STUDIES ON THE EFFECT OF ACEPROMAZINE MALEATE AND TRIFLUPROMAZINE HYDROCHLORIDE ON ELECTROANAESTHESIA IN CALVES

By

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*This is to Certify that the thesis entitled "**STUDIES ON THE EFFECT OF ACEPROMAZINE MALEATE AND TRIFLUPROMAZINE HYDROCHLORIDE ON ELECTROANAESTHESIA IN CALVES**" submitted in partial fulfilment of the requirements for the degree of **MASTER OF VETERINARY SCIENCE** of the Acharya N.G.Ranga Agricultural University, Hyderabad, is a record of the bonafide research work carried out by **Mr.KADIYALA SURESH BABU** under my guidance and supervision. The subject of the thesis has been approved by the student's advisory committee.*

No apart of the thesis has been submitted for any other degree or diploma. The published part has been fully acknowledged. All assistance and help received during the course of the investigations have been duly acknowledged by the author of the thesis.

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ABSTRACT

The present investigation consisted of evaluation of acepromazine maleate and triflupromazine hydrochloride as premedicants for sine wave electroanaesthesia in twenty four calves. Following standardization of optimum doses of these drugs, further studies were conducted on clinical manifestations, haematological, biochemical and haemodynamic alterations during electroanaesthesia.

An integrated circuit electroanaesthesia apparatus capable of producing sine, square and triangular wave forms with alternating current was used. The frequency was fixed at 700 Hertz with variable electromotive force and milliamperage.

Stainless steel hypodermic needles, plalced bitemporally and subcutaneously were used as electrodes. There was neither surface coating nor local thermal burns with these electrodes.

Out of the different doses of premedicants evaluated acepromazine and triflupromazine at 0.10 mg/Kg and 0.2. mg/Kg body weight were found to be optimum for electroanaesthesia. Both drugs potentiated the anaesthesia with smooth induction.

Salivation, lachrymation and micturition was a constant feature in both premedicated groups during electroanaesthesia. Palpebral, conjunctival and corneal reflexes were lost earlier in triflupromazine group when compared to acepromazine group. Balanced anaesthetic state was obtained in both groups as indicated by central position of eyeball, prolapsed membrana nictitans with presence of weak pupillary light reflex. Pain sensation to pin pricks disappeared starting from palpebral, ear, fore limbs, hind limbs and abdominal wall. However, mild pain reflexes were present at perineum and tail in both groups.

There was a non-significant hyperthermia in both groups along with tachycardia. Acepromazine group of animals showed forceful expiration even though inspiration was smooth.

Haemogram revealed significant leukocytosis with neutrophilia and lymphopenia in both groups. Biochemical analysis revealed non significant changes in SGOT, SGPT, BUN and creatinine. Acepromazine group showed significant hyperglycemia during anaesthesia.

Significant increase in mean systolic and diastolic pressures were seen in both groups. Acepromazine group showed significant increase in central venous pressure. Recovery was instantaneous following discontinuance of anaesthesia. Triflupromazine premedicated animals showed better potentiation of anaesthesia with good muscular relaxation when compared to acepromazine premedicated animals.

CHAPTER - I

1. INTRODUCTION

Application of electric current to anaesthetised animal was a nightmare for scientists about 130 years ago. Later ample experimental and clinical evidence has been accumulated in literature to suggest that electric current can produce a dependable anaesthesia in animals. However the inquisitiveness about the subject made several workers to try the technique in one way or other. Electroanaesthesia has gain popularity due to its merit over inhalation or chemical anaesthesia. It is economical, well tolerated by poor anaesthetic risk patients (North-way, 1971); controllable and reversible, no chemical to be exerted, distributed or detoxified throughout the patient (Poznakand Artusio, 1962) and no drug hang over after recovery (Smith *et al.*, 1967). However demerits like muscular contractions, struggling, salivation, increased breath holding time and poor muscle relaxation the scientists for further investigations.

Several workers tried different methods involving direct current, alternating or a combination of both for surgery in animals (Nelson, 1944; short, 1964; Rao and Rao, 1978). Several wave forms and mode of application of electric current have been reported (Chandrasekhar *et al.*, 1991).

Sinewave electroanaesthetic apparatus suitable for bovine has been fabricated and tested by Rao (1975). Use of premedicants resulted minimal side effects during induction of electroanaesthesia (Short, 1964) Reduction in the quantity of current required following tranquilization has been reported in dogs (Smith, 1963) and buffaloes (Rao and Rao, 1979). Many draw backs of electroanaesthesia reported

previously have been eliminated by the use of different wave forms and appropriate selection of premedicants. The present investigation was aimed to compare the effect of two preanaesthetics, namely triflupromazine hydrochloride and acepromazine maleate on sine wave electroanaesthesia with the following objectives in calves.

1. To standardise the optimum dose of acepromazine maleate and triflupromazine hydrochloride.

2. To evaluate the clinical symptoms during electoranaesthesia following premedication.

3. To study the haematological, biochemical and haemodynamic alterations at the optimum dose of acepromazine maleate and triflupromazine hydrochloride during sinewave electroanaesthesia.

CHAPTER - II

2. REVIEW OF LITERATURE

Recently, application of electroanaesthesia has made rapid progress in clinical and experimental cases. The many drawbacks reported previously have been corrected with development of different wave forms along with meticulous use of preanaesthetic drugs. Available literature on electroanesthesia has been reviewed under the following heads.

1. Clinical manifestations
2. Haematological studies
3. Biochemical changes
4. Haemodynamic changes
5. Studies on premedication

2.1 CLINICAL MANIFESTATIONS

Nagelschmidt (1912) reported struggling during induction with intermittent direct current, Muscular contractions along with increased respiration and tachycardia was observed during with alternating current electroanaesthesia.

Maksov (1950) noticed excitement during induction. Increased respirations was common in all the animals.

Knutson (1954) observed respiratory obstruction, tonic spasms and cardiac irregularities with alternative current. Atropine, detubocurarine, intubation and phenobarbitones were used to control the side effects of current.

Knutson *et al.*, (1956) recorded harmful cardiopulmonary cmplications in human due to electroanaesthesia. These included hypertension, tachycardia and cardiac irregularities.

Hardy *et al.*, (1961 a) reported salivation and hypertension as side effects of current in humans. I lowever rapid recovery from electroanaesthesia was noticed.

Smith *et al.*, (1961 a) graded muscular relaxation as adequate for abdominal surgery in five, fair in two and poor in two cases. All animals exhibited salivation starting from induction and persisted throughout the period of anaesthesia. None of the animals showed muscular convulsions. either, during or after anaesthesia. Recovery was instantaneous regardless the length of time the animal was under electroanaesthesia. A temporary post narcotic skin analgesia was observed in five out of nine animals.

Smith *et al.*, (1961 b) noticed elevated rectal temperature in animals anaesthetised with square wave current. Electroencephalography and microscopic examination of brain showed no evidence of injury to cells.

Poznak and Artusio (1962) reported convulsions, profuse salivation, laryngospasm and strong stimuli with sine and triangular waves. They observed occasional skin irritation and local burning at the point of electrodes. Respirations were not smooth in any animal. Recovery was rapid and uneventful in all the animals.

Smith and Cullen (1962) described electroanaesthesia as having effect on the function of heart regulating centers. They opined that the increased body temperature

might be due to muscular activity during electroanaesthesia; Quick inspiration, slow and forcible expirations were seen in all animals during electroanaesthesia.

Volpitto *et al.*, (1962) recorded continuous urination in dogs during electroanaesthesia with alternative current super imposed on direct current.

Herin (1963) gradually increased the current to avoid severe spasms of muscle and apnoea commonly seen with too rapid induction. He mentioned incomplete muscle relaxation and convulsive movements during electroanaesthesia

Smith (1963) observed hyperthermia during electroanaesthesia in dogs. Respirations were slow and deep. Breath holding was noticed during rapid induction of anaesthesia.

Fabian *et al.*, (1964) noticed excessive salivation with sine wave electric current in humans. Significant respiratory depression and generalised muscular convulsions were also noticed during anaesthesia.

Gowing *et al.*, (1964) recorded hyperthermia with square wave electroanaesthesia.

Short (1964) noticed slight increase in rectal temperature in bovine, equine, ovine and porcine species. The rise was less than 1^{o} celsius.

Smith *et al.*, (1964) concluded that rapid induction produced lowered body temperature than the slow induction. This was attributed to muscular activity during preinduction and induction of anaesthesia.

Smith *et al.*, (1967) reviewed electroanaesthesia narcosis in animals. They claimed bitemporal electrodes with sine wave form as the best combination for producing surgical anaesthesia.

Herin (1968) reported undesirable side effects like apnoea, muscle tremors of head and neck and generalised muscular rigidity, urination and defecation during electroanaesthesia. Induction was smooth with sine wave rather than pulse wave. Though pulse wave produced more severe side reactions during induction, the animal was more relaxed with normal respiration during anaesthesia.

Northway (1971) observed defecation, urination, clonic spasms of muscles and profuse salivation during electroanaesthesia. He suggested additional muscle relaxants to control the convulsions.

Shimoji *et al.*, (1971) noticed analgesia, anaesthesia or a combination of these in humans. Respiratory rate increased along with decreased tidal volume during electroanaesthesia. The eyeballs were fixed centrally in all the patients and pupils were dilated in 17, constricted in 9 and approximately normal in 6 humans. Increased salivation, sweating on face was seen in 18 out of 32 patients. Skin hyperaemia was noted only in two patients.

Smith (1971) recorded convulsions, temporary dislodgement of electrodes and electrical burns as some of the side effects of electroanesthesia. He claimed burns as a result of poor technique.

Short (1974) opined response of animals to electroanaesthesia varied with species , size, breed and temperament of animal. Indiscriminate use of current produced convulsions and mild muscle spasms. There was no change in body temperature during electroanaesthesia.

Sances and Larson (1975) claimed good analgesia and somatic muscle relaxation with rectangular pulse wave current. Painful manipulations like skin and peritoneal incisions, renal palpations and mesenteric traction failed to produce irregularities in respiratory and cardiac functions. Intestinal tone was normal without any distension. Recovery was found to be quick.

Rao and Rao (1978) described an indigenously fabricated electroanaesthesia apparatus for use in buffaloes. The equipment has capacity to produce sine, square and triangular wave forms.

Bhanumurthy and Rao (1979) recorded occasional bloat and regurgitation during electroanaesthesia in buffaloes.

Komar (1979) noticed defensive reflexes and cationic contractions of fascial muscles during electroanaesthesia in piglets. Recovery occured 3 to 5 minutes after discontinuance of anaesthesia.

Kumar *et al.*, (1982) reported quick recovery and resumption of normal digestive functions immediately following electroanaesthesia. No ill effects were seen even after two hours following electroanaesthesia.

Chandrasekhar *et al.*, (1991) observed that the induction of anaesthesia was smooth with mild muscular contractions with sinewave current. Salvation, lachrymation, defecation and micturition slight increase in rectal temperature and post narcotic analgesia were noticed starting from induction with all the wave farms.

Yedukondalu (1992) reported that salivation and lachrymation as constant features with all the wave forms throughout the period of anesthesia. However, micturition and defecation were not observed.

2.2 HAEMATOLOGICAL STUDIES

Maksov (1950) observed changes in blood coagulation in dogs and horses during electroanaesthesia.

Herin (1963) recorded a significant increase in total leukocytic count during electroanaesthesia. There was a significant increase in catacholamines, free and conjugated corticosteriods and blood sugar.

Short (1965) noticed a slight but non significant increase in red blood corpuscles, haemoglobin, mean corpuscular volume and packed cell volume. However, total leukocyte count showed significant increase with neutrophilia and lymphopenia.

Herin (1968) observed increase in haemoglobin with sine, triangular and pulse wave currents. These remained unchanged with raw tooth and square waves of current. Packed cell volume and total leukocyte count significantly increased with sine, triangular and pulse waves of current.

Kumar *et al.*, (1982) noted a non significant increase in total erythrocyte count, sedimentation rate and mean corpuscular haemoglobin concentration in buffaloe calves given sine wave electric current.

Narasimha Rao (1983) mentioned significant leukocytosis, neutrophilia and lymphopenia with square and triangular waves than with sinewave currents.

Czaka (1986) reported reduced cardiac and respiratory rate and haemoglobin during electroanaesthesia. There was lymphocytopenia, neutrophilia, hypokalemia, hypomagnesemia and hypophosphatemia.

Eimolaev (1986) mentioned that electronarcosis in yearling bullocks resulted in thrombocytosis with reduction in coagulation time, blood heparin, blood viscosity and haematocrit. There was an increase in fibrinogen.

Chandrasekhar *et al.*, (1991) recorded transient, non significant increase in total erythrocyte count, haemoglobin and packed cell volume in all the wave forms. A highly significant leukocytosis with neutrophilia was observed with square and triangular waves compared to sinewave current.

Suresh Kumar *et al.*, (1996) observed a non significant increase in total erythrocyte count, haemoglobin and packed cell volume and a significant leukocytosis and neutrophilia in sheep. Lymphocyte, eosinophil and monocyte counts showed non significant alterations.

2.3 BIOCHEMICAL CHANGES

Volpitto *et al.*, (1962) recorded changes in plasma, chemistry during electroanaesthesia. They noticed a mild increase in blood glucose under electro anaesthesia.

Fabin *et al.*, (1964) observed significant increase in catacholamines, free and conjugated corticoid and blood sugar levels. This suggested a marked sympathoadrenal response to current.

Komar (1979) noticed increased serum asperate and alanine transferases, aldolase and sodium. There was a decrease in alkaline phosphatase and potassium.

Komar (1982) recorded a significant increase in sodium after one day and fail in potassium after one hour of electroanaesthesia. There was reduced calcium, inorganic phosphorus and chloride values.

Rao *et al.*, (1982) reported on the effect of electroanaesthesia on serum electrolytes of ten buffalo calves. They noticed no significant changes in serum sodium, potassium, calcium and chloride levels during electroanesthesia.

Rao (1984) analysed whole blood and plasma, during electroanaesthesia. There were no significant changes in glucose, protein and electrolytes.

Yedukondalu (1992) observed no significant changes in the biochemical constituents of blood except a slight increase in plasma potassium during electroanaesthesia with all the wave forms.

2.4. HAEMODYNAMIC CHANGES

Maksov (1950) reported change in blood pressure and cardiac activity during electroanaesthesia. However, these disappeared as soon as the current was put off.

Knutson *et al.*, (1956) mentioned hypertension during induction of electroanaesthesia. At later stages the blood pressure was within normal limits.

Hardy *et al.*, (1961 b) noticed hypertension and increased pulse rate during induction and at the beginning stage of surgical anaesthesia. They demonstrated an increased catecholamine release during electroanaesthesia.

Poznak and Artusio (1962) noted hypertension during electroanaesthesia. Bradycardia and cardiac arrythmias were also noted during anaesthesia.

Volpitto *et al.*, (1962) noticed no change in blood pressure unless the animal was struggling.

Herin (1963) observed significant increase in femoral arterial blood pressure during induction and early stages of surgical anaesthesia. This was thought to be due to release of catecholamines or direct stimulation of autonomic nervous system by the current.

Price and Dornette (1963) observed increased blood pressure and pulse rate during electroanaesthesia.

Smith (1963) attributed the rise in blood pressure due to struggling. A slow pulse with sinus brady cardia was seen in all the animals.

Smith and Cullen (1963) reported sinus bradycardia, secondary to forceful expiration in dogs.

Gowing *et al.*, (1964) failed to record any abnormality in blood pressure in animals given square wave electric current. Electrocardiogram had no irregularity in rate, rhythm and conduction.

Short (1964) noticed increased heart rate and respirations during the induction of electro anaesthesia. However, these returned to preinduction levels during anaesthesia.

Short (1965) observed reduced heart rate and respirations in cows under electroanaesthesia.

Rama Rao *et al.*, (1967) and Sachkov *et al.*, (1967) reported increased pulse and blood pressure during electroanaesthesia.

Herin (1968) noted changes in blood pressure, respiration rate, heart rate, Po_2 ,PCo_2 and PH of blood during various wave forms of electroanesthesia. A significant decrease in respiration was noticed with pulse wave, However, the increase was very slight with square wave. Heart rate significantly increased with sine and sawtooth waves. A slight increase in heart rate was seen with triangular, square and pulse wave anaesthesia.

Shimoji *et al.*, (1971) observed polypnoea with decreased tidal volume during electroanaesthesia. The minimal and maximal blood pressure increased immediately with current application, then declined slowly and remained constant. However five patients developed temporary hypertension which became normal without any drug therapy.

Short (1974) noticed no change in heart rate, blood gas and blood chemistry of cattle. He opined that proper attention to anaesthetic management avoids any cardiac irregularities.

Sharma and Singh (1983) utilized low frequency monophasic and biphasic wave forms. They recorded a significant increase in mean arterial pressure and heart rate during induction and maintenance of electroanaesthesia.

Rao *et al.*, (1984) mentioned that square and triangular wave current produced a significant increase in central venous pressure, mean systolic and diastolic pressures during electroanaesthesia in young buffaloes. The sinewave seemed to produce these changes to a lesser degree than the other wave forms.

Sharma and Singh (1985) employed low frequency and high frequency square and sine bursts of currents. They observed a significant rise in mean arterial pressure and heart rate during induction and maintenance of electroanaesthesia.

Reddy (1989) reported a significant increase in centralvenous pressure and mean arterial pressure with square and triangular wave forms. These changes were less significant with sinewave current.

2.5 STUDIES ON PREMEDICATION

Jha and Johnston (1961) discussed the effects of trifluprornazine hydrochloride on goats. Laboured breathing, salivation, respiratory depression and incoordination of hind quarters were reported to be the principal signs. A dose related hypotension was reported along with tachycardia.

Short (1967) noticed the effects of premedication on electroanaesthesia. Premedicated animals consumed less current than unpremedicated animals.

Popovic *et al.*, (1972) stated that Acepromazine maleate caused a significant increase in central venous pressure. However there was a decrease in mean arterial pressure, respiratory rate, rectal temperature, heart rate, haemoglobin and packed cell volume values.

Short (1974) observed that premedicated animals required few adjustments in applied electric current. He preferred tranquilizers with a long gradual elemination than the short acting agents.

Rao (1975) compared the effect of electroanaesthesia on premedication using a sinewave alternating current of 700 cycles per second with zero to hundred milliamperes and with zero to fifty volts. He concluded that premedication induced smooth induction with good muscular relaxation.

Amresh Kumar and Harpal Singh (1977) studied the effects of chlorpromazine hydrochloride, triflupromazine hydrochloride and xylazine as tranquilizers in buffaloes. They opined that the administration of triflupromazine and chlorpromazine produced an increase in heart rate and decrease in rectal temperature and respiratory rate. Tranquillization varied from fair to good in triflupromazine and chlorpromazine groups animals.

Rao and Rao (1979) reported that the premedicated animals consumed less current when compared to unpremedicated animals.

Rao *et al.*, (1980) performed caesarian section in a premedicated animal under electroanaesthesia. They reported good muscle relaxation during surgery.

Parry and Anderson (1983) stated that acepromazine maleate administration in equines causes a significant decrease in haematocrit and blood pressure.

Rao *et al.*, (1983) noticed that premedication with triflupromazine Hydrochloride provided smooth induction, reduced breath holding time, good muscle relaxation and decreased the quantity of milliamperage required to produce anaesthesia.

Sharma *et al.*, (1983) studied the effect of triflupromazine hydrochloride as a premedicant to thiopental sodium in atropinised dogs. It was opined that respiratory and heart rates were increased with a reduction in body temperature. The recovery was smooth and uneventful.

Sharma and Singh (1985) mentioned that premedication facilitated proper uptake of current and its distribution to the target area. Premedication minimised induction time, discomfort and muscle activity.

Darryl *et al.*, (1986) reported that the anaesthetic requirement of halothane would be less for patients premedicated with acepromazine maleate than unpremedicated ones.

Toms *et al.*, (1986) concluded that acepromazine caused significant decrease in arterial blood pressure, stroke volume, rate of oxygen consumption and left ventricular work,. Heart rate was unaffected while systemic and central venous pressure was decreased.

Rao *et al.*, (1987) mentioned that premedication with trifluprομazine hydrochloride produced satisfactory electroanaesthesia with minimal side effects and the quantum of current was decreased.

Balagopalan *et al.* (1990) mentioned that premedication with trifluprομazine hydrochloride reduced the induction time. Loss of reflexes, extent of muscle relaxation and duration of anaesthesia were more when combined with gluceral guaicolate, ether and thiopentone sodium.

Bearley *et al.* (1990) investigated into the effects of acepromazine on stress response in cattle. Plasma cortesol and blood glucose levels were significantly increased, while the haematocrit and the total plasma protein contents were decreased following acepromazine administration.

Hadgson *et al.* (1991) compared acepromazine and xylazine and inferred that the former was superior to latter since the uterine blood flow reduction was nearly one third that of xylazine. Oxygen delivery was always reduced with acepromazine. This marked reduction in oxygen delivery with xylazine was thoght to put the foetus at risk.

Sharma *et al.* (1991) evaluated acepromazine maleate and detomidine Hcl combination in five male cow calves. Tachycardia was seen following acepromazine and detomidine. But the heart rate remained within normal range. No significant changes were seen in temperature, haemoglobin, electrolytes, total proteins, blood urea nitrogen and creatinine.

Balagopalan *et al.* (1993) inferred that triflupromazine hydrochloride when administered with Glycerol guiacolate, ether and thiopentone sodium caused progressive hypotension and decreased central venous pressure. Total erythrocyte count, haemoglobin and packed cell volume were decreased, while erythrocyte sedimentation rate and neutrophils increased. Blood glucose level was increased while total serum protein was decreased.

Nancy Brock (1994) felt that following acepromazine administration the animal should be left undisturbed for obtaining maximum hypotension. It was thought to depress thermoregulatory centre in hypothalamus resulting in intraoperative hypothermia.

Rebecca *et al.* (1995) reported that acepromazine maleate depressed the cardiac function. Systemic blood pressure and respiratory rate were significantly decreased.

Naveen kumar *et al.* (1996) noticed a non significant decrease in haemoglobin, packed cell volume and total blood cell count in calves that were premedicated with diazepam and triflupromazine-hydrochloride. It was concluded that both the drugs produced good sedation and analgesia.

CHAPTER - III

3. MATERIALS AND METHODS

3.1 SELECTION OF ANIMALS

The present study was conducted on 24 apparently healthy calves of 1-2 years of age. The animals were kept under identical conditions and fed on concentrates and paddy straw. Prior to experimentation all the animals were dewormed. The animals were divided into four groups of six animals in each group as follows. All the animals were given sine wave electro-anaesthesia 30 minutes after premedication either with acepromazine nealeate[1] or triflupromazine hydrochloride[2].

Group I : Six animals at 72 hrs intervals were administered with acepromazine maleate @ 0.1, 0.2 and 0.3 mg/kg body weight intramuscularly under sinewave electroanaesthesia.

Group II : Six animals at 72 hrs intervals were administered with triflupromazine hydrochloride @0.1,0.2 and 0.3 mg/kg body weight intramuscularly under sinewave electroanaesthesia.

GroupIII : Six animals were used to study the haematological, haemodynamic and biochemical changes following premedication with 0.1 mg/kg body weight of acepromazine maleate under sinewave electroanaesthesia.

1 Promace, Fort Dodge Laboratories Inc, Iowa, USA.

2 Siquil - Sarabhai, Baroda, India

Group IV : Six animals were used to study the haematological, haemodynamic and biochemical changes following premedication with 0.2 mg/kg body weight of trifluprornazine HCl under sinewave electroanaesthesia.

Group I and Group II animals were utilised for the pilot study to assess the optimum dose level of preanaesthetics required.

3.2 APPARATUS

An integrated circuit electroanaesthetic apparatus was used. The apparatus works on 220 volts alternating current. Three wave forms namely sine, square and triangular were incorporated. The frequency range of 50 Hertz to 1 kelo Hertz was choosen. The magnitude of the current was fixed between 0 to 100 milliamperes.

The equipment mainly consists of three sections (Fig. 1,2,3). The first section consisted rectifier and IC 723 regulators to provide constant power supply for the subsequent stage. The second section comprised of a generator with IC 8038 to produce sinusoidal, square and triangular wave forms. Frequency was varied by a multiple switch along with different valves of capacitor (C) for each selting of the switch. The output magnitude was controlled by potentiometer (PI) from 0 to 50 volts. The switch PI provided selection of out wave form of sinusoidal, square or triangular. The third section consisted of power/voltage amplifier by using IC 741 operational amplifier along with complementary pairs of power transistors. This will amplify the signal generator output without distortion upto the required frequency of 1 kelo Hertz.

There was right distortion in the sinusoidal wave form as the frequency was varied. Potentiometer P2 controls the output wave form and undistorted sinusoidal wave form results. The loading effect of the system was almost negligible for varying load of 50 ohms to 1000 ohms. Even if animal's skull resistance varies, the instrument will not be overloaded as ICs were protected from the phenomena.

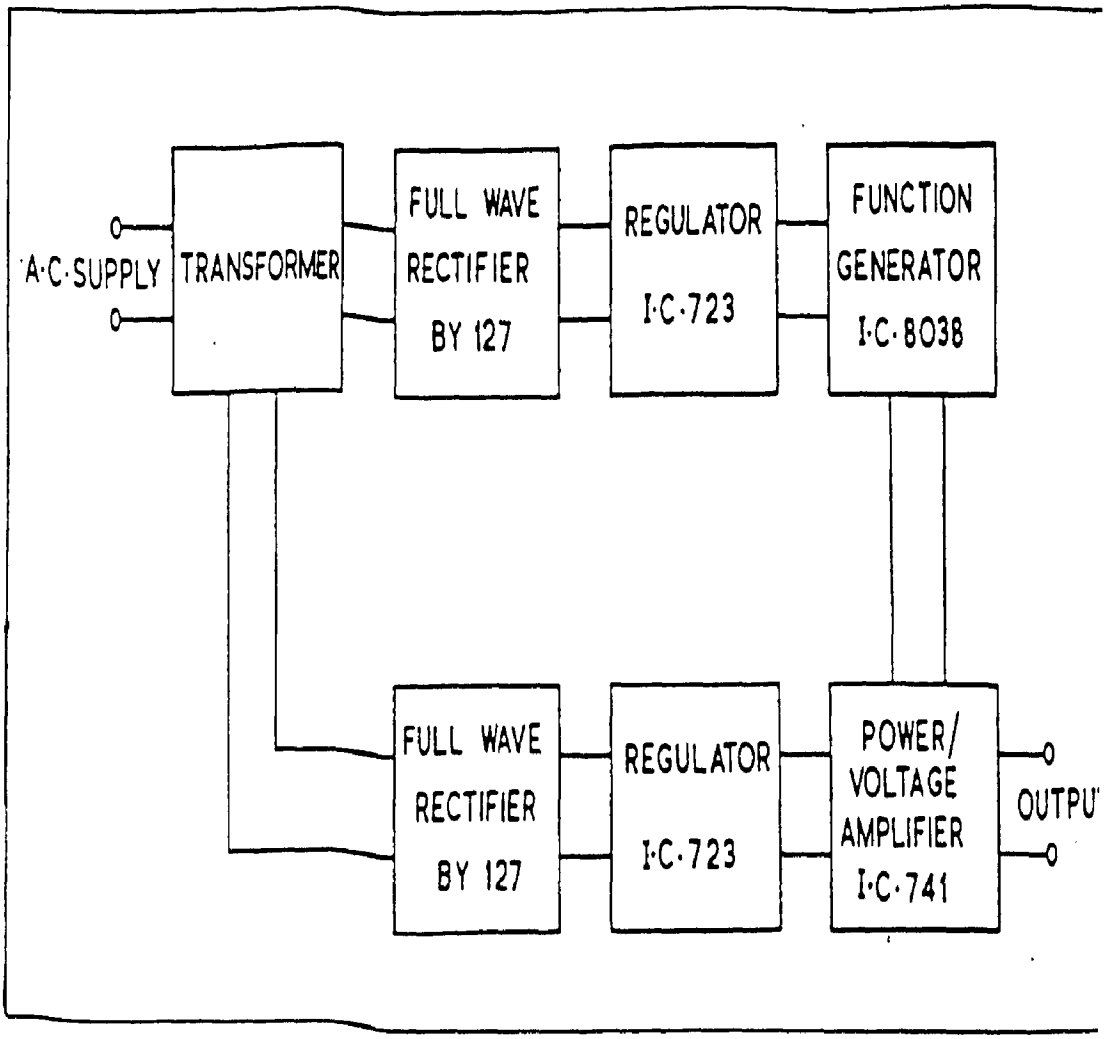

FIG.1. BLOCK DIAGRAM OF ELECTRO-ANAESTHETIC APPARATUS

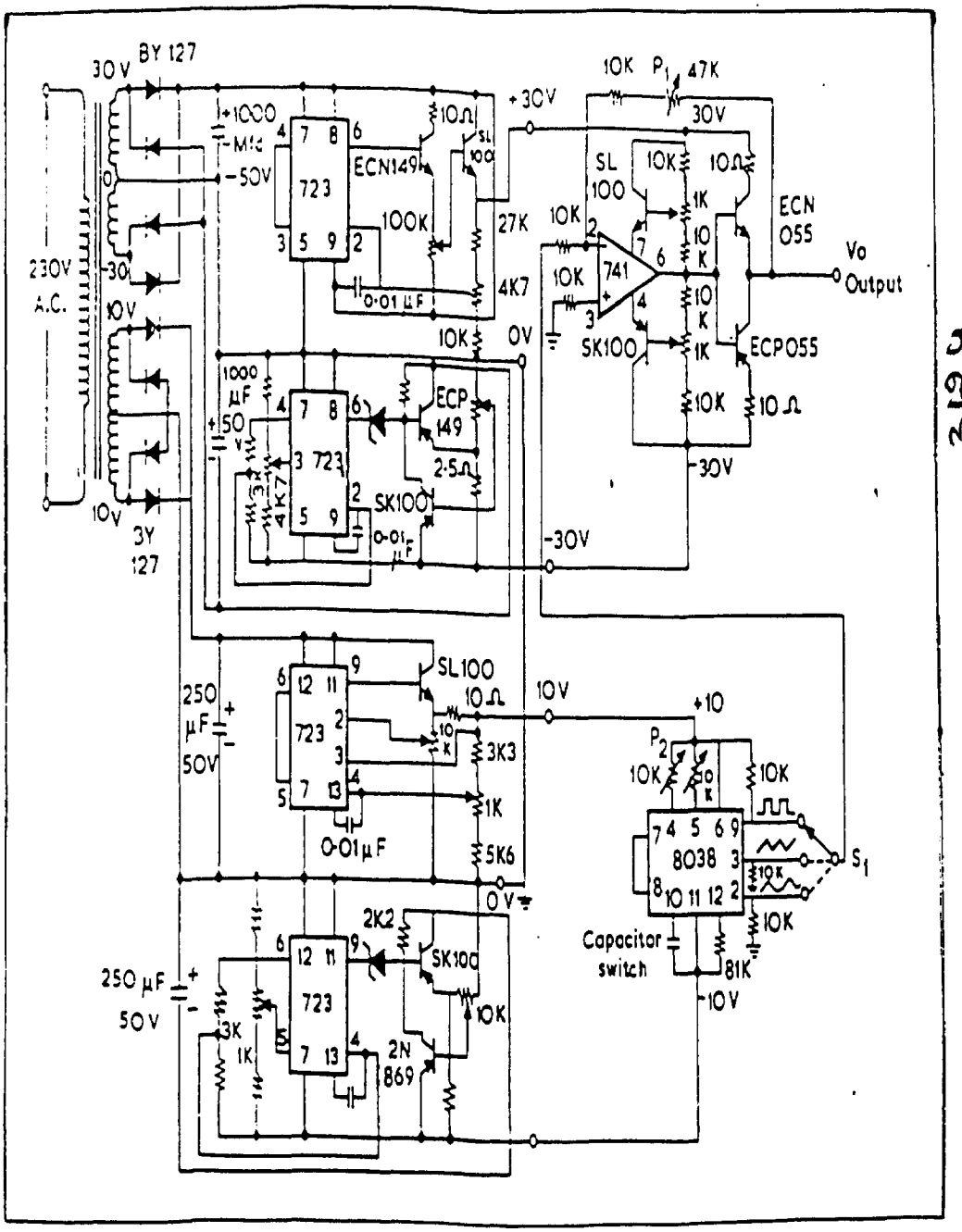

FIG. 2. CIRCUIT DIAGRAM OF ELECTRO-ANAESTHETIC APPARATUS

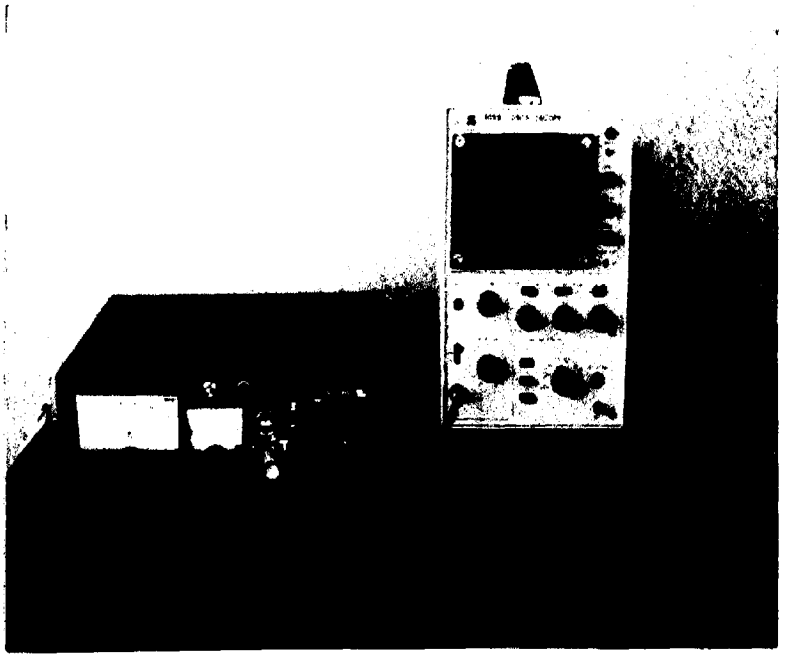

Fig.3 Electroanaesthetic apparatus showing sine wave current.

Fig.4 Photograph showing [illegible] electrodes temporarily.

3.6 HEAMATOLOGICAL STUDIES

Five milliliters of venous blood was collected from Jugular vein into a vial containing double oxalate (Heller and paul, 1934) for the following estimation.

a. Total erythrocyte count (TEC) and total leukocyte count were estimated following the procedure of Schalm (1965). They were expressed as millions per cubic millimeter and thousands per cubic millimeter, respectively.

b. Haemoglobin (Hb) was measured by acid haematin method (Schalm, 1965) with Hellige Sahli haemometer and expressed as grams per 100 ml.

c. Packed cell volume (PCV) was determined by wintrobe haematocrit method (Schalm, 1965) as volume percent.

d. Erythrocyte sedimentation rate (ESR) was expressed as millimeters per hour with wintrobe haematocrit tube (Schalm, 1965).

e. Differential leukocyte count (DLC) was done on blood smears prepared without any anticoagulant and stained by Wright's methods (Schalm, 1965).

3.7 BIOCHEMICAL CHANGES

Five milliliters of venous blood from jugular vein was collected into a vial containing Heller and Paul mixture before, during electroanaesthesia and 30 mts following discontinuance of sinewave electroanaesthesia. Plasma was separated from red cells by centrifugation at 2000 rpm for 15 mts for the following estimations.

a. Glutamic oxalo-acetic transaminase (GOT) and glutamic pyruvic transaminase (GPT) were estimated as per the procedure of Reitman and Frankel (1957) and expressed as Sigma-Frankel units per milliliter of serum.

b. Blood urea nitrogen (BUN) was estimated following the procedure of Richeter and Lapointe (1962) and expressed as milligrams per 100 milliliters.

c. Serum creatinine was measured as described by Oser (1954) and expressed as milligrams per 100 milliliters.

d. Glucose was estimated in whole blood by copper reduction method (Nelson, 1944) and expressed as milligram percent.

e. Total proteins were estimated by Biuret method and expressed as gram percent.

3.8 HAEMODYNAMIC CHANGES

Haemodynamics were measured with PE-160 polyethylene tube[3]. The tube was passed through a 12 gauge hypodermic needle into the blood vessels. The catheter was flushed intermittently with heparinised saline (10 IU/ml). The following pressures were recorded.

a. Systolic and diastolic pressures were recorded with a Condon type mercury manometer[4] with the catheter in carotid artery. The pressure was expressed as mm Hg.

b. Central venous pressure (CVP) was measured as centimeters of saline against a saline column.

All the data were subjected to students t-test as described by Snedecor and Cochran (1967) to find the level of significance using 2-tailed test.

3 Intramedic - clap Adams, parsippany, New Jersey, USA

4 Inco, Anebala, India.

CHAPTER - IV

4. RESULTS

The present work was carried out to standardise the optimum dose of acepromazine maleate and triflupromazine hydrocholide as premedicants in twenty four calves under sinewave electroanaesthesia with bitemporal electrodes. The various clinical, biochemical, haematological and haemodynamic alterations were studied under sinewave electroanaesthesia following premedication. The observations recorded have been grouped under the following heads.

4.1 EFFECT OF PREMEDICATION ON CURRENT CONSUMPTION DURING SINEWAVE ELECTROANAESTHESIA

An alternating current of 700 Hertz was used. Initially anaesthesia was induced with an electromotive force (e.m.f) of 6 volts. In all the animals, the applied e.m.f produced a current flow of 20 malliamperes (mA). The voltage was gradually increased till there was breath holding and then decreased till respirations were normal. Stail less steel hypodermic needles were used as electrodes which were not coated by any electrical isulation. The needles were introduced deep into the temporal fossa posterior to eyes and oriented parallel to long axis of skull. Surface coating of needles was not noticed during anaesthesia. No local tissue burning was noticed at the place of electrode placement.

The voltage and amperage required to produce surgical plane of anaesthesia in unpremedicated and premedicated group of animals given in tables 1 to 2. Significant decrease in the quantity ($P<0.01$) of milliamperage required to produce

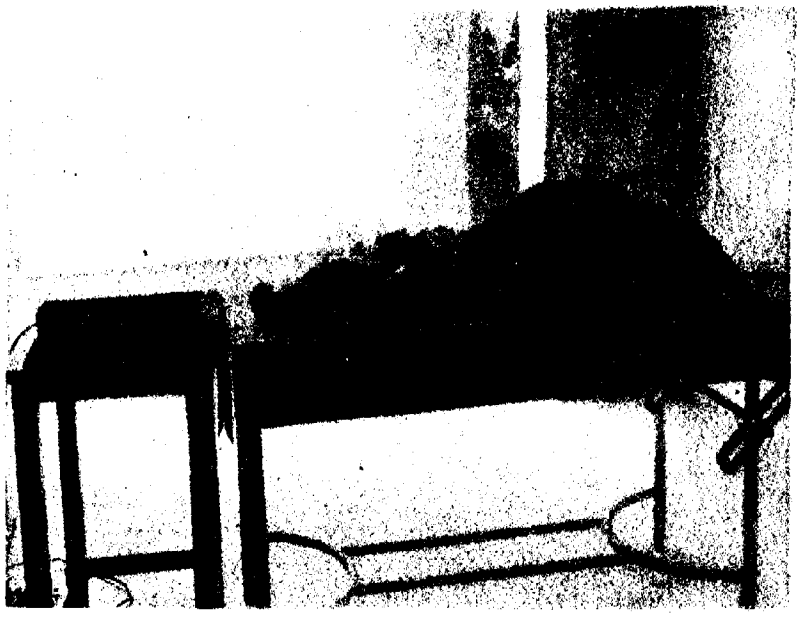

Fig.5 Animal under one wave electrocardiostasis

Table - 1 : Current consumption during sinewave electroanaesthesia following premedication with acepromazine maleate.

S. No.	Weight of the animal	Unpremedicated		Premedicated					
		Volts	mA	Group I (0.1 mg/Kg) body weight		Group II (0.2 mg/Kg) body weight		Group III (0.3 mg/Kg) body weight	
				Volts	mA	Volts	mA	Volts	mA
1.	48	10	56	9	36	10	42	8	42
2.	52	9	66	8	48	8	62	10	62
3.	50	14	64	12	50	12	48	12	48
4.	63	12	58	10	52	10	44	10	44
5.	72	16	60	16	38	16	38	18	48
6.	68	18	56	17	42	18	48	16	38
Mean		13.16	60.00	12.00	44.33**	12.33	47.00*	12.33	47.00*
± SE		1.421	1.719	1.391	2.462	1.452	3.096	1.796	3.094
Range		9-18	56-66	8-71	36-52	8-18	38-62	8-18	38-62

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

** Significant at 1 per cent level ($P < 0.01$)

Table - 2 : Current consumption during sinewave electroanaesthesia following premedication with triflupromazine hydrochloride.

S. No.	Weight of the animal	Unpremedicated		Premedicated					
		Volts	mA	Group I (0.1 mg/Kg) body weight		Group II (0.2 mg/Kg) body weight		Group III (0.3 mg/Kg) body weight	
				Volts	mA	Volts	mA	Volts	mA
1.	59	9	80	8	58	8	53	9	58
2.	72	10	65	10	70	10	55	8	48
3.	47	14	65	12	64	12	52	14	54
4.	51	10	65	8	68	10	40	12	40
5.	60	12	70	12	76	12	51	10	51
6.	53	18	80	16	68	12	55	12	60
Mean		12.16	70.81	11.00	67.33	10.66	50.81**	10.83	51.83**
± SE		1.260	3.000	1.243	2.250	0.670	2.380	0.913	2.972
Range		9-18	65-80	8-16	58-76	8-12	40-55	8-14	40-60

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

** Significant at 1 per cent level ($P < 0.01$)

anaesthesia was noticed in animals premedicated with triflupromazine at 0.2 and 0.3 mg/kg body weight dose levels. The milliamperage Consumption was significantly lower ($P<0.01$) at 0.1 mg dose than at 0.2 mg/kg body weight dose ($P< 0.05$) with acepromazine (Table - 1). Decrease was more in the animals premedicated with triflupromazine hydrochloride @ 0.2 mg/kg body weight than in the animals premedicated with acepromazine maleate at any dose level studied.

4.2 DISAPPEARANCE OF REFLEXES

The time taken for disappearance of skeletal muscle reflexes following intramuscular administration of various doses of acepromazine and triflupromazine under sinewave electroanaesthesia were given in the tables 3 to 8.

4.2.1 Palpebral reflex

The reflex disappeared in 13.83 ± 0.280 (range 13-15), 9.16 ± 0.390 (range 8-12) and 9.16 ± 0.520 (range 8-10) seconds following electroanaesthesia in groups I to III (Tables 3 to 5). Triflupromazine administered animals showed disapperance of palpebral reflex in 13.66 ± 0.730 (range 10-15), 8.83 ± 0.760 (range 6-12) and 8.66 ± 0.450 (range 7-10) seconds respectively in groups IV to VI (Tables 6 to 8).

Triflupromazine administered animals showed early disapperance of palpebral reflex when compared to acepromazine group of animals at all the dose levels studied.

4.2.2 Ear reflex

Ear reflex disappeared in 20.50 ± 1.050 (range 18-24), 10.16 ± 0.720 (range 9-13) 10.50 ± 0.810 (range 8-13) seconds in groups I to III respectively (Tables 3-5).

Triflupromazine administered animals showed ear reflex disappearance in 19.83 ± 0.760 (range 17-22), 12.83 ± 0.550 (range 11-15) and 12.16 ± 0.430 (range 11-14) seconds in groups IV to VI respectively (Tables 6 to 8).

Triflupromazine premedicated animals exhibited early disappearance of ear reflex when compared to acepromazine at dose levels studied in all the groups.

4.2.3 Fore limb reflex

Fore limb reflex disappeared in 38.66 ± 0.990 (range 36-42), 36.83 ± 1.0610 (range 34-40) and 34.16 ± 1.460 (range 30-38) seconds in groups I to III respectively. Triflupromazine administered animals showed forelimb reflex disapperance in 29.66 ± 0.600 (range 28-32), 20.16 ± 0.890 (range 18-24) and 19.33 ± 0.560 (range 18-22) seconds respectively in groups IV to VI (Tables 6 to 8).

4.2.4 Hind limb reflex

Premedication with acepromazine during sinewave electroanaesthesia abolished hind limb reflex in 69.50 ± 0.730 (range 68-72), 65.12 ± 1.090 (range 62-69) and 65.60 ± 1.100 (range 62-70) seconds in groups I to III respectively (Tables 3 to 5). Triflupromazine premedicated animals showed disappearance of hind limb reflex in 48.50 ± 0.810 (range 46-52), 29.00 ± 0.880 (range 25-32) and 32.83 ± 0.950 (range 30-36) seconds in groups IV to VI respectively at all dose levels studied (Tables 6 to 8).

Animals premedicated with triflupromazine exhibited early disapperance of hind limb reflex when compared to acepromazine premedicated animals at all dose levels.

Table - 3 : Disappearance of reflexes (in sec) in response to sine wave electroanaesthesia following premedication with acepromazine maleate @ 0.1 mg/kg body weight intramuscularly.

Animal No.	Palpebral	Ears	Forelimb	Hind limb	Abdominal	Perineum	Tail
1	14	20	40	72	120	+	+
2	13	24	36	68	111	+	+
3	14	18	41	68	124	+	+
4	14	18	36	72	134	+	+
5	13	24	42	69	122	+	+
6	15	19	37	68	122	+	+
Mean	13.83	20.50	38.66	69.50	122.16		
± SE	0.280	1.050	0.990	0.730	2.760		
Range	13-15	18.24	36-42	68-72	111-134		

+ = Reflex not abolished

Table - 4 : Disappearance of reflexes (in sec) in response to sine wave electroanaesthesia following premedication with acepromazine maleate @ 0.2 mg/kg body weight.

Animal No.	Palpebral	Ears	Forelimb	Hind limb	Abdominal	Perineum	Tail
1	8	9	35	62	122	+	+
2	9	8	34	64	112	+	+
3	8	9	40	62	124	+	+
4	12	10	34	69	110	+	+
5	8	12	38	67	124	+	+
6	10	13	40	67	130	+	+
Mean	9.16	10.16	36.83	65.12	120.33		
± SE	0.390	0.720	1.060	1.090	2.890		
Range	8-12	9-13	34-40	62-69	110-130		

+ = Reflex not abolished

Table - 5 : Disappearance of reflexes (in sec) in response to sine wave electroanaesthesia following premedication with acepromazine maleate @ 0.3 mg/kg body weight.

Animal No.	Palpebral	Ears	Forelimb	Hind limb	Abdominal	Perineum	Tail
1	8	12	37	62	112	+	+
2	8	10	30	70	128	+	+
3	10	13	32	64	120	+	+
4	9	12	30	66	128	+	+
5	10	8	38	64	128	+	+
6	10	8	38	68	116	+	+
Mean	9.16	19.50	34.16	65.60	120.57		
± SE	0.520	0.810	1.460	1.100	2.820		
Range	8-10	8-13	30-38	62-70	112-128		

+ = Reflex not abolished

Table - 6 : Disappearance of reflexes (in sec.) in response to sine wave electroanaesthesia following premedication with triflupromazine Hcl @ 0.1 mg/kg body weight intramuscularly.

Animal No.	Palpebral	Ears	Forelimb	Hind limb	Abdominal	Perineum	Tail
1	10	22	30	46	66	+	+
2	15	17	28	48	68	+	+
3	14	20	32	52	79	+	+
4	15	22	29	47	79	+	+
5	13	20	31	50	68	+	+
6	15	18	28	48	64	+	+
Mean	13.66	19.83	29.66	48.50	70.66		
± SE	0.730	0.760	0.600	0.810	2.450		
Range	10-15	17-22	28-32	46-52	64-79		

+ = Reflex not abolished

Table - 7 : Disappearance of reflexes (in sec.) in response to sine wave electroanaesthesia following premedication with triflupromazine Hcl @ 0.2 mg/kg body weight intramuscularly.

Animal No.	Palpebral	Ears	Forelimb	Hind limb	Abdominal	Perineum	Tail
1	12	12	24	30	45	+	+
2	8	14	18	25	51	+	+
3	9	12	20	29	48	+	+
4	10	15	18	30	46	+	+
5	6	13	19	32	46	+	+
6	8	11	22	28	45	+	+
Mean	8.83	12.83	20.16	29.00	46.31		
± SE	0.760	0.550	0.890	0.880	0.860		
Range	6-12	11-15	18-24	25-32	45-51		

+ = Reflex not abolished

Table - 8 : **Disappearance of reflexes (in sec.) in response to sine wave electroanaesthesia following premedication with triflupromazine Hcl @ 0.3 mg/kg body weight intramuscularly.**

Animal No.	Palpebral	Ears	Forelimb	Hind limb	Abdominal	Perineum	Tail
1	10	11	19	30	48	+	+
2	8	14	18	36	46	+	+
3	9	11	22	36	50	+	+
4	10	12	19	32	47	+	+
5	8	13	18	31	52	+	+
6	7	12	20	32	46	+	+
Mean	8.66	12.16	19.33	32.83	48.16		
± SE	0.450	0.430	0.560	0.950	0.890		
Range	7-10	11-14	18-22	30-36	46-52		

+ = Reflex not abolished

4.2.5 Abdominal reflex

Abdominal reflex disappeared in 122.16 ± 2.76 (range 111-134), 120.33 ± 2.890 (range 110-130) and 120.57 ± 2.820 (range 112-118) seconds in groups I to III respectively (Tables 3 to 5). Triflupromazine premedicated groups of IV to VI animals showed disappearance of abdominal reflex in 70.66 ± 2.450 (range 64-79), 46.31 ± 0.860 (range 45-51) and 48.16 ± 0.890 (range 46-52) seconds in groups IV to VI respectively (Tables 6 to 8).

Disappearance of abdominal reflex was earlier in triflupromazine groups when compared to acepromazine groups of animals.

4.2.6 Perineal reflex

The perineal reflex was not abolished during electroanaesthesia following premedication with acepromazine or triflupromazine at any dose rate studied (Tables 3 to 8).

4.2.7 Tail reflex

Pain reflex persisted throughout the anaesthetic period in anterior part of the tail in both groups at any dose rate studied (Tables 3 to 8).

Reappearance of all the reflexes were found to be instantaneous following cessation of current flow and post anaesthetic skin analgesia of five minutes duration was seen in both the groups.

From the above investigation, it was deduced that the optimum doses of acepromazine and triflupromazine were 0.1 mg/kg and 0.2 mg/kg body weight respectively. At these dose levels, further investigations were carried out to evaluate their effects on clinical manifestations, haematological, biochemical and haemodynamic changes.

4.3 CLINICAL MANIFESTATIONS

All unpremedicated animals showed breath holding and muscular contractions during the period of induction and during electroanaesthesia. Premedicated animals, either with acepromazine or triflupromazine exhibited mild contractions of neck and head muscles during induction period only and the induction of anaesthesia was smooth. Salivation, lachrymation and micturition was a common feature during anaesthesia in unpremedicated and premedicated animals.

All the animals had closed eyelids and prolapsed membrana nictitans. The eye ball was centrally placed. Palpebral, conjunctival and corneal reflexes were absent during anaesthesia. The pupil was constricted with presence of slight pupillary reflex to light.

The changes in the rectal temperature, heart rate and respiratory rates are given in tables 9 and 10. There was a slight, non significant increase in rectal-temperature during anaesthesia in both premedicated groups. Heart rate was significantly increased ($P<0.01$) in both premedicated groups during surgical anaesthesia. The increase was more in triflupromazine group than in acepromazine group. Respiratory rate showed a slight decrease in both the groups of animals.

Table - 9 : Clinical signs in response to sine wave electronaesthesia following premedication with acepromazine (0.1 mg/kg body weight)

Animal No.	Temperature (°F)			Heart rate/minute			Respiration/minute		
	Before	During	After	Before	During	After	Before	During	After
1	99.8	100.4	100.0	72	92	70	14	12	14
2	101.4	101.8	101.2	80	96	82	14	12	12
3	99.6	101.2	99.4	82	100	84	12	10	14
4	101.2	101.6	101.4	72	84	80	16	14	14
5	100.0	100.0	99.8	84	92	82	14	14	12
6	101.2	101.8	101.4	88	98	90	12	10	10
Mean	100.53	101.13	100.52	79.66	93.66**	81.33	13.66	12.00	12.66
± SE	0.300	0.280	0.330	2.430	2.120	2.440	0.560	0.660	0.610
Range	99.6-101.4	100.0-101.8	99.4-101.4	72-88	84-100	70-90	12-16	10-14	10-14

** Significant at 1 per cent level ($P < 0.01$)

Table - 10 : Clinical signs in response to sine wave electronaesthesia following premedication with triflupromazine Hcl (0.2 mg/kg body weight).

Animal No.	Temperature (°F)			Heart rate/minute			Respiration/minute		
	Before	During	After	Before	During	After	Before	During	After
1	99.8	100.2	99.6	86	112	94	16	18	16
2	100.2	101.0	100.4	80	102	88	14	12	12
3	100.0	100.6	100.4	94	108	90	16	14	16
4	99.4	100.2	99.4	78	100	78	18	16	18
5	101.2	101.4	101.4	96	116	94	16	12	14
6	100.8	101.2	100.4	82	106	80	18	16	16
Mean	100.23	100.76	100.26	86.00	107.33**	87.33	16.33	14.66	15.33
± SE	0.240	0.190	0.260	2.790	2.250	2.560	0.560	0.900	0.770
Range	99.4-101.2	100.2-101.4	99.4-101.4	78-96	100-116	78-94	14-18	12-18	12-18

** Significant at 1 per cent level ($P < 0.01$)

Inspiration was smooth, but the expiration was forceful in acepromazine group of animals. Recovery was instantaneous once anaesthesia was discontinued.

4.4 HAEMATOLOGICAL STUDIES

The mean haematological values under sinewave electroanaesthesia following premedication with optimum doses of acepromazine maleate (0.1 mg/kg body weight) and trifluprornazine hydrochloride (0.2 mg/kg body weight) are given in tables 11 to 18. There was non significant increase in red blood cell count, haemoglobin, packed cell volume and erythrocyte sedimentation rate in both the groups (tables 11 to 14). The total leukocyte count showed a highly significant increase ($P>0.01$) in both the groups along with a significant neutrophilia ($P>0.01$) and lymphopenia ($P>0.01$) (tables 15 to 16) during anaesthesia. No significant alterations were noticed in eosinophil and monocytes count (tables 17 to 18).

4.5 BIOCHEMICAL CHANGES

The biochemical changes during sinewave electroanaesthesia following premedication with acepromazine maleate (0.1 mg/kg body weight) and triflupromazine hydrochloride (0.2 mg/kg body weight) are given in the tables 19 to 24. There was a non significant increase in serum glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, blood urea nitrogen and serum creatininelevels were noticed in both the group of animals. However blood glucose levels were non significantly increased in triflupromazine group and was significantly increased ($P<0.05$) in acepromazine group. The total protein levels were non significantly decreased in both the groups. These values approached towards base values following discontinuance of anaesthesia.

Table - 11 : Heamtalogical changes (RBC and Hb) in response to sine wave electoanaesthesia following premedication with acepromazine maleate (0.1 mg/kg body weight).

Animal No.	RBC (10^6/cmm)			Hb (g%)		
	Before	During	After	Before	During	After
1	5.20	5.82	5.80	8.10	8.80	8.70
2	4.25	5.00	5.00	9.20	9.20	9.20
3	6.15	6.45	6.20	8.80	9.10	9.00
4	4.85	4.50	4.42	10.50	10.80	10.70
5	5.42	5.62	5.62	8.20	9.10	9.10
6	4.12	4.15	4.10	8.60	8.80	8.40
Mean	4.99	5.25	5.19	8.90	9.30	9.18
± SE	0.280	0.320	0.300	0.320	0.280	0.290
Range	4.12-6.15	4.15-6.45	4.10-6.20	8.10-10.50	8.80-10.80	8.40-10.70

Table - 12 : Heamatological changes (RBC and Hb) in response to sine wave electoanaesthesia following premedication with triflupromazine hydrochloride (0.2 mg/kg body weight).

Animal No.	RBC (10^6/cmm)			Hb (g%)		
	Before	During	After	Before	During	After
1	4.10	4.20	4.00	8.20	8.40	8.40
2	5.34	5.82	5.35	9.60	9.60	9.20
3	4.25	4.78	4.24	10.20	10.40	10.20
4	4.80	5.24	4.80	10.30	10.40	10.60
5	5.65	6.12	6.24	8.60	8.60	8.50
6	6.03	6.26	6.24	8.00	8.20	8.10
Mean	5.02	5.40	5.08	9.15	9.26	9.16
± SE	0.290	0.300	0.330	0.370	0.370	0.380
Range	4.10-6.03	4.20-6.26	4.00-6.24	8.00-10.30	8.20-10.40	8.10-10.60

Table - 13 : Heamatological changes (PCV and ESR) in response to sine wave electoanaesthesia following premedication with acepromazine maleate (0.1 mg/kg body weight).

Animal No.	PCV (%)			ESR (mm/hr)		
	Before	During	After	Before	During	After
1	30	32	32	60	62	62
2	31	33	33	62	60	58
3	27	28	28	64	65	63
4	28	30	32	60	62	62
5	30	34	32	66	66	65
6	29	29	29	68	69	68
Mean	29.16	31.00	31.00	63.33	64.00	63.00
± SE	0.550	0.880	0.880	1.220	1.220	1.250
Range	27-31	28-34	28-33	60-68	60-69	58-68

Table - 14 : Heamatological changes (PCV and ESR) in response to sine wave electroanaesthesia following premedication with triflupromazine hydrochloride (0.2 mg/kg body weight).

Animal No.	PCV (%)			ESR (mm/hr)		
	Before	During	After	Before	During	After
1	29	30	30	64	64	62
2	30	32	30	62	66	66
3	31	31	31	66	68	68
4	28	28	26	61	62	60
5	34	34	32	63	62	64
6	33	36	36	60	61	60
Mean	30.83	31.83	30.83	62.66	63.83	63.33
± SE	0.860	1.060	1.210	0.800	1.010	1.220
Range	28-34	28-36	26-36	60-66	61-68	60-68

Table - 15 : Changes in leucocytes (TLC, neutrophils and lymphocytes) in response to sine wave electroanaesthesia following premedication with acepromazine meleate (0.1 mg/kg body weight).

Animal No.	TLC (10^3/cmm)			Neutrophils			Lymphocytes		
	Before	During	After	Before	During	After	Before	During	After
1	8.20	9.50	8.25	2870	4840	2887	5210	5000	5420
2	10.50	12.00	10.60	2990	6682	3039	4422	3810	4537
3	9.80	12.20	9.40	3462	6582	3780	5772	4280	5724
4	10.20	12.30	10.10	3421	6259	3347	5292	4647	5186
5	10.60	12.50	10.50	3327	6754	3509	5936	4852	5874
6	9.60	12.60	10.00	3605	6274	3672	5934	4863	5880
Mean	9.81	11.85**	9.80	3279.16	6231.83**	3372.33	5427.66	4575.33**	5436.66
± SE	0.320	0.430	0.320	107.090	265.440	131.410	217.930	168.100	193.130
Range	8.20-10.60	9.50-12.60	8.25-10.60	2870-3605	4840-6754	2887-3780	4422-5936	3810-5000	4537-5880

** Significant at 1 per cent level ($P < 0.01$)

Table - 16 : Changes in leucocytes (TLC, neutrophils and lymphocytes) in response to sine wave electroanaesthesia following premedication with triflupromazine hydrochloride (0.2 mg/kg body weight).

Animal No.	TLC (10^3/cmm)			Neutrophils			Lymphocytes		
	Before	During	After	Before	During	After	Before	During	After
1	10.60	11.15	11.60	3610	5575	3945	5800	4464	6490
2	9.50	11.15	10.10	2934	6201	3380	5536	4234	6482
3	9.80	11.00	10.10	3925	6110	3400	5220	4086	5454
4	8.05	9.65	8.00	3650	6814	3796	6020	4972	6134
5	8.90	11.70	9.65	3528	5820	3600	5290	4681	5420
6	10.75	13.00	11.15	2817	5200	2740	5832	4332	5830
Mean	9.60	11.27	10.08	3410.66	6076.28**	3476.83	5616.33	4461.50**	5968.33
± SE	0.380	0.400	0.470	162.800	229.230	157.500	119.370	119.360	179.250
Range	8.05-10.75	9.65-13.00	8-11.60	2817-3925	5200-6814	2740-3945	5220-6020	4086-4972	5454-6490

** Significant at 1 per cent level ($P < 0.01$)

Table - 17 : Changes in leucocytes (eosinophils and monocytes) in response to sine wave electroanaesthesia following premedication with acepromazine maleate (0.1 mg/kg body weight).

Animal No.	Eosinophils			Monocytes		
	Before	During	After	Before	During	After
1	410	475	412	520	610	490
2	430	620	530	524	600	530
3	630	600	636	452	464	480
4	615	640	636	510	592	500
5	530	612	520	550	625	408
6	624	630	640	584	630	510
Mean	539.83	596.16	562.33	523.33	586.83	486.33
± SE	37.210	22.710	34.280	17.960	25.270	15.660
Range	410-630	475-640	412-640	452-584	464-630	408-530

Table - 18 : Changes in leucocytes (eosinophils and monocytes) in response to sine wave electroanaesthesia following premedication with triflupromazine hydrochloride (0.2 mg/kg body weight).

Animal No.	Eosinophils			Monocytes		
	Before	During	After	Before	During	After
1	530	532	550	382	474	489
2	560	557	505	632	557	458
3	654	610	600	390	557	550
4	480	650	500	436	610	400
5	552	540	580	645	680	551
6	430	654	669	460	540	500
Mean	534.33	590.5	567.33	490.83	569.66	492.33
± SE	28.330	22.40	23.730	43.980	28.39	21.900
Range	430-654	532-654	500-669	382-645	474-680	400-557

Table - 19 : Changes in GOT and GPT (S.F.units/ml) of serum in response to sine wave electroanaesthesia following premedication with acepromazine maleate @ 0.1 mg/kg body weight.

Animal No.	SGOT (SF units/ml)			SGPT (S.F.Units/ml)		
	Before	During	After	Before	During	After
1	50	52	50	20	21	21
2	54	54	52	21	22	20
3	52	54	50	19	19	20
4	58	58	56	24	24	22
5	56	56	54	25	26	25
6	58	60	58	24	25	24
Mean	54.66	55.66	53.33	22.16	22.83	22.10
± SE	1.220	1.100	1.220	0.920	0.980	0.786
Range	50-58	52-60	50-58	19-25	19-26	20-25

Table - 20 : Changes in GOT and GPT (S.F.units/ml) of serum in response to sine wave electroanaesthesia following premedication with triflupromazine hydrochloride @ 0.2 mg/kg body weight.

Animal No.	SGOT (SF units/ml)			SGPT (S.F.Units/ml)		
	Before	During	After	Before	During	After
1	52	54	50	23	24	24
2	66	66	62	18	20	19
3	62	64	60	24	24	22
4	60	62	62	20	21	21
5	50	52	50	19	20	20
6	62	60	58	23	26	25
Mean	58.66	59.66	57.00	21.16	22.50	21.25
± SE	2.350	2.090	2.090	0.920	0.930	0.860
Range	50-66	54-66	50-62	18-24	20-26	19-25

Table - 21 : Changes in blood urea nitrogen (BUN mg%) and serum creatinine (mg%) in response to sine wave electroanaestesia following premedication with acepromazine maleate @ 0.1 mg/kg body weight.

Animal No.	BUN (mg%)			Serum Creatinine (mg%)		
	Before	During	After	Before	During	After
1	10.12	11.00	10.82	1.51	1.62	1.50
2	13.50	14.21	14.20	1.09	1.43	1.32
3	12.27	12.29	12.12	1.89	2.00	1.89
4	11.43	11.85	11.85	2.00	2.01	2.00
5	15.75	16.00	15.83	1.02	1.23	1.19
6	14.00	14.24	14.00	1.13	1.37	1.00
Mean	12.84	13.26	13.13	1.44	1.61	1.48
± SE	0.740	0.690	0.690	0.160	0.120	0.140
Range	10.12-15.75	11.00-16.00	10.82-15.83	1.02-2.00	1.23-2.01	1.00-2.00

Table - 22 : Changes in blood urea nitrogen (BUN mg%) and serum creatinine (mg%) in response to sine wave electroanaestesia following premedication with trifluprom azine hydrochloride @ 0.2 mg/kg body weight.

Animal No.	BUN (mg%)			Serum Creatinine (mg%)		
	Before	During	After	Before	During	After
1	16.21	16.82	16.41	1.02	1.75	1.42
2	14.47	14.60	14.60	1.20	1.43	1.43
3	15.32	16.00	15.83	2.00	2.00	1.92
4	14.80	15.21	15.00	1.83	1.92	1.46
5	16.93	17.00	17.00	0.98	1.13	1.00
6	15.40	15.43	15.10	1.72	1.82	1.32
Mean	15.50	15.83	15.65	1.45	1.67	1.42
± SE	0.350	0.350	0.340	0.160	0.120	0.110
Range	14.47-16.93	14.60-17.0	14.60-17.00	0.98-2.00	1.13-2.00	1.00-1.92

Table - 23 : Changes in blood glucose (mg%) and plasma total protein (g%) in response to sine wave electroanaesthesia following premedication with acepromazine maleate @ 0.1 mg/kg body weight.

Animal No.	Glucose (mg%)			Total Protein (g%)		
	Before	During	After	Before	During	After
1	72	76	74	7.89	7.12	7.35
2	76	78	75	6.25	6.21	6.22
3	82	89	84	8.12	8.00	8.00
4	80	84	80	6.03	5.87	6.00
5	78	87	81	6.53	6.25	6.33
6	76	80	78	7.21	7.21	7.25
Mean	77.33	82.33*	78.66	7.00	6.77	6.85
± SE	1.310	1.930	1.410	0.320	0.300	0.290
Range	72-82	76-89	74-84	6.03-8.12	5.87-8.00	6.00-8.00

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

Table - 24 : Changes in blood glucose (mg%) and plasma total protein (g%) in response to sine wave electroanaesthesia following premedication with triflupromazine hydrochloride @ 0.2 mg/kg body weight.

Animal No.	Glucose (mg%)			Total Protein (g%)		
	Before	During	After	Before	During	After
1	63	67	66	6.72	6.23	6.24
2	72	74	74	7.03	7.00	7.00
3	66	68	65	7.45	7.24	7.25
4	76	78	76	6.64	6.31	6.66
5	74	78	77	7.82	7.19	7.30
6	68	70	68	8.00	8.00	7.89
Mean	69.83	72.50	71.00	7.27	6.99	7.05
± SE	1.860	1.820	1.970	0.210	0.240	0.210
Range	63-76	67-78	65-77	6.64-8.00	6.23-8.00	6.24-7.89

4.6 HAEMODYNAMIC CHANGES

The alternations in the haemodynamic parameters during sinewave electroanaesthesia following premedication with acepromazine maleate (0.1 mg/kg body weight) and trifluprornazine hydrochloride (0.2 mg/kg body weight) are given in the tables 25 to 30. Systolic and diastolic blood pressures significantly increased ($P<0.01$) during anaesthesia in trifluprornazine group (tables 26 to 28). There was no significant alterations in acepromazine group (tables 25 to 27).

Trifluprornazine group exhibited non significant alterations in central venous pressure. On the contrary acepromazine premedicated animals exhibited significant increase in central venous pressure (Table 29) starting 30 minutes after electroanaesthesia and persisted throughout the anaesthetic period.

Table - 25 : Changes in systrolic pressure (mm/Hg) in response to sine wave electroanaesthesia following premedication with acepromazine maleate @ 0.1 mg/kg body weight.

Animal No.	Before	During				After
		15 min	30 min	45 min	60 min	
1	109	110	110	111	112	109
2	110	112	114	115	110	110
3	114	114	112	112	110	113
4	113	116	116	117	114	114
5	108	110	108	108	112	109
6	107	109	110	112	108	106
Mean	110.16	111.83	111.66	112.50	111.00	110.16
± SE	1.040	1.010	1.100	1.170	0.780	1.090
Range	107-114	109-116	108-116	108-117	108-114	104-110

Table - 26 : Changes in systolic pressure (mm/Hg) in response to sine wave electroanaesthesia following premedication with triflupromazine Hcl @ 0.2 mg/kg body weight.

Animal No.	Before	During				After
		15 min	30 min	45 min	60 min	
1	114	121	120	115	112	111
2	113	116	116	112	110	109
3	116	120	120	120	116	114
4	110	115	115	115	115	113
5	110	114	118	114	112	110
6	112	118	116	116	114	112
Mean	112.50	117.33**	117.50**	115.33*	114.25	111.50
± SE	0.870	1.040	0.810	0.970	1.010	0.690
Range	110-116	114-121	115-120	112-120	110-116	109-114

** Significant at 1 per cent level ($P < 0.01$)

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

Table - 27 : Changes in diastolic pressure (mm/Hg) in response to sine wave electroanaesthesia following premedication with acepromazine maleate @ 0.1 mg/kg body weight.

Animal No.	Before	During				After
		15 min	30 min	45 min	60 min	
1	106	108	107	107	107	105
2	108	110	110	110	108	108
3	110	111	112	111	110	108
4	105	107	106	106	106	104
5	104	106	108	107	107	104
6	106	108	106	104	104	102
Mean	106.50	108.33	108.16	107.50	107.00	105.16
± SE	0.810	0.960	0.890	0.960	0.740	0.890
Range	104-110	106-11	106-112	104-111	104-110	102-108

Table - 28 : Changes in diastolic pressure (mm/Hg) in response to sine wave electroanaesthesia following premedication with triflupromazine Hcl @ 0.2 mg/kg body weight.

Animal No.	Before	During				After
		15 min	30 min	45 min	60 min	
1	105	111	110	111	110	105
2	110	117	118	116	113	108
3	106	112	113	113	110	106
4	108	110	109	110	110	107
5	112	116	117	115	114	110
6	105	110	110	110	108	105
Mean	107.66	112.66**	112.83*	112.83**	110.83*	106.83
± SE	1.070	1.150	1.440	0.960	0.830	0.720
Range	105-112	110-117	109-118	110-116	108-114	105-110

* Significant at 5 percent level ($P < 0.05$)

** Significant at 1 per cent level ($P < 0.01$)

Table - 29 : Changes in central venous pressure (cm/saline) in response to sine wave electroanaesthesia following premedication with acepromazine maleate @ 0.1 mg/kg body weight.

Animal No.	Before	During				After
		15 min	30 min	45 min	60 min	
1	13.00	14.00	14.50	15.00	15.50	14.00
2	14.00	14.50	15.00	16.50	16.50	13.50
3	11.50	12.00	13.50	15.00	14.50	14.00
4	14.50	14.50	15.00	16.50	16.50	12.50
5	11.50	12.50	13.50	16.50	17.50	15.00
6	12.50	13.00	13.50	14.50	16.00	12.50
Mean	12.83	13.25	14.16**	15.66**	16.08	13.75
± SE	0.460	0.450	0.280	0.340	0.380	0.300
Range	11.50-14.50	12.00-14.50	13.50-15.00	14.50-16.50	14.50-17.50	12.50-15.00

** Significant at 1 per cent level ($P < 0.01$)

Table - 30 : Changes in central venous pressure (cms/saline) in response to sine wave electroanaesthesia following premedication with triflupromazine Hcl @ 0.2 mg/kg body weight.

Animal No.	Before	During				After
		15 min	30 min	45 min	60 min	
1	11.50	12.50	12.00	12.50	12.50	10.00
2	12.25	14.00	14.00	14.50	15.00	11.50
3	14.00	15.00	15.00	15.00	14.50	13.00
4	14.00	16.00	14.50	15.50	15.00	14.50
5	11.25	12.00	12.00	11.00	11.50	11.00
6	13.00	14.50	14.50	15.00	15.00	14.25
Mean	12.66	14.00	13.66	13.91	13.91	12.37
± SE	0.440	0.560	0.490	0.660	0.570	0.680
Range	11.25-14.00	12.04-16.00	12.00-15.00	11.00-15.50	11.50-15.00	10.00-14.50

CHAPTER - V

5. DISCUSSION

Electric current has been shown to produce dependable anaesthesi animals. Several wave forms and application modes have been studied. The e nature of effects of electroanaesthesia cannot be judged by using the same clir parameters as in chemical or inhalation anaesthesia. However, the advantage electroanaesthesia, are many compared to conventional agents. These include ra induction, remarkable and sustained ameliorating effect on surgical pain with having any adverse effects on circulatory and respiratory functions, and qı reversibility once electric current is discontinued.

An integrated electroanaesthetic apparatus was designed and fabricated work on alternating current. Three wave forms, namely sine, square and triangı waves can be produced at a low frequency of 700 Hertz (Rao, 1975; Bhanumur and Rao, 1979). Sinewave has been choosen in the present experimentation sinc has proved to produce least tissue damage and easy to monitor the varic parameters (Smith *et al.*, 1967; Smith, 1971; Reddy, 1987). The frequency of 7 Hertz was kept constant in the present series since it was reported to be the m efficient form of current (Knutson, 1954; Hardy *et al.*, 1961 a; Herin, 1963, 19(Prise and Dornette, 1963, Smith, 1971; Rao, 1975; Rao *et al.*, 1980, 1984, 198 Short (1974) and Sharma and Singh (1983) reported less respiratory embarrassm(using low frequency current. On the other hand Smith (1971) noticed less pain usi high frequency current.

Anaesthesia was induced with a minimum electromotive force (e.m.f) and gradually increased by step-by-step method until breath holding was noticed. The current was then reduced till normal respirations resumed. This method of induction elicited less excitement without cyanosis as reported by Rao *et al.*, (1982, 1983 and 1984). Smith *et al.*, (1967) and Knutson *et al.*, (1956) observed cyanosis, tonic contractions and cardiac arrhythimias using high induction technique. discomfort during induction, Violent struggling and breath holding was reported to be a feature of slow induction technique (Smith *et al.*, 1967). Both high and low induction techniques produced a marked reduction in heart rate, hyperthermia, increased metabolic rate and blood glucose with hypertension (Smith *et al.*, 1967).

Two premedicants, namely acepromazine maleate and triflupromazine hydrochloride were choosen in the present study. They were given at dose rates of 0.1, 0.2 and 0.3 mg/kg body weight, intramuscularly, prior to electroanaesthesia. In general, premedication produced smooth induction, decreased current consumption and reduced struggling. Acepromazine and triflupromazine at dose level of 0.10 mg/kg and 0.20 mg/kg body weight produced maximum reduction in consumption of milliamperage. These doses were used for further studies on the effects of sinewave electroanaesthesia on various parameters.

Un-premedicated animals showed severe muscular contractions with prolonged periods of breath holding, both during induction and surgical plane of electroanaesthesia. On the contrary, premedication with acepromazine or triflupromazine produced mild contractions of head and neck muscles during induction period only. Breath holding time is less. Breath holding has been described by Nagelschmidt (1912) and Knutson (1954) and was attributed to rapid induction

method (Smith, 1963). A gradual increase in current avoided apnoea and muscle spasms in the present animals as reported by Herin (1963). Premedication with trifluprομazine hydrochloride produced more smooth induction with minimal struggling, less muscular contractions and better muscular relaxation during anaesthesia when compared to acepromazine maleate premedicated group of animals. Pozank and Artusio (1962) noticed convulsions when a strong current was used to produce anaesthesia. Hardy *et al.*, (1961 a,b) Rama Rao *et al.*, (1975), Rao and Rao (1979), Rao *et al.*, (1980, 1983, 1987) advocated the use of preanaesthetics to enhance the depth of anaesthesia. Rao *et al.*, (1983) reported that induction was more tolerable when trifluprομazine hydrochloride was used than with chlorpromazine hydrochloride. On the other hand Smith *et al.*, (1967) opined that as the species response to various tranquillizers has not been established, the utility of drugs to calm nervous animals is questionable. Price and Dornette (1963), Fabian *et al.*, (1964) and Rama Rao *et al.*, (1967) observed failure of premedicants to potentiate electroanaesthesia.

Stainless steel hypodermic needles were used as electrodes since it was easy to place in position and least equipment is needed to hold them in situ (Smith *et al.*, 1967). Surface coating of the electrodes was not observed in any animal. This might be due to the use of alternating current. Smith *et al.*, (1967) noticed surface coating of stainless steel safety pins, copper and silver electrodes, when direct current is used. They recommended wet sponge electrodes with direct current. Smith and Cullen (1962) opined palladium as the best electrode since it is tough, bright and easily moulded.

No local burns were noticed in any animal at the electrode site with sinewave as reported by Smith *et al.*, (1961 a). Smith (1971) suggested that burns are due to a high current density per square millimeter of area. The bitemporal electrodes in the present series were retained well in position without displacement. Short (1974) regarded that proper electrode contact is essential for optimum anaesthesia. Northway (1971) deduced bitemporal electrodes as the best when compared to fronto-occipital and palato-occipital placements. Smith *et al.*, (1961 b, 1967) observed that placement of electrodes posterior to neck muscles leads to muscular contractions. Short (1967) concluded that placement of electrodes close to cerebrospinal fluid produces faster and extensive response to a given amplitude.

Salivation, lachrymation and micturition were common in both unpremedicated and premedicated animals during the period of electroanaesthesia. Continuous salivation was reported by Smith *et al.*,(1961 a), Poznak and Artisio (1962), Fabian *et al.*, (1964), Smith *et al.*, (1961 a) and Rao *et al.*, (1980, 1982, 1987). Poznak and Artusio (1962). Smith and Cullen (1962), Herin (1968), Northway (1971) and Rao and Rao (1978) noticed urination during the period of induction only. Persistence of urination throughout the anaesthetic period was reported by Volpitto *et al.*, (1962).

Closed eyelids, prolapsed membrananictitans, constricted pupil with sluggish pupillary light reflex was suggestive of balanced conditions of electroanaesthesia as reported by Knutson *et al.*,(1956), Narasimha Rao (1983), Rao *et al.*,(1987) and Chandrasekhar *et al.*, (1991). However, Shimoji *et al.*,(1971) stated that the correction between the eye signs and effectiveness of electroanaesthesia was not established.

Slight hyperthermia noticed in both premedicated groups during sinewave electroanaesthesia might be related to muscular contractions rather than the effect of current on hypothalamus as suggested by Smith *et al.*,(1961 a), Smith (1963), Smith *et al.*,(1964, 1967, 1971), Gowing *et al.*,(1964), Northway (1971), Rao (1984) and Nancy Brock (1994). This was further supported by observations of smith and Cullen (1962) in which the function of heat regulatory centre was not affected by electroanaesthesia. Short (1965) mentioned no rise in body temperature during electroanaesthesia.

There was a significant tachycardia in both premedicated groups during anaesthesia. The increase in heart rate was more in animals premedicated with triflupromazine than in animals premedicated with acepromazine. This was related to hypertension as stated by Sances and Larson (1975). Herin (1968) recommended sinewave current as it produced minimum changes in heart rate, blood pressure, blood gas and blood pH when compared to square and triangular wave forms of electroanaesthesia. Increased heart rate during sinewave electroanaesthesia was also reported by Knutson *et al.*, (1954, 1956), Chandrasekhar *et al.*, (1991) and Yedukondalu (1992).

There was a non significant decrease in respiratory rate during electroanaesthesia in both premedicated groups. Acepromazine group of animals showed forceful expiration, but had smooth inspiration. Fabian *et al.*, (1964), Short (1965), and Reddy *et al.*, (1989) recorded a slight decrease in respiratory rate with sine, square and triangular wave forms of electroanaesthesia. While Shimoji *et al.*, (1971) reported a slight increase in respirations; Smith *et al.*, (1967) observed that the current had no inherent factor to induce hypoxia.

Reaction to pin pricks disappeared first from palpebral, then ears, fore limbs, hind limbs and finally from abdominal wall. Triflupromazine premedicated animals showed early disappearance of the reflexes when compared to acepromazine premedicated animals. However, both groups showed sluggish reflex to pin pricks of perineum and tail. This was also reported by Smith *et al.*, (1961 b), Rao (1975) and Rao (1984).

Haemogram of animals premedicated either with triflupromazine or acepromazine, showed non significant increase in total red blood cell count, haemoglobin, packed cell volume and erythrocyte sedimentation rate during electroanaesthesia. There was no significant variation between the groups. Increased red blood cell count is self explanatory for increase in haemoglobin and packed cell volume. A direct proportion is shown to exist between packed cell volume and erythrocyte count per unit volume and size (Schalm, 1965). The highly significant leukocytosis, neutrophilia and lymphopenia noticed in both groups was in agreement with the observations of Herin (1963), Short (1965), Shimoji *et al.*, (1971), Kumar *et al.*, (1982) and Suresh Kumar *et al.*, (1996). These alterations might be due to increased adrenal activity and Stress (Schalm, *et al.*, 1965).

The serum biochemistry revealed non significant increase in glutamic oxaloacetic and glutamic pyruvic transaminase, blood urea nitrogen and creatinine in both groups during electroanaesthesia. This suggested that liver and kidney functions were not altered appreciably during sinewave electroanaesthesia as reported by Komar (1979), 1982) and Sharma *et al.*, (1991). Blood glucose levels increased significantly in acepromazine group when compared to triflupromazine group during anaesthesia. The hyperglycemia might be due to $\alpha 2$ mediated inhibition of insulin

release and increased hepatic mobilization of glucose (Brearley *et al.*, 1990). The slight decrease in total proteins during electroanaesthesia in both groups might be due to catabolism produced by muscular contractions as reported by Brearley *et al.*, (1990) and Balagopalan *et al.*, (1993).

There was increase in mean systolic and diastolic blood pressure during electroanaesthesia in both the groups. While the increase was significant in triflupromazine premedicated animals, it was non significant in animals premedicated with acepromazine. Rama Rao *et al.*, (1967), Herin (1968), Rao *et al.*, (1984), Sharma and Singh (1985), and Reddy (1987) reported moderate hypertension with sinewave electroanaesthesia. The hypertension in the present animals might be related to the release of catecholamines or to direct autonomic nervous system stimulation as reported by Hardy *et al.*, (1961 a), popovic *et al.*, (1972), Rao *et al.*, (1984) and Rebecca *et al.*, (1995). Central venous pressure exhibited a significant increase in acepromazine group when compared to triflupromazine group during sine wave electroanaesthesia. This might be due to increased pressure on vena cava due to forced expiration observed in acepromazine group as suggested by sances and Larson (1975) and Reddy (1987). Smith (1963), Shimoji *et al.*,(1971), Rao *et al.*, (1984) and Toms *et al.*,(1986) ascribed increased central venous pressure to increased venous tone by catecholamines.

CHAPTER - VI

6. SUMMARY

Sinewave electroanaesthesia using bitemporal stainless steel needle electrodes was studied on twenty four calves. The effect of acepromazine maleate triflupromazine hydrochloride and as premedicants given prior to electroanaesthesia was evaluated.

1. An integrated circuit electroanaesthesia apparatus capable of producing sinewave alternating current was used. The frequency was fixed at 700 Hertz with variable electromotive force and milliamperage.

2. Stainless steel hypodermic needles, placed bitemporally and subcutaneously were used as electrodes.

3. Acepromazine maleate at dose of 0.10 mg/kg body and triflupromazine hydrochloride at dose level of 0.20 mg/kg weight were found to be optimum doses as preanaesthetics with sinewave current.

4. Both premedicants potentiated the anaesthetic qualities of sinewave current by reducing the milliamperage required to produce surgical anaesthesia.

5. Surface coating of the electrodes was not noticed in any animal. No local tissue burns were seen.

6. Anaesthesia was induced by step-by-step method using a low electromotive force. It was increased gradually till breath holding was seen. Then the current was reduced till normal breathing resumed.

7. Induction of anaesthesia was smooth in both groups of premedicated animals. Muscular contractions of head and neck were mild during induction period only.

8. Salivation, lachrymation and micturition was seen in both premedicated groups during anaesthesia.

9. Palpebral, conjunctival and corneal reflexes were lost during early stages of anaesthesia. The eye ball was central in position with prolapse of membrane nictitans. The pupil was constricted with weak pupillary light reflex.

10. Pain reflexes to pin pricks disappeared first from palpebral, ears, forelimbs, hind limbs and abdominal wall. However perineal and tail reflexes were not abolished.

11. Both groups showed slight hyperthermia during anaesthesia.

12. A slight decrease in respiratory rate was observed in both groups. Acepromazine group showed forceful expiration during anaesthesia.

13. Tachycardia was significant in all animals.

14. Recovery was instantaneous once current was switched off.

15. Haemogram showed slight, non significant increase in total erythrocyte count, haemoglobin, packed cell volume and erythrocyte sedimentation rate. Both groups had significant leukocytosis, neutrophilia and lyphopaenia.

16. There was a non significant increase in SGOT, SGPT, BUN and creatinine in both groups. A significant hyperglycemia was noticed in acepromazine group. Both groups showed slight decrease in total proteins during anaesthesia.

17. Significant increase in mean systolic and diastolic pressure was noticed in triflupromazine group. Acepromazine group showed significant increase in central venous pressure.

18. Triflupromazine hydrochloride premedicated animals provided better potentiation of electroanaesthesia with good muscular relaxation than acepromazine maleate premedicated animals.

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