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R51163 AS A SEDATIVE FOR HANDLING AND TRANSPORTING PLAINS BISON AND WAPITI

Lyle A. Renecker,[1] Jim Bertwistle,[2] Henry M. Kozak,[3] Robert J. Hudson,[3] Denis Chabot,[4] and Stan MacLean[5]

[1] Agriculture and Forestry Experiment Station, School of Agriculture and Land Resources Management, University of Alaska, Fairbanks, Alaska 99775, USA
[2] Elk Island National Park, R.R.# 1, Site 4, Fort Saskatchewan, Alberta, Canada T8L 4J6
[3] Department of Animal Science, University of Alberta, Edmonton, Alberta, Canada T6G 2P5
[4] Department of Biological Sciences, University of Calgary, Calgary, Alberta, Canada T2N 1N4
[5] 1952 Glenmore Ave., Sherwood Park, Alberta, Canada T8A 0X5

ABSTRACT: Forty captive wapiti (*Cervus elaphus*) and thirty-two bison (*Bison bison bison*) were tested in April and October 1988, respectively, for their response to the sedative R51163. Treatment animals were injected with either 0.1, 0.2, or 0.3 mg of R51163/kg and then observed for 72 hr. Behavior was significantly altered by the drug. Hyperactive, aggressive, and milling behavior was characteristic of treated wapiti and they were extremely dangerous and reared when hind quarters were touched. Although treated plains bison displayed some milling behavior, they were generally more calm than wapiti. There was a marked difference between sexes in plains bison for all behavioral categories. Male bison were more ataxic, often observed in sternal or lateral recumbency, less conscious, and were slower to respond than females or controls. Respiratory rate increased in treated wapiti and plains bison, and heart rates of treated wapiti increased. Because of the powerful sedative effect on large, male bison, R51163 may be useful for handling unmanageable or dangerous animals and warrants further studies.

Key words: Behavior, plains bison, R51163, sedation, wapiti, chemical immobilization, *Cervus elaphus*, *Bison bison bison*.

INTRODUCTION

Sedatives and analgesics used to immobilize ungulates in North America are unsafe for both personnel and animals. Animals effectively immobilized for long periods of time may experience bloat, aspiration pneumonia, pressure damage to nerves and muscles, hyper- and hypothermia, and excessive salivation. Many analgesics and sedatives available today are only effective for a few species and fall short of the "ideal immobilizing drug" as defined by Franzmann (1982).

In recent years, there have been numerous relocation projects of native wild ungulates. During such projects, animals are captured, handled, and transported over long distances. This process often results in stress, such as shipping fever (Anonymous, 1973; Hoerlein, 1973) in domestic cattle and capture myopathy in wild ungulates (Lewis et al., 1977) or injury induced from animals fighting. With development of the new game farm industry in Canada and the United States, there is the additional need to sort, handle, weigh, trim hooves, and take blood samples from commercially-raised wapiti (*Cervus elaphus*) and plains bison (*Bison bison bison*). During the autumn round-up, obstinate animals are often difficult or impossible to herd into corrals or handle in a squeeze.

The drug R51163 is considered a sedative which appears to improve animal tractability during handling and for minor surgical procedures in domestic cattle (Degryse and Ooms, 1986a, b) but depressed intake in moose (*Alces alces*) (Schwartz et al., 1991). The purpose of this study was to determine the optimum effective dose of R51163 in wapiti and plains bison for sedation and handling.

MATERIALS AND METHODS

The dose titration study involved forty wapiti (12 subadult males and 28 mature females) maintained in a 65 ha enclosure at the Ministik Wildlife Research Station, Alberta, Canada (53°30′N, 112°50′W) on natural forage and a pelleted alfalfa-concentrate ration. Body weights averaged 192 ± 18 kg for stags and 244 ± 5 kg

TABLE 1. Scale and categories used to assess behavior of treated and control bison and elk for R51163 immobilization.

Scale	Behavior categories			
	Ataxia	Recumbency	Consciousness	Response when approached
1	None, no staggering	Standing head up and alert	Alert, no sign of tranquillization	Moves away as if not tranquillized
2	Slight stumbling	Sitting or in stemal recumbency with head up and alert	Alert, but calm and relaxed	Aware, attempts to move away but slow to respond
3	Obvious difficulty in walking	Standing with head down and not alert	Somewhat aware of surroundings, but very slow to respond	Aware, but no attempt to move, very calm and relaxed
4	Cannot walk	In stemal or lateral recumbency with head down and not alert	Appears aware of surroundings, dissociative	No reaction, unaware of being approached

for hinds. Animals were allocated to groups according to sex, age, body weight, and temperament. Behavior was described as wild and unapproachable by humans, born in captivity but excitable, or tractable but animal would not stand for blood sampling. In April 1988, wapiti were randomly assigned to a treatment or control group using a split plot design for repeated measures (Miltiken and Johnson, 1984). Treatment animals were given an intramuscular (i.m.) dose of either 0.1, 0.2, or 0.3 mg R51163/kg (Wildtrans, Wildlife Laboratories, Inc., Fort Collins, Colorado 80524, USA) at a concentration of 20 mg/ml solution with a hand syringe into the rump.

Behavior was monitored following administration of the drug and evaluated subjectively on a scale of 1 to 4 for categories of ataxia, recumbency, consciousness, and response when approached (Table 1). Duration of the experiment was 72 hr with sample intervals at 0, 1, 3, 6, 12, 24, 48, and 72 hr after drug administration. Respiratory rate of 4–8 animals was monitored opportunistically at each sample interval during recovery by observation of the expansion of the thoracic region and by visual signs of breath from the nostrils when ambient temperature dropped below 4 C. Heart rate was monitored on 5 treatment animals (two animals from 0.3, two animals from 0.2, and one animal from 0.1 mg R51163/kg groups) instrumented with a harness/heart rate radio transmitter (modified from Johnston et al., 1980). Electrocardiograms were received using a radio telemetry receiver (Model LA12, AVM Instrument Corp., Livermore, California 94550, USA) and stored on cassette tapes. Heart beats were later counted over 3-8 twenty-second interval periods every 15–60 min when possible.

Thirty-two mature plains bison (18 males and 14 females) were maintained on natural forage at Elk Island National Park (53°35′N, 112°50′W) and Ministik Wildlife Research Station, Alberta, Canada in 13,000 and 194 ha enclosures, respectively. Body weights were 635 ± 44 kg for males and 416 ± 17 kg for females at the time of the study.

Animals were allocated to treatments and observed according to behavioral categories and criteria given in Table 1. All treatment animals were given an i.m. injection of R51163 with a hand-held syringe except for 1 adult male that was injected with a projectile syringe fired from a powder charge rifle (Pneu Dart, Inc., Williamsport, Pennsylvania 17703, USA). Respiratory rate of three to eight animals was monitored opportunistically at each sample interval during recovery by observation of the expansion of the thoracic region and by visual signs of breath from the nostrils when ambient temperature dropped below 4 C.

Ambient temperatures in Alberta ranged between −10 and 8 C with a mean of 2 ± 3 C during the study. Animals were always injected in the morning when ambient temperatures were coolest.

All data were treated with a Box-Cox transformation then applied to a Likert Scale for use with continuous variables (Sokal and Rohlf, 1981). A split plot design for repeated measures ($Y = u + A + B + AB + C/AB + D + AD + BD + ABD + CD/AB + E$; where, A = treatment, B = sex, C = animals, D = period, and E = error) was analyzed using the SPSS-x sta-

tistical package (Anonymous, 1983). Only periods with differences were used in the model. A paired t-test (Steele and Torrie, 1980) was used to test for differences between mean animal weights and physiological parameters.

RESULTS

Differences were evident among wapiti treatment groups in the scales of ataxia ($P < 0.001$) and consciousness ($P < 0.05$). There were significant differences among sample periods for the ataxia ($P < 0.001$) and response when approached ($P < 0.05$) behavioral categories. Differences from the control animals were most profound from 1 to 12 hr after the injection time period with greatest contrasts in the majority of treatment animals occurring within the 1–6 hours post-injection. A treatment x period interaction was significant for the ataxia ($P < 0.001$) and recumbency ($P < 0.05$) behavioral categories. Differences among sexes were only evident for the response when approached category ($P < 0.05$).

Generally, wapiti responded to R51163 with hyperactivity, increased aggression, and milling and circling behavior. Within 15 to 45 min after injection, animals would frequently vocalize, urinate, and display poor tongue control with an open mouth. Treated animals were uncoordinated when standing (front legs often crossed) and walked with a gait that resembled a canter; however, some animals became ataxic with an increase in dosage. Excessive chewing on wood and wire fence became evident as induction progressed. After a 1 hr period, the high dosage group was moved into the handling facility for an assessment of tractability. Although all animals required minimal restraint and tolerated handling procedures in the head, neck, and shoulder regions that simulated procedures for blood sampling and fitting of neck collars, wapiti became extremely aggressive, in some cases biting and then rearing and striking with the front legs, when hind quarters were touched. After 2 hr, agression between animals diminished and they bedded in sternal recumbency. Hypersensitive animals were observed in lateral recumbency for brief periods of time and displayed difficulty when they attempted to stand. All animals walked with a stiff-legged gait. Lethargy was observed in all animals at 3 hr after injection and was followed by normal behavior by 12 hr post-injection. Although these observations were characteristic of individuals in all treatment groups, problems with balance and consciousness were most profound in animals that received the high dosage of R51163.

The injection of R51163 in plains bison produced a somewhat different response. Significant treatment ($P < 0.05$), sex ($P < 0.001$), and period ($P < 0.05$) differences were observed for all behavioral categories. A significant treatment × sex ($P < 0.05$) interaction was observed for the ataxia and consciousness behavioral categories. Differences ($P < 0.05$) were observed in the treatment × period interaction for ataxia, consciousness, and reaction when approached and for the sex × period interaction ($P < 0.01$) in the latter two categories.

Bison responded initially to the drug with some milling and circling behavior during the first 30 to 60 min after injection of the drug. Effects were most evident in the medium and high dosage groups. A protruding tongue and drooling was characteristic of most animals in all treatment groups until 3 hr post-injection. Some bulls continued to drool until 6 hr after R51163 administration which probably reflected the sex differences and greater sensitivity to the drug.

Significantly different behavioral responses attributed to sex were observed. After 3 hr, female bison were bedded in a sternal posture and moved away slowly when approached. In contrast, large, excitable, untractable male bison were most profoundly affected by the drug. One bull charged an observer on a catwalk before injection; however, this animal did not react to noise at 1 hr post-injection. Bulls

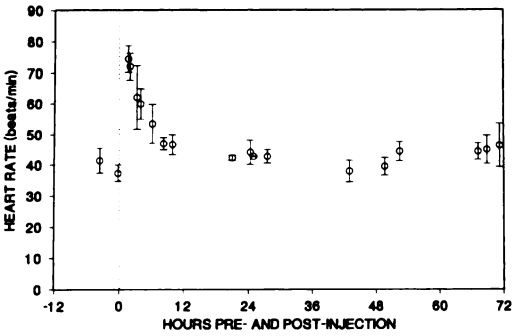

FIGURE 1. Change in mean (±SE) bedded heart rate of two wapiti cows before and after an injection of 0.3 mg/kg of R51163 at the Ministik Wildlife Research Station, Alberta, Canada.

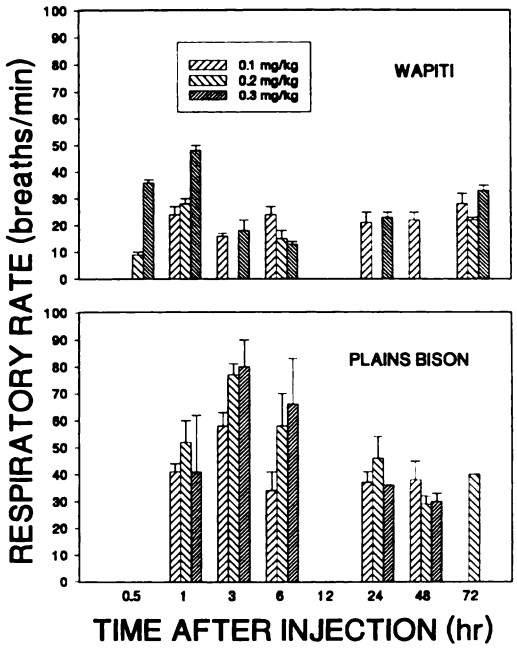

FIGURE 2. Response of respiratory rate in wapiti and plains bison at the Ministik Wildlife Research Station and Elk Island National Park, Alberta, Canada, respectively, given a dosage of either 0.1, 0.2, 0.3 mg/kg of R51163. Bars represent population mean ± SD.

given 0.2 or 0.3 mg/kg were most frequently observed in sternal and often lateral recumbency from 1 to 3 hr after injection. Loud noises and movements were required to make these animals ambulatory. Five bulls were slow to stand and moved away even at 6 hr after drug administration. Some treatment animals remained slow to respond and calm even after 12 hr of recovery, but did not differ from the control group after 24 hr.

Bedded heart rates of treated wapiti ranged from 33 to 80 beats per minute (bpm) over the 72 hr period. The greatest amplitude in heart rates was observed in animals receiving the heaviest dose (Fig. 1). Maximum bedded pulse rates were recorded at 1.7 hr after injection. Pulse rates had returned to near the normal mean (±SE) of 39 ± 3 bpm by 20 hr post-injection. Heart rates for standing wapiti were also elevated for 1 to 2 hr after injection with maximums of 125 ± 5, 37 ± 30, and 73 ± 67% above the means for the low, medium, and high treatment groups. In one female in the high treatment group, heart rate for standing appeared to decline to normal levels in a cascading fashion from 68 bpm at 0.7 hr, to 112 bpm at 1.7 hr, and to 52 bpm at 18.2 hr post-injection.

Respiratory rates of wapiti and plains bison fluctuated during recovery (Fig. 2). Compared to controls, post-injection respiratory rates of plains bison were elevated ($P < 0.001$) at 1 hr for the medium dosage group and 3 hr for all treatments ($P < 0.01$, $P < 0.01$, and $P < 0.001$, respectively). One wapiti hind that received 0.2 mg/kg showed extreme respiratory depression with 9 breaths/min at 15 min after injection. Respiratory rate was significantly ($P < 0.02$) higher than controls for the high treatment group at 3 hr after drug administration. Respiratory depression also appeared evident in the high treatment group with a significant ($P < 0.02$) decrease from 18 ± 4 to 11 ± 1 breaths/min at 3 and 4 hr post-injection, respectively.

DISCUSSION

There were striking differences in behavioral responses of wapiti and plains bison injected with R51163. The explanation for these differences among ungulate species may lie with several possibilities. Often, differences between individuals' and

species' responses have been observed for other sedatives and analgesics (Thorne, 1982). While wapiti appeared to be almost excited by the drug, plains bison, especially large males, became sedated and lethargic. Initial studies on R51163 by Degryse and Ooms (1986a, b) suggested that the drug produced reliable sedation in cattle for caesarian sections. Generally, R51163 seems more effective in bovid species more closely related taxonomically to cattle. These species may have a similar frequency of occurrence of 5-HT_2, alpha$_1$, and H_1 neurotransmitter receptors that have a high affinity and DA_1 neurotransmitter receptors that have a moderate affinity to bind R51163 (Degryse and Ooms, 1986b). Although plains bison (a bovid) appeared more sedate than wapiti (cervid) in this study, they were not sufficiently tranquillized for surgical procedures. Differences probably reflected the higher levels of excitement that are observed in wild species in comparison to domestic cattle.

The nature of the sedation induced by R51163 in wapiti was considered a detriment for both animals and personnel. The ability to handle the head and neck regions of wapiti could possibly cause a false state of confidence in the worker. The speed and explosiveness displayed by animals that were touched on the rump or rear flank negated any possible advantage. Currently, xylazine (Rompun®, Bayvet Division, Miles Laboratories Ltd., Mississauga, Ontario L4W 2A1, Canada) is commonly used as a sedative and analgesic for wapiti on commercial game farms and in wild capture operations. Although the side effects of xylazine, such as respiratory and heart rate depression, are well recognized and documented (Renecker and Olsen, 1985, 1986; Degryse and Ooms, 1986a), we have concluded that xylazine is more consistent, and with an acceptable antagonist, more practical than R51163.

Findings from this study suggested that R51163 may be a suitable sedative for plains bison. Previous records from Elk Island National Park indicate that large bulls from this study were older, aggressive animals. These males were rarely or never handled because of their obstinate and sometimes dangerous behavior. However, after an injection of R51163, their ability to respond rapidly to a noise stimulus from an observer was reduced and uncoordinated. Animal response to the drug also appeared to reflect male body size and previous behavior. One extremely aggressive male (695 kg) was given a low dose of R51163 and became sedated with legs braced 13 min after drug administration and was laterally recumbent for 97 min post-injection. In contrast, a smaller bull (374 kg) received the same dosage, and although the animal responded slowly to noise and observers, and was somewhat unstable when standing, it remained ambulatory. These findings indicate how R51163 may modify temperament of male bison to permit handling.

Absence of an effective sedative for bison has been well recognized. Recently, carfentanil (Wildnil®, Wildlife Laboratories, Inc., Fort Collins, Colorado 80525, USA) was found effective for plains bison (Berger and Kock, 1988); however, this drug induces a state of general anesthesia that must be reversed by a specific antagonist. Because of their large size, bison are difficult to handle and relocate when completely immobilized. Further research may show that R51163 may be an effective sedative to herd, handle, and relocate bison with greater ease and less stress.

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LITERATURE CITED

ANONYMOUS. 1983. SPSS-x User's Guide, 3rd ed. SPSS Inc., Chicago, Illinois, 806 pp.

———. 1973. Curbing shipping fever, handling calves discussed. Feedstuffs 45: 34.

BERGER, J., AND M. D. KOCK. 1988. Overwinter survival of carfentanil-immobilized male bison. Journal of Wildlife Diseases 24: 555–556.

DEGRYSE, A. -D. A. Y., AND L. A. A. OOMS. 1986a. Comparative studies on cardiovascular, respiratory and gastrointestinal effects of sedatives R51163 and xylazine in cattle. Drug Development Research 8: 433–441.

———, AND ———. 1986b. Clinical evaluation of R51163, a sedative in cattle. Journal of Veterinary Pharmacology Therapy 9: 376–384.

FRANZMANN, A. 1982. An assessment of chemical immobilization in North American moose. *In* Chemical immobilization of North American wildlife, L. Nielsen, J. C. Haigh, and M. E. Fowler (eds.). Wisconsin Humane Society, Milwaukee, Wisconsin, pp. 383–407.

HOERLEIN, A. B. 1973. Preconditioning of beef cattle. Journal of the American Veterinary Medical Association 163: 825–827.

JOHNSTON, R. H., R. A. MACARTHUR, AND V. GEIST. 1980. A biotelemetry system for monitoring heart rates in unrestrained ungulates. Biotelemetry Patient Monitoring 7: 188–198.

LEWIS, R. J., G. A. CHALMERS, M. W. BARRETT, AND R. BHATNAGER. 1977. Capture myopathy in elk in Alberta, Canada: A report of three cases. Journal of the American Veterinary Medical Association 171: 927–932.

MILTIKEN, G. A., AND D. E. JOHNSON. 1984. Analysis of messy data, Vol. 1. Designed experiments. Van Nostrand Reinhold Comp., New York, New York, 473 pp.

RENECKER, L. A., AND C. D. OLSEN. 1985. Use of yohimbine and antagonize xylazine-induced immobilization in North American Cervidae. Journal of the American Veterinary Medical Association 187: 1199–1201.

———, AND ———. 1986. Antagonism of xylazine hydrochloride with yohimbine hydrochloride and 4-aminopyridine in captive wapiti. Journal of Wildlife Diseases 22: 91–96.

SCHWARTZ, C. C., K. J. HUNDERTMARK, AND W. R. LANCE. 1991. Effects of R51163 on intake and metabolism in moose. Journal of Wildlife Diseases 27: 119–122.

SOKAL, R. R., AND F. J. ROHLF. 1981. Biometry: The principles and practices of statistics in biological research, 2nd ed., W. H. Freeman, San Francisco, California, 859 pp.

STEELE, R. G. D., AND J. H. TORRIE. 1980. Principles and procedures of statistics. A biometrical approach, 2nd ed., McGraw-Hill Book Co., New York, New York, 633 pp.

THORNE, E. T. 1982. Agents used in North American ruminant immobilization. *In* Chemical immobilization of North American wildlife, L. Nielsen, J. C. Haigh, and M. E. Fowler (eds.). Wisconsin Humane Society, Milwaukee, Wisconsin, pp. 304–334.

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