CAPTURE AND IMMOBILIZATION OF EXOTIC SMALL RUMINANTS

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Nondomestic small ruminants can be encountered on exotic animal or cervid ranches on breeding farms, in zoos or petting farms, and even as pets. Species commonly kept outside of a zoological institution include:

- Cervids: North American species such as elk (*Cervus elaphus* sp) white tail deer (*Odocoileus virginianus*) and reindeer (*Rangifer tarandus*) or Eurasian species such as sika deer (*Cervus nippon),* fallow deer (*Dama dama*), axis deer (*Axis axis*), red deer (*Cervus elaphus*), and muntjac (*Muntiacus muntjak*)
- Antelope: Scimitar-horned oryx (*Oryx dammah*), addax (*Addax nasomaculatus*), blackbuck (*Antilope cervicapra*)
- Nondomestic sheep and goat species: Mouflon (*Ovis musiman*), aoudad (*Ammotragis lervia*), bighorn sheep (*Ovis canadensis*), and mountain goats (*Oreamnos americanus*)

To get "hands on" most exotic small ruminants will require manual restraint using a hydraulic squeeze or drop floor chute or immobilization The approach to restraint and anesthesia for these species will be governed by the level of habituation to handling and human contact, the handling facilities (holding pens, raceways and squeeze chutes) available, and the animal handling expertise of the caretakers. All ruminants are prey species and flight is likely their first response to any threat. The more intensively reared or tame the animals, the easier they will be to work and decreasing the flight zone will make the capture or immobilization procedure less unpleasant and stressful for the animal, the handler, and the veterinarian.

MANUAL RESTRAINT

A properly set up chute and squeeze system is often the most economical, efficient and safest method for handling exotic small ruminants. A standard squeeze chute (with or without a head catch) is utilized for larger animals such as elk. A drop floor chute (where after entering the chute, the floor is dropped leaving the animal suspended) is appropriate for deer and antelope species. The drop floor chute decreases struggling and allows the animal to be safely handled with minimal stress. The width of the drop floor chute can be adjusted to accommodate a variety of species. Most chute systems allow access to the front and rear of the animal and also the back and legs, thus enabling the producer or clinician to perform routine husbandry procedures, disease testing, and reproductive manipulations. The tops of the chutes are wide to allow for horns and antlers. Once in the chute the animal should be blindfolded to reduce visual stimulation. If the head, ears, antlers, or horns are manipulated then a halter can be applied and the head tied. Local anesthetic, sedation, or immobilization agents can be administered within the chute.

The design of the sorting and holding pens and runways leading to the chute should incorporate principles developed for safely moving domestic cattle, sheep, and farmed deer. A circular pattern layout with, non-slip solid footing, adequate lighting, and appropriate visual barriers are recommended for decreasing stress during the handling of any grazing species. Any unnecessary noise should be minimized and lighting should be adequate but muted. Elevated catwalks facilitate animal handling but should never go over the top of chute area as animals will become distracted by what is above them and reluctant and fearful to move forward. Animals should be restrained and handled gently but firmly and it is important that they feel secure and balanced in the squeeze. Reports from feedlots have shown that gentle handling of cattle resulted in less bruising and neck or shoulder injuries, as well as a decrease in the number of sick animals and in the time it took for animals to return to feed after being handled.

IMMOBILIZATION

If a chute system is not available or practical then sedation or immobilization may be necessary. Extremely tame (hand raised) animals may allow administration of anesthetic agents by hand syringe either intramuscularly (IM) or intravenously (IV). Pole syringes or jab sticks can be utilized on animals that can be confined to small pens or stalls. Remote delivery systems involving darts ("flying syringes") delivered by blow pipe, dart pistol or rifle are available (Telinject USA, www.telinject.com; DAN-INJECT of North America, www.daninjectusa.com; Pneu Dart, www.pneudart.com) and can be utilized for animals in large pens or pastures. The Telinject and DAN-INJECT darts utilize compressed air to depress the plunger within the dart and the Pneu Dart system utilizes either a powder charge or spring and charge system. Pistols and rifles are powered by CO_2 cylinders or .22 caliber charges or compressed air. The Telinject and DAN-INJECT darts and needles can be reused whereas the Pneu Darts are designed for single use. Darts come in a variety of sizes from 1 to 10 mL. The Telinject and DAN-INJECT systems require larger rifle barrels for darts over 5 mL, whereas any size Pneu dart fits within their barrel. Pneu Dart barrels have also been manufactured to fit DAN-INJECT rifles so that these CO_2 powered rifles can fire Pneu darts.

IMMOBILIZATION AGENTS

It is beyond the scope of this paper to list specific drugs and dosages for exotic small ruminants. However, there are excellent references that provide such information for all species.[1-4]

The ideal immobilization drug for any species has a wide safety margin, small volume for delivery, and is fully reversible. A small volume will facilitate rapid

administration especially if remote delivery systems are used. Concentrated solutions of medetomidine (10, 20, 40 mg/mL) are available (ZooPharm, www.zoopharm.net). Ketamine can be lyophilized and reconstituted at 200 to 250 mg/mL, although it often will crystallize out of solution in cold temperatures. Tiletamine has largely replaced ketamine due to its greater potency and faster onset. Telazol (tiletamine 250 mg and zolazepam 250 mg) is reconstituted with 5 mL of sterile water per label instruction to a concentration of 100 mg of combined drug/mL. However, it can be made up with a smaller volume of water to increase the concentration to 250 mg of combined drug/ml, or reconstituted with an alpha-2 agonist. It is important that bottles containing these cocktails are well labeled with the resulting formulation including the mg/mL of each drug and the date of preparation.

The potent opioids (carfentanil, etorphine, fentanyl) or cocktails containing these drugs are often used in the immobilization of captive exotic or free-ranging small ruminants. These agents meet the ideal drug profile in that they have a wide margin of safety for most hoofed animals, low delivery volume, and are fully reversible. However, many factors including high cost, stringent regulations involving use of a Drug Enforcement Agency Schedule 2 narcotic, and human safety concerns make the use of these drugs impractical for the average practitioner. As an alternative all small ruminants can be effectively and safely immobilized with drug cocktails that do not contain these potent narcotics.

Alpha-2 agonists (xylazine, medetomidine, detomidine) combined with a cyclohexylamine (ketamine or Telazol [tiletamine and zolazepam]) are the most common non-narcotic mixtures used for immobilizing exotic hoofed stock. Cyclohexylamines have a wide margin of safety; however, the volume of delivery, especially with ketamine, is large and they cannot be reversed. Combining ketamine or Telazol with an alpha-2 agonist balances out the excitement, convulsions, and muscle hypertonicity that may be seen when using only a dissociative. The addition of the alpha-2 agonist also decreases the dosage of ketamine or Telazol required (increasing the reversibility of the combination) and enhances sedation and analgesia. As a rule of thumb, the alpha-2 should not be reversed sooner than 30 and ideally 60 minutes after induction if the combination contained ketamine or Telazol. This usually allows enough of the cyclohexylamine to be metabolized before the alpha-2 is reversed. The opioid agonist-antagonist butorphanol or the butyrophenone tranquilizer azaperone are often added into these cocktails to enhance sedation. Butorphanol can be antagonized with the opioid antagonist naltrexone; azaperone has no antagonist and is often used to smooth the recovery. A new combination that has been used effectively in cervid species is butorphanol, medetomidine, and azaperone or BAM (ZooPharm, www.zoopharm.net). The advantage of BAM is that the butorphanol and medetomidine are fully reversible, greatly shortening recovery times over cyclohexylamine-based combinations.

The butyrophenone tranquilizer haloperidol along with the long-acting neuroleptics (LANs) such as zuclopenthixol and perphenazine are used to calm extremely flighty species before transport, group introductions, or game auctions. These agents are commonly used in wildlife capture in Africa. Long-acting neuroleptics cause a decrease in motor activity, reduce excitement, and relieve anxiety. Extrapyramidal side effects may occur from overdose or individual or species sensitivity and can range from repeated licking, chewing, or facial movements to agitation, circling, and altered levels of consciousness.

Haloperidol is frequently administered to animals immediately at capture. It has a relatively short period of onset with initial sedation occurring within 15 minutes and lasting for 8 to 12 hours. It may be utilized as a sole agent or administered in conjunction with a LAN. As the sedative effect of the haloperidol is decreasing the LAN is beginning to take effect and sedation may last for 7 to14 days. Haloperidol appears to be absorbed orally in ruminants and can be utilized in captive settings prior to transportation, introductions, or medical procedures.

PLANNING AN IMMOBILIZATION

Attention to detail in preparing for a capture or immobilization may be the greatest predictor of a successful outcome. Fear, anxiety, perception of danger, novel environments, and crowded conditions all cause stress in animals and are usually present to varying degrees during a capture or immobilization event. Every effort should be made to reduce these stressors by; providing visual barriers (blindfolds), decreasing extraneous noise (ear plugs, no unnecessary talking), having an adequate number of well-trained animal handlers, and utilizing proper equipment and facilities.

Animals should be confined to the smallest enclosure in which they can be safely worked. Multiple gates to separate herd mates once the animal has become heavily sedated or immobilized should be available. If the enclosure is small then a visual barrier should be in place so that the person shooting the dart is able to remain outside of the animal's flight zone thereby reducing agitation of the animal and the herd prior to immobilization. If the immobilization area is a field or pasture then it should be assessed for potential hazards such as bodies of water, ditches, steep terrain and dense tree cover or brush and contingency plans made to remove or deal with animals in the event that they become recumbent in such areas.

As much focus should also be placed on the recovery phase of the immobilization. Ideally the animal should be held in a quiet, small, secure area with level footing. Animals should be separated from herd mates until they regain control as individuals that act abnormally may be attacked and injured.

MONITORING AND EMERGENCIES

Hyperthermia is a common problem during the immobilization of exotic ruminants and body temperature should be monitored throughout the procedure. An animal's internal temperature may increase from physical exertion as well as psychological stress and fear and the response of the thermoregulatory center to changes in temperature is decreased by immobilization agents such as tranquillizers and sedatives. Hyperthermia may predispose the animal to metabolic complications such as capture myopathy, or if the body temperature increases above 109°F (43°C) death may occur. As the ambient temperature increases it becomes more difficult for animals to dissipate heat and ideally a capture or immobilization should be planned for a cool, cloudy day with temperatures less than 77°F (25°C).

Animals should be fasted for 12 to 24 hours to decrease the incidence of regurgitation and bloat; however, in a free-range setting this may be difficult. Thus during the immobilization care should be taken to protect the airway by maintaining the animal in sternal whenever possible (which will decrease the pressure of the abdominal viscera on the diaphragm) and by placing the head with the nose and mouth below the level of the ears to allow saliva or regurgitated rumen contents to drain. If the terrain is not level then the animal should be positioned with the thorax above the level of the abdomen to decrease pressure from the abdominal viscera. Horns and antlers can complicate head placement but make useful handles for positioning the head. Be aware that antlers in velvet are a living part of the animal. The velvet contains nerves and a rich supply of blood vessels and should be handled gently to avoid damage.

Many immobilizing drugs as well as the act of recumbency can lead to hypoxemia in the anesthetized ruminant. Hypoxemia if severe and left untreated can lead to cardiac arrhythmias, organ function compromise, adverse metabolic changes such as capture myopathy, and even death. It is strongly advised that supplemental oxygen is provided to maintain the SpO_2 level above 95%. Nasal insufflation can be accomplished with a small non-cuffed endotracheal tube that is advanced to the level of the medial canthus of the eye. A flow rate of 6 to 8 L/min is usually adequate for smaller species such as white-tail deer; larger species such as elk may require 10 L/min.[4,5]

Capture myopathy is a syndrome that is not infrequently seen during capture and handling events in exotic small ruminants and is somewhat similar to exertional rhabdomyolisis in humans and horses. However, the pathogenesis of capture myopathy not only includes muscular activity but the sympathetic nervous and adrenal systems as well as perception of fear. Capture shock is the acute manifestation of capture myopathy in which the animal develops tachypnea, tachycardia, hyperthermia, hypotension, and depression usually followed by death within 1 to 6 hours. Less acute syndromes occur from the sequela to muscle necrosis and metabolic abnormalities and include severe myoglobinuria with resulting renal failure or acute rupture of the gastrocnemius muscle. Treatment is usually unsuccessful and prevention is the most effective way to manage capture myopathy.

REFERENCES

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HANDLING EQUIPMENT

1. JK Reid. 7647 Wellington County Road 10, R.R.#1 Moorefield, ON, Canada, www.jkreid.com.
2. JDL Longhorn, Inc. 39637 260th Ave., Pittsfield, IL, 62363, www.jdlsalesinc.com