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Source: Journal of Wildlife Diseases, 22(2) : 245-248

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-22.2.245

EFFECTS ON FAWN SURVIVAL OF MULTIPLE IMMOBILIZATIONS OF CAPTIVE PREGNANT WHITE-TAILED DEER

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ABSTRACT: Fawn viability was tested in captive, pregnant white-tailed deer (*Odocoileus virginianus*) immobilized with xylazine hydrochloride and ketamine hydrochloride and reversed by yohimbine hydrochloride or tolazoline hydrochloride. Nine pregnant does were immobilized 10 times each from December 1984 to May 1985. Their mean parturition date was 8 June. The number of fawns produced per pregnant doe was 1.88. Mean weight of newborn fawns was 4.18 kg. Seventy-five percent of the does produced twins or triplets. Three (20%) fawns died postnatally within 48 hr, but the remaining 12 survived for the full 72 hr they were allowed to remain with their dams. These observations compare favorably with those of non-immobilized captive deer on similar diets.

INTRODUCTION

Chemical immobilization of deer (*Odocoileus* spp.) has become common, having been achieved via the use of succinylcholine chloride (Miller, 1968; Allen, 1970; Jacobsen et al., 1976), nicotine salicylate (Behrend, 1965), phencyclidine hydrochloride (Seal et al., 1972a, b, 1978a; Dean et al., 1973), etorphine hydrochloride (Wallach et al., 1967; Presnell et al., 1973; Mautz et al., 1980), xylazine hydrochloride (Bauditz, 1972; Roughton, 1975; Jacobsen, 1983; Jessup et al., 1983; Hsu and Shulaw, 1984; Warren et al., 1984; Mech et al., 1985), and other drugs. Steady improvement in chemical immobilization procedures during the past 2 decades has enabled researchers to conduct more detailed and insightful studies of deer nutrition, physiology, and reproduction in captivity and with wild populations. Furthermore, researchers have demonstrated the effects of physical restraint and immobilizing drugs on hematological and serum-chemical parameters, thus contributing to more accurate interpretations of such data (Seal et al., 1972a; Mautz et al., 1980).

Xylazine hydrochloride is currently one of the most commonly used immobilizing drugs. It is relatively safe, particularly when used with other tranquilizers or anesthetic agents as it strongly potentiates these drugs (Knight, 1980). Ruminants are more sensitive to xylazine hydrochloride, requiring a substantially smaller dose than most other animals (Knight, 1980). Deer feeding behavior (Warren et al., 1984) and various serum-chemical parameters (Eichner et al., 1979; Mautz et al., 1980) are affected by this drug.

Yohimbine hydrochloride (Jessup et al., 1983; Hsu and Shulaw, 1984; Mech et al., 1985) and tolazoline hydrochloride (Kreeger et al., 1986) are effective and useful neural antagonists of xylazine hydrochloride in deer. However, we have been unable to find any documentation of the potential effects of xylazine hydrochloride, yohimbine hydrochloride, or tolazoline hydrochloride on pregnancy or neonatal fawn survival. Any such effects would be most important to management of wild populations and to the use of these drugs in research. Knight (1980) claimed that abortion was induced by xylazine hydrochloride in ruminants if used during late

Received for publication 9 September 1985.
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pregnancy due to an oxytocin-like effect on the uterus, but he presented no documentation. Verme (1962) attributed a number of prenatal fawn deaths in captive does on a high nutritional plane to physical restraint procedures, and White et al. (1972) observed increased natural mortality from capturing and marking free-ranging fawns. The recent introduction of the radio-capture collar (Mech et al., 1984; Chapman et al., 1985) greatly increases the potential for more intensive studies of free-ranging deer, involving frequent immobilizations. In view of the aforementioned, the increased use of chemical restraint of deer must be scrutinized for adverse effects.

In the present study, we tested the effects on fawn survival of multiple immobilizations of captive, pregnant white-tailed deer with a xylazine hydrochloride–ketamine hydrochloride combination, reversed by yohimbine hydrochloride or tolazoline hydrochloride.

MATERIALS AND METHODS

This study was conducted with nine captive, pregnant does (six adults, two 2-yr-olds, one yearling), ranging in weight from 42.64 to 69.85 kg. These deer were maintained in separate, 15.5 × 30.0-m outdoor pens near Grand Rapids, Minnesota, and fed on commercial deer pellets at a rate of 12.97–312.72 kcal digestible energy/kg$^{0.75}$ and 0.41–9.82 g protein/kg$^{0.75}$ per day. Each deer was chemically immobilized once every 2 wk from 18 December 1984 to 3 May 1985, for a total of 90 immobilizations. A standard combination of 100 mg of xylazine hydrochloride (Rompun, Haver-Lockhart, Bayvet Division, Miles Laboratory, Inc., Shawnee, Kansas 66201, USA) and 300 mg of ketamine hydrochloride (Ketaset, Bristol Veterinary Products, Division of Bristol Myers, Syracuse, New York 13201, USA) was administered intramuscularly (i.m.) via jabstick. Mean initial xylazine hydrochloride and ketamine hydrochloride doses were 1.73 (±0.03) mg/kg (1.13–2.68 mg/kg) and 5.07 (±0.08) mg/kg (2.86–8.03 mg/kg), respectively.

Supplemental i.m. administrations of ketamine hydrochloride (100–2,100 mg) were used to maintain immobilization for various periods. Immobilized deer were weighed, samples of blood and urine were obtained, and their rectal temperatures were measured. Forty-five immobilizations were reversed with a standard intravenous injection of 15 mg (0.26 ± 0.01 mg/kg) of yohimbine hydrochloride (Sigma Chemical Co., P.O. Box 14508, St. Louis, Missouri 63178, USA). Doses ranged from 0.21 to 0.35 mg/kg. The remaining 45 immobilizations were reversed with a mean dose of 2.15 (±0.15) mg/kg of tolazoline hydrochloride (Sigma Chemical Co., P.O. Box 14508, St. Louis, Missouri 63178, USA) injected i.v. (Kreeger et al., 1986); doses ranged from 0.25 to 4.00 mg/kg. Pregnant does were observed every day from 20 May to 15 June to document parturition dates. After 3 days with their mothers, fawns were weighed and removed for hand-rearing.

Values are reported as means and standard errors.

RESULTS

Each deer was immobilized 10 times during the study. The average downtime was 83 min (14–213 min).

All the does were pregnant, and no fetuses aborted. One yearling doe suffered an accident on 10 January during handling, lost more than 28% of her peak weight, and died of malnutrition on 3 May; she carried mummified fetuses approximately 30 mm in crown–rump length. Parturition occurred from 1 June to 15 June, with a mean fawning date of 8 June. Gestation periods were unknown since observations were not made during the breeding season. Fifteen fawns were produced, 13 of which ranged in weight from 3.25 to 5.45 kg (4.18 ± 0.20 kg). Two members of a set of triplets each weighed 2.04 kg, less than half that of the third fawn and died within a day after parturition.

The fecundity rate was 1.89 (±0.15) male and female fawns per pregnant doe. The number of fawns produced per doe was 1.88 (±0.17). Six of the does (75%) produced twins or triplets. Only 33% of the fawns produced were males; 60% were females, and the sex of one (7%) could not be determined due to decomposition.

Of the 15 fawns produced, three (20%)

died within 48 hr after birth, including the two members of the set of triplets. The other fawn death was attributed to stillbirth or suffocation, as it appeared that the doe had lain upon it. The remaining 12 fawns all seemed normal in appearance and behavior and survived at least for the full 72 hr during which they were left with their dams.

DISCUSSION AND CONCLUSION

Repeated chemical immobilizations with xylazine hydrochloride and ketamine hydrochloride, and reversals with yohimbine hydrochloride or tolazoline hydrochloride, as well as the prolonged downtimes under winter and spring conditions, had no effect on mean fawning date or survival. Our parturition dates paralleled those of deer on high nutritional planes that did not experience chemical immobilization (Verme, 1962, 1965, 1967, 1969; Langenau and Lerg, 1976). Weights of newborn fawns were also comparable to those of fawns from experimental does fed high nutrition diets (Verme, 1962, 1963, 1965).

The mummified fetuses carried by the malnourished yearling doe were probably related to the stress of her first pregnancy (Verme, 1962) coupled with the stress of her introduction to small-pen confinement and initial handling. Based on their size, they probably died at about 48 days of gestation (Short, 1970), before most of the immobilizations.

Neonatal fawn mortality in our chemically immobilized deer was no greater than has been reported in non-immobilized deer. Fawn mortality at or near the critical 48-hr postnatal period (Verme, 1962) was only 20%, less than what would be expected from malnourished deer (Verme, 1962; Ozoga and Verme, 1982), and similar to deer on high nutrition. The two members of the set of triplets were notably underweight and probably died of "nutritive failure" (Verme, 1962). The third postnatal fawn death apparently resulted from suffocation by the mother, behavior also observed by Langenau and Lerg (1976).

Although an abortion-inducing effect of xylazine hydrochloride during late pregnancy has been reported (Knight, 1980), our study did not support the claim. Our deer lost almost 20% of their body weight as winter progressed and were chemically immobilized repeatedly up to a few weeks before parturition, with no adverse effects on pregnancy, fawn weight, or neonate survival.

ACKNOWLEDGMENTS

This study was supported by the Big Game Club, the U.S. Fish and Wildlife Service, and the Minnesota Department of Natural Resources. We appreciate the assistance of Colleen Baggot, Neil Barton, John Burch, Nancy Dietz, Ken Kerr, Terry Kreeger, Pam Coy, Linda Laack, Mary Maule, Dan Monson, U. S. Seal, Jay Tischendorf, and Jay Wollowitz.

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