CLINICAL EVALUATION OF THE COMPARATIVE EFFECT OF XYLAZINE AND XYLAZINE - KETAMINE PREMEDICATION IN THIOPENTONE ANAESTHESIA IN DOGS

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Thesis submitted in partial fulfilment of the requirement for the degree of

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DECLARATION

I hereby declare that this thesis, entitled **"CLINICAL EVALUATION OF THE COMPARATIVE EFFECT OF XYLAZINE AND XYLAZINE-KETAMINE PREMEDICATION IN THIOPENTONE ANAESTHESIA IN DOGS"** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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CERTIFICATE

Certified that the thesis entitled **"CLINICAL EVALUATION OF THE COMPARATIVE EFFECT OF XYLAZINE AND XYLAZINE-KETAMINE PREMEDICATION IN THIOPENTONE ANAESTHESIA IN DOGS"** is a record of research work done independently by **Sri. Philip Varghese**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to him.

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We, the undersigned members of the Advisory Committee of **Sri. Philip Varghese**, a candidate for the degree of Master of Veterinary Science in Surgery, agree that the thesis entitled **"CLINICAL EVALUATION OF THE COMPARATIVE EFFECT OF XYLAZINE AND XYLAZINE-KETAMINE PREMEDICATION IN THIOPENTONE ANAESTHESIA IN DOGS"** may be submitted by Sri. Philip Varghese, in partial fulfilment of the requirement for the degree.

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PHILIP VARGHESE

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Introduction

1. INTRODUCTION

Anaesthesia is an essential prerequisite to all surgical manipulations in animals. General anaesthesia is preferred to any other anaesthetic techniques for major surgical interventions. The concept of anaesthesia has itself undergone changes with newer drugs and techniques evolved. Use of a single drug to achieve the three requirements of general anaesthesia like unconsciousness, analgesia and muscle relaxation may lead to untoward side effects and even death in animals. Hence, now-a-days drug combinations are used for the induction and maintenance of anaesthesia. By this, the requirement of individual drugs can be reduced and thereby the toxic effects are minimized. Injectable anaesthetic drugs are more practiceable in veterinary practice because of the ease of administration and lack of need for sophisticated facilities and equipments.

Intramuscular injectable drugs like xylazine hydrochloride and ketamine hydrochloride are being administered alone or in combination or with other sedatives and tranquilizers in various animals (Purohit *et al.*, 1981; Jacobson, 1983; Waterman, 1983 and Tiwari *et al.*, 1994) for general anaesthesia.

The active ingredient of xylazine is 2(2,6-dimethyl phenylamino)-5dehydro 4H-1,3, thiazine hydrochloride, resembles tranquilizer in activity producing sedative, analgesic and muscle relaxant effects (Sharma *et al.*, 1983). It has a particularly marked hypnotic action on the central nervous system leading to general muscle relaxation which supplements the state of sleep and freedom from pain, but side effects include bradycardia, cardiac dysarrhythmia, retching and vomiting (Hall, 1985).

Ketamine is chemically designated as 2-(0-chlorophenyl)-2-(methylamino) cyclohexanone is the most commonly used dissociative anaesthetic. It is known to induce seizures (Wright, 1982) and hypersalivation (Short, 1987) in dogs when used alone.

Xylazine premedication was found useful in reducing the dose of thiopentone sodium for producing general anaesthesia (Sharma and Kumar, 1986). On perusal of the available literature, references regarding the use of a combination of xylazine and ketamine for premedication in thiopentone anaesthesia is not traceable.

The present study was undertaken with the objective to evaluate the comparative effect of xylazine and xylazine-ketamine premedication in thiopentone anaesthesia in dogs subjected to surgical operations.

Review of Literature

2. REVIEW OF LITERATURE

Branch *et al.* (1975) suggested that occasional second degree atrio-ventricular block might be a normal finding in dogs especially in young ones. Atrioventricular block was especially frequent after surgical operations, which did not always involve manipulation of the heart.

Klide *et al.* (1975) reported subjective sedative effects like lying down, lack of response to environment; medial rotation of eye ball and prolapse of nictitans in dogs following the administration of xylazine. The drug did not produce any effect on respiratory functions but it did produce changes in blood pressure, heart rate, cardiac output and cardiac rhythmicity.

Horwitz (1977) reported that with intravenous administration in dogs, the mean heart rate rose to 185 beats per minute with ketamine hydrochloride and 147 beats per minute with thiopental. Ketamine and thiopental have myocardial depressant effects, but thiopental did not alter sympathetic tone and the depressive effects of ketamine was obscured by stimulation of cardiac sympathetic nerves. Myocardial depressant effects were more pronounced with thiopental. Cardiac output was significantly increased by ketamine, but was unchanged by thiopental. Left ventricular systolic pressure did not change significantly with thiopental. Left ventricular end diastolic pressure was unchanged with both ketamine and thiopental in dogs. Ketamine was associated with a substantial increase in beta-adrenergic stimulation but the thiopental was not associated with this effect.

Muir and Piper (1977) reported that the intravenous and intramuscular administration of xylazine hydrochloride produced a short-lasting pressor response followed by long lasting hypotension and bradycardia in horses, dogs, cats, rabbits and rats. Ten minutes after the administration of xylazine

hydrochloride at a dose rate of 1.1 mg/kg body weight i.v. in dogs , mean arterial blood pressure increased to 138 ± 17 from 94 ± 13 mm of Hg. Mean arterial pressures were 89 ± 12 and 84 ± 14 mm of Hg at 30 and 60 minute after xylazine administration i.v., respectively.

Parsania *et al.* (1977) observed severe muscle contraction and profuse salivation in dogs when ketamine hydrochloride was used alone. Though different reflexes were present, fair to poor muscle relaxation was observed when used along with promazine hydrochloride and variety of operations could be performed with the combinations.

Weiser *et al.* (1977) measured direct and indirect blood pressures from 45 clinically normal dogs. The mean systolic pressures determined directly and indirectly were 155 ± 27 mm of Hg and 155 ± 26 mm of Hg respectively. The mean direct and indirect diastolic values were 73 ± 14 mm of Hg and 74 ± 14 mm of Hg respectively.

Manziano and Manziano (1978) reported that augmentation of muscle relaxation and prolongation of anaesthesia was possible with administration of ketamine in combination with thiamylal sodium, morphine, xylazine, or acepromazine. It was also reported that ketamine had no cumulative effect when it is administered i.v. in small doses. No convulsions were seen in dogs younger than six months of age.

Muir *et al.* (1978) reported an increase in systolic, diastolic and mean arterial pressures in horses following the administration of xylazine.

Stephenson *et al.* (1978) achieved the desired plane of anaesthesia in 10 minutes by intramuscular administration of a total dose of 0.25 mg of atropine sulphate followed by fifteen minutes later, xylazine hydrochloride and ketamine hydrochloride mixed in common syringe in the doses of 2.0 mg/kg and 5.5 mg/kg

respectively. The anaesthesia persisted for 30 minutes and got fully recovered within one to two hours.

Jones (1979) opined that with injectable anaesthetic agents, the induction of anaesthesia was rapid, with no irritation of the respiratory tract. Thiopentone produced small variable changes in blood pressure and heart rate while large doses caused hypotension and tachycardia. The injection of ketamine in large doses provoked a depressor response but normal doses caused hypertension and tachycardia.

Peshin *et al.* (1980) observed transient bradycardia and decrease in respiratory rate in dogs following intramuscular administration of xylazine at the rate of 3.0 mg/kg body weight. Xylazine caused a decrease in 'T' wave interval and in the amplitude of 'P' wave interval and QRS complex. The PR and QT intervals decreased during tachycardia and increased during bradycardia. Changes in the T-wave along with elevation of S-T segment were suggestive of myocardial hypoxia. There was slight decrease in total erythrocyte and leucocyte counts, packed cell volume and haemoglobin concentration. There was decrease in lymphocyte count with subsequent increase in neutrophil count following xylazine administration. Significant increase in blood glucose, mild increase in serum sodium and decrease in potassium and chloride concentrations were also observed.

Colby and Sanford (1981) studied the changes in blood pressure in cats under ketamine-xylazine and ketamine-acepromazine anaesthesia. The blood pressure was depressed by both the combinations and was prolonged by ketamine-xylazine than ketamine-acepromazine. The ketamine-xylazine combination presented a slow decline in the blood pressure lasting dampering effect. The blood pressure did not rise until long after the animal had begun to show visible signs of recovery from anaesthesia.

Nowrouzian *et al.* (1981) evaluated the anaesthetic properties of ketamine and ketamine-xylazine-atropine combination in sheep. The combination of ketamine, xylazine and atropine appeared to give the most satisfactory results with regard to muscle relaxation, suppression of salivation, urination and rugurgitation as well as reflexes.

Purohit *et al.* (1981) evaluated the effects of xylazine and ketamine on the electrocardiogram in six horses. In all the six horses xylazine administration resulted in second degree AV block and subsequent administration of ketamine abolished this effect in 4 of 6 horses.

Schulman (1981) reported that subcutaneous administration of atropine at the rate of 0.045 mg/kg body weight prior to ketamine reduced salivation.

Kolata and Rawlings (1982) found that when atropine (0.04 mg/kg of body weight) and the combination of xylazine (1.1 mg/kg) and ketamine (11 mg/kg) were administered i.v. in dogs, caused hypoventilation, as reflected by increased $PaCO_2$ and a 30% decrease in cardiac index whereas arterial pressure, left arterial pressure, and peripheral resistance were increased.

Wallner *et al.* (1982) reported that dogs when injected with a combination of 0.045 mg/kg of atropine sulphate and 2.2 mg/kg of xylazine hydrochloride intramuscularly causes prostration and maximum sedation in 3 to 19 minutes. Pedal reflex in thoracic and pelvic limbs were dulled or disappeared, but jaw, tongue, palpebral and righting reflexes were not uniformly depressed.

Jacobson (1983) employed ketamine-xylazine combination for immobilizing springbok (*Antidorcas marsupialis*) and compared the haematologic and serum biochemical values, before and after immobilization. The haematological, serum aspartate transaminase, blood urea nitrogen and

chloride values before immobilization were not significantly different from thereafter immobilization, whereas the potassium values were significantly lower.

Sharma *et al.* (1983) studied the effect of xylazine on thiopental sodium anaesthesia in atropine premedicated dogs and observed decrease in heart and respiration rates, mean arterial blood pressure and body temperature. Decrease in total erythrocyte and leukocyte counts, haemoglobin concentration and packed cell volume were also observed. The duration of anaesthesia was found significantly increased in thiopental sodium induced anaesthesia when maintained with xylazine.

Waterman (1983) reported that xylazine premedication prolonged significantly the duration of ketamine anaesthesia in cats.

Hatch *et al.* (1984) reported that thiopental anaesthesia could be rapidly, safely, smoothly and permanently reversed in atropinized cats treated with xylazine and given 4-aminopyridine with yohimbine. Administrtion of atropine sulphate at a dose rate of 0.05 mg/kg body weight was found useful in preventing excessive salivation, laryngospasm, bronchosecreation, bronchoconstriction and bradycardia during anaesthesia.

Hall (1985) opined that premedication is the term used to describe medication given immediately before anaesthesia to make the anaesthetic period safer and more comfortable for the animal and to simplify the tasks of the anaesthetist. Atropine may be given i.m., i.v. or s.c. at the dose rate of 0.02-0.1 mg/kg. Xylazine can produce deep sedation with centrally induced muscle relaxation, but side effects include bradycardia, cardiac dysarryhthmias, retching and vomiting. The prolonged sedation produced may give rise to hypothermia, if measures are not taken to maintain body temperature. Xylazine reduced the rigidity produced by the dissociative agent ketamine, used to induce anaesthesia.

For this purpose, it is administered intramuscularly in the doses of 1.0-3.0 mg/kg body weight.

Haskins *et al.* (1985) reported that ketamine (10 mg/kg) administered i.v. in dogs' increased heart rate and mean systemic blood pressure, whereas breathing rate decreased. One of the dog exhibited brief tonoclonic seizures after ketamine administration whereas all the dogs salivated profusely. The duration of surgical anaesthesia of a single dose of ketamine was about 13-15 minutes. Ketamine at the rate of 10 mg/kg produced unsatisfactory anaesthesia for surgical purposes. Muscle tone was extreme and exuberant spontaneous movement was virtually continuous after about 15 minutes. It was recommended that dogs should be given adjunctive sedative or tranquilizer premedication when ketamine is to be used, since ketamine is a cardiovascular and metabolic stimulant.

Hatch *et al.* (1985) administered xylazine hydrochloride (2.2 mg/kg body weight, i.m.) in atropinized dogs followed by thiopental sodium (1 % w/v) to loss of pedal reflexes and found that the dose of thiopental sodium to induce anaesthesia was 5.5 ± 1.6 mg/kg. The mean arousal time and mean walk time were 37.1 minutes and 53.8 minutes respectively.

Hsu (1985a) administered xylazine (2.2 mg/kg body weight, i.m.) followed in 10 minutes by i.v. injection of pentobarbital (14.0 mg/kg body weight). Absence of pedal reflex, the resultant duration of anaesthesia and time from return of consciousness to ambulation were 111.8, 137.3 and 59.6 minutes respectively. Xylazine injections caused bradycardia without changing mean arterial blood pressure. Subsequent i.v. pentobarbital administration abolished xylazine induced bradycardia for approximately 20 minutes and decreased arterial blood pressure slightly and gradually. Respiration was markedly depressed for the first 20 minutes of xylazine-pentobarbital anaesthesia and gradually decreased during the rest of the 50 minute monitoring period. Five minutes after i.m.injection of xylazine (2.2 mg/kg body weight) all dogs under

study were sedated. The principal advantage of using xylazine and pentobarbital over pentobarbital alone was the smoother recovery without post anaesthetic excitement.

Hsu (1985b) administered atropine sulphate (0.045 mg/kg body weight, i.m.) 15 minutes after pentobarbital (14.0 mg/kg i.v.) with prior administration of xylazine (2.2 mg/kg body weight, i.m.) at an interval of 10 minutes. Atropine sulphate injection did not significantly change the duration of absence of pedal reflex, duration of anaesthesia and the time from return of consciousness to ambulation as 107.4, 123.4 and 59.2 minutes respectively as the pattern of respiration in the anaesthetized dogs. Although atropine sulphate antagonized xylazine bradycardia, but the data indicated that it caused increased respiratory depression in dogs anaesthetized with xylazine and pentobarbital.

Haskins *et al* (1986) administered xylazine (1.0 mg/kg) i.v. and then ketamine (10.0 mg/kg) i.v. in dogs and found a decrease in heart rate after xylazine administration and increase in heart rate after ketamine administration. First and second-degree atrioventricular block were seen after xylazine administration. Ketamine transiently reversed these changes. Systemic blood pressure increased significantly after xylazine administration and no further changes occurred with the administration of ketamine. Breathing rate decreased after xylazine and decreased further after ketamine administration. Muscle relaxation was better and salivation was less with xylazine-ketamine combination compared with xylazine alone. The time to first spontaneous movement was 32 minutes with xylazine-ketamine; it was 15 minutes with ketamine alone. The time to ultimate recovery was similar between xylazine-ketamine and ketamine alone.

Sharma and Kumar (1986) reported that in dogs, with atropine premedication, thiopentone sodium at the rate of 24.2 ± 2.42 mg/kg produced surgical anaesthesia for 11.75 ± 0.85 minutes, whereas xylazine (1.5 mg/kg)

premedication reduced the dose of thiopentone sodium to 16.25 ± 3.2 mg/kg and prolonged the duration of surgical anaesthesia to 45.65 ± 4.68 minutes. It also increased the extent of muscle relaxation. The time of recovery was also prolonged to 82.12 ± 5.52 minutes in xylazine-premedicated animals given only the thiopentone sodium.

Srivastav *et al.* (1988) reported that surgical anaesthesia in dogs could be maintained for one hour by repeated i.v. injection of 5% thiopentone sodium with a total dose of 40.6 ± 5.12 mg/kg. The total protein remained insignificantly affected.

Hikasa *et al.* (1989) observed that intramuscular injection of xylazine induced dose dependent vomiting as there was an increase in the number of bouts of vomiting in cats as the dose increased.

Usha and Rajagopalan (1990) studied ketamine anaesthesia in dogs and found that with ketamine administered at the rate of 20 mg/kg i.m., the average sternal recumbency time was 4.33 ± 1.20 minutes; duration of anaesthesia was 45.67 ± 3.67 minutes; regaining of sternal recumbency time was 50.00 ± 2.89 minutes; standing time to be 72.00 ± 6.98 minutes and total recovery time to be 99.17 ± 17.58 minutes.

Ilkiw *et al.* (1991) reported that three minutes after thiopental administration in dogs an increased heart rate, mean arterial pressure, mean pulmonary arterial pressure, pulmonary vascular resistance and mixed venous oxygen tension, whereas oxygen utilization ratio and arterial and mixed venous oxygen pH decreased from values measured prior to thiopental administration. Fifteen minutes after thiopental administration, heart rate was still increased, however 60 minutes after thiopental administration all measurements had returned to values similar to those obtained prior to thiopental administration.

Pandey *et al.* (1991) reported that in dogs intravenous administration of a total dose of 0.65 mg atropine sulphate and 3.0 mg/kg diazepam, followed by 10 mg/kg i.v., ketamine hydrochloride, 10 minutes later, induced anaesthesia for an average duration of 37.00 ± 3.29 minutes. It produced drop in pulse rate, respiration and body temperature. There was a significant increase in total leucocytic count and neutrophil percentage, while lymphocytes were dropped significantly. It was opined that higher values of leucocytes obtained in the study might be related to the adrenal corticoid related to combat stress.

Ramaswamy *et al.* (1991) could achieve rapid induction (44.17 seconds) of anaesthesia in dogs by administration of a combination of xylazine (at the rate of 0.5 mg/kg) with ketamine (at the rate of 10 mg/kg).

Wagner *et al.* (1991) reported decreased heart rate, cardiac output and reduction in mean arterial pressure in horses following the administration of xylazine.

Bisen *et al.* (1994) administered atropine sulphate at the rate of 0.65 mg/dog and ketamine at the rate of 10 mg/kg body weight i.v. to dogs reported that the total erythrocyte count, packed cell volume and haemoglobin levels were not significantly affected. A moderate drop in total erythrocyte count, packed cell volume and haemoglobin and a significant increase is seen in neutrophils and a decrease in lymphocytes percentage in early interval were recorded. Total leukocyte count remained within a normal range during different intervals.

Brock (1994) opined that hypothermia reduced anaesthetic dose requirements, so that relative, overdoses are possible if patient cooling is not detected. Hypothermia is also a common cause of slow recovery from an anaesthesia.

Kumar and Singh (1994) reported that the administration of diazepam at the rate of 3.0 mg/kg body weight i.v. and xylazine at the rate of 1.0 mg/kg body weight i.m. separately or as a mixture i.v. in atropine sulphate (0.04 mg /kg, i.m.) premedicated dogs revealed a significant decrease in onset of effects, duration of anaesthesia and recovery time in animals given mixture of diazepam and xylazine. A significant ($P < 0.05$) decrease in respiration and heart rates and non-significant ($P > 0.05$) decrease in rectal temperature were observed following the administration of the drug. A significant ($P < 0.05$) decrease in arterial blood pressure observed at 10-40 minutes after xylazine injection. The ECG changes included first degree AV block.

Tiwari *et al.* (1994) reported that administration of xylazine with ketamine produced excellent muscle relaxation, deep sedation, moderate analgesia, with loss of righting reflex in dogs. There was increase in blood glucose level, but the urea nitrogen, sodium and potassium levels remain unaffected.

Thiruthalinathan *et al.* (1995) opined that dissociative anaesthesia was characteristized by analgesia, dissociation from consciousness awareness, intact laryngeal and pharyngeal reflexes, normal or increased muscle tone, cardiac stimulation and respiratory depression. A major advantage of these agents was their tendency to cause excitement, muscle rigidity, convulsions and unpredictable recoveries. Xylazine is a sedative, analgesic and muscle relaxant effective in a wide range of species. The use of xylazine-ketamine combination reduced the side effects of ketamine while retaining its anaesthetic properties. It was also reported that convulsions, muscle rigidity and salivation were observed in wild canines under captivity when treated with ketamine at the rate of 8.25-18 mg/kg, I.M. But the wild canines (wild dogs, wolf, jackals) treated with ketamine–xylazine combination did not show any such effects and showed better sedation, good muscle relaxation and faster recovery

Hellyer (1996) opined that in dogs and cats, xylazine when used intramuscular as opposed to intravenous administration decreased the incidence and severity of the abnormalities such as bradycardia, first and second-degree heart block, ventricular arrhythmias, and decreased output.

Singh *et al.* (1997), administered atropine sulphate at the rate of 0.04 mg/kg s.c about 20 min prior to the administration of xylazine (1-2 mg/kg) and ketamine (5–10 mg/kg) i.m. in a single syringe in dogs. The regimen augmented the onset of anaesthesia within 5–10 minutes and duration of surgical anaesthesia lasted for 30–45 minutes. The recovery was smooth and uncomplicated and was seen between 60–90 minutes. There was moderate depression of palpebral reflex and absence of pedal and cough reflexes during surgical anaesthesia. The eyeball and corneal reflexes disappeared and tongue protruded out of buccal cavity. Eyes remained open. A nonsignificant decrease in heart and respiratory rates after induction of anaesthesia was seen. Rectal temperature decreased slightly in all animals. Xylazine–ketamine combination administered animals had good sedation, analgesia and muscle relaxation.

Amma (1998) reported satisfactory anaesthesia following the intravenous administration of 5% solution of thiopentone sodium with prior intramuscular administration of atropine sulphate (0.045 mg/kg body weight) and xylazine (0.5 mg/kg body weight). The anaesthesia was maintained whenever necessary with incremental doses of thiopentone. The induction and recovery were smooth and uneventful.

Grosenbaugh and Muir (1998) opined that the normal systolic pressures ranged from 110 to 160 mm Hg in dogs and cats and the normal diastolic pressures ranged from 70 to 90 mm Hg.

Rishniw *et al.* (1999) reported that i.v. administration of 0.04 to 0.06 mg/kg body weight of atropine in clinically normal dogs increased heart rate,

regardless of dose. Heart rate increased to more than 135 beats per minute in 5 of 6 dogs after the 0.04 and 0.06 mg/kg doses but failed to reach 135 beats per minute in 5 of 6 dogs after the 0.02 mg/kg dose. Dose as high as 0.06 mg/kg did not induce excessive tachyarrhythmias.

Dugdale *et al.* (2001) reported that premedication with sedative agents normally reduced thiopentone induction dose requirements, but sufficient time must be allowed for it to take effect. Anaesthetic induction was excitement free in all dogs, where 6.7 mg/kg of 2.5% thiopentone i.v. was given prior to 0.2 mg/kg diazepam i.v. as a rapid bolus.

Baniadam *et al.* (2004) studied the effect of xylazine-ketamine on temperature, heart and respiratory rate, arterial blood pressure and blood gases in sheep had reported little depressant effects on the cardiovascular system. It was also observed that the combination was responsible for a little disturbed ventilation, decreased PaO_2, increased $PaCO_2$ and decreased body temperature during anaesthesia.

Materials and Methods

3. MATERIALS AND METHODS

The study was carried out in 12 dogs of different breeds of either sex, presented to the College Hospitals at Mannuthy and Kokkalai for various elective surgical procedures. All dogs were clinically examined before the administration of the anaesthetics. These dogs were randomly divided into two groups' *viz.* Group I and Group II, each consisting of six dogs. They were numbered serially from 1 to 6.

All the dogs were withheld food for 24 hours and water for 12 hours prior to the administration of the anaesthetics. Atropine sulphate[1] at the rate of 0.045mg/kg body weight was administered intramuscularly, 15 minutes prior to the administration of the drugs under trial.

The anaethetics trials were carried out as given under:

Group I

Xylazine[2] at the rate of 1.0 mg/kg bodyweight was administered intramuscularly for premedication. Fifteen minutes later, thiopentone sodium[3] 2.5% solution was administered intravenously "to effect" general anaesthesia. Incremental doses of thiopentone were also administered for the maintenance of anaethesia for completing the surgery.

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1. Atropine Sulphate – Atropine sulphate 0.6 mg/ml, Hindustan Pharmaceuticals, Barauni
2. Xylaxin – Xylazine hydrochloride 23.22 mg/ml (equivalent to 20 mg of xylazine), Indian Immunologicals, Hyderabad
3. Anesthal – Thiopentone sodium 0.5 g vial, Jagsonpal Pharmaceuticals, Haryana

Group II

Xylazine at the rate of 1.0 mg/kg bodyweight and ketamine[4] at the rate of 2.5 mg/kg body weight were administered intramuscular as a combined injection for premedication. Fifteen minutes later, thiopentone sodium 2.5 % solution was administered intravenously "to effect" general anaesthesia. Incremental doses of thiopentone were also administered for the maintenance of anaesthesia for completing the surgery.

The dogs were subjected to various surgical operations (Tables 1 and 6). The physiological observations, electrocardiogram and collection of blood samples were carried out immediately before the administration of atropine sulphate, before and after the administration of xylazine/xylazine-ketamine combination, and, at 15, 30, 45 and 60 minute and at 24 hour after the administration of thiopentone sodium.

MAIN ITEMS OF OBSERVATIONS:

I Clinical Observations

1. Clinical signs

The salient clinical signs exhibited by the dogs following the administration of anaesthetic drugs during induction, maintenance and recovery were observed.

2. Induction time

It was calculated as the time from injection of thiopentone to the time of loss of pedal reflex

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4. Ketmin 50 – Ketamine hydrochloride 50 mg/ml, Themis Medicare, Gujarat

3. Duration of surgical anaesthesia with first induction of thiopentone

It was calculated as the time from loss of pedal reflex to the time of return of pedal reflex.

4. Average duration of surgical anaesthesia following subsequent administration of incremental doses of thiopentone (if used)

It was calculated as an average of the interval between the time from loss of pedal reflex after the first incremental dose to the time of return of pedal reflex after the administration of last incremental dose was divided with the number of incremental doses.

5. Recovery time

It was calculated as the time from return of the head-righting reflex to the time when the animal could stand up and walk unassisted.

6. Quantity of thiopentone administered for induction

It was calculated as the quantity in milligram of thiopentone required per kilogram body weight for the induction of general anaesthesia.

7. Average incremental quantities of thiopentone administered (if used)

The average incremental quantities of thiopentone required administered for prolonging the duration of surgical anaesthesia were recorded.

8. Muscle relaxation time

It was calculated as the time from loss of resistance to jaw opening to the return of resistance to jaw opening.

9. Degree of muscle relaxation

It was rated as excellent, good, moderate, or poor depending upon the resistance in opening the jaws in manually.

10. Surgery performed and the time required for surgical operation

The surgery performed was recorded and the duration of surgery was calculated as the time from start of surgery to the finish of surgery.

II. Physiological Observations

Rectal temperature (°C), pulse rate (per minute), respiration rate (per minute) and systolic and diastolic blood pressures (mm Hg) were recorded.

Blood pressure was recorded using an inflatable paediatric cuff, which was fixed into the forelimbs above the point of elbow and inflated. An acoustic stethoscope was placed below the cuff on the medial aspect of the limb on the radial artery. Both the systolic and diastolic sounds were auscultated and recorded using a sphygmomanometer, calibrated in millimeters of mercury (Harvey *et al.* 1983)

III. Electrocardiogram (ECG)

It was recorded using lead II system in **BPL-CARDIART®** 6108 machine, at a paper speed of 25 millimeters per second (Bolton, 1975).

IV. Haemogram

In all the animals i.v. canula of 20 gauge was affixed in the cephalic vein for the periodic collection of blood samples. Out of the five milliliters of whole blood collected, two milliliters of blood was mixed in sterile vials containing 2.0

mg of EDTA, one drop was used for the preparation smear and remaining quantity was collected in centrifuge tube for separating serum.

Packed cell volume (PCV.) (Wintrobe, 1961), Haemoglobin concentration (Sahli method), total erythrocyte count (RBC), total leukocyte count (TLC) and differential leukocytic count (DLC) (Schalm, 1975) were estimated.

V. Serum Constituents

Serum sodium and serum potassium concentration were estimated by the flame photometric method.

Serum total protein content and albumin/globulin ratio were estimated using total protein and albumin kit[5] by Biuret method.

VI. Post anaesthetic complication(s), if any

Postoperatively, all the dogs were observed for any post anaesthetic complications.

Statistical Analysis

The data were analysed by Students 't'- test (Snedecor and Cochran, 1985).

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5. Total Protein/Albumin Kit – Agappe Diagnostics, Maharashtra

Results

4. RESULTS

GROUP I

The observations are presented in Tables 1 to 5.

Atropine sulphate at the dose rate of 0.045 mg/kg body weight was administered intramuscularly, 15 minutes prior to the administration of xylazine to all the dogs of this group.

Xylazine at the rate of 1.0 mg/kg bodyweight was administered intramuscularly for premedication. Fifteen minutes later, thiopentone sodium 2.5% solution was administered intravenously "to effect" general anaesthesia. Incremental doses of thiopentone were also administered for the maintenance of anaethesia for completing the surgery.

I. Clinical Observations

1. Clinical signs

Following the administration of xylazine, the symptoms like yawning, winking of eyes and incoordination of hindquarters were observed. Salivation was scanty in all the dogs. The other symptoms noticed were vomiting (Animal No. I/4), licking (Animal Nos. I/2, I/4 & I/6) and urination (Animal Nos. I/2 & I/4). Two dogs (I/1 & I/4), assumed lateral recumbency but the others (I/2, I/3, I/5 & I/6) were in sternal recumbency with head down posture.

The induction of anaesthesia was smooth following the administration of thiopentone. The surgical anaesthesia and muscle relaxation were satisfactory. Maintenance of satisfactory anaesthesia was possible with repeated administration of thiopentone.

The recovery from anaesthesia was smooth and uneventful. But most of the dogs were drowsy till next day.

2. Induction time (Table 2)

The induction time was 6.83 ± 1.40 minutes following the administration of the thiopentone.

3. Duration of surgical anaesthesia with first induction of thiopentone (Table 2)

Following first induction the duration of anaesthesia was 11.67 ± 3.90 minutes. For long duration surgical operations anaesthesia was prolonged with repeated administration of thiopentone.

4. Average duration of surgical anaesthesia following subsequent administration of incremental doses of thiopentone (if used) (Table 2)

With repeated administration of thiopentone on an average 13.63 ± 3.76 minutes duration of surgical anaesthesia was achieved with every incremental doses.

5. Recovery time (Table 2)

The recovery time was 124.00 ± 48.55 minutes. Most of the animals were drowsy until the next day.

6. Quantity of thiopentone administered for induction (Table 2)

For the first induction of anaesthesia the quantity of thiopentone was 9.31 ± 1.87 mg/kg body weight.

7. Average incremental quantities of thiopentone administered (if used) (Table 2)

The incremental quantities of thiopentone required was on an average 3.83 ± 1.10 mg/kg body weight for prolonging the duration of surgical anaesthesia. The incremental dose(s) administered for three times in one dog, five times in one dog, and one time in three dogs. In one dog the operation was completed with the induction dose itself.

8. Muscle relaxation time (Table 2)

The average muscle relaxation time was 50.67 ± 9.01 min

9. Degree of muscle relaxation (Table 2)

It was moderate to excellent

10. Surgery performed and the duration of surgery (Table 1 and 2)

The surgery performed were oophrectomy in three dogs (Animal Nos. I/1, I/2 and I/4), correction of rectovaginal fistula in one dog (Animal No. I/3), enterotomy in one dog (Animal No. I/5) and Zepp's operation in one dog (Animal No. I/6). The average duration of surgery was 37.83 ± 6.27 minutes.

II. Physiological observations (Table 3)

The rectal temperature (°C) was 39.78 ± 0.08 before the administration of atropine sulphate and, 39.57 ± 0.33 and 39.41 ± 0.23 before and after the administration of xylazine respectively. It was 39.02 ± 0.50, 38.76 ± 0.60, 38.75 ± 0.73, 38.48 ± 0.69 and 39.13 ± 0.45 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was gradual decrease in

rectal temperature throughout the period of observation and was significant ($P<0.05$) at 60 minute after the administration of thiopentone.

The pulse rate (per minute) was 94.50 ± 4.83 before the administration of atropine sulphate and, 141.33 ± 15.19 and 117.00 ± 15.32 before and after the administration of xylazine respectively. It was 114.50 ± 14.99, 103.00 ± 10.03, 93.33 ± 5.81, 88.67 ± 4.98 and 112.67 ± 7.60 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was decrease in pulse rate after the administration of xylazine premedication and after thiopentone. The increase was significant ($P<0.05$) after administration of atropine sulphate and at 24 hour.

The respiration rate (per minute) was 61.67 ± 5.25 before the administration of atropine sulphate and, 56.50 ± 6.54 and 42.83 ± 7.57 before and after the administration of xylazine respectively. It was 24.83 ± 2.17, 26.17 ± 2.48, 25.00 ± 2.78, 18.17 ± 0.95 and 48.84 ± 4.34 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was gradual decrease in respiration rate and it was significant ($P<0.05$) after the administration of xylazine and at 15, 30, 45 and 60 minute after thiopentone.

The systolic pressure (mm Hg) was 168.33 ± 7.03 before the administration of atropine sulphate and, 159.17 ± 4.90 and 144.17 ± 5.83 before and after the administration of xylazine respectively. It was 184.67 ± 4.37, 180.83 ± 4.90, 172.67 ± 4.33, 170.83 ± 3.75 and 158.00 ± 3.06 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was significant ($P<0.05$) decrease in systolic pressure after the administration of atropine sulphate and xylazine, and increase at 15 minute after administration of thiopentone. Thereafter there was gradual decrease.

The diastolic pressure (mm Hg) was 102.50 ± 4.68 before the administration of atropine sulphate and, 103.33 ± 3.26 and 107.50 ± 4.04 before

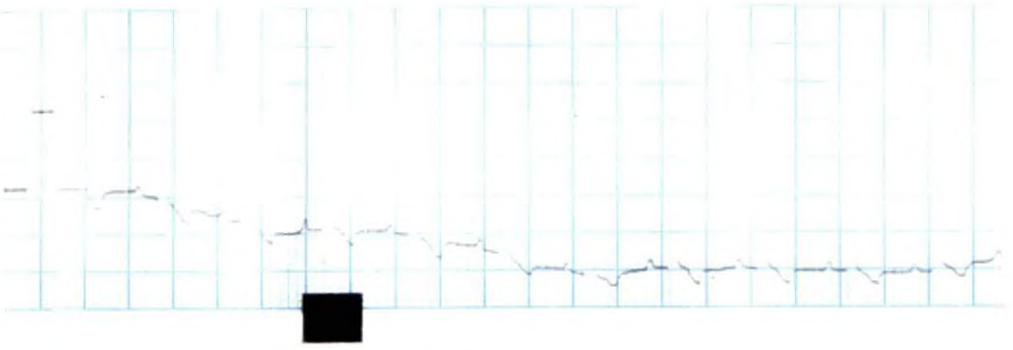
and after the administration of xylazine respectively. It was 128.33 ± 4.81, 131.67 ± 3.26, 109.33 ± 1.96, 110.17 ± 2.13 and 85.00 ± 1.67 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was increase in diastolic pressure throughout the period of observation, except at 24 hours. The increase at 15 and 30 minutes and decrease at 24 hours were significant ($P<0.05$).

III. Electrocardiogram (ECG)

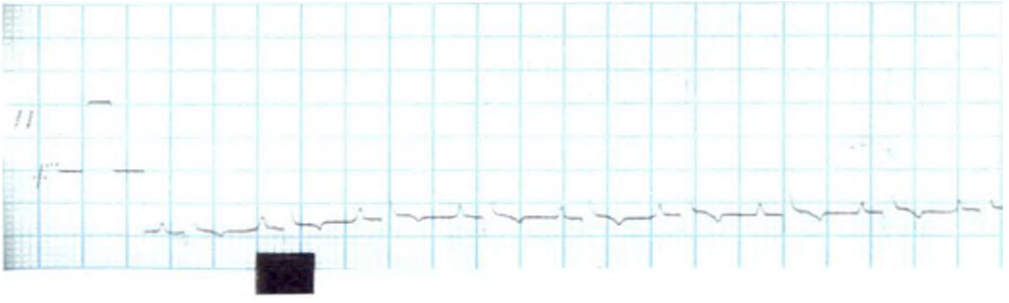
All dogs had elevation in heart rate after the administration of atropine sulphate invariably. But the heart rate was resumed to normalcy after xylazine. Thiopentone administration reduced the heart rate below normal in all the dogs at 15 minute. There was marked reduction in heart rate in five out of six animals after thiopentone administration. Before premedication, deep 'Q' waves (Plate 1A) were observed in two dogs of the Group I, but after atropine and xylazine administration there was reduction in amplitude of 'Q' wave (Plate IB). Slight increase in PR interval was observed in all the dogs after the administration of xylazine and thiopentone. QRS configuration remained the same as that of normal dogs during whole of ECG study in Group I. An increase in QRS duration was observed after 15 minutes of thiopentone administration in 3 out of six days. S-T slurring was observed after 30 minutes in four dogs. The polarity of the T wave remained same in all the dogs.

IV. Haemogram (Table 4)

The packed cell volume (%) was 40.93 ± 2.38 before the administration of atropine sulphate and, 39.63 ± 1.63 and 37.43 ± 3.59 before and after the administration of xylazine respectively. It was 41.03 ± 2.01, 41.77 ± 2.04, 38.42 ± 2.78, 37.97 ± 2.81 and 38.05 ± 3.03 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was decrease in packed cell volume after the administration of atropine and xylazine, and increase at 15



A



B

A.Deep 'Q' wave before the administration of atropine sulphate.

B. Reduction in the amplitude of 'Q' waves after the administration of xylazine premedication.

Plate 1 .ECG changes (lead II) in a dog following the administration of thiopentone sodium with xylazine premedication.

and 30 minute after thiopentone. Thereafter there was gradual decrease and was significant ($P<0.05$) at 24 hour.

The haemoglobin concentration (g/dl) was 13.47 ± 1.54 before the administration of atropine sulphate and, 12.70 ± 0.94 and 12.95 ± 1.18 before and after the administration of xylazine respectively. It was 12.32 ± 1.21, 13.80 ± 1.23, 12.82 ± 1.24,12.88 ± 1.26 and 14.18 ± 1.45 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. The variations were marginal and within normal range.

The total erythrocyte count (10^6 /mm^3) was 6.30 ± 0.59 before the administration of atropine sulphate and, 6.25 ± 0.54 and 5.55 ± 0.45 before and after the administration of xylazine respectively. It was 5.50 ± 0.49, 5.67 ± 0.44, 5.75 ± 0.49, 5.98 ± 0.46 and 6.12 ± 0.60 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was gradual decrease in total erythrocyte count throughout the period of observation and the decrease was significant ($P<0.05$) at 15 minute and 24 hour after the administration of thiopentone.

The total leucocyte count (10^3/mm^3) was 11.29 ± 0.94 before the administration of atropine sulphate and 11.00 ± 1.33 and 11.25 ± 1.25 before and after the administration of xylazine respectively. It was 10.95 ± 1.13, 10.13 ± 0.66, 10.33 ± 0.70, 9.70 ± 0.58 and 10.68 ± 0.42 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was gradual decrease in total leucocyte count throughout the period of observation and was significant ($P<0.05$) at 30, 45 and 60 minute after the administration of thiopentone.

The neutrophil count (%) was 74.50 ± 1.95 before the administration of atropine sulphate and 74.83 ± 1.11 and 84.33 ± 2.14 before and after the administration of xylazine respectively. It was 82.67 ± 2.40, 81.67 ± 2.97, 75.33

± 3.33, 73.00 ± 3.54 and 77.00 ± 2.25 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was increase in neutrophil count and the increase was significant ($P<0.05$) after administration of xylazine and at 15, 30 minute and 24 hour after the administration of thiopentone.

The lymphocyte count (%) was 25.33 ± 1.99 before the administration of atropine sulphate and, 24.67 ± 1.31 and 15.17 ± 2.02 before and after the administration of xylazine respectively. It was 16.50 ± 2.55, 18.00 ± 2.99, 24.50 ± 3.45, 26.17 ± 3.26 and 21.50 ± 2.45 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was decrease in lymphocyte count throughout the period of observation. The decrease was significant ($P<0.05$) after the administration of xylazine and at 15, 30 minute and 24 hour after thiopentone.

The monocyte count (%) was 0.00 ± 0.00 before the administration of atropine sulphate and, 0.00 ± 0.00 and 0.17 ± 0.17 before and after the administration of xylazine respectively. It was 0.00 ± 0.00, 0.33 ± 0.33, 0.33 ± 0.21, 0.00 ± 0.00 and 0.50 ± 0.22 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. The variations were marginal.

The eosinophil count (%) was 0.17 ± 0.17 before the administration of atropine sulphate and, 0.50 ± 0.34 and 0.33 ± 0.33 before and after the administration of xylazine respectively. It was 0.50 ± 0.22, 0.33 ± 0.21, 0.00 ± 0.00, 0.00 ± 0.00 and 1.00 ± 0.37 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. The variations were marginal, though there was a significant ($P<0.05$) increase in eosinophil count at 24 hour after the administration of thiopentone.

The basophil count (%) was zero throughout the period of observation.

V. Serum Constituents (Table 5)

The serum sodium concentration (mEq/L) was 96.47 ± 2.84 before the administration of atropine sulphate and, 104.77 ± 3.36 and 103.12 ± 2.97 before and after the administration of xylazine respectively. It was 107.27 ± 2.33, 104.43 ± 5.85, 102.94 ± 6.11, 103.20 ± 4.98 and 108.23 ± 3.33 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was increase in serum concentration throughout the period of observation and the increase was significant ($P<0.05$) at 24 hour after the administration of thiopentone.

The serum potassium concentration (mEq/L) was 2.47 ± 0.23 before the administration of atropine sulphate and, 2.75 ± 0.13 and 3.08 ± 0.13 before and after the administration of xylazine respectively. It was 2.62 ± 0.11, 2.78 ± 0.10, 2.67 ± 0.06, 2.58 ± 0.05 and 2.94 ± 0.14 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was increase in serum potassium concentration and the increase was significant ($P<0.05$) after the administration of xylazine and at 24 hour after thiopentone.

The serum total protein content (g/dL) was 6.92 ± 0.30 before the administration of atropine sulphate and, 7.14 ± 0.27 and 7.43 ± 0.21 before and after the administration of xylazine respectively. It was 7.20 ± 0.27, 7.34 ± 0.24, 6.90 ± 0.17, 6.77 ± 0.18 and 6.65 ± 0.55 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was gradual increase in serum total protein content after the administration of atropine, xylazine and at 30 minute after thiopentone. Thereafter there was gradual decrease.

The serum albumin/globulin ratio was 2.38 ± 0.25 before the administration of atropine sulphate and, 2.32 ± 0.22 and 1.66 ± 0.12 before and after the administration of xylazine respectively. It was 1.70 ± 0.15, 2.12 ± 0.46, 1.83 ± 0.08, 1.94 ± 0.36 and 1.99 ± 0.13 at 15, 30, 45, 60 minute and 24 hour

after the administration of thiopentone respectively. There was decrease in serum albumin/globulin ratio throughout the period of observation and the decrease was significant ($P<0.05$) after the administration of xylazine.

VI. Post anaesthetic complications, if any

All the dogs had uneventful recovery, except for prolonged recovery time in long duration surgical operations.

Table 1. Observations on age, breed, sex and body weight of the dogs and the surgery performed (Group I)

Animal No.	Age (months)	Breed	Sex	Body weight (kg)	Surgery performed
1	12	Non descript	Female	12.20	Oopherectomy
2	36	Cross bred	Female	13.20	Oopherectomy
3	08	Labrador	Female	20.00	Correction of rectovaginal fistula
4	12	Non descript	Female	10.00	Oopherectomy
5	36	German Shepherd Dog	Female	23.50	Enterotomy
6	60	German Shepherd Dog	Male	43.00	Zepp's operation

Table 2. Induction time, duration of anaesthesia, recovery time, quantity of thiopentone administered, muscle relaxation time and duration of surgery in dogs (Group I) (Mean ± SE) (n=6)

Clinical Observations	Mean ± SE
Induction time (min)	6.83 ± 1.40
Duration of surgical anaesthesia with first induction of thiopentone sodium (min)	11.67 ± 3.90
Average duration of surgical anaesthesia following subsequent administration of incremental doses of thiopentone sodium (min)	13.63 ± 3.76*
Recovery time (min)	124.00 ± 48.55
Quantity of thiopentone sodium administered for first induction (mg/kg)	9.31 ± 1.87
Average incremental quantities of thiopentone sodium administered (mg/kg)	3.83 ± 1.10
Muscle relaxation time (min)	50.67 ± 9.01
Degree of muscle relaxation	Moderate to excellent
Duration of surgery (min)	37.83 ± 6.27

* Significant at 5 per cent level ($P<0.05$)

Table 3. Effects of administration of xylazine with thiopentone sodium on rectal temperature, pulse rate, respiration rate, systolic pressure and diastolic pressure in dogs. (Group I) (Mean ± SE) (n=6)

Parameters	Before the administration of atropine sulphate	After the administration of atropine sulphate	After the administration of xylazine	After the administration of thiopentone sodium				
				15 min.	30 min.	45 min.	60 min.	24 hours
Rectal temperature (°C)	39.78 ± 0.08	39.57 ± 0.33	39.41 ± 0.23	39.02 ± 0.50	38.76 ± 0.60	38.75 ± 0.73	38.48 ± 0.69*	39.13 ± 0.45
Pulse rate (per minute)	94.50 ± 4.83	141.33 ± 15.19*	117.00 ± 15.32	114.50 ± 14.99	103.00 ± 10.03	93.33 ± 5.81	88.67 ± 4.98	112.67 ± 7.60*
Respiration rate (per minute)	61.67 ± 5.25	56.50 ± 6.54	42.83 ± 7.57*	24.83 ± 2.17*	26.17 ± 2.48*	25.00 ± 2.78*	18.17 ± 0.95*	48.84 ± 4.34
Systolic pressure (mm Hg)	168.33 ± 7.03	159.17 ± 4.90*	144.17 ± 5.83*	184.67 ± 4.37*	180.83 ± 4.90*	172.67 ± 4.33	170.83 ± 3.75	158.00 ± 3.06
Diastolic pressure (mm Hg)	102.50 ± 4.68	103.33 ± 3.26	107.50 ± 4.04	128.33 ± 4.81*	131.67 ± 3.26*	109.33 ± 1.96	110.17 ± 2.13	85.00 ± 1.67*

* Significant at 5 per cent level ($P<0.05$) as compared to the value before the administration of atropine sulphate

Table 4. Effects of administration of xylazine with thiopentone sodium on packed cell volume, haemoglobin concentration and, total erythrocyte, total leukocyte, neutrophil, lymphocyte, monocyte, eosinophil and basophil counts in dogs. (Group I) (Mean ± SE) (n=6)

Parameters	Before the administration of atropine sulphate	After the administration of atropine sulphate	After the administration of xylazine	After the administration of thiopentone sodium				
				15 min.	30 min.	45 min.	60 min.	24 hours
Packed cell volume (%)	40.93 ± 2.38	39.63 ± 1.63	37.43 ± 3.59	41.03 ± 2.01	41.77 ± 2.04	38.42 ± 2.78	37.97 ± 2.81	38.05 ± 3.03*
Haemoglobin concentration (g/dl)	13.47 ± 1.54	12.70 ± 0.94	12.95 ± 1.18	12.32 ± 1.21	13.80 ± 1.23	12.82 ± 1.24	12.88 ± 1.26	14.18 ± 1.45
Total erythrocyte count (10^6/mm^3)	6.30 ± 0.59	6.25 ± 0.54	5.55 ± 0.45	5.50 ± 0.49*	5.67 ± 0.44	5.75 ± 0.49	5.98 ± 0.46	6.12 ± 0.60*
Total leucocyte count (10^3/mm^3)	11.29 ± 0.94	11.00 ± 1.33	11.25 ± 1.25	10.95 ± 1.13	10.13 ± 0.66*	10.33 ± 0.70*	9.70 ± 0.58*	10.68 ± 0.42
Neutrophil count (%)	74.50 ± 1.95	74.83 ± 1.11	84.33 ± 2.14*	82.67 ± 2.40*	81.67 ± 2.97*	75.33 ± 3.33	73.00 ± 3.54	77.00 ± 2.25*
Lymphocyte count (%)	25.33 ± 1.99	24.67 ± 1.31	15.17 ± 2.02*	16.50 ± 2.55*	18.00 ± 2.99*	24.50 ± 3.45	26.17 ± 3.26	21.50 ± 2.45*
Monocyte count (%)	0.00 ± 0.00	0.00 ± 0.00	0.17 ± 0.17	0.00 ± 0.00	0.33 ± 0.33	0.33 ± 0.21	0.00 ± 0.00	0.50 ± 0.22
Eosinophil count (%)	0.17 ± 0.17	0.50 ± 0.34	0.33 ± 0.33	0.50 ± 0.22	0.33 ± 0.21	0.00 ± 0.00	0.00 ± 0.00	1.00 ± 0.37*
Basophil count (%)	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

* Significant at 5 per cent level ($P<0.05$) as compared to the value before the administration of atropine sulphate

Table 5. Effects of administration of xylazine with thiopentone sodium on serum sodium concentration, serum potassium concentration, serum total protein content and albumin/globulin ratio in dogs (Group I) (Mean ± SE) (n=6)

Parameters	Before the administration of atropine sulphate	After the administration of atropine sulphate	After the administration of xylazine	After the administration of thiopentone sodium				
				15 min.	30 min.	45 min.	60 min.	24 hours
Serum sodium concentration (mEq/L)	96.47 ± 2.84	104.77 ± 3.36	103.12 ± 2.97	107.27 ± 2.33	104.43 ± 5.85	102.94 ± 6.11	103.20 ± 4.98	108.23 ± 3.33*
Serum potassium concentration (mEq/L)	2.47 ± 0.23	2.75 ± 0.13	3.08 ± 0.13*	2.62 ± 0.11	2.78 ± 0.10	2.67 ± 0.06	2.58 ± 0.05	2.94 ± 0.14*
Serum total protein content (g/dl)	6.92 ± 0.30	7.14 ± 0.27	7.43 ± 0.21	7.20 ± 0.27	7.34 ± 0.24	6.90 ± 0.17	6.77 ± 0.18	6.65 ± 0.55
Serum albumin/ globulin ratio	2.38 ± 0.25	2.32 ± 0.22	1.66 ± 0.12*	1.70 ± 0.15	2.12 ± 0.46	1.83 ± 0.08	1.94 ± 0.36	1.99 ± 0.13

* Significant at 5 per cent level ($P<0.05$) as compared to the value before the administration of atropine sulphate

GROUP II

The observations are presented in Tables 6 to 10.

Atropine sulphate at the dose rate of 0.045 mg/kg body weight was administered intramuscular, 15 minutes prior to the administration of xylazine-ketamine combination to all the dogs of this group.

Xylazine at the rate of 1.0 mg/kg bodyweight and ketamine at the rate of 2.5 mg/kg body weight was administered intramuscular as a combined injection for premedication. Fifteen minutes later, thiopentone sodium 2.5% solution was administered intravenously "to effect" general anaesthesia. Incremental doses of thiopentone were also administered for the maintenance of anaesthesia for completing the surgery.

I Clinical Observation

1. Clinical signs

Following the administration of xylazine-ketamine combination the symptoms like sniffing, yawning, winking of eyes and incoordination of hindquarters were observed. Salivation was scanty in all the dogs. The other symptoms noticed were vomiting in one dog (Animal No. II/2), licking in four dogs (Animal Nos. II/2, II/3, II/4 & II/5) and urination in one dog (Animal No. II/2). Two dogs (II/1 & II/6) assumed lateral recumbency, but the others (II/2, II/3, II/4 & II/5) were in sternal recumbency with head down posture (Plate 2A). Side to side movement of the head was noticed in four dogs (II/1, II/3, II/4 & II/5).

The induction of anaesthesia was smooth following the administration of thiopentone. The surgical anaesthesia and muscle relaxation was satisfactory.

Maintenance of satisfactory anaesthesia was possible with repeated administration of thiopentone.

The recovery from anaesthesia was smooth and uneventful, but during recovery following the first induction and incremental doses of thiopentone, one dog (Animal No. II/6) exhibited muscle twitching. Most of the dogs were drowsy until next day.

2. Induction time (Table 7)

The induction time was 5.10 ± 1.29 minutes following the administration of the thiopentone.

3. Duration of surgical anaesthesia with first induction of thiopentone (Table 7)

Following first induction the duration of anaesthesia was 12.50 ± 2.64 minutes. For long duration surgical operations required anaesthesia was prolonged with repeated administration of thiopentone.

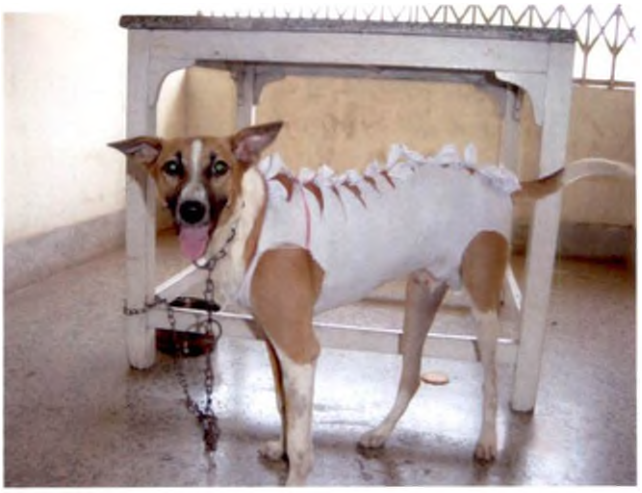
4. Average duration of surgical anaesthesia following subsequent administration of incremental doses of thiopentone (if used) (Table 7)

With repeated administration of thiopentone on an average 32.17 ± 5.39 minutes duration of surgical anaesthesia was achieved with every incremental dose.

5. Recovery time (Table 7)

The recovery time was 89.83 ± 43.12 minutes (Plate 2B). Most of the dogs were drowsy until next day.

A



B

A. Dog in a sternal recumbency with head down posture after premedication with xylazine-ketamine.

B. Dog- after recovery from thiopentone anaesthesia.

Plate 2.

6. Quantity of thiopentone administered for induction (Table 7)

For the first induction of anaesthesia the quantity of thiopentone was 9.72 ± 1.23 mg/kg body weight.

7. Average incremental quantities of thiopentone administered (if used). (Table 7)

The incremental quantities of thiopentone required was on an average 5.59 ± 1.43 mg/kg body weight for prolonging the duration of surgical anaesthesia. The incremental dose(s) was administered for five times in two dogs, two times in one dog and one time in three dogs.

8. Muscle relaxation time (Table 7)

The average muscle relaxation time was 54.50 ± 7.32 minutes.

9. Degree of muscle relaxation (Table 7)

It was moderate to excellent.

10. Surgery performed and the duration of surgery (Table 6 and 7)

The surgery performed were oopherectomy in three dogs (Animal Nos. II/2, II/4 & II/6), ovariohysterectomy in two dogs (Animal Nos. II/1 & II/3) and the operation for aural haematoma in one dog (Animal No. II/5). The duration of surgery was 41.83 ± 6.79 minutes.

II. Physiological observations (Table 8)

The rectal temperature (°C) was 39.53 ± 0.35 before the administration of atropine sulphate and, 39.63 ± 0.57 and 38.78 ± 0.48 before and after

administration of xylazine-ketamine combination respectively. It was 37.67 ± 1.41, 37.57 ± 1.08, 36.98 ± 1.11, 36.77 ± 1.20 and 39.39 ± 0.26 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was significant ($P<0.05$) decrease after the administration of xylazine-ketamine combination and thiopentone. It became normal at 24 hour.

The pulse rate (per minute) was 114.83 ± 3.81 before the administration of atropine sulphate and, 126.00 ± 10.22 and 90.83 ± 6.50, before and after administration of xylazine-ketamine combination respectively. It was 85.67 ± 8.52, 89.67 ± 5.90, 76.17 ± 6.22, 105.50 ± 3.98 and 123.33 ± 8.40 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was increase in pulse rate after the administration of atropine and decrease after the administration of xylazine-ketamine combination and thiopentone, though there was an increase at 60 minute and 24 hour. The decrease after the administration of xylazine-ketamine combination and at 15, 30 and 45 minute after the administration of thiopentone was significant ($P<0.05$).

The respiration rate (per minute) was 51.17 ± 11.74 before the administration of atropine sulphate and, 42.00 ± 10.05 and 20.50 ± 3.52 before and after administration of xylazine-ketamine combination respectively. It was 19.00 ± 1.91, 23.67 ± 4.57, 22.50 ± 4.20, 25.67 ± 4.36 and 48.33 ± 10.91 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was decrease in respiration rate throughout the period of observation and the decrease was significant ($P<0.05$) after the administration of xylazine-ketamine combination and at 15, 30, 45 and 60 minute after the administration of thiopentone.

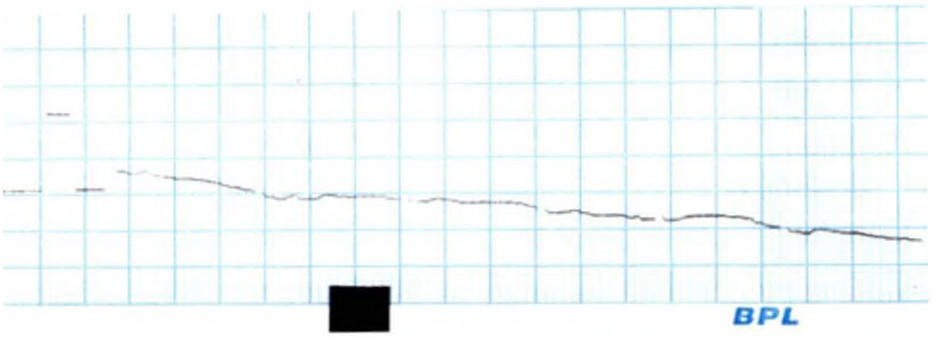
The systolic pressure (mm Hg) was 156.87 ± 11.16 before the administration of atropine sulphate and, 165 .00 ± 17.08 and 166.67 ± 17.11 before and after administration of xylazine-ketamine combination respectively. It was 170.17 ± 16.25, 155.83 ± 15.19, 160.00 ± 10.33, 170.00 ± 9.13 and 150.00 ±

3.65 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was increase in systolic pressure after the administration of atropine, xylazine-ketamine combination and thiopentone though there was decrease at 30 minute and 24 hour.

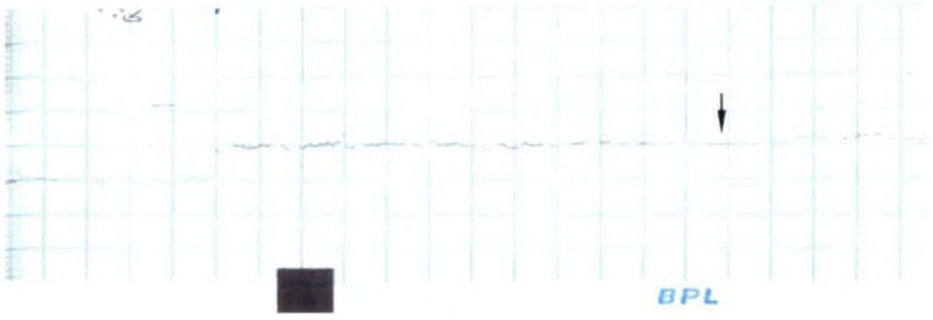
The diastolic pressure (mm Hg) was 102.50 ± 11.81 before the administration of atropine sulphate and, 123.33 ± 15.85 and 117.00 ± 15.56 before and after administration of xylazine-ketamine combination respectively. It was 125.00 ± 6.00, 126.67 ± 13.40, 140.83 ± 11.86, 155.83 ± 11.14 and 83.33 ± 2.17 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was increase in diastolic pressure throughout the period of observation except at 24 hour and the increase was significant ($P<0.05$) at 15, 30, 45 and 60 minute after the administration of thiopentone.

III. Electrocardiogram (ECG)

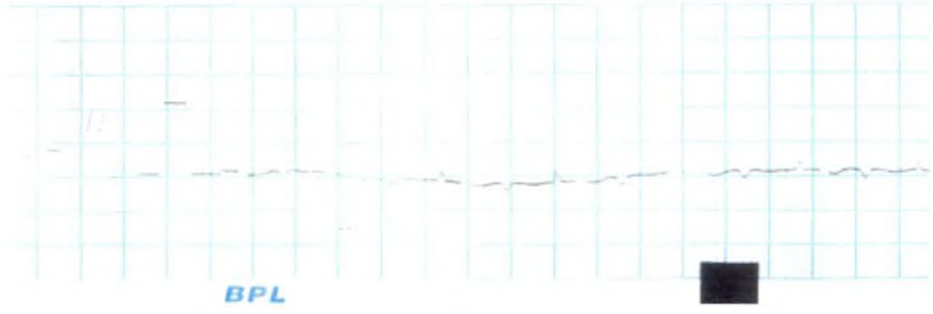
All the dogs had normal ECG parameters, except one, which had wandering pacemaker (Plate 3A). There was elevation of heart rate after atropine administration. Four of the dogs had positive 'T' wave and two had negative 'T' wave in the whole recording in Group II. The 'P' wave amplitude have increased to a little extent after xylazine and the wandering pacemaker had also disappeared (Plate 3B). R amplitude was progressively reducing after consequent administration of xylazine and thiopentone. Mild baseline undulations ('F' waves) were observed in one dog after xylazine-ketamine administration (Plate 3B). ECG tracings showed exaggerated 'F' wave. After thiopentone administration no more 'F' wave were seen (Plate 3C) and normal 'QRS' morphology was present. Thiopentone administration caused reduction in heart rate, reduction in 'R' amplitude and slight slurring.



A



B



C

A. Continous change in 'P' morphology (wandering pacemaker) before the administration of atropine sulphate.

B. Restoration of normal 'P' wave morphology (disappearance of wandering pacemaker) and presence of 'F' waves after the administration of xylazine-ketamine premedication.

C.Disappearance of 'F' waves after the administration of thiopentone sodium at 15 minutes.

Plate 3 .ECG changes (lead II) in a dog following the administration of thiopentone sodium with xylazine - ketamine premedication.

IV. Haemogram (Table 9)

The packed cell volume (%) was 37.55 ± 2.21 before the administration of atropine sulphate and, 33.63 ± 2.63 and 36.88 ± 2.41 before and after administration of xylazine-ketamine combination respectively. It was 36.85 ± 2.17, 35.67 ± 2.09, 33.88 ± 1.94, 34.70 ± 2.00 and 36.87 ± 2.20 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was reduction in packed cell volume throughout the period of observation and the reduction was significant ($P<0.05$) after the administration of atropine and at 30, 45 and 60 minute after the administration of thiopentone.

The haemoglobin concentration (g/dl) was 12.35 ± 0.78 before the administration of atropine sulphate and, 11.18 ± 0.78 and 12.07 ± 0.76 before and after administration of xylazine-ketamine combination respectively. It was 12.27 ± 0.88, 11.70 ± 0.88, 10.82 ± 0.72, 10.98 ± 0.73 and 11.93 ± 0.76 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was decrease in haemoglobin concentration throughout the period of observation. The decrease was significant ($P<0.05$) after the administration of atropine and at 45 and 60 minute after the administration of thiopentone.

The total erythrocyte count ($10^6/mm^3$) was 4.32 ± 0.28 before the administration of atropine sulphate and, 4.10 ± 0.30 and 4.30 ± 0.28 before and after administration of xylazine-ketamine combination respectively. It was 4.45 ± 0.27, 4.32 ± 0.33, 3.80 ± 0.17, 3.72 ± 0.15 and 4.12 ± 0.24 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was decrease in total erythrocyte count after the administration of atropine and xylazine-ketamine combination, but though there was slight increase at 15 minutes, thereafter there was decrease. The decrease was significant ($P<0.05$) at 45 and 60 minute. The count become near normal at 24 hour.

The total leucocyte count ($10^3/mm^3$) was 12.64 ± 1.08 before the administration of atropine sulphate and, 11.33 ± 0.76 and 12.69 ± 0.64 before and after administration of xylazine-ketamine combination respectively. It was 11.69 ± 0.81, 11.80 ± 0.90, 9.90 ± 0.42, 9.67 ± 0.42 and 15.44 ± 2.23 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. Though there was increase after the administration of xylazine-ketamine combination, there was decrease throughout the period of observation and the decrease was significant ($P<0.05$) at 45 and 60 minute. The count became above normal at 24 hour.

The neutrophil count (%) was 76.33 ± 3.36 before the administration of atropine sulphate and, 74.33 ± 3.09 and 71.67 ± 2.74 before and after administration of xylazine-ketamine combination respectively. It was 69.00 ± 3.97, 69.33 ± 4.27, 69.50 ± 3.85, 70.33 ± 3.50 and 79.33 ± 5.06 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was decrease in neutrophil count after the administration of atropine, xylazine-ketamine combination and thiopentone. The decrease was significant ($P<0.05$) at 15 minute and became normal at 24 hour.

The lymphocyte count (%) was 24.67 ± 2.96 before the administration of atropine sulphate and, 24.33 ± 2.89 and 28.17 ± 2.77 before and after administration of xylazine-ketamine combination respectively. It was 29.50 ± 3.41, 30.33 ± 4.21, 30.17 ± 3.78, 29.67 ± 2.47 and 21.67 ± 4.29 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. Though there was a decrease in lymphocyte count after the administration of atropine, there was increase after the administration of xylazine-ketamine combination and thiopentone.

The monocyte count (%) was 0.17 ± 0.17 before the administration of atropine sulphate and, 0.33 ± 0.33 and 0.00 ± 0.00 before and after administration of xylazine-ketamine combination respectively. It was 0.67 ± 0.49, 0.00 ± 0.00,

0.00 ± 0.00, 0.17 ± 0.17 and 0.00 ± 0.00 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. The variations were marginal.

The eosinophil count (%) was 0.5 ± 0.22 before the administration of atropine sulphate and, 1.00 ± 0.52 and 0.17 ± 0.17 before and after administration of xylazine-ketamine combination respectively. It was 0.83 ± 0.40, 0.33 ± 0.21, 0.17 ± 0.17, 0.00 ± 0.00 and 0.67 ± 0.49 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. The variations were marginal.

The basophil count (%) was zero throughout the period of observation.

V. Serum Constituents (Table 10)

The serum sodium concentration (mEq/L) was 107.35 ± 5.80 before the administration of atropine sulphate and, 114.50 ± 5.69 and 112.10 ± 5.81 before and after administration of xylazine-ketamine combination respectively. It was 121.09 ± 5.45, 114.06 ± 4.11, 101.14 ± 3.96, 109.08 ± 5.41 and 104.16 ± 4.26 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was increase in serum sodium concentration after the administration of atropine, xylazine-ketamine combination and thiopentone

The serum potassium concentration (mEq/L) was 2.36 ± 0.43 before the administration of atropine sulphate and, 2.64 ± 0.18 and 3.02 ± 0.20 before and after administration of xylazine-ketamine combination respectively. It was 2.42 ± 0.27, 2.63 ± 0.15, 2.41 ± 0.18, 2.27 ± 0.14 and 3.06 ± 0.06 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was increase in serum potassium concentration after the administration of xylazine-ketamine combination. The increase after the administration of

xylazine-ketamine combination and at 24 hour after the administration of thiopentone was significant ($P<0.05$).

The serum total protein content (g/dL) was 6.18 ± 0.17 before the administration of atropine sulphate and, 5.89 ± 0.31 and 6.58 ± 0.22 before and after administration of xylazine-ketamine combination respectively. It was 6.85 ± 0.34, 6.17 ± 0.29, 5.71 ± 0.18, 6.01 ± 0.07 and 6.49 ± 0.75 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was decrease in serum total protein content, after the administration of atropine, but it increased after the administration of xylazine-ketamine combination and thiopentone. The increase was significant ($P<0.05$) at 15 minute and thereafter the variations were marginal.

The serum albumin/globulin ratio was 3.49 ± 0.33 before the administration of atropine sulphate and, 2.45 ± 0.37 and 2.39 ± 0.31 before and after administration of xylazine-ketamine combination respectively. It was 2.83 ± 0.27, 4.17 ± 0.20, 2.84 ± 0.47, 3.48 ± 0.28 and 2.49 ± 0.29 at 15, 30, 45, 60 minute and 24 hour after the administration of thiopentone respectively. There was decrease in serum albumin/globulin ratio after the administration of atropine, xylazine-ketamine combination and thiopentone. It was significant ($P<0.05$) after the administration of xylazine-ketamine combination.

VI. Post anaesthetic complications if any

All the dogs had uneventful recovery, except for prolonged recovery time in long duration surgical operations.

Table 6. Observations on age, breed, sex and body weight of the dogs with the surgery performed (Group II)

Animal No.	Age (months)	Breed	Sex	Body weight (kg)	Surgery performed
1	07	Non descript	Female	12.00	Ovario-hysterectomy
2	48	Non descript	Female	15.00	Oopherectomy
3	07	Non descript	Female	10.00	Ovario-hysterectomy
4	36	Non descript	Female	13.00	Oopherectomy
5	60	German Shepherd Dog	Male	23.00	Operation for aural haematoma
6	11	Non descript	Female	10.50	Oopherectomy

Table 7. Induction time, duration of anaesthesia, recovery time, quantity of thiopentone administered, muscle relaxation time and duration of surgery in dogs (Group II) (Mean ± SE) (n=6)

Clinical Observations	Mean ± SE
Induction time (min)	5.10 ± 1.29
Duration of surgical anaesthesia with first induction of thiopentone sodium (min)	12.50 ± 2.64
Average duration of surgical anaesthesia following subsequent administration of incremental doses of thiopentone sodium (min)	32.17 ± 5.39*
Recovery time (min)	89.83 ± 43.12
Quantity of thiopentone sodium administered for first induction (mg/kg)	9.72 ± 1.23
Average incremental quantities of thiopentone sodium administered (mg/kg)	5.59 ± 1.43
Muscle relaxation time (min)	54.50 ± 7.32
Degree of muscle relaxation	Moderate to excellent
Duration of surgery (min)	41.83 ± 6.79

* Significant at 5 per cent level ($P<0.05$)

Table 8. Effects of administration of xylazine-ketamine combination with thiopentone sodium on rectal temperature, pulse rate, respiration rate, systolic pressure and diastolic pressure in dogs (Group II) (Mean ± SE) (n=6)

Parameters	Before the administration of atropine sulphate	After the administration of atropine sulphate	After the administration of xylazine-ketamine combination	After the administration of thiopentone sodium				
				15 min	30 min	45 min	60 min	24 hours
Rectal temperature (°C)	39.53 ± 0.35	39.63 ± 0.57	38.78 ± 0.48*	37.67 ± 1.41*	37.57 ± 1.08*	36.98 ± 1.11*	36.77 ± 1.20*	39.39 ± 0.26
Pulse rate (per min)	114.83 ± 3.81	126.00 ± 10.22	90.83 ± 6.50*	85.67 ± 8.52*	89.67 ± 5.90*	76.17 ± 6.22*	105.50 ± 3.98	123.33 ± 8.40
Respiration rate (per minute)	51.17 ± 11.74	42.00 ± 10.05	20.50 ± 3.52*	19.00 ± 1.91*	23.67 ± 4.57*	22.50 ± 4.20*	25.67 ± 4.36*	48.33 ± 10.91
Systolic pressure (mmHg)	156.87 ± 11.16	165.00 ± 17.08	166.67 ± 17.11	170.17 ± 16.25	155.83 ± 15.19	160.00 ± 10.33	170.00 ± 9.13	150.00 ± 3.65
Diastolic pressure (mmHg)	102.50 ± 11.81	123.33 ± 15.85	117.00 ± 15.56	125.00 ± 6.00*	126.67 ± 13.40*	140.83 ± 11.86*	155.83 ± 11.14*	83.33 ± 2.17

* Significant at 5 per cent level ($P<0.05$) as compared to the value before the administration of atropine sulphate

Table 9. Effects of administration of xylazine-ketamine combination with thiopentone sodium on packed cell volume, haemoglobin concentration and, total leukocyte, neutrophil, lymphocyte, monocyte, eosinophil and basophil counts in dogs (Group II) (Mean ± SE) (n=6)

Parameters	Before the administration of atropine sulphate	After the administration of atropine sulphate	After the administration of xylazine-ketamine combination	After the administration of thiopentone sodium				
				15 min	30 min	45 min	60 min	24 hours
Packed cell volume (%)	37.55 ± 2.21	33.63 ± 2.63*	36.88 ± 2.41	36.85 ± 2.17	35.67 ± 2.09*	33.83 ± 1.94*	34.70 ± 2.00*	36.87 ± 2.20
Haemoglobin concentration (g/dl)	12.35 ± 0.78	11.18 ± 0.78*	12.07 ± 0.76	12.27 ± 0.88	11.70 ± 0.88	10.82 ± 0.72*	10.98 ± 0.73*	11.93 ± 0.76
Total erythrocyte count (10^6/mm^3)	4.32 ± 0.28	4.10 ± 0.30	4.30 ± 0.28	4.45 ± 0.27	4.32 ± 0.33	3.80 ± 0.17*	3.72 ± 0.15*	4.12 ± 0.24
Total leucocyte count (10^3/mm^3)	12.64 ± 1.08	11.33 ± 0.76	12.69 ± 0.64	11.69 ± 0.81	11.80 ± 0.90	9.90 ± 0.42*	9.67 ± 0.42*	15.44 ± 2.23
Neutrophil count (%)	76.33 ± 3.36	74.33 ± 3.09	71.67 ± 2.74	69.00 ± 3.97*	69.33 ± 4.27	69.50 ± 3.85	70.33 ± 3.50	79.33 ± 5.06
Lymphocyte count (%)	24.67 ± 2.96	24.33 ± 2.89	28.17 ± 2.77	29.50 ± 3.41	30.33 ± 4.21	30.17 ± 3.78	29.67 ± 2.47	21.67 ± 4.29
Monocyte count (%)	0.17 ± 0.17	0.33 ± 0.33	0.00 ± 0.00	0.67 ± 0.49	0.00 ± 0.00	0.00 ± 0.00	0.17 ± 0.17	0.00 ± 0.00
Eosinophil count (%)	0.50 ± 0.22	1.00 ± 0.52	0.17 ± 0.17	0.83 ± 0.40	0.33 ± 0.21	0.17 ± 0.17	0.00 ± 0.00	0.67 ± 0.49
Basophil count (%)	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

* Significant at 5 per cent level ($P<0.05$) as compared to the value before the administration of atropine sulphate

Table 10. Effects of administration of xylazine-ketamine combination with thiopentone sodium on serum sodium concentration, serum potassium concentration, serum total protein content and albumin/globulin ratio in dogs (Group II) (Mean ± SE) (n=6)

Parameters	Before the administration of atropine sulphate	After the administration of atropine sulphate	After the administration of xylazine-ketamine combination	After the administration of thiopentone sodium				
				15 min	30 min	45 min	60 min	24 hours
Serum sodium concentration (mEq/L)	107.35 ± 5.80	114.50 ± 5.69	112.10 ± 5.81	121.09 ± 5.45	114.06 ± 4.11	101.14 ± 3.96	109.08 ± 5.41	104.16 ± 4.26
Serum potassium concentration (mEq/L)	2.36 ± 0.43	2.69 ± 0.18	3.02 ± 0.20*	2.42 ± 0.27	2.63 ± 0.15	2.41 ± 0.18	2.27 ± 0.14	3.06 ± 0.06*
Serum total protein content (mEq/L)	6.18 ± 0.17	5.89 ± 0.31	6.58 ± 0.22	6.85 ± 0.34*	6.17 ± 0.29	5.71 ± 0.18	6.01 ± 0.07	6.49 ± 0.75
Serum albumin/ globulin ratio (mEq/L)	3.49 ± 0.33	2.45 ± 0.37	2.39 ± 0.31*	2.83 ± 0.27	4.17 ± 0.20	2.84 ± 0.47	3.48 ± 0.28	2.49 ± 0.29

* Significant at 5 per cent level ($P<0.05$) as compared to the value before the administration of atropine sulphate

Discussion

5. DISCUSSION

The study was carried out in 12 dogs of different breeds of either sex, presented to the College Hospitals at Mannuthy and Kokkalai for various elective surgical procedures. All dogs were clinically examined before the administration of the anaesthetics. These dogs were randomly divided into two groups, viz. Group I and Group II, each consisting of six dogs. They were numbered serially from 1 to 6.

Atropine sulphate at the rate of 0.045 mg/kg body weight was administered intramuscularly, 15 minutes prior to the administration of xylazine/xylazine-ketamine combination. In Group I, xylazine at the rate of 1.0 mg/kg body weight was administered intramuscularly for premedication. Fifteen minutes later, thiopentone sodium 2.5% solution was administered intravenously "to effect" general anaesthesia. In Group II, xylazine at the rate of 1.0 mg/kg body weight and ketamine at the rate of 2.5 mg/kg body weight was administered intramuscularly as a combined injection for premedication. Fifteen minutes later, thiopentone sodium 2.5% solution was administered intravenously "to effect" general anaesthesia. In both the groups, incremental doses of thiopentone were also administered for the maintenance of anaesthesia for completing the surgery. The dogs were subjected to various surgical operations.

I. Clinical Observations (Table 11)

1. Clinical Signs

After premedication, yawning, winking of eyes and incoordination of hindquarters were the commonly observed symptoms in both the groups. Other symptoms noticed were vomiting (in two dogs), licking (in seven dogs) and

urination (in three dogs). Xylazine induced vomiting had also been reported by Hikasa *et al.* (1989). Hence, it could be inferred that the probable reason for vomiting observed in the present study may be due to the prior administration of xylazine. In both the groups, two dogs each assumed lateral recumbency and others were in sternal recumbency with head down posture. The recumbency assumed by the animal may be due to the sedative effects of xylazine and xylazine-ketamine combination (Klide *et al.*, 1975).

In the present study, salivation was scanty in both the groups probably due to prior administration of atropine sulphate. Suppression of salivation had been reported when atropine was combined with xylazine (Hatch *et al.*, 1984) and xylazine-ketamine combination (Nowrouzia *et al.* (1981). Parsania *et al.* (1977) and Haskins *et al.* (1985) reported profuse salivation in dogs when ketamine alone was used.

Side to side movement of head was noticed in four dogs which were premedicated with xylazine-ketamine combination, but was absent in the animals premedicated with xylazine alone. Hence it could be inferred that this peculiar symptom is probably due to the effect of ketamine. Symptoms like tonoclonic seizures (Haskins, 1985) and muscle rigidity (Hall *et al.*, 1985 and Thiruthalinathan *et al.*, 1995) are usually encountered in animals following the administration of ketamine, but were not observed in the present study since ketamine was combined with xylazine (Hall, 1985).

2. Induction time

The induction time was 6.83 ± 1.40 and 5.10 ± 1.29 minutes in Group I and Group II respectively (Fig.1). It was seen that the induction was quicker in dogs premedicated with xylazine-ketamine combination than with xylazine alone probably due to the synergestic sedative effects of the drugs. Ramaswamy *et al.*

(1991) also reported rapid onset of induction when a combination of xylazine and ketamine was administered.

3. Duration of anaesthesia with first induction of thiopentone

Duration of anaesthesia with first induction of thiopentone sodium was 11.67 ± 3.90 and 12.50 ± 2.64 minutes in Group I and Group II respectively (Fig.1). It was seen that the duration of anaesthesia was more prolonged in dogs which were premedicated with xylazine-ketamine combination than xylazine alone. Manziano and Manziano (1978) reported that prolongation of anaesthesia is possible with ketamine in combination with xylazine.

4. Average duration of surgical anaesthesia following subsequent administration of incremental doses of thiopentone

With repeated administration of thiopentone on an average 13.63 ± 3.76 and 32.17 ± 5.39 minutes duration of anaesthesia was achieved with every incremental doses in Group I and Group II respectively (Fig.1). It was seen that with xylazine-ketamine premedication, the duration of surgical anaesthesia could be prolonged more than with xylazine alone. It was also observed that the duration of anaesthesia persisted for longer period with subsequent administration when ketamine was included for premedication.

5. Recovery time

The recovery time was 124.00 ± 48.55 and 89.83 ± 43.12 minutes in Group I and Group II respectively (Fig.2). Haskins *et al.* (1986) reported almost equal recovery time in xylazine and xylazine-ketamine administered dogs. But in the present study, the recovery time was less in dogs premedicated with xylazine-ketamine combination. Hence it could be inferred that the recovery time could be shortened if ketamine is included in the regimen. Sharma and Kumar (1986) also

reported prolonged recovery in thiopentone anaesthesia with xylazine premedication.

6. Quantity of thiopentone administered for induction

For the first induction of anaesthesia, the quantity of thiopentone required was 9.31 ± 1.87 and 9.72 ± 1.23 mg/kg body weight in Group I and Group II respectively (Fig.3). In the present study, the requirement of thiopentone was reduced to a greater extent in both the group of animals which were premedicated with xylazine alone and xylazine-ketamine combination, but was slightly higher in the latter. Sharma and Kumar (1986) and Dugdale *et al.* (2001) reported that with xylazine premedication the requirement of thiopentone could be reduced.

7. Incremental quantities of thiopentone administered

The average incremental quantities of thiopentone administered was 3.83 ± 1.10 and 5.59 ± 1.43 mg/kg body weight for prolonging anaesthesia in Group I and Group II respectively (Fig.3). It was seen that the incremental quantities of thiopentone required was more in dogs which were premedicated with xylazine-ketamine combination for prolonging the duration of surgical anaesthesia. Amma (1998) also reported that the duration of thiopentone anaesthesia in xylazine premedicated dogs could be prolonged safely with repeated administration of incremental doses of thiopentone.

8. Muscle relaxation time

The average muscle relaxation time was 50.67 ± 9.01 and 54.50 ± 7.32 minutes in Group I and Group II respectively (Fig.2). The muscle relaxation time was seen more prolonged when xylazine was combined with ketamine for premedication in thiopentone anaesthesia.

9. Degree of muscle relaxation

The degree of muscle relaxation was moderate to excellent in both the groups. According to Manziano and Manziano (1978) augmentation of muscle

relaxation is possible with the administration of ketamine in combination with barbiturate, morphine, xylazine or acepromazine. Haskins *et al.* (1986) reported better muscle relaxation with xylazine-ketamine combination compared with xylazine alone.

10. Surgery performed and duration of surgery

Various types of surgical operations viz., oopherecetomy, correction of rectovaginal fistula, enterotomy, Zepp's operation, ovariohysterectomy, operation for aural haematoma were carried out satisfactorily. The duration of surgery varied from 20 to 58 and 20 to 61 minutes in Group I and Group II respectively.

II. Physiological observations

There was decrease in rectal temperature following premedication and after administration of thiopentone in both the groups. But, decrease was significant in Group II. Decrease in body temperature following the administration of thiopentone in xylazine premedicated dogs had also been reported by Sharma *et al.* (1983) and Singh *et al.* (1997) and following the administration of xylazine-ketamine combination in sheep (Baniadam *et al.*, 2004).

There was decrease in pulse rate following premedication and after administration of thiopentone in both groups. Though there was a increase initially, the decrease was significant in dogs which were premedicated with xylazine-ketamine combination but was not significant in those premedicated with xylazine alone. Decrease in pulse rate had been reported by Pandey *et al.* (1991) following the administration of diazepam followed by ketamine in dogs and Wagner *et al.* (1981) following the administration of xylazine in horses.

The respiration rate was significantly reduced after premedication in both the groups. Decrease in respiration rate had been reported in dogs following

administration of xylazine alone (Peshin *et al.*, 1980) and, xylazine and ketamine (Haskins *et al.*, 1986). Reduction in respiration rate is a normal feature in dogs under general anaesthesia due to the depressant effect of the drugs on the central nervous system.

There was significant increase in systolic and diastolic pressures in both the groups. Muir *et al.* (1978) had reported an increase in systolic and diastolic pressures following the administration of xylazine. Increase in blood pressure had also been reported in dogs which were given xylazine-ketamine combination (Kolata and Rawlings, 1982 and Haskins *et al.*, 1986).

III. Electrocardiogram

In Group I, increase in heart rate and decrease in PR interval was noticed after the administration of atropine sulphate and it reassumed to normalcy after premedication with xylazine. Reduction in heart rate was well marked after administration of thiopentone. Slight increase in PR interval was observed in all the dogs after the administration of xylazine and thiopentone. QRS configuration remained same throughout the study.

In Group II, there was increase in heart rate, after administration of atropine sulphate. Out of six dogs, four had positive 'T' wave and two had negative 'T' wave. One dog had wandering pacemaker before administration of atropine sulphate which disappeared after the administration of xylazine-ketamine. In one animal mild baseline undulations ('F' waves) was noticed. But, after thiopentone administration no more 'F' wave was seen and there was reduction in heart rate.

Since all the changes were corrected spontaneously at recovery, it may be inferred that the effect of the drugs on heart rate and myocardium are transient.

Decrease in PR interval during tachycardia after administration of atropine sulphate and increase in PR interval during bradycardia have been

reported (Peshin *et al.*, 1980). Occurrence of atrio-ventricular block have been reported following the administration of xylazine in horses (Purohit *et al.*, 1981) and in dogs (Kumar and Singh, 1994), but in the present study it was absent, may be due to the prior administration of atropine sulphate.

IV. Haemogram

There was decrease in packed cell volume in both the groups. The decrease was significant in the dogs which were premedicated with xylazine-ketamine combination. Decrease in PCV had been reported in dogs, following the administration of xylazine alone (Peshin *et al.*, 1980) and xylazine and thiopentone (Sharma *et al.*, 1983).

The variations in haemoglobin concentration were marginal in the dogs which were premedicated with xylazine alone, but there was significant decrease in concentration in dogs which were premedicated with xylazine-ketamine. Decrease in haemoglobin concentration had been reported in dogs following the administration of xylazine alone (Peshin *et al.*, 1980) and xylazine and thiopentone (Sharma *et al.*, 1983).

There was decrease in total erythrocyte count in both the groups. Decrease in total erythrocyte count had been reported in dogs following the administration of xylazine alone (Peshin *et al.*, 1980) and xylazine and thiopentone (Sharma *et al.*, 1983).

There was decrease in total leukocyte count in both the groups. Decrease in total leukocyte count had been reported in dogs following the administration of xylazine alone (Peshin *et al.*, 1980) and xylazine and thiopentone (Sharma *et al.*, 1983).

There was increase in neutrophil count in dogs which were premedicated with xylazine alone, but it was significantly decreased in dogs, which were

premedicated with xylazine-ketamine. Increase in neutrophil count had been reported in dogs following the administration of xylazine (Peshin *et al.*, 1980).

Lymphocyte count was significantly decreased in dogs which were premedicated with xylazine alone, but it was increased in dogs which were premedicated with xylazine-ketamine. Decrease in lymphocyte count had been reported in dogs following the administration of xylazine (Peshin *et al.*, 1980).

The variations in monocyte and eosinophils count were marginal in both the groups.

V. Serum constituents

There was increase in serum sodium concentration in both the groups and the increase was significant at 24 hour in dogs which were premedicated with xylazine alone. Mild increase in serum sodium concentration had been reported in dogs following the administration of xylazine (Peshin *et al.*, 1980). Tiwari (1994) reported no change in serum sodium in animals which were given xylazine with ketamine. But in the present study there was an increase.

There was increase in serum potassium concentration in both the groups and increase was significant after premedication at 24 hour in both the groups. Whereas Peshin *et al.* (1980) had reported a decrease in serum potassium concentration following the administration of xylazine. Tiwari *et al.* (1994) reported no change in serum potassium concentration following the administration of xylazine with ketamine.

There was increase in serum total protein content after premedication and immediately after induction of thiopentone anaesthesia in both the groups. But Srivastava *et al.* (1988) had reported no change in serum total protein content following the administration of thiopentone.

There was decrease in serum albumin/globulin ratio in both the groups. The decrease was significant in both the groups immediately after premedication.

The reason for the decrease in packed cell volume, total erythrocyte count and total leucocyte count observed during the maximal depth of anaesthesia can be attributed due to either splenic dilation and subsequent pooling of blood or haemodilution. The increase in neutrophils with corresponding decrease in lymphocytes observed in the study can be attributed to the stressful condition of the dogs during the anaesthesia. From the non-significant increase sodium and potassium level observed in the study it could be inferred that there is not much haemodilution and hypoxia during anaesthesia.

VI. Post anaesthetic complications

All the dogs had smooth and uneventful recovery from anaesthesia without any complications. But most of the dogs were drowsy till next day.

Table 11. Induction time, duration of anaesthesia, recovery time, quantity of thiopentone administered, muscle relaxation time and duration of surgery in dogs (Group I and II) (Mean ± SE) (n=6)

Clinical Observations	Group I	Group II
Induction time (min)	6.83 ± 1.40	5.10 ± 1.29
Duration of surgical anaesthesia with first induction of thiopentone sodium (min)	11.67 ± 3.90	12.50 ± 2.64
Average duration of surgical anaesthesia following subsequent administration of incremental doses of thiopentone sodium (min)	13.63 ± 3.76*	32.17 ± 5.39*
Recovery time (min)	124.00 ± 48.55	89.83 ± 43.12
Quantity of thiopentone sodium administered for first induction (mg/kg)	9.31 ± 1.87	9.72 ± 1.23
Average incremental quantities of thiopentone sodium administered (mg/kg)	3.83 ± 1.10	5.59 ± 1.43
Muscle relaxation time (min)	50.67 ± 9.01	54.50 ± 7.32
Degree of muscle relaxation	Moderate to excellent	Moderate to excellent
Duration of surgery (min)	37.83 ± 6.27	41.83 ± 6.79

* Significant at 5 per cent level ($P<0.05$)

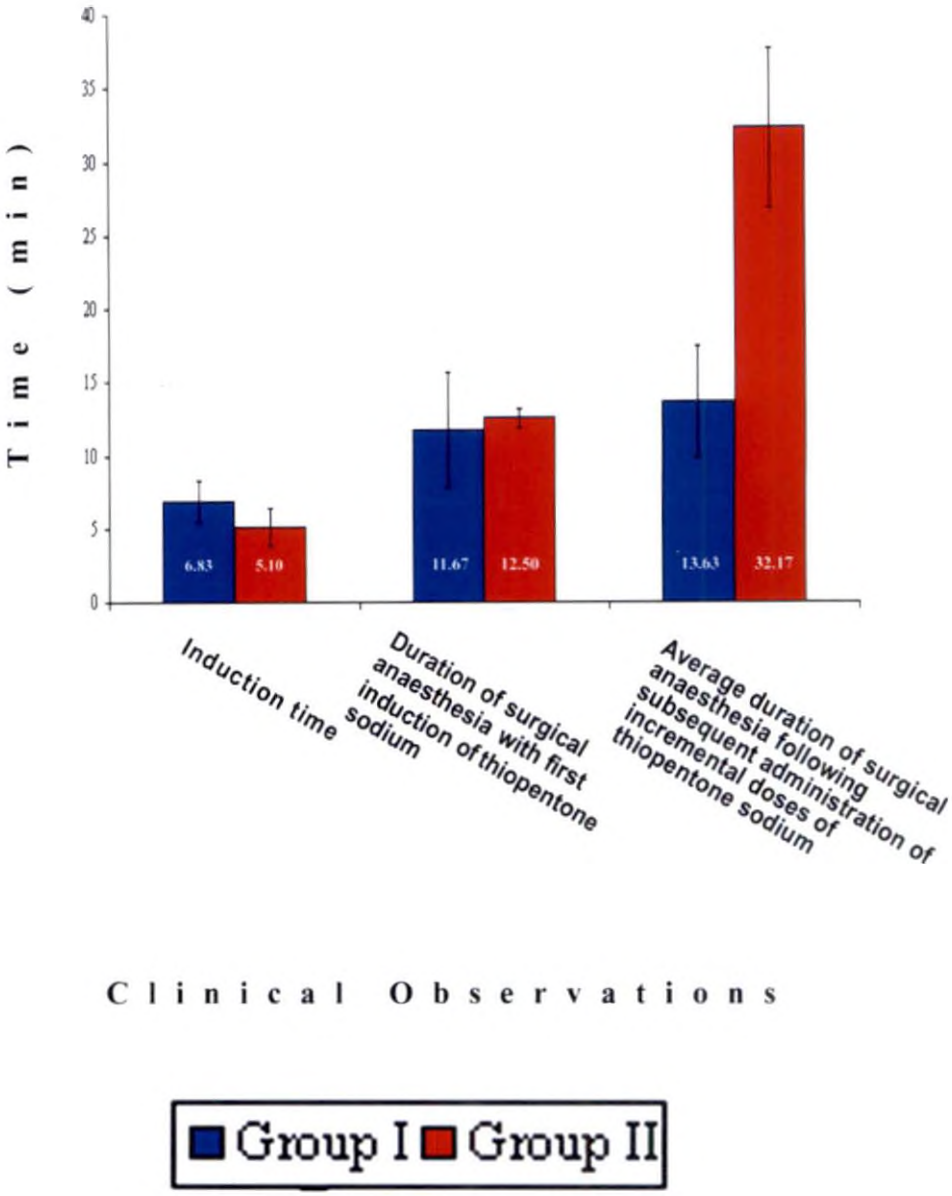


Fig. 1. Comparison of the clinical observations showing induction time, duration of surgical anaesthesia with first induction of thiopentone sodium and average duration of surgical anaesthesia following subsequent administration of incremental doses of thiopentone sodium .

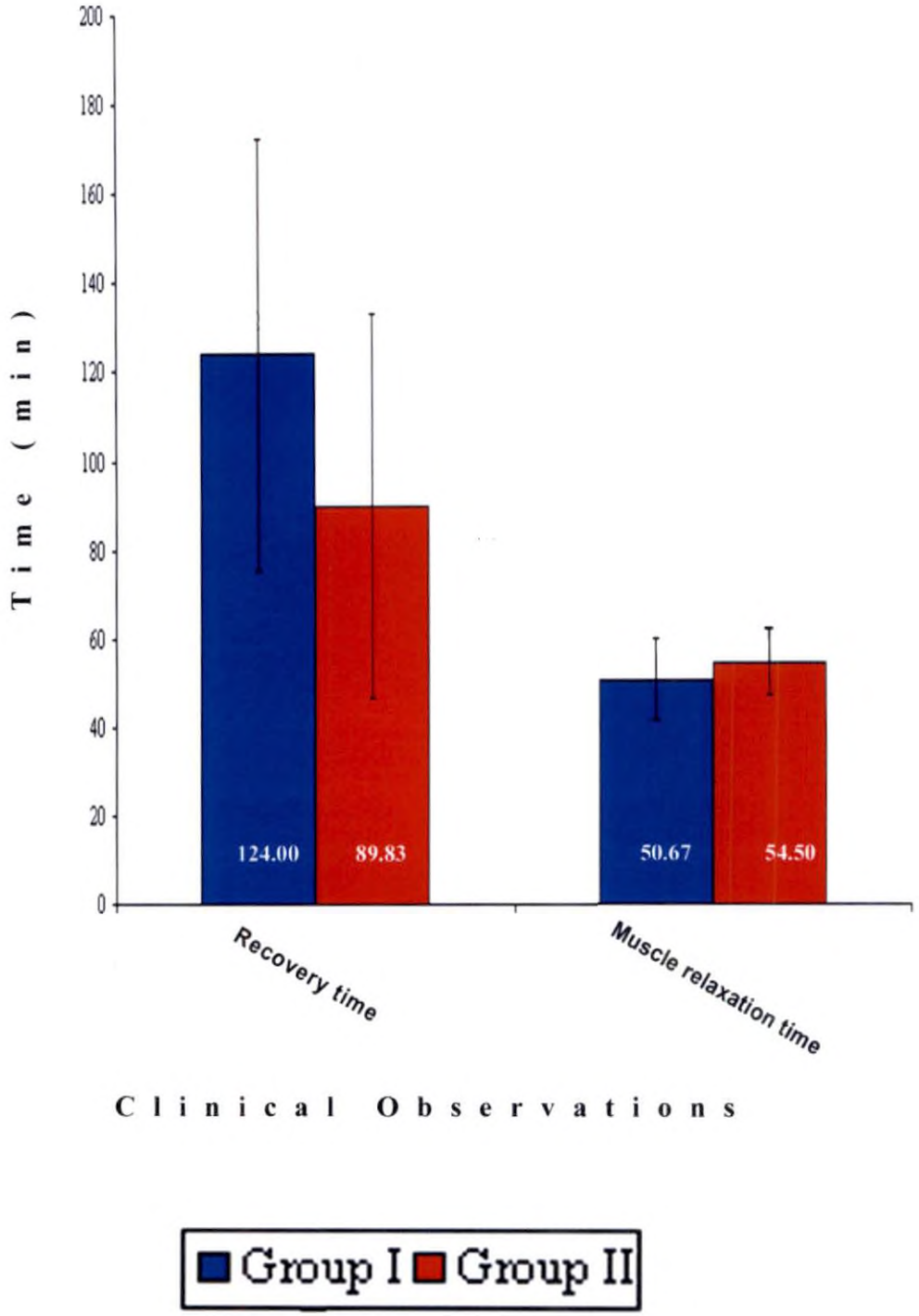


Fig. 2. Comparison of the clinical observations showing recovery time and muscle relaxation time .

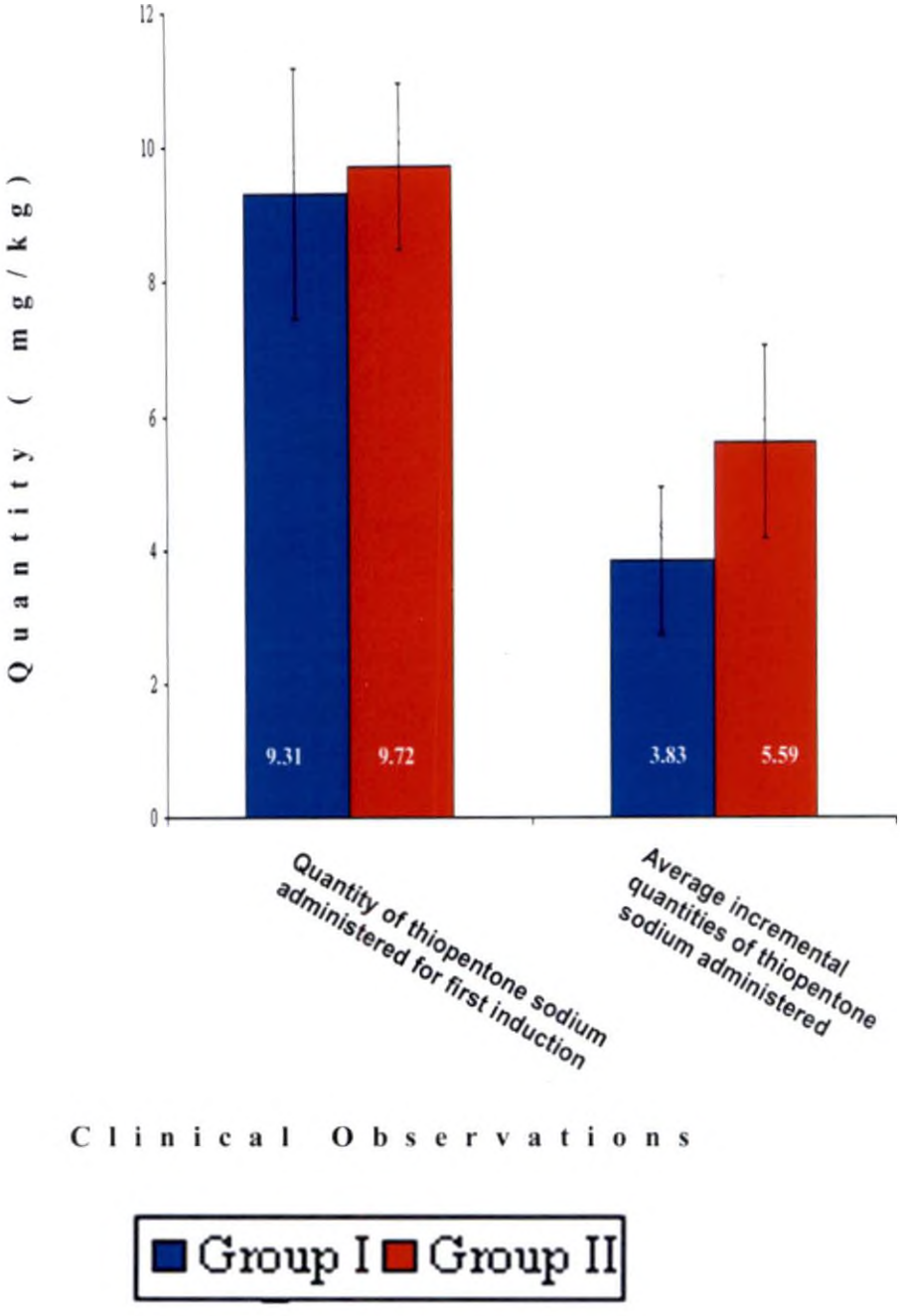


Fig. 3. Comparison of the clinical observations showing quantity of thiopentone sodium administered for first induction and average incremental quantities of thiopentone sodium administered .

Summary

5. SUMMARY

The study was carried out in 12 dogs of different breeds of either sex, presented to the College Hospitals at Mannuthy and Kokkalai for various elective surgical procedures. All dogs were clinically examined before the administration of the anaesthetics. These dogs were randomly divided into two groups, viz. Group I and Group II, each consisting of six dogs. They were numbered serially from 1 to 6.

Atropine sulphate at the rate of 0.045 mg/kg body weight was administered intramuscularly, 15 minutes prior to the administration of xylazine/xylazine-ketamine combination. In Group I, xylazine at the rate of 1.0 mg/kg body weight was administered intramuscularly for premedication. Fifteen minutes later, thiopentone sodium 2.5% solution was administered intravenously "to effect" general anaesthesia. In Group II, xylazine at the rate of 1.0 mg/kg body weight and ketamine at the rate of 2.5 mg/kg body weight was administered intramuscularly as a combined injection for premedication. Fifteen minutes later, thiopentone sodium 2.5% solution was administered intravenously "to effect" general anaesthesia. In both the groups, incremental doses of thiopentone were also administered for the maintenance of anaesthesia for completing the surgery. The dogs were subjected to various surgical operations.

After premedication yawning, winking of eyes, incoordination of hindquarters were the more commonly observed symptoms in both the groups. Other symptoms noticed were vomiting (in two dogs), licking (in seven dogs) and urination (in three dogs). In both the groups, two dogs each assumed lateral recumbency and others were in sternal recumbency with head down posture.

Salivation was scanty in both the groups. Side to side movement of head was noticed in most of the dogs which were premedicated with xylazine-ketamine combination and was absent in dogs which were premedicated with xylazine alone.

The induction time was 6.83 ± 1.40 and 5.10 ± 1.29 minutes in Group I and Group II respectively.

The duration of anaesthesia with first induction of thiopentone was 11.67 ± 3.90 and 12.50 ± 2.64 minutes in Group I and Group II respectively. The duration of anaesthesia was more in dogs premedicated with xylazine-ketamine combination than with xylazine alone.

With repeated administration of thiopentone an average 13.63 ± 3.76 and 32.17 ± 5.39 minutes duration of anaesthesia was achieved with every incremental doses in Group I and Group II respectively. In xylazine-ketamine premedication the duration of anaesthesia was prolonged more than with xylazine premedication alone. It was also observed that the duration of anaesthesia in subsequent administration resulted for longer duration when ketamine was included for premedication.

Recovery time was 124.00 ± 48.55 and 89.83 ± 43.12 minutes in Group I and Group II respectively. The recovery time was shorter in dogs premedicated with xylazine-ketamine combination in thiopentone anaesthesia.

For the first induction of anaesthesia, the quantity of thiopentone required was 9.31 ± 1.87 and 9.72 ± 1.23 mg/kg body weight in Group I and Group II respectively. The requirement of thiopentone was reduced to a greater extent in both the groups, but was slightly higher with xylazine-ketamine premedication.

The average incremental quantities of thiopentone administration was 3.83 ± 1.10 and 5.59 ± 1.43 mg/kg body weight for prolonging anaesthesia in

Group I and Group II respectively. The incremental quantities of thiopentone required was more in dogs which were premedicated with xylazine-ketamine for prolonging the anaesthesia.

The average muscle relaxation time was 50.67 ± 9.01 and 54.50 ± 7.32 minutes in Group I and Group II respectively. The muscle relaxation time was more prolonged when xylazine was combined with ketamine for premedication in thiopentone anaesthesia. The degree of muscle relaxation was moderate to excellent in both the groups.

The surgical operations viz., oopherectomy, correction of rectovaginal fistula, enterotomy, Zepp's operation, ovariohysterectomy, operation for aural haematoma were carried out satisfactorily. The duration of surgery varied from 20 to 58 and 20 to 61 minutes in Group I and Group II respectively.

There was decrease in rectal temperature, pulse rate and respiration rate in both the groups. The decrease in rectal temperature and pulse rate was significant in dogs which were premedicated with xylazine-ketamine combination.

There was significant increase in systolic and diastolic pressures in both the groups.

There was elevation of heart rate after the administration of atropine sulphate in all the dogs and it was reduced after premedication with both xylazine and xylazine-ketamine combination in thiopentone anaesthesia. There was wandering pacemaker in one dog which got corrected after xylazine-ketamine premedication. Decrease in PR interval was observed after the administration of atropine but it was slightly increased after administration of xylazine and thiopentone.

There was decrease in packed cell volume in both the groups and the decrease was significant in dogs which were premedicated with xylazine-

ketamine combination. The variations in haemoglobin concentration were marginal in dogs which were premedicated with xylazine alone, but there was significant decrease in haemoglobin concentration in dogs which were premedicated in xylazine-ketamine combination.

Decrease in total erythrocyte and total leukocyte counts was noticed in both the groups. Increase in neutrophil count with decreased lymphocyte count was observed in dogs which were premedicated with xylazine but, in dogs which were premedicated with xylazine-ketamine combination there was decrease in neutrophil counts with increase in lymphocyte count. The variations in monocyte and eosinophil count were marginal in both the groups.

There was increase in serum sodium and serum potassium concentrations and serum total protein content in both the groups. The serum albumin/globulin ratio was decreased in both the groups.

All the dogs had smooth uneventful recovery without any complications, though most of the dogs were drowsy till next day.

The following conclusions could be drawn from the study:

(i) Premedication with xylazine-ketamine combination in thiopentone anaesthesia produced quick and smooth induction, prolonged duration of anaesthesia, moderate to excellent muscle relaxation and early recovery.

(ii) Satisfactory general anaesthesia was achieved by thiopentone, both with xylazine and xylazine-ketamine premedication for elective surgical operations.

(iii) The dose requirement of thiopentone could be reduced with premedication of both xylazine and xylazine-ketamine combination.

(iv) The incremental quantities of thiopentone required for prolonging the duration of anaesthesia was more when premedicated with xylazine-ketamine combination than xylazine alone.

(v) The changes in the cardiovascular and respiratory systems, and blood and serum constituents were transient.

(vi) Repeated administration of thiopentone for prolonging the duration of anaesthesia with xylazine or xylazine-ketamine premedications had not produced any deleterious systemic changes in dogs.

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CLINICAL EVALUATION OF THE COMPARATIVE EFFECT OF XYLAZINE AND XYLAZINE - KETAMINE PREMEDICATION IN THIOPENTONE ANAESTHESIA IN DOGS

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ABSTRACT

The study was carried out in 12 dogs of different breeds of either sex, presented to the College Hospitals at Mannuthy and Kokkalai for various elective surgical procedures. All dogs were clinically examined before the administration of the anaesthetics. These dogs were randomly divided into two groups, viz. Group I and Group II, each consisting of six dogs. They were numbered serially from 1 to 6.

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After premedication yawning, winking of eyes, incoordination of hindquarters were the more commonly observed symptoms in both the groups. Other symptoms noticed were vomiting (in two dogs), licking (in seven dogs) and urination (in three dogs). In both the groups, two dogs each assumed lateral recumbency and others were in sternal recumbency with head down posture.

Salivation was scanty in both the groups. Side to side movement of head was noticed in most of the dogs which were premedicated with xylazine-ketamine combination and was absent in dogs which were premedicated with xylazine alone.

The induction time was 6.83 ± 1.40 and 5.10 ± 1.29 minutes in Group I and Group II respectively.

The duration of anaesthesia with first induction of thiopentone was 11.67 ± 3.90 and 12.50 ± 2.64 minutes in Group I and Group II respectively. The duration of anaesthesia was more in dogs premedicated with xylazine-ketamine combination than with xylazine alone.

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For the first induction of anaesthesia, the quantity of thiopentone required was 9.31 ± 1.87 and 9.72 ± 1.23 mg/kg body weight in Group I and Group II respectively. The requirement of thiopentone was reduced to a greater extent in both the groups, but was slightly higher with xylazine-ketamine premedication.

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There was significant increase in systolic and diastolic pressures in both the groups.

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There was decrease in packed cell volume in both the groups and the decrease was significant in dogs which were premedicated with xylazine-ketamine combination. The variations in haemoglobin concentration were marginal in dogs which were premedicated with xylazine alone, but there was significant decrease in

haemoglobin concentration in dogs which were premedicated in xylazine-ketamine combination.

Decrease in total erythrocyte and total leukocyte counts was noticed in both the groups. Increase in neutrophil with decreased lymphocyte count was observed in dogs which were premedicated with xylazine but, in dogs which were premedicated with xylazine-ketamine combination there was decrease in neutrophil count with increase in lymphocyte count. The variations in monocyte and eosinophil counts were marginal in both the groups.

There was increase in serum sodium and serum potassium concentrations, and serum total protein content in both the groups. The serum albumin/globulin ratio was decreased in both the groups.

All the dogs had smooth uneventful recovery without any complications, though most of the dogs were drowsy till next day.