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Source: Bulletin of the Wildlife Disease Association, 5(3) : 307-310

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-5.3.307

ANESTHESIA, SEDATION AND CHEMICAL RESTRAINT IN WILD AND DOMESTIC ANIMALS[1]

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Introduction

The use and study of wild and domestic animals frequently involves physical handling and in some instances the performance of surgical or other painful procedures. With few exceptions the needs in domestic animals are basically for relief of pain and relaxation to allow comfort to the patient and convenience to the surgeon. Agents can be selected without much concern for excessive restraint of the animal before medication in most cases.

The preparation of the wild animal for some form of chemical restraint, sedation or anesthesia most often must be made without the benefit of a physical examination to determine the physiological condition or specific needs. In many cases the animal must receive the initial medication via propelled dart or other systems used from a point distant from the animal.

Since it is difficult to measure preanesthetic responses in wild animals, an attempt has been made to evaluate specific responses to certain medications in domestic animals and relate these to the gross responses seen in both domestic and wild animals.

Materials and Methods

The animals used in these experiments included white tailed deer, dogs, cats, horses, ponies and primates. Results of other investigators were incorporated in establishing guidelines for medications and dosages.

Arterial blood gas and pH measurements were made on an Instrumentation Labs Model No. 113 apparatus. E.C.G.'s were monitored with a Hewlett-Packard portable visocardette #500.

Results

Varying results have been reported on the use of chemical restraint in deer. Fisher[2] reported using 4 to 7 mg. of succinylcholine in adult deer. Peterson[3] used succinylcholine in deer at a rate of 0.2 mgm/kg body weight. Recovery required 30 to 60 minutes. Since our wildlife investigators had experienced considerable mortality with succinylcholine in deer, with evidence of myocardial damage in some sacrificed survivors, an attempt to use M99 (etorpine)[2] was made. The initial tests were made using M99 (etorphine) alone, later a combination of M99 (etorphine and acepromazine[3] were used. In some 20 adult white-tailed deer a variety of results were observed. Two cases resulted in a very tranquil and analgesic state although the animals did not collapse until handled.

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[1] Supported in part by American Cyanamid Co. and Parke, Davis and Co.

[2] American Cyanamid Co., Princeton, New Jersey.

[3] Ayerst Labs; New York, New York.

Five animals did not show noticeable relaxation, probably due to improper location of the dart or incomplete injection. Dosages used were 2.5 mg. M99 with or without 5 mg acepromazine in 150-pound deer. Maximum effects occurred in 14 to 16 minutes. The most noticeable sign was an increase in respiratory rate, sometimes up to 120 breaths per minute. The use of cyprenorphine (M285) as an antagonist administered at a rate of 5.0 mg/150 pound deer intravenously (I.V.) resulted in immediate reversal of the analgesic and immobilizing effects.

In a summary of reports by other investigators compiled by American Cyanamid, 194 deer were injected with 0.53 to 1.4 mg M99/100 lbs. body weight. Eighty-two percent were immobilized in standing or recumbent position and would tolerate surgery, 13 percent were not completely immobilized but could be easily captured and 1.5 percent showed no effect.

Antelope made similar response since 82 percent of 145 animals receiving 0.38 to 2.2 mg M99/100 lbs body weight were immobilized in standing or recumbent positions.

Average induction time in deer and antelope has been calculated at 12 minutes and excessive excitement will result in increased respiratory rates.

In the horse 90 mcg/kg. I.V. produced recumbency and immobilization in 2 minutes or less. Respiratory rates increased only slightly but it was common to see a four-fold increase in heart rate. Two animals showed excessive body temperature elevation up to 106°F when maintained on M99 for up to 60 minutes. Reversal with M285 at a 2:1 ratio with M99 resulted in immediate recovery. Arterial blood gases were studied in three horses and the following values were determined, indicating a reduction in PaO_2 values during the effective periods:

Time	Arterial pH
Pre M99 injection	7.395
10 min. post M99 injection	7.306 ± .011
20 min. post M99 injection	7.313 ± .041
30 min. post M99 injection	7.382 ± .078
40 min. post M99 injection	7.353 ± .048
50 min. post M99 injection	7.431 ± .056
10 min. post antagonist	7.405 ± .078

Time	Arterial PaO_2
Pre M99 injection	71.0 mm. Hg.
10 min. post M99	34.8 ± 2.8
20 min. post M99	28.2 ± 7.3
30 min. post M99	41.7 ± 2.1
40 min. post M99	32.2 ± 7.4
50 min. post M99	41.7 ± 2.1
10 min. post antagonist	53.7 ± 9.2

Time	Arterial $PaCO_2$
Pre M99 injection	32.5 mm Hg.
10 min. post M99	43.7 ± 1.4
20 min. post M99	47.5 ± 7.2
30 min. post M99	32.0 ± 8.2
40 min. post M99	34.3 ± 1.2
50 min. post M99	23.8 ± 9.3
10 min. post antagonist	25.0 ± 11.7

The administration of Quivet[R][4] containing M99 in six dogs at the rate of 7.48 mcg./kg resulted in neuroleptanalgesic with good immobilization and analgesia for 45 to 55 minutes at which time it was reversed with an antagonist M50-50[4]. It was worthwhile to admin-

Quivet[R]

Time	Arterial pH	PaO_2	$PaCO_2$
Preinjection	7.438 ± .028	103.6 ± 11.4	29.6 ± 8.4
15 min. post injection	7.317 ± .046	84.4 ± 12.4	41.0 ± 5.1
30 min. post injection	7.280 ± .028	85.6 ± 17.4	45.0 ± 11.1
45 min. post injection	7.265 ± .040	87.4 ± 20.8	43.0 ± 14.8
15 min. post antagonist	7.363 ± .020	122.8 ± 13.9	20.4 ± 5.1
30 min. post antagonist	7.377 ± .017	112.0 ± 7.4	21.2 ± 7.3

[4] American Cyanamid Co., Princeton, New Jersey.

ister atropine to prevent bradycardia. Evaluations of arterial blood gases and pH were made in each dog to determine respiratory response.
Acidosis and lower PaO_2 values developed with time until the antagonist was administered, at which time the trend was reversed to values within normal limits.

Dosages of M99 used in other wild animals for immobilization reported by Cyanamid tecnical reports are:

Species	Weight lbs.	Dose mg.
Thompsons Gazelle	28	0.7
American Bison	1200	2.5
Grant's Zebra	300-400	1.0-1.25
Bighorn sheep	130	0.8
African elephant	12,000	6.0
Giraffe	2,500	2.5
Ostrich	270	3.0
Dingos	25	0.1-0.15
Wolves and Coyotes	40	0.2
Reindeer	300	0.8-1.0
Moose	450	1.0-1.5
Black Bear	300	1.0

Phencyclidine HCl as been used for immobilization in a number of species. This drug produces an analgesic state with paralysis and can be administered intramuscularly as can M99. Peterson[5] used Sernylan (phencyclidine HCl) on 13 bears at the rate of 1.0 mg/kg. Respiration and heart action remained strong throughout the immobilization period. Some animals required additional anesthesia for surgical procedures but the dosage was sufficient for handling. The principle use of this drug at our facilities has been on cats and primates. Phencyclidine HCl in 40 domestic cats at 10 to 20 mg/kg I.M. dosages resulted in deep analgesia and immobilization and allowed surgical procedures. Induction required 3 minutes and recovery 6 to 8 hours. It was compatable with barbiturates, methoxyflurane and halothane anesthesia.

Blood gases and pH evaluations in 10 animals indicate that respiratory function stays within normal ranges.

Suitable dosages of Phencyclidine HCl in other wild animals according to Fisher[2] are:

Adult zebra 32.55 mg.

Adult eland 10-18 mg.

Adult kudu 8 mg.

Young kudu 4-7 mg.

Jaguar 35 mg/140 lbs.

Adult lion 52 mg/300 lbs.

Adult zoo cats 20 mg/100 lbs.

Adult Japanese black bear 30-40 mg.

Adult deer 4-7 mg.

These are not the only products used in wild animals restraint. The barbiturates have been used for wild animal anesthesia. Graham et al[3] found pentobarbital more effective than thiamylai sodium in ranch mink and a dosage of 40 mg/kg was effective in 88% of their cases.

Clarke et al[1] used pentobarbital anesthesia for black bear, with a 13.5 mg/kg initial dose permitting safe handling and minor surgery. Supplemental dosages were used for additional anesthesia.

Larson[4] studied the effects of barbiturates in a number of wild animals. Ultrashort and short-acting barbiturates were used in the lion at the rate of approximately 1 gr./10 lbs. Promazine (4.0 mg/kg.) produces depression which aids in ease of handling. He anesthetized a poor-risk tiger with promazine, thiopentone and mixture of nitrous oxide, oxygen and halothane with success. Thiopentone was also effective in the jaguar, ocelot, kangaroo, elephant, mongolian wild horse, deer, and antelope. It should be pointed out that the 2300 lb. elephant required 165gr. of thiopentone following 1250 mg. promazine injected intravenously. Promazine and chloroform to effect have been used by Larson in the kodiak bear and 4 oz. of chloral hydrate and 50.0 gr. thiopentone were effective for two hours of surgical anesthesia in a 1200 lb. rhinoceros.

Summary

Our experiences and the results of other investigators indicate three principal problems in restraint, anesthesia and sedation of wild animals.

1. The wild animal is more prone to excitement and is under great physiological and psychological stress at the time of induction, resulting in great anesthetic risk.

2. Due to the natures of wild animals, prenaesthetic evaluation and routine administration of medications cannot be accomplished.

3. Due to animal, equipment and facility problems, many of the advances in inhalation anesthesia have not been utilized in wild animals.

Acknowledgment

The author would like to extend thanks to Dean Murphy and his associates of the Missouri Wildlife Commission for the opportunity to work with deer and to Fred Bendict, William Greenwald and Joyce Murphy for assistance in obtaining data.

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