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Authors: Fournier-Chambrillon, Christine, Fournier, Pascal, and Vié, Jean-Christophe

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IMMOBILIZATION OF WILD COLLARED ANTEATERS WITH KETAMINE- AND XYLAZINE-HYDROCHLORIDE

Christine Fournier-Chambrillon,[1,2] Pascal Fournier,[1] and Jean-Christophe Vié[1]

[1] Programme "Faune Sauvage", E.D.F./C.N.E.H., Savoie Technolac, 73373 Le Bourget du Lac cedex, France
[2] SEPANGUY (Société d'Etude pour l'Aménagement et la Protection de la Nature en Guyane), BP 411, 97328 Cayenne cedex, Guyane française

ABSTRACT: Collared anteaters (*Tamandua tetradactyla*) were immobilized for clinical procedures as part of a wildlife rescue during the filling of a hydroelectric dam (Petit Saut, French Guiana) from March 1994 to March 1995. Two doses of ketamine hydrochloride (KH) (group I $\bar{x} \pm$ SD = 11.2 ± 1.4 mg/kg, group II = 19.7 ± 1.3 mg/kg) in combination with xylazine hydrochloride (XH) (1.0 ± 0.1 mg/kg) were evaluated in seven and 10 collared anteaters, respectively. Induction time did not differ between the two groups. Immobilization time was significantly longer in group II than in group I (48.3 ± 15.8 min and 35.0 ± 9.5 min, respectively), without lengthening the recovery process. Adverse effects were not observed. The degree of anesthesia and the muscle relaxation were better in group II than in group I. Rectal temperature decreased in both groups and was significantly higher in group II than in group I. Heart rate was significantly higher in group II than in group I at 5 min post-injection and decreased in group II. No effects on respiratory rate were observed. We recommend the 20 mg/kg KH − 1 mg/kg XH combination, especially for manipulations longer than 30 to 40 min and for minor surgery procedures.

Key words: Collared anteater, immobilization, ketamine hydrochloride, *Tamandua tetradactyla*, xylazine hydrochloride.

INTRODUCTION

The collared anteater (*Tamandua tetradactyla*), also called southern tamandua (Wetzel, 1985; Emmons, 1990) or golden anteater (Montgomery, 1985a), is a lesser anteater that belongs to the order Xenarthra (=Edentates) and to the family Myrmecophagidae. Its geographic range is South America east of the Andes from Venezuela to Argentina and Uruguay (Wetzel, 1985; Emmons, 1990). Some authors have reported on myrmecophagid ecology and medicine (Meritt, 1975; Montgomery, 1985a, b; Shaw et al., 1985, 1987; Divers, 1986; Emmons, 1990; Gillepsie, 1993), but references concerning wild collared anteaters are scarce. To our knowledge, the anesthesia of Myrmecophagidae is relatively poorly documented. Montgomery (1985a, b) and Divers (1986) reported some doses for different drugs, without specifying the quality or the duration of immobilization. Gillepsie (1993) recommended, in all edentates, ketamine at 10 to 20 mg/kg, with addition of diazepam (0.1 mg/kg) or acepromazine (0.1 mg/kg) to avoid catatonia and spontaneous movements. Several other protocols of intramuscular, intravenous or inhalation anesthesia, were indicated with details about the different stages, but they mainly concerned the giant anteater. Only Shaw et al. (1987) used a ketamine- and xylazine- hydrochloride combination in wild giant anteaters, but reported few results.

The dissociative and cataleptic anesthetic ketamine hydrochloride (KH) has good sedative and analgesic properties, but induces poor muscle relaxation (Wright, 1982). The alpha$_2$-adrenoceptor agonist xylazine hydrochloride (XH), a sedative and muscle relaxant, complements the actions of KH and may equilibrate its negative effects (Wright, 1982; Waterman, 1983). Therefore, this combination has been used successfully to immobilize numerous domestic and wild species (Wright, 1982; Jessup et al., 1983; Herbst et al., 1985; Greene and Thurmon, 1988; Kreeger et al., 1990; Ferreras et al., 1994; Beltrán and Tewes, 1995). This incited us to use it for anesthetizing lesser anteaters.

The objectives of this study were to describe the duration and the quality of immobilization of wild collared anteaters with KH and XH combinations and to

compare the effects using two different dosages.

MATERIALS AND METHODS

A wildlife rescue was organized by Electricité de France during the flooding of 365 km^2 of primary rainforest (4°45′ to 5°04′N, 52°55′ to 53°15′W) by the Petit Saut hydroelectric dam built on the Sinnamary river in French Guiana. Subsequently named "Programme Faune Sauvage", this operation intended to (1) capture and translocate threatened mammals and reptiles to a protected forest area, (2) conduct numerous scientific studies including translocation effects, and (3) create a database and a biological bank on the wildlife of French Guiana (Vié, 1996).

Data reported herein were recorded from 17 wild collared anteaters captured between March 1994 and March 1995. The seven males and 10 females were clinically healthy, presumed adult and had a mean (± SD) weight of 4.8 ± 0.9 kg (range = 3.3 to 6.2 kg). Fifteen were located in the flooded forest and were caught in trees (n = 12) or in the water (n = 3). Capture methods were by climbing and/or cutting down branches or trees and the use of a net or a snare. These captures were conducted between 8:00 and 14:00 hr, and most of the animals (n = 11) were alert at this time. One individual was caught by hand on the release area, and another along the road to the dam. Once captured, the animals were individually housed in plastic cages and transferred to the veterinary facility. They were placed in a calm shady room for 1 to 2 hr before immobilization for routine clinical procedures including a clinical exam, collection of biological samples (blood, ectoparasites, skin biopsy), determination of body dimensions and identification with color-tag and tattoo. The mean time between capture and anesthesia was 6.0 ± 1.9 hr.

All tamanduas were manually given a thigh intramuscular injection of the KH-XH combination, with doses based on estimated body weights. Injection was made in a large wire cage (3.0 × 1.5 × 2.0 m), holding the tail of the animal by hand, the individual was half hoisted out of an inner plastic cage so that it could not turn over. After complete injection, it was released into the wire cage to monitor the effects of the drugs. When the procedures were completed, recovery was followed in the wire cage once more. The animal was released the next day at dawn or dusk, according to the manipulation time.

Two groups were distinguished. Tamanduas in group I (four males and three females) received 11.2 ± 1.4 mg/kg KH (Ketamine 500 UVA®, Laboratories UVA, 94200 Ivry/Seine, France) combined with 1.0 ± 0.1 mg/kg XH (Rompun®, Bayer Pharma, 92800 Puteaux, France). Tamanduas in group II (three males and seven females) received 19.7 ± 1.3 mg/kg KH combined with 1.0 ± 0.1 mg/kg XH.

The following times from anesthetic injection were monitored: (1) initial effects, first appearance of ataxia; (2) first recumbency; (3) induction time, no response to external stimuli (auditory and tactile); (4) first signs of recovery, head-up and limb movements, response to external stimuli; (5) time to first standing; (6) locomotion time or the time until the animal could walk in a directed, coordinated manner, but not necessarily judged behaviorally normal. Because of the placid behavior pattern this mammal demonstrated when kept in a small cage, locomotion time could not be evaluated in all animals.

Throughout immobilization, the degree of anesthesia was defined as no effects, moderate sedation, heavy sedation, light anesthesia, complete anesthesia, deep anesthesia, and death due to drug overdose. The degree of muscle relaxation was expressed as excellent, good, moderate, or poor. Heart rate, respiratory rate, and rectal temperature were recorded at 5, 15, and 30 min post-injection, respectively.

Student's t-test for unpaired data was used to compare the two groups and a two-way analysis of variance (ANOVA) for repeated measures was used to compare physiological data at 5, 15 and 30 min (Sokal and Rohlf, 1981). The differences were considered to be significant at $P \leq 0.05$. Measured values are reported herein as mean ± SD.

RESULTS

The mean times to initial effects and to first recumbency and the mean induction time did not differ between the two groups and both combinations induced a lack of response to external stimuli 2.9 ± 1.1 min after administration. Differences were observed in first signs of recovery and time to first standing (P = 0.03 and P = 0.02, respectively), which appeared earlier in group I than in group II (Table 1). However, time from first signs of recovery to first standing (18.2 ± 13.6 min, range = 4.0 to 42.0 and 35.7 ± 28.1 min, range = 10.0 to 91.0, respectively) did not differ significantly. The mean time from first standing to locomotion was comparable at

TABLE 1. Mean ± SD (range) values of immobilization characteristics of collared anteaters with two mixtures of ketamine hydrochloride and xylazine hydrochloride.

	Number of samples	Weight of the animals (kg)	Ketamine (mg/kg)	Xylazine (mg/kg)	Initial effects (min)	First recumbency (min)	Induction time (min)	First signs of recovery (min)	Time to standing (min)
Group I	7	5.0 ± 1.1 (3.3–6.2)	11.2 ± 1.4 (9.8–13.5)	1.0 ± 0.1 (0.8–1.2)	1.0 ± 0.4 (0.5–1.7)	2.2 ± 0.8 (1.3–3.5)	3.0 ± 1.5 (1.5–5.0)	35.0 ± 9.5 (24.0–50.0)	53.0 ± 15.3 (28.0–70.0)
Group II	10	4.6 ± 0.8 (3.5–6.1)	19.7 ± 1.3 (18.1–22.6)	1.0 ± 0.1 (0.9–1.2)	1.2 ± 0.3 (0.8–2.0)	1.9 ± 0.7 (1.1–3.5)	2.9 ± 1.0 (1.8–5.0)	48.3 ± 15.8 (20.0–80.0)	84.0 ± 31.4 (50.0–140.0)

25.7 ± 7.8 min (n = 3) in group I and 22.0 ± 2.8 min (n = 2) in group II.

In group I, four anteaters achieved light anesthesia and three, complete anesthesia. The muscle relaxation was moderate in one case, good in four, and excellent in two. In group II, three animals achieved light anesthesia and seven, complete anesthesia. The muscle relaxation was good in four cases and excellent in six. No animals in either of the groups required additional doses of the drugs.

The mean rectal temperatures at 5 min, 15 min, and 30 min, and the mean heart rate at 5 min were higher in group II than in group I (P = 0.02, $P < 0.05$, $P < 0.05$ and P = 0.03, respectively). No differences were observed between the two groups in the other physiological parameters recorded. The mean rectal temperature decreased significantly between 5 min versus 15 min ($P < 0.01$), and 5 min versus 30 min ($P < 0.01$) in group I, and between 5 min versus 15 min ($P < 0.01$), and 15 min versus 30 min ($P < 0.05$) in group II. The mean heart rate decreased significantly between 5 min and 15 min ($P < 0.02$), and 5 min and 30 min ($P < 0.01$) in group II, but did not differ in group I throughout immobilization. No differences between mean respiratory rates were observed throughout anesthesia in either group (Table 2).

DISCUSSION

XH-KH combinations were found effective for immobilizing collared anteaters. Both combinations induced complete immobilization in all tamanduas, without any adverse effects during or after anesthesia and no tamanduas required additional KH injection. Gillepsie (1993) recommended avoiding the use of XH in edentates because of its potential for regurgitation and difficulty of intubation. In our study the animals were fasted for about 6 hr before anesthesia and no regurgitations were recorded. Gillepsie (1993) also specified that atropine could be used in edentates to

TABLE 2. Mean ± SD (range) values of physiological parameters of collared anteaters immobilized with two mixtures of ketamine hydrochloride and xylazine hydrochloride.

	Number of samples	Rectal temperature (C)			Heart rate (beats/minute)			Respiratory rate (breaths/minute)		
		5 min	15 min	30 min	5 min	15 min	30 min	5 min	15 min	30 min
Group I	6	34.6 ± 1.0 (33.4–36.0)	33.9 ± 1.3 (32.6–35.8)	33.5 ± 1.4 (32.4–35.9)	77.8 ± 11.3 (66.0–87.0)	69.2 ± 16.1 (46.0–90.0)	67.8 ± 14.5 (45.0–80.0)	17.3 ± 10.1 (8.0–36.0)	17.5 ± 9.7 (8.0–34.0)	22.4 ± 10.0 (8.0–36.0)
Group II	7	35.7 ± 0.7 (34.6–37.0)	35.0 ± 0.8 (33.8–36.5)	34.6 ± 0.5 (33.8–35.0)	91.1 ± 15.3 (79.0–121.0)	77.0 ± 9.3 (68.0–92.0)	78.4 ± 10.9 (65.0–96.0)	16.3 ± 2.9 (12.0–24.0)	17.3 ± 6.0 (12.0–28.0)	18.3 ± 10.9 (10.0–42.0)

control salivation, but we did not observe excess salivation.

Induction was smooth and complete immobilization was obtained 3 min after injection in both groups. Different dosages of KH did not influence induction time as Ferreras et al. (1994) noted in Iberian lynx (*Felis pardina*). These authors reported a significant negative correlation between induction time and XH dosage but not KH dosage, so induction time was determined by the KH/XH ratio, with low values of KH/XH giving shorter induction times. On the other hand, Herbst et al. (1985) noted that induction time was negatively correlated with XH dosage and positively correlated with KH dosage, but KH correlation resulted in additional injection of KH given to complete the induction process.

In the giant anteater, Shaw et al. (1987) used similar KH doses and 1.5× XH doses employed in group I to achieve a 30 to 40 min immobilization within 4 to 6 min. In our study, with similar XH doses and double KH doses, the immobilization time obtained in group II was longer than in group I, muscle relaxation was more often excellent and complete anesthesia more often achieved. Recovery was smooth in both groups. Although Divers (1986) mentioned that drug action may be prolonged in edentates because of their lower metabolic rate, higher KH doses prolonged the immobilization time without significantly increasing the recovery time. Moreover, the immobilization time we observed in the lesser tamandua did not seem to be longer than those observed in other wild mammals receiving similar doses. Actually, Beltrán and Tewes (1995) reported a 38 to 44 min immobilization time in ocelots (*Felis pardalis*) and a 44 to 59 min immobilization time in bobcats (*Felis rufus*), both receiving about 13 mg/kg of KH and 1.1 mg/kg of XH. Jessup et al. (1983) indicated a response to stimuli and locomotion 150 min after injection of 9.2 mg/kg of KH and 0.73 mg/kg of XH in mule deer (*Odocoileus hemionus*). Kreeger et al. (1990) mentioned a head-up time

86 min after injection of 22 mg/kg of KH and 1.2 mg/kg of XH in red foxes (*Vulpes vulpes*).

The effects on body temperature resulted from the pharmacological profile of the alpha$_2$-agonist, XH, which is known to induce dose-dependent hypothermia (Livingston et al., 1984) and hypo- or hyperthermia depending to ambient temperature (Ponder and Clark, 1980). However, all edentates show "heterothermia" (Divers, 1986); body temperature fluctuates depending on environment and air temperature, especially in periods of inactivity (Gillepsie, 1993; Divers, 1986). For anteaters, husbandry conditions require the temperature to be maintained at between 24 C and 29 C and humidity of at least 40% (Gillepsie, 1993). Although Divers (1986) mentioned in the collared anteater a rectal temperature between 30 and 35 C, most tamanduas in our study had a rectal temperature >35 C 5 min post-injection, especially in group II. This could result from high ambient temperatures (>30 C) prevailing for group II. Body temperature decreased by one degree in both groups and mean body temperatures observed at 30 min were consequently in the range previously mentioned.

The cardiovascular and respiratory effects of KH and XH combinations have been well documented (Colby and Sanford, 1982; Kreeger et al., 1987). The higher mean heart rate observed at 5 min post-injection in group II is certainly due to the cardiac stimulating action of KH (Wright, 1982) and is more pronounced in this group which received higher doses of KH. These effects were rapidly attenuated by the depressive effects of XH (Aziz and Carlyle, 1978; Greene and Thurmon, 1988) 15 min post-injection. In the same way, Moens and Fargetton (1990) indicated that bradycardia induced by alpha$_2$-agonists was less pronounced as the dose of KH was increased. In group I, the bradycardic properties of XH may have balanced the positive chronotropic effects of KH as early as 5 min after injection, and heart rate remained unchanged during immobilization. No respiratory effects were observed in either group, although XH is known to induce respiratory depression (Aziz and Carlyle, 1978; Greene and Thurmon, 1988) and KH may cause dose-dependent respiratory depression (Wright, 1982). However, Wright (1982) noted opposite responses of the respiratory rate according to the species given KH.

In conclusion, our results support the use of KH-XH as a safe immobilization agent for free-ranging collared anteaters. We recommend the 20 mg/kg KH − 1 mg/kg XH combination, especially for manipulations longer than 30 to 40 min and for minor surgery procedures.

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LITERATURE CITED

AZIZ, M. A., AND S. S. CARLYLE. 1978. Cardiovascular and respiratory effects of xylazine in sheep. Zentralblatt Veterinary Medicine A 25: 173–180.

BELTRÁN, J. F., AND M. E. TEWES. 1995. Immobilization of ocelots and bobcats with ketamine hydrochloride and xylazine hydrochloride. Journal of Wildlife Diseases 31: 43–48.

COLBY, E. D., AND T. D. SANFORD. 1982. Feline anesthesia with mixed solutions of ketamine/xylazine and ketamine/acepromazine. Feline practice 12: 14–24.

DIVERS, B. J. 1986. Edentata. *In* Zoo and wild animal medicine, 2nd ed., M. E. Fowler (ed.). W. B. Saunders Company, Philadelphia, Pennsylvania, pp. 622–630.

EMMONS, L. H. 1990. Neotropical rainforest mammals. A field guide. The University of Chicago Press, Chicago, Illinois, 281 pp.

FERRERAS, P., J. J. ALDAMA, J. F. BELTRÁN, AND M. DELIBES. 1994. Immobilization of the endangered Iberian lynx with xylazine- and ketamine-hydrochloride. Journal of Wildlife Diseases 30: 65–68.

GILLEPSIE, D. S. 1993. Edentata: Diseases. *In* Zoo and wild animal medicine, current therapy 3, M. E. Fowler (ed.). W. B. Saunders Company, Philadelphia, Pennsylvania, pp. 304–309.

GREENE, S. A., AND J. C. THURMON. 1988. Xylazine—A review of its pharmacology and use in vet-

erinary medicine. Journal of Veterinary Pharmacology and Therapeutics 11: 295–313.

HERBST, L. H., C. PACKER, AND U. S. SEAL. 1985. Immobilization of free-ranging African lions (*Panthera leo*) with a combination of xylazine hydrochloride and ketamine hydrochloride. Journal of Wildlife Diseases 21: 401–404.

JESSUP, D. A., W. E. CLARK, P. A. GULLET, AND K. R. JONES. 1983. Immobilization of mule deer with ketamine and xylazine, and reversal of immobilization with yohimbine. Journal of the American Veterinary Medicine Association 183: 1,339–1,340.

KREEGER, T. J., A. M. FAGGELA, U. S. SEAL, L. D. MECH, M. CALLAHAN, AND B. HALL. 1987. Cardiovascular and behavior responses of gray wolves to ketamine-xylazine immobilization and antagonism by yohimbine. Journal of Wildlife Diseases 23: 463–470.

———, U. S. SEAL, AND J. R. TESTER. 1990. Chemical immobilization of red foxes (*Vulpes vulpes*). Journal of Wildlife Diseases 26: 95–98.

LIVINGSTON, A., J. LOW, AND B. MORRIS. 1984. Effects of clonidine and xylazine on body temperature in the rat. British Journal of Pharmacology 81: 189–193.

MERITT, D. A. JR. 1975. The lesser anteater in captivity. International Zoo Yearbook 15: 41–45.

MOENS, Y., AND X. FARGETTON. 1990. A comparative study of medetomidine/ketamine and xylazine/ketamine anaesthesia in dogs. The Veterinary Record 127: 567–571.

MONTGOMERY, G. G. 1985a. Impact of vermilinguas (Cyclopes, Tamandua: Xenarthra = Edentata) on arboreal ant populations. *In* The evolution and ecology of armadillos, sloths, and vermilinguas, G. G. Montgomery (ed.). Smithsonian Institution. Press, Washington D.C., pp. 351–363.

———. 1985b. Movements, foraging and food habits of the four extant species of neotropical vermilinguas (Mammalia; Myrmecophagidae) *In* The evolution and ecology of armadillos, sloths, and vermilinguas, G. G. Montgomery (ed.). Smithsonian Institution. Press, Washington D.C., pp. 365–377.

PONDER, S. W., AND W. G. CLARK. 1980. Prolonged depression of thermoregulation after xylazine administration in cats. Journal of Veterinary Pharmacology and Therapeutics 3: 203–207.

SHAW, J. H., T. S. CARTER, AND J. MACHADO-NETO. 1985. Ecology of the giant anteaters (*Myrmecophaga tridactyla*) in Serra Da Canastra, Minas Gerais, Brazil: A pilot study. *In* The evolution and ecology of armadillos, sloths, and vermilinguas, G. G. Montgomery (ed.). Smithsonian Institution. Press, Washington, D.C., pp. 379–384.

———, J. MACHADO-NETO, AND T. S. CARTER. 1987. Behavior of free-living giant anteaters (*Myrmecophaga tridactyla*). Biotropica 19: 255–259.

SOKAL, R. R., AND F. J. ROHLF. 1981. Biometry. Freeman and Co., New York, New York, 859 pp.

VIÉ, J.-C. 1996. Wildlife rescue in French Guiana: objectives, methodology and preliminary results. *In* Proceedings of the annual conference of the American Association of Zoo Veterinarians, AAZV, Puerto Vallarta, Republic of Mexico, pp. 350–357.

WATERMAN, A. E. 1983. Influence of premedication with xylazine on the distribution and metabolism of intramuscularly administered ketamine in cats. Research in Veterinary Science 35: 285–290.

WETZEL, R. M. 1985. The identification and distribution of recent Xenarthra (= Edentata). *In* The evolution and ecology of armadillos, sloths, and vermilinguas, G. G. Montgomery (ed.). Smithsonian Institution. Press, Washington D.C., pp. 5–8.

WRIGHT, M. 1982. Pharmacologic effects of ketamine and its use in veterinary medicine. Journal of the American Veterinary Medicine Association 180: 1,462–1,471.

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