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The Effects of Combination of Subcutaneous Ketamine-Intravenous Xylazine Anaesthesia on Haematology and Serum Biochemistry Parameters in Dogs

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Abstract: The combination of ketamine HCl and xylazine HCl has been used to immobilize numerous wild and domestic carnivores. The aim of this study was to evaluate effects of the combination of subcutaneous ketamine and intravenous Xylazine anaesthesia on the haematology and blood biochemistry of dogs. In this study, the combined effect of the ketamine and Xylazine were investigated in local dogs which were of different ages, body weight and sex. The animals were injected with the ketamine (15 mg/kg) subcutaneously and Xylazine (0.15 mg/kg) intravenously. Haematological and biochemical findings were recorded before and during anaesthesia. The haematological and biochemical effects of the combination subcutaneous ketamine and intravenous Xylazine anaesthesia did not vary significantly in dogs either before or during anaesthesia except a slight decrease in the mean value of MCHC and eosinophil. In conclusion, the combination of subcutaneous ketamine and intravenous Xylazine had mild effect on the haematology of the dogs and did not have any detrimental effect on the liver, kidney and muscular tissue of the dogs.

Key words: Ketamine · Xylazine · Subcutaneous · Dog · Anaesthesia · Haematology

INTRODUCTION

Ketamine is one of the synthetic, non-barbiturate, injectable dissociative anaesthetics. It produces dissociative anaesthesia in which the patient appears awake but is unconscious and does not feel pain [1]. It has quick onset and short duration of action. It has slight cardio-respiratory depression in comparison with other general anaesthetics. The use of ketamine as a sole anaesthetic has been limited by muscle hypertonicity, violent recovery and occasional occurrence of convulsions [2]. When Ketamine is combined with an alpha-2-agonist (Xylazine), it produces muscle relaxation and analgesia, prevent seizures/convulsions and prolongs the duration of the anesthetic effect.

Xylazine, a potent alpha-2-adenoreceptor agonist, is from the non-opioid group with analgesic, sedative and muscle relaxant effects [3]. The use of Xylazine in combination with ketamine hydrochloride results in a smooth induction and recovery from anaesthesia [4]. This combination is very useful and safe in dogs because of its invariable status on physiological functions, haematologic and biochemical parameters. It ameliorated the cataleptic effects of ketamine HCl due to its sedative and myorelaxing effects [4].

So, this study aimed to explore the effect of Xylazine in combination with ketamine anathesia on the dog's haematology and blood biochemistry.

MATERIALS AND METHODS

Animal(s): Three apparently healthy Nigerian indigenous breed of dogs with mean body weight of 8.3 ± 1.5 kg were used for the current study. They were purchased from Umuariaga village around Michael Okpara University of Agriculture Umudike. The dogs were housed at the small animal kennel of the Department of Veterinary Surgery and Radiology, College of Veterinary medicine Umudike

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and fed on home-made food supplemented with left over from restaurants. They were also vaccinated against rabies.

Drug(s): Ketamine hydrochloride (katenir® 50mg/ml Rotexmedica, Trittau, Germany). Xylazine (XYL-M2® 20mg/25ml, V.M.D. HogeMauwAvendonk-Belgium).

Others: Syringes (5ml), cotton wool, antiseptic, EDTA bottle, plain bottle, cannula, plaster, hand glove, weighing balance.

Methods: The dogs were kept for two weeks to acclimatize with the local environment of the department of veterinary surgery kennel before the study commenced. The dogs were fasted for 12hr of food and 6 hr of water before the commencement of the experiment.

Anaesthetic Protocol: Each dog was given the recommended dose of the drug combination: ketamine at 15mg/kg body weight subcutaneously and xylazine at 0.15mg/kg body weight intravenously. The dogs' reactions were observed during and after the injection of the drugs, the onset of the drug action and the time to recumbence were noted at mean time of 3 ± 1.2 minutes.

Experimental Procedure: Blood samples (2ml) were collected from the cephalic vein before administering the drugs to the dogs. Then at 30 minutes' interval during anaesthesia (2 ml each time, each dog was bled 5 times) 1.0 ml into EDTA bottles for haematology and the other 1.0 ml into plain bottles for serum chemistry.

Statistical Analysis: All the data collected are expressed as mean ± standard errors of mean using Simple 0ne-Way ANOVA statistical package for social sciences (SPSS). The values of means at other times (30 min, 60 min, 90 min and 120 min) were statistically compared to the value just before the anesthetic induction by subcutaneous ketamine and intravenous Xylazine combination. P value of less than 0.05 (P<0.05) was taken as significant.

RESULTS

Packed Cell Volume (PCV): The mean value of PCV recorded during the experimental study did not show any significant (*P*>0.05) difference with a non-significant decrease compared to the mean of the base line value before induction (Table 1).

Table 1: Changes in packed cell volume (PCV) in Dogs Administered Subcutaneous Ketamine - Intravenous Xylazine for the Induction of Surgical Anaesthesia

PCV	Pre	30 min	60 min	90 min	120 min	P-Value
dog I	30	34	38	40	36	
dog II	30	28	26	25	25	
dog III	30	15	24	28	26	
Mean	30.0	25.7	29.3	31.0	29.0	0.908
SEM	±0.0	±5.6	±4.4	±4.6	±3.5	

Table 2: Changes in Haemoglobin (Hb) concentration in Dogs Administered SubcutaneousKetamine - Intravenous Xylazine for the Induction of Surgical Anaesthesia

HB	Pre	30 min	60 min	90 min	120 min	P-Value
dog I	11.2	11.6	12.6	13	11.8	
dog II	11.1	9.6	9.1	8.8	8.6	
dog III	11.2	6.5	8.3	9.2	8.9	
Mean	11.2	9.2	10.0	10.3	9.8	.818
SEM	±0.0	±1.5	±1.3	±1.3	±1.0	

Table 3: Changes in red blood cell courpusels' (RBCs) in Dogs Administered Subcutaneous Ketamine - Intravenous Xylazine for the Induction of Surgical Anaesthesia

RBC	Pre	30 min	60 min	90 min	120 min	P-value
dog I	6	7.4	8.3	5.7	6.5	
dog II	5	3.2	3.3	4.8	4.2	
dog III	4.4	2	3.5	4.3	4.3	
Mean	5.1	4.2	5.0	4.9	5.0	0.975
SEM	±0.5	±1.6	±1.6	±0.4	±0.8	

Hemoglobin Concentration (HB): The mean HB recorded during the experimental study showed a non-significant (*P*>0.05) decrease compared to the mean of the base line value. Before the induction of anesthesia (Table 2).

Red Blood Cell Count (RBC): In this study, the mean total erythrocyte count showed a non-significant decreases (*P*>0.05) during the experimental study when compared to the mean of the base line value. (Table 3)

Effect of Combination of Subcutaneous Ketamine – Intravenous Xylazine Administration for Induction of Surgical Anaesthesia on White Blood Cells of Dogs.

White Blood Cell (WBC): The mean values of WBCs recorded during the experiment in all the dogs' showed no significant (*P*>0.05) difference when compared to the mean base line WBC values (Figure 1).

Mean Corpuscular Volume (MCV): In the experimental study, the values of the mean MCV recorded shows no significant (*P*>0.05) when compared to the mean base line of MCV values (Figure 1).

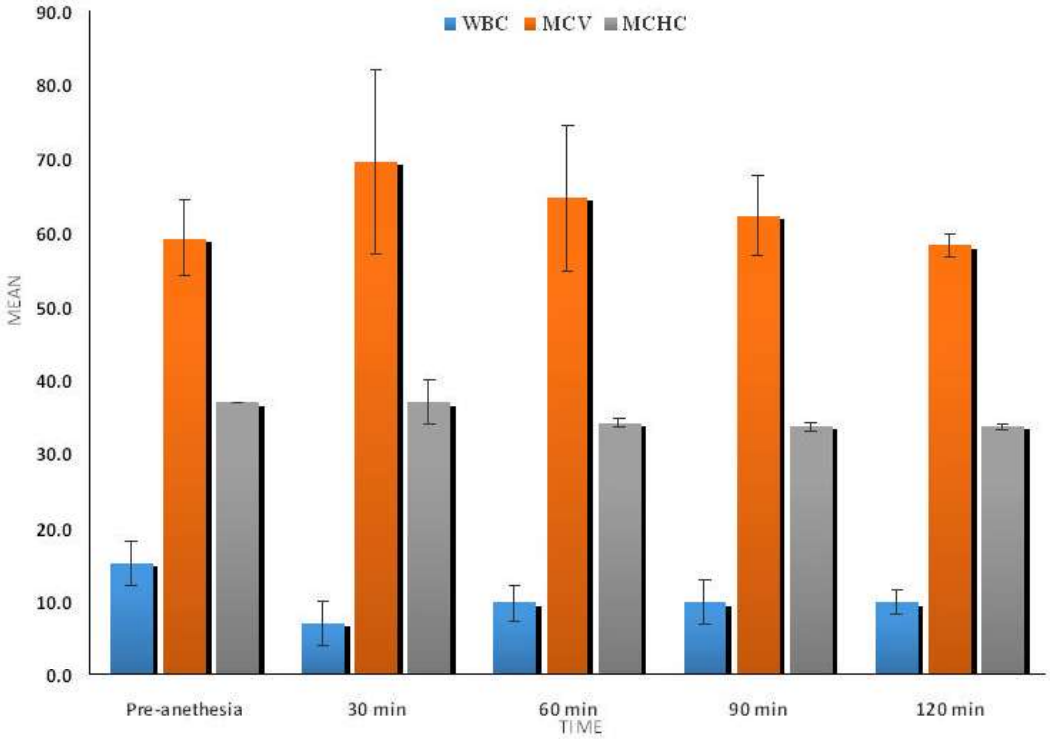

Fig. 1: Changes in WBC, MCV and MCHC in Dogs Administered Subcutaneous Ketamine - Intravenous Xylazine for the Induction of Surgical Anaesthesia

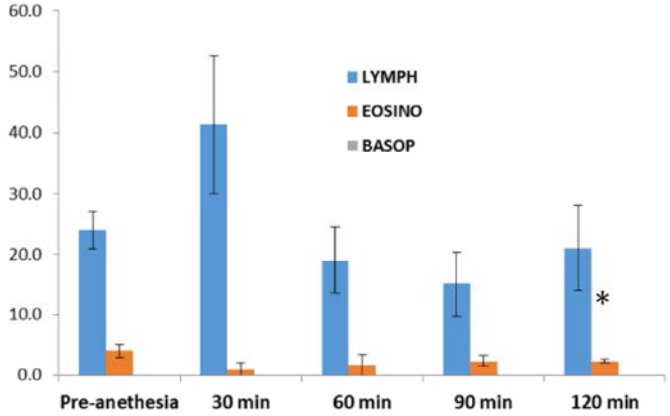

Fig. 2: Effect of Subcutaneous Ketamine – Intravenous Xylazine Administration for Induction of Surgical Anaesthesia on Differential Leucocyte Count (DLC) of Dogs

Mean Corpuscular Hemoglobin Concentration (MCHC): There was a significant (P<0.05) decrease in the mean values of MCHC at 90 and 120 minutes when compared to the mean base line values of MCHC respectively (Figure 1).

Effect of Combination of Subcutaneous Ketamine – Intravenous Xylazine Administration for Induction of Surgical Anaesthesia on Differential Leucocyte Count (DLC) of Dogs.

Eosinophil: There was a significant (P<0.05) decrease in the experimental value recorded of the mean eosinophil counts at 120 minutes when compared to the pre anesthetic values (Figure 2).

Lymphocyte: The mean values of lymphocyte recorded during the experiment in all the dogs' did not show any significant (P>0.05) difference when compared to the mean base line lymphocyte values (Figure 2).

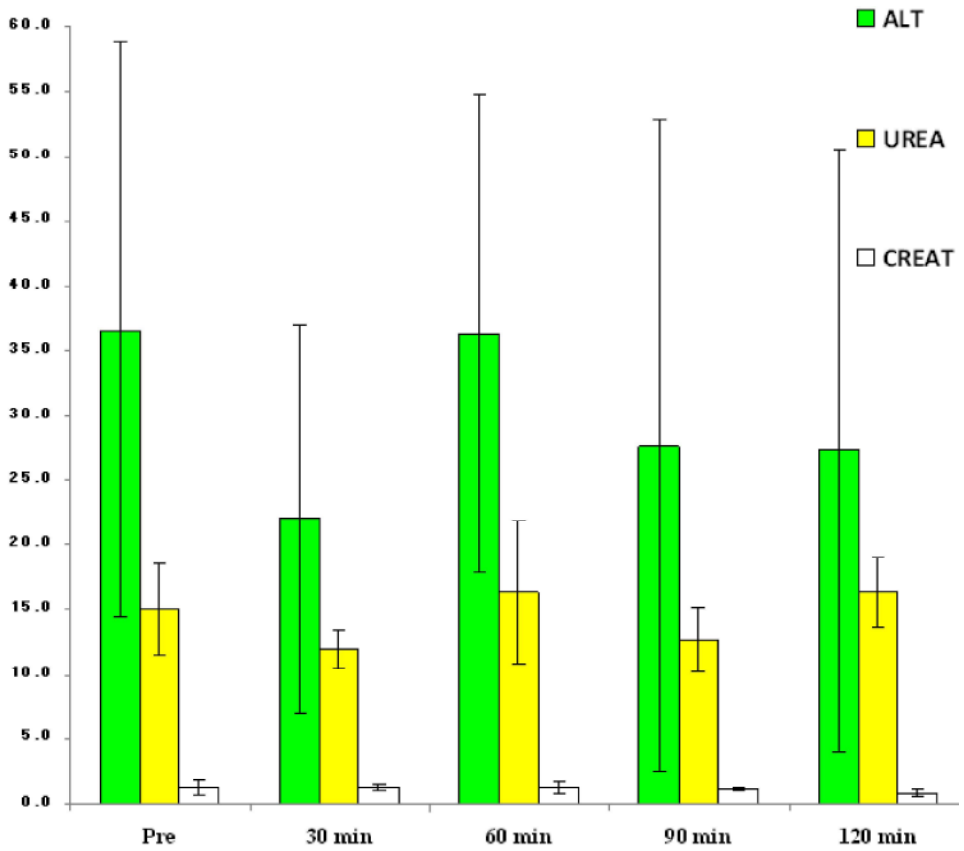

Fig. 3: Effect of Subcutaneous Ketamine – Intravenous Xylazine Administration for Induction of Surgical Anaesthesia on Serum Biochemistry of Dogs

Basophil: There was no significant (P>0.05) difference in the experimental values of the mean basophil count recorded in this experiment (Figure 2).

Effect of Combination of Subcutaneous Ketamine – Intravenous Xylazine Administration for Induction of Surgical Anaesthesia on Serum Biochemistry of Dogs.

There is no significant (P>0.05) change in the mean experimental values recorded of alanine transferase (ALT), creatinine and blood urea nitrogen (BUN) compared to the baseline values Figure 3.

DISCUSSION

The mean time of onset and time to recombency when the combination of subcutaneous ketamine and intravenous xylazine anaesthesia was 3 ± 1.2 min in this study. This is similar to what Babalola [5] reported using the combination of subcutaneous ketamine and intravenous Chlorpromazine in dogs.

The non-significant decrease in the mean haemoglobin, packed cell volume and total erythrocyte count observed in this study could be as a result of pooling of circulating blood cells into the spleen and other reservoirs secondary to decreased sympathetic activity. This finding is in agreement with the findings of Gebremedhin *et al.* [6]. Who had reported a non-significant decreased the hemoglobin concentration, packed cell volume and total erythrocyte count after administration of ketamine alone and xylazine-ketamine combinations in dogs. This is also similar to the findings of Kilic [7], he reported a non-significant decrease in packed cell volume, haemoglobin and RBC following detomidine-midazolam-ketamine anaesthesia in calves and Xylazine-ketamine anaesthesia in goat. This decrease in the mean values of packed cell volume, haemoglobin and RBC may also be due to repeated bleeding as research protocol requires repeated bleeding of animals during experiments, as was reported by Wall *et al.* [8]. He reported the effects of continuous bleeding of animals on haematology.

The decrease in mean value of MCHC observed in this study could be as a result of iron deficiency caused by repeated bleeding leading to severe depletion of the haemoglobin level in the dogs thus decreased mean

corpuscular haemoglobin concentration (Douglas *et al*. [9]. This report is similar to the report of Umar *et al.* [10] who evaluated the effect of intravenous Ketamine-medetomidine combination on haematology and serum biochemistry of dogs. The decrease in the mean eosinophil value recorded in this study could be stress related and can be observed in dogs undergoing repeated bleeding which can results in stress on the dogs. This agrees with the report of Darren [11].

The absence of significant effect on the serum biochemical parameters (ALT, BUN and CRE) concentrations recorded in this study is similar to the findings of Umar *et al.* [10]. He reported no significant effect of intravenous ketamine-medetomidine anaesthesia on serum biochemical parameters (ALT, BUN and CRE) in dogs. This finding also, agrees with that of Ismail *et al.* [11], who investigated the effects of ketamine-xylazine-diazepam anesthesia on plasma biochemical values in sheep and goats. His result showed no significant difference before and during ketamine- xylazine anesthesia in ALT, Creatinine, blood urea nitrogen in sheep.

CONCLUSION

Based on the results from this study, the effects of the combination of subcutaneous ketamine-intravenous xylazine anaesthesia in dogs produced a transient decrease in Packed Cell Volume, Haemoglobin and Red blood Cell and significant decrease in eosinophils and Mean Corpuscular Haemoglobin Concentration (MCHC). This implies that this combination has mild effect on the haematology of the dogs. The combination of subcutaneous ketamine-intravenous xylazine anaesthesia has no significant effect on BUN, ALT and CRE. This finding in the serum chemistry could imply that the combination of subcutaneous ketamine-intravenous xylazine does not have any detrimental effect on the liver, kidney and muscular tissue of the dogs. Therefore, one may conclude that, the combination of subcutaneous ketamine-intravenous xylazine anaesthesia is a safe method of inducing surgical anaesthesia and could be a reliable alternative to intramuscular or intravenous routes of administration of Ketamine for routine induction of surgical anaesthesia in dogs.

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