CENTRAL ZOO AUTHORITY OF INDIA

and

TAMIL NADU VETERINARY AND ANIMAL SCIENCES UNIVERSITY

Madras Veterinary College, Chennai

(in collaboration with Arignar Anna Zoological Park)

National Workshop For Zoo Veterinarians on

"PROTOCOL FOR THE VETERINARY CARE AND SAFETY OF WILD ANIMALS DURING TRANSPORTATION WITH SPECIAL REFERENCE TO DEER SPECIES"

24th– 28th January 2011

Organized by

Department of Wildlife Science

Madras Veterinary College. TANUVAS, Chennai

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Tamil Nadu Veterinary and Animal Sciences University

Dr. R. PRABAKARAN
VICE-CHANCELLOR

Madhavaram Milk Colony
Chennai - 600 051

I am extremely pleased to learn that the Department of Wildlife Science, Faculty of Basic Sciences, Tamilnadu Veterinary and Animal Sciences University is organizing a National Workshop for Zoo Veterinarians on "**Protocol for the Veterinary care and safety of wild animals during transportation with the special reference to deer species**" in collaboration with Central Zoo Authority of India (CZA) and Arignar Anna Zoological Park, Chennai, from January 24th -28th, 2011 at Madras Veterinary College, Chennai.

Veterinary Care and Safety of Wild Animals during transportation are the important components in the conservation of wildlife in India as well as in other countries. The theme of the workshop is appropriate that will help to enlighten the field veterinarians, especially those working in various zoos, zoological parks, zoological gardens as well as in deer parks etc.

Evolving protocols for transport in fact may lead to enrichment of the scientific management of the captive wild animal species that are subjected to various transport stresses. Fresh graduates and even the experienced zoo veterinarians associating with transport of various wild animal species especially the deer will get immensely benefited by attending this workshop at the national level.

I appreciate the organizers for their sincere efforts in conducting this national level workshop for zoo veterinarians in a successful manner.

Place : Chennai - 51
Date : 07-01-2011

(R. PRABAKARAN)
VICE-CHANCELLOR

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GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT & FORESTS
Central Zoo Authority

Message

Indeed its my pleasure to extend congratulation & thanks to the Department of Wildlife Science, Faculty of Basic sciences of Tamil Nadu, Veterinary and Animal Sciences University for accepting Central Zoo Authority's request to organize workshop on the topic greatly felt needed "Protocol for the veterinary care and safety of wild animals during transportation with special reference to deer species" in collaboration with Arignar Anna Zoological Park, Vandalur, from January 24th - 28th 2011 at Madras Veterinary College, Chennai.

Transportacon of animals (deer, ungulates & other species) from one facility to other involves high risk of casualties as experienced in the past few years. It has been serious concern for the Central Zoo Authority and other concerned organization & individuals. The issue had recently been deliberated in Parliament by the Hon'ble Members, the Ministry of Environment & Forests, Government of India assured the Members of Parliament that same will be dealt seriously. Many zoos at the same time had successfully transported deer and other species of wild animals from their zoos to other and translocated to forests for rehabilitation. Hence, it is the right time that we focus on developing protocol for the transportation of the animals, considering their safety as well as veterinary care. This is an opportunity when all participants can share their experiences and develop the protocol and play an important role in making transportation in scientific manner.

I am sure that this workshop will serve as an excellent platform for valuable deliberation on new ideas, innovations and technologies on said subject among the participating zoo veterinarians along with national as well as international expert and set guideline for future use and reference for the zoos in country.

I wish this workshop a grand success.

(B. S. Bonal)
Member Secretary,
Central Zoo Authority
DATE: 14.01.2011

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Dated: 18.01.2011

Wildlife has been threatened by human activities throughout history to this day. Development of sophisticated and efficient weapons meant for poachers have killed animals in numbers greater than the recruitment rate that many species of animals have become extinct. Many other species of animals have become endangered and a greater number have become vulnerable. Urbanization has seriously harmed or destroyed large areas of plant and wildlife habitat. These disruptions affect the diversity and size of living populations in the habitats. Many such habitats are small and no longer connected to vast ecosystems.

The past two decades have seen the emergence of pathogenic infectious diseases associated with a range of underlying causal factors. Wildlife plays a key role in most of the human emerging infectious diseases by providing a "zoonotic pool" from which previously unknown pathogens may emerge. This occurs classically for influenza virus, which causes pandemics in humans after periodic exchange of genes between the viruses of wild and domestic birds, pigs, and humans.

Wild animals either free ranging or under captive are subjected to great stress while on transport for various reasons. Stress has a major impact on the cause of disease during transport itself or in a delayed manner through the immune system of animals. In the recent past, there have been number of instances of death during or subsequent to transport. Especially, in sensitive deer species, this has assumed an alarming size. Hence, the workshop on "Protocol for the veterinary care and safety of wild animals during transport with special reference to deer species" is very pertinent. The topics of lectures and practical demonstrations covering the various aspects of health, disease and conservation of wild life including deer species is most appropriate and need of the hour.

I congratulate the organizers of the workshop, Dr.M.G.Jayathangaraj, Organising Secretary and Professor and Head, Department of Wild Life Science, Dr.R.Sridhar, Co-organising Secretary and Professor and Head, Department of Veterinary Pathology and other faculties of wild life science department for their yeoman efforts to conduct the workshop for the benefit of the wild life veterinarians engaged in the different aspects of wild life health, disease and conservation.

18.01.11

(S.R.SRINIVASAN)

National Workshop for Zoo Veterinarians on

"PROTOCOL FOR THE VETERINARY CARE AND SAFETY OF WILD ANIMALS DURING TRANSPORTATION WITH SPECIAL REFERENCE TO DEER SPECIES"

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Vice-Chancellor, TANUVAS, Chennai

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Member Secretary, Central Zoo Authority, New Delhi

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Assistant Professors, Dept.of Wildlife Scienc, MVC, Chennai

Dr. P.Thirunavukkarasu,
Assistant Professor,
Dept.of Veterinary Clinical Medicine, Ethics and Jurisprudence, MVC, Chennai

CONTENT

Carlos Sanchez, DVM MSC
Chicago Zoological Society
Brookfield Zoo

PHYSIOLOGY CONCEPTS APPLICABLE TO THE CHEMICAL IMMOBILIZATION OF WILD ANIMALS

Physiology, the science that studies the functions of organisms or their components, is a subject which can be taught as extensively, on many levels, and encompasses a wide range of topics. This lecture will provide only basic information which seems relevant to the capture of wild animals.

Definition of terms:

1. Basal Metabolic Rate: The metabolic rate necessary to produce the energy required by an animal to carry out basic maintenance functions while at rest is termed the basal metabolic rate. These functions include blood circulation, respiration, kidney function, and maintenance of all tissues at the cellular level.

2. Homeostasis: Homeostasis is the maintenance of body functions within ranges compatible with life, reached by actions or reactions initiated in response to environmental chance. It is a state of internal balance of stability.

3. Hypoxia: Hypoxia means decreased availability of oxygen in the tissues. Anoxia is a total absence of oxygen. Hypoxia may be generalized, in which all tissues lack sufficient brain and cardiac muscles, which are particularly susceptive to insufficient oxygen
   Causes: Some species can breathe through both the mouth and nostrils, others breathe primarily through the nose (equids, elephants). Airways may be obstructed by tight ropes or snares around the neck, too tight a grip can occur easily if an animal sticks its head through a net or a webbing containing spaces inappropriately sized for the species. Obstruction of the nostrils during restrain can result in hypoxia. Gloves diminish tactile discrimination and may mask excessive pressure applied to the thoracic cavity while gripping the animal. Birds breath with a bellows type of respiration that necessitates movement of the keel bone or sternum forward and down of inspiration and backwards and up for expiration. A restraint procedure that interferes with such movement will quickly produce suffocation.
   Other causes of hypoxia include regurgitation with inhalation of ingesta, bloat, and concurrent respiratory diseases such as pneumonia or emphysema, and blood loss. Wild animal are capable of masking signs of severe respiratory disease until the condition is almost terminal.

4. Hypoglycemia. Hypoglycemia is a decrease of glucose levels in the blood. Any malnourished animal may be prone to develop hypoglycemia especially if asked to quickly mobilize energy reserves, as might occur with capture. Hypoglycemia deprives the brain of the substrate upon which it is dependent for the use of oxygen. Thus hypoglycemia results in hypoxia and anoxia of the brain. If continued it results in convulsions, coma, and irreversible brain damage.

5. Acidosis: Homeostasis necessitates maintenance of a delicate acid-base balance in the blood. Normal mammalian blood pH varies between 7.35 and 7.45. Minor changes in either direction trigger serious metabolic consequences. If the pH is less than 7.35 the condition is called acidosis and if over 7.45 is called alkalosis. The prime cause of acidosis in restrained animals is excessive muscular activity associated with excitement, chase and resistance to electrolyte upsets. Acidosis associate with exercise persists for several minutes after running or struggling has ceases, thus animals are commonly manipulated or anaesthetized while in an acidotic state.

6. Electrolyte imbalance: Blood contains a balance of ionic substances that aid primarily in water balance. Of these, sodium, chloride, and potassium are the most important. Because the body can only tolerate these concentrations within very narrow limits, even minor fluctuations can be life-threatening.

7. Dehydration: Dehydration results when the total amount of body fluids, both within the circulation and the tissues is less than normal. It can be a life-threatening condition because of the electrolyte imbalances that accompany or follow the condition.

Vital Organs

At a very basic level, organisms are composed of cells, with then group themselves into tissues, organs and systems. While all these are necessary for the overall well being of the organism, some are considered vital, which means pertaining to life, because loss of function of these organs rapidly results in loss of life. The respiratory system, cardiovascular system, central nervous system, liver, and kidney are the vital organs and tissues which are of most importance in field conditions of capture and restraint. The basic functions and consequences of functional loss of each will be discussed in turn.

Central Nervous system

The central nervous system is composed of the brain and spinal cord. The brain functions directly in the control of the most vital functions, including heart rate, respiration, and blood pressure. With loss of function death can rapidly result. The most likely cause for loss of central nervous system function in field situations is through traumatic injury or drug overdoes. Fractures to the skull or spinal cord may result in acute loss of consciousness or paralysis, respectively. Even a blow to the head which does not fracture the skull can be of significant force to cause intracranial bleeding or produce edema of the brain, both of which are life-threatening conditions. Since the immobilizing drugs affect the central nervous system directly, calculation of dosage is important. Drugs that reduce blood pressure and/or respiration are likely to result in hypoxia to the brain because its oxygen requirements are high.

Cardiovascular System

The cardiovascular system is composed of the heart, the vessels and the blood within the system. Its main function is the pumping of oxygen-laden blood to the entire body so that oxygen can be used in the production of energy needed for functional requirements and maintenance of tissues. The heart is the pump that receives deoxygenated blood from the body, pumps it through the lungs where it receives oxygen, receives it back from the lungs and then pumps it in its oxygenated form back to the body. Because of the opening and closing of the valves in the heart, auscultation allows two distinct sounds (lub, dub) to be heard normally. The beating of the heart is controlled by a sophisticated nervous system network, and in general the larger the species of animal, the slower the rate under normal circumstances. Heart rate increases dramatically with exercise and stress, and may be altered significantly by some drugs.

Blood consists of red cells, white cells, and platelets bathed in a protein-rich fluid called plasma. The functions of the blood are included in the following list:

1. Blood carries nutrients made available by the digestive tract to the body tissues.
2. Blood carries oxygen from the lungs to the tissues
3. Blood carries carbon dioxide from the tissue to the lungs
4. Waste products from various tissues are carried to the kidneys for excretion (urea)
5. Hormones are carried from endocrine glands to other organs of the body (insulin, thyroxin).
6. Blood plays and important role in temperature control by transporting heat from deeper structures to the surfaces of the body
7. Water balance is partly maintained by the blood
8. Buffers such as bicarbonate in the blood help maintain a constant pH (acid-base balance) of the tissues and body fluids
9. The clotting ability of blood prevents excess loss of blood from injuries (platelets, clotting factors)
10. Blood contains important factors for defense of the body against disease (white blood cells, antibodies, plasma proteins)
11. Drugs, their metabolites and other compounds are carried in the blood to sites of action, metabolism and excretion

Because blood functions in different systems, signs of functional loss are varied. The most obvious capture-related effect of the blood occurs with exsanguinations, which rapidly results in generalized hypoxia because the blood's ability carry oxygen and carbon dioxide are lost with the loss of red blood cells. Underlying disease conditions that results in functional disturbances of the blood, for example anemia (extreme parasitism, malnutrition), can be important and capture an animal with such a condition may unbalance the already altered state of homeostasis enough to result in death.

Blood pressure is another important feature of the cardiovascular system, and is defined as the pressure that blood experts against the vessel walls. Many drugs are capable of causing significant lowering of the blood pressure, which if sustained, can cause serious damage because of hypoxia. The renal tubules in the kidneys are often damage when shock develops because of the associated drop in blood pressure and resultant hypoxia.

Respiratory system

The cardiovascular and respiratory systems are closely linked in function, and disturbances in one system invariably results in changes in the other. The ventilatory function of the lung is well appreciated, but it has other functions as well, including body defense from irritants and pathogens in the air, metabolic functions, filtration of blood, and reservoir for blood, heat exchange and elimination of volatile substances.

Liver

The liver is the largest gland in the body and has many complex functions. These include the formation of bile, storage of carbohydrates, metabolism of carbohydrates and fats, manufacture of plasma proteins, and the metabolism of many drugs and toxic compounds. With underlying hepatic disease (biliary system parasites, hepatitis) metabolism of drugs can be slowed and the effects might, therefore, be greater or of longer duration. In addition, since the metabolites of some drugs are toxic, and since the liver is the organ where the toxic metabolites are produced, liver damage can result with drugs are used.

Kidneys

The kidney, along with the rest of the urinary system, is responsible for excretion of many waste products of the body. It also has a role in maintenance of homeostasis, including the regulation of water balance, pH, osmotic pressure, and electrolyte levels, which is achieved through filtration of blood. The kidney also functions in the metabolism of some drugs. Adequate arterial blood pressure is important functionally for the kidney, not only for its filtration function but also for its basic metabolic needs. The renal tubules are very sensitive to hypoxia, making them very sensitive to the effects of shock.

As animals age kidney function tends to decline. This is often subclinical because of the tremendous reserve capacity of the kidneys, but may be important when using a drug (ketamine) which might be metabolized by the kidneys. If the functional capability is less than normal the drug's effects might be of a magnitude greater than desired or might last longer, both of which might be deleterious to the animal.

CHEMICAL RESTRAINT OF NON-DOMESTIC CARNIVORES AND HOOFSTOCK

GENERALITIES

Unless it is an emergency, always plan an anesthetic procedure.

-What needs to be done? (Obtain biological samples? Perform physical exam?)
-Is anesthesia necessary? – Is physical restraint possible?
-Where is the anesthesia going to be carried out?
-Do we have the necessary equipment to carry out the immobilization and the procedure?
-Do we have the personnel to carry out the procedure?
-Do we have the right drugs to chemically restrain the animal(s)?
-Take the weather conditions into account.
-Be aware of possible complications.
-Know how to prevent and treat/respond to these complications.
-Assign roles to the different personnel involved in the procedure.
-Obtain a recent weight of the animal to be anesthetized whenever possible.

In preparation for the procedure:

*Human safety is paramount.
*Animal safety is very important.
*Review information on the species to be captured/restrained.
*Contact people with experience anesthetizing this species.
*If possible perform a visual exam PRIOR to the anesthetic event

FREE RANGE vs CAPTIVE ANESTHESIA

Reasons to anesthetize:

- Free ranging: Translocation, health assessment, tx injuries (human intervention), ecologic studies (GPS, telemetry)
- Captive: Emergency, PEx, blood sample, Radiographs, Quarantine exams, Pre-shipme exam, transportation.

Free range	Captive
Higher dosages are required due to nervous nature of the animal and need of shorter induction times	Animals are more used to human presence, therefore lower dosages are needed. Physical restraint MAY be possible
Fasting will not be possible	Fast accordingly to size/metabolism of anim
Estimated body weights at the best	More accurate weights
More affected by climate	More control on weather and temp
Difficult to approach animal for drug delivery	Different options to deliver drugs
Need minor volume of drugs	Possible to inject larger volumes
Monitoring could be more difficult	Easier to monitor

Carlos Sanchez, DVM MSC

Chicago Zoological Society
Brookfield Zoo

Hoofstock and carnivore chemical restraint

January 2011

Ideal anesthetic agent must be/have:

-Potent
-High safety margin (3x)
-Smooth and fast induction/recovery
-Reversible effect
-Short lasting
-Minimum side effects
-Non-toxic

} One product with all these characteristics DOES NOT EXIST

The combination of drugs (cocktails) ⟹ ideal anesthetic plane.

-<u>Know drug pharmacokinetics/Pharmacodynamics (mechanisms), side effects.</u>
*Narcotics – Renarcotization
*Alpha-2 – Recycling
*Stress – Override alpha-2 effects
*Tiletamine-zolazepam has been associated with deaths in tigers and at least one gorilla.

-<u>Know basic principles of anatomy, anesthesia and physiology.</u>
*Stress – Capture myopathy
*Position will be different for different species once in recumbency
- Hoofstock: Sternal with head up and nares pointing down to prevent regurgitation
- Elephant, tapirs: Do not keep in sternal >20min ⇨ suffocation
*Physiological adaptations: Diving reflex in marine mammals

-<u>Recognize that we are anesthetizing animals w/o the benefit of pre-anesthetic exam/bloodwork.</u>
*Kidney disease
*Liver disease
*Cardiac disease

Drug delivery

Routes:
Injection – IM – IV
Oral – Common for pre-anesthetic sedatives
Inhalation

Administration methods:
Hand syringe
Physical restraint
Squeeze cage
Training

Darts
- Plastic
- Metal
- Home-made

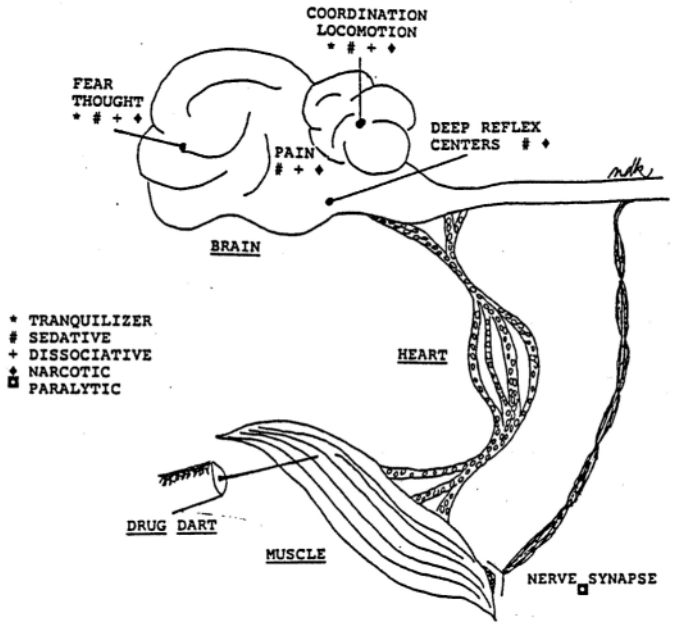
Blowguns
Longbows/crossbows
Powered projected rifles/pistols
- CO2
- .22 caliber powder charge (fire arm permit)
- Compressed air

Pole-syringes
- Manual
- Spring-loaded

Drugs commonly used in zoo and free ranging mammals

Tranquilizers*
Sedatives
Dissociatives (Cyclohexamines)
Opioids (Narcotics)
Hypnotics (ultra-short action)
Inhaled agents
*Long acting neuroleptics

Tranquilizer	**Sedative**
Decrease anxiety, aggression and fear Cause dizziness	Cause unawareness of environment Cause dizziness
Do not affect reflexes	Decrease motor activity
↑ Dose ⇨ ↑ Toxicity ↑ Dose does not ↑ effect	↑ Dose ⇨ ↑ effect Useful as immobilizing agent
e.g. Butyrophenones Phenothiazines	e.g. Benzodiazepines Alpha-2 agonist



Sites of drug actions.

Tranquilizers

Phenothiazines

- **Propiopromacine**
- **Perphenazine** (Long acting)
- **Acepromazine**
  - Anti-emetic
  - Anti-spasmodic
  - Causes hypotension
  - Affects thermoregulation
  - Does not provide analgesia
  - Moderately long action (4-12 hrs)

Butyrophenones

- **Azaperone** (considered a short acting neuroleptics)
  - Useful for suid anesthesia
  - Effect: 2-3 hrs
- **Haloperidol** (haldol)
  - Medium to long action (water soluble) – Long acting (oil based solution)
  - Useful in hoofstock transportation

Sedatives

Benzodiazepines

Commonly used in combination with cyclohexamines in carnivores and primates. Especially useful to control seizures.
All benzodiazepines can be reversed with flumazenil ($$$$$$)

-**Diazepam** – Non-water soluble
  Controlled substance
  Muscle relaxation
  Anti-convulsion
  Anxiolytic
  IV: Respiratory depression
  IM: Variable effect
  Metabolized in liver
-**Midazolam** – Water-soluble
  Controlled substance
  4x more potent than diazepam
  Similar effects than diazepam but more expensive
  Less respiratory depression if given IV
  Better absorption (and more consistent effects) when given IM
  IV, IM and oral route.
-**Zolazepam**
  In combination with tiletamine = telazol®
-**Lorazepam**
  Used orally in humans

Alpha-2 adrenoceptor agonists

-Normally used in combination with cyclohexamines or narcotics.
-Reversible* with any of the alpha-2 antagonist: Atipamezole, tolazoline, yohimbine
-All produce sedation and muscle relaxation.
-Marked cardiac effect (bradycardia, cardiac AV blockage type II)
-Biphasic cardiovascular effects: Initial hypertension followed by hypotension.
-Avoid supplementation of alpha-2 if possible.

Vasodilatation ⇒ ⇩ blood pressure

⇩ Blood pressure ⇒ vasoconstriction

Vasoconstriction ⇒ difficult to get partial O2 saturation with pulse oximeters

Vasoconstriction ⇒ more difficult to have access to peripheral veins

Over-excitation ⇒ increase in circulating catecholamines

Circulating catecholamines ⇒ override alpha-2 effects

-**Xylazine (Roumpun®)** (160:1 alpha-2 : alpha-1)
Ruminants more susceptible than horses, horses more susceptible than carnivores
Causes vomiting in carnivores
Route IM or IV (IV route will cause more marked CR effects)
Initial effect (IM): 10-20 min.
*Can be reversed with yohimbine, tolazoline or atipamizole.

-**Detomidine (Domosedan®)** (250:1 alpha-2 : alpha-1)
Similar effects to xylazine but 2-3x more potent
Great for standing sedation of hoofstock and equids
*Can be reversed with yohimbine, tolazoline or atipamizole

-**Medetomidine (Domitor®)** (1,600:1 alpha-2 : alpha-1)
Two enantiomers (dextro and levo-enantiomer)
10x more powerful (and expensive) than xylazine
Marked hypertension followed and drop in blood pressure in carnivores > primates
*Atipamizole is the specific reversal agent for medetomidine.

- Dexmedetomidine (Dexdomitor®) (Considered a full agonist of alpha-2 adrenoceptors)
Active enantiomer of medetomidine (Dextro-enantiomer)
Does not contain the inactive enantiomer levomedetomidine (levo-enantiomer)
Levomedetomidine prologs hepatic metabolism of ketamine and other drugs
Degree of sedation higher with dexmedetomidine alone than when in combination with levomedetomidine (Domitor®)
Reversible with atipamezole

Cyclohexamines

-Cause a dissociative effect.
-Although ketamine can be used alone (primates) it is better to combine it with a sedative.
-Palpebral and corneal reflex present and eyes wide open (lubrication)
- Pharyngeal and laryngeal reflex remain present; therefore intubation is more difficult to achieve
-They do not cause muscle relaxation, occasionally ⇨ seizures

-**Ketamine**
Most used agent in primate anesthesia
Rapid effect when given IM (2-10min)
It has cardiostimulatory effects
Wide safety margin
Minimal to moderate analgesia
Increases blood and CSF pressure
If given IV too fast it could cause respiratory depression
It is NOT reversible
Ketamine is metabolized in liver, therefore the⇧ the dose the ⇧duration of effect.
Ketamine is excreted by the kidneys, avoid in animals with confirmed or suspected renal disease.
Duration of effect: 45-120 min (dose dependent)

Ideal agent for supplementation

-Tiletamine (only sold mixed with zolazepam)

Can be concentrated up to 400mg/ml ⟹ field immobilizations
Depending on the species the tiletamine will be metabolized first (cats) then the zolazepam (in dogs is the opposite).
Once prepared can be stored in fridge for up to 1 month
3-4x more potent than ketamine
Initial effect (IM) 1-2 min
Effect lasts 3-4x more than ketamine
Affects thermoregulation
Causes splenomegaly
Good analgesia and muscle relaxation
High dosages can cause respiratory depression
The author recommends never supplementing with tiletamine-zolazepam
Long recoveries often (when tiletamine is metabolized first)
Rough recoveries sometimes (when zolazepam is metabolized first)
Do not use in tigers, avoid in gorillas

Opioids (Narcotics)

-Often used in combination with alpha-2 adrenergic agonists, phenothiazine derivates or butyrophenones.
-Mostly used in ungulates and occasionally in bears, not used in felids or canids

-"Ultra-potent -narcotics"- **Etorphine** (M-99), **Carfentanil**, **A-3080**

-A single drop can kill a person in matter of minutes without the appropriate treatment
-Must be used by experienced people with appropriate safety gear.
-Act at specific opioid receptors in the CNS (mu, kappa an delta opioid receptors)
-Provide good analgesia but poor muscle relaxation
- Etorphine is 1,000x more potent than morphine
-Carfentanil is 10,000x more potent than morphine
-Cause severe respiratory depression
-Reversible:

Naltrexone: pure antagonist, long half-life; diprenorphine (M50-50): Partial antagonist with agonist properties; naloxone: Only approved human pure antagonist, very short half-life. It's best to use naltrexone for any "super-narcotic".

-Renarcotization can occur (2-72 hrs post-antagonist administration).

-Butorphanol

Agonist/antagonist
Causes deep sedation rather than anesthesia
4-7x more potent than morphine
Can cause hypotension and bradycardia
Causes excellent analgesia
When used in primates as analgesic causes deep sedation
Can be given oral (slow absorption), IM or IV

Reversible with naloxone or naltrexone

Used to partially reverse the cardio-respiratory effects of the super-narcotics when used as an antagonist.

-**Fentanyl**

100x more potent than morphine

Rapid onset (more lipid soluble than morphine thus quickly crosses the blood-brain barrier).

Short duration of action (30 min)

Causes minimal cardio-respiratory depression even at larger dosages

Route: Oral, IV

Excellent to produce initial sedation in great apes prior to darting them.

Hypnotics

-**Propofol**

Must be given IV therefore only practical if animal is physically restrained first.

IV injection can cause severe pain

Rapid redistribution of the drug from the blood to other body compartments therefore rapid recovery is expected

Provides only minimum analgesia

Metabolized 10x faster than thiopental

Effects last 3-15 minutes (dose dependent)

Should be given slowly (over 60-90secs) and to effect

Can cause severe hypotension if used in animals with hypovolemia

It is a potent respiratory depressant and if O2 is not supplemented arterial O2 levels ↓, and arterial CO2 levels will ↑

Intubation is strongly recommended

Excellent for animals with liver or renal disease

Inhalant anesthesia

-Rarely used in the field but commonly used in captivity

-Appropriate equipment needed

-Solubility: Sevofluorane < Isoflurane < Halothane. The higher the solubility the more distributed the drug will be in the organism.

- Sevofluorane will cause shorter inductions and recoveries due to minimum solubility

-**Halothane**

Can cause hepatic damage

Causes cardiac arrhythmias

Can cause malignant hyperthermia

-**Isoflurane**

Causes less cardiac arrhythmias than halothane

Less flammable than halothane

Less toxic for humans

-**Sevofluorane**

As it is less soluble, higher concentrations of the gas are needed for induction

Its minimum metabolism makes it very safe

Long acting neuroleptics

- Used to tranquilize and decrease stress in animals. It allows them to adjust to new environments or situations.
-All but haldol are phenothiazine derivates
  -Zuclopenthixol
  -Perphenazine enanthate
  -Pipothiazine palmitat
  -Haloperidol decanoate

Supportive or emergency drugs

-Anticholinergics (atropine/glycopirrolate) – Hyper-salivation and slow HR (bradycardia).
-Doxapram – Respiratory stimulant - short half life!
- Prednisolone sodium succinate - Head trauma
-Dexamethasone – Shock
-Crystalloid / Colloid fluids – Hypotension, hypovolemia, shock.
-Epinephrine – Cardiac arrest.
- Dopamine/Dobutamine – Severe hypotension

MONITORING

Free range	Captive
MM CRT and color (blue MM = cyanosis)*	MM CRT color (blue MM = cyanosis)*
Respiration (frequency, depth, rhythm, effort)*	Respiration (frequency, depth, rhythm, effort)*
Auscultation* – pulse*	Auscultation* - pulse*
Temperature*	Temperature*
Pulse oximetry* (HR, SPO2, CO2?) Should be >95%	Pulse oximetry* (HR, SPO2, CO2) Should be >95%
Blood gases (iSTAT)	Blood pressure* (direct or indirect)
	Electrocardiography
	Blood gases (iSTAT or in-house lab)

***MINIMUM**

If you see:

- Slow respiration (bradypnea), irregular respiration and/or abdominal respiration
- Pale or cyanotic MM
- Tachycardia / bradycardia
- Cardiac arrhythmia (can be "normal" if halothane or isoflurane is used)
- Weak or absent pulse
- CRT > 3 secs
- Dilated and fixed pupils
- Severe hypertension/hypotension

THE ANESTHETIC PLANE IS TOO DEEP AND COMPLICATIONS CAN ARISE ANY TIME.

COMPLICATIONS - EMERGENCIES

-Human

-Exposure to one of the "super-narcotics"

Have and know the emergency exposure protocol for these drugs (antagonist, CPR training, supportive care).

-Trauma

-Animal

Before drugs delivered	**During procedure**	**During reversal**	**After procedure**
Stress	Regurgitation/vomit ⇩ Aspiration	Rough recovery ⇩ Trauma	Capture myopathy -Acute death syndrome -Delayed peracute death syndrome -Ataxic-myoglobinuric syndrome -Muscle rupture syndrome
Trauma	Bloat	Too fast recovery ⇩ Trauma	Drug recycling ⇩ Vomit ⇨ Aspiration
Hyperthermia	Hyperthermia Hypothermia	Unmask primary anesthetic if antagonist given too soon.	Renarcotization
	Seizures		Trauma
	Trauma		
	Respiratory problems: -Hypoventilation -Dyspnea / apnea -Hyperventilation -Hypoxia -Respiratory insufficiency -Respiratory arrest		
	Cardiac problems: -Hypotension / peripheral vasoconstriction -Bradycardia / tachycardia -Arrhythmias -Cardiac arrest		

Recommended literature

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DRUG DELIVERY SYSTEMS

After making the decision on the types of drug to be used, the next challenge is to get the immobilizing agent into the animal. The most satisfactory technique varies from species to species and from animal to animal, according to the size, distance from the operator, ability to partially confine the animal, operator skill, and effectiveness of available equipment. Delivery options may be oral or by means of injection.

- *Oral*: Efficiency of oral medication to sedate wild animals depends upon the acceptance of the drug and the absorption and stability of the drug once taken orally. Unfortunately, it is futile to depend on oral medication to sedate wild animals. Drugs such as tiletamine-zolazepam may be effective in sedating primates but doses often need to be two to three times normal and most primates learn the first time not to accept the same trick the second time. Oral administration of tranquillizer such as haloperidol has been found to be effective when administered on fodder to certain hoof-stock and game birds may be captured by offering grain impregnated with an immobilizing agent. Wildlife professionals in Namibia successfully captured stock-raiding lions by adding tranquilizer (midazolam) to a 'bait'. Following ingestion, the animals became sufficiently tranquilized to approach and dart.

- *Hand-held injection:* Intramuscular (IM) injections can be given very quickly, with practice, using a hand-held syringe. This may be useful when an animal is crated but extreme caution must be used when using dangerous immobilizing agents to prevent accidental self-injection. To gain experience, hand-injection technique may be practiced on a watermelon or orange using a large-bore needle attached to a luer lock syringe.

- *Pole syringe (Jab-stick):* Various homemade and commercial pole syringes act as extensions of arms for administering drugs to dangerous animals in crates or

bomas. All work on the principle of injection immediately upon inserting the needle into the muscle – therefore a quick jab is necessary to effect administration. The operator should follow through with the animal if it moves or jumps away in order to ensure a complete injection. Commercially available spring-loaded pole syringes (e.g. Dan-Inject®) negate the need to follow through with injection. The risk of the animal kicking or biting the jab stick is always present; therefore the manufacture of the stick should be strong and rugged.

- *Blow-dart:* Blow-darts have been used for centuries to capture wild animals. The blow-dart system offers certain advantages over other delivery systems; in particular, its silent projection and reduced dart impact energy. It is adaptable for use on small and large animals, is easily sighted, and has no mechanical parts requiring maintenance. The disadvantages of the blow-dart projector include its length and relatively short range (15-25 meters) but it is useful in the boma or crate situation. Blow-dart projectors can be purchased commercially or easily constructed from aluminum electrical conduit, copper, stainless steel, plastic etc. Darts may be purchased commercially or easily crafted from regular plastic syringes.

- *Crossbow:* The crossbow has been adapted for use with various projectile syringes. It tends to be accurate and depending on design, silent. However, the system is bulky, difficult to manipulate in a restricted space and may require considerable strength to tense the bowstring.

- *Projectile syringes or darts:* The requirements of a dart system for capturing wild animals include rugged and dependable design, few moving parts (therefore limited need for spare parts), accuracy at long ranges, versatility (ability to accurately and safely project the dart both short and long distances), light weight darts to reduce impact trauma, and cost effectiveness. The most popular darting systems available fulfill these criteria.

Important Concepts In Darting Wild Animals

A basic understanding of ballistics, distance and impact energy in darting wild animals in a free-ranging situation is essential. The projectile dart, unless shot at high velocity describes an arc through the air and will drop considerably at long distances. Accuracy with a dart gun requires experience by the operator in estimating distances and modifying the charge and/or power emission control to compensate for unexpected changes in distance. Adjustments need to be made rapidly as the opportunity to dart often lasts only a few seconds before the animal moves away. Extensive practice and familiarity with the darting system is the key prior to going out into the field.

The temptation to use powerful projectors at close range to improve accuracy should be avoided at all costs. Impact energy is an important concept in the understanding of dart-related tissue damage and one of the major problems with the delivery of drugs via projectile syringe is *excessive* impact energy, which can lead to trauma, contusion and other significant tissue damage. Impact or kinetic energy (KE) refers to the amount of energy generated when the dart strikes the animal and is proportional to a function of dart mass (m) and the square of the velocity (v) at which the dart travels through the air.

$$\mathbf{KE = \tfrac{1}{2}mv^2}$$

As a result, with a fixed dart size and mass, the amount of energy generated when the dart impacts the animal increases greatly with even minor increases in dart velocity. The velocity of the projected dart depends on a number of complicated factors and in many newer dart guns is adjustable. The simplest way to deal with the problem of excessive impact energy therefore is to use the lowest projection velocity that will get the dart to the animal. In small or thin-skinned animals, reducing the drug volume and choosing the smallest and lightest darts available will provide added benefits. The following examples illustrate the significant differences in common dart systems: the 3cc aluminum Palmer Cap-Chur dart (Palmer Chemical and Equipment Company, Douglasville, Georgia USA),

loaded with water weighs 19.6 grams; darts of similar capacity, made of plastic (Aeroject, Ballistivet Inc., White Bear Lake, Minnesota USA) or plastic and aluminum (PneuDart, PneuDart Inc., Williamsport, Pennsylvania USA) weigh 13.3 grams and 11.0 grams respectively. All of these darts are .50-caliber and can be fired from a number of different dart projectors. At similar velocity, the latter two darts will result in reduced impact energy and therefore have considerably less potential to injure the animal. However, even lightweight darts fired at a higher velocity, will strike the animal with proportionately much greater energy and will likely cause significant muscle trauma and hemorrhage. The concept of impact energy should always be considered.

Injection Routes And Dart Sites

There are a number of routes available for injecting animals. The most suitable injection route is *intramuscular* (IM) and the aim of injection by any projectile syringe is an IM injection. The objective is to introduce the syringe contents into vascular tissues, from which rapid absorption can take place. Recommended drug dosages tend to be selected and calibrated for IM injections.

Alternative Routes Of Drug Administration

Intravenous (IV): This may a suitable route once the animal is immobile and is the preferred route for the administration of the antidote but if an animal is lightly sedated then it may be dangerous to attempt an IV injection. Many operators administer antidotes by one or more routes - IV, SQ (sub-cutaneous) or IM. Most antelope and giraffe can be injected into the jugular vein, or the recurrent tarsal vein running over the outside of the hock (hind leg). Some species such as zebra have a number of superficial veins on the hind legs, which may be easily accessed. Elephant and rhino have well developed ear veins and the rhino has a superficial vein (radial vein) on the inside of the front leg just above the carpus (knee joint); the elephant also has superficial veins in the hind limbs. The recurrent tarsal vein is preferred in the buffalo, waterbuck and sable antelope. Some antelope have a prominent vein just above the knee joint. Cats may be injected in the saphenous vein (front leg), recurrent tarsal and tail vein in larger species.

Intra-arterial (IA): It is very unlikely that an injection with a projectile syringe will be made into an artery (arterial walls tend to be thick and highly elastic). When administering the antidote or any other drug however, it is imperative that the operator draws back on the syringe to ensure an artery has not been accessed (bright red-colored blood will be seen). Injection of certain drugs such as local anesthetic or yohimbine may result in convulsions if injected into an artery.

Sub-cutaneous (SQ): SQ injections result in slow absorption especially in those animals that have extensive fatty tissue or connective tissue layers under the skin. Once an injection has been made SQ it is difficult to assess the onset of action or degree of sedation if it occurs at all.

Intra-pulmonary (IPul.): Inadvertent IPul injections (into the lung) due to misplaced darts that penetrate the thorax are absorbed very rapidly. The force of the explosive injection can severely damage lung tissue and cause fatal hemorrhage.

Intra-peritoneal (IP): IP injections (into the abdominal cavity) are absorbed more quickly than those given IM and there is a significant danger of damage to vital organs. Equine species such as zebra tend to have resilient skin and particularly taut abdominal walls; misplaced darts penetrate easily and often result in fatal peritonitis.

Intraosseus (IO): IO injections (into bone tissue) usually result in needle blockage without injection. Ribs, shoulder bone (scapula) and hip (ileum) are sites most frequently hit. Significant pain in addition to bone fracture are obvious and serious complications.

The Capture Event

The duration of the capture process should not be underestimated. In the majority of cases it is important to begin the process early in the day so that all work may be performed during daylight hours – animals darted at dusk may be impossible to locate

once immobilized. Each capture episode should be meticulously planned in advance and a contingency plan developed. Alongside planning, accurate record keeping is a prerequisite for successful wild animal capture. This is important to track the expenditure of legally controlled drugs as well as for determining the most appropriate drug dosages and combinations for use in other animals. Chemical capture is expensive so it is important that it be performed correctly at the first attempt.

It is essential to check and test all equipment before attempting to dart an animal. The dart gun should be clean and functional and with many of the 'reusable' systems it is important to ensure that the darts have not become misshapen and fit smoothly into the barrel of the dart projector. During the preparation phase consideration should be given to the following:

- Species peculiarities. (The effects of drugs may vary between species as well as within species. For example, carfentanil is a suitable agent for immobilizing eland but works poorly in zebra; xylazine is more effective in a quiet animal than in a nervous animal.)
- Physiological factors. (Old or very young animals or those in poor health may require substantially less drug for effective immobilization than a healthy animal.)
- Physical condition of the animal. (Emaciation affects many metabolic functions and may modify the effects of the chemical restraint agent. Free-living wild animals generally maintain excellent physical condition to obtain food and to escape predators. During adverse climatic conditions such as prolonged drought or when captive, wild animals often lack optimal physical conditioning and choice of immobilizing drug and dosage should reflect these considerations.)
- Emotional status of the target animal. (Highly excited or alarmed animals may be resistant to the effects of certain sedatives.)

Prior to darting the animal, it is valuable to write a checklist of important procedures that must be performed before reversal that can easily be referred to during the procedure.

Approaching the Animal for Darting

The operator must approach the target silently and calmly. To prevent alerting the animal, a direct approach should be avoided and a tangential approach from a downwind position tends to have the greatest chance of a success. Consideration of distance from target, wind speed, movement of the animal and access to suitable darting sites must be made before selecting a power setting for the dart projector. The operator should be prepared to attempt the shot as soon as an opportunity presents itself, as there is often only a single chance to dart before the animal moves away. The operator should always however, carry a basic immobilizing drug kit and a second dart as well as the blindfold, basic monitoring equipment etc. Occasionally, following a missed shot, there remains an opportunity to attempt a second shot and the operator should be prepared for this. If the shot is successful, the person darting is often the first to arrive at the immobilized animal and must be prepared to begin anesthetic monitoring immediately.

When darting from a moving vehicle or a helicopter it is very important not to chase the animal over long distances, particularly when it is hot. Wild animals tend to be adapted for short bursts of speed, not sustained, long-distance chases which can lead to exhaustion, hyperthermia and capture myopathy.

Target Sites for Darting or Injection:

Studies by Harthoorn in 1976 showed that animals injected in the abdomen, subcutaneous tissue or near skeletal structures took longer to become immobilized and appeared more prone to capture stress and mortality. In these studies the most rapid induction times occurred following injection in the muscle of the neck (in oryx), closely followed by shoulder and withers. Injections in the hindquarters took about 25% longer to take effect and those in the lumbar region twice as long. An animal may be severely compromised by a slow induction and the operator must make every effort to place the dart accurately and in a large muscle mass. Animals as large as elephant can be immobilized in as little as 3 minutes if dart placement is good.

Neck: This is a suitable injection area in heavily muscled animals including rhino, hippo, zebra, buffalo and antelope such as oryx, eland and wildebeest. It is suitable for elephant if the ear can be avoided. The neck should be avoided in smaller antelope (impala, gerenuk and gazelle) and in those larger species with thin necks (giraffe). The cervical vertebrae lie close to the surface in the mid portion of the neck and there are vital structures nearby. Injection into the nuchal ligament of the neck will result in a failure to immobilize the animal.

Shoulder: The shoulders (muscles of the shoulder, biceps and triceps) are generally one of the best places for remote injection in ungulate species and present a good site for darting rhino and elephant. The upper part of the shoulder should be avoided because the dart needle may embed in the cartilage. In slight or emaciated animals, darts may strike the spine of the scapula and result in fracture, hemorrhage and dart blockage. In thin or lightly muscled animals, the hindquarters may offer a preferable dart site.

Withers and hump: The eland and rhino have a well-developed withers/hump and due to the large muscle mass in this region, it provides a suitable dart site. When aiming from

above (e.g. when darting from a helicopter) the target site may appear large but due to the proximity of the head leaves little room for error and can be surprisingly easy to miss.

Chest: The brisket and pectoral area can be suitable for darting when no alternative sites are available and animals such as giraffe, buffalo and eland have been darted successfully in these areas. In the interests of animal safety, the chest region should only be used when the subject refuses to shift position and you are confident of the accuracy of the shot.

Hindquarters: This area is a very common site for injection and there are good muscle masses present (e.g. quadriceps muscle group). It is possible to dart most ungulates from any angle into the hind leg but the dart must hit perpendicular to the surface to prevent deflection and to ensure deep IM injection. The mid-lateral part of the hind leg should be avoided due to the proximity of the femur (and a large bony prominence, notable in rhino). Placement of a dart high up on the hind leg from behind and to the side should be avoided as the bony prominences of the pelvis may deflect the dart.

The dart should not hit the knee (stifle) and the tendon area behind and below the knee. In certain situations it is possible to place a dart into the muscle mass on the inside of the hind leg however, darting from directly behind the animal should be avoided due to the possibility of penetrating the soft tissue of the perineum. This is particularly so in equine species.

Care should be taken to *avoid* the following areas when darting animals:

- Thorax: A dart hitting the chest will either strike a rib, intercostal muscle or even penetrate the pleural cavity. This may result in damage to the lung and possible lung collapse. The chest lacks resilience and in smaller species, darts may penetrate deeply resulting in death.
- Lumbar region: This area is an unlikely target site when darting from the ground because of the angle required for the dart to strike perpendicularly - in most cases misdirected darts are merely deflected off the animal. There are muscles in the

lumbar area however, and on occasion, this region can provide a narrow and acceptable target when darting large, well-muscled animals (e.g. rhino) from a helicopter.

- Flank and abdominal area: This is not a suitable site for darting but it is an area that is frequently struck when aiming at the hindquarters from the side. The flank, in most species is resilient and thick and darts generally do not penetrate completely (equine species, particularly zebra are an exception). The abdomen, situated below the flank area, should be avoided in all animals.

Complications during physical and chemical restraint
CAPTURE MYOPATHY

Summary: It is a syndrome that causes fatality and debilitation in wild animals following capture or prolonged exertion; it is characterized by degeneration and necrosis of skeletal and cardiac muscle, the myoglobin released causes kidney damage that often leads to death.

Other names include:

Exertional rhabdomyolysis
Muscle dystrophy
Overstraining disease
Capture stress disease
White muscle disease
Idiopathic muscle necrosis

Most common in wild ungulates but also reported in:

Primates
Crocodiles
Birds (rheas, emus, ostriches, pelicans)
Kangaroos

Similar syndromes seen in:

Humans (Marching disease)
Dogs
Horses (Monday morning disease, azoturia, tying-up)
Cattle
Sheep

Causes:

It is a complex process involving perception of fear or stress, activity of the sympathetic nervous and adrenal systems, and muscular activity. Involves the failure of biological mechanisms whose function is maintenance of homeostasis during crisis; similar to shock.

Causes:

Prolonged exertion

Intense air or ground pursuit (Sequel of strenuous exercise)
Capture with or without drugs
Transportation

Fear and anxiety:

May be triggering mechanisms exacerbated by overexertion, exhaustion, hyperthermia, unnecessary disturbance, excessive handling, transportation and shock.

Severe stress
Immobilizing drugs that cause hyperthermia and/or acidosis
Other possible causes:

Nutritional deficiencies?
Vitamin E/Selenium deficiency – their role is not clear
"Animals deficient in selenium may be more susceptible to CM"
Genetic?
Some species more susceptible (waterbuck, kudus, peccaries, sable, Oryx)

Pathogenesis and signs:

May occur within hours, days or weeks after restraint
Early clinical signs:
Increased respiratory and cardiac rate
Elevated temperature
Unsteady gait, in coordination, stiffness, tremors and torticollis
Inability to stand
MYOGLOBINURIA (red/blackish urine) may be present

Pathophysiology

METABOLIC ACIDOSIS IN AN IMPORTANT COMPONENT OF THE PATHOPHYSIOLOGY OF CAPTURE MYOPATHY

The biochemistry of stress and fear create an atmosphere of increased metabolic activity and oxygen and glucose requirements. The muscles use up all available oxygen and resort to anaerobic glycolysis, a normal physiological process in muscle tissue. A by-product of glycolysis is lactic acid. Lactic acid is usually further metabolized in the liver to glycogen, but with sudden strenuous exercise, the massive increase of lactic acid creates a localized acidosis which progresses to a systemic acidosis.

Classification:

Four different syndromes related to Capture Myopahty
Capture shock syndrome
Ataxic myoglobinuric syndrome
Ruptured muscle syndrome
Delayed-peracute syndrome

Capture shock syndrome

Clinical signs: shallow rapid breathing, rapid pulse, hypotension, elevated temperature, death
Animals usually die within 1-6 hrs post-capture

Ataxic myoglobinuric syndrome

Most common form
Clinical signs: ataxia, torticollis, myoglobinuria
Animals show signs several hrs-several days post-capture
May survive if signs are mild

Ruptured muscle syndrome

Normal at capture; clinical signs develop 24-48 hrs later
Drop in hindquarters with hyperflexion of hock due to rupture of gastrocnemius muscle
May survive for several weeks then die

Delayed-peracute syndrome

Affected animals have been in captivity for at least 24 hrs
Appear clinically normal until disturbed
Acute death due to ventricular fibrillation

Pathology

Similar lesions to those observed in syndromes in domestic animals with nutritional myopathies (Vitamin E and selenium – White muscle disease)
Affected muscles: Large muscles of limb (gluteus, biceps femoris, semimembranosus, semitendinosus and gastrocnemius) also pectoral, intercostals and cardiac muscle
Lesions tend to be bilateral and symmetrical
Muscular lesions

Early stages: Hemorrhages and edema with uniform pallor and/or dull white striations
Later stages: More pronounced lesions that appear as sharply demarcated white streaks

Other organs:
Liver: Swollen and pale
Kidneys: Swollen and pale or red/dark
Lungs: Pulmonary hyperemia and edema, tracheal and bronchial froth
Urinary bladder: Red urine

Diagnosis

History
Clinical signs
Clinical pathology: Elevation of "muscle enzymes" particularly CPK due to muscular insult. CPK can be as high as 100,000 IU/L. Metabolic acidosis (low pH, low bicarbonate).

Treatment

It is very difficult, if not impossible to treat once clinical signs become apparent; treatment is basically supportive treatment; NOTE: **Avoid causing more stress/fear to the animal.**
Multiple treatments reported in the literature, some have been successful:

Treatments:

Fluid therapy (stimulate diuresis and prevent renal damage due to myoglobin)
Supportive care (steroids, anti-inflammatory)
Antioxidants
Vit E 5-7 IU/kg IM, PO
Vit C SQ, PO
selenium 0.05-0.1 mg/kg IM
– Sodium bicarbonate IV (with fluids)
Muscle relaxants (methocarbamol)

PREVENTION RATHER THAN TREATMENT

Prevention

Minimize potential for excitement
Avoid excessive struggling/restraint
Avoid underdosing
Maintain body temperature, ventilation, blood pressure/volume
Do not exhaust animals (trap vs chase)
Reduce heat stress
Minimize contact with humans (use blindfold and a well trained crew!)
Shorten period of chase/restrain (know when to stop)

RECOMMENDED LITERATURE

Kristine M. Smith D.V.M., Suzan Murray D.V.M., Dipl. A.C.Z.M., Carlos Sanchez D.V.M, MSc, Successful treatment of suspected exertional myopathy in a rhea (Rhea Americana) Journal of Zoo and Wildlife Medicine 36(2):316-320. 2005

Meltzer, D and Kock N. Stress and capture related deaths (Chapter 5) In: Chemical and Physical Restraint of Wild Animals (A training and field manual for African species). Ed. By Kock, M, Meltzer, D., and Burroughs R. 2006 Pp 68-76

Spraker T., Stress and capture myopahty in artiodactyls. In: Zoo and Wild Animal Medicine, Current Therapy 3. Ed By Fowler, M. 1993. Pp 481-488.

Wildlife Restraint Series (African Series). Compiled and edited by Clark, R, and Jessup, D. Chapter 8; Medical concerns. 1991

MIXING INSTRUCTIONS:

Using a sterile three cc or larger syringe and a sterile needle (18-22 gauge) remove the contents of the azaperone vial (2 cc) and inject into the butorphanol vial. Remove excess air from the butorphanol vial by aspiration with the syringe as you inject the azaperone. Next, remove the contents of the medetomidine vial (3 cc) and inject into the butorphanol vial again removing excess air from the vial by aspiration with the syringe as you inject. You will have 11 cc of the BAM mix in the butorphanol vial. Clearly mark this as BAM. Protect from excessive heat and direct sunlight. Administer the antagonists (naltrexone, tolazoline and atipamezole (Antisedan) in separate sterile syringes and needles-deep into the muscle tissue.

White Tailed Deer Dose Chart for BAM

Drug	Concentration	Amount (ml) to add to one vial	Total drug (mg)	mg/ml	Dose Rate mg/kg	BAM stock solution for Fawn	Bam stock solution for Adult Doe	BAM stock solution for Large Buck
Butorphanol	50 mg/ml	6	300	27.3	0.41 - 0.62	0.3 - 0.5 cc	1.0 - 1.5 cc	2 cc up to 2.25 cc
Azaperone	100mg/ml	2	200	18.2	0.31 - 0.41			
Medetomidine	40 mg/ml	3	120	10.9	0.19 - 0.25			
Total ml		11						
REVERSE WITH:		**To Reverse Give**						
Antisedan	5 mg/ml	fawns and does 3 cc IM-bucks 5 cc IM						
Naltrexone	50mg/ml	give all 1 cc IM						
Tolazoline	200mg/ml	fawns and does 1 cc IM-bucks 2 cc IM						
SPECIAL INSTRUCTIONS:		DO NOT USE FOR SEMEN COLLECTION. If recovery is extended give another 2 cc of antisedan						

Elk Dose Chart for BAM

Drug	Concentration	Amount (ml) to add to one vial	Total drug (mg)	mg/ml	Dose Rate mg/kg	BAM stock solution for Cow Elk	BAM stock solution for Bull Elk	
Butorphanol	50 mg/ml	6	300	27.3	0.18	2 cc	3 cc	
Azaperone	50mg/ml	2	100	9.1	0.06			
Medetomidine	40 mg/ml	3	120	10.9	0.07			
Total ml		11						
REVERSE WITH:		**To Reverse Give**						
Antisedan	5 mg/ml	calves and cows 3 cc IM-bulls 5 cc						
Naltrexone	50mg/ml	1 cc IM to all						
Tolazoline	200mg/ml	calves and cows 2 cc IM-bulls 3 cc IM						
SPECIAL INSTRUCTIONS:		DO NOT USE FOR SEMEN COLLECTION. If recovery is extended give another 2 cc of antisedan						

The information provided in this document is for guideline purposes only and is based on experience.
Please contact your veterinary professional for advice for your specific situation.

Bison Dose Chart for BAM

Drug	Concentration	Amount (ml) to add to one vial	Total drug (mg)	mg/ml	Dose Rate mg/kg	BAM stock solution for Bison		
Butorphanol	50 mg/ml	6	300	27.3		2.0 - 2.2 cc		
Azaperone	100mg/ml	2	200	18.2				
Medetomidine	40 mg/ml	3	120	10.9				
Total ml		11						
REVERSE WITH:		**To Reverse Give**						
Antisedan	5 mg/ml	Calves and cows 3 cc-bulls 5 cc IM						
Naltrexone	50mg/ml	1 cc IM to all						
Tolazoline	200mg/ml	Calves and cows 2 cc IM-bulls 3 cc						
SPECIAL INSTRUCTIONS:		DO NOT USE FOR SEMEN COLLECTION. If recovery is extended give another 2 cc of antisedan						

Moose Dose Chart for BAM

Drug	Concentration	Amount (ml) to add to one vial	Total drug (mg)	mg/ml	Dose Rate mg/kg	BAM stock solution for Cow Moose	BAM stock solution for Bull Moose	
Butorphanol	50 mg/ml	6	300	27.3		2.0 cc *estimated*	3.0 cc *estimated*	
Azaperone	100mg/ml	2	200	18.2				
Medetomidine	40 mg/ml	3	120	10.9				
Total ml		11						
REVERSE WITH:								
Antisedan	5 mg/ml	Calves and cows 3 cc-bulls 5 to 7 cc IM						
Naltrexone	50mg/ml	1 cc IM to all						
Tolazoline	200mg/ml	Calves and cows 2 cc-bulls 3 cc IM						
SPECIAL INSTRUCTIONS:		You may reverse with just tolazoline at 3 mg/kg IM. Recovery may be a little slower than using with atipamezole (Antisedan) and naltrexone.						

The information provided in this document is for guideline purposes only and is based on experience.
Please contact your veterinary professional for advice for your specific situation.

ZooPharm - Confidential

Anesthesia Record for Annuals

Date: ______________

Species: ________________________________

Accession # ____________________

House Name: ___________Sex: _______

Birth Date/Age: ____________________

Microchip:_______________________________

Physical status: ______________

1=normal health, 2=mild disease3=severe disease, 4=chronic severe disease, 5=may not survive anaesthesia

Anesthesia calculated at: _____________kg

Comments: ______________________________

Blood: S: ☐ E: ☐
EDTA: # Tubes ____
Serum: # Tubes ____

Vaccinated:
_________☐
_________☐
_________☐

Frontline: ☐
Deworm: ☐

Antibiotic: ____________________

Fluids: _______ml
Subcutaneous: ☐
Intravenous: ☐

Body score: ____ / __

Dose	Drug Given	Dosage mg/kg	Amount mg / %	Route	Time Given	Delivery Success	Effect	Time of Effect	Bottle#
_____	__________________	______	_____	_____	___:___	_____	_____	____:____	_____
_____	__________________	______	_____	_____	___:___	_____	_____	____:____	_____
_____	__________________	______	_____	_____	___:___	_____	_____	____:____	_____
_____	__________________	______	_____	_____	___:___	_____	_____	____:____	_____
_____	__________________	______	_____	_____	___:___	_____	_____	____:____	_____
_____	__________________	______	_____	_____	___:___	_____	_____	____:____	_____
_____	__________________	______	_____	_____	___:___	_____	_____	____:____	_____
_____	__________________	______	_____	_____	___:___	_____	_____	____:____	_____

Initial Time Effect: _____:_____
(Head down)

Recumbency Time: _____:_____

Weight: _____________kg

Anaesthesia Ratings

	Excellent	Good	Fair	Poor
Induction	1. [ ]	2. [ ]	3. [ ]	4. [ ]
Muscle relaxation	1. [ ]	2. [ ]	3. [ ]	4. [ ]
Overall	1. [ ]	2. [ ]	3. [ ]	4. [ ]

Endotracheal Tube: intubated at_____:______ extubated at _____:______

Complications:
1. [ ] None
2. [ ] Minor
3. [ ] Major
4. [ ] Fatal

Recovery:
1. [ ] Normal
2. [ ] Abnormal
3. [ ] Prolonged
4. [ ] Stormy
5. [ ] Re-narcotized

Recovery Date:

Head Up Time: _____:_____ Effect: __________

Standing Time: _____:_____ Effect: __________

Recorded by: ____________________________

Veterinarian Name: _________________________

Dose:
P - Pre anaesthetic
I - Immobilizing
S- Supplement
M- Maintenance
A- Antagonist
O - Other

Route:
P - Pole syringe,
Blow dart,
Metal Dart,
Hand Syringe,
Non-metal Dart,
Oral Facemask,
Chamber,
Endotracheal Tube,

M=intramuscular, **V**=intravenous, **P**=intraperitoneal, **S**=subcutaneous

Success:
C- Complete **P**- **Partial** **N**- None

Effect:
0 = no effect, 1 = mild sedation, 2 = heavy sedation, 3 = light anaesthesia, 4 = surgical anaesthesia, 5 = excessively deep, 6 = death

Dose: Pre anaesthetic, Immobilizing, Supplemental, Maintenance, Antagonist, Other
Route: Pole syringe, Blow dart, Metal Dart, Hand Syringe, Non-metal Dart, Oral Facemask, Chamber, Endotracheal Tube, Venous catheter
M=intramuscular, V=intravenous, P=intraperitoneal, S=subcutaneous
Success: Complete, Partial, None
Physical Status: 1=normal health, 2=mild disease3=severe disease, 4=chronic severe disease, 5=may not survive anaesthesia
Effect: 0 = no effect, 1 = mild sedation, 2 = heavy sedation, 3 = light anaesthesia, 4 = surgical anaesthesia, 5 = excessively deep, 6 = death

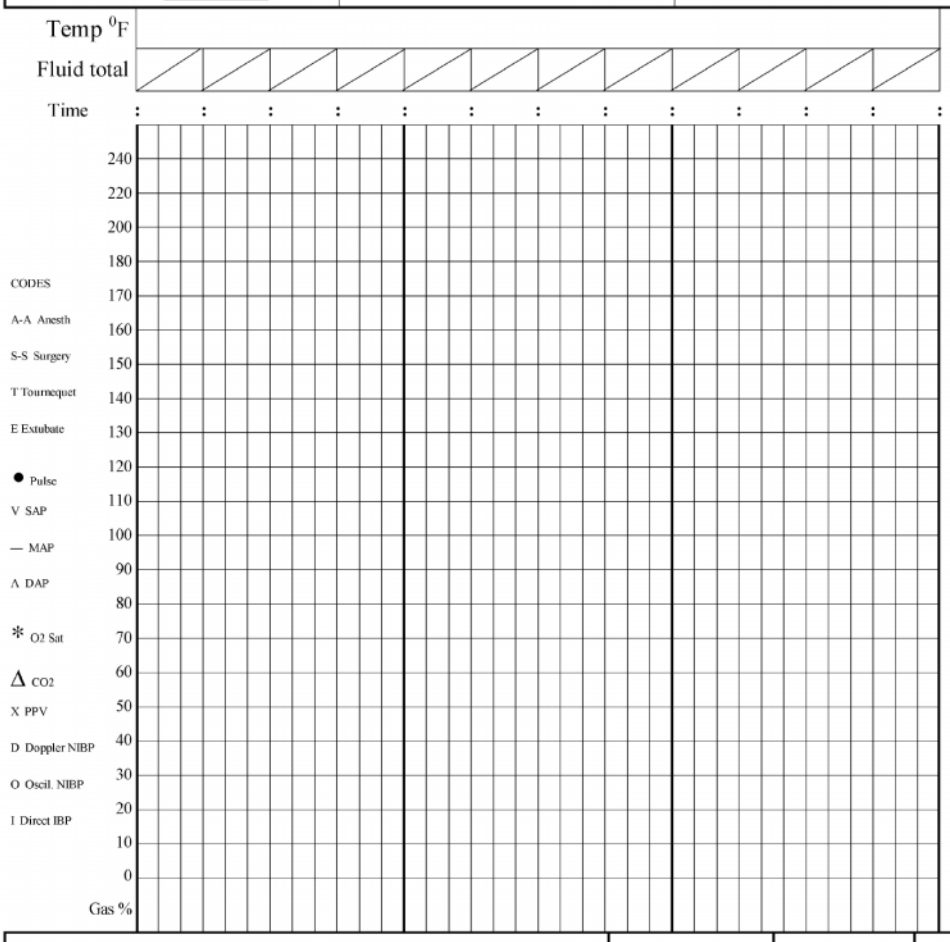
Please X all meds when given

Anesthesia Record

Date

E Sheet Printed? Yes No

Client Animal	Surgeon	Anesthesia Technicians	Procedures
Body Weight Kg. Lbs.	MM Color/CRT/Pulse	Physical Status E G F P C	
Species	Age/Sex	Mental Status	Lab Tests – List pertinent abnormalities below
Premed Drugs, Dose, Route, Time		Premed Effect	
Induction Agent	Amount Drawn Up	Route	Unused Amount
Drug, Dose, Route, Time	Drug, Dose, Route, Time	Drug, Dose, Route, Time	Drug, Dose, Route, Time
Inhalant use - Isoflurane / Sevoflurane / None	Inhalant System Adult Circle / Ped Circle / Bain W/Block	Reservoir Bag Size	ET Tube Size
IV Catheter Size _____ Total # Used _____	IV Fluid Type	Total Fluids Given	Comments/Alerts



Notes

Recovery Notes	T,P,R	MM,CRT	Post OP Meds/Dose/Route/Time

CAPTIVE WILD ANIMAL MANAGEMENT - AAZP EXPERIENCE

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Madras had the distinction of having the first zoo in India, which was started during the year 1855. This zoo was in effect a menagerie. The major concerns of a menagerie would be species husbandry and propagation with the standard style of exhibit in a cage. Therefore, a cage is practically the only form of exhibit which guarantees a close look at the animals which is also satisfying the general visitors. The animal is genuinely captive before their eyes. Moreover people were fascinated by diversity. Therefore, the older zoos or menageries try to exhibit as many different kinds of animals as possible. The menagerie does not reflect the essential features and characteristics of zoological park eg. Animal habitats and behavioral biology, understanding of holistic conservation both by zoo managers as well as visitors.

The Madras Zoo lacked in several features and characteristics and was not truly an ex-situ conservation facility for conservation of flora and fauna of Eastern and Western Ghats. To achieve this objective, relocation of the (menagerie) old Corporation zoo to a larger area with conditions conducive for such ex-situ conservation was planned and accomplished with the shifting of the zoo to Vandalur RF. This place sprawling over an area of about 510 ha (in its initial stages) provided an environment similar to natural wilderness which helped to meet the biological and physiological need of the animals and birds.

Further, in the case of Madras zoo factors like air and sound pollution, insufficient place for accommodating the animals, and highly dense human population around the zoo was a health hazard to animals. The situation necessitated the shifting of the zoo to a more conducive and ideal place for establishment of a modern zoological park. The Madras zoo was shifted to Vandalur Reserve Forest in the out-skirt of Madras city and work for the establishment of the zoo was started in 1976. This is one of the biggest zoos in South East Asia extending to an area of 602 ha. The zoo was opened for the public during the year 1985. The existing landscape has been utilized as it is and all the animals are exhibited in large open moated island type enclosure with simulated environment. The entire area of 602 ha has been clothed with vegetation both by natural and artificial regeneration.

The modern zoological park set up in Vandalur was conceived for collecting an array of animals of Eastern and Western Ghats and arranging them as per the taxonomic classifications, ecological characteristics and behavioural repertoire exhibited by animals. The assemblage should reflect the natural occurrence of animals in wild.

Any zoo or captive facility should look into the following aspects to make it successful and viable one:

1. Behavioural management

   Animals in captivity should exhibit their natural behavior. A lion should behave like a lion and deer should behave like a deer. A lion should not behave like a deer and vice versa. Hand reared and lone animals may not have the chance to learn the natural behavior of that species in captivity but few are exhibited as inborn characters. Social animals will learn the normal behavior from their parents or herd mates

2. Environmental enrichment

   In the wild, animals engage themselves throughout their active periods in their habitats either for finding food / prey, grazing, hunting, finding mates…etc. But in captivity all these are readily available in a small habitat called enclosure and the animals develop the habit of sedentary lifestyle and as a result all sorts of behavioral abnormalities. Vices like pacing, aggression, plucking of feathers…etc are exhibited by these animals.

   To prevent all these abnormalities and to maintain behavioural and psychological well-being, the enrichment of enclosures should be carried out. There are different types of enrichments like Physical, social, sensory, occupational and nutritional enrichments.

3. Reinforcement training

   Operant conditioning techniques may be used as a method of enrichment for captive wild animals. Operant conditioning can be divided into three types: positive reinforcement, negative reinforcement and punishment.

4. Improving husbandry and veterinary skills

   The most important aspect of captive wild animal management is providing and improving husbandry practices for the animal in question. Husbandry manuals may help in this regard. The healthcare management of captive wild animals will be taken care of by the veterinary unit and the unit should be capable of handling emerging diseases and conditions alike. They should improve their skills in diagnosing and treating the diseases and handling emergency situations.

5. Managing social interactions

   In gregarious animals, the hierarchy should be established well so that the dominant animal should tolerate the presence of sub dominant animals in the groups. By using co-operative feeding technique, the compatibility related issues can be overcome.

6. Psychological well being

   If the captive animal is provided with all the required facilities and is properly trained, abnormal behavior like stereotypic behavior (an indicator of poor well being) can be reduced.

7. Improving captive breeding

   Captive animals should exhibit the normal reproductive behavior and as a result successful breeding should happen. Only healthy animals can breed successfully and all the requisites for such breeding should be provided to the animal in captivity.

8. Reintroduction into the wild

   The ultimate goal of captive breeding is to reintroduce or restock the species in the wild.

9. Beautiful visual experience to the visitors

   Finally the visit to the zoo by the general public should be a pleasing and ever remembered one.

TRANSPORTATION OF LIVE SLOTH BEARS *(Melursus ursinus)*

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Introduction

Transportation of any live captive / Zoo animal or free ranging wild animal in group or individual from place to place is very critical, important in terms of safety and transit care. Transportation is one of the most traumatic events to which a wild animal can be exposed. More animals die during transportation, or due to injuries or infections sustained during transportation, than during capture. Many of these deaths go unnoticed because the animals usually die in the field after release.

We in Wildlife SOS, an Indian Non Governmental Organisation, have involved in much wildlife transportation which includes many reptiles to large mammals like elephants within the country due to various reasons like confiscation, rescued from natural calamities like flood, Tsunami etc. For example, we shifted five Asiatic Lions from Sangli Municipal Corporation Zoo, Maharashtra to Thirupathi Zoo of Andhra Pradesh by trucks on road due to heavy flood at former place. We shifted Sloth bears (2 Nos) by air from Goa to Delhi and by road safely within the country.

Sloth bears belong to the order Carnivore, family Ursidae and genus Melursus. We have done inter and intra state shifting of Sloth bears in India, for example from Rescued bear transit facility, Hyderabad to Agra bear Rescue Facility (26 Nos), from West Bengal (22 Nos), Nagpur (3 Nos), Chhattisgarh (2 Nos), Chennai (3 Nos), Puducherry (2 Nos) wild Sloth bear with two cubs which were delivered in an abandoned house close to the natural habitat to Bannerghatta bear rescue & rehabilitation centre, Bangalore, in addition to many other intra state short distance transportation. Any wild animal should only be transported by experienced persons using suitable equipment and principles to avoid Stress, Temperature extremes, and Injuries which are the major fatal factors.

Stress

Both psychological stress and physical stress are usually caused by excessive muscular exertion or fear during capture, loading, or transportation. This excessive muscular exertion may result in damage to locomotor, respiratory, or heart muscles, resulting in 'white muscle disease' or capture myopathy. At times the situation may be so stressful that the animal dies immediately of shock. On the other hand, the animal may show no immediate signs of the stress but may later succumb to an infection as a secondary result of the stress. Animals that have been unduly stressed during capture usually die during transportation, especially if transported over a long distance. This may not be a reflection of the quality of the transport operation.

Extremes Temperature

Temperatures must be kept in mind at all times during the capture, loading, and transportation. As a thumb rule the conditions most favorable for capture are also best suited for transportation. Both capture and transportation should be avoided during the hot summer unless it is emergency. In that case hyperthermia, or over-heating, can be a serious problem, but can be prevented by using properly ventilated vehicles or crates and by loading the correct number of animals in a mass crate. A crate left in the sun and a breakdown of the vehicle during the daytime in summer can have disastrous results. Exposure to very low temperatures can be serious, often resulting in hypothermia and death. Alternatively, pneumonia may develop which may lead to mortality after release. Hypothermia can be prevented by using sufficient bedding during transportation, and by planning transportation times and routes.

Physical Injuries

Injuries may be caused by the capture process, but usually occur during loading and transportation. Excessive trauma may be caused by using incorrectly designed crates or vehicles, or by animals fighting during transportation.

SOME BASIC PRINCIPLES FOLLOWED FOR THE TRANSPORTATION OPERATION

Keeping the road as mode of transportation the following steps were suggested based on experience, although the transportation technique used to be a species specific one, certain basic principles to be followed in transportation of any wild animal such as,

i) Preparation before transportation

Preconditioning of animals: (Boma training in case of herbivores) or Crate training, mode of transport like by air, by road or by sea. Based on road transport, the major categories are

a) Short travel (< 100 Kms or < 5 hrs)

b) Long travel (> 100 Kms to 500 Kms or < 24 hrs)

c) Very long travel (> 500 Kms or > 24 hrs)

According to the length of travel, the bears need to precondition by keeping them in a transport cage for 10 to 15 minutes twice in a day for couple of days. If the animal is reluctant to get into the transport cage, then the tranquilisation procedure should be followed and the bear should be placed inside the transport cage 8 to 12 hours before the departure day of the transportation. An optimum size of the transportation cage would be 4'6" L X 3' W X 3' H, this would be the best for bears of various age (above 2 yrs) and body weight (40 kgs upto 200 kgs). For bears the transportation cage should have the feeding passage on the bottom side of the sliding door, so that en route feeding and watering of the bear would be easily taken care off.

Accompanying veterinarian with necessary veterinary drug kit should be made ready in addition to the documentation part of the animal and vehicle.

ii) Target animal

Apart from species characterization, specific individual animal's behavior, mode of transportation, time of transportation, degree of restraint required for the transportation of captive wild animal/s like Zoo animals or of Free ranging wild animal/s should be taken into account. In case of Sloth bears, individual crate approach is advisable than mass transportation approach. Behavioral characteristic like male used to be dominant, Mother bear should be shifted along with cubs with minimal handling etc. Though it is necessary to cover the crates in both captive and wild caught animals, it is must to give extra calm environment to the non captive wild animals for stress free travel and ventilation.

The use of tranquillizers remains an area of uncertainty. Currently there is no scientific data to support both use and non use of tranquilisers claim: the success of the operation often depends more on the style and ability of the transporter than on drugs or other technological solutions. Both short- and long-acting tranquilisers are used extensively to facilitate the transportation of aggressive animals. Tranquilisers can also reduce the stress levels of the transported animal, and can thereby improve success rates and reduce mortality during and after transportation. The dose rate of 2 mg/ Kg b.wt Xylazine and Ketamin @ 5 mg/Kg.b.wt is ideal. In case of heavily injured animals, the maintenance dose of 0.5 mg /Kg.b.wt Xylazine and 2 mg/Kg.b.wt of Ketamin can be used whenever the bear shows the symptom of recovery, to avoid self injuries or aggressive behavior due to stress and pain during transportation. Remote injection using a pole syringe or distance projectile also eliminates some of the stress associated with injection.

iii) Selection of crate & loading

In addition to the size, sex and age of the wild animal, knowing the basic behavior pattern of the animal is immense importance in designing a transportation crate or cage. Confinement in a crate or vehicle after capture results in additional stress for the animal. This may be particularly severe if the crate or vehicle is not of proper design or construction, or if the animals continually attempt to escape. The size and strength of the crate must be appropriate for the animal to be transported in addition to a good locking mechanism. Too large a crate is often as bad as a crate that is too small. Padding on the sides and grass or sand bedding on the floor of the crate should facilitate less damage on the

extremities of the bear body as well as the claw and canine damage also to retain its footing even on rough roads. The floor must allow drainage of urine or spilt water.

The ventilation of the crate must be good to prevent overheating, accumulation of ammonia on very long trips, at the same time ventilation must be controllable. Ventilation openings should not encourage escape attempts and should allow flow of air vertically as well as horizontally in the crate. Doors should be of the top sliding type with the mechanism of such a nature that it cannot jam. There should always be more than one door to facilitate access and to facilitate release. Once animals have been in a crate for a while they feel secure in the confined space, and are often reluctant to leave through a single door that is suddenly opened.

The loading of captured animals must be done as quickly and as quietly as possible to prevent further stress. Animals should be loaded in the early morning and transported during the day in the cold winter months and night transportation is often resorted to in summer to avoid excessively high temperatures. Shouting during loading only serves to confuse and stress wild animals and serves no useful purpose. Depart as soon as the animals are loaded.

iv) Selection of vehicle and route

The selection of the vehicle should be appropriate based on the number of animal which are moved, the size of the vehicle should be fair enough to hold multiple cages with free air movement and space to access individual cages for feeding, cleaning and treatment.

The selection of route should be very important to avoid bad roads and heavily traffic. Negotiation should be done between well connected high ways with short distance of very bad roads.

v) During en route

According to the length of travel the feeding should be done in between but the watering of animal is must irrespective of travel length unless if it is a sedated animal. Even fairly tamed animals will not eat or drink when deprived of freedom of movement, and their health will be affected adversely if they are transported in this state for prolonged periods. In general feeding and watering is usually only necessary on very long (>24 hour) trips. But we practice once in 6 to 8 hours the bear should be fed with fresh fruits and drinking water. During the short halt the bear should be checked for injuries like damages in claws and canines. The key points are,

- Avoid brake or accelerate sharply.
- Travel slowly on rough roads.
- Take maximum care of obstacles that cause the vehicle to rock from side to side.
- Stops should be made away from areas of noisy or high activity.
- If injections must be administered en route this must be done away from crowds of people.
- Stops should be as brief and infrequent as possible. Animals tend to settle down once the vehicle is moving, and unnecessary stops disturb the animals.
- Two drivers should be used for long journeys to ensure a rapid, uninterrupted trip, and to avoid problems with driver fatigue. Change drivers every eight hours or every 400 km.

FEW "DON'TS" OF TRANSPORTATION OPERATION

- Do not waste time en route.
- Do not permit people other than the handlers to climb onto or around crates containing animals.
- Do not allow animals, particularly tranquillized ones, to lie down for too long in a crate.

- Don't transport adult males and other incompatible animals together in the same crate.
- The transportation of very young and pregnant animals must be avoided.
- Many times short-cut leads to disaster (like common crate designing, mode of transportation, in appropriate vehicle selection, more than the carrying capacity etc.)
- Though the economic part is a limiting factor, it should never be a constraint.

In short more than a standard operating protocol, the transportation of wild animal is a continually evolving process depends on the species involved.

HEALTH PROTOCOL FOR TRANSPORTATION OF RESCUED ANIMALS, WITH SPECIAL REFERENCE TO DEER AND LEOPARDS

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Rescue of wildlife stranded or displaced from its natural habitat due to natural calamities and anthropogenic causes have attained great importance in human dominated landscapes where wildlife is forced to share its environment with overabundant human presence. Deforestation, encroachment, fragmentation and other forms of biotic interferences have restricted the movement of animals, forcing wild animals to 'stray out' of their forest habitats into human dominated landscapes, where they either get killed or traumatically wounded, or caught and deposited in zoos (Ashraf et al, 2006). More often than not, such animals require no handling but overenthusiastic amateurs cause more harm to the animals by trying to 'rescue' them. Where intervention become necessary, every precaution has to be taken for the safety of the animal as well as the handler.

Unlike healthy animals being captured for the purpose of translocation (or for captive breeding or research), wild animals in distress more often than not, do demand elaborate efforts be captured. Their wellbeing is already compromised due to man-made or natural causes and is also incapable of defending themselves when approached by rescuers. At times wildlife managers consider animals especially carnivores living in or near human dominated landscapes as threat to people and property and prescribe capture and translocation as a possible solution to conflict (Athreya, et al 2010). Since 'rescue' by definition is "to save or set free from harm, loss or danger" (Longman's dictionary of contemporary English), even non-target animals may sometimes be drug immobilized to facilitate the rescue of its conspecific, and to safeguard public from getting injured or safeguard the animal itself from being persecuted or killed.

Fig 1. Injuries resulted by barbed wires when chased

If the animal is healthy and is not in a compromising situation, chemical capture can be undertaken. Chasing of animals may force them to take a dangerous path like through barbed wire/drains resulting in their injuries (Fig 1). Aggressive and nervous animals may also injure the public if approached closely. Chasing animals can also lead to exhaustion, fatigue and shock resulting in their death. For these reasons, all efforts are made to guide or drive the stranded animals back to the herd or forest without any handling if the animal is not injured or diseased.

Healthy animals should be released at or near the site of capture at the earliest (Fig 2). The animal need not be transferred a rescue centre in case of minor injuries as transportation would mean further stress to the animal. Animals with minor bruise or laceration can be released immediately with a first aid treatment.

Fig 2. Release of a hog deer in Assam.

Next to elephants, two of the most commonly rescued species of mammals at the Centre for Wildlife Rehabilitation and Conservation (CWRC) and its associated satellite centres in Assam have been hog deer (Axis porcinus) and common leopard *(Panthera pardus)* (WTI, data unpubl.). Since 2001, veterinarians at Wildlife Trust of India working in the states

of Assam, Arunachal Pradesh, Uttarakhand and Uttar Pradesh have handled 305 cases of deer and 78 cases of leopards. The wealth of experience gained during the rescue operations during the transfer of deer and leopards is presented in this paper.

Translocation of ungulates and carnivores

Translocation of an already compromised animal is fraught with danger to its life and handlers. Rescued animals do not recognize the attempts of the rescuers trying to help them (Loftin, 1985) and therefore have to be calmed down to avoid struggle and the resulting untoward accidents. Transportation of animals after a rescue operation is different from transfer of healthy animals for the purpose of reintroduction or restocking.

- Rescued animals, especially leopards and ungulates, are invariably translocated in single and rarely in groups
- While translocation operations can be organized at a suitable season and time of the day, rescue can happen at any period of the year or time of the day. It can be during extremely hot or cold hours of a season.
- Deer translocations are taken up during the post-breeding season when antlers are shed, while rescue can happen at any time. The deer at the time of 'rescue' may be with velvet or hard antlers and this is a major disadvantage when it comes to capture, transfer and accommodation.

For reasons mentioned above, handling a 'rescued' animal during transportation demands greater attention on the part of the handlers.

Handling a captured animal

A blindfolded animal can be directed towards the crate. Blindfolding all animals under sedation has the double benefit of calming down the animal as w ell as protecting its eyes. Reducing or eliminating an animal's visual contact with its environment is an important restrain technique (Fig 3). If the crate is far away, the animal may have to be carried on a stretcher. In the case of ungulates, this would necessitate restraining the animal with ropes, but this must be avoided as much as possible. Where necessary, especially in the case of grown up fawns, the legs can be secured with jute or cotton ropes, as a method of physical restraint. The conventional practice of transporting the animal upside down by tying the legs to a pole should be avoided on all accounts (Fig 4). A canwash-made stretcher is a good means of transporting the animal from the field to the crate or vehicle, and from the crate to the enclosure at the captive facility. In the case of adult male deer, antlers can be used to restrain head. It can be padded and wrapped up to prevent injury to the handlers. If the buck is in velvet, care should be taken to avoid injury to the animal.

Fig 3. A blindfolded leopard and hog deer under medical care in Assam.

Fig 4. Holding or transporting animals upside down should be discouraged (left) and a stretcher should be in place to carry animals instead (right).

Initially, the rescued animal should be left alone to stabilize and recover from the stress of capture and shock. This is obligatory in situations where the animal is not in a position to further withstand the rigours of transportation to a rescue centre or veterinary facility. Depending on the condition of the animal and nature of injury, bleeding if any should be arrested by applying pressure bandage or administration of anticoagulants. Monitor ambient temperature and ensure comfortable breathing.

All body measurements and if possible the weight of the 'rescued' animal should be recorded when opportunity presents itself after chemical restraint. Ketamine hydrochloride induced anaesthesia is known to cause seizures in rare cases in felids, even when Xylazine hydrochloride is added. Administer Diazepam (5-10 mg per leopard, slow IV) to control seizures that are not self limiting (Athreya and Belsare, 2007).

Care during transportation

It is important to use appropriate crates during transport which in turn can eliminate the risk of escape during transportation. The standard crate dimensions of most of the mammalian species are available in various publications (Singh and Malhotra, 2008; McKenzie, 1993). Calves of elephant, rhino and large ruminants do not require a crate as they can be transported directly in a vehicle. For adult and sub-adult big cats, rhinos and antler-shed deer crates are preferred if transit time is long. Large ungulates such as wild buffalo *(Bubalus arnee)* and gaur *(Bos gaurus)* can be transported as such once they can be loaded into a truck directly.

Crates of appropriate size should be used to prevent injury of the animal during transit. There are standard specifications recommended for ungulates and big cats. All crates should have most of the features recommended by Openshaw (1993) and Espie (1993) (Table 1).

Table 1: Essential features of ungulate and carnivore crates

Crate essentials for ungulates	Crate essentials for carnivores
(i) spacious enough to permit getting up and lying down	For short distances, just wide enough to accommodate the animal and for long distances wide enough to permit turn
(ii) narrow well placed and adequate number of ventilator holes (sides, front & rear)	100 mm ventilation holes spaced out at 300 mm interval along sides near the top
(iii) solid floor which is not slippery for the hooves of the animal	Floor can be wooden with metal lining or slated to permit urine & faeces to pass through
(iv) sides must be high and wide if horned/antlered	High enough to allow the animal get up on its feet
(v) Doors must be of vertical sliding type	Double vertical sliding doors on either side

Carnivores that are awake seem to consider the ventilator holes of the box as possible exits and scratch them, trying to escape; it is therefore very important to have boxes with many small holes instead of a few big ones (Ryser-Degiorgis et al, 2002). If the crate is dark and the animal is used to it, the animal can be transported without drug immobilization, though this would depend on the individual animal's temperament (Espie, 1993).

- Chemical restraint: All trapped leopards, even if meant for release in a short period of time, should be mandatorily drug-immobilized to permit closer examination. They will anyway need to be immobilized for loading them into a crate. A trap cage is not a crate and has many disadvantages if used to serve also as a transportation cage. A trap cage will not have sliding doors on either side, trays to collect urine and feaces or for that matter provisions to provide a darker environment. Otherwise, the crate or trap cage should be covered with a sheet of tarpaulin or thick cloth to provide a darker and secure environment inside (Fig 5). However, chemical restraint would also help in the treatment of injuries sustained during capture or conflict with people. Trapped leopards get abrasions and cut wounds on the head with contusions in the ocular region and sometimes even damaged claws and broken teeth. These bruises would require some dressing with topical applicants and parental administration of long acting antibiotics.

Fig 5. Crates like this have to be covered with dark sheets to calm down the animal.

- Posture during transit: Healthy rescued animals, especially ungulates, do not lie down during transit. To avoid anxiety and restlessness, it is advisable to administer mild sedatives strong enough to keep them quiet and mild enough to prevent them from becoming recumbent. Being ruminants, all cervids should be kept in sternal recumbency during most part of the journey. Tranquilized animals in particular have to be ensured to remain so to avoid regurgitation of ruminal contents and development of bloat. Legs should be folded below the body, head held high and the muzzle directed towards the ground (Burroughs and McKenzie, 1993). It will be ideal to keep shifting the position of sternally recumbent deer from left to right or vice versa to facilitate the release of gas from the rumen. Shifting the position may not be feasible in large ungulates like sambar deer, gaur or wild buffalos, especially when the sedated animals are in a crate or truck. Rarely, even change of positions may not facilitate the release of gas and during such occasions, guttural or laryngeal region can be externally stimulated to trigger eructation. In times of emergency, the rumen can be depressurized using a stomach tube or punctured using trocar and canula or large bore hypodermic needle.

  In the case of carnivores like leopards, lateral recumbency is appropriate. The position of the tongue in carnivores should be checked regularly and if the tongue is immobile and flaccid, it should be pulled out to one side after opening the mouth (Burroughs and McKenzie, 1993). This is to prevent it from getting dry.

- Body temperature: The body temperature of the immobilized animals should be regularly examined rectally during transit. Signs of hyperthermia include rapid panting, hyper salivation, licking of forearms, chest, hind legs, congested mucous membrane, dehydration and oliguria (Choy, 2006). In extreme cases, if need be, a hyperthermic animal can be doused with cold water to increase heat loss. Cooling also diminishes an animals' ability to respond to stimuli. Precautions need to be taken to avoid pouring water into the nostrils or ears, which can be anyway avoided if the animal is held upright in sternal recumbency. Signs of hypothermia include cold skin - especially the extremities, lethargy and bradycardia. Provision of artificial source of heat is a simple ameliorative measure.

- Eyes and ears: Since Ketamine induced immobilizations leave the animals with eyes wide open, it is ideal to apply some ointment in the eyes to prevent drying. As immobilized animals can be aroused by strong auditory

stimuli, one should avoid taking the animal through crowded areas with loud noise. In extreme cases, it may be advisable to plug the auditory canal with cotton, but one should ensure that these are promptly removed before the animal's release.

- Respiration and pulse: A deer held in appropriate sternal position and carried in a well ventilated vehicle should exhibit a regular deep respiration. Respiration can become shallow and slow under the effects of high dosage resulting in deep anaesthesia, and sometimes due to obstructions in the passage because of handling or bloating. If bradypoenea is drug induced, administration of the specific antagonist could be considered. Respiratory stimulants like Doxapram can be administered I/V in species that cannot be restrained manually after drug reversal. For monitoring pulse of an immobilized ungulate, carotid, femoral, facial or sometimes ear arteries can be palpated (Burroughs and McKenzie, 1993).

- Feeding: Newly captured animals generally avoid feeding in the new environment. It is not necessary to feed or water animals during transit from the field to the rescue centre or zoo. If captive facility is far away, the animal could be held in a makeshift enclosure temporarily till it is stabilized and judged fit enough to take a longer journey. Feeding and watering will then become necessary during transit and the animals would have also by then got accustomed to accept them.

- Capture myopathy: Also known as exertional myopathy, this is perhaps the single most important cause of death among ungulates during capture, pursuit, restraint and translocation. It is a non-infectious disease characterized by damage to muscle tissues brought about by complex physiological changes. Hyperthermia and metabolic acidosis due to elevated levels of lactic acid from anaerobic glycolysis, as a response to intense muscular activity, are said to be the central factors (Williams and Thorne, 1996). All cervids are generally very nervous and easily stressed and prone to capture myopathy.

- Treatment and diagnosis: The opportunity could be utilized to collect blood samples for laboratory investigations like haematology, blood chemistry, serology, genetic and cell culture research. However, the results of these laboratory investigations may not have any bearing in the case of temporarily displaced deer and leopards. Non-Steroid Anti Inflammatory Drugs (NSAID) are contraindicated in felids. These include paracetamol, diclofenac, ibuprofen, meloxicam etc. Fluid therapy is required if more than 5% of the body mass has been lost. All orphans (calves and cubs) should be given oral rehydration fluids first before slowly introducing milk formulas. Fluids should be administered after assessing the degree of dehydration and that too after making sure that the animal is warm and its condition is stabilized (Choy, 2006).

- At destination: As soon as the rescued deer reaches the destination, it should be moved to dark, quiet and well padded warm enclosure as soon as possible, and allowed to recover. Carnivores like leopard can be held in the crate itself if it is only a matter of hours before it is released, or moved into a treatment cage if it has to be housed for a week for treatment, or released into a larger enclosure if it requires a long term care.

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HEALTH CARE OF CROCODILE UNDER TRANSPORT

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The first thing that comes to mind when one talks of transporting is crocodile is why? Why would one want to transport a mostly large potentially dangerous animal? Transport need not necessarily pertain to moving animals over very large distances. Rogue crocodiles are captured in the wild and moved away to safer locations but often it could be a few yards, from one enclosure to another. But the precautions and the care remain unchanged.

Only animals that are in good health should be transported, but there may be occasions when it may be necessary, in the animals' interest, for them to travel to another location. On such occasions it is probable that the animal will be accompanied by a qualified veterinarian or trained attendant.

Transport

The method of transport used for live crocodiles will generally be determined by the size of crocodile(s) involved. Care must always be taken to avoid the effects of exposure, including dehydration, overheating (>35^{o}C), excessive cooling (<20^{o}C) and struggling, and to minimize transport time. Smooth interiors for containers and padding around the snout of the crocodile can minimize snout damage, and are recommended. A simple restraining board with webbing straps is effective for crocodiles up to 3m long for short]term transport under supervision. Crocodiles may also be transported in a vehicle for short distances if adequately restrained.

A solid ventilated box is necessary for long-distance transport or unsupervised cartage. It is almost always necessary to build containers on a framework when timber or hardboard is employed. In the case of certain large animals, the use of bolts and nuts in place of screws and metal reinforcement for corners, and for walls and roof, is also to be recommended. It is important that all containers should have inner surfaces which are completely free of any projecting nails, screws, ends of mesh or any other sharp or jagged materials which could cause injury to the animal. If any wood preservative or paint is used on the containers, it should not be toxic or a skin irritant.

The container may be designed to house one specimen only, or may be made up of a number of compartments, provided that the overall size is such that it may be handled without difficulty. The container or compartment should be of a size which prevents undue movement of the reptiles, and thus minimizes the risk of injury in the event of violent movement of the container. Health Care of Crocodile Under Transport.

In most cases the containers are more satisfactory if sliding doors are fitted, as the ingress and egress of the animals is more easily controlled than with hinged doors. Suitable lifting handles or gripper bars should be fitted and, in the case of heavily loaded containers.

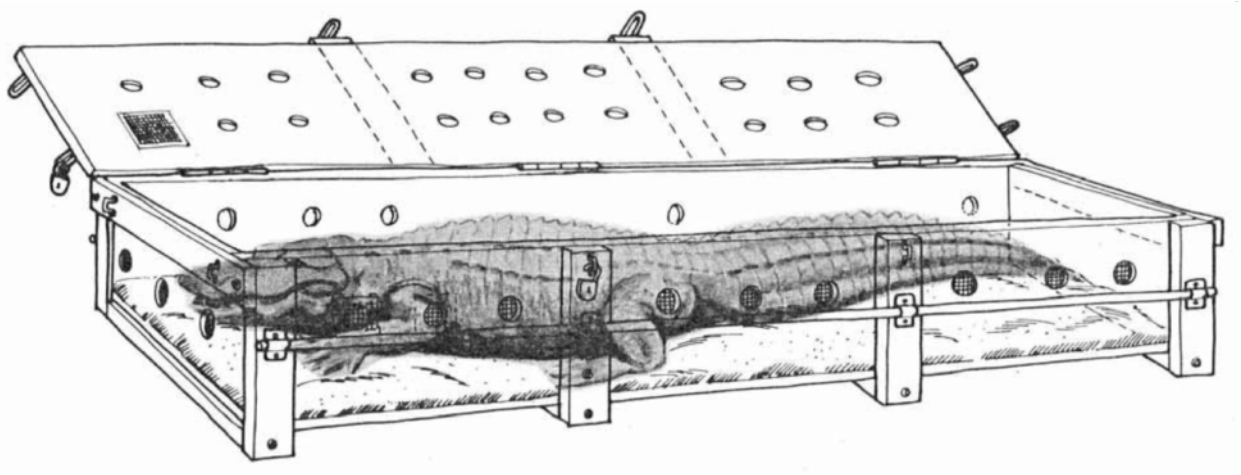
Always ensure that the head is not lower than the body during transport so that any regurgitated fluids can flow back down the oesophagus rather than pool at the opening of the glottis. If the mouth of a crocodile is tied closed and a fasting history is not known, a stick or block must be placed between the teeth to hold the mouth slightly ajar. This will minimize the risk of drowning and if it vomits under restraint. Where possible, crocodiles should not be fed for at least three days prior to transport to minimize risks. The boxes should have smooth material that will limit frictional damage to the skin and claws when the animal moves or struggles.

Despite their size, crocodiles are delicate animals and are easily killed by pounding on hard surfaces during transportation. Suitable cushioning must be used to minimize vibration and shocks, where these are unavoidable. There should be no sharp edges or projections on the inside surfaces of the container. Gavials should have their noses protected

Where possible, crocodiles should not be subjected to large public gatherings and display during transport or handling operations. Visual stimulation should be reduced by covering the eyes or keeping the crocodile in a dark

container. Captured animals are already in a stressed condition and noise and handling must be kept to a minimum.

As the effects of capture stress may persist for many days, animals must be closely monitored for the first few days after release.

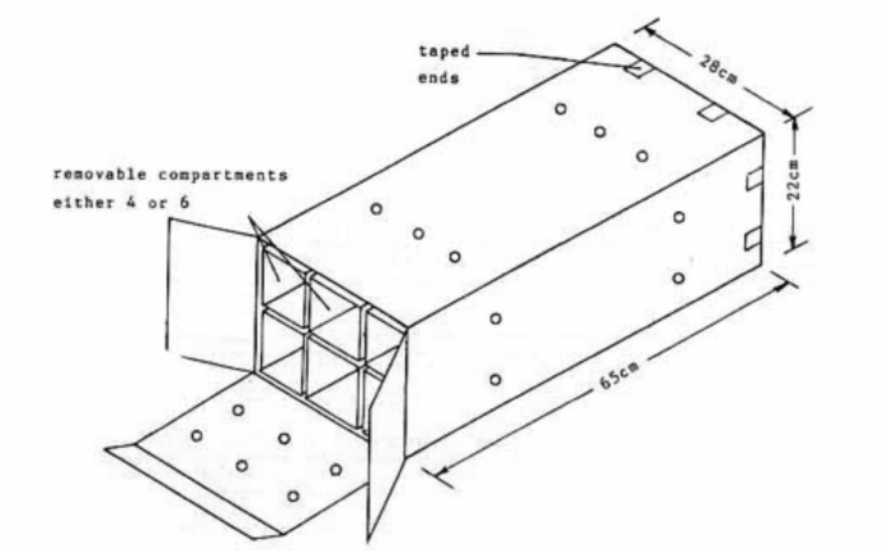


Restraint

Attempting to restrain large crocodiles for transport over long distances by tying ropes at multiple points on the body is rarely effective and can lead to severe injuries if the animal struggles. The most effective method for holding an animal for any length of time is for it to be unrestrained within a specially designed crocodile transport box. Great care must be taken to ensure that crocodiles are not exposed to direct sunlight for any length of time. Direct sunlight can kill within hours through overheating. Crocodiles held out of water for more than a day or two must be covered with sacks and watered regularly to prevent sunburn which causes cracking and bleeding between the scales. Care must be taken to ensure the crocodile is not attacked by ants or that moist parts of the body, like eyes and nostrils, or open wounds, do not get fly-blown. The condition of restrained animals must be monitored regularly.

Limb restraint

As soon as the jaws are secured, the eyes must be covered with a wet sack (hessian bag) to reduce visual stimulation. If it is essential to restrain the limbs temporarily (to prevent struggling), use only wide webbing or tape (5-10cm wide), tied loosely so as not to restrict the blood circulation. Do not restrain the limbs of crocodiles for longer than two hours. This procedure invariably causes oedema (fluid accumulation) in the feet and can cause severe tissue damage or loss of limbs.



General welfare

- Ideally Pregnant / Gravid animals should not be transported. .
- Sedation is inadvisable, as the side-effects are still not fully known and, furthermore, animals that are in a lethargic state are very vulnerable to injury if violent movement of the aircraft, ship, lorry or train is experienced.
- Animals of different species should not be housed in the same container. Under certain conditions each unit of a fully partitioned container can be treated as a separate container.
- Containers should be secured to the carrier to avoid any possible movement and when being handled it is important that every care be taken to ensure that the containers are kept in a horizontal position.
- When animals are being transported over long distances, and will be passing from one climatic zone to another, it is important to plan the journey so that animals are not suddenly moved to a country having a contrasting climate to that which they are accustomed, unless a controlled environment is available.
- Great distress can be caused to animals due to prolonged transit. It is, therefore, most important that, on occasions when these transit stops are likely to occur, proper arrangements be made in advance to ensure that they are not subjected to extremes of temperature.
- Advance preparation should be made for any necessary quarantine measures or other animal health regulations at the ports of intermediate stops or final destination.
- Animal consignments should be collected promptly at their final destination. If live animals have to be left for prolonged periods in airports, etc., they should be housed in places to which unauthorized persons do not have access. Animals that are already under considerable stress, as a result of being transported, suffer great distress through unnecessary interference by curious members of the public. Crated animals should be kept away from direct exposure to the sun and inappropriate temperatures.
- One of the causes of death in animals during transport is lack of sufficient air, so great attention should be paid to the ventilation of containers. Regardless of the fact that containers may have mesh or bar fronts, ventilation holes should be provided in all walls and, in certain cases, also in the roof. The diameter of these holes should be governed by the species of animal the container is to house, and it is important that no part of the animal should be able to protrude through these holes; in the case of certain animals, these holes would require to be covered with fine mesh. However, in spite of this, careful attention should also be given to insulation.

Labeling and documentation

Durable, waterproof labels should be provided as follows:

"LIVE REPTILES" . DO NOT TIP" on all sides and top.

"THIS WAY UP", with arrows indicating the top, on all sides.

Consignor's and consignee's name, address and telephone number. Box numbers should not be used as the sole address. Detailed list of contents: number of reptiles, scientific name and common names used in the exporting and importing countries.

Temperature range required.

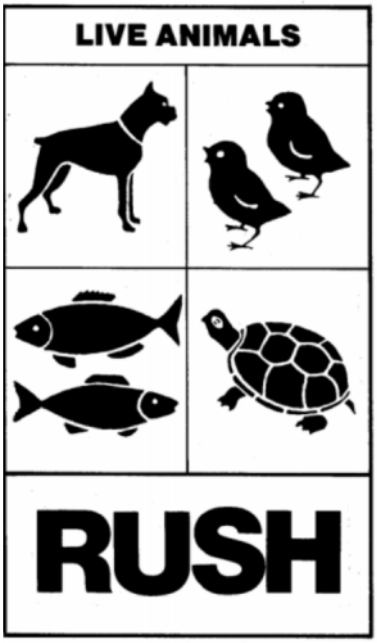
Date on which reptiles were packed for transport.

Copies of relevant export and import licenses.

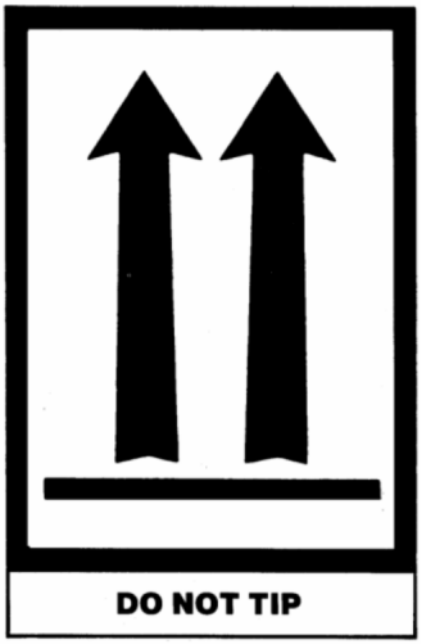
Copy of valid health certificate issued in accordance with the requirements of the importing country.

Duplicate information regarding temperature range required.

CONSIGNOR	VIA	DESTINATION
Name: Address: Tel. No: Date of despatch:	DATE OF DESPATCH Carrier's official stamp	Name: Address: Tel. No.
CONTENTS		**FEEDING**
Scientific name:		
Common name in exporting country: Common name in importing country: Number of animals:		
TEMPERATURE RANGE REQUIRED: MAX °C. _____ MIN °C. _____	**SEDATION**	**ATTACHMENTS** Duplicate details of those given on this label Copies of relevant export and import licences Valid health certificate Details of any sedation or treatment given



Minimum dimensions 10 x 15 cm.



Minimum dimensions 10 x 15 cm.

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TRANSPORTING OF DEER AND ELEPHANTS

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Transportation of Elephants

As an elephant range country with large number of captive elephants our requirements are much different from rest of the world. Captive elephants are also transported frequently for various purposes. In addition, deprading wild elephants when caught are transported to the nearby camp on foot and then to the destination often using truck. Hence we have to discuss and set standard and humane protocol for elephant transport. Elephants by their very size, versatile nature and intelligence are a formidable task both with wild elephants and intractable captive elephants. Skilled mahout with his ward which is tame and docile is almost exactly opposite to the one mentioned earlier. In this context 'captive elephant' means an animal which is either caught from the wild or born in captivity and tamed and trained.

Captive elephants

Transporting norms for elephants depend upon the mode of transport like on foot, truck, rail or by air as the case may be. For any type of transport a fitness certificate from a qualified veterinarian is required. If the transport is from one district to another district a transport permit from the designated forest officer is required. If the transport is trans-national it needs CITES permit compliance.

1. On foot

Often this method is used to transport elephants from one elephant facility to another like one elephant camp to another or from one zoo to another zoo or for ceremonial or festival occasions. During transport do not change the mahout. Because a new mahout will take time to establish dominance over the animal. Our free contact system is based on establishing dominance over the animal and submission by the animal unlike the protected contact a method often practiced in non-range country zoos. Ensure that the animal is familiar with the festival and the fire- works, involving crackers associated with it. Kerala State has a rule like 'Captive Elephant Management Rules'. If the sate concerned has any rules like that needless to say that those rules are to be adhered to.

Inter-state transfer will involve language problem like, command words, food and fodder, restraint methods (E.g Spiked hobbles) It may be noted that spiked hobbles are not humane and not recommended. This is important when animals are taken from the northern States to the southern States. If the mahouts are different at new facility retain the old mahout for while till the mahouts at the new site is confident about the animal. There are cases in which the old mahouts never allow the new mahouts to familiarise with animal fearing the loss of job. In a leisurely walk, elephants can cover a distance of 4-5 kilometres in an hour. Animals are walked for 2-3 hours in the morning and another 2-3 hours in the evening avoiding heat of the day. Hence the optimum distance covered in a day will be 25-30 Kms. Tethering site during halt should be away from sound and noise of the road and rail traffic. This is more so at night halt.

Crossing a river or a water body like a lake should be done with caution. Elephants are good swimmers especially if used to. Mahouts shall preferably keep standing on the elephant, since elephants a have habit of ducking in the water while it is in the water. Mahouts by default should know how to swim. Animal is allowed to cool down before taken into the water if it is coming from a long march. Experienced elephants will even stand on raft. Avoid flood and quick sand. If the river is having strong current like in the monsoon two elephants are tied together. Keep the large one at the upstream and the smaller one downstream. If a calf is to be crossed, it is kept in between two elephants with the larger one upstream and smaller one downstream. This how the wild elephants take their young ones across the river!

Rail-road level cross are another place to take caution in the case of animal which are not familiar with. The sight and sound of the train can frighten the animal and bolt.

2. On Truck

Floor should be strong enough to support the weight of the animal not only at rest but also when the vehicle takes a quick turn the body weight will shift differently. Experienced animals will need very little or even no support at all to mount on to the truck. First mahout is to enter the truck at first, put some fodder and call the animal inside. The second mahout may coax it from behind. Truck shall remain steady either putting block at the wheels or applying hand break. Reversing the truck to a straight land cutting and making the animal walk into the truck is another method, if animal is not familiar with loading itself into a truck. Intractable animals are put on mild sedation (80mg xylazine for a ton of B.Wt). Neck is tied to the sides and a knot in the shape of figure of '8' is put at the hind. A sharp knife is kept handy to cut the ropes in case of emergency. For long distance journey a vet shall accompany to top-up the sedation if needed. Truck is driven only for 5 hours at a stretch. Drive slow and steady, avoid crowded areas. Elephants are always crowd puller. In extreme climatic conditions like heavy snow or blizzard crate is used, which has provision for heating.

3. On Rail

Two adult animals can be put on double sized flat open wagon. Provide proper scaffolding for the elephants and hoods for mahout. Provide with 100.Lit drum for water.(Cutting a 200 L drum in the middle and round off the sharp edges). Familiarisation or trial runs are sometimes done before a long distance journey. Some animals may need mild sedative initially. Do not stop in the hot sun with the animals which are sedated, to avoid sun burn. Adult animals can stand for days. Calves are loaded into the horse wagon, wherein it can lie down, rest and sleep even. Have provision for cleaning and supply of fodder.

4. On Air

International Air Transport Association (IATA) regulations are to be checked. Not all airlines take elephants as cargo. There are height specifications. Make sure that the animal does not grow beyond the prescribed limit by the time 'red-tape' formalities are completed. Establish proper communication both at the shipping end and receiving end. Crate should have all the necessary information like shipping origin, destination, and emergency contacts both in transit as well at the destination etc. Crate is designed so that it can be easily handled by the airport cargo handling system. More details are available at <iataonline.com>. If the mahout is accompanying the animal give details of health, de-worming, particulars of musth, (in males), temperament, etc.

Salient points of crate

- Roof over the head should restrict undue movements of head and trunk
- No sharp projections into the crate.
- Design to protect humans from elephant.
- Strong platform
- The whole crate should be strong enough to restrain the animal
- Non-slip floor.
- Adequate ventilation
- Provision for drainage and ventilation

Better to be accompanied by an experienced vet and mahout and carry emergency drugs like sedative, reversing agents, respiratory stimulants, parentral fluids, etc.

Wild-Caught.

Usually on foot to the nearest camp and next to a distant place on truck. On transport to the camp kumkies depending on the size of the animal, like two in the front to pull, one or two at the back to push and on sides to prevent from straying away. If possible avoid which is musth, advanced pregnancy or cow with a calf at foot. Considerable resistance will be put up by the wild one and conspecifics may come to help the herd-mate. To subdue the wild-caught, a mock fight with the kumkies are done after a shot of mild sedative to the new capture. Often a small portion of the tip of the tusk is also cut, say 10 Cms or so to disorient the animal in putting up resistance using its tusk. Thick ropes made of natural fibre are preferred over chain and single strong rope made of synthetic material. Ropes are tied in webbed fashion to avoid limb injury. The animal is loaded into the truck with front facing backward.

Always EXPECT THE UNEXPECTED! Try to get the help of an experienced elephant vet if possible. A mock drill with a captive one can be done.

If animal is to be released in protected area tagging, with radio collar is ideal. Visual marking can be put on the rump or shoulder preferably on both sides using rubber based road paint like one used for zebra-marking. This will last even after wallowing. This tagging will help in finding the home range, health condition, establishing its herd hierarchy etc.

TRANSPORTATION OF DEER

- Sambar is the sturdiest and he cheetal (spotted deer) most delicate.
- Claim like familiarisation of cage and transporting without sedation has not been proved beyond doubt.
- Long distance is not a problem once the animal is familiarised with the cage and sound and shake of transport.
- Droppings placed in the cage/crate has calming effect.
- Release in the back ward direction so that the animal will not run strait and hit on objects or barrier. The lack stereoscopic vision and blind at the front.
- Black plastic sheets can be used in herding the flock and make visual barriers
- Bloating of rumen is common in ruminants. Mild bloat can be cured by stretching the neck, pulling the tongue, stimulating at the throat and massaging the area of rumen. In full blown bloat antizymotics are to be used. If the distance is long and not accompanied by a vet, not monitored and also is in a laying position, it safe to give the anizymotic as a safe precaution.
- Keeper accompanying in a contact position has always to have a calming effect on the animal.
- Responsible persons at the receiving end should be informed sufficiently in advance and if there is any change in the schedule, that too is to be intimated accordingly.
- In long distance transport if vet,is not accompanying, he should be informed from time to time as well other officers concerned.

TRANSPORT OF SMALL INDIAN BLACK KITES *(Milvus migrans)* AND BARN OWLS *(Tyto alba)*

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The transport related information pertaining to small Indian black kites and barn owls are furnished here since they are the frequently rescued birds as observed in the past fourteen years in general.

Planning

Plan the trip well in advance associating the followings in the planning process:

- Whether the bird is recently caught from wild or under captive condition for a long term.
- Mode of the transport.
- Infrastructures required in case of emergency.
- Number of transfers
- Number of times of rest
- Legal issues

Mode of transport

- Road
- Rail
- Ship
- Air

Follow international air transport association for live animal registration

Time of transport

- Being a nocturnal bird it is better to transport the barn owls at day time because the activities of these birds are less during the day time.
- Similarly, being a diurnal bird it is better to transport the small Indian black kites mainly during the night time.
- Avoid the transportation of these birds during extremes of climate as well as in the mid day of the peak summer season.

Activities before transport

Observation for existence of many birds in a single confinement place

Observe by combining the birds of same species in a single cage/cabin/compartment/other container and if they do not tolerate each other, it is better to have one bird only in each cage/cabin/box/other container.

Acclimatization Activity and rejection of aviary species for transport:

If the numbers of birds are more for transport to a very distant place (exceeding about 500-600 kms):

It appears better to have acclimatization trial before the transporting day.

- Birds that were found dull or with fluffed appearance or with crouched appearance after about 20 minutes of confined condition inside the actual transport cage (in which acclimatization trial is ongoing) may be avoided for the actual transport.
- Birds that have not taken feed or the ones that have not drunk water (as assessed from the texture of droppings from these birds) may be avoided for the actual transport.

All these measures may assist the enhancement of the survival rate in general for the aviary species in large numbers to be transported.

HEALTH CARE MEASURES

- Rule out parasitic evidences and deworm them accordingly.
- Rule out specific disease depending on endemicity or frequency of occurrence of specific disease/s in birds of that region.
- Administration of B'complex fluids in water few days prior to transport may be of helpful
- Any bird with signs of diarrhea, lameness, ruffled feathers, crouching, dullness, wound/abscess, swelling etc. is to be avoided for transportation.
- Preferably, Ketamine with diazepam or xylazine with ketamine may be used prior to the transport in order to minimize the stress of transport in the birds.

Size of cage/ cabin/ box/other container

For transport, the bird in general requires to be placed in normal posture in the selected cage / cabin / box / container. The provision of space for flying activity is not recommended.

Note:

However, there should be adequate space for the bird under transport to move around inside.

Floor and sides of cage/cabin/box/other container

- To reduce any hazards, it is better to pad the floor and sides of these with materials that will not harm the bird species inside. Anchored - clean carpeting may be more appropriate for raptor birds like black Indian kite, barn owl etc.

Finishing of cage/ cabin/ box/other container

- There should not be any protrusions in the moving spaces of small Indian black kite or the barn owl.
- Should not have paint-flakes hanging inside and if not bird may consume accidentally and get intoxicated leading to health related problems.

Multiple birds in cage/ cabin/ box/other container

- Avoid over-crowding inside. If not, there are likely chances of development of excess heat or disruption in the ventilation and ultimately, all these may often lead to mortality among the transported birds.

Perch:

Placement of non-slip and harmless perch/s inside the cage/cabin/box/other container may help to minimize the occurrence of injuries and such excitement during the transport may lead the bird to feel more secure, in general.

Ventilation:

Adequate arrangement should be carried out to provide more ventilation inside the confinement place.

Temperature:

- Thermal variation may quickly lead to stress and collapse of the bird.
- Stress will be more if there is excitement of the bird in the place with high temperature. In case of transport of prococcical birds or altricial nestling, the provision of protected heat source is better inside the transport cage. In case of young ones, take care of hand feeding intermittently.

Food and water

- One hour distance, there is no necessity to provide with food or water.

Legal issues

Legal matters are to be taken care of both at national as well as international levels.

TRANSPORTATION OF ELEPHANTS AND DEERS

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TRANSPORTATION OF ELEPHANTS

Classification

Kingdom	:	Animalia
Phylum	:	Chordata
Order	:	Proboscidea
Family	:	Elephantidae
Genus	:	*Elephas maximus* (Asian elephant)

Before associating with transport of elephants, one should know the danger potential pertaining to elephants.

Danger potentials with elephants

Movement

- When watching elephants moving, one may receive the impression that the elephant is slow. But they can run at amazing speed.

Trunk

- The trunk probably is capable of causing more injuries than any other weapon. It can be used as either an offensive or a defensive weapon. The elephant does not usually bite, but the victim may be pulled close by the trunk and/or it can be banged against solid objects.
- In addition to direct contact, the trunk can be used as a tool to throw objects such as feces, straw, dirt, pieces of wood, rocks, or other missiles at a handler.
- Some elephants have the bad habit of slapping people with the trunk. Pl. mind that the. The force can even fracture facial bones or ribs or knock a person over.

Tusk

- The tusks are an obvious hazard. Elephants have gored unwary victims and have also been known to crush people against walls with the tusks.

Body

- The vast bulk of the elephant may also injure by pressing people against solid objects.

Feet

- Those who work around elephants should be extremely careful; the elephant continually moves from one foot to another, and if due caution is not followed, exercised; a person may be stepped on - either by accident or on purpose.
- It is unwise for anyone to work on an elephant alone. Some elephants become adept at maneuvering a person into a position where he or she cannot get free. The regular attendant should be present to control the head and command the elephant to move into positions suitable for examination and/or treatment.

Chemical restraint of elephant

One should know about restraint based drugs with dosing regimen.

- Numerous drugs are being used to immobilize the elephants.

Sedative and Chemical restraint- agents used in elephants

Agent	Asian Elephant			
	Sedation		**Immobilization**	
	Total dose	**mg/kg**	**Total dose**	**mg/kg**
Acepromazine	10 – 30	0.004-0.005		
Carfentanil			5 – 12	0.002-0.004
Etrophine			6 – 20	0.002-0.004
Xylazine	180 - 360	0.04 – 0.08		0.15-0.20
Xylazine/Ketamine				0.12/0.33

The above table lists a variety of drugs that have been used in elephants.

- Free ranging elephants may require a higher dose than a docile captive animal and Asian elephants may require more than comparably sized Africans.
- No inexperienced person should attempt to sedate or immobilize an elephant without prior consultation with experienced veterinarians.
- Etorphine hydrochloride (M99) is valuable when it is necessary to obtain complete control of an elephant. It is a marvel of biology that 5mg of a drug given to an elephant weighing 5,000 kg can immobilize it within 15-30 minutes.
- In a zoo, the procedure for immobilizing an elephant should include draining of any pools in the enclosure and chaining the elephant, so it does not fall into a moat or empty pool.
- Effects of etorphine may will be observed within 10-15 minutes. The trunk hangs limp or loses some of its investigativeness. The animal will start to sway back and forth and falls suddenly.
- Keepers or handlers must stay away from the animal from this point on because the elephant may fall suddenly. Recumbency occurs generally within 20-30 minutes.
- At the conclusion of the necessary period of immobilization The antidote, diprenorphine (M50-50), is administered intravenously in an ear vein. The dosage is double that of the etorphine. The elephant will begin to investigate with its trunk within 1 - 2 minutes.

Transportation

Elephants can be preferably trained and habituated to transport, with no obvious ill effects. However, zoo elephants are not routinely transported, and planning for movement should be started well in advance. Transport plans require coordination between elephant handlers familiar with the individual elephant to be moved, veterinarians and elephant managers at the sending and receiving institutions, and the contracted transporter; and must comply with local, state, and centralfederal regulations

The following information should be used as general guidelines when conducting an elephant transport. The final decision for specific procedures should be made in partnership between the shipping and receiving institutions.

Prior to Transport

- Transport should be arranged with an individual or company experienced in and properly equipped for moving an elephant.
- A written- transport plan should be developed.
- Elephant managers and veterinarians from the sending and receiving institutions should be involved.
- Plan should detail responsibilities of all parties involved.
- Facilities in route should be contacted in advance for assistance with possible emergencies.

- If an elephant will be transported in a trailer, the trailer should be inspected and meet the following criteria:
  - Allow the elephant to stand comfortably.
  - Provide drainage for urine.
  - The animal needs to be comfortable throughout transport but at the same time safe. HBe adequately reinforced and allow the elephant to be safely tethered.
  - Have adequate heating or cooling systems to maintain the temperature between 55 and 70 degrees F with adequate ventilation; if temperatures will be outside this range, the elephant should be monitored more frequently.
  - Permit access for food and water.
  - Allow handlers to adequately monitor the elephant's condition.
  - If an elephant is to be will be transported in a crate, it is best to contact personnel other facilities with experience in crate design.
  - Elephants to be shipped by airline must meet the guidelines of the International Air Transport Association (IATA).
  - Acclimatization to the trailer or crate may take from 1-6 weeks depending on the individual elephant's temperament. This process should begin as early as possible before the transport date. Note: access to the trailer being used for transport may not be feasible if the institution contracts with a private transporter.

During Transport

- Handlers familiar with the individual elephant should travel with the elephant up to the receiving place. institution.
- A two week supply of routine feedhay and grain should accompany the elephant to the new facility. This allows a gradual transition to the new diet.
- The decision to use sedation or chemical immobilization for transport of an elephant should be made in advance as part of the written transport plan.
- If chemical immobilization or sedation is used to load the animal, the elephant should be held for up to 24 hours and preferably, or have a veterinarian to accompany the transport-vehicle in order to accompany the shipment to avoid complications associated with drug effects.
- Personnel accompanying the elephant must be familiar with common side effects of the drugs and actions needed to prevent or correct complications. Adequate equipment and supplies should be available.

- If the elephant is being transported by airplane, it is strongly recommended that a veterinarian should accompany the elephant. The effects of sedatives or anesthetic drugs combined with the effects of altitude may lead to potentially more serious signs.
- During transport, the elephant should periodically be provided with feed in moderate amounts hay and should be given access to water if the transport time is greater than 16 hours.
- Personnel should regularly monitor the condition of the animal during transport. It is important that adequate ventilation and temperature control be maintained for the comfort and well-being of the elephant.

Head facing side

- In day time: Head may face front/back of truck (have barrier if head faces driver-cabin).
- In night time: Better to have head facing the front of truck.
- In slope (from upper to lower place): Better to have head facing backward.
- In slope (from lower to upper place): Better to have head facing towards anterior side of truck.
- If specially designed truck is not used, you will go for make-shift truck. In this case specially use the scaffolding structures. Have adequate number of logs, ropes, buckets, mugs, chains etc., in vehicle.
- Travel in cooler parts of day.
- In case of nervous (or) in experienced elephants under transport, "side-padding" is a must with wooden logs on sides of the elephant.
- Mahout is to be with animal in case of trained elephant.
- Especially in slope or undulating terrains, legs should be tied separately.
- Break in case of long-journey is a must.
- Avoid driving on 'bridge-route' (If highly unavoidable, let him drive slowly and cautiously).
- In rail journey, request the driver to move the train slowly esp. when crossing tunnel or bridge.
- Speed of truck should be around 30-40 kmph in National Highways and he has to avoid applying sudden brakes and should negotiate well in speed-breakers.
- Pilot vehicle in front of vehicle with elephant is often necessary to regulate the crowd and to have smooth transport esp. in case of a nervous or inexperienced or wild elephant.
- If mother and calf are to be transported, it appears better that the calf is to be tied with the fore limb of the mother.

After transport

- Off-loading should be smooth and comfortable (gentle slope fitted precisely to the back of truck)
- Feed, water and shade should be provided as soon as it lands down.

TRANSPORTATION OF DEER

- Transportation of deer can be a stressful experience not only to deer but also the associated veterinarian. Deer should be well accustomed to being handled.

- Only deer that are healthy are eligible for transport. The animals must be free from diseases and the deer must be socially compatible with pen cohorts.
- Animals should have no discharges from external orifices or skin diseases.

Factors to be taken into account

- Animals should be bright and mentally alert.
- Young animals must be sufficiently developed to cope with the duration and type of journey.
- Animals must stand on all feet and be able to move freely.
- Any wounds should be under treatment and not likely to present problems in transit.
- Where animals are on medication, consideration must be given to whether the stress of travel might compromise that animal's health.
- Body weight must be adequate for the duration and type of journey
- Young deer must be a minimum age of 6 months and must have been weaned for at least 2 months prior to assembly for export.
- Avoid transport of deer in last trimester of pregnancy.
- Males with velvet should not be transported. Male deer with bleeding antler stubs or in the first week after velveting must not be transported.
- Stags over 1 year of age must not be transported in group during the roar and rut periods.
- Deer should be fed with moderate amount of feed and water before or during or after transport.
- Clean and palatable drinking water must be provided at all times, on an ad-libitum basis.
- Deer should be grouped according to body weight (+/- 10%) and sex.
- All right angled corners or sharp objects on or next to the feeding and watering troughs in particular must be covered or smoothed.
- All pens, containers and fittings must be designed for easy operation and be strong enough to contain the animals' weight, to prevent the animals escaping or falling out and to allow ready access to food and water.
- Bedding, such as straw, shavings or sawdust must be provided and must be spread before the deer are loaded.
- Ventilation system must be capable of allowing normal animal behaviour during extreme climatic conditions. Deer are very sensitive to heat stress and there must be management practices in place to cope with effects of high temperatures and humidity such as increasing air flow, increasing the concentrate content of the diet, increasing water consumption, spraying etc.
- Deer must be fed no less than maintenance rations. Two per cent of the body weight of good quality fodder, or its equivalent, will usually achieve this. Where concentrates are fed, they should be included at an approximate rate of 1:4 with the roughage.
- Clean and palatable water should be available to deer within12 hours of leaving the zoo/farm.
- Clean and palatable water must be available on demand throughout the transport period.
- Padding of sides of vehicle is a must.

- Single animal transport: Mild sedation is better for the single deer before transport because single deer is often nervous otherwise.
- Group of animals transport: Sedation may not be needed in general when group of deer are transported.

Post-transport

- Release the deer in new environment with sufficient day time.
- The floor of truck associated with transport of deer is normally slippery. Hence it is advisable to use sand as bedding material (at least half foot depth).

HANDLING AND RESTRAINT OF DEER PRIOR TO TRANSPORT

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Generally, deer are at high risk of stress, shock and capture myopathy while they are being handled prior to their transport from one place to another. The risk increases if the deer with antlers or in velvet are allowed to struggle during their capture or restraint and the process is carried out in hot weather.

To reduce such risk and calm down the deer before they are transported, a well planned deer handling and restraint protocol needs to be developed in tone with the onsite situation and the same needs to be followed strictly by the deer handling and restraint team comprising of animal handlers, assisting workers and veterinarians working on the assignment.

In today's lecture my sole focus will be the handling and restraint of deer species as a whole and I will be discussing the general protocol required for their safe handling and restraint with minimum risk to the human members assigned with this type of job as a part of the main animal transport strategy.

For the purpose of catching, restraining and carrying out the examination & treatment of different deer species, this group of ungulates needs to be categorized on the basis of their size:

1) Large-sized deer: Pere David's deer *(Elaphurus davidianus)*, Sambar *(Rusa unicolor)*, Red deer *(Cervus elaphus)*, Barasingha *(Rucervus duvaucelii)*.

2) Medium-sized deer: Hog deer *(Axis porcinus)*, Chital *(Axis axis)*, Fallow deer *(Dama dama)*, Sika deer *(Cervus nippon)*, Eld's deer *(Rucervus eldii).*

3) Small-sized deer: Chinese water deer *(Hydropotes inermis)*, Musk deer *(Moschus moschiferus)*, Barking Deer *(Muntiacus muntjak)*

Equipment / Chemicals / Accessories to be kept handy

1) Appropriate nets - large hand-nets, "walk-towards" nets.

1) Hand net of one metre depth, 70cm frame (rim) dia., 10cm mesh, with a stout 1m handle.

2) "Walk towards" net one metre wide, several metres long, similar to tennis netting in appearance.

2) Appropriate blindfold/ suitable cloth or bandage for use as a blindfold.

3) Carrying equipment such as stretcher or cargo net.

4) Dart gun and darts if chemical restraint is required for capture.

5) Appropriate drugs if required for capture or restraint.

6) Gloves (various types)

7) Boxes/cages

8) Bags/sacks

9) Blankets/towels

10) Rope

11) Knife

12) Wire-cutters

13) Graspers

14) Goggles or similar eye protection.

Handling and Restraint process

A. Catching

Large-sized deer

1. Large deer which are still mobile require sedation/general anesthesia with drugs administered by darting (remote injection).
2. Large deer which are partially immobilized, for example caught in a fence or severely injured in a road traffic accident, will generally require sedation/general anesthesia delivered by dart, pole syringe or possibly by hand injection, in order to allow safe restraint with minimum risk of injury to deer or handlers and minimum stress to the deer.
3. Only for animals which are already in shock sedation/general anesthesia may be contraindicated.
4. Always cover the eyes as soon as possible to help calm the animal, e.g. with a blanket or large towel thrown over before the deer is under control (for a deer which is partially immobilized, for example caught in a fence) or a shirt tied under the chin once the deer is caught.

Medium-sized deer

1. The deer which are still mobile may require sedation/general anaesthesia with drugs administered by darting (remote injection).
2. Catching in a "walk-towards" net (these are about 1 metre wide, several metres long and similar in appearance to a tennis net) may also be applicable.
3. Deer which are partially immobilised, for example caught in a fence or severely injured in a road traffic accident, may also require sedation/general anaesthesia delivered by dart, pole syringe or hand injection, in order to allow safe handling with minimum risk of injury to deer or handlers and minimum stress to the deer.
4. Only for animals which are already in shock may tranquillisation be unnecessary or contraindicated.
5. A minimum of two people are preferable for handling; one person should hold the head/neck and forelimbs, the other have control over the hindquarters, to minimise kicking and thrashing.
6. Always cover the eyes as soon as possible to help calm the animal, e.g. with a blanket or large towel thrown over before the deer is under control (for a deer which is partially immobilised, for example caught in a fence) or a shirt tied under the chin once the deer is caught.
7. Hard antlers (out of velvet) may be used for holding the head; antlers should be covered with cloth such as a towel as soon as possible to help prevent goring injuries to the handlers (antlers of roe deer are very sharp).
8. Care must be taken to avoid damage to antlers in velvet.
9. Transfer to an appropriate-sized and preferably padded transport crate as soon as possible.

Small-sized deer

1. These species are very nervous and prone to stress and capture myopathy.
2. Large long-handled nets and/or "walk-towards" nets (these are about 1 metre wide, several metres long and imilar in appearance to a tennis net) may be used for catching small deer.

3. If possible a "walk-towards" net should be placed in position without the deer being aware of the operation

- It has been documented that muntjac which have had a chance to see and inspect a net before being driven towards it will be reluctant to approach the net, make considerable efforts to avoid it and be more likely to be in a highly excited state by the time capture is successful

4. The time taken in running the deer into a net must be minimised.

- Chinese water deer in particular may easily overheat if they are run around for more than a few minutes.

5. Deer caught in a net may struggle sufficiently to break a leg or their neck; the risk of this may be minimised by rapid restraint of the animal by one or two people.

- The deer should be retrained by being held to the ground by the shoulders and rump.

- Kneeling astride the deer may be useful but great care must be taken not to kneel/tread on the deer's legs nor to put excessive pressure on the deer (it should not be sat on).

6. Always cover the eyes as soon as possible to help calm the animal, e.g. with a blanket or large towel thrown over before the deer is under control or a shirt tied under the chin once the deer is caught.

7. Hard antlers (out of velvet) may be used for holding the head; antlers should be covered with cloth such as a towel as soon as possible to help prevent goring injuries to the handlers.

8. Care must be taken to avoid damage to antlers in velvet.

9. Mild sedation by hand-injection may be appropriate to reduce risk of injury to deer or handlers and minimum stress to the deer.

10. Transfer to an appropriate-sized and preferably padded transport crate as soon as possible. - Transport Container

B. Handling/Carrying

Large-sized deer

1. Larger deer species, unless severely injured/debilitated, require sedation/general anaesthesia for safe handling and carrying.

- Handling of non-sedated individuals should not be attempted with conscious, bright, wild adult deer.

2. The eyes should be covered as soon as possible and kept covered during handling and carrying.

3. Hard antlers (out of velvet) may be used for holding the head; antlers should be covered with cloth such as a towel as soon as possible to help prevent goring injuries to the handlers.

4. Care must be taken to avoid damage to antlers in velvet.

5. Once sedated, these deer may be carried on a stretcher, on a tarpaulin or using a cargo net. At least two people will be required for carrying these deer; more people may be required for carrying animals over difficult terrain including uphill or through mud.

Medium-sized deer

1. The deer should be restrained by being held to the ground by the shoulders and rump.

- Kneeling astride the deer may be useful but great care must be taken not to kneel/tread on the deer's legs nor to put excessive pressure on the deer (it should not be sat on).

2. Mild sedation by hand-injection is required for carrying and handling except perhaps for severely debilitated animals or deer in shock.
3. Cover the eyes as soon as possible with a cloth mask and keep them covered during handling.
4. Hard antlers (out of velvet) may be used for holding the head; antlers should be covered with cloth such as a towel as soon as possible to help prevent goring injuries to the handlers.
5. Care must be taken to avoid damage to antlers in velvet.
6. Careful restraint is important to prevent the legs thrashing around and reduce the risk of self inflicted injury, including leg fractures.
7. These deer may be carried using a stretcher, a cargo net or a tarpaulin carried by at least two people; more people may be required for carrying animals over difficult terrain including uphill or through mud.
8. These deer should preferably be carried inside an appropriate-sized and preferably padded transport crate - Transport Container

Small-sized deer

1. These species are very nervous and prone to stress and capture myopathy.
2. The deer should be restrained by being held to the ground by the shoulders and rump.

- Kneeling astride the deer may be useful but great care must be taken not to kneel/tread on the deer's legs nor to put excessive pressure on the deer (it should not be sat on).

3. Careful restraint is important to prevent the legs thrashing around and reduce the risk of self inflicted injury, including leg fractures.
4. Hard antlers (out of velvet) may be used for holding the head of muntjac deer; antlers should be covered with cloth such as a towel as soon as possible to avoid goring injuries to the handlers.
5. Care must be taken to avoid damage to antlers in velvet.
6. Cover the eyes as soon as possible with a cloth mask and keep them covered during handling.
7. It is possible for deer of this size to be carried by hand by one person; this is not appropriate for bright, active deer but may be useful for stunned animals or animals in shock.
8. Mild sedation by hand-injection may be appropriate to reduce risk of injury to deer or handlers and minimum stress to the deer.
9. These deer should preferably be carried inside an appropriate-sized and preferably padded transport crate - Transport Container

C. Restraint for examination and treatment:

Large-sized deer -

1. Sedation/general anaesthesia is generally required for examination and treatment of individuals of these species.
2. Only for animals which are already in shock may sedation/general anaesthesia be unnecessary or contraindicated.
3. The eyes should be kept covered at all times for animals which are not fully anaesthetised

Medium-sized deer

1. Brief examination and minor treatment may be possible using physical restraint only.
2. If physical restraint is used, the deer should be restrained in a quiet stable on ample bedding such as hay, with particular care taken to ensure adequate careful restraint of the limbs and antlers.

- The head and legs must be controlled quickly.
- Hold the animal in a sitting position (sternal recumbency) if possible.
- A firm but flexible grip on the legs is required; leg fractures may result from too rigid holding.

3. Hard antlers (out of velvet) may be used for holding the head; antlers should be covered with cloth such as a towel as soon as possible to avoid goring injuries to the handlers
4. Care must be taken to avoid damage to antlers in velvet.
5. Sedation/general anaesthesia may be required for prolonged examination and extensive treatment of individuals of this species.
6. The animals already in shock, sedation/general anaesthesia may be contraindicated.
7. The eyes should be kept covered at all times for animals which are not fully anaesthetised.

Small-sized deer

1. These species are very nervous and prone to stress and capture myopathy.
2. Brief examination and minor treatment may be possible using physical restraint.
3. If physical restraint is used, the deer should be restrained in a quiet stable on ample bedding such as hay, with particular care taken to ensure adequate careful restraint of the limbs and antlers.

- The head and legs must be controlled quickly.
- Hold the animal in a sitting position (sternal recumbency) if possible.
- A firm but flexible grip on the legs is required; leg fractures may result from too rigid holding.

4. Hard antlers (out of velvet) may be used for holding the head of muntjac deer; antlers should be covered with cloth such as a towel as soon as possible to avoid goring injuries to the handlers.
5. Care must be taken to avoid damage to antlers in velvet.
6. Cover the eyes as soon as possible with a cloth mask and keep them covered during handling.
7. Sedation/general anaesthesia may be required for prolonged examination and extensive treatment of individuals of these species.
8. Only for animals which are already in shock may sedation/general anaesthesia be contraindicated.
9. The eyes should be kept covered at all times for animals which are not fully anaesthetised.
10. An elaborate crate has been described, incorporating observation panels and a crush facility to allow examination and restraint prior to anaesthesia of muntjac deer during scientific studies.

TRANSPORTATION OF NATIVE NON-HUMAN PRIMATES

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Safe and humane transportation of non-human primates requires dedicated and informed personnel who carefully plan and attend to the details of appropriate animal care and handling throughout the shipping process. Transportation must be anticipated by the authorities well in advance of the specified date of transport, because it always been a complex task in order to getting the prior permission for the transportation of Bonnet macaques. Planning and executing of primates locally and internationally can be an over healing experience. Considering how many variables are at play, including quarantine of the animals, meticulous preparation of paperwork, along with applying for import and export permits, it can be a daunting task. In addition to that each country has its own unique import requirements and the rules change continually. Shipping animals internationally can make for an extremely time consuming project.

Animals die during transportation due to injuries and stress than capture. Those who care for primates in captivity should be aware that any form of transport may induce stress in a primate. Transporting an animal around within a local area (between rooms or buildings), short local road transport, long road transport (as much as 24 hours), combined transportation by plane (nationally or internationally), ship and road with a total journey time that may exceed 60 hours. Full account should be taken of the impact on the animals when carrying out a cost-benefit analysis of obtaining and using animals for scientific procedures. Pairing animals allows for mutual support during stress. The factors to consider for transportation are:

- Regulatory requirements
- Crates design
- Vehicle selection
- Route planning
- Physical and environmental conditions
- Attitude and skills of handling and transporting staff
- Animal Selection

To avoid the needless transportation and relocating of non-human primates that obviously would not be acceptable. Hence, the transportation of non-human primates should be healthy and free from diseases. Transportation of pregnant, very young and very old animals should be carried out only where there is no other option for that special consideration and veterinary monitoring should be given.

Smaller animals can be shipped in pairs within the transport container. However it is therefore particularly important that the social compatibility of animals transported together should be ensured. Some may worry about the potential for animals to harm each other when subjected to the stressful conditions undoubtedly imposed during the transport process. Evidence suggests that when primates are subjected to a stressful event, either in the presence of conspecifics or when alone, they exhibit markedly reduced physiological stress when in the presence of other individuals. Pairing animals allows for mutual support during stress.

Preparation of shipment crates

Container size and structure standards are described by IATA. There are four types of container (CR31, CR32, CR33 and CR34) were used for transportation of primates. The container types are based up on the both the species and individuals. IATA defines the dimensions and construction (including building materials) of containers to meet their specifications ensuring sufficient space, ventilation, separation and light for the occupants. The removal of faeces

and urine is also important to ensure hygiene and comfort, and the IATA requirements specify that the provision of waterproof droppings tray at the base of the container.

Selection of vehicle and route

The selection of the vehicle should be based on the number of animals which are transported and have good space to hold crates with free air movement. The selection of route should be very important. Well connection high ways with short distance and also to avoid bad roads and traffic.

Capture

Non-human primates have large canine teeth and strong jaws. The adult males used the canine teeth as weapons. Non-human primates are able to grasp with strong fingers and hard fingernails, and scratches may be deep and painful. Hence, handling is dangerous because of their large canine teeth and their aggressiveness. Handling of non-human primates by using hand gloves is most important. The arms of a monkey may be gripped above the elbows and pulled behind the back. Nets and trap cages are commonly used to capture primates weighing up to 15 kg. Special precautions should be taken when capturing of an individual from a group, because the alpha male may attack. Large non-human primates should be handled in squeeze cages or by chemical restraint. Use low doses for quick procedures. While administering chemical immobilizing drugs to nonhuman primates that are in oestrus should take more caution.

Immobilization Drugs	Animal size	Dosage
Ketamine	Smaller individuals require a higher dose	8.0–15.0 mg/kg
Combination of Tiletamine/Zolazepam	Smaller animals	7.0–8.0 mg/kg
	Medium-sized animals	4.0–6.0 mg/kg
	Larger animals	3.0–4.0 mg/kg

Loading

The loading of animals must be done as quickly as possible to prevent further stress. Animals should be loaded in the early morning and transported during the day in the cold winter months and during summer to avoid high temperatures, transportation of animals in night. Start the journey as soon as loaded the vehicles.

Feeding and watering

In general, primates should not feed during transport for a short period (less then 12 hours). Transporting primates for a long period (more than 12 hours) it will cause dehydration. In such kind of transportation sufficient quantity of portable water should be provided to primates to overcome their thirst. Water should be provided at least twice a day. Fruits and fresh vegetables have more moisture content it meet both water and feed requirements. Sufficient quantity of any familiar, non-perishable/dry diet also provided during long period transport. Any change in diet (unfamiliar diet) that can affect the gut flora may cause stress to the animal.

Environment

The environment in the back of a truck or van and an aircraft compartment are likely to give stressful atmosphere to the primates due to motion, vibration, noise, humidity, temperature and unusual smells. Measures should be taken to prevent exposing the animals in such environments. Temperature should be maintained within the range of 180 -240C. Unless any emergency, transportation should be avoided during the hot summer.

Special consideration

The transportation of primates requires special consideration because the risk of zoonotic disease transmission is higher. Disease transmission risks may be associated with the transportation of primates, both between the animals and

handling staff and between the animals. Personal hygiene precautions should be taken who handed primates. Transport container design should be such as to prevent physical contact between the animals and staff. This is particularly in case of animals with unknown health profile that may be carrying zoonotic diseases.

Disinfection and sanitation

Transportation protocols should have standardized procedures for disinfection and sanitation of crates, transport vehicles and holding areas. It prevents the transmission of disease from one shipment to the next shipment by using the same crates, vehicles and areas.

Physical Injuries

Injuries may be caused during loading and transportation. During transportation, trauma may be caused by incorrectly designed crates or vehicles, or by animals fighting.

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VETERINARY CONSIDERATIONS IN TRANSPORTATION OF WILD CARNIVORES

D

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"The successful handling of animals with drugs, capture in the wild and restraint for various purposes can ultimately be performed successfully only by those who, at least to a large extent, put the animal first; by those who are guided by a code; as medical doctors and veterinarians are subjected to a code; by those who have an awareness of the value of animal life; and by those who set their sights on the welfare of all the animals with which they work; a goal ethically higher than that of the survival of a species"

-A.M. Harthoorn

Wild animals need to be moved elsewhere for various reasons that may involve movement of animals as a part of animal exchange program, as a part of the species recovery program or more commonly as a part of the rescue and rehabilitation operations. Transportation of wild animals has thus become an essential and integral component in wildlife management.

Stress during transport

Transportation can have considerable effect on the physiological and psychological well being of the animals. Though stress is unavoidable during transport; efforts need to be put in to make it minimal. Though there is limited scientific literature on effect of transport on wild sentient; good practices can be established by drawing some universal concepts from the available scientific literature and most importantly by understanding species -specific needs.

In general the stress during transport can be physical (changes in temperature, humidity, or noise), physiological (limitation of access to food and water), and psychological (exposure to novel individuals or environments). Although stress is a body's response to adapt to altered situation it can be harmful if the animal is subjected to stress for a longer period and is unable to adapt successfully to it. Normally, animals live in a uniform, familiar environment; during transport, almost every aspect of their environment changes. The transportation container, motion, human handling, temperature, light, and perhaps social group mates, odours, sounds, floor surface, food and water availability, vibrations, unusual gravitational forces (such as during acceleration, braking, or turning of vehicles), and other factors all change from moment to moment. These changes are perceived as stressful even under the best of conditions. This is because the transportation experience is not part of the normal routine, and the animal has no control of the situation. Since stress during transportation is unavoidable, it is relevant to minimize the intensity and duration of excessive stress.

All the procedures practiced (handling and transport) during transportation should have a scientific, professional and humane basis since the transportation stress in great intensity or duration adversely affects animals' wellbeing. In general, the good transport practices should address issues related to animal well-being, comfort and safety and should address following:

1. Space, food and water requirements
2. Social interaction and group transportation
3. Anaesthetic needs and handling procedures
4. Environment conditions affecting animal during transport
5. Animal monitoring during transport
6. Emergency procedures and protocols
7. Personnel training.

These would vary depending on the species to be handled and would require appropriate modifications. The purpose of the article is to highlight safe, humane and expeditious transportation of wild carnivores.

Transportation of carnivores

As wild carnivores are potentially aggressive and dangerous, their transportation requires a thorough understanding of the behaviour, temperament, physical, psychological and physiological needs, anaesthetic requirement and knowledge of altered behaviour/ response.

a. Transport crate

The International Air Transport Association (IATA) has formulated detailed guidelines for container cages for transport of animals over long distances. While this has been done primarily for air travel, the designs may be adopted for other means of transportation as well applying suitable modifications if the need arises. The major considerations while designing a transport crate is to ensure adequate space, proper ventilation, adequate strength and safety, escape proof designing, and provision of opening for treatment, feeding and watering.

Transport cage dimension

The height of the container must allow the animal to stand erect with its head extended and the length must permit it to lie in the prone position. The measurements will vary with the species involved. A universal formula that can be used to ensure that the crate is of a suitable size is given below

Crate length= body length (nose to rump) +half the elbow height

Crate height= Total height (to the top of the head) in standing position

Crate width= 2X shoulder width in non anaesthetized animals and for an anaesthetized animal placed on its side with its head extended for adequate respiration, the width should approximate the shoulder height of the animal.

Crate design

For large carnivore especially large cats, the frame must be made from solid wood or metal bolted or screwed together. The frame must have additional metal re-enforcing braces. Alternatively hollow iron bars appropriately placed can be used to provide the basic structure on which plywood or equivalent material can be mounted to give a strong and smooth interior. Interiors with plywood would help animals to settle down fast as it would provide adequate darkness. Animals settle quicker in dark/ semi-dark conditions. Wild carnivores should not be carried in open metal crates. In case these open crates have to be used, they should be covered with tarpaulin as it would minimize stress and would prevent the animal from reaching out through the bars and injuring the handlers. The floor may be constructed with wooden planks joined together having adequate gap through which excreta / waste would drop onto a tray. If slatted floor is not used, it must be leak-proof and covered by sufficient absorbent material in order to prevent any excreta escaping. Roof must be solid with ventilation openings. Sliding or hinged entry and exit doors must be provided.. The doors must be fastened with screws or bolts in order to prevent accidental opening. Ventilation openings must be placed at heights that will provide through ventilation at all levels, particularly when the animal is lying down in a prone position. Spacer Bars/Handles should be made from the framework of the container. Alternatively there can be provision for putting rings on the sides in which long poles can be put for lifting the crates. Human safety is of prime concern while designing the crate.

For transportation of hyenas; wooden crates can be used however these need to be metal lined. These animals being aggressive have powerful jaws and can easily chew through a wooden crate if kept in the crate for a prolonged period. It would be worth to use metal crates for these animals.

For small carnivores, sky-crates can be effectively used for transport. These are available indifferent sizes and are made of hard plastic or fibreglass with a mesh door and ventilation holes. These can be effectively used for transportation of jackals, foxes, caracal, etc.

b. Immobilization needs

Due to their variable and unpredictable temperament, large carnivores need to be invariably immobilized for loading; though smaller carnivores may be easily manipulated into smaller crates and therefore do not usually require immobilization. The decision to tranquilize or not depends on individual animal's behaviour and temperament.

It is not advisable to keep the animal in immobilized state for more than 6-8 hours. Too deep a level of anaesthesia can be life threatening, while too little drug can result in an anaesthetized animal suddenly becoming mobile and turning aggressive. The vital signs of the anaesthetized animal (body temperature, quality and rate of respiration) must be constantly monitored during transport.

c. Transport needs

Route map, road conditions, type of vehicle, speed of vehicle, halting areas, availability of water and total time for journey are important factors that should be considered while planning road transport. Air transport is a better option where considerable distances over rough terrain are involved as the animal is subjected to less stress and is able to reach destination faster.

d. Personnel

Transporting wild animal is a complex matter. It requires that those involved in transport have appropriate qualification and experience in care of the species. This would ensure that needs of each species is cared for in a professional and humane manner. Prior to transport, it is important that a mock drill of entire procedure (capture, loading, crating, monitoring and release) is demonstrated. This would ensure that all concerned are aware of the procedures and are able to handle any emergencies if they arise.

e. Legalities

Provisions under the Wildlife (Protection) Act 1972 as amended upto 2006 (section 48A) need to be considered while moving wild animals. Additionally sub-rule (2) and (5) of rule 8 of the Wildlife (Transaction and Taxidermy) Rules, 1973 (G.S.R. 198 (E), dated 9th April, 1973 need to be essentially followed while transport of wild animals between states. Other rules viz; the Animal Transportation Rules, 1978 under the Prevention of Cruelty to Animal Act, 1960 though applicable for domestic animals and non-human primates may aid in developing basic protocols.

For air transport, the International Air Transport Association (IATA) follows the live animal regulations and should be considered prior to undertaking journey. For international transport, the provision of Convention on International Trade in Endangered Species of Flora and Fauna (CITES) should be taken into consideration.

Conclusion

The effective management of wild animal population is becoming a critical and demanding task for both the veterinarians and the PA Managers. There are number of occasions when the services of professionals are called for, to mitigate issues related to wild animal management. Safe and effective transport of wild animals is an integral component of wildlife management and requires careful planning, adequate skills, knowledge of animal behavior and biology, and the experience. The article touches on critical issues related to wild carnivore transport.

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TRANSPORT OF A NILE HIPPOPOTAMUS

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Soundarya, the Chamarajendra Zoological Gardens, Mysore, 6-year-old Nile hippopotamus, was transported on January 30, 2006, to his new home at the Arignar anna Zoological Park at Vandalur, Chennai. The 1000-kg hippo arrived safely, shortly after 3 p.m. on January 31, at her destination.

Soundarya's move to Arignar Anna Zoological park will pair her with 6-year old male hippo, Wampuri, for possible breeding. Soundraya was transported in a custom-made, spacious, wooden-framed and lumber-lined crate built by Chamarajendra Zoological garden staff.

Size of the Hippo

The river hippopotamus males average about 1.5 to 1.8 tons., with the females averaging 1.3 to 1.5 tons. They can be as long as a dozen feet and stand 5 feet tall at the shoulder. The males continue putting on weight as they grow older, but the females stop growing when they reach about 25 years old.

The Crate

When the keepers, curators, and scientists at the Arignar Anna Zoological Park and Chamarajendra Zoological gardens made the decision to transfer Soundraya to AAZP, where she will have male hippo companion and an enlarged luxurious habitat, they wanted to make that transition was as smooth as possible.

Moving a 1,500-kg animal requires careful forethought and planning, as well as special equipment. In this case, Soundraya went to AAZP, Chennai by truck, so she needed somewhere to spend the drive.

The crate ended up being almost fifteen feet long, nine feet tall, and seven feet wide. Because of its solid steel construction, it ended up weighing 1300 kg-without its hippo occupant!

Once it was complete, the builders needed to test the crate to make sure it could safely hold a hippo as a crane lifted it up onto the flatbed truck for transport. Given Soundraya's one-ton weight, so how would they weight-test the crate? Nothing the Zoo had, other than Soundaraya's, was heavy enough to suit the engineers but also small enough to fit into the crate. So they contacted an elevator company and asked to borrow the weights used to test elevators. Eventually, they loaded the crate with 2 tons and watched as a crane lifted it up in the air and held it there for ten minutes. (When it came time to lift Soundaraya, the crate was in the air for less than five minutes.)

Both the ends of the crate is having doors that can be opened on either side. The doors are designed in such a way that the keepers could open it easily and safely to check in on Soundaraya during drive. Ventilation slats gave him lots of fresh air and kept her comfortably during his drive.

Capture of Hippo

The hippo was trained daily to enter and calmly remain in the crate by feeding grasses and apples in the crate to prepare him for the road trip to AAZPBoth the ends of the crate were closed on the day of transfer by the keepers once the Hippo entered the crate for feeding on the day. Soundaraya was not sedated for the journey.

The crate was lifted onto the back of a flatbed truck by use of a construction crane. The truck started its journey at approximately 6 p.m and followed by a car with a veterinarian and a Forestor. Two animal keepers were traveled along the Hippo in the truck.

The Journey

The Hippo traveled nearly 500 km and reached Arignar Anna Zoological Park in the next day (31-01-2006) at approximately 4 p.m. Through out the journey the vehicle was stopped for every 2 hrs and checked the condition of the animal. Spraying of water allover the body and to the mouth by a simple garden sprayer.

Upon arrival, Soundaraya entered quarantine in the Zoo's indoor hippo holding area where she remained for six weeks before his public debut to visitors of the Arignar Anna Zoological Park.

POST-MORTEM OF WILD ANIMALS WITH SPECIAL REFERENCE TO DEER

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The postmortem examination or necropsyy is often the most important factor in establishing a diagnosis. Evaluation of gross lesions tells the Pathologist what type of disease process has occurred and to what extent it has damaged specific organ systems. Therefore autopsy is an indispensable tool for the scientific understanding of the disease process.

What is necropsy?

The methodical examination of organs and tissues of dead animal may be called either Necropsy (Greek NECROS dead body; plus OPSIS = sight) or Autopsy (Greek AUTOPSIA = SEEN BY ONSESELF).

It is also commonly known as post-mortem examination (Latin POST-MORTEM = after death). Veterinary pathologists prefer necropsy and autopsy is used in Medical pathology; but can be used interchangeably.

Objectives of necropsy

1. Diagnosis of disease
2. Experimental purpose - produces diseases artificially in experimental animals and study the nature of the disease process.
3. In vetero-legal cases - to know the cause of death and the time of death (Forensic Pathology)
4. To detect and eliminate abnormalities, including contamination in food animals, as well as to enforce meat inspection legislation throughout the world.
5. To advance general knowledge and contribute to the science of disease.
6. Autopsy also serves as an instrument for education at all levels, for the beginners and advanced learners.
7. Autopsy creates a direct link to research in laboratory sciences such as experimental pathology and bacteriology.

Different types of necropsy

1. Diagnostic necropsy
2. Cosmetic necropsy
3. Vetero-legal necropsy

I. Necropsy procedure for wild animals

Difficulties in determining the cause of death in non-domestic animals in captivity or natural habitat are attributed to

1. Want of history
2. Observation not possible before death
3. Animals exhibit no symptoms of illness until they are too weak to walk, fly or crawl.
4. Sudden death without showing gross or microscopic lesions.
5. Veterinarians who are un-familiar with the normal habits and anatomy of wild animals.

Necropsy procedures for certain wild animals are similar to that of domestic animals as indicated below:

II. Necropsy procedure for herbivores

External examination procedure is common to all species

1. Place the animal on the left side so that the rumen is away from the prosecutor.
2. Make incision on the midline from between jaws to the perineal regional avoiding mammary gland and external genitalia of male.
3. Lift the right leg away from the body.
4. Make incision down on the medial side of each leg connecting the midline.
5. Reflect the skin and cut the muscle to separate the legs. Disarticulate the hip joint to separate hind legs.
6. Open the abdominal cavity by incising the abdominal muscles, the incision extends from the sternum to pelvis.
7. To open the abdominal cavity by incising the abdominal muscles, the incision extends from the sternum to pelvis.
8. To open the thoracic cavity cut through ribs at the joints junction with sternum, costo-chondral and vertebra. Cut the diaphragm.
9. Pelvic cavity is opened by cutting the pubis to examine the organs.
10. Remove the omentum.
11. By lifting the left leg tips the carcass. Examine anterior surfaces of reticulum.
12. Remove the spleen and examine (Anthrax, Anaplasmosis, traumatic peritonitis, Copper poisoning, tumor).
13. Remove the mammary gland with skin intact. Examine for symmetry, swelling, and atrophy; palpate each quarter separately; examine the mammary lymph nodes. Cut each quarter from teat canal to cistern.
14. Open and examine the nasal cavity for ulcers, granulomas, parasites or tumors.
15. Examine the pericardium by palpation for thickening and fluid accumulation.
16. Open the pericardium from the apex; tip the apex to draw the contents that collect at the bottom of the heart.
17. Examine the thyroid and parathyroid.
18. Remove the tongue, larynx, trachea and esophagus along with heart and lung by cutting soft tissues and the mandible (cut before premolar and after the molar).
19. Examine mouth and tongue.
20. Arrange thoracic organs in normal position and wash.
21. Open the esophagus, larynx and trachea and examine.
22. Examine lung by palpation and also after incision.
23. Examine the heart for dilatation and hypertrophy.
24. Cut open the heart on right side first and then left side. Examine the muscle, endocardial valves and also the vessels.

25. Examine pancreas and mesenteric lymph nodes.
26. Straighten the intestine and then cut open and examine.
27. Examine the liver surface for fibrinous tufts, adhesion or thickening of the covering.
28. Free the liver from the attachment to the diaphragm. Note the size, weight border and the cut surface.
29. Open the gall bladder and bile duct and examine for worms, glasstones, inflammation etc.
30. Examine the adrenals, kidneys and ureter.
31. Remove the kidney and then remove the capsule after incising the organ longitudinally.
32. Examine the cortex, medulla and pelvis.
33. Open the urinary bladder and examine nature of content.
34. Open and examine the uterus, vagina and vulva.
35. Open the skull and examine the meninges and then open and examine the brain.
36. Open and examine the forestomach, abomasums and intestine.

DISEASES AND PATHOLOGY OF CERVIDS (DEER)

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Introduction.

Deer are the most ancient of all ruminants. India has a distinction of having the largest number of deer species in the world. The species found in India varies in size as per the areas they live in. They are one of the most beautiful creatures on this earth and extend to approximately 34 species. They are affected by many diseases both infectious and non infectious diseases. Some of the common diseases are highlighted.

Viral Diseases

Vesicular Diseases

Foot-and-mouth disease (FMD) is a highly contagious viral disease that primarily affects cloven-hooved livestock and wildlife.-virus - Aphthovirus, There are seven immunologically distinct serotypes - O, A, C, SAT 1, SAT 2, SAT 3 and Asia 1 -Deer highly susceptible FMDV can infect most or all members of the order Artiodactyla (cloven-hooved mammals), as well as a few species in other orders. The characteristic lesions of foot-and-mouth disease are single or multiple, fluid-filled vesicles or bullae from 2 mm to 10 cm in diameter. Foot-and-mouth disease is characterized by fever and vesicles (blisters) on the feet, in and around the mouth, and on the mammary gland. Occasionally, vesicles may occur at other locations including the vulva, prepuce or pressure points on the legs. Vesicles often rupture rapidly, becoming erosions. Pain and discomfort from the lesions leads to a variety of symptoms including depression, anorexia, excessive salivation, lameness and reluctance to move or rise.

Rabies : Rhabdovirus

Most of the deer in zoos or free ranging deer near parks are as a result of rabid dog bites Rabid deer may display abnormal behavior ranging from severe depression to violent aggression, or they may appear uncoordinated, partially paralyzed, or unable to rise. Diagnosis -rarely clinical signs (if observed), FAT, HP

Deer Cutaneous Fibromas: Papillomavirus

Syndromes: cutaneous wart-like growths Infection: direct contact Species: all deer species Histopath: features of papillomas, fibropapilloma or fibromas

Bluetongue : Orbiviruses;

Bluetongue virus infects many domesticated and wild ruminants including sheep, goats, cattle, buffalo, deer, antelope. Clinical signs - peracute, hemorrhages, respiratory distress lameness and sudden death., , chronic: overgrown hoof, cracks in hoof wall, sloughing of hooves.Infection: Culicoides vectorSpecies: All species Histopath: DIC, petechial, ecchymotic or suffusive hemorrhages anywhere esp. gi tract, heart, pulmonary artery, pyloris of abomasums

Bacterial Diseases

Anthrax

Anthrax is a bacterial disease that can cause rapid death losses in deer and in unvaccinated domestic livestock. Organism - *Bacillus anthracis*. Spores of the bacterium can survive for years in the soil, and sudden changes in soil moisture caused by flooding or drought can trigger the development of infectious bacteria from these dormant spores. Animals become afflicted when they ingest the anthrax bacteria and are rapidly overwhelmed when the bacteria invade all body systems. Classical signs of anthrax include failure of the blood to clot, bleeding from body orifices, an enlarged spleen, and sudden death. In case of suspicion do not open the carcass. Take smears rule out Anthrax before

opening. Spores can also survive for two years in water, 10 years in milk, and up to 71 years on silk threads. Vegetative organisms are thought to be destroyed within a few days during the decomposition of unopened carcasses. If a carcass is opened by mistake then tarry unclotted blood, enlarged spleen and lesions of septicemia are observed.

Bovine Tuberculosis

Deer are becoming more and more susceptible -aerosol or oral ingestion --Associated with infected cattle especially in encroached areas, high deer density, - subclinical infection, cranila lymph nodes lungs, disseminated Species -all species

Histopath: caseogranulomas, partial mineralization, multi-nucleated giant cells, rare Acid-fast bacilli

Pasteurellosis

Pasteurella multocida,

More common in captivity rare in wild. Major clinical signs and pathologic changes included extensive swelling of the head and the neck and peracute or acute septic pneumonia, fibrino-suppurative bronchopneumonia, petechial and ecchymotic hemorrhages on serous membranes, and severely hemorrhagic adrenal glands and abomasum.

Leptospirosis

Leptrospirosis can be caused by any of over 189 known serovars of the spirochete Leptospira interogans. The organism infects a large variety of domestic and wild animals, including humans. Studies indicate that deer are routinely exposed to the organism but rarely suffer clinical signs of infection. Signs- asymptomatic. Additionally, it does not appear the deer are of significance in either the maintenance or spread of the organism. In captivity contact with contaminated environment and rodents, mongoose etc

Are likely way they can get infected.

Johne's Disease

-*Mycobacterium avium subsp. Paratuberculosis*

-Primarily captive species: -Infection: fecal-oral, massive fecal shedding, early age infection -Signs: diarrhea, weight loss, chronic -Lesions: thickened ileum & cecum, enlarged ileo-cecal lymph node, histiocytic or granulomatous infiltrate with numerous acid-fast bacilli

Brucellosis

-*Brucella abortus, B. suis*

-Species: all the species-Syndromes: abortion, retained placenta, metritis, orchitis, epididymitis -Infection associated with cattle.

Abscesses & Bacterial Infection of CNS

Staphylococcus, Streptococcus, Arcanobacterium pyogenes: These pyogenic bacteria are commonly associated with subcutaneous abscesses. Clinical signs: subcutaneous abscesses; brain abscesses & menigoencepahlitis. Infection: dermal abrasions and wounds; direct extension from retrobulbar; hematogenous.Species: all cervids susceptible

Histopath: suppurative cellulitis and abscesses, with bacterial colonies

Black Leg

-All cervids susceptible

-*Clostridium chauvei, Cl. Novyi, Cl. Septicum*

-Trauma to muscle mass results in anaerobic environment, growth of bacteria, release of preformed toxins -Gross: muscles dark red to black, gas-bubbles, spongy, dry

-Histopath: muscle necrosis, large bacterial rods

Parasitic Infestations

External Parasites Fleas, ticks and lice:

Many genera and species of biting & sucking lice, ticks, fleas

Syndromes: incidental, clinical anemia and debilitation, secondary infections

Species: all deer susceptible, more severe in neonates, seasonality

Ticks

-Amblyomma, Ixodes, & Dermacentor spp.

-Local irratation and swelling, heavy infestation anemia

-May carry Lyme Disease

Sarcoptic Mange

Sarcoptes scabiei: Contagious burrowing skin mite of man and animals, worldwide

Syndromes: Mange, immunosuppression, debilitation, death

Infection: direct and indirect contact

Species: Moose, elk, caribou, not reported white-tailed

Histopath: pruritis, crusts, hyperkeratosis, epidermal hyperplasia, intracorneal tunnels containing myriads of adults, larvae, eggs

Demodectic Mange

Demodex sp.-Hosts: Deer Spp. : subclinical, alopecic dermatitis, marked subcutaneous edema distal muzzle, Infection: Not considered contagious, normal skin inhabitant to dermatitis -Histopath: low numbers of organism in hair follicles or sebaceous glands are incidental; alopecia, folliculitis, furunculosis, granulomatous cellulitis, lymphadenopathy, associated with high numbers of classic cigar-shaped, stubby limbed intra-follicular adult and larval mites

Internal Parasites

Nasal Bots

Cephenemyia spp.: Nasal/pharyngeal bots of deer; adults free-living

Clinical signs: subclinical. Species: cervids, histopath: Minimal inflammation of pharyngeal lining

Lung Worms

-*Dictyocaulus viviparus,* high infestation rate

-Hosts: all species

-No intermediate hosts

-Signs: weakness, respiratory distress, patchy consolidation & pneumonia

-Gross: slender white nematodes 3-4 cm in length, filling trachea, bronchi, alveoli

-Histo: bronchointerstital pneumonia, numerous adults, larvae & eggs

Liver Flukes

-Fasciolodes spp-

Hosts: all species. Life cycle: require aquatic intermediates including snails

Aberrant hosts: variety of domestic ruminants Lesions: thick fibrous capsules in liver, migration tracts, black fluke pigment

Echinococcosis- Hydatid Disease

-*Echinococcous granulosis*- zoonotic disease

-Hosts: Carnivore definitive host: wolf, coyote, fox, small 3-5 mm long adult tapeworm in gi tract. Cervid intermediate host: -Lesions: numerous pale, fluid-filled cystic cavities in lungs and liver.

-Histopath: thick-walled fibrous capsule, protoscoleces & hydatid sand

Protozoan parasites

Trypanosomosis /Surra is a protozoal disease that can affect most mammals but is generally more severe in horses. An acute form of the disease, which is generally fatal unless treated, occurs in cattle, buffalo, deer, and other animals. This form is caused by Trypanosoma evansi and is transmitted by horse-flies. In deer, surra is usually chronic and is characterized by edema, anemia, emaciation, and nervous signs.Post -motem lesions may include emaciation of the carcass, anemia, and petechiae on some internal organs. Hydrothorax and ascites are sometimes seen. The spleen and lymph nodes may be enlarged. To detect trypanosomes, several thick and thin blood films should be made during the febrile phase and air-dried. Thick and thin slides may be also made from needle biopsies of the prescapular or precrural lymph nodes, and smears from any skin exudates. Post-mortem, impression smears should be collected from the lungs, liver, and kidney.In live animals, repeated sampling may be necessary to detect the organism.

Miscellaneous Conditions

Peritoneal Fibrosis

-Deer have very reactive peritoneum, similar to domestic ruminants -Fibrotic response may become excessive, fibrotic encapsulation of abdominal viscera -Similar to humans undergoing peritoneal dialysis for renal failure prior to modern dialysis machines

Tumors and Tumor-like Masses

Lymphosarcoma

- Sites: Lymph nodes, spleen, liver, kidney, lung heart, retrobulbar area

-No known association with retroviruses -Uncommon incidence

Cervids and Antlers

-Antlers are bony structures, covered with highly vascular velvet during growth, shed and regrown annually.-Physiology: -Pedicle is thickened periosteum and spongy bone from which the antler developes -Increasing daylight

stimulates antler growth -Antlers are the most rapidly growing tissue of any adult mammalian tissue; completely regenerates annually.-Antlers generally grow over a 3 to 6 month period, depending on species

Deformities: Antler -Genetic causes-Injury: directly to the growing antler or pedicle; indirect to contra-lateral hindlimb, or same-side front limb-Physiologic/endocrine: testosterone, estrogen, pituitary hormones, thyroid hormones, all play a role in controlling antler growth & development Antlers & Testosterone: -Castrated fawns never develop antlers -Increasing testosterone level results in velvet loss, cessation of growth, and eventual death of antler tissue - Decreasing testosterone leads to casting off antlers, and subsequent regrowth -Antlered deer which are castrated develop uncontrolled antler growth. - Antleromas

Trauma ; deer are highly prone for trauma since they are easily frightened. Shock and stress related death is also common among deer improperly handled.

Capture myopathy: Exertional myopathies are a group of diseases or exhaustive activity of the major muscle groups (gluteal, femoral and lumbar muscles).Main factors here is extensive running as result of being chased or frightened. Following skeletal muscle damage there is a massive release of myoglobin, aspartate aminotransferase (AST) and creatine kinase into the circulation. Results in myoglobinuria and death.

TECHNICAL INFORMATION FROM THE PARTICIPATING ZOO VETERINARIANS

TRANSPORTATION OF HERBIVORES

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1. Transport of one-homed Rhino from Kajirango National Park to Alipore Zoo, Kolkata

The Semi-Wild one horned Rhino "Ratul" was captured by me and my zoo staffs from the Kajirango National Park, Jaipaiguri, W.B. without tranquilization but by trapping with the transport cage kept below the ground and camouflaged with wallowing mud. It took 22 days to trap the animal from the wild. After trapping, the cage with the animal was lifted and loaded on a truck and transported to Alipore Zoo, Kolkata. Cooling of the body by spraying water was an important factor during transit and green fodder was fed to the rhino en-route to Kolkata.

2. Transport of four-horned antelope from Indira Gandhi Park Zoo, Rourkela to Nandankanan Biological Park, Orissa.

The lone, female four horned antelope was transported from Indira Gandhi Park Zoo, Rourkela to Nandankanan Biological Park, Orissa for the purpose of pairing and breeding. The animal was very shy and shock and stress during transport were avoided by fully covering the inner side of the transport crate with straw filled gunny bags.

3. Transport of Barking Deer from Indira Gandhi Park Zoo, Rourkela to Maitri Baag Zoo, Bhilai

A pair of Barking Deer was successfully transported from Indira Gandhi Park Zoo, Rourkela to Maitri Baag Zoo, Bhilai without any untoward incident.

4. Transport of Spotted Deer from Ramkrishna Mission, Khardah to sundarban in west Bengal.

Spotted deer - being shock prone to tranquilization - were captured by making passage with gunny bags leading to the transport cages placed serially one after another with drop gates. The animals were captured with no casualty and finally transported to Sundarban forests and successfully released.

TRANSPORTATION & TRANSLOCATION OF 85 SPOTTED DEER

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History of the deer population at Powai Garden

Before Independence some British Officers kept few spotted deer at their Bungalows. After independence these deer were shifted to the Powai garden run by Brihan Mumbai Municipal Corporation. The deer number increased to 85. Forest Department filed complaint against Municipal Commissioner for illegal captivity of deer. The P.C.C.F. had given order to release the deer in the wild. Sanjay Gandhi National Park has to take over the charge of translocation operation.

Procedure of Translocation

Deer were kept empty stomach for 24 hrs before translocation. They were not offered water for 16 hrs before translocation. As a routine, feed was offered to the deer in the circular enclosure. So after 4-5 deer entered inside the circular enclosure, door was closed from a distance.

Anesthetics used

Female - Xylazine 120 mg & Ketamine 120 mg ,

Male - Xylazine 150 mg & Ketamine150 mg.

After 10 minutes of induction, the veterinary team entered inside and blinds were tied over the eyes of all the animals. Deer were kept in the wooden cages specially designed for transport purpose. In a crate either two females or a male was kept. Only 5-6 deer were translocated twice in a week.

Laboratory Screening

Blood samples & dung samples were taken from 25 % of the animals (1-2 animals / batch). C.B.C , Serum testing for Brucellosis & Tuberculosis were carried out. Body weights were recorded. Avg wt. of female was - 40 kg & Avg. wt. of male - 60 kg .

All the samples were negative for infectious diseases like Brucellosis & Tuberculosis

Transportation

All the deer were kept in sternal recumbency with head extended on pillow underneath it. 4-5 cages were transported at a time in a truck . Body Temperature & respiration were monitored while transportation. Journey was of 2 hrs & the distance was about 80 km.

Complications observed during deer tranquilization

1.Hyperthermia 2.Hypoxia 3.Ruminal Tympany 4.Capture myopathy

In this operation we faced complications like hyperthermia & ruminal tympany . Hyperthermia was controlled by sprinkling cold water on the body or by giving cold saline i/v.

Few cases of ruminal tympany were observed as few deer were fed mistakenly by the garden authority prior to tranquilization.

Quarantine

Cages were unloaded through ramp slowly. If required antidote was given (Inj. yohimbine 1ml i/m). All the deer were kept in quarantine for one month in the special enclosure made at the release site. Fecal samples were collected again 3 weeks after translocation .

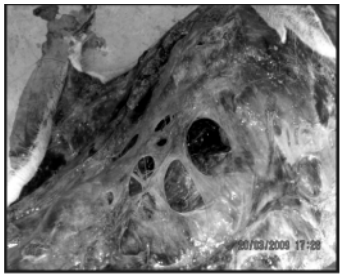

Release in the wild

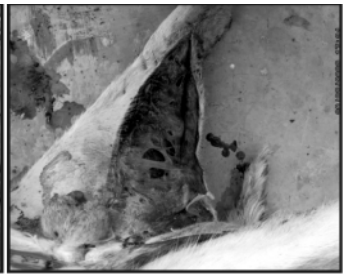
The deer were released in nature after close observation of the health status. A total of 74 healthy deer were released in the wild. 11 animals died in this operation, six due to excessive injury & five due to tympany. The entire operation took 3 months.

Post release monitoring

Close observation was carried out for six months by the forest guards from Tungareshwar sanctuary.

A deer was found dead after release due to capture myopathy.






All the above procedure of translocation & release of Spotted deer in Tungareshwar Sanctury was carried out as per I.U.C.N. guidelines.

STANDARDIZATION OF CAPTURE TECHNIQUES USING DROP NET FOR CROP RAIDING NILGAI BOSELAPHUS TRAGOCAMELUS AND TRANSPORT TO KUNO WILDLIFE SANCTUARY, THE PROPOSED SECOND HOME FOR THE ASIATIC LIONS

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Reasons for capture

(i) To remove the crop raiding - abundant Nilgai population from cultivated lands.

The main crops are wheat, mustard, maize, jowar, bajra and berseem fodder.

(ii) To enhance prey-base in Palpur Kuno Wildlife Sanctuary, the proposed second home for Asiatic lions (Panthera leo persica)

Period of study

February to June 2001.

Capture Site

In ravine thorn forests of Bhind District in Madhya Pradesh near Gwalior (latitude 250 5' - 26045' N and longitude 78 012' - 79 0 05' E).

Capture

Three Nilgai were captured by "Drop Net Method" using baits & water.

Sedation

After Drop Net Capture, each Nilgai was partially tranquilized to safely remove the animal from the entangled drop net. The animals were then radio collared and shifted to wooden transport crates.

Transportation

The animals in the wooden crates were transported 300 kms from the capture site to Kuno Wildlife Sanctuary in trucks and it took 12-15 hours to travel.

Relocation site

All the three Nlgai were successfully re-introduced in the Kuno Wildlife Sanctuary. The sanctuary is with tropical dry deciduous type of vegetation and is located between lattitude of 25030' -250 53' N and longitude of 770 07' -770 26' N in North -West Madhya Pradesh.

Post release monitoring

All the three released animals were seen in an area of 2-4 sq. km. with four other Nilgai.

CAPTURE AND TRANSPORTATION OF STRAYED OUT ONE HORNED RHINOCEROS FROM MANAS NATIONAL PARK, ASSAM

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History - One adult male One horned Rhino which was translocated from Pobitora Wildlife Sanctuary to Manas National Park, Assam was reported to have strayed out of the national park during the month of September 2008. The Rhino was finally captured after 14 days of operation in the field, near Bhutan Border on 14-09-2008 at 6 p.m by chemical immobilization and sent back to Manas National Park. The whole operation was carried out under the leadership of Director, Manas National Park, Assam.

Veterinarians involved in the operation were

1. Dr Bijoy Dutta , Associate Professor, College of Veterinary Science, Guwahati, Assam.
2. Dr Mohan Lal Smith, Forest Veterinary Officer, Assam State Zoo, Guwahati-5, Assam
3. Dr Bhaskar Choudhury, Veterinary Officer, Wildlife Trust of India, Assam

Logistics required during operation

1. Wooden cage having following specifications, built strongly to hold an adult Rhinoceros- Length: 3.30 m appx, Width: 1.80 mt appx and Height : 2.10 m appx

   Note: The "width-ends" should have facility to open and close as per requirement (both sides)
2. Wooden sledge of size: Length: 3.20 m appx and Width: 1.30 m appx
3. Five to six numbers of departmental Elephants to trace and chase the Rhino from the place of escape.
4. One tractor, One Excavator to pull and push the sedated Rhino with sledge and place into the Wooden cage safely.
5. Crane to place wooden cage from truck to the ground to load the sedated Rhino and thereafter to load the cage with Rhino for onward journey to the destination.
6. Good numbers of forest officials for over all management of the operation.

Season during operation

It was rainy season and there were water bodies everywhere and chemical immobilization was not carried out to avoid drowning. It took 14 days to complete the operation because of the water bodies in the field.

Place of rescue:- The Rhino was rescued at Kalcheni Nepali Basti under Tamulpur Subdivision of Assam.(near Butan Border)

Chemical Immobilization

Darting was done with help of Dist inject rifle and brown cartridge in the neck muscle with 1.5 ml Large Animal Immobilon (containing 2.25 mg Etorphine hydrochloride and 10 mg Acepromazine per ml). 10 ml Steroid injection (Inj.Enidex) and 10 ml Vitamin E and Selenium Injection (Inj. E Care Se Injection) were administered. After this, the Rhino was placed and loaded into the wooden cage and 1.5 ml of Large Animal Revivon (containing Diprenorphine hydrochloride 3.26 mg per ml) by i/m was given.. As there was no sufficient light facility, the reversal injection was administered intra-muscularly. The Rhino revived within three minutes of reversal injection.

Dose

The following dosage was used during chemical immobilization.

1. Etorphine hydrochloride @ 1 mg/500 kg body weight
2. Diprenorphine hydrochloride @ 1.45 times of Etorphine hydrochloride i.e. 1ml Large Animal Revivon against 1 ml of Large Animal Immobilon.

Time of darting and completion of operation

The rhino was darted at 6 p.m. after sun set and it took about one hour and forty five minutes for entire operation from sedation, placing the rhino in the cage, loading into the truck and reversal. All steps had to be carried out in the dark with the help of gas and torch lights.

Transportation

The Rhino was loaded in the truck and transported 120 km away from the place of rescue during the night time at a constant speed of 40 km/hour with four stoppages in between and the rhino was released in the Manas National park at 7:30 A.M.

Precaution taken during transportation

1. The speed of the transporting vehicle was controlled.
2. Checking the condition of Rhino at the stopping points.
3. Frequent spraying of water over Rhino's body during transportation.
4. Acepromazine Injection was kept ready to administer in case the Rhino becomes uncontrollable in the crate.

Constraints during the operation

1. It was very difficult to avoid water bodies during the month of September 2008 and hence, it took 14 days to complete the operation. All possible measures were taken to avoid drowning.
2. The rescue operation had to be carried out during dark- an uncomfortable situation.
3. Overcrowded people at the place of rescue were also a problem during the operation.
4. Expensive.
5. The Rhino was crossing human habitations (village after village) daily.

Conclusion

Very long, tiresome, but successful rescue operation without any casualty of human beings as well as of Rhino and departmental Elephants.

TRANSPORT OF ADULT OSTRICH FOR LONG - DISTANCE

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The experience shared is related to transport of Ostrich for 1600 km

1. Use the truck of size 8 ft × 6 ft with height of 7 ft.
2. Place river sand up to 3 inches thickness and paddy straw up to 2 inches.
3. Place plastic sheets over the truck partially and keep 30 per cent area open for ventilation.
4. Properly restraint the ostrich (hold the wings and put the neck downwardly, so that it could not kick others or run) and make them to walk by properly using a wooden plank as ramp.
5. Provide food and water adlibitum in their old utensils.
6. Acclimatize the bird in the truck for few days.
7. Provide rut for every 3 - 4 hr.
8. Mix B - complex liquid in drinking water.
9. Proper quarantine is a must after the arrival.

TRANQUILIZATION OF DEERS (PRECAUTIONS AND DOSAGE)

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Precautions:- The following precautionary measures are to be taken in tranquilizing deer

1. There ambient temperature should be optimum.
2. Morning time is best suited for tranquilization and should be preferred.
3. The animal should not be in restless state and should not be stressed.
4. There should not be panting type of respiration.
5. Preferably fast the animal at least 24hours prior to tranquilization.
6. Animal should not to be tranquilized near water bodies.
7. The terrain should be preferably plain area and surface should not be undulating.
8. After tranquilization, the animal should be revived as quick as possible.

Drug doses for different species of deer (Practical doses)

Name of the species	Etorphine	Xylazine (100mg per ml)	Hellabrunn Mixture (Xylazine + Ketamine) (100mg per ml)	
			Male	Female
Eland	3ml	-	6 ml + 3 ml	3 ml + 1.5 ml
Nilgai	1ml	-	5 ml + 3 ml	4 ml + 2 ml
Sambar Deer	1ml	-	4 ml + 2 ml	3 ml + 1.5 ml
Spotted Deer	0.5ml	-	3 ml + 1.5 ml	2.5 ml + 1 ml
Swamp Deer	1.5ml	-	4 ml + 2 ml	3 ml + 1 ml
Black Buck	-	1ml	1 ml + 0.5 ml	0.5 ml + 0.5 ml
Sangai Deer	-	-	3 ml + 1.5 ml	2.5 ml + 1 ml
Hog Deer	-	1ml	1 ml + 0.5 ml	1 ml +ye
Barking Deer	-	1ml	0.5 ml + 0.5 ml	-
Chowsingha	-	-	1 ml + 0.5 ml	0.5 ml + 0.5 ml
Chinkara	-	1ml	0.5 ml + 0.05	0.5 ml + 0.05
Goral	-	-	2 ml + 1 ml	0.5 ml + 0.5 ml

TRANSPORTATION OF ONE PAIR ROYAL BENGAL TIGER FROM SANJOY GANDHI ZOOLOGICAL PARK,PATNA TO SEPAHIJALA ZOOLOGICAL PARK,AGARTALA

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In the Sepahijala Zoological Park since 2002 there was no tiger. Considering the conservation value & public demand we started searching for one pair Royal Bengal Tiger for captive rearing. Ultimately Chhatbir Zoo, Chandigarh agreed to spare one pair Royal Bengal Tiger in exchange of two pair Leopard cat, one pair Common palm civet, one pair Pigtailed macaque & one Himalayan Black bear. CZA has approved the deal vide no 23-6/2005-CZA dt 07/08/06 & accordingly Tripura State Govt. also approved the deal. It was decided the exchange of animals will be held at Sanjoy Gandhi Zoological park,Patna.

Before starting the journey I examined the health condition of all the animals to be transported & found healthy. Also I thoroughly checked the transportation container whether inner surfaces are completely free of any projecting nails, screw or any other sharp material which could cause injury to the animals. As it was long journey I instructed to provide suitable bedding material in the container. During transportation I kept with me some sedative drug, necessary medicines for wound management & restraining equipment. In every container only one animal was allowed.

After the completion of all these arrangement I started journey on 15/12/06 accompanied by Curator, zoo, head guard & two efficient worker. We generally performed journey during day time & avoid night journey as the climatic condition was very cold. Every before journey I used to examined the health condition of the animal after the cleaning of container. Then sufficient food & water used to provide to each animal. During the transportation period the animal was disturbed as little as possible.

Ultimately we reached at Sanjoy Gandhi Zoological park,Patna on 19/12/06 at 1.30 AM. On the next day I handed over two pair Leopard cat, one pair Common palm civet, one pair Pigtailed macaque & one Himalayan Black bear to Chhatbir Zoo party in good health condition and also they handed over me one pair Royal Bengal Tiger in good health condition.

Again we started journey on 21/12/06 and reached at Sepahijala Zoo on 25/12/06. After reaching at the Zoo both the Tiger released in the quarantine box in front of the Forest minister, Tripura and other dignitaries. This pair was kept in quarantine box for one month & then released in the enclosure.

In this way we successfully completed the exchange programme of wild animals between Chhatbir Zoo, Chandigarh & Sepahijala Zoological park.

TRANSPORTATION OF ANIMALS FROM MYSORE - SRICHAMARAJENDRA ZOOLOGICAL GARDEN

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Followings are informed with regard to transfer of birds from between countries:

- Need of following of proper guidelines as quoted in the IATA specifications
- Capture the birds in the early morning
- Burlap sacs stuffed with paddy straw may be of useful to pad all the sides of the transport vehicle
- Open rings made of PVC may be used to tag the birds under transport
- Sexing and disease screening need to be carried out before translocation of birds
- Proper quarantine is a must at arrival place

TRANSPORTATION OF DEER - AAZP EXPERIENCE

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This article is based on the observations during capture and transport of different deer species on various occasions at Arignar Anna Zoological Park, Vandalur and surrounding areas.

Reasons for intervention

- Rescue of strayed animals
- Treatment
- Removal of habituated animals that beg in the visitors' area
- Collection of materials
- Shifting between enclosures
- Exchange between zoos

The following activities ensured successful capture and transportation:

- Blindfolding
- Position
- Tying the legs
- Sedation

Blindfolding

As you know, deer are highly susceptible to capture shock, utmost care should be exercised to minimize the stressors. When the deer is restrained either physically or chemically, it must be blindfolded and if possible ears may be plugged by using cotton to reduce the excitement. Once blindfolded, the deer will lie quietly. Before release, the blindfold and ear plugs should be removed. There are cases where the ear plugs were not removed and the released deer were killed by predators.

Position

All ruminants should be positioned in sternal recumbency if they have to be. During transport, deer should not be allowed to go to lateral recumbency, either they should stand or go to sternal recumbency. The crate may be designed accordingly.

Tying the legs

Deer should be transported without tying the legs. If the legs have to be tied, all four should not be tied together. If tied, the deer will go to lateral recumbency. It is better to tie both the forelimbs and both the hindlimbs together. If the legs are tied, gunny bags filled with paddy straw should be kept on both the sides to prevent lateral recumbency. Head should be held high always.

Sedation

Mild to moderate sedation should be given during transport. This will avoid the unnecessary excitement that arise from the movement of the vehicle, confinement, noise…etc.

- Deer are short sighted animals. So if they are confined in a place covered by chain link, they will try to escape and hit repeatedly over the chain link. Deer that fell dead after hitting the chain link during confinement have been observed in the zoo. So use of opaque sheets will prevent this problem. That's why, during mass capture operations in Africa, opaque sheets are being used to confine herbivores.
- Supplementation of Vitamin - E and Selenium: Deer that is deficient in Vitamin - E and Selenium is highly prone for capture shock. But studies report that supplementation should be started at least a month before the capture operation.
- The captured deer will develop respiratory acidosis and hyperthermia and have to be treated accordingly.