Intranasal Administration of Xylazine to Reduce Stress in Elk Captured by Net Gun

Authors: Cattet, Marc R. L., Caulkett, Nigel A., Wilson, Clay, Vandenbrink, Tony, and Brook, Ryan K.

Source: Journal of Wildlife Diseases, 40(3) : 562-565

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-40.3.562

Journal of Wildlife Diseases, 40(3), 2004, pp. 562–565

Intranasal Administration of Xylazine to Reduce Stress in Elk Captured by Net Gun

Marc R. L. Cattet,[1,5] **Nigel A. Caulkett,**[2] **Clay Wilson,**[3] **Tony Vandenbrink,**[3] **and Ryan K. Brook**[4] [1] Canadian Cooperative Wildlife Health Centre, Department of Veterinary Pathology, Western College of Veterinary Medicine, University of Saskatchewan, 52 Campus Drive, Saskatoon, Saskatchewan S7N 5B4, Canada; [2] Department of Small Animal Clinical Sciences, Western College of Veterinary Medicine, University of Saskatchewan, 52 Campus Drive, Saskatoon, Saskatchewan S7N 5B4, Canada; [3] Bighorn Helicopters Inc., 1817 Theatre Road, Cranbrook, British Columbia V1C 4H7, Canada; [4] Environmental Science Program, 239 Machray Hall, Faculty of Science, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada; [5] Corresponding author (email: marc.cattet@usask.ca)

ABSTRACT: Forty free-ranging elk (*Cervus elaphus manitobensis*) were captured by net gun in Riding Mountain National Park (Manitoba, Canada) during February 2002 and were administered either saline (control) or xylazine by the intranasal route, to evaluate the efficacy and benefit of intranasal xylazine to reduce stress. Elk that received xylazine had higher relaxation scores than control elk, and the onset of sedation occurred quickly, often <1 min. Serum concentrations of cortisol, creatine kinase, and γ-glutamyltransferase were lower in elk that received xylazine than in control elk. At the conclusion of handling, the intravenous administration of yohimbine quickly abolished the sedative effect of xylazine, which allowed elk to be released without concern of physical injury due to ataxia. The intranasal administration of xylazine can be used to reduce stress in wild animals under situations where they are being handled while physically restrained.

Key words: Capture, *Cervus elaphus manitobensis*, elk, handling, intranasal, net gun, saline, serum biochemistry, stress, xylazine, yohimbine.

The use of net guns has been advocated as an effective method to capture free-ranging wild animals (Kock et al., 1987a, b). In comparison to capture by chemical immobilization, capture by net gun is more rapid, the specific location of capture is better controlled, and the duration of immobility is greatly reduced. Furthermore, capture by net gun is less likely to induce the physiologic disturbances sometimes seen with chemical immobilization—for example, respiratory depression, hypoxia, and hyperthermia.

Although capture by net gun and subsequent handling of captured animals is often carried out without the use of drugs, the administration of low doses of α_2-agonist drugs has potential to reduce stress by providing light sedation and analgesia (Klein and Klide, 1989). However, to be beneficial, α_2-agonist drugs must be administered as soon as possible after capture and provide a rapid effect. The intravenous administration of drugs provides a rapid effect, but restraining a wild animal sufficiently to permit venipuncture can sometimes involve a struggle and almost always requires hobbling of limbs and removal of the net to allow access to veins. The time required for this can further exacerbate stress, negating any potential benefit from drug therapy. Alternatively, drugs can be administered intramuscularly with minimal struggle, but they require more time (10–20 min) for the maximum effect to occur (Fowler, 1995; Kreeger, 1996) and, as a consequence, can lengthen the handling time.

The intranasal administration of various types of drugs, including tranquillizers and opioids, to children is a safe and efficacious method of drug delivery, with rapid time to effect, which is often as quickly as that of intravenous administration (Lahat et al., 2000; Lloyd et al., 2000; Finkel et al., 2001; Klossek et al., 2001). Although the intranasal administration of drugs is not a common procedure in veterinary medicine, it has been described as an effective method to deliver anesthetic drugs to rabbits (Robertson and Eberhart, 1994). This method of drug delivery also holds potential for handling captive wildlife and zoo animals in situations where a rapid drug effect is required but intravenous access may be difficult. As part of a study of the ecology and movement patterns of elk (*Cervus elaphus manitobensis*) in the vicinity of Riding Mountain National Park (Manitoba, Canada; 51°52′N, 100°36′W), we investigated the efficacy and benefit of xylazine administered by the intranasal route to reduce handling stress.

Between 10 and 13 February 2002, a net gun fired from a Hughes 500D helicopter was used to capture 40 elk within Riding Mountain National Park. After capture, elk were restrained with hobbles, the net was removed, and a blindfold was applied. Radio collars were fitted around the neck of 35 elk, and an ear radio transmitter was applied to an additional five animals. Identification ear tags were applied to both ears on all elk. At the conclusion of handling, blood samples (50 ml) were collected by venipuncture of the jugular vein, hobbles and blindfolds were removed, and the elk were released. Blood samples were centrifuged within 8 hr of collection to separate serum from cells. Serum samples were stored frozen (at −20 C) until they were analyzed within 1 wk of collection using an Abbott Spectrum Series II biochemistry analyzer (Abbott Laboratories Diagnostic Division, Abbott Park, Illinois, USA).

A single-blind study was used to determine the efficacy and stress-reducing effect of xylazine administered by the intranasal route. Either 5 ml of saline (control) or xylazine hydrochloride (Rompun 100 mg/ml; Bayer Inc., Agriculture Division–Animal Health, Etobicoke, Ontario, Canada) was administered at 1.5–2.0 mg/kg estimated body weight using a syringe and a 15-cm feeding tube inserted into one nostril of captured animals as soon as possible after capture, often before hobbles were applied. Two handlers who were highly experienced in the capture of elk were blinded as whether saline or xylazine was administered to each animal. After the collection of blood, but before removing the hypodermic needle from the jugular vein, 10 ml of yohimbine (Antagonil; Wildlife Pharmaceuticals, Inc., Fort Collins, Colorado, USA) was administered by the intravenous route at 0.15–0.20 mg/kg to elk that received xylazine. Similarly, 10 ml of saline was administered to control elk. The allocation of xylazine or saline among elk was done randomly, with 20 animals receiving treatment and 20 animals serving as controls. The capture and handling protocol for elk was approved by the Animal Care Committee at the University of Manitoba (Winnipeg, Manatoba, protocol F01-037).

Immediately after the release of each elk, the same handler would be asked to score the animal's level of relaxation, using a visual analog scale graded from 1 (continuously fighting against restraint) to 10 (completely relaxed throughout handling). Visual analogue scales have been used extensively in human and veterinary medicine to quantify a variety of subjective data, especially pain (Mathews, 2000).

Data were analyzed using computer software (SPSS 10.0 for Windows; SPSS Inc., Chicago, Illinois, USA). Two-way analysis of variance (ANOVA) was used to detect significant effects of treatment (xylazine vs. saline) on relaxation scores and serum biochemistry values, while controlling for sex (female vs. male) as a factor, and for times required for pursuit, drug administration, and handling as covariates (Zar, 1996). Significance was determined at $P<0.05$. Unless indicated otherwise, results are presented as mean ± standard error of the mean (SE).

Hazing elk into open locations by helicopter to permit capture required no more than 6 min, during which time elk responded generally by walking, with occasional short bursts of running. Once suitably positioned, pursuit required 16±5 sec for 37 elk captured by a single net. Three other elk required two nets for capture and longer pursuit times (2.1–14.1 min). Xylazine or saline was administered by the intranasal route to elk within 1.7±0.2 min of capture, and the total handling time, from capture to the removal of hobbles, was 8.8±0.4 min. Blood samples were collected, and either yohimbine or saline administered, immediately before the hobbles were removed.

Elk that received xylazine had higher relaxation scores (7.8±0.1; range, 6.9–8.9) than elk that received saline (6.6±0.3; range, 2.7–9.3; F=38.7, P<0.001). Furthermore, many treated animals showed varying degrees of sedation (i.e., decrease in respiratory rate, cessation of struggling, and relaxation of limbs) within 1 min after the xylazine administration that were not observed in the control animals. Treatment elk also had lower serum concentrations of cortisol (75±4.8 vs. 93±5.9 mmol/l; F=5.1, P<0.05), creatine kinase (385±57.9 vs. 570±57.1 U/l; F=5.1, P<0.05), and γ-glutamyltransferase (28±1.3 vs. 33±1.3 U/l; F=8.6, P<0.01) than did elk administered saline. After the removal of hobbles, most elk were on their feet immediately and running from the site of capture. A few elk that received xylazine and yohimbine remained recumbent after the removal of hobbles but rose to their feet and ran, without ataxia, after light physical stimulation.

After capture, all animals were located twice weekly by radio telemetry. A 2-yr-old male that received xylazine and an adult female that received saline were found dead at approximately 9 and 16 wk, respectively, after capture. Field necropsies were performed and predation by wolves was suspected to be the cause of death of both animals.

The administration of xylazine by the intranasal route provided a quick sedative effect and helped reduce stress during handling. Extension of the syringe with a 15-cm feeding tube was sufficient to ensure that most, if not all, the syringe content was retained in the nasal cavity of elk after injection. Evidence of sedation, including a slowing of the respiratory rate, the cessation of struggling, and relaxation of limbs, was usually apparent in treated elk within 1 min of receiving xylazine. This onset of effect is nearly as rapid as when xylazine is administered intravenously and is significantly faster than when it is administered intramuscularly, where sedation is not apparent for 15–20 min after the injection (Klein and Klide, 1989). Higher relaxation scores and lower serum cortisol concentrations in xylazine-treated elk were consistent with a lower degree of stress than those experienced by control elk. Furthermore, the lower concentration of creatine kinase in xylazine-treated elk indicated less leakage of the enzyme from muscle tissue, an observation that is consistent with reduced muscle injury as a result of struggling during restraint. The intravenous administration of yohimbine quickly abolished the sedative effect of xylazine, which allowed elk to be released without concern of physical injury due to ataxia.

Serum concentrations of γ-glutamyltransferase were lower in elk that were administered xylazine than in those administered saline. Although the significance of this finding is uncertain, high γ-glutamyltransferase concentrations have been observed in association with strenuous physical activity in other captured wild mammals, including beluga whales (*Delphinapterus leucas*; St. Aubin and Geraci, 1989) and grizzly bears (*Ursus arctos*; Cattet et al., 2003). Nevertheless, the tissue responsible for the leakage of this enzyme under stressful situations has yet to be determined.

Two radio-collared elk that died after the study were determined by field necropsy to have been killed by wolves. Given the length of time that elapsed between capture by net gun and death (9–16 wk), it appears unlikely that the procedures used during capture and handling increased the probability of predation on these animals.

In conclusion, xylazine administered by the intranasal route was effective at reducing handling stress in elk captured by net gun. The drug could be administered soon after capture, while elk were still entangled by the net, before hobbles were applied. The onset of sedation was fast, often <1 min, and the intravenous administration of yohimbine at the conclusion of handling was effective at quickly antagonizing the sedative effect of xylazine. Although the intranasal administration of xylazine may not be required for all animals captured by net gun, it can be used to reduce stress in animals that struggle excessively or in animals that are severely entangled in the net. Furthermore, the intranasal administration of xylazine, or other more potent and specific α_2-agonists (e.g., detomidine and medetomidine), may have beneficial application in other situations where wild animals are being handled while physically restrained, e.g., animals held in squeeze chutes.

Funding for this study was provided by Parks Canada–Riding Mountain National Park, Manitoba Conservation, Manitoba Food and Agriculture, and the Canadian Food Inspection Agency. Logistic support during field operations was provided by Parks Canada–Riding Mountain National Park and was coordinated by D. Bergeson and B. Fyten.

LITERATURE CITED

CATTET, M. R. L., K. CHRISTISON, N. A. CAULKETT, AND G. B. STENHOUSE. 2003. Physiologic responses of grizzly bears to different methods of capture. Journal of Wildlife Diseases 39: 649–654.

FINKEL, J. C., I. T. COHEN, R. S. HANNALLAH, K. M. PATEL, M. S. KIM, K. A. HUMMER, S. S. CHOI, M. PENA, S. B. SCHREIBER, AND G. ZALAL. 2001. The effect of intranasal fentanyl on the emergence characteristics after sevoflurane anesthesia in children undergoing surgery for bilateral myringotomy tube placement. Anesthesia and Analgesia 92: 1164–1168.

FOWLER, M. E. 1995. Restraint and handling of wild and domestic animals, 2nd Edition. Iowa State University Press, Ames, Iowa, 383 pp.

KLEIN, L. V., AND A. M. KLIDE. 1989. Central α_2-adrenergic and benzodiazepine agonists and their antagonists. Journal of Zoo and Wildlife Medicine 20: 138–153.

KLOSSEK, J. M., F. LALIBERTE, M. F. LALIBERTE, N. MOUNEDJI, AND J. BOUSQUET. 2001. Local safety of intranasal triamcinolone acetonide: Clinical and histological aspects of nasal mucosa in the long term treatment of perennial allergic rhinitis. Rhinology Utrecht 39: 17–22.

KOCK, M. D., D. A. JESSUP, R. K. CLARK, AND C. E. FRANTI. 1987a. Effects of capture on biological parameters in free-ranging bighorn sheep (*Ovis canadensis*): Evaluation of drop-net, drive-net, chemical immobilization and the net gun. Journal of Wildlife Diseases 23: 641–651.

———, ———, ———, ———, AND R. A. WEAVER. 1987b. Capture methods in five subspecies of free-ranging bighorn sheep: an evaluation of drop-net, drive-net, chemical immobilization, and the net gun. Journal of Wildlife Diseases 23: 634–640.

KREEGER, T. J. 1996. Handbook of wildlife chemical immobilization. Wildlife Pharmaceuticals, Inc., Fort Collins, Colorado, 342 pp.

LAHAT, E., M. GOLDMAN, J. BARR, T. BISTRITZER, AND M. BERKOVITCH. 2000. Comparison of intranasal midazolam with intravenous diazepam for treating febrile seizures in children: Prospective randomized study. British Medical Journal 321: 83–86.

LLOYD, C. J., T. ALREDY, AND J. C. LOWRY. 2000. Intranasal midazolam as an alternative to general anesthesia in the management of children with oral and maxillofacial trauma. British Journal of Oral and Maxillofacial Surgery 38: 593–595.

MATHEWS, K. A. 2000. Pain assessment and general approach to management. Veterinary Clinics of North America: Small Animal Practice 30: 729–752.

ROBERTSON, S. A., AND S. EBERHART. 1994. Efficacy of the intranasal route for administration of anesthetic agents to adult rabbits. Laboratory Animal Science 44: 159–165.

ST. AUBIN, D. J., AND J. R. GERACI. 1989. Adaptive changes in hematologic and plasma chemical constituents in captive beluga whales, *Delphinapterus leucas.* Canadian Journal of Fisheries and Aquatic Sciences 46: 796–803.

ZAR, J. H. 1996. Biostatistical Analysis, 3rd Edition. Prentice Hall, Upper Saddle River, New Jersey, 662 pp.

Received for publication 10 October 2003.