

# IMMOBILIZATION OF CAPTIVE NON-DOMESTIC HOOFSOCK WITH CARFENTANIL

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## Introduction

Many factors complicate the field immobilization of semi-free ranging exotic hoofstock. Injuries may occur when an animal encounters obstacles in its enclosure; ditches, ponds, trees, steep hillsides and rocks are all potential sources of animal trauma during an immobilization. The opportunity to run, pace or prance in wide open spaces during the induction period can lead to hyperthermia, metabolic collapse, and/or myopathy. Additionally, the inability to control food and water intake increases the chance of passive regurgitation with resultant aspiration pneumonia. This is a particular problem for the large members of the subfamily bovinæ.

Some of these problems can be minimized by using a rapidly acting immobilizing agent such as carfentanil, an extremely potent synthetic opiate. Small volumes of the drug can be administered by relatively atraumatic low volume darts. In general, carfentanil produces more rapid induction and immobilization with greater tractability and safety than previously available narcotics.

The majority of published reports on carfentanil immobilization of exotic hoofstock describe experience with members of the family Cervidae and the subfamily Caprinae.<sup>3,4,6,7,8,9</sup> Species diversity is lacking in the remaining reports<sup>1,2,5</sup> Although these reports have added to our understanding and clinical experience with carfentanil, many species of exotic hoofstock that are commonly exhibited in zoological collections in the United States and that pose problems with immobilization are underrepresented or missing entirely.

This report presents generalized doses and experiences from a large (328 immobilizations) and diverse (49 species) series of exotic hoofstock immobilizations performed at the San Diego Wild Animal Park in 1986.

## Materials and methods

A total of 328 exotic hoofstock immobilizations were conducted during 1986. These included representatives of 49 species from 2 families and 7 subfamilies. An additional 5 immobilizations from southern white rhinoceroses are included. Carfentanil (Wildnil, Wildlife Laboratories, P.O. Box 8938, Fort Collins, CO 80525). injections were administered via a plastic projectile syringes (Vario Dart, Telinject USA, Inc., 9316 Soledad Canyon Rd., Saugus, CA 91350). Immobilizations were conducted to facilitate

health examination, relocation and shipping. Accurate body-weights were obtained on 16% of all animals immobilized. The time from initial injection to recumbency (induction time) was recorded. Animals were observed for a minimum of 48 hours post-immobilization for complications.

Reversal procedures included 3 regimens: (a) diprenorphine (M50-50, Lemmon Company, Sellersville, p A 18960). given iv and im, each injection being 5 times the carfentanil dose, or (b) nalmefene (Nalmefene (experimental drug), Schering Research, Miami FL 33169) given iv at 10 times the carfentanil dose, or (c) nalmefene given iv and im, each injection being 10 times the carfentanil dose.

Supplementary drugs included ketamine (Ketaset, Bristol Laboratories, Syracuse, NY 13201) or glyceryl guaiacolate (Glyceryl Guaiacolate, Western Medical Supply Inc, Arcadia, CA) given iv as necessary to enhance muscle relaxation and allow safe handling. Xylazine (Rompun, Bayvet Division, Miles Lab Inc., Shawnee, Kansas 66201) was used in a few immobilizations as a premedication agent or simultaneously with carfentanil. The concurrent use of xylazine with carfentanil occurred primarily with members of the family cervidae and to a lesser extent the Hippotraginae. Premedication with xylazine (im) was only possible for animals that were confined to small pens. This was done in a limited number of cases involving animals in the subfamilies Bovinae and Reduncinae. When xylazine was used, it was antagonized with yohimbine iv at 0.1 mg/kg bodyweight.

Most of the immobilizations were done under semi-free ranging conditions at the San Diego Wild Animal Park and no control of food or water consumption was possible. Some of the animals that were confined to a pen were fasted from food for 24 to 48 hours with a 12 hour water fast prior to the immobilization.

## **Results**

Of the 328 immobilizations, the largest number were with the subfamily Hippotraginae and the least with rhinoceros. Reference dosages are listed by animal group (Table 1) and species (Table 2).

Premedication with xylazine decreased muscle rigidity and kicking in recumbent animals. However, premedication under semi-free ranging conditions is difficult due to the large and diverse territory in the exhibit and the flighty behavior of many exotic hoof stock. When xylazine was combined with carfentanil (in cervidae and a few hippotraginae), a calmer, more relaxed animal resulted as compared to the use of carfentanil alone. In those xylazine/carfentanil immobilizations, it was important to wait an additional 5 to 10 minutes following recumbency to gain the benefits of xylazine (increased relaxation and decreased kicking). Premature handling of the animal negated these effects. This also emphasized the importance of premedication when possible.

Post-immobilization complications were minimal. Animals receiving supplementary drugs (ketamine, glyceryl guaiacolate) appeared slightly groggy for 30-60 minutes following reversal, but this was felt not to be clinically detrimental.

## Discussion

This study involved a large number of animals representing diverse taxonomic groups. In general, the subjective quality of the immobilizations and reversals was good. Members of the subfamily Hippotraginae and Reduncinae consistently showed the greatest amount of kicking and increased muscle rigidity. This dangerous activity coupled with their large body size made them good candidates for supplementary drugs.

Initial evaluation of xylazine premedication followed by carfentanil was beneficial and useful in animals that were confined to holding pens or small exhibits. In large exhibits with swift, flighty animals, when premedication was not possible, a single dart with carfentanil or carfentanil in combination with xylazine was recommended.

The major advantages of carfentanil over other immobilizing agents for exotic hoofstock noted in this study are that it had a rapid induction time, was delivered in small volumes and was used safely in a diverse number of species.

Included is a reference dosage table (Table 2) listing the average total dose for normal adult animals of various species. This table is meant to be used as a starting point reference for semi-free ranging normal animals. General body condition and health status of individual animals must be taken into consideration when determining actual dose administered.

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Table 1. Data for Carfentanil immobilization of exotic hoofstock

Animal Group	n	Mean Bodyweight (kg)	Mean Dose (mg)	Mean Dosage (ug/kg)	Mean Induction time (minutes)
Rhinocerotidae	5	1627	1.0	0.6	14.2
Cervidae	56	63	0.8	12.6	5.0
Tragelaphinae	23	181	2.0	11.0	5.0
Hippotraginae	80	113	2.3	20.3	4.5
Reduncinae	36	116	2.0	17.2	4.3
Alcelaphinae	17	140	1.3	9.3	6.8
Antilopinae	44	37	1.0	27.0	5.2
Caprinae	59	57	1.1	19.3	4.4
Bovinae	8	681	5.0	7.3	5.25

Table 2. Carfentanil reference dosage table

SUBFAMILY / SPECIES	COMMENTS	ADULT ♂ Normal, Semi-free Ranging		ADULT ♀ Normal, Semi-free Ranging	
		AVERAGE TOTAL DOSE (mg)	ADDITIONAL DRUGS	AVERAGE TOTAL DOSE (mg)	ADDITIONAL DRUGS
<b>RHINOCEROTIDAE</b>					
Southern White Rhinoceros ( <i>Ceratotherium simum</i> )	Incomplete reversal noted with M50/50 antagonist.	1.2	none	1.2	none
<b>CERVIDAE</b>					
European Fallow Deer ( <i>Cervus dama dama</i> )	Dopram usually given to stimulate respiration.	1.2	none	1.2	none
Indian Hog Deer ( <i>Cervus porcinus porcinus</i> )	Dopram usually given to stimulate respiration. Require careful monitoring.	0.45	none	0.3	none
Barasingha ( <i>Cervus duvauceli duvauceli</i> )	Dopram usually given to stimulate respiration. Prone to sudden rear leg kicks when down.	2.1	none	2.1	none
Javan Rusa ( <i>Cervus timorensis rusa</i> )	Dopram usually given to stimulate respiration.	0.6	15mg Xylazine	0.6	15mg Xylazine

SUBFAMILY / SPECIES	COMMENTS	ADULT ♂ Normal, Semi-free Ranging		ADULT ♀ Normal, Semi-free Ranging	
Malayan Sambar ( <i>Cervus unicolor malaccensis</i> )	Dopram usually given to stimulate respiration. Prone to sudden rear leg kicks when down.	0.9	5mg Xylazine	0.6	5mg Xylazine
Indian Sambar ( <i>Cervus unicolor niger</i> )	Dopram usually given to stimulate respiration.	2.1	30mg Xylazine	1.2	15mg Xylazine
Indo-Chinese Sika ( <i>Cervus nippon pseudaxis</i> )	Dopram usually given to stimulate respiration.	0.6	none	0.6	none
Formosan Sika ( <i>Cervus nippon taiouanus</i> )	Dopram usually given to stimulate respiration.	1.5	none	1.5	none
European Roe Deer ( <i>Capreolus c. capreolus</i> )		0.6	none	0.6	none
TRAGELAPHINAE					
East African Sitatunga ( <i>Tragelaphus spekii spekii</i> )		0.9	none	0.9	none
South African Greater Kudu ( <i>Tragelaphus s. strepsiceros</i> )	Dopram usually given to stimulate respiration. Prone to excessive running during induction. Xylazine premed recommended	3.0	35mg Xylazine	2.7	25mg Xylazine
Nilgai ( <i>Boselaphus tragocamelus</i> )	Prone to excessive running during induction.	3.9	none	3.0	none

SUBFAMILY / SPECIES	COMMENTS	ADULT ♂ Normal, Semi-free Ranging		ADULT ♀ Normal, Semi-free Ranging	
East African Eland ( <i>Taurotragus o. pattersonianus</i> )	Prone to excessive running during induction. Generally difficult to immobilize.	6.0	50mg Xylazine	6.0	50mg Xylazine
East African Bongo ( <i>Tragelaphus e. isaaci</i> )		2.0	none	1.5	none
HIPPOTRAGINAE	Prone to renarcotize. Vocalize during immobilization. Generally difficult to immobilize.				
Gemsbok ( <i>Oryx gazella gazella</i> )		3.0	none	2.7	none
Fringe-eared Oryx ( <i>Oryx gazella callotis</i> )		3.0	10mg Xylazine	2.7	5mg Xylazine
Scimitar-horned Oryx ( <i>Oryx gazella dammah</i> )		3.0	10mg Xylazine	2.5	none
Arabian Oryx ( <i>Oryx leucoryx</i> )		3.0	5mg Xylazine	2.7	5mg Xylazine
Addax ( <i>Addax nasomaculatus</i> )		2.4	10mg Xylazine	1.8	10mg Xylazine
REDUNCINAE					
Ellipsen Waterbuck ( <i>Kobus e. ellipsiprymnus</i> )	Prone to excessive running during induction.	3.0	25mg Xylazine	3.0	none
Defassa Waterbuck ( <i>Kobus e. adolfi-friderici</i> )	Prone to excessive running during induction.	4.5	none	3.6	none

SUBFAMILY / SPECIES	COMMENTS	ADULT ♂ Normal, Semi-free Ranging		ADULT ♀ Normal, Semi-free Ranging	
Zambesi Lechwe (Kobus leche leche)	Prone to sudden rear leg kicks when down. Prone to excessive running during induction.	1.8	none	1.5	none
Kafue Lechwe (Kobus leche kafuensis)	Prone to sudden rear leg kicks when down. Prone to excessive running during induction.	1.5	5mg Xylazine	1.2	none
Nile Lechwe (Kobus megaceros)	Prone to sudden rear leg kicks when down. Prone to excessive running during induction.	2.1	none	1.5	none
Uganda Kob (Kobus kob thomasi)		2.1	5mg Xylazine	2.1	5mg Xylazine
ALCELAPHINAE					
Blesbok (Damaliscus dorcas phillipsi)		1.2	none	1.2	none
White-tailed Gnu (Connochaetes gnou)		1.5	none	1.2	none
Eastern White-bearded Gnu (Connochaetes t. albojubatus)		1.5	none	1.5	none
ANTILOPINAE					
Blackbuck (Antilope cervicapra)		1.5	none	1.2	none



SUBFAMILY / SPECIES	COMMENTS	ADULT ♂ Normal, Semi-free Ranging		ADULT ♀ Normal, Semi-free Ranging	
Kenya Impala ( <i>Aepyceros melampus rendilis</i> )	Dopram usually given to stimulate respiration. Require careful monitoring.	1.5	none	1.2	none
Angolan Springbok ( <i>Antidorcas m. angolensis</i> )		0.9	none	0.9	none
Roosevelt's Gazelle ( <i>Gazella granti roosevelti</i> )		1.5	none	1.2	none
Addra Gazelle ( <i>Gazella dama ruficollis</i> )	Prone to excessive running during induction.	1.0	none	1.0	none
Mhorr Gazelle ( <i>Gazella dama mhorr</i> )		1.8	none	1.5	none
Persian Gazelle ( <i>Gazella s. subgutturosa</i> )	Prone to excessive running during induction.	1.5	none	1.2	none
Sand Gazelle ( <i>Gazella subgutturosa marica</i> )	Prone to excessive running during induction.	0.75	none	0.6	none
Slender-horned Gazelle ( <i>Gazella leptoceros</i> )		1.0	none	0.9	none
Thompson's Gazelle ( <i>Gazella t. thomsoni</i> )		1.2	none	1.0	none
SAIGINAE					

SUBFAMILY / SPECIES	COMMENTS	ADULT ♂ Normal, Semi-free Ranging		ADULT ♀ Normal, Semi-free Ranging	
Russian Saiga ( <i>Saiga tatarica tatarica</i> )	Dopram usually given to stimulate respiration. Prone to excessive running during induction. Require careful monitoring.	2.1	none	2.1	none
CAPRINAE					
Armenian Mouflon ( <i>Ovis orientalis gmelini</i> )		1.5	none	1.2	none
Afghan Urial ( <i>Ovis orientalis cycloceros</i> )		1.2	none	1.0	none
Alpine Ibex ( <i>Capra ibex ibex</i> )		1.5	none	1.5	none
West Caucasian Tur ( <i>Capra ibex caucasica</i> )		1.5	none	1.5	none
Siberian Ibex ( <i>Capra ibex sibirac</i> )		1.5	none	1.2	none
Nubian Ibex ( <i>Capra ibex nubiana</i> )		1.5	none	1.2	none
Turkomen Markhor ( <i>Capra falconeri heptneri</i> )		1.2	none	0.9	none
Himalayan Tahr ( <i>Hemitragus jemlahicus</i> )		1.2	5mg Xylazine	1.2	5mg Xylazine
BOVINAE					
Indian Gaur ( <i>Bos gaurus gaurus</i> )		6.0	75mg Xylazine	5.0	75mg Xylazine

SUBFAMILY / SPECIES	COMMENTS	ADULT ♂ Normal, Semi-free Ranging		ADULT ♀ Normal, Semi-free Ranging	
Cape Buffalo ( <i>Syncerus caffer nanus</i> )		6.0	none	6.0	none