INFLUENCE OF GLYCERYL GUAIACOL ETHER ON ANAESTHESIA IN GOATS

By

T. P. BALAGOPALAN

THESIS

Submitted in partial fulfilment of the requirement for the degree

Master of Veterinary Science

Faculty of Veterinary and Animal Sciences
Kerala Agricultural University

Department of Surgery
COLLEGE OF VETERINARY AND ANIMAL SCIENCES
Mannuthy - Trichur

1986

To my Parents

DECLARATION

I hereby declare that this thesis entitled "INFLUENCE OF GLYCERYL GUAIACOL ETHER ON ANAESTHESIA IN GOATS" 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,
14-11-1986

T.P. BALAGOPALAN

CERTIFICATE

Certified that this thesis, entitled "INFLUENCE OF GLYCERYL GUAIACOL ETHER ON ANAESTHESIA IN GOATS" is a record of research work done independently by Sri. T.P. BALAGOPALAN under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

Dr. K.N. Muraleedharan Nayar,
(Chairman, Advisory Board)
Professor in-charge,
Department of Surgery.

Mannuthy,
14-11-1986.

ACKNOWLEDGEMENTS

I am deeply indebted to Dr. K.N. Muraleedharan Nayar, Professor i/c and Major Advisor, Department of Surgery, College of Veterinary and Animal Sciences, for the guidance, advice, constant encouragement and whole-hearted co-operation in carrying out the study.

I am grateful to Dr. P.O. George, Professor and Head, member of Advisory Committee, Department of Surgery, College of Veterinary and Animal Sciences, for the valuable help, suggestions and encouragement during my study.

I am thankful to Dr. P.A. Ommer, Professor and Head, Department of Anatomy and Dr. C. Abraham Varkey, Associate Professor of Surgery, members of Advisory Committee for their valuable guidance and help.

My sincere thanks are due to Dr. A.M. Jalaluddin, Dr. S. Ravindran Nayar, Dr.(Mrs.) T. Sarada Amma and Dr. K. Rajankutty, staff, Department of Surgery, for the keen interest in the work and their valuable help and suggestions.

I place on record my most sincere thanks to Dr. A. Rajan, Professor and Head, Dr. T. Sreekumaran, Dr. N. Divakaran Nair, Dr. M. Gopalakrishnan Nair and Dr. P.M. Jayakumar, staff, Department of Pathology for providing laboratory facilities and for the help rendered in histopathological work and interpretation.

Grateful acknowledgement is made to Dr. G. Venugopalan, Professor and Dr. K.P. Sreekumar, Junior Assistant Professor, Department of Physiology; Dr. D. Noble, Dr. S. Ramkumar and Dr. (Miss) P.T.A. Usha, my colleagues for the help rendered.

Help rendered by Dr. K.C. George, Dr. (Mrs.) Sosamma Iype, Mr. K.L. Sunny and Smt. K.P. Santhabhai in analysis of data is acknowledged with thanks.

Thanks are due to Dr. A.I. Jose, Professor, Dr. M. Achuthan Nair, Associate Professor and Smt. P.K. Sushama, of the College of Horticulture, for their valuable help and assistance in laboratory analysis.

I express my gratitude to Dr. K. Radhakrishnan, Dean in-charge, and Dr. M. Krishnan Nair, former Dean for providing me necessary facilities to carry out this research work.

I am thankful to the Indian Council of Agricultural Research for the financial assistance in the form of Junior fellowship awarded to me for the study.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

INFLUENCE OF GLYCERYL GUAIACOL ETHER ON ANAESTHESIA IN GOATS

INTRODUCTION

The role of effective and safe general anaesthesia for ensuring efficiency in surgery is well known. The search for an ideal anaesthetic which will provide satisfactory analgesia, narcosis and muscle relaxation is still in progress.

The technique of Lundy's balanced anaesthesia using suitable drug combinations to ensure the effectiveness and to reduce the chances of toxicity and undesirable side effects of a single drug has become popular.

Goats form a sizable portion of the animal population in our country, for milk production and for supply of meat. The necessity of subjecting them for major surgery arises often. Being ruminants, they are poor subjects for general anaesthesia. Aspiration of rumen content and lack of facilities for artificial respiration are the main problems facing the veterinarians in adopting techniques of general anaesthesia in goats.

Glyceryl guaiacolate of ether is a guaiacol derivative closely related to mephenesin. This is a centrally acting skeletal muscle relaxant. It is reported that it has a wide margin of safety, with little side effects on the cardiovascular and respiratory system (Davis and Wolff, 1970). Glyceryl guaiacol ether had been reported to be satisfactory in combination with nacrotics for anaesthetising large

ruminants (Takarkhede et al., 1973; Honalikar et al., 1982; Agarwal et al., 1983). Trials of such combinations in dogs, pigs and horses were also reported (Tavernor and Jones, 1970; Bathke, 1978; and Brouwer, 1985). However, reports on a detailed study in goats could not be seen on perusal of the available literature.

Hence the present study was undertaken to evaluate the influence of glyceryl guaiacolate of ether on anaesthesia in goats using Pre-anaesthetic (Triflupromazine) and general anaesthetic (Thiopentone sodium) with GGE.

Review of Literature

REVIEW OF LITERATURE

Westheus and Fritsch (1961) reported that, in horses, an intravenous dose of 3-4 g/50 kg of guaiacol glycerine ether (GGE) with chloral hydrate produced satisfactory relaxation of abdominal muscles. It was recommended alone or in combination with other anaesthetics for casting horses. With thiobarbiturate, it produced light general anaesthesia.

Kraft (1962) found that administration of GGE was accompanied by slight changes in cardiac rate and rhythm.

Westheus and Fritsch (1965) observed that GGE did not cross the placental barrier and the effects lasted for 10-20 minutes after a single dose administration.

Smithcors (1966) found that GGE was well tolerated as a muscle relaxant of short duration for examination of animals, for surgery using only local anaesthesia and as a pre-anaesthetic. In dogs satisfactory muscle relaxation was produced by a dose of 200 mg/kg body weight. Higher doses produced paralysis of skeletal muscles and/or tonic spasm, moderate excitement, recumbency similar to general anaesthesia, and death due to respiratory and circulatory failure. Concentration of the drug exceeding 10 per cent produced haemolysis.

Burger (1968) reported that the compound 3-phenoxy-1, 2-propanediol was introduced as an analgesic and antipyretic as early as 1910. It caused sharp, but momentary decrease in body temperature with flaccid paralysis of skeletal muscles.

During later investigations of alpha-substituted ethers of glycerol, it was found to produce relaxation of skeletal muscles. Small doses in laboratory animals caused tranquilization, muscular relaxation and sleep. Larger doses caused ataxia and muscular paralysis. The animals did not react to pain, recovery was complete and there was no evidence of excitement, tremors or convulsions.

Roberts (1968) stated that GGE was employed as an adjunct in equine anaesthesia for muscle relaxation. He suggested the use of 0.25 g of thiopental sodium or methitural sodium/50 kg body weight in 1 litre of five per cent GGE solution, administered at the rate of 100 ml/50 kg body weight. Wide margin of safety, smooth induction and quiet recovery were the advantages of this combination of drugs.

Davis and Wolff (1970) reported that the side effects of GGE were moderate hypotension, slight reduction in respiratory volume, haemolysis and precipitation of crystalline metabolic products in the urinary tract. Intravascular haemolysis was related to the concentration of the solution, when it exceeded 10 to 12.5 per cent. The authors observed in horses a complete relaxation of skeletal muscles, except the diaphragm, when the plasma concentration was in excess of 238 µg/ml. Recovery was delayed in stallions, probably due to delay in disappearance of the drug from the plasma. The toxic signs were attributed to the biotransformation of GGE to catachol.

Heath (1970) recommended the use of GGE for restraining patients for intubation and induction of inhalation anaesthesia. He observed a gentle excitement free relaxation and recumbency with minimal systemic changes. The duration of recumbency was approximately nine minutes. The blood pressure during the period was within the normal limits.

Jackson and Lundvall (1970) in an experimental study, administered GGE in combination with various anaesthetic and analgesic agents to 150 equine subjects. The most satisfactory combination was 50 g of GGE with 2 g of thiamylal sodium in 1 L water administered intravenously in the tranquilized subject. Induction of anaesthesia and recovery were uniformly smooth and uncomplicated. GGE had no significant clinical effects on blood glucose, haemoglobin, packed cell volume, erythrocyte count or leukocyte count.

Tavernor (1970) reported the use of GGE for casting horses. Intravenous administration of GGE at the rate of 160 mg/kg produced recumbency, minor changes in heart rate and respiratory rate, slight drop in mean systemic arterial pressure and a drop in arterial pO_2. When GGE (80 mg/kg) with thiopental sodium (3.5 mg/kg) was administered, recumbency with a fall in the mean systemic arterial pressure was noticed. The heart rate and respiratory rate increased in conjunction with a moderate fall in arterial pO_2. It was concluded that the cardiovascular and respiratory effects of GGE with pentothal sodium were relatively mild.

Coffman and Pedersoli (1971) administered GGE with ultra short acting barbiturate to 12 equine patients. Pre-anaesthetic medication with tranquilizer or narcotics, followed by intravenous administration of five per cent GGE and 0.2 per cent thiopentone sodium in Dextrose at a dose of 1 ml/lb body weight, produced general anaesthesia of five minutes duration.

Soma (1971) indicated that unlike other muscle relaxants, the central depressant action of GGE produced drowsiness. Along with five per cent solution of GGE, thiopental sodium at the rate of 5 mg/kg was advocated. Stronger solutions of GGE produced haemolysis.

Jackson and Lundvall (1972) observed that the intravenous administration of a solution containing GGE and 0.2 per cent thiamylal sodium had no significant effect on haemoglobin content, packed cell volume, erythrocyte count and blood glucose level in thirty horses. It depressed paO_2 but $paCO_2$ and pH of blood were not affected.

Keeran (1972) reported that the rapid intravenous administration of a combination of GGE (60 g), pentobarbital sodium (3 g) and 50 per cent Dextrose (125 ml) in water (upto 1 litre) was satisfactory for ovariectomy in mares.

Pedersoli (1972) recommended pre-anaesthetics like chloral hydrate (4 g/50 kg), promazine hydrochloride (300 mg/1000 lb) and Acetylpromazine maleate (4 mg/100 lb) for intravenous use prior to administration of GGE.

Takarkhede et al. (1973) studied the effects of five per cent solution of GGE with trifluprομazine (10 mg/kg), thiopentone sodium and chloral hydrate in four groups of buffalo calves. Pre-medication with trifluprομazine reduced the dose of thiopental sodium, chloral hydrate and GGE. A significant rise in heart rate and a fall in rectal temperature was noticed in all the groups. A few animals showed significant increase in blood glucose, and a decrease in serum potassium values.

Acosta (1975) concluded in an experimental study that GGE was suitable for brief surgical operations in horses.

D'Ieteren (1976) combined methitural with GGE to eliminate undesirable side effects like respiratory depression and cardiovascular interference of methitural. Pre-medication with propionyl promazine/Promazine/Atropine had also been studied along with this.

Lindley (1976) concluded from a study in 100 horses that the combination of GGE and thiamylal sodium was satisfactory for surgery which require less than an hour.

Bishop (1978) stated that GGE could be a useful sedative and anaesthetic agent in horses, but for the disadvantage of administration of large volume to obtain the desired effect.

Muir et al. (1978) studied the effect of intravenous administration of GGE and ketamine hydrochloride after intramuscular administration of xylazine. Anaesthesia was further

maintained with halothane or enflurane. Anaesthesia was accompanied by decreased cardiac output, arterial blood pressure, and PaO_2. Respiratory rate was decreased and arterial CO_2 tension was higher during maintenance of anaesthesia with enflurane than with halothane. A safe and rapid induction of anaesthesia and uneventful recovery were observed.

Schatzman et al. (1978) evaluated GGE in rapid intravenous injection (100 mg/kg) and found that the muscle relaxation lasted for 17-50 minutes. There were no changes in blood picture apart from the transient haemolysis when 20 per cent solution was administered.

Ketelaars et al. (1979) studied the effects of intravenous injection of GGE at a rate of 100 mg/kg in equines (1-13 years old) as a single dose. Relaxation of muscles was pronounced for 16 minutes (5-35 min.) and the horses recovered within 40 and 45 minutes.

Muir et al. (1979) studied chemical restraint in horses with thiamylal, GGE alone and with ketamine hydrochloride, followed by general anaesthesia using halothane. Administration of GGE and ketamine hydrochloride increased arterial blood pressure during induction and maintenance with halothane anaesthesia. Recovery was very short. Thiamylal produced more depression to the cardiopulmonary system and required a high initial concentration of halothane. Combination of GGE with thiamylal or ketamine hydrochloride reduced the initial

concentration of halothane and provided rapid and safe restraint with minimal cardiopulmonary depression.

Schatzman (1979) compared the effect of GGE alone and with thiamylal sodium for casting, and maintenance of anaesthesia with halothane in horses. GGE produced a higher average respiration rate and a lower more balanced pulse rate during 100 minutes of halothane.

Wright et al. (1979) induced intravenous anaesthesia in horses with intravenous administration of GGE followed by sodium thiamylal after pre-medication with acetylpromazine. Anaesthesia was maintained with halothane. There was a reduction in arterial blood pressure immediately after induction, which was followed by a gradual increase till it attained normal values by 45 minutes.

Grandy and Mc Donell (1980) evaluated the pH, osmolality, stability and bacteriostatic characteristics of 5, 10 and 15 per cent solutions of GGE in equines. The results revealed that a 10 per cent solution of GGE in sterile distilled water was most suitable for clinical anaesthesia in horses. It had satisfactory storage qualities and did not induce clinically significant haemolysis.

Hubbell et al. (1980) studied the cardiopulmonary changes in horses after intravenous administration of GGE alone or xylazine intravenously followed by GGE in horses. The dose of GGE necessary to produce lateral recumbency in adult horses

was 134 ± 34 mg/kg body weight. GGE caused non-significant changes in heart rate, respiratory rate, right atrial pressure, pulmonary arterial pressure and cardiac output. Significant decrease was observed in the systolic, diastolic and mean arterial blood pressure. Arterial pO_2 was transiently but significantly reduced. Xylazine reduced the dose of GGE necessary to produce lateral recumbency and there were significant but transient decrease in heart rate, respiratory rate, cardiac output and paO_2. Central venous pressure was significantly increased whereas systolic, diastolic and mean arterial pressures were significantly decreased. Neonatal concentration of the GGE was approximately 30 per cent of that of dam immediately after parturition indicating that significant amounts crossed the placental barrier.

Honalikar et al. (1982) studied the liver function, viz., icterus index, levels of alkaline phosphatase, serum aspartate, amino transferase, total plasma protein and fibrinogen values, in male calves after intravenous administration of GGE, triflupromazine, thiopental sodium and chloral hydrate. Administration of GGE caused a significant rise in icterus index. GGE and triflupromazine had no effect on liver function but a slight decline in the icterus index was noticed, when GGE was administered with thiopentone sodium.

Pandey et al. (1982) using GGE at different dose rate with triflupromazine, thiopentone sodium and chloral hydrate found that kidney functions in calves were not significantly altered.

Blood urea nitrogen, creatinine and uric acid levels remained within the normal clinical limits upto 72 hours.

Agarwal et al. (1983a) studied the changes during surgical anaesthesia with five per cent solution of GGE alone or in combination with 0.2 per cent solution of thiopentone sodium or six per cent solution of chloral hydrate. Induction, duration of anaesthesia and recovery were prolonged with chloral hydrate and the dose rate of GGE was more. An overlapping of reflexes was noticed in the group treated with thiopental and GGE. Marked bulging of eye ball was noticed at the onset of anaesthesia with GGE alone or along with thiopental sodium, while there was marked salivation in thiopentone combination. In all the groups, a significant fall in rectal temperature was noticed.

Agarwal et al. (1983b) studied the cardiovascular and respiratory dynamics, acid base status, blood gases and certain biochemical constituents of blood in buffalo calves administered with GGE. There was appreciable hypotension, tachycardia, tachypnoea and a decrease in central venous pressure and tidal volume. Variations in acid base status were minor while hyperglycaemia and hypokalaemia were salient features.

Agarwal et al. (1983c) studied the physiological and biochemical effects of GGE-thiopentone sodium anaesthesia in buffalo calves. During surgical anaesthesia there was marked hypotension and tachycardia along with decrease in central

venous pressure, tidal volume, plasma potassium level and pO_2 in arterial blood and plasma potassium. Hyperglycaemia was a consistent feature but changes in acid base equilibrium were mild and inconsistent.

Agarwal et al. (1983d) studied the effect of intravenous administration of five per cent solution of GGE with chloral hydrate in buffalo calves. The combination has reduced the dose of GGE considerably (61.5 per cent). There was significant hypotension and tachycardia along with decrease in central venous pressure and tidal volume. The animals exhibited mild respiratory acidosis and significant arterial hypoxaemia and hyperglycaemia.

Agarwal et al. (1983e) studied the histopathological changes in liver and kidney, three hours after induction of anaesthesia using intravenous administration of GGE alone and with chloral hydrate and thiopental sodium in buffalo calves. High degree of degenerative changes in liver and kidney was noticed with GGE-chloral hydrate combination.

Karimi (1983) conducted an experimental study to induce anaesthesia in horses using xylazine (0.06-1 mg/kg body weight) followed by GGE, thiopentone and halothane in one group and acepromazine (0.05 mg/kg body weight), thiopentone and halothane in a second group. When xylazine was administered atrio ventricular block was observed along with a reduced pH of blood. The paO_2 increased after the induction but dropped to one-third of the initial level at the time of recovery.

A marked fall in respiratory rate was observed in the second group. Bradycardia was observed during halothane anaesthesia in both the groups. Acidemia that gradually developed following induction in second group was reduced on recovery. All anaesthetized horses showed high arterial and venous CO_2 tension.

Kalharo and Rex (1984) evaluated the effect of premedication using atropine and acepromazine followed by intravenous administration of 15 per cent GGE and thiobarbiturate in horses. The induction was smooth. Anaesthesia was maintained with oxygen and halothane. Immediately after induction, the heart rate increased but respiratory rate was found decreased. The horses showed respiratory acidosis and increased arterial blood oxygen tension.

Pandey *et al.* (1984) recorded an increase of blood urea nitrogen, serum creatinine and serum uric acid following the administration of diazepam, GGE or diazepam, GGE and pentobarbitone sodium in goats.

Schatzman *et al.* (1984) studied the immediate effects of GGE with pre-anaesthetics in horses. An increase in respiratory rate was noticed without any change in minute volume. During infusion of the drug, a period of shallow respiration was observed, but paO_2 and $paCO_2$ were unchanged. Arterial blood pressure decreased but the heart rate increased.

Brouwer (1985) compared the effects of two combinations

of anaesthetics in horses, viz. acepromazine maleate thiopentone sodium and suxamethonium chloride and, acepromazine maleate, GGE and thiopentone sodium. Induction of anaesthesia was uneventful in both the cases. Anaesthesia was maintained with halothane. The duration of anaesthesia was compared and the mean duration of effect was 48.0 ± 25.0 minutes and 35.0 ± 22.0 minutes in the two groups.

Kinge et al. (1985) found that diazepam-GGE combination reduced the dose of thiopentone and pentobarbitone required for surgical anaesthesia in goats. A moderate to heavy salivation and lacrimation were noticed. Haematuria was noticed in animals treated with GGE and barbiturate. The fall in rectal temperature was not significant. The diazepam-GGE combination caused depression of respiration and reduction in packed cell volume and erythrocyte count. The diazepam-GGE-thiopentone sodium combination caused a decrease in erythrocyte count and increase in heart rate. Diazepam-GGE-pentobarbitone combination prolonged the duration of anaesthesia and recovery, decreased the respiration rate, erythrocyte count and packed cell volume with an increase in heart rate.

Rugh et al. (1985) experienced a smooth induction of anaesthesia with intravenous administration of acepromazine, thiopentone sodium and 5 per cent GGE. Anaesthesia was maintained using halothane. Total duration of anaesthesia was 1.5 to 2.5 hours. Recovery was rapid.

Materials and Methods

MATERIALS AND METHODS

3.1. Experimental animals

Eighteen apparently healthy cross-bred male kids, aged 5-9 months and weighing 11-16 kg were used for the study. All the animals were housed separately in pens, under identical conditions of feeding and management. All kids were dewormed and kept under observation for a period of 10 days prior to the experiment.

These 18 animals were divided into three groups of six animals each and were numbered.

Group A: A(1), A(2), A(3), A(4), A(5) and A(6)

Group B: B(1), B(2), B(3), B(4), B(5) and B(6)

Group C: C(1), C(2), C(3), C(4), C(5) and C(6)

Five per cent solution of Glyceryl guaiacol ether (GGE), prepared in five per cent Dextrose solution was used for the present study. The animals were weighed before the administration of drugs. GGE was administered alone intravenously (Group A), or along with a tranquilizer (Group B) or with a tranquilizer followed by a barbiturate (Group C).

3.2. Preparation of animals

Food and water were withheld for 24 hours prior to the experiment. The animals were secured in right lateral recumbency. The left jugular vein in the midcervical region was the site preferred for the administration of the drugs. The site was prepared by clipping, shaving and painting with

Tr. Iodine. Local linear infiltration anaesthesia of the site was induced by injecting 4 ml of 2 per cent Lignocaine hydrochloride* solution subcutaneously at the jugular furrow.

Procedure.

A skin incision, 4 cm long was made over the lower border of the jugular furrow. The left carotid artery and jugular vein were exteriorised by careful dissection. A polythene catheter, 0.9 mm diameter and 13 cm long was introduced into the carotid artery and connected to the aneroid manometer by means of a three way valve for measuring the arterial blood pressure (Fig.1). Another polythene catheter, 0.9 mm diameter and 20 cm long was introduced into the anterior venacava through the jugular vein and was connected to a water manometer by a three way valve for recording central venous pressure and for administration of the drugs. Both the catheters were fixed *in situ* by means of ligatures. After a period of stabilization of 20 minutes and recording the initial values and collection of blood samples, the drugs were administered through the venous catheter as detailed hereunder:

Group A: GGE solution was administered at the rate of 100 mg/kg body weight.

Group B: After premedication with Triflupromazine hydrochloride** at the rate of 0.2 mg/kg body weight, GGE solution was administered at the rate of 100 mg/kg body weight.

---

* Gesicain 2% - Lignocaine hydrochloride 2% - SG Pharmaceuticals, Baroda, India.

** Siquil - Triflupromazine hydrochloride 20 mg/ml - Sarabhai Chemicals, Baroda, India.

Group C: After premedication with Triflupromazine hydrochloride at the rate of 0.2 mg/kg body weight and administration of GGE solution at the rate of 100 mg/kg body weight, five per cent solution of Thiopentone sodium*** was administered to effect anaesthesia.

3.3. The items of observations

3.3.1. Volume of anaesthetics administered

3.3.2. Time for induction

3.3.3. Clinical signs viz.,

Disappearance of reflexes,

Muscle relaxation,

Temperature,

Heart rate, and

Respiration rate

3.3.4. Duration of anaesthesia

3.3.5. Period of recovery

3.3.6. Haemodynamic factors viz.,

Arterial blood pressure, and

Central venous pressure

3.3.7. Electrocardiogram (ECG)

*** Intraval sodium - Thiopentone sodium - May and Baker (India) Ltd., Bombay.

3.3.8. Haemogram,

Total erythrocyte count,

Total and differential leukocyte count,

Haemoglobin content,

Packed cell volume, and

Erythrocyte sedimentation rate.

3.3.9. Serum constituents viz.,

Total serum protein,

Serum sodium,

Serum potassium,

Serum chloride, and

Blood glucose.

3.3.10. Liver function test

Serum glutamic pyruvic transaminase (SGPT) level.

3.3.11. Post anaesthetic observations

3.3.12. Autopsy and Histopathological examination

Observations were recorded before the administration of the drugs and after administration at intervals of 5, 15, 30, 60 and 120 min. and at 24 hours wherever necessary.

Methods

3.3.1. Volume of anaesthetics administered.

The volume of GGE and Triflupromazine hydrochloride were calculated according to the body weight of the individual animals and administered slowly through the venous catheter. The volume of Thiopentone sodium administered to effect the anaesthesia was recorded.

3.3.2. Time of induction

It was calculated as the time from the administration of the drugs to the time of disappearance of reflexes.

3.3.3. Clinical signs

Disappearance of corneal, pedal, cutaneous and palpebral reflexes and relaxation of the muscles of jaw, tail anus, penis, limb and abdomen were the criteria for deciding the onset of anaesthesia.

The rectal temperature was recorded using a clinical thermometer. Heart rate and respiration rate were recorded by ascultation.

3.3.4. Duration of anaesthesia

It was calculated as the time interval between the induction of anaesthesia and the time of reappearance of reflexes.

3.3.5. Time for recovery

It was calculated from the time of reappearance of reflexes and the time when the reflexes were brisk.

3.3.6. Haemodynamic factors

Arterial blood pressure: The systolic and diastolic pressures were recorded directly from the manometer at intervals mentioned above.

Central venous pressure: It was recorded from the water manometer calibrated from -15 to +30 cms. The readings were

taken at intervals mentioned above. Mean arterial pressure (MAP = $\frac{SP + 2(DP)}{3}$) and pulse pressures (PP =(SP-DP) were derived from the recordings of arterial blood pressure.

3.3.7. Electrocardiogram

ECG was recorded using a base apex lead system, at a paper speed of 25 mm per second, at the same time intervals mentioned above.

3.3.8. Haemogram

Total erythrocyte count, total and differential leukocyte counts and haemoglobin content were estimated as per the technique described by Schalm (1975). Packed cell volume and erythrocyte sedimentation rate were estimated following the method of Wintrobe (1961).

3.3.9. Serum constituents

Total serum protein was estimated using Biuret method of Inchiosa (1964). Serum sodium and potassium were determined by flame photometry (Oser, 1971). Serum chloride was estimated by Osterberg and Schmidt's quantitative test (1927). Blood glucose was estimated following the method of Folin and Wu (Oser, 1971).

3.3.10. Liver function test

Serum samples of animals from each group were collected before the experiment and after the experiment at 24th hour 4th day and 10th day. The method of Reitman and Frankel, as

given by King (1965) was followed for estimating serum glutamic pyruvic transaminase using SGPT test kit.**** The values were converted to IU/L as detailed out by Benjamin (1978).

3.3.11. Post-anaesthetic observation

After 120 min. the catheters were withdrawn and the vessels were ligated to arrest haemorrhage. The skin incision was closed with simple interrupted sutures using monofilament nylon. The animals were kept under observation for varying periods, upto a maximum of 10 days.

3.3.12. Autopsy

Two animals from each group were sacrificed by exsanguination, one on the 4th day and the other on the 10th day. The organs were examined for gross pathological changes, if any, and samples were collected for histopathological examination.

Histopathological examination

Samples of liver and kidney from the sacrificed animals were fixed in 10 per cent buffered neutral formalin and processed by routine paraffin embedding technique (Armed Forces Institute of Pathology, 1968). Paraffin sections of 4 µm thickness were stained with haemotoxylin and eosin method (Scheehan and Hrapchack, 1980).

**** SGPT test kit - Hi-tech Laboratories, Bombay, India.

3.4. Statistical analysis

The data were analysed using Student's 't' test (Snedecor and Cochran, 1967).

Fig. 1.

Fig. 2.

Results

RESULTS

GROUP A

The observations are presented in Tables 1 to 4 and 13.

4.1(A). The average body weight of the animals in this group was 14.00 ± 0.50 kg.

4.2(A). GGE alone was administered at the rate of 100 mg/kg body weight intravenously to all the animals of this group.

4.3.1(A). An average of 28.00 ± 0.10 ml. five per cent GGE solution in five per cent Dextrose was administered intravenously. There were no untoward symptoms at the time of administration of the drug.

4.3.2(A). The induction time was 3.42 ± 0.20 min.

4.3.3(A). Clinical signs.

Induction was smooth in all the animals. Slight salivation was noticed in four animals. One animal (A5) showed shivering for three minutes immediately after the administration of the drug. Pedal, cutaneous and corneal reflexes were seen abolished but palpebral reflex persisted. Dilation of pupil with complete relaxation of muscles of jaw, limbs, penis, abdomen and anus except the tail were noticed as the effect deepened.

The rectal temperature (°F) was 102.36 ± 0.17 before administration, 101.66 ± 0.18 at 5 min, 101.26 ± 0.31 at 15 min.,

101.40 ± 0.25 at 30 min., 101.83 ± 0.38 at 60 min., 101.90 ± 0.13 at 120 min. and 102.73 ± 0.19 at 24 hours. There was significant reduction ($P < 0.05$) at 5, 15 and 30 min. It was near normal by 60 min.

The heart rate (per min.) was 111.50 ± 9.42 before administration, 115.16 ± 6.81 at 5 min., 118.67 ± 13.31 at 15 min., 141.33 ± 7.07 at 30 min., 129.00 ± 3.45 at 60 min., 157.33 ± 8.24 at 120 min. and 122.16 ± 7.04 at 24 hours. The significant increase ($P < 0.05$) in heart rate by 30 min. was followed by a decrease at 60 min. and a significant increase ($P < 0.05$) by 120 min. It was within normal range by 24 hours.

The respiration rate (per min.) was 38.16 ± 5.46 before administration, 27.83 ± 4.97 at 5 min., 29.00 ± 4.22 at 15 min., 31.83 ± 5.22 at 30 min., 93.67 ± 21.64 at 60 min., 70.17 ± 19.60 at 120 min. and 57.16 ± 9.52 at 24 hours. After an initial reduction, there was a significant rise ($P < 0.05$) at 60 min. Thereafter it showed a decline upto 24 hours.

4.3.4(A). The duration of anaesthesia was 28.83 ± 2.27 min.

4.3.5(A). The recovery period was 18.00 ± 0.89 min. Recovery from anaesthesia was smooth and uneventful.

4.3.6(A). Haemodynamic factors.

Systolic pressure (mmHg) was 118.33 ± 6.56 before administration, 112.33 ± 6.13 at 5 min., 111.33 ± 6.50 at 15 min., 106.66 ± 7.17 at 30 min., 93.60 ± 1.94 at 60 min., and 90.40 ± 2.23 at 120 min. The fall in systolic pressure at 60 min. and 120 min. was significant ($P < 0.05$).

Diastolic pressure (mmHg) was 109.67 ± 7.87 before administration, 102.33 ± 7.72 at 5 min., 103.66 ± 7.61 at 15 min., 100.00 ± 7.98 at 30 min., 85.60 ± 1.47 at 60 min. and 82.00 ± 2.10 at 120 min. There was significant fall ($P < 0.05$) in the diastolic pressure at 60 min. and 120 min.

Mean arterial pressure (mmHg) was 112.78 ± 7.64 before administration, 105.66 ± 7.23 at 5 min., 106.22 ± 7.24 at 15 min., 102.22 ± 7.24 at 30 min., 88.26 ± 1.53 at 60 min. and 84.80 ± 2.11 at 120 min. The fall in mean arterial pressure was significant ($P < 0.05$) at 60 min. and 120 min.

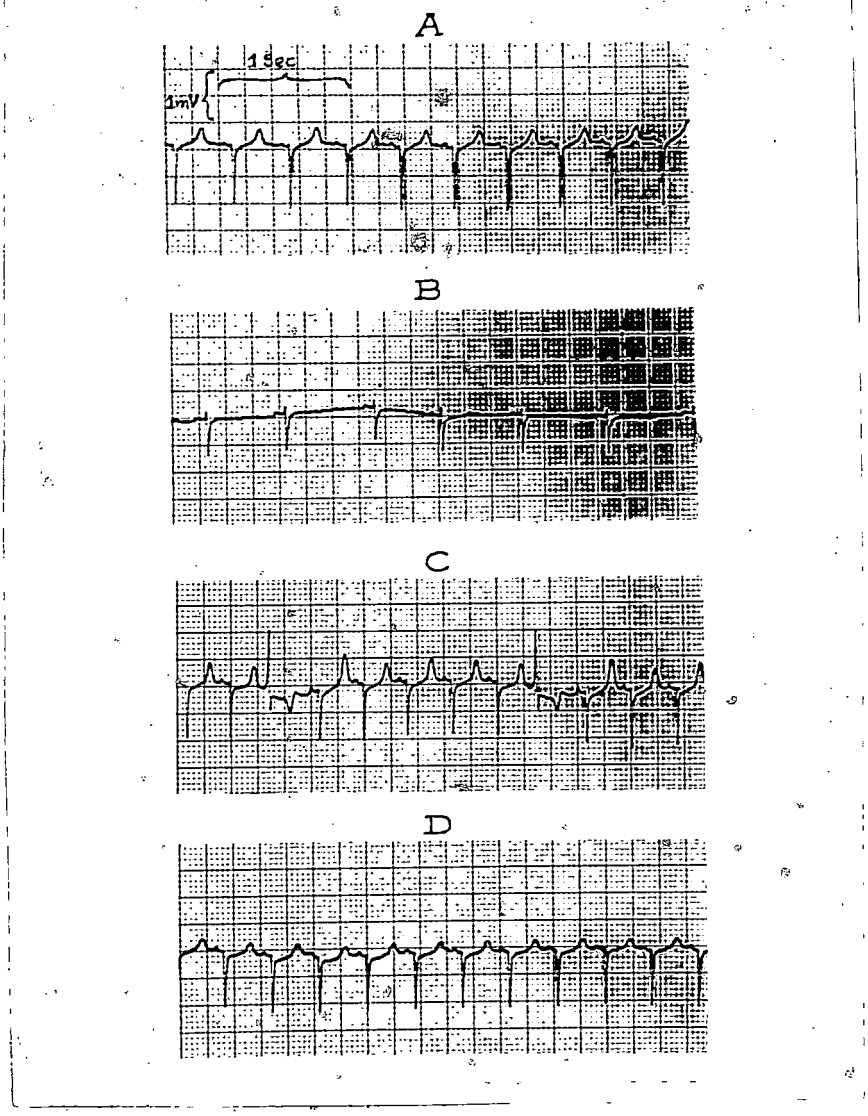
Pulse pressure (mmHg) was 8.67 ± 1.43 before administration, 10.00 ± 1.79 at 5 min., 7.67 ± 1.20 at 15 min., 6.67 ± 1.23 at 30 min., 10.00 ± 1.26 at 60 min., and 8.40 ± 0.75 at 120 min. The variations were not significant.

The central venous pressure (cm water) was 0.50 ± 1.02 before administration, 0.25 ± 0.57 at 5 min., 2.25 ± 2.68 at 15 min., 2.23 ± 3.07 at 30 min., -1.20 ± 1.36 at 60 min. and 0.00 ± 0.58 at 120 min. There was an increase upto 30 min. but the variations were not significant.

4.3.7(A). Electrocardiogram.

Changes in electrocardiogram included S-T segment depression in all the animals during anaesthesia and tachycardia during recovery. A momentary ectopic ventricular beat was noticed during anaesthesia in one animal. All the changes disappeared spontaneously at recovery (Fig. 3).

Fig. 3.



4.3.8(A). Haemogram.

Total erythrocyte count was 21.18 ± 3.01 x $10^6/mm^3$ before administration, 18.00 ± 2.21 x $10^6/mm^3$ at 120 min. and 18.01 ± 2.34 at 24 hours. The variations in the total erythrocyte count were not significant.

Total leukocyte count ($10^3/mm^3$) was 8.62 ± 1.17 before administration, 5.88 ± 1.40 at 120 min., and 11.08 ± 1.12 at 24 hours. The variations were not significant though there was an apparent reduction at 120 min.

The lymphocyte count (per cent) was 58.33 ± 2.67 before administration, 57.00 ± 1.00 at 120 min. and 37.67 ± 3.65 at 24 hours. The reduction at 24 hours was significant ($P < 0.05$).

The neutrophil count (per cent) was 38.60 ± 1.93 before administration, 40.00 ± 1.37 at 5 min., and 61.00 ± 4.24 at 24 hours. The increase observed at 24 hours was significant ($P < 0.05$).

Eosinophil and monocyte counts did not show marked variations.

The haemoglobin content (g/dl) was 8.67 ± 0.32 before administration, 8.13 ± 0.19 at 5 min., 8.43 ± 0.21 at 15 min., 8.48 ± 0.32 at 30 min., 8.05 ± 0.23 at 60 min., 8.13 ± 0.37 at 120 min. and 7.90 ± 0.42 at 24 hours. Variations in the haemoglobin content were marginal and not significant.

Packed cell volume (per cent) was 29.67 ± 0.80 before administration, 29.00 ± 0.77 at 5 min., 30.17 ± 0.98 at 15 min.,

29.50 ± 0.72 at 30 min., 28.83 ± 0.79 at 60 min., 28.67 ± 1.02 at 120 min. and 26.83 ± 0.83 at 24 hours. The reduction in the value at 24 hours was significant ($P < 0.05$).

The erythrocyte sedimentation rate (mm per 24 h) was 2.17 ± 0.17 before administration, 1.83 ± 0.17 at 5 min., 1.83 ± 0.31 at 15 min., 1.83 ± 0.17 at 30 min., 3.00 ± 0.63 at 60 min., 2.50 ± 0.50 at 120 min. and 2.00 ± 0 at 24 hours. It decreased initially at 5 min. followed by an increase upto 60 min. The variations were not significant.

4.3.9(A). Serum constituents.

Total serum protein (g/dl) was 5.33 ± 0.11 before administration, 5.23 ± 0.30 at 5 min., 4.68 ± 0.66 at 15 min., 4.85 ± 0.41 at 30 min., 4.63 ± 0.32 at 60 min., 4.33 ± 0.39 at 120 min. and 4.65 ± 0.27 at 24 hours. The reduction in the total serum protein was significant ($P < 0.05$) at 120 min and 24 hours.

The serum sodium values (meq/l) were 131.65 ± 5.02 before administration, 138.43 ± 4.31 at 5 min., 136.36 ± 2.50 at 15 min., 131.43 ± 3.55 at 30 min., 129.69 ± 2.02 at 60 min., 137.45 ± 7.59 at 120 min. and 126.57 ± 5.63 at 24 hours. The variations were not significant.

The serum potassium level (meq/l) was 5.01 ± 0.44 before administration, 4.60 ± 0.29 at 5 min., 4.43 ± 0.37 at 15 min., 4.82 ± 0.21 at 30 min., 4.60 ± 0.41 at 60 min., 4.48 ± 0.36 at 120 min. and 4.55 ± 0.05 at 24 hours. The variations were not significant.

The serum chloride value (meq/l) was 100.52 ± 4.61 before administration, 101.37 ± 1.03 at 5 min., 102.95 ± 1.46 at 15 min., 100.88 ± 2.80 at 30 min., 102.30 ± 1.98 at 60 min., 104.37 ± 2.00 at 120 min. and 101.27 ± 2.56 at 24 hours. The variations were not significant.

The blood glucose value (mmol/l) was 5.50 ± 0.38 before administration, 7.41 ± 0.98 at 5 min., 6.89 ± 0.35 at 15 min., 7.11 ± 0.33 at 30 min., 6.77 ± 0.49 at 60 min., 6.10 ± 0.48 at 120 min. and 4.79 ± 0.42 at 24 hours. The increase in the blood glucose at 15 and 30 min. was significant ($p < 0.05$).

4.3.10(A). Liver function test.

The SGPT level (IU/L) was 16.80 ± 2.29 before administration, 18.72 ± 2.88 on first day, 16.32 ± 2.09 on 4th day and 15.84 on 10th day. The variations were not significant.

4.3.11(A). Post-anaesthetic observations.

All animals were found to be weak and dull and did not take food and water for 12 hours. After 24 hours all the animals were apparently normal.

4.3.12(A). Autopsy.

Gross pathological changes were not seen in any of the organs in the animals sacrificed on the 4th and the 10th day after the experiment.

Histopathological Examination.

Liver

4th day: Extensive cloudy swelling with degenerative

changes in nuclei and vacuolated cytoplasm were noticed in focal areas. Periportal lymphoid accumulation and engorgement of central veins were also distinct (Fig.6 and 7).

10th day: There was centrilobular necrosis with bile duct proliferation and engorged central veins (Fig.7).

Kidney.

4th day: Varying degrees of degenerative and necrotic changes in focal areas with slight tubular dilatation and oedema were observed. Medullary haemorrhage was prominent. Degeneration and accumulation of proteinaceous material in the tubules were also observed (Fig.9-11).

10th day: Tubular degeneration, medullary oedema and haemorrhage were more distinct. Prominent nuclei with condensation of chromatin were noticed at the distal convoluted tubules (Fig.9-11).

Table 1. Effects of intravenous administration of GGE in goats: Time of induction, duration of anaesthesia and recovery

Animal No.	Body weight (kg)	Volume of GGE administered (ml)	Time of induction (min.)	Duration of Anaesthesia (min.)	Time for recovery (min.)	Other observations
A_1	14.50	29.00	3.00	28.00	17.00	Salivation and dilation of pupil
A_2	16.00	32.00	4.00	28.00	17.00	Dilation of pupil
A_3	14.50	29.00	4.00	39.00	21.00	Slight salivation
A_4	13.00	26.00	3.00	25.00	20.00	Slight salivation
A_5	13.00	26.00	3.50	23.00	18.00	Shivering
A_6	13.00	26.00	3.00	30.00	15.00	Salivation
Mean ± S.E.	14.00 ± 0.50	28.00 ± 0.10	3.42 ± 0.20	28.83 ± 2.27	18.00 ± 0.89	

Table 2. Effects of intravenous administration of GGE in goats: Temperature, heart rate, respiration rate and haemodynamics (Mean ± S.E.), n=6

Parameters and units	Intervals						
	0 min.	5 min.	15 min.	30 min.	60 min.	120 min.	24 h
Temperature (°F)	102.36 ±0.17	101.66* ±0.18	101.26* ±0.31	101.40* ±0.25	101.83 ±0.38	101.90 ±0.13	102.73 ±0.19
Heart rate/min.	111.50 ±9.42	115.16 ±6.81	118.67 ±13.31	141.33* ±7.07	129.00 ±3.45	157.33* ±8.24	122.16 ±7.04
Respiration/min.	38.16 ±5.46	27.83 ±4.97	29.00 ±4.22	31.83 ±5.22	93.67* ±21.64	70.17 ±19.60	57.16 ±9.52
Systolic pressure (mm Hg)	118.33 ±6.56	112.33 ±6.13	111.33 ±6.50	106.66 ±7.17	93.60* ±1.94	90.40* ±2.23	-
Diastolic pressure (mm Hg)	109.67 ±7.87	102.33 ±7.72	103.66 ±7.61	100.00 ±7.98	85.60* ±1.47	82.00* ±2.10	-
Mean arterial pressure (mm Hg)	112.78 ±7.64	105.66 ±7.23	106.22 ±7.24	102.22 ±7.24	88.26* ±1.53	84.80* ±2.11	-
Pulse pressure (mm Hg)	8.67 ±1.43	10.00 ±1.79	7.67 ±1.20	6.67 ±1.23	10.00 ±1.26	8.40 ±0.75	-
Central venous pressure ($cm\ H_2O$)	0.50 ±1.02	0.25 ±0.57	2.25 ±2.68	2.23 ±3.07	-1.20 ±1.36	0.00 ±0.58	-

* Significant at 5% level

Table 3. Effects of intravenous administration of GGE in goats: Haemogram (Mean ± S.E.), n=6

Parameters and units	Intervals		
	0 min.	120 min.	24 h
Total erythrocyte count ($10^6/mm^3$)	21.18 ±3.01	18.00 ±2.21	18.01 ±2.34
Total leukocyte count ($10^3/mm^3$)	8.62 ±1.17	5.88 ±1.40	11.08 ±1.12
Lymphocyte (%)	58.33 ±2.67	57.00 ±1.00	37.67* ±3.65
Neutrophil (%)	38.60 ±1.93	40.00 ±1.37	61.00* ±4.24
Eosinophil (%)	3.00 ±0.82	3.00 ±0.68	1.33 ±0.61
Monocytes (%)	0.17 ±0.17	0	0

* Significant at 5% level

Table 4. Effects of intravenous administration of GGE in goats: Haemogram and serum constituents (Mean ± S.E.), n=6

Parameters and units	Intervals						
	0 min.	5 min.	15 min.	30 min.	60 min.	120 min.	24 h
Haemoglobin (g/dl)	8.67 ±0.32	8.13 ±0.19	8.43 ±0.21	8.48 ±0.32	8.05 ±0.23	8.13 ±0.37	7.90 ±0.42
Packed cell volume (%)	29.67 ±0.80	29.00 ±0.77	30.17 ±0.98	29.50 ±0.72	28.83 ±0.79	28.67 ±1.02	26.83* ±0.83
Erythrocyte sedimentation rate (mm/24 h)	2.17 ±0.17	1.83 ±0.17	1.83 ±0.31	1.83 ±0.17	3.00 ±0.63	2.50 ±0.50	2.00 ±0
Blood glucose (mmol/l)	5.50 ±0.38	7.41 ±0.98	6.89* ±0.35	7.11* ±0.33	6.77 ±0.49	6.10 ±0.48	4.79 ±0.42
Total serum protein (g/dl)	5.33 ±0.11	5.23 ±0.30	4.68 ±0.66	4.85 ±0.41	4.63 ±0.32	4.33* ±0.39	4.65* ±0.27
Serum sodium (meq/l)	131.65 ±5.02	138.43 ±4.31	136.36 ±2.50	131.43 ±3.55	129.69 ±2.02	137.45 ±7.59	126.57 ±5.63
Serum potassium (meq/l)	5.01 ±0.44	4.60 ±0.29	4.43 ±0.37	4.82 ±0.21	4.60 ±0.41	4.48 ±0.36	4.55 ±0.05
Serum chloride (meq/l)	100.52 ±4.61	101.37 ±1.03	102.95 ±1.46	100.88 ±2.80	102.30 ±1.98	104.37 ±2.00	101.27 ±2.56

* Significant at 5% level

GROUP B

The observations are presented in Tables 5 to 8 and 13.

4.1.(B). The average body weight of the animals in this group was 12.17 ± 0.33 kg.

4.2(B). Triflupromazine hydrochloride solution was administered intravenously at the rate of 0.2 mg/kg body weight followed by GGE, five per cent solution at the rate of 100 mg/kg.

4.3.1(B). An average of 0.12 ± 0.003 ml, Triflupromazine hydrochloride solution and 24.33 ± 0.67 ml of GGE solution were administered intravenously. The animals did not show any discomfort during injection.

4.3.2(B). The induction time was 2.08 ± 0.08 min.

4.3.3(B). Clinical signs.

Induction was smooth in all the animals. Salivation was seen in all the animals. One animal (B_3) showed vigorous muscular contraction, stretching and stiffness of limbs and neck, immediately after administration of drugs. Pedal, corneal, cutaneous and palpebral reflexes disappeared on induction. Dilation of pupil with complete relaxation of muscles of jaw, limbs, penis, abdomen and anus except tail were evident as the effect deepened.

The rectal temperature (°F) was 103.13 ± 0.27 before administration, 102.63 ± 0.30 at 5 min., 102.03 ± 0.44 at 15 min.,

101.97 ± 0.37 at 30 min., 101.97 ± 0.42 at 60 min., 101.80± 0.58 at 120 min. and 102.40± 0.19 at 24 hours. There was significant reduction ($P < 0.05$) at 30 and 60 min.

The heart rate (per min.) was 139.33 ± 7.42 before administration, 117.00 ± 13.44 at 5 min., 105.66 ± 11.15 at 15 min., 124.00 ± 10.32 at 30 min., 126.67 ± 12.42 at 60 min., 144.33 ± 12.84 at 120 min. and 137.25 ± 5.88 at 24 hours. The reduction at 15 min. was significant ($P < 0.05$). Later it showed a gradual upward trend by 120 min. and it became normal at 24 hours.

The respiration rate (per min.) was 26.67 ± 3.29 before administration, 30.33 ± 9.51 at 5 min., 29.33 ± 6.40 at 15 min., 22.83 ± 3.54 at 30 min., 25.00 ± 3.17 at 60 min., 25.50 ± 2.89 at 120 min. and 38.50 ± 4.35 at 24 hours. The variations in the rate were not significant.

4.3.4(B). The duration of anaesthesia was 44.83 ± 1.74 min.

4.3.5(B). The recovery period was 17.33 ± 1.05 min. Recovery from anaesthesia was smooth and uneventful.

4.3.6(B). <u>Haemodynamic factors</u>.

Systolic pressure (mmHg) was 117.00 ± 3.61 before administration, 91.33 ± 2.91 at 5 min., 92.00 ± 7.66 at 15 min., 73.60 ± 6.11 at 30 min., 65.00 ± 4.34 at 60 min., and 81.60 ± 3.87 at 120 min. The fall in systolic pressure from 5 min. to 120 min. was significant ($P < 0.05$).

Diastolic pressure (mmHg) was 106.67 ± 3.33 before administration, 81.33 ± 2.91 at 5 min., 81.33 ± 7.33 at 15 min., 66.40 ± 6.99 at 30 min., 56.67 ± 5.58 at 60 min. and 72.00 ± 5.83 at 120 min. There was a significant reduction in the diastolic pressure by 5th min. which persisted till 120 min. ($P < 0.05$).

Mean arterial pressure (mmHg) was 110.04 ± 3.45 before administration, 84.65 ± 2.90 at 5 min., 84.83 ± 7.41 at 15 min., 68.80 ± 6.68 at 30 min., 59.44 ± 5.16 at 60 min. and 77.86 ± 4.64 at 120 min. There was a significant reduction in the value by the 5th min. which persisted upto 120 min. ($P < 0.05$).

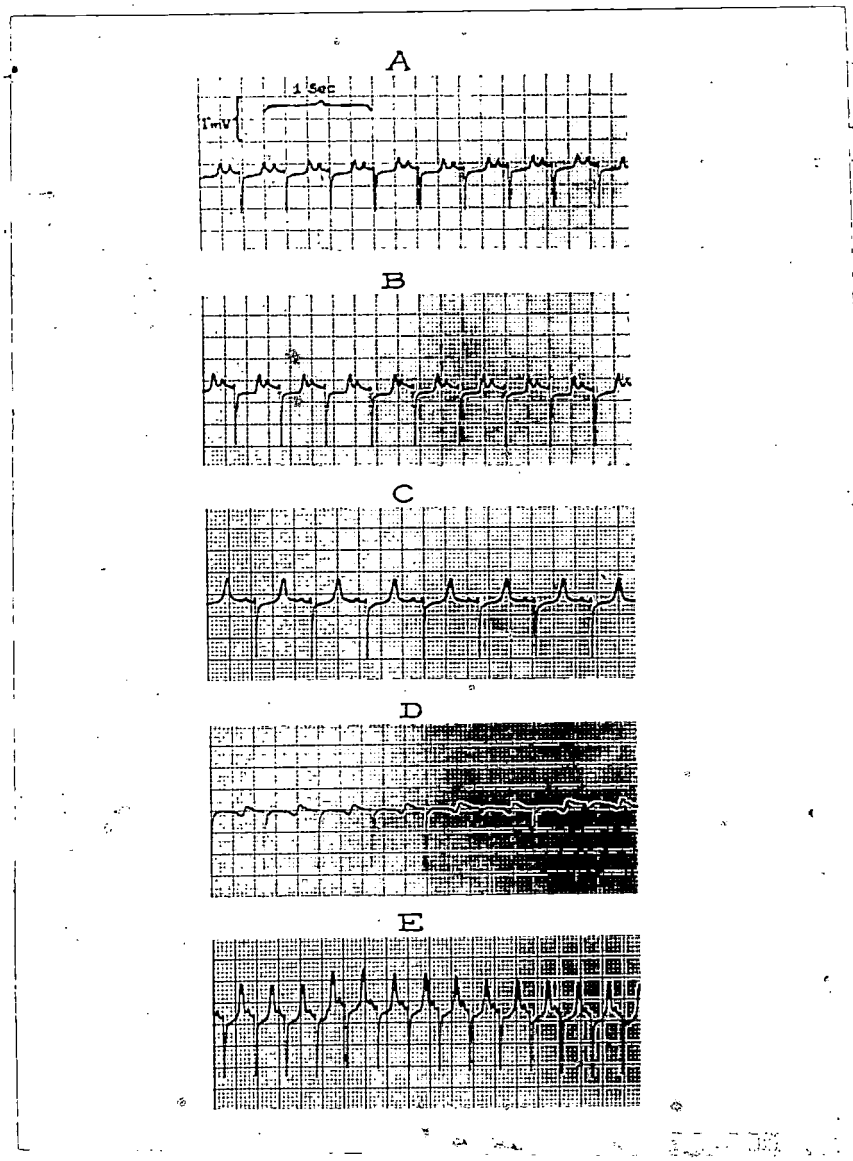
The pulse pressure (mmHg) was 10.33 ± 0.33 before administration, 10.00 ± 0.52 at 5 min., 10.67 ± 0.67 at 15 min., 7.20 ± 1.36 at 30 min., 8.33 ± 1.44 at 60 min. and 9.60 ± 2.93 at 120 min. A significant reduction ($P < 0.05$) was noticed at 30 min. followed by a gradual improvement.

The central venous pressure (cm water) was -3.83 ± 0.28 before administration, -3.08 ± 3.07 at 5 min., -2.92 ± 0.57 at 15 min., -4.17 ± 0.98 at 30 min., -3.25 ± 1.05 at 60 min., -3.83 ± 0.86 at 120 min. The variations were not significant.

4.3.7(B). Electrocardiogram.

The changes in electrocardiogram included P and S-T segment depression in all the animals between 15-60 min. and moderate tachycardia during recovery. All the changes disappeared spontaneously at recovery (Fig.4).

Fig. 4.



4.3.8(B). Haemogram.

Total erythrocyte count ($10^6/mm^3$) was 26.55 ± 1.68 before administration, 21.24 ± 2.09 at 120 min. and 20.28 ± 1.64 at 24 hours. The decrease in value at 24 hours was significant ($P<0.05$).

Total leukocyte count ($10^3/mm^3$) was 12.53 ± 2.07 before administration, 4.50 ± 1.16 at 120 min. and 20.18 ± 3.19 at 24 hours. A significant decrease ($P<0.05$) in the count was noticed at 120 min. and was followed by an increase at 24 hours.

The lymphocyte count (per cent) was 62.17 ± 5.76 before administration, 67.16 ± 2.66 at 120 min. and 25.50 ± 2.78 at 24 hours. The decrease in the values at 24 hours was significant ($P<0.05$).

Neutrophil count (per cent) was 33.83 ± 4.16 before administration, 32.00 ± 2.46 at 120 min. and 73.00 ± 2.80 at 24 hours. The increase noticed at 24 hours was significant ($P<0.05$).

The eosinophil and monocyte count did not show marked variation.

Haemoglobin content (g/dl) was 9.63 ± 0.25 before administration, 8.97 ± 0.51 at 5 min., 8.70 ± 0.23 at 15 min., 9.27 ± 0.28 at 30 min., 8.70 ± 0.30 at 60 min., 8.53 ± 0.32 at 120 min. and 8.95 ± 0.30 at 24 hours. Decrease in the haemoglobin content was statistically significant at 15, 60 and 120 min. ($P<0.05$).

Packed cell volume (per cent) was 35.53 ± 1.58 before administration, 31.67 ± 2.01 at 5 min., 31.50 ± 1.48 at 15 min., 33.33 ± 1.71 at 30 min., 30.33 ± 1.54 at 60 min., 30.83 ± 1.76 at 120 min. and 31.60 ± 1.44 at 24 hours. The reduction at 60 min. was significant ($P < 0.05$).

The erythrocyte sedimentation rate (mm/24 h) was 2.33 ± 0.33 before administration, 1.83 ± 0.17 at 5 min., 2.50 ± 0.34 at 15 min., 2.33 ± 0.21 at 30 min., 3.00 ± 0.63 at 60 min., 3.33 ± 0.61 at 120 min., and 2.00 ± 2.60 at 24 hours. It decreased initially at 5 min. followed by an increase upto 120 min. The variations were not significant.

4.3.9(B). Serum constituents.

The total serum protein (g/dl) was 5.20 ± 0.15 before administration, 5.17 ± 0.08 at 5 min., 5.08 ± 0.14 at 15 min., 5.02 ± 0.14 at 30 min., 4.80 ± 0.15 at 60 min., 4.63 ± 0.27 at 120 min. and 4.80 ± 0.30 at 24 hours. The variations were not significant.

Serum sodium values (meq/l) were 179.44 ± 1.09 before administration, 177.26 ± 1.46 at 5 min., 179.80 ± 0.72 at 15 min., 176.90 ± 0.72 at 30 min., 179.22 ± 1.48 at 60 min., 179.08 ± 0.92 at 120 min. and 178.89 ± 1.04 at 24 hours. Variations were not significant.

The serum potassium value (meq/l) was 4.90 ± 0.21 before administration, 4.69 ± 0.12 at 5 min., 4.54 ± 0.21 at 15 min., 4.33 ± 0.23 at 30 min., 3.99 ± 0.29 at 60 min., 3.92 ± 0.11 at

120 min. and 4.79 ± 0.31 at 24 hours. The reduction at 60 and 120 min. was significant ($P<0.05$).

The serum chloride value (meq/l) was 102.01 ± 4.30 before administration, 104.75 ± 2.04 at 5 min., 104.35 ± 5.91 at 15 min., 104.77 ± 2.43 at 30 min., 111.04 ± 5.38 at 60 min., 101.98 ± 3.24 at 120 min. and 103.32 ± 1.24 at 24 hours. The variations were not significant.

The blood glucose (mmol/l) level was 4.68 ± 0.32 before administration, 6.44 ± 0.31 at 5 min., 6.31 ± 0.51 at 15 min., 6.54 ± 0.53 at 30 min., 5.88 ± 0.51 at 60 min., 6.16 ± 0.67 at 120 min. and 3.39 ± 0.29 at 24 hours. The increase at 5, 15 and 30 min. and the decrease at 24 hours were significant ($P<0.05$).

4.3.10(B). Liver function test.

SGPT level (IU/L) was 15.87 ± 1.05 before administration, 19.34 ± 1.61 on first day, 12.00 ± 2.40 on 4th day and 13.92 on 10th day. The variations were not significant.

4.3.11(B). Post anaesthetic observations.

Two animals (B_4 and B_5) died at 130 min. and within 4 hours after injection due to aspiration of rumen content and respiratory arrest. Animal No.B_3 died within 48 hours due to respiratory arrest. After 36 hours, rest of the animals were apparently normal. All the other animals were found to be weak and dull, did not take food and water upto 24 hours.

Incordination of movements and tilting of head to a side was noticed upto 24 hours.

4.3.12(B). Autopsy.

Gross pathological changes were not seen in any of the organs in the animals sacrificed on the 4th and the 10th day after the experiment.

Histopathological examination.

Liver.

4th day: The architectural details and arrangement of the hepatocytes were lost. Cytoplasm of the cells showed a granular appearance. Fatty degeneration was prominent (Fig.8).

10th day: There was moderate degree of degeneration and partial necrosis (Fig. 6 and 7).

Kidney.

4th day: Focal medullary haemorrhage, glomerular congestion and tubular degeneration were the salient features (Fig.11).

10th day: There was medullary oedema, haemorrhage and conglomeration of the cells (Fig.11).

Table 5. Effects of intravenous administration of Triflupromazine and GGE in goats: Time of induction, duration of anaesthesia and recovery

Animal No.	Body weight (kg)	Volume of drugs administered		Time of induction (min.)	Duration of anaesthesia (min.)	Time for recovery (min.)	Other observations
		Tri-flupromazine (ml)	GGE (ml)				
B_1	13.00	0.13	26.00	2.00	49.00	19.00	Marked salivation
B_2	13.00	0.13	26.00	2.00	50.00	15.00	Salivation and immediate dilation of pupil
B_3	12.50	0.125	25.00	2.00	45.00	15.00	Vigorous contraction of musculature, stiffness and salivation
B_4	12.00	0.12	24.00	2.50	40.00	20.00	Immediate dilation of pupil and salivation
B_5	11.00	0.11	22.00	2.00	45.00	15.00	Slight salivation, laboured breathing
B_6	11.50	0.115	23.00	2.00	40.00	20.00	Salivation
Mean	12.17	0.12	24.33*	2.08	44.83	17.33	
± S.E.	±0.33	±0.003	±0.67	±0.08	±1.74	±1.05	

Table 6. Effects of intravenous administration of Triflupromazine and GGE in goats: Temperature, heart rate, respiration rate and haemodynamics (Mean ± S.E.), n=6

Parameters and units	Intervals						
	0 min.	5 min.	15 min.	30 min.	60 min.	120 min.	24 h
Temperature (°F)	103.13 ±0.27	102.63 ±0.30	102.03 ±0.44	101.97* ±0.37	101.97* ±0.42	101.80 ±0.58	102.40 ±0.19
Heart rate/min.	139.33 ±7.42	117.00 ±13.44	105.66* ±11.15	124.00 ±10.32	126.67 ±12.42	144.33 ±12.84	137.25 ±5.88
Respiration/min.	26.67 ±3.29	30.33 ±9.51	29.33 ±6.40	22.83 ±3.54	25.00 ±3.17	25.50 ±2.89	38.50 ±4.35
Systolic pressure (mmHg)	117.00 ±3.61	91.33* ±2.91	92.00* ±7.66	73.60* ±6.11	65.00* ±4.34	81.60* ±3.87	-
Diastolic pressure (mmHg)	106.67 ±3.33	81.33* ±2.91	81.33* ±7.33	66.40* ±6.99	56.67* ±5.58	72.00* ±5.83	-
Mean arterial pressure (mmHg)	110.04 ±3.45	84.65* ±2.90	84.83* ±7.41	68.80* ±6.68	59.44* ±5.16	77.86* ±4.64	-
Pulse pressure (mmHg)	10.33 ±0.33	10.00 ±0.52	10.67 ±0.67	7.20* ±1.36	8.33 ±1.44	9.60 ±2.93	-
Central venous pressure ($cm\ H_2O$)	-3.83 ±0.28	-3.08 ±3.07	-2.92 ±0.57	-4.17 ±0.98	-3.25 ±1.05	-3.83 ±0.86	-

* Significant at 5% level

Table 7. Effects of intravenous administration of Triflupromazine and GGE in goats: Haemogram (Mean ± S.E.), n=6

Parameters and units	Intervals		
	0 min.	120 min.	24 h
Total erythrocyte count ($10^6/mm^3$)	26.55 ±1.68	21.24 ±2.09	20.28* ±1.64
Total leukocyte count ($10^3/mm^3$)	12.53 ±2.07	4.50* ±1.16	20.18 ±3.19
Lymphocytes (%)	62.17 ±5.76	67.16 ±2.66	25.50* ±2.78
Neutrophils (%)	33.83 ±4.16	32.00 ±2.46	73.00* ±2.80
Eosinophils (%)	1.67 ±0.56	0.50 ±0.34	0.50 ±0.50
Monocytes (%)	0.66 ±0.49	0.50 ±0.34	1.00 ±0.58

* Significant at 5% level

Table 8. Effects of intravenous administration of Triflupromazine and GGE in goats: Haemogram and serum constituents (Mean ± S.E.), n=6.

Parameters and units	Intervals						
	0 min.	5 min.	15 min.	30 min.	60 min.	120 min.	24 h
Haemoglobin (g/dl)	9.63 ±0.25	8.97 ±0.51	8.70* ±0.23	9.27 ±0.28	8.70* ±0.30	8.53* ±0.32	8.95 ±0.30
Packed cell volume (%)	35.53 ±1.58	31.67 ±2.01	31.50 ±1.48	33.33 ±1.71	30.33* ±1.54	30.83 ±1.76	31.60 ±1.44
Erythrocyte sedimentation rate (mm/24 h)	2.33 ±0.33	1.83 ±0.17	2.50 ±0.34	2.33 ±0.21	3.00 ±0.63	3.33 ±0.61	2.00 ±2.60
Blood glucose (mmol/l)	4.68 ±0.32	6.44* ±0.31	6.31* ±0.51	6.54* ±0.53	5.88 ±0.51	6.16 ±0.67	3.39* ±0.29
Total serum protein (g/dl)	5.20 ±0.15	5.17 ±0.08	5.08 ±0.14	5.02 ±0.14	4.80 ±0.15	4.63 ±0.27	4.90 ±0.30
Serum sodium (meq/l)	179.44 ±1.09	177.26 ±1.46	179.80 ±0.72	176.90 ±0.72	179.22 ±1.48	179.08 ±0.92	178.89 ±1.04
Serum potassium (meq/l)	4.90 ±0.21	4.69 ±0.12	4.54 ±0.21	4.33 ±0.23	3.99* ±0.29	3.92* ±0.11	4.79 ±0.31
Serum chloride (meq/l)	102.01 ±4.30	104.75 ±2.04	104.35 ±5.91	104.77 ±2.43	111.04 ±5.38	101.98 ±3.24	103.32 ±1.24

* Significant at 5% level

GROUP C

The observations are presented in Tables 9 to 13.

4.1(C). The average bodyweight of the animals in this group was 12.00 ± 0.32 kg.

4.2(C). Triflupromazine hydrochloride solution was administered at the rate of 0.2 mg/kg immediately followed by GGE five per cent solution at the rate of 100 mg/kg bodyweight and Thiopentone sodium five per cent solution to effect anaesthesia.

4.3.1(C). On an average 0.12 ± 0.003 ml, Triflupromazine hydrochloride solution 23.83 ± 0.54 ml GGE solution and 2.97 ± 0.19 ml of Thiopentone sodium solution were administered. There were no adverse symptoms at the time of injection.

4.3.2(C). The induction time was 2.40 ± 0.24 min.

4.3.3(C). Clinical signs.

Induction was smooth in all the animals. Marked salivation was noticed in all the animals. Pedal, corneal, cutaneous and palpebral reflexes disappeared. Dilation of pupil with complete relaxation of the muscles of jaw, neck, limbs, penis, abdomen, anus and tail were noticed as the effect deepened. Two animals (C_1 and C_2) exhibited shivering. Respiratory arrest was seen in one animal (C_2) at 5 min., but recovered following artificial respiration.

The rectal temperature (°F) was 101.84 ± 0.26 before administration, 101.44 ± 0.27 at 5 min., 101.24 ± 0.37 at 15 min., 100.52 ± 0.21 at 30 min., 100.64 ± 0.36 at 60 min., 100.92 ± 0.44 at 120 min. and 102.68 ± 0.26 at 24 hours. There was significant reduction ($P < 0.05$) at 30 and 60 min.

The heart rate (per min.) was 136.40 ± 18.94 before administration, 129.60 ± 4.17 at 5 min., 128.00 ± 11.47 at 15 min., 133.40 ± 18.47 at 30 min., 138.00 ± 11.56 at 60 min., 157.60 ± 8.57 at 120 min. and 119.20 ± 7.12 at 24 hours. The heart rate decreased at 15 min., then gradually increased upto 120 min. and at 24 hours, It was less than the initial value. The variations were not significant.

Respiration rate (per min.) was 25.00 ± 2.86 before administration, 22.75 ± 6.80 at 5 min., 20.00 ± 1.45 at 15 min., 20.20 ± 3.00 at 30 min., 18.00 ± 2.95 at 60 min., 25.80 ± 4.65 at 120 min. and 26.80 ± 3.14 at 24 hours. It decreased upto 60 min. followed by an increase upto 24 hours. The variations were not significant.

4.3.4(C). Duration of anaesthesia was 52.60 ± 3.57 min.

4.3.5(C). Recovery period was 34.40 ± 1.69 min. Recovery from anaesthesia was smooth and uneventful.

4.3.6(C). <u>Haemodynamic factors</u>.

The systolic pressure (mmHg) was 118.40 ± 2.32 before administration, 66.40 ± 14.25 at 5 min., 92.80 ± 3.67 at 15 min.,

86.40 ± 5.38 at 30 min., 90.40 ± 3.76 at 60 min. and 92.00 ± 2.00 at 120 min. The fall in the systolic pressure was significant ($P < 0.05$).

The diastolic pressure mmHg) was 109.20 ± 2.87 before administration, 58.40 ± 15.51 at 5 min., 86.40 ± 3.87 at 15 min., 77.60 ± 6.31 at 30 min., 82.00 ± 3.74 at 60 min. and 84.00 ± 2.28 at 120 min. The fall in diastolic pressure was significant ($P < 0.05$).

The mean arterial pressure (mmHg) was 112.26 ± 2.67 before administration, 61.06 ± 15.08 at 5 min., 88.53 ± 3.70 at 15 min., 80.53 ± 5.99 at 30 min., 84.53 ± 3.78 at 60 min. and 86.66 ± 2.13 at 120 min. The fall in the mean arterial pressure was significant ($P < 0.05$).

The pulse pressure (mmHg) was 9.20 ± 0.80 before administration, 8.00 ± 1.55 at 5 min., 6.40 ± 1.83 at 15 min., 8.80 ± 1.20 at 30 min., 8.39 ± 0.75 at 60 min. and 8.00 ± 1.10 at 120 min. The variations were not significant.

The central venous pressure (cm water) was -3.90 ± 0.58 before administration, -2.20 ± 3.12 at 5 min., -5.60 ± 1.28 at 15 min., -5.30 ± 0.83 at 30 min., -5.00 ± 0.69 at 60 min. and -4.60 ± 0.81 at 120 min. The variations were not significant.

4.3.7(C). Electrocardiogram.

The changes in ECG included P and S-T segment depression in all the animals upto 60 min. Tachycardia was noticed after

Thiopentone administration. Moderate tachycardia was recorded during recovery. All the changes disappeared spontaneously at recovery (Fig.5).

4.3.8(C). Haemogram.

Total erythrocyte count ($10^6/mm^3$) was 25.19 ± 0.85 before administration, 19.27 ± 2.78 at 120 min. and 16.61 ± 2.19 at 24 hours. The reduction at 24 hours was significant ($P < 0.05$).

Total leukocyte count ($10^3/mm^3$) was 8.17 ± 1.13 before administration, 5.29 ± 0.79 at 120 min. and 11.60 ± 1.95 at 24 hours. The variations were not significant, though there was an apparent reduction at 120 min.

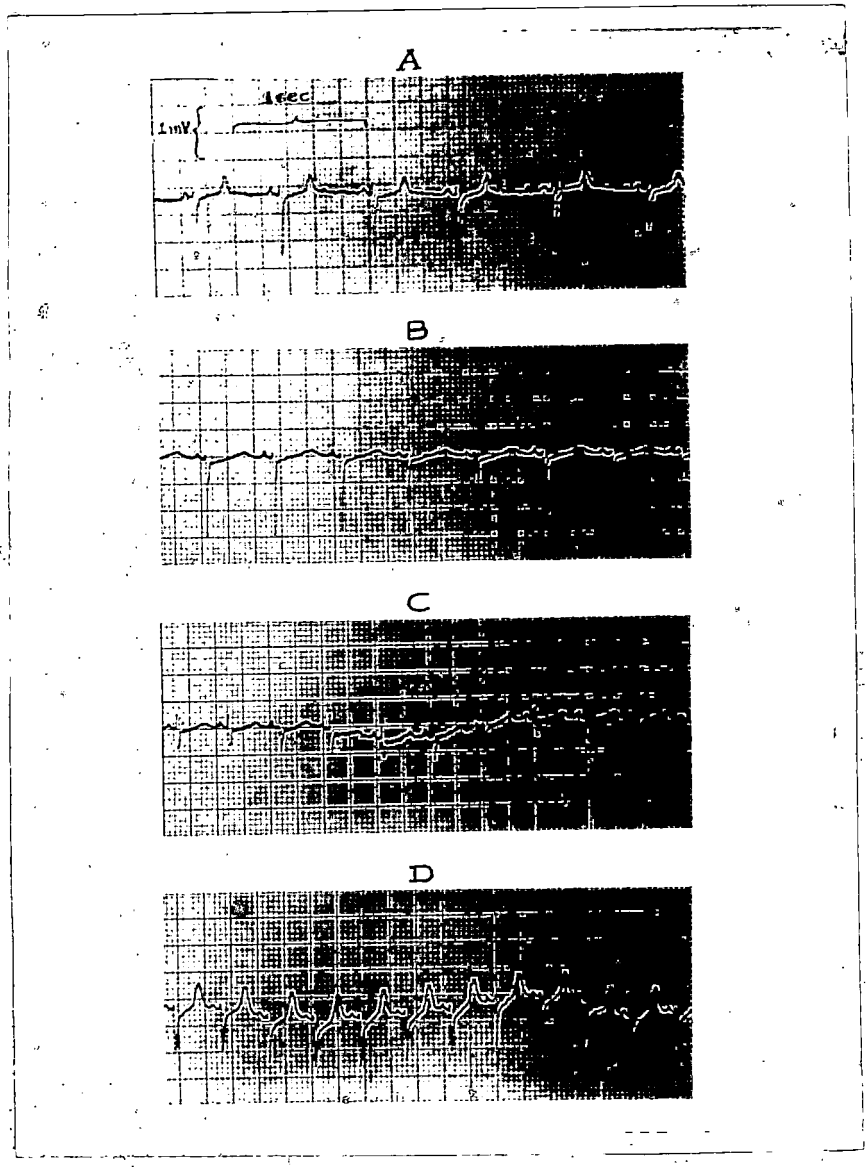
Lymphocyte count (per cent) showed a gradual decline in the initial value of 54.20 ± 11.76 to 35.80 ± 3.84 at 24 hours. The variations were not significant.

The neutrophil count (per cent) increased gradually from the initial value of 45.40 ± 11.64 to 63.00 ± 3.85 at 24 hours. The variations were not significant.

The eosinophil and monocyte count did not show marked variation.

Haemoglobin content (g/dl) was 9.28 ± 0.19 before administration, 9.12 ± 0.49 at 5 min., 8.52 ± 0.19 at 15 min., 8.40 ± 0.30 at 30 min., 8.32 ± 0.33 at 60 min., 8.56 ± 0.32 at 120 min. and 8.12 ± 0.46 at 24 hours. The reduction in the haemoglobin content was significant at 15 min., 30 min. and 24 hours ($P < 0.05$).

Fig 5.



Packed cell volume (per cent) was 32.40 ± 0.75 before administration, 29.80 ± 1.02 at 5 min., 29.20 ± 1.46 at 15 min., 29.20 ± 1.39 at 30 min., 30.00 ± 2.35 at 60 min., 30.20 ± 1.56 at 120 min. and 27.40 ± 2.40 at 24 hours. The variations were not significant.

Erythrocyte sedimentation rate (mm/24 h) was 2.60 ± 0.24 before administration, 3.40 ± 0.24 at 5 min., 3.60 ± 0.40 at 15 min., 3.80 ± 0.58 at 30 min., 4.20 ± 0.37 at 60 min., 3.60 ± 0.39 at 120 min. and 2.00 ± 0.00 at 24 hours. The increase in the value at 60 min. was significant ($P < 0.05$).

4.3.9(C). Serum constituents

The total serum protein (g/dl) was 5.26 ± 0.07 before administration, 5.00 ± 0.15 at 5 min., 5.08 ± 0.06 at 15 min., 5.06 ± 0.10 at 30 min., 4.92 ± 0.19 at 60 min., 4.98 ± 0.14 at 120 min. and 5.28 ± 0.16 at 24 hours. The variations were not significant.

The serum sodium values (meq/l) were 179.22 ± 2.24 before administration, 177.05 ± 1.63 at 5 min., 177.05 ± 2.89 at 15 min., 176.61 ± 0.81 at 30 min., 176.72 ± 1.04 at 60 min., 178.79 ± 1.74 at 120 min. and 184.01 ± 4.10 at 24 hours. The variations were not significant.

The serum potassium level (meq/l) was 4.48 ± 0.17 before administration, 4.73 ± 0.60 at 5 min., 3.94 ± 0.08 at 15 min., 3.81 ± 0.18 at 30 min., 3.51 ± 0.61 at 60 min., 3.66 ± 0.30 at 120 min. and 5.19 ± 0.23 at 24 hours. The reduction in the

values from 15 to 120 min. and the increase at 24 hours were significant ($P < 0.05$).

Serum chloride value (meq/l) was 98.53 ± 7.38 before administration, 99.07 ± 1.96 at 5 min., 97.94 ± 2.18 at 15 min., 93.37 ± 2.99 at 30 min., 101.05 ± 1.37 at 60 min., 101.98 ± 2.82 at 120 min. and 105.62 ± 2.55 at 24 hours. The variations were not significant.

Blood glucose (mmol/l) was 4.45 ± 0.29 before administration, 7.43 ± 1.00 at 5 min., 6.24 ± 0.71 at 15 min., 6.22 ± 0.70 at 30 min., 5.94 ± 0.79 at 60 min., 4.87 ± 0.72 at 120 min. and 4.80 ± 0.47 at 24 hours. The increase at 5th min. was significant ($P < 0.05$) and it persisted upto 30 min.

3.3.10(C). Liver function test.

SGPT level (IU/L) was 8.80 ± 0.79 before administration, 8.00 ± 0.79 on first day, 9.28 ± 1.12 on 4th day and 9.12 on 10th day. The variations were not significant.

3.3.11(C). Post anaesthetic observation.

One animal (C_6) died immediately after induction due to respiratory arrest. All the other animals were found to be weak and dull. They did not get up for 4-6 hrs and did not take food and water for 24 hours. After 60 hours all the animals were apparently normal.

3.3.12(C). Autopsy.

Gross pathological changes were not seen in any of the organs in the animals sacrificed on the 4th and the 10th day after the experiment.

Histopathological Examination.

Liver.

4th day: There was extensive cloudy swelling with granular cytoplasmic degeneration. Periportal accumulation of lymphocytes was also noticed (Fig.6 and 7).

10th day: There was cloudy swelling, with granular cytoplasmic degeneration, at a moderate level. Periportal accumulation of lymphocytes was also noticed (Fig.7).

Kidney.

4th day: Tubular degeneration, medullary oedema and haemorrhage were the salient features (Fig.9 to 11).

10th day: There was tubular degeneration and medullary congestion with haemorrhage (Fig. 9-11).

Table 9. Effects of intravenous administration of Triflupromazine, GGE and Thiopentone sodium in goats: Time of induction, duration of anaesthesia and recovery

Animal No.	Body weight (kg)	Volume of drugs administered			Time of induction (min.)	Duration of anaesthesia (min.)	Time for recovery (min.)	Other observations
		Triflupromazine	GGE	Thiopentone sodium (ml)				
C_1	13.00	0.13	26.00	2.50	2.00	60.00	30.00	Shivering and dilation of pupil
C_2	12.00	0.12	24.00	2.50	2.00	58.00	32.00	Dilation of pupil, shivering, respiratory arrest at 5th min.
C_3	11.00	0.11	22.00	3.50	3.00	50.00	40.00	Salivation and dilation of pupil
C_4	12.00	0.12	24.00	3.00	3.00	55.00	35.00	Dilation of pupil and salivation
C_5	12.00	0.12	24.00	3.50	2.00	40.00	35.00	Salivation and dilation of pupil
C_6	11.00	0.11	23.00	2.80	Animal died immediately after induction of anaesthesia			
Mean ± S.E.	12.00 ±0.32	0.12 ±0.003	23.83 ±0.54	2.97 ±0.19	2.40 ±0.24	52.60 ±3.57	34.40 ±1.69	

Table 10. Effects of intravenous administration of Triflupromazine, GGE and Thiopentone sodium in goats: Temperature, heart rate, respiration rate and haemodynamics (Mean ± S.E.), n=5.

Parameters and units	Intervals						
	0 min.	5 min.	15 min.	30 min.	60 min.	120 min.	24 h
Temperature (°F)	101.84 ±0.26	101.44 ±0.27	101.24 ±0.37	100.52* ±0.21	100.64* ±0.36	100.92 ±0.44	102.68 ±0.26
Heart rate/min.	136.40 ±18.94	129.60 ±4.17	128.00 ±11.47	133.40 ±18.47	138.00 ±11.56	157.60 ±8.57	119.20 ±7.12
Respiration/min.	25.00 ±2.86	22.75 ±6.80	20.00 ±1.45	20.20 ±3.00	18.00 ±2.95	25.80 ±4.65	26.80 ±3.14
Systolic pressure (mmHg)	118.40 ±2.32	66.40* ±14.25	92.80* ±3.67	86.40* ±5.38	90.40* ±3.76	92.00* ±2.00	-
Diastolic pressure (mmHg)	109.20 ±2.87	58.40* ±15.51	86.40* ±3.87	77.60* ±6.31	82.00* ±3.74	84.00* ±2.28	-
Mean arterial pressure (mmHg)	112.26 ±2.67	61.06* ±15.08	88.53* ±3.70	80.53* ±5.99	84.53* ±3.78	86.66* ±2.13	-
Pulse pressure (mmHg)	9.20 ±0.80	8.00 ±1.55	6.40 ±1.83	8.80 ±1.20	8.39 ±0.75	8.00 ±1.10	-
Central venous pressure (cm H_2O)	-3.90 ±0.58	-2.20 ±3.12	-5.60 ±1.28	-5.30 ±0.83	-5.00 ±0.69	-4.60 ±0.81	

* Significant at 5% level

Table 11. Effects of intravenous administration of Triflupromazine, GGE and Thiopentone sodium in goats: Haemogram (Mean ± S.E.), n=5.

Parameters and units	Intervals		
	0 min.	120 min.	24 h
Total erythrocyte count ($10^6/mm^3$)	25.19 ±0.85	19.27 ±2.78	16.61* ±2.19
Total leukocyte count ($10^3/mm^3$)	8.17 ±1.13	5.29 ±0.79	11.60 ±1.95
Lymphocytes (%)	54.20 ±11.76	48.00 ±9.16	35.80 ±3.84
Neutrophils (%)	45.40 ±11.64	51.80 ±9.13	63.00 ±3.85
Eosinophils (%)	0.40 ± 0.40	0.20 ±0.20	1.00 ±0.45
Monocytes (%)	0	0	0.20 ±0.20

* Significant at 5% level

Table 12. Effects of intravenous administration of Triflupromazine, GGE and Thiopentone sodium in goats: Haemogram and serum constituents (Mean ± S.E.), n=5

Parameters and units	Intervals						
	0 min.	5 min.	15 min.	30 min.	60 min.	120 min.	24 h
Haemoglobin (g/dl)	9.28 ±0.19	9.12 ±0.49	8.52* ±0.19	8.40* ±0.30	8.32* ±0.33	8.56 ±0.32	8.12* ±0.46
Packed cell volume (%)	32.40 ±0.75	29.80 ±1.02	29.20 ±1.46	29.20 ±1.39	30.00 ±2.35	30.20 ±1.56	27.40 ±2.40
Erythrocyte sedimentation rate (mm/24 h)	2.60 ±0.24	3.40 ±0.24	3.60 ±0.40	3.80 ±0.58	4.20* ±0.37	3.60 ±0.39	2.00 ±0
Blood glucose (mmol/l)	4.45 ±0.29	7.43* ±1.00	6.24* ±0.71	6.22* ±0.70	5.94 ±0.79	4.87 ±0.72	4.80 ±0.47
Total serum protein(g/dl)	5.26 ±0.07	5.00 ±0.15	5.08 ±0.06	5.06 ±0.10	4.92 ±0.19	4.98 ±0.14	5.28 ±0.16
Serum sodium (meq/l)	179.22 ±2.24	177.05 ±1.63	177.05 ±2.89	176.61 ±0.81	176.72 ±1.04	178.79 ±1.74	184.01 ±4.10
Serum potassium (meq/l)	4.48 ±0.17	4.73 ±0.60	3.94* ±0.08	3.81* ±0.18	3.51* ±0.61	3.66* ±0.30	5.19* ±0.23
Serum chloride (meq/l)	98.53 ±7.38	99.07 ±1.96	97.94 ±2.18	93.37 ±2.99	101.05 ±1.37	101.98 ±2.82	105.62 ±2.55

* Significant at 5% level

Table 13. Effect of GGE alone, GGE with Triflupromazine and GGE with Triflupromazine and Thiopentone sodium on serum glutamic pyruvic transaminase level in goats (Mean ± S.E.)

Groups	Intervals			
	0 min.	1st day	4th day	10th day
A	16.80 ±2.29	18.72 ±2.88	16.32 ±2.09	15.84
B	15.87 ±1.05	19.34 ±1.61	12.00 ±2.40	13.92
C	8.80 ±0.79	8.00 ±0.79	9.28 ±1.12	9.12

Fig. 6.

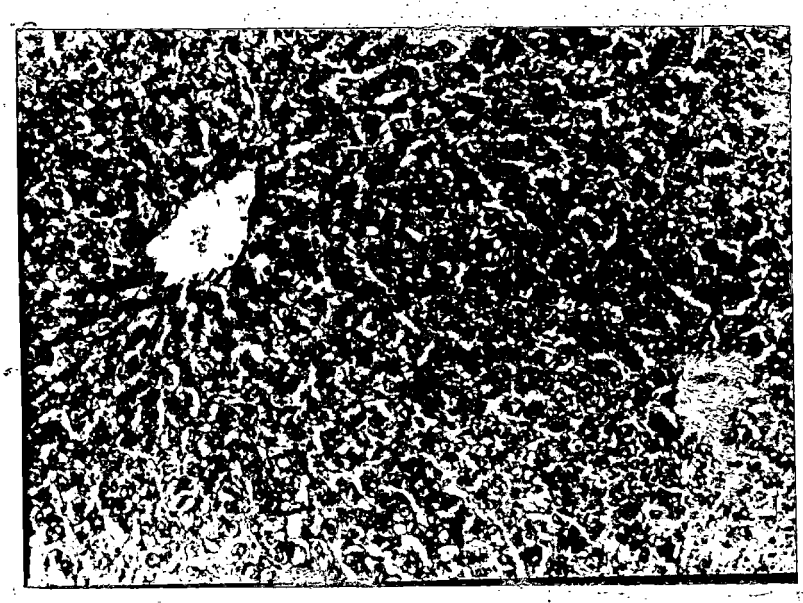


Fig. 7.

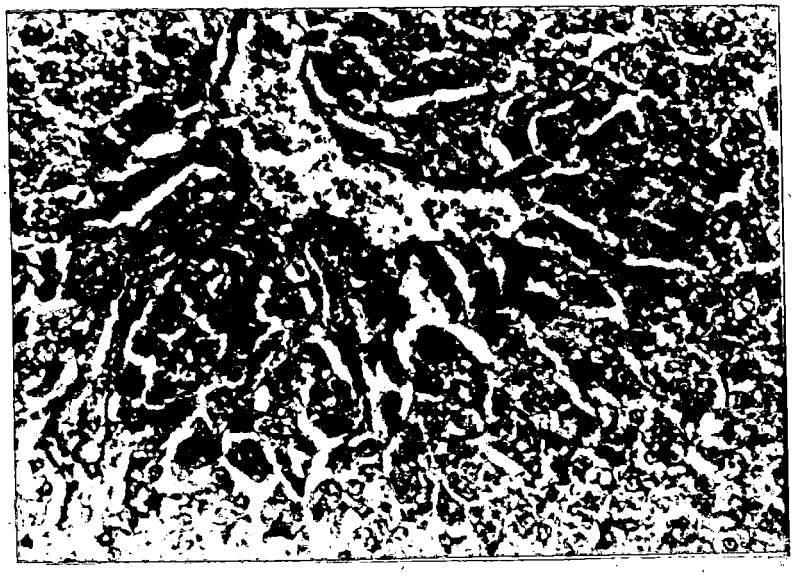


Fig. 8.

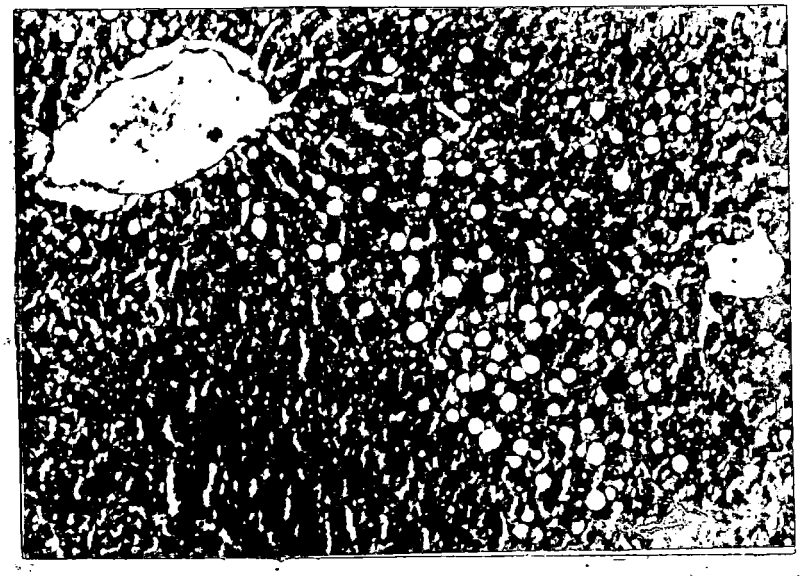


Fig. 9.

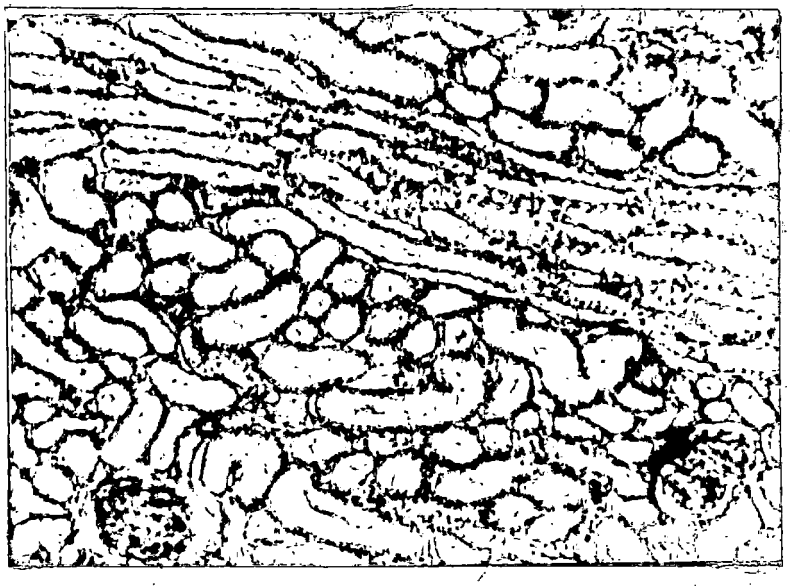
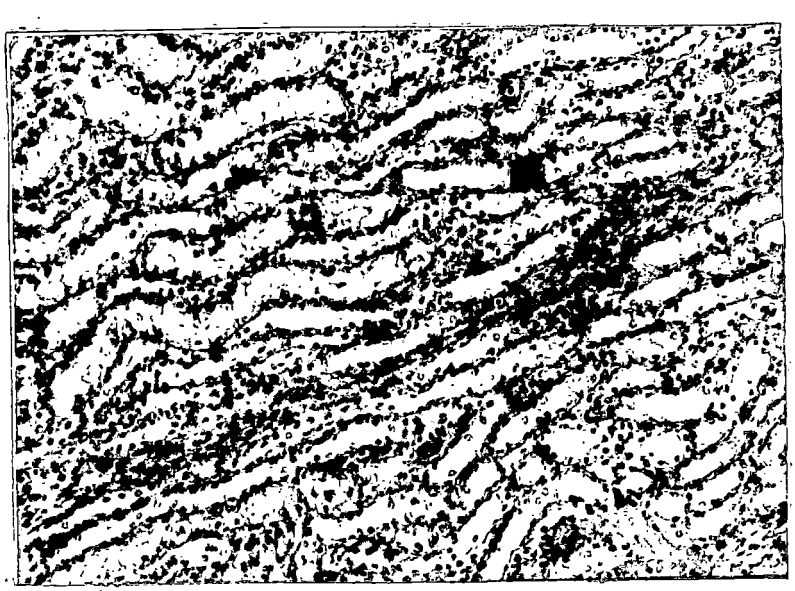


Fig. 10.

Fig. 11.



Discussion

DISCUSSION

5.1. The average body weight of the animals were 14.00 ± 0.50, 12.17 ± 0.33 and 12.00 ± 0.32 Kg respectively in groups A, B and C.

5.2. GGE five per cent solution alone was administered intravenously in Group A, after premedication with Triflupromazine hydrochloride in Group B, and after premedication with Trifluprομazine and followed by Thiopentone sodium solution in Group C.

5.3.1. On an average 28.00 ± 0.10 ml GGE solution was administered in Group A, 0.12 ± 0.003 ml Trifluprομazine hydrochloride followed by 24.33 ± 0.67 ml GGE solution in Group B and 0.12 ± 0.003 ml Trifluprομazine hydrochloride, 28.83 ± 0.54 ml GGE followed by 2.97 ± 0.19 ml Thiopentone sodium solution in Group C. There were no untoward reactions or discomfort at the time of administration of the drugs.

5.3.2. The induction time was 3.42 ± 0.20 min., 2.08 ± 0.08 min. and 2.40 ± 0.24 min. in groups A, B and C respectively. The induction time was lesser after premedication with Trifluprομazine hydrochloride.

5.3.3. In all the three groups, induction was smooth. Signs of anaesthesia developed in different degrees in the three groups. Slight to moderate degree of salivation was noticed in all the animals but it was more when

thiopentone was administered after GGE. Similar observations were made by Takarkhede et al. (1973) and Agarwal et al. (1983) in calves. Pedal, cutaneous, corneal and palpebral reflexes disappeared as anaesthesia deepened in groups B and C while the palpebral reflex persisted in group A, where GGE alone was administered. There was complete relaxation of muscles of jaw, anus, tail, penis, limbs and abdomen in all the groups but flaccidity of tail was not pronounced in groups A and B. Shivering was noticed in two animals (A_5 and C_1) and vigorous muscular contractions, stretching of limbs and neck immediately after induction was observed in one animal (B_3), but the symptoms disappeared spontaneously.

5.4.1. A fall in rectal temperature was observed in all the groups of animals during the period of anaesthesia but at 24 hours the body temperature became near normal. The reduction was seen prolonged in group C (Fig.12). However the changes were within normal physiological range. Takarkhede et al. (1973) and Agarwal et al. (1983) have observed similar changes in calves and have opined that it may be due to lowering of basal metabolic rate during anaesthesia.

5.4.2. Initial reduction followed by an increase in heart rate was seen in group B and C. In group A, there was increase in heart rate from the beginning. Tachycardia was observed at the time of recovery in all the groups (Fig.13). Similar

observations were made by Takarkhede et al. (1973) and Agarwal et al. (1983) in calves and by Kalharo and Rex (1984) in horses.

5.4.3. An initial decrease in the respiration rate was followed by an increase to near normal in all the groups. In group A, the increase was significant at 60 min., which might be due to early recovery from the anaesthesia (Fig.14). The variations in respiration rate as in the present study had been reported by Agarwal et al.(1983) in calves. An increase in respiration rate was recorded by Smithcors (1966) in horses, when GGE alone was administered whereas Kalharo and Rex (1984) had recorded a decrease in respiration rate in horses, when Acepromazine and Thiobarbiturate were used with GGE.

5.5.1. The duration of anaesthesia were 28.83 ± 2.27 min., 44.83 ± 1.74 min. and 52.60 ± 3.57 min in groups A, B and C respectively. Pre-medication with Triflupromazine hydrochloride (Group B) and administration of Triflupromazine hydrochloride and Thiopentone sodium (Group C) prolonged the duration of anaesthesia significantly ($P<0.05$).

5.5.2. The period of recovery in the present study was 18.00 ± 0.89 min. in group A, 17.33 ± 1.05 min. in group B and 34.40 ± 1.69 min. in group C. Administration of Triflupromazine hydrochloride did not alter the recovery period. However, administration of Thiopentone sodium prolonged the recovery period significantly ($P<0.05$). Takarkhede et al. (1973) had reported similar findings in calves. Recovery

Fig. 12.

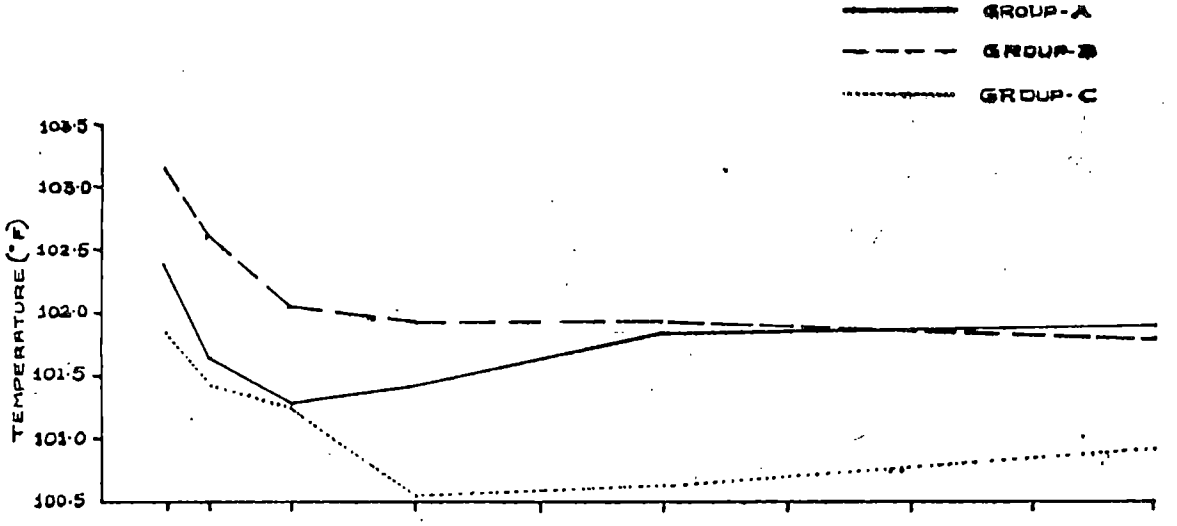


Fig. 13.

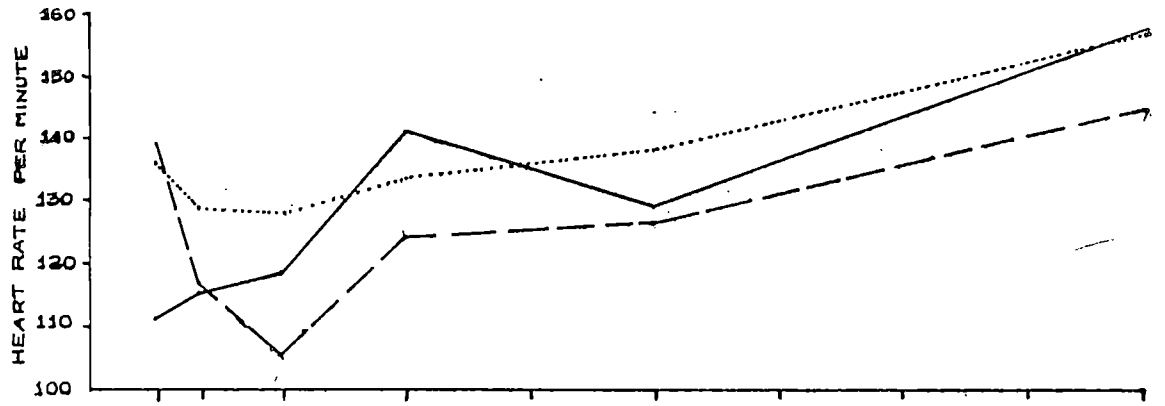
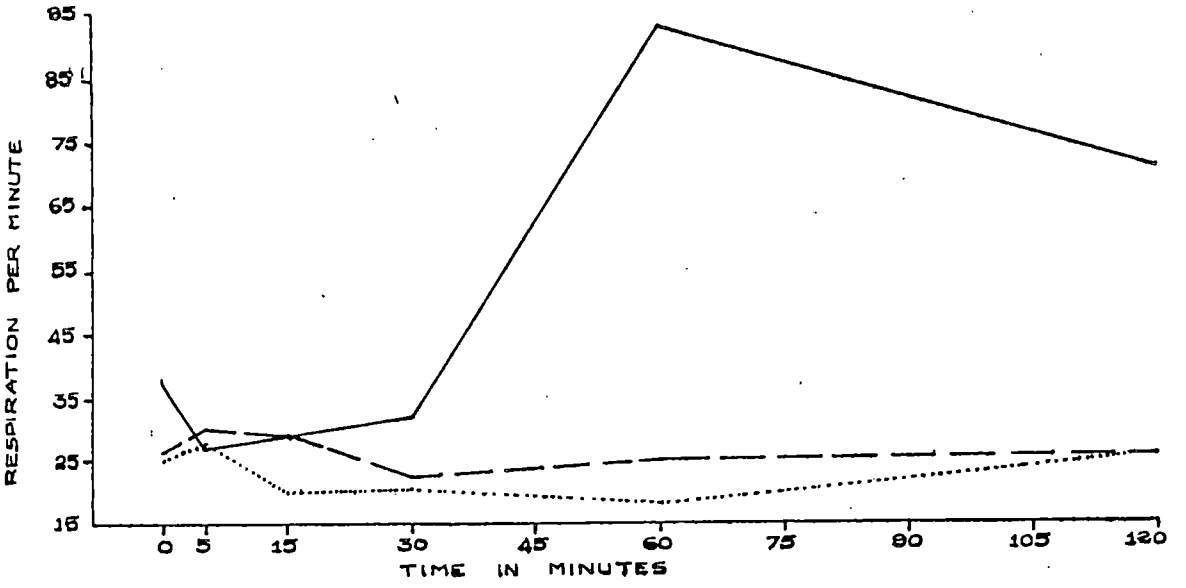


Fig. 14.



was smooth and uneventful in all the animals as reported by Agarwal et al. (1983) in calves and Kalharo and Rex (1984) in horses.

5.5.3. The animals were dull and were not taking food and water during the first 12 hours in group A and upto 24 hours in group B and C. They became apparently normal after 24, 36 and 60 hours in group A, B and C respectively. Incordination of movements and tilting of head were observed upto 24 hours in group B. Three animals in group B and one animal in group C died due to aspiration of rumen contents and respiratory arrest.

5.6.1. There was a gradual fall in the blood pressure (Systolic, diastolic and mean arterial pressure) after induction in all the three groups. The fall in blood pressure was significant from 5 min. to 120 min. in group B and C. But in group A, it was significant at 60 and 120 min. The initial depression was more in group C (Fig.15). Hypotension had been reported after administration of GGE and GGE with Thiopentone sodium by Agarwal et al. (1983) in calves by Smithcors (1966) in dogs, by Coffman and Pedersoli (1971), Traimongkolkul (1979) and Hubbel et al. (1980) in horses.

5.6.2. Pulse pressure showed marginal variations throughout the period of observation in all the groups. The variations were not significant at any stage except in group B where the fall was pronounced and significant at 30 min. (Fig.16).

5.6.3. An increase in central venous pressure was observed upto 30 min. in group A and 15 min. in group B, followed by a progressive decline, but the variations were not significant (Fig. 17). Agarwal et al. (1983) reported reduction in central venous pressure followed by gradual improvement with GGE alone but a steady decline with the GGE-barbiturate combination, in calves.

5.6.4. The electro cardiogram revealed a depression of S-T segment during anaesthesia in all the three groups and depression of P wave in group B and C. Tachycardia was a common feature at the time of recovery and all the changes disappeared spontaneously. Similar changes were observed by Agarwal et al. (1983) in calves, but the changes were not significant.

5.6.5. The progressive fall in blood pressure with more or less steady CVP and unaffected ECG indicate that GGE alone or in combination has not seriously affected the cardiovascular function.

5.7.1. There was a gradual reduction in total erythrocyte count in all the three groups and it was significant in groups B and C.

5.7.2. The leukocyte count was found to be reduced at 120 min. and was significant in group B. At 24 hours there was improvement in the leukocytic count in all the groups.

Fig. 15.

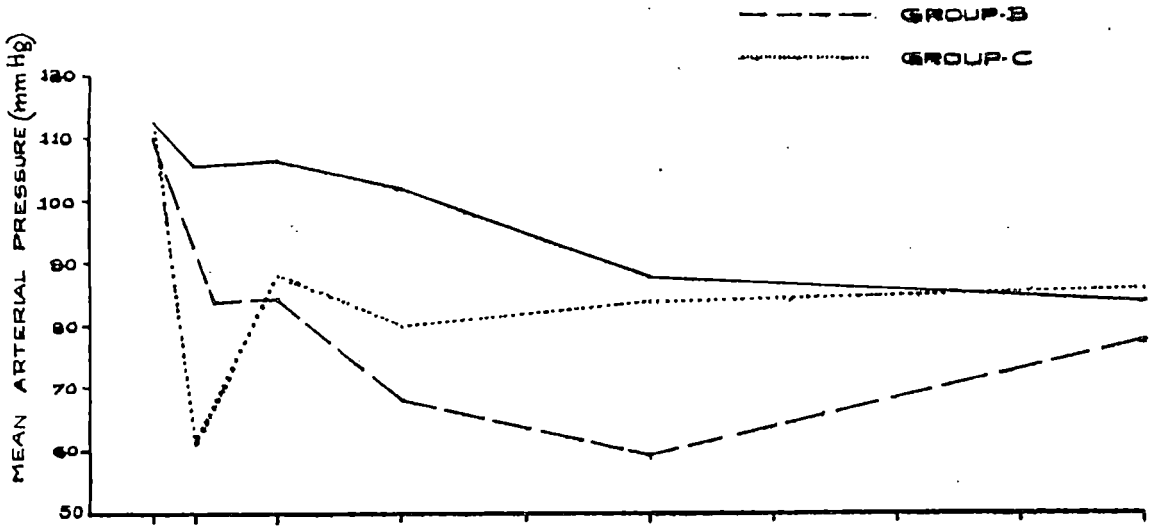


Fig. 16.

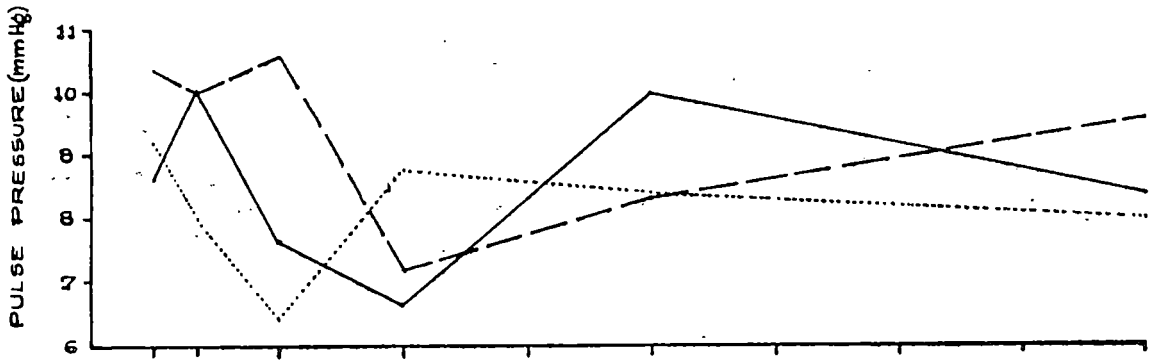
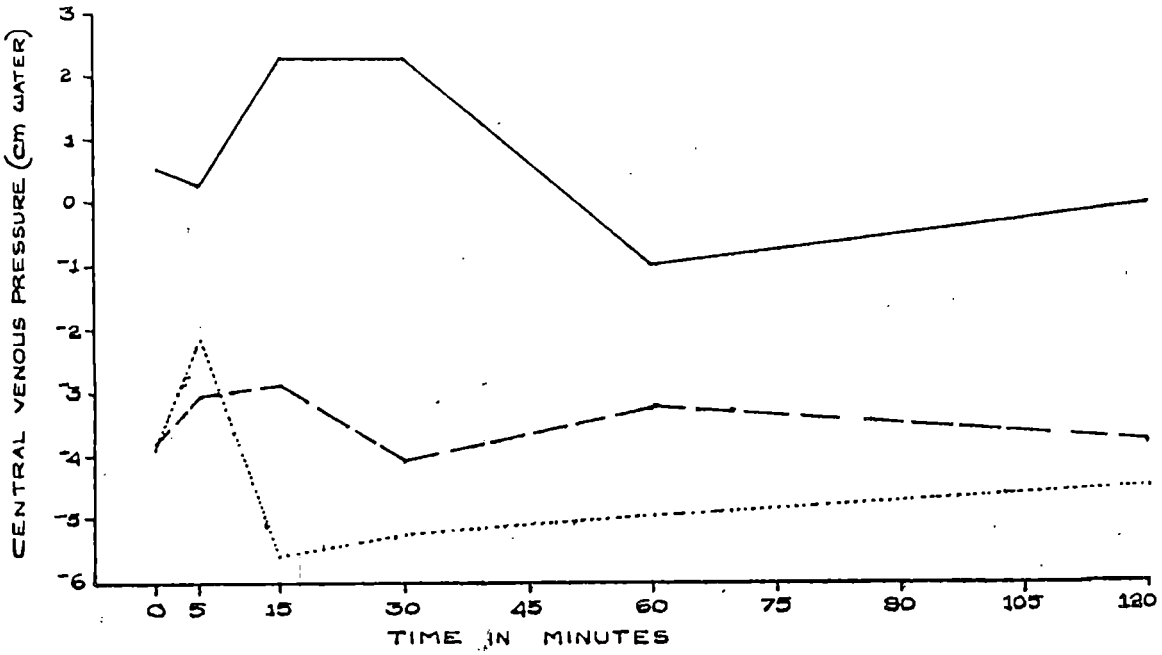


Fig. 17.



5.7.3. The lymphocyte count had shown a decrease in all the three groups and was significant in group A and B at 24 hours.

5.7.4. The neutrophil count was found to be increased in all the groups and was significant in groups A and B at 24 hours.

5.7.5. Variations in eosinophil and Monocyte count were not significant in any of the three groups. Thakarkhede et al. (1973) had observed similar changes in total erythrocyte and leukocyte count in calves, but Jackson and Lundvall (1970) could not find significant variations in total erythrocyte and leukocyte count following the administration of GGE in horses.

5.8.1. There was reduction in haemoglobin concentration in all the groups, which was significant in group B and C (Fig.17). Thakarkhede et al. (1973) also reported reduction in haemoglobin concentration in calves and Jackson and Lundvall (1970) and Heath and Gabel (1970) in horses, under GGE anaesthesia.

5.8.2. In all the three groups, packed cell volume showed an initial reduction followed by an increase. In group A and C the values decreased further but in group B it showed a tendency to increase at 24 hours. The changes were significant in group A and B (Fig.19). Takarkhede et al. (1973) observed initial reduction and subsequent increase in packed cell volume with GGE alone in calves. Agarwal et al. (1983) observed a decreasing trend in packed cell volume

Fig. 18.

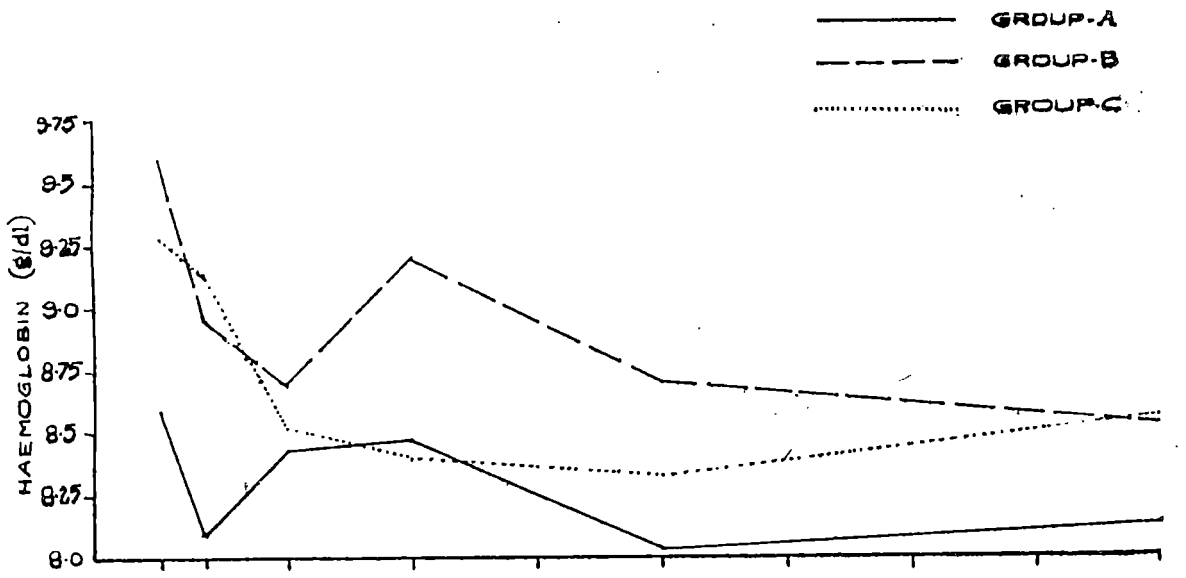


Fig. 19.

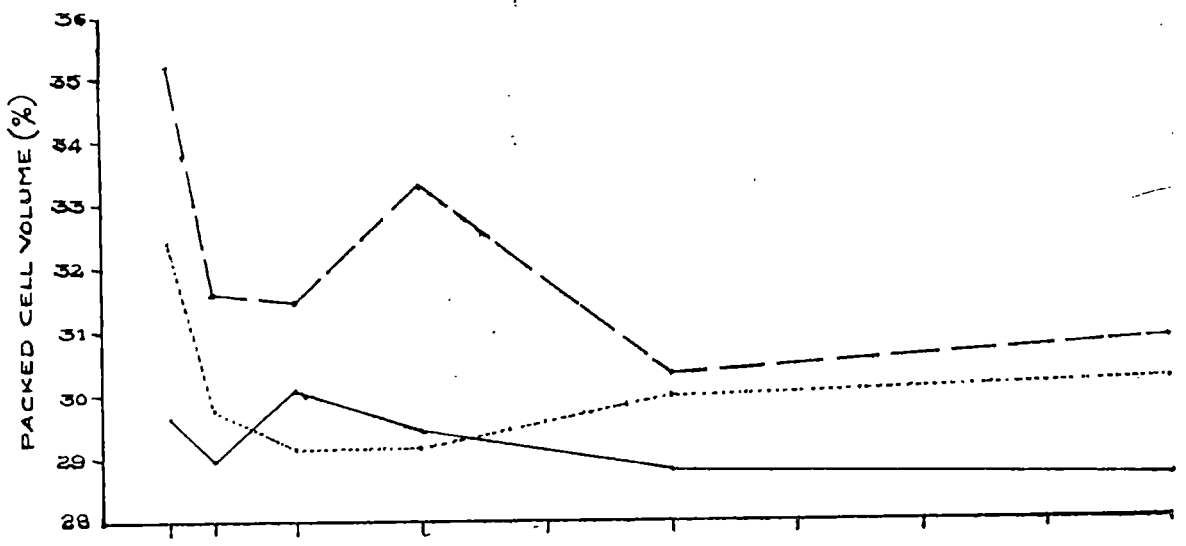
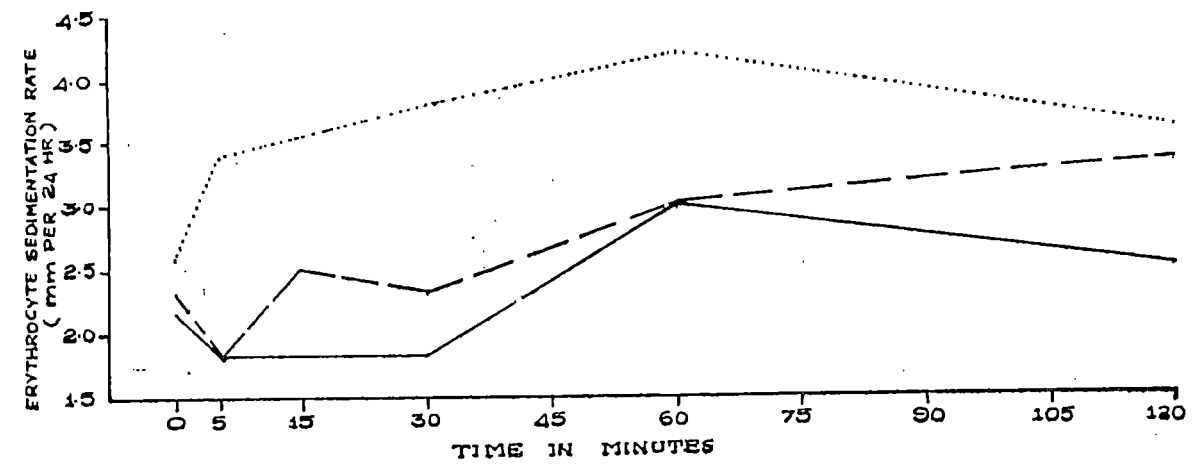


Fig. 20.



with the administration of GGE alone or in combination with barbiturate in calves. But in horses, Jackson and Lundvall (1970) and Heath and Gabel (1970) reported that the packed cell volume was not significantly altered with the administration of GGE alone or in combination with Barbiturate.

5.8.3. The erythrocyte sedimentation rate, after a decrease initially at 5 min. increased to near normal values at 24 hrs in group A and B. In group C, it gradually increased upto 60 min. and reached near normal values by 24 hour (Fig.20). Takarkhede et al. (1973) observed initial increase followed by a decrease in erythrocyte sedimentation rate in calves using GGE alone and GGE with Triflupromazine and Barbiturate.

5.9.1. The serum protein values decreased gradually in all the groups upto 120 min. and the reduction was significant at 120 min. and 24 hours in group A (Fig.22). According to Honalikar et al. (1982) the total plasma protein remained unaltered under GGE and Barbiturate anaesthesia in bull calves but Agarwal et al. (1983) had reported a decline in the total serum protein level upto 180 min. with GGE alone and GGE with Barbiturate in calves.

5.10.1. Serum sodium level did not show any significant variations in all the groups (Fig.24). Serum potassium level showed a decrease in all the groups. The reduction in serum potassium

was significant at 60 and 120 min. in group B and 5 min. to 120 min. in group C. At 24 hours it reached near normal values in group A and B while it showed a significant increase in group C (Fig.25). Serum chloride values showed an increase initially followed by a decrease in all the three groups (Fig.26). At 24 hours the values were within normal range. These observations are in agreement with the findings of Takarkhede et al.(1973) and Agarwal et al. (1983) with GGE alone, and GGE with Thiopentone sodium in calves. However, significant changes in serum chloride levels were not observed by Jackson and Lundvall (1970) in horses.

5.11.1. Increase in blood glucose was observed by 5 min. in all three groups followed by reduction which was significant in group B (Fig.21). Significant hyperglycaemia was reported in calves with GGE and its combinations by Takarkhede et al. (1973) and Agarwal et al. (1983). However hyperglycaemia was not observed when GGE was administered in horses by Jackson and Lundvall (1970).

5.11.2. Serum glutamic pyruvic transaminase level were within the normal limits in all the three groups (Fig.23).

5.12.1. Gross pathological changes were not seen in any of the organs in the animals sacrificed on the 4th and the 10th day after the experiment.

5.12.2. Early focal degenerative changes were noticed in liver and kidney by the 4th day. The changes were not so extensive as

Fig. 21.

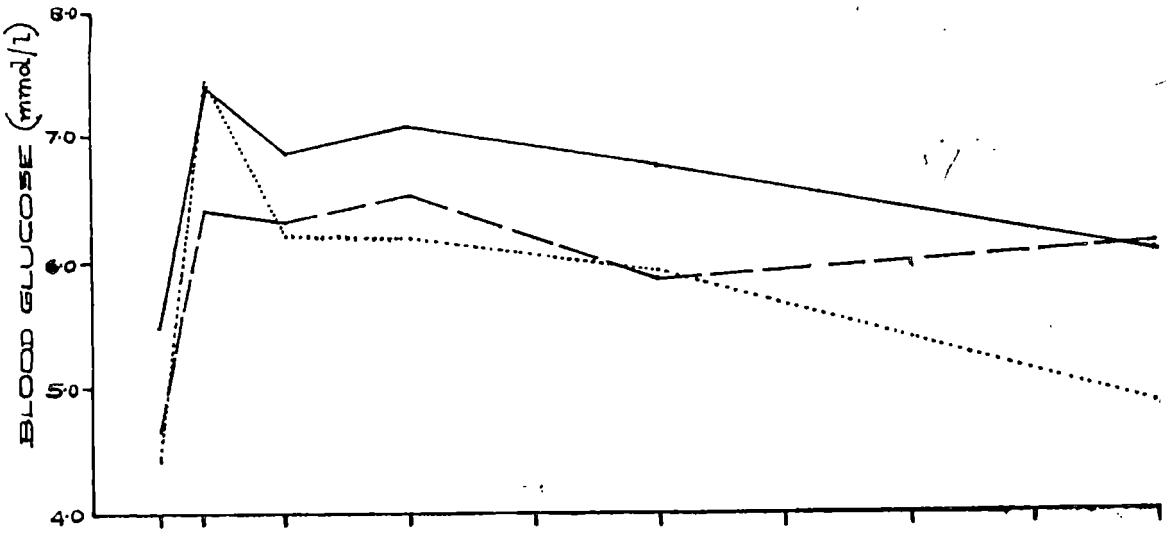


Fig. 22.

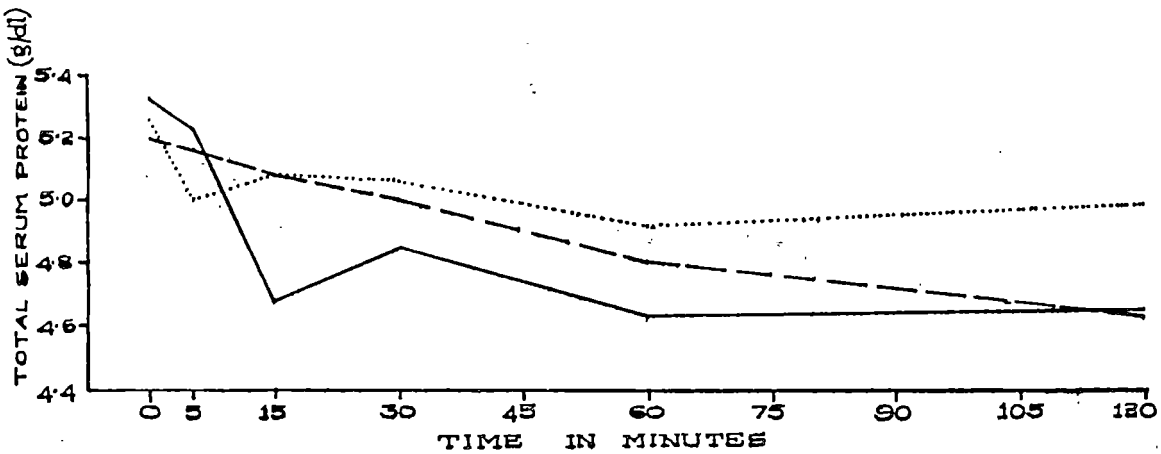


Fig. 23.

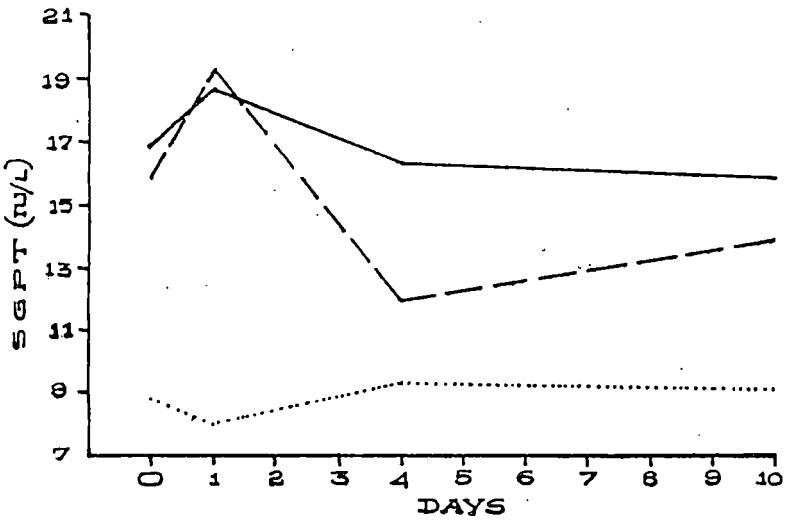


Fig. 24.

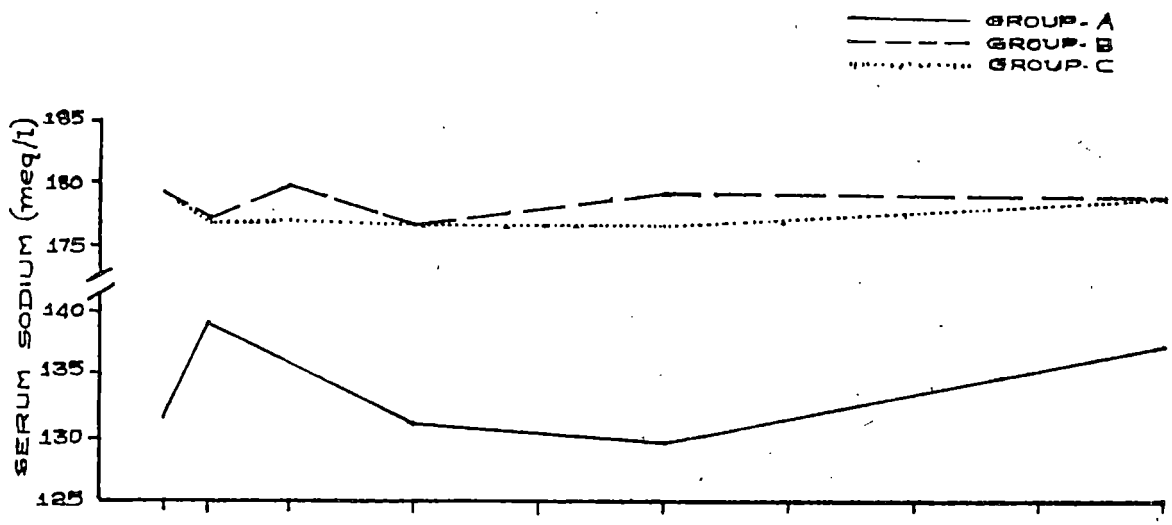


Fig. 25.

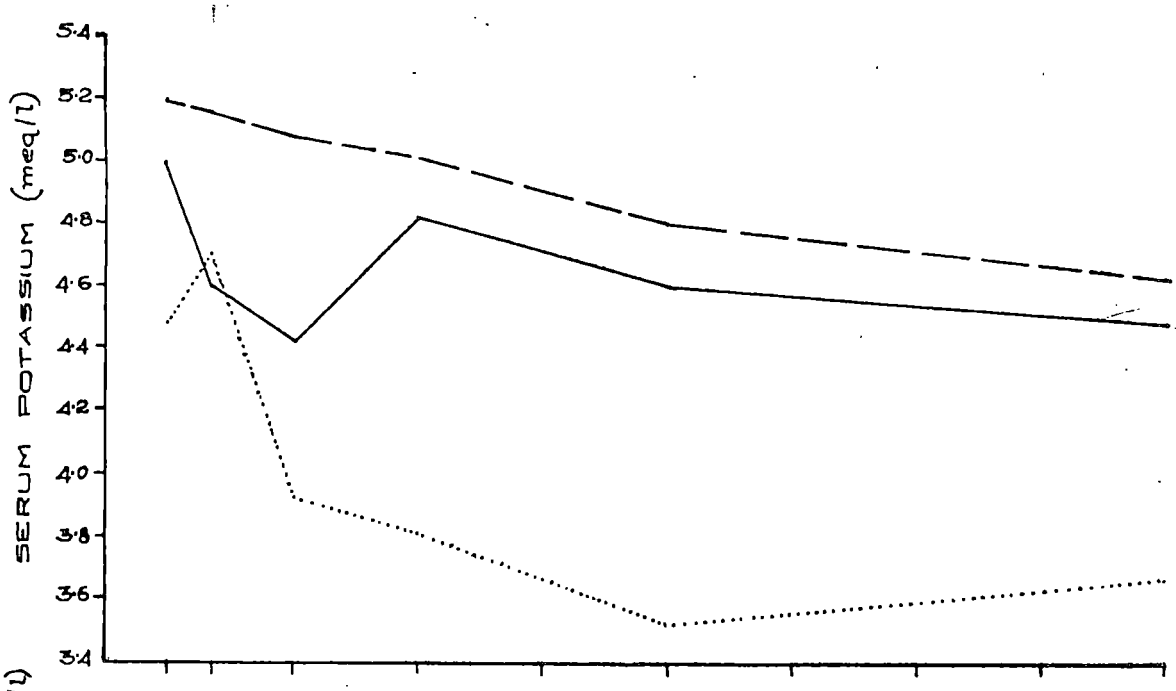
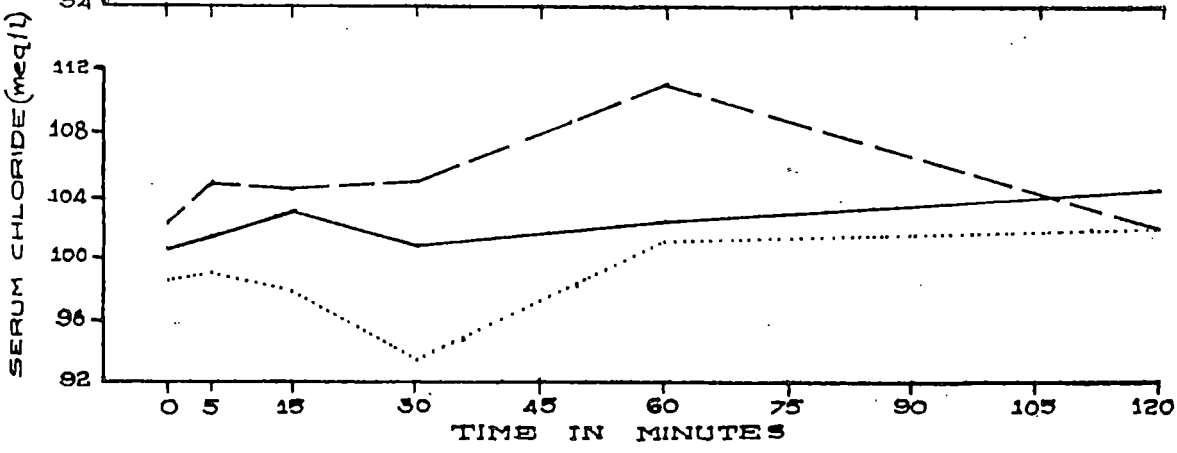


Fig. 26.



to suggest severe damage. By 10th day, lesions were moderate and the cells surrounding the damaged area showed moderate degenerative changes.

5.12.3. The SGPT values and the histopathological observations suggest that GGE and its combinations do not produce extensive tissue damage though there is focal degenerative changes in liver and kidney.

Summary

SUMMARY

Three groups of six animals each with an average body-weight of 14.00 ± 0.50, 12.17 ± 0.33 and 12.00 ± 0.32 kg were used for the experiment. GGE, five per cent solution alone at the rate of 100 mg/kg was administered intravenously in group A. Triflupromazine hydrochloride at the rate of 0.2 mg/kg and GGE solution at the rate of 100 mg/kg were administered in group B. Triflupromazine hydrochloride, GGE and five per cent Thiopentone sodium solutions were administered in group C. An average of 28.00 ± 0.10 ml GGE solution was administered in group A, 0.12 ± 0.003 ml Triflupromazine hydrochloride followed by 24.33 ± 0.67 ml GGE solution in group B and 0.12 ± 0.003 ml Triflupromazine hydrochloride, 28.83 ± 0.54 ml GGE and 2.97 ± 0.19 ml Thiopentone sodium solutions were administered in group C. There were no untoward symptoms at the time of administration of the drugs.

The induction time was 3.42 ± 0.20 min. in group A, 2.08 ± 0.08 min. in group B and 2.40 ± 0.24 min. in group C. The induction was smooth in all the groups.

On induction pedal, corneal, cutaneous and palpebral reflexes disappeared in all the groups, While palpebral reflex alone persisted in group A. Dilation of pupil with complete relaxation of jaws, anus, penis and abdomen was noticed in all the animals as the anaesthetic effect deepened. Flaccidity of tail was pronounced in group C. All the animals were

found to be weak and dull and did not take feed and water upto 12 hours in group A and upto 24 hours in group B and C. They were apparently normal by 24, 36 and 60 hours in group A, B and C respectively.

Reduction in rectal temperature was noticed in all the groups. Initial reduction followed by an increase in heart rate was seen in group B and C. In group A there was increase in heart rate from the beginning. Tachycardia was observed at the time of recovery in all the groups. The variations in respiration rate were within the normal limits.

The duration of anaesthesia was 28.83 ± 2.27 min., 44.83 ± 1.74 min. and 52.60 ± 3.57 min. in group A, B and C respectively. The period of recovery was 18.00 ± 0.89 min., 17.33 ± 1.05 min. and 34.40 ± 1.90 min. in group A, B and C respectively. Recovery was smooth and uneventful.

There was a significant fall in the blood pressure (systolic, diastolic and mean arterial pressure) in all the groups, but pulse pressure showed marginal variation. Variations in central venous pressure was not significant.

The electrocardiogram revealed a depression of S-T segment in all the groups and depression of P wave in group B and C. Tachycardia was seen at recovery.

There was reduction in total erythrocyte count while the leukocyte count showed an initial decrease followed by an increase at 24 hours. The lymphocyte count decreased and the

neutrophil count increased. Variation in the eosinophil and monocyte count was not significant.

A reduction in the haemoglobin content and packed cell volume was observed in all the groups. The erythrocyte sedimentation rate showed an increase during anaesthesia.

Significant increase in blood glucose was noticed in all the groups during anaesthesia and the serum protein values decreased. The serum sodium values showed marginal variations but the serum potassium values showed decrease upto 120 min. There was an increase in the serum chloride values followed by a decrease in all the groups.

In all the three groups of animals, variation in serum glutamic pyruvic transaminase level was within normal limits.

Gross lesions were not seen in any of the animals sacrificed on 4th or 10th day. But microscopic examination, early degenerative changes were noticed in the liver and kidney of all the animals sacrificed on the 4th day. Evidence of regeneration could be observed by the 10th day.

The following conclusions could be drawn from the study:

1. The induction and recovery were smooth in all the groups. The induction was quick, duration was prolonged and recovery was delayed when preanaesthetic (Triflupromazine hydrochloride) and Barbiturate (Thiopentone sodium) were administered along with GGE solution.

2. The progressive fall in blood pressure with more or less steady CVP and unaffected ECG were observed when GGE and its combinations were used.

3. GGE and its combinations produced a reduction in the erythrocyte count and an increase in leukocyte count with marginal variations in haemoglobin content, packed cell volume and erythrocyte sedimentation rate.

4. Increase in blood glucose was significant. Decrease in serum protein and variations in sodium, potassium and chloride were not significant.

5. Variations in SGPT values were not significant. Macroscopic and microscopic examination of liver and kidney did not reveal evidence of extensive tissue damage.

References

REFERENCES

*Acosta, F.O. (1975). Use of Guaiacol glycerol ether alone or in association with Sodium thiamylal in the horse. Arquivos da Escola de Veterinaria da Universidade Federal de Mulas Gerais., 27(3): 400-401. (Cited in Vet. Bull. (1977), 47(10): Abstr. No.5862).

Agarwal, K.B.P., Prasad, B. and Sobti, V.K. (1983a). Clinical observations during anaesthesia with Glyceryl guaiacolate and its combination with Thiopentone sodium and Chloral hydrate in buffalo calves. Indian vet. J., 60(7): 536-539.

Agarwal, K.B.P., Prasad, B. and Sobti, V.K. (1983b). Some cardiovascular, respiratory and biochemical effects of Glyceryl guaiacolate ether in buffalo calves. Acta vet., 33(2-3): 107-114.

Agarwal, K.B.P., Prasad, B. and Sobti, V.K. (1983c). Physiological and biochemical effects of Glyceryl guaiacolate-Thiopentone sodium anaesthesia in buffalo calves. Res. vet. Sci., 35(1): 53-57.

Agarwal, K.B.P., Prasad, B. and Sobti, V.K. (1983d). Evaluation of Glyceryl guaiacolate in combination with Chloral hydrate in buffalo calves. Acta vet., 33(5-6): 307-314.

Agarwal, K.B.P., Prasad, B. and Sobti, V.K. (1983e). Histopathological observations after administration of Glyceryl guaiacolate with and without Chloral hydrate/Thiopental sodium in buffalo calves. Indian J. Vet. Surg., 4(2):64-65.

Armed Forces Institute of Pathology (1968). Manual of Histology Staining Methods. McGraw-Hill Book Company, New York, 3rd Ed. pp. 12-184.

*Bathke, J. (1978). Use of Guaiacol glycerol ether in anaesthesia in pigs. Tierarztliche Hochschule, Hannover: 56. (Cited in Vet. Bull. (1980), 50(5): Abstr. No.3110).

Benjamin, M.M. (1978). Outline of Veterinary Clinical Pathology. The Iowa State University Press, Ames, Iowa, USA, 3rd Ed. pp. 67, 225-268.

*Bishop, W.J. (1978). Glyceryl guaiacolate in equine anaesthesia. N.Z. vet. J., 26(11): 284-285. (Cited in Vet. Bull. (1979), 49(8): Abstr. No. 4874).

*Brouwer, G.J. (1985). Use of Guaiacol glycerine ether in clinical anaesthesia in the horse. Equine. vet. J., 17(2): 133-136. (Cited in Vet. Bull. (1985), 55(7): Abstr. No.4580).

Burger, A. (1968). Drugs affecting the central nervous system. Vol.2. Marcel Dekker, New York, N.Y. Cited by Coffman, M.T. and Pedersoli, W.M. (1971). Glyceryl guaiacolate as an adjunct to equine anaesthesia. J. Am. vet. med. Ass., 158(9): 1548-1553.

Coffman, M.T. and Pedersoli, W.M. (1971). Glyceryl guaiacolate as an adjunct to equine anaesthesia. J. Am. vet. med. Ass., 158(9): 1548-1553.

Davis, L.E. and Wolff, W.A. (1970). Pharmacokinetics and metabolism of Glyceryl guaiacolate in ponies. Am. J. vet. Res., 31(3): 469-473.

*D'Ieteren, G. (1976). General anaesthesia of the horse with a combination of Guaiacol glyceryl ether and Methitural. Annales de Me'decine ve'terinaire., 120(8): 551-557. (Cited in Vet. Bull. (1977), 47(9): Abstr. No.5279).

*Grandy, J.L. and McDonell, W.N. (1980). Evaluation of concentrated solutions of Guaifenesin for equine anaesthesia. J. Am. vet. med. Ass., 176(7): 619-622. (Cited in Vet. Bull. (1980), 50(11): Abstr. No.7753).

Hall, L.W. (1958). Advances in anaesthesia in the last 10 years. Vet. Rec., 70: 314-318.

Heath, R.B. (1970). Personal communication, Colorado State University, Fort Collins, Colorado. Cited by Lumb, W.V. and Jones, E.W. (1973). Veterinary Anaesthesia. Lea and Febiger, Philadelphia, pp. 361-362.

Heath, R.B. and Gabel, A.A. (1970). Evaluation of Thiamylal sodium, Succinyl choline and Glyceryl guaiacolate prior to inhalation anaesthesia in horses. J. Am. vet. med. Ass., 157(11): 1486-1494.

Honalikar, V.K., Pandey, S.K. and Sharma, I.J. (1982). Effect of Glyceryl guaiacolate combinations on certain liver functions in male cow calves. Indian J. Anim. Sci., 52(9): 736-740.

*Hubbell, J.A.E., Muir, W.W. and Sams, R.A. (1980). Guaifenesin: Cardiopulmonary effects and plasma concentrations in horses. Am. J. Vet. Res., 41(11): 1751-1755. (Cited in Vet. Bull. (1981), 51(6): Abstr. No.3658).

Inchiosa, M.A. (1964). Direct Biuret determination of total protein in tissue homogenates. J. Lab. clin. Med., 63: 319-324.

Jackson, L.L. and Lundvall, R.L. (1970). Observations on the use of Glyceryl guaiacolate in the horse. J. Am. vet. med. Ass., 157(8): 1093-1095.

Jackson, L.L. and Lundvall, R.L. (1972). Effect of Glyceryl guaiacolate-Thiamylal sodium solution on respiratory function and various haematological factors of horse. J. Am. vet. med. Ass., 161(2): 164-168.

Kalharo, A.B. and Rex, M.A.E. (1984). Observations on the use of Glyceryl guaiacolate as an adjunct to General anaesthesia in horses. Aust. vet. J., 61(2): 49-53.

Karimi, A. (1983). Comparison of the effects of two sets of anaesthetic agents (a-xylazine, Glyceryl guaiacolate, Thiopentone and Halothane) (b-Acetyl promazine, Glyceryl guaiacolate, Thiopentone and Halothane) and posture on heart rate, respiratory rate, pH, blood gas and acid-base status in horse. Indian vet. J., 60(8): 610-618.

Keeran, R.J. (1972). Equine ovariectomy: Anaesthesia and Positioning. Proc. Am. Assoc. Equine Pract: 41. Cited by Jones, L.M., Booth, N.H. and Mc Donald, L.E. (1977). Veterinary Pharmacology and Therapeutics. The Iowa State University Press, Ames, 4th Ed. pp. 284-285.

*Ketelaars, H.C.J., Dieten, J.S., Van, M.M. and Lagerweij, E. (1979). Guaiacol glyceryl (Guaifenesin) in horses and ponies. I. Pharmacokinetics after a single intravenous injection. Berliner und Munchener Tierarztliche Wochenschrift., 92(11): 211-214. (Cited in Vet. Bull. (1949), 49(12): Abstr. No.7621).

King, J. (1965). Practical Clinical Enzymology. D.Van Nostrand Company Ltd., London, pp. 87, 130.

Kinge, A.E., Pandey, S.K. and Bhargava, M.K. (1985). Clinical and haematological observations on the use of Diazepam, Glyceryl guaiacolate and Barbiturate combinations in goats. Indian J. Vet. Surg., 6(1): 1-6.

Kraft, H. (1962). ECG and narcosis in the horse. Berl. M. Munch. Tierarzt. Wschr., 75: 165. Cited by Soma, L.R. (1971). Textbook of Veterinary Anaesthesia. The Williams and Wilkins Company, Baltimore, p. 585.

Lindley, W.H. (1976). Glyceryl guaiacolate in anaesthesia. Mod. vet. Pract., 57(2): 121-122.

Muir, W.W., Skarda, R.T. and Sheehan, N. (1978). Evaluation of xylazine, Guaifenesin and Ketamine hydrochloride for restraint in horses. Am. J. vet. Res., 39(8): 1274-1278.

*Muir, W.W., Skarda, R.T., Sheehan, W. and Gates, B.R. (1979). Evaluation of Thiamylal, Guaifenesin and Ketamine hydrochloride combinations administered prior to Halothane anaesthesia in horses. J. Equine. med. Surg., 3(4): 178-184. (Cited in Vet. Bull. (1979), 49(11): Abstr. No.6945).

Oser, B.L. (1971). Hawk's Physiological Chemistry. Tata McGraw Hill Publishing Company Ltd., Bombay, pp. 1052-1053, 1141-1142.

Osterberg, A.E. and Schmidt, E.V. (1927). The estimation of plasma chlorides. J. Lab. Clin. Med., 13: 172-175. (Cited by Todd, J.C., Sanford, A.H. and Wells, B.B. (1953). Clinical Diagnosis by Laboratory Methods. W.B. Saunders Company, Philadelphia, London, 12th Ed. pp. 414-416.

Pandey, S.K., Honalikar, V.K. and Sharma, I.J. (1982). Effect of Glyceryl guaiacolate on kidney functions in calves. Indian J. Vet. Surg., 3(2): 51-54.

Pandey, S.K., Kinge, A.E. and Bhargava, M.K. (1984). A note on the effect of different Diazepam-Glyceryl guaiacolate combination on kidney functions in goats. Indian J. Vet. Surg., 5(1): 80-81.

Pedersoli, W.M. (1972). Glyceryl guaiacolate as an adjunct to equine anaesthesia. Auburn vet., 29: 6. Cited by Jones, L.M., Booth, N.H. and Mc Donald, L.E. (1977). Veterinary Pharmacology and Therapeutics. The Iowa State University Press, Ames, 4th Ed. pp. 284-285.

Roberts, D. (1968). The role of Glyceryl guaiacolate in a balanced equine anaesthetic. Vet. Med. Small Anim. clin., 63: 157. Cited by Lumb, W.V. and Jones, E.W. (1973). Veterinary Anaesthesia. Lea and Febiger, Philadelphia, pp. 361-362.

*Rugh, K.S., Zinn, G.M., Paterson, J.A. and Thorne, J.G. (1985). Inhalation anaesthesia in adult cattle. Lab. Anim. Sci., 35(2): 178-181. (Cited in Vet. Bull. (1985), 55(10): Abstr. No.6614).

Schalm, C.W. (1975). Veterinary Haematology. Lea and Febiger, Philadelphia, 3rd Ed. pp. 39-40, 52-66.

*Schatzman, U. (1979). Induction of general anaesthesia in horse with Guaiacol glycerine ether alone or in association with Sodium thiamylal. Pratique Veterinaraire Equine., 11(4): 223, 225-230. (Cited in Vet. Bull. (1980), 50(7): Abstr. No.4448).

*Schatzman, U., Koehli, M., Dudan, F. and Jones, R.S. (1984). Some cardiopulmonary effects of Glyceryl guaiacolate in combination with pre-anaesthetics in standing horse. Equine. Pract., 6(2): 17-21. (Cited in Vet. Bull. (1984), 54(7): Abstr. No.4657).

Schatzman, U., Tschudi, P., Held, J.P. and Muhlebach, B. (1978). An investigation of the action and haemolytic effect of Glyceryl guaiacolate in horses. Equine. vet. J., 10(4): 224-228.

Sheehan, D.C. and Hrapchak, B.B. (1980). Theory and Practice of Histotechnology. The C.V. Mosby Company, St. Louis Toronto, London, 2nd Ed. pp. 143-144.

Smithcors, J.F. (1966). Guaiacol glycerine ether as a muscle relaxant. Mod. vet. Pract., 47(2): 88.

Snedecor, G.W. and Cochran, W.G. (1967). Statistical Methods. The Iowa State University Press, U.S.A., 6th Ed. pp. 91-296.

Soma, L.R. (1971). Textbook of Veterinary Anaesthesia. The Williams and Wilkins Company, Baltimore, p. 585.

Takarkhede, M.L., Patel, M.R. and Pandey, S.K. (1973). Evaluation of Glyceryl guaiacolate as a muscle relaxant alone and in combination with Thiopental sodium and Chloral hydrate in buffalo calves. Indian vet. J., 50(9): 900-910.

Tavernor, W.D. (1970). The influence of Guaiacol glycerol ether on cardiovascular and respiratory function in the horse. Res. vet. Sci., 11:91. Cited by Lumb, W.V. and Jones, E.W. (1973). Veterinary Anaesthesia. Lea and Febiger, Philadelphia, pp. 361-362.

Tavernor, W.D. and Jones, E.W. (1970). Observations on the cardiovascular and respiratory effects of Guaiacol glycerol ether in conscious and anaesthetized dogs. J. Small Anim. Pract., 11: 177. Cited by Jones, L.M., Booth, N.H. and Mc Donald, L.E. (1977). Veterinary Pharmacology and Therapeutics. The Iowa State University Press, Ames, 4th Ed. pp. 284-285.

*Traimongkolkul, T. (1979). Behaviour of blood gases, blood pressure and acid-base equilibrium during anaesthesia of horses with Chloral hydrate, Guaifenesin and Methitural. Inaugural Dissertation, Tierarztliche Hochschule, Hannover: 75. (Cited in Vet. Bull. (1980), 50(9): Abstr. No.6084).

Westheus, M. and Fritsch, R. (1961). Die Narkose der Tiere: Allgemeinnarkose. Berlin, Paul Parey. Cited by Hall, L.W. (1971). Wright's Veterinary Anaesthesia and Analgesia. English Language Book Society and Bailliere Tindall, 7th Ed. pp. 414.

Westheus, M. and Fritsch, R. (1965). Cited by Lumb, W.V. and Jones, E.W. (1973). Veterinary Anaesthesia. Lea and Febiger, Philadelphia, pp. 361-362.

Wintrobe, M.M. (1961). Clinical Haematology. Lea and Febiger, Philadelphia, 5th Ed. P. 381.

*Wright, M., Mcgrath, C.J. and Raffe, M. (1979). Indirect blood pressure reading in horses before and after induction of general anaesthesia with Acetyl promazine, Glyceryl guaiacolate and Sodium thiamylal. Vet. anae., 6(3): 41-48. (Cited in Vet. Bull. (1980), 50(11): Abstr. No.7752).

* Originals not consulted

INFLUENCE OF GLYCERYL GUAIACOL ETHER ON ANAESTHESIA IN GOATS

By

T. P. BALAGOPALAN

ABSTRACT OF A THESIS

Submitted in partial fulfilment of the requirement for the degree

Master of Veterinary Science

Faculty of Veterinary and Animal Sciences
Kerala Agricultural University

Department of Surgery
COLLEGE OF VETERINARY AND ANIMAL SCIENCES
Mannuthy - Trichur

1986

ABSTRACT

The present study was undertaken with the object of finding out the influence of GGE and its combinations on anaesthesia in goats. Eighteen apparently healthy cross-bred male kids, aged 5-9 months, weighing 11-16 kg were used for the study in three groups of six animals each.

GGE, five per cent solution alone at the rate of 100 mg/kg was administered intravenously in group A. Triflupromazine hydrochloride at the rate of 0.2 mg/kg and GGE solution at the rate of 100 mg/kg were administered in group B. Triflupromazine hydrochloride, GGE and five per cent Thiopentone sodium solutions were administered in group C. An average of 28.00 ± 0.10 ml GGE solution was administered in group A, 0.12 ± 0.003 ml Triflupromazine hydrochloride followed by 24.33 ± 0.67 ml GGE solution in group B and 0.12 ± 0.003 ml Triflupromazine hydrochloride, 28.83 ± 0.54 ml GGE and 2.97 ± 0.19 ml Thiopentone sodium solutions were administered in group C. There were no untoward symptoms at the time of administration of the drugs.

The induction time was 3.42 ± 0.20 min. in group A, 2.08 ± 0.08 min. in group B and 2.40 ± 0.24 min. in group C. The induction was smooth in all the groups.

On induction pedal, corneal, cutaneous and palpebral reflexes disappeared in all the groups, while palpebral reflex alone persisted in group A. Dilation of pupil with complete

relaxation of jaws, anus, penis and abdomen was noticed in all the animals as the anaesthetic effect deepened. Flaccidity of tail was pronounced in group C. All the animals were found to be weak and dull and did not take feed and water upto 12 hours in group A and upto 24 hours in group B and C. They were apparently normal by 24, 36 and 60 hours in group A, B and C respectively.

Reduction in rectal temperature was noted in all the groups. Initial reduction followed by an increase in heart rate was seen in group B and C. In group A there was increase in heart rate from the beginning. Tachycardia was observed at the time of recovery in all the groups. The variations in respiration rate were within the normal limits.

The duration of anaesthesia was 28.83 $\pm$ 2.27 min., 44.83 $\pm$ 1.74 min. and 52.60 $\pm$ 3.57 min. in group A, B and C respectively. The period of recovery was 18.00 $\pm$ 0.89 min., 17.33 $\pm$ 1.05 min. and 34.40 $\pm$ 1.69 min. in group A, B and C respectively. Recovery was smooth and uneventful.

There was a significant fall in the blood pressure (systolic, diastolic and mean arterial pressure) in all the groups, but pulse pressure showed marginal variation. Variations in central venous pressure was not significant.

The electrocardiogram revealed a depression of S-T segment in all the groups and depression of P wave in group B and C. Tachycardia was seen at recovery.

There was reduction in total erythrocyte count while the leukocyte count showed an initial decrease followed by an increase at 24 hours. The lymphocyte count decreased and the neutrophil count increased. Variation in the eosinophil and monocyte count was not significant.

A reduction in the haemoglobin content and packed cell volume was observed in all the groups. The erythrocyte sedimentation rate showed an increase during anaesthesia.

Significant increase in blood glucose was noticed in all the groups during anaesthesia and the serum protein values decreased. The serum sodium values showed marginal variations but the serum potassium values showed decrease upto 120 min. There was an increase in the serum chloride values followed by a decrease in all the groups.

In all the three groups of animals, variation in serum glutamic pyruvic transaminase level was within normal limits.

Gross lesions were not seen in any of the animals sacrificed on 4th or 10th day. But microscopic examination, early degenerative changes were noticed in the liver and kidney of all the animals sacrificed on the 4th day. Evidence of regeneration could be observed by the 10th day.