REVERSIBLE IMMOBILIZATION OF EURASIAN OTTERS WITH A COMBINATION OF KETAMINE AND MEDETOMIDINE

Authors: Fernandez-Moran, Jesus, Perez, Emi, Sanmartin, Marta, Saavedra, Deli, and Manteca-Vilanova, Xavier

Source: Journal of Wildlife Diseases, 37(3) : 561-565

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-37.3.561

Journal of Wildlife Diseases, 37(3), 2001, pp. 561–565

REVERSIBLE IMMOBILIZATION OF EURASIAN OTTERS WITH A COMBINATION OF KETAMINE AND MEDETOMIDINE

Jesus Fernandez-Moran,[1,4] **Emi Perez,**[1] **Marta Sanmartin,**[1] **Deli Saavedra,**[2] **and Xavier Manteca-Vilanova**[3]

[1] Barcelona Zoo, Veterinary Service, Barcelona, 08003, Spain
[2] Fundació Territori i Paistage, Provença 261-265, 08008 Barcelona, Spain
[3] School of Veterinary Science, Universitat Autonoma de Barcelona, Spain
[4] Corresponding author (e-mail: fernandez@mail.cinet.es)

ABSTRACT: The efficacy and safety of the combination of medetomidine and ketamine was examined in order to establish an adequate chemical immobilization protocol in the Eurasian otter (*Lutra lutra*) for use during translocation projects in Spain. Thirty-eight Eurasian otters ranging in body mass from 3 to 8.7 kg (mean 5.3 kg) were successfully anesthetized on 82 occasions. The dosage of ketamine was 5.1 ± 0.8 (3.4–6.6) mg/kg (mean ± SD; range) combined with medetomidine at a dosage of 51 ± 8 μg/kg (34–66 μg/kg). In most cases anaesthetic effect occurred within 3 min and the mean induction time was 5.5 ± 3.2 min. The mean pulse rate was 95 beats/min. The mean respiratory rate was 32 respirations/min while the relative oxyhemoglobin saturation was 93%. According to these results, this anesthetic protocol is considered safe and can be recommended in wild caught Eurasian otters for immobilization during translocation projects. It is safe, rapid and can be reversed when needed with atipamezole. However caution is required as heart depression resulting in bradychardia may occur.

Key words: Atipamezole, Eurasian otter, immobilization, ketamine, *Lutra lutra*, medetomidine.

INTRODUCTION

The Eurasian otter (*Lutra lutra*) is distributed throughout Europe, Asia, and northern Africa. The population is considered threatened and a total of 4,000 individuals has been estimated to occur in Spain (Ruiz-Olmo and Delives, 1999). Translocation projects are being conducted in different countries including Spain (Sjöåsen, 1997; Saavedra and Sargatal, 1998).

References on immobilization for Eurasian otters are scarce (Holmes, 1974; Jenkins and Gorman, 1981; Kuiken, 1988; Arnemo, 1990; Vogt, 1994). However, some studies have been published with the similar North American river otter (*Lutra canadensis*) (Spelman, 1999).

In this paper, we report our experiences with numerous immobilizations conducted during a reintroduction project with the aim of determining the efficacy and safety of the combination of medetomidine-ketamine in order to establish an adequate and reversible immobilization protocol in the Eurasian otter for use during translocation projects in Spain.

MATERIAL AND METHODS

Thirty eight otters (13 males and 25 females) were live-trapped in southwestern (Extremadura) (39°30′N, 6°30′W) and northern (Asturias) (43°30′N, 6°30′W) Spain between February 1996 and October 1998. Victor double long spring traps (#1–1.5 Softcatch; Woodstream Corp., Lititz, Pennsylvania, USA) were set and checked every morning following the method described elsewhere (Serfass et al., 1996). Otters were urgently transported to the Barcelona Zoo (Barcelona, Spain) by night in an 11 hr trip.

Once the animals arrived at the Barcelona Zoo, they were individually housed indoors in wire-mesh cages (2.44 m long × 1.22 m wide × 1.22 m high) suspended above the ground, with attached wooden nest boxes (0.91 m long × 0.61 m wide × 0.51 m high). Food and water was offered ad libitum. The diet consisted of a mixture of fresh trout, chicks, and crayfish.

Otters were considered adapted to captivity when they started to eat, which usually took about 2 to 3 days. Animals were released within 30 days of capture, in the Parc Natural Aiguamolls de l'Empordà, (Girona, Cataluña, Spain; 3°05′E, 42°15′N). Throughout the captivity period they were subjected to several medical evaluations including blood sampling, weighing, radiologic studies, and complete physical examination in which anesthesia was required.

TABLE 1. Summary of 82 immobilizations in 38 Eurasian otters (13 males and 25 females) immobilized with medetomidine and ketamine. Pulse rate, respiratory rate, SpO_2 and rectal temperature were recorded 15 min after darting.

Parameters	Number	Mean	SD	Range
Weight (kg)	82	5.3	1.3	3.0–8.7
Ketamine dose (mg/kg)	82	5.1	0.8	3.4–6.6
Medetomidine dose (μg/kg)	82	51	8	34–66
SpO_2 (%)	48	93	6	91–99
Breaths/min	28	32	7	20–44
Heart beats/min	54	95	21	56–173
First anesthetic effect (min)	82	3	2	2–7
Induction time (min)	82	5	3	3–9
Rectal temperature (C)	45	38.4	1.5	31.9–40.9

Eighty-two chemical immobilizations were evaluated.

The anesthetic agents were administered intramuscularly (i.m.) in the hind limb by means of a 2 ml plastic dart equipped with a 1.1 × 38 mm needle and delivered by blow pipe (Daninject International, Gelsekirchen, Germany). A mixture of approximately 5 mg/kg of ketamine hydrochloride (100 mg/ml, Imalgene 1000, Rhône Mérieux, Lyon, France) and 50 μg/kg of medetomidine hydrochloride (1 mg/ml, Domtor, Orion Corporation, Turku, Finland) was delivered. For reversal atipamezole hydrochloride (5 mg/ml, Antisedan, Orion Corporation) was administered i.m. at 5 mg per mg medetomidine hydrochloride. When needed, a complementary dose of ketamine was administered at 2.5 mg/kg. Other products used were intravenous (i.v.) or i.m. atropine sulphate (1 mg/ml, Atropina 1 mg, Braun, Barcelona, Spain) at dosage of 0.02 mg/kg when heart rate decreased lower than 100 and oxygen flows administered by nasal tube or facemask at a rate of 21 per min, in cases when poor oxygenation was detected.

Fasting time was at least 5 hr. During anesthesia animals remained in dorsal recumbency. The eyes were humidified with eye protector drops (Bañoftal, Alconcusí, Laboratorios Cusí, Barcelona, Spain).

The degree and quality of the immobilizations were evaluated as (1) fair where the animal was sedated but able to struggle; (2) good with deep sedation but occasional muscle tension or mild struggling when subject to painful procedures and (3) excellent in which there was good muscle relaxation and no response to venipuncture.

Most otters were monitored during the anesthesia for pulse rate and relative arterial oxygen saturation (SpO_2), (N-20P pulse oximeter system, Nellcor, Hayward, California, USA) with a D-20 probe placed on the tongue. Respiration rate was determined by breathing movements. Rectal temperature was measured with a rectal thermometer. SpO_2 and body temperature were recorded on 48 events and heart and respiratory rates on 54 and 28 occasions respectively, 15 min after darting. On 12 occasions, the heart rate and SpO_2 were recorded at time, 15, 20 and 25 min after darting.

The following potential problems were considered during the anesthesias: tachycardia with a heart rate >180 beats/min; bradychardia with the heart rate <100 beats/min; hyperthermia where the rectal temperature was >40 C; hypoxemia when the SpO_2 was <80%; movement during the procedure, response to handling, and/or poor myorelaxation.

Throughout the immobilizations, behavioral changes were recorded. The initial effect time was defined as the interval between time of injecting and onset of ataxia. Induction time was the interval between the injection time and the time when otters became recumbent and nonresponsive to stimuli. Reversal time was the time from administration of the reversal agent to the time when the animals were able to stand and walk. Analgesia was defined as the lack of purposeful response to a painful stimulus (venipuncture).

RESULTS

In this study 38 Eurasian otters (13 males and 25 females) were successfully anaesthetized on 82 occasions. Table 1 summarizes the results of the 82 immobilizations. The induction was rapid and smooth in all cases. Myorelaxation was generally good and according to the quality of the anesthesia, 64 (78%) events were classified as excellent, 17 (21%) as good, and only 1 as fair.

Severe bradycardia (<70 beats/min) occurred in four cases (5%) while moderate bradychardia (heart rates between 70 and 100 beats/min) occurred in 28 cases (34%). Fifty otters (61%) had rates >100 beats/min. Mean value for heart rate increased from 89 beats/min at 15 min to 91 and 97 beats/min at 20 and 25 min, respectively. In all the episodes of bradychardia, otters responded within 5 min to atropine (0.02 mg/kg i.v. or i.m.) administration with increasing heart rates.

Rectal temperature data showed only one case of hyperthermia (40.9 C) that was treated successfully with ice packs applied to the body.

Breathing was regular and deep in most cases. Apneas shorter than two min occurred in three animals during the first min of immobilizations. In those cases administration of oxygen maintained the oxygen saturation level above 80% until breathing resumed.

Only one animal had an SpO_2 value of <80%. Mean values for SpO_2 also increased from 91% to 94% and then maintained at 93% (min 15, 20 and 25).

Between 30 and 40 min after induction all the animals were given atipamezole at a dose rate of five times of the initial dose of medetomidine i.m. and left in the attached wooden nest boxes without light or external stimuli. Otters recovered gradually and quietly but ataxia was present in most otters at the first stages. In <5 min all animals were able to move and responded to external stimuli. Observation period was longer than 5 hr and we observed limb ataxia in a few recovered otters but we never observed resedation.

DISCUSSION

Ketamine has been used in a variety of carnivores alone and combined with xylazine, diazepam, midazolan and medetomidine (Ramsden et al., 1976; Kreeger et al., 1996). Dosages reported for the otter when used alone are as high as 6 to 30 mg/kg (Jenkins and Gorman, 1981; Reuther and Brandes, 1984; Kuiken, 1988; Serfass et al., 1993). In North American river otters, dosages of 10 mg/kg resulted in poor myorelaxation, variable quality of anesthesia, hyperthermia, struggling and cardiopulmonary complications (Spelman et al., 1993). When combined with the alpha-2-agonist medetomidine the muscle relaxation improves and the anaesthetic depth increases (Spelman et al., 1993) while reversibility is obtained. Ketamine-medetomidine combinations have been used successfully, safely and reversibly in a wide variety of exotic mammals including the otter (Jalanka and Roeken, 1990; Spelman et al., 1994). The EEP/studbook husbandry guidelines for *Lutra lutra* (Vogt, 1994) recommend among others, medetomidine (150 μg/kg) combined with ketamine (5–10 mg/kg) or medetomidine (100 μg/kg) with ketamine (5 mg/kg) and midazolan (0.2 mg/kg). Medetomidine (25 μgm/kg) combined with a low dosage of ketamine (2.5 mg/kg) produced stable short-term anesthesia in river otters while severe respiratory depression developed when using ketamine (10 mg/kg) combined with xylazine (1–2 mg/kg) (Spelman, 1999). In a report where 10 Asian otters were successfully immobilized, the author recommended dose rates of 100 to 120 μg/kg medetomidine with 4–5 mg/kg ketamine (Lewis, 1991).

The dosage of 50 μg/kg medetomidine used in this study was based primarily on previous studies with North American river otter (Spelman et al., 1993) and on the author's experience. Lower dosages resulted in an insufficient level of anesthesia whereas higher dosages caused severe respiratory depression (respiration rates below 10 respirations/min and SpO_2 lower than 80%). In combination with medetomidine, the immobilizing effects of ketamine are enhanced, allowing a reduction in the amount of ketamine and leading to improved myorelaxation and increased potential for adequate reversal (Jalanka, 1989). We found a dosage of 5 mg/kg ketamine to be effective and adequate for Eurasian otter immobilization. Atipame-

zole has been reported to cause excitement and overalertness in some wild carnivores treated with medetomidine and medetomidine-ketamine (Jalanka and Roeken, 1990), perhaps as a result of a residual ketamine effect or a high dose. In our study, signs of excitement were of brief duration and in most cases recoveries were smooth and calm.

Hyperthermia has been claimed to be a serious anesthetic complication in otters (Reuther and Brandes, 1984) and has been described as a potential adverse effect of ketamine anesthesia. In our study, however only one case of hyperthermia occurred.

River otters are highly sensitive to the depressant effects of ketamine on the respiratory system (Spelman et al., 1993). Medetomidine in dogs depresses the respiratory rate and may alter respiratory patterns but ketamine tends to ameliorate these effects (Kreeger et al., 1996). In our study respiratory depression did not happen. Otters had in most cases deep and regular breathing. Values for SpO_2 below 90% are considered undesirable and indicate depressed cardiopulmonary function in river otters (Spelman et al., 1997). In our case, mean SpO_2 was higher than 90% (93%). In one case however there was respiratory depression with SpO_2 value as low as 75%. Furthermore, the supplementation of oxygen via facemask or nasal tube is advisable when using this combination. Spelman et al. (1997) recommend to have an endotracheal tube available when injectable anesthetics are used. Under field conditions, reversing the anesthesia and leaving the animal in a quiet and dark pen can be advisable if severe respiratory depression is detected.

Information on baseline heart rate for Eurasian otters is lacking, but Spelman et al. (1993) defined bradychardia in North American river otter as heart rate below 100 beats/min. According to this, bradychardia was a serious concern in this study. Indeed, 39% of otters immobilized with this combination showed heart rates below 100 beats/min. Although the central stimulating effects of ketamine on the cardiovascular system may offset the depressive effects of the alpha 2-adrenergic agonists, significant bradychardia may occur when using medetomidine-ketamine, even at low dosages (Spelman et al., 1994). The advantages of using anticholinergic drugs with alpha 2-adrenergic agonists has not been proven, but concurrent administration of atropine with medetomidine can mediate ventricular arrhythmias in dogs and wolves (Kreeger et al., 1996). In our cases otters responded to atropine (0.02 mg/kg) by increasing heart rates when used. Hypertension may develop with concurrent use of atropine and medetomidine and this effect can be promoted by the dissociative anesthetics (Spelman, 1999). In our case blood pressure was not monitored so we could not determine exactly the importance of the use of atropine. Heart rates increased during the immobilizations in most cases and values fluctuated from 89 beats/min at min 15, to 91 beats/min and 97 beats/min at min 20 and 25 respectively. Values above 180 beats/min which were considered as tachycardia were not seen on this trial.

The primary advantage of this combination is potential reversibility. Antagonism with atipamezole was rapid and complete and recoveries were smooth and calm in all the cases shown here.

In conclusion, the anaesthetic protocol studied here consisting of a combination of medetomidine (50 μgm/kg) with ketamine (5 mg/kg) is considered safe and can be recommended in wild caught Eurasian otter for chemical immobilization during translocation projects. It is safe, rapid and can be reversed with atipamezole. However caution is needed as heart depression resulting in bradychardia may occur.

ACKNOWLEDGEMENTS

The authors acknowledge the valuable help of the Barcelona Zoo staff in taking care of the otters during their stay under human care. This project was supported by the Foundation Territori i Paisatge and the Barcelona Zoo. We are

grateful to L. Spelman and J. Ruiz-Olmo for their helpful suggestions when preparing this manuscript.

REFERENCES

ARNEMO, J. M. 1990. Chemical immobilization of European river otter (*Lutra lutra*). Norsk Veterinaertidsskrift 102: 767–770.

HOLMES, A. A. 1974. Immobilon in the otter. Veterinary Record 95: 574.

JALANKA, H. H. 1989. Medetomidine- and ketamine-induced immobilization of snow leopards (*Panthera uncia*): doses, evaluation, and reversal by atipemazole. Journal of Zoo and Wildlife Medicine 20: 154–162.

———, AND B. O. ROEKEN. 1990. The use of medetomidine, medetomidine-ketamine combinations, and atipemazole in non domestic mammals. Journal of Zoo and Wildlife Medicine 21: 259–282.

JENKINS, D., AND M. L. GORMAN. 1981. Anaesthesia of the European otter (*Lutra lutra*) using ketamine hydrochloride. Journal of Zoology 194: 265–267.

KREEGER, T. J., M. CALLAHAN, AND M. BECKEL. 1996. Use of medetomidine for chemical restraint of captive gray wolves (*Canis lupus*). Journal of Zoo and Wildlife Medicine 27: 507–512.

KUIKEN, T. 1988. Anaesthesia in the European otter (*Lutra lutra*). The Veterinary Record 123: 59.

LEWIS, J. C. M. 1991. Reversible immobilisation of Asian small-clawded otters with medetomidine and ketamine. The Veterinary Record 128: 86–87.

RAMSDEN, R. O., P. F. COPPIN, AND D. H. JOHNSTON. 1976. Clinical observation on the use of ketamine hydrochloride in wild carnivores. Journal of Wildlife Diseases 12: 221–225.

REUTHER, V. C. AND B. BRANDES. 1984. Occurrence of hyperthermia during immobilization of European otter (*Lutra lutra*) with ketamine hydrochloride. Deutsche Tieräztliche Wochenschrift 91: 66–68.

RUIZ-OLMO, J., AND M. DELIVES. 1999. La nutria en España ante el horizonte del año 2000. SECEM (Sociedad Española para la Conservacion y el Estudio de los Mamiferos), Malaga, Spain, 300 pp.

SAAVEDRA, D., AND J. SARGATAL. 1998. Reintroduction of the otter *Lutra lutra* in NE Spain. Galemys 10: 191–199.

SERFASS, T. L., L. P. RANDALL, M. T. WHARY, AND R. P. BROOKS. 1993. River otter (*Lutra canadensis*) reintroduction in Pennsylvania: Prerelease care and clinical evaluation. Journal of Zoo and Wildlife Medicine 24: 28–40.

———, R. P. BROOKS, T. J. SWIMLEY, L. M. RYMON, AND A. H. HAYDEN. 1996. Considerations for capturing, handling, and translocating river otters. Wildlife Society Bulletin 24: 25–31.

SJÖÅSEN, T. 1997. Movement and establishment of reintroduced European otters (*Lutra lutra*). Journal of Applied Ecology 34: 1070–1080.

SPELMAN, L. H. 1999. Otter anesthesia. *In* Zoo and wild animal medicine, current therapy 4th Edition. M. Fowler and E. Miller (eds.). W. B. Saunders Company, Philadelphia, Pennsylvania, pp. 436–443.

———, P. W. SUMMER., J. F. LEVINE, AND M. K. STOSKOPF. 1993. Field anesthesia in the North American river otter (*Lutra canadensis*). Journal of Zoo and Wildlife Medicine 24: 19–27.

———, ———, ——— AND ———. 1994. Medetomidine-ketamine anesthesia in the North American river otter (*Lutra canadensis*) and reversal by atipemazole. Journal of Zoo and Wildlife Medicine 25: 214–223.

———, ———, W. B. KARESH, AND M. K. STOSKOPF. 1997. Tiletamine-zolazepam anesthesia in North American river otters (*Lutra canadensis*) and partial antagonism with flumazemil. Journal of Zoo and Wildlife Medicine 28: 418–425.

VOGT, P. 1994. Husbandry Guidelines for *Lutra lutra*. European Endangered Species Program, EEP, (Studbook for *Lutra lutra*), 17 pp.

Received for publication 16 July 2000.