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COMPARISON AND ASSESSMENT OF DRUGS USED TO IMMOBILIZE ALASKAN GRAY WOLVES *(CANIS LUPUS)* AND WOLVERINES *(GULO GULO)* FROM A HELICOPTER

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Abstract: One hundred and three Alaskan gray wolves and 12 wolverines were immobilized in the Nelchina and upper Susitna River Basins of southcentral Alaska between March 1977 and May 1981. Sixty-five wolves were immobilized with a mixture of phencyclidine HCl and promazine HCl (PP/HCl); 38 wolves were immobilized with etorphine HCl (EHCl) and 12 wolverines were immobilized with EHCl or with a mixture of EHCl and xylazine HCl (XHCl). Phencyclidine HCl is no longer commercially available and an assessment of etorphine HCl as a replacement drug was made. Etorphine HCl dosage of 2.5 mg/wolf proved to be a suitable replacement for PP/HCl for immobilizing wolves while 0.7 mg EHCl with 50 mg XHCl appeared suitable for wolverines.

INTRODUCTION

Phencyclidine HCl [3] with promazine HCl [4] (PP/HCl) has been a widely used drug combination to immobilize free-ranging gray wolves (Seal et al., 1970; Mech, 1974; Van Ballenberghe et al., 1975; Ballard et al., 1981), while PHCl and a combination of PHCl and Xylazine HCl (XHCl) have been used successfully to immobilize wolverines (Magoun, pers. comm.). Ketamine HCl [5] (KHCl) has also been successfully utilized to immobilize wolverines caught in barrel traps, but full recovery requires 3-8 hr (Hash and Hornocker, 1980). Recently phencyclidine HCl was removed from the commercial market, forcing biologists to seek suitable alternatives. Fuller and Keith (1981) reported successful immobilization of 12 wolves with etorphine HCl, [6] nine of which were caught in steel traps. Darting from a helicopter has become a common method for immobilizing wolves in Alaska (Ballard et al., 1981) and an assessment of a replacement drug (etorphine HCl) for phencyclidine HCl was done for both wolves and wolverines. This paper compares responses of 65 wolves immobilized with PP/HCl with 38 wolves immobilized with etorphine HCl and reports on the successful immobilization of 12 wolverines immobilized with EHCl or a mixture of EHCl and xylazine HCl [7] (XHCl). All wolves and 11 of 12 wolverines were darted from a helicopter.

MATERIALS AND METHODS

The study was conducted in the Nelchina and upper Susitna River Basins of southcentral Alaska from

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[3] Sernylan®, Bio-ceutic Laboratories, Inc., St. Joseph, Missouri 64502, USA.

[4] Sparine®, Wyeth Laboratory, Inc., Philadelphia, Pennsylvania 19101, USA.

[5] Vetelar®, Parke, Davis Co., Detroit, Michigan 48232, USA.

[6] M-99, D-M Pharmaceuticals, Inc., Rockville, Maryland 20850, USA.

[7] Rompun, Haver-Lockhart Laboratories, Shawnee, Kansas 66201, USA.

March 1977 to May 1981. Descriptions of the area have been reported elsewhere (Skoog, 1968; Bishop and Rausch, 1974; Taylor and Ballard, 1979; Ballard, 1982).

Wolves and wolverines were located by searching edges of streams and lakes and ridgelines for footprints from fixed-wing aircraft when fresh snow depths generally exceeded 8 cm. Footprints were followed until either wolves or wolverines were observed, at which time their location was relayed by radio to a crew in a nearby helicopter.[a]

Wolves and wolverines were immobilized using a dart gun[g] fired from the helicopter. To facilitate shooting, the helicopter was equipped with a zippered canvas door which replaced the right rear window. Generally from the time animals were first spotted from the helicopter, 1-5 min elapsed until darted, requiring an average of three shots for one hit with an experienced shooter. Once darted, the animal was observed at a distance from the helicopter until it became immobile. Usually the fixed-wing aircraft either continued to observe remaining wolf pack members or began another search so that additional animals could be captured. Induction time was from injection to immobilization of the animal.

From March 1977 to March 1979 a combination of 100 mg phencyclidine HCl and 50 mg promazine HCl (PP/HCl) was utilized to immobilize 65 wolves of both sexes and all age groups. Recovery time for this group was not measured; however, all were subsequently observed in the wild usually within 24 hr. From April 1980 through May 1981 2 - 2.5 mg etorphine HCl was used to immobilize 38 wolves of both sexes and all age classes. During the latter time period a mixture of from 0.4 - 0.7 mg etorphine HCl (1 mg/ml) and 50 mg XHCl (100 mg/ml) was utilized to immobilize wolverines of both sexes and all ages. One wolverine was captured in a barrel trap in Prince William Sound, and was administered 0.6 mg EHCl with a pole syringe. For both species, once processing was complete, an equivalent cc dosage of the antagonist diprenorphine HCl[10] was administered either intravenously (IV) in the radial or saphenous vein or intramuscularly (IM) in the hip area. Recovery time was the period between injection of antagonist and regained mobility. All statistical comparisons were by t-test (Snedecor and Cochran, 1973).

RESULTS AND DISCUSSION

Initially 2.0 - 2.25 mg etorphine HCl was tested on seven adult wolves ($\bar{x}$ = 0.050 mg/kg). Four of these wolves required additional dosages of etorphine HCl to become immobile (from 0.4 to 2.0 mg additional). Average induction time was 17.3 min (S.D. = 8.2). With the required additional drug ($\bar{x}$ = 0.064 mg/kg, S.D. = 0.024) the dosages required for immobilization were considerably larger than those recommended by Fuller and Keith (1981) for both trapped and darted wolves. Subsequently we began using 2.5 mg etorphine for all wolves.

There was a significant reduction ($P<0.001$) in induction time between initial injection of 2.5 mg ($\bar{x}$ = 6.1 min) versus 2.0 mg ($\bar{x}$ = 17.3 min). This suggests that a larger initial dose results in quicker induction which was similar to that reported for moose *(Alces alces)* immobilized with etorphine (Franzmann and Arneson, 1974).

Induction times for wolves immobilized with 2.5 mg etorphine ($\bar{x}$ = 6.1 min, S.D. = 2.37) were significantly less

[a] Bell 206B, Bell Helicopter, Fort Worth, Texas 76101, USA.

[g] Cap-Chur, Palmer Chemical Co., Douglasville, Georgia 30134, USA.

[10] M 50-50, D-M Pharmaceuticals, Inc., Rockville, Maryland 20850, USA.

($P<0.001$) than those for wolves immobilized with PP/HCl ($\bar{x}$ = 10.0 min, S.D. = 5.39). An average of 0.063 mg/kg (S.D. = 0.018) etorphine HCl was used to successfully immobilize 25 wolves ranging in weight from 20.9 to 50.9 kg. Numbers of wolves requiring additional drug after the first injection was similar for the two drugs (EHCl - 2 of 30; PP/HCl - 2 of 65). Additional drug was required for four additional wolves (two with PP/HCl and two with EHCl) due to malfunction of the dart. Although initial drug costs for etorphine HCl are substantially higher than that of PP/HCl, a reduction of 40% induction time significantly reduced costs per captured animal by reduced helicopter time. Therefore, overall use of etorphine HCl was no more expensive than that of PP/HCl.

An average of 0.144 mg/kg (range 0.098 - 0.282 mg/kg) of the antagonist diprenorphine HCl was used to reverse immobilization. When administered IV, recovery to full mobility averaged 1.58 min. As expected, there was a significant ($P<0.001$) increase in recovery time when the antagonist was administered IM ($\bar{x}$ = 8.4 min). Because no antagonist was available for PP/HCl, accurate comparison of recovery times between PP/HCl and etorphine HCl was not possible. However, observations of radio-collared wolves immobilized with PP/HCl suggested that from 1 to 12 hr was required for full recovery (Ballard et al., 1981). In one case the prolonged recovery resulted in one wolf drowning (op. cit.) while no mortalities occurred with those immobilized with EHCl.

During 1980 and 1981, ten 14.6 - 17.7 kg male and one 10.5 kg female wolverines were darted from a helicopter, and one 8.6 kg female was caught in a barrel trap. EHCl dosages delivered from the helicopter were 0.023 - 0.129 mg/kg ($\bar{x}$ = 0.048 mg/kg, S.D. = 0.030) while XHCl dosages were 2.74 - 4.76 mg/kg ($\bar{x}$ = 3.20 mg/kg, S.D. = 0.62). Induction time ranged from 2 - 25 min, ($\bar{x}$ = 10.5 min, S.D. = 6.9). One 17.3 kg male wolverine was darted several times and did not become fully immobile for 2 hr because -14 C temperatures froze the darts. The trapped wolverine was immobilized with 0.6 mg EHCl (0.07 mg/kg) and was immobile within 5 min. Recovery time for three wolverines which were given the antagonist IV ranged 1 - 7 min ($\bar{x}$ = 3.3, S.D. = 3.21) while an average of 10.8 min (S.D. = 5.6) was required for four wolverines administered the antagonist IM. No recovery times were available for five wolverines administered EHCl/XHCl. Similar to wolves and moose (Franzmann and Arneson, 1974), wolverines administered larger initial doses of EHCl appeared to have quicker induction times ($\bar{x}$ = 3.0 min) than those administered lesser doses ($\bar{x}$ = 11.6 min, S.D. = 6.82).

Based upon the quick recovery period, EHCl for wolves and EHCl/XHCl for wolverines appears superior to other immobilization drugs because it does not expose animals to prolonged extreme temperatures (Fuller and Keith, 1981) which are common in habitats occupied by the two species, and it does not leave the animal susceptible to accidental death or vulnerable to hunting and trapping mortality.

Etorphine has two major disadvantages associated with its use: (1) a narcotics license is required and (2) it is extremely toxic to humans. Although there is no substitute for extreme caution when handling etorphine, a human antidote naloxone HCl [1] should be available at all times.

In conclusion, results of this comparison suggest that etorphine HCl is suitable and in some cases more advantageous than PP/HCl for immobilizing wolves from a helicopter. We recommend that 2.5 mg EHCl be used for im-

[1] Narcan, Endo Laboratories, Inc., Garden City, New York 11530, USA.

mobilizing wolves to be darted from helicopter and that an equivalent ml dosage (2 mg/ml) of the antagonist deprenorphine HCl be administered following processing. The dosage of EHCl was much higher (0.063 mg/kg versus 0.042 mg/kg) than previously reported for wolves (Fuller and Keith, 1981). We also recommend dosages of 0.7 mg EHCl with 50 mg XHCl for wolverines weighing 10.5 - 17.7 kg when darted from helicopter.

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