IMMOBILIZATION OF CHACOAN PECCARIES (CATAGONUS WAGNERI) USING MEDETOMIDINE, TELAZOL®, AND KETAMINE

Authors: Sutherland-Smith, Meg, Campos, Juan Manuel, Cramer, Carrie, Thorstadt, Cindy, Toone, William, et al.

Source: Journal of Wildlife Diseases, 40(4) : 731-736

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-40.4.731

Journal of Wildlife Diseases, 40(4), 2004, pp. 731–736

IMMOBILIZATION OF CHACOAN PECCARIES (*CATAGONUS WAGNERI*) USING MEDETOMIDINE, TELAZOL®, AND KETAMINE

Meg Sutherland-Smith,[1,3] Juan Manuel Campos,[2] Carrie Cramer,[1] Cindy Thorstadt,[1] William Toone,[1] and Patrick J. Morris[1]

[1] Zoological Society of San Diego, P.O. Box 120551, San Diego, California 92112, USA
[2] Proyecto Tagua, Avd. Stma. Trinidad 2637 c/Itapua, Asuncion, Paraguay
[3] Corresponding author (email: msutherlan@sandiegozoo.org)

ABSTRACT: A combination of medetomidine, Telazol®, and ketamine hydrochloride was used to immobilize captive Chacoan peccaries (*Catagonus wagneri*) for translocation within Paraguay during August–October 2002. Animals were darted in enclosed areas of varying size. The average dose used was 32.5±7.2 μg/kg of medetomidine, 0.63±0.2 mg/kg of Telazol®, and 3.9±0.65 mg/kg of ketamine. First effects were noted at 4.3±2.1 min, and ability to handle the animals was achieved by 12.6±3.7 min. Heart and respiratory rates declined and oxygen saturation increased during anesthesia. Muscle relaxation was good. Atipamezole was used to antagonize the medetomidine, although recoveries were still slow. This drug combination provided adequate immobilization of Chacoan peccaries; however, this protocol would not be considered to be reversible, and confinement during recovery is recommended.

Key words: Anesthesia, *Catagonus wagneri,* Chacoan peccary, immobilization, ketamine, medetomidine, Telazol®, tiletamine, zolazepam.

INTRODUCTION

Peccaries are in the suborder Suiformes and belong to the family Tayassuidae. The Chacoan peccary (*Catagonus wagneri*) is an endangered species (Convention on International Trade of Endangered Species, Appendix I) that inhabits the semiarid thorn forest known as the Gran Chaco area of northwest Paraguay, northern Argentina, and southeastern Bolivia (Toone et al., 2002). A group of captive Chacoan peccaries in Paraguay required anesthesia for prerelease evaluations and translocation to a release site (Toone et al., 2003).

Telazol®, a combination of tiletamine hydrochloride and zolazepam, has been used to anesthetize domestic swine; however, poor analgesia and rough recoveries have been reported (Thurmon et al., 1988; Ko et al., 1993b). Combining xylazine with Telazol® improved the quality of domestic swine anesthesia (Thurmon et al., 1988; Ko et al., 1993b). A protocol combining Telazol®, xylazine, and ketamine for anesthetic induction and short-term anesthesia in domestic swine has been described (Ko et al., 1993a, b).

Medetomidine has been used in anesthetic protocols for domestic and nondomestic swine. Medetomidine is more effective than xylazine for sedation in domestic swine (Sakaguchi et al., 1992). The advantages of medetomidine are increased selectivity for α-2 adrenoreceptors over α-1 adrenoreceptors, compared with other α-2 agonists. Medetomidine can be antagonized using atipamezole and is rapidly eliminated.

Many protocols developed for domestic swine have been successfully applied to nondomestic suinae (Calle and Morris, 1999). Wild pigs (*Sus scrofa*) have been successfully anesthetized using Telazol® and xylazine (Sweitzer et al., 1997). Ketamine has been used in collared peccaries (*Tayassu tajacu*) (Gallagher et al., 1985; Hellgren et al., 1985), and Telazol® has been used in Chacoan peccaries (Allen, 1992).

METHODS AND MATERIALS

The purpose of this study was to evaluate a chemical restraint protocol for Chacoan peccaries in Paraguay using medetomidine (Domitor or Zalopine; Orion Pharma, Orion Corp., Espoo, Finland). A pilot study was done using high doses of medetomidine (80–100 μg/kg) and low doses of Telazol® (0.6–0.7 mg/kg, tiletamine hydrochloride and zolazepam; Fort Dodge Animal Health, Fort Dodge, Iowa,

USA). The addition of medetomidine to Telazol® was to provide better muscle relaxation and to reduce the dose of Telazol®. It was anticipated that lower doses of Telazol® and the antagonism of medetomidine with atipamezole (Antisedan; Orion Pharma) would result in faster recoveries. Piloerection resulted in overestimations of weight, and peccaries tended to receive higher than anticipated doses of medetomidine. This resulted in prolonged ataxia, despite atipamezole antagonism. The protocol was modified to use a lower dose of medetomidine (30–40 μg/kg), and ketamine hydrochloride (3–5 mg/kg or 115 mg/ml; Bremer Pharma GMBH, Bremerhaven, Germany) was added in an attempt to achieve a similar effect with the same dose of Telazol®.

The study took place between August and October 2002 at Estancia Toledo, Gran Chaco, Paraguay (22°21′S, 60°2′W). Peccaries were maintained in groups of 1–30 animals. The pen size varied from small holding pens (150 m^2) to large enclosures (3 ha) that contained dense natural vegetation. The diet consisted of pig starter feed, assorted squash, manioc, yams, cactus pads, and occasional bananas. Animals were not fasted before the administration of anesthesia.

Peccaries were darted in rear limb musculature using a Telinject rifle and 3-ml darts (Telinject USA, Inc., Saugus, California, USA). For most animals, the injection volume was fitted in a 3-ml dart using a 1 mg/ml concentration of medetomidine. For larger animals (>42 kg), concentrated medetomidine (10 mg/ml) was used to keep the volume ≤3 ml. Weight was estimated for determining the dose of anesthetic.

Thirty-seven anesthetic trials involving 15 females and 14 males were conducted for this study. Eight individuals were immobilized twice. Animals ranged in age from approximately 2 yr to 7 yr of age. Actual body weights ranged from 29 kg to 45 kg. Animals that did not receive a complete intramuscular injection or that required supplemental dosing were eliminated from the data set. All animals included in the study were considered to be healthy.

Ambient temperatures during darting ranged 12–40 C. The animals were calm to highly excited during darting. After darting, times for initial drug effect, recumbency, and when an animal could be safely handled (hands on) were recorded. Initial drug effect times were not available for all animals, because dispersal after darting made it difficult to relocate darted individuals. If an animal was recumbent when located, that time was used for the time to recumbency. Anesthetized animals were transported via truck to a processing area approximately 0.5 km from the holding facilities. Physiologic monitoring started either at the time of handling or when an animal reached the processing site.

Once anesthetized, each animal received a physical examination and was weighed using a hanging scale. Microchip transponders and ear tags were placed for identification. Heart rate, respiratory rate, and oxygen saturation readings were obtained every 5–10 min. Heart rate was obtained via thoracic auscultation and pulse oximetry (Nellcor, Inc., Pleasanton, California). The respiratory rate was determined via visual assessment of chest excursions. Oxygen saturation readings were obtained using a hand-held pulse oximeter with the sensor placed on the tongue. Supplemental oxygen was not available. A venous blood sample was obtained from the lateral saphenous vein located along the cranial tibia for complete blood count (CBC), limited plasma chemistries, blood gas analysis, and banking. A second blood gas sample was obtained 20–30 min after the first sample. Chemistry and blood gas analyses were performed on whole heparinized blood using a hand-held chemistry analyzer (Heska I-Stat; Sensor Devices, Inc., Waukesha, Wisconsin, USA). Results are available for only 30 of the 37 procedures because of technical difficulties with the analyzer. Body temperatures were measured using a digital rectal thermometer (Becton Dickinson Consumer Products, Franklin Lakes, New Jersey, USA) at the time of blood gas sampling. Blood gas values were corrected for body temperature.

Medetomidine was antagonized using atipamezole at five times the medetomidine dose given intramuscularly. Animals spent 2–24 hr in wooden recovery crates. Continuous observations of animal recoveries were not possible because of subsequent procedures. Opportunistic observations of the time an animal was noted to have head movement, attain sternal recumbency, and stand were recorded. Some animals were released back to pens on site, whereas others were transported in crates to the release site via truck. Animals were released the following morning into pens for an approximate 7-day acclimation period before release.

Data are presented as the mean±1 SD. Statistical analyses were performed using Statview® statistical software (1999; SAS Institute Inc., Cary, North Carolina, USA). Analysis of variance for drug doses and anesthetic times revealed no significant differences between sexes, so males and females were grouped together (results not presented). Paired Student's *t*-tests were used to compare the blood gas results. Because not all of the physiologic data

TABLE 1. Immobilizaton parameters for 37 anesthetic trials in adult Chacoan peccaries.

Drug	Dose
Medetomidine	32.5±7.2 μgkg
Telazol	0.63±0.2 mg/kg
Ketamine	3.9±0.65 mg/kg
Effect	**Time (minutes)**
Time to first effect	4.3±2.1[a]
Time to recumbency	7.3±2.9
Time to hands-on[b]	12.6±3.7
Time of reversal	75.9±15.4
Time to first movement[c]	10–360
Time to sternal[c]	70–440
Time to stand[c]	55–455

[a] n=29.
[b] Time to hands-on = time to adequate immobilization for handling.
[c] Ranges based on opportunistic observations.

were normally distributed, Mann-Whitney *U*-tests were used to compare physiologic variables between time periods. The unpaired Student's *t*-test was used to compare body temperature results. CBC results were used to assess animal health and were not analyzed with respect to the anesthetic protocol; therefore, these data are not presented.

RESULTS

Anesthetic doses and times are presented in Table 1. Average doses were 32.5±7.2 μg/kg medetomidine, 0.63±0.2 mg/kg Telazol®, and 3.9±0.65 mg/kg ketamine. The first effect was noted at 4.3±2.1 min. Animals became recumbent at 7.3±2.9 min. It was necessary to allow several minutes after recumbency before initiating physical contact. Animals approached too soon after recumbency would get up and stumble away. Handling was achieved at 12.6±3.7 min. Muscle relaxation was good, with minimal to no response to external stimuli such as venipuncture or ear tagging.

Results of blood chemistry analyses for 30 of 37 procedures are presented in Table 2. Statistical differences ($P<0.05$) were noted for pH, partial pressure of oxygen and carbon dioxide, sodium bicarbonate, base excess, and blood glucose. Values for electrolytes, total CO_2, ionized calcium, anion gap, and blood urea nitrogen were not compared between the two time periods.

The average body temperature was 39.4±0.98 (n=36) and 39.2±1.2 C (n=26) 28.8±11.5 and 58.2±10.7 min, respectively, from the time of darting. Differences were not significant. The average heart and respiratory rates at the beginning of the procedure were 87±10 and 69±21, respectively, and declined throughout the

TABLE 2. Venous blood gas and serum chemistries for 30 adult Chacoan peccary during anesthesia.

Parameter[a]	Time[b] 1 (29.7±6.0)	Time[b] 2 (57.6±8.0)	P[c]
PH	7.39±0.03	7.37±0.03	<.0001
PCO_2, mm Hg	47.65±5.25	54.96±7.47	<.0001
PO_2, mm Hg	53.1±8.9	58.1±10.8	.03
SvO_2, calculated %	80.7±6.3	82.4±8.7	0.33
Bicarbonate, mEq/l	28.4±2.6	31.4±2.3	<.0001
Base excess	4.0±2.6	6.6±2.3	<.0001
Glucose, mg/dl	161±32	213±48	<.0001
Sodium, mmol/l	143±2.4		
Potassium, mmol/l	3.3±0.3		
Chloride, mmol/l	115±3.1		
Total CO_2	29.7±2.8		
Ionized calcium, mg/dl	1.15±0.21		
Anion gap	6.6±4.4		
Blood urea nitrogen, mg/dl	5.7±2.9		

[a] pCO_2 = partial pressure of carbon dioxide; PO_2 = partial pressure of oxygen; SvO_2 = venous oxygen saturation.
[b] Time from darting, in minutes.
[c] Difference between times 1 and 2.

procedure to 74±8 and 53±22, respectively, by 60 min. The first oxygen saturation readings averaged 90±7% and increased to 94±2% by 60 min. For all three physiologic variables, the values at the beginning time periods were statistically different from those at the ending time periods.

Atipamezole was administered intramuscularly 75.9±15.4 min after darting. Peccaries were not monitored continuously during recovery, so only opportunistic observations were made. First movements were noted between 10 and 360 min after darting in 30 animals. Twenty-two animals were noted to be sternal between 70 and 440 min after darting. Twenty-eight animals were observed to stand between 55 and 455 min after darting. Animals may have started to move, become sternal, or stand earlier than the times noted, because observations were not continuous. Variable degrees of ataxia were noted in animals when they stood in the crates. Animals would frequently resume a sternal position after standing. Animals were calm during recovery. Sixteen animals were released back to the pens at Estancia Toledo between 162 and 474 min after darting. Although animals were able to walk out of the crates at the time of release, mild to moderate ataxia was still noted. Twenty-one animals released into the acclimation pens at the release site did not exhibit ataxia.

DISCUSSION

Medetomidine, Telazol®, and ketamine (MTZK) proved to be an adequate combination for anesthesia in Chacoan peccaries. Once the drug effects were noted, peccaries anesthetized with MTZK had smooth inductions. Because some animals were already sternal when they were found, the times to recumbency may have actually been shorter than are reported. A large amount of variation was evident for the physiologic parameters, and this is attributed to the wide range of ambient temperatures and varying degrees of excitement in semi–free-ranging animals. The trend for heart and respiratory rates to decrease over time was not unexpected, given the anesthesia and lack of excitatory stimuli. Domestic swine anesthetized with Telazol®, ketamine, and xylazine had a decline in heart rate over the anesthetic period (Ko et al., 1993). Bradycardia was not noted in this study. This may have been due to the relatively low dose of medetomidine used and/or the coadministration of ketamine and tiletamine, which may have counteracted the bradycardia associated with α-2 agonists. Oxygen saturation values were considered to be satisfactory for animals not supplemented with oxygen.

Venous blood samples were analyzed, because we were unable to consistently obtain arterial blood samples because of hypotension commonly associated with α_2-agonists. Statistical differences were present for pH, partial pressure of oxygen and carbon dioxide, sodium bicarbonate, base excess, and glucose between the two sampling times. The magnitude of change for pH was small and was not considered to be physiologically significant. The partial pressure of carbon dioxide increased 15% over time. There was a small increase in the partial pressure of oxygen over time; however, there was no significant change in the calculated venous oxygen saturation over time. Small increases were also seen for bicarbonate and base excess. The increase in the blood glucose levels was not unexpected, because α-2 agonists are known to cause hyperglycemia. We feel that the above-noted changes did not adversely affect the quality of the anesthesia. The plasma electrolytes, total carbon dioxide, ionized calcium, and anion gap levels were considered to be within normal ranges on the basis of in-house values for captive Chacoan peccaries housed at the San Diego Zoo (unpublished data), as well as International Species Information System (ISIS; Apple Valley, Minnesota, USA) values. The blood urea nitrogen value was lower than in-house and ISIS values. This may reflect differences in dietary protein levels.

Allen (1992) reported a dose of 2.18±0.46 mg/kg of Telazol® to immobilize Chacoan peccaries, and the mean induction time, defined as time from injection to recumbency, was 7.6 min. A similar time to recumbency, 7.3±2.9 min, was seen in the current study. Time to handling was longer because peccaries were allowed to lie quietly after becoming recumbent, to allow the medetomidine to have a maximum effect. Onset of immobilization in wild collared peccaries that received an average of 18 mg/kg ketamine occurred at an average of 6 min (Gallagher et al., 1985). In Hellgren et al.'s (1985) study, captive collared peccaries anesthetized with 20 mg/kg ketamine became immobilized in 10–12 min. Handling was achieved at 12.6±3.7 min in peccaries anesthetized with MTZK.

In Chacoan peccaries anesthetized with Telazol®, mean oxygen saturation was 93.2%; however, trends were not reported (Allen, 1992). Peccaries in the present study started with lower oxygen saturations, but by 20–29 min after handling, the mean oxygen saturation was approximately 92%. Allen (1992) also noted that Chacoan peccaries anesthetized with Telazol® reacted to venipuncture with limb movement. This has been reported by others who have used Telazol® in domestic swine (Thurmon et al., 1988). Peccaries anesthetized with MTZK showed minimal to no response to external stimuli such as ear tagging or venipuncture.

Even though observations were opportunistic, recovery times were slower than expected. A response to antagonism with intramuscular atipamezole was seen based on an increase in heart rate within 5 min after administration. Residual Telazol® and/or ketamine may explain slower recoveries, despite what seemed to be low doses. The metabolism of medetomidine, atipamezole, ketamine, and/or Telazol® may differ in peccaries. Domestic swine anesthetized with 4.4 mg/kg Telazol®, 2.2 mg/kg ketamine, and 2.2 mg/kg xylazine were walking (with ataxia) by approximately 80 min after drug administration (Ko et al., 1993) Chacoan peccaries anesthetized with 2.18±0.46 mg/kg Telazol® (Allen, 1992) stood between 90 and 240 min but were not considered to be fully recovered until 6–8 hr after immobilization. In a study by Gallagher et al. (1985), collared peccaries immobilized with an average of 18 mg/kg ketamine stood after an average of 122 min. Wild pigs were considered to have recovered (controlled walking) 2 hr after the administration of Telazol® (3.2 mg/kg) and xylazine (1.6 mg/kg) (Sweitzer et al., 1997). Several animals anesthetized with only Telazol® at an average of 3.2 mg/kg during the present study took longer than 8 hr to recover (data not presented). Recoveries from the MTZK combination were subjectively shorter than for those immobilized with Telazol® only. Flumazenil (Romazicom; Roche Laboratories, Inc., Nutley, New Jersey) has been used to antagonize the effects of zolazepam in nondomestic suids (James et al., 1998; Calle and Morris, 1999) and would be worth evaluating with this protocol in the future. It was not used in this project because the expense was prohibitive.

Mortality directly associated with the anesthetic protocol was not observed. Three pregnant females were found dead 8, 11, and 19 days after anesthesia, following their release from the acclimation pens. Necropsies were not done. No adverse effects were noted by Jalanka et al. (1990) in a variety of pregnant nondomestic animals anesthetized with medetomidine-ketamine. The contribution of anesthesia to these mortalities is not known; however, it is less likely the longer the time period from anesthesia to death.

Regulatory requirements need to be considered when planning studies involving anesthesia in other countries. It was necessary to export the Telazol® to Paraguay because it is a controlled substance. Medetomidine is not a controlled substance and did not pose any logistical problems in transportation. Ketamine was available in Paraguay.

In conclusion, the combination of MTZK provided adequate immobilization of Chacoan peccaries. Physiologic parameters were acceptable, given the environmental conditions and lack of supplemental oxygen. Relaxation was improved and recoveries shorter compared with Telazol® immobilizations. However, this protocol would not be considered to be reversible, and confinement during recovery is recommended. This protocol would be useful in instances where limited amounts of Telazol® are available.

AKNOWLEDGMENTS

The authors thank the Zoological Society of San for providing funding for this study. The authors also are grateful to J. Dankovchik for her assistance with statistical analyses.

LITERATURE CITED

ALLEN, J. L. 1992. Immobilization of giant Chacoan peccaries (*Catagonus wagneri*) with a tiletamine/zolazepam hydrochloride combination. Journal of Wildlife Diseases 23: 499–501.

CALLE, P. P., AND P. J. MORRIS. 1999. Anesthesia for nondomestic suids. *In* Zoo and wild animal medicine: Current therapy 4, M. E. Fowler and R. E. Miller (eds.). W. B. Saunders Co., Philadelphia, Pennsylvania, pp. 639–646.

GALLAGHER, J. F., R. L. LOCHMILLER, AND W. E. GRANT. 1985. Immobilization of collared peccaries with ketamine hydrochloride. Journal of Wildlife Management 49: 356–357.

HELLGREN, E. C., R. L. LOCHMILLER, M. S. AMOSS, JR., AND W. E. GRANT. 1985. Endocrine and metabolic responses of the collared peccary (*Tayassu tajacu*) to immobilization with ketamine hydrochloride. Journal of Wildlife Diseases 21: 417–425.

JALANKA, H. H., AND B. O. ROEKEN. 1990. The use of medetomidine, medetomidine-ketamine combinations, and atipamexole in nondomestic mammals: A review. Journal of Zoo and Wildlife Medicine 21: 259–282.

JAMES, S. B., R. A. COOK, B. L. RAPHAEL, M. D. STETTER, P. KALK, K. MACLAUGHLIN, AND P. P. CALLE. 1998. Immobilization of babirusa (*Babyrousa babyrousa*) with xylazine and tiletamine/zolazepam and reversal with yohimbine and flumazenil. *In* Proceedings of American Association of Zoo Veterinarians, C. K. Baer (ed.). Omaha, Nebraska. pp. 204–205.

KO, J. C., B. L. WILLIAMS, V. L. SMITH, C. J. MCGRATH, AND J. D. JACOBSON. 1993b. Comparison of Telazol, Telazol-ketamine, and Telazol-ketamine-xylazine as chemical restraint and anesthetic induction combination in swine. Lab Animal Science 43: 476–480.

SAKAGUCHI, M., R. NISHIMURA, N. SASAKI, T. ISHIGURO, H. TAMURA, AND A. TAKEUCHI. 1992. Sedative effects of medetomidine in pigs. Journal of Veterinary Medical Science 54: 643–647.

SWEITZER, R. A., G. S. GHNEIM, I. A. GARDNER, K. VAN VUREN, B. J. GONZALES, AND W. M. BOYCE. 1997. Immobilization and physiological parameters associated with chemical restraint of wild pigs with Telazol® and xylazine hydrochloride. Journal of Wildlife Diseases 33: 198–205.

THURMON, J. C., G. J. BENSON, W. J. TRANQUILLI, W. A. OLSON, AND C. H. TRACY. 1988. The anesthetic and analgesic effects of Telazol® and xylazine in pigs: Evaluating clinical trials. Veterinary Medicine 83: 841–845.

TOONE, W., AND M. WALLACE. 2002. The giant Chacoan peccary: An outstanding example of adaptation to a subtropical dryland ecosystem. Biodiversity 3: 28–31.

———, J. CAMPOS, AND M. WALLACE. 2003. Release of radio-collared giant Chacoan peccary in Paraguay. Reintroduction News 22: 34–36.

Received for publication 28 August 2003.