CLINICAL EVALUATION OF PROPOFOL-ISOFLURANE ANAESTHESIA WITH XYLAZINE PREMEDICATION 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 PROPOFOL-ISOFLURANE ANAESTHESIA WITH XYLAZINE PREMEDICATION 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.

Mannuthy
17.03.2008

SOUMYA RAMANKUTTY

CERTIFICATE

Certified that the thesis entitled **"CLINICAL EVALUATION OF PROPOFOL-ISOFLURANE ANAESTHESIA WITH XYLAZINE PREMEDICATION IN DOGS"** is a record of research work done independently by **Soumya Ramankutty,** 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 her.

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Introduction

1. INTRODUCTION

The important goal of anaesthesia is achieving unconsciousness, analgesia and muscle relaxation through a safe technique culminating in smooth and uneventful recovery with minimal side effects to the body systems. In the ancient days the anaesthetists were attempting to achieve all these goals with administration of a single drug either by oral, parenteral or inhalation route. But they failed to achieve the desired effects of anaesthesia, encountered many side effects and were often fatal. Still a safe anaesthesia in compromised patients remains a challenge in front of a veterinary anaesthetist. In such patients, where multiple organ failure is a general feature, delayed recovery or fatality is often confronted as the removal of the anaesthetic drug(s) from the system demands a functional detoxifying mechanism of the body.

The recent trend in veterinary anaesthesia is to produce balanced anesthesia by combining drugs like anticholinergics, sedatives and injectable and/or inhalant anaesthetics, thereby reducing the side effects to the minimal level. The present study was carried out with the anticholinergic glycopyrrolate, and the sedative xylazine, for premedication, and the anaesthetics propofol for induction and isoflurane for maintenance of anaesthesia.

Glycopyrrolate is a potent anticholinergic superior to the widely used atropine in terms of stability of cardiovascular function, reduction in salivation (Watney *et al.*, 1987) and slower in crossing the blood-brain and placental barriers (Hall, 1985).

Xylazine, alpha-2 agonist, is a proven preanaesthetic to induce sedation, analgesia and muscle relaxation in dogs (Klide *et al.*, 1975) and reduces the dose of propofol (Bufalari *et al.*, 1988).

In veterinary practice propofol is used as an agent for induction and maintenance of anaesthesia and claims to produce rapid induction and rapid excitement free recovery (Watkins *et al.*, 1987) with lack of cumulative effects on repeated administration (Morgan and Legge, 1989) and caused slightly less physiological effects (Branson and Gross, 1994).

Isoflurane, one of the modern inhalant anaesthetics has the advantage of faster induction and recovery (Ludders, 1992). It was reported to have been safely used in compromised patients with liver disease (Robertson and Lerche, 2003) and for caesarean section in bitches (Funquist *et al.*, 1997).

The present study was undertaken with the objective of evaluating the clinical efficacy of propofol-isoflurane anaesthesia with glycopyrrolate-xylazine premedication for conducting surgery in healthy and compromised dogs.

Review of Literature

2. REVIEW OF LITERATURE

2.1. GLYCOPYRROLATE

According to Hall (1985) glycopyrrolate is five times more potent than atropine as an antisialagogue and have little effect on cardiovascular system. It was also claimed that glycopyrrolate is slow to cross the blood-brain barrier and has little central effect.

Watney *et al.* (1987) compared atropine, hyoscine, and glycopyrrolate as premedicant in canine anaesthesia and reported that the cardiovascular stability and reduction in salivation produced by glycopyrrolate was proved to be significant when the administration of an antimuscarinic agent was considered necessary.

Pablo *et al.* (1995) compared the effects of atropine sulphate (0.2 mg/kg) and glycopyrrolate (0.01 mg/kg) on heart rates in conscious mature goats and reported that at these doses, glycopyrrolate had longer duration of action than atropine and that it would be useful in preventing bradyarrhythmias during induction and the initial phase of anaesthetic maintenance.

According to Singh *et al.* (1996) in healthy horses, prior administration of glycopyrrolate in small doses prevented bradycardia, improved haemodynamic status and increased tissue oxygen supply during anaesthesia with xylazine and ketamine without causing prolonged stasis of gastrointestinal tract

Neto *et al.* (2004) reported that the positive chronotropic effects of glycopyrrolate resulted in improvement of haemodynamic function in horses anaesthetized with halothane and xylazine.

Mohan (2006) reported scanty salivation in dogs sedated with xylazine with prior administration of glycopyrrolate.

According to Narayanan (2007) prior administration of glycopyrrolate in dogs sedated with xylazine resulted in scanty salivation.

2.2. XYLAZINE

Yates (1973) reviewed the clinical use of xylazine in dogs and cats and reported that xylazine provided easy handling of the patient, smooth induction and reduced the requirement of intravenous barbiturates by 50 per cent. It was opined that xylazine could be used routinely for caesarean section along with local anesthetic without depressing the pups.

According to Klide *et al.* (1975) Xylazine, alpha-2 agonist induces sedation, analgesia and muscle relaxation when administered to dogs.

Navarro and Friedman (1975) evaluated the use of ketamine hydrochloride with xylazine premedication for caesarean section in dogs and reported that the puppies delivered were depressed, whereas the puppies were not depressed when xylazine was used at the dose range 0.5 to 1.0mg/kg in conjunction with local infiltration of lidocaine.

Muir and Piper (1977) studied the effect of xylazine on indices of myocardial contractility in dogs and reported that xylazine exerted an initial temporary positive cardiac contractile effect independent of heart rate.

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. Changes in the T wave along with elevation of ST segment were suggestive of myocardial hypoxia. There was slight decrease in total erythrocyte and leukocyte 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.

Clark *et al.* (1982) studied cardiopulmonary responses to xylazine/ ketamine anaesthesia in dog and observed certain electrocardiographic changes like sinus tachycardia, sinus arrest, first degree heart block, second degree heart block and mild to moderate ST slurring.

Hsu *et al.* (1985) studied the effect of xylazine (1mg/kg i.v) on heart rate and arterial blood pressure in conscious dogs and reported bradycardia with sinus arrhythmia initiated within 15 seconds of xylazine administration, which lasted for 30 minutes. It was also reported that there was initial increase of arterial blood pressure for five minutes followed by hypotension which lasted for about 45 minutes.

Haskins *et al.* (1986) studied the cardiopulmonary consequences of intravenous administration of xylazine (1mg / kg) followed by ketamine (10 mg / kg) and reported that bradycardia, first and second degree heart block were observed after the administration of xylazine. A decrease in cardiac output, breathing rate and minute ventilation and an increase in systemic blood pressure were also reported after xylazine administration.

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.

2.3 PROPOFOL

Hall and Chambers (1987) used propofol for the induction and maintenance of general anaesthesia in dogs. Propofol was administered at a dose rate of 3 mg/kg body weight. Anaesthesia was maintained by intravenous injection at an infusion rate of 0.4 mg/kg/minute. A fall in respiratory rate was observed during infusion. There was no evidence of phlebitis or thrombosis of vein in any of the dogs within 24 hours of infusion. In a few dogs, persistent coughing until the removal of endotracheal tube, jerky respiratory movements

throughout anaesthesia, shivering during inspiration and vomiting during recovery were observed.

Watkins *et al.* (1987) reported smooth and rapid induction and excitement free recovery of dogs, irrespective of duration anaesthesia as the most useful feature of propofol anaesthesia with acepromazine premedication. The recovery time recorded was 25.00 ± 13.00 minutes.

According to Morgan and Legge (1989) the mean induction dose of propofol in unpremedicated and premedicated dogs was 6.55 mg/kg and 4.5 mg/kg respectively. Apnoea was reported as the commonest adverse effect and rapid reocovery and lack of cumulative effect even on repeated administration as attractive features of propofol anaesthesia.

David (1992) evaluated the anaesthetic efficacy of propofol alone and in combination with the preanaesthetic drugs atropine and trifluprομazine in 48 nondescript dogs. The mean induction dose required for unpremedicated group was 5.55 mg/kg and for premedicated group 5.02 mg/kg. Induction took about 60 seconds. Males required more induction dose than females. Duration of surgical anaesthesia lasted for four minutes and three seconds in unpremedicated and nine minutes in premedicated dogs. Recovery time was 19.5 min when propofol alone was used and 23.27 minutes when used in premedicated group. There was significant increase in heart rate and decrease in respiratory rate and central venous pressure during anaesthesia in both groups. Apnoea of 30 to 40 seconds was seen during induction. It was opined that propofol was an excellent general anaesthetic for dogs.

Robertson *et al.* (1992) studied cardiopulmonary, anaesthetic and post anaesthetic effects of intravenous infusions of propofol in dogs and observed apnoea for about 60 to 90 seconds during induction. Mild muscle tremors and paddling of limbs were also reported.

Watney and Pablo (1992) in their study observed marked extensor rigidity accompanied by struggling and some degree of muscle twitching around limbs and muzzle after administration of propofol (5mg/kg) to unpremedicated dogs.

Keegan and Greene (1993) reported occurrence of apnoea and cyanosis during induction of anaesthesia with propofol in dogs.

Branson and Gross (1994) had reported propofol to have some advantages over the ultrashortacting thiobarbiturates like shorter recovery period, minimal cumulative effects and slightly less physiological effects. It was opined that propofol could be administered as a single bolus for induction of anaesthesia to allow endotracheal intubation and initiation of inhalant anaesthetics.

Thurmon *et al.* (1994) reported propofol to have poor analgesic effect and hence supplementation with an analgesic and a muscle relaxant was recommended along with propofol to maintain anaesthesia.

In a clinical study Thurmon *et al.* (1995) observed that dogs given propofol at the rate of 2mg /kg by intravenous administration did not become recumbent but were ataxic. But with 4mg/kg the animals became recumbent, but endotracheal intubation could not be achieved, which required premedication or higher doses of propofol (5.5-6.5 mg/kg).

According to Bufalari *et al.* (1998b) induction of anaesthesia with propofol was safe with premedication. The most common side effect noticed was a low oxygen saturation value, which was correctable with supplementation of oxygen. It was also opined that either rapid injection or excessive doses of propofol can promote respiratory depression and in contrast, very slow injection was less likely to cause respiratory depression but may either fail to induce anaesthesia or increase the total dose of propofol required.

Muir III and Gadawski (1998) reported respiratory depression and apnoea as the most likely adverse effects induced by intravenous administration of

propofol in dogs, particularly when administered at rapid rates of infusion. It was also reported that increasing dosages of propofol resulted in greater decrease in respiratory rate and slower recovery of respiratory rate to preanaesthetic values. The rectal temperature was decreased after administration of propofol and throughout the period of anaesthesia. The decrease in body temperature during propofol anaesthesia was attributed to decrease in skeletal muscle tone and shivering threshold, vasodilation and impairment of thermoregulatory control.

Quandt *et al.* (1998) in a clinical study observed neuromuscular side effects, such as muscular tremors, shivering, paddling and opisthotonus in more than eight per cent of the dogs anaesthetized with propofol. The recovery from anaesthesia was noticed within eight minutes after propofol administration and started walking within one hour.

Lerche *et al.* (2000) opined that the anaesthetic effect and side effects of propofol are largely dose-related and so it would be advantageous to combine propofol with other anaesthetic agents, to reduce the dose and thereby minimize the adverse effects.

Sooryadas (2001) studied the clinical evaluation of propofol anaesthesia with xylazine premedication in dogs and found the anaesthetic regimen effective and safe for induction and maintenance of anaesthesia for surgery in healthy and compromised dogs with fewer side effects.

Bayan *et al.* (2002) administered propofol at the rate of 5.5 mg/kg body weight intravenously as a bolus dose in dogs and evaluated the haematological and biochemical changes during anaesthesia. There was significant decrease in haemoglobin concentration and total erythrocyte count following induction of anesthesia, but at the end of observation period those increased to the preinduction level. The changes in differential leukocyte count were non significant throughout the period of observation. The serum glutamic pyruvate transferase, serum glutamic oxaloacetate transaminase and glucose levels were

initially increased, and the total protein levels decreased, but all the values returned to preinduction level at the end of observation period.

Venugopal *et al.* (2002) reported significant decrease in rectal temperature, respiratory rate and haematological parameters like total erythrocyte count, total leukocyte count, haemoglobin and packed cell volume after propofol-ketamine anaesthesia with and without triflupromazine/diazepam premedication in dogs. A significant increase in pulse rate was also reported

Khan *et al.* (2006) observed a significant decrease in haematological parameters viz., total erythrocyte count, total leukocyte count and haemoglobin and a significant increase in level of glucose in blood during propofol anaesthesia with midazolam premedication.

Mohan (2006) had reported a decrease in respiratory rate and increase in heart rate in dogs during propofol anaesthesia with xylazine premedication.

Umar *et al.* (2006) reported that in horses, propofol in combination with other anaesthetic agents improved the quality of anaesthesia achieved better than with the drug alone and also decreased the total dose of propofol required.

Dennis *et al.* (2007) compared the electrocardiographic observations in dogs anaesthetized with thiopentone and propofol. On the basis of the study it was recommended that propofol should be used in any dog with a long QT interval, ventricular arrhythmias, or conditions that increase the potential for arrhythmogenesis such as heart failure, myocardial disease, thoracic trauma, electrocyte imbalance or high catecholamine levels.

Jain *et al.* (2007) observed significantly increased plasma glucose level during propofol-ether anaesthesia in dogs. It was opined that the increase might be due to the stimulation of adrenocortical hormone from adrenal cortex resulting in increased secretion of cortisone and thereby gluconeogenesis during anaesthesia.

Khan *et al.* (2007) studied the effect of propofol in combination with midazolam, acepromazine and haloperidol in canines and observed significant decrease in rectal temperature and respiratory rate with significant increase in heart rate and pulse rate with all the preanaesthetics studied.

Sharma and Bhargava (2007) studied the clinical changes induced by propofol as general anaesthetic in combination with various pre-anaesthetics in dogs and reported a significant increase in heart rate after the administration of propofol which was attributed to the stimulation of cardio-excitatory centre of brain or stimulation of sympathetic nervous systems. Apnoea was noticed as a consistent finding with the administration of various doses of propofol.

2.4 ISOFLURANE

Klide (1976) studied the cardiopulmonary effects of enflurane and isoflurane in the dogs. It was reported that both the drugs depressed cardiopulmonary functions, which increased with increasing depth of anaesthesia. Enflurane depressed the functions to a greater extent than isoflurane. Muscle twitching was noticed in all the dogs anaesthetized with enflurane, but not with isoflurane. Induction and recovery from anaesthesia was quite rapid with both the agents.

Zbinden *et al.* (1988) studied the anaesthetic uptake and elimination of halothane and isoflurane in dogs and reported that rate of uptake of isoflurane was more rapid than halothane from the alveolar space to blood. The uptake and elimination from the brain tissue and blood were found similar for both halothane and isoflurane.

Scheller *et al.* (1990) compared the cerebral effects of sevoflurane in the dogs with those of enflurane and isoflurane and reported that both sevoflurane and isoflurane had minimal effects on cerebral blood flow and decreased the cerebral metabolic rate for oxygen which makes them suitable for use in

neurosurgery. It was also reported that both drugs decreased arterial pressure in a dose dependent manner, but neither drug significantly altered cardiac output.

Ludders (1992) reported many advantages for isoflurane than over other inhalant anaesthetics such as faster induction and recovery, relative sparing effect on cardiovascular function and cerebral blood flow auto regulation and negligible metabolism.

Steffey *et al.* (2000) reported that the administration of xylazine reduced the anaesthetic requirement for isoflurane in horses, and the magnitude of decrease was dose and time dependent.

Topal *et al.* (2004) compared the end tidal carbondioxide and arterial oxygen saturation during halothane, isoflurane and sevoflurane anaesthesia in dogs and both parameters were found lower in halothane anaesthesia than during isoflurane or sevoflurane anaesthesia. It was suggested that in dogs both isoflurane and sevoflurane anaesthesia were safer than halothane anaesthesia.

Narayanan (2007) had reported an increase in blood glucose, serum sodium and chloride concentration with a decrease in serum total protein content, creatinine and potassium concentration during ketamine-isoflurane anaesthesia with glycopyrolate-xylazine-midazolam premedication

2.5 PROPOFOL-ISOFLURANE

Smith *et al.* (1993) observed rapid induction to anaesthesia in dogs following the administration of propofol. Apnoea was observed as a frequent adverse effect. The frequency and duration of apnoea was not seen influenced by preanaesthetic medication. Following maintenance of anaesthesia with isoflurane the recovery was rapid and adverse effects were minimal.

Funquist *et al.* (1997) reported rapid excitation free recovery in bitches after caesarean section under propofol-isoflurane anaesthesia and were able to care for their puppies soon after extubation. The proportion of puppies born alive

was similar to that for bitches in which epidural anaesthesia was used and markedly higher than in those given thiopental sodium.

Bufalari *et al.* (1998a) reported that propofol 6.6 mg/kg i.v.) given over 60 seconds to unpremedicated dogs produced safe, smooth, reliable anaethetic induction without adverse effects. The ventilatory depressive effects produced were clinically manageable. Intubation was easy and without complication. It was opined that propofol should be administered to effect, after selecting an appropriate dose based on premedication, temperament of the patient and speed of injection. It was also reported that propofol in combination with the inhalant agents, halothane or isoflurane could be used effectively and safely for canine anaesthesia.

Gaynor *et al.* (1998) compared the haemodynamic effects of propofol and isoflurane in pregnant ewes and observed that continuous propofol infusions maintained maternal haemodynamics at significantly higher levels than does inhaled isoflurane, whereas uterine arterial and umbilical venous flows did not change significantly. It was also suggested that propofol and isoflurane have the potential to be excellent anaesthetic agents for caesarean sections in many species including human beings.

According to Moon *et al.* (1998) among the dogs undergoing caesarean section in United States and Canada, the most common methods of inducing and maintaining anaesthesia were administration of propofol for induction and maintenance, and administration of propofol for induction, followed by administration of isoflurane. The authors claimed that the mortality rates of dams and puppies under going caesarean section were low in United States and Canada.

2.6 ANAESTHESIA IN COMPROMISED PATIENTS

Reid and Nolan (1996) studied the pharmacokinetics of propofol as an induction agent in geriatric dogs and observed slower clearance of propofol in

aged dogs than in young dogs. Hence lower doses of propofol were recommended for maintenance of anaesthesia in aged dogs. .

Short and Bufalari (1999) reported that no significant alterations in pharmacokinetic parameters were found with propofol in human patients, having renal or hepatic disease, suggesting that propofol could be used in both groups of human patients

Moon *et al.* (2000) reported that isoflurane and propofol were associated unconditionally with a positive effect on neonatal survival at seven days and suggested that the relatively rapid clearance of propofol and isoflurane from the body might have allowed dams to care for puppies better, and puppies to be more active.

Moon-Massat and Erb (2002) reported that the use of propofol for caesarean section was associated with better puppy vigor than with thiopentone or thiamylal.

Robertson and Lerche (2003) reported isoflurane as the most common inhalant anaesthetic in veterinary practice and recommended it for patients with liver disease in animals requiring repeated anaesthesia.

Robertson and Moon (2003) reviewed the anaesthetic management for caesarean section in bitches and opined that the likelihood of puppies born alive is increased if propofol or isoflurane is a part of anaesthetic protocol. It was also reported that propofol was associated with better puppy vigor than thiopentone or thiamylal.

Materials and Methods

3. MATERIALS AND METHODS

3.1. SELECTION OF ANIMALS

The study was conducted in 12 dogs aged one and a half to 10 years of different breeds of either sex presented to the Veterinary College Hospitals at Mannuthy and Kokkalai, for various surgical procedures. Clinical examination was carried out in all the dogs. These dogs were divided into two groups of six animals each. Healthy animals presented for elective procedures were included in Group I and those animals in a compromised condition were included in Group II. They were numbered serially, viz:

Group I- I_1, I_2, I_3, I_4, I_5, & I_6.

Group II- II_1, II_2, II_3, II_4, II_5, & II_6

3.2. PREPARATION OF THE ANIMALS

All dogs in Group I were withheld water for 12 hours and food for 24 hours and prior to anaesthesia and in Group II being in compromised condition, surgery was performed without prior preparation.

3.3. ANAESTHETIC TRIALS

All the dogs were anaesthetized with the following protocol.

3.3.1. Preanaesthetic Medication (Plate 1)

Glycopyrrolate[1] at the rate of 0.01mg/kg bodyweight, followed by xylazine[2] at the rate of 1 mg/kg bodyweight at 15 minutes interval were administered intramuscularly.

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1. Pyrolate- Neon Laboratories Ltd.,Thane, Mumbai

2. Xylaxin- Indian Immunologicals Ltd., Hyderabad

3.3.2. Induction of Anaesthesia (Plate 1)

Fifteen minutes after preanaesthetic medication, propofol[3] 1% emulsion at the rate of 4 mg/kg bodyweight was administered by rapid intravenous bolus injection. Endotracheal intubation was carried out in all the dogs to maintain airway patency.

3.3.3. Maintenance of Anaesthesia (Plate 1)

Anaesthesia was maintained with isoflurane[4] at three percent level in pure oxygen at the rate of 10ml/kg bodyweight by Bain's (Plate 10) circuit system[5] using isoflurane vapouriser[6] (Plate 2). During the recovery period, the animals were maintained in pure oxygen supply till the swallowing reflexes reappeared.

The physiological observations and collection of blood samples were carried out before and 15 minutes after premedication, during anaesthesia at 15 minutes after the administration of isoflurane, immediately after recovery and at 24 hours.

3.4. SURGICAL MANAGEMENT (Plate 3)

The animals were subjected to various surgical operations under strict aseptic conditions. Normal saline was administered intravenously to all the animals at the rate of 10 ml/kg bodyweight. Surgeries performed in Group I were oophorecctomy (I_1, I_2, I_3, I_4) operation for aural haematoma (I_5) and resection of mammary tumour (I_6) and in Group II correction of eventration due to disruption of surgical wound (II_1) ovario-hysterectomy for pyometra (II_2) caesarean section

3. Propofol- Neon Laboratories Ltd., Mumbai
4. Forane- Abbot India Ltd., Mumbai
5. Phoebus MA 201-Ferrocurves, Kolkota
6. Penlon-Penlon Ltd Abingdon Oxon,UK

(II_3, II_5), resection of lipoma in a debilitated animal (II_4) and urethrotomy in acute urethral obstruction (II_6). All the dogs were given postoperative antimicrobial therapy with ampicillin–cloxacillin[7] at the rate of 10 mg/kg bodyweight intramuscularly for five consecutive days. The suture line was dressed daily with gentamicin[8] ointment and sutures were removed the eighth postoperative day.

3.5. MAIN ITEMS OF OBSERVATION

Details regarding the age, sex, breed, disease/condition and the surgery performed were recorded (Table 1&2).

3.5.1. Clinical Observations

*3.5.1.1. **Clinical Signs:*** The salient clinical signs exhibited by the animals like winking of the eye, licking, yawning, vomiting, incoordination, loss of pedal reflexes, assumption of recumbency, degree of muscle relaxation, easiness in endotracheal intubation etc; following the administration of drugs after premedication, during induction, maintenance and recovery from anaesthesia were noted.

*3.5.1.2. **Time for Induction of Anaesthesia:*** Induction time was calculated as the time from injection of propofol to the disappearance of the pedal reflex.

*3.5.1.3. **Duration of Anaesthesia:*** Duration of anaesthesia was calculated as the time interval between the time of disappearance of pedal reflex following the administration of propofol and the time of return of pedal reflex after stopping the administration of isoflurane.

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7. Megapen-Aristo Lab, Maharastra
8. Lyramycin Vet Cream- Lyka Exports Ltd., Andheri, Mumbai

3.5.1.4. Depth of Anaesthesia: Depth of anaesthesia was assessed based on various clinical signs viz, disappearance of palpebral and pedal reflexes, the degree of muscle relaxation and the responses during surgery.

3.5.1.5. Degree of Muscle Relaxation: It was rated as poor (+), moderate (++), good (+++) or excellent (++++), depending on resistance in opening jaws manually and by assessment of relaxation of abdomen during surgery.

3.5.1.6. Recovery Time: Recovery time was calculated as the time interval between return of pedal reflex and the time when the animal could stand up and walk unassisted.

3.5.2. Physiological Observations

Rectal temperature, pulse rate, respiration rate, pulse oximetry and electrocardiogram (ECG) were recorded using a multiparamonitor[9] (Plate 2). Colour of mucous membrane and capillary refill time were also recorded.

3.5.3. Haematological Observations

Blood samples were collected for the estimation of haemoglobin (Sahli's method), volume of packed red cells (VPRC), erythrocyte sedimentation rate (ESR) (Wintrobe method) and total and differential leukocyte counts (Benjamin, 1985).

3.5.4. Serum Constituents

Serum samples were collected for the estimation of glucose, blood urea nitrogen (BUN), creatinine, aspartate amino transferase (AST), alanine amino transferase (ALT), total protein, using the diagnostic kits[10] by Semi Auto Analyser (Secomam, France) and sodium, potassium and chloride using Atomic Absorption Spectrophotometer (Perkin Elmer-Model 2380).

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9. Planet 50, Larsen and Toubro Ltd, Pondicherry
10. Agappe Diagnostics Pvt. Ltd. Ernakulam

3.5.5. Post anaesthetic and Postoperative Complication(s) if any

The animals were observed till complete recovery and at 24 hours after the surgery and the clinical signs and any complications shown were recorded.

3.5.6. Statistical Analysis

Statistical analysis was carried out using student t-test method for all the parameters under investigation (Snedecor and Cochran, 1985).

Results

4. RESULTS

4.1. GROUP I

Six animals were utilized for the study. The results obtained were analysed and the observations are presented in Tables 2 to 10.

Glycopyrrolate at the rate of 0.01 mg per kg body weight, followed by xylazine at the rate of 1 mg/kg body weight at 15 minutes interval were administered intramuscularly for premedication to all the animals of this group. Fifteen minutes later, propofol 1% emulsion at the rate of 4 mg per kg body weight was administered by intravenous bolus injection, for induction of anaesthesia. Anaesthesia was maintained with isoflurane at three per cent level in pure oxygen at the rate of 10 ml/kg bodyweight by Bain's circuit system utilizing isoflurane vapourizer.

4.1.1. Clinical Observations (Table 5)

4.1.1.1. Clinical Signs: The common clinical signs exhibited by the dogs following premedication with glycopyrrolate-xylazine were winking of the eye, licking, yawning in coordination of movements, and sitting on haunches followed by sternal recumbency with head down posture within 15 minutes. Only one animal (I_4) assumed the position of lateral recumbency (Plate 4) and two (I_2, I_3) vomited.

Induction of anaesthesia was smooth in all the animals following the administration of propofol. In one animal (I_5) apnoea persisted for a period of about one minute. The recovery from anaesthesia was uneventful in all the animals.

4.1.1.2. Time for Induction of Aanaesthesia: The time for induction following the intravenous bolus injection of propofol was 1.11± 0.25 minutes (Fig.1).

4.1.1.3. Duration of Anaesthesia: The duration of anaesthesia was 29.66 ± 6.05 minutes (Fig.1).

4.1.1.4. Depth of Anaesthesia: The depth of anaesthesia was satisfactory in all the animals. The surgeries performed were oophorectomy (I_1, I_2, I_3, I_4), operation for aural haematoma (I_5) and resection of mammary tumour (I_6) (Plate 3).

4.1.1.5. Recovery Time: The recovery time was 27.5 ± 10.36 minutes (Fig.1).

4.1.1.6. Degree of Muscle Relaxation: The degree of muscle relaxation was excellent in all the animals for performing the surgeries.

4.1.2. Physiological Observations (Table 6)

4.1.2.1. Rectal Temperature: The rectal temperature (°C) was 38.87 ± 0.96 and 37.22 ± 1.72 before and after premedication respectively. It was 34.60 ± 1.79, 35.43 ± 3.57 and 38.78 ± 0.81 respectively during anaesthesia, after complete recovery and at 24 hours. There was decrease in rectal temperature after premedication, during anaesthesia ($p<0.01$) and recovery ($p<0.05$). By 24 hours it increased to the near normal value (Fig.2).

4.1.2.2. Respiratory Rate: The respiratory rate (per min) was 36.50 ± 3.78 and 26.67 ± 2.66 before and after premedication respectively. It was 18.50 ± 2.59, 26.83 ± 1.94 and 37.17 ± 2.56 respectively, during anaesthesia, after recovery and at 24 hours. There was significant ($p<0.01$) decrease in respiratory rate after premedication, during anaesthesia, and recovery. It returned to the near normal value by 24 hours (Fig.3).

4.1.2.3. Pulse Rate: The pulse rate (per min) was 83.00 ± 4.86 and 94.33 ± 5.13 before and after premedication respectively. It was 101.67 ± 3.20, 96.67 ± 2.07 and 80.67 ± 2.73 respectively, during anaesthesia, after recovery and at 24 hours. There was significant ($p<0.01$) increase in pulse rate after premedication, during anaesthesia and recovery. It returned to near normal value by 24 hours (Fig.4).

4.1.2.4. Colour of Visible Mucous Membrane: The colour of visible mucous membrane was pale roseate in all the animals throughout the period of study.

4.1.2.5. Capillary Refill Time: The capillary refill time (in seconds) was 1.00 ± 0 and 1.17 ± 0.41 before and after premedication respectively. It was 1.83 ± 0.41, 1.67 ± 0.52 and 1.00 ± 0 respectively during anaesthesia, after recovery and at 24 hours. There was an increase in capillary refill time after premedication and during anaesthesia, and returned to the baseline value by 24 hours (Fig.5).

4.1.2.6. Pulse Oximetry: The oxygen saturation (SpO_2) level (%) was 86.00 ± 1.90 and 86.50 ± 0.55 before and after premedication respectively. It was 95.67 ± 2.25, 97.00 ± 1.10 and 86.17 ± 0.75 respectively during anaesthesia, after recovery and at 24 hours. There was significant ($p<0.01$) increase in oxygen saturation level during anaesthesia and recovery, and it decreased to the baseline value by 24 hours (Fig.6).

4.1.2.7. Electrocardiogram: Electrocardiographic (ECG) changes noticed following premedication were tachycardia (I_6), first degree heart block, and sinus arrest (I_3). During anaesthesia the changes noticed were deep S-T segment depression (I_3), ventricular premature contractions (I_2) (Plate 6 and 7).

4.1.3. Hematological Observations (Table 7 and 8)

4.1.3.1. Erythrocyte Sedimentation Rate: The erythrocyte sedimentation rate (ESR) (mm/hr) was 1.17 ± 0.41 and 1.67 ± 0.82 before and after premedication respectively. It was 2.00 ± 0.63, 2.00 ± 0.89 and 0.50 ± 0.55 respectively during anaesthesia, after recovery and at 24 hours. There was significant increase in ESR during anaesthesia ($p<0.01$) and recovery ($p<0.05$) and it decreased below to the baseline value by 24 hours (Fig.7).

4.1.3.2 Haemoglobin Concentration: The haemoglobin concentration (g/dl) was 11.70 ± 0.90 and 11.63 ± 1.03 before and after premedication respectively. It was 10.78 ± 0.91, 11.17 ± 0.80 and 11.68 ± 0.86 respectively during

anaesthesia, after recovery and 24 hours. There was significant ($p<0.01$) decrease in haemoglobin concentration during anaesthesia and recovery. It increased to the baseline value by 24 hours (Fig.8).

4.1.3.3 Volume of Packed Red Cells: Volume of packed red cells (VPRC) (%) was 35.33 ± 1.21 and 33.67 ± 1.75 before and after premedication respectively. It was 30.00 ± 2.10, 31.33 ± 2.07 and 35.67 ± 1.21 respectively during anaesthesia, after recovery and at 24 hours. There was significant decrease in VPRC after premedication ($p<0.05$) during anaesthesia ($p<0.01$) and recovery ($p<0.01$).It returned to the baseline value by 24 hours (Fig.9).

4.1.3.4. Total Leukocyte Count: Total leukocyte count (TLC) ($10^3/mm^3$) was 12.97 ± 1.36 and 12.85 ± 1.35 before and after premedication respectively. It was 12.65 ± 1.27, 12.80 ± 1.29 and 12.62 ± 1.31 respectively during anaesthesia, after recovery and at 24 hours. There was a significant ($p<0.01$) decrease in TLC after premedication during anaesthesia and recovery (Fig.10).

4.1.3.5. Differential Leukocyte Count

4.1.3.5.1. Neutrophils: The neutrophil count (%) was 68.83 ± 3.37 and 68.17 ± 3.76 before and after premedication respectively. It was 70.17 ± 4.54, 70.00 ± 3.16 and 66.83 ± 3.49 respectively during anaesthesia, after recovery and at 24 hours. Neutrophil count increased after premedication, during anaesthesia and at recovery. It decreased to the baseline value by 24 hours (Fig.11).

4.1.3.5.2. Lymphocytes: The lymphocyte count (%) was 23.50 ± 3.67 and 21.50 ± 3.78 before and after premedication respectively. It was 19.33 ± 2.88, 20.00 ± 4.56 and 21.83 ± 3.60 respectively during anaesthesia, after recovery and at 24 hours. There was significant decrease ($p<0.01$) in lymphocyte count after premedication, during anaesthesia and recovery. The decrease at 24 hours was also significant ($p<0.05$) (Fig.12).

4.1.3.5.3. Monocytes: The monocyte count (%) was 2.83 ± 1.16 and 3.33 ± 0.81 before and after premedication respectively. It was 4.33 ± 0.81, 2.67 ± 0.51 and 2.50 ± 0.54 respectively during anaesthesia, after recovery and at 24 hours. There was an increase in monocyte count after premedication and during anaesthesia, and thereafter it was decreased (Fig.13).

4.1.3.5.4. Eosinophils: The eosinophil count (%) was 2.16 ± 0.75 and 1.50 ± 0.54 before and after premedication respectively. It was 2.00 ± 0.89, 2.50 ± 0.54 and 1.67 ± 0.51 respectively during anaesthesia, after recovery and at 24 hours. Marginal variations were noticed after premedication, during anaesthesia and recovery (Fig.14).

4.1.4. Serum Constituents (Table 9 & 10)

4.1.4.1. Glucose: The glucose level (mg/dl) was 64.33 ± 3.50 and 79.67 ± 2.07 before and after premedication respectively. It was 102.83 ± 0.98, 109.00 ± 3.03 and 85.67 ± 2.34 respectively during anaesthesia, after recovery and at 24 hours. There was significant increase ($p<0.01$) in serum glucose level after premedication, during anaesthesia, recovery and at 24 hours (Fig.15).

4.1.4.2. Blood Urea Nitrogen: The blood urea nitrogen (BUN) level (mg/dl) was 17.83 ± 2.32 and 19.00 ± 1.41 before and after premedication respectively. It was 19.00 ± 2.00, 18.17 ± 1.47 and 18.50 ± 1.64 respectively during anaesthesia, after recovery and at 24 hours. There was an increase in BUN level after premedication and during anaesthesia and decreased to the baseline value at recovery. The changes were not significant (Fig.16).

4.1.4.3. Creatinine: The creatinine level (mg/dl) was 1.42 ± 0.40 and 1.43 ± 0.42 before and after premedication respectively. It was 1.38 ± 0.52, 1.37 ± 0.49 and 1.30 ± 0.30 respectively during anaesthesia, after recovery and at 24 hours. The serum creatinine level decreased during anaesthesia and recovery and increased to baseline value at 24 hours. The changes were not significant (Fig.17).

4.1.4.4. Total Protein: The total protein content (g/dl) was 7.00 ± 0.37 and 6.95 ± 0.40 before and after premedication respectively. It was 6.73 ± 0.38, 6.57 ± 0.37 and 7.07 ± 0.36 respectively during anaesthesia, after recovery and at 24 hours. There was significant decrease ($p<0.01$) in total protein content during anaesthesia and recovery. But it was increased by 24 hours though not significant (Fig.18).

4.1.4.5. Aspartate Amino Transferase: The aspartate amino transferase (AST) level (U/L) was 34.83 ± 2.32 and 37.67 ± 2.07 before and after premedication respectively. It was 39.50 ± 2.66, 35.83 ± 2.14 and 35.17 ± 1.47 respectively during anaesthesia, after recovery and at 24 hours. There was significant increase in AST level after premedication ($p<0.05$) and during anaesthesia ($p<0.01$), but with a decrease in trend towards the baseline value after recovery and by 24 hours (Fig.19).

4.1.4.6 Alanine Amino Transferase: The alanine amino transferase (ALT) level (U/L) was 43.83 ± 1.17and 44.83 ± 0.98 before and after premedication respectively. It was 46.67 ± 1.37, 44.17± 2.14 and 43.33 ± 1.75 during anaesthesia, after recovery and at 24 hours. There was increase in ALT after premedication, during anaesthesia and recovery. The increase during anaesthesia was significant ($P<0.01$). It decreased to the base line value by 24 hours (Fig.20).

4.1.4.7. Sodium: The sodium concentration (mEq/l) was 142.83 ± 3.87 and 138.33 ± 4.46 before and after premedication respectively. It was 138.17 ± 4.02, 140.33 ± 6.15 and 142.83 ± 2.04 respectively during anaesthesia, after recovery and at 24 hours. Sodium levels decreased after premedication and during anaesthesia and reached the baseline value after 24 hours. The decrease during anaesthesia was significant ($p<0.05$) (Fig.21).

4.1.4.8. Potassium: The potassium concentration (mEq/l) was 4.35 ± 0.32 and 4.57 ± 0.40 before and after premedication respectively. It was 4.63 ± 0.26, 4.80 ± 0.25 and 4.35 ± 0.32 respectively during anaesthesia, after recovery and at 24

hours. Potassium level increased after premedication during anaesthesia and at recovery, but the changes were not significant (Fig.22).

4.1.4.9. Chloride: The chloride concentration (mEq/l) was 103.50 ± 1.52 and 104.67 ± 1.37 before and after premedication respectively. It was 107.67 ± 1.51, 108.50 ± 1.87 and 103.83 ± 0.75 respectively during anaesthesia, after recovery and at 24 hours. There was significant increase in chloride level after premedication ($p<0.05$), during anaesthesia ($p<0.01$) and at recovery ($p<0.01$) and it decreased to the baseline values by 24 hours (Fig.23).

4.1.5. Post anaesthetic and Postoperative Complication(s), if any

All the animals had rapid and smooth recovery from anaesthesia and uneventful recovery from surgery.

4. RESULTS

4.2. GROUP II

Six animals were utilized for the study. The results obtained were observations are presented in Tables 3 to 10.

To the animals of this group, glycopyrrolate at the rate of 0.01 mg per kg body weight, followed by xylazine at the rate of 1 mg/kg body weight at 15 minutes interval were administered intramuscularly for premedication. Fifteen minutes later, propofol 1% emulsion at the rate of 4 mg per kg body weight was administered by intravenous bolus injection for induction of anaesthesia. Anaesthesia was maintained with isoflurane at three per cent level in pure oxygen at the rate of 10 ml/kg bodyweight by Bain's circuit system utilizing isoflurane vapourizer.

4.2.1. Clinical Observations (Table 5)

4.2.1.1. Clinical Signs: The common clinical signs exhibited by the dogs following premedication with glycopyrrolate-xylazine were and winking of the eye, licking, yawning in coordination of movements, and sitting on haunches followed by sternal recumbency with head down posture (Plate 4) within 15 minutes. Three animals (II_1, II_2, and I_4) vomited.

Induction of anaesthesia was smooth in all the animals following the administration of propofol. In two animals (II_1, II_3) apnoea persisted for a period of about one minute. The recovery from anaesthesia was uneventful in all the animals.

4.2.1.2. Time for Induction of Aanaesthesia: The time for induction of anaesthesia following the intravenous bolus injection of propofol was 0.83± 0.15 minutes (Fig.1).

4.2.1.3. Duration of Anaesthesia: The duration of anaesthesia was 35.83 ± 16.86 minutes (Fig.1).

4.2.1.4. Depth of Anaesthesia: Depth of anaesthesia was satisfactory in all the animals. The surgeries performed were correction of eventration due to disruption of surgical wound (II_1), overio-hysterectomy for pyometra (II_2), caesarean section (II_3 [Plate 3] II_5), resection of lipoma in a debilitated animal (II_4) and urethrotomy in acute urethral obstruction (II_6).

4.2.1.5. Recovery Time: The recovery time was 27.66 ± 11.79 minutes (Fig.1).

4.2.1.6. Degree of Muscle Relaxation: The degree of muscle relaxation was excellent in all the animals for performing the surgeries.

4.2.2. Physiological Observations (Table 6)

4.2.2.1. Rectal Temperature: The rectal temperature (°C) was 39.17 ± 1.07 and 38.95 ± 1.03 before and after premedication respectively. It was 38.47 ± 1.01, 38.12 ± 0.61 and 38.33 ± 1.17 respectively during anaesthesia, after complete recovery and at 24 hours. Temperature decreased after premedication, during anaesthesia and recovery and showed increase in trend at 24 hours. The changes in values were not significant (Fig.2).

4.2.2.2. Respiratory Rate: The respiratory rate (per min) was 40.33 ± 8.41 and 31.50 ± 3.94 before and after premedication respectively. It was 23.33 ± 4.41, 31.33 ± 3.98 and 41.50 ± 11.20 respectively, at during anaesthesia, after recovery and at 24 hours. There was significant decrease ($p<0.05$) in respiratory rate after premedication, during anaesthesia, and recovery. It returned to the near normal value by 24 hours (Fig.3).

4.2.2.3. Pulse Rate: The pulse rate (per min) was 73.33 ± 12.23 and 76.33 ± 3.72 before and after premedication respectively. It was 89.00 ± 16.71, 84.83 ± 15.42 and 74.17 ± 13.96 respectively, during anaesthesia, after recovery and at 24 hours. Pulse rate increased after premedication, during anaesthesia and recovery

and by 24 hours it was decreased to the baseline values. But the changes were not significant (Fig.4).

4.2.2.4. Colour of Visible Mucous Membrane: The colour of visible mucous membrane was pale roseate in all animals throughout the period of study except in one animal (II_5) in which pale mucous membrane was observed during anaesthesia.

4.2.2.5. Capillary Refill Time: The capillary refill time (in seconds) was 1.00 ± 0 and 1.50 ± 0.55 before and after premedication respectively. It was 2.00 ± 0, 1.33 ± 0.52 and 1.00 ± 0 respectively during anaesthesia, after recovery and at 24 hours. There was an increase in capillary refill time after premedication and during anaesthesia, and returned to the baseline value by 24 hours (Fig.5).

4.2.2.6. Pulse Oximetry: The oxygen saturation (SpO_2) level (%) was 88.00 ± 1.10 and 88.00 ± 0.89 before and after premedication respectively. It was 95.83 ± 2.04, 93.83 ± 3.19 and 89.67 ± 2.80 respectively during anaesthesia, after recovery and at 24 hours. There was significant increase ($P<0.01$) in oxygen saturation level during anaesthesia and recovery and it decreased to baseline value by 24 hours (Fig.6).

4.2.2.7. Electrocardiogram: Electrocardiographic (ECG) changes noticed following premedication were first degree heart block (II_2), second degree heart block (II_4) sinus arrest (II_6). During anaesthesia, the changes noticed were peaked T wave (II_6) and ventricular premature contractions (II_2) (Plate 6 and 7).

4.2.3. Haematological Observations (Table 7 & 8)

4.2.3.1. Erythrocyte Sedimentation Rate: The erythrocyte sedimentation rate (ESR) (mm/hr) was 2.33 ± 0.82 and 1.83 ± 0.75 before and after premedication respectively. It was 1.50 ± 1.38, 1.67 ± 1.21 and 1.67 ± 0.52 respectively during anaesthesia, after recovery and at 24 hours. The ESR decreased after

premedication, during anaesthesia, after recumbency and 24 hours. The values were not significant (Fig.7).

4.2.3.2. Haemoglobin Concentration: The haemoglobin (g/dl) was 9.17 ± 0.61 and 9.08 ± 0.51 before and after premedication respectively. It was 8.80 ± 0.51, 8.82 ± 0.52 and 9.27 ± 0.55 respectively during anaesthesia, after recovery and at 24 hours. There was decrease in haemoglobin concentration during anaesthesia ($P<0.01$) and recovery ($P<0.05$). It increased to baseline value by 24 hours (Fig.8).

4.2.3.3. Volume of Packed Red Cells: The volume of packed red cells (VPRC) (%) was 27.17 ± 1.72 and 26.67 ± 1.63 before and after premedication respectively. It was 25.33 ± 1.75, 25.50 ± 1.87 and 28.00 ± 1.79 respectively during anaesthesia, after recovery and at 24 hours. There was significant decrease in VPRC during anaesthesia ($P<0.01$) and recovery ($P<0.05$). It increased to the baseline value by 24 hours (Fig.9).

4.2.3.4. Total Leukocyte Count: The total leukocyte count (TLC) ($10^3/mm^3$) was 14.23 ± 3.38 and 14.08 ± 3.33 before and after premedication respectively. It was 13.55 ± 3.97, 13.93 ± 3.24 and 14.32 ± 3.26 respectively during anaesthesia, after recovery and at 24 hours. Total leukocyte count was decreased during anesthesia and recovery, and increased to the baseline value by 24 hours. The decrease during recovery was significant ($P<0.05$) (Fig.10).

4.2.3.5. Differential Leukocyte Count

4.2.3.5.1. Neutrophills: The neutrophil count (%) was 71.33 ± 1.97 and 73.33 ± 2.07 before and after premedication respectively. It was 74.17 ± 2.04, 74.00 ± 1.79 and 71.83 ± 1.60 respectively during anaesthesia, after recovery and at 24 hours. There was significant increase ($P<0.01$) in neutrophill count after premedication, during anaesthesia and recovery. It decreased to baseline value by 24 hours (Fig.11).

4.2.3.5.2 Lymphocyte: The lymphocyte count (%) was 25.67 ± 2.25 and 23.67 ± 2 .42 before and after premedication respectively. It was 23.33 ± 2.16, 23.50 ± 2.26 and 24.67 ± 2.42 respectively at during anaesthesia, after recovery and at 24 hours. There was significant decrease in lymphocyte count after premedication, ($P<0.01$) during anaesthesia, recovery and at 24 hours ($P<0.05$) (Fig.12).

4.2.3.5.3 Monocytes: The monocyte count (%) was 0.67 ± 0.82 and 0.83 ± 0.40 before and after premedication respectively. It was 1.00 ± 0.89, 0.83 ± 0.40 and 0.83 ± 0.40 respectively during anaesthesia, after recovery and at 24 hours. There was an increase in the monocyte count after premedication and during anaesthesia with decrease in trend at recovery (Fig.13).

4.2.3.5.4 Eosinophills: The eosinophill count (%) was 2.16 ± 1.16 and 2.17 ± 1.16 before and after premedication respectively. It was 2.17 ± 0.89, 2.33 ± 1.21 and 1.83 ± 0.98 respectively during anaesthesia, after recovery and at 24 hours. Marginal variations were noticed after premedication, during anaesthesia, after recovery and at 24 hours (Fig.14).

4.2.4. Serum Constituents (Table 9 & 10)

4.2.4.1. Glucose: The glucose level (mg/dl) was 67.00 ± 7.32 and 70.00 ± 7.98 before and after premedication respectively. It was 75.17 ± 7.39, 79.33 ± 7.87 and 73.00 ± 3.90 respectively during anaesthesia, after recovery and at 24 hours. There was significant increase ($P<0.01$) in serum glucose level after premedication, during anaesthesia and recovery. The increase at 24 hours was also significant ($P<0.05$), though it was with decrease in trend towards the base-line value (Fig.15).

4.2.4.2. Blood Urea Nitrogen: The blood urea nitrogen (BUN) level (mg/dl) was 17.17 ± 3.37 and 17.50 ± 3.83 before and after premedication respectively. It was 18.33 ± 4.84, 17.75 ± 4.45 and 17.33 ± 3.89 respectively during anaesthesia, after recovery and at 24 hours. There was an increase in BUN level during

anaesthesia and decreased to the base-line value at recovery. The changes were not significant (Fig.16).

4.2.4.3. Creatinine: The creatinine level (mg/dl) was 1.10 ± 0.41 and 1.18 ± 0.52 before and after premedication respectively. It was 1.08 ± 0.53, 0.96 ± 0.45 and 1.25 ± 0.49 respectively during anaesthesia, after recovery and at 24 hours. The creatinine level decreased during anaesthesia and recovery and increased to baseline at 24 hours. The changes were not significant (Fig.17).

4.2.4.4. Total Protein: The total protein content (g/dl) was 7.08 ± 0.27 and 7.00 ± 0.25 before and after premedication respectively. It was 6.80 ± 0.28, 6.82 ± 0.29 and 6.95 ± 0.33 respectively during anaesthesia, after recovery and at 24 hours. There was significant decrease ($P<0.01$) in total protein content after premedication and during anaesthesia. At recovery and by 24 hours it was with an increase inn trend towards the base-line value (Fig.18).

4.2.4.5. Aspartate Amino Transferase: The aspartate amino transferase (AST) level (U/L) was 47.67 ± 17.44 and 49.00 ± 17.74) before and after premedication respectively. It was 50.67 ± 17.77, 50.67 ± 17.19 and 48.17 ± 17.70 respectively during anaesthesia, after recovery and at 24 hours. There was significant increase in AST level after premedication ($P<0.05$), during anaesthesia ($P<0.01$) and recovery ($P>0.01$). But it decreased to baseline value by 24 hours (Fig.19).

4.2.4.6. Alanine Amino Transferase: The alaninne amino transferase (ALT) level (U/L) was 35.67± 7.09 and 36.33 ± 6.65 before and after premedication respectively. It was 38.17 ± 6.62, 37.67 ± 6.80 and 35.83 ± 7.08 during anaesthesia after recovery and at 24 hours. There was an increase in the ALT level after premedication, during anaesthesia and recovery. The increase was significant ($P<0.01$) during anaesthesia. The ALT level decreased to the base-line value by 24hours (Fig.20).

4.2.4.7. Sodium: The sodium concentration (mEq/l) was 136.83 ± 3.92 and 135.50 ± 4.51 before and after premedication respectively. It was 133.67 ± 4.32,

134.83 ± 3.66 and 137.17 ± 3.54 respectively during anaesthesia, after recovery and at 24 hrs. The decrease in sodium levels were significant after premedication ($P<0.05$), during anaesthesia ($P<0.01$) and at recovery ($P<0.05$). But by 24 hours, it increased to the baseline value (Fig.21).

4.2.4.8. Potassium: The potassium concentration (mEq/L) was 4.20 ± 0.17 and 4.37 ± 0.16 before and after premedication respectively. It was 4.55 ± 0.14, 4.45 ± 0.11 and 4.27 ± 0.12 respectively during anaesthesia, after recovery and at 24 hours. Potassium level increased after premedication during anaesthesia and at recovery, but the changes were insignificant (Fig.22).

4.2.4.9. Chloride: The chloride concentration (mEq/l) was 106.33± 4.13 and 107.17 ± 3.87 before and after premedication respectively. It was 108.83 ± 4.07, 107.83 ± 4.45 and 106.17 ± 4.62 respectively during anaesthesia, after recovery and at 24 hours. There was significant increase in chloride level after premedication ($P<0.01$), during anaesthesia ($P<0.01$) and at recovery ($P<0.05$). It decreased to baseline value by 24 hours (Fig.23).

4.2.5. Post anaesthetic and Postoperative Complication(s), if any

All the animals had rapid and smooth recovery from anaesthesia (Plate 5) and uneventful recovery from surgery.

Table 1. Normal values of physiological and haematological parameters and serum constituents of dogs
(Courtesy: Benjamin, 1985 and Chauhan and Agarwal, 2006)

Physiological parameters	Range	Haematological parameters	Range	Serum constituents	Range
Rectal temperature (°C)	37.50-39.20	Erythrocyte sedimentation rate (mm/h)	1-6	Serum glucose (mg/dl)	55-90
Respiratory Rate (per min)	10-30	Haemoglobin concentration (g/dl)	12-18	Blood urea nitrogen (mg/dl)	10-20
Pulse rate	90-100	Volume of packed red cells (%)	37-54	Serum creatinine (mg/dl)	1.0-2.7
Capillary refill time	1-2 sec	Total leukocyte count (10^3/mm^3)	8.2-13.5	Total protein (g/dl)	6.1-7.8
Oxygen saturation (SpO_2) (per cent)	>95%	Lymphocytes (%)	12-30	Aspartate amino transferase (U/L)	10-62
		Neutrophils (%)	60-75	Alanine amino transferase (U/L)	25-92
		Eosinophils (%)	2-10	Serum sodium (mEq/l)	140-154
		Monocytes (%)	3-9	Serum potassium (mEq/l)	3.7-5.8
		Basophils (%)	0-1	Serum chloride (mEq/l)	108-119

Table 2. Observations on, age, sex, breed disease/condition, and surgery performed (Group I)

Animal Number	Age	Sex	Breed	Disease/Condition	Surgery performed
I_1	2 years	F	Non Descript	Brought for spaying	Oophorectomy
I_2	1½ years	F	Non Descript	Brought for spaying	Oophorectomy
I_3	8 years	F	Non Descript	Brought for spaying	Oophorectomy
I_4	6 years	F	Doberman	Brought for spaying	Oophorectomy
I_5	6 years	M	German Shepherd Dog	Haematoma auris pinnae	Operation for haematoma
I_6	9 years	F	German Shepherd Dog	Mammary tumour	Tumour resection

Table 3. Observations on, age, sex, breed disease/condition, health status and surgery performed (Group II)

Animal Number	Age	Sex	Breed	Condition	Health status	Surgery performed
II_1	1½ years	F	German Shepherd Dog	Eventration- disruption of surgical wound	Compromised	Correction of eventration
II_2	10 years	F	German Shepherd Dog	Pyometra in a geriatric dog	Compromised	Ovario-hysterectomy
II_3	2 years	F	Bull Mastiff	Dystocia	Compromised	Caesarean section
II_4	4 years	M	German Shepherd Dog	Lipoma ventral thoracic region-debilitated dog	Compromised	Resection of tumour
II_5	6 years	F	Dachshund	Dystocia	Compromised	Caesarean section
II_6	9 years	M	Dachshund	Acute urethral obstruction	Compromised	Urethrotomy

Table 4. Body weight and quantities of drugs administered (Mean ± SD)

n=6

Groups	Body weight (kg)	Glycopyrrolate (mg)	Xylazine (mg)	Propofol (mg)
I	21.08 ± 10.04	1.06 ± 0.50	1.06 ± 0.50	8.43 ± 4.02
II	23.50 ± 9.18	1.78 ± 0.46	1.78 ± 0.46	9.40 ± 3.67

Table 5. Time of induction, duration of anaesthesia, depth of anaesthesia, recovery time and degree of muscle relaxation

n = 6

Clinical observations	I	II
Time of induction of anaesthesia (minutes)	1.11 ± 0.25	0.83 ± 0.15
Duration of surgical anaesthesia (minutes)	29.66 ± 6.05	35.85 ± 16.86
Depth of anaesthesia	Satisfactory	Satisfactory
Recovery time (minutes)	27.50 ± 10.36	27.66 ± 11.79
Degree of muscle relaxation	Excellent	Excellent

Table 6. Observations on respiratory rate, pulse rate, rectal temperature, capillary refill time and oxygen saturation before and after premedication during anaesthesia, after recovery and 24 hours (Group I and II) Mean ± SD

n = 6

Parameters	Group	Premedication		During anaesthesia	Recovery	24 hours
		Before	After			
Respiratory rate (per min)	I	36.50 ± 3.78	26.67 ± 2.66**	18.50 ± 2.59**	26.83 ± 1.94**	37.17 ± 2.56
	II	40.33 ± 8.41	31.50 ± 3.94*	23.33 ± 4.41*	31.33 ± 3.98*	41.50 ± 11.20
Pulse rate (per min)	I	83.00 ± 4.86	94.33 ± 5.13**	101.67 ± 3.20**	96.67 ± 2.07**	80.67 ± 2.73
	II	73.33 ± 12.23	76.33 ± 3.72	89.00 ± 16.71	84.83 ± 15.42	74.17 ± 13.96
Rectal temperature (°C)	I	38.87 ± 0.96	37.22 ± 1.72	34.60 ± 1.79**	35.43 ± 3.57*	38.78 ± 0.81
	II	39.17 ± 1.07	38.95 ± 1.03	38.47 ± 1.01	38.12 ± 0.61	38.33 ± 1.17
Capillary refill time (sec)	I	1.00 ± 0.00	1.17 ± 0.41	1.83 ± 0.41	1.67 ± 0.52	1.00 ± 0.00
	II	1.00 ± 0.00	1.50 ± 0.55	2.00 ± 0.00	1.33 ± 0.52	1.00 ± 0.00
Oxygen saturation (SpO_2) per cent	I	86.00 ± 1.90	86.50 ± 0.55	95.67 ± 2.25**	97.00 ± 1.10**	86.17 ± 0.75
	II	88.00 ± 1.10	88.00 ± 0.89	95.83 ± 2.04**	93.83 ± 3.19**	89.67 ± 2.80

* $P<0.05$
** $P<0.01$

Table 7. Observations on erythrocyte sedimentation rate, haemoglobin concentration, volume of packed red cells and total leukocyte count before and after premedication during anaesthesia, after recovery and 24 hours (Group I and II) Mean ± SD

n = 6

Parameters	Group	Premedication		During anaesthesia	Recovery	24 hours
		Before	After			
Erythrocyte sedimentation rate (mm/h)	I	1.17 ± 0.41	1.67 ± 0.82	2.00 ± 0.63**	2.00 ± 0.89*	0.50 ± 0.55
	II	2.33 ± 0.82	1.83 ± 0.75	1.50 ± 1.38	1.67 ± 1.21	1.67 ± 0.52
Haemoglobin concentration (g/dl)	I	11.70 ± 0.90	11.63 ± 1.03	10.78 ± 0.91**	11.17 ± 0.80**	11.68 ± 0.86
	II	9.17 ± 0.61	9.08 ± 0.51	8.80 ± 0.51**	8.82 ± 0.52*	9.27 ± 0.55
Volume of packed red cells (%)	I	35.33 ± 1.21	33.67 ± 1.75*	30.00 ± 2.10**	31.33 ± 2.07**	35.67 ± 1.21
	II	27.17 ± 1.72	26.67 ± 1.63	25.33 ± 1.75**	25.50 ± 1.87*	28.00 ± 1.79
Total leukocyte count ($10^3/mm^3$)	I	12.97 ± 1.36	12.85 ± 1.35**	12.65 ± 1.27**	12.80 ± 1.29**	12.62 ± 1.31
	II	14.23 ± 3.38	14.08 ± 3.33	13.55 ± 3.97	13.93 ± 3.24*	14.32 ± 3.26

* $P<0.05$
** $P<0.01$

Table 8. Observations on neutrophils, lymphocyte, monocytes, eosinophils before and after premedication during anaesthesia, after recovery and 24 hours (Group I and II) Mean ± SD

n = 6

Parameters	Group	Premedication		During anaesthesia	Recovery	24 hours
		Before	After			
Neutrophils (%)	I	68.83 ± 3.37	68.17 ± 3.76	70.17 ± 4.54	70.00 ± 3.16	66.83 ± 3.49
	II	71.33 ± 1.97	73.33 ± 2.07**	74.17 ± 2.04**	74.00 ± 1.79**	71.83 ± 1.60
Lymphocyte (%)	I	23.50 ± 3.67	21.50 ± 3.78**	19.33 ± 2.88**	20.00 ± 4.56**	21.83 ± 3.60*
	II	25.67 ± 2.25	23.67 ± 2.42**	23.33 ± 2.16*	23.50 ± 2.26*	24.67 ± 2.42*
Monocytes (%)	I	2.83 ± 1.16	3.33 ± 0.81	4.33 ± 0.81	2.67 ± 0.51	2.50 ± 0.54
	II	0.67 ± 0.82	0.83 ± 0.40	1.00 ± 0.89	0.83 ± 0.40	0.83 ± 0.40
Eosinophils (%)	I	2.16 ± 0.75	1.50 ± 0.54	2.00 ± 0.89	2.50 ± 0.54	1.67 ± 0.51
	II	2.16 ± 1.16	2.17 ± 1.16	2.00 ± 0.89	2.33 ± 1.21	1.83 ± 0.98

* P<0.05
** P<0.01

Table 9. Observations on serum glucose, total protein, serum sodium, serum potassium and serum chloride before and after premedication during anaesthesia, after recovery and 24 hours (Group I and II) Mean ± SD

n = 6

Parameters	Group	Premedication		During anaesthesia	Recovery	24 hours
		Before	After			
Serum glucose (mg/dl)	I	64.33 ± 3.50	79.67 ± 2.07**	102.83 ± 0.98**	109.00 ± 3.03**	85.67 ± 2.34**
	II	67.00 ± 7.32	70.00 ± 7.98**	75.17 ± 7.39**	79.33 ± 7.87**	73.00 ± 3.90*
Total protein (g/dl)	I	7.00 ± 0.37	6.95 ± 0.40	6.73 ± 0.38**	6.57 ± 0.37**	7.07 ± 0.36
	II	7.08 ± 0.27	7.00 ± 0.25**	6.80 ± 0.28**	6.82 ± 0.29	6.95 ± 0.33
Serum sodium (mEq/l)	I	142.83 ± 3.87	138.33 ± 4.46	138.17 ± 4.02*	140.33 ± 6.15	142.83 ± 2.04
	II	136.83 ± 3.92	135.50 ± 4.51*	133.67 ± 4.32**	134.83 ± 3.66*	137.17 ± 3.54
Serum potassium (mEq/l)	I	4.35 ± 0.32	4.57 ± 0.40	4.63 ± 0.26	4.80 ± 0.25	4.35 ± 0.32
	II	4.20 ± 0.17	4.37 ± 0.16	4.55 ± 0.14	4.45 ± 0.11	4.27 ± 0.12
Serum chloride (mEq/l)	I	103.50 ± 1.52	104.67 ± 1.37*	107.67 ± 1.51**	108.50 ± 1.87**	103.83 ± 0.75
	II	106.33 ± 4.13	107.17 ± 3.87**	108.83 ± 4.07**	107.83 ± 4.45*	106.17 ± 4.62

Table 10. Observations on serum creatinine, blood urea nitrogen, aspartate amino transferase and alanine amino transferase before and after premedication during anaesthesia, after recovery and 24 hours (Group I and II) Mean ± SD n=6

Parameters	Group	Premedication		During anaesthesia	Recovery	24 hours
		Before	After			
Serum creatinine (mg/dl)	I	1.42 ± 0.40	1.43 ± 0.42	1.38 ± 0.52	1.37 ± 0.49	1.30 ± 0.30
	II	1.10 ± 0.41	1.18 ± 0.52	1.08 ± 0.53	0.96 ± 0.45	1.25 ± 0.49
Blood urea nitrogen (mg/dl)	I	17.83 ± 2.32	19.00 ± 1.41	19.00 ± 2.00	18.17 ± 1.47	18.50 ± 1.64
	II	17.17 ± 3.37	17.50 ± 3.83	18.33 ± 4.84	17.75 ± 4.45	17.33 ± 3.89
Aspartate amino transferase (U/L)	I	34.83 ± 2.32	37.67 ± 2.07*	39.50 ± 2.66**	35.83 ± 2.14	35.17 ± 1.47
	II	47.67 ± 17.44	49.00 ± 17.74*	50.67 ± 17.77**	50.67 ± 17.19**	48.17 ± 17.70
Alanine amino transferase (U/L)	I	43.83 ± 1.17	44.83 ± 0.98	46.67 ± 1.37**	44.17 ± 2.14	43.33 ± 1.75
	II	35.67 ± 7.09	36.33 ± 6.65*	38.17 ± 6.62**	37.67 ± 6.80**	35.83 ± 7.08

* P<0.05
** P<0.01

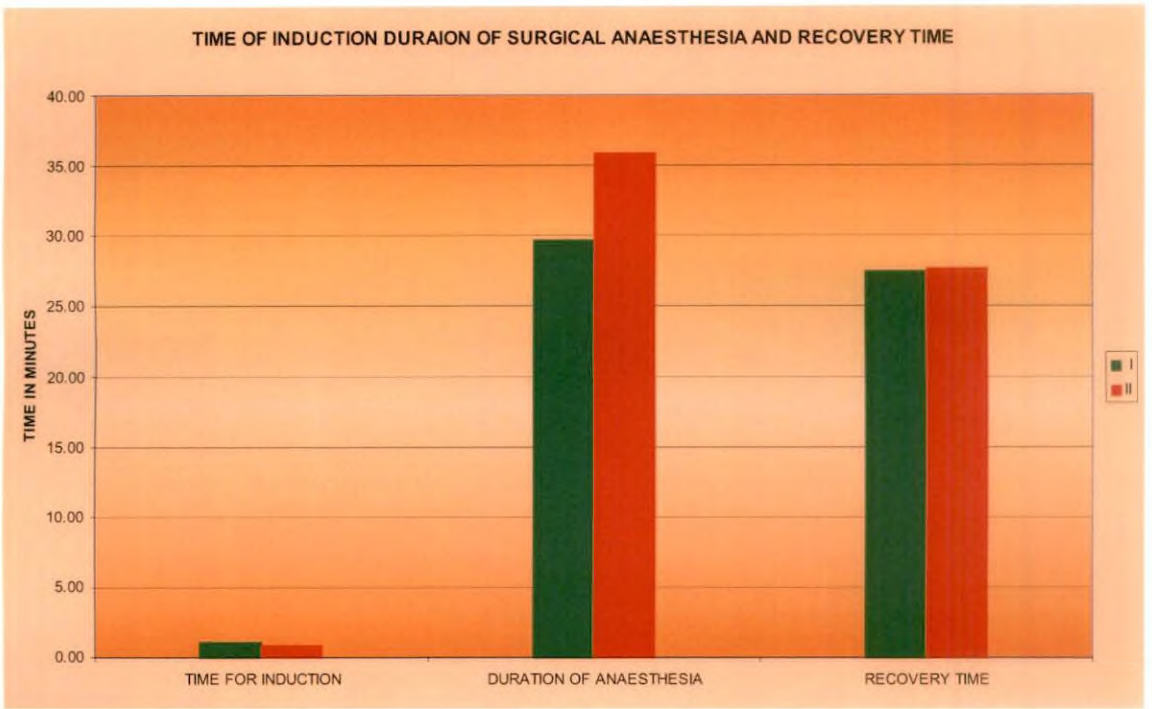


Fig.1: Mean Time of Induction, Duration of Surgical Anaesthesia and Recovery Time

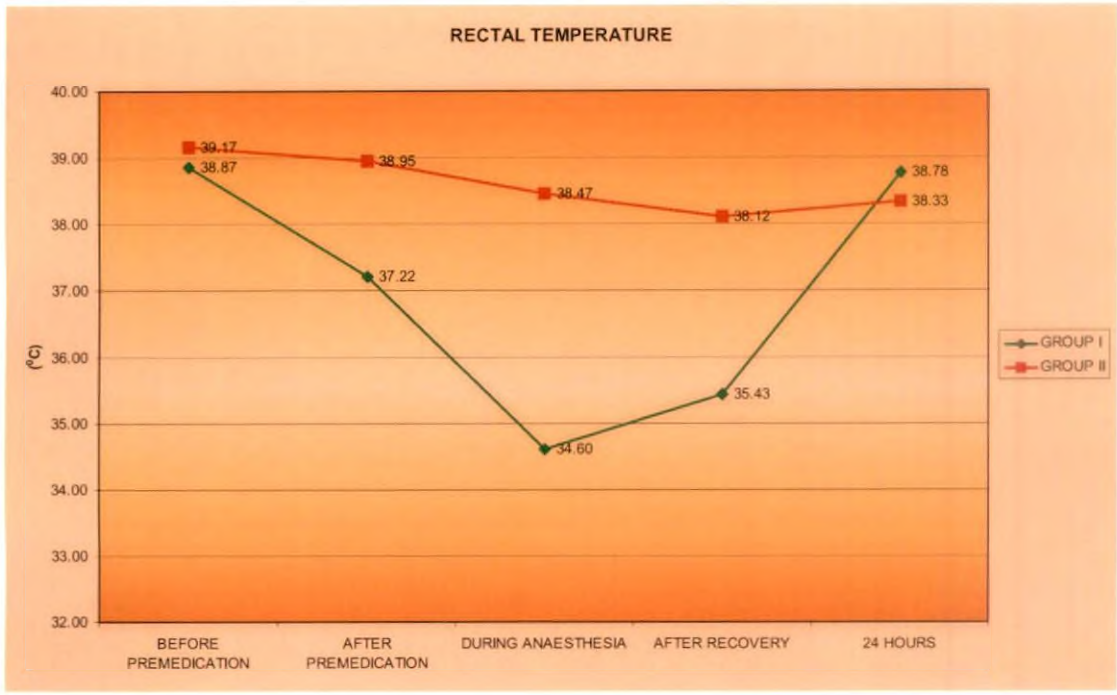


Fig.2: Mean Rectal Temperature

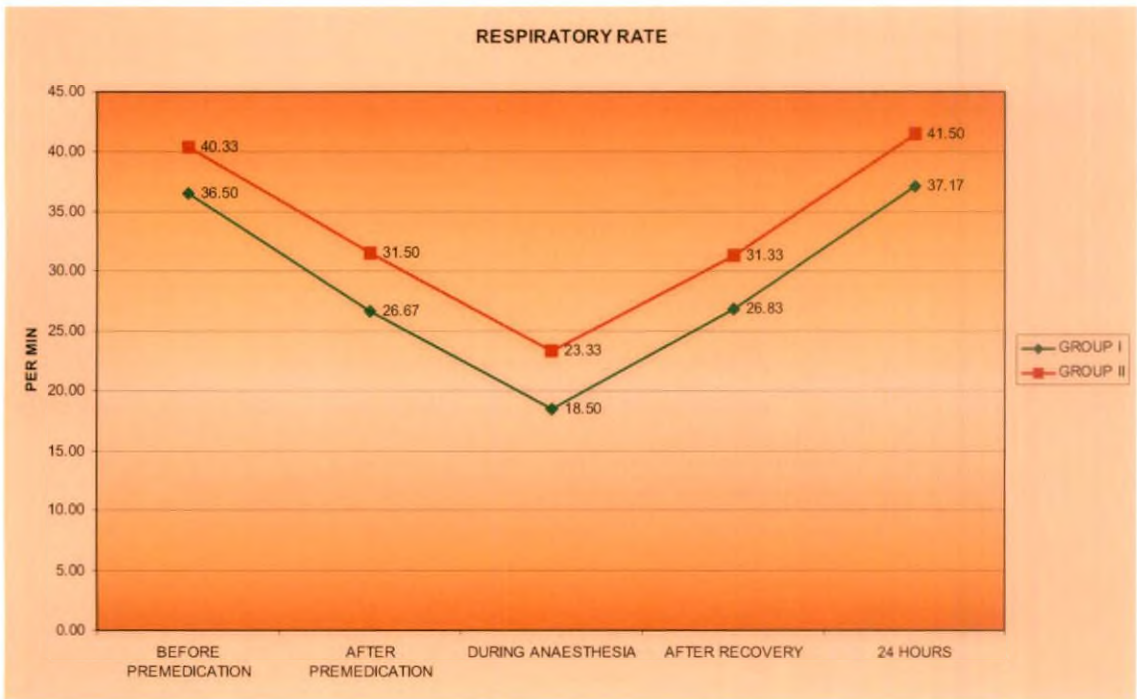


Fig.3: Mean Respiratory Rate

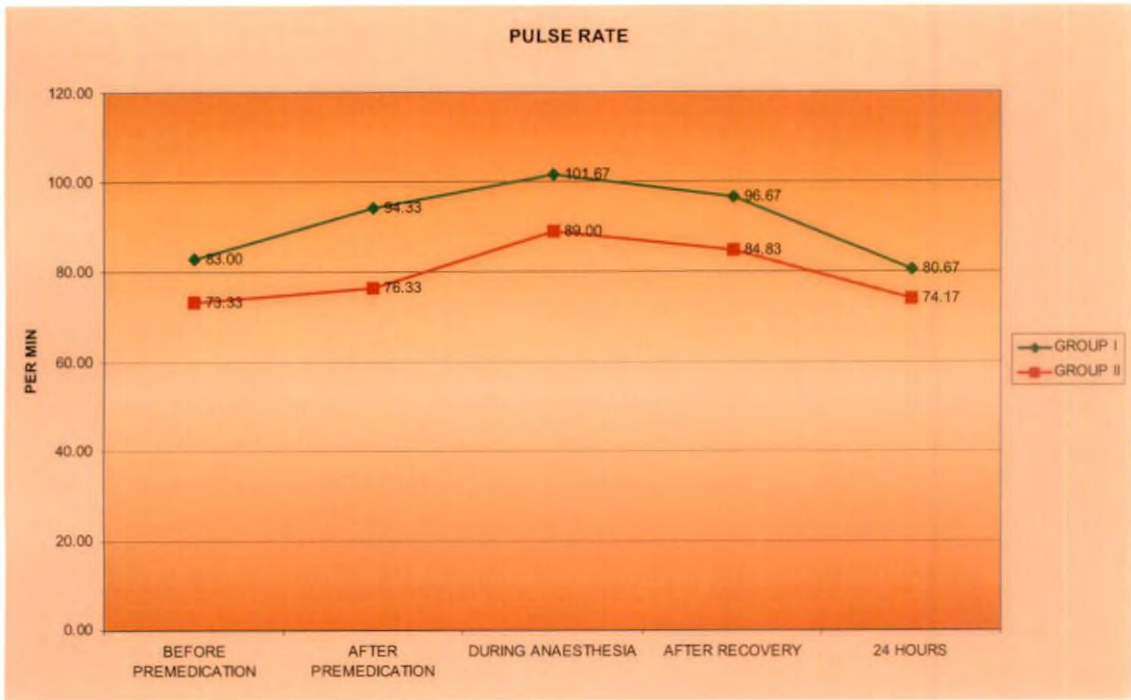


Fig.4: Mean Pulse Rate

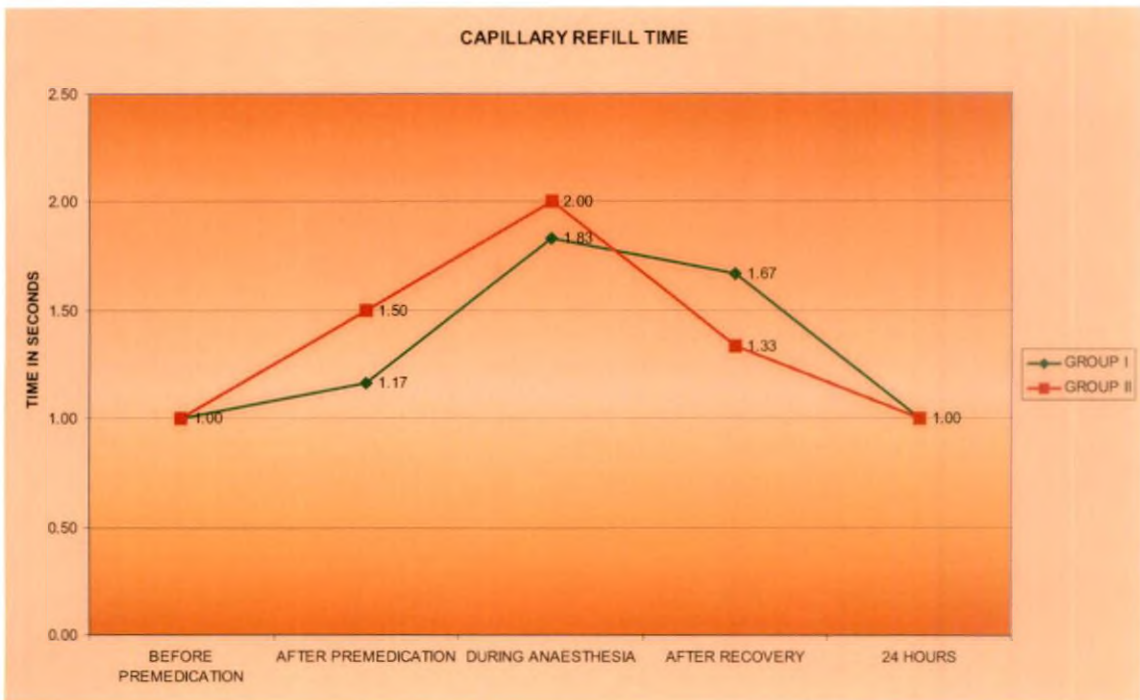


Fig.5: Mean Capillary Refill Time

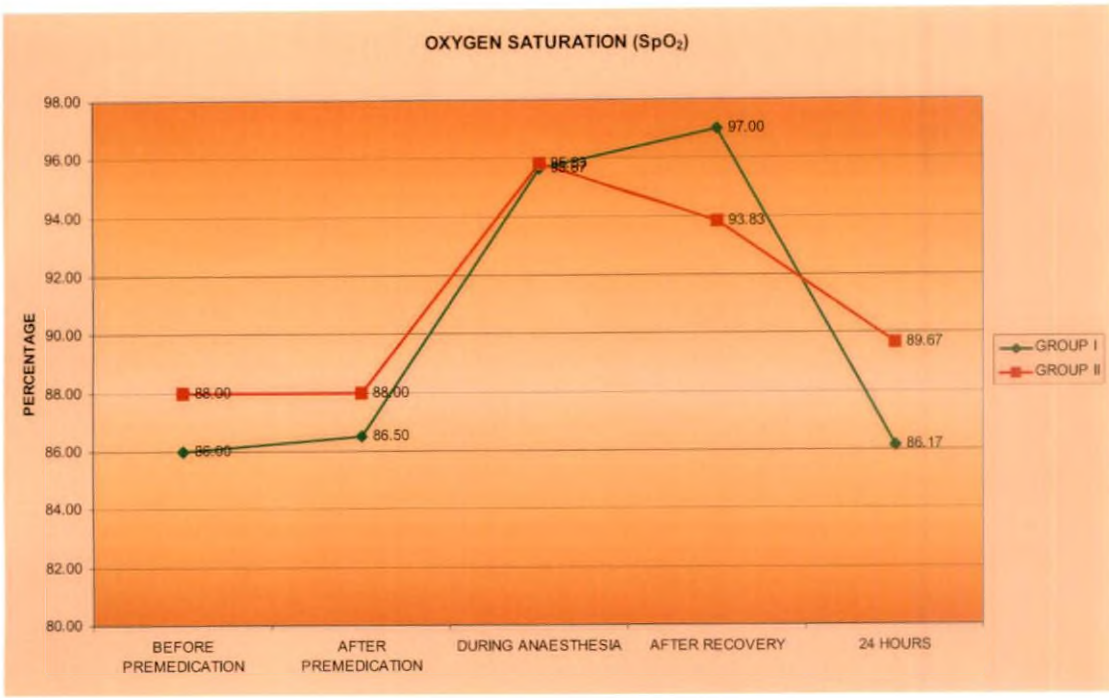


Fig.6: Mean Oxygen Saturation Level

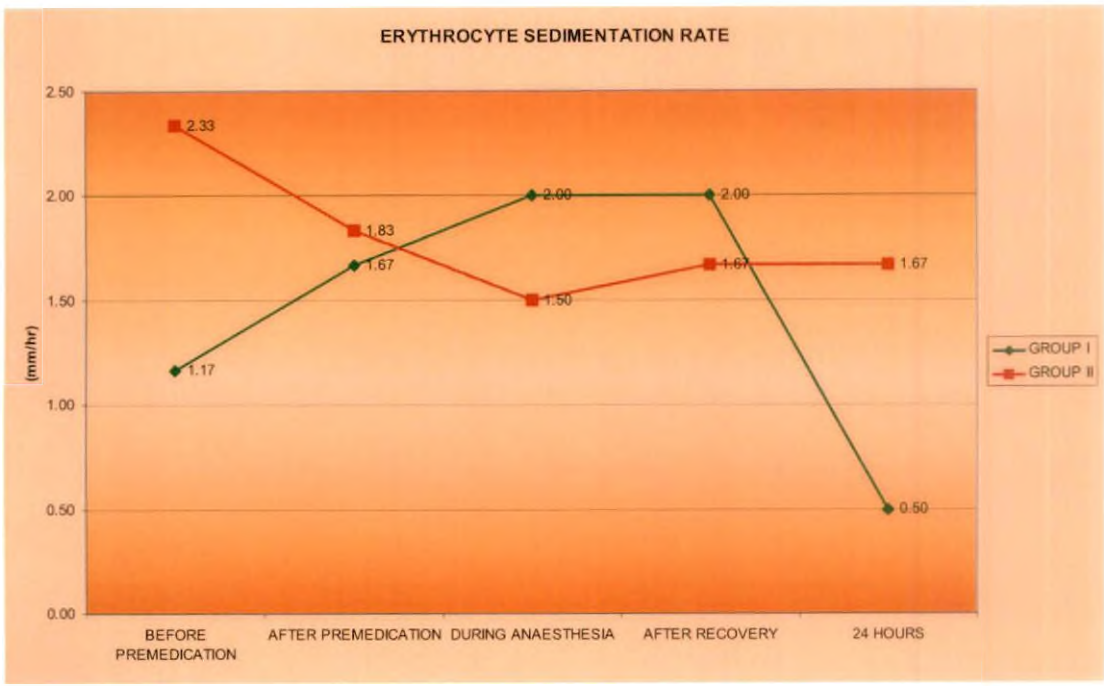


Fig.7: Mean Erythrocyte Sedimentation Rate

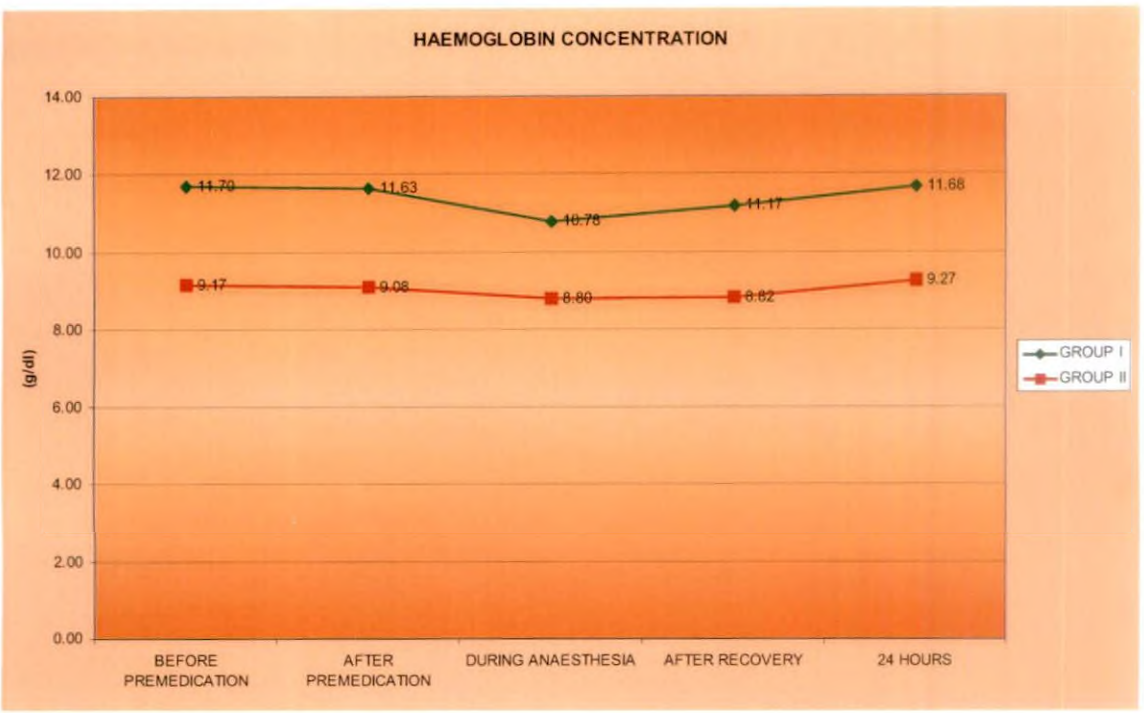


Fig.8: Mean Haemoglobin Concentration

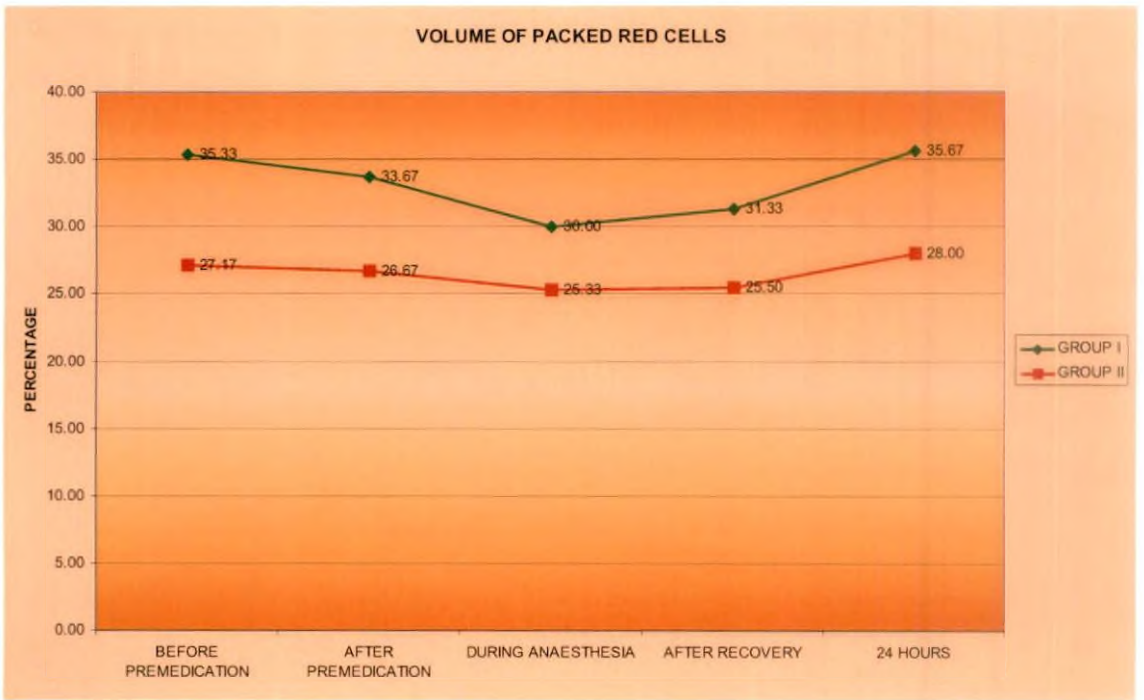


Fig.9: Mean Volume of Packed Red Cells

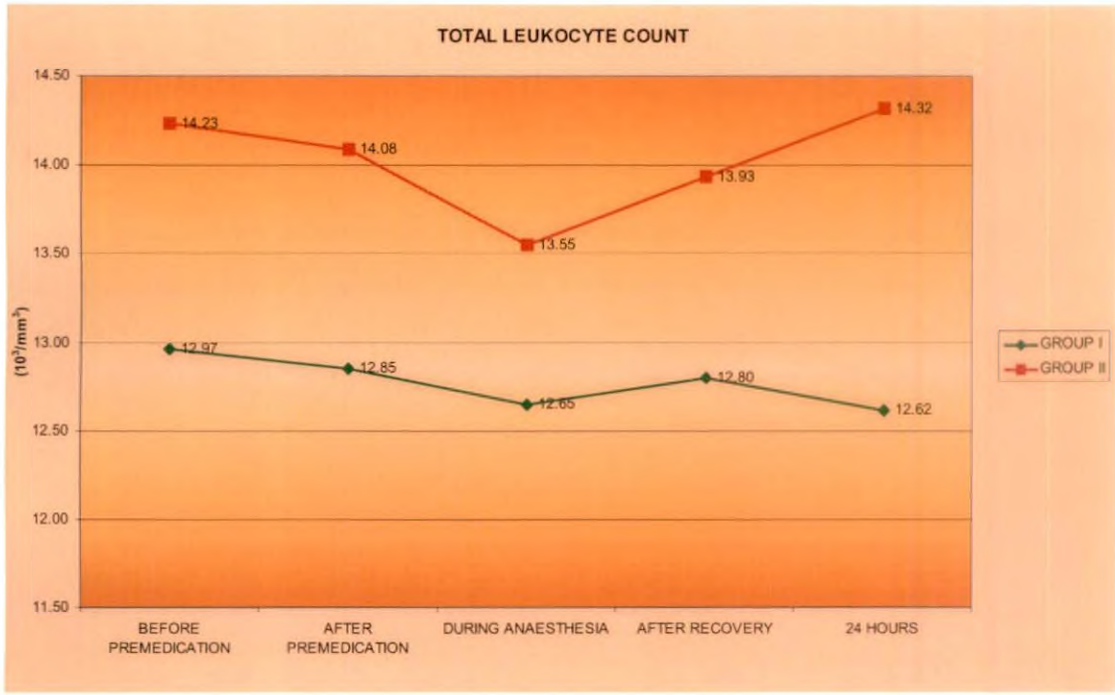


Fig.10: Mean Total Leukocyte Count

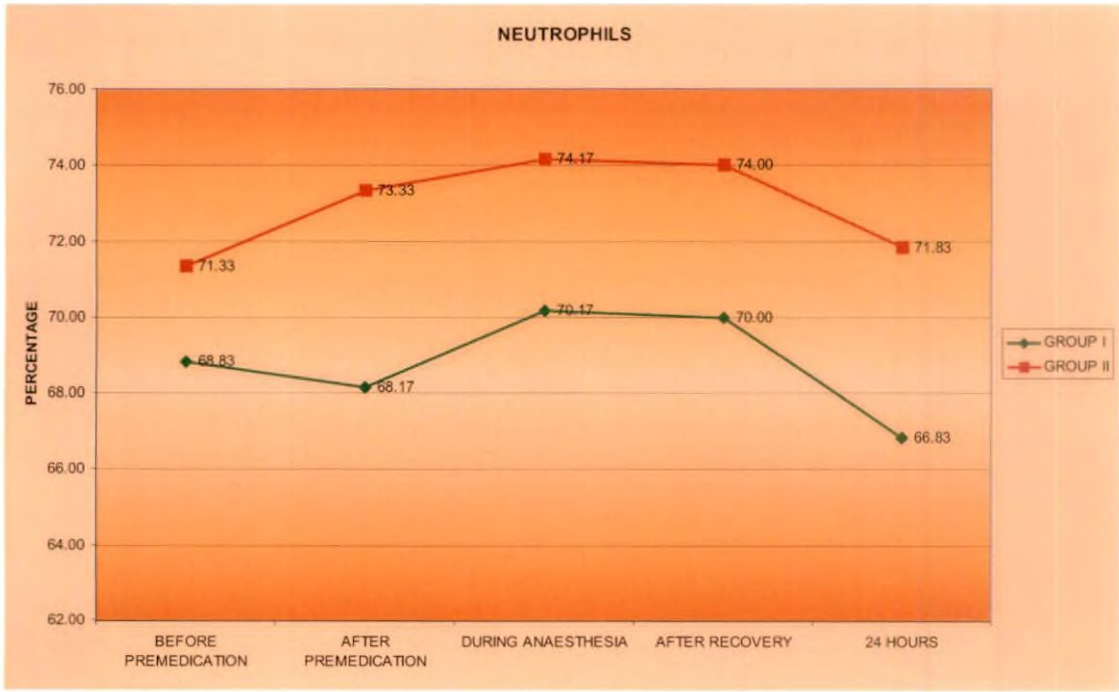


Fig.11: Mean Neutrophil Count

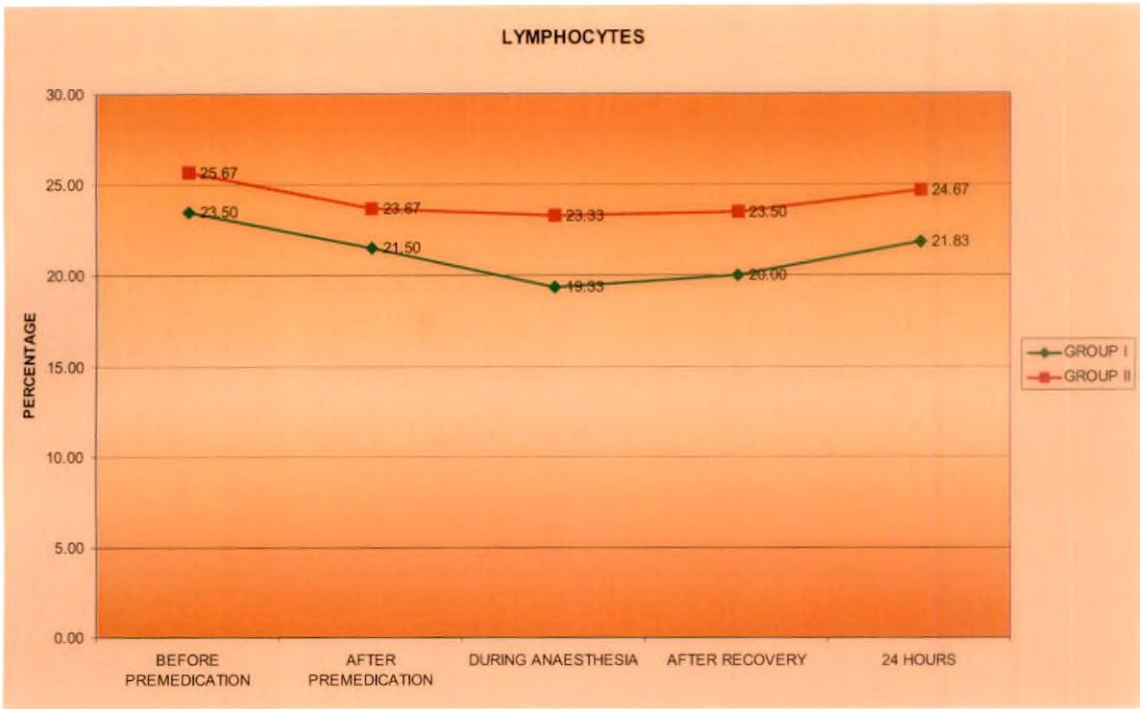


Fig.12: Mean Lymphocyte Count

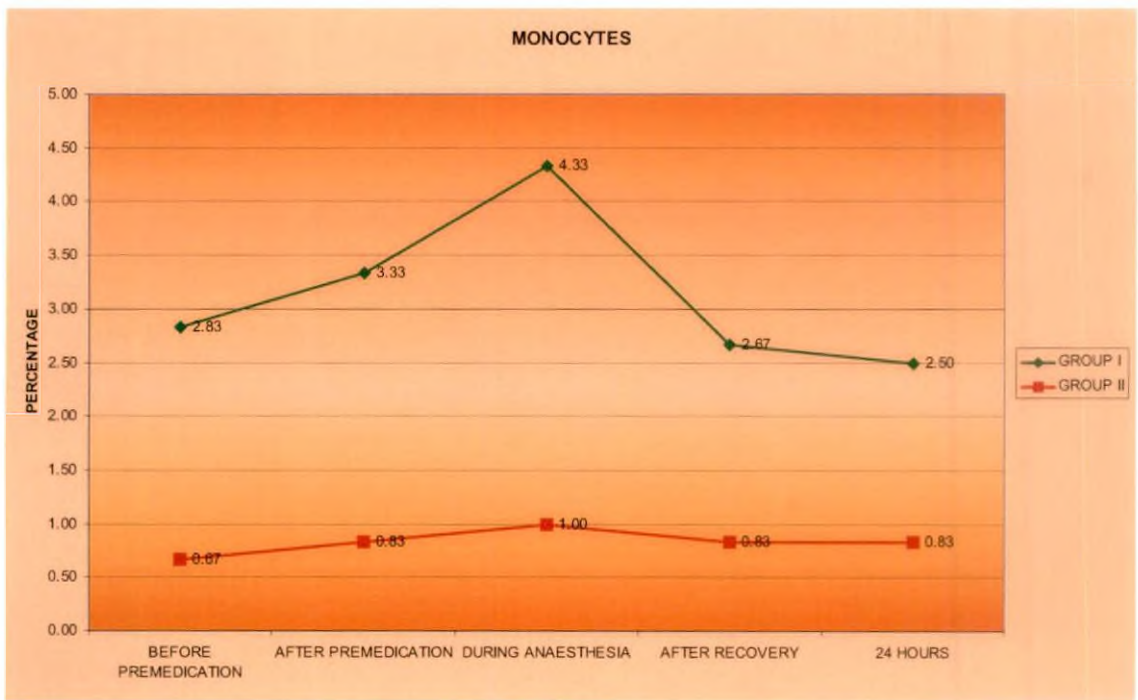


Fig.13: Mean Monocyte Count

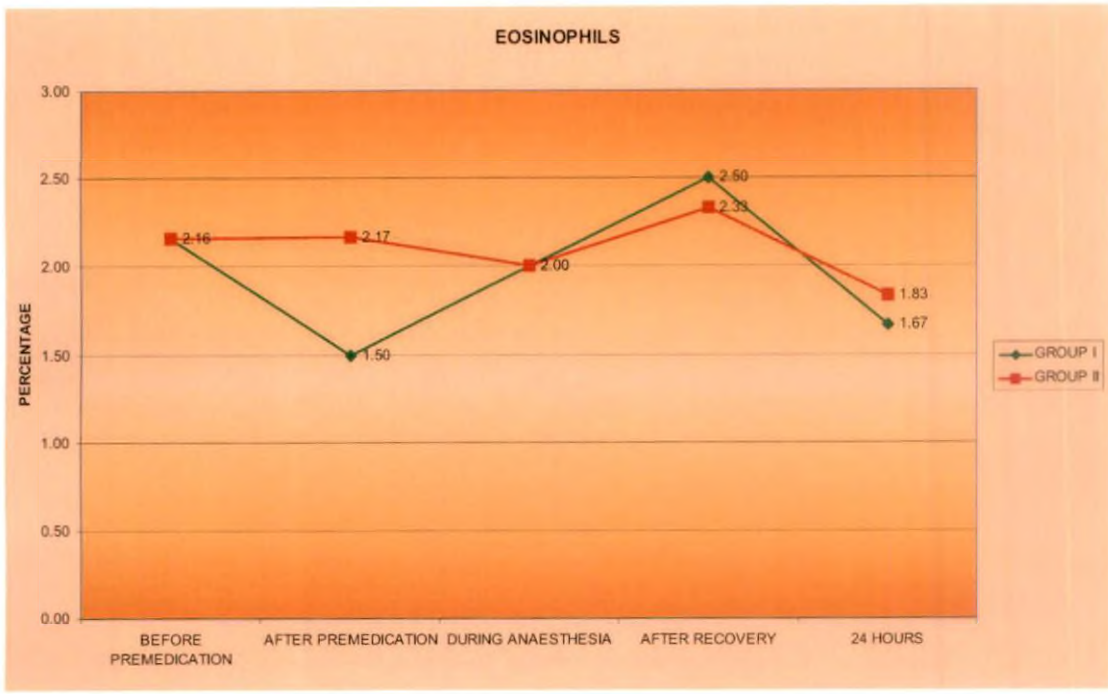


Fig.14: Mean Eosinophil Count

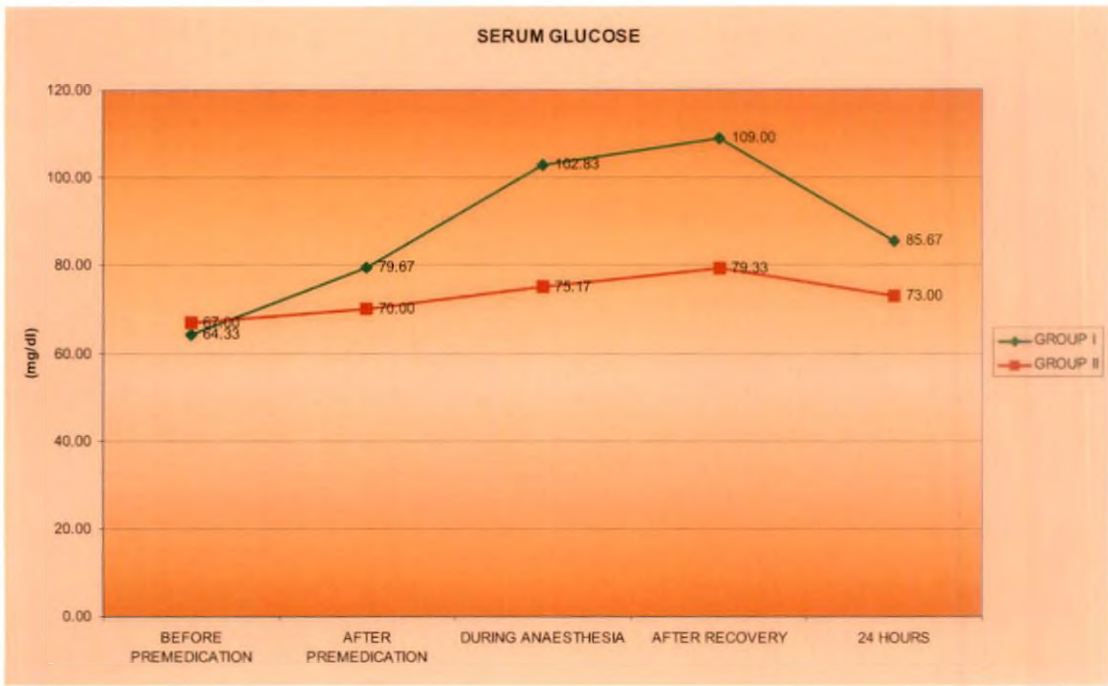


Fig.15: Mean Serum Glucose Level

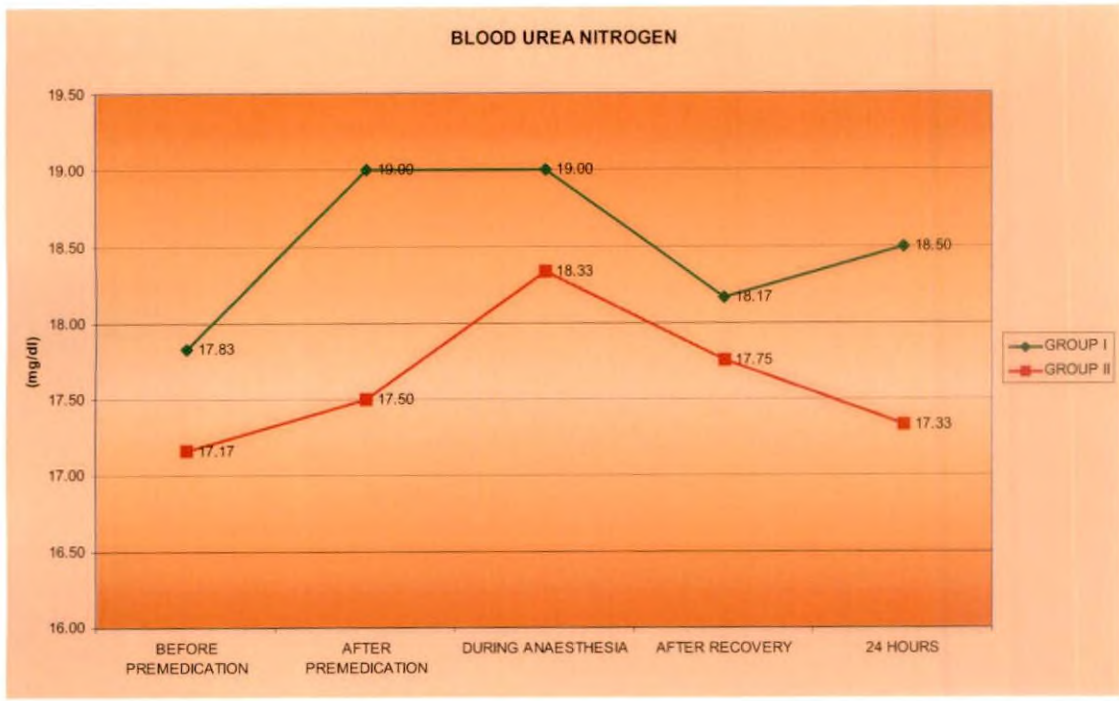


Fig.16: Mean Blood Urea Nitrogen

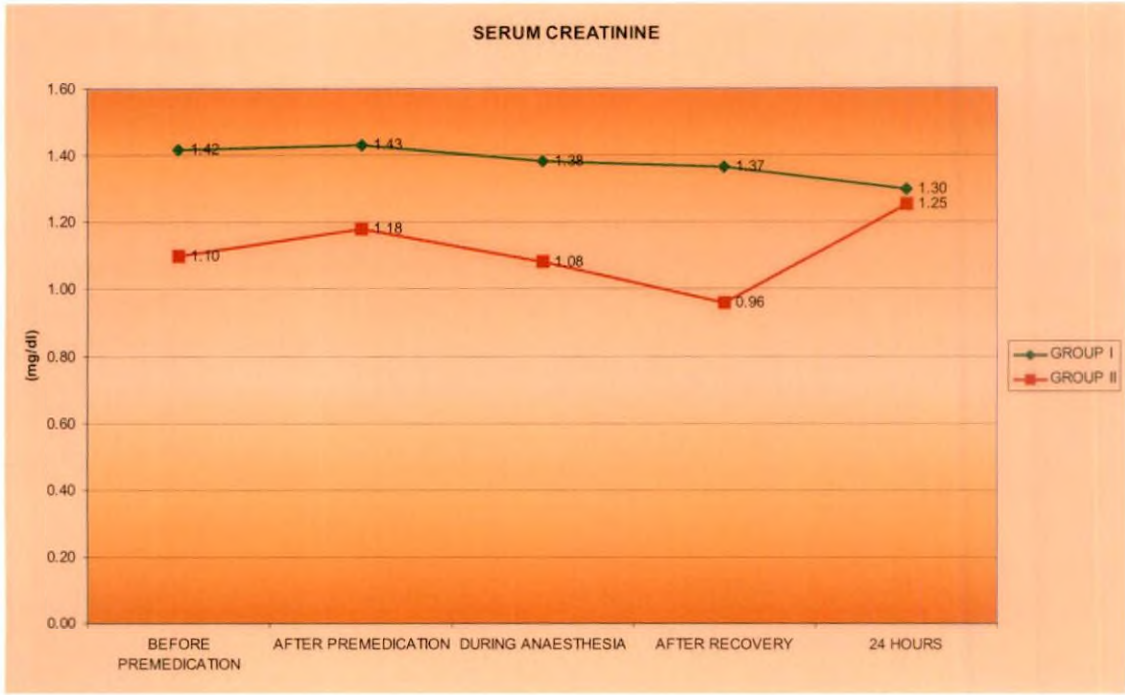


Fig.17: Mean Serum Creatinine Level

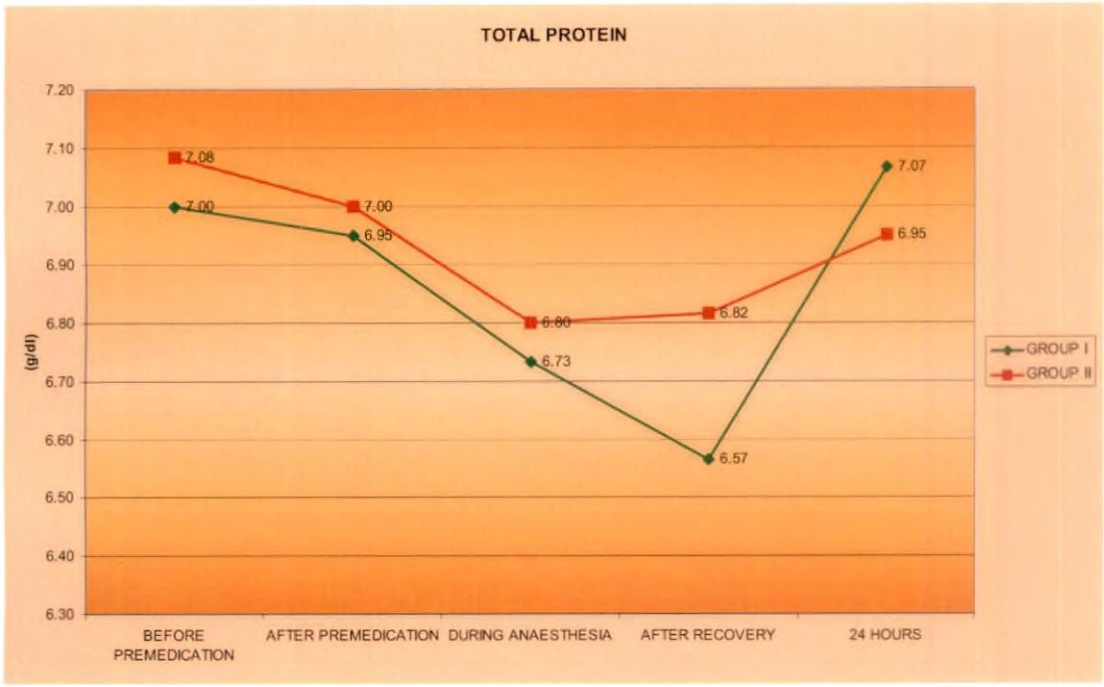


Fig.18: Mean Total Protein Content

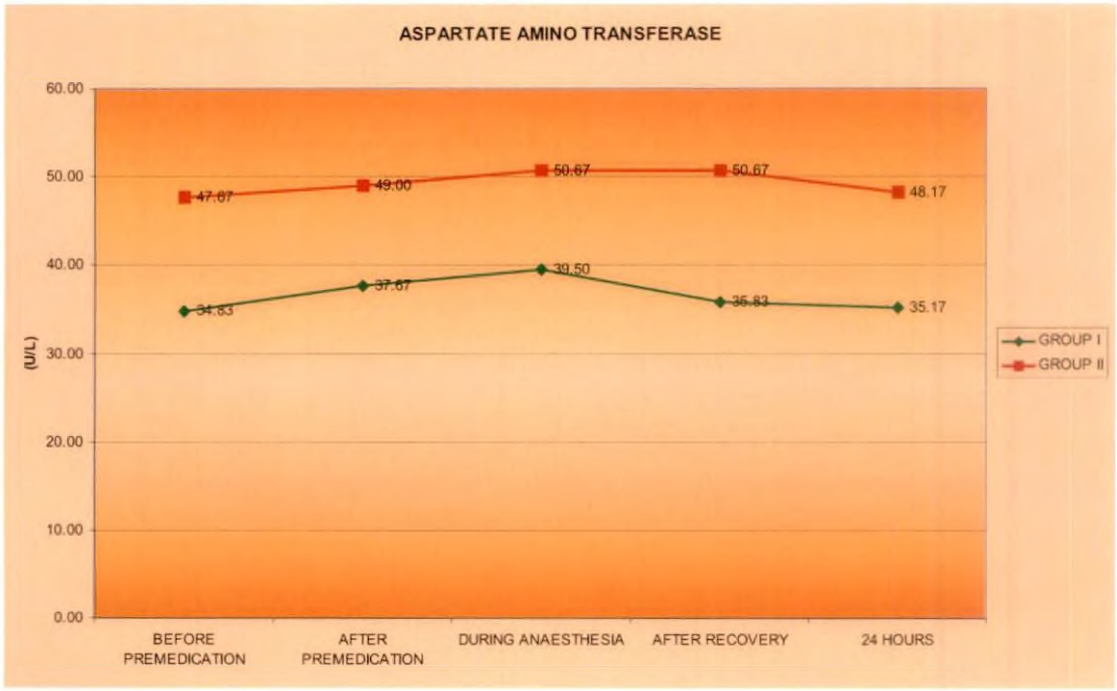


Fig.19: Mean Aspartate amino Transferase Level

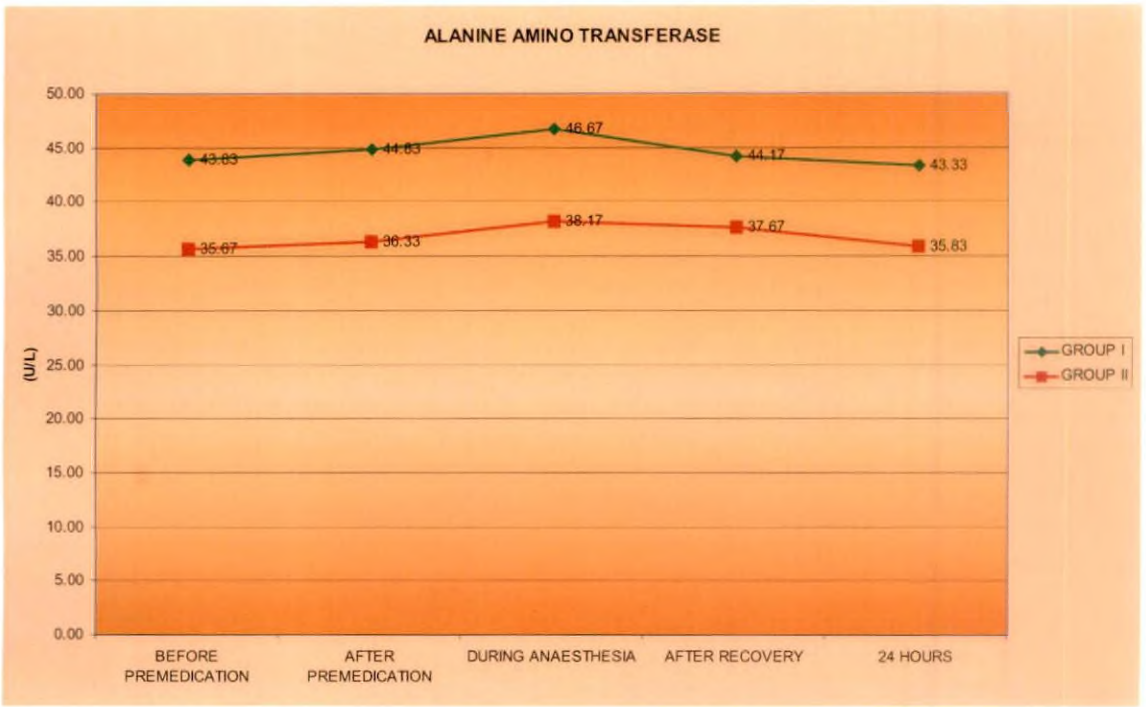


Fig.20: Mean Alanine amino Transferase Level

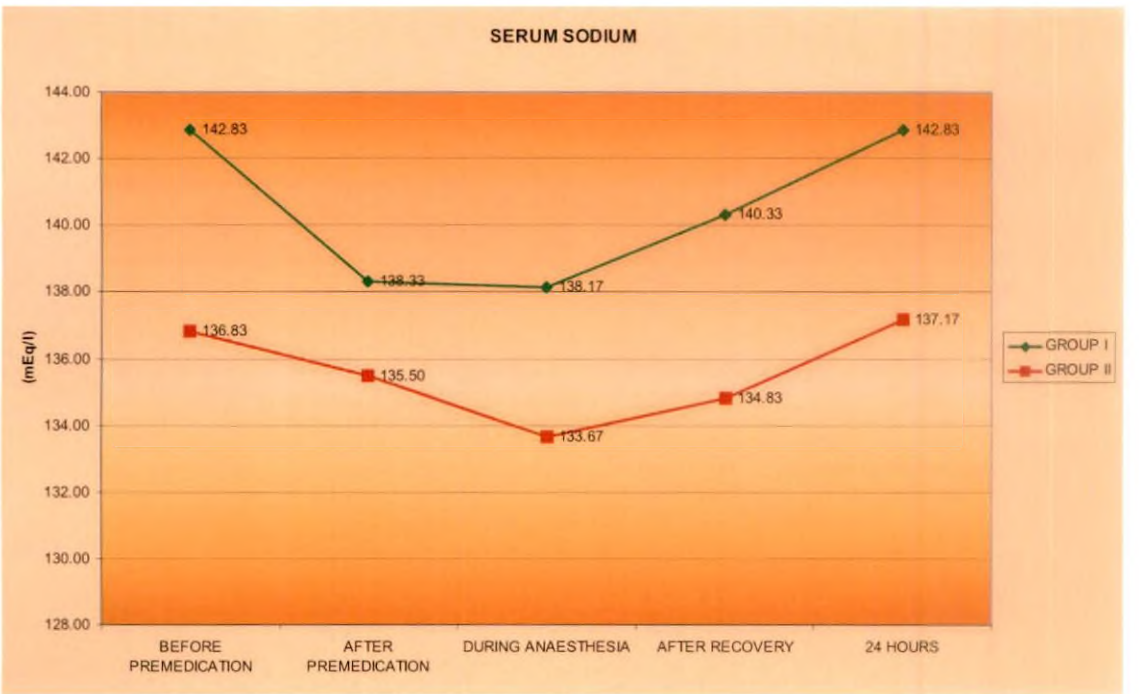


Fig.21: Mean Serum Sodium Concentration

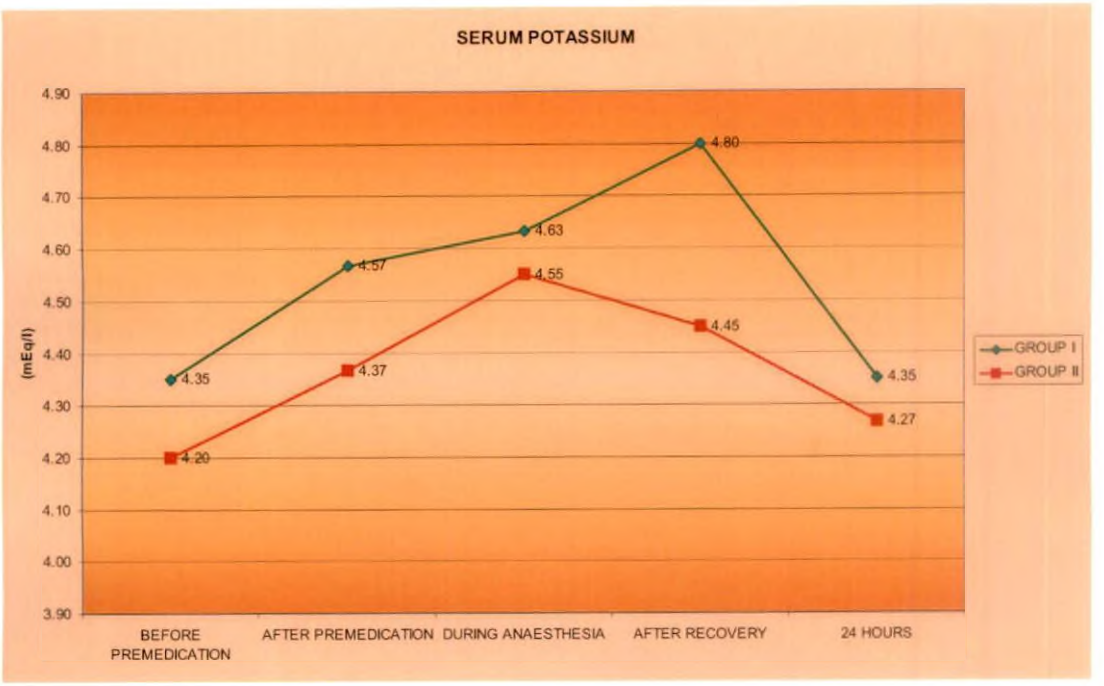


Fig.22: Mean Serum Potassium Concentration

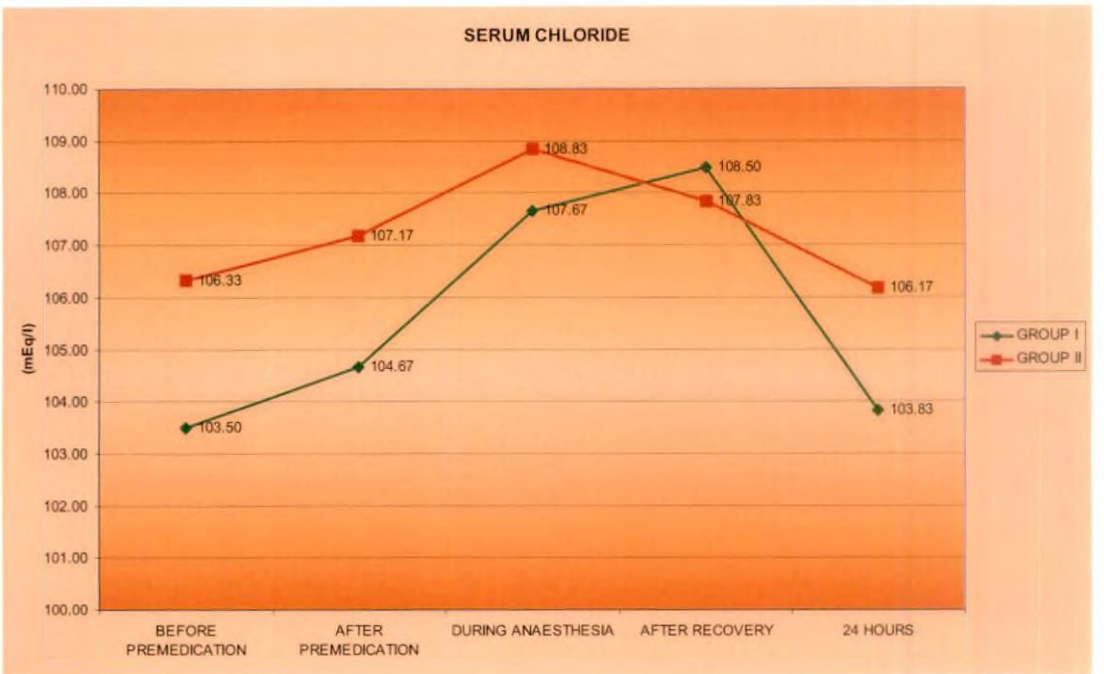
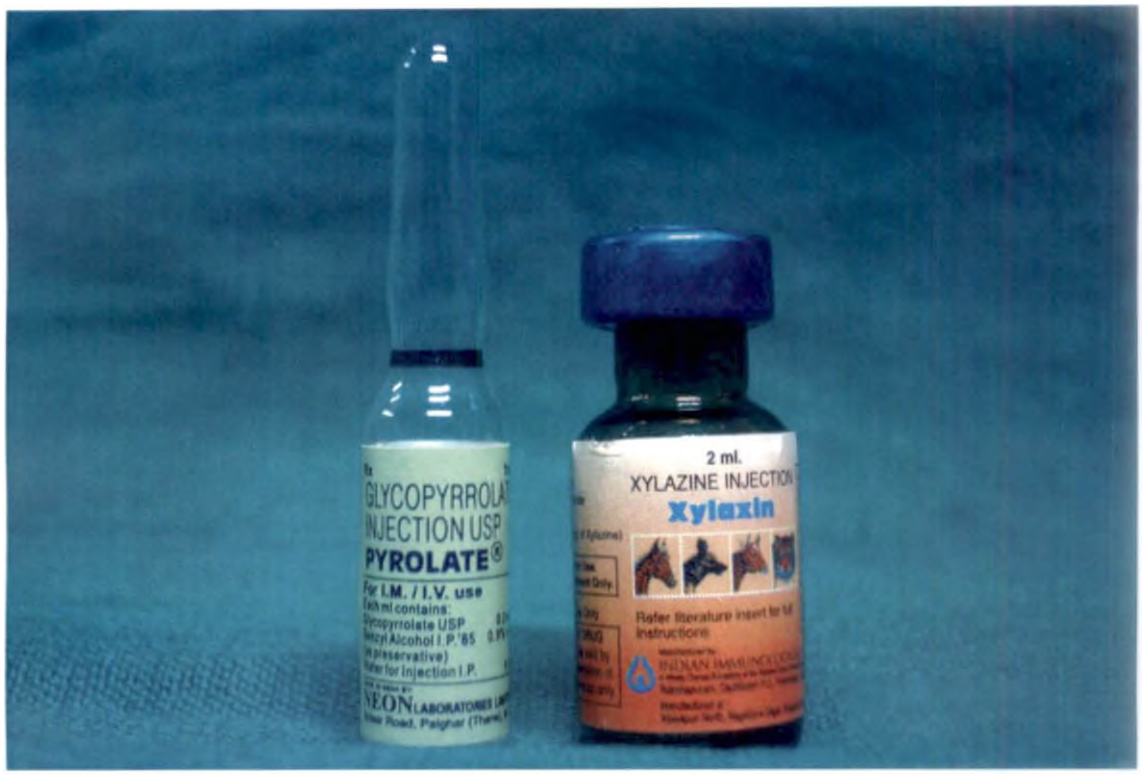
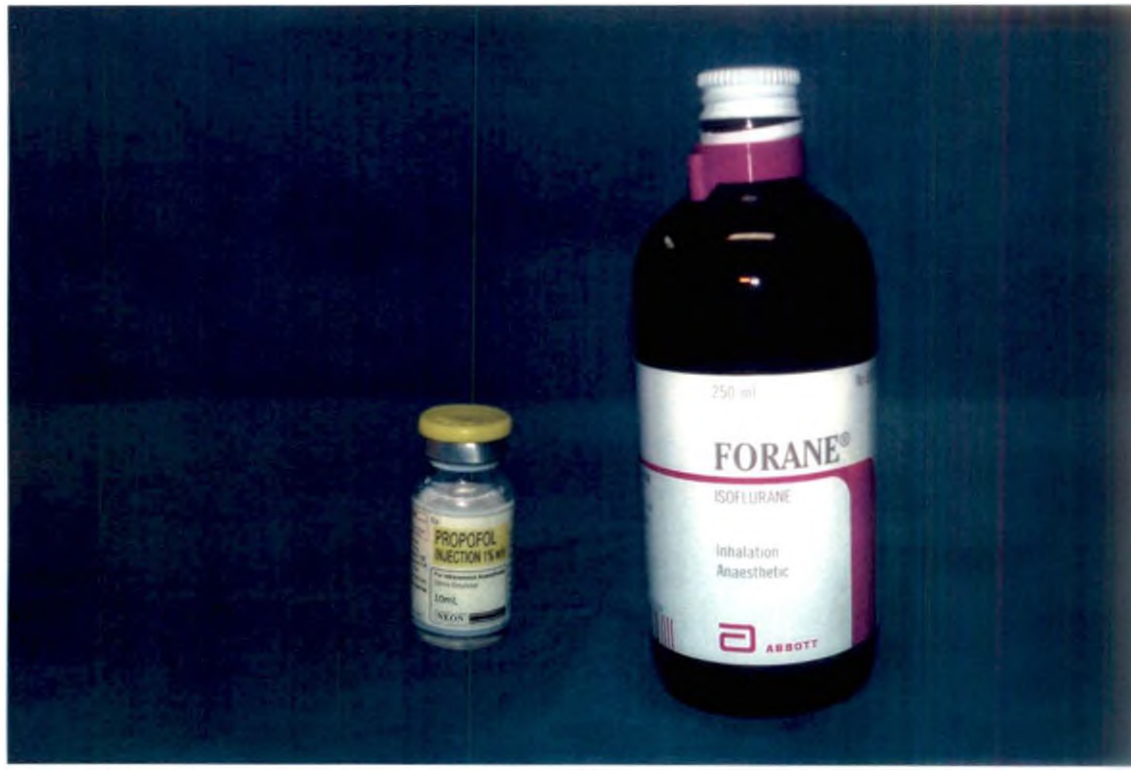


Fig.23: Mean Serum Chloride Concentration

Plate1. Drugs used for the Study



A. PYROLATE (Glycopyrrolate) and XYLAXIN (Xylazine)

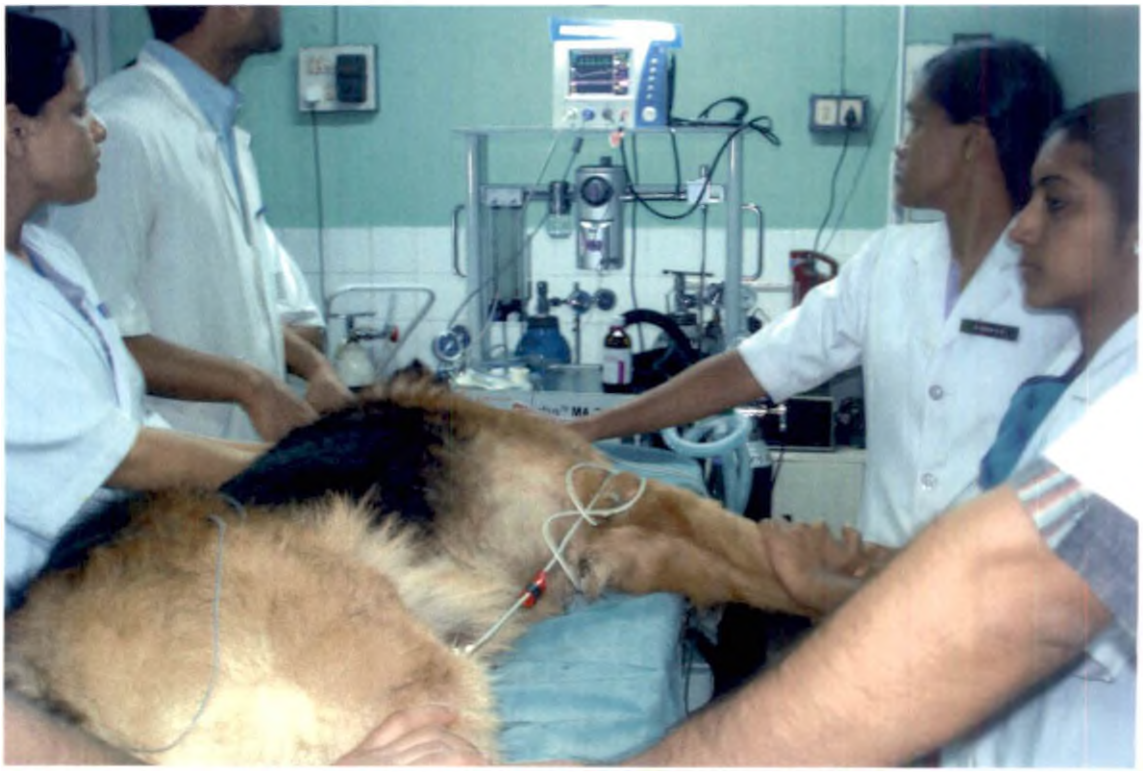


B. PROPOFOL and FORANE (Isoflurane)

Plate 2. Anaesthetic Equipment and Monitoring

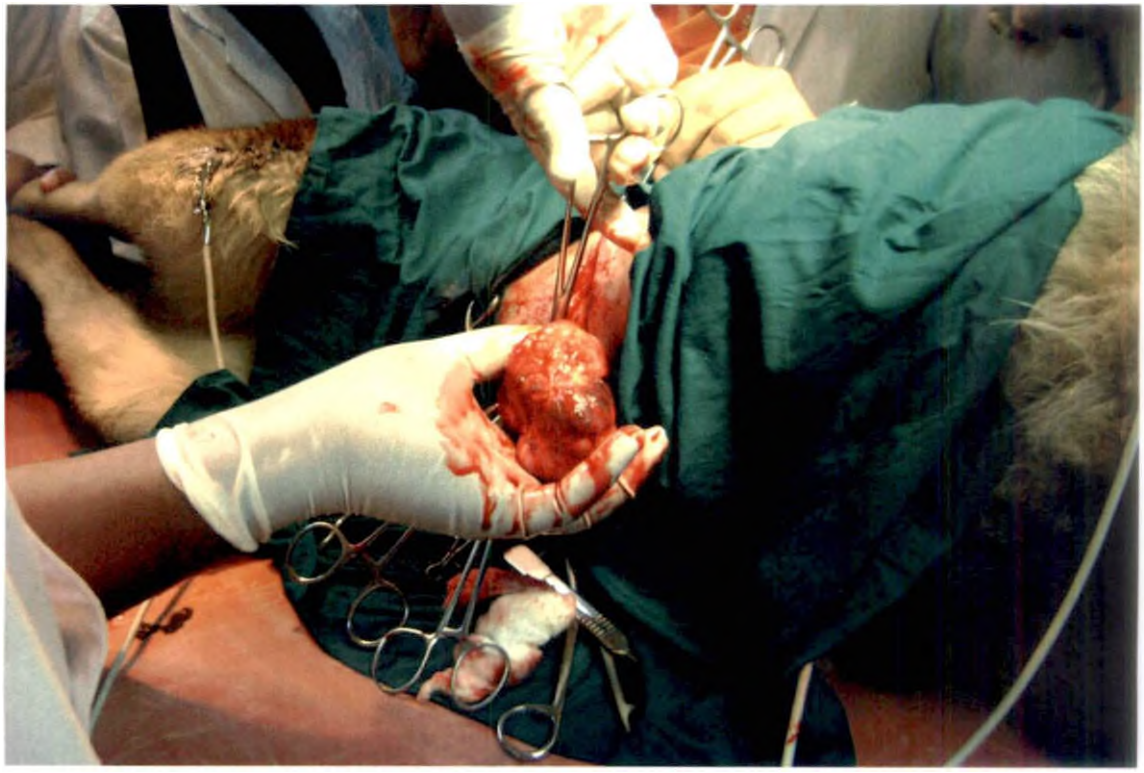
A. Anaesthetic Machine

B. Isoflurane Vapourizer

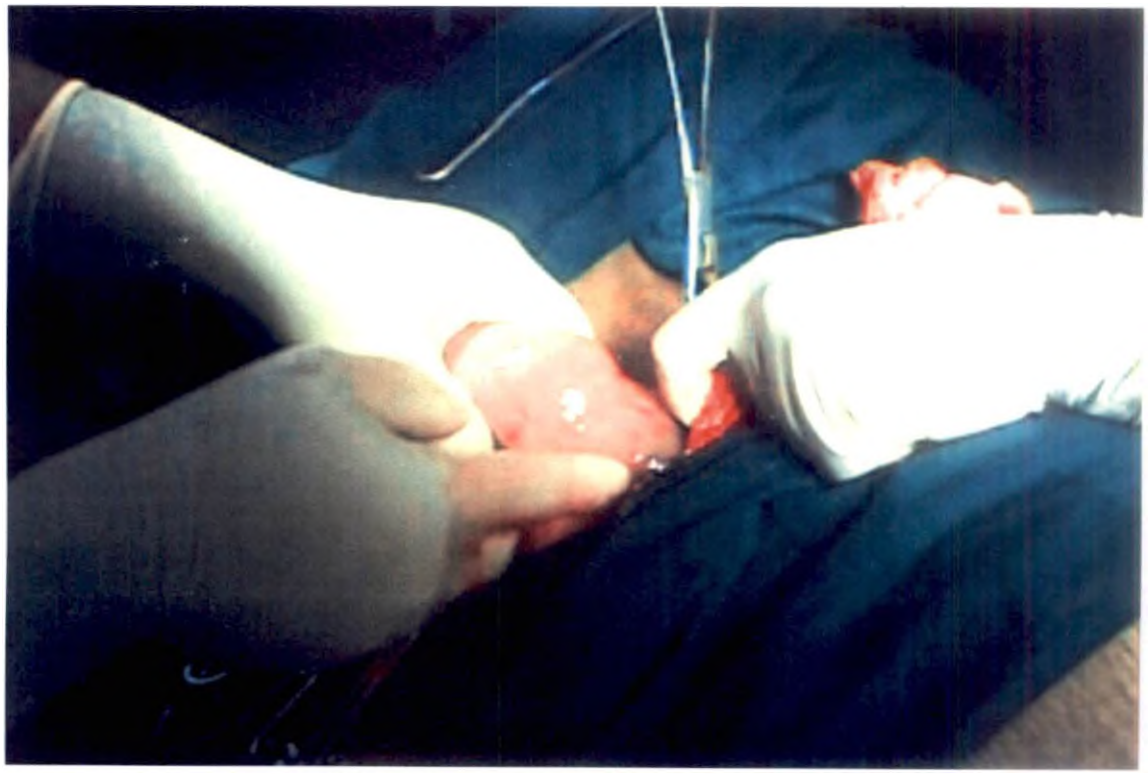


C. Multipara Monitor in Use

Plate 3. Surgical Procedures



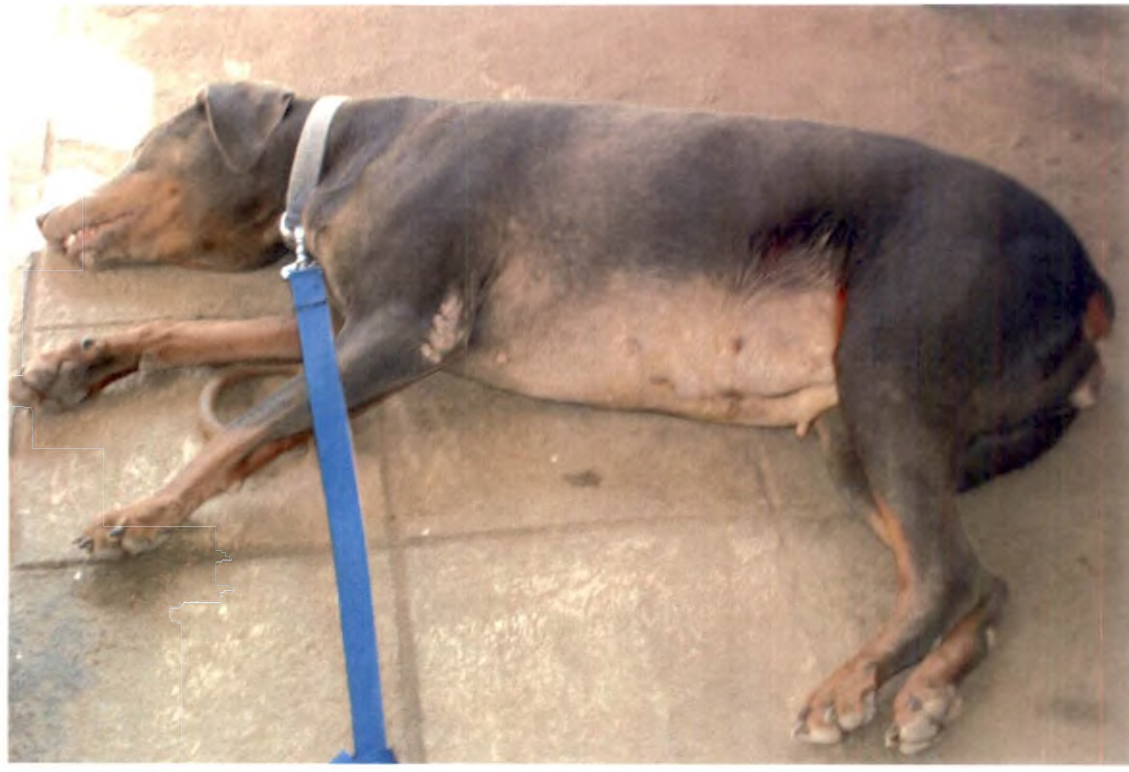
A. Resection of Mammary Tumour(I_6)



B. Exteriorization of Uterus for Caesarean Section (II_3)

Plate 4. Dogs Under Anaesthetic Trials

A. Sternal Recumbency with Head Down Posture (after premedication)(II_5)



B. Lateral Recumbency (after premedication)(I_4)

Plate5. A Female Dog Fully Recovered from Anaesthesia (II_5)

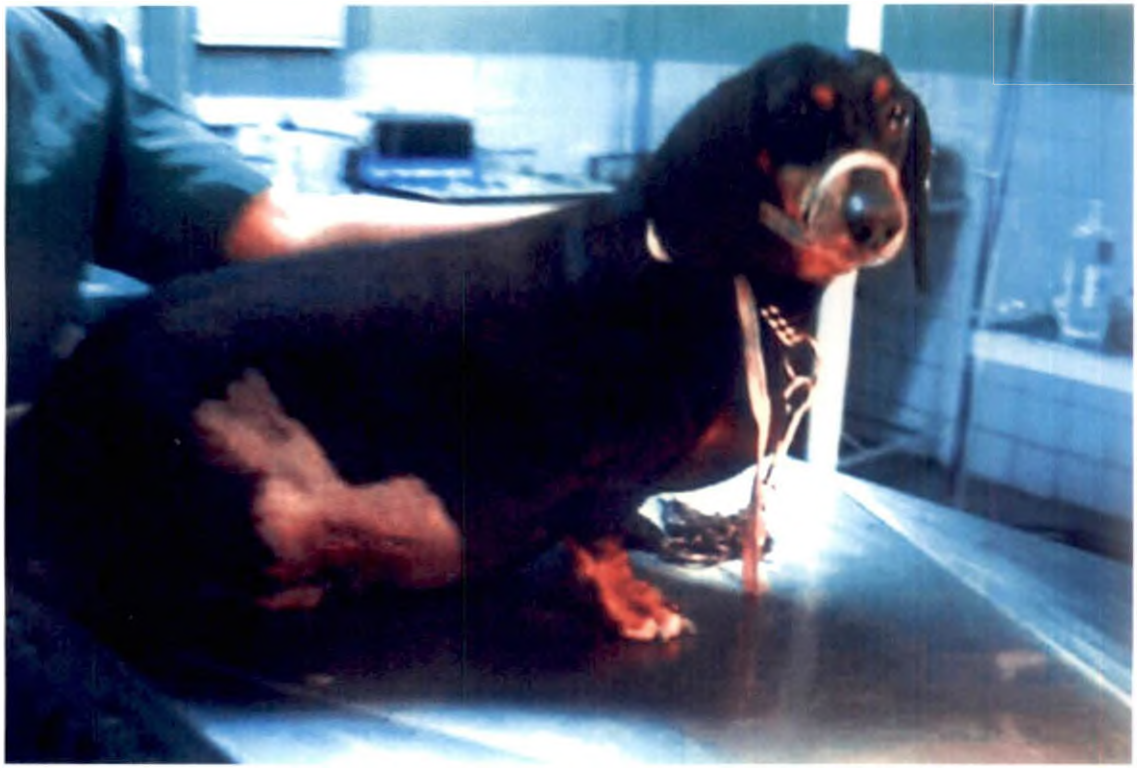
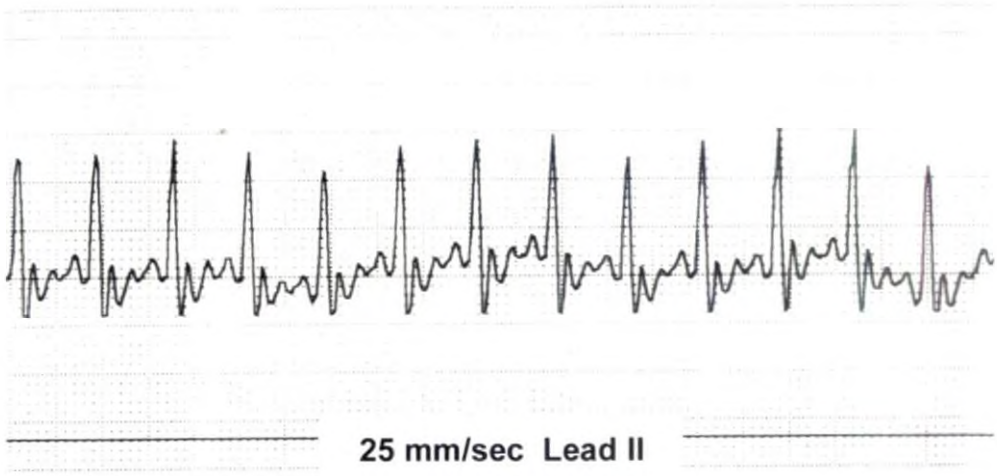
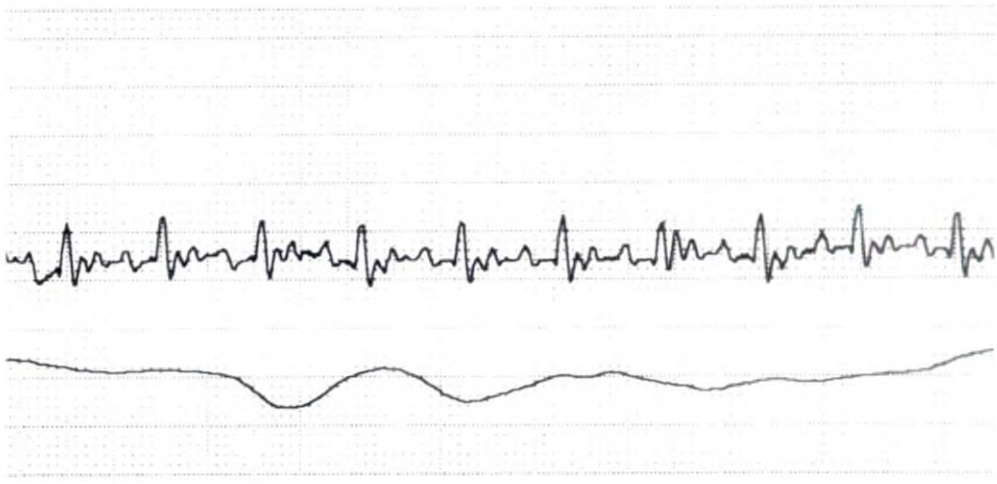


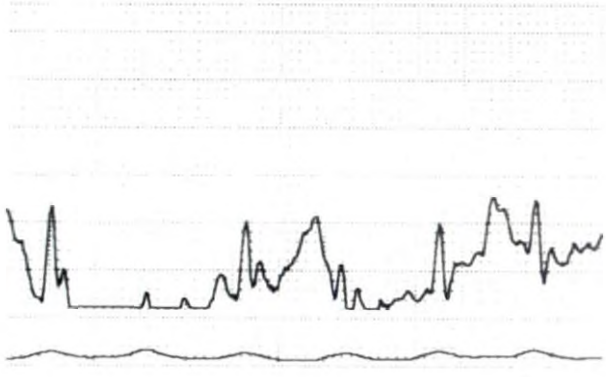
Plate 6. Electrocardiogram



A. Tachycardia - after premedication (I_6)

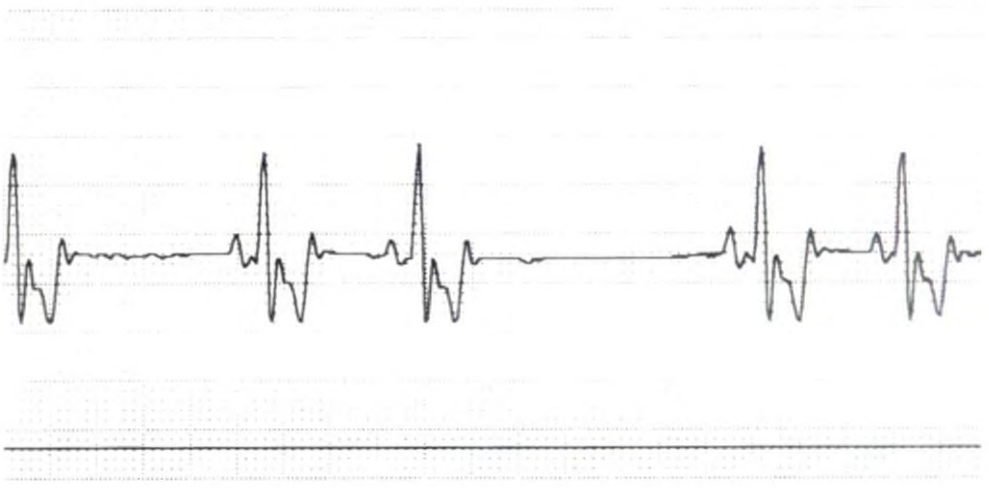


B. First Degree Heart Block - after premedication (I_3)

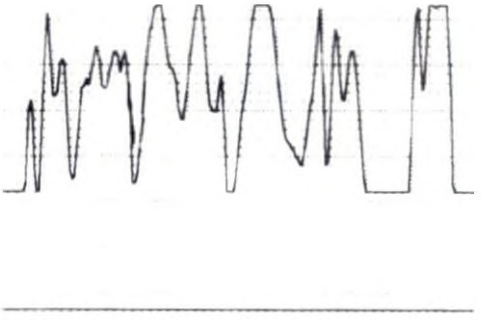


C. Second Degree Heart block - after premedication (II_4)

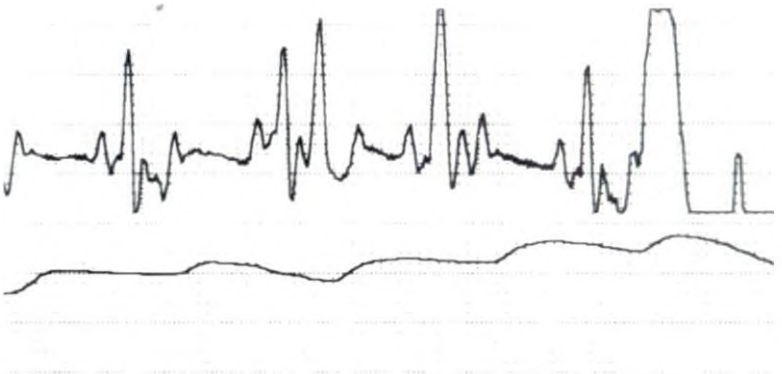
Plate 7. Electrocardiogram



A. Sinus Arrest - after premedication (II_6)



B. Ventricular Premature Contraction - during anaesthesia (I_2)



C. Peaked T wave - during anaesthesia (II_6)

Discussion

5. DISCUSSION

The study was conducted in twelve dogs of different breeds of either sex presented to the Veterinary College Hospitals at Mannuthy and Kokkalai, for various surgical procedures. Healthy animals presented for elective surgeries were included in Group I and those compromised animals for emergency surgery were included in Group II. They were numbered serially from 1 to 6.

To the animals of both the groups, glycopyrrolate at the rate of 0.01 mg per kg body weight, followed by xylazine at the rate of 1 mg/kg body weight, at 15 minutes interval, were administered intramuscularly for premedication. Fifteen minutes later, propofol 1% emulsion at the rate of 4 mg per kg body weight was administered by intravenous bolus injection for induction of anaesthesia. Anaesthesia was maintained with isoflurane at three percent level in oxygen at the rate of 10 ml/kg bodyweight by Bain's circuit system utilizing isoflurane vapourizer.

Evaluation of anaesthesia for surgery included continuous monitoring of clinical observations and physiological, haematological and biochemical parameters.

5.1. Clinical Observations

*5.1.1. Clinical Signs:*The common clinical signs exhibited by the animals following premedication with glycopyrrolate-xylazine were winking of the eye, licking, yawning, incoordination of movements and sitting on haunches followed by sternal recumbency with head down posture within 15 minutes. Among the two groups, one animal assumed the position of lateral recumbency and five vomited. Vomiting in cats following xylazine administration had also been reported by Hikasa *et al.* (1989). Salivation

was scanty in all the animals of the groups, evidently due to the prior administration of the anticholinergic, glycopyrrolate (Mohan, 2006 and Narayanan, 2007).

Induction of anaesthesia following the administration of propofol was smooth in all the animals and all were on lateral recumbency. Sooryadas (2001) reported smooth induction of anaesthesia with propofol under atropine-xylazine premedication in dogs. All the animals permitted easy endotracheal intubation as reported by Branson and Gross (1994). Thurmon *et al.* (1995) could intubate the dogs only when propofol was administered with premedication or when higher doses (5.5 to 6.5 mg/kg) were used. Apnoea persisting for a period of about one minute was noticed in three animals. A short period of apnoea during propofol induction in dogs had also been reported by Morgan and Legge (1989), David (1992), Robertson *et al.* (1992), Keegan and Greene (1993) and Smith *et al.* (1993). Persistant coughing until the removal of endotracheal tube and jerky respiratory movements during anaesthesia using propofol were reported by Hall and Chambers (1987). In a clinical study, Quandt *et al.* (1998) reported neuromuscular side effects such as muscle tremors, shivering, paddling and opisthotonus in dogs anaesthetized with propofol. Mild tremors in the limbs during induction were also reported by Robertson *et al.* (1992). But in the present study, these symptoms were not observed in any of the animals, probably due to the muscle relaxant effect of xylazine.

5.1.2. Time for Induction of Anaesthesia: Time for induction of anaesthesia was 1.11 ± 0.25 and 0.83 ± 0.15 minutes following intravenous bolus injection of propofol in Group I and II respectively. Induction of anaesthesia was quicker in compromised patient, probably due to its stressful status.

5.1.3. Duration of Anaesthesia: The duration of anaesthesia was 29.66 ± 6.05 and 35.85 ± 16.86 in Group I and II respectively.

5.1.4. Depth of Anaesthesia: With the anaesthetic regimen the surgeries performed in Group I were oophorectomy (4), operation for aural haematoma (1) and resection of mammary tumour (1), and in Group II were correction of eventration due to disruption of surgical wound a disrupted surgical wound (1), caesarean section (2), ovario-hysterectomy for pyometra (1), resection of lipoma in a debilitated animal (1) and urethrotomy in acute urethral obstruction (1). The depth of anaesthesia, as assessed by the surgery performed, was satisfactory in all the animals. Thurmon *et al.* (1994) reported propofol to have poor analgesic effect and hence supplementation with an analgesic and muscle relaxant was recommended along with propofol to maintain general anaesthesia. Umar *et al.* (2006) had also reported the use of other anaesthetic agents along with propofol to improve the quality of anaesthesia in horses.

5.1.5. Recovery Time: The recovery time was 27.50 ± 10.36 and 27.66 ± 11.79 in Group I and II respectively. In both the groups the recovery time was similar. Watkins *et al.* (1987) reported a recovery time of 25.00 ± 13.00 minutes following propofol anaesthesia in dogs premedicated with acepromazine and suggested that premedication did not produce statistically significant increase in recovery time. Robertson *et al.* (1992) reported opisthotonus accompanied by forelimb paddling during recovery in a few dogs anaesthetized with propofol. Branson and Gross (1994) reported propofol to have shorter recovery period with minimal cumulative effects and slightly less physiological effects compared to ultra short acting barbiturates. In the present study untoward effects were not noticed, probably due to xylazine premedication and maintenance of anaesthesia with isoflurane. Sooryadas (2001) had reported rapid, smooth and uneventful recovery in dogs anaesthetized with propofol under atropine-xylazine premedication. Rapid recovery in dogs anaesthetized

with isoflurane had been reported in dogs by Klide (1976) and Ludders (1992). Smith *et al.* (1993) had reported rapid recovery with minimal adverse effects and Funquist *et al.* (1997), rapid excitation free recovery in dogs following propofol-isoflurane anaesthesia.

*5.1.6. **Degree of Muscle Relaxation:*** The degree of muscle relaxation was excellent in all the animals for performing the surgeries probably due to xylazine premedication and maintenance of anaesthesia with isoflurane. Thurmon *et al.* (1994) had recommended the use of analgesic and muscle relaxant along with propofol to maintain general anaesthesa.

5.2. Physiological Observations

*5.2.1. **Rectal Temperature:*** There was decrease in rectal temperature during anaesthesia and recovery, in the animals of both the groups and it was significant in the animals of Group I. Decrease in rectal temperature had been reported in dogs following the administration of propofol alone (Muir III and Gadawaski, 1998) and propofol with preanaesthetic(s) (David, 1992; Venugopal *et al.*, 2002 and Khan *et al.*, 2007). According to Muir III and Gadawaski (1998) the reduction in body temperature during propofol anaesthesia was due to decrease in skeletal muscle tone and the shivering threshold, vasodilatation and impairment of thermoregulatory control.

*5.2.2. **Respiratory Rate:*** There was significant decrease in respiratory rate after premedication, during anaesthesia and recovery, in the animals of both the groups. Decrease in respiratory rate had been reported in dogs following the administration of xylazine alone (Peshin *et al.*, 1980), propofol alone (Muir III and Gadawaski, 1998 and Quandt *et al.*, 1998) and propofol with preanaesthetic(s) (Hall and Chambers, 1987; Sooryadas 2001; Mohan 2006 and Khan *et al.*, 2007).

5.2.3. Pulse Rate: There was increase in pulse rate after premedication, during anaesthesia and recovery, in the animals of both the groups, but the increase was significant only in animals of Group I. An increase in heart rate during propofol anaesthesia with preanaesthetic(s) had been reported by Venugopal *et al.* (2002), Mohan (2006) and Khan *et al.* (2007). According to Sharma and Bhargava (2007), the increase in heart rate following administration of propofol was due to increased myocardial blood flow.

5.2.4. Colour of Visible Mucous Membrane: The colour of visible mucous membrane was pale roseate in all animals of both the groups throughout the period of study except in one animal (II_5) in which it was pale during anaesthesia.

5.2.5. Capillary Refill Time: There was an increase in capillary refill time, after premedication and during anaesthesia, and it returned to the baseline value by 24 hours in animals of both the groups.

5.2.6. Pulse Oximetry

There was significant increase in the oxygen saturation (SpO_2) level during anaesthesia and recovery in both the groups. According to Bishnoi and Saini (2005) a decrease in SpO_2 level could be evident during hypoventilation. In the present study, in all the animals the tissue oxygenation status of the peripheral tissues was very good evidently due to maintenance of anaesthesia with isoflurane and supplementation of oxygen. According to Grosenbaugh and Muir (1998), pulse oximetry provided an estimate of the percentage of haemoglobin saturated with oxygen, which reflected patient's oxygenation status in blood. The most common side effect reported by Bufalari *et al.* (1998a) during induction of anaesthesia with propofol with premedication was low oxygen

saturation value, which was correctable with oxygen supplementation. Topal *et al.* (2004) observed a lower oxygen saturation value with halothane than isoflurane or sevoflurane and hence suggested that in dogs both isoflurane and sevoflurane were safer than halothane anaesthesia

5.2.7. Electrocardiogram (ECG)

The continuous recording of electrocadiographic changes during premedication, anaesthesia and recovery helped to identify the exact nature of arrhythmias. Electrocardiographic changes noticed following premedication were tachycardia (1) first degree heart block (2) second degree heart block (1) and sinus arrest (2). Clark *et al.* (1982) had observed electrocardiographic changes like sinus tachycardia, sinus arrest, first degree heart block, second degree heart block and mild to moderate S-T slurring with xylazine/ketamine anaesthesia. Peshin *et al.* (1980) reported changes in T wave along with elevation of S-T segment suggestive of myocardial hypoxia in dogs following the administration of xylazine. But with the present study after xylazine premedication, such changes were not noticed probably due to prior administration of glycopyrrolate. During anaesthesia the changes suggestive of myocardial hypoxia (Bolton 1975) noticed were S-T segment depression (1), peaked T wave (1) and ventricular premature contractions (2). But these changes were not consistent and were spontaneously corrected during recovery period. The results of ECG recording indicated that life threatening myocardial abnormalities were absent with the anaesthetic regimen under study.

5.3. Haematological Observations

5.3.1. Erythrocyte Sedimentation Rate: There was increase in ESR during anaesthesia and recovery, in animals of Group I whereas it was found decreased in Group II. The reason for the decrease could be attributed to the compromised status of animals.

5.3.2. Haemoglobin Concentration: There was significant decrease in haemoglobin concentration during anaesthesia and recovery in both the groups. Decrease in haemoglobin concentration had been reported in dogs, following the administration of xylazine (Peshin *et al.*, 1980), propofol alone (Bayan *et al.*, 2002) and propofol with preanaesthetic(s) (Venugopal *et al.*, 2002 and Khan *et al.*, 2006).

5.3.3. Volume of Packed Red Cells: There was significant decrease in VPRC during premedication, anaesthesia and recovery in Group I. But in Group II, significant decrease in VPRC was noticed only during anaesthesia and recovery. Decrease in VPRC had been reported following the administration of xylazine (Peshin *et al.*, 1980) and propofol – ketamine (Venugopal *et al.*, 2002) in dogs.

5.3.4. Total Leukocyte Count: There was significant decrease in TLC during anaesthesia and recovery in Group I animals. In Group II, the decrease in TLC was significant during recovery. Slight decrease in TLC had been reported in dogs following the administration of xylazine by Peshin *et al.* (1980). Khan *et al.* (2006) observed significant decrease in TLC during propofol anaesthesia with midazolam premedication.

5.3.5 Differential Leukocyte Count: There was increase in neutrophil count and decrease in lymphocyte count during anaesthesia and recovery in both the groups. There was an increase in monocyte count during anaesthesia and recovery, and variations in eosinophil count were marginal. Increase in neutrophil count with concurrent decrease in

lymphocyte count had been reported in dogs following the administration of xylazine (Peshin *et al.*, 1980) and propofol (David 1992).

5.4. Serum Constituents

5.4.1. Serum Glucose: There was significant increase in serum glucose level after premedication, during anaesthesia, at recovery and at 24 hours in animals of both the groups. Significant increase in glucose concentration had been reported in dogs following the administration of xylazine (Peshin *et al.*, 1980) and propofol (Bayan *et al.*, 2002). Jain *et al.* (2007) also observed significantly increased plasma glucose level during propofol anaesthesia in dogs and it was attributed to the stimulation of adrenocortical hormone from adrenal cortex resulting in increased secretion of cortisone and thereby gluconeogenesis during anaesthesia. Narayanan (2007) also reported increased glucose levels in dogs during ketamine-isoflurane anaesthesia with glycopyrrolate-xylazine-midazolam (G-X-M) premedication.

5.4.2. Blood Urea Nitrogen: There was an increase in blood urea nitrogen level after premedication and during anaesthesia in animals of Group I and during anaesthesia in animals of Group II. But the changes were within the normal limits and indicate that it does not affect the kidney functions much. Lang and White, (1976) reported a rise in blood urea nitrogen level during fasting, could be due to decreased renal flow or glomerular destruction. The fluctuations in values noticed in the present study might be due to preoperative fasting in healthy animals or reduced feed intake in compromised animals.

5.4.3. Serum creatinine: The creatinine level decreased during anaesthesia and recovery but the decrease was not significant in animals of both the groups. Narayanan (2007) ad also reported a decrease in creatinine level during ketamine-isoflurane anaesthesia with G-X-M anaesthesia.

5.4.4. Total Protein: There was significant decrease in total protein content during anaesthesia and recovery in animals of Group I and in Group II the decrease was significant after premedication and during anaesthesia. A decrease in total protein content in dogs during propofol anaestheia had been reported by Bayan *et al.* (2002). Narayanan (2007) also reported a decrease in total protein content in dogs with G-X-M premedication.

5.4.5. Aspartate Amino Transferase: There was significant increase in aspartate amino transferase level after premedication and during anaesthesia in animals of Group I. In Group II, the increase was significant after premedication, during anaesthesia and at recovery. Bayan *et al.* (2002) had reported an increase in AST value in dogs under propofol anaesthesia.

5.4.6. Alanine Amino Transferase: There was significant increase in ALT level after premedication, during anaesthesia and at recovery in animals of both the groups. Bayan *et al.* (2002) had also reported an increase in ALT level during propofol anaesthesia in dogs.

5.4.7. Serum Sodium: There was significant decrease in sodium concentration during anaesthesia in animals of Group I. In Group II, the decrease was significant after premedication, during anaesthesia and recovery. This effect might be due to the haemodilution in response to fluid administration. Narayanan (2007) had reported marginal increase in sodium concentration during ketamine-isoflurane anaesthesia with G-X-M premedication.

5.4.8. Serum Potassium: Potassium concentration increased after premedication, during anaesthesia and at recovery. But the increase was not significant in animals of both the groups. Narayanan (2007) had reported a decrease in potassium concentration during ketamine isoflurane anaesthesia with G-X-M premedication.

5.4.9. Chloride: There was significant increase in chloride concentration after premedication, during anaesthesia and at recovery, in animals of both the groups. Narayanan (2007) had reported an increase in serum chloride concentration with G-X-M premedication during ketamine-isoflurane anaesthesia.

5.5. Post anesthetic and Post operative Complication(s) if any

All the animals had rapid and smooth recovery from anaesthesia and uneventful recovery from surgery.

Summary

6. SUMMARY

The study was conducted in twelve dogs of different breeds of either sex presented to the Veterinary College Hospitals at Mannuthy and Kokkalai, for various surgical procedures. Healthy animals presented for elective surgeries were included in Group I and those compromised animals for emergency surgery, were included in Group II.

To the animals of both the groups, glycopyrrolate at the rate of 0.01 mg per kg body weight, followed by xylazine at the rate of 1 mg/kg body weight, at 15 minutes interval, were administered intramuscularly for premedication. Fifteen minutes later, propofol 1% emulsion at the rate of 4 mg per kg body weight was administered by intravenous bolus injection for induction of anaesthesia. Anaesthesia was maintained with isoflurane at three per cent level in pure oxygen at the rate of 10 ml/kg bodyweight by Bain's circuit system utilizing isoflurane vapourizer.

The common clinical signs exhibited by the animals following premedication with glycopyrrolate-xylazine were winking of the eye, licking, yawning, incoordination of movements and sitting on haunches followed by sternal recumbency with head down posture within 15 minutes. Among these two groups, five animals vomited and only one animal assumed the position of lateral recumbency. Salivation was scanty in all the animals.

Time for induction of anaesthesia was 1.11 ± 0.25 and 0.83 ± 0.15 minutes following intravenous bolus injection of propofol in Group I and II respectively. Induction of anesthesia was smooth in all the animals and permitted easy endotracheal intubation. Apnoea persisting for a period of about one minute was noticed in a few animals.

The duration of anaesthesia was 29.66 ± 6.05 and 35.85 ± 16.86 in Group I and II respectively.The depth of anaesthesia and the degree of muscle relaxation were satisfactory in all the animals. With this anaesthetic regimen the surgeries performed were in Group I were oophorectomy(4), operation for aural haematoma(1) and resection of mammary tumour(1) in, and in Group II were correction of a disrupted surgical wound (1), caesarean section(2), ovario-hysterectomy for pyometra (1) and resection of lipoma in a debilitated animal (1) and urethrotomy in acute urethral obstruction (1) in Group II.

The recovery time was 27.50 ± 10.36 and 27.66 ± 11.79 in Group I and II respectively. All the animals had smooth and uneventful recovery from anaesthesia.

Decrease in rectal temperature and respiratory rate was noticed after premedication, during anaesthesia and recovery in the animals of both the groups. But the pulse rate was seen increased.

The colour of visible mucous membrane was pale roseate in all animals of both the groups throughout the period of study, except in one animal in which it was pale. There was increase in the capillary refill time in animals of both the groups. There was increase in the oxygen saturation level during anaesthesia and recovery in both the groups. .

Electrocardiographic changes noticed were tachycardia, first-degree heart block, second-degree heart block, sinus arrest, S-T segment depression, peaked T wave and ventricular premature contractions. All these changes were spontaneously corrected during the recovery period

Increase in erythrocyte sedimentation rate was noticed during anaesthesia and recovery, in animals of Group I, whereas there was decrease in Group II.

Both haemoglobin concentration and volume of packed red cells were also seen decreased.

There was significant decrease in total leukocyte count after premedication, during anaesthesia and recovery in both the groups.

The neutrophil and monocyte count were seen increased after premedication, during anaesthesia and recovery, but the lymphocyte count was decreased. The variations in eosinophil count were marginal.

There was increase in serum glucose, blood urea nitrogen,aspartate amino transferase and alanine amino transferase levels, and potassium and chloride concentrations after premedication, during anaesthesia, at recovery and at 24 hours in animals of both the groups. The total protein content, creatinine level and sodium concentration were seen decreased. But the variations were within the normal physiological limits. Post anaesthetic and postoperative complications were not observed in any of the animals.

The following conclusions could be drawn from the study:

(i) Xylazine (1mg/kg body weight, i.m) with prior administraton of glycopyrrolate (0.01 mg/kg body weight, i.m) resulted in satisfactory sedation in dogs with scanty salivation.

(ii) Glycopyrrolate-xylazine premedicaton with propofol induction permitted easy endotracheal intubation.

(iii) Propofol isoflurane anaesthesia with glycopyrrolate-xylazine premedication resulted in rapid smooth induction excellent muscle relaxation and satisfactory depth of surgical anaesthesia.

(iv) Propofol isoflurane anaesthesia with glycopyrrolate-xylazine premedication is a safe anaesthetic regimen for performing surgeries in both healthy and compromised canine patients.

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CLINICAL EVALUATION OF PROPOFOL-ISOFLURANE ANAESTHESIA WITH XYLAZINE PREMEDICATION IN DOGS

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ABSTRACT

The study was conducted in twelve dogs of different breeds of either sex presented to the Veterinary College Hospitals at Mannuthy and Kokkalai, for various surgical procedures. Healthy animals presented for elective surgeries were included in Group I and those compromised animals for emergency surgery, were included in Group II.

To the animals of both the groups, glycopyrrolate at the rate of 0.01 mg per kg body weight, followed by xylazine at the rate of 1 mg/kg body weight, at 15 minutes interval, were administered intramuscularly for premedication. Fifteen minutes later, propofol 1% emulsion at the rate of 4 mg per kg body weight was administered by intravenous bolus injection for induction of anaesthesia. Anaesthesia was maintained with isoflurane at three per cent level in pure oxygen at the rate of 10 ml/kg bodyweight by Bain's circuit system utilizing isoflurane vapourizer.

The common clinical signs exhibited by the animals following premedication with glycopyrrolate-xylazine were winking of the eye, licking, yawning, incoordination of movements and sitting on haunches followed by sternal recumbency with head down posture within 15 minutes. Among these two groups, five animals vomited and only one animal assumed the position of lateral recumbency. Salivation was scanty in all the animals.

Time for induction of anaesthesia was 1.11 ± 0.25 and 0.83 ± 0.15 minutes following intravenous bolus injection of propofol in Group I and II respectively. Induction of anesthesia was smooth in all the animals and permitted easy endotracheal intubation. Apnoea persisting for a period of about one minute was noticed in a few animals.

The duration of anaesthesia was 29.66 ± 6.05 and 35.85 ± 16.86 in Group I and II respectively.The depth of anaesthesia and the degree of muscle relaxation were satisfactory in all the animals. With this anaesthetic regimen the surgeries performed in Group I were oophorectomy (4), operation for aural haematoma (1) and resection of mammary tumour (1), and in Group II were eventration due to disruption of surgical wound (1), caesarean section (2), ovario-hysterectomy for pyometra (2) and resection of lipoma in a debilitated dog(1) in Group II.

The recovery time was 27.50 ± 10.36 and 27.66 ± 11.79 in Group I and II respectively. All the animals had smooth and uneventful recovery from anaesthesia.

Decrease in respiratory rate and rectal temperature was noticed after premedication, during anaesthesia and recovery in the animals of both the groups. But the pulse rate was seen increased.

The colour of visible mucous membrane was pale roseate in all animals of both the groups throughout the period of study, except in one animal in which it was pale. There was increase in the capillary refill time in animals of both the groups. There was increase in the oxygen saturation level during anaesthesia and recovery in both the groups.

Electrocardiographic changes noticed were tachycardia, first-degree heart block, second-degree heart block, sinus arrest, S-T segment depression, peaked T wave and ventricular premature contractions. All these changes were spontaneously corrected during the recovery period

Increase in erythrocyte sedimentation rate was noticed during anaesthesia and recovery, in animals of Group I, whereas there was decrease in Group II. Both haemoglobin concentration and volume of packed red cells were seen decreased.

There was significant decrease in total leukocyte count after premedication, during anaesthesia and recovery in both the groups.

The neutrophil and monocyte count were seen increased after premedication, during anaesthesia and recovery, but the lymphocyte count was decreased. The variations in eosinophil count were marginal.

There was increase in serum glucose, blood urea nitrogen, aspartate amino transferase and alanine amino transferase levels, and potassium and chloride concentrations after premedication, during anaesthesia, at recovery and at 24 hours in animals of both the groups. The total protein content, creatinine level and sodium concentration were seen decreased. Post anaesthetic and postoperative complications were not observed in any of the animals.