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Source: Journal of Wildlife Diseases, 10(4) : 377-383
Published By: Wildlife Disease Association
URL: https://doi.org/10.7589/0090-3558-10.4.377

THE EFFECT OF XYLAZINE AND XYLAZINE-ETORPHINE-ACEPROMAZINE COMBINATION ON SOME CLINICAL AND HAEMATOLOGICAL PARAMETERS IN IMPALA AND ELAND[1]

S. DREVEMO and L. KARSTAD[2]

Abstract: Impala (*Aepyceros melampus*) and eland (*Taurotragus oryx*) were immobilized with a xylazine-etorphine-acepromazine combination or with xylazine alone. Clinical observations were made and blood samples were taken at intervals to determine the drug effects on clinical and blood parameters. During the immobilization period heart rate and body temperature decreased, as well as numbers of circulating erythrocytes and leukocytes, and values for haemoglobin and packed cell volumes. The possible causes are discussed.

INTRODUCTION

Haematology in wild game animals has been of limited value, partly because of the lack of standardized blood collecting methods. The introduction of drug-immobilization techniques some years ago has made it possible to take blood specimens from wild animals under standardized conditions. However, reports have been published concerning changes in blood parameters caused by various drugs used.[15,17,18,19] Since we routinely use drug-immobilization for capture and experimental handling of game animals,[5] we have attempted to investigate the changes in blood and clinical parameters caused by the drugs we use, xylazine and a xylazine-etorphine-acepromazine (XEA) combination.

MATERIALS AND METHODS

Five adult female impala weighing 30-45 kg and one male and one female eland, 175-225 kg, were immobilized with a combination of xylazine,[3] 0.6-0.8 mg/kg; etorphine HCL,[4] 0.008-0.020 mg/kg; and acepromazine maleate,[4] 0.03-0.08 mg/kg. Four of the impala were later immobilized with 2.0-2.4 mg/kg xylazine only, and one male impala weighing 20 kg with xylazine, 0.5 mg/kg; etorphine, 0.01 mg/kg; and acepromazine, 0.04 mg/kg. Animals given xylazine only were allowed to recover without further treatment. The effects of etorphine were reversed by diprenorphine,[5] 0.3 mg for each 0.25 mg etorphine injected. The animals had been kept in captivity 3 to 12 months and all were apparently normal. The drugs were administered by intramuscular injection

[1] A project of the Government of Kenya supported by the United Nations Development Program with the Food and Agriculture Organization (FAO) of the United Nations as the executing agency.

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[3] Rompun 2%: Bayer A. G., 509 Leverkusen, Bayerwerke, West Germany.

[4] Large Animal Immobilon, containing 2.45 mg of etorphine hydrochloride and 10 mg of acepromazine maleate per ml and hereafter referred to as etorphine-acepromazine; Reckitt and Colman Ltd., Hull, England.

[5] Large Animal Revivon, containing 3 mg of diprenorphine hydrochloride per ml, Reckitt and Colman Ltd., Hull, England.

using a short range projector and projectile syringes.[6] The immobilization time, i.e., the time from injection to recumbency, and ambient temperature were recorded for each trial. Observations of rectal temperature, heart rate and respiration frequency, as well as samples of blood taken immediately after the animals became recumbent were considered to be the baseline values. Observations and sampling was continued every 15 min for 75 min. The male impala was observed clinically only. Blood samples of 5 ml were collected in glass vials containing 10 mg ethylenediamintetraacetic acid (EDTA) for red blood cell (RBC), white blood cell (WBC), packed cell volume (PCV) and haemoglobin (Hb) determinations. For inorganic phosphorus (P) and copper (Cu) analyses, 10 ml samples of blood were taken into glass vials containing 6 mg of sodium fluoride as anticoagulant and 1 mg Thiomersal[7] as preservative. Twenty-ml samples of blood were allowed to clot in glass bottles without anticoagulant. The clotted blood was centrifuged and serum was taken for calcium (Ca) and magnesium (Mg) determinations. The specimens were stored on ice before processing. The test procedures were carried out within 12 hours, except for the Ca and Mg analyses, for which the serum was frozen and processed within 1 month. RBC and WBC counts were made in an electronic particle counter.[8] Because of the high numbers and small size of the erythrocytes,[5] for RBC counts the impala blood was diluted 40,000 times and the eland blood 10,000 times, and for WBC counts 500 times for both species. The need for these dilutions had been established by replicate counts in parallel with standard manual counting procedures. PCV was measured in the electronic particle counter with attached mean cell volume/haematocrit accessory[9] and Hb determinations were made in an automatic haemoglobinometer.[9] P was measured according to the method of Fiske and Subbarow.[6] The Cu analysis was based on the method of Clare et al.[3] Their method was further modified by drying the amyl alcohol extract by centrifugation over AR anhydrous sodium sulphate before measuring its absorbance, instead of filtering the extract through acid-extracted filter-papers. Ca and Mg were determined by using a Perkin-Elmer Atomic Absorption Spectrophotometer.[10]

RESULTS

The first signs of drug effect were seen 3-5 min after injection, at which time the animals began to stagger and droop their eyelids. When xylazine alone was used the animals lowered their heads but when the XEA combination was used, elevation of head usually occurred. Salivation was seen in most cases. The time from injection to recumbency for impala immobilized with the XEA combination was 3-10 min and for impala immobilized with xylazine alone, 9-33 min. The two eland became recumbent after 5 and 10 min, respectively. When immobilized, the animals usually lost their palpebral and corneal reflexes. This was most pronounced in animals immobilized with the XEA combination, however there were occasional movements of head and limbs. The observations on heart and respiration rates and body temperature in impala are given in Table 1. A decrease in body temperature was found in all animals, the mean temperature reduction, 2.5-3.0 C. The greatest decrease in heart rate occurred when the XEA combination was used, the reduction in mean values approximately 35%. The respiration frequency was rather unstable, sometimes with intermittent apnoe

[6] Palmer Chemical and Equipment Company, Douglasville, Georgia, U.S.A.

[7] British Drug House Chemicals, Poole, England.

[8] Coulter Counter, Model ZB1 Coulter Electronics, Inc., Hialeah, Florida, U.S.A. For erythrocyte counts, aperture setting was 0.177 threshold was 7 and amplification ½ for impala blood, and 0.25, 7 and 1, respectively, for eland blood. For leukocyte counts the aperture setting was 0.25, threshold was 12 and amplification 1, for both species.

[9] Coulter Electronics, Inc., Hialeah, Florida, U.S.A.

[10] Perkin-Elmer Corporation, Norwalk, Connecticut, U.S.A.

soon after the animals became recumbent. The respiratory frequency was much higher with xylazine alone, compared to the XEA combination. The mean values and ranges in impala for RBC, WBC, PCV, Hb, Ca, P, Mg are given in Tables 2 and 3. A marked decrease in RBC, WBC, PCV and Hb was observed in all animals immobilized with both xylazine and XEA. The decrease was most pronounced during the first 30 min, after which there was usually a tendency to increase toward the baseline values again. The RBC number was higher when the animals were immobilized with XEA and the WBC number slightly lower, compared to the values obtained in animals immobilized with xylazine alone. Ca, Mg and Cu did not change appreciably during the period of immobilization; however, the Ca values increased slightly when xylazine only was used. The mean values for P increased 1 mg/100 ml between the first and last samples.

The temperature, and the heart and respiration frequency, as well as blood parameters in the two eland immobilized with XEA followed the same pattern as for the impala. For example, PCV decreased from 35% and 43% to 31% and 36% respectively, and the body temperature from 36.7 C and 38.5 C, to 34.8 C and 37.2 C, during the period of immobilization. The ambient temperatures were between 18.0 C and 26.5 C.

DISCUSSION

The purpose of these experiments was to investigate the effects on clinical and blood parameters of some immobilizing drugs commonly used in wildlife research. Impala and eland were selected

TABLE 1. Mean values and ranges for rectal temperatures, heart and respiration rates during immobilization with a xylazine-etorphine-acepromazine (XEA) combination with xylazine (X) alone in impala.

Observations at 15 min intervals		Rectal temperature centigrade		Heart rate /min		Resp. frequency /min	
		XEA(5)*	X(5)	XEA(5)	X(5)	XEA(5)	X(5)
1	$\bar{x}$	39.1	39.4	102	63	10	24
	Range	38.8-39.2	38.8-39.9	76-148	50-68	2-20	12-54
2	$\bar{x}$	38.3	38.8	72	60	13	48
	Range	37.7-38.8	37.7-39.3	60-80	56-64	6-20	10-76
3	$\bar{x}$	37.8	37.9	75	60	13	49
	Range	37.2-38.3	36.9-38.9	56-90	52-60	6-20	18-80
4	$\bar{x}$	37.2	37.3	70	58	11	42
	Range	36.3-38.2	36.3-38.4	60-82	48-66	6-14	13-78
5	$\bar{x}$	36.7	36.8	67	62	11	31
	Range	35.8-37.7	36.1-38.0	60-72	48-92	6-16	12-50
6	$\bar{x}$	36.3	36.3	74	59	9	28
	Range	34.9-37.5	35.7-37.5	68-88	40-84	6-16	12-38

$\bar{x}$: mean value

*: numbers of animals observed are given in parentheses.

TABLE 2. Mean values and ranges for some haematological parameters during immobilization with a xylazine-etorphine-acepromazine (XEA) combination and xylazine (X) alone in impala.

Samples at 15 min intervals		Erythrocytes 10^6/mm³		Leukocytes 10^3/mm³		Packed Cell Volume %		Haemoglobin g/100 ml	
		XEA(4)*	X(5)	XEA(4)	X(5)	XEA(4)	X(5)	XEA(4)	X(5)
1	$\bar{x}$	19.18	16.89	5.75	8.25	34	34	12.7	11.6
	Range	12.84-23.83	12.12-23.24	4.70-7.88	4.78-15.76	25-42	24-44	9.4-14.8	8.1-15.9
2	$\bar{x}$	17.15	15.84	5.51	7.29	30	29	11.4	10.8
	Range	10.40-21.30	10.96-22.72	5.40-6.10	3.59-15.20	20-39	21-39	8.5-16.3	7.0-14.8
3	$\bar{x}$	14.90	14.70	4.41	6.32	27	29	9.6	10.1
	Range	9.64-20.39	9.28-22.36	3.29-5.85	2.74-13.20	19-33	22-33	7-8-11.1	6.1-12.8
4	$\bar{x}$	13.14	14.46	4.44	5.94	24	28	9.9	9.7
	Range	9.40-17.21	7.96-22.96	3.63-5.34	3.08-12.15	18-30	19-31	7.0-12.2	6.6-12.8
5	$\bar{x}$	13.89	14.47	4.81	6.14	26	28	9.4	9.9
	Range	9.76-16.92	6.48-20.52	4.30-6.05	4.12-11.88	19-33	19-36	7.4-11.9	6.6-12.4
6	$\bar{x}$	13.19	14.13	5.40	6.24	25	29	10.4	9.9
	Range	10.86-15.62	8.72-18.20	3.40-7.13	3.88-11.74	21-30	19-39	8.1-14.8	6.4-13.0

$\bar{x}$: mean value

*: numbers of animals studied are given in parentheses.

TABLE 3. Mean values and ranges for some serum biochemical parameters during immobilization with a xylazine-etorphine-acepromazine (XEA) combination and xylazine (X) alone in impala.

Serum Samples at 15 min intervals		Calcium mg/100ml		Phosphorus mg/100ml		Magnesium mg/100ml		Copper ppm	
		XEA(4)*	X(5)	XEA(4)	X(5)	XEA(4)	X(5)	XEA(4)	X(5)
1	$\bar{x}$	8.3	8.7	4.1	4.3	1.7	1.6	0.99	1.20
	Range	6.7-10.2	6.0-10.7	3.0-4.8	3.8-5.2	1.4-2.3	1.3-1.9	0.70-1.28	0.56-1.70
2	$\bar{x}$	7.9	8.9	4.3	4.4	1.8	1.7	0.72	1.20
	Range	6.8-9.2	6.0-11.0	3.2-5.4	3.7-4.9	1.6-2.2	1.3-2.0	0.40-1.20	0.53-1.80
3	$\bar{x}$	8.5	8.8	4.5	4.6	1.7	1.6	1.00	1.22
	Range	8.0-9.7	5.5-11.0	3.7-4.8	3.8-5.4	1.5-2.0	1.3-2.0	0.47-1.28	0.53-1.80
4	$\bar{x}$	8.1	9.1	5.0	4.9	1.8	1.7	0.89	1.20
	Range	7.0-9.7	6.4-11.6	4.6-5.7	4.2-5.8	1.6-2.1	1.3-2.0	0.31-1.34	0.50-1.87
5	$\bar{x}$	8.0	9.6	5.2	5.2	1.7	1.9	0.93	1.21
	Range	6.7-9.3	7.0-11.9	4.5-60	4.6-6.0	1.7-1.9	1.4-2.4	0.40-1.40	0.48-1.80
6	$\bar{x}$	8.1	9.4	5.0	5.3	1.6	1.8	0.89	1.17
	Range	7.0-9.4	6.8-11.6	4.5-6.2	4.1-.5	1.5-1.7	1.4-2.2	0.45-1.28	0.42-1.87

$\bar{x}$: mean value

*: numbers of animals studied are given in parentheses.

as representatives of medium-sized and large antelope species. A reduction in cardiac and respiratory rates with a rise in body temperature has been reported in cattle sedated with xylazine.[2,17] Depression of heart rate and blood pressure in horses has also been described.[1,11] Etorphine causes tachycardia and increased blood pressure but depression of respiration and body temperature in various species[11]; and acepromazine maleate is reported to decrease the blood pressure, respiration frequency and body temperature in dogs.[12] Others have found tachycardia and increased blood pressure in horses sedated with etorphine and acepromazine.[4,16] In the present experiment, heart rate was reduced in all animals immobilized with xylazine and with the XEA combination. The bradycardia could be caused by drug action on the autonomic nervous system.[12,15,16]

The rectal temperature decreased significantly in all animals immobilized. This is contrary to the results of Szeligowski[17] and Bollwahn[2] who reported a rise in body temperature in cattle sedated with xylazine and Presnell et al.[14] who found the same in white-tailed deer immobilized with etorphine and xylazine in combination. Addition of acepromazine to the etorphine-xylazine combination may explain the depression of body temperature in our experiments. In addition, the ambient temperature might influence the body temperature, as indicated by Grosskopf et al.[8] A reduction of the respiration frequency was observed. However, respiration was sometimes unstable, with intermittent apnoe. Respiration was more depressed when the XEA combination was used, which could be expected because all three drugs are described as respiratory depressants.[9,12,14] In general, our observations confirm those of others on reduction or absence of corneal and palpebral reflexes with etorphine[9] and xylazine,[2] drooping of eyelids with xylazine,[17] occasional dyspnoe and movements of the limbs and head with etorphine and xylazine,[14] and with etorphine-acepromazine,[10] also salivation with etorphine-acepromazine.[10] A marked decrease in RBC, WBC, PCV and Hb was observed in all animals immobilized. This is similar to the results obtained by Presidente et al.[13] who use an etorphine-xylazine combination in white-tailed deer and to Goranov[7] who sedated cattle with xylazine. The decrease in some blood constituents could be caused by decreased heart rate, low blood pressure[7,13] and resultant haemodilution with interstitial fluids.[13,18]

The first samples after the animals had been immobilized had haematological values similar to those found previously in drug-immobilized individuals of these species but lower than values from shot animals.[5] The blood mineral constituents did not show any major variations throughout the experiments, except for P which increased. This is difficult to explain and needs further investigation for clarification.

The results from this investigation indicate that blood sampling and observations of clinical parameters should be made as soon as possible after an animal has been immobilized. In this way, values for parameters can be established for various species, which can be useful when these animals are used in experiments and also in field investigations. Such values would correspond to the baseline values in our experiments, the first measurements obtained after drug injection.

Acknowledgements

Published with approval of the Director of Veterinary Services, Kenya and the Director General, F.A.O.

The authors wish to express their gratitude to Miss Jenny Higgs, Section of Diagnosis, for the haematology, and the staff in the Section of Biochemistry, Veterinary Research Laboratory, Kabete, for the biochemical analyses; and to Michel Kirui, Samuel Githiomi, Lawrence Migwi, Robert Muna and Richard Omolo, who assisted in collection and processing of specimens.

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Received for publication 8 March 1974