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ANESTHESIA IN A BAIRD'S TAPIR (*TAPIRUS BAIRDII*)

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Abstract: A Baird's tapir (*Tapirus bairdii*) was satisfactorily immobilized on two occasions with i.m. detomidine (0.065–0.13 mg/kg) and butorphanol (0.13–0.2 mg/kg). On the second occasion, anesthesia was induced by i.v. administration of ketamine (2.2 mg/kg). Twenty minutes later, endotracheal intubation was performed after an additional i.v. injection of ketamine (1.5 mg/kg). Anesthesia was maintained with isoflurane, which provided excellent conditions for radiology and surgery. Anesthesia was associated with hypoxemia when the tapir was allowed to breathe air and with hypoventilation. Mean arterial pressure remained satisfactory. No antagonist drugs were administered, and recovery from anesthesia was rapid and smooth.

Key words: Tapirus bairdii, detomidine, butorphanol, ketamine, isoflurane.

INTRODUCTION

Etorphine has long been recommended for immobilization of tapirs.[2,6,7] More recently, the combination of carfentanil, ketamine, and xylazine has been used for immobilization of these animals.[3] In this report, we describe administration of detomidine and butorphanol on two occasions to a Baird's tapir (*Tapirus bairdii*), producing sufficient immobilization to allow venipuncture for collection of blood, or induction of anesthesia with ketamine, tracheal intubation, and subsequent maintenance of anesthesia with isoflurane.

CASE REPORT

An 11-yr-old female Baird's tapir weighing 230 kg was admitted to the University of Georgia Veterinary Teaching Hospital for anesthesia, radiography of the mandible, and dental examination. The tapir had a history of intermittent anorexia, colic, and painful mastication for the previous 2 wk but had eaten well the last 5 days. Sulfamethoxazole and trimethoprim (SMZ-TMP, Biocraft Laboratories, Fairlawn, New Jersey 07410, USA) (21 mg/kg, p.o.q 12 hr) and flunixin meglumine (Banamine granules, Schering-Plough Animal Health Corp, Kenilworth, New Jersey 07033, USA) (4.3 mg/kg, p.o.q 12–24 hr) had been administered for 2 wk. Eight days previously, the animal was given 15 mg (0.065 mg/kg) detomidine (Dormosedan, Pfizer, Exton, Pennsylvania 19341, USA) and 30 mg (0.13 mg/kg) butorphanol (Torbugesic, Fort Dodge Laboratories, Fort Dodge, Iowa 50501, USA) i.m. This drug combination produced recumbency after 25 min and sufficient sedation to facilitate physical examination and blood collection.

Food was withheld for 24 hr, and water was withheld for 12 hr. The animal was coaxed into a 6-foot long × 4-foot high × 2-foot wide aluminum cage and transported 150 mi to the University of Georgia. The animal was given 20 mg (0.09 mg/kg) detomidine and 30 mg (0.13 mg/kg) butorphanol i.m. using a pole syringe with the animal confined in the cage. Within 10 min, the tapir was mildly ataxic, and slight hanging of the head and decreased movement of the proboscis were observed. The tapir went into a "dog sitting" position prior to assuming sternal recumbency at 27 min. Ear twitching and blepharospasm were observed. An additional 10 mg (0.04 mg/kg) detomidine and 15 mg (0.07 mg/kg) butorphanol were given i.m. 7 min later. Twenty-five minutes later, the animal responded sluggishly to tactile stimuli of the head and ears, so it was considered unsafe to approach the head without additional drug administration. The rear guillotine door of the transport cage was lifted and the right hind limb was exteriorized. Five hundred milligrams of ketamine (Ketaset, Fort Dodge Laboratories) (2.2 mg/kg) was injected percutaneously into a saphenous vein. After an unsuccessful attempt to place a catheter in the saphenous vein, a 14-gauge 5.25-inch catheter was inserted into the cephalic vein on the forelimb. Twenty minutes after the first injection of ketamine, regurgitation of approximately 50–100 ml of brown flocculent fluid was noted. Because jaw tone was excessive, an additional 350 mg (1.5 mg/kg) ketamine was injected i.v., after which the trachea was intubated with a 25-mm cuffed endotracheal tube. Intubation was accomplished easily using the blind method common in equine anesthesia. The tube was connected to a circle circuit (Large Animal Control Center,

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North American Dräger, Telford, Pennsylvania 18969, USA), and isoflurane (IsoFlo, Solvay Animal Health, Mendota Heights; Minnesota 55120, USA) was administered in oxygen at a vaporizer setting of 1%.

The tapir was removed from the cage and disconnected from the anesthesia machine for transportation to the radiology room. An additional dose of 350 mg (1.5 mg/kg) ketamine was administered on arrival in radiology, the anesthesia circuit was reconnected, and the vaporizer was set at 2%. Radiographic procedures required 55 min. The endotracheal tube was subsequently disconnected from the anesthesia machine for 10 min during transportation to the surgery room, where the animal was hobbled and lifted onto the table with a hoist. The animal was placed in right lateral recumbency, 200 mg (0.9 mg/kg) ketamine was administered i.v., and the anesthesia circuit was reconnected. The vaporizer was set at 2.5% for 15 min, after which it was decreased to 2% with an oxygen flow rate of 3 L/min for the remainder of the anesthesia period. The surgical procedure involved removal of an oral fibrotic tissue mass and curettage of a bone cyst. Total isoflurane anesthesia time was 3 hr. A total of 7.9 L acetated Ringer's solution was administered i.v. during this time.

Monitoring equipment during anesthesia included a pulse oximeter (Vet/Ox 4402, Sensor Devices, Waukesha, Wisconsin 53188, USA) with the probe on the tongue, electrocardiogram, direct measurement of arterial pressure from a catheter in an auricular artery (Isotec, Healthdyne Cardiovascular, Costa Mesa, California 92626, USA; MR-1340, Mennen Medical, Clarence, New York 14031, USA), arterial pH and blood gas analysis (Model 170, CIBA Corning, Medfield, Massachusetts 02052, USA), and rectal temperature.

Heart rates recorded before administration of isoflurane and during the first 20 min were between 50 and 62 beats/min. Administration of 3.5 mg (0.015 mg/kg) atropine i.v. increased the heart rate from 50 to 75–80 beats/min for 35 min. The heart rates then progressively decreased to plateau at 60–65 beats/min for the duration of anesthesia. An additional i.v. injection of the same dose of atropine failed to increase the rate.

Mean arterial pressure was 115 mm Hg early during anesthesia and increased to 150 mm Hg after the tapir was moved to the radiology room. While radiographs were being taken, mean arterial pressure was 100–105 mm Hg when the tapir was in lateral recumbency but decreased to 75 mm Hg after it was repositioned in dorsal recumbency. Mean arterial pressure had increased to 120 mm Hg by the time the tapir was in the surgery suite but progressively decreased to 70–80 mm Hg and remained within this range for the duration of surgery.

Table 1. Respiratory acidosis and mild metabolic alkalosis were present in a tapir anesthetized with isoflurane. Hypoxemia was present after the tapir began breathing air during transportation to radiology (30-min sample). Arterial Po_2 was adequate 12 min after reconnection to the anesthesia circuit following transportation to surgery (115-min sample).

	Time postintubation (min)	
	30	115
pHa	7.330	7.303
$Paco_2$ (mm Hg)	62.5	65.4
Pao_2 (mm Hg)	54.4	186.4
HCO_3 (mEq/L)	32.8	32.6
BE (mEq/L)	5.2	3.8
Temperature (°C)	37.6	35.9

Ventilation was spontaneous at 12–16 breaths/min throughout anesthesia. Results of the pH and blood gas analyses are given in Table 1. $Paco_2$ was severely increased; however, spontaneous breathing was allowed to continue. The pulse oximeter O_2 saturation reading was 81% at the time of the first blood gas analysis and 97% at the time of second analysis.

The tapir was returned to her cage for recovery from anesthesia. Oxygen was insufflated at 15 L/min into the endotracheal tube until extubation was performed when the swallowing reflex had returned 8 min after the vaporizer was turned off. The tapir appeared sedated, but the transition to standing was smooth and without complication.

The animal remained calm during the 150-mile transportation to the zoo and walked out of the cage and into a stall without difficulty. The animal had a normal attitude and appetite the following morning.

DISCUSSION

Induction of anesthesia in this tapir was protracted because additional doses of detomidine and butorphanol were administered to ensure complete unresponsiveness. The doses of detomidine and butorphanol required were higher than those that had previously produced satisfactory immobilization. This decrease in effect was presumably due to increased sympathetic nervous system stimulation associated with transportation and exposure to an unfamiliar environment. Regurgitation occurred at the start of anesthesia before the animal was moved and before tracheal intubation. Pulmonary aspira-

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tion was of concern, but the animal exhibited no evidence of respiratory involvement in the postoperative course. Regurgitation and potential for pulmonary aspiration in anesthetized tapirs has previously been reported[7] in contrast to domestic horses, which do not regurgitate while under anesthesia unless gastrointestinal obstruction is present.

Anesthesia was maintained with isoflurane, and muscle relaxation was excellent. Supplemental doses of ketamine were administered after the tapir was transported to the radiology facilities and again after the tapir was moved to the surgery room to ensure maintenance of the desired plane of anesthesia. Isoflurane was discontinued during transportation, and observation of palpebral reflex, eye position, and increased blood pressure indicated that the depth of anesthesia had lightened, although no movement occurred.

Hypoventilation was severe during anesthesia. Hypercarbia and low Pao_2 had been anticipated based on the animal's conformation, which predisposed it to ventilation–perfusion inequality. Hypoxemia was present when the tapir was breathing air; however, administration of oxygen produced satisfactory Pao_2. The pulse oximeter provided adequate warning of low Pao_2 and was useful for monitoring heart rate. Spontaneous breathing was allowed to continue because the depth of anesthesia was adequate and because the arterial pH was above 7.30. Controlled ventilation would have been instituted if the plane of anesthesia had been inadequate, indicating that uptake of isoflurane was impaired by hypoventilation. Similarly, controlled ventilation may have been used to prevent a serious decrease in pH if the animal had developed a metabolic acidosis. In the absence of equipment for blood gas analysis or capnography, use of controlled ventilation may be advisable. Hypotension was not encountered in this animal. Recovery from anesthesia was rapid and smooth.

Etorphine, with subsequent antagonism by diprenorphine, has been previously recommended for immobilization of tapirs.[2,6] Immobilization of free ranging tapirs (*Tapirus bairdii*) with a combination of etorphine and acepromazine (Large Animal Immobilon, C-vet, UK) has been described.[5] A combination of carfentanil, ketamine, and xylazine produced satisfactory immobilization in four mountain tapirs (*T. pinchaque*) on six occasions.[3] The standard combination used for an adult tapir was carfentanil (1 mg), ketamine (50 mg), and xylazine (20 mg), and anesthesia was maintained with isoflurane. Propofol (approximately 0.3 mg/kg) was injected i.v. to provide an additional 6–8 min of muscle relaxation as needed. The carfentanil and xylazine were satisfactorily antagonized by i.v. injection of naltrexone (100 mg naltrexone : 1 mg carfentanil) and yohimbine (0.13 mg/kg) respectively.

Recent recommendations for dosages of detomidine and butorphanol to produce sedation in exotic equids are (0.1–0.15 mg/kg) detomidine with (0.3–0.4 mg/kg) butorphanol i.m..[4] However, lower dosages of detomidine (0.08–0.09 mg/kg) and butorphanol (0.1–0.15 mg/kg) have provided adequate sedation in tapirs for short procedures (<60 min including induction time). Lower dosages of detomidine (0.05 mg/kg) with butorphanol (0.15 mg/kg) i.m. for tapirs also have been recommended.[1] To prolong immobilization in exotic equids, recommendations include i.v. boluses of ketamine (1 mg/kg) as needed or propofol (0.1–0.2 mg/kg/min) as a continuous infusion.[3] The effects of detomidine and butorphanol can be antagonized by i.v. or i.m. injection of yohimbine (0.3 mg/kg) and naltrexone (0.5 mg/kg) given at least 20 min after the last administration of ketamine.[3]

The combination of detomidine and butorphanol was chosen for immobilization of this tapir because anecdotal reports of this combination had been encouraging (P. J. Morris, San Diego Zoo, pers. comm.) Advantages of this combination are that the drugs can be combined in a single syringe and administered i.m., good muscle relaxation is induced, and antagonists are available. Additionally, the consequences of accidental human injection of these drugs are substantially less than those associated with carfentanil. A disadvantage is the large volume to be injected if the drugs are to be administered by a remote delivery system.

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HEARTWORM (*D*
GLOMERULONEP
NIGRIPES)

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Abstract: A 6-yr-old, 1.36-k
Teaching Hospital, University
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Key words: Heartworm, *Di*

INTRODU

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