerous encapsulated epithelioid granulomas with caseation necrosis surrounded by foreign body giant cells, lymphocytes and epithelioid cells. Branched septate hyphae with spores resembling *Aspergillus* species were seen in the caseonecrotic tissue.

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Indian vet. J. 67. January, 1990 : 79-80

Candidiasis in Peacocks (*Pavo cristatus*)

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Mycotic infections of the digestive tract in birds is not infrequent but in many cases sufficient significance is not attributed seriously. Thrush has been observed in chickens, pigeons, geese, pheasant, ruffed grouse, quail, peacocks and parakeets (Chutre, 1984). Deaths in peacocks due to candidiasis is reported in this communication.

Peacocks belonging to a private poultry breeder in Hyderabad were reported to have been dying after showing symptoms of dullness, off feed and dyspnoea. The peacocks have been treated symptomatically at the local Veterinary Hospital for two days but the birds have not responded to the treatment. Fresh carcasses of the birds were brought to the poultry investigation division of Veterinary Biological and Research Institute, Hyderabad, for postmortem examination and diagnosis of the disease.

Post-mortem examination revealed haemorrhagic enteritis with blood stained material in the intestines. The vessels of the mesentery were congested with petechial haemorrhages in the intestines throughout its length. Extensive haemorrhagic spots were observed in the lumen of the trachea with frothy exudate and the mucosa of the crop showed whitish circular raised ulcer formations. The proventticulus was found swollen with caulyflower like growths in the mucosa. Dried up condition of the muscles have been observed in the abdominal region.

Examination of the intestinal contents revealed heavy infestation by tapeworms of *Amoebotaenia* spp. and small oval, budding, thin walled yeast like cells resembling Candida sp. Swabs from the lesions were collected aseptically and inoculated on Sabouraud's dextrose agar with antibiotics. Growth became evident after 48 hours of incubation at 37°C as creamy, medium sized moist colonies. For further specific identification of the culture, the organisms were picked from the slants on a straight wire and a deep cut was made in the corn meal agar and a flamed sterile cover slip was placed over the streak. Along the streaks mycelial bearing ball like clusters of budding cells with characteristic

round chlamydospores have been observed after 48 hours incubation at 37°C which were identified as *Candida albicans* on sugar fermentation tests (Conant *et al.*, 1954).

The lesions observed in peacocks in this study are in agreement with those described by Davis *et al.* (1971) and Arnall and Keymer (1975) in other birds in general which died due to candidiasis. The authors are of opinion that though the alimentary tract was heavily infested with tapeworms of *Amoebataenia* sp. which are practically harmless under normal conditions (Soulsby, 1969), the infection due to *Candida albicans* might have aggravated the condition resulting in the deaths of the peacocks. Though the source of infection was not established in this study, poor environmental sanitary conditions and other factors might have contributed to the death of the peacocks from candidiasis.

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Indian Vet. J. 71, December, 1994 : 1239 - 1241

INTESTINAL CANDIDIASIS IN CAPTIVE WILD HERBIVORES

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Gastro-intestinal candidiasis in domestic animals are well known, however, reports of its occurrence in wild animals are scanty. The present communication relates with intestinal candidiasis in captive wild herbivores.

In a study of mortality of captive wild herbivores in Assam State zoo, from 1985 to 1989 altogether 214 animals were necropsied, in which two animals (0.93%), showed intestinal candidia infection. The animals affected were a black buck (*Antilope cervicapra*) and one sambar (*Cervus unicolor*).

Tissue pieces from the affected area were processed for routine haematoxylin and eosin staining and Gomoris' Methanine Silver nitrate (GMS) staining for the demonstration of fungi. The affected tissues were also preserved in 3.0% glutaraldehyde in 0.1M cacodylate buffer at pH 7.2, processed for scanning electron microscopy and observed by a Scanning Electron Microscope (JEOL). However, cultural examination could not be undertaken.

In an adult black buck, a perforated ulcer measuring about 4 inches in length was noticed at the anterior end of duodenum near the pylorus. The area was constricted and thickened due to deposition of fibrinous flakes and debris. Fibrinous adhesions of the abdominal organs including the intestinal loops were also noted. The peritoneal cavity was soiled with ingesta and dark coloured fluid. Most of the mesenteric lymph nodes were enlarged and few were caseated. In the other sambar calf, an ulcer of about 1.5 inches in length in the duodenum was noticed. Fibrinous flakes were seen to be deposited over the area.

Histopathologically, both the ulcerated areas showed necrotic changes and the area was structureless. Bacterial colonies were seen in large numbers at the mucous sruface. In the submucosa, pseudo-hyphae and spores of candida could be demonstrated in both the cases by GMS stain (Fig. 1). Hyperemia, edema and infiltration of neutrophils were seen in the adjacent part of the perforated area.

On scanning electron microscopic study of the ulcerated part of the black buck, both the cellular and

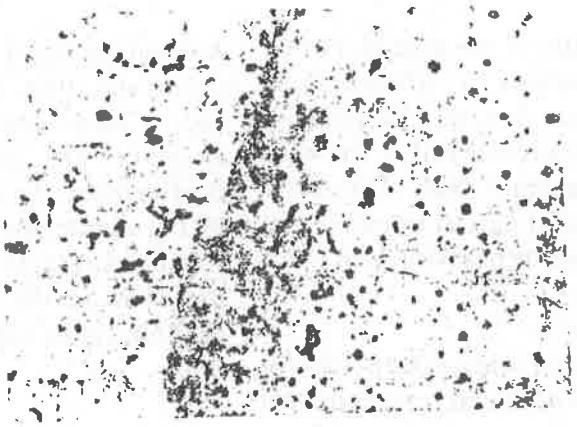

Fig.1 Photomicrograph of ulcerated area of duodenum. Submucosa showing spores and pseudohyphae of candida (GMS)

Fig. 2 SEM Photograph of ulcerated area of duodenum showing structureless and homogeneous mass with transverse section of a nematode parasite

architectural details of the area were lost and the area became a structureless homogeneous mass. A nematode parasite was also seen to have invaded the area (Fig. 2). The animal had Trichuris infection in the lower part of intestine and probably, the nemtode parasite seen was a Trichuris species.

Mycotic infection in captive wild animals had not been reported from India so far, although prevalence of Mucor and Candida (Fletch and Anderson, 1969) and *Aspergillus fumigatus* (Williamson *et al.*, 1963) have been reported from other countries. The stress of confinement and transportation may play a role in the development of ulcer in the intestine (Jones and Hunt, 1983; Jubb *et al.*, 1985) and in these cases also, as the captive animals are always in stress of confinement, the animals developed ulcer in the duodenum and the opportunistic Candida aggravated the lesions. Probably these two are the first record of intestinal candidiasis in captive wild herbivores in India.

Acknowledgement

The authors are grateful to the DFO, State Zoo, Assam for the materials and the senior author is grateful to CSIR, for the financial assistant in the form of SRF for the study.

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Indian Journal of Veterinary Pathology 22(1): 55-56. June, 1998

Short Communication

CANDIDIASIS IN A HIMALAYAN BLACK BEAR (*SELENARCTOS THIBETANUS*)

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Gastrointestinal candidiasis in domestic animals are well documented while its occurrence in wild animals are rare . To our knowledge candidiasis has not been reported in bear and hence the present paper deals a case of candiadsis in a captive Himalayan black bear at Assam State Zoo, Guwahati.

A sixteen years old male Himalayan black bear had a history of anorexia, vomition, choking and occasional bleeding from nose. It was symptomatically treated without any result and ultimately died about 9 months after the onset of clinical illness. At necropsy an obliquely perforated ulcer measuring about 18.0 x 6.5 cm. was noticed at the lower part of oesophagus near the cardiac end of stomach (Fig.1).The perforated area was blackish in colour and there was deposition of fibrinous flakes and tissue debris. The stomach was highly congested and patchy haemorrhage could be seen at two spots at the fundic region.The duodenum showed high degree of inflammation. The nasal sinuses were highly congested and at places deposition of fibrinuos flakes were noted. Other organs did not show any significant gross

Fig. 1: Perforated ulcer near cardiac end of stomach.

Fig. 2: Pseudohyphae and spores of candida H.E. x 280.

lesions, however, the lungs were slightly pneumonic and mild haemorrhage could be seen in the liver.

Tissue pieces from all the affected organs/areas were collected and processed routinely for histopathological studies and for demonstration of fungi Gomori's Methanine-silver nitrate (GMS) staining was undertaken.

Microscopically, the ulcerated area showed necrotic changes, surrounded by bacterial colonies on the mucosal surface . Large number of red blood cell and infiltrating cell mostly the neutrophils and occasionaly eosinophlils could be noticed. Macrophages and lymphocytes were also present .In the sub - mucosa, pseudohyphae and spores of candida could be demonstrated (Fig. 2) by GMS stain. The nasal sinuses also showed inflammatory cells and yeasts on special staining. However, no significant change and candida could be demonstrated in the lungs, liver and stomach.

On cultural examination on selected media *Candida albicans* could be isolated from the oesophagus as well as from the sinuses.

Gastrointestinal candida infection in wild animals like deer, rock hyrox and chimpanzee have been reported[1,2,5]. Jubb *et al*[4] opined that the stress of confinement may play a major role in the development of ulcer in the intestinal tract and in this case also the animal was ill for quit sometime the candia which are obligatory saprophytes of warm blooded animals is considered as opportunistic invader of gastrointestinal tract[3] and as the animals were treated for a long period with antibiotics the candida have aggravated the lesions . The possibility of taking up infection from soil may not be ruled out as the bears are known for its sniffing habit. Probably it is the first record of candidal oesophagatis leading to perforation and death in Himalayan black bear.

ACKNOWLEDGEMENTS

The author is grateful to D.F.O., Assam State Zoo for the materials and to the Department of Microbiology , College of Veterinary Science for the help in cultural examination of the materials.

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Indian vet. J. 57. September, 1980 : 774-775

PNEUMOMYCOSIS IN A FLAMINGO (*PHANECOPTERIS RUBER L.*)

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Reports of pneumomycosis in flamingos are scarce, though fungal diseases in captive birds are reported commonly in the literature. Owen (1832) and Mohler and Buckley (1904) reported one case each of pneumomycosis in flamingos. In the present report, one case of aspergillosis involving lungs was recorded in a flamingo kept at Zoo park, Hyderabad.

Materials and Methods: Representative portions of lungs, liver, heart and kidney were recived for histopathological examination from a flamingo of Zoo park, Hyderabad. The tissues were processed and paraffin sections were made. The sections were stained with haematoxylin and eosin.

Results: Grossly, all the tissues exhibited congestion on the surface and cut sections revealed greyish necrotic areas alternating with congestion.

Microscopically, lungs revealed necrosed areas surrounded by areas of haemorrhages. A few bronchi and bronchioles contained mucus and septate hyphae. Mycelia were prominent in the necrosed areas and also penetrated into the walls of the bronchi and alveoli (Fig). Only haemorrhages could be discernible in other tissues.

Discussion: Ainsworth and Austwick (1958) listed *Aspergillus flavus*, *A. nidulus*, *A. niger* and *A. terrous* also besides the usual *A. fumigatus* as isolates from cases of aspergillosis in wild life. In the present case, specific identification of the fungus could not be attempted, as the tissues received were formalin fixed. However, the fungus was identified as *Aspergillus* spp. based on morphological characters. The lung lesions observed were similar to those observed by Chakravarthy (1976) in an emu from Delhi zoo. Norman *et al.* (1954) emphasised that necrotic lesion was the chief lesion in pulmonary aspergillosis of human beings. Lung lesions in the present case did not show any nodules in conformity with the observation of Davies (1958), as the condition might have been very acute showing the inflammation of the lung without the nodules having had time to form. Actinomycotic forms and the asteroid bodies described by Jubb and Kennedy (1972) associated with chronic aspergillosis were not observed, supporting the acute nature of the present case. Fungi of genus *Aspergillus* are ubiquitous and the flamingo might have got the disease by inhalation of spores from mouldy feeds or grains dampened during storage.

Acknowledgements: The authors' thanks are due to the veterinary officer, Zoo park, Hyderabad for providing materials and to Dr. M. Madhava Krishna Reddy, Joint Director and to Dr. Zaheer Ahmed, Deputy Director (Disease investigation) for the encouragement given

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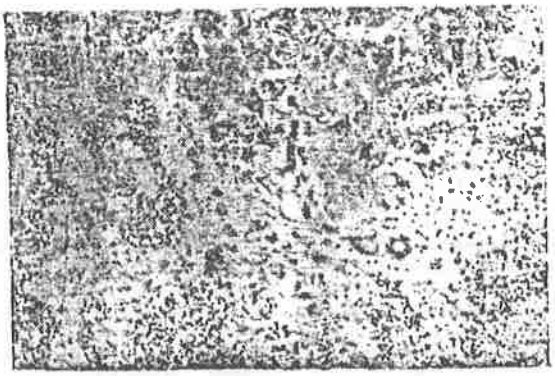
Pneumomycosis in a flamingo (*Phanecopteris ruber* L)

M.R.K. Mohanrao and Ch. Choudary



Lung showing fungal hyphae in the necrosed area
H. & E.

Reprint : Zoos' Print, 12 (4) : 13-14, April, 1997

DERMATOPHYTOSIS IN A BEAR DUE TO *Microsporum gypseum*

M. Pal

ABSTRACT

Microsporum gypseum, a soil inhabitating fungus,was found to be the cause of ringworm in a one-year-old pet bear which had a minor traumatic injury on the skin of left rump. The diagnosis was established both by demonstration of dermatophyte in the cutaneous lesions by potassium hydroxide technique and also by isolation of *M. gypseum* from the infected crusts in Sabouraud medium. No epidemiological investigation was conducted to find out the source of infection, though the fungus occurs as a saprophyte in Indian environment. Chemotherapy was done with 2% solution of tincture iodine. In the author's view, this appears to be the first report of dermatophytosis in the bear due to *M. gypseum*.

INTRODUCTION

Dermatophytosis (ringworm, tinea) is the most frequently occuring mycotic disease of man and a wide variety of animals including birds (Ainsworth and Austwick, 1973; Pal, 1988; Pal *et al.*, 1990; Pal and Lee, 1996). The disease is of economic as well as public health importance (Pal, 1987; Pal and Matsusaka, 1991), and is world-wide in distribution (Ainsworth and Austwick, 1973; Pal, 1989; Pal and Thapa, 1993). The available literature did not mention any information on ringworm in the bear (Monga and Mohapatra, 1980). Hence, the present paper wishes to put on record of natural infection due to *M. gypseum* in a young pet bear following an injury with soil contaminated object.

MATERIALS AND METHODS

The skin scrapings with hair collected from the active margin of the cutaneous lesion situated on left side of the rump of the bear under aspetic condition were submitted by the Veterinarian to the laboratory of Veterinary Public Health. The animal belonged to a juggler in Delhi, was used by his master to exhibit shows in the streets of rural areas of Delhi. A part of the sample was digested in 10% KOH for 15-20 minutes and examined under light microscope for the fungal elements, if any. The remaining sample was inoculated into three slants of Sabouraud dextrose agar with chloramphenicol (0.1 mg/ml) and actidione (0.5 mg/ml) and nutrient agar and these were incubated at 25°C and examined daily for fungal growth over a penod of three weeks. The microscopic morphology of the culture was studied in "PHOL" stain (Pat *et al.*, 1990). The "PHOL" stain contained 3ml of glycerol, 5ml of 4% aqueous solution of formaldehyde and 0.3ml of 3% aqueous solution of methylene blue. The detailed identification of the isolate was made according to the criterion laid down by Robell and Taplin, 1974. The treatment was done with 2% solution of tincture iodine; and the drug was applied daily two times for 21 days on the lesion after the removal of crusts.

RESULTS

On physical examination, the bear showed one irregularly crusted scaly patch of about 2.5 x 3.7 cm in diameter on the left side of the rump. Urine, faeces and respiratory parameters were normal. There was no evidence of lice or tick on the body of animal. Microscopic examination of the infected crusty material in 10% KOH failed to demonstrate mange mite but showed fungal hyphae and arthrospores charecteristic of dermatophyte. There was no growth of bacteria on nutrient agar but on Sabouraud medium the flat, powdery, buff - coloured colonies were observed after 7 days of incubation at 25°C. In "PHOL" stain, the culture exhibited many cylindrical shaped macroconidia with 4-6 septa and few small, club-shaped microconidia. The isolate was identified as *M. gypseum*. The topical application of tincture iodine was found effective in curing the ringworm lesion of the pet bear. No mycological follow up was possible to evaluate the response of the drug. Only clinical improvement noticed by the animal owner was reported to the Veterinarian.

DISCUSSION

The absence of bacteria and ectoparasites in the clinical material, detection of dermatophyte both by culture as well as direct microscopy and clinical response with tincture iodine indicate that the animal had dermatitis due to *M. gypseum*. The breach to the skin by a soil contaminated object may be considered an important predisposing factor in the present case. As *M. gypseum* is recovered from the soil in India (Pal and Matsusaka, 1990), it is quite likely that the fungus would have entered the host following the injury to the skin. However, no epidemiological investigation was conducted to establish the source of infection.

Mycosporum gypseum has a wide host range and natural infection has been recorded in baboon, black buck, cat, cattle, chamois, chimpanzee, chinchilla, daman, dog, fowl, gerbil, guinea pig, horse, kiwi, leopard, lion, marsupial, monkey, mouse, parrot, rabbit, rat, rodent, tapir, tiger besides man (Ainsworth and Austwick, 1973; Pal, 1988; Pal, 1989; Pal *et al.*, 1994). The demonstration of *M. gypseum* by direct microscopy and the culture of the clinical specimen from the dermatitis of the pet bear perhaps records a new host for this geophilic fungus. Further studies should be undertaken to investigate the etiologic role of *M. gypseum* in dermatological conditions of the zoo and wild animals.

Since ringworm infection simulates bacterial folliculitis, scabies and streptothricosis, the direct microscopical detection of the fungal pathogen and its isolation from the clinical specimen is highly imperative to confirm an unequivocal diagnosis of the disease.

The emphasis is given on early diagnosis and prompt chemotherapy to prevent the further spread of the organisms in the environment of susceptible animals and man.

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ACKNOWLEDGEMENT

The author is greatful to Dr. G.D. Dube, Department of Animal Husbandry, Delhi for sending the skin scrapings and clinical history of the animal.

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Indian vet J. 54, January, 1977 : 84

AFLATOXICOSIS IN TUFTED POCHARD DUCKS

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Following an outbreak of Turkey 'X' disease (Blount 1960), a considerable amount of literature had accumulated on aflatoxicosis. Two carcases of tufted pochard ducks were received from Nehru Zoological Park, Hyderabad, for postmortem examination. These birds were reported to have been fed with fungus-contaminated groundnuts. The livers were removed/fixed in 10% neutral buffered formol saline. Paraffin sections were prepared and stained by haematoxylin and eosin, Gomori's reticulum stain and Perl's stain.

The livers were considerably enlarged grossly, reddish brown in colour with fairly rounded borders. Lungs were congested and the other organs did not present any significant changes.

Histologically, the livers presented a variable degree of necrosis with biliary and mesenchymal cell proliferation. Necrosis often involved the peripheral and adjacent midzones and at times the centrilobular zones. Hyperplastic bile ducts appeared as cords radiating from the portal tracts (Fig. 1). The proliferated mesenchymal cells extended from the portal tracts into the liver lobules, dividing them into several small islands, resembling pericellular cirrhois (Fig. 2). There was periphlebitis and engorgement of the sinusoids. Eosinophilic hyaline bodies were noticed frequently in the degenerating hepatocytes (Fig.3). In the necrotic areas, macrophages were heavily laden with haemosiderin.

Eosinophilic hyaline bodies in liver were reported by Newberne *et al* (1964). They were reported to be the degenerative changes of hepatic endoplasmic reticulum due to toxin (Nayak *et al* 1969). They were prominent in the liver in this study. The histological evidence of haemosiderin observed in macrophages might be due to the release of iron from severely damaged liver cells. The histological changes associated with the history that these birds were fed with fungus-contaminated groundnuts, which fluoreced under ultraviolet light indicated aflatoxicosis. The toxin was extracted from the feed and identified as aflatoxin by thin layer chromatography.

Acknowledgment : The authors are thankful to Dr. G. Venkataratnam, Dean of Veterinary Faculty and Dr. C. V. Rao, Associate Director of Research (Vety.) for their valuable guidance.

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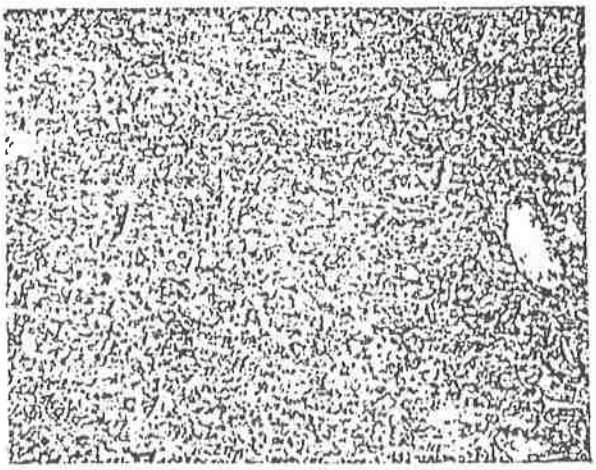

Fig. 1 Severe hepatic cell necrosis involving the peripheral zone, with extensive bile duct hyperplasia.
H. & E. ×100

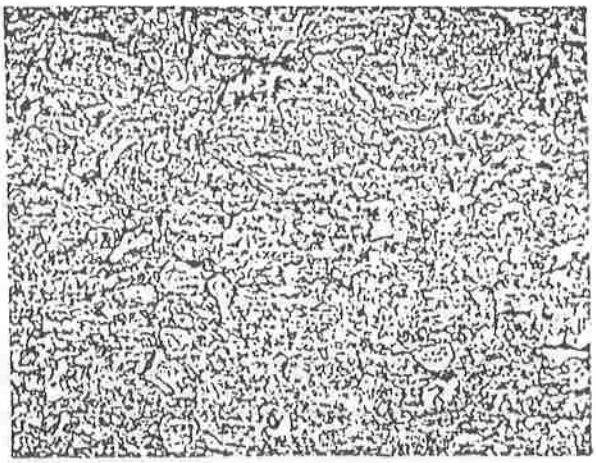

Fig. 2. The reticulum fibres dividing the hepatic lobule, altering the liver structure. Gomori's reticulum stain. × 100

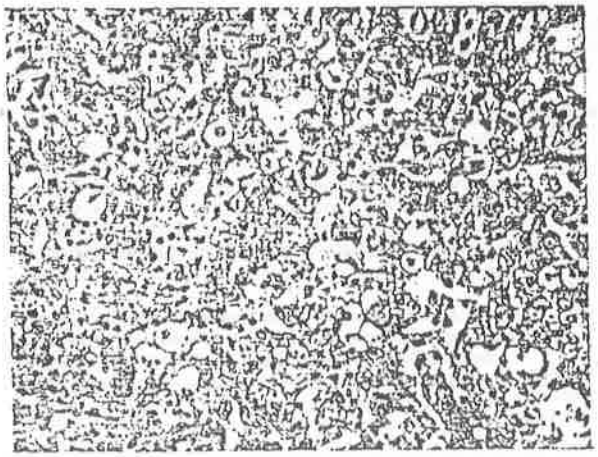

Fig. 3. Eosinophilic hyaline bodies in the degenerating hepatocytes
H. & E. ×250

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Reprint : Zoos' Print, 6 (11) : 1-4, November, 1991

THE ELEPHANT

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The elephant is the largest living mammal in the land and has an evolutionary history of more than 60 million years. They are classified under the order Proboscidae. Of the large number of different types of elephants which at one time seen in the earth, only two remain, the African elephants and the Asiatic elephants.

The existing elephants are classified as follows:

Genus - Loxodonta
Species - *Loxodonta africana*
Races - *L. africana africana* (Bush elephants)
- *L.africana cyclotis* (Forest elephants)

Genus - Elephas
Species - *elephas maximus* (Asian elephant)
Races - *Elephas maximus ceylonicus* (Ceylon elephants)
- *Elephas maximus sumatranus* (Sumatra elephants)
- *Elephas maximus hirsutus* (Malayan elephants)
- *Elephas maximus indicus* (Indian elephants)

The Indian elephants are seen in 2 varieties, *Elephas maximus dakhamensis*, and *Elephas maximus bengalensis*. There are several differences between the two living species, African elephants and Indian elephants. The main points of difference are as listed in Chart I at the end of this article.

The trunk is the most distinctive feature of the elephant and is the most lengthy nose in the animal kingdom. This is simply the elongated upper lip, composed of flesh and muscles and is used in multiple ways for the animals day-to-day work. The elephants sense of smell is greatly developed and raised up trunk can test the breeze for scents that may reveal the presence of hidden enemies and it also helps to determine whether an object is edible or not. The finger-like process at the tip of the trunk combined with a little suction enables the elephant to pick up object as small as a pin. The sensory nerve endings at the tip of the finger-like process at the tip of the nose, can transmit impulses as to the shape, texture, temperature, etc.

The ears vary greatly in size between the African and Asiatic species. Both have an excellent hearing power. They eyes are smaller to the size of the elephant and sight is poor.

The dental formula of the elephant is I 1/0 1/0 M 6/6 6/6. In elephants the canines and all but two of the incisors are lacking. The two incisors have undergone an exaggerated evolutionary development to form the tusk in males and tushes in the females. Only about 2/3 of their total length is visible remaining portion being embeded in the bone of the skull.

There are also tuskless male elephants which are known as "Makhanas". These Makhanas are stronger than the tuskers and their trunk is more powerful and is broad at the base. A pair of milk-tusk which appear first at the age of about 8 months and are shed between the first and second year. In African elephants both bulls and cows will possess the tusk. The molars are big, commonly measuring about 30 cms. or one foot in length and weighing about 2.7 to 3.6 kg or 6 to 8 lbs. The vertebral formula is C 7 D 19-20 L4 S4 Cy 30.

The heart is having twin apexes and there is only one Coronary artery. superficial veins can be observed on the exterior and interior of the Ears, on the antenor surface of proximal forelimbs and on the medial aspect of distal portion of the rear limbs. The Liver has no Gall bladder. The inner Pancreatic duct opens at the same level as the bile duct in the opposite wall of the duodenum. The pleural cavities although present in the young one, is obliterated in the adult and the lung is adhered to the chest wall and so the elepnant has no Pleural cavity.

Elephants have a single stomach and its digestive system is similar to that of horses. The small and large intestines are about 65 to 75 ft. or 19.8 to 22.8 M and 35 to 45 ft. or 10.7 to 13.7 M respectively in length. The caecum presents three taenic caecel and three rows of sacculations in its wall.

A notable feature of the elephant's male reproductive tract is the absence of a Pampiniform plexus, Cremaster muscles and Inguinal canal. The testis is intra-abdominal in position. The mammary glands are pectoral in position and the milk secretion is from lactiferous ducts opening on its apex.

The elephants can rest standing and will sleep by lying on their sides with their trunk coiled for several hours. Life span is 50 - 70 years.

Elephant has a small surface area that radiates heat away from its large body. They are unable to tolerate high temperature and direct sunlight for a very long time without access to shade or cool water. Spraying itself with sand, evaporation of moisture from the trunk during the respiration, radiation of heat from ears, wallowing, throwing slush on its back, standing in shade, eating a great quantity of succulent plant materials are the methods adopted to cool their body.

Captive elephants can grow faster than wild elephants, owing to better plan of nutrition, decreased parasiticism, in addition to the genetic inheritance. In the wild, a mature elephant will spend as many as 18 hours per day feeding, consuming as much as 280 kg of food. Obviously the food consumed in the wild is low in nutrients and high in fiber. Normally food passed through the elephants digestive tract takes 24 to 50 hrs.

Elephants adapt well to receive water once or twice per day; unless the ambient temperature is quite high in which case they require water more often. Adult elephants consume an average of 140 to 200 lts of water per day, but smaller elephants require less.

Good records of growth rates are the useful index to the plan of nutrition and the evaulation of an individual animal's condition and health. An accurate perpendicular measurement of height at the shoulder in case of African elephants and highest point at the middle of the back in Asiatic elephants using Benedict's measuring scale is the best indication of growth rate. A number of methods, formulae and equations have been derived that permits accurate calculation of the body weight. The best prediction of total suface area (S) in m 2 was obtained for an adult elephant irrespective of sex by using the two parameters, the height at the shoulders (H) in a m and fore foot pad circumference (FFC) in m in the formula S = - 8.245 + 6.807H + 7.073 FFC (Sree Kumar and Nirmalan 1990).

Reproductive Parameters

The female elephant attains maturity at the age of 15 +/- 2 years in captivity. Studies have shown that females can conceive from the seventh year onwards. The males are often sexually matured at 14 - 15 years of age.

Elephants do not have a breeding season. Female elephants have an oestrus cycle of 20 - 27 days with a mean of 22 days. But oestrus signs are not predominent in the female elephants except the exhibition of willingness to be mounted by a male and attempt at arousing the male. The olfactory stimuli play an important part in the male's ability to detect oestrus, probably from a specific odour emiting from female genetalia. The oestrus lasts 3 to 4 days.

Gestation period is 18 to 22 months. Labour (delivery) is usually completed within one hour after labour pains are noticed. New born calves should be up, walking in 15 to 60 minutes after birth and it is important that they be provided with good traction to help them stand up and stay on their feet.

The elephant milk is white, watery and sweet with ph ranging between 6 and 7. Fat contents differ from 5.8 % to 19 % and fat increases is sudden at weaning time. The calf will suck the milk of the mother beyond 4 years of age unless it is weaned. The weaning is being done at the age of 2 years. The time of weaning is determined by the ability of the animal to digest the green fodder. Composition of elephants' milk is given in Chart II and the end of this article.

Musth in Elephants

Male Asiatic elephant in captivity or Wild state shows periodically the phenomenon of "Musth", which is characterised by enlargement and dischange of the temporal glands. This gland is a paired organ found on either side of the head located just beneath the skin in the subcutaneous fascia, above the zygomatic arch. Its duct opens at the temporal pore close to the lateral canthus of each eye. During the Musth period the gland gets enlarged and discharges the temporal gland secretion, excessive bulging out of the perineal part, frequent erection of penis as well as dribbling of urine. The temperament is highly unpredictable and the Musth elephant will be easily provoked by slight sensual irritation. Musth will be exhibited by all healthy males over 20 - 25 years. Annual periodicity is noticed, and the duration ranges from 3 weeks to 3 months. During Musth, males are signalling that they place a very high value on oestrus females, whereas non musth males, no matter how old or large, they are in a low value on receptive females. During Musth the circulating testosterone is increased from normal 0.2 to 1.4 ng/ml level to 29.6 to 65.4 ng/ml than the non-musth levels. Musth males can be observed year-round, although the frequency of Musth is high following the rainy season. The number of males in Musth per month correlates closely with the number of females observed in oestrus. Though the period of oestrus lasts only 3 - 4 days and Musth may last several months, the onset of musth in a male is not necessarily triggered by the onset of oestrus in a particular female.

The non-volatile chemical composition of the temporal gland secretion (TGS) of an Asian elephant is given in Chart III.

Certain Physiological Data of Indian Elephants is given in Chart IV at the end of this article.

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CHART I
Comparative differences between

African elephants	Indian elephants
1. Larger in size (6000 kg)	Comparatively smaller (5000 kg)
2. Taller in height (3.5 to 3.85 M)	Comparatively shorter (3 to 3.25 M)
3. Highest point at the shoulder	Highest point at the middle of the back
4. Ears are larger (1.6 X 1.0 M)	Comparatively smaller
5. Small trunk	Larger trunk
6. Transverse ridges and groves on the trunk	More or less uniform
7. Two finger-like process at the tip of the trunk	Only one finger-like process
8. Large tusks (3.5 M - 130 kg.)	Small tusks (2.66M - 73 kg.)
9. Tusks in both males and females	Tusks only in males
10. Four nails each on forefeet	Five nails each on forefeet and sometimes four each
11. Four nails each on hind feet	Four nails each on the hind feet, sometimes five each.
12. Marked dip on the back between fore and hind quarters	Back an unbroken convex curve
13. Elongate and narrow face with flat fore head	Bull dog face with twin domed forehead
14. Skin coarser and lacks the depigmentation areas	Smooth skin with white or pinkish depigmented areas
15. Temporal glands secrete in both males and females	Temporal gland secretes in males only and that too during musth
16. Less intelligent	More intelligent
17. Difficult to domesticate	Easy to domesticate

CHART II
Composition of Elephants milk
(Compiled from Dr. G. Nirmalan's Report)

Sp. gravity	- 1.023	- 1.038
Total solids %	- 16.4	- 28.55
Total ash %	- 0.57	- 0.8
Fat %	- 5.8	- 49.0
Total protein %	- 4.4	- 5.4
Casein %	- 1.4	- 2.5
Lactose %	- 3.4	- 5.4
Calcium mg %	- 84.6	- 178.0
Phosphate mg %	- 186.0	- 309.0
Vitamin C mg %	- 0.25	- 0.4
Choloride mg %	- 42.0	- 64.0

CHART III
Temporal gland secretion (TGS) of Asian Elephant

Protein Mg/ml	- 25.000
Urea mM/L	- 3.840
Acid Phosphate m.M/mg protein	- 0.072
Alkaline Phosphates m.M/mg Protein	- 1.193
Triglycerides mg %	- 15.000
Amylase (Somogy I units/100ml	- 146.000
Lacticdehydrogenase m.M/mg protein	- 0.449
Cholestrol mg %	- 80.000
Sodium mg %	- 279.000
Potassium mg %	- 58.500
Calcium mg %	- 9.300

CHART IV

Physiological Date of Indian Elephants

Compiled from Dr. G. Nirmalans report - 1989)
Vety. College Mannuthy

Normal Temperature	- 35.9.° C (96.6 ° F)
Respiration	- At rest 4 - 6 breaths / minute
Standing	- 10 breaths / minute
Excited	- More than 15 breaths / minute
Pulse Lying down	- 35 beats / minute
Standing	- 28 beats / minute

Constituents	Adult Male	Adult Female
1. RBC Count (Millions/mm³)	- 2.47	- 2.40
2. Haemoglobin gms %	- 10.24	- 10.72
3. Haematocrit %	- 34.80	- 34.80
4. MCV (/U3)	- 142.00	- 116.90
5. MCHG (%)	- 29.69	- 31.06
6. ESR (mm/hr)	- 63.40	- 51.30
7. Leucocytes (thousands/mm³)	- 8.78	- 9.81
8. Neutrophils (%)	- 34.10	- 32.30
9. Eosinophiles (5)	- 6.10	- 6.60
10. Basophils (%)	- 0.70	- 0.90
11. Lymphocytes (%)	- 52.81	- 56.20
12. Monocytes (%)	- 6.01	- 3.90
13. Total NPN (mg/100 ml)	- 32.66	- 35.45
14. Urea.N. (Mg/100 ml)	- 12.04	- 15.40
15. Uric Acid (mg/100 ml)	- 2.45	- 2.73
16. Creatinine (mg/100 ml)	- 1.95	- 1.88
17. Free Amonia (mg/100 ml)	- 7.38	- 7.51
18. Total Plasma Protein (gm %)	- 8.49	- 9.25
19. Plasma Albumin (gm%)	- 2.36	- 2.10
20. Plasma Globulin (gms %)	- 5.56	- 5.50
21. A/G Ratio	- 0.40	- 0.34
22. Plasma Fibrinogen (gm %)	- 0.57	- 0.65
23. Blood Glucose (mg/100 ml)	- 59.54	- 52.86
24. Blood Chloride (")	- 488.00	- 496.00
25. Blood Inorganic Phosphate (")	- 4.47	- 4.07
26. Blood Calcium (")	- 11.80	- 12.50
27. Blood Magnesium (")	- 2.06	- 2.33
28. Total cholestrol (")	- 111.38	- 93.66

	In Adult elephant
29. SGOT (R.F. Units / ml)	- 13.60
30. SGPT (R.F. Unite / ml)	- 4.73
31. Alkaline Phosphatase (B. Unites/100 Ml)	- 1.25
32. Acid Phosphatase (B. Units/100 Ml)	- 0.35
33. Amylase (S. Units / 100 ML)	- 381.09

Reprint : PASHUDHAN, Volume 7, Issue 6, June 1992 : 5

Chronic metritis in a captive Indian elephant (*Elephas maximus*): A case report

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The Indian elephant (*Elephas maximus*) is a common animal exhibited in most of the zoological parks. The Nandankanan Biological park, Orissa has been exhibiting elephants since the date of its establishment (December 1960). The present paper records a clinical case of chronic metritis in one of the she-elephants of the park.

Case history

One of the five she-elephants of the park, aged about 80 years, showed intermittent uterine bleeding consisting of fresh blood, blood clots and reddish uterine discharges from June 1, 1987 to June 21, 1987, from August 11, 1987 to September 30, 1987 and from July 4, 1988 to July 22, 1988. The body temperature, food intake, urination, defecation and general behaviour were normal during these periods. No abnormality was detected when examined per vagina. Smears from vaginal washings when stained with pappanacolaeu technique were found negative for any cancerous cells. The animal was being used for joy rides of the visitors as usual except during the period of illness.

During each bleeding period, the animal was treated with antibiotics (six vials of Dicrysticin-S large dose i/m daily once for 6 days) and stryptics (methargin 10 ml. and chromostat 50 ml. i/m once daily for 5 days with 100 Styplon tablets orally daily for 7 days) and uterine antiseptics (Bangshil @ 100 tablets daily for 10-30 days) orally. Uterine irrigation with Acriflavin solution (1 in 100) was also done but without any apparent effect.

On August 8, 1988 an enlarged hard swelling (30 cm x 45 cm) appeared on the perennial region with the tapering end towards the vagina. Manual examination of vagina revealed presence of neurotic debris admixed with blood clots and partial blockage of long vaginal canal. The animal was treated with antibiotics, stryptics and uterine antiseptics as before along with hot fomentation, anti-septic vaginal wash etc. without any apparent benefit.

Eventually, anorexia and debility developed. Profuse uterine discharges were seen in later stages and the animal died on August 25, 1988 (after 15 months of showing the first clinical signs of uterine bleeding).

Post-mortem examination

Post-mortem examination revealed the prolapse of the ulcerated uterus with metritis measuring about 50 cm in length and 25 cm in diameter into the vaginal canal and congestion of visceral organs.

Histopathological examination of the uterus suggested chronic suppurative metritis associated with extensive fibrosis and haemorrhages. Nephritis, toxic hepatitis and chronic enteritis were also noted.

Perusal of available books (Evans, 1910; Fowler, 1986) did not reveal any report of such condition.

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Reprint : Zoos' Print, 13 (9) : 49, September, 1998

NOTE

ENTERITIS AND IT'S TREATMENT IN AN ASIAN ELEPHANT

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Diet induced gastrointestinal disorders are commonly reported in Asian elephants (*Elephas maximus*) (Vasantha & Yathiraj, 1990). A thirty year old male tusker (Lalbahadur) at Jaldapara Wildlife Sanctuary, weighing about 4 tonnes, was suffering from enteritis. The animal was said to be eating soil and taking partial food even two weeks before the onset of symptoms.

The animal when examined evinced symptoms of abdominal pain. The projectile catarrhal diarrhoea had an unpleasant odor and contained mud. On day 2, faeces became so fluidy that it smeared the tail and inner side of the hock. Subsequently the animal became severely dehydrated with body temperature touching 40°C. Blood, urine and faecal samples were collected for laboratory analysis; the results of which are as follows. The normal values for Asian elephants provided by Joshi (1991) has been given in brackets.

Blood samples showed TRC 3:1(2.81) millions/cmm; Haemoglobin- 9:5 (13.4) g/dl; TLC-8.6 (10:2) thousand/cmm; Neutrophils 36% (36.5); Lymphocytes - 56% (51.7); Monocytes- 3% (2.2) and Eosinophil 8% (9'4). Urine had a specific gravity of 1.20 and a pH of 7, and was negative for albumin, bile salts, sugar and sediments. Fecal sample was negative for parasitic ova. The condition was therefore ascribed to diet-induced enteritis. The treatment was oriented towards the restoration of fluid balance.

Phase-I

a. Inj. Rintose(R) (Wockhardt) - 540 ml x 5 bottles I/V. daily.
b. Inj. Oxysteclin(R) (Sarabhai) - 90 ml I/M daily.
c. Inj. Pepsid(R) (Concept) - 40 ml I/M daily.
d. Electronion(R) (Merdk) - 300 gms. Orally-daily.

The above treatment was continued for 5 days. As there was no marked improvement in the overall condition of the animal, the line of treatment was changed. Abdominal pain, diarrhoea and partial anorexia were still present.

Phase-II

a. Tab. Lomofen(R) - (Searle) - 5 tablets four times daily.
b. Cap. Digiplex-T(R) - (Rallis) - 5 tablets four times daily.
c. Minamil(R) - (Brihans) - 50 Gms. daily.

Ripe banana (30 pcs daily) and sugarcane juice (two litres daily) were given along with these drugs. Soon after the commencement of phase-II treatment, the animal regained its appetite and the dung became normal. Banana and sugar-cane juice were continued for two months even after recovery.

The author grateful to Mr. S. Mukherjee, I.F.S. D.F.O. Wild Life Division-III, Cooch Behar Division for providing the facilities.

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Reprint : Zoos' Print, 12 (12) : 2-3, December, 1997

DROPSY IN AN INDIAN ELEPHANT (*Elephas maximus*)

S.P. Sharma, R.S. Chauhan* and G.C. Gupta

Introduction

"Project Elephant" was initiated during the year 1991 to strengthen the conservation wearness in all Protected Areas of India (Anon, 1993). One of the major recommendations of project elephant is the establishment of Veterinary care for the sick animals in and around the park area to provide therapeutic and preventive facilities. The present study describes a case of dropsy in an old Indian elephant, its haematobiochemical observations and the line of treatment adopted.

Case History and Clinical Observations

Director, Corbett Tiger Reserve, Ram Nagar (Nainital), again more than 70 years Uttar Pradesh reported that a she-elephant named 'Gulbakali' belonging to Bijrani block of Corbett Park has been suffering from some my stenous disease for the last one month or more.

On enquiry, the mahout told us about the uneasines, oliguna, inappetance and a swelling in the ventral abdomen with almost normal water intake and defecation. clinical examination revealed a large oedematous swelling in the postenor half of ventral abdomen which was painless, soft, cold and pitted on pressure (Fig.1). A clear transparent watery fluid oozed out drop by drop on needle puncture. The animal skin coat was leathery with decreased subcutaneous fat. Body temperature, pulse and respiration rates were found to be within normal limits. Urine, faecal, blood and oedematous fluid samples were collected for laboratory investigations which were carried out by adopting standard techniques as described by Chauhan (1995).

Result and Discussion

Unne sample collected was turbid with an alkaline pH. It was negative for portein, sugar, blood and ketone bodies but was positive for bile pigments. A moderate number (++) of crystals of calcium oxalate and triple phoshate were observed on microscopic examination of unnary sediment. Culture examination of both unne and oedematous fluid failed to demonstrate any bacteral growth. Haematobiochemical observations are presented in the table. Coprological examination demonstrated a large number of Strongylid eggs.

The line of treatment suggested by us inclued parenteral administration of Frusemide (Lasix)*, streptopenicillin, Vitamin B complex with liver extract and oral administration of diuretic mixture consisting of potassium nitrate, Magnesium sulphate and Ammoniam chloride. The above treatment continued for a week. Fenbendazole boli (Panacur)* were also given once orally. A good nutritious diet consisting of sugarcane tops, wheat flour, gur and mineral mixture was also advocated for the sick elephant. There was a significant improvement in the body condition of the animal and the large oedematous swelling almost disappeared leaving thick skin cushion at the site within 15-20 days after institution of therapy.

It was evident from haematobio chemical values that the animal was having hypoprot einemia and hyper chromic microcytic anaemia (Serum protein 68 g/l, MCV 47.887 fl and MCHC

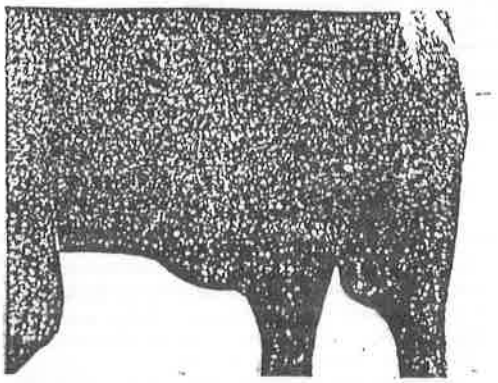

Fig. 1 Subcutaneous oedema (Dropsy) in Ventral abdomen of an elephant

54.117 g/dl). A significant high serum bilirubin level (25.65 u mol/l) in comparison to normal values ranging from 1.71-5.13 u mol/l was indicating a hepatic injury. The alterations in other haematobiochemical parameters observed here fall within normal limits reported for Asian elephants. According to Caple et al. (1978), the causes of dropsy varies but most often associated with hyproteinemia and anaemia. This confirms our observations in the present case. Hypoproteinemia and anaemra recorded here may be due to moderate to heavy

Table: Haematobiochemical changes in an Indian elephant with dropsy

Parameters Studied	Haematobiochemicals values
TEC	3.55x10 12/1
Haemoglobin	92 g/l
PCV	17%
TLC	4.7x10⁹/1
MCV	47.887 fl
MCHC	54.117 g/dl
Differential leucocytic count:	
Neutrophil	47%
Lymphocyte	43%
Eosinophil	2%
Monocyte	8%
Blood Sugar	6.549 m mol/l
Blood urea nitrogen	1826 m mol/l
Serum Creatinine	53.04 u mol/l
Serum protein	68 g/l
Serum bilirubin	25.65 u mol/l

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stronglid infection, poor quality of food consisting mainly of dry peepul leaves and some hepatic damage as reflected from the higher bilirubin values. Fowler (1986) indicated that large oedematous pockets can develop in any of the dependent areas of elephant's body which associated with general debility and stress.

Acknowledgement

Authors are thankful to Dean, College of Veterinary Sciences, Pantnagar for providiing necessary facilities. Thanks are also due to Director, Corbett Park and his staff members in rendering help during Clinical examination and collection of samples for laboratory investigation.

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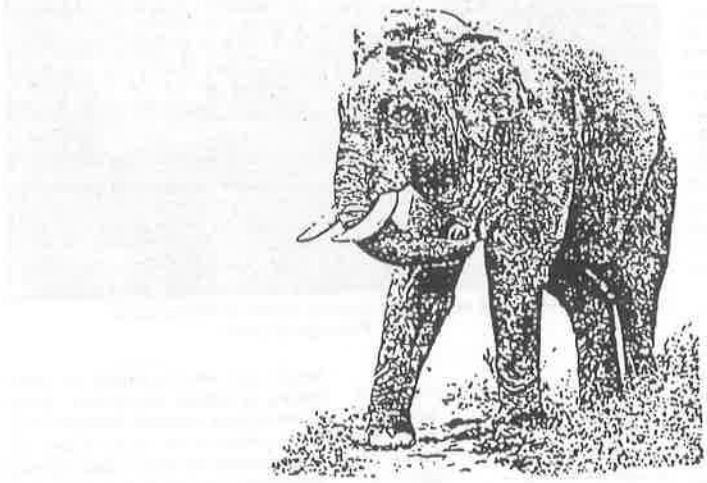

Reprint : Zoos' Print, 11 (4) : 13, April, 1996

PHOTOSENSITIZATION AND IT'S TREATMENT IN AN ASIAN ELEPHANT - A CASE REPORT.

N. Paneer Selvam*, R. Thiruthalinathan*, D. Swaminathan* and V. Krishnamurthy**.

INTRODUCTION

Photosensitization is hypersensitivity of thinly haired skin to direct sunlight. It May be due to the abnormal presence of a photo dynamic agent (pigment) in the peripheral blood. This condition occurs following acquisition of photo sensitizing substances in the body (or) failure of the body to excrete photosensitizing substance that are normally metabolised by the liver and excreted in bile. Though it is common in domestic animals, very rarely reported in wild animals. Among the wild animals, Elephants are more prone to this problem due to their mode of transport i.e., they are exposed to sunlight for prolonged duration when they are translocated to long distance by walk under mild sedation.

CASE HISTORY

A fifty years old, male Asian Elephant (*Elephas maximus*) weighing approximately 5 tonnes was tranquilised using Acepromazine HCl (90mg) and Xylazine HCl (300 mg) intramuscularly to translocate from Srirangam to Madras, within that week, the animal was tranquilised twice earlier using Acepromazine HCl. After mild sedation sets in, the animal was made to walk during hottest peak of summer. While doing so, the animal developed photosensitization reaction due to prolonged exposure to sunlight in addition to transquilisation using phenothiazine derivative - Acepromazine HCl.

CLINICAL SIGNS AND TREATMENT

While transport, the animal became dull all of the sudden and the skin on the dorsal aspect of the abdomen, forehead, and ears showed hyperemic changes in addition to bilateral keratitis and also which in turn became edematous and necrosed, later formed the dry gangrene followed by sloughing of the epidermis of the skin.

As the condition was diagnosed as photo sensitization, immediately the animal was given rest under shade thereby further exposure to sunlight was avoided then the following treatment was adopted.

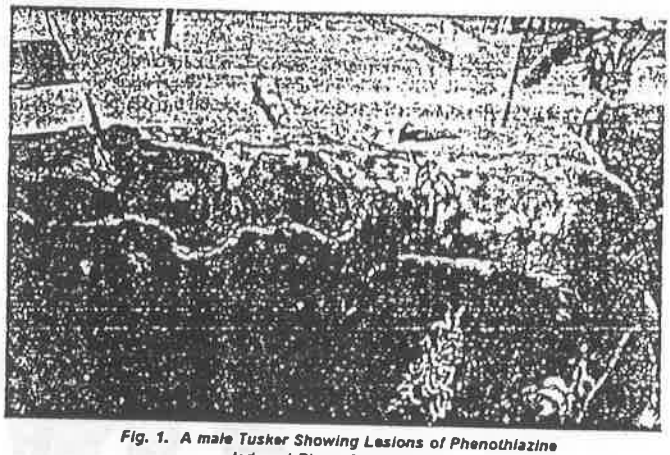

Fig. 1. A male Tusker Showing Lesions of Phenothiazine Induced Photo-Sensitization

1. Inj. ringers lactate -540 ml x 5 bottles-I/V
2. Inj. Tetracycline -30 ml - I/M
3. Inj. Chloril -20ml - I/M
4. Inj. Beekom-L -20ml - I/M
5. Electral Powder -500gms-orally

The above treatment was continued for 5 days. Simultaneously Himax ointment was applied over the skin lesions initially for a week followed by dressing with sulphanilaine and Absorb Powder. Cold water was sprinkled all over the body daily.

RESULTS AND DISCUSSION

On reaction to intense treatment and rest under shade, the animal responded on fourth day by started feeding and the skin lesions completely healed in 20 days. Various authors (Clarke, N.T.1947; Bijmal, G and Patnaik, B.1961) reported photosensitization reaction in cattle and sheep following the administration of phenothiazine derivatives. Since their administration in domestic animals has a direct (or) primary photosensitization effect i.e., without interfering the liver function tests, it was diagnosed and treated easily. Though photosensitization usually involves unpigmented skin, but in the present case it involved pigmented skin which supports the earlier finding by Gibbon W.J.(1953). Since phenothiazine induced photosensitization is limited to the ocular tissues, besides bilateral keratitis, it also involved pigmented skin which is in contrary to the earlier reports by clarke, N.T.(1947); Bijmal, G and Patnaik, B.(1961).

ACKNOWLEDGEMENTS

Authors are grateful to Mr. R. Sundararaju, I.F.S., Director and Mr. M.Jaganatha Rao, I.F.S. Deputy Director, Arignar Anna Zoological Park, Vandalur, Madras-48 for providing the facilities.

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Reprint : Zoos' Print, 11 (4) : 15-16, April, 1996

HAND-REARING WITH PATERNAL CARE OF ORPHANED INDIAN ELEPHANT CALVES AT ASSAM STATE ZOO, GUWAHATI.

D.B. Thakuria*, T. Barthakur** and P.K. Barborah***

During monsoon, flood causes havoc in Assam and threatens the lives of human as well as animals without any exception. Many baby animals of Wildlife Parks become orphaned or swept away by flood water and thereafter attacked/ killed by wild predators. Those fortunate babies specially of rhinos and elephants which are rescued by the Forest personnel or wildlife lovers are brought to this zoo.

Every year the zoo people wait with great enthusiasm to welcome the new arrivals of baby elephants to its family which is an exciting event for the keepers to offer "paternal care" for the young ones by "hand-rearing". Extra duties and attention have to be rendered by the Zoo Vets for management and protection of health of the orphans.

The calves have to pass through a series of physical stress during rescue/ capture and transportation. Moreover, they suffer from psychological stress on missing their family and maternal care.

INFANT CARE

The infants of 1-3 months old show a variety of problems, when they arrive at the zoo. They cry for some days in search of their mother and are reluctant to suckle milk from the feeding bottle. Of course, gradually they become accustomed with the feeding practice.

Very often they show stomach trouble like constipation, diarrhoea, flatulence, etc, while taking artificial diet. Therefore, cleanliness of the feeding equipments including hygiene and sanitation of the quarantine yard are to be monitored very carefully to avoid such complications.

Special attention and care have to be provided whenever any baby elephant arrives during extreme climatic condition as in winter or rainy season. When the babies are exposed to such extreme climatic change they usually suffer from pneumonia.

To combat against such climatic stress the following measures are adopted.

Winter Season

During night, fire is kept at a safe distance to warm up, bodies are covered with gunny bags and straw mattress are provided on the floor. During morning hours, calves are massaged with mustard oil.

Summer Season

At the beginning regular bathing is done near the quarantine yard and there after calves are taken to the pond daily along with the herd for wallowing.

The calves usually arrive with a variety of complaints which are to be dealt with immediate care and attention and till recovery are kept in the quarantine yard.

GENERAL COMPLAINTS

Traumatic injuries : Newly arrived calves are very prone to receive major/ minor traumatic injuries during rescue operation as well as transportation. Wounds are dressed with local applications and treated with antibiotics.

Stress and debility : Treated with normal and dextrose saline i.v. along with multivitamins. ORS are also given for a considerable period of time.

Fever : Treated parenterally with antibiotics and antipyretics are given orally.

Low body temperature : Nikethamide is injected i.v. with NSS and multivitamins. This condition is commonly observed during winter months.

Diarrhoea : Treated with anti-diarrhoeal drugs mainly Dependal M liquid given along with milk which gives satisfactory result.

Constipation :Tried with paraffin enema or Livomyn liquid given along with Gripe Water syrup.

Griping Colic pain : Gripe water syrup given along with enteromycitin gives a good result.

Pneumonia : Treated with antibiotics.

Worm infestation : Faecal samples are examined and anthelmintics are given accordingly. Deworming practice is carried out at 2-3 months interval depending on severity of infestation. Commonly, round worm infestation is observed. Liver flukes are found occasionally.

Diet

for 0 - 3 month infant : Lactogen powder - 500 gms.

Powder milk is mixed with luke-warm water and infants are fed at least 7 times at two hours interval. Feeding bottle is prepared with the help of a 750 ml conical glass bottle fitted with a piece of rubber tube of a bicycle.

for 3 - 6 month calf :Lactogen powder - 1 kg, boiled rice - 1/ 2kg, sugar - 50 gms

The method of preparation and feeding schedule of milk is same as above. In addition to it, 1/2 kg boiled rice is mixed properly with milk and sugar and then drenched to the calf. Formerly calves'(03-06 months) were fed with boiled barley which caused acute flatulence with discomfort colic pain. Then on trial, it was found that feeding with Lactogen milk

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with sugar and boiled rice giving good result in gaining body weight and growth.

for 6 - 12 month calf: Lactogen powder - 1 kg, sugar - 100 gms, athia banana - 4 nos, rice - 1 kg, masur dal - 250 gms

Milk is prepared by mixing properly with luke warm water with sugar and Athia banana (without seeds) and feed to the calves with the help of feeding bottle for 5 times a day. "Khisiri", is prepared by cooking rice and masur dal and offered to the calves 2 times a day.

for 12 - 15 month calf: Lactogen powder - 1.5 kgs, sugar - 100 gms, athia banana - 10 nos, rice - 1 kg, masur dal - 1 kg, soaked gram whole - 1 kg

The method of preparation of milk, sugar and athia banana is same as above and given 4 - 5 times a day. Khisiri and soaked gram whole is given twice a day.

for 15 - 24 month calf: Lactogen powder - 1.5 kg, sugar - 100 gms, athia banana - 10 nos, rice - 1 kg, masur dal - 1 kg, soaked gram whole - 1 kg, banana tree with leaves - 1 no, dol grass - 50 kgs (Also grazing in natural vegetation)

for 2 - 6 years sub-adult calf: When the calves attain an average age of two years, powder milk and sugar are withdrawn from the diet schedule which is replaced by the following commodities.

Soaked gram whole - 2 kg, sugar Cane - 1 kg, athia banana - 10 nos , molasses - 200 gms, garlic - 25 gms, turmeric (green) - 20 gms, black salt - 250 gms, common Salt - 25 gms, dol grass - 1 qtl, banana tree with leaves - 2-3 nos. (Also grazing in natural vegetation for 2-3 hrs).

for 6 year old sub-adult elephant: Soaked gram whole - 4 kgs, sugar cane - 1 kg, athia banana - 10 nos, molasses - 200 gms, garlic - 50 gms, turmeric (green) - 20 gms, black Salt - 500 gms, common Salt - 50 gms, dol grass - 1 qtl, banana tree with leaves - 4 nos (Also grazing in natural vegetation for 2 - 3 hrs).

TAMING

The calves that arrive at the zoo are completely wild and have to be tamed. They are chained properly and kept at a near sight of the herd until they are sufficiently tamed. Older the newly arrived calves, more the time required to tame them.

As soon as the new comer becomes completely tamed, it is allowed to mix with the herd during walking, bathing, exercise and grazing in the natural vegetation at least for 2 - 3 hrs a day. It is observed that within a short span of days the new comer becomes a member of the new family. During day and night elephants are chained and kept together within the herd.

TRAINING

When the calves attain an average age of 5 years and if they are normal from all aspects to go for training, they are then selected accordingly. At present the Zoo is rearing 12 nos. of Indian Elephants of different age group (Table).

There are 5 mahouts and 2 helpers who are giving training to the elephants. Usually training is given within the herd. The elephants are trained with the following procedures - stop; proceed; move forward/ back; sit down; get up; lie down to right/ left; open mouth/ raise trunk; pick up objects; drag objects

Once the elephants are trained, they are engaged in minor works like lifting/ dragging of the bundles of grass, banana trees, etc.

Previously trained elephants from this zoo either transferred to other wildlife sanctuaries/ parks or abroad on exchange basis. Since 1967, 8 elephants were transferred to different parks within the country and 2 abroad (Belgium) in exchange of 2 Chimpanzees, still there is a proposal for transfer of 2 elephants to the M.M.C. Zoological Park, Chhatbir, Punjab, on exchange basis.

For the first time "elephant joy ride" event is introduced for children visitors to the Zoo which was inaugurated on the 41st Wildlife Week. Presently for this purpose four trained elephants are engaged.

Table. Present status of orphaned Indian elephant calves reared at Assam State Zoo, Guwahati

CALL NAME	DATE OF RECEIPT	AGE AT RECEIPT (APPROX)	SEX	TRAINED (T) OR UNTRAINED (UT)	PRESENT AGE (APPROX)	HEIGHT (CM)
DIPKANYA	04.11.88	3 M	F	T	7 YR	184
MADHABI	24.08.89	2 M	F	T	6 YR	175
JOHN	30.05.90	2 M	M	T	5 YR	160
LAKSHMI	07.01.91	3 M	F	T	5 YR	155
MAYA	06.09.91	2 M	F	UT	4 YR	162
DOLI	09.04.92	4 YR	F	T	7 YR	168
CHILARAI	17.05.92	2 YR	M	T	5 YR	160
HEMANTI	06.07.92	1 YR	F	UT	4 YR	142
RAJKUMAR	17.07.92	1 YR	M	UT	4 YR	146
CHAMELEE	08.08.93	2 YR	F	UT	4 YR	140
LANKESWARI	17.01.95	15 M	F	UT	2 YR	133
RANI	12.08.95	21/2 YR	F	UT	2 YR	130

Reprint : Zoos' Print, 11 (6) : 20, June, 1996

"ERANDAKETTU" OR IMPACTION

Shri. Avanapparambu Maheshwaran Namboothiri

Causes of Impaction

- After a long hot walk if the elephant greedily gulps down water, or feeds, it can cause impaction.

- When the elephant is very hungry and feeds on large quantities of any fibrous food like coconut tree leaves, palm leaves etc. The dung will a itself become elongated like the fibre causing discomfort.

- Over consumption of grains and seeds can cause impaction. Seeds and grains are likely to sprout within. These will clump around in the intestine, causing a blockage.

- Elephants in Kerala enjoy a period of treatment and care (Sukha Chikitsa) once a year where they do not work but are just left under the care of the mahout and the doctor for improving their health rejuvinating. During this time they are given plenty of food and medicines (herbal). After this phase is over one has to be very careful with the digestion. Because of this treatment (which is Ayurvedic), the elephants are likely to have what is called 'Aamam' in their stomach. Aamam is related to the gas problem. When the elephant consumes food, some of it is likely to remain undigested and accumulate. Thus this Aamam deteriorates and may cause impaction.

- Indigestion may also cause impaction.

- Mud-eating can also cause impaction.

Remedies

Mahouts must immediately inform the employer in case of impaction. But mahouts must also be aware of what they can do as medical aid and in the absence of a doctor.

They can use hot compresses on the stomach and below. This may not help in the case of indigestion. They can also slowly rub the area with hot water. Steaming can also be done with hot water. While using the compress one must be careful. Water should be used only for some cases but it is safe to make a cloth compress of sand or fried sawdust. This method can be used for any stomach ailment. This hot compress method can be considered "first aid" because there will be times when the mahout will not have time to inform his employer or a doctor. A hot compress can be used in the meantime to alleviate the pain and condition. After 4 - 5 days of impaction, if the condition seems to be progressing the mahouts may give hot or warm water to drink. They may also give a rub with warm water. One must never use cold water for any stomach ailment. Even if warm water is not available, one must try and warm some water in the sun.

Some Pointers for Mahouts

- Never take an elephant out without chains (body chains). Even the most docile of elephants should be taken around on chains. If by accident something frightens it, like an unexpected noise or a brick falling, it may bolt and become very difficult to control without chains. Mahouts must always remember that with elephants one can never predict events.

- Mahout's common sense may save him and also his elephant. Much of elephant handling is learned from experience and observation. A mahout must always keep his mental faculties alert.

- Elephants are usually brought from other states especially Bihar in North India. When these elephants are brought to Kerala, the mahout gives commands in his own local language (Malayalam). The elephant not being used to this style may not respond. The mahout who does not understand this, beats the life out of the elephant until it performs the command (for example, to sit) by pure coincidence. The beating stops and the elephant may realise that he was asked to sit. This approach is wrong. In the case of elephants from other states, the mahout must learn the other command equivalent to his own command. He must then repeat this (other) command along with his own until the elephant realises that both commands mean the same.

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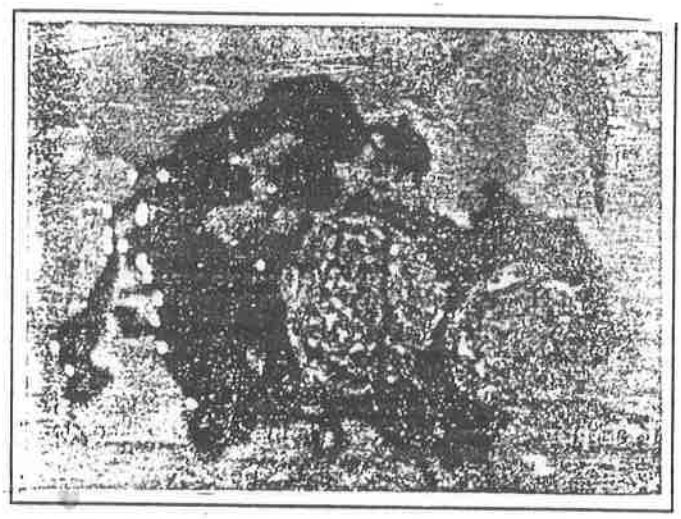
Reprint : PASHUDHAN, Volume 8, Issue 9, September 93 : 2



Cholelithiasis in an Indian elephant

A.T. Rao, L.N. Acharjyo, P.K. Dehury
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Choleliths seldom occur in domestic animals. In 1973, *Decker* and *Krohn* recorded a case of cholelithasis in an Indian elephant (*Elephas maximus*). The present report is apparently the second recorded case.

An elephant cow (Bhola) aged 35 years, was shot and killed as it was a nuisance to human and animal life and property. On post-mortem examination, it was observed that the intrahepatic bile duct contained four elongated, light in weight, dark green, seemingly fragile bile balls with crystals of cholesterol, weighing about 130 grams. The chemical estimation of the bile stones revealed the presence of cholesterol (12.5 mgm/100mgm) crude protein (19.8 mg/100 mgm) as well as the presence of bile salts and pigments. Such stones have been frequently seen in squirrels, monkeys and baboons maintained on diets containing high levels of cholesterol (*Jones* and *Hunt*, 1983).

Gall stones are usually found in the gall bladder at necropsy. They are occasionally found in the intrahepatic bile duct, as was seen in the present case. It is quite likely that some of the constituents of bile were resorbed during the elephant's life, leaving highly dessicated residues.

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Reprint : Zoos' Print, 11 (6) : 18, June, 1996

SOME TRADITIONAL MEDICINAL PREPARATIONS FOR AILMENTS

Shri Radhakrishnan

There are some herbal preparations that mahouts make in cases of minor ailments. Some of them are discussed below.

Stomach ailments

Mala inji (Special variety of Ginger), salt, garlic, pepper, asafoetida (fried, ground and powdered), all of these are ground well and made into a paste. This cannot be fed as it is, to the elephant as they won't eat it. A cup like depression is made inside a ball or "bolus" of rice (ration) and the medicine is placed inside this cup and covered with more rice.

The elephant must not see the medicine being prepared. Also, the person who has ground and prepared the medicine should not feed the elephant as the smell may warn the elephant. A person who has not touched the medicine should feed it. After the ailment has subsided the elephant is still fed asafoetida mixed with its rice for a few days.

Loosening the bowels

Asafoetida (*pal kayam*) mixed with *Inthuppu* (a combination of 5 different kind of salts) is given.

Improvement of appetite

Ashtachoornam (an Ayurvedic medicine)is fed to improve the elephants appetite. This should not be fed every day.

Gastric trouble and loss of appetite

Ashtachoornam, Inthuppu, tablets for gas problems (*Vayu Gulika*), wild cumin seeds (*Kattu Kadugu*), garlic, ginger, etc. are mixed and fed to elephants that do not eat well. This medicine will improve their appetite and they will start feeding immediately.

Removal of mud from the stomach

Wild ginger, green chillies, salt, are mixed and fed. This is to remove excessive mud from their stomachs. The elephant is made to stand in the water or is made to drink plenty of water. The wastes are all removed immediately along with the water.

Bruises

Elephants that work in a timber camp occasionally hurt themselves when the logs strike their legs or chest. This is very painful and the hurt region swells up immediately. Human urine mixed with hot ash and salt are mixed and rubbed in a downward motion on these areas to reduce swelling.

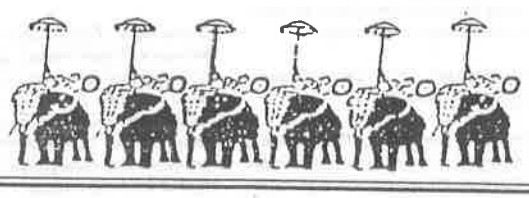
Musth

Elephants in musth are fed curd rice.

Impaction

In case of impaction the mahouts bring the elephant to the water and insert their hands through the anus to pull out the blockage. The body cavity of the elephant will be really hot and so as soon as the hands are withdrawn they are dipped in the water. This method is possible only if the impaction is on the rear portion of the alimentary canal.

* Assistant mahout , Kodanadu Range Office



Reprint : Zoos' Print, 11 (4) : 17-20, April, 1996

COMMON AILMENTS OF ELEPHANTS

Dr. S. Gopalan

The following are some common ailments met with, among elephants.

GALLS : These are generally caused by ill-fitting gear, ropes and chains. These should be treated as wounds and washed both morning and evening with antiseptic lotions such as cresol saponified (1 in 100) or carbolic acid (1 in 40) and dressed with anti-fly dressing. Then dry dressing such as zinc oxide and charcoal powder (1 in 8) may be dusted.

WOUNDS: Wounds are generally caused among working elephants due to fighting and falls etc and to new-captures, due to external violence, such as butting against posts and bars in the kraal. There are different kinds of wounds and the treatment varies for each.

If bleeding is noticed, arrest bleeding by tying or twisting the blood-vessels; clean the blood-vessels thoroughly with antiseptic lotion , remove foreign matter such as mud, stones and if possible the edges of the wounds may be brought together by a few sutures. Paint tincture of iodine, smear anti-fly dressing and dust dry such as Iodoform and Boric Acid.

For persistent wounds an application of copper sulphate (3 grains to an ounce of water) once daily for two or three successive days, followed by anti-fly dressing will promote rapid healing with one pint of anti fly dressing, two ounces (of 56 grams) of sulphanilamide powder can be added.

Preparation of anti-fly dressing:-

Dikamalli - 1 ounce (28 grams).
Camphor - 1 ounce (28 grams)
Garlic - 1 ounce (28 grams)
Neem oil - 24 ounces (one bottle) or (681 ml).

(Dikamalli is the resin of *Gardenia lucida* available in the bazaar).

Directions for preparation:

Dikamalli and garlic should be well -crushed and kept separate. Boil first of all, a small quantity of neem oil in a suitable vessel, add garlic and stir it frequently until froth subsides and the garlic turns to a golden-brown colour, as will be the case when onion or garlic is fried in oil for curry-purposes. Then add the remaining quantity of neem oil to the vessel and as soon as the neem oil boils, dikamalli powder may be added and stirred well; then remove the vessel from the oven and keep it away from the fire-side; to the hot oil add camphor and cover the vessel with a lid; wait till the oil cools down to room-temperature, then transfer it to a suitable container.

GUNSHOT WOUNDS: Occasionally, it may become necessary to treat elephants for gunshot wounds.

The following case may interest to the reader. Once when a party went in a jeep into the jungle, one of the trained and privately owned elephants, scared by the sound and sight of the jeep, came in the opposite direction to attack the jeep; the party inside the jeep had to apply break, stop and get down. The animal began to attack the vehicle; in self-defence one of the members of the party fired two 'shots at the animal; the letter made a frightful trumpeting noise, and ran away. Subsequently the attendants of the animal went and brought the elephant to the camp; his two fore-limbs were swollen very much and with much difficulty the elephant moved slowly and reached the camp; since then he had been tethered to a tree and allowed fodder and water at the standing.

For purpose of facilitating examination of the two wounds, and probing them, the elephant had to be stood by the side of a large bamboo-clump, some bamboos had to be removed and the Veterinarian had to stand under cover of the bamboo - clump and examine the wounds.

The elephant had sustained a bullet wound, a few inches above the point of elbow of one fore-limb, and another bullet-wound on the forearm of the other fore-limb: The direction of the bullet-wounds had been passing obliquely and the exact places where the bullets were lodged could not be located. Before inserting the probe, the parts surrounding the openings of the wounds were sprayed with ethylchloride.

Treatment: The swellings were fomented twice daily for half-an-hour, each morning and evening. On the first day, 30 grams of strepto-penicillin were pushed in intramuscularly. On the second day 25 grams and on the third and fourth day 20 grams daily were pushed in the fifth day, 300 C.C. of sulphadimidine sodium solution 33 1/3%, was pushed in subcutaneously. From the sixth to the ninth day daily 125 grams of sulphadimidine was administered orally after mixing with 50 grams of sodium bicarborate and 225 grams of jaggery and masking in balls of cooked rice.

Subsequently the inflamed parts were being irrigated with cold water, each morning and evening for half-an-hour, and the wounds were being dressed with gauze soaked in camphor-oildressing. Also arrangements were made to purchase an infraphil lamp and pass infra-red rays from a distance of about a foot for 15 minutes on each forelimb, each morning and evening at day break and at dusk as a routine-measure. In about three months the swelling completely subsided and the wounds healed up. The animal was released for dragging timber.

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Editor's Note: The present article is taken from the notes of an relatively old hand-written and unpublished document. Some of the suggestions and treatment are so straightforward and simple that they seem eminently useful. These will be typeset and brought out as a casual publication by Zoo Outreach Organisation. Some of the chapters and treatments will be translated into Malayalam for use by participants of the next mahout training course.

ABSCESSES IN ELEPHANTS: An abscess is charactensed by the collection of pus in a cavity of the body. It is caused by pyogenic organisms entering through breaches of skin, mucous membrane, tissues etc., mostly brought by inflammation, generally caused by external violence, pricks and punctures of thorns, and stakes and bruises from uneven pressure of ill-fitting gear in elephants. It may also be due to heavy falls, severe blows and knocks against heavy objects, and wasp-stings .

Abscesses may be acute or chronic; they may also be superficial or deep. Acute abscesses are generally formed in about three to five days from the date of commencement of infection; at first there is acute inflammation; the acute superficial abscess is more or less circumscribed, firm hot red and very painful; then the centre gradually softens and the periphery continues to be firm; later there is fluctuation or pitting on pressure by the fingers. Left to itself the centre becomes thinner day by day and at this stage, it is said to be pointing; soon it bursts and exudes purulent matter. Usually there may not be any febrile symptoms.

Acute deep abscess generally develops under thick layers of tissues, as muscles of limbs, back etc; at the very outset, febrile symptoms will manifest, then interference with the movement or stiffness in the affected part or by oedema in its vicinity. Subsequently local symptoms as swelling with or without pain, pointing etc may develop.

Treatment Consists in adopting measures to hasten the opening or pointing of the abscess and opening and evacuation of the purulent matter, and regularly dressing the abscess-wounds to promote early and rapid healing. The application of hot fomentations and stupes, acts as an analgesic and relieves the pain of the patient. The application of a blister may quicken the opening-process but it may, somewhat, aggravate the pain of the patient, temporarily. For opening the abscesses, it is advisable to use a sharp-pointed bistuory. For enlarging the pouches, the use of a probe-pointed bistuory may be resorted to, and bold incisions may be made. In the case of large pouches, a counter-opening may be made at the lowest dependent part by means of a seton needle.

CHRONIC ABSCESSES: (Superficial and deep ones) The process of development is very slow in elephants. It is either painless or slightly painful and it persists for a long time as an indurated, swelling. These may be caused by slight and repeated injuries as may be for kneeling on hard surface, for loading, unloading baggage, riding-sets or howdahs. They may occur on the back, shoulder, chest, point of elbow, knees, stifles, etc., Owing to the thickness of the skin it does not readily come to a head in the elephant. The most prominent part of the swelling may be chosen and a knife plunged or stabbed with force into it; a fine trocar and canula may be used for exploring and finding out as to whether matter has been formed. Before using them, Ethyl chloride may be sprayed on the part. Better still, planocaine about 1/2 to 1 drachur may be injected in three or four places around the site intended to be penetrated by the exploring needle or by the knife.

The following line of treatment may be followed: For an hour in the morning and evening foment the affected part; apply a mild blister by mixing equal quantities of powdered mustard and lime with a little groundnut oil to form the consistency of condensed milk and smear it on the swelling.

In lancing the abscess, the cavity may be cleaned with a warm antiseptic solution say, one once of izal or phenyle to a gallon of warm water, by means of a garden-syringe on stirrup-pump; dry out the wound; smear swabs of proflavina 1 in 1000 solution; insert lint or gauze soaked in camphor-oil or eusol or saline - When the cavity is clean and healthy, cleanse the cavity once daily; plug the wound with lint or gauze dipped in 20% magsulph solution. The lips of the wounds may be smeared with camphor-oil dressing.

A handy prescription for camphor-oil dressing is as follows:-

1.	Coconut:- oil	one bottle or 24 ounces or 681 ml.
2.	Turpentine	ounces or 227 ml.
3.	Camphor	2 ounces or 56 ml.
4.	Izal or phenyle	1/2 ounces or 14 ml.
5.	Petrol	5 ounces or 140 ml.

N.B: First of all, boil the coconut oil well for five minutes in a clean vessel provided with a lid. Then remove it from the oven, add the camphar. Cover the vessel with the lid and allow it cool the remaining articles. An addition of four ounces or 112 grams of sulphanilamide to the above dressing will be beneficial. In order to bring about rapid healing of abscess-wounds, an initial dose of 60 to 90 lakh units of Avloprocil, followed by 30 to 45 lakh units of the same drug daily for 2 or 3 days may be tried. A subcutaneous injection of 125 c.c. of soluseptasine, 20% solution also, was found useful to promote rapid-healing.

The following record of treatment of a deep-seated abscess in an elephant complicated by a large oedema may interest the reader.

1. Name of the elephant: Bhaskaran, a good timber dragging animal
2. Age: Over 35 years (In the prime of life)
3. Height: 8'4' or 2.54 metres.
4. General condition: good.
5. Name of owner: Sri V. K. U. Sons., Nilambur
6. Date of inspection and commencement of treatment: 28.10.55.

HISTORY AND SYMPTOMS: Since last two days, the animal had developed a large diffused swelling on the left side of the neck extending from the angle of the lower jaw to the base of the neck. It was hard to the touch and not hot. In continuation of this swelling, an extensive oedema was present extending from the throat along the neutral aspect of the neck, sternum and abdomen up to the perineum, and the animal presented an alarming sight. He was dull and sluggish in movements. The temperature was 97°F ; it was normal; he was feeding and grazing quite satisfactorily; the dung and urine appeared normal; no fluctuation of matter could be felt on the swelling in the neck.

Treatment: 28.10.1955: Foment the swelling on the neck and oedema with water as hot as can be borne by the hand for half-an-hour, twice and paint liquid Iodine.
Avloprocil 60 lakh units 1/m.

Sulphadimidine BVet c 5gm tablets	25.
Sodium Bicarbonate (crushed)	55gms.
Jaggery	225gms.

Mixed well, masked into a rice ball and administered orally.

N.B. In addition to supply of cut-fodder, about 8 kilograms of rice was cooked and fed after masking the above drugs in it. Also another, quantity of about 8 kilograms of rice was prepared into gruel and allowed to the animal. He was not bathed. 29.10.55, 30.10.55, 31.10.55. Instructions were given to repeat the fomentation twice daily and repeat the administration of the sulphadimidine B-Vet-C with sodium bicarbonate and jaggery on these three days.

1.11.55: The fomentation was repeated.

2.11.55: Inspected the elephant this day. The oedema of the abdomen and sternum had reduced considerably; nearly three quarter of the oedema had subsided. The swelling on the neck, had become rounded like a foot-ball and it was tense, cold to the touch and painless. The feeding was normal; the temperature was normal. The swellings were fomented for half-an-hour, twice. Orally the following mixture was prescribed for four days.

Pot.Iodide - 2 ounces or 56 grams.
Tinct. Hyoscyamus-4 ounces or 112 ml.
Ext. Punarv. liq - 8 ounces or 227 ml
Syrup simplex-12 ounces.

To be given in doses of 3 ounces twice daily for 4 days, ie, from 2nd to 5th Nov'55, masked in rice.ball. (Instructions were also given to continue to foment the swelling twice daily)

10.11.55: Inspected this day; the oedema had practically subjected in the sternal and abdominal region; there was only very slight oedema now; but the swelling on the neck, remained in the same stage, without getting reduced in size. Then 60 lakh units of avioprocil were pushed in i/m. The swelling was explored with aseptic precautions. Only blood oozed out.

Instructed to bath the animal twice daily as usual and irrigate the part with cold water for half - an hour twice daily; instructed to give the following mixture for 8 days.

Pot.Iodine - 2 ounces (56 grams)
Ammon chlor - 4 ounces (112 grams)
Liq/Ext Sarasoparilla - 8 ounces (227 ml)
Aqua ad - 32 ounces.
Sig: give two ounces each morning and evening masked in rice-ball.

11.11.55. Repeat

12.11.55. Repeat

13.11.55. The swelling did not show any reduction in size Avioprocil, 60 lakh units, was pushed in i/m. Repeat oral administration of the mixture. Ablister with an ounce of zing Hydrargyri Iodidi Rubri was applied.

14.11.55. No Treatment : except oral administration of the mixture.

15.11.55. The inflammation was found increased in size and there was a little fluctuation. Explored the part; serum mixed with pus was noticed. Lanced and evacuated about four pints of sanguino-purulent matter. After cleaning the wound with dettol, lotion gauze soaked in camphor oil dressing was inserted.

Also pushed in 300 c.c. sulphadimidine sodium solution, 331/3% B.Vet.c. subcutaneously. The administration of the dropsy-mixture was stopped.

16.11.55, 17.11.55, 18.11.55, 19.11.55 Foment the abscess-wound twice daily with water as hot as can be borne by the hand, irrigate the abscess-wound with dettol lotion and clean; dress with gauze soaked with camphor oil dressing; give daily on these four days sulphadimidine B.Vet.C. 125 grams or 25 tablets each weighing 5 grams, sodium bicarbonate, 50 grams and jaggery 225 grams mixed well and masked in rice-balls. From 20th onwards, the abscess wounds was being regularly fomented and dressed with camphor oil dressing. The swelling had considerably reduced.

23.12.55, 24.12.55 on each of these days; in addition to dressing the wound regularly, a quantity of 20 grams of strepto-penicillin, was pushed in intramuscularly.

The abscess wound had completely healed up by about the end of Feb' 96.

SPRAINS: Though elephants are really sure-footed animals, they occasionally sustain sprains by stepping on ground which collapses under their weight, or by shipping on a steep hill side, or by getting one of the legs caught between rocks or logs etc.

Symptoms: Lameness, pain, heat and, inflammation of the affected joint.

Treatment: Irrigate the park with cold water twice daily for one hour and rub stimulating liniment; allow rest; supply cut fodder and water at the standing.

DISLOCATIONS: Sudden falls, external Violence, or slips may cause dislocation of joints in legs and hips. These occurrences are generally rare.

Symptoms: Alternation in shake of the joint, inability to use the limb, pronounced pain and swelling.

Treatment: Tie the animal and give cut fodder. Or put it in the Kraal or crush; one or two bars may be passed underneath the belly to support the animal for standing and sleeping. Reduction of dislocation in elephant is practically impossible. Application of hot water, poultices, or a bag of hot sand for an hour morning and evening may be tried; these will ease the pain and may do good, especially for cases of partial dislocations; in due course, it will set itself right. In case there is no improvement, the animal will have to be shot.

FRACTIONS: are generally caused by falls or by falling logs in steep country. Dragging logs downhill on steep slopes, may sometimes bring about fractures of the legs. Occasionally one or more ribs may be fractured when elephants fight. It

may be simple or severe; the bones may be broken in one or more places; the surrounding tissues may or may not be injured badly.

The symptoms of fractures of legs are,
1. alteration in the shape of leg.
2. swelling
3. pain
4. inability to bear any weight
5. shortening
6. excessive mobility of the limb.

Treatment: In the case of a simple fracture give a chance for the animal it may be tied up and hand fed or kept in a kraal or crush.

No treatment to set the bone or reduce shortening is possible, and if the animal shows no sign of recovery, it should be shot.

COLIC: Colic is a symptom of many abdominal diseases. The animal suffering from colic constantly lies down and gets up and rolls from side to side, and cronches often. Colic may show itself in cases of indigestion, tympany, enteritis, peritonitis, hernia etc., but the most common form of colic is that due to indigestion. In such cases it is very violent and tympany may also be present.

Give enema, walk the animal about; foment the abdomen and give the following; oil of turpentine - 2 ounces, with oil of arachis, 4 ounces or 112 ml., twice daily. During this time, give easily digestible food such as rice-gruel.

How to give an enema:- Dissolve about two ounces or 56 grams of soap in about 4 gallous or litres of luke-warm water. Make the animal sit; clear the rectum of its contents by passing the hand; it should be smeared with castor oil groundnut oil. Reids Enema syringe is commonly used for this purpose. Lubricate the nozzle of the syringe with vaseline or oil. Pass the tube into the rectum about a foot or two; slowly pump the liquid and if possible walk the animal slowly for a short distance. (In the absence of Reids Enema syringe, the stirrup pump or garden syringe may be thoroughly cleaned and then used for giving enema for the elephant.)

Reprint : Zoos' Print, 9 (11) : 19, November, 1994

VETERINARY CARE AND REHABILITATION OF A FREE LIVING SAMBAR (*Cervus unicolor*) IN KAZIRANGA NATIONAL PARK - A CASE REPORT

S.Islam*, B. C. Lahkar*, K. K. Dutta*, P. Sarma** and C.R. Bhobora***

Ecological aspects of the Sambar deer in Kaziranga National Park (KNP) has been reported by Lahan and Sonowal (1973), Muley (1992) and Parihar and Panigrahy (1993). When the park gets flooded every year during the monsoon season, almost all the wild mammals migrate to the highland areas for shelter, located along the southern boundary of the park and subsequently become easy target of poachers from nearby villages.

During the month of June, 1994, a young male sambar was rescued by the range officer from a forest village near the Bagori range of KNP. Upon enquiry it was revealed that the male sambar had strayed out of the park to the fringe areas. The animal was chased for a few hours by the villagers before it was rescued by the forest guards. It was subsequently brought to the range office and restrained by the forest personnel with commonly available ropes. The eyes were covered with a black cloth in order to minimise optical stimuli.

When examined closely, a deep laceration could be found on the arm region of the right side (Fig. 1 & 2). Another laceration was seen on the lateral side and middle half of the left fore leg. Several other minor lacerations were also found on both sides of the dorsal spines extending from the thorasic to lumbar vertebrae. The lacerations in front of the right shoulder joint was severe and blood was oozing out from a disrupted vein.

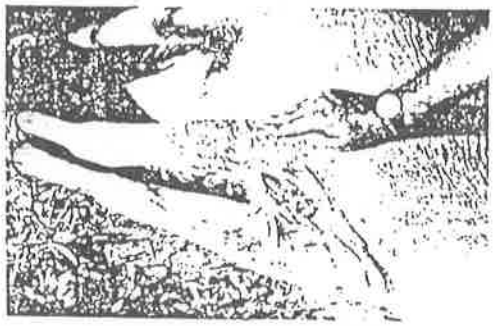

Fig.1 Laceration on the righ arm region

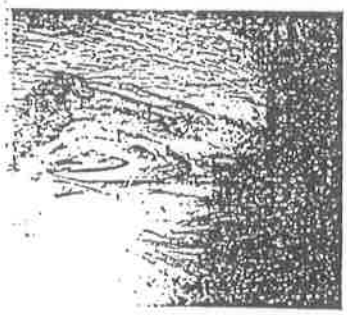

Fig.2. The laceration is prepared for corrective apposing.

Veterinary Care :

The dirt material from the lesions were removed and washed with normal saline. After applying an antiseptic soap solution, the hair surrounding the lesions were shaved off. Blood clots from the lesions was removed by dry cotton. The severed vein was ligated by a black braided silk thread. The muscular layers were sequentially apposed by interrupted sutures. Finally, the skin was closed by black braided silk thread with interrupted sutures and the wound was painted with a dressing oil to repel possible fly nuisance. Two intramuscular injections of Novalgin (R)[1] 10 ml. and Oxysteclin (R)[2] 10ml was administered to reduce the pain of injury and guard the possible bacterial infection. Other minor lacerations were treated with the same procedures mentioned above.

Rehabilitation:

The animal did not show any adverse reaction upto 5 hours post-treatment. Interestingly, the animal became very docile when it was freed from restrain. At 7th hour post-treatment, the animal was restrained again by ordinary rope, carried by a vehicle and let loose in the Kachanjuri Beat under the Bagori Range of KNP.

Acknowledgement :

The senior author is thankful to all the forest personnel of the Kaziranga National Park who helped in the rescue and rehabilitation operation of the sambar.

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[1]. Novalgin (R) : Hoechst India Limited, Bombay
[2]. Oxysteclin (R) : Sarabhai Chemicals, Bombay.

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Reprint : Zoos' Print, 6 (11) : 27, November, 1991

CARE AND MANAGEMENT OF TIGER CUBS IN ZOO

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Introduction : In recent years the growing interest in zoological gardens, game parks, circuses and private collections of different species of animals has created an indispensable role for the Veterinanans in this specialised field.

The present work is an attempt to make the information available in respect of management of tiger cubs at Maharajabagh Zoo, Nagpur.

Materials and Methods : A pair of normal coloured tigers of Maharajbagh Zoo aged about 10 years (male) and 8 years (female) respectively in the month of April 1991, during the hot summer season in Nagpur.

Results and Discussion :

The cubs born were weighing about 1 1/2 Kg. (male) and 1 kg (female), immediately after birth. The extreme high mortality amongst tiger cubs in the wild are reported by Rathore et al. (1983). In the present study it was observed that mother tigress showed a lack of interest in feeding the cubs a few days after the birth, that is from 3 May 1991 and subsequently the mother tigress fell sick on 7 May 1991.

The lack of milk in the tigress could be due to the phase of incubation period prior to the onset of sickness.

Accordingly an attempt was made to maintain the cubs by hand feeding from 3 May 1991 and milk was offered to both the cubs *ad libitum* (Table 1) for a period of two weeks and more. The body weight of the cubs was taken again on 8 May 1991 as 4 kg (male), 2 1/2 kg (female) and subsequently on 20 May 1991 as 4 1/2 kg (male), 2 kg, 100 gm (female) cub.

The symptoms exhibited by tigress (mother) during sickness were refusal to accept meat, dullness, reduced maternal instinct. Faecal sample examined on first day of sickness revealed negative for parasites. In view of this, the cubs were seriously deprived of mothers milk and matenal care. The sickness continued up to 13 May 1991. The treatment given from 7 May 1991 to 12 May 1991, twice daily, comprised of Oriprim powder 10 gm, glucose D. 20 gm and the chicken essence 10 ml in water. She started accepting some quantity of milk from 14 May 1991. Liquid Vimeral 10 ml and chicken essence 10 ml in water was continued from 14 May 1991 until the appetite was restored to normal. Subsequently, she started accepting meat on 23 May 1991. In general, sickness in tigress could be due to stress of delivery followed by the high atmospheric temperature of the summer. This is in agreement with Blood et al. (1989), who stated that the above factors brings damaging changes in the internal body environment of the animal.

Hence, the female cub from the same tigress aged about 1 1/2 months and weighing 2 kg, 100 gm fell sick on 20 May 1991 showing symptoms like dullness, refusal to accept milk, stationary position, moderate dehydration, and dry body coat. The feacal sample examination revealed negative for the presence of parasites. It was subjected for treatment: Oriprim powder 2 gm, liquid Vimeral 5 ml and electrol powder 5 gm administered in water orally, twice daily but sucumbed to death on the next day.

The Post-mortem examination was conducted immediately after death and revealed dehydration, empty urinary bladder, congestion in myocardium, coronary vessels, lungs, liver and the cause of death was acute catharal enteritis. This could be due to lack of colostrum and the high atmospheric temperature, ranging from 110-112 o F, might have cause dehydration. Khurana (1986) reported that the maintenance of proper temperature in captivity is an important factor for survival of cubs. Presently a male cub and the mother tigress maintaining good health, the possible minor ailments are being tackled by routine deworming and multivitamins.

Conclusion : The authors place on record the care and management of tiger cubs in captivity.

Acknowledgement: The authors are highly thankful to the Associate Dean, College of Agriculture, Nagpur for help.

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Table 1 Showing Observation of Feeding the Cubs

Sl. No.	Date	Accepted quantity of milk in ml (hand feeding)			
		Morning		Evening	
		Male	Female	Male	Female
1	3.5.91	30	60		
2	4.5	30	60		
3	5.5	30	90		
4	6.5	30	120		
5	8.5	30	150		
6	9.5	50	150		
7	11.5	100	200		
8	12.5	100	150	50	150
9	13.5	100	200	50	100
10	14.4	100	150	60	120
11	15.5	150	250		
12	16.5	150	150		
13	17.5	100	150		
14	18.5	100	150	150	100
15	19.5	150	100	100	100
16	20.5	200	sick	150	
17	21.5	150	died	200	

Reprint : Zoos' Print, 7 (4) : 25, April, 1992

Artificial Rearing and Medical Care of a Tiger Cub

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A tiger cub was born on June 26, 1987. It was decided to remove the cub for handrearing. Two hours after birth the cub was removed and washed in Savlon and lukewarm water. After cleaning, a milking goat was arranged. The udder was washed and the cub was pushed towards the udder. The udder was squeezed and, after 2 minutes, the cub started suckling for about 7 minutes. The cub's mouth was washed, and the cub was placed under a box after giving 5 drops of ABDEC drops. First urination took place on June 27th at 08:15 am. The first stools on June 28th were dark yellowish in colour and mucousy, just like a human being. The right eye opened on July 1st, and the left was also open by July 3rd. A glandular structure was observed on the belly portion. Gradually this structure increased in size. Some bandages were put over the swelling but this did not serve any purpose.

On July 1st, the cub suffered from diarrohea. FOROXEN suspension was given every 6 hours. ELECTRAL powder was also given. On July 4th, the cubs's weight was 1kg 745g, the length was 21 inches, and the height was 8 inches.

On July 14th, the cub vomited and became dull. There was a foul smell to the vomited matter, so treatment was again given for indigestion. On July 19th, the cub's weight was 2 kg and this increased to 4kg by July 27th. At this time a fresh goat was brought and the udder washed and put inside the cub's mouth. After 2 days the cub started taking liver 10 gm at a time. It was taking 6 oz milk.

On August 1st, suddenly, the cub developed torticolos symptoms. There was no pain, however, in the neck. Some neurostimulant was given and some fomentation was also given. The cub was x-rayed in three positions and the radiologist advised action. On August 17th, a trial Macalvit injection was given, 1 ml intravenously. Some improvement was shown.

Later it was found that the ailment was due to lack of calcium. The twisting of the neck improved but the size of the hernia had developed so much that it touched the floor. Some veterinary surgeons were contacted and, on September 22nd, an operation was undertaken.

At 11:45 am, Siquil 1mg in/m was given, and at 12:00 noon Atropin 0.3mg was given. Ether was administered for anaesthesia. At 12:12 the operation started and it lasted until 1:22 pm. The wound was stitched and bandaged. At 13:30 the cub recovered from the anaesthesia and some Atobelgin was given to relieve the pain. Ampicillin was given after 12 hours and Coclaxialine after 2 days. Incrimin syrup was given - 1 teaspoonful twice. On September 28th, the stitches were cut alternately and on October 1st, all stitches were removed. The cub's weight at that time was 14kg on October 12th, and it was taking 200g liver daily.

TIGER

Want to test your knowledge? Then read on.

1. Do you know the zoological name of the tiger?
2. Do you know the habitat of the tiger?
3. Do you know the habit of the tiger?
4. Can you say which type of tiger are?
5. Do you think ever why the tiger are kept under threatened status?
6. Do you know the gestation period of a tiger.
7. Do you know why conservation of tigers is essential.

Ans. *Panthera tigris tigris*
Ans. All over India
Ans. Carnivorous animal whose prey is deer, samber and wild boar
Ans. Polyoestrus. It breeds all around the year.
Ans. Increasing human population and vanishing habitat of tiger
Ans. 100 to 110 days
Ans. Look at the map below.

Dr. A. K. Jha, Sanjay Gandhi Biological Park, Patna

Reprint : Zoos' Print, 6 (11) : 28, November, 1991

ANTERIOR LUXATION OF EYE LENS IN TIGER

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Anterior luxation of lens is not a common disease entity in domestic animals and there appears to be no report of this condition in the wild and zoo animals. Two cases of anterior luxation of lens into the aqueous humor were recorded in tigers. In both of the animals, the left eye was involved.

Case No. 1:

A circus tiger was reported to shy off at periodic intervals from the routine show-jump, shaking of the head sideways or up and down for a few minutes settled the animal, which could perform the show-jumping as per the routine. The animal was put in a squeeze cage and the eyes were examined. In the left eye, a floculant material was observed floating in the aqueous humor. A closer examination revealed it to be the lens which had dislodged from its normal position (Fig. 1).

Case No. 2:

Another tiger which was maintained in a state zoo was reported by the attendants to show signs of headshaking and sometimes tilting of head and neck. The animal was put in a squeeze cage for examination. There was no apparent injury or inflammation in the area of head and neck. Ears were found to be normal. Examination of the eyes revealed a cricular floating object in the anterior chamber of the left eye. A closer examination revealed it to be the luxated lens complete with its capsule.

It is known that felines and canine are highly susceptible to metabolic diseases. Felines in particular are prone to cataract formation and strabismus (Fowler, 1978). There is every possibility that luxation of lens in the cases under report may also be associated with metabolic disorder since the animals were living in captivity, although it needs to be confirmed.

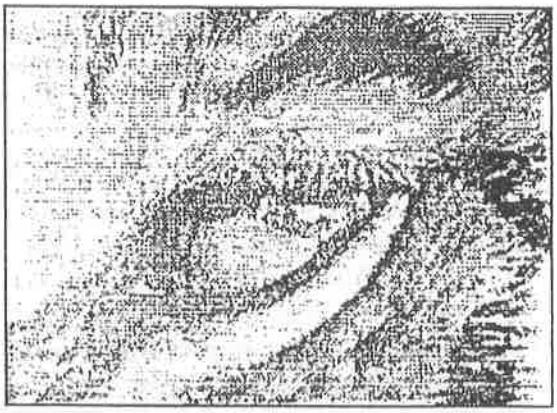

Fig. 1 Anterior luxation of eye-lens in tiger. Photo by Bhardwaj and Chandra

In the case No.1, the owners of the circus refused the surgical intervention, but agreed to the proposal of using the animal only for show-display to avoid injury to the animal while jumping.

The case No. 2 was left untreated as it did not interfere with the normal activity of the animal except when the animal was excited and felt disturbance in the line of vision.

Fowler, M. E. (1976). In Zoo and Wild Animal Medicine, "Metabolic Diseases", W. B. Saunders Company, Philadelphia, London, Toronto, pp. 61.

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Reprint : Livestock Adviser, VI (XI) : 3-4

A Case of Ulcerative Keratitis in One-Horned Indian Rhinoceros

(RHINOCEROS UNICORNIS)

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Nehru Zoological Park, Hyderabad

1. CASE HISTORY :

Wild Animals when kept in captivity due to boredom develop certain vices. The same is true of a male Indian rhinoceros of Nehru Zoological Park, Hyderabad. The animal being alone started rubbing the stumpy horn, head and the huge body against the artificial cement concrete boulders and acacia trees which are plenty in his open enclosure. In doing so a thorn might have pricked into its left eye. Lachrymation was noticed on 12 10-70. The animal was secured and examined. The cornea of the left eye was turned into a white mass with a slight erosion in the middle and encircled with hyperaemia allround. There was no thorn inside.

1. TREATMENT :

In the Zoo some exotic animals including rhinos and hippos are hand fed. This is advantageous to administer medicines hidden in foodstuffs and to clean and dress up minor injuries with dressing powders and ointments. During the course of morning and afternoon meals, Terramycin eye ointment was applied into the affected eye of the rhino. This treatment was continued upto the end of October 70, with no improvement. The animal continued rubbing its eye with the hard objects which it could find in its enclosure and as a result the eye used to bleed. The hyperaemic portion around the opaqued cornea had covered the whole eye and started becoming more and more red in colour, and later turned into a fleshy growth with small ulcers in it (Ulcerative Keratitis) with profuse discharge. By this time the rhino has lost its vision completely. The line of treatment was changed from 1-11-70 as follows :

a. Terramycine Tablets (5) gm. 8 morning and afternoon.

b. Vitamain C. Tablets(500)m.gm. 6. Bd.

c. Vitamin B. Complex fortified tablets with B. 12 (Glaxo) 10 tablets.

d. Application of Terramycine eye ointment with Atropine eye ointment Bd.

The above treatment was continued upto 7-11-70 with no change. As there was no progress in the case, the eye was washed with Proacine Peniciline solution in distilled water daily, and the eye ointment was changed to Cambison with Cartisone (Hocchst) Vitamin B and C.tablets were continued and a second course of Terramycine 5 gms. tablets was also administered.

The improvement noticed in the case is given below :

12.11.70. The condition of the eye is better. There is no discharge. The ulceration is reducing in size.

18.11.70. The discharge is completely stopped now. The fleshy growth is persisting with a fade colouration. There is a small opaque spot visible in the centre of the fleshy growth.

25.11.70. No discharge. No further improvement is noticed.

2.12.70. No further progress is noticed in the size and the colouration of the growth.

Vitamin B and C. tablets are stopped aud Vitamin A+D capsules (Glaxo) 24 Bd. are being administered. Washing of the eye with procain pencilllin lotion and application of Cambison eye ointment is still being continued.

5.12.70. The ulcerative growth is subsiding.

8.12.70. The ulcerative growth has subsided completely. There is no opacity of cornea. The eye ball has become a normal structure, but there is no vision still.

10.12.70. The animal is responding to external stimuli-able to see, winking when a stick is waved before the eye.

13.12.70. Complete vision is restored and the rhino is able to see and respond to men and surrounding

SUMMARY:

A case of Ulcerative Keratitis in a male rhino and its successful treatment with washing the eye daily with procaine penicilline solution, application of cambi son with Cartisone eye ointment and oral administration of broad specturm antibiotic, vitamins B and C. is described in this article.

ACKNOWLEDGEMENT

The author is grateful to Dr. Sathapathi then Asst. Surgeon of Sarojinidevi Eye Hospital, Hyderabad, who examined the animal patient and suggested the washing of eye with procaine penciline solulion (in distilled water) and the use of Cartisone ointment.

The author is also thankful to Mr. Pushp Kumar, the then Director of Nehru Zoological Park, Hyderabad for his encouragement.

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Vol X Issue VI June-85

Cataract in Captive Pheasants -A Case Report

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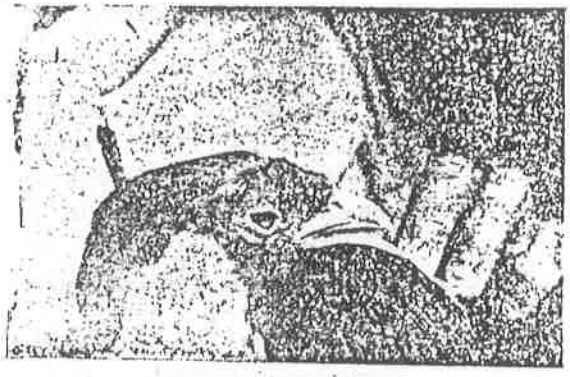
Dr. Saber Ali, Assistant Director, A.H. and Dr. Dattatri Rao, Veterinary Officer
Nehru Zoological Park, Hyderabad

Cataract may be defined as an opacity of the lens or its capsule. Cataracts can be classified under two heads.

DEVELOPMENT CATARACT

During normal development the lens substance loses its transparency as a result of degenerative changes due to various causes. This group includes the congenital and juvenile cataracts which are encountered occasionally in young dogs.



DEGENERATIVE CATARACTS

In this kind of cataract the fully developed substance loses its transparency as a result of degenerative changes. This group includes senile, nuclear and cortical cataracts and those associated with systematic or varied intraocular diseases.

CAUSES

Any condition which interferes with the nutrition of the lens, such as due to inflammation of iris, pressure from the tumors, glaucoma etc. may give rise to a cataract. This also occurs in connection with diabetics and with injuries to the eyes, such as severe blow.

In birds it is commonly observed in old age and possibly it is also of hereditary nature. It is reported from canaries, parrots and a few birds of prey reared for many years in

captivity (Arnall, K. et al. 1975). Opacity of the lens in fowls (cataract) is also a sequele to Avian Encephalo Myelitis infection (Halpin-1967). Flowers et al (1957) found cataract in a flock of fowls for which they could not find any cause at all and Devolt (1944) could also find no cause for an outbreak of Lymphomatosis.

CASE REPORT

A pair of Swinhoes pheasant (Lophura Swinhoei) were purchased for the Nehru Zoological Park, Hyderabad. One of the male birds developed opacity of lens (cataract) of both the eyes (bilateral) esulting in loss of vision when roughly nine years old.

A second case of cataract was observed in a male Silver Pheasant (Lophura nycthemera), which was 11 years two months old at the time of writing this article and which developed opacity of lens bilaterally.

Initially the right eye was found slightly opaque and within a few days the opacity became intense. The left eye also got affected later. A thick bilateral opacity of both the lens developed and the bird was unable to respond to light and external stimuli. But it could locate its feed and water. Otherwise, the pheasant was found normal. This condition was reported earlier by Arnall, K. et al, 1975. A free living bird would obviously be unable to survive for long with bilateral cataract. In captivity, with food provided regularly and always placed in the same position, a partially blind bird can remain in relatively good condition for many months.

TREATMENT

The line of treatment adopted for both the pheasants was as follows: (The treatment was administered intermittently.)

1) Terramycin antigerm formula (Pfizer) was given in drinking water.
2) Vitamin A in liquid form was administered in drinking water.
3) Intra-muscular injection of antibiotics Terramycin/Achromycin was given.
4) Eye ointments and eye lotions such as Terramycin eye ointment; Cambison Eye ointment (Hoechst) and Gentamycine eye-drops were tried.
5) Vitamin A Injections were also given, bi-weekly. Ten injections were given.
6) Rovisol AD_3 (Roche) was administered in drinking water to the phesants.

The above treatment was not effective an the cataract still persisted. The pheasant was apparently healthy and was able to locate its feed and drinking water, which were placed at the same place. Treatment was discontinued later.

CONCLUSION

Two cases of bilateral cataract in male pheasant (swinhoes and silver) are described. The precise cause of cataract is not known, but this condition can be attributed to senility, as the male swinhoes

pheasant lived in captivity in the Zoological Park, up to an age of 8 years 8 months and 13 days, whereas the male silver pheasant was two years and two months old.

Both the cases did not respond to the routine thrapy of administration of broad spectrum antibiotics along with Vitamin A, both orally and parenterally including cortisone preparations.

ACKNOWLEDGEMENT

The authors are thankful to the following Officers, for their encouragement.

1. Mr. Pushpa Kumar. I. F. S. Conservator of Forests (Wild Life) Hyd. A. P.

2. Mr. T. Ramakrishna, I. F. S. Curator, Nehru Zoological Park, Hyd. A. P.

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Reprint : Livestock Adviser, VII (IX) : 35-37, 1982

Partial Blindness in an African Lion (Panthera leo) A Case Report

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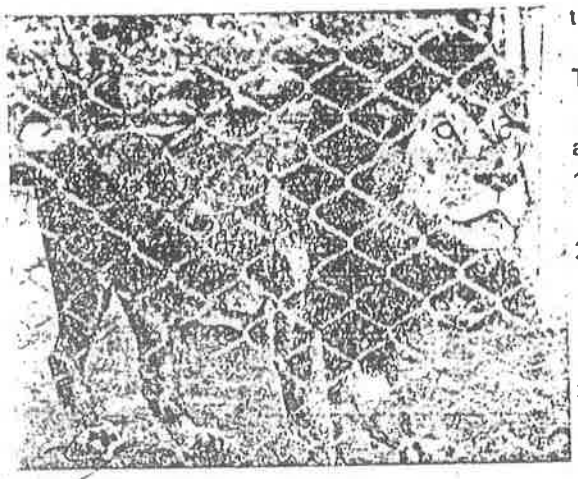
Dy: Director (A. H.), Nehru Zoological Park, Hyderabad

INTRODUCTION

A cat can see even in pitch darkness because there is a well developed system of muscles within its eyes. These muscles contract the pupils in bright light and protect the eye from glare In the dark, the pupils dilate to allow as much light as possible to enter the eyes (Prater, S. H.). But widening or dilatation of pupils In broad day light could be considered abnormal.



African lion male. Note the dilatation of the pupils in broad daylight.

CASE HISTORY

On 22.11.1974, in one of the male African lions aged about 4 years, dilatation of both pupilis was observed in broad day light. The animal was unable to locate and eat beef when fed in a normal fashion. Throughout the day the pupils remained dilated. It was kept under observation without any treatment for 2 days. During these days the animal was reluctant to leave its quarters and the pupils were dilated throughout.

TREATMENT AND OBSERVATION:

The following medicines were administered on 25.11.74.

1. Terramycin Capsules (Pfizer) 250 Mgm. each - 6 capsules a day.
2. Adexoline Capsules (Glaxo), 12 capsules a day. Each capsule contains
   vitamin A 6000 I.U.
   vitamin D. 10,000 I.U.
3. 1/4th kilo more of raw liver was added to the diet.

29-11-75: No improvement was seen. Terramycin capsules were discontinued. Vitamin A & D therapy was continued.

5.1.1975: On this day slight improvement was observed. The pupils were not found to be as highly dilated as they were at the commencement of the treatment. The animal had no difficulty in locating the beef pieces. A second course of Terramycin capsules was given. Vit. A & D was continued.

11.1.75: The administration of antibiotics was discontinued.

26.1.75: This day there was no dilation of the pupils. The eyes returned to normal shape and the animal was declared to be normal.

DISCUSSION

Acute vitamin A deficiency in this case might have resulted in partial blindness. This deficiency could be due to feeding the lion with muscle meat without addition of sufficient quantity of raw liver and vitamin A supplement. The muscle meat is very much deficient in vit.a. Moore, Sharman and Scott, 1963, have found that vitamin A is limited to certain tissues, large amounts are found only in liver, and, in small quantities in lungs, adrenals and kidneys. Body fat and muscles are virtually devoid of the vitamin. It is therefore apparent that cats fed exclusively on carcass meat without livercod liver or a synthetic source of vitamin A will inevitably suffer from deficiency.

Wackernagel opines that "muscle meat by itself is not balanced nutritionally as it lacks in calcium and oil soluble vitamins. All carnivorus therefore have to be given a supplement of a protein mineral vitamin concentrate."

In the Nehru Zoological Park all the felines are fed with supplementary diet of raw liver and multivitamins daily. This is the first case of its kind reported for this deficiency. In this particular case it is possible that the requirement of vitamin A was high and the intake was inadequate. As Scott says: "The difficulty about vitamin A is that the stores within any individual animal vary enormously,- from almost nothing (although the animal is not showing much sign of deficiency) to something like 200,000 per gm. of liver."

It is also possible that the lion referred to above had little chance of getting sufficient quantities of colostrum and mother's milk and developed deficiency of vitamin A from the very early age but the deficiency symptoms were noticed very late. "Kittens are born with small reserves of vitamin A in the liver and obtain great quantities from the colostrum and subsequently from mothers's milk" (Patricia, P. Scott).

The partial blindness can also be attributed to high rate of excretion of sulphur from the kidneys.

"A high protein intake presents cats with a problem in the disposal of excess nitrogen, sulphur and phosphorus. This is partly solved by excretion in the urine. If the sulphur excretion through urine is very high there a comes stage when the cat goes into a negative sulphur balance and

ultimately a negative nitrogen balance developed and in this state the utilization of vit. A appears to be defective to such an extent that the cat may become blind". Scott, Greaves and Scott-1954).

SUMMARY

A case of partial blindness in an African lion (Panthera leo) is described in the article. The cause of this condition was found to be - Avitaminosis A. Administration of heavy doses of vitamin A for a period of 2 months and more brought back the case to normalcy.

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ACKNOWLEDGEMENT

The author thanks Mr Pushpa Kumar, I. F. S., Director, Nehru Zoo Park for his encouragement.

The author also thanks Mr Bhano Murthy B.Sc. for the photograph of the lion.

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Vol VII Issue 1 Jan-1982

Hypertrophy of Harder's Gland in an African Lion (Panthera leo)

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The lymphoid tissue on the concave surface of the nictitating membrane of the dog is universally referred to as Harder's Gland. Behind the membrane, at the inner canthus the outline of Harder's gland may be seen as a bean sized swelling. Adenoma of Harder's gland is of common occurrence in small animal practice. It is commonly seen in young dogs and rarely observed in cats (Todd) O. Munson).

The common ocular lesion of dogs is often improperly referred to as Harderian gland enlargement. It is most often seen in young and growing animals. The sudden appearance of a red mound of conjunctival lymphoid tissue is seen at the medial canthus of the eye (Merk's Vety. Manual).

This article deals with the occurrence of hypertrophy of Harder's gland in an African lion (Panthera leo).

CASE HISTORY:

On 6.11.1970 swelling of the Harder's gland was noticed in the inner canthus of the right eye of a male African lion. The appearance was sudden. It was blood red in colour and was of the size of a marble. The gland used to bleed as soon as it came in contact with hard objects. The lion was seen rubbing it against the iron rods of the cage occasionally. There was a slight lachrymation. No deviation in the normal habits of the lion was seen except for the appetite which remained poor to some extent.

TREATMENT:

The animal was taken into a small cage for treatment and was released

afterwards in the big enclosure.
10.11.1970.

1. A· O. 5% solution of copper sulphate was prepared (in distilled water) and the inflammed gland was syringed out with the solution in a 20 M. 1. glass syringe, once in a day.

Copper sulphate was used as an astringent collyrium for granular conjunctivitis in the dog. 1-2 grains to the ounce of distilled water (Hoare-1949).

2. Terramycine capsules (oxytetracycline) Pfizer- (250 mg. each-) 6 capsules were given in a piece of liver.

3. Vitamin C. (500) Mg. 2 tablets and Adexoline capsules (Glaxo) 12 capsules were administered in beef pieces.

OBSERVATIONS:

18.11.70 The gland is no more red, it has become a pink mass-No change in the size. Treatment no. 1 is discontinued, no. 2 and 3 are repeated.

15.11.70 The inflamed glans is reduced in size to a considerable extent. No discharge through the eye. Treatment no. 2 and 3 being continued.

3.12.70 Swelling subsided completely. Harder's gland could not be seen now. The eye has returned to its normal shape.

SUMMARY:

This communication places on record a rare case of Hypertrophy of Harder's gland in an African lion-probably the first reported case of its kind in a large cat, and its successful treatment without involving surgical procedure.

ACKNOWLEDGEMENT:

The authors sincere thanks are to Mr. Surjan Singh, Ex. Vety. Livestock Inspector, Nehru Zoological Park, Hyderabad for his persuasion to make me use copper sulphate 0.5% as a collyrium.

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Reprint : Zoos' Print, 5 (3) : 35-36, March, 1990

Two Cases of Ascites in *Panthera leo persica*

By P. P. Raval, Zoo Officer and Dr. R. H. Sabapara, Zoo Vety. Officer

Case number I

A wild lion subadult male from Gir Sanctuary was given over to the Sakkarbaug Zoo for treatment of a maggot wound by the Forest Department on 29-8-88. During the course of treatment it was observed that the animal consumed an unusually large quantity of food even though it was weak and unthrifty. The abdomen was somewhat distended. Deworming treatment was given with wormin on 5-12-88.

On 10-12-88 the animal was thoroughly examined. The abdomen demonstrated fluidy palpation on applying pressure. The temperature of the animal was 102 F. Defecation and urination were normal. The condition was given a preliminary diagnosis of ascites.

From 10-12-88 to 20-12-88 the following treatment was carried out. :

Antibacterial Injection	Ampicillin	1000 mg.	1/m B. D.
Diuretic Injection	(Lasix Frucemide)	40 mg.	1/m B. D.
B-Complex Injection	Vibelan	15 ml.	1/m daily
Liver stimulant Liquid	Tefroli	50 ml.	oral daily
Protein food	Pet food	50 gm.	oral daily

Along with above treatment other supportive treatment was given as under :

Inj. Tonophosphan	10 ml 1/m on 11-12-88 and 18-12-88
Inj. Vet ADE	10 ml 1/m on 12-12-88 and 19-12-88
Inj. Inferon	5 ml 1/m on 15-12-88
Tab. Benminth II (Maruntulcitrate)	1 gm orrally on 13-12-88

After ten days of treatment there was no improvement of general condition: abdominal distention was increased. A decision was taken to tap out the peritonial fluid.

On 22-12-89 the animal was anaesthetized with ketamine hydrochloride 1000 mg 1/m after overnight fasting and withdrawal of water for six hours. The mid-ventral abdomen was prepared for aseptic surgery. Two 14 gauge hypodermic needles were inserted at mid-ventral abdomen. Slowly 9.5 litres of peritonial fludid was removed. This peritonial fluid was sticky, turbid, odourless and straw-coloured.

Result of Laboratory Examination

Peritonial fluid - Drug sensitivity test

Sensitive to : Amplcillin Gentamycin
Resistant to : Pencillin
Blood smear : High nentrophilic count
Fecal sample: Negative for any parasitic ova

After removal of the abdominal fluid the following treatment was given :

Inj. Ampicillin	1000 mg 1/m B. D.	for 10 days
Inj. Lasix	40 mg 1/m	for 20 days
Inj. Vibelan	15 ml 1/m	for 45 days
Tefroli	50 ml orally	for 60 days
Pet food	50 gm orally	for 60 days

After removal of fluid the condition of the animal improved steadily during the course of treatment without any sign of abdominal distention.

The animal was kept under observation for about four months without any kind of treatment but no abnormal signs of disease were observed.

On 18 June 1989, having made a complete recovery of its health, the animal was released back into the Gir Sanctuary.

Case number II

The lioness Ruksana was about nine years of age born on 20-2-80 at Sakkarbaug Zoo.

Ruksana gave birth to two cubs on 2-5-89. An abdominal distention was observed about two months subsequent to delivery. The characteristic belly-fold of an Asiatic lion was not evident due to distention. The coat of the animal was dull and loose. Teats were placed laterally. On squeezing of teats a milky discharge was found. The animal was still nursing her cubs and no further mating had taken place after delivery. There was a fluidy palpation of abdomen on pressure.

In order to collect fluid for analysis, a puncture was made about six inches away from teats on the lateral side of the abdomen and some fluid was collected. The abdominal fluid was pure milky white in colour, completely homogenous, non-sticky, and odourless. Blood, blood-smear and fecal samples were collected for pathological examination.

For about five days following collection of fluid, treatment was given from 10-9-88 to 15-9-89 as follows :

Inj. Ampicillin	2 gm 1/m B. D.
Inj. Belamyl	10 ml 1/m Daily
Inj. Lasiz	40 mg 1/m B. D.
Tab Panacur (Fenbendazole)	1.5 gm orally on 12-9-89

After five days of treatment the animal remained in a dull condition, partially off feed, with slightly loose faeces, normal urination, normal temperature. The abdomen was distended even more than before beginning treatment.

On 15-9-89 Ruksana was anaesthetized with Ketamine hydrochloride 1000 mg 1/m and three x-rays of abdomen and pelvic region were taken.

Results of clinical examination

Radiology examination

- Distended coils of intestine observed
- Ascitic fluid noted in abdominal cavity
- No evidence of pregnancy noted
- No mass effect or abdominal calcification or any other abnormality noted.

Blood smear

- Neutrophil - 88%
- Lymphocytes - 12%

Fecal sample

Positive for 1. Toxoscaris leonina
2. Anchylostoma ova

Ascitic fluid

Culture examination positive for staphylococcus

Drug sensitive to Gentamycine, Ampicillin, Nitrofurozone

From 16-9-89 to 20-9-89 the treatment described previously was repeated. Deworming was also repeated on 16-9-89 with Wormin (Mebandazole) 2000 mg. given orally.

On 17-9-89 the animal was anaesthetized with ketamine hydrochloride 1000 mg 1/m. The ventral part of the abdomen was prepared aseptically. Two needles of fourteen gauge were inserted at ventral abdomen and nine litres of ascitic fluid was removed. On 20-9-89, eight litres of fluid were removed by the same procedure.

Cytological examination of fluid

Polymorphs - 30%
Lymphocytes - 65%
RBC - few
Staining with Gram stain - No organisms
Staining with ZN stain - No AFB seen
Cholesterol test was positive

Therefore, on the basis of the cytological examination we conclude that the fluid was chyleous.

To rule out the possibility of lymphatic blockage by filerial parasite Tab Hetrazan 300 mg. BD was started.

From 21-9-89 the following treatment was given:

Inj. Ampicillin	1000 mg 1/m BD
Tab. Hetrazene	300 mg orally BD
Inj. Lasix	2 ml 1/m BD

Above treatment was supported with other multi-vitamin and mineral suppliments throughout the illness.

Even after all-mentioned efforts the animal died on 23-10-89.

Post-mortem Report

Entire abdominal cavity was filled with ascitic fluid which was somewhat more thick, milky-white with slight reddish colouration.

Liver was having many necrotic spots. Spleen was shrunken and pale. Kidneys were enlarged with pus-like material inside.

Peritonium was enflamed with some fibrous deposition.

The lungs were infested with many small necrotic focci.

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Vol VIII Issue Jan-83

Nutritional Infertility in Captive Tigresses

Dr. Mir Gowher Ali Khan
Deputy Director (AM), Nehru Zoological Park, Hyderabad

Three fully grown tigresses (3½ to 4 years of age RANI) (Junior) ORI and NANDINI belonging to the Nehru Zoological Park, Hyderabad were left for breeding with males in different enclosures. Rani (Junior) was allowed to mate with her father-Ram Singh, ORI and NANDINI were left with Tipu (son of Ram Singh) to mate during the oestrous only. All the tigresses showed typical signs of oestrous and were found receptive. Both the males were aggressive and were observed to mount the oestrous females satisfactorily. However none of the three tigresses conceived.

The infertility problem was reviewed. At first the various functional diseases of the ovary or uterine interference were thought to be the probable cause. But as there were no vaginal discharges in all three tigresses, uterine interference as the probable cause was eliminated, Next the state of ovaries was to be evaluated to eliminate ovarian cysts and other diseases. This could be possible, by means of LAPAROSCOPE (WILDT, D. E. et al), But could not be taken up due to some limitations. As a last resort synthetic ovarian hormones were administered orally to all the females intermittently. Even PRAJANA of Indian Herbs Research & Supply Co., one capsule a day, was tried for 5 days but did not give the desired effects.

Both the males were also reviewed for fertility. Ram Singh (male tiger) was a proven successful breeder as it has sired 2 cubs (1.1 = 2) Rani (junior) and Tipu on 17-4-69. Hence he was excluded from the evaluation. To examine the male genetalia of Tipu, he was taken in the squeeze cage and both the testes were found descended into the scrotum. they were firm and not spongy and on. palpation the epididymii rolled easily. Apparantly there was no pus like discharge from the opening of the sheath. The semen could not be examined for sperm motility as it was found difficult to collect a neat and clean sample of it; in the absence of an electric ejaculator.

However the tigers were treated with Vitamin B12 and TENTEX FORTE tablets orally.

After referring available literature, GIBBONS, U.I. was found to opine as "hereditary and nutritional causes to be involved in some types of infertility." Hereditary record of all three tigresses was not completely available. Hence nutritional aspect was taken up for investigation. The big cats of Nehru Zoological park, Hyderabad, were fed on the following diet:

TABLE 1

Showing Details of Breeding Record of Three Tigresses of Nehru Zoological Park Hyderabad. A.P.

S No. 1.	Species and Sex.	Pet Name.	Date of acquisition.	Estimated age at acquisition.	Probable date of maturity or puberty.	Date of First Mating.	Period of subsequent mating with no conception
1	2.	3.	4.	5.	6.	7.	8
	Panthera tigris (Female)	Rani (Junior)	Born in the Nehru Zoological Park, Dt.27.4.59	Born in the Zoo Dt. 27.4.69	October 1972 attained 3½ yrs of age)	5.6.74	3 years
	Panthera tigris (Female)	Ori.	24.2.74	1½ years	February 1976 attained 3½ yrs.	13.7.77	5½ months
	Panthera tigris (Female)	Nandini (white-tigress)	12.4.73	2½ years	April 1974 attained 3½ yrs of age.	8.8.75	2 years 8 months

Date of Supplementation of diet with 1. Raw liver. 2. Calcium Syrup .	Date of Successful mating and conception	Date of delivery	gestation period.	No.of cubs born with sex.	Died within a month.	Survived Survived after a month.
9.	10.	11.	12.	13.	14.	15.
December 1976.	1.7.77 to 4.7.77	16.10.77	105 days	one Male Cub.	one Male Cub.	
August 1977.	7.1.78 to 15.1.78	16.4.78	92 days.	2+1 = 3	-	1+2 = 3
December 1976	17.4.77 to 22.4.77	1.8.77	107 days.	1+1 = 2	-	1+1 = 2

I. MORNING.

Milk- ½ to one litre with 1-2 raw eggs.

II. AFTERNOON.

1. Muscle pieces of beef 6-8 kilos.
2. Long bones 1-2 kilos.
3. Multivitamins 6-8 tablets per animal per day.
4. T.M 5 (Pfizer) or Aurofac (Cyanamide) feed supplement intermittently was sprinkled on the beef pieces.
5. Raw liver which was fed from 1964 to 1973 was totally excluded from the diet as the liver received from the slaughter houses was found to be extensively infected with liver flukes.

As per the research carried out by SCOTT on the Nutrition of Wild cats in London zoo, it has been found that vitamin A content of muscle pieces of beef is very poor. Following is the extract:

"Reproduction process is depressed when liver is removed from the diet in which it is the principle source of vitamin A. Liver was the main source of vitamin A in a stock diet, on which satisfactory reproduction was obtained in a large number of cats over a 10-year period. Supplies of liver were reduced early in 1963 and entirely cut off later that year with marked effect on the efficiency of reproduction. Comparing the average number of litter from seventeen breeding females on this diet (1 st January to 15th April) they produced 4.0. each in 1962, 3.5 in 1963 and 2.0 in 1964. In 1962, all littered in the spring period, but in 1964 six out of seventeen were barren."

In the same article Scott further throws light on the poor calcium and phosphorous ratio in the beef and stated the following:

"Owing to the rather high calcium requirement of lions, the low absolute level of calcium in carcass meat and the poor calcium and phosphorous ratio (1-20) steps must be taken to correct the deficiency and imbalance in compounding diets for them.

When muscle meat and heart is given to animals the total amount of calcium provided is very small indeed."

TREATMENT:

In the light of the abcve reaearch work of PATRICIA, P. SCOTT and others the diet of all the three tigresses which presumed to be deficient in vitamin A content and poor in calcium aud phosphorous ratio, was supplemented with raw liver ½ kilo, and OSTOCALCIUM SYRUP with B 12 (Glaxo) 60 ml. (This was given in milk daily). After the supplementation of the diet mentioned above for a period of 4 to 8 months regularly, all the three tigresses conceived and gave birth to healthy cubs. Table I shows details of breeding records of these tigresses.

SUMMARY:

Infertility due to Avitaminosis A and improper balance of calcium and phosphorous in the diet, (beef muscle) in three tigresses of Nehru Zoological Park, Hyderabad, is described in this article. In the light of the work of various wild life scientists, the deficiency was corrected by providing raw liver in their diet and supplementing it with Ostocalcium Syrup with B 12 (Glaxo). This resulted in successful conception and birth of healthy cubs to all the three tigresses.

ACKNOWLEDGMENT

The author is thankful to the following officers for their encouragement and facilities provided:

1. Mr. P.S Rao-Chief Conservator of Forests. Andhra Pradesh, Hyderabad (Retired)
2) Pushpa Kumar- Conservator of Wild Life Management, Andhra Pradesh, Hyderabad.
3. Kamal Naidu- Curator, Nehru Zoological Park, Hyderabad. A.P.

(References on request)

Reprint : Zoos' Print, 8 (11) : 28-30, November, 1993

VITAMIN E DEFICIENCY IN CAPTIVE ELEPHANTS & RHINOCEROSES

Tuhin Chakraborty[1]

Vitamin E deficiency syndrome has been well established in domestic animals since the early 1900s and this vitamin has been recognised as a health problem in captive exotic species for more than 50 years (Dierenfeld, 1989). Little information is available concerning the levels of vitamin E in wild animals in captivity, their requirements or its degree of physiological importance. In domestic animals, deficiency of this vitamin has been associated with myodegenerative disorder and cardiomyopathy (Blaxter,1962; Vanvleet & Ruth, 1977), as well as impaired reproductive capacity (Trinder et al.,1986) and nervous system disorders (Muller et al; 1983, Nelson 1980). Vitamin E may also play a role in the immune response to infection and in Prostaglandin synthesis (Lipinski and Machlin, 1981,Stuart,1982).

But the pathologies in wild animals are various and there is great species difference in utilisation of dietary vitamin E. Its effects and pathology. There are few reports of vit E deficiency manifestation of wild species which include cardiomyopathy in Camels (Finlayson et al.,1971; and Nyla Liu et al., 1982) and myodegenerative disorders in ruminants (Wallach, 1970) Pathology consistent with Vit E deficiency has also been reported in cases of capture myopathy in elephant (Dierenfeld 1989). Actual cause of Vit E deficiency in captive wild animals are various and there is great variation in physiology species individuality of vit E absorption as well as diet supplied to them. It has been found that even prolonged vitamin E supplement to animals can show low level of plasma tocopherol. There are several forms of vitamin E available as feed supplements for animals. But it is very important to be sure which forms of vitamin E available as feed supplementation with D,L α tocopheryl acetate in good quality has been proved to be unsuccessful to raise the tocopherol level of plasma in elephants and black rhinoceroses (Diernfeld & Dolensek, 1988; Lewis and Kirkwood 1990).

In this context, the etiology and pathophysiology of Vit E deficiency in elephants and rhinoceroses are discussed. A trial has also been made towards supplementation of vitamin E to Asian elephant.

MATERIALS & METHODS FOR VITAMIN E ESTIMATION

Vitamin E has become synonymous with the most active form α tocopherol and its esters in most cases. But in natural foods and feeds, addition to alpha, beta, gamma and delta tocopherol, are found to have some Vitamin E activity.

The vitamin E is usually available in the form of D,L α tocopheryl acetate (Iμ/g), D α tocopheryl polyethylene glycol succinate TPGS, 20% solution in water, 77.4 Iμ/ml, Dα tocopheryl oil (Iμ/g) D α tocopheryl acetate in oil or water dispersible solid. The D,L forms of vitamin E are mixture of eight stereoisomer and are produced synthetically and Dα tocopheryl is a single stereoisomer derived from natural sources and modified chemically to produce its esters. The TPGS is prepared by esterification of polyethylene glycol 1000 to the acid group to the Dα tocopheryl succinate This waxy solid can be dissolved in water to form up to 20% solution (Weight basis).

Blood samples are taken usually by catheterizing an accessible ear vein and aspirating in a disposable syringe. The samples are then transferred into a tube and sent to veterinary investigation service of the Ministry of Agriculture, Fisheries & Food for plasma tocopheryl estimation. The blood samples are collected for plasma α tocopheryl because circulatory blood concentration reflect the amount absorbed in the gut (Machlin, 1980). But tocopherol level in the liver is a more accurate indicator of vit E status than in the plasma though it is very difficult to get sample in case of live and especially large animals (Blood et al, 1983). Also Vit E levels in tissues other than blood have not been studied in most zoo species. It has also been established that no changes occur on long storage of plasma at temperature below -70°C.

FACTORS CAUSING VITAMIN E DEFICIENCY

Primary vitamin E deficiency occurs most commonly when animals are fed on inferior quality hay or straw and on root crops. Cereal grains, green pasture and well cured fresh hay contain adequate amounts of vitamin. Higher serum tocopherol has been seen in new born calves born from an individual fed on grass silage than in those born from cows fed the same grass as hay and also from animals fed on high moisture grain which was treated with propionic acid as a method of inexpensive storage and for protection from fungal infection (Allen 1975). Marked decrease of the vitamin E concentration has also been observed in case of acid treated grains with an increase in the levels of peroxides of fat which is consistent with a loss of naturally occuring antioxidant like tocopherol.

Though vit E deficiency of farm animals is due to vit E deficient diet, the cause of the deficiency in captive wild animals differs to a great extent. It has been found that vit E supplement in the form of α tocopheryl acetate fails to meet the vit E demand in some animals like rhinoceroses and elephants. The form in which vit E supplement is to be given differs in different species. Hidiroglou *et al*, (1988) compared the natural and synthetic form of α tocopherol in cattle. While all experimental cattle received 1000 Iμ/day and similar circulating levels would be expected but the circulating levels were higher with natural form. In addition the α tocopherl form produced higher increase over acetate form.

In practical feeding, the non alpha tocopherols are assigned zero Iμ value and are not included in feed supplement because of their low activity in rat fetal resorption and other bioassay in comparision to α tocopherol. In vitro gamma tocopherol is found to be more active than alpha and there is evidence that

the gamma is absorbed that may have a sparing effect on the alpha (Machlin,1980; Traber and kayden, 1989).

Many physiological factors are also responsible for vit E absorption and that is why Iμ value does not predict the absorption of various forms by different species. It is important to note that in general, vit E absorption is poor ranging from 20-40% (Papas *et al.*, 1989). A variety of factors such as billary and pancreatic secretions influence the vit E absorption (Sokol *et al.*,1987). This may be a factor in elephants and rhinoceroses especially as they have no gall bladder (Reuther, 1977) and absence of bile acid which may result in incomplete emulsification.

The dietary items which are rich in unsaturated fatty acids such as cod liver oil, other fish oil, fishmeal, used as a protein concentrate, linseed, soyabean, corn oil have been found to cause destruction of vitamin and thus increasing the dietary requirement of vitamin E.

Micro-organisms also play an important role in vitamin E absorption. These micro-organisms in the gut of animals may cause degradation of this vitamin before absorption. Alderson *et al* .(1971) reported a high degree of vit E in the rumen increasing with large concentrate feeding.

Inadequate dietary fat may limit vitamin E absorption, thereby increasing requirements.

NORMAL α TOCOPHEROL LEVEL IN BLOOD

Circulation level of vitamin E in wild black rhinoceros has been found to be 0.77+/- 0.05 μg/ml, much higher than in captive rhinoceroses which was found to be 0.18+/- 0.03 μg/ml. However there is no information available about vitamin E status of blood in Indian Rhino. The black and Indian rhinoceroses are more prone to this deficiency. The level of α tocopherol observed however for captive elephants and black rhinoceroses were significantly lower than those reported for other species in captivity (Brush & Anderson, 1986, Dierenfeld 1989).

In these species, the deficiency seemed to be caused by physiological factors in fat metabolism. Mean plasma level of α tocopherol in healthy animals are highly dependent upon blood lipid levels. It has been seen that shrubs preferred by black rhino usually contain 25% crude fat as well as higher tocopherol content than grasses or dried forages and pellets commonly fed captive animals. Vitamin E concentration in tissues also may have an important role in the deficiency of this vitamin. The circulating level of vit E in African elephant has been found to be .80 μg per ml. The mean serum or plasma level of α tocopherol and cholesterol are presented in Table-1. There are few reports available in those, where vitamin E deficiency can cause death (Papas *et al.*, 1991) .

CLINICAL SIGNS AND PATHOLOGY

Though neurologic abnormalities i.e. degenerative myoencephalopathy are very common clinical manifestation of vit E deficiency in horse, it is not commonly observed in elephant or rhinoceroses. Clinical and pathological findings have been reported in captive zebras (Montable *et al.* 1974) and Przewalski horse (Liu *et al.* 1983). Skeletal muscle degeneration due to vitamin E deficiency has been reported in elephant due to vitamin E deficiency but muscle tissue α tocopherol level were not reported (Papas *et al.*,1989, 1991). The changes noted included acute and chronic severe rhabdomyolysis of skeletal muscle in the hind leg and mild acute degeneration of heart muscles.

Cardiomyopathy resembling "Mulbery heart disease" of swine has been reported in Asian elephant by Dierenfeld & Dolensek (1988). The vitamin E concentration in blood was found 0.26 μg/ml and it was 0.64 μg/g in the liver. The liver concentration was considered below normal (10 μ g/g % as compared to equine liver). The pathology included micro-angiopathy, edema, liver necrosis and steatitis.

The microscopic and histological appearance of the muscle lesion is quite constant but their distribution varies widely in different animals. Affected group of skeletal muscles are always bilaterally symmetrical. In skeletal muscle the diaphragm, there are localised white or graysh areas of degeneration which have an appearance of fish flesh. In cases of myocardial involvement, white areas of degenaration are usually visible under endocardium.

TRIALS ON VITAMIN E

The etiology of vitamin E deficiency as discussed earlier are varied and several efforts have been made to supplement an adequate quantity of tocopherol to raise the normal blood levels in elephant and rhino especially. Black and Indian rhinoceroses are browsers and grazers respectively. For this reason, vitamin E deficiency is common in these animals in captivity, though elephant are also equally affected.

In London zoo, a trial was made to supplement vit E in the form of α tocopherol acetate with an amount of 12500 IU/day, apart from normal diet consisting of vegetables, concentrate and forage. After eight months supplementation, no significant increase in plasma vit E was observed. (Lewis & Kirkwood, 1990).

In the case of elephant (both Asian and African) the same results were obtained after supplementation with D L α tocopherol acetate at 1.5-2.0 IU/Kg bodyweight for 9 months. The D α tocopherol acetate in oil form at a high dose also failed to increase α tocopherol level in blood (Papas et al., 1991)

It has been shown that instead of α tocopherol acetate, D α tocopheryl poly ethylene glycol 1000 succinate (TPGS) is to be given then α tocopherol level of plasma can easily be raised.

In a study of TPGS supplementation to black rhinoceroses it was observed that plasma α tocopherol was eleveated after 13 days of supplementation to 3.9. mg/lit (Kirkwood *et al.*, 1991). In another study it has been seen that TPGS supplementation elevated the α tocopherol level in plasma within a very short time in black rhino and captive elephant. In elephant TPGS increased the plasma α tocopherol level to 0.4 μg/ml immediately after supplementation and did not return to base line after withdrawal of the supplementation. From research

work in Whipsnade Wild Animal Park, two Asian elephant were provided with 13500 IU TPGS which showed very good reflection of α tocopherol level in blood 3.75 µg/lit. The supplementation was continued for six months. The initial elevation of α tocopherol level was followed by decrement and maintained a standard level 2-3 µg/lit after 60 days. In contrast to fat soluble and water dispersible forms, TPGS does not require biliary secretion, ie bile acid for solubilisation and absorption (Sokol *et al.*, 1987, Traber *et.al.*, 1986).

CONCLUSION

1. There are great differences in the absorption and utilisation of vitamin E in different species. So selection of vit E supplementation should be done on the basis of bioavailability to animal species.

2. Elephants and black rhinoceroses absorb fat soluble forms of D L α tocopherol acetate, D α tocopherol poorly. In contrast TPGS is readily absorbed.

3. These findings explain the persistently low circulating blood α tocopherol in captive elephant and black rhino despite of dietary supplementation of D L α tocopherol acetate.

4. Some evidence exists that hypovitaminosis E in elephants may result in myodegeneration of both skeletal and heart muscles and is suspected in hemolytic anemia in black rhino.

5. Research is needed to determine if similar peculiarities of vit E metabolism exist in the Indian rhino.

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ACKNOWLEDGEMENT

The author is thankful to Mr. S. S Bist Divisional Forest Officer Wildlife Division II Govt of West Bengal for his kind cooperation and continuous initiation also express gratefulness to Mr. B.Majumdar, former Joint Director (Wildlife) Ministry of Environment & Forest, Govt of India and to Mr. N. C. Bahuguna Director, Padmajanidu Himalayan Zoological Park, Darjeeling, West Bengal for their kind help.

[1] Padmajanaidu Himalayan Zoological Park Darjeeling West Bengal

Table -1

Mean serum or palsma tocopherol (E) and cholesterol in elephant rhinoceros.

A	Elephant	Tocopherol µg/ml	Cholesterol mg/ml
1	Captive\ (Asian&African)	0.4	0.62
2	Free ranging(African)	0.8	0.69
B	Rhinoceros		
1	Captive (3 species)	0.4	0.79
2	Free ranging (black rhino)	0.6	

Reprint : Zoos' Print, 4 (12) : 21, December, 1989

A NOTE ON VITAMIN E AND GAVIALIS GANGETICUS

During my fifteen long years in crocodilian management and husbandry I have found Vit. E of particular help to hatchling gharial (*Gavialis gangeticus*). Compared to the other two Indian species of crocodilians *Crocodylus palustris* and *C. porosus*, gharial are difficult to rear. Gharial is a fish-eating crocodile. It insists on live fish atleast during the first 5-6 months in captivity. Healthy looking hatchlings may die in large numbers without adequate and more obvious notice. The symptoms may include hypersensitivity, gyration at the surface or under water and an overall weak control on muscle (and probably nerve too).

During a mass mortality (129 out of 215 in a period of 59 days) in 1977 treatment of survivors with ampicillin and Vit. E appeared to have caused recovery. From the subsequent year I recommended a prophylactic Vit. E dose of 30mg / hatchling / day for seven days during the second or 3rd fortnight after hatching. Where practised survival have been better (up to 100%) and there have never been a mass mortality as before.

The situation appears parallel to muscle and nerve degeneration in hoofstock and reduced survivability in birds, because of Vit. E deficiency (Dierenfeld, E. S. 1988: Vitamin-E: facts and fables. *Animal Keepers Forum*, Nov. 1988 : 345)

Lala A. K. Singh, Ph. D. Research Officer
Similipal Tiger Reserve
Khairi - Jashipur, Orissa, India 757 091.

dt. 22 July 1988.

Dierenfeld responds:

Dear Dr. Singh, *20 August, 1989*

In response to your letter concerning potential vitamin E deficiency in gharial, I would say you were quite correct in your recommendation of dietary supplementation with this nutrient. Fish lipids are very highly unsaturated which makes them quite susceptible to oxidation. The antioxidant role of vitamin E increases the dietary requirement as polyunsaturated, fats and/or rancidity increases.

We have measured the Vitamin E content of whole fish commonly fed in zoos and aquariums, and found them to contain an average of 1.0 mg Vitamin E/100g (wet basis; range 0.6 - 5.7 mg). This is equivalent to about 40mg/kg on a dry basis. We typically try to formulate all diets at the zoo to contain atleast 200 mg/kg vitamin E (dry basis). Recommendations for another piscivore, the harp Seal (phoca groenlandica) were 100 mg Vitamin E per kg fish (wet basis), or approximately 350 mg/kg (dry matter basis).

Dietary Vitamin E supplementation is recommended in the diets of all fish-eating species. I am enclosing a copy of a review article that documents several incidences of Vitamin E deficiency in crocodilians, as well as other reptiles, birds, and mammals for your information. I hope you find this useful.

Ellen S. Dierenfeld, Ph. D. Nutritionist

Reprint : Veterinarian, 8(5), 1984

Short Communication

Hyperthermia in a female gaur *(Bos gaurus)*

Dr. Mir Gowher Ali Khan
Dy. Director (AH) Retd., Nehru Zoological Park,
Hyderabad, A.P.

Introduction :

Nehru Zoological Park was exhibiting a group of gaurs in a big moated enclosure since 1973. This enclosure is oval in shape and 0.5 hectres in area. This area is protected by means of angle irons and chain link (2Mt. High) all round, with an open dry moat in front (viewing area) the moat is having a gradual slope for easy accessability for the animals, there is an asbestos shed in a corner and plenty of acacia trees provided the required shade.

Case Report :

In May 1975, (April and May are the hottest month in Hyderabad), one guar cow 2.5 years old was observed shaking her head frequently with anxious expression and was walking wobbly. Before she could be taken into the enclosure for close observation and treatment, she fell down many a times on the ground and got up with great difficulty. Her respirations were rapid and the conjunctiva was injected. The body temperature was 107F. Tongue was protruded and was coated with frothy saliva. The case was diagnosed to be Heat stroke. Heat stroke or thermic fever results from Hyper pyrexia, an accummulation of body heat. The incident is greatest during a prolonged heat wave.

Treatment :

The following treatment was administered.

1) Splashes of Ice Cold Water on the head and body.
2) Ice Cold Water enema.
3) Injection of Strepto Pencilin intramuscurlarly (2gms of Dihydro streptomycin and 40 lakhs) of Procain Penicilline).
4) Novalgin 30 ml / alternately Largactil 10 ml i/m with 4 hours interval.

The condition became worse and the animal expired during the night.

Autopsy :

The next day autopsy was conducted and heavy congstion of the brain was observed.

Reprint : Veterinarian, 7(5):II, 1983

Short Communication

Treatment and Control of Diarrhoea in an Indian Rhino Calf

Dr. Mir Gowher Ali Khan
Dy. Director (AH), Nehru Zoological Park,
Hyderabad, A.P. - 500 264

An Indian Rhinoceros male calf, aged about 7 months was observed to pass loose green coloured stools. The calf was being reared by the mother satisfactorily. At this age the calf had started nibbling a few blades of green grass and concerntrates from the keepers hand. Microscopical examination of faeces did not reveal any helminthic ova/cyst.

Conventionally used antidiarrhoeal preparations were used for 4 days and when the Rhino failed to respond to them, then to minimise the irritation of the intestinal mocous membrance and to control diarrhoea BARALGAN TABLETS were used. Four such tablets were administered along with Pectokaoline, Creta preparata and yeast tablets for 4 days and the Rhino calf passed stools of normal colour and consistency at the end of the treatment period.

Even though the rhino calf had severe diarrhoea the general condition of the calf throughout the period of treatment remained normal and no loss of appetite or dehydration was observed.

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Vol VII Issue III Mar-82

A NOTE ON USE OF BETNOSOL IN A CASE OF HYPOTHERMIA IN A BOSGUAR (BOSGUARUS) CALF

Dr. Mir Gowher Ali Khan
Deputy Director (A.H) Nehru Zoological Park, Hyderabad

Betnosol (Betamethasone sodium phosphate) of Glaxo is being extensively used on the wild animals and birds of Nehru Zoological Park, Hyderabad, as this is found to be most potent of all corticosteroids and gives a swift intensive response. A case of hypothermia in a Bosguar calf is described here, wherein this drug has helped in quick recovery.

A gaur calf, male, aged about 4-6 months got fully drenched in its enclosure during the night of 25th June, 1975, this being the first monsoon showers the city received. Next day in the morning it was found in a very bad shape. It was dull, both the eyes were half closed, there was hiccup with regular intervals of 1-2 minutes with jerks at the flanks. Pulse was weak, heart beats slow, and the body temperature sub normal i.e. 93°F. The animal was unable to stand, hence was carried to the inpatient ward manually.

The following treatment was immediately administered.

1. The body of the calf was rubbed thoroughly with d ied gunny bag and a warm bedding of paddy straw was provided.
2. Betnosol 1.Ml. was injected i/m.
3. Dicrysticine 15 lakhs was given 1/m.
4. Injected Belamyl 1 m1. 1/m.

After the above treatment, the calf was forced fed, slowly with lukewarm mi k and was made to sit on the Brisket.

TIME.	MEDICINES ADMINISTERED AND OBSERVATIONS MADE
10-10 A.M. ...	Hiccups and the jerks at the flanks had stopped completely. Injected MIFIX 20ml. sub cutaneously.
2.00 P.M ...	Body temperature is found slightly raised i.e. 95°F. Injected Betnosol 1ml. 1/m.
3.00 P.M. ...	The calf got up on its legs, of its own accord. Started picking and munching few green leaves.
5.00 P.M. ...	The calf appears much better. Body temparature rose to 100°F. Injected Betnosol 1 ml. 1/m.

Injected MIFIX 20 ml.

The calf was shut in the cubicle of of the ward for the rest of the night. A night attendant was instructed to keep a watchful eye on the animal.

The next morning the calf was found to be active and alert. It had urinated and passed normal stool during the night. The eyes were bright and glistening. The body temperature was 101. 4°F The above mentioned treatment i.e. injections of Betnosol, Dicrysticine, and Belampyl was continued for 2 more days. (Betnosol was given 3 times in a day) and the calf recovered completely.

ACKNOWLEDGEMENT

The author is thankful to Sri Pushp Kumar, I.F.S., Conservator of Forests, Wild Life Management, A.P. Hyderabad for his encouragement and permission for publishing this article.

Indian vet. J. 54, August 1977 : 676

MY FAIR LADY

Mir Gowher Ali Khan
Veterinary Officer, Nehru Zoological Park, Hyderabad

The Zoo Lady Amherst Pheasant named Helen, a female became a problem on 13-6-74. The bird was dull with ruffled feathers and had no desire to share its morning meal served with its mate. It was sick and was unable to walk and when made to do so, she went wobbly. The bird was admitted as an in patient for close observation and treatment.

It had no fever, no nasal discharge or throat congestion. It was treated symptomatically with Achromycine i/m in one thigh-muscle and Berin (B_1) 0.1 ml mixed with little distilled water into the other thigh. The pheasant was placed then in a box and was keenly observed. After some minutes, it fainted, almost flat with closed eyes and rested its head on the box, but she was breathing regularly. Immediately 0.1 ml of Betnosol (Betamethosone sodium phosphate-Glaxo) and 0.5 ml of distilled water drawn into a tuberculin syringe was pushed into the tender muscle of the pheasant (time 11.30 a.m.). Then it was left undisturbed in the same box for close observation. At about 1.30 p.m. it opened its eyes, raised the neck slowly and got up on her toes. The same injection was repeated and the bird was hand-fed with powdered bengalgram soaked in water and rolled into small pills. On the next morning the bird was found to be much better. It was walking and resenting when handled for treatment. Achromycine with 0.1 ml of Vitamin B Complex i/m was given for three consequent days and Terramycin egg formula in drinking water was continued for a period of seven days. During this period, it was able to walk properly and started picking grains of her own accord. On 20-6-74 it was taken back to the "Pheasant Section" and was left with its male in her old room.

Acknowledgment

Thanks are due to the Director, Nehru Zoological Park, Hyderabad for his encouragement and inspiration given.

Reprint : Zoos' Print, 7 (4) : 21, April, 1992

Disease and Remedy in Zoos

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There are four main sources of disease in zoos. Disease can be 1. water-borne, 2. air-borne, 3. it can be transmitted through food or 4. it can be due to managemental error.

Disease can be specific or non-specific. We will first look at the breakdown of specific disease. Specific disease can be caused by parasites, bacteria or viruses.

Parasites can live on the outside of their hosts (Ectoparasites) or they can live inside the host's body (Endoparasites). Ectoparasites include a fungal disease common to birds called Aspergillosis, a fungus common in carnivores called Coccidiomycosis and another fungus to which all animals are susceptible called Ringworm. Endoparasites include Cestodes, Nematodes, Trematodes and Protozoa. Protozoa cause diseases such as Theileriasis, Babesia, Trypanosomiasis and Coccidiosis.

Bacterial diseases such as Tetanus can be found in both carnivores and herbivores, while Anthrax, Pasturellosis and Brucellosis are found only in herbivores. Salmonellosis is another bacterial disease, as is Tuberculosis which is common in primates.

Viral disease such as Foot & Mouth and Rinderpest occur in herbivores, while Feline enteritis is common in cats and Ranikhet disease is common in birds.

There are a number of other specific diseases which are of zoonotic importance such as Rabies, Scabies, Toxoplasmosis, Filariasis, Streptococcosis, the common cold and Hepatitis.

Non-specific diseases are also common and important in zoo animals. Traumatic injury is usually caused by fighting between animals. Pneumonia can be caused by mismanagement and environmental pollution, especially in zoos which are situated in cities. Emmaciation and malnutrition can be due to over-crowding of animals in an enclosure or other types of faulty management. Animals can be poisoned by pesticides, insecticides, poisonous plants and forage, and also construction materials such as zinc oxide, lead, etc.

Other conditions may also develop. Infertility can be due to faulty management or vitamin and mineral deficiency. Prolapse and abortions can result from both traumatic and organic sources. Dystocia is also seen in many zoos.

The following measures can be taken to combat the situation. Sheds, floors and enclosures should be properly cleaned with disinfectant. Food should be carefully checked and a proper ratio of DCP and TDN should be maintained. Additional vitamins and minerals should be supplemented as necessary.

There should be a good supply of clean drinking water and all reservoirs and water containers should be cleaned periodically. Workers should be neat and clean when they are handling food, etc. Lime should be put at entrances to prevent disease being spread by shoes.

Stray cattle should, if possible, be controlled. The zoo animals should be observed daily and periodical routine de-worming treatment should be given, at least at 3 month intervals. An immunised circle zone should be created and the circumference adjacent villages should be also vaccinated.

The two main points to remember regarding disease in zoo animals is that the best managerial effort maintains the best health, and that prevention is better than cure.

Reprint : Zoos' Print, 12 (2) : 8, February, 1997

TRIALS WITH METOCLOPROMIDE FOR PROMOTING MILK SECRETION IN A LIONESS

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Lioness 'Sheroo' at the Tata Steel Zoological Park, Jamshedpur gave birth to three lion cubs on 19th May, 1994. All the cubs were normal and the birth weight of the cubs were 1200 g., 1000 g. and 900 g. respectively. The lioness took care of the cubs by allowing them to suckle for 15 days. Thereafter, the mother's milk was found to be insufficient. The growth rate of the cubs became poor and the cubs had to be hand reared. The lioness came into oestrus and started neglecting the cubs. All the three cubs were put on artificial feeding with Lactogen-I[1]. Two of the cubs, both female, Chandni and Tara accepted Lactogen very well (50 ml. each at 4 hr. interval in a day), through feeding bottle, but Suraj, the male cub did not accept any of the weaning foods and succumed to death on 30.6.94. At the age of 45 days Egg Farex[2] 50 g. each once daily was introduced and frequency of feeding Lactogen-1 (60 ml each feed) was reduced to every 5 hours. At the age of 60 days both the cubs were initiated to consume finely minced chicken meat and chicken soup once daily. Growth rate was monitored and the weight of the cubs was recorded once a week. At the age of 90 days boiled and minced mutton was introduced and given twice a day which they accepted very well.

On 7th October '94, the lioness again gave birth to two cubs of normal size and weight. The milk secretion of the mother was very poor and none of the cubs of this litter accepted hand rearing, consequently, both the cubs died.

On 4th April, 1995, Sheroo gave birth to three cubs once again all of normal size and weight.

To ensure that the cubs received adequate mother's milk, a trial was made to enhance the milk secretion of the lioness by administering Reglan[3] (Metoclopromide) - two tabs of 10 mg each - twice daily for 25 days, followed by 3 tabs of 10 mg each twice daily for upto 90 days. The trial results were very encouraging. The milk secretion of the lioness increased. The lion cubs thrived entirely on the mother's milk and grew well.

It may be stated that the authors consulted a few medical practioners who stated that they use Metoclopromide for the purpose of increasing the availability of 'mother's milk', to the infants, over and above, its common use as an anti-emetic.

The authors are not aware of anyone having successfully used Metoclopromide in domestic animals or in zoo animals for the said purpose of improving milk secretion even though the drug is very commonly used as an anti-emetic in domestic animals.

Metoclopromide, a dopamine antagonist drug, which is vastly used to prevent vomition associated with gastro-intestinal disorders, is reported to have a stimulating effect as to cause prolactin release. Knowledge of this fact gained from the medical practitioners and subsequently from books was made use of in this trial. This was our first trial of the drug in an animal and that too in a lioness to improve the secretion of dam's milk.

The trial was a success and we could save all the three lion cubs as they received dam's milk in sufficient quantities.

As observed in this trial, the milk secretion increased to an extent as to suffice the requirement of the three cubs in the litter upto 90 days after administration of Metoclopromide to the lioness obviously due to the action of Metoclopromide in stimulating prolactin release, prolactin, being the main hormone responsible for milk secretion, in turn, promoted and enhanced milk secretion.

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Laurence, D.R. and Bennet, R.N., 1992. Gastro-intestinal system, adverse reaction to metoclopromide. In: *Bennet clinical pharmacology*

* Consultant Vety. Surgeon, ** Asst. Director & Vety. Surgeon, Tata Steel Zoological Park, Jubilee Park, Jamshedpur 831 001.

[1] Infant powdered milk, Nestle India Ltd.
[2] Cereal based weaning food containing egg, Glaxo India Ltd.
[3] Trade name of Metoclopromide

Reprint : Zoos' Print, 13 (3) : 21-22, March, 1998

TREATMENT OF MONA - THE FEMALE LEOPARD AT KANPUR ZOOLOGICAL PARK, KANPUR UTTAR PRADESH

Ashok Singh[1], Mamta Sharma[2], R.K. Dwivedi[3]

Kanpur Zoo received three leopards from Nainital on 19 October 1996, one female and two males. These leopards were named Mona, Raja and Man-eater. Man-eater was so named bacause it was actually a maneater caught from the jungles of Pithoragarh. Mona and Raja were healthy animals while Man-eater had lost his teeth presumably during the capture.

Mona was an 11 month old female cub, very healthy and active and immediately endeared herself to the zoo staff.

The leopards were kept in hospital in quarantine ward for 10 days and then were shifted to exhibit enclosures. In the first week of December 1996, it was observed that Mona as well as Raja were shedding hair. Initially we thought that this shedding was part of normal coat shedding change. However it was observed by the Director that this shedding was accompanied by reddish bare spots on skin and also that the animal looked distressed. Treatment was started on 7 December 1996 and both animals were shifted to the hospital. Treatment was started with Gentamycin, Avil and Himex Lotion (External application). Thus treatment was for superficial lesions only to control infection.

Raja responded to treatment but Mona continued to be dull. Then on 11 January 1997 Dr. Arora from I.V.R.I., Bareilly visited Kanpur Zoo. He very kindly consented to examine the animals and suggested application of Quadriderm and Trioderm externally. He also suggested that animals be given Hivit. Both animals responded to treatment. The bare patches on body disappeared. Both animals were shifted to the exhibit enclosures.

In the enclosures Raja was seen to be healthy and active but Mona was very dull. She would sit at one spot for long hours with her head bent and would not respond at all to any disturbance or call. Then on close examination it was observed that her skin had become greyish black in colour in certain areas notably the nape and forehead. These areas lacked hair and looked wrinkled and flaky. Apparently the disappearance of redness which was taken as improvement had actually been a deterioration. The animal was shifted back to hospital and it was thought that the condition was not superficial but a a mainfestation of some internal problem.

A series of tests including blood and stool tests were performed. Stool tests showed positive for parasites. Mona was diagnosed to be suffering from complex dermatitis.

Now a strategy was devised to control parasites, counter their toxin in body, control secondary infection and build up the immune system of the animal. At the same time the body surface was regularly cleaned with Dettol and Wockhadiene to counter any secondary infection on body.

A deworming schedule was devised and deworming was done every 15 days. To enable the liver to withstand heavy deworming doses administered orally and intramuscular, livovet was administered orally. Besides common dewormers like Piperazine zodex and Penacuri (fenbendazol), Invermectin was also used, which is a strong drug that kills endo- as well as ectoparasite.

Initially the animal did not appear to respond at all. In fact her condition apparently detenorated. She could not open her eyes and was not able to stand. The only hope was that she maintained her diet. This fact alone kept us going. Other wise it appeared to be a hopeless case and anyone who saw Mona told us that she would not survive the disease. But we believed that "Jab tak Sans Hai Aas Hai" and continued with our combination of deworming, antibiotics, antiseptic lotion application, vitamin, mineral and Livovet treatment (Supportive therapy). The daily treatment regimen is given in Table I.

Then in last week of March we observed that normal skin with normal hair growth was gradually replacing the necrotic, flaky grey areas. We finally saw a ray of hope and were assured about the correctness of our approach. By mid-April the animal had opened her eyes and could stand on her own. Some of her playfulness and ferocity also returned.

She was kept under observation for 15 more days and was finally shifted back to her enclosure on 27 April 1997.

Now Mona is an active healthy and some what ferocious animal. She has the confidence to take on Raja who incidentally is her father and can give him a run for his life.

[1]P.C.F. (Wildlife), [2]Director, [3]Vety. Officer
Kanpur Zoological Park, Kanpur, Uttar Pradesh

Table I

Date and Medication	Remarks
7.12.96 to 11.12.96	
1. Gentamycin Inj. 3 ml I/M	Antibiotic to control infection
2. Avil Inj. 3 ml. I/M	External body application
3. Himex Lotion Spray	
11.1.97 to 28.01.97	
1. Quadriderm Cream	Morning external body application
2. Trioderm Cream	Evening external body application
3. Binocin Inj. I/M 1 Vol X 1 gram	
4. Pridinisolone Inj. 3 ml. I/M	
5. Hivit Inj. 3 ml. I/M	To strengthen immune system
24.2.97 to 5.3.97	
1. Wockhadine lotion	External body application
2. Detol - Washing	
8.3.97	
1. IverMectin Inj. 1 ml S/C	To kill external & internal parasites.
2. Ectosep cream	
9.3.97 1. Piparazine Liquid - 15 ml.	Orally to control worms
10.3.97 to 16.3.97	
1. D.C. Inj. 1 gram I/M	
2. Avil Inj. 3 ml I/M	
3. Vita A, D3, E Inj. 3 ml. I/M	To strengthen immune system
4. Ectosep cream	External body application
11.3.97 1. Zodex-1 Bolus	Orally (Mebendazole) To control worms
12.3.97 2. Zodex-1 Bolus	Orally (Mebendazole) A/a
13.3.97 3. Zodex - 1 Bolus	Orally (Mebendazole) A/a
17.3.97 4. Ivermectin 1 Ml. S/C	Orally A/a
13.3.97 to 23.3.97	
1. Dermokil -1 Botal X 100 ml	External body application
2. Detol	
23.3.97	
3. Avil Inj. 3 ml. I/M	
4. Hivit Inj. 3 ml. I/M	
5. Livovet liquid 15 ml.	Per day Orally To strengthen liver.
24.3.97 to 18.4.97	
1. Hivit Inj. 3 ml. I/M	Orally to control iodiene deficiency
2. Eltroxin TAB -1. Tab	
3. Recovit 2 Ml. liquid	Oral administration
4. Ostocalcium - 10 Ml. liquid	Oral administration.
5. Dermokil - 1 Bottle X 100-ml.	External body application
27.3.97 – vermectin Inj. 1 Ml. S/C	
5.4.97	
1. Panllume Tab 500 mg. (Fenbendazole)	Orally to control worms
2. Punoure Tab (Fenbendazole) 500 mg.	Orally
3. Panure. Tab. 500 mg. (Fenbendazole)	Orally
19.4.97 to 26.4.97	
1. Recovit - 2 ml. liquid	Orally
2. Ostocalcian - 10 ml. liquid	Orally

Reprint : Zoos' Print, 13 (3) : 15, March, 1998

METABOLIC BONE DISEASE IN STRIPED HYENA *(Hyaena hyaena)*

M.G. Jayathangaraj[1], Mathew C. John[2] and Baskaran[3]

'Metabolic bone diseases' are more commonly encountered in domestic animals and are rarely documented in wild animals. The case encountered in a striped hyena *(Hyaena hyaena)* has been discussed in detail in this paper.

Materials and Methods

An adult striped hyaena at Vandalur Zoological Park was said to be 'weak' in condition. Apparently, the animal was found moving in a lethargic manner with mild tremors and mild bowing of limbs within the confined place. Chemical immobilization was carried out using xylazine and ketamine combination, by means of a blow pipe with the darting syringe, by the zoo veterinarian. Within fifteen minutes, the animal evinced satisfactory signs of immobilization. Blood sample was collected from the cephalic vein forsubsequent haematological and biochemical examination; Blood smears were prepared for differential count from the peripheral veins and througnout the course of immobilization. saturation pressure level of oxygen was assessed using a pulse oximeter (Nellcor N-20PA, USA). Blood samples were analysed at the Centralised Clinical Laboratory of Madras Veterinary College and the results were obtained and discussed accordingly.

Results and Discussion

The haematological sample revealed the PCV of 36 percent, haemoglobin level of 12 gm percent, RBC count of 5.6 m/ Cumm and W.B.C. count of 9600/Cumm. Differential count revealed 59 per cent of neutrophils and 41 percent of lymphocytes. No abnormalities were detected in the blood picture and no blood parasites were detected. The pulse oximetry revealed the saturated pressure level of oxygen as 94 percent. The direct fecal examination earlier failed to reveal the evidence of helminthic presence. The biochemical examination revealed the BUN value of 48.2 mg percent, serum creatinine value of 1 mg per cent, serum total protein level of 7.8 gm percent, serum calcium level of 21.5 mg percent and phosphorous level of 9.2 percent. Metabolic bone diseases are commonly noticed in wild animals under the captive conditions: Donoghue and Langenberg (1994) quoted on their occurrence in both the juvenile and adult wild animals. Many of the clinical biochemistry - reference values have not been established for the non-domestic species, thus, leading to difficulty in interpretation (Gascoyne et al, 1994). In the animal under study, the serum calcium and phosphorous levels were abnormally high, when compared to the values given by Fowler (1986). Gourley and Vasseur (1985) quoted that increased serum phosphorous level develops when glomerular filtration is reduced by about 75 percent and hypocalcemia does not occur, until the disease is more severe. Likewise, Ettinger and Feldman (1995) stated on the correlation between the renal disease and the hypercalcemia. Dehydration also may lead to increase in BUN value, as the case with renal diseases. The cause of renal disease did not arise in the case under study, even though there is an increase in the BUN value than the normal; The probable reasons that can be attributed to this are that there are no signs related with renal disease in this case and the creatinine level was not found high. Further, even under partial sedation, the animal did not evince any signs of pain when the renal regions were palpated firmly. Fowler (1986) quoted that hyaenids have the speciality of bone-crushing adaptation of the premolars, inorder to scavenge on the kills of other species and Prater (1971) also indicated on the bone crushing power of jaws and teeth in hyaenas.

These facts lead to the understanding that calcium and phosphorous are the vital elements in the feeding regimen of hyaenids in the wild. The imbalances in their dietic regimens of diseases might result in derangements in the metabolism of calcium, phosphorous in this case. The tremors noticed earlier in this case might be attributed to the neuro-muscular effects of increased calcium status, as reported by Gourley and Vasseur (1985) and the generalised weakness in this case also may be attributed to this increased calcium level as quoted by Kirk (1995). Though radiography helps to detect specific changes, it was not carried out in this case.

The metabolism of calcium, phosphorous and /or vitamin 'D' are often the inter-related and complex ones, as discussed by Cunningham (1992) and hence, in this atmosphere, the emphasis can be stressed mainly on the 'preventive steps', rather on the 'therapeutical aspects'. Fowler (1986) also quoted on the placement of special emphasis on calcium, in case of hyaenids. The diet offered routinely need to be examined for Ca/P ratio, in addition to ruling out the causes of metabolic bone disease in wild animals like renal diseases, hormonal imbalances etc. Since the SP O2 level was more than 90 percent, no clinical significance was given to the value obtained in the pulse oximeter, in this case and provision of respiratory support did not arise through out the course of immobilization.

Acknowledgement:

The facilities rendered by Director-Vandalur Zoo, Dean, Madras Veterinary College and Director of Clinics are greatly acknowledged.

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The Assam Veterinarian, December, (1989) 4 (2) :-89

TRAUMATIC HEPATITIS IN A FOX (*Vulpes vulpes*)

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Traumatic hepatitis is frequently reported in cattle but its occurrence in captive fox is lacking in the available literature. The present communication describes a case of traumatic hepatitis in a eight year old captive fox belonging to Assam State Zoo.

Postmortem examination revealed clotted blood in the peritoneal cavity. The right lateral lobe of the liver was found to be pierced obliquely by a pointed bamboo piece measuring 7 cm in length and 5 mm in thickness. Petechial haemorrhage was observed in both kidney. No lesion was seen in the skin and stomach.

Histopathological examination of liver sections stained by H & E stain showed haemorrhagic tract and infiltration of polymorphonuclear cells in the region of the wound. Degenerative changes in the hepatocytes in and around the haemorrhagic fistula was found to be pronounced. Hepatic blood vessels and sinusoides were engorged with blood. Sections of kidney revealed focal haemorrhages.

Absence of any visible wound in the skin and stomach indicated that the foreign body (bamboo piece) entered orally along with feed and subsequently it penetrated the stomach wall and got lodged in the peritoneal cavity for some time, although, no adhesion of the peritoneum with the stomach could be seen. Finally it penetrated the liver and caused death due to haemorrhagic shock.

Indian Journal of Veterinary Pathology 21(2): 138-141. December, 1997

ENTEROLITHIASIS AND THEIR STRUCTURAL FEATURES IN ZEBRA (*EQUUS ZEBRA*)

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SUMMARY

Enteroliths in 3 zebras were recorded at necropsy. In all the three cases large numbers of enteroliths were seen mostly in the large intestine of which only one big lith had partial attachment with the wall of the colon. The enteroliths could be cut with electric saw and the cut surface showed concentric laminated structure with a central nucleus. Following analysis by energy dispersive x-ray micro-analysis, these were found to be composed mostly of magnesium, phosphate, calcium, silicon, magnese and iron, however, the composition varied from piece to piece.

Key words : Enterolith, energy dispersive x-ray micro-analysis, zebra.

INTRODUCTION

Enteroliths or intestinal concretions are considered rare in domestic equidae[4], although there are some reports of enteroliths in horses[1,5,6]. On perusal of the available literature it is seen that there is a single reference on the subject in zebra[2] from abroad. The present paper puts on record the presence of enteroliths and their structural features in captive zebras (*Equus zebra*) of Assam State Zoo.

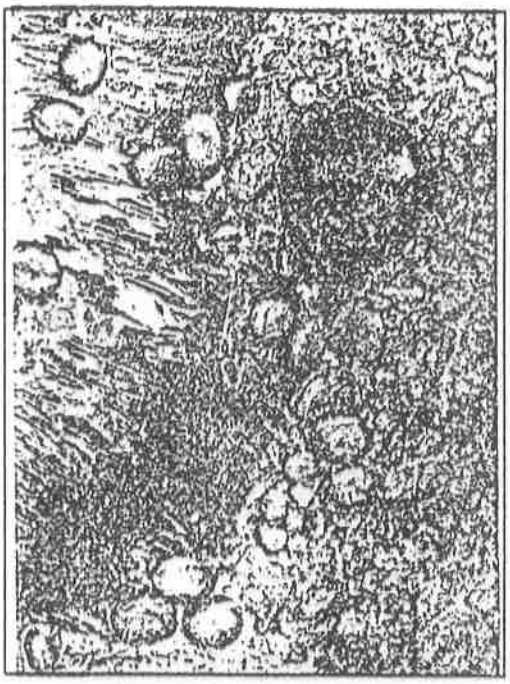
MATERIALS AND METHODS

At Assam State Zoo, Guwahati, 4 zebras were necropsied during 1984 to 1991 and 3 zebras had enteroliths in the large intestine. Besides routine histopathological study of the large intestine Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Microanalysis (EDAX) study of the enteroliths were carried out. For SEM and EDAX study few small enteroliths were air dried. The lith was then secured to a brass stub with double sided sticky tape. Conductive coating was applied to the sample using gold as a target metal in a JFC-1100 (Jeol) iron sputter coat and observed with a JMS-35CF (Jeol). EDAX was carried out in EDS system (Link) attached to JSM-35CF. Air dried enteroliths were coated with carbon in the vacuum evaporator FEE 4X (Jeol). Analytical conditions were set at accelerating voltage of 20KV, till of 45.00, elevation of 0.00 and azimuth of 0.00. Quantitative analyser were carried out using ZAF programme (Link). Instructions were given to normalise all elements analysed.

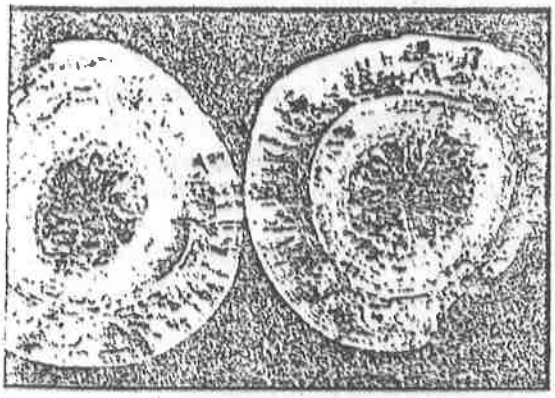
Both the SEM and EDAX studies were carried out at Regional Sophisticated Instrumentation Centre, Shillong-3.

RESULTS AND DISCUSSION

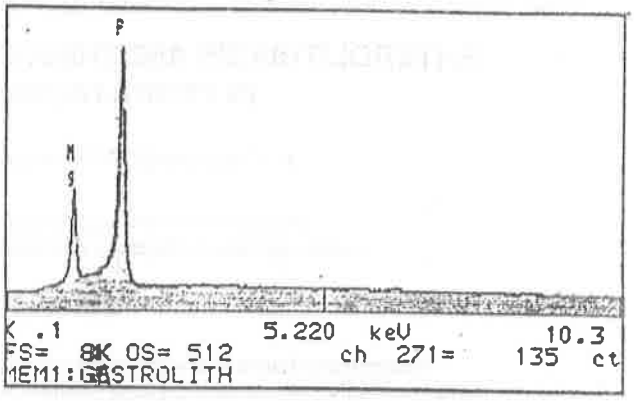
The enteroliths were seen in the large intestine, mostly the colon. However, in



1. Enteroliths in large intestine intermixed with ingesta and fluid with severe congestion of intestinal mucosa.



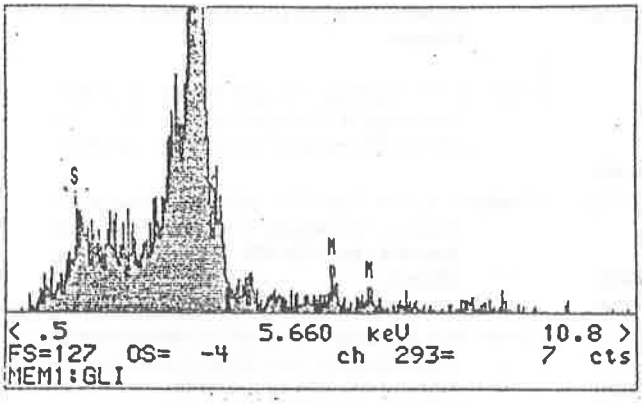
2. Section of enterolith showing layers of mineral deposition with nidus at centre.



3. EDAX of outer surface of an enterolith : 20.00 KV TILT =45.00 ELEV = .00 AZIM = .00 COSINE = 1.000 Spectrum : GESTROLITH All elements analysed normalised

ELMT	ZAF	% Elmt	Atom %
Mg K :	01.149	33.353	38.930
IC :	01.777	66.656	61.070
Total		100.008	100.000

one case few liths were seen in small intestine which is rarely seen. All the three animals were adult (male - 1, female - 2) and the cause of death were traumatic injury, botryomycosis and senility. Large numbers of enteroliths were noticed in the intestine (Fig. 1) and were lying free in intestinal lumen except one which was the largest (9.5 cm in diameter) and partially attached to the wall of the posterior colon. At the sites of attachment there were ulcerative lesions while at other sites discrete areas of necrotic foci were discernible. Microscopically, the area showed suppurative fibro-necrotic enterocolitis and on Brown and Brenn stain, organisms indistinguishable from *Actinomyses* sp. could be recorded. The third case which died due to senility, had about 4 kg of sand in the large intestine particularly in the colon intermixed with ingesta and fluid. Grossly the colon showed marked con-



4. EDAX of inner part of an enterolith : 20.00 KV TILT = 45.00 ELEV = .00 AZM = .00 COSINE = 1.000 Spectrum : GLI GLI All elmts analysed, normalise

ELMT	ZAF%	ELMT	ATOM %
CaK :	1.066	89.276	88.863
SiK :	0.947	4.802	6.820
MnK :	0.819	5.946	4.317
Total		100.024	100.000

gestion and inflammation. Microscopically, haemorrhage/congestion and enteritis could be detected.

The enterolith weighed 2.8 kg, 3.2 kg and 3.9 kg, respectively. The size of the liths varied from 0.2 to 9.5 cm in diameter and were mostly smooth and lighter when compared to solid stone of similar size. However, a few liths were rough and hexagonal. The cut surface showed concentric laminated structure with a central nucleus (Fig. 2). Lamination could also be seen on SEM study. Scrapping from the enteroliths revealed ash coloured powdery materials which were inorganic in nature. Following analysis by EDAX it was found that the composition varied from piece to piece and in outer and inner surfaces of the liths (Fig.3 and 4). The outer surface consisted of magnesium (33.35%) and phosphate (66.65%) while the inner surface was composed of calcium (89.27%) , silicon (4.87%) and manganese (5.44%). Iron (6.72%) and phosphate (48.05%) were also detected in another area in the inner surface and hence, it was concluded that the composition slightly varies from place to place, and piece to piece.

The presence of magnesium phosphate as the constituent of the enteroliths is in agreement with that of the enteroliths of horse[1,6]. In the present study calcium could be detected as the single major constituent and might be because of high calcium content of the concentrated ration.

It is stated[3] that the enteroliths when free are usually of little consequences, but becomes dangerous if impacted on the conical entrance of the colon. In the present study however, except one all the enteroliths were free and did not pose threat to the life of the individual. Neiberle and Cohrs[5] reported that the size of enteroliths vary from a pea to that of human head and may exist singly or even in several hundreds. When large number of enteroliths occurs in the intestine the condition is stated as 'intestinal gravels'. In all the three cases in present study intestinal gravels were seen. The present study also endorsed the views of Blue and Wittkoph[1] that enteroliths could exist in the large colon for entended periods without causing any illness and is passed out through the faeces as in these cases large number of enteroliths could be found in the large intestine as well as in the enclosure indicating that enteroliths had passed through the faeces.

It is speculated that excessive amount of wheat bran and other feeds rich in magnesium and phosphorus and some degree

of sluggish intestinal movement might have helped in the formation of enteroliths.

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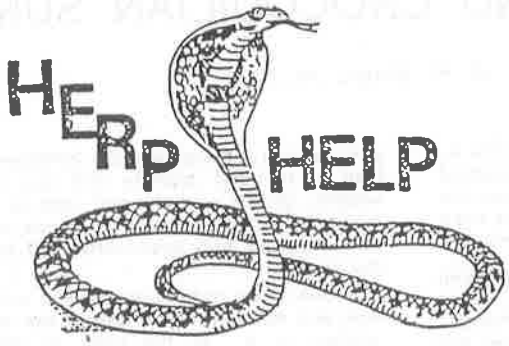
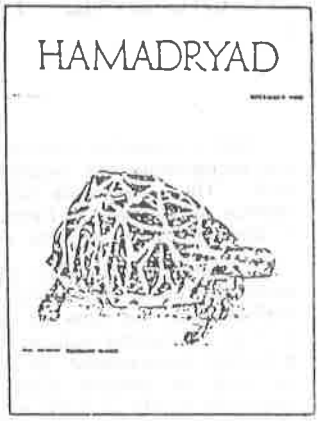
Reprint : Zoos' Print, 4 (12) : 22, December, 1989





A Note on Gharial Oviduct Extrusion while Nesting at the Madras Crocodile Bank

By Harry Andrews and Rom Whittaker

Reprinted from HAMADRYAD, Vol. 13, No. 2, December, 1988

The oldest female gharial at the Madras Crocodile Bank aged 32-36 years (estimated) acquired from the Calcutta Zoo seven years ago, extruded her oviduct in a nesting attempt on 29th March 1988. This was her second nesting attempt, the first one being in 1986. On both occasions she laid soft, uncalcified eggs. Most eggs were thin, long, with the inner membrane joined together.

This year the female dug trial nests in three different locations on a very steep sandy slope. On the 29th of March she selected a shaded location on the slope 5 metres from the pool. Nest excavation started at 19-40 hours and was completed at 12-30 hours. The first egg was deposited at 01-10 hours. After a pause of 30 minutes the female deposited the second egg, after which the cloaca appeared enlarged and reddish in colour. After a 6 minute pause she tried depositing again. Slightly raising her posterior and balancing on her tailbase and hind legs for 2 minutes, she contracted her body and ejected only egg contents mixed with blood. This was repeated eight times, but each attempt to deposit eggs only resulted in an egg/blood mixture being ejected. At this stage the oviduct was noticably extruded. The female, raising herself again on her hind legs, tried egg deposition, but the oviduct started extruding further (about 12 cm) and the cloaca was bulging. Through all this the female appeared normal, with her jaws agape and head raised.

On two occasions during the egg mixture deposition, egg shell membranes were also ejected. On feeling the oviduct (which was in a 'U' shaped position out of the cloaca) an egg could be felt inside. Each time the female attempted to deposit her eggs, they were being compressed, broken and the contents and shells ejected instead.

At 04-45 hours the oviduct was protruding 17 cm from the cloaca while the female kept trying to deposit more eggs. At 05-30 hours the female lay still for 18 minutes and started covering her nest. By this time the cloaca contracted a little, but the oviduct remained in the nest. After 10 minutes of covering, the female moved forward, collapsing the sand from the top of the nest into the nest cavity and covering the oviduct. An hour latter, a second attempt by the female to move upward, wrenched a portion of the oviduct from her, resulting in profuse bleeding.

Two eggs that looked well developed were collected, candled and found to be infertile. The shells were very thin and porous. The female guarded her nest for almost 75 days. She appears normal and healthy, but it is not known whether the oviduct extrusion was due to the advanced age of the female and whether any permanent injury has resulted.

Reprint : Zoos' Print, 4 (12) : 1-2, December, 1989

RESIDUAL YOLK AND CROCODILIAN SURVIVAL

By L. A. K. Singh, Ph. D.

Many crocodile hatchers commit a mistake by not recognising the negative effects of 'residual yolk'. This one single factor can bring down the chance of survival of hatchlings considerably even if other hygienic aspects are under full control.

'Residual yolk' is a portion of the unutilised embryonic yolk which the hatchling retains in the abdomen at the time of hatching *('Y' in Plates 1 and 2)*. Residual yolk of the size of a betel nut provides nourishment to a hatchling when it is learning to procure food from outside. By the time the ability is fully acquired, the residual yolk reduces in size and gradually disappears. At the age of six months it may be smaller than the size of a small green pea.

Under certain situations the residual yolk will not disappear from the abdomen. Instead, it may absorb fluid, enlarge in size, compress the stomach, lead to reduced appetite and loss of actual body weight, impart a distended look to the abdomen, make it difficult to maintain balance during surfacing or swimming and eventually lead to the death of the young.

Death due to unabsorbed and enlarged residual yolk will normally occur before the end of the first winter, i. e., in the case of gharial *(Gavialis gangeticus)* and mugger *(Crocodylus palustris)*, before an age of about 8-9 months. Once the summer sets in and enhanced activities and growth rates are evident, the residual yolk will disappear. Things, however, do not wait that long. Therefore, one has to learn to manage the 'residual yolk' early in hatchlings.

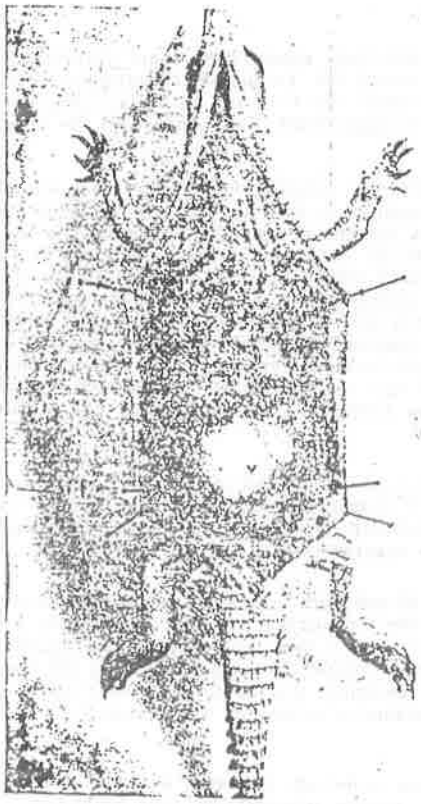


Plate 1 Viscera of a hatchling gharial (G. gangeticus) showing the location of the residual yolk sac (Y)

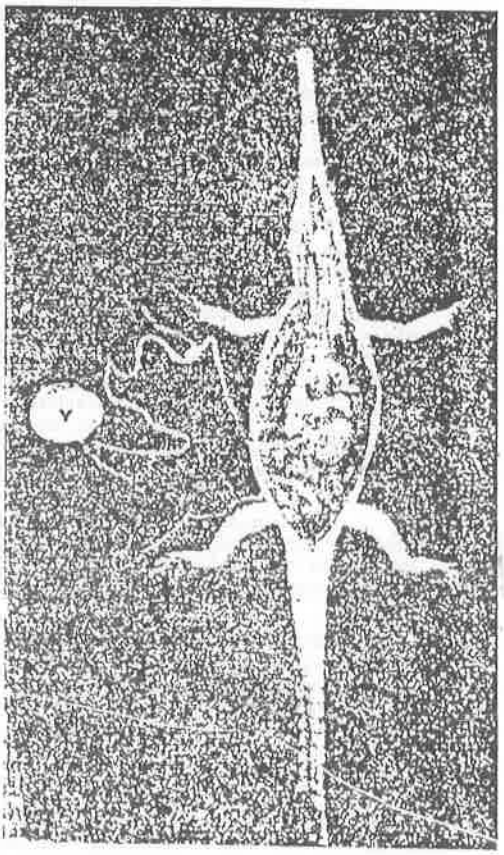


Plate 2 The intestine of gharial showing the point of attachment of the residual yolk sac (Y)

Steps in managing residual yolk

1. Avoid premature hatching

Do not be in a haste to open a nest when you hear the yelping of only one or a few hatchlings which have grown fast and are ready to hatch. Wait for 1-3 days until the yelping (some say, croaking) is heard in a chorus from all the young in the brood. During this period a lot of residual yolk will get absorbed and the young will hatch better 'fit'.

2. Attend to premature hatchlings

If some young did hatch premature you will know it from their appearance. The closure of the skin near the middle of the abdomen will be incomplete. The gap may be up to 10 mm in 'recoverable cases'. Also, the abdomen will appear distended because of a large amount of residual yolk inside.

Keep such premature hatchlings on a moist (3-4% by weight) sand bed until the skin closes. In recoverable cases of premature hatching it may take from 2 to 10 days. During this period the young must be allowed to rest and dehydrate. Sometimes it is more helpful if the young are allowed to bask for 60-90 minutes in 2-3 sessions spread over the day.

Good rest can be ensured if small leafy twigs are fixed to the sand bed at the corners and elsewhere scattered at one or two points on the bed. When only one or two hatchlings are premature and need such attendance, it will be ideal to keep these in a bucket half filled with moist sand and covered with a thick towel at the top.

In a 'recoverable case' when the hatchling is left on ground its all four limbs will touch below and the young will also walk, though in a clumsy manner. In a 'non-recoverable case', i. e , where the hatchling is too premature, it practically sits over the mass of residual yolk sac, and only the head and tail may touch the ground. These cases can possibly be handled if there is an access to an incubator.

3. Syringe-out the residual yolk

In rare cases (less than 1%) a hatchling which had appeared to have absorbed the residual yolk to normalcy and the skin had almost completely closed-up, may show a reversing trend — the residual yolk sac will absorb fluid, enlarge and create the usual complications. In such cases attempt the dehydration technique by keeping it out of water. If that doesn't work then with the help of a syringe drain out the contents of the residual yolk sac. If at all any opening appears, it will gradual heal up *(Plate 3)*.

4. Feeding prescription

Premature hatchlings, for whom you attempt to reduce the quantity of residual yolk content, must not have access to any external feeding. Access to food or 'force feeding' by an affectionate keeper will only complicate the situation.

5. Hatching record

'Non recoverable cases' of premature young may not be taken into account for hatching record. Such individuals will almost certainly die in 7-10 days unless special care in incubator or yolk-draining is tried. In any case, the young had not 'hatched', you had 'pulled it out of the egg shell' and now throwing a challenge to keep it alive !

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Plate 3 The healing mark (arrow) left on the skin immediately after the residual yolk was syringed out to save the ailang young. This mark gradually disappears.

Reprint : Zoos' Print, 3 (3) : 7, March, 1988

TREATMENT OF MOUTH-ROL IN SNAKES

By HIMANSHU PREM
Mahim Nature Park

Mouth-rot is one of the most common troubles that snakes face In captivity.

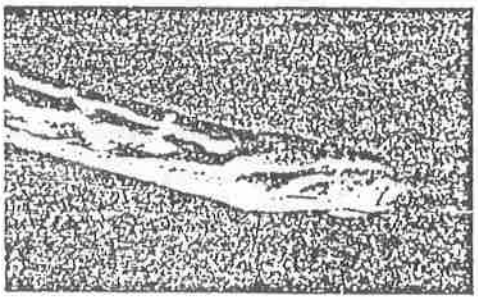
Perhaps this problem occurs because of the snakes' skin being torn due to rubbing against rough surfaces and then being followed by the development of fungal or viral infection, and Vitamin deficiencies. Untidy and moist surroundings may also generate this.

Many snakes I have seen with snake-charmers, suffer from mouth-rot - a very common victim being the Royal / Diadem snake *Spalerosophis Diadema (Schiegel)*, I wonder if it is the result of force-feeding which is unnatural for snakes.

However, one must admit that snake-charmers have been keeping snakes for generations.

Recently, my Indian python, *Python molurus (Linnaeus)*. Urvashi (the famous Apsara in Lord Indra's Court), developed mouth-rot. I contacted Isaac Kehimkar in Bombay Natural History Society, who willingly gave me a copy of The Dodo (Journal of the Jersey WIldlife P reservation Trust) No 15. 1978, page 102 containing veterinary Report by Mr. Blampied & Mr. Allchurch, of mouth-rot in Water Dragons.

Himanshu Prem Works at Mahim Nature Park and is a member of Z. O. O. as well as other nature and wildlife organisations



Urvashi, now healthy and happy

A few hints from "Zoo and Wild Animal Medicine" (by Murray Fowler) the 'Bhagvad Gita' of Vets, as Dr. Batve of Borivli National Park describes it, were also useful.

I began cleaning her mouth and jaws with luke warm water every morning. After cleaning and removing the fungal accumulation from the lower jaw very gently, I gave her about 3 drops of Multi Vitamin drops (ABDEC) mixed in a little water, filled in a syringe (without needle of course) and emptied into the mouth This was followed by a solution of anti-biotic capsule (Ledermycin) in water given orally as described above. Finally on ointment bacitracin (Mycitracin) was applied on the skin over jaws and surrounding the nostrils.

Python was placed In a dry, glass cage even without providing any rough floor (sand, stones etc) during this treatment About 25 minutes of mild (morning or evening) sunlight was given everyday. This treatment was carried out daily, for about five days. Next two days only cleaning with luke-warm water and applying ointment continued. This started showing signs of improvement and on the tenth day the snake had almost recovered. Before I had started this treatment, one other thing was also noticed along with mouth-rot. This was a dark mucus like, stinking substance accumulated over the snake's nostrils Even this disappeared gradually as a result of the above treatment But it must be noted that treatment started immediately after this infection was observed.

Urvashi is quite alright and healthy now, and (indirectly) helps many of her fellow beings from human destruction by way of educational demonstrations in schools and colleges etc.

Reprint : Zoos' Print, 10 (7) : 39-42, July, 1995

SEX DETERMINATION, HEALTH CONDITIONS AND BIOMETRIC STUDY OF CAPTIVE MUGGERS OF BONDLA ZOO, GOA.

Manoj R. Borkar and Meenakshi K. Mallya

ABSTRACT

Fourteen captive muggers in Bondla Sanctuary's Zoo section were examined for determining sex and assessing their health conditions. Employing standard techniques, 16 parameters were investigated for recording biometric data. This study is the first attempt towards investigating the captive muggers in the state of Goa and hence assumes importance in captive management of this species. Contrary to the impression that captive environments are stressful, often resulting in stunted growth, the inmates of the enclosures in the present study conformed to desirable health conditions. The data recorded in this study could be used for comparing the growth of muggers in captivity elsewhere.

INTRODUCTION

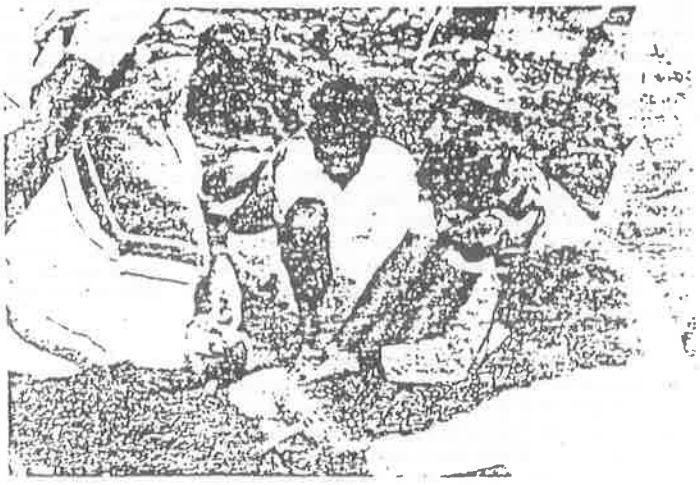
The success of a population depends upon the interaction between its biotic potential and the environmental resistance. Biotic potential of a species would depend upon parameters like sex ratio, age structure, reproductive potential and the percentage of reproductive individuals in the population.

It is obvious therefore that the determination of sex, health conditions and biometric data is a pre-requisite for understanding population and formulating management policies. Such studies are of vital importance not only in the wild but also in captive environments. It is often said that captivity is a stressful environment but captive environment need not simulate wilderness in every detail (Shepherdson,1988). However, any inadequacy in providing basic requirements to captive animals reflect in their body condition. In the light of these facts biometric investigations could best serve as a yardstick for evaluating captivity induced stress.

METHODS

Immobilising wild animals is a pre-requisite for investigating all the envisaged parameters in this study. Admittedly, it is much easier to immobilise the captive crocodiles as compared to their wild relatives. Immobilisation could either be accomplished by mechanical or chemical means. Galamine triethiodide has been recommended for chemical immobilisation for muggers. The drug, being a muscle relaxant, is specifically used for restraining a crocodile movement. Its utility as an immobilisation drug is further enhanced by the fact that the mortality in the drugged animals is as low as 1.25% and that the animal suffers no untoward side effect (Whitaker & Andrews, 1989) Further more in event of a desired speedy recovery, Neostigmine methyl sylphate could be used as an antagonist.

In the present study, however, the animals were immobilised by noosing due to nonavailability of anaesthetic drugs. The animal was laid on canvas with eyes and ears covered to minimise visual and auditory stress. Examination was carried out in a cool shady place; limbs and tail were held to restrain the animal movement. All the 16 parameters were recorded in the least possible time to minimise the immobilisation trauma. Sex determination was done following the simple cloacal probe technique (Whitaker *et al*, 1981). Tail bending method was adopted to confirm the sex. The individuals to be sexed were laid on their back and their cloacal area was cleaned with water. A finger (preferably with closely cropped nail) was inserted into the cloaca to check for the



Sex determination by the cloacal probe method

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presence or absence of penis., In the male cloacal chamber, the penis can be felt as a soft obstruction whereas it is absent in the cloaca of the female. Confirmation by 'Tail Bending' involves bending the tail and exerting a moderate pressure on the lateral sides of the cloaca and this will induce extrusion of the penis.

All the captive individuals were examned for health conditions by following the health check cards provided by Madras Crocodile Bank. The parameters recorded were the presence of skin scrapings, the girth dimensions, clarity of the eyes, eye reflexes, presence of fluid in the eyes, dentition, jaw length, nostrils and cloacal aperture, etc. The findings of this study have been tabulated in Table & 2. Prior to release, individuals were identified by recording some naturally occuring peculiarities or deformities rather than by scute clipping which involves mutilation (Sale et. al., 1988)

RESULTS & DISCUSSION

Of the 14 captive animals examined, 3 individuals could not be sexed as they measured less than 75 cms. which is the minimum specimen size required for cloacal probe method. Among the rest, 6 were males and 5 were females.This parameter is important because problems in breeding of crocodiles has been ascribed partly due to the difficulty in sexing them. The live weight of the examined animals ranged between 0.800 kg to 57 kg, the heaviest individual being a male. Average weight of the male individuals ws found to be 19.825 kg. where as that of a female was 14.100 kg. Similarly, the total length of the examined individuals ranged from 60.5 cm to 222 cm. Here again the longest individual was a male. The average length of a male in this captive environment was 150 cm. whereas that of a female was 134.4 cm. These observations are in conformity with those made by other workers that males grow larger even in captivity, (Whitaker, 1981) parameters investigated for assesing general health conditions convincingly establish good health of these reptiles in the enclosures here. Only one of the 14 individuals examined revealed nematode infection 'track' on the ventral skin. Incidentally the first record of such infection was made at Madras Crocodile Bank in 1983 on the mugger (Whitaker & Andrews, 1988). Such infection, however, may not cause any pathological effects on the host, but only depress the commercial value of the skin.

The dentition of the examined individuals was generally normal except for two individuals with irregular placement of teeth and one with eroded teeth. The state of dentition is also of secondary importance in assesing the health conditions as there is a continuous teeth replacement in these reptiles a fact that can be easily verified by collecting fallen teeth within the enclosures. All the other parameters investigated confirmed good health. All the examined individuals were administered adequate doses of B-Complex, prior to release.

Health care and vetennary facilities are essential features for a good management of captive animals. Ironically, this is what most of the capive animals are usually deprived of, the crocodiles of the Bondla reserve being no exception despite the presence of a full time veterinary expert on the campus of the reserve. It must be realised that health care system for wild animals differs from the routine verterinary practice and the concerned expert is expected to have a sound knowledge of the ecology and the behaviour of the animals under his care. At the Bondla wildlife Reserve, the vetennary expert takes a round near the enclosures and asseses the animal, health on visual observation and Zookeepers report. Thus a specific health care sytem is lacking. That the animals are enjoying good health despite this lacuna, however, does not imply that the captive muggers here have been emancipated from the rigours of the captivity pressures. One may well imagine the extent of crowding when all the animals descend into the enclosure measuring 2 1/2 x 2 x 3/4 cubic meters. Such extreme artificialization may have long term deleterious effects . It is important to rectify this immediately.

ACKNOWLEDGEMENTS

We wish to acknowledge the assistance and encouragement given by the following persons: Our colleagues Dr. Sulabha Patnak and Samuel Christopher, Mr. Rohidas N. Naik IFS, Dy Conservator (Wildlife Division) Forest Dept. Goa Govt , Dr Pai, Vetennary Surgeon, Bondla Wildlife Reserve; Miss Subhadra Devi, Gadi Carmel College for Women.

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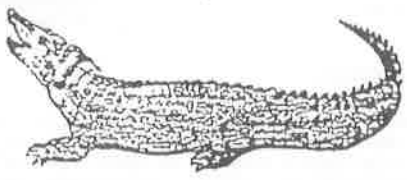

Table 1 Biometric data of captive mugger crocodiles, Crocodylus palustris *(Lesson) from Bondla Wildlife Reserve, Goa (1993) * *(Data collected in March 1993)*

No.	Sex	Total weight Kg.	Total length Cm.	Snout upper jaw Cm.	Length lower jaw Cm.	Girth Cm.	Caudal, length Cm.	Post occipital length Cm.	Limb fore Cm.	Length hind Cm.	Stretched limb fore Cm.	Span hind Cm.	Cloacal length Cm.	Dorsal length Cm.	Scutes max. number long series	Caudal number trans-verse rows	Scutes number single row
1.	-	1.475	66.5	19.0	17.0	20.0	27.5	4.0	9.5	13.5	28.00	32.00	5.0	16	6	18	8
2.	-	0.800	60.5	8.0	6.8	17.0	29.0	2.5	9.0	12.0	22.50	27.00	1.0	16	6	18	17
3.	male	2.500	91.0	11.0	10.0	26.0	43.0	4.5	15.5	20.5	37.50	43.5	1.5	17	7	19	13
4.	female	2.600	91.0	11.0	10.3	30.0	44.5	5.0	14.5	19.5	36.00	43.5	1.5	15	6	18	18
5.	-	1.000	66.5	8.0	7.0	21.5	31.5	2.0	10.0	13.5	20.50	30.5	1.0	16	6	18	18
6.	male	5.450	116.5	12.5	10.0	38.0	55.6	5.0	17.5	23.0	46.55	52.0	2.0	17	6	19	17
7.	female	1.990	81.0	10.5	9.5	34.0	41.0	3.5	13.0	16.5	32.00	37.5	1.5	17	7	18	14
8.	male	8.000	123.5	14.5	13.2	42.0	61.5	6.0	18.5	24.5	48.50	48.8	2.1	16	6	19	19
9.	female	30.000	190.0	33.0	23.0	73.0	84.0	10.0	30.0	50.0	80.00	88.0	5.0	16	6	17	16
10.	male	57.000	222.0	36.0	35.0	90.0	114.0	12.0	43.0	53.0	90.00	99.0	5.5	17	6	19	18
11.	male	32.000	191.0	39.0	24.0	75.0	94.0	12.5	29.0	36.0	79.00	89.0	4.8	18	6	18	15
12.	female	15.500	150.0	26.0	25.0	59.0	69.0	7.5	20.0	25.0	59.00	70.0	3.5	17	6	18	11
13.	female	21.000	160.0	29.0	27.0	67.0	81.0	10.0	24.0	35.0	63.00	78.0	5.0	17	6	18	16
14.	male	14.000	155.0	27.0	26.0	58.0	79.0	8.0	25.0	30.0	61.00	72.0	4.3	20	7	18	16

*Table 2. Health conditions of captive mugger crocodiles, Crocodylus palustris (Lesson) from Bondla Wildlife Reserve, Goa (1993) * * Data collected in March*

No.	Nasal apertures		Eyes			Neck		Dentition	Belly		Back		Cloaca	Tail		
	Fluid	Clear	Reflex	Trans-parent	Fluid	Round	Not round		Round	Not round	Arched	Straight		Round	Not round	Skin nema-todes
1.		+	Good	Clear	-	+		Normal	+			+	Normal	+		Absent
2.		+	Good	Clear	-	+		Normal	+			+	Normal	+		Absent
3.		+	Good	Clear	-	+		Normal	+			+	Normal	+		Infected
4.		+	Good	Clear	-	+		Normal	+			+	Normal	+		Absent
5.		+	Good	Clear	+	+		Irregular	+			+	Normal	+		Absent
6.		+	Good	Clear	-	+		Normal	+			+	Normal	+		Absent
7.		+	Good	Clear	-	+		Normal	+			+	Normal	+		Absent
8.		+	Good	Clear	-	+		Normal	+			+	Normal	+		Absent
9.		+	Slow	Clear	+	+		Eroded	+			+	Mucous	+		Absent
10.		+	Slow	Clear	-	+		Normal	+			+	Elevated	+		Absent
11.		+	Good	Clear	-	+		Normal	+			+	Cloacal shield large	+		Absent
12.		+	Good	Clear	-	+		Deformed	+			+	Cloacal glands in secretion	+		Absent
13.		+	Slow	Clear	-	+		Deformed	+			+	Normal	+		Absent
14.		+	Good	Clear	-	+		Irregular	+			+	Cloacal shield large	+		Absent

* Parameters selected for this study reflect health conditions.
* Except for one senile animal, most captive individuals were healthy.

Reprint : Zoos' Print, 10 (7) : 37-38, July, 1995

TWINNING ABNORMALITY IN *Crocodylus palustris* (REPTILIA, CROCODILIA)

L.A.K. Singh and S.D. Rout

Ferguson (1995) has catalogued three types of twinning possibilities in crocodilians: double yolks, twins and axial bifurcation causing partial twinning. For Indian crocodilians Acharjyo and Singh (1989) have reported two instances of "twinning abnormality" and one instance of double-yolk for *Gavialis gangeticus*. Webb *et al* (1983) have recorded double yolked eggs for *Crocodylus palustris* in northern Australia. In this note we report for the mugger, *Crocodylus palustris* an instance of double yolked egg producing two live hatchlings.

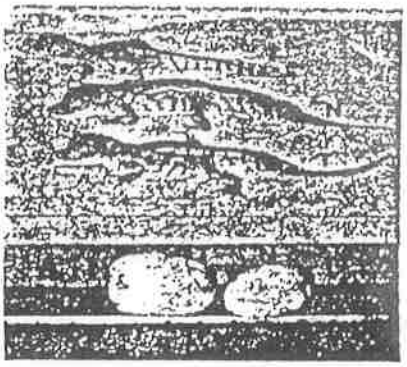

Fig. 1. Mugger: Twin (T) and normal (N) hatchlings from double-yolked (T) and normal (N) eggs, respectively.

OBSERVATION

At the Mugger Research and Conservation Unit, Ramatirtha Orissa, four females breed in captivity every year since 1984. The smallest female (F4) measured 2.10m in total body length on 3 June 1990. During 1988 through 1993 it has produced clutches containing 24,24,28,27,27 and 30 eggs.

The maximum egg length and egg width were 7.4 x 4.8 cm for the normal eggs (mean) and 9.8 x 5.1cm for the abnormal egg. On dt.27.5.91, after 74 days incubation, a total of 19 young (70.4%) hatched from the clutch. The abnormal egg produced two live hatchlings, smerging out at either ends of the egg. The sizes of the normal and twin hatchlings are given in Table 1. The colour patterns on the single - whorl tail scutes are presented in Table 2, as per the method described for *Gavialis gangeticus* by Singh and Bustard (1977).

DISCUSSION

The tail scute colour patterns were different. Therefore, these are not identical twins. It could be a case of double-yolked egg because the egg was about 32% longer and 6% wider than the normal egg. The female which laid the double yolked egg is the smallest of all. In the American Alligator, *Alligator mississippiensis* it has been recorded that double yolked eggs are laid first or last by young females (Ferguson and Joanen, 1983).

In our observation, both the hatchlings were alive. In *G. gangeticus* only the larger young remained alive (Acharjyo and Singh, 1989). Because the hatchlings are unequal in length and weight, the larger hatchling had, evidently grown faster. Faster growth resulted in longer body length and reduced residual yolk resulting in reduced body weight.

The reason for one of the twins growing faster may be the result of a complex system of embryonic competition, as suggested for *G. gangeticus* (Acharjyo and Singh, 1989). Such competition may also have some dependence on the orientation of individual whithin the double -yolked egg. This discussion raises the question, that if a double-yolked egg is shifted on the day following nesting and incubated by placing it horizontally along axis, will it produce twins of equal size and weight?

Table 1. Dimensions of normal and twin mugger (after 15 days of hatching)

Specimen	Snout-vent (cm)	Tail length (cm)	Total length (cm)	Body Weight (g)
Twin-1	11.2	10.7	21.9	55
Twin-2	12.0	13.0	25.0	50
Normal	13.0	14.1	27.1	70

ACKNOWLEDGEMENTS

The observations were recorded at the Mugger Research and Conservation Unit under Similipal Tiger Reserve. We record our thanks to the Field Director, Similipal Tiger Reserve for facilities.

* Mugger Research and Conservation Unit, Similipal Tiger Reserve, Khairi Jashipur 757091, Orissa.

Table 2. Individual identification of twin C. palustris based on colour pattern on single-whorl tail scutes

Side of Body	Twin no.	Sl. no. of scute counted front to back									
		1	2	3	4	5	6	7	8	9	10
Left	1	A	-	F	-	P	F	-	P	F	-
	2	F	A	T	F	F	-	T	F	F	-
Right	1	-	-	F	-	P	F	-	P	F	-
	2	F	-	T	T	F	-	-	F	F	-

Note : letters in the Table stand for portions of the scute whcih is black.
A: anterior; F: full; P:posterior; T; tip, '-' indicates no shade of black.

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Reprint : Zoos' Print, 10 (7) : 46, July, 1995

CONGENITAL EYE DEFECTS IN MUGGER CROCODILE *Crocodylus palustris*

L.A.K. Singh

Congenital deformities related to the incubation temperature have been reported for *C. palustris* from Ramatirtha, Orissa (Singh and Sagar, 1992). R. Whitaker (pers. comm., 1980) had recorded two of the 1977 - hatchlings at a Tamil Nadu Forest Department hatchery which had no single whorl of caudals at all. Apart from tail-deformities the defects in the eyes appear to be worth a record for *C. palustris*.

(1) At the Ghanal Research and Conservation Unit, Tikerpada, Orissa, five of the hatchlings reared in 1975 were obtained from eggs originating from the Hoggenakal area of river Cauvery in Tamil Nadu. One of these hatchlings had its left eye smaller, paler and with a crooked pupil. The entire surface of the eye was depressed (Fig. 1). This eye had noticeably poor vision, as were evident form poor responses to stimuli.

(2) At the Mugger Crocodile Research and Conservation Unit, Ramatirtha, Orissa during 1992 - Incubation season, one hatchling had a defective right eye. The pupil remained

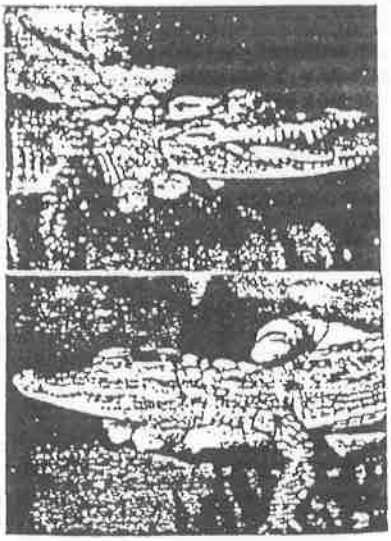

Fig. 1. Above: normal hatchling; Below: hatchling with the defect

almost opened but shifted backward. In the front the pupil was bordered with a horizontal black streak (Fig 2). The movement of the nictitating membrane was slower. The young had hatched from a clutch of 31 eggs registering 70.96 % hatching after 100 days incubation. The defective eye had a lower level of response to stimuli. The left eye was normal in appearance and response.

The second deformity appears similar to the "squint eye" of ghanal, *Gavialis gangeticus* (Singh and Bustard, 1982), and is a condition traceable to muscular defects. In ghanal the

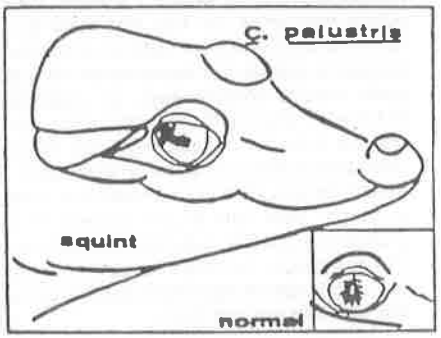

Fig. 2. Difference between normal and defective eye

eye defects were the most consistent among twelve kinds of congenital defects. The eye defects in ghanal included complete absence of both the eyes, absence of one eye, defects in the corneal colouration, squint and unsmooth pupil (Singh and Bustard, 1982). Mr. Whitaker stated (pers. comm.) that the eye defects in *C. palustris* were seen in both captive and wild individuals.

ACKNOWLEDGEMENTS

I acknowledge with thanks the facilities provided by the Orissa Forest Department at large and the Field Director, Similipal Tiger Reserve in particular. Mr. Rom Whitaker had generously provided information on mugger from Tamil Nadu.

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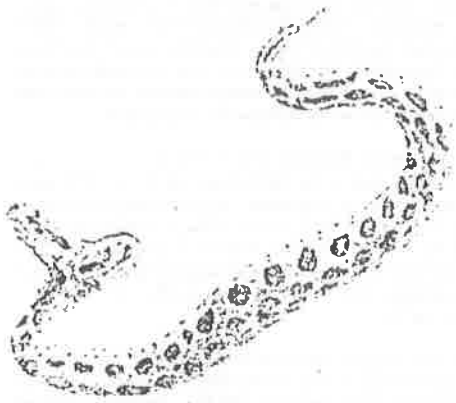
Reprint : Zoos' Print, 9 (11) : 22, November, 1994

THE BIRTH OF DOUBLE HEADED RUSSELL'S VIPER

Dipak Mitra *

The snake charmers often show double-headed snakes to spectators with a demonstration that each head of the snake is active for six months. It is actually nothing but a non-venomous snake with a blunt tail known as Red Sand Boa (*Eryx johnii*). All the conscious people who know the fact that there is no double headed snake on earth are trying heart and soul to dispale this wrong notion from the public through different ways of publicities. But it was a great surprise to me and to every one that a double headed snake had actually taken birth on 9th June '94 in my snake park. A female russell's viper of three feet four inches in length gave birth to ten numbers of live youngs of which one is double headed. It was 21 cm. in length from the neck joint upto nose tip . The length of right head was 2.4 cm and the left head was just 3 cm.



On 12th June afternoon it had changed its first slough. Drinking water was given on a small flat plate and the snake was drinking through both the mouths. On 16th June, it was seen accept a "house gecko" of 3.4 cm. length. The food was offered to the snake was a forcep close to its mouths and it swallowed the gecko through the left mouth. The snake survived for 23 days. It used to move with both the heads turned in one direction.

I may mention here that more than five thousand russell's vipers have been born in our snake park since 1974, but this is the only exception with a double head.

* Calcutta Snake Park, Calcutta

Reprint : Zoos' Print, 9 (5) : 16, May, 1994

POSSIBILITY OF SECONDARY POISONING HAZARD TO HOUSE CROW, Corvus Splendens & JUNGLE CROW, *Corvus macrorhynchos*

P. Neelanarayanan, R. Nagarajan and R. Kanakasabai[1]

During a rodent control campaign conducted on 23-7-93 with 2% zinc phosphide (an acute rodenticide) mixed in parched rice bait, a group of house crows Corvus splendens and jungle crows Corvus macrorhynchos were observed to feed on the baits. Tarrant et al. (1992) have reported that the Aphicide Demeton - S-Methyl intoxication can induce significant changes in the histoarchitecture of live and serum enzyme values of house sparrows, Passer domesticus. The rodenticide used during this rodent control campaign can also perhaps generate deleterious effects on the ingested birds. Therefore, attention on this aspect is indispensable in order to know its sublethal dose for the crows. Morever these birds have to be subjected to such toxicity studies by researchers. Although crows have been classified under the vermins category of the Wildlife Protection Act 1972, their scavenging role cannot be neglected (Ali 1979).

To avoid this intoxication by the wild crows, we advice baiting late in the evening and destroy the residual bait the next day early morning. Above all, traditional methods of rodent control viz., burrow digging, placing Tanjore bow traps, implanting pots., placing perching sites for barn owls etc., can be strongly advocated to avoid such intoxication dangers to non-targets. The traditional rodent control methods are equally good and this knowledge may be disseminated among the farmers to discourage the use of rodenticides.

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ACKNOWLEDGEMENT

Authors are thankful to the Principal and the Management for having provided the necessary facilities and encouragement.

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Reprint : Zoos' Print, 6 (5) : 7, May, 1991

CUTANEOUS NODULATIONS OF HORNS OF A SWAMP DEER, *Cervus duvaucelli*

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A Swamp deer (*Cervus duvaucelli*), age five years, had a history of gradually developing nodular swellings from the base of both the horns. These sellings had shown the tendency to bleed easily on rubbing or from a slight trauma of the horn. The swellings were first noticed to have appeared nearly six months back — at first at the base of the right horn and thereafter on the left one associated with occasional rubbing of the horns against fixed objects. The earlier treatment given was a local application of nitrofurazone ointment with parenteral injection of streptopenicillin and antihistaminics, which failed to have shown any significant improvement. Both the horns became affected ultimately with nodular growths all over.

Clinical examination revealed cold, firm, irregular, painless and nodular swellings present extensively on both the horns. These showed a tendency for bleeding easily at the slightest scratching. Occasionally passage of mucinous, rusty-coloured, foul-smelling discharges were noticed oozing in small quantity even from the nostrils. It was decided that the horns should be amputated. Accordingly, the right horn was removed first from its base under Triflupromazine tranquilisation together with a local infiltration of 2% Lidocaine hydrochloride (Pandya, et al., 1990). One week after the left horn was removed surgically in a similar fashion. Wounds were regularly dressed and nitrofurazone ointment applied daily locally. Inj. streptoampicillin - 1 g., administered intramuscularly daily for five days of post-operative period. The sutures were removed from the horns after a week respectively, when healing was complete. Since then the animal was kept under periodic clinical checking for six months. There was no evidence of recurrence of the growth at the site of the operation or at any other location.

The deer was reported to be healthy. Laboratory examination of the scrapings from the affected horns were negative for external parasites or burrowing mites. Culturally, the aseptically collected scrapings and macerated nodules did not reveal any fungal or bacterial growths.

Histologically, skin sections - 5/mm thick - were cut from different representative areas of the growth. Sections were stained by routine haematoxylin and eosin method. No inflammatory tissue reaction was noticeable in the growth. However, the stratum germinativum — the basal layer of the epidermis was seen descending, at places, like cords into the dermis. But there was no budding or branching of these epithelial cords. Isolated clusters of these cells showed enlarged nuclei, hyperchromatism and vacuolations. In dermis, there was increased proliferation of connective tissue and immature fibroblasts. Dermis revealed increased vascularity which may account for the observed tendency to bleed easily. The non-inflammatory nature of the growth along with the histological characteristics in absence of any infectious agent suggests the possibility of an early neplastic transformation of skin of the horn, associated possibly with the repeated trauma and bleeding.

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Reprint : Zoos' Print, 9 (5) : 15-16, May, 1994

RAT CONTROL IN ZOOS

Jacob V. Cheeran

Rodents, especially rats, are a big menace in zoos. Rats not only consume food meant for zoo animals, but also collect and store a substantial amount in burrows. They also spoil the food items by defecating and urinating on them. Rats also act as carriers of leptospirosis, and are mechanical carriers of Salmonella.

The various control methods available can be broadly classified into the following categories :
(1) Chemical
(2) Physical
(3) Biological (cats, rat snakes, barn owl, etc.)
(4) Miscellaneous

Chemical :
Poisons (i) Acute poisons : zinc phosphide, Phosphorus, Strychnine.
(ii) Slow death poisons : Anticoagulants e.g. Warfarine, Bromodiol.

Of the acute poisons, Zinc phosphide, which is available as a brownish/black crystalline powder, is the most commonly used one. Phosphorus (elemental) is mixed with an ointment base and is available under the brand name 'Ratol'. When applied on a bait, the luminescence will attract the rat to 'try' the bait.

To keep the bait or traps, the baiting points are to be selected. Baiting points can easily be located by observing how the rats move about in a room or a warehouse. Rats run fast in the open and reach for a cover behind a cupboard or an almirah. Then, they come out at the other end, look around, and take another run to reach for next cover. By observing these movement, we can decide on the baiting points. The ideal baiting points are the 'wait and look around points' of rats before they move for the next cover. The baits could be ready made poisons or 'home-made'. Seasonal, locally available foods of rats, can also be used. They can be made more luring by baking them in oven (e.g fish, tapioca etc.) The smell emitted by the baked bait will attract rats. It may be noted that, rats too have a seasonal food preference. Bengal gram is a delicacy for rats.

Pre-baiting :
Rats are likely to shun away unusual food kept/seen at unusual places. To gain confidence of rats and to make the rats to ingest bait without any suspition prebaiting is required. This involves (fish, wheat flour or rice flour with oil) keeping the food at baiting points for a few days without adding the poison. This will make the rat to swallow the poisoned bait quickly and completely. One advantage in poisoning the rat is that rats cannot vomit unlike dogs and cats, and once poison is ingested it will take its course of action. This is the principle that was being used to kill the rats using red squill; if accidently consumed by cats and dogs they will vomit and are unlikely to get poisoned.

In the case of acute poisons, the rats will eat the poisoned bait for a few days and then they will stop taking the bait. This is because rats associate the death of their 'brothers' with the new food and avoid consuming it. This is a big disadvantage in using acute poisons. So acute poisons should be used with an 'on and off' strategy as well change the bait from one type to another. Another disadvantage with acute poisons is that, the poisoned rat seeks dark corners for death and as dead rats are not easily located, they get decayed and putrified causing inconvenience before they are picked up and disposed.

Slow death poisons are mostly anticoagulants. The first generation anti-coagulants, like warfarin are multiple dose poisons and the modern versions are single dose anti-coagulants (e.g. Bromodiol - 'Moosh moosh'). In this case also, the bait can be prepared as in acute poisons. Quick ingestion can be encouraged by adding vegetable oil (3-10%), sugar, jaggery or molasses at 1.5 to 2% adding fishmeal, or any other local feed attractants. The feeding points (baiting points) should be refilled regularly until a small quantity is left behind. This is more important in the case of multiple ingestion anticoagulants like warfarin. By this method, the entire rat population will gradually get 'saturated' with the anti-coagulant / poison. Rats will usually die in the open and can be easily disposed.

Accidental ingestion by domestic or non-target animals can be countered by heavy doses of Vitamin K.

Fumigants :
Fumigation is useful in godowns, stores, and rat burrows in the compound etc. One colony of rat burrows can have several openings and rats can escape through any of the openings. Hence, close all the burrows except the one which is intended for fumigation. Aluminium phosphide is the common chemical used for the purpose of fumigation and is available as a tablet. It will release phosgene, a poisonous gas, on exposure to atmosphere or soil moisture. So it is better to pour some quantity of water into the burrows especially in dry season before the tablets are introduced. Once the tablets are inserted deep into the burrows the opening is closed tightly using mud, rocks, etc. To select live burrows, all the burrows can be closed on the previous day, and observed the next day for the burrow holes which are reopened. These are live burrows. Fumigation of live burrows exclusively will save time and money.

Vitamin D in heavy doses, is also used as a non toxic poison. It will cause sclerosis of blood vessels by the deposition of calcium on blood vessel walls and results in slow death. High potency feed supplements of Vitamin D, which are available now, can be used in this manner.

Chemosterilants are another group of chemicals that can be used to sterilize rats, but these are not commonly used in India.

Traps :
Traps of various types are available locally. As in the case of acute poisons, rats may avoid the traps initially. Also when trapped, the trapped rats become a sign of warning to the rest of the rat population. This can be avoided by quickly disposing the trapped rat. This will prolong the development of bait shyness among the colony mates. Hence do not leave the rats which are trapped for the whole night in the trap to be seen by the rest of the rats.

Biological :
Biological control of rats using predators needs no explanation except that predators like cats may multiply quickly and can lead to problems. Hence sterilization of cats is to be considered before the cat population itself becomes a problem. Availability of Xylazine (2 mg/kg) and Ketamine (33 mg/Kg) in the country, for anaesthesia, makes cat sterilization easy.

Miscellaneous :
Several local methods exist in rat control. A couple of safe methods that can be used in the zoo are listed below:

1. **Cotton ball method :**
Small balls of cotton is made by using jaggery with gum acasia. These cotton balls are kept at baiting points or spread along the tracts of rats. The balls eaten by rats will swell up gradually and block the alimentary canal.

2. **Plaster of Paris and Sugar :**
A mixture of powdered sugar or jaggery with plaster of Paris can be kept at baiting points. Water in a receptacle is also provided alongside. The rat will eat or drink one after another, and the plaster of paris will solidify in the stomach and will gradually kill the rat.

Rat-proofing is the best method to save animal feed. This should be done while constructing the feed store. Similarly, animal houses can also be made rat proof by specially designing the walls.

It may be noted that rat population can spring back to the original level within six months even if 75 % of the population is destroyed by different methods. Hence a constant vigil and continuous rat control methods are to be adopted.

Editor's Note: We know that any humane thinking person may shudder to think even of a rat dying of theCotton ball or Plaster of paris method. The alternatives of using poisons which might be consumed by zoo animals either by careless placement or contact with the killed rodent are even more abhorent however. It is an indicator of the difficulty of zoo management that this and many other anomalies are faced by zoo managers every day.

VETERINARY LETTERS

Editor:

1 August 1990

Recently we noticed a case of "Malignant tumour of gall bladder in a male Common langur. The first sign of sickness was noticed by us when it started losing weight and became dull. It was however taking less food. We tried and gave some vitaminised medicines in tablet or liquid form with banana and drinking water.

After a week on 30 June 1990 evening it was noticed that the male langur was totally dull, sitting on the ground with low head and shivering. Immediately we separated him and kept him in an iron cage for observation and treatment. The second day we noticed distension of abdomen (pot belly) but it was taking small quantity of food. Medicinal treatment with Ampicillin and Anti-histaminic drugs was given daily for four days but the animal did not respond to the treatment and died on 4 July 1990 at 11 p.m.

Post mortem examination revealed that the peritoneal cavity was filled with about 2 kgs. fluid and liver showed dark blackish appearance with "malignant tumour of gall bladder". The tumour was hard and large, about potato-sized. We are bringing the above to your notice for advice, if any.

Dr. M. A. Salam, Sr. Surgeon (Veterinary)
Nehru Biological Park, Bokaro Steel City
District Dhanbad, Bihar

Malignant growths in animals are notoriously difficult to treat and not worth putting the animal to more discomfort than he is already suffering. Readers are welcome to comment on this request if anyone has had a history of success with this veterinary medical problem. Ed.

EDITOR:

1 August 1990

We are having 3.2 peafowls in our park for the last one and a half years. Both females are about 5 years old. The male is about 6 years old and the remaining two males about 2 years old. The female lays eggs normally during the month of April to June. One female on record lays her eggs in about 3 to 5 numbers generally. However our two females started laying eggs in the 3rd week of May 1990 and laid 22 numbers of eggs up to the third week of June 1990.

Also our white peafowl pair is about 2 years and 6 months of age. Their growth is satisfactory. They are getting the same diet as the common peafowls. Our female white peacock laid only one egg without shell for the first time on 15 July 1990, however and thereafter she could not lay any egg to date. Now we have started giving Calcium feed supplements and also in liquid form in drinking water.

Their diet / feeding schedule is noted below :

Standard poultry feed	40 grams/head/day
Pulse grain mixture	140 grams "
Onion	50 grams "
Garlic	05 grams "
Palak or genary sag	150 grams "
Cabbage leaves	As per consumption

Dr. M. A. Salam, Sr. Surgeon (Veterinary)
Nehru Biological Park, Bokaro Steel City
District Dhanbad, Bihar

In the case of peafowls, leather eggs indicates calcium deficiency and calcium supplements are good. Shell grit is cheap and also aids the digestion. I do not know cabbage along as a green, that too ad libitum may have anything to do with thyroid in the long run. Editor.

Reprint : Zoos' Print, 6 (11) : 34, November, 1991

VETERINARY LETTERS

7 May 1991

Dear Editor:

Kindly refer to research note on Paragonimiasis in a tiger by Rao et al. (1991) published in May '91 issue of ZOOS' PRINT. Authors have mentioned that - "This report appears to be probably the first report of respiratory trematode belonging to the genus Paragonimus in the lung of a tiger." In this connection I submit the following information.

Paragonimus westermanii was first reported in the lungs of two Bengal tigers that died in Hamburgh and Amsterdam Zoological gardens (Kerbert, 1887). Later the trematode was reported from the lungs of a tiger in England (Shipley, 1905), leopard and tigers in Chine (Wu, 1938-39) and from two tigers from Uttar Pradesh (Sinha and Somvashi, 1978).

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R. Somvanshi, Indian Veterinary Research Institute, Mukteswar

Reprint : Zoos' Print, 9 (12) : 27-28, December, 1994

VETERINARY NOTES

BENZIMIDAZOCES IN EXOTIC ANIMAL PRACTICE,

Dr. Jacob V. Cheeran, Professor
Kerala Agricultural University, Trichur

The benzimidazoles, including TBZ, have been used successfully in zoo and game mammals, birds, reptiles, and amphibians. Dosages and safety in these hosts appear to be similar to those of their domesticated counterparts; e.g., in Colorado, USA, excessive lamb mortalities have occurred from lungworm infections (Protostrongylus) among wild Bighorn sheep. A program of administering cambendazole (8.4g/68 kg pregnant ewe) or fenbendazole (3 g on each of 2 days) has markedly reduced the lungworm population and increased lamb survival (Schmidt *et al.* 1979). These free-ranging sheep were treated by mixing the drug with an apple-pomace bait.

Mebendazole is used frequently in treatment of nematode and cestode infections of zoo animals. At the Munich zoo (Forstner *et. al.* 1977), this drug is given to Equines (zebra, tapir) and Ruminants (camel, giraffe, antelope, gazelle, elk, deer) in feed (620 ppm) for 14 consecutive days, representing a daily dose of approximately 1 mg/kg (equine) and 5 mg/kg (ruminants). Specific recommendations (Eriksen 1978) for treatment of tapeworms with mebendazole are: primates, 5-10 mg/kg on 5 successive days administer with fruit); carnivores, 15 mg/kg on 2 successive days; pinnipedia, 10 mg/kg on 2 successive days (administer with fish); Artiodactyla, 15 mg/kg on 2 successive days (administer with fish); Artiodactyla, 15 mg/kg on 2 successive days; Proboscidae, 10 mg/kg on 3 successive days; Rodentia and Marsupialia, 15mg/kg (single dose).

Standard methods of diagnosing and treating parasitic infections of subhuman primates and pet laboratory animals (rabbits, guinea pigs, hamsters, tortoises) are reviewed by Schutze (1977 a,b). Of particular interest is the use of mebendazole in treating primate infections of *Strongyloides fuelleborni* and *S.stercoralis*. The latter is sometimes fatal. Successful treatment can be obtained only by a rigorous schedule of repeated oral administration with mebendazole at 25 mg/kg twice daily for 7 days with 7 days rest, 50 mg/kg twice daily for another 7 days rest, then 25 mg/kg twice daily for 7 final days.

Use of fenbendazole in zoo park animals is being investigated with very encouraging results. In general, the granulated formulation is administered in feed as a single treatment for hooled animals (zebras, ruminants) at a dose of 5-7.5 mg/kg, a 2-day treatment for bears (paste formulation in doughnuts) at 10 mg/kg/day, and a 3-day treatment for carnivores at 10 mg/kg/days. Most GI parasites of reptiles and amphibians are eliminated by a single dose of 30-50 mg/kg except spirurids, oxyurids and capillaria which require either a single dose (50-100 mg/kg) or 2-day dosing at 30-50 mg/kg/day. Either the granulated, powder, or suspension formulations can be given to reptiles and amphibians in food. A single dose at ten times the therapeutic dose or repeated daily treatment for 14 days (10-30 mg/kg/day) have not caused side effects in amphibians and reptiles (Frank and Reichel 1977). Other zoo and park animals appear to tolerate overdoses of fenbendazole equally well. A distinct advantage of this drug is its palatability. Medicated feed is readily consumed by even the most fastidious species.

BALANTIDIUM COLI INFECTION IN CAPTIVE BABOONS IN ALIPORE ZOO

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Heavy protozoan invasion can cause severe damage to the intestinal wall and ultimately lead to death,(Wallace and Gilles, 1977). This paper presents the results of a study which was under taken to isolate *Balantidium coli* infection in Captive Baboons in Zoological Garden, Alipore, Calcutta.

Stool samples were taken from 2 Baboons at monthly interval over a year. Samples were properly labelled after collection in clean plastic tubes without contamination with urine, water or other extrinsic substances. The samples were examined as per sedimentation and flotation techniques.

Samples proved positive for *Balantidium coli* infection. Nine out of the 18 samples collected over the year were found positive for this protozoan infection. Craig and Faurt (1943) also reported a higher prevalance of this infection. As the animals are confined in cages, poor hygienic condition perhaps predispose the animals to the spread of infection to others in the cage.

Acknowledgement:
The authors are thankful to Shri A.K. Das, Director and Dr. B.D. Biswas and Dr. B.K. Mazumdar, Veterinary Surgeons, Zoological Garden, Alipore, Calcutta for their generous help in collecting samples from the animals.

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1. Craig, C.F. and Faust , E.C. (1943) The Ciliata (Ciliate parasites of man). In the book Clinical parasitology, 3rd edn. Pub.Lea & Febiger, Philadelphia : 208-14.

NOTE ON CONTROLLING MUSTH ELEPHANTS

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The article entitled 'Controlling Musth Elephants" by Dr. R.H. Sabapara and P.P. Raval in November 1993 issue of ZOOS' PRINT was very interesting and informative. However, they themselves say that, there was remarkable difference in the behaviour of two elephants. The reason can be explained as follows:

(1) The authors have used 3 M1 of Immobilon containing 2.45 mg of etorphine and (the word printed as atropine is a misprint) 10mg of acepromazine per ml on each animal i.e. a total dose of 7.35 mg (2.45 x 3) was used. If we consider a dose rate of 1 mg/450kg, the animal should have weighed 3.3 tons (7.35/450). From the time of onset, the dose seems to be all right. This has been reinforced with 225 mg of Xylazine i.e.,68 mg/Ton (225/3.3), that too, after 1/2 hrs. of the darting.

In the 2nd case, the drug has started showing results within 3 minutes, which indicates that the dose is slightly on a higher side i.e., the animal was weighing less than 3.3 tons. The Xylazine given in this case, is a total dose of 600 mg. Even if the weight is assumed as 3.3 tons, the dose in the 2nd animal is 181.8 mg/Ton i.e. 2.67 times more than the 1st animal.

This clearly indicates that, the Xylazine dose was much higher in the 2nd animal, and that too, was given by 15th minute. In the first case, it was given after half an hour, giving a longer time to recover from Etorphine Acepromazine sedation. Hence, in the 2nd case, the delayed recovery was due to administrating 2 drugs at a close interval and also in a higher dose.

Even if Xylazine is used alone in controlling captive rogues, 100-120 mg/Ton will be sufficient. The drug will start acting within 5-8 minutes and will reach a peak by 40-45 minutes. Animal should not be disturbed during induction and should be handled only after it is completely tranquilized. The limbs can be noosed and pulled alternatively by giving oral and prod commands. The animal will not lie down and if the sedation is not on a higher side, it will obey the commands and coaxing as if it is in a hypnotic trance.

Sternal recumbancy is fatal in elephants if it exceeds more than 20-30 minutes and animal has to be turned to lateral recumbancy.

Use of tractor or crane to lift elephant in recumbancy is not advisable. An elephant used in lumbering operation is ideal for this purpose. If this is not available, men and plenty of gunny bags filled with straw can be used.

Another point that should be noted in both these cases is that both of them start misbehaving when all restraints are removed. The Elephant being an intelligent animal, the presence of any gear for restraint, like chain, hobbles etc. will psychologically make the animal obey the commands. The feeling of 'freedom' will make the animal misbehave. That is why, a loose body chain, or if necessary, a trailing chain is always recommended. This becomes all the more important with aggresive males or bulls in musth.

RESEARCH NOTE

Treatment of Tetanus in an Elephant - A successful case report

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Incidence of tetanus in captive elephants is found to be less as compared to other animals. Six cases of tetanus were recorded in captive elephants in Kerala previously and all of them died during the course of treatment. An adult tusker was brought for treatment with a history of a fall from a lorry and consequent loss of one of its tusks. The elephant showed off feed , partial locked jaw, salivation, inability to swallow, stiffness of the limbs and neck, muscular tremors and inability to walk and lie down. Immediately after diagnosing the condition the elephant was given intramuscular injections of [1] Novalgin 90ml, [2] Avil 80ml, Crystalline penicillin 400 lakhs and [3] Esgipyrin 75 ml. and intravenous infusion of Antitetanus serum 2,00,000 units, Diazepem 250 mg, Polybion 50 ml and 5% Dextrose saline 10800 ml. This line of treatment was repeated on the second day also and the elephant showed marked improvement. The elephant was able to flex its limbs and walk some distance and also started to eat palm leaves and drink water. All the drugs except Antitetanus serum were administered for two days more and the elephant fully recovered by restoring normal intake of feed and water.

1. Analgin 0.5 gm/ml Hoest India Ltd.
2. Pheniramine Maleate Hoest India Ltd.
3. Phenylbutazone 750 mg
   Analgin 750mg
   Lignocaine hcl. 50mg per 5ml- S. G. Pharmaceuticals

Reprint : Zoos' Print, 11 (4) : 14, April, 1996

RESEARCH NOTES

Praziquantel - An Effecctive Drug Against Tape Worm in Elephants

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Tape worm infection caused by *Anoplocephala manubriata* is comparatively rare in Indian elephants. The disease is characterised by off feed, colic, weakness, loose motion and emaciation. Typical eggs and detached segments of the parasites were detected from the dung of infected elephants. E.P.G. was estimated on the day of medication and on the first, second, third and seventh day following medication. Cestonil tablets (Praziquantel - 50 mg - Alved Pharma & Food Pvt. Ltd.) at the dose rate of 2.5 mg per kg. body weight was given as a single dose. The tablets were powdered before administration and fed with jaggery. The efficacy of the drug was estimated on the basis of the reduction of eggs of the worm in dung after medication and disappearance of the typical symptoms and segments in the dung. Large number of segments of the worm were noticed in the dung of the elephant after 24 hours following medication upto a period of three days. The EPG was reduced to nil on the third day proving 100% efficacy. The drug is tolerated well and the general condition of all the seven treated elephants improved considerably and restored usual intake of feed and water without showing any colic or loose motion.

Decay of Dental Pulp and Extraction of Tusk in Captive Elephants

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The tusks in elephants are modified incisor teeth and have dental pulp extending about 2/3 its length. Accidental injury during work or mischevious activities or cutting the tusk short lead to infection and damage to the dental pulp. Three cases of decay and disintegration of dental pulp were treated and in all three cases, because of the damage to the root of the tusk, tusks were removed. The decay in dental pulp was bilateral in one animal and unilateral in other two. In all the three cases there was severe suppuration of the pulp with disintegration of the pulp leaving an infected tract to the full length of the tusk and the alveoli. The root of the tusk was shaky and the tusk lost its normal colour, was not growing in length and had a hollow sound in tapping. Cleaning with antiseptics and hydrogen peroxide and packing with ointment was done. Parenteral adminstration of antibiotics was also given. Since the tusks became shaky, removal of tusk was done by cutting it close to the alveoli and removing the root by cutting it longitudinally after tranquilising with xylazine. The tusks were hollow, had a dirty black inner lining and thin. The roots were soft, pliable and dark coloured. After removal of tusks, the alveoli was treated by cleaning with hydrogen peroxide and dressing with nitrofuran ointment. Healing was uneventful. In two elephants where it was unilateral, artifical tusks were prepared with soft wood and fixed.

A Prolonged case of Impaction of Colon in an Elephant and its Effective Line of Treatment

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Impaction of colon is a common ailment in captive elephants which are maintained under defective management practices. Irregular feeding with dry and wet fodder, sudden cooling of the body after a prolonged march during hot climate and improper scrub bath are attributed to be the important causes for this condition. As adult tusker which was reported to have fed with dry and very fibrous palm leaves showed the symptoms of impaction of colon, constipation, colic with frequent attempts of lying down and getting up, off feed and reluctance to drink water. The rectum was found to be empty on examination. Initially for two days the elephant was given intramuscular injections of Baralgan 90 ml, Calcium pantothenate 70 ml, and Pennorm 50 ml and the symptoms of colic were subsided. From third day onwards the animal was administered on alternate days, intramuscular injections of [1] Avil 70ml, [2] Prostigmin 31/2 mg and intravenous infusions of [3] Calcium pantothenate 70ml, [4] Pennorm 50ml, [5] Polybion 50 ml, [6] Calcium boro gluconate 900 ml, 5% Dextrose saline 5400 ml, Electrolyte 5400 ml and 10% Dextrose 5400 ml in order to control dehydration and to improve the peristaltic movements of the intestine. A course of antibiotic, Chloramphenicol succinate 10gm was also given intravenously for seven days. This line of treatment was continued up to the 54th day and during this period the elephant refused to feed and drink water. On 55th day a big dung bolus was located in the rectum and it was manually removed and the animal became normal.

1. Pheniramine Maleate - Hoechst India Limited
2. Neostigmine methyl sulphate 0.5 mg/ml
3. D. panthenol 50mg/ml Sigma Lab
4. Metaclopramide hydrochloride 5mg/ml IPCA Lab
5. Vitamin B complex with Vitamin B12- Merck
6. Calcium boroglucanate 25% Sarabhai Chemicals

Reprint : Zoos' Print, 11 (4) : 24, April. 1996

RESEARCH NOTES

Oxyclozanide - An Effective Drug Against Amphistomiasis in Elephants

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Amphistomiasis is common in Indian elephants and is characterised by off feed, colic, exhaustion, loose motion, and oedematous swellings on the neck and lower abdomen. Twenty two elephants brought from North India to Kerala were found to be very weak and emaciated with occasional colic, off feed and loose motion. Amphistome eggs were detected from the dung samples. E.P.G. was estimated on the day of medication and on the first, second, third and fifteenth day following medication. Distodin tablets (Ocyclozanide 1gm - Pfizer) at the dose rate of 3.5 mg. per kg. body weight were powdered and administered orally to each elephant well mixed with jaggery as a single dose. The efficacy of the drug was estimated on the basis of reduction of eggs in hours post-medication onwards a large number of live and dead amphistomes were noticed in the dung and disappeared on the third day. The E.P.G. was reduced to nil on the third day providing 100% efficacy. The worms were identified as *Pseudodiscus collinsi*, *P. hawkesi* and *Gastrodiscus secundus*. The general condition of both the elephants improved considerably and restored usual intake of feed and water.

Translocation of Captive Rogue Tuskers

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In Kerala caparisoned tuskers are a part and parcel of festivals and public functions. Most of the festivals are during the period between November to April and the same period is also the season for Musth in bull elephants. An ill-tempered bull used in a festival or for timber logging may suddenly bolt by a slight provocation from the mahout. These animals are to be tranquillised using drugs with the help of a syringe projector. After they are brought under control and chained, they are again to be translocated to a safe place to be tethered properly. NO kunkies (Monitor elephants) will be available for such translocation. Hence the drug is administered only to such an extent just to "tritrate" the aggressiveness. The animal will retain certain amount of ambulatory property. The animal is moved and translocated to a safe place for tethering. This is achieved by noosing all the four limbs and pulling the fore limb alternatively and also giving commands and coaxing the animal to move. At times a mahout is allowed to ride and toe commands were also given. The dose of the drug, Xylazine, given is 100-120mg/metric ton of body weight. Operation of noosing and translocation is done only after attaining the peak action of the drug which is after 40-45 minutes following darting the drug. A total of 262 elephants has been translocated by this method using Xylazine during a period of 14 years.

Reprint : Zoos' Print, 11 (4) : 26, April, 1996

RESEARCH NOTE

Use of an Indigenous Product "Resant" for Wounds in Elephants

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"Resant" (Respel Pharma) is an indigenous product containing Sarvatobadra, Naktamala, Sharshapah, Tamratuttu, Bhuchanaka and Processed in Sindhu Varam, Waidehi, Peetadaru, Ksharapatra, Bhangura, Mukhmal Pushpa and Sudda. As an ointment it has been recommended as antiseptic and parasiticidal for treatment in animals. The ointment was used in 75 cases in elephants for treatment of abscesses, sinuses, superficial wounds and in decay of the root of tusks. In abscessess after opening it and in sinuses, the cavity or inflammatory tract, was cleaned with hydrogen peroxide, mopped dry and the ointment was applied impregnated in surgical gauze. Chronic inflammatory tracts and abscesses were cauterised with triple sulph and after removal of necrotic core, Resant was applied. In wounds which were superficial, after cleaning with antiseptics, the drug was applied. In the alveoli of the tusk and in cases of decay of dental pulp of the tusk, the cavity was cleaned with hydrogen peroxide, mopped dry and the ointment was applied. With the use of Resant, it was observed that there was considerable reduction in suppurative reaction and the necrotic tissue was separated within 48-72 hours. Granulation tissue was noticed in 5-7 days time and the healing of wounds was uneventful. The ointment also possessed satisfactory fly repellent property.

Reprint : Zoos' Print, 11 (4) : 28, April, 1996

RESEARCH NOTE

Use of Xylazine as an Anaesthetic for Elephants in Surgical Conditions

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Use of Xylazine as an anaesthetic in elephants is described. The total cases described are thirty in numbers and varied from minor injuries to bullet injuries and tiger maul. The normal dose of 100 mg per 1000 kg body weight I/M was effective in most cases. But the dose has to be increased more than double the normal, when extensive areas are involved and the standing posture. Animals which are reluctant to move due to pain became more ambulatory after initial dose of Xylazine. This may be due to the analgesic property of Xylazine. No animals showed vomitting tendency as seen in the case of carnivores.