SHORT COMMUNICATIONS

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Use of Xylazine Sedation with Yohimbine Antagonism in Captive Gray Wolves

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ABSTRACT: Captive gray wolves (*Canis lupus*) were given 2.2 mg/kg xylazine hydrochloride intramuscularly resulting in profound sedation in 9.1 ± 0.6 min (mean ± SE). Heart rate was 42.0 ± 1.0 beats per minute and respiratory rate was 20.1 ± 1.6 respirations per minute during sedation. A variety of manipulations could be performed on sedated animals in relative safety. Thirty min after xylazine administration, the animals were given either 0.15 mg/kg yohimbine hydrochloride or 5% dextrose solution intravenously causing recovery in 5.3 ± 1.0 and 97.1 ± 14.0 min, respectively ($P < 0.001$).

Key words: Gray wolves, *Canis lupus*, xylazine, yohimbine, chemical immobilization, experimental study.

Xylazine hydrochloride (XYL) is an alpha$_2$-adrenergic agonist that has been used singly or as an adjunct to other drugs for the immobilization of many wild species (Bauditz, 1972; Roughton, 1975; Philo, 1978). Ungulates appear to be more sensitive to this drug than do carnivores; domestic cattle, for instance, require one-tenth the dose per kg for sedation than do dogs or cats (Knight, 1980). Although xylazine does not technically cause anesthesia (analgesia and unconsciousness), it can cause profound sedation characterized by hypotension, bradycardia, respiratory depression, analgesia and muscle relaxation (Knight, 1980). Xylazine has not been widely used alone in wild carnivores because sedation can be prolonged and sedated animals can be aroused unpredictably (Booth, 1982).

Yohimbine hydrochloride (YOH) is an alpha$_2$-adrenergic antagonist which has been used to antagonize XYL or the XYL component of drug combinations in many wild species (Jessup et al., 1983, 1985; Hsu and Shulaw, 1984; Mech et al., 1985; Kreeger and Seal, 1986a; Kreeger et al., 1987). Yohimbine markedly reduces recovery times for wolves immobilized with XYL and ketamine hydrochloride (KET) while having minimal physiological or behavioral alterations when used at recommended doses (Kreeger et al., 1987).

Philo (1978) used XYL to chemically restrain captive wolves (*Canis lupus*), but did not evaulate YOH. Our study reports on the efficacy and uses of XYL with YOH antagonism in the management of captive wolves.

This study took place in October 1987 in east central Minnesota. Thirteen adult wolves (seven female, six male) were used. The husbandry of these animals has been previously reported (Kreeger et al., 1987). All animals were given 2.2 mg/kg (1.0 mg/lb) XYL (Rompun, Haver-Lockhart Laboratories, Shawnee, Kansas 66201, USA) intramuscularly (i.m.) via pole syringe. Injections were in the dorsal musculature of the hindlimb. Thirty min after XYL administration, six animals (three female, three male) received 0.15 mg/kg YOH (Sigma Chemical Co., St. Louis, Missouri 63178, USA) and seven animals (four female, three male) received an equal volume of 5% dextrose (control) in the cephalic vein. Preparation of YOH has been previously reported (Kreeger et al., 1987). Test and control animals were selected at random.

Just prior to administration of YOH or 5% dextrose, heart rates (HR) and respiratory rates (RR) were determined by auscultation and recorded. Induction and recovery times also were recorded. Induction time was defined as the time from injection of XYL to recumbency with eyes closed; recovery was the time from injection of either YOH or dextrose to return to normal motor function, alertness and appropriate responses to stimuli. We were unable to record physiological parameters after YOH administration.

Statistical analyses were by one- and two-way ANOVA (Number Cruncher Statistical Systems, Kaysville, Utah 84307, USA). Statistical significance was determined at $P \leq 0.05$. Means are reported with standard errors (SE).

Induction time was 9.1 ± 0.6 min for all animals. Sedation was usually characterized by sternal or lateral recumbency, eyes closed, regular but shallow respirations and variable responses to sound stimuli. Heart rate was 42.0 ± 1.0 beats per minute (bpm) and respiratory rate was 20.1 ± 1.6 respirations per minute (rpm) 30 min after injection of XYL. Wolves receiving YOH recovered significantly faster than did control animals (5.3 ± 1.1 versus 97.1 ± 14.2 min; $P < 0.001$). There were no differences in induction times, physiological indices, or recovery times between sexes ($P > 0.05$).

Sedated wolves could be approached and handled safely if no loud noises or abrupt contact with the animal were made. Intravenous injections usually caused no response. If necessary, a muzzle could be gently placed on the animal without arousal. Heart rate of sedated wolves (42.0 ± 1.0 bpm) was lower than that of unanesthetized, sleeping wolves (54.0 ± 5.0 bpm) as measured by radiotelemetry (T. J. Kreeger, unpubl. data). This is consistent with the bradycardic properties of XYL (Klide et al., 1975). Respiratory rate was similar to those of undrugged, sleeping wolves (19 ± 4 rpm) (T. J. Kreeger, unpubl. data).

Philo (1978) used a higher dose of XYL (>3.1 mg/kg) than used in this study to sedate wolves, but induction times, level of sedation and recovery times were similar. Respiratory rates, however, were lower. He reported a mean respiratory rate of 15 rpm with periods of apnea of ≥30 sec. Decreased respiratory rate was not observed at the doses we used.

We have used XYL and YOH for a variety of animal management purposes: translocating animals, taking blood and urine samples, cleaning and treating wounds, administering vaccinations and other medications, and attaching radio collars. If gross manipulation of the animal is required, a muzzle should always be used. If an animal becomes aroused, ceasing any manipulations and remaining quiet usually results in the animal reverting to profound sedation. The use of XYL sedation is best reserved for short procedures (<15 min) requiring moderate handling of the wolf. For situations involving deep pain (i.e., surgery) or lengthy procedures, we recommend that complete anesthesia be induced with KET and XYL. The main advantage of using XYL alone is the rapid and complete recovery upon antagonism. Using KET and XYL offers total immobilization, but recoveries are lengthier and characterized by ataxia and disorientation (Kreeger et al., 1987). Recoveries are further complicated and lengthened if boosters of KET are required to maintain anesthesia. Yohimbine does not fully antagonize the KET component of this combination resulting in the residual effects of KET probably prolonging recovery (Kreeger and Seal, 1986b).

We feel that the use of XYL sedation with YOH antagonism can be useful for management of captive wolves. Xylazine produces a tractable animal with minimal physiological alterations which can be quickly returned to normalcy when desired by the use of YOH.

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