

**A COMPARATIVE STUDY OF  
KETAMINE HYDROCHLORIDE AND THIOPENTONE  
SODIUM ANAESTHESIA IN BIRDS**

By

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**THESIS**

Submitted in partial fulfilment of the  
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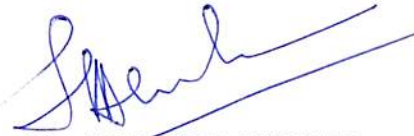
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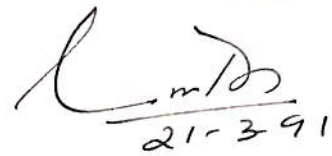
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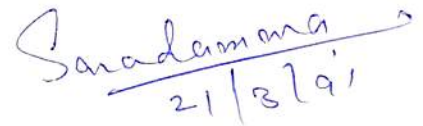
  
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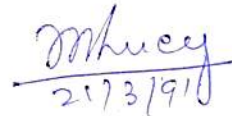
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*Dedicated to my parents*

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# *Introduction*

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## INTRODUCTION

The demand for the treatment of avian diseases has been on the increase nowadays. The veterinarians have to bestow more attention than in the past, since the cost of the domestic birds had enormously increased. Surgical care and management of the avian patients had become an integral part in the every day practice of any veterinarian. Administration of anaesthetic prior to surgical intervention, is but a necessity. Moreover, it helps in rendering surgical procedures less hazardous and avoiding stress for which the avian patients are most notorious.

Administration of anaesthetics in birds had been resorted to orally and parenterally viz., intramuscularly, intravenously and intraperitoneally. Inhalation anaesthetics had also been tried. Barbiturates such as sodium amytal (Fretz, 1932), sodium pentobarbital (Warren and Scott, 1935), sodium pentothal (Lee, 1953), methohexitone sodium (Desforges and Scott, 1971) and combination of barbiturates namely Combuthal (Sanger and Smith, 1957) and Equithesin (Gandal, 1956) had been recommended in birds.



Dissociative anaesthetic such as ketamine hydrochloride (Mandelker, 1973), along with bezodiazepine drugs viz., diazepam (Redig and Duke, 1976) and clonazepam (Kummerfeld and Ganter, 1986), with xylazine hydrochloride (Harvey et al., 1985), with steroid mixture alfaxalone-alphadolone (Samour et al., 1984) and inhalation anaesthetics such as ether and chloroform (Lee, 1953) had been employed in the past.

The search for an ideal anaesthetic which will provide satisfactory analgesia, narcosis and muscle relaxation, is still in progress. The present study was undertaken to assess the efficacy of (i) ketamine hydrochloride, a congener of phencyclidine hydrochloride, a dissociative anaesthetic, (ii) thiopentone sodium, an ultra short acting barbiturate and (iii) a combination of these two, i.e. by administering ketamine hydrochloride followed by thiopentone sodium, for anaesthetising domestic chicken and ducks.

# *Review of Literature*

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## REVIEW OF LITERATURE

Fretz (1932) reported satisfactory general anaesthesia in birds using sodium amytal (0.1 g per ml) solution intravenously. Injections of 0.5 - 1.0 ml of this solution was adequate for birds ranging from 4 - 8 lb bodyweight.

Warren and Scott (1935) considered sodium pentobarbital (Nembutal) as the most satisfactory general anaesthetic in poultry practice. Intravenous injections of 0.50 - 0.75 ml produced effective anaesthesia upto 2 hours.

Lee (1953) made trials using ether, chloroform, chloral hydrate, sodium pentothal and sodium amytal in domestic fowls. Ether and chloroform were inadequate for use in all fowls due to sudden death from asphyxia. Chloral hydrate on oral administration produced general anaesthesia for 30 minutes and the anaesthetic effect persisted for  $\frac{1}{2}$ ,  $2\frac{1}{2}$  and  $4\frac{1}{2}$  hours in geese, ducks and chicken respectively. The anaesthetic dose of chloral hydrate was 0.10 - 0.15 g per lb bodyweight for geese, 0.125 - 0.150 g for ducks and 0.08 - 0.15 g for chicken. During anaesthesia the temperature showed a decrease of 1 - 2.4°C. In pigeons

chloral hydrate did not produce general anaesthesia, instead it produced only depression and staggering gait. Intravenous injections of sodium pentothal produced anaesthesia immediately or within few minutes. The anaesthesia with sodium amytal lasted 1 - 1½ hours in geese and ducks, and 15 - 30 minutes in chicken and pigeons. In the case of sodium pentothal it lasted for 10 minutes in all fowls. For sodium pentothal adequate anaesthetic doses were 0.016 - 0.024 g per lb bodyweight for geese, ducks and chicken, and 0.008 - 0.024 g for pigeons. For sodium amytal, the doses were 0.006 - 0.010 g for geese, 0.008 - 0.024 g for ducks and 0.006 - 0.008 g for chicken and pigeons. The initial signs of anaesthesia were relaxation of all voluntary muscles and ruffled feathers. The loss of sensation and reflexes, the corneal reflex being the last to abolish, were the indications of complete anaesthesia. The respiration was decreased in frequency and force. During recovery the reflex of neck muscles was the first to appear and gradually extended to the whole body. Muscular tremors, vomiting and staggering gait were always noticed.

Gandal (1956) used Equithesin as anaesthetic in domestic birds. In 122 clinical trials on birds ranging from canaries to peacocks, safe satisfactory surgical anaesthesia was readily induced by Equithesin at a dose of 2.5 ml per kg bodyweight intramuscularly (500 ml of Equithesin contains 21.30 g chloral hydrate, 4.8 g pentobarbital sodium and 10.60 g magnesium sulphate in aqueous solution of propylene glycol with 9.5 per cent alcohol).

Church (1957) tried Combuthal, a combination of equal parts of sodium pentobarbital (Nembutal) and sodium pentothal (Thiopentone sodium) intraperitoneally and it was found to be a satisfactory anaesthetic in baby chicks. The optimum dose for one day old chick was 0.05 ml. In general, 0.01 ml was needed for each additional day of age. The initial signs of anaesthesia in baby chicks were constant regardless of sex. A throat reflex comparable to that observed during swallowing developed immediately after injection. After that chicks lost their balance and assumed sitting position. As anaesthesia progressed the wings dropped, closely followed by beak. The feathers ruffled and all voluntary muscles became relaxed. Respiration rate was increased first, but it returned to normal as surgical anaesthesia was attained. As surgical anaesthesia

was approached the chicks fell to one side. When placed on back, extension rigidity of the legs developed. Pinching of the toes elicited a withdrawal reflex. Indications of surgical anaesthesia was loss of sensation and reflexes, the corneal reflex being the last to disappear. Pupil size and eyeball activity were not reliable criteria for chicks in this young age. The time required to reach surgical anaesthesia varied from 1 - 5 minutes. Complete recovery time varied from 4 - 6 hours, although reflexes especially of neck muscles appeared earlier.

Sanger and Smith (1957) administered Equithesin and Ccmbuthal intramuscularly in 12 one day old chicks, 14 five week old broilers and 12 turkeys to study the induction time, depth and duration of anaesthesia and the tissue reaction to each drug. All injections were given at the pectoral muscle. The dose of Equithesin was 1.1 ml per lb bodyweight in chicken and 1.3 ml per lb bodyweight in turkeys. In the case of Ccmbuthal the dose to induce surgical anaesthesia was 0.5 g per lb bodyweight in chicken and 1.5 g per lb bodyweight in turkeys. With Equithesin, induction time was 2 - 3 minutes in day old chicks, 20 - 25 minutes in broilers and 15 - 20 minutes in turkeys. Surgical anaesthesia lasted for 20 - 30 minutes in day old

chicks, 25 - 30 minutes in broilers and 50 - 60 minutes in turkeys. With Combuthal, surgical anaesthesia was induced in 2 - 3 minutes in day old chicks, 20 - 30 minutes in broilers and 15 - 30 minutes in turkeys. Surgical anaesthesia lasted for 20 - 30 minutes in day old chicks, 25 - 30 minutes in broilers and 50 - 60 minutes in turkeys.

Donovan (1958) obtained satisfactory anaesthesia in birds namely sparrows, canaries, chicken and parakeets when rapidly injected intramuscularly with pentobarbital sodium (10 mg per ml) at a dose of 0.01 ml per 2 g of bodyweight. The induction was smooth and in about 2 minutes all birds closed their eyes. After 5 - 9 minutes there was no muscular resistance for extension of the extremities. Surgical anaesthesia was satisfactory for about 30 minutes. Within 90 minutes after injection, birds were on their feet. Recovery was smooth and margin of safety was wide. There were no externally visible tissue reaction found at the site of injection.

Jordan et al. (1960) made trials with pentobarbital sodium, Combuthal, Equithesin, CM I (mixture of chloral hydrate and magnesium sulphate) and Largactil. The depth of anaesthesia was assessed by the response of the bird to pinching of the comb and interdigital web. Complete lack of

response to stimulation of both these structures were termed light anaesthesia. During anaesthesia corneal reflex was always present and stimulation of epiglottis sometimes evoked a response.

Klimes (1962) reported that thiopentone sodium at intravenous doses of 20 - 25 mg per kg for ducks and 15 - 20 mg per kg bodyweight for fowls produced satisfactory anaesthesia.

Soliman et al. (1965) administered Baytenal (3 ml per kg bodyweight), Valium (0.5 mg per kg bodyweight) and combination of Baytenal (3 ml per kg bodyweight) and Valium (0.5 mg per kg bodyweight) intravenously for anaesthesia in dogs. The main haematological changes observed following the administration of Valium were a decrease in the number of red blood cells, packed cell volume and haemoglobin, and an increased erythrocyte sedimentation rate. The total number of white cells and percentage of lymphocytes, eosinophils and basophils decreased, while neutrophils were increased. The changes due to Baytenal were a slight decrease in the erythrocyte and leukocyte count, packed cell volume and haemoglobin. The blood changes were markedly evident specially after two hours of injection, but returned to near normal range by about 24 hours.



Desforbes and Scott (1971) administered intravenously pentobarbital sodium (Nembutal), methohexitone sodium ethyl carbamate and Equithesin to anaesthetise Aylesbury domestic ducks with bodyweight ranging between 2.0 and 3.5 kg. Pentobarbital sodium was given at the dose of 30 - 60 mg per kg bodyweight to 10 birds over a 30 - 120 seconds period. But the results were varied. Methohexitone sodium had no effect on ducks when given at doses ranging from 5 - 10 mg per kg bodyweight. The reason for variable action might be related to the presence of large fat deposits in the ducks. Ethyl carbamate produced only little effect and the ducks were capable of locomotion immediately after injection. Equithesin was given at a dose of 3.0 - 3.5 ml per kg bodyweight in ducks with weight varied from 2.8 - 3.3 kg. The response to anaesthetic was uniform and resulted in deep anaesthesia. The weakening of the foot withdrawal reflex, together with the onset of very slow, regular and deep breathing were used as indicators of satisfactory anaesthesia.

Borzio (1973) studied the effect of ketamine hydrochloride in 22 birds and suggested that 15 - 20 mg per kg body weight administered intramuscularly was adequate for immobilisation.

Mandelker (1973) reported ketamine hydrochloride as a safe anaesthetic for use in parakeets. A dose of 0.05 mg per g to 0.10 mg per g administered intramuscularly was adequate. In this toxicity study the induction time varied from a few seconds to 45 seconds. Clinical signs of anaesthesia following administration of ketamine were typical of dissociative anaesthesia. Muscle relaxation in parakeets was adequate at doses greater than 0.01 mg per g bodyweight. Respiration was deep and regular.

Kumar et al. (1974) administered ketamine hydrochloride intravenously at the dose of 22 mg per kg bodyweight to 14 sheep in 35 trials. A slight decrease in red blood cells, packed cell volume, haemoglobin and total leukocyte count was noticed during anaesthesia. Differential count revealed slight neutrophilia and lymphopenia. The values returned to preanaesthetic levels in 24 hours.

Boever and Wright (1975) used ketamine in more than 50 birds of 12 species ranging in weight from 15 g - 45 kg. In the trials conducted it was concluded that the dose of ketamine per kg bodyweight for birds was inversely proportional to the weight of the birds. Heavier doses of ketamine produced deeper planes of anaesthesia. Hence with

a low dose they could achieve only restraint, while a large dose produced anaesthesia suitable for diagnostic or minor surgical procedures. It was suggested that birds weighing between 500 g and 3000 g required 0.02 - 0.10mg per g body-weight administered intramuscularly. During recovery period frenzied wing flapping and head-shaking were common in long-necked birds such as ducks and swans.

Redig and Duke (1976) tried a combination of ketamine hydrochloride and diazepam given intravenously to induce anaesthesia for various surgical procedures in 40 birds of prey. A dose of 30 - 40 mg per kg ketamine and 1 - 1.5 mg per kg diazepam was satisfactory for diurnal species. Owls were more sensitive to the anaesthetic combination necessitating greater care and consideration in calculation of proper dose of this combination.

Heidenreich (1978) used ketamine hydrochloride 30 mg per kg bodyweight intramuscularly in 78 diurnal birds of prey and 19 owls consisting of 25 species for surgical anaesthesia. During the onset of anaesthesia mild excitation was observed in many birds, but not during anaesthesia. Excitation was also observed in half of the

birds on waking. During anaesthesia the eyes were open. Slight movement of the head occurred often.

Nara et al. (1979) administered ketamine hydrochloride along with atropine sulphate and chlorpromazine hydrochloride in 24 trials involving 8 dogs. During maximum depth of anaesthesia values for PCV and Hb were slightly decreased. Direct leukocyte count revealed slight neutrophilia and lymphopenia resulting in slight decrease in TLC.

Neal et al. (1981) used ketamine in doses of 75 - 150 mg per kg bodyweight intramuscularly in pigeons and this produced light anaesthesia with minimal changes to physiological functions and to acid-base status. Adverse side effects, other than salivation and moderate muscular rigidity were not noted. The depth of anaesthesia was adequate for manipulative clinical procedures and for minor surgical procedures.

Sharma et al. (1983 a) administered procaine hydrochloride 0.5 per cent and 1.0 per cent solution at 1 - 2 mg per kg per min. intravenously, as maintenance agents in dogs anaesthetized with thiopental sodium. It produced a significant increase in heart rate and respiration rate 10 min. after anaesthetic induction, and remained elevated

upto 90 min. Hypothermia was recorded in all animals upto 90 min. Haematological changes included minor reduction in total erythrocyte count, leukocyte count, haemoglobin percentage, packed cell volume and lymphocyte at maximum depth of anaesthesia with corresponding increase in neutrophils.

Sharma et al. (1983 b) tried chlorpromazine hydrochloride at 1.5 mg per kg intramuscularly after induction with thiopental sodium at 25 mg per kg intravenously. This combination produced increase in heart rate and respiration rate, and mean arterial pressure. Hypothermia was observed in all animals. Haematological examination revealed slight reduction in total erythrocyte count, total leukocyte count, packed cell volume, haemoglobin concentration and lymphocytes at maximum depth of anaesthesia.

Samour et al. (1984) studied the effects of three injectable anaesthetics viz., ketamine hydrochloride, xylazine hydrochloride and steroid mixture alphaxalone-alphadolone and their combination in 154 species of birds. The results were varied.

Harvey et al. (1985) recommended doses for 3 week old leghorns, ie. 2 mg ketamine per kg combined with 2 mg per kg xylazine administered intramuscularly.

Gandini et al. (1986) recommended that ostrich chicks required large frequent doses of alphaxalone-alphadolone. However, induction with a mixture of ketamine and xylazine considerably reduced the amounts of steroids required. During anaesthesia respiration rate was faster, heart rate was increased and corneal reflexes were present. Cloacal temperature showed a decrease of about 1°C, at an ambient temperature of 20°C. Recovery was smooth and as rapid as with steroid alone.

Kumar and Sharma (1986) administered thiopentone sodium intravenously at the dose of  $9.20 \pm 1.25$  mg per kg after premedication with xylazine at the dose of 0.22 mg per kg to anaesthetise buffalo calves. Decrease in heart rate and respiration rate, rectal temperature and mean arterial and central venous pressure occurred at maximum depth of anaesthesia, returning to normal by 90 min.

Kummerfeld and Ganter (1986). anaesthetised pigeon using ketamine hydrochloride at 25 mg per kg in combination with benzodiazepine drug climazolam at 1.25 mg per kg as intramuscular injection. Anaesthesia lasted for about 25

minutes. Recovery time was 10 - 20 minutes after injection of the benzo diazepine antagonist 'RO - 15/1788'.

Pfeil and Duesterberg (1987) studied the effect of immobilisation with ketamine in the blood picture of domestic cats. The erythrocyte count, haematocrit, haemoglobin, mean erythrocyte volume, reticulocyte, total leukocyte count and neutrophil count decreased significantly.

Singh et al. (1988) conducted repair of compound long bone fractures in three species of birds using ketamine hydrochloride intramuscularly. The birds were anaesthetised with ketamine hydrochloride given into pectoral muscle at the rate of 20 mg per kg in pea hen and 21 mg per kg in pea hawk and eagle. Recovery from anaesthesia was uneventful in all these species and it occurred in 60 minutes in peak hen and 45 minutes in peak hawk and eagle.

# *Materials and Methods*

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## MATERIALS AND METHODS

### Experimental birds

The experimental study was conducted on thirty apparently healthy White Leghorn cocks, aged 18 - 20 weeks and weighing 1.120 - 1.920 kg (Group I), and thirty apparently healthy White Pekin drakes, aged 20 - 22 weeks and weighing 1.700 - 2.100 kg (Group II). Groups I and II were further divided into three sub-groups, viz. A, B and C each consisting of ten birds and numbered serially from 1 to 10 viz.,

I A(1),A(2),A(3),A(4),A(5),A(6),A(7),A(8),A(9) and A(10)

I B(1),B(2),B(3),B(4),B(5),B(6),B(7),B(8),B(9) and B(10)

I C(1),C(2),C(3),C(4),C(5),C(6),C(7),C(8),C(9) and C(10)

II A(1),A(2),A(3),A(4),A(5),A(6),A(7),A(8),A(9) and A(10)

II B(1),B(2),B(3),B(4),B(5),B(6),B(7),B(8),B(9) and B(10)

II C(1),C(2),C(3),C(4),C(5),C(6),C(7),C(8),C(9) and C(10)

All the birds were maintained under identical conditions of feeding and management.

### Preparation of birds

The birds were weighed before the administration of drugs. The site for intraperitoneal injection was the midpoint between the cloaca and keel bone (Fig.1). The

feathers at the site were plucked and 70 per cent alcohol was applied. The birds were controlled on dorsal recumbency before the administration of drugs and the following drugs were administered.

Sub-group A: Ketamine hydrochloride\* at the rate of 100 mg per kg bodyweight.

Sub-group B: Thiopentone sodium\*\* (2.5 per cent solution) at the rate of 15 mg per kg bodyweight.

Sub-group C: Ketamine hydrochloride at the rate of 50 mg per kg bodyweight followed by thiopentone sodium (2.5 per cent solution) at the rate of 7.5 mg per kg bodyweight.

The following observations were recorded;

1. Onset of anaesthesia
2. Time for induction
3. Duration of anaesthesia
4. Duration of recovery
5. Temperature and respiration rate, before and during anaesthesia, and during recovery phase.

---

\* Ketmin 50 - Ketamine hydrochloride 50 mg per ml  
Themis Chemicals Ltd., Bombay

\*\* Intraval sodium - Thiopentone sodium 0.5 g  
May & Baker (India) Ltd., Bombay

6. Haemogram,  
Total erythrocyte count,  
Total and differential leukocyte count,  
Haemoglobin,  
Erythrocyte sedimentation rate, and  
Packed cell volume
7. Assessment of anaesthetic effect
8. Side effects, if any.

The birds were kept under observation for five days.

### Methods

1. Onset of anaesthesia

Loss of balance, unsteadiness of head, ruffled feathers, dropping of wings, assumption of sitting posture, sternal recumbency, lateral recumbency and gradual abolition of pedal reflexes were the symptoms suggestive of onset of anaesthesia.

2. Time for induction

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

3. Duration of anaesthesia

It was calculated as the time interval between the time of abolition of pedal reflexes and time of reappearance of pedal reflexes.

4. Duration of recovery

It was calculated as the time interval between the reappearance of pedal reflexes and the time when the bird was able to walk normally.

5. Temperature was recorded using a clinical thermometer inserted into the cloaca for one minute.

Respiration rate was recorded by noting the movements of thoracic wall.

The observations on temperature and respiration rate were recorded before administration, and after administration at intervals of 15 minutes upto 2½ hours, and then at the 3rd hour, 24th hour and on the 5th day.

6. Haemogram

The observations on haemogram were recorded at the following intervals, ie. before administration, and after administration at 10 min., 24th hour and on the 5th day.

### Collection of blood

#### Equipment

A scalp vein set (25 G) needle was detached from the set and connected to a 2.0 ml syringe by means of a flexible polythene capillary tube (Fig.2).

#### Procedure

The bird was controlled on lateral recumbency with the wing from which blood to be collected, keeping the wing

free. Brachial vein was raised by digital pressure proximal to the site of collection. After introducing the needle approximately 2.0 ml of blood was collected from the vein aseptically (Fig. 3).

Total erythrocyte count and total leukocyte count were estimated as per the technique described by Natt and Herrick (1952). Differential leukocyte count was estimated as per the method of Sato and Sekiya (1965). Haemoglobin content was estimated as per the cyanmethaemoglobin method described by Miale (1967). Erythrocyte sedimentation rate and packed cell volume were estimated following the method of Wintrobe (1961).

#### 7. Assessment of anaesthetic effect

The anaesthetic effect was assessed by performing a laparotomy incision at the last intercostal space.

##### Procedure

The feathers at the region of last intercostal space on the right side were plucked and the site was prepared aseptically (Fig. 4). A 2.0 cm long laparotomy incision was made in the last intercostal space (Fig. 5). The response to pain at the time of incision, manipulation of wound edges and suturing was noted. The incision was closed by silk in separate layers and Tr.benzoin seal was applied (Fig. 6 & 7).

At the time of surgery, if the bird did not respond to pain, it was considered as good, and slight response as satisfactory anaesthesia.

#### 8. Side effects

One bird from each sub-group was sacrificed by exsanguination on the 5th day after administration of the drugs and the gross lesions in the peritoneal cavity consequent on intraperitoneal injection, if any were examined.

#### Statistical analysis

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

Fig. 1. Site for intraperitoneal injection

Fig.1





Fig. 2. Device for collection of blood

Fig. 3. Blood being collected from the brachial vein

Fig.2

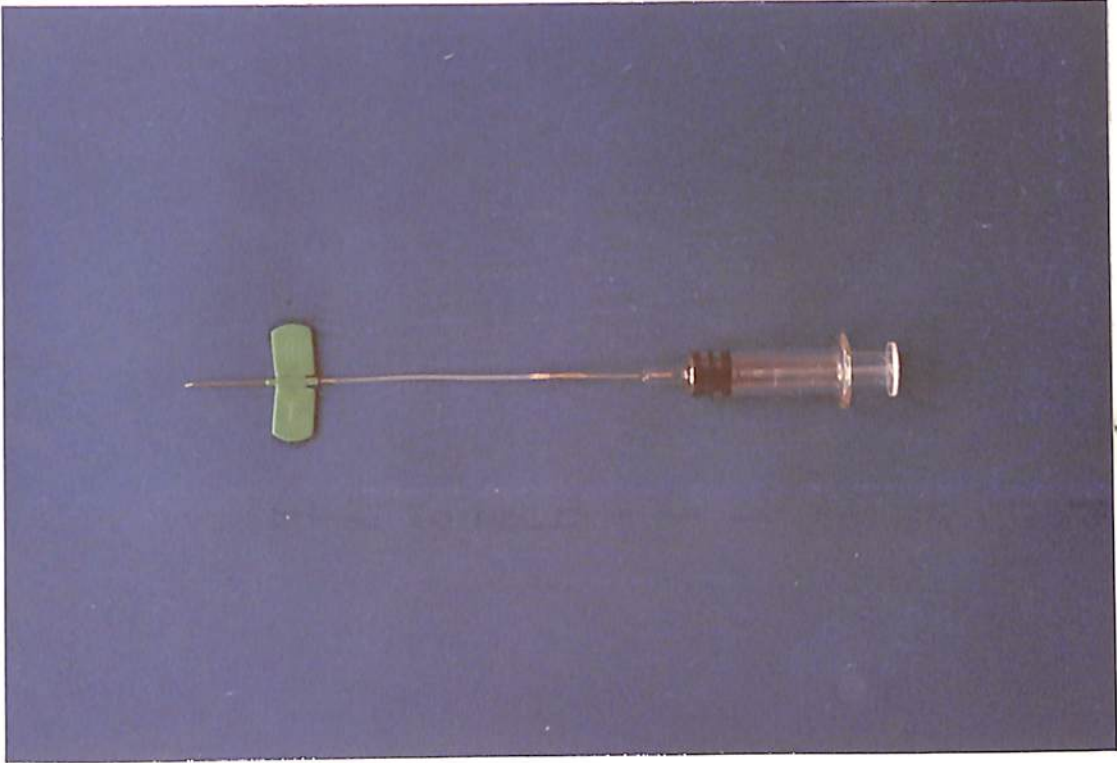


Fig.3

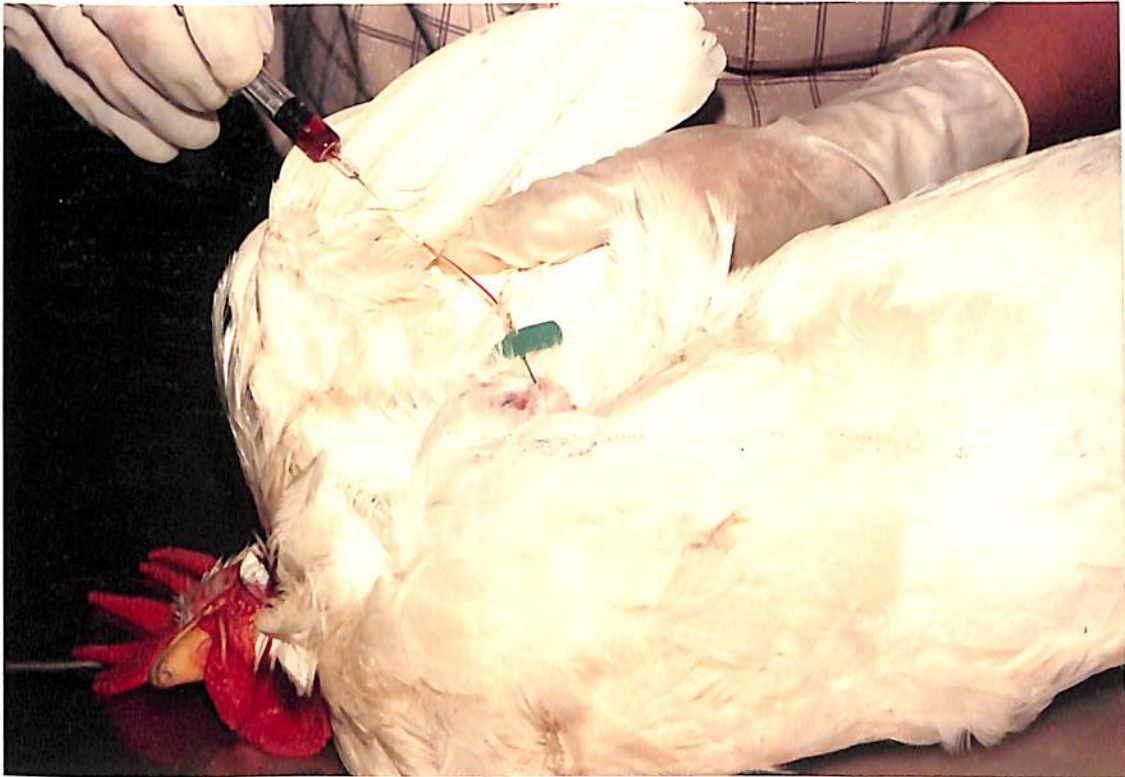




Fig. 4. Site prepared for surgical operation

Fig. 5. Laparotomy incision

Fig.4

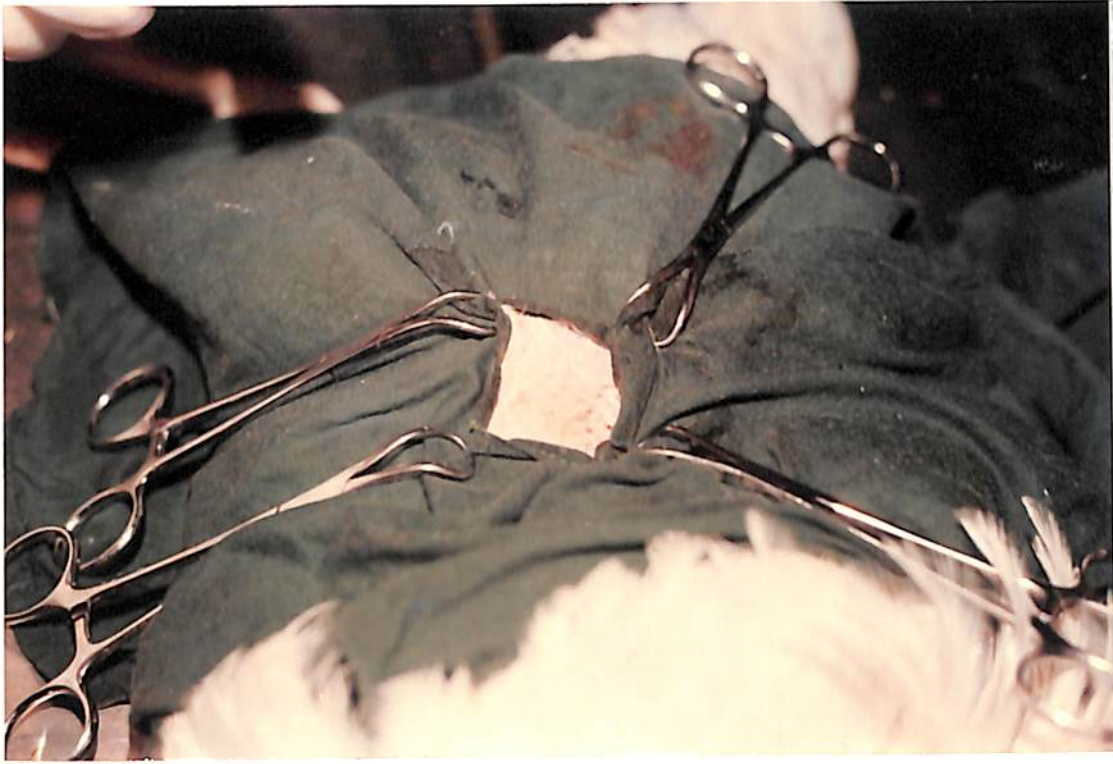


Fig.5

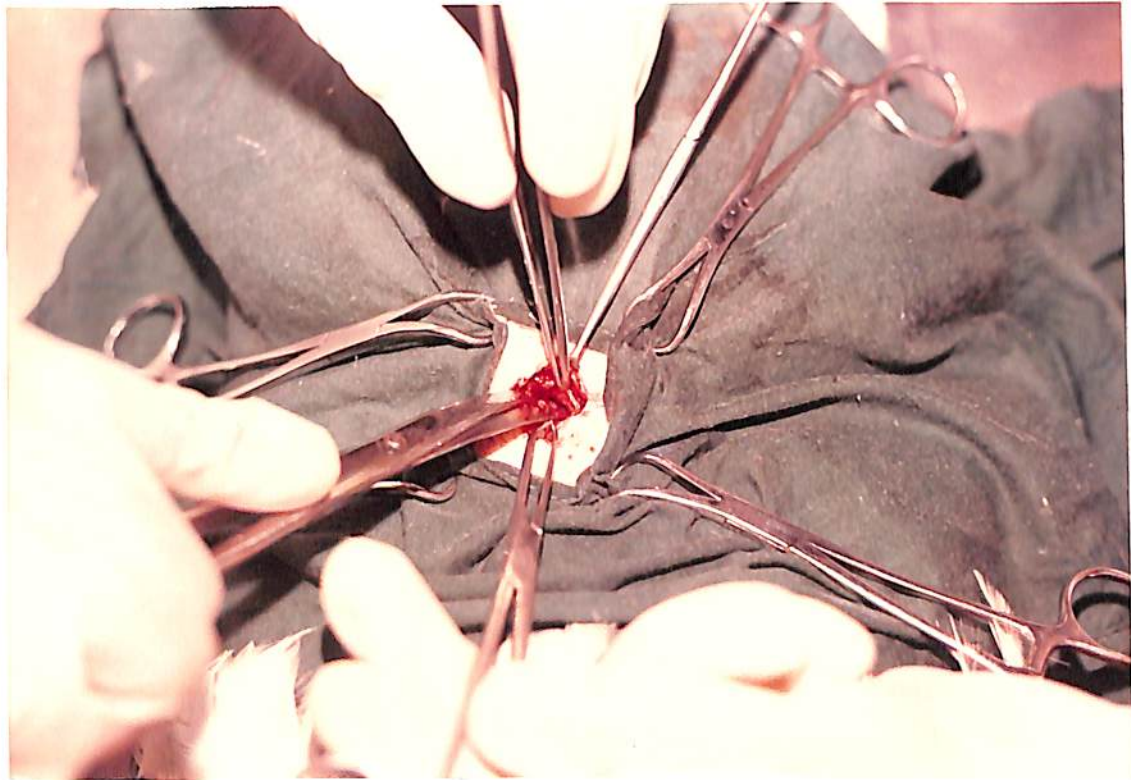




Fig. 6. Suturing of peritoneum and muscles

Fig. 7. Suturing of skin



Fig.6

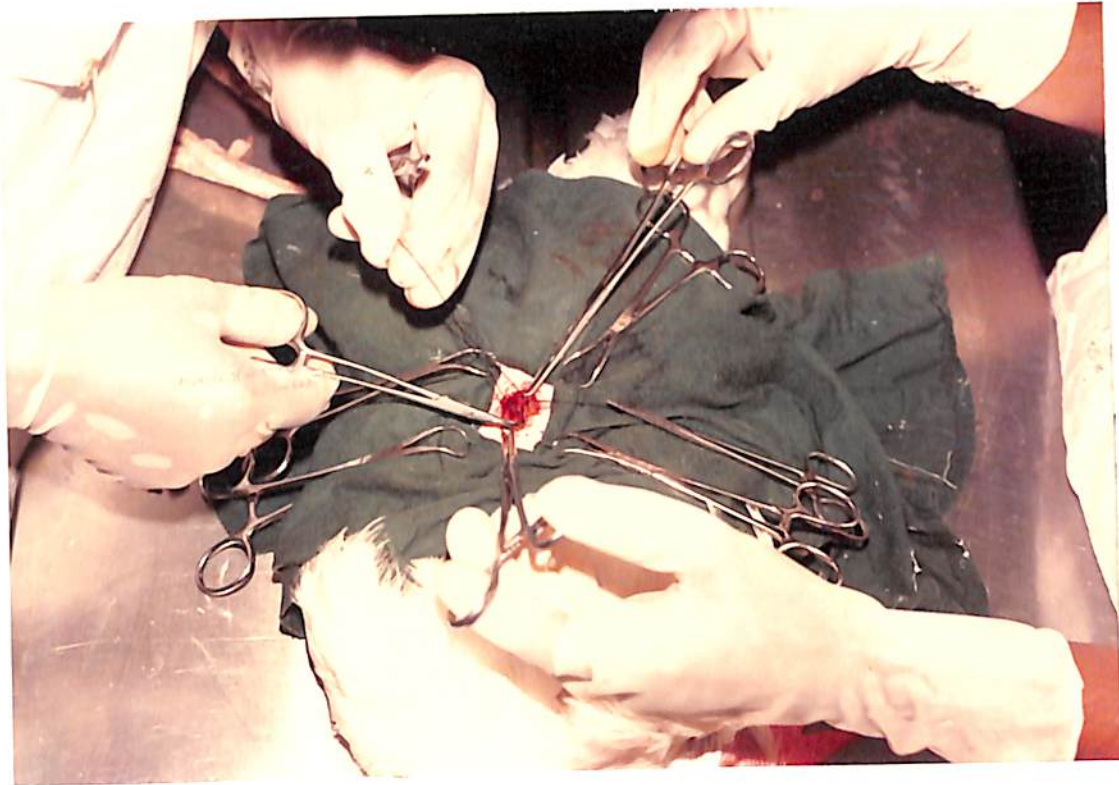


Fig.7



## *Results*

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## RESULTS

### GROUP I CHICKEN

#### Sub-group A

The observations are presented in Tables 1 to 3.

The bodyweight of the birds in this sub-group was  $1.438 \pm 0.058$  kg.

Ketamine hydrochloride at the rate of 100 mg per kg bodyweight was administered intraperitoneally to all the birds.

#### Onset of anaesthesia

During the onset of anaesthesia, defaecation, vocalisation, loss of balance, unsteadiness of head, and cyanosis of comb and wattles were noticed.

#### Time for induction

The time for induction was  $7.30 \pm 0.53$  min. The induction was smooth and uneventful.

#### *Duration of anaesthesia*

The duration of anaesthesia was  $63.40 \pm 2.16$  min. During anaesthesia eyes were open. Corneal, pupillary and palpebral reflexes persisted. Reflexes of third eyelid,



comb and wattles were present. There was no resistance to extension of the legs and the pedal reflexes were abolished. Digits were curled and arching of the neck towards the body.

#### Duration of recovery

The duration of recovery was  $135.50 \pm 9.24$  min. The recovery from anaesthesia was smooth and uneventful.

#### Temperature

The cloacal temperature ( $^{\circ}\text{F}$ ) before administration was  $106.16 \pm 0.15$  and after administration it was  $105.42 \pm 0.29$  at 15 min.,  $104.80 \pm 0.34$  at 30 min.,  $104.38 \pm 0.37$  at 45 min.,  $104.40 \pm 0.38$  at 60 min.,  $104.76 \pm 0.37$  at 75 min.,  $104.80 \pm 0.32$  at 90 min.,  $104.98 \pm 0.34$  at 105 min.,  $105.18 \pm 0.35$  at 120 min.,  $105.28 \pm 0.33$  at 135 min.,  $105.40 \pm 0.30$  at 150 min.,  $105.62 \pm 0.27$  at 180 min.,  $106.10 \pm 0.17$  at 24th hour and  $106.10 \pm 0.17$  on the 5th day.

There was significant reduction ( $P < 0.05$ ) in temperature upto 150 min. and it became near normal by the 24th hour.

## Respiration rate

The respiration rate (per min.) before administration was  $36.10 \pm 1.60$  and after administration it was  $36.50 \pm 3.76$  at 15 min.,  $31.40 \pm 4.06$  at 30 min.,  $30.30 \pm 3.54$  at 45 min.,  $33.00 \pm 3.20$  at 60 min.,  $34.20 \pm 3.05$  at 75 min.,  $36.10 \pm 2.72$  at 90 min.,  $37.00 \pm 2.61$  at 105 min.,  $36.60 \pm 2.65$  at 120 min.,  $36.80 \pm 2.79$  at 135 min.,  $36.40 \pm 2.37$  at 150 min.,  $36.70 \pm 1.99$  at 180 min.,  $33.50 \pm 1.31$  at 24th hour and  $34.30 \pm 1.60$  on the 5th day.

The variations in the respiration rate were not significant.

## Haemogram

### Total erythrocyte count

The total erythrocyte count ( $10^{12}/l$ ) before administration was  $2.33 \pm 0.08$  and after administration it was  $2.18 \pm 0.12$  at 10 min.,  $2.30 \pm 0.11$  at 24th hour and  $2.42 \pm 0.13$  on the 5th day.

The variations in the total erythrocyte count were not significant.

### Total leukocyte count

The total leukocyte count ( $10^9/l$ ) before administration was  $0.0061 \pm 0.0008$  and after administration it was  $0.0054 \pm 0.0008$  at 10 min.,  $0.0094 \pm 0.0017$  at 24th hour and  $0.0071 \pm 0.0009$  on the 5th day.

The variations in total leukocyte count were not significant.

### Differential leukocyte count

The lymphocyte count (per cent) before administration was  $67.90 \pm 0.68$  and after administration it was  $66.60 \pm 1.39$  at 10 min.,  $59.20 \pm 1.46$  at 24th hour and  $67.10 \pm 1.00$  on the 5th day.

The decrease in the count at 24th hour was significant ( $P < 0.05$ ).

The heterophil count (per cent) before administration was  $28.60 \pm 0.57$  and after administration it was  $29.60 \pm 1.18$  at 10 min.,  $25.00 \pm 0.68$  at 24th hour and  $29.00 \pm 0.85$  on the 5th day.

The decrease in the count at 24th hour was significant ( $P < 0.05$ ).

The eosinophil count (per cent) before administration was  $3.40 \pm 0.57$  and after administration it was  $3.60 \pm 1.12$  at 10 min.,  $15.60 \pm 1.93$  at 24th hour and  $3.70 \pm 0.62$  on the 5th day.

The increase in the count at 24th hour was significant ( $P < 0.05$ ).

The monocyte count (per cent) before administration was  $0.10 \pm 0.09$  and after administration it was  $0.20 \pm 0.13$  at 10 min.,  $0.20 \pm 0.13$  at 24th hour and  $0.20 \pm 0.13$  on the 5th day.

The variations were not significant.

#### Haemoglobin

The haemoglobin content (mmol/l) before administration was  $4.68 \pm 0.07$  and after administration it was  $4.41 \pm 0.09$  at 10 min.,  $4.43 \pm 0.11$  at 24th hour and  $4.47 \pm 0.09$  on the 5th day.

The decrease at 10 min. was significant ( $P < 0.05$ ).

#### Erythrocyte sedimentation rate

The erythrocyte sedimentation rate (mm/hr) before administration was  $2.40 \pm 0.21$  and after administration it

was  $2.30 \pm 0.20$  at 10 min.,  $2.30 \pm 0.14$  at 24th hour and  $2.40 \pm 0.15$  on the 5th day.

The variations were not significant.

#### Packed cell volume

The packed cell volume (l/l) before administration was  $0.31 \pm 0.01$  and after administration it was  $0.30 \pm 0.01$  at 10 min.,  $0.28 \pm 0.01$  at 24th hour and  $0.29 \pm 0.01$  on the 5th day.

The variations were not significant.

#### Assessment of anaesthetic effect

In this sub-group the birds exhibited slight movement of the body on incision on the skin. Nociceptive responses were not noticed on incising the muscles and peritoneum and on suturing the peritoneum, muscles and skin.

#### Side effects

On examination of peritoneal cavity, areas of mild degree of congestion were observed at the edges of the liver. Focal areas of congestion were noticed on the surface of kidney. There were no adhesions in the peritoneal cavity and at the site of penetration of needle into the peritoneal cavity.

Table 1. Effects of intraperitoneal administration of Ketaminehydrochloride in chicken: Time for induction, duration of anaesthesia and recovery.

| Bird No.        | Bodyweight (kg) | Quantity of drug administered (mg) | Time for induction (min.) | Duration of anaesthesia (min.) | Duration of recovery (min.) |
|-----------------|-----------------|------------------------------------|---------------------------|--------------------------------|-----------------------------|
| A <sub>1</sub>  | 1.360           | 136.00                             | 9.00                      | 65.00                          | 129.00                      |
| A <sub>2</sub>  | 1.600           | 160.00                             | 5.00                      | 66.00                          | 133.00                      |
| A <sub>3</sub>  | 1.400           | 140.00                             | 10.00                     | 59.00                          | 166.00                      |
| A <sub>4</sub>  | 1.560           | 156.00                             | 7.00                      | 50.00                          | 137.00                      |
| A <sub>5</sub>  | 1.220           | 122.00                             | 6.00                      | 67.00                          | 117.00                      |
| A <sub>6</sub>  | 1.260           | 126.00                             | 6.00                      | 66.00                          | 160.00                      |
| A <sub>7</sub>  | 1.660           | 166.00                             | 10.00                     | 77.00                          | 125.00                      |
| A <sub>8</sub>  | 1.240           | 124.00                             | 7.00                      | 57.00                          | 80.00                       |
| A <sub>9</sub>  | 1.720           | 172.00                             | 6.00                      | 66.00                          | 191.00                      |
| A <sub>10</sub> | 1.360           | 136.00                             | 7.00                      | 61.00                          | 117.00                      |
| Mean±<br>SE     | 1.438±<br>0.058 | 143.80±<br>5.79                    | 7.30±<br>0.53             | 63.40±<br>2.16                 | 135.50±<br>9.24             |

Table 2. Effects of intraperitoneal administration of Ketamine hydrochloride in chicken: Temperature and respiration rate (Mean  $\pm$  S.E), n = 10.

| Parameters and units        | Intervals            |                       |                       |                       |                       |                       |                       |
|-----------------------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                             | 0 min.               | 15 min.               | 30 min.               | 45 min.               | 60 min.               | 75 min.               | 90 min.               |
| Temperature ( $^{\circ}$ F) | 106.16<br>$\pm$ 0.15 | 105.42*<br>$\pm$ 0.29 | 104.80*<br>$\pm$ 0.34 | 104.38*<br>$\pm$ 0.37 | 104.40*<br>$\pm$ 0.38 | 104.76*<br>$\pm$ 0.37 | 104.80*<br>$\pm$ 0.32 |
| Respiration rate/min.       | 36.10<br>$\pm$ 1.60  | 36.50<br>$\pm$ 3.76   | 31.40<br>$\pm$ 4.06   | 30.30<br>$\pm$ 3.54   | 33.00<br>$\pm$ 3.20   | 34.20<br>$\pm$ 3.05   | 36.10<br>$\pm$ 2.72   |

| Parameters and units        | Intervals             |                       |                       |                       |                      |                      |                      |
|-----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|----------------------|----------------------|
|                             | 105 min.              | 120 min.              | 135 min.              | 150 min.              | 180 min.             | 24th hr              | 5th day              |
| Temperature ( $^{\circ}$ F) | 104.98*<br>$\pm$ 0.34 | 105.18*<br>$\pm$ 0.35 | 105.28*<br>$\pm$ 0.33 | 105.40*<br>$\pm$ 0.30 | 105.62<br>$\pm$ 0.27 | 106.10<br>$\pm$ 0.17 | 106.10<br>$\pm$ 0.17 |
| Respiration rate/min.       | 37.00<br>$\pm$ 2.61   | 36.60<br>$\pm$ 2.65   | 36.80<br>$\pm$ 2.79   | 36.40<br>$\pm$ 2.37   | 36.70<br>$\pm$ 1.99  | 33.50<br>$\pm$ 1.31  | 34.30<br>$\pm$ 1.60  |

\* Significant at 5% level

Table 3. Effects of intraperitoneal administration of Ketamine hydrochloride in chicken: Haemogram (Mean  $\pm$ S.E), n = 10.

| Parameters and units                   | Intervals           |                     |                     |                     |
|--|---------------------|---------------------|---------------------|---------------------|
|  | 0 min.              | 10 min.             | 24th hr             | 5th day             |
| Total erythrocyte count( $10^{12}/l$ ) | 2.33 $\pm$ 0.08     | 2.18 $\pm$ 0.12     | 2.30 $\pm$ 0.11     | 2.42 $\pm$ 0.13     |
| Total leukocyte count( $10^9/l$ )      | 0.0061 $\pm$ 0.0008 | 0.0054 $\pm$ 0.0008 | 0.0094 $\pm$ 0.0017 | 0.0071 $\pm$ 0.0009 |
| Lymphocyte (%)                         | 67.90 $\pm$ 0.68    | 66.60 $\pm$ 1.39    | 59.20 $\pm$ 1.46*   | 67.10 $\pm$ 1.00    |
| Heterophil (%)                         | 28.60 $\pm$ 0.57    | 29.60 $\pm$ 1.18    | 25.00 $\pm$ 0.68*   | 29.00 $\pm$ 0.85    |
| Eosinophil (%)                         | 3.40 $\pm$ 0.57     | 3.60 $\pm$ 1.12     | 15.60 $\pm$ 1.93*   | 3.70 $\pm$ 0.62     |
| Monocyte (%)                           | 0.10 $\pm$ 0.09     | 0.20 $\pm$ 0.13     | 0.20 $\pm$ 0.13     | 0.20 $\pm$ 0.13     |
| Basophil (%)                           | 0.00                | 0.00                | 0.00                | 0.00                |
| Haemoglobin (mmol/l)                   | 4.68 $\pm$ 0.07     | 4.41 $\pm$ 0.09*    | 4.43 $\pm$ 0.11     | 4.47 $\pm$ 0.09     |
| Erythrocyte sedimentation rate (mm/hr) | 2.40 $\pm$ 0.21     | 2.30 $\pm$ 0.20     | 2.30 $\pm$ 0.14     | 2.40 $\pm$ 0.15     |
| Packed cell volume (l/l)               | 0.31 $\pm$ 0.01     | 0.30 $\pm$ 0.01     | 0.28 $\pm$ 0.01     | 0.29 $\pm$ 0.01     |

\* Significant at 5% level.



### Sub-group B

The observations are presented in Tables 4 to 6.

The bodyweight of the birds in this sub-group was  $1.440 \pm 0.070$  kg.

Thiopentone sodium (2.5 per cent solution) at the rate of 15 mg per kg bodyweight was administered intraperitoneally to all the birds.

#### Onset of anaesthesia

During the onset of anaesthesia, loss of balance, ruffled feathers, dropping of wings, unsteadiness of head and cyanosis of comb and wattles were noticed.

#### Time for induction

The time for induction was  $9.30 \pm 0.38$  min. The induction was smooth and uneventful.

#### Duration of anaesthesia

The duration of anaesthesia was  $31.40 \pm 1.82$  min.

During anaesthesia eyes were closed. Corneal, pupillary and palpebral reflexes were persisting. Reflexes of third eyelid, comb and wattles were present. There was

no resistance to handling of legs and the pedal reflexes were abolished. The neck and the digits were kept extended.

#### Duration of recovery

The duration of recovery was  $149.60 \pm 8.32$  min. The recovery from anaesthesia was smooth and uneventful.

#### Temperature

The cloacal temperature ( $^{\circ}\text{F}$ ) before administration was  $106.40 \pm 0.19$  and after administration it was  $105.06 \pm 0.19$  at 15 min.,  $104.56 \pm 0.23$  at 30 min.,  $104.60 \pm 0.24$  at 45 min.,  $104.44 \pm 0.26$  at 60 min.,  $104.18 \pm 0.24$  at 75 min.,  $104.16 \pm 0.30$  at 90 min.,  $104.28 \pm 0.30$  at 105 min.,  $104.38 \pm 0.25$  at 120 min.,  $104.64 \pm 0.21$  at 135 min.,  $104.88 \pm 0.21$  at 150 min.,  $105.20 \pm 0.20$  at 180 min.,  $105.90 \pm 0.19$  at 24th hour and  $106.12 \pm 0.18$  on the 5th day.

There was significant decrease ( $P < 0.05$ ) in temperature upto 180 min., which became near normal on the 5th day.

#### Respiration rate

The respiration rate (per min.) before administration was  $36.20 \pm 1.25$  and after administration it was  $38.90 \pm 1.97$  at 15 min.,  $35.50 \pm 2.37$  at 30 min.,  $33.10 \pm 2.04$  at 45 min.,  $30.70 \pm 1.95$  at 60 min.,  $31.50 \pm 2.25$  at 75 min.,  $31.40 \pm 2.17$  at

90 min.,  $32.80 \pm 2.04$  at 105 min.,  $33.50 \pm 1.88$  at 120 min.,  $33.30 \pm 1.64$  at 135 min.,  $33.80 \pm 1.61$  at 150 min.,  $34.90 \pm 1.64$  at 180 min.,  $36.00 \pm 1.10$  at 24th hour and  $37.50 \pm 1.34$  on the 5th day.

After an initial increase, the respiration rate showed a gradual decrease and became near normal by 24th hour. The decrease at 60 min. was significant ( $P < 0.05$ ).

#### Haemogram

##### Total erythrocyte count

The total erythrocyte count ( $10^{12}/l$ ) before administration was  $2.60 \pm 0.07$  and after administration it was  $2.33 \pm 0.10$  at 10 min.,  $2.37 \pm 0.06$  at 24th hour and  $2.49 \pm 0.07$  on the 5th day.

The decrease in the total erythrocyte count was significant ( $P < 0.05$ ) at 10 min. and 24th hour.

##### Total leukocyte count

The total leukocyte count ( $10^9/l$ ) before administration was  $0.0053 \pm 0.0008$  and after administration it was  $0.0046 \pm 0.0005$  at 10 min.,  $0.0084 \pm 0.0013$  at 24th hour and  $0.0098 \pm 0.0013$  on the 5th day.

The increase in total leukocyte count on the 5th day was significant ( $P < 0.05$ ).

#### Differential leukocyte count

The lymphocyte count (per cent) before administration was  $68.40 \pm 0.68$  and after administration it was  $67.60 \pm 1.39$  at 10 min.,  $61.40 \pm 1.18$  at 24th hour and  $68.60 \pm 0.71$  on the 5th day.

The decrease in the count at 24th hour was significant ( $P < 0.05$ ).

The heterophil count (per cent) before administration was  $29.50 \pm 0.57$  and after administration it was  $30.20 \pm 1.20$  at 10 min.,  $28.30 \pm 1.13$  at 24th hour and  $26.90 \pm 0.48$  on the 5th day.

The decrease in the count on the 5th day was significant ( $P < 0.05$ ).

The eosinophil count (per cent) before administration was  $2.10 \pm 0.36$  and after administration it was  $2.10 \pm 0.48$  at 10 min.,  $10.20 \pm 1.04$  at 24th hour and  $4.50 \pm 0.71$  on the 5th day.

The increase in the count at 24th hour and on the 5th day was significant ( $P < 0.05$ ).

The monocyte count (per cent) before administration was 0.00 and after administration it was  $0.10 \pm 0.09$  at 10 min.,  $0.10 \pm 0.09$  at 24th hour and 0.00 on the 5th day.

The variations were not significant.

#### Haemoglobin

The haemoglobin content (mmol/l) before administration was  $5.31 \pm 0.18$  and after administration it was  $4.84 \pm 0.14$  at 10 min.,  $4.82 \pm 0.13$  at 24th hour and  $4.95 \pm 0.11$  on the 5th day.

The decrease in haemoglobin content at 24th hour was significant ( $P < 0.05$ ).

#### Erythrocyte sedimentation rate

The erythrocyte sedimentation rate (mm/hr) before administration was  $1.20 \pm 0.13$  and after administration it was  $1.90 \pm 0.17$  at 10 min.,  $2.00 \pm 0.14$  at 24th hour and  $1.60 \pm 0.21$  on the 5th day.

There was increase in the erythrocyte sedimentation rate after administration, but the increase was significant ( $P < 0.05$ ) at 10 min. and 24th hour.

### Packed cell volume

The packed cell volume (1/1) before administration was  $0.32 \pm 0.01$  and after administration it was  $0.30 \pm 0.01$  at 10 min.,  $0.29 \pm 0.01$  at 24th hour and  $0.29 \pm 0.00$  on the 5th day.

The decrease at 24th hour and on the 5th day was significant ( $P < 0.05$ ).

### Assessment of anaesthetic effect

The birds in this sub-group did not exhibit any nociceptive response on incision on the skin, muscles and peritoneum. While suturing the above tissues there was no sensation of pain.

### Side effects

On examination of peritoneal cavity mild inflammatory reaction on the parietal peritoneum was noticed at the point of entry of the needle. Focal areas of congestion of liver and kidney were observed.

Table 4. Effects of intraperitoneal administration of Thiopentone sodium in chicken: Time for induction, duration of anaesthesia and recovery

| Bird No.         | Bodyweight (kg)      | Quantity of drug administered (mg) | Time for induction (min.) | Duration of anaesthesia (min.) | Duration of recovery (min.) |
|------------------|----------------------|------------------------------------|---------------------------|--------------------------------|-----------------------------|
| B <sub>1</sub>   | 1.600                | 24.00                              | 9.00                      | 35.00                          | 127.00                      |
| B <sub>2</sub>   | 1.120                | 16.80                              | 8.00                      | 40.00                          | 193.00                      |
| B <sub>3</sub>   | 1.720                | 25.80                              | 9.00                      | 23.00                          | 155.00                      |
| B <sub>4</sub>   | 1.180                | 17.70                              | 9.00                      | 27.00                          | 164.00                      |
| B <sub>5</sub>   | 1.500                | 22.50                              | 7.00                      | 32.00                          | 90.00                       |
| B <sub>6</sub>   | 1.400                | 21.00                              | 10.00                     | 40.00                          | 135.00                      |
| B <sub>7</sub>   | 1.200                | 18.00                              | 11.00                     | 29.00                          | 165.00                      |
| B <sub>8</sub>   | 1.540                | 23.10                              | 9.00                      | 32.00                          | 163.00                      |
| B <sub>9</sub>   | 1.740                | 26.10                              | 11.00                     | 33.00                          | 159.00                      |
| B <sub>10</sub>  | 1.400                | 21.00                              | 10.00                     | 23.00                          | 145.00                      |
| Mean $\pm$<br>SE | 1.440 $\pm$<br>0.070 | 21.60 $\pm$<br>1.05                | 9.30 $\pm$<br>0.38        | 31.40 $\pm$<br>1.82            | 149.60 $\pm$<br>8.32        |

Table 5. Effects of intraperitoneal administration of Thiopentone sodium in chicken: Temperature and respiration rate (Mean  $\pm$  S.E.), n = 10

| Parameters and units        | Intervals            |                       |                       |                       |                       |                       |                       |
|-----------------------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                             | 0 min.               | 15 min.               | 30 min.               | 45 min.               | 60 min.               | 75 min.               | 90 min.               |
| Temperature ( $^{\circ}$ F) | 106.04<br>$\pm$ 0.19 | 105.06*<br>$\pm$ 0.19 | 104.56*<br>$\pm$ 0.23 | 104.60*<br>$\pm$ 0.24 | 104.44*<br>$\pm$ 0.26 | 104.18*<br>$\pm$ 0.24 | 104.16*<br>$\pm$ 0.30 |
| Respiration rate/<br>min.   | 36.20<br>$\pm$ 1.25  | 38.90<br>$\pm$ 1.97   | 35.50<br>$\pm$ 2.37   | 33.10<br>$\pm$ 2.04   | 30.70*<br>$\pm$ 1.95  | 31.50<br>$\pm$ 2.25   | 31.40<br>$\pm$ 2.17   |

| Parameters and units        | Intervals             |                       |                       |                       |                       |                      |                      |
|-----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|----------------------|
|                             | 105 min.              | 120 min.              | 135 min.              | 150 min.              | 180 min.              | 24th hr              | 5th day              |
| Temperature ( $^{\circ}$ F) | 104.28*<br>$\pm$ 0.30 | 104.38*<br>$\pm$ 0.25 | 104.64*<br>$\pm$ 0.21 | 104.88*<br>$\pm$ 0.21 | 105.20*<br>$\pm$ 0.20 | 105.90<br>$\pm$ 0.19 | 106.12<br>$\pm$ 0.18 |
| Respiration rate/<br>min.   | 32.80<br>$\pm$ 2.04   | 33.50<br>$\pm$ 1.88   | 33.30<br>$\pm$ 1.64   | 33.80<br>$\pm$ 1.61   | 34.90<br>$\pm$ 1.64   | 36.00<br>$\pm$ 1.10  | 37.50<br>$\pm$ 1.34  |

\* Significant at 5% level.



Table 6. Effects of intraperitoneal administration of Thiopentone sodium in chicken:  
Haemogram (Mean  $\pm$  S.E), n = 10

| Parameters and units                    | Intervals           |                     |                     |                      |
|---|---------------------|---------------------|---------------------|----------------------|
|   | 0 min.              | 10 min.             | 24th hr             | 5th day              |
| Total erythrocyte count ( $10^{12}/l$ ) | 2.60 $\pm$ 0.07     | 2.33 $\pm$ 0.10*    | 2.37 $\pm$ 0.06*    | 2.49 $\pm$ 0.07      |
| Total leukocyte count ( $10^9/l$ )      | 0.0053 $\pm$ 0.0008 | 0.0046 $\pm$ 0.0005 | 0.0084 $\pm$ 0.0013 | 0.0098 $\pm$ 0.0013* |
| Lymphocyte (%)                          | 68.40 $\pm$ 0.68    | 67.60 $\pm$ 1.39    | 61.40 $\pm$ 1.18*   | 68.60 $\pm$ 0.71     |
| Heterophil (%)                          | 29.50 $\pm$ 0.57    | 30.20 $\pm$ 1.20    | 28.30 $\pm$ 1.13    | 26.90 $\pm$ 0.48*    |
| Eosinophil (%)                          | 2.10 $\pm$ 0.36     | 2.10 $\pm$ 0.48     | 10.20 $\pm$ 1.04*   | 4.50 $\pm$ 0.71*     |
| Monocyte (%)                            | 0.00                | 0.10 $\pm$ 0.09     | 0.10 $\pm$ 0.09     | 0.00                 |
| Basophil (%)                            | 0.00                | 0.00                | 0.00                | 0.00                 |
| Haemoglobin (mmol/l)                    | 5.31 $\pm$ 0.18     | 4.84 $\pm$ 0.14     | 4.82 $\pm$ 0.13*    | 4.95 $\pm$ 0.11      |
| Erythrocyte sedimentation rate (mm/hr)  | 1.20 $\pm$ 0.13     | 1.90 $\pm$ 0.17*    | 2.00 $\pm$ 0.14*    | 1.60 $\pm$ 0.21      |
| Packed cell volume (l/l)                | 0.32 $\pm$ 0.01     | 0.30 $\pm$ 0.01     | 0.29 $\pm$ 0.01*    | 0.29 $\pm$ 0.00*     |

\* Significant at 5% level

Fig. 8. Anaesthesia - sitting posture (Thiopentone sodium)

Fig. 9. Anaesthesia - sternal recumbency (Thiopentone sodium)

Fig. 10. Anaesthesia - lateral recumbency (Thiopentone sodium)



Fig.8



Fig.9

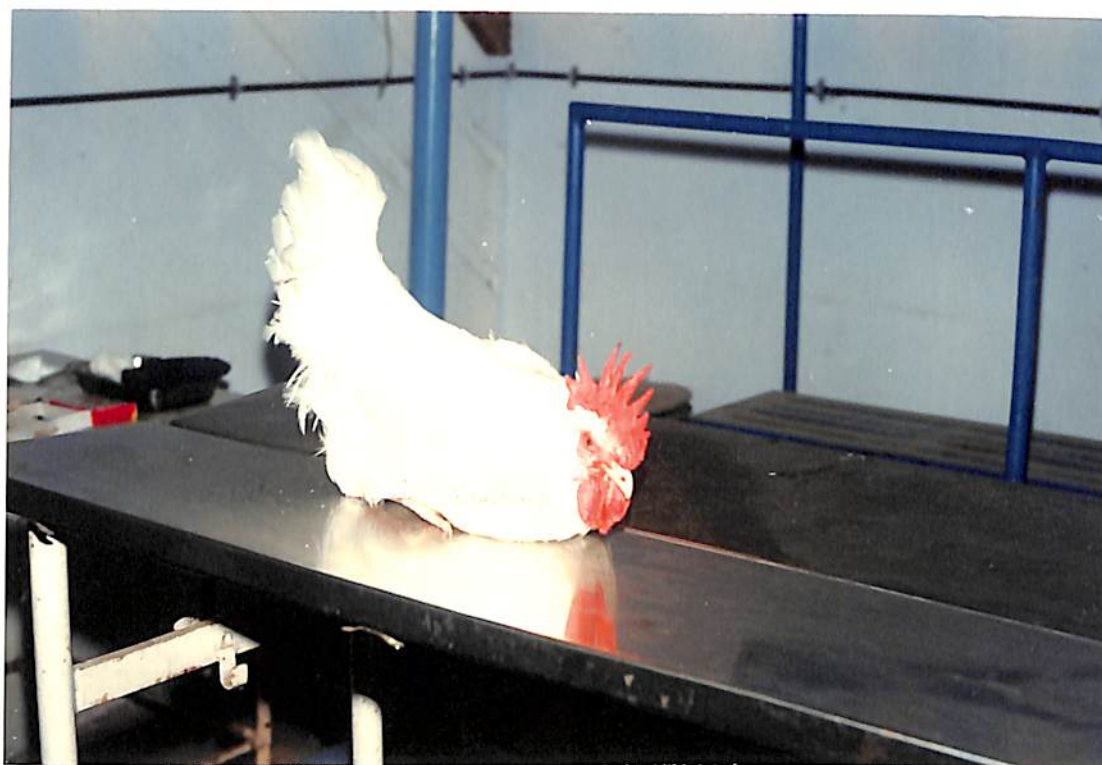
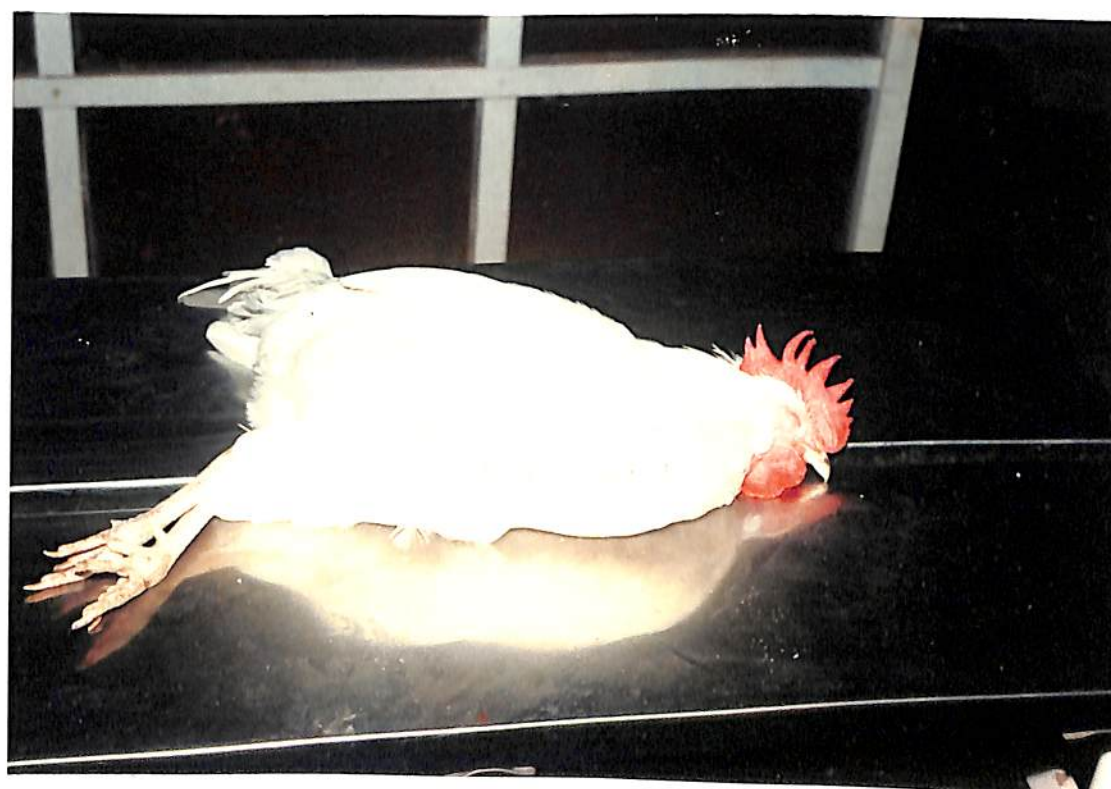


Fig.10



### Sub-group C

The observations are presented in Tables 7 to 9.

The bodyweight of the birds in this sub-group was  $1.686 \pm 0.051$  kg.

Ketamine hydrochloride at the rate of 50 mg per kg followed by thiopentone sodium (2.5 per cent solution) at the rate 7.5 mg per kg bodyweight were administered intraperitoneally to all the birds.

#### Onset of anaesthesia

During the onset of anaesthesia, loss of balance, unsteadiness of head, cyanosis of comb and wattles, dropping of neck and wings, and closing of eyelids were noticed.

#### Time for induction

The time for induction was  $8.00 \pm 0.58$  min. The induction was smooth and uneventful.

#### Duration of anaesthesia

The duration of anaesthesia was  $40.20 \pm 3.99$  min.

During anaesthesia, eyes were closed. Corneal, pupillary and palpebral reflexes were persisting. Reflexes

of third eyelid, comb and wattles were present. There was no resistance to handling of legs. Head turned towards the body. Digits were extended. Pedal reflexes were abolished.

#### Duration of recovery

The duration of recovery was  $131.20 \pm 5.10$  min. The recovery from anaesthesia was smooth and uneventful.

#### Temperature

The cloacal temperature ( $^{\circ}\text{F}$ ) before administration was  $107.22 \pm 0.19$  and after administration it was  $106.46 \pm 0.16$  at 15 min.,  $105.96 \pm 0.16$  at 30 min.,  $105.86 \pm 0.22$  at 45 min.,  $105.78 \pm 0.22$  at 60 min.,  $105.80 \pm 0.22$  at 75 min.,  $105.76 \pm 0.22$  at 90 min.,  $105.86 \pm 0.28$  at 105 min.,  $105.86 \pm 0.28$  at 120 min.,  $105.92 \pm 0.30$  at 135 min.,  $106.10 \pm 0.29$  at 150 min.,  $106.40 \pm 0.24$  at 180 min.,  $106.50 \pm 0.21$  at 24th hour and  $106.72 \pm 0.21$  on the 5th day.

There was significant reduction ( $P < 0.05$ ) in temperature upto 24th hour.

#### Respiration rate

The respiration rate (per min.) before administration was  $40.70 \pm 2.23$  and after administration it was  $41.10 \pm 3.13$

at 15 min.,  $33.20 \pm 4.05$  at 30 min.,  $30.60 \pm 2.93$  at 45 min.,  $30.40 \pm 2.53$  at 60 min.,  $31.20 \pm 2.72$  at 75 min.,  $31.40 \pm 1.79$  at 90 min.,  $31.20 \pm 1.84$  at 105 min.,  $32.50 \pm 1.67$  at 120 min.,  $32.80 \pm 1.68$  at 135 min.,  $34.40 \pm 1.81$  at 150 min.,  $37.10 \pm 1.82$  at 180 min.,  $38.60 \pm 1.92$  at 24th hour and  $40.40 \pm 1.69$  on the 5th day.

There was significant reduction ( $P < 0.05$ ) in respiration rate at 45 min., 60 min., 75 min., 90 min., 105 min., 120 min., 135 min. and 150 min. Thereafter it showed gradual rise and by 5th day it was near normal.

#### Haemogram

##### Total erythrocyte count

The total erythrocyte count ( $10^{12}/l$ ) before administration was  $2.63 \pm 0.08$  and after administration it was  $2.36 \pm 0.06$  at 10 min.,  $2.49 \pm 0.09$  at 24th hour and  $2.59 \pm 0.08$  on the 5th day.

The reduction in total erythrocyte count was significant ( $P < 0.05$ ) at 10 min. after administration.

##### Total leukocyte count

The total leukocyte count ( $10^9/l$ ) before administration was  $0.0058 \pm 0.0006$  and after administration

it was  $0.0077 \pm 0.0009$  at 10 min.,  $0.0146 \pm 0.0012$  at 24th hour and  $0.0094 \pm 0.0009$  on the 5th day.

The increase in leukocyte count was significant ( $P < 0.05$ ) at 24th hour and on the 5th day.

#### Differential leukocyte count

The lymphocyte count (per cent) before administration was  $68.50 \pm 0.90$  and after administration it was  $61.80 \pm 1.08$  at 10 min.,  $65.30 \pm 1.11$  at 24th hour and  $67.60 \pm 0.87$  on the 5th day.

The decrease in the count at 10 min. and 24th hour after administration was significant ( $P < 0.05$ ).

The heterophil count (per cent) before administration was  $29.40 \pm 0.92$  and after administration it was  $35.10 \pm 0.84$  at 10 min.,  $29.80 \pm 1.25$  at 24th hour and  $28.30 \pm 0.74$  on the 5th day.

The increase in the count at 10 min. was significant ( $P < 0.05$ ).

The eosinophil count (per cent) before administration was  $2.10 \pm 0.22$  and after administration it was  $3.10 \pm 0.50$  at 10 min.,  $5.90 \pm 0.70$  at 24th hour and  $4.10 \pm 0.62$  on the 5th day.

There was increase in the eosinophil count and the increase was significant ( $P < 0.05$ ) at 24th hour and on the 5th day.

#### Haemoglobin

The haemoglobin content (mmol/l) before administration was  $4.82 \pm 0.13$  and after administration it was  $4.54 \pm 0.13$  at 10 min.,  $4.58 \pm 0.14$  at 24th hour and  $4.72 \pm 0.12$  on the 5th day.

There was no significant reduction in the haemoglobin content.

#### Erythrocyte sedimentation rate

The erythrocyte sedimentation rate (mm/hr) before administration was  $1.80 \pm 0.24$  and after administration it was  $2.20 \pm 0.31$  at 10 min.,  $2.00 \pm 0.35$  at 24th hour and  $1.80 \pm 0.24$  on the 5th day.

There was increase in the erythrocyte sedimentation rate at 10 min. and 24th hour, which became normal by the 5th day.



### Packed cell volume

The packed cell volume (1/1) before administration was  $0.29 \pm 0.01$  and after administration it was  $0.28 \pm 0.01$  at 10 min.,  $0.28 \pm 0.01$  at 24th hour and  $0.28 \pm 0.01$  on the 5th day.

The reduction in packed cell volume was not significant.

### Assessment of anaesthetic effect

The birds in this sub-group did not evince any nociceptive response upon incision on skin, muscles and peritoneum. While suturing the above tissues there was no sensation of pain.

### Side effects

On examination of peritoneal cavity focal areas of congestion were noticed on the surface of kidney. No adhesions were noticed in the peritoneal cavity and at the point of entry of the needle.

Table 7. Effects of intraperitoneal administration of Ketamine hydrochloride followed by Thiopentone sodium in chicken: Time for induction, duration of anaesthesia and recovery.

| Bird No.        | Bodyweight (kg) | Quantity of drug administered (mg) |                    | Time for induction (min.) | Duration of anaesthesia (min.) | Duration of recovery (min.) |
|-----------------|-----------------|------------------------------------|--------------------|---------------------------|--------------------------------|-----------------------------|
|                 |                 | Ketamine hydrochloride             | Thiopentone sodium |                           |                                |                             |
| C <sub>1</sub>  | 1.600           | 80.00                              | 12.00              | 9.00                      | 62.00                          | 149.00                      |
| C <sub>2</sub>  | 1.820           | 91.00                              | 13.65              | 10.00                     | 42.00                          | 115.00                      |
| C <sub>3</sub>  | 1.840           | 92.00                              | 13.80              | 6.00                      | 39.00                          | 134.00                      |
| C <sub>4</sub>  | 1.800           | 90.00                              | 13.50              | 10.00                     | 50.00                          | 125.00                      |
| C <sub>5</sub>  | 1.700           | 85.00                              | 12.75              | 4.00                      | 42.00                          | 105.00                      |
| C <sub>6</sub>  | 1.600           | 80.00                              | 12.00              | 8.00                      | 22.00                          | 135.00                      |
| C <sub>7</sub>  | 1.400           | 70.00                              | 10.50              | 7.00                      | 36.00                          | 150.00                      |
| C <sub>8</sub>  | 1.640           | 82.00                              | 12.30              | 10.00                     | 56.00                          | 150.00                      |
| C <sub>9</sub>  | 1.920           | 96.00                              | 14.40              | 8.00                      | 22.00                          | 140.00                      |
| C <sub>10</sub> | 1.540           | 77.00                              | 11.55              | 8.00                      | 31.00                          | 109.00                      |
| Mean±           | 1.686±          | 84.30±                             | 12.65±             | 8.00 ±                    | 40.20±                         | 131.20±                     |
| S.E.            | 0.051           | 2.53                               | 0.38               | 0.58                      | 3.99                           | 5.10                        |

Table 8. Effects of intraperitoneal administration of Ketamine hydrochloride followed by Thiopentone sodium in chicken: Temperature and respiration rate (Mean  $\pm$ S.E.), n = 10.

| Parameters and units        | Intervals            |                       |                       |                       |                       |                       |                       |
|-----------------------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                             | 0 min.               | 15 min.               | 30 min.               | 45 min.               | 60 min.               | 75 min.               | 90 min.               |
| Temperature ( $^{\circ}$ F) | 107.22<br>$\pm$ 0.19 | 106.46*<br>$\pm$ 0.16 | 105.96*<br>$\pm$ 0.16 | 105.86*<br>$\pm$ 0.22 | 105.78*<br>$\pm$ 0.22 | 105.80*<br>$\pm$ 0.22 | 105.76*<br>$\pm$ 0.22 |
| Respiration rate/<br>min.   | 40.70<br>$\pm$ 2.23  | 41.10<br>$\pm$ 3.13   | 33.20<br>$\pm$ 4.05   | 30.60*<br>$\pm$ 2.93  | 30.40*<br>$\pm$ 2.53  | 31.20*<br>$\pm$ 2.72  | 31.40*<br>$\pm$ 1.79  |

| Parameters and units        | Intervals             |                       |                       |                       |                       |                       |                      |
|-----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|
|                             | 105 min.              | 120 min.              | 135 min.              | 150 min.              | 180 min.              | 24th hr               | 5th day              |
| Temperature ( $^{\circ}$ F) | 105.86*<br>$\pm$ 0.28 | 105.86*<br>$\pm$ 0.28 | 105.92*<br>$\pm$ 0.30 | 106.10*<br>$\pm$ 0.29 | 106.40*<br>$\pm$ 0.24 | 106.50*<br>$\pm$ 0.21 | 106.72<br>$\pm$ 0.21 |
| Respiration rate/<br>min.   | 31.20*<br>$\pm$ 1.84  | 32.50*<br>$\pm$ 1.67  | 32.80*<br>$\pm$ 1.68  | 34.40*<br>$\pm$ 1.81  | 37.10<br>$\pm$ 1.82   | 38.60<br>$\pm$ 1.92   | 40.40<br>$\pm$ 1.69  |

\*Significant at 5% level.

Table 9. Effects of intraperitoneal administration of Ketamine hydrochloride followed by Thiopentone sodium in chicken: Haemogram (Mean  $\pm$ S.E.), n = 10

| Parameters and units                    | Intervals           |                     |                      |                      |
|---|---------------------|---------------------|----------------------|----------------------|
|   | 0 min.              | 10 min.             | 24th hr              | 5th day              |
| Total erythrocyte count ( $10^{12}/l$ ) | 2.63 $\pm$ 0.08     | 2.36 $\pm$ 0.06*    | 2.49 $\pm$ 0.09      | 2.59 $\pm$ 0.08      |
| Total leukocyte count ( $10^9/l$ )      | 0.0058 $\pm$ 0.0006 | 0.0077 $\pm$ 0.0009 | 0.0146 $\pm$ 0.0012* | 0.0094 $\pm$ 0.0009* |
| Lymphocyte (%)                          | 68.50 $\pm$ 0.90    | 61.80 $\pm$ 1.08*   | 65.30 $\pm$ 1.11 *   | 67.60 $\pm$ 0.87     |
| Heterophil (%)                          | 29.40 $\pm$ 0.92    | 35.10 $\pm$ 0.84*   | 29.80 $\pm$ 1.25     | 28.30 $\pm$ 0.74     |
| Eosinophil (%)                          | 2.10 $\pm$ 0.22     | 3.10 $\pm$ 0.50     | 5.90 $\pm$ 0.70*     | 4.10 $\pm$ 0.62*     |
| Monocyte (%)                            | 0.00                | 0.00                | 0.00                 | 0.00                 |
| Basophil (%)                            | 0.00                | 0.00                | 0.00                 | 0.00                 |
| Haemoglobin (mmol/l)                    | 4.82 $\pm$ 0.13     | 4.54 $\pm$ 0.13     | 4.58 $\pm$ 0.14      | 4.72 $\pm$ 0.12      |
| Erythrocyte sedimentation rate (mm/hr)  | 1.80 $\pm$ 0.24     | 2.20 $\pm$ 0.31     | 2.00 $\pm$ 0.35      | 1.80 $\pm$ 0.24      |
| Packed cell volume (l/l)                | 0.29 $\pm$ 0.01     | 0.28 $\pm$ 0.01     | 0.28 $\pm$ 0.01      | 0.28 $\pm$ 0.01      |

\* Significant at 5% level.

## GROUP II DUCKS

Sub-group A

The observations are presented in Tables 10 to 12.

The bodyweight of the birds in this sub-group was  $2.015 \pm 0.018$  kg.

Ketamine hydrochloride at the rate of 100 mg per kg bodyweight was administered intraperitoneally to all the birds.

## Onset of anaesthesia

During the onset of anaesthesia, loss of balance, unsteadiness of head, ruffled feathers, fluttering, dropping of wings, vocalisation and wagging of tail were noticed.

## Time for induction

The time for induction was  $9.20 \pm 0.58$  min. The induction was smooth and uneventful.

## Duration of anaesthesia

The duration of anaesthesia was  $35.90 \pm 2.43$  min.

During anaesthesia eyes were open. Corneal, pupillary and palpebral reflexes were persisting. Reflexes of third eyelid were present. Legs were kept in an extended position. Head turned towards the body. Digit were curled. Pedal reflexes were absent.

#### Duration of recovery

The duration of recovery was  $84.50 \pm 7.31$  min. The recovery from anaesthesia was smooth and vigorous shaking of the head was noticed.

#### Temperature

The cloacal temperature ( $^{\circ}\text{F}$ ) before administration was  $107.24 \pm 0.12$  and after administration it was  $106.10 \pm 0.13$  at 15 min.,  $106.06 \pm 0.15$  at 30 min.,  $106.22 \pm 0.13$  at 45 min.,  $106.30 \pm 0.16$  at 60 min.,  $106.38 \pm 0.16$  at 75 min.,  $106.48 \pm 0.14$  at 90 min.,  $106.56 \pm 0.12$  at 105 min.,  $106.72 \pm 0.14$  at 120 min.,  $106.86 \pm 0.16$  at 135 min.,  $106.90 \pm 0.16$  at 150 min.,  $107.06 \pm 0.14$  at 180 min.,  $106.94 \pm 0.15$  at 24th hour and  $107.08 \pm 0.17$  on the 5th day.

There was significant decrease in temperature upto 120 min. ( $P < 0.05$ ) which became near normal by 180 min.

### Respiration rate

The respiration rate (per min.) before administration was  $28.70 \pm 1.30$  and after administration it was  $43.20 \pm 1.91$  at 15 min.,  $41.20 \pm 1.21$  at 30 min.,  $41.20 \pm 1.48$  at 45 min.,  $40.00 \pm 1.72$  at 60 min.,  $38.40 \pm 1.36$  at 75 min.,  $37.30 \pm 1.25$  at 90 min.,  $36.60 \pm 1.33$  at 105 min.,  $34.60 \pm 1.17$  at 120 min.,  $33.40 \pm 1.17$  at 135 min.,  $33.00 \pm 1.07$  at 150 min.,  $31.10 \pm 0.75$  at 180 min.,  $29.70 \pm 1.00$  at 24th hour and  $30.60 \pm 0.74$  on the 5th day.

There was significant increase ( $P < 0.05$ ) in respiration rate at 15 min. followed by gradual but significant decrease upto 150 min.

### Haemogram

#### Total erythrocyte count

The total erythrocyte count ( $10^{12}/l$ ) before administration was  $3.30 \pm 0.06$  and after administration it was  $3.02 \pm 0.05$  at 10 min.,  $3.02 \pm 0.06$  at 24th hour and  $3.12 \pm 0.05$  on the 5th day.

The decrease in the total erythrocyte count was significant ( $P < 0.05$ ) at 10 min., 24th hour and on the 5th day.

### Total leukocyte count

The total leukocyte count ( $10^9/l$ ) before administration was  $0.0062 \pm 0.0005$  and after administration it was  $0.0072 \pm 0.0004$  at 10 min.,  $0.0139 \pm 0.0015$  at 24th hour and  $0.0108 \pm 0.0004$  on the 5th day.

There was increase in total leukocyte count which was significant ( $P < 0.05$ ) at 24th hour and on the 5th day.

### Differential leukocyte count

The lymphocyte count (per cent) before administration was  $69.10 \pm 0.81$  and after administration it was  $66.10 \pm 1.10$  at 10 min.,  $64.50 \pm 0.71$  at 24th hour and  $65.20 \pm 1.29$  on the 5th day.

The decrease in the count at 10 min., 24th hour and on the 5th day was significant ( $P < 0.05$ ).

The heterophil count (per cent) before administration was  $28.10 \pm 0.85$  and after administration it was  $30.50 \pm 0.86$  at 10 min.,  $25.60 \pm 0.81$  at 24th hour and  $28.10 \pm 0.59$  on the 5th day.

There was decrease in heterophil count which was significant ( $P < 0.05$ ) only at 24th hour.



The eosinophil count (per cent) before administration was  $2.80 \pm 0.31$  and after administration it was  $3.40 \pm 0.29$  at 10 min.,  $9.90 \pm 0.94$  at 24th hour and  $6.50 \pm 0.89$  on the 5th day.

There was increase in eosinophil count which was significant ( $P < 0.05$ ) at 24th hour and on the 5th day.

#### Haemoglobin

The haemoglobin content (mmol/l) before administration was  $7.98 \pm 0.18$  and after administration it was  $7.71 \pm 0.15$  at 10 min.,  $7.65 \pm 0.14$  at 24th hour and  $7.67 \pm 0.15$  on the 5th day.

The variations in haemoglobin content were not significant.

#### Erythrocyte sedimentation rate

The erythrocyte sedimentation rate (mm/hr) before administration was  $1.10 \pm 0.09$  and after administration it was  $1.20 \pm 0.13$  at 10 min.,  $1.40 \pm 0.15$  at 24th hour and  $1.20 \pm 0.13$  on the 5th day.

The variations in erythrocyte sedimentation rate were not significant.

### Packed cell volume

The packed cell volume (1/1) before administration was  $0.46 \pm 0.01$  and after administration it was  $0.45 \pm 0.01$  at 10 min.,  $0.44 \pm 0.01$  at 24th hour and  $0.44 \pm 0.01$  on the 5th day.

There was reduction in packed cell volume which was significant ( $P < 0.05$ ) at 24th hour and on the 5th day.

### Assessment of anaesthetic effect

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In this sub-group there was no nociceptive response on incision of muscles and peritoneum. On incision of skin, mild degree of struggling was noticed. Suturing the above tissues did not evoke any painful response.

### Side effects

On examination of peritoneal cavity, focal areas of mild degree of congestion were observed on liver and kidney. No adhesions were observed in the peritoneal cavity and at the point of entry of the needle into the peritoneal cavity.

Table 10. Effects of intraperitoneal administration of Ketamine hydrochloride in ducks: Time for induction, duration of anaesthesia and recovery

| Bird No.           | Bodyweight (kg)      | Quantity of drug administered (mg) | Time for induction (min.) | Duration of anaesthesia (min.) | Duration of recovery (min.) |
|--------------------|----------------------|------------------------------------|---------------------------|--------------------------------|-----------------------------|
| A <sub>1</sub>     | 2.040                | 204.00                             | 13.00                     | 41.00                          | 46.00                       |
| A <sub>2</sub>     | 2.100                | 210.00                             | 12.00                     | 31.00                          | 69.00                       |
| A <sub>3</sub>     | 2.000                | 200.00                             | 9.00                      | 35.00                          | 91.00                       |
| A <sub>4</sub>     | 2.100                | 210.00                             | 8.00                      | 22.00                          | 114.00                      |
| A <sub>5</sub>     | 2.000                | 200.00                             | 9.00                      | 31.00                          | 91.00                       |
| A <sub>6</sub>     | 2.000                | 200.00                             | 7.00                      | 40.00                          | 102.00                      |
| A <sub>7</sub>     | 2.000                | 200.00                             | 8.00                      | 49.00                          | 70.00                       |
| A <sub>8</sub>     | 2.010                | 201.00                             | 10.00                     | 32.00                          | 110.00                      |
| A <sub>9</sub>     | 1.900                | 190.00                             | 8.00                      | 46.00                          | 50.00                       |
| A <sub>10</sub>    | 2.000                | 200.00                             | 8.00                      | 32.00                          | 102.00                      |
| Mean $\pm$<br>S.E. | 2.015 $\pm$<br>0.018 | 201.50 $\pm$<br>1.81               | 9.20 $\pm$<br>0.58        | 35.90 $\pm$<br>2.43            | 84.50 $\pm$<br>7.31         |

Table 11. Effects of intraperitoneal administration of Ketamine hydrochloride in ducks: Temperature and respiration rate (Mean  $\pm$ S.E.), n = 10.

| Parameters and units        | Intervals            |                       |                       |                       |                       |                       |                       |
|-----------------------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                             | 0 min.               | 15 min.               | 30 min.               | 45 min.               | 60 min.               | 75 min.               | 90 min.               |
| Temperature ( $^{\circ}$ F) | 107.24<br>$\pm$ 0.12 | 106.10*<br>$\pm$ 0.13 | 106.06*<br>$\pm$ 0.15 | 106.22*<br>$\pm$ 0.13 | 106.30*<br>$\pm$ 0.16 | 106.38*<br>$\pm$ 0.16 | 106.48*<br>$\pm$ 0.14 |
| Respiration rate/<br>min.   | 28.70<br>$\pm$ 1.30  | 43.20*<br>$\pm$ 1.91  | 41.20*<br>$\pm$ 1.21  | 41.20*<br>$\pm$ 1.48  | 40.00*<br>$\pm$ 1.72  | 38.40*<br>$\pm$ 1.36  | 37.30*<br>$\pm$ 1.25  |

| Parameters and units        | Intervals             |                       |                      |                      |                      |                      |                      |
|-----------------------------|-----------------------|-----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                             | 105 min.              | 120 min.              | 135 min.             | 150 min.             | 180 min.             | 24th hr              | 5th day              |
| Temperature ( $^{\circ}$ F) | 106.56*<br>$\pm$ 0.12 | 106.72*<br>$\pm$ 0.14 | 106.86<br>$\pm$ 0.16 | 106.90<br>$\pm$ 0.16 | 107.06<br>$\pm$ 0.14 | 106.94<br>$\pm$ 0.15 | 107.08<br>$\pm$ 0.17 |
| Respiration rate/<br>min.   | 36.60*<br>$\pm$ 1.33  | 34.60*<br>$\pm$ 1.17  | 33.40*<br>$\pm$ 1.17 | 33.00*<br>$\pm$ 1.07 | 31.10<br>$\pm$ 0.75  | 29.70<br>$\pm$ 1.00  | 30.60<br>$\pm$ 0.74  |

\* Significant at 5% level.

Table 12. Effects of intraperitoneal administration of Ketamine hydrochloride in ducks:  
Haemogram (Mean  $\pm$ S.E.), n = 10

| Parameters and units                    | Intervals           |                     |                      |                      |
|---|---------------------|---------------------|----------------------|----------------------|
|   | 0 min.              | 10 min.             | 24th hr              | 5th day              |
| Total erythrocyte count ( $10^{12}/l$ ) | 3.30 $\pm$ 0.06     | 3.02 $\pm$ 0.05*    | 3.02 $\pm$ 0.06*     | 3.12 $\pm$ 0.05*     |
| Total leukocyte count ( $10^9/l$ )      | 0.0062 $\pm$ 0.0005 | 0.0072 $\pm$ 0.0004 | 0.0139 $\pm$ 0.0015* | 0.0108 $\pm$ 0.0004* |
| Lymphocyte (%)                          | 69.10 $\pm$ 0.81    | 66.10 $\pm$ 1.10*   | 64.50 $\pm$ 0.71*    | 65.20 $\pm$ 1.29*    |
| Heterophil (%)                          | 28.10 $\pm$ 0.85    | 30.50 $\pm$ 0.86    | 25.60 $\pm$ 0.81*    | 28.10 $\pm$ 0.59     |
| Eosinophil (%)                          | 2.80 $\pm$ 0.31     | 3.40 $\pm$ 0.29     | 9.90 $\pm$ 0.94*     | 6.50 $\pm$ 0.89*     |
| Monocyte (%)                            | 0.00                | 0.00                | 0.00                 | 0.00                 |
| Basophil (%)                            | 0.00                | 0.00                | 0.00                 | 0.00                 |
| Haemoglobin (mmol/l)                    | 7.98 $\pm$ 0.18     | 7.71 $\pm$ 0.15     | 7.65 $\pm$ 0.14      | 7.67 $\pm$ 0.15      |
| Erythrocyte sedimentation rate (mm/hr)  | 1.10 $\pm$ 0.09     | 1.20 $\pm$ 0.13     | 1.40 $\pm$ 0.15      | 1.20 $\pm$ 0.13      |
| Packed cell volume (l/l)                | 0.46 $\pm$ 0.01     | 0.45 $\pm$ 0.01     | 0.44 $\pm$ 0.01*     | 0.44 $\pm$ 0.01*     |

\*Significant at 5% level.

### Sub-group B

The observations are presented in Tables 13 to 15.

The bodyweight of the birds in this sub-group was  $1.838 \pm 0.037$  kg.

Thiopentone sodium (2.5 per cent solution) at the rate of 15 mg per kg bodyweight was administered intraperitoneally to all the birds.

#### Onset of anaesthesia

During the onset of anaesthesia, loss of balance, unsteadiness of head, ruffled feathers, fluttering, dropping of wings and vocalisation were noticed.

#### Time for induction

The time for induction was  $10.20 \pm 0.87$  min. The induction was smooth and uneventful.

#### Duration of anaesthesia

The duration of anaesthesia was  $18.90 \pm 0.99$  min.

During anaesthesia eyes were closed. Corneal, pupillary and palpebral reflexes were persisting. Reflexes of third eyelids were present. Neck was extended in position. The pedal reflexes were abolished and the digits were kept extended.

### Duration of recovery

The duration of recovery was  $64.40 \pm 8.33$  min. The recovery from anaesthesia was smooth and uneventful.

### Temperature

The cloacal temperature ( $^{\circ}\text{F}$ ) before administration was  $107.24 \pm 0.15$  and after administration it was  $105.76 \pm 0.19$  at 15 min.,  $105.68 \pm 0.19$  at 30 min.,  $105.62 \pm 0.20$  at 45 min.,  $105.66 \pm 0.19$  at 60 min.,  $105.78 \pm 0.20$  at 75 min.,  $105.84 \pm 0.20$  at 90 min.,  $106.00 \pm 0.20$  at 105 min.,  $106.16 \pm 0.19$  at 120 min.,  $106.22 \pm 0.20$  at 135 min.,  $106.36 \pm 0.18$  at 150 min.,  $106.60 \pm 0.16$  at 180 min.,  $106.62 \pm 0.13$  at 24th hour and  $106.82 \pm 0.14$  on the 5th day.

The decrease in temperature was significant ( $P < 0.05$ ) upto 24th hour.

### Respiration rate

Respiration rate (per min.) before administration was  $29.40 \pm 1.31$  and after administration it was  $44.60 \pm 1.16$  at 15 min.,  $41.00 \pm 0.86$  at 30 min.,  $39.00 \pm 1.02$  at 45 min.,  $37.80 \pm 0.73$  at 60 min.,  $36.10 \pm 0.73$  at 75 min.,  $35.50 \pm 0.99$  at 90 min.,  $34.00 \pm 1.02$  at 105 min.,  $33.60 \pm 0.93$  at 120 min.,  $31.70 \pm 0.87$  at 135 min.,  $31.40 \pm 0.75$  at 150 min.,  $30.90 \pm 0.88$  at 180 min.,  $32.10 \pm 0.94$  at 24th hour and  $31.80 \pm 1.07$  on the 5th day.

There was significant increase ( $P < 0.05$ ) in respiration rate at 15 min., followed by gradual and significant reduction upto 120 min.

#### Haemogram

##### Total erythrocyte count

The total erythrocyte count ( $10^{12}/l$ ) before administration was  $2.96 \pm 0.06$  and after administration it was  $2.64 \pm 0.07$  at 10 min.,  $2.78 \pm 0.04$  at 24th hour and  $2.85 \pm 0.04$  on the 5th day.

The decrease in the total erythrocyte count was significant ( $P < 0.05$ ) at 10 min. and 24th hour.

##### Total leukocyte count

The total leukocyte count ( $10^9/l$ ) before administration was  $0.0038 \pm 0.0005$  and after administration it was  $0.0055 \pm 0.0007$  at 10 min.,  $0.0074 \pm 0.0011$  at 24th hour and  $0.0097 \pm 0.0009$  on the 5th day.

There was increase in the total leukocyte count which was significant ( $P < 0.05$ ) at 24th hour and on the 5th day.



### Differential leukocyte count

The lymphocyte count (per cent) before administration was  $69.30 \pm 1.10$  and after administration it was  $69.10 \pm 0.77$  at 10 min.,  $64.90 \pm 1.62$  at 24th hour and  $65.40 \pm 0.84$  on the 5th day.

There was decrease in lymphocyte count which was significant ( $P < 0.05$ ) at 24th hour and on the 5th day.

The heterophil count (per cent) before administration was  $27.50 \pm 0.92$  and after administration it was  $27.70 \pm 1.02$  at 10 min.,  $23.80 \pm 0.96$  at 24th hour and  $28.40 \pm 0.49$  on the 5th day.

There was decrease in heterophil count which was significant ( $P < 0.05$ ) only at 24th hour.

The eosinophil count (per cent) before administration was  $3.20 \pm 0.28$  and after administration it was  $3.20 \pm 0.44$  at 10 min.,  $11.30 \pm 1.48$  at 24th hour and  $6.20 \pm 0.78$  on the 5th day.

The increase in the count at 24th hour and on the 5th day was significant ( $P < 0.05$ ).

## Haemoglobin

The haemoglobin content (mmol/l) before administration was  $7.85 \pm 0.10$  and after administration it was  $7.46 \pm 0.13$  at 10 min.,  $7.42 \pm 0.12$  at 24th hour and  $7.62 \pm 0.11$  on the 5th day.

The decrease in haemoglobin content at 10 min. and 24th hour was significant ( $P < 0.05$ ).

## Erythrocyte sedimentation rate

The erythrocyte sedimentation rate (mm/hr) before administration was  $1.20 \pm 0.13$  and after administration it was  $1.50 \pm 0.16$  at 10 min.,  $1.80 \pm 0.13$  at 24th hour and  $1.10 \pm 0.09$  on the 5th day.

There was increase in erythrocyte sedimentation rate which was significant ( $P < 0.05$ ) only at 24th hour.

## Packed cell volume

The packed cell volume (l/l) before administration was  $0.46 \pm 0.01$  and after administration it was  $0.44 \pm 0.01$  at 10 min.,  $0.43 \pm 0.01$  at 24th hour and  $0.44 \pm 0.01$  on the 5th day.

The decrease at 10 min., 24th hour and on the 5th day was significant ( $P < 0.05$ ).

### Assessment of anaesthetic effect

In this sub-group the birds did not exhibit any nociceptive response on incision of skin, muscles and peritoneum. Suturing the above tissues evoked no painful response.

### Side effects

On examination of peritoneal cavity mild inflammatory reaction on the parietal peritoneum was noticed at the point of entry of the needle. Focal areas of congestion of liver and kidney were also noticed.

Table 13. Effects of intraperitoneal administration of Thiopentone sodium in ducks:  
Time for induction, duration of anaesthesia and recovery

| Bird No.        | Bodyweight (kg) | Quantity of drug administered (mg) | Time for induction (min.) | Duration of anaesthesia (min.) | Duration of recovery (min.) |
|-----------------|-----------------|------------------------------------|---------------------------|--------------------------------|-----------------------------|
| B <sub>1</sub>  | 1.700           | 25.50                              | 7.00                      | 15.00                          | 40.00                       |
| B <sub>2</sub>  | 1.900           | 28.50                              | 8.00                      | 17.00                          | 25.00                       |
| B <sub>3</sub>  | 1.840           | 27.60                              | 15.00                     | 23.00                          | 68.00                       |
| B <sub>4</sub>  | 2.040           | 30.60                              | 12.00                     | 13.00                          | 58.00                       |
| B <sub>5</sub>  | 1.700           | 25.50                              | 8.00                      | 20.00                          | 38.00                       |
| B <sub>6</sub>  | 2.000           | 30.00                              | 13.00                     | 21.00                          | 75.00                       |
| B <sub>7</sub>  | 1.900           | 28.50                              | 12.00                     | 23.00                          | 50.00                       |
| B <sub>8</sub>  | 1.800           | 27.00                              | 8.00                      | 18.00                          | 100.00                      |
| B <sub>9</sub>  | 1.700           | 25.50                              | 12.00                     | 21.00                          | 78.00                       |
| B <sub>10</sub> | 1.800           | 27.00                              | 7.00                      | 18.00                          | 112.00                      |
| Mean±<br>S.E.   | 1.838±<br>0.037 | 27.57±<br>0.58                     | 10.20±<br>0.87            | 18.90±<br>0.99                 | 64.40±<br>8.33              |

Table 14. Effects of intraperitoneal administration of Thiopentone sodium in ducks:  
Temperature and respiration rate (Mean  $\pm$  S.E.), n = 10.

| Parameters and units        | Intervals            |                       |                       |                       |                       |                       |                       |
|-----------------------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                             | 0 min.               | 15 min.               | 30 min.               | 45 min.               | 60 min.               | 75 min.               | 90 min.               |
| Temperature ( $^{\circ}$ F) | 107.24<br>$\pm$ 0.15 | 105.76*<br>$\pm$ 0.19 | 105.68*<br>$\pm$ 0.19 | 105.62*<br>$\pm$ 0.20 | 105.66*<br>$\pm$ 0.19 | 105.78*<br>$\pm$ 0.20 | 105.84*<br>$\pm$ 0.20 |
| Respiration rate/<br>min.   | 29.40<br>$\pm$ 1.31  | 44.60*<br>$\pm$ 1.16  | 41.00*<br>$\pm$ 0.86  | 39.00*<br>$\pm$ 1.02  | 37.80*<br>$\pm$ 0.73  | 36.10*<br>$\pm$ 0.73  | 35.50*<br>$\pm$ 0.99  |

| Parameters and units        | Intervals             |                       |                       |                       |                       |                       |                      |
|-----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|
|                             | 105 min.              | 120 min.              | 135 min.              | 150 min.              | 180 min.              | 24th hr               | 5th day              |
| Temperature ( $^{\circ}$ F) | 106.00*<br>$\pm$ 0.20 | 106.16*<br>$\pm$ 0.19 | 106.22*<br>$\pm$ 0.20 | 106.36*<br>$\pm$ 0.18 | 106.60*<br>$\pm$ 0.16 | 106.62*<br>$\pm$ 0.13 | 106.82<br>$\pm$ 0.14 |
| Respiration rate/<br>min.   | 34.00*<br>$\pm$ 1.02  | 33.60*<br>$\pm$ 0.93  | 31.70<br>$\pm$ 0.87   | 31.40<br>$\pm$ 0.75   | 30.90<br>$\pm$ 0.88   | 32.10<br>$\pm$ 0.94   | 31.80<br>$\pm$ 1.07  |

\*Significant at 5% level.

Table 15. Effects of intraperitoneal administration of Thiopentone sodium in ducks:  
Haemogram (Mean  $\pm$  S.E), n = 10.

| Parameters and units                    | Intervals           |                     |                      |                      |
|---|---------------------|---------------------|----------------------|----------------------|
|   | 0 min.              | 10 min.             | 24th hr              | 5th day              |
| Total erythrocyte count ( $10^{12}/l$ ) | 2.96 $\pm$ 0.06     | 2.64 $\pm$ 0.07*    | 2.78 $\pm$ 0.04*     | 2.85 $\pm$ 0.04      |
| Total leukocyte count ( $10^9/l$ )      | 0.0038 $\pm$ 0.0005 | 0.0055 $\pm$ 0.0007 | 0.0074 $\pm$ 0.0011* | 0.0097 $\pm$ 0.0009* |
| Lymphocyte (%)                          | 69.30 $\pm$ 1.10    | 69.10 $\pm$ 0.77    | 64.90 $\pm$ 1.62*    | 65.40 $\pm$ 0.84*    |
| Heterophil (%)                          | 27.50 $\pm$ 0.92    | 27.70 $\pm$ 1.02    | 23.80 $\pm$ 0.96*    | 28.40 $\pm$ 0.49     |
| Eosinophil (%)                          | 3.20 $\pm$ 0.28     | 3.20 $\pm$ 0.44     | 11.30 $\pm$ 1.48*    | 6.20 $\pm$ 0.78*     |
| Monocyte (%)                            | 0.00                | 0.00                | 0.00                 | 0.00                 |
| Basophil (%)                            | 0.00                | 0.00                | 0.00                 | 0.00                 |
| Haemoglobin (mmol/l)                    | 7.85 $\pm$ 0.10     | 7.46 $\pm$ 0.13*    | 7.42 $\pm$ 0.12*     | 7.62 $\pm$ 0.11      |
| Erythrocyte sedimentation rate (mm/hr)  | 1.20 $\pm$ 0.13     | 1.50 $\pm$ 0.16     | 1.80 $\pm$ 0.13*     | 1.10 $\pm$ 0.09      |
| Packed cell volume (l/l)                | 0.46 $\pm$ 0.01     | 0.44 $\pm$ 0.01*    | 0.43 $\pm$ 0.01*     | 0.44 $\pm$ 0.01*     |

\*Significant at 5% level.

### Sub-group C

The observations are presented in Tables 16 to 18.

The bodyweight of the birds in this sub group was  $1.886 \pm 0.043$  kg.

Ketamine hydrochloride at the rate of 50 mg per kg followed by thiopentone sodium (2.5 per cent solution) at the rate of 7.5 mg per kg bodyweight were administered intraperitoneally to all the birds.

#### Onset of anaesthesia

During the onset of anaesthesia, loss of balance, unsteadiness of head, dropping of neck and wings, and closing of eyelids were noticed.

The onset was very quick in this sub-group.

#### Time for induction

The time for induction was  $4.60 \pm 0.70$  min. The induction was smooth and uneventful.

#### Duration of anaesthesia

The duration of anaesthesia was  $20.20 \pm 0.89$  min.

During anaesthesia eyes were closed. Corneal, pupillary and palpebral reflexes were persisting. Reflexes of third eyelid were abolished. Head turned towards the body. Pedal reflexes were abolished.

#### Duration of recovery

The duration of recovery was  $113.10 \pm 6.15$  min. The recovery from anaesthesia was smooth and uneventful.

#### Temperature

The cloacal temperature ( $^{\circ}\text{F}$ ) before administration was  $107.18 \pm 0.13$  and after administration it was  $105.98 \pm 0.23$  at 15 min.,  $105.72 \pm 0.22$  at 30 min.,  $105.82 \pm 0.23$  at 45 min.,  $105.80 \pm 0.23$  at 60 min.,  $105.88 \pm 0.24$  at 75 min.,  $106.00 \pm 0.25$  at 90 min.,  $106.04 \pm 0.24$  at 105 min.,  $106.26 \pm 0.22$  at 120 min.,  $106.32 \pm 0.22$  at 135 min.,  $106.52 \pm 0.22$  at 150 min.,  $106.62 \pm 0.22$  at 180 min.,  $106.70 \pm 0.18$  at 24th hour and  $106.82 \pm 0.18$  on the 5th day.

There was significant reduction ( $P < 0.05$ ) in temperature upto 24th hour.



### Respiration rate

The respiration rate (per min.) before administration was  $30.30 \pm 1.65$  and after administration it was  $42.10 \pm 2.24$  at 15 min.,  $37.80 \pm 2.95$  at 30 min.,  $34.60 \pm 1.65$  at 45 min.,  $33.60 \pm 1.46$  at 60 min.,  $32.60 \pm 1.58$  at 75 min.,  $32.90 \pm 1.45$  at 90 min.,  $31.50 \pm 1.41$  at 105 min.,  $32.10 \pm 1.20$  at 120 min.,  $31.00 \pm 1.07$  at 135 min.,  $31.20 \pm 0.91$  at 150 min.,  $31.10 \pm 1.17$  at 180 min.,  $31.40 \pm 1.70$  at 24th hour,  $33.20 \pm 1.41$  on the 5th day.

There was significant increase ( $P < 0.05$ ) in respiration rate at 15 min. and 30 min. Thereafter it showed gradual decrease.

### Haemogram

#### Total erythrocyte count

The total erythrocyte count ( $10^{12}/l$ ) before administration was  $3.05 \pm 0.04$  and after administration it was  $2.74 \pm 0.04$  at 10 min.,  $2.80 \pm 0.02$  at 24th hour and  $2.92 \pm 0.03$  on the 5th day.

The decrease in total erythrocyte count was significant ( $P < 0.05$ ) at 10 min., 24th hour and on the 5th day.

### Total leukocyte count

The total leukocyte count ( $10^9/l$ ) before administration was  $0.0057 \pm 0.0008$  and after administration it was  $0.0085 \pm 0.0006$  at 10 min.,  $0.0103 \pm 0.0008$  at 24th hour and  $0.0103 \pm 0.0005$  on the 5th day.

The increase in leukocyte count was significant ( $P < 0.05$ ) at 10 min., 24th hour and 5th day.

### Differential leukocyte count

The lymphocyte count (per cent) before administration was  $69.30 \pm 0.86$  and after administration it was  $67.80 \pm 0.82$  at 10 min.,  $67.30 \pm 1.30$  at 24th hour and  $65.70 \pm 0.68$  on the 5th day.

There was decrease in lymphocyte count which was significant ( $P < 0.05$ ) only on the 5th day.

The heterophil count (per cent) before administration was  $27.20 \pm 0.72$  and after administration it was  $29.80 \pm 0.77$  at 10 min.,  $23.00 \pm 0.68$  at 24th hour and  $27.90 \pm 0.50$  on the 5th day.

There was significant rise ( $P < 0.05$ ) in the count at 10 min. and reduction at 24th hour.

The eosinophil count (per cent) before administration was  $3.50 \pm 0.25$  and after administration it was  $2.70 \pm 0.47$  at 10 min.,  $9.70 \pm 1.40$  at 24th hour and  $6.40 \pm 0.74$  on the 5th day.

The increase in the count at 24th hour and on the 5th day was significant ( $P < 0.05$ ).

#### Haemoglobin

The haemoglobin content (mmol/l) before administration was  $8.28 \pm 0.13$  and after administration it was  $7.98 \pm 0.13$  at 10 min.,  $7.98 \pm 0.13$  at 24th hour and  $8.13 \pm 0.13$  on the 5th day.

The decrease in haemoglobin content was not significant.

#### Erythrocyte sedimentation rate

The erythrocyte sedimentation rate (mm/hr) before administration was  $1.40 \pm 0.15$  and after administration it was  $1.60 \pm 0.15$  at 10 min.,  $1.70 \pm 0.14$  at 24th hour and  $1.10 \pm 0.09$  on the 5th day.

The variations were not significant.

### Packed cell volume

The packed cell volume (1/1) before administration was  $0.46 \pm 0.01$  and after administration it was  $0.44 \pm 0.01$  at 10 min.,  $0.44 \pm 0.00$  at 24th hour and  $0.45 \pm 0.00$  on the 5th day.

The decrease at 10 min. and 24th hour was significant ( $P < 0.05$ ).

### Assessment of anaesthetic effect

The birds in this sub-group did not evince any nociceptive response while incising and suturing the skin, muscles and peritoneum.

### Side effects

On examination of peritoneal cavity focal areas of congestion were noticed on the surface of kidney. No adhesions were noticed in the peritoneal cavity and at the point of entry of the needle.

Table 16. Effects of intraperitoneal administration of Ketamine hydrochloride followed by Thiopentone sodium in ducks: Time for induction, duration of anaesthesia and recovery.

| Bird No.        | Bodyweight (kg) | Quantity of drug administered (mg) |                    | Time for induction (min.) | Duration of anaesthesia (min.) | Duration of recovery (min.) |
|-----------------|-----------------|------------------------------------|--------------------|---------------------------|--------------------------------|-----------------------------|
|                 |                 | Ketamine hydrochloride             | Thiopentone sodium |                           |                                |                             |
| C <sub>1</sub>  | 1.700           | 85.00                              | 12.75              | 2.00                      | 18.00                          | 121.00                      |
| C <sub>2</sub>  | 1.800           | 90.00                              | 13.50              | 5.00                      | 20.00                          | 132.00                      |
| C <sub>3</sub>  | 1.900           | 95.00                              | 14.25              | 2.00                      | 24.00                          | 144.00                      |
| C <sub>4</sub>  | 2.100           | 105.00                             | 15.75              | 2.00                      | 25.00                          | 114.00                      |
| C <sub>5</sub>  | 1.700           | 85.00                              | 12.75              | 8.00                      | 20.00                          | 98.00                       |
| C <sub>6</sub>  | 2.000           | 100.00                             | 15.00              | 5.00                      | 19.00                          | 135.00                      |
| C <sub>7</sub>  | 2.040           | 102.00                             | 15.30              | 6.00                      | 22.00                          | 112.00                      |
| C <sub>8</sub>  | 1.900           | 95.00                              | 14.25              | 8.00                      | 21.00                          | 105.00                      |
| C <sub>9</sub>  | 1.900           | 95.00                              | 14.25              | 5.00                      | 15.00                          | 90.00                       |
| C <sub>10</sub> | 1.820           | 91.00                              | 13.65              | 3.00                      | 18.00                          | 80.00                       |
| Mean $\pm$      | 1.886 $\pm$     | 94.30 $\pm$                        | 14.15 $\pm$        | 4.60 $\pm$                | 20.20 $\pm$                    | 113.10 $\pm$                |
| S.E.            | 0.043           | 2.13                               | 0.32               | 0.70                      | 0.89                           | 6.15                        |

Table 17. Effects of intraperitoneal administration of Ketamine hydrochloride followed by Thiopentone sodium in ducks: Temperature and respiration rate (Mean  $\pm$ S.E.), n = 10

| Parameters and units      | Intervals            |                       |                       |                       |                       |                       |                       |
|---------------------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                           | 0 min.               | 15 min.               | 30 min.               | 45 min.               | 60 min.               | 75 min.               | 90 min.               |
| Temperature (°F)          | 107.18<br>$\pm$ 0.13 | 105.98*<br>$\pm$ 0.23 | 105.72*<br>$\pm$ 0.22 | 105.82*<br>$\pm$ 0.23 | 105.80*<br>$\pm$ 0.23 | 105.88*<br>$\pm$ 0.24 | 106.00*<br>$\pm$ 0.25 |
| Respiration rate/<br>min. | 30.30<br>$\pm$ 1.65  | 42.10*<br>$\pm$ 2.24  | 37.80*<br>$\pm$ 2.95  | 34.60<br>$\pm$ 1.65   | 33.60<br>$\pm$ 1.46   | 32.60<br>$\pm$ 1.58   | 32.90<br>$\pm$ 1.45   |

| Parameters and units      | Intervals             |                       |                       |                       |                       |                       |                      |
|---------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|
|                           | 105 min.              | 120 min.              | 135 min.              | 150 min.              | 180 min.              | 24th hr               | 5th day              |
| Temperature (°F)          | 106.04*<br>$\pm$ 0.24 | 106.26*<br>$\pm$ 0.22 | 106.32*<br>$\pm$ 0.22 | 106.52*<br>$\pm$ 0.22 | 106.62*<br>$\pm$ 0.22 | 106.70*<br>$\pm$ 0.18 | 106.82<br>$\pm$ 0.18 |
| Respiration rate/<br>min. | 31.50<br>$\pm$ 1.41   | 32.10<br>$\pm$ 1.20   | 31.00<br>$\pm$ 1.07   | 31.20<br>$\pm$ 0.91   | 31.10<br>$\pm$ 1.17   | 31.40<br>$\pm$ 1.70   | 33.20<br>$\pm$ 1.41  |

\* Significant at 5% level.

Table 18. Effects of intraperitoneal administration of Ketamine hydrochloride followed by Thiopentone sodium in ducks: Haemogram (Mean  $\pm$ S.E), n = 10.

| Parameters and units                    | Intervals           |                      |                      |                      |
|---|---------------------|----------------------|----------------------|----------------------|
|   | 0 min.              | 10 min.              | 24th hr              | 5th day              |
| Total erythrocyte count ( $10^{12}/l$ ) | 3.05 $\pm$ 0.04     | 2.74 $\pm$ 0.04*     | 2.80 $\pm$ 0.02*     | 2.92 $\pm$ 0.03*     |
| Total leukocyte count ( $10^9/l$ )      | 0.0057 $\pm$ 0.0008 | 0.0085 $\pm$ 0.0006* | 0.0103 $\pm$ 0.0008* | 0.0103 $\pm$ 0.0005* |
| Lymphocyte (%)                          | 69.30 $\pm$ 0.86    | 67.80 $\pm$ 0.82     | 67.30 $\pm$ 1.30     | 65.70 $\pm$ 0.68*    |
| Heterophil (%)                          | 27.20 $\pm$ 0.72    | 29.80 $\pm$ 0.77*    | 23.00 $\pm$ 0.68*    | 27.90 $\pm$ 0.50     |
| Eosinophil (%)                          | 3.50 $\pm$ 0.25     | 2.70 $\pm$ 0.47      | 9.70 $\pm$ 1.04*     | 6.40 $\pm$ 0.74*     |
| Monocyte (%)                            | 0.00                | 0.00                 | 0.00                 | 0.00                 |
| Basophil (%)                            | 0.00                | 0.00                 | 0.00                 | 0.00                 |
| Haemoglobin (mmol/l)                    | 8.28 $\pm$ 0.13     | 7.98 $\pm$ 0.13      | 7.98 $\pm$ 0.13      | 8.13 $\pm$ 0.13      |
| Erythrocyte sedimentation rate (mm/hr)  | 1.40 $\pm$ 0.15     | 1.60 $\pm$ 0.15      | 1.70 $\pm$ 0.14      | 1.10 $\pm$ 0.09      |
| Packed cell volume (l/l)                | 0.46 $\pm$ 0.01     | 0.44 $\pm$ 0.01*     | 0.44 $\pm$ 0.00*     | 0.45 $\pm$ 0.00      |

\*Significant at 5% level.

## *Discussion*

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## DISCUSSION

### GROUP I CHICKEN

The bodyweight of the birds in sub-group A was  $1.438 \pm 0.058$  kg.

Ketamine hydrochloride at the rate of 100 mg per kg bodyweight was administered intraperitoneally to all the birds. With this dose satisfactory anaesthesia could be achieved. The same dose of ketamine hydrochloride had been recommended by Mandelker (1973) in parakeets, Boever and Wright (1975) in chicken, owls, hawks and other larger birds, and Neal *et al.* (1981) in pigeons. According to Borzio (1973), ketamine hydrochloride at the rate of 15 - 20 mg per kg bodyweight was adequate for immobilisation.

The bodyweight of the birds in sub-group B was  $1.440 \pm 0.070$  kg. Thiopentone sodium (2.5 per cent solution) at the rate of 15 mg per kg bodyweight was administered intraperitoneally to all the birds. Anaesthetic effect was satisfactory at this dose level. This is in agreement with the dose of thiopentone sodium recommended by Lee (1953) in geese, ducks and chicken, and Klimes (1962) in chicken.

The bodyweight of the birds in sub-group C was  $1.686 \pm 0.051$  kg. Ketamine hydrochloride at the rate of 50 mg

per kg bodyweight followed by thiopentone sodium (2.5 per cent solution) at the rate of 7.5 mg per kg was administered intraperitoneally to all the birds. With this combination satisfactory anaesthesia could be attained.

During the onset of anaesthesia, in all the birds loss of balance and unsteadiness of head could be observed. This is in agreement with the observations of Church (1957) in baby chicks. Cyanosis of comb and wattles was present. When ketamine hydrochloride alone was administered, defaecation and vocalisation were noticed. On intraperitoneal administration of thiopentone sodium, ruffled feathers and dropping of wings as observed by Church (1957) in baby chicks could be seen. When ketamine hydrochloride followed by thiopentone sodium was administered, dropping of neck and wings as reported by Church (1957) and closing of the eyelids as reported by Donovan (1958) in sparrows, canaries, chicken and parakeets were noticed. After the onset of anaesthesia all the birds assumed sternal recumbency followed by lateral recumbency.

As the effect of anaesthesia deepened, pedal reflexes were abolished in all the birds. This is in agreement with the observations of Jordan et al. (1960) in fowls, and Desforges and Scott (1971) in Aylesbury domestic ducks.

However, other reflexes such as corneal, pupillary, palpebral and reflexes of the third eyelid, comb and wattles persisted. When ketamine hydrochloride alone was administered the eyes were kept open, but there was no resistance on extension of the limbs. Gandini et al. (1986) had recorded persistence of corneal reflex in ostriches and Heidenreich (1978) had observed that the eyes were kept open in birds of prey. When thiopentone sodium alone or ketamine hydrochloride followed by thiopentone sodium were administered, the eyes were kept closed though there was no resistance to handling the legs. This is in agreement with the observations of Donovan (1958) during barbiturate anaesthesia.

The induction was smooth and uneventful in all the sub-groups. This is in agreement with the observations of Donovan (1958) in sparrows, canaries, chicken and parakeets. The time for induction was  $7.30 \pm 0.53$  min.,  $9.30 \pm 0.38$  min. and  $8.00 \pm 0.58$  min. in sub-groups A, B and C respectively. The time for induction was the least when ketamine hydrochloride alone was used.

The duration of anaesthesia was  $63.40 \pm 2.16$  min.,  $31.40 \pm 1.82$  min. and  $40.20 \pm 3.99$  min. in sub-groups A, B and

C respectively. The duration of anaesthesia was maximum when ketamine hydrochloride alone was used and minimum when thiopentone sodium alone was used.

The duration of recovery was  $135.50 \pm 9.24$  min. in sub-group A,  $149.60 \pm 8.32$  min. in sub-group B and  $131.20 \pm 5.10$  min. in sub-group C. The duration of recovery was the least when ketamine hydrochloride followed by thiopentone sodium was used. The recovery from anaesthesia was smooth and uneventful in all the sub-groups. Similar observations had been recorded by Donovan (1958) in sparrows, canaries, chicken and parakeets with pentobarbital sodium, and Gandini *et al.* (1986) in ostriches and Singh *et al.* (1988) in pea hawk, pea hen and eagle with ketamine hydrochloride.

A fall in cloacal temperature was observed in all the sub-groups during anaesthesia, but the variations were within normal range (Fig. 11). This is in agreement with the earlier observations of Lee (1953) in geese, ducks and chicken; Sharma *et al.* (1983 a&b) in dogs; Gandini *et al.* in ostriches, and Kumar and Sharma (1986) in buffaloes.

An initial rise in respiration rate followed by gradual reduction was observed in all the sub-groups. This

reduction was significant at 60 min. in sub-group B and from the 45th min. to 150th min. in sub-group C. Thereafter it showed gradual rise and became near normal by 90th min. in sub-group A, by the 24th hour in sub-group B and by 5th day in sub-group C (Fig. 12). Earlier observations of Lee (1953) in geese, ducks and chicken; and Kumar and Sharma (1986) in buffaloes are in agreement with the results of the present study.

The total erythrocyte count was decreased in all the sub-groups during anaesthesia, but it was significant in sub-group B and C (Fig. 13).

The total leukocyte count was decreased at 10 min. in sub-groups A and B, whereas in sub-group C there was an increase. However, the total leukocyte count recorded an increase in all the sub-groups by the 24th hour and on the 5th day. This increase in the count was not significant in sub-group A, but significant on the 5th day in sub-group B, and at the 24th hour and on the 5th day in sub-group C (Fig. 14).

The lymphocyte count had shown a decrease in all the sub-groups and the decrease was significant in sub-groups A and B at the 24th hour and in sub-group C at 10 min. and the 24th hour (Fig. 15).

Fig.11. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Temperature in chicken (sub-groups A, B and C respectively)

Fig.12. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Respiration rate in chicken (sub-groups A, B and C respectively)

\_\_\_\_\_ SUB GROUP A  
 - - - - - SUB GROUP B  
 ······ SUB GROUP C

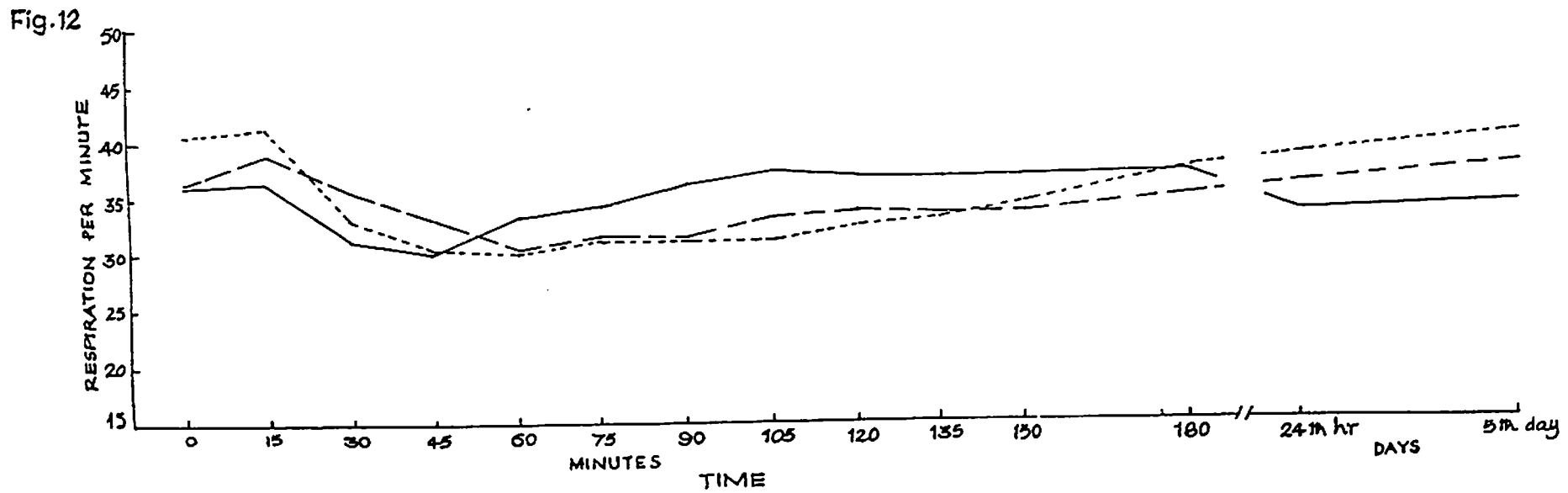
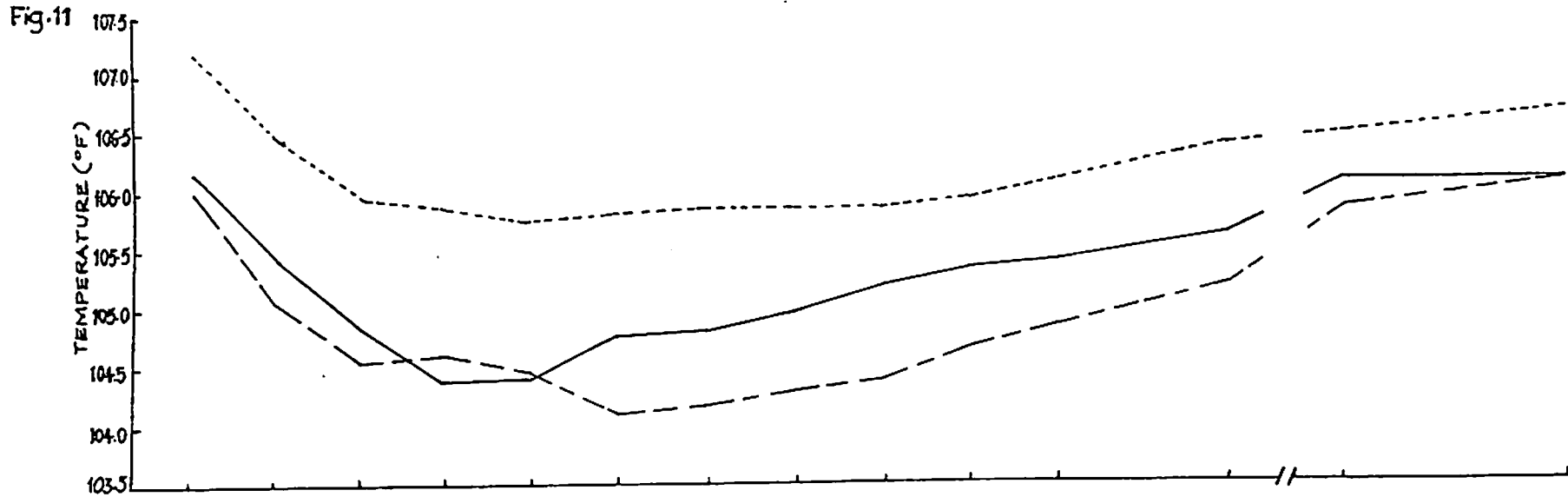


Fig. 13. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Total erythrocyte count in chicken (sub-groups A, B and C respectively)

Fig. 14. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Total leukocyte count in chicken. (sub-groups A, B and C respectively)



Fig. 13

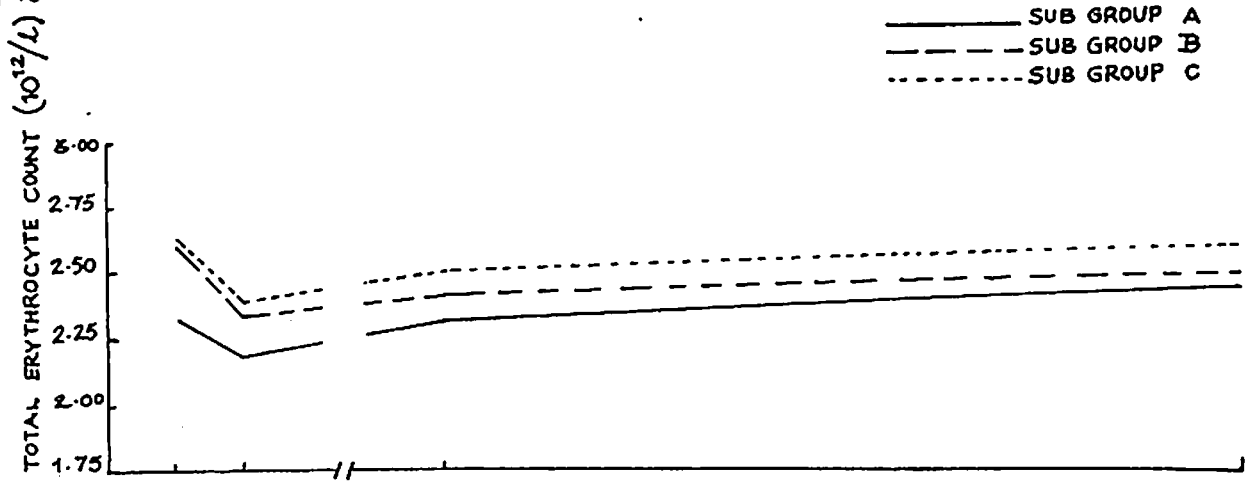
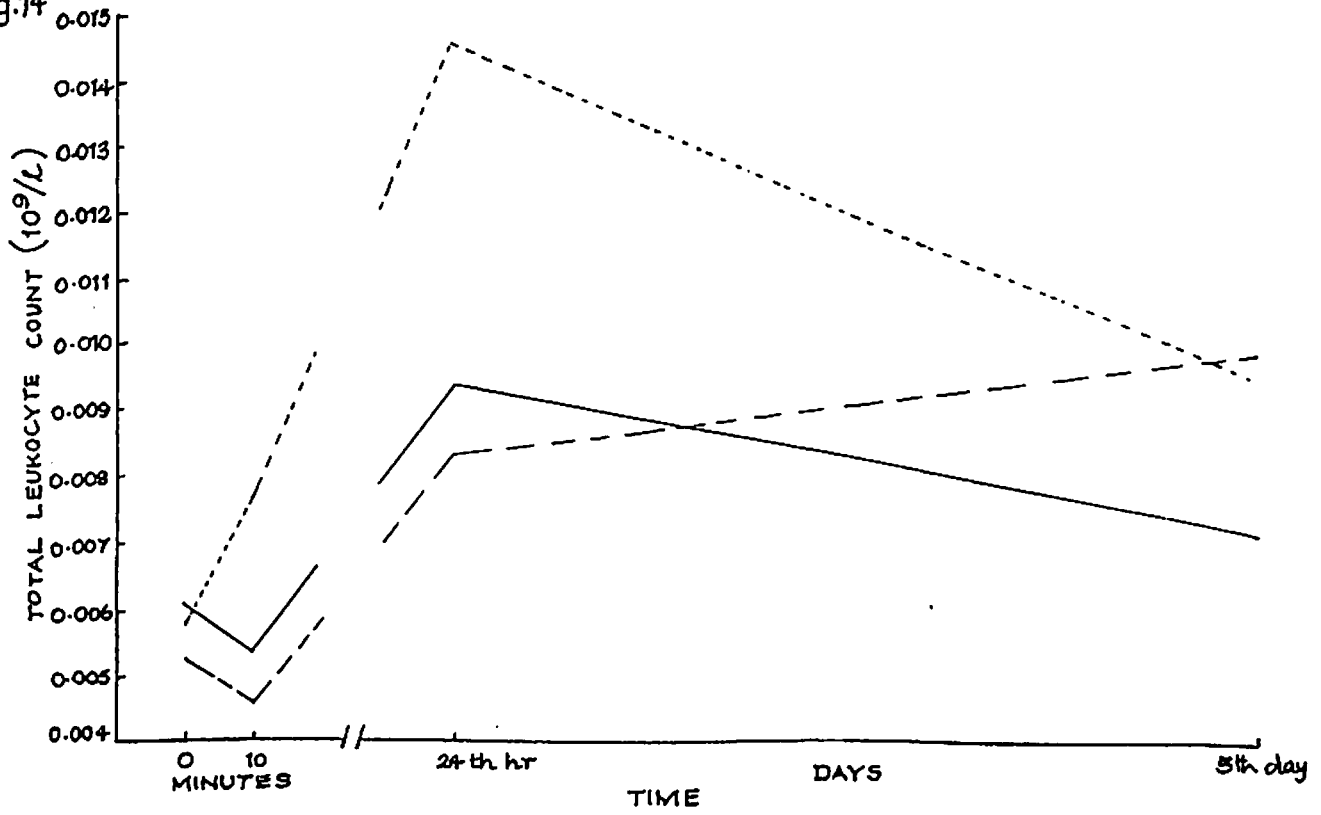


Fig. 14



The heterophil count was on the increase at 10 min. in all the sub-groups, but significant only in sub-group C. Thereafter the count decreased and became near normal by the 24th hour in all the sub-groups (Fig. 16).

The observations are in agreement with the earlier observations of Soliman et al. (1965), Nara et al. (1979) and Sharma et al. (1983 a&b) in dogs; Kumar et al. (1974) in sheep, and Pfeil and Duesterberg (1987) in cats.

The eosinophil count recorded a significant increase at the 24th hour in all the sub-groups, but decreased gradually by the 5th day (Fig. 17).

The haemoglobin content was reduced in all the sub-groups and this reduction was significant at 10 min. in sub-group A, and at the 24th hour in sub-group B (Fig.18). Reduction in the haemoglobin content had been recorded by Soliman et al. (1965), Nara et al. (1979) and Sharma et al. (1983 a&b) in dogs; Kumar et al. (1974) in sheep, and Pfeil and Duesterberg (1987) in cats.

The erythrocyte sedimentation rate was decreased in sub-group A, but increased in sub-groups B and C. The increase at 10 min. and the 24th hour was significant only

Fig. 15. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Lymphocyte count in chicken (sub-groups A, B and C respectively).

Fig. 16. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Heterophil count in chicken. (sub-groups A, B and C respectively)

Fig. 17. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Eosinophil count in chicken (sub-groups A, B and C respectively)

\_\_\_\_\_ SUB GROUP A  
 - - - - - SUB GROUP B  
 ..... SUB GROUP C

Fig.15

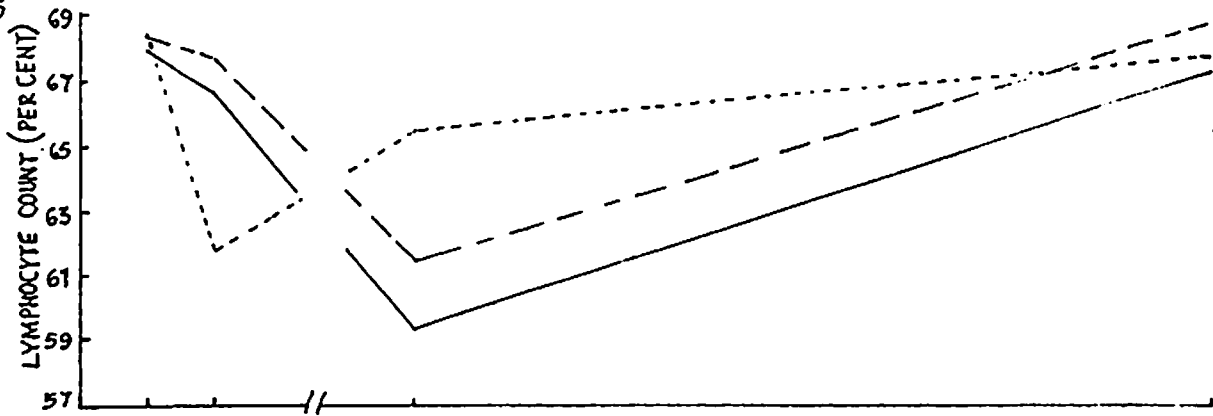


Fig.16

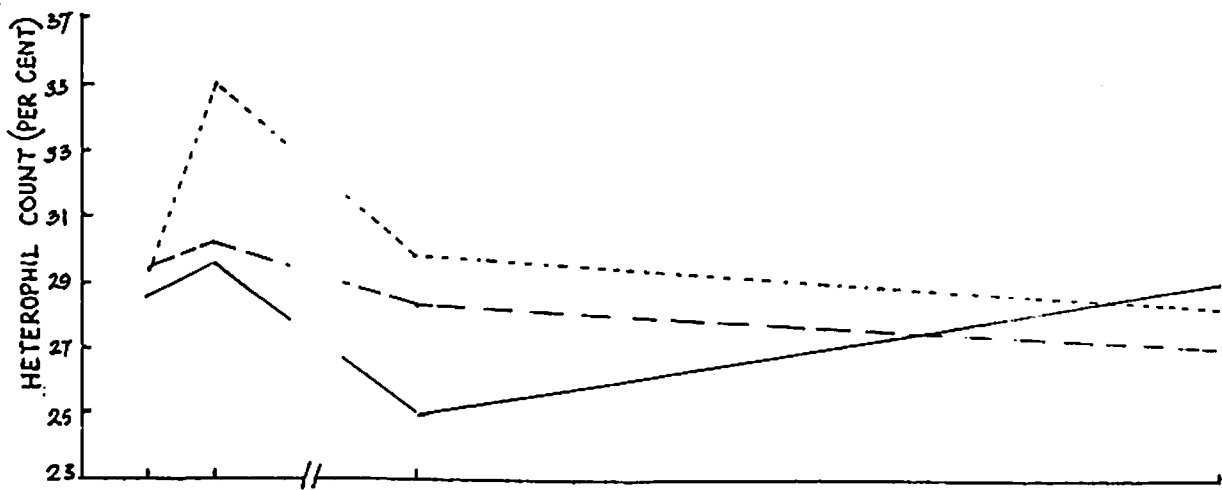
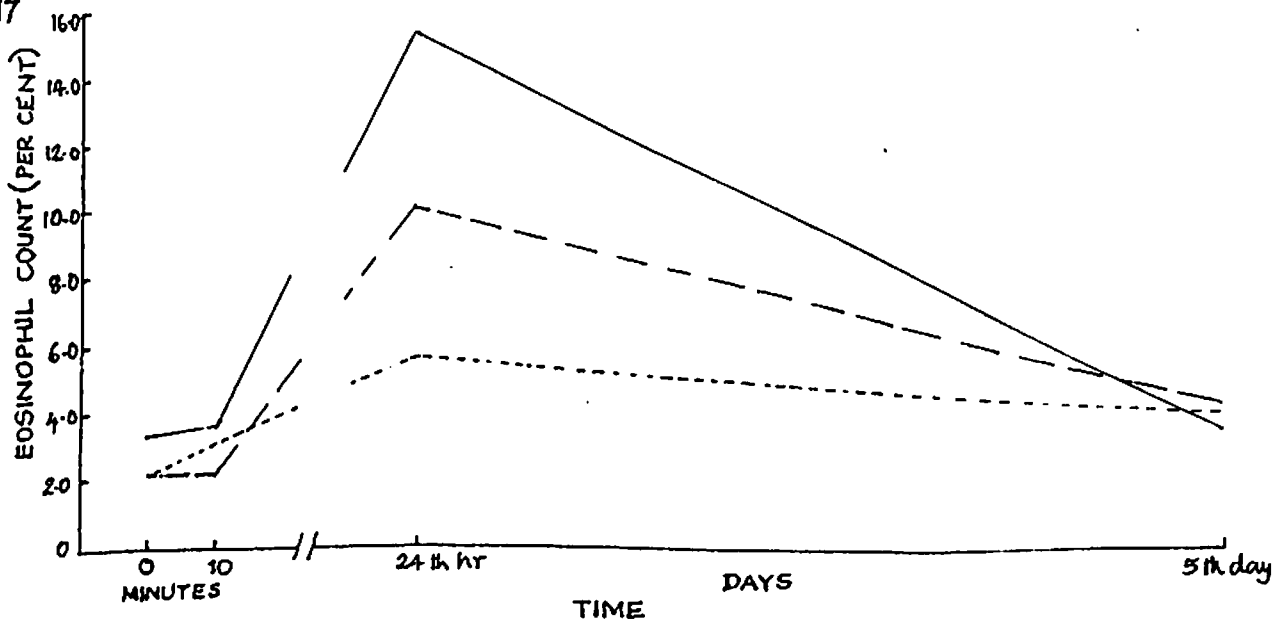


Fig.17



in sub-group B (Fig. 19). Soliman et al. (1965) had recorded increase in erythrocyte sedimentation rate during barbiturate anaesthesia in dogs.

The packed cell volume had shown gradual reduction upto 24th hour and it became near normal by the 5th day in all the sub-groups. These changes at the 24th hour and on the 5th day were significant only in sub-group B (Fig. 20). Earlier observations of Soliman et al. (1965), Nara et al. (1979) and Sharma et al. (1983 a&b) in dogs; and Kumar et al. (1974) in sheep are in agreement with the findings of the present study.

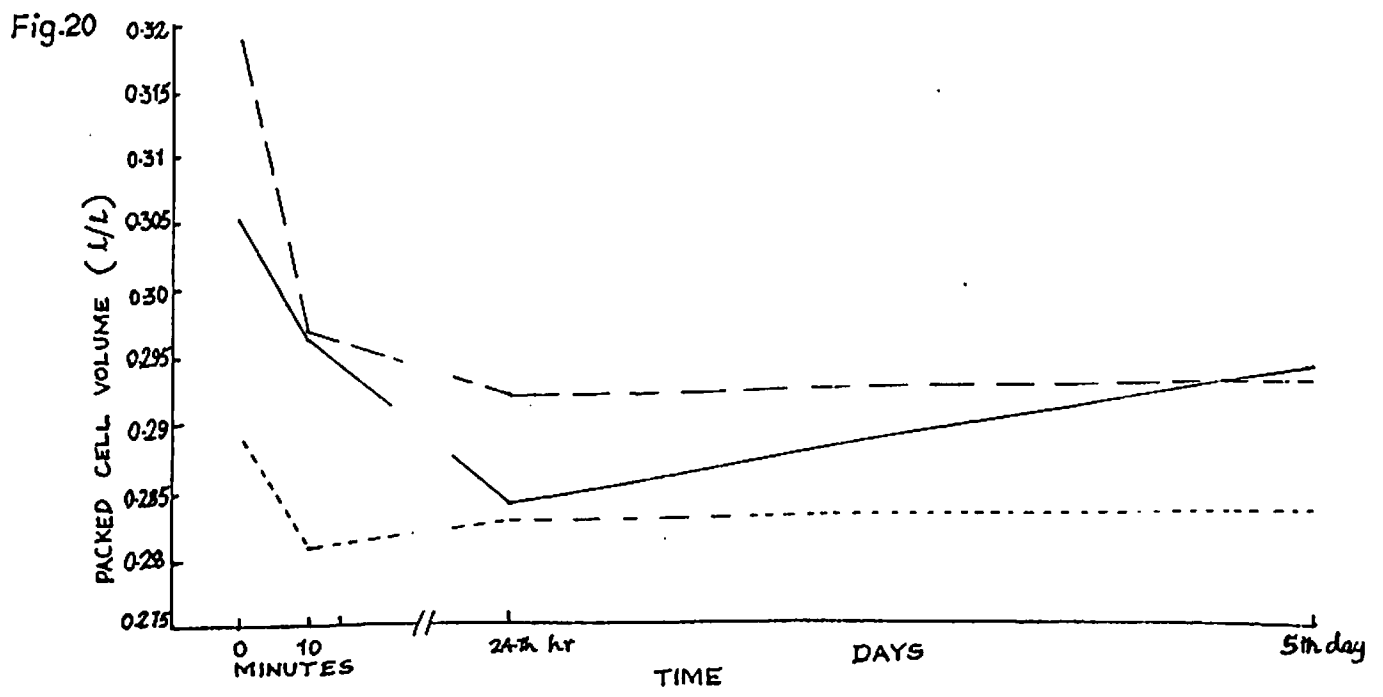
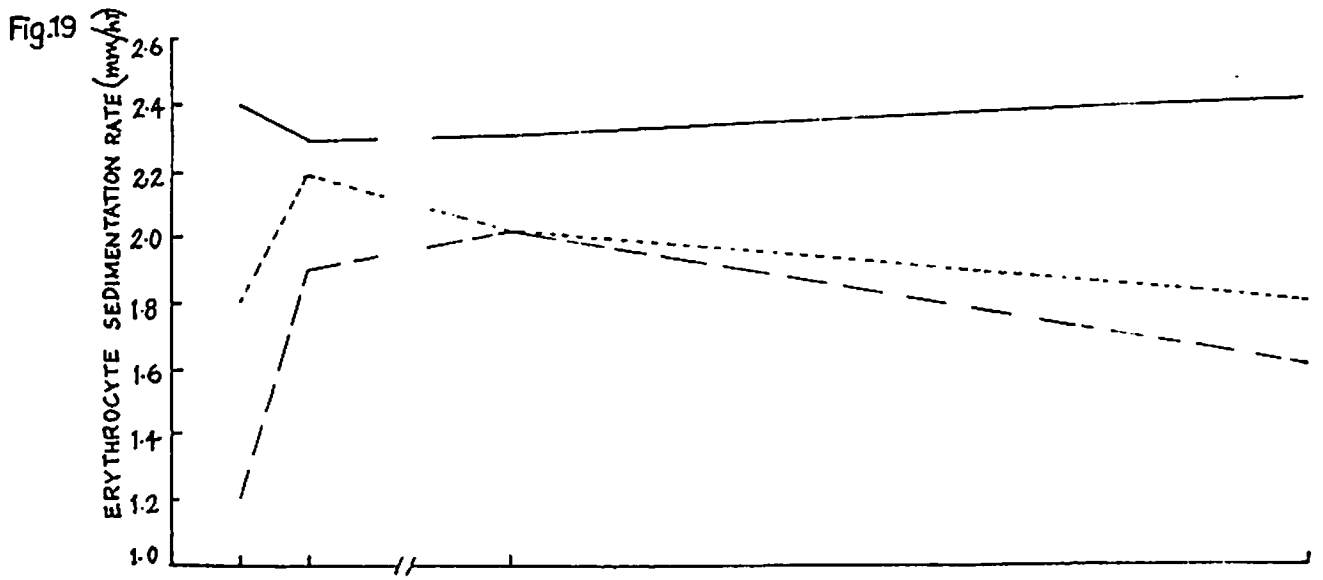
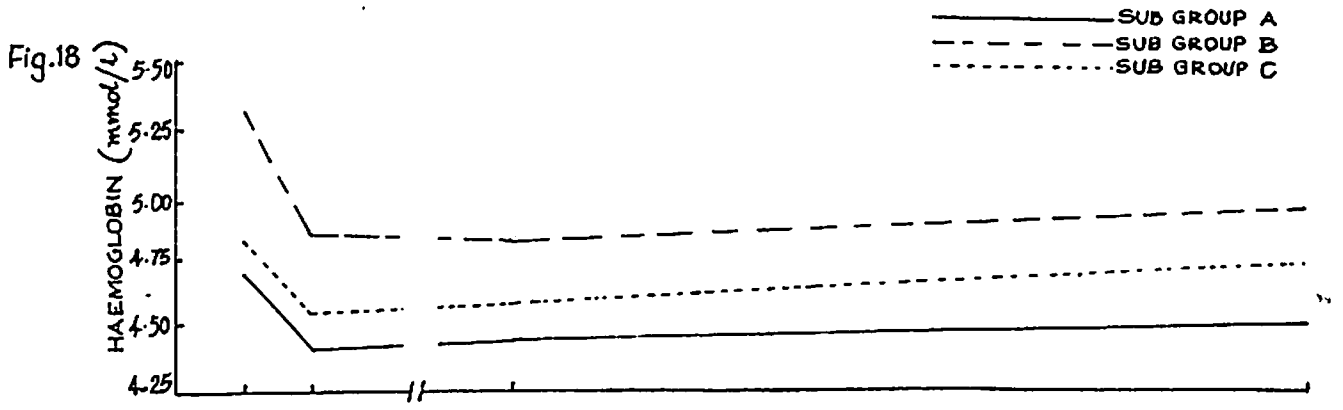
In all the sub-groups nociceptive responses were not noticed on incision on the skin, muscles and peritoneum. While in sub-group A, slight movement of the body was observed on incising the skin. On suturing no symptoms of pain could be noticed in all the sub-groups.

Focal congestion of liver and kidney was observed in all the sub-groups. Mild degree of inflammatory reaction on the parietal peritoneum was noticed at the point of entry of the needle in sub-group B.

Fig. 18. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Haemoglobin content in chicken (sub-groups A, B and C respectively)

Fig. 19. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Erythrocyte sedimentation rate in chicken (sub-groups A, B and C respectively)

Fig. 20. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Packed cell volume in chicken (sub-groups A, B and C respectively)



## GROUP II DUCKS

The bodyweight of the birds in sub-group A was  $2.015 \pm 0.018$  kg. Ketamine hydrochloride at the rate of 100 mg per kg bodyweight was administered intraperitoneally to all the birds. With this dose satisfactory anaesthesia could be achieved. The same dose of ketamine hydrochloride had been recommended by Mandelker (1973) in parakeets, Boever and Wright (1975) in chicken, owls, hawks and other larger birds, and Neal *et al.* (1981) in pigeons. According to Borzio (1973), ketamine hydrochloride at the rate of 15 - 20 mg per kg bodyweight was adequate for immobilisation.

The bodyweight of the birds in sub-group B was  $1.838 \pm 0.037$  kg. Thiopentone sodium (2.5 per cent solution) at the rate of 15 mg per kg bodyweight was administered intraperitoneally to all the birds. Anaesthetic effect was satisfactory at this dose level. This is in agreement with the dose of thiopentone sodium recommended by Lee (1953) in geese, ducks and chicken.

The bodyweight of the birds in sub-group C was  $1.886 \pm 0.043$  kg. Ketamine hydrochloride at the rate of 50 mg



per kg bodyweight followed by thiopentone sodium (2.5 per cent solution) at the rate of 7.5 mg per kg was administered intraperitoneally to all the birds. With this combination satisfactory anaesthesia could be attained.

During the onset of anaesthesia, in all the birds loss of balance and unsteadiness of head could be observed. This is in agreement with the observations of Church (1957) in baby chicks. When ketamine hydrochloride alone was administered, ruffled feathers and dropping of wings as reported by Church (1957) in baby chicks, and vocalisation, fluttering, and wagging of tail were noticed. On intraperitoneal administration of thiopentone sodium, ruffled feathers, dropping of wings, as observed by Church (1957), and vocalisation and fluttering were noticed. When ketamine hydrochloride followed by thiopentone sodium was administered, dropping of neck and wings as reported by Church (1957) and closing of the eyelids as observed by Donovan (1958) in sparrows, canaries, chicken and parakeets were seen. After the onset of anaesthesia all the birds assumed sternal recumbency followed by lateral recumbency.

As the effect of anaesthesia deepened, pedal reflexes were abolished in all the birds. This is in agreement with the observations of Jordan et al. (1960) in fowls and Desforges and Scott (1971) in Aylesbury domestic ducks. However, other reflexes such as corneal, pupillary, palpebral and reflexes of the third eyelid were persisting in all the sub-groups, but reflexes of the third eyelid were abolished in sub-group C. When ketamine hydrochloride alone was administered, eyes were kept open. Gandini et al. (1986) had recorded persistence of corneal reflex in ostriches and Heidenreich (1978) had observed that the eyes were kept open in birds of prey. When thiopentone sodium alone or ketamine hydrochloride followed by thiopentone sodium were administered, the eyes were kept closed. This is in agreement with the observations of Donovan (1958) during barbiturate anaesthesia.

The induction was smooth and uneventful in all the sub-groups. This is in agreement with the observations of Donovan (1958) in sparrows, canaries, chicken and parakeets. The time for induction was  $9.20 \pm 0.58$  min.,  $10.20 \pm 0.87$  min., and  $4.60 \pm 0.70$  min. in sub-groups A, B and C respectively. The time for induction was the least when ketamine hydrochloride followed by thiopentone sodium was used.

The duration of anaesthesia was  $35.90 \pm 2.43$  min.,  $18.90 \pm 0.99$  min., and  $20.20 \pm 0.89$  min. in sub-groups A, B and C respectively. The duration of anaesthesia was maximum when ketamine hydrochloride alone was administered and minimum when thiopentone sodium alone was administered.

The duration of recovery was  $84.50 \pm 7.31$  min. in sub-group A,  $64.40 \pm 8.33$  min. in sub-group B, and  $113.10 \pm 6.15$  min. in sub-group C. The duration of recovery was the least when thiopentone sodium alone was used. The recovery from anaesthesia was smooth and uneventful in all the sub-groups. Similar observations had been recorded by Donovan (1958) in sparrows, canaries, chicken and parakeets with pentobarbital sodium, and Gandini *et al.* (1986) in ostriches and Singh *et al.* (1988) in pea hawk, pea hen and eagle with ketamine hydrochloride. When ketamine hydrochloride was used vigorous shaking of the head was noticed as reported by Boever and Wright (1975) in ducks and swans.

There was a fall in cloacal temperature in all the sub-groups during anaesthesia and the changes were within normal range (Fig. 21). This observation is in agreement with the earlier observations of Lee (1953) in geese, ducks and chicken; Sharma *et al.* (1983 a&b) in dogs; Gandini *et al.* (1986) in ostriches, and Kumar and Sharma (1986) in buffaloes.

There was rise in respiration rate initially followed by gradual reduction in all the sub-groups. In sub-groups A and B reduction was significant upto 150th min., and 120th min. respectively. But in sub-group C, it was significant only at 30th min. (Fig. 22). Earlier observations of Lee (1953) in geese, ducks and chicken; and Kumar and Sharma (1986) in buffaloes are in agreement with the results of the present study.

The total erythrocyte count was increased significantly in all the sub-groups during anaesthesia (Fig. 23).

The total leukocyte count was increased at 10 min., the 24th hour and on the 5th day. The increase at the 24th hour and on the 5th day was significant in all the sub-groups and in sub-group C at 10th min. also (Fig. 24).

The lymphocyte count had shown a decrease in all the sub-groups and was significant at 10 min., the 24th hour and on the 5th day in sub-group A, at the 24th hour and on the 5th day in sub-group B and on the 5th day in sub-group C (Fig. 25).

Fig. 21. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Temperature in ducks (sub-groups A, B and C respectively)

Fig. 22. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by thiopentone sodium on Respiration rate in ducks (sub-groups A, B and C respectively)

\_\_\_\_\_ SUB GROUP A  
 - - - - - SUB GROUP B  
 - · - · - SUB GROUP C

Fig.21

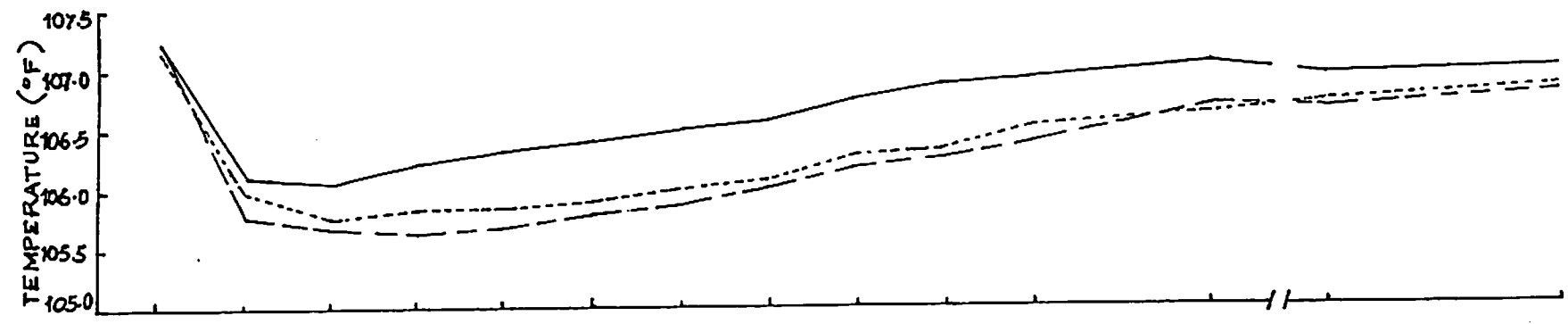


Fig.22

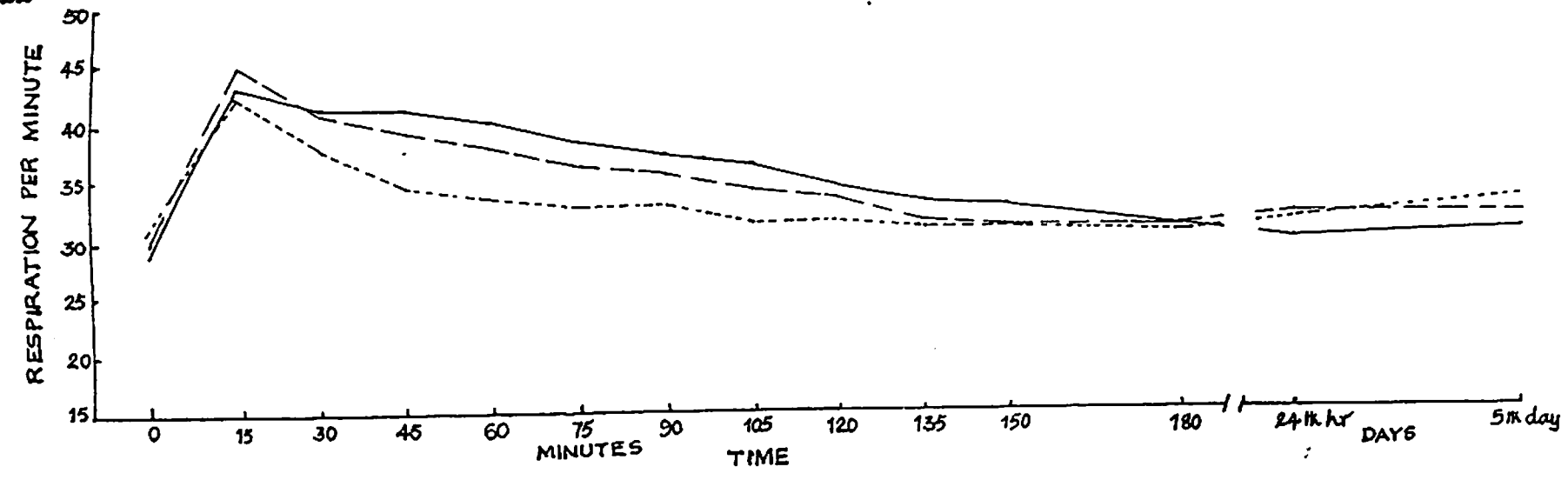


Fig.23. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Total erythrocyte count in ducks (sub-groups A, B and C respectively)

Fig. 24. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Total leukocyte in ducks (sub-groups A, B and C respectively)

Fig.23

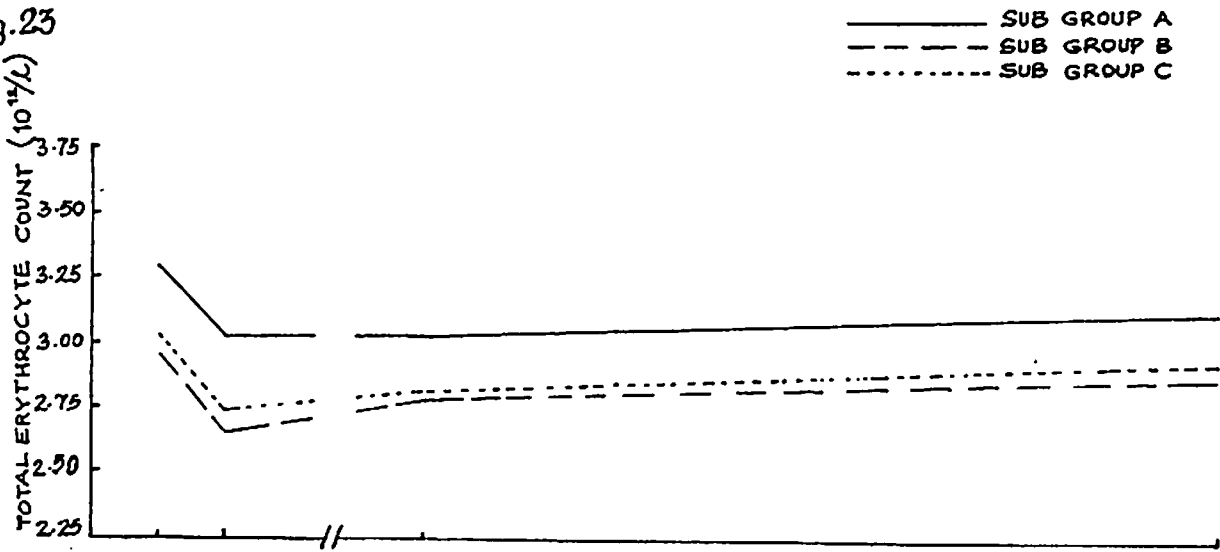
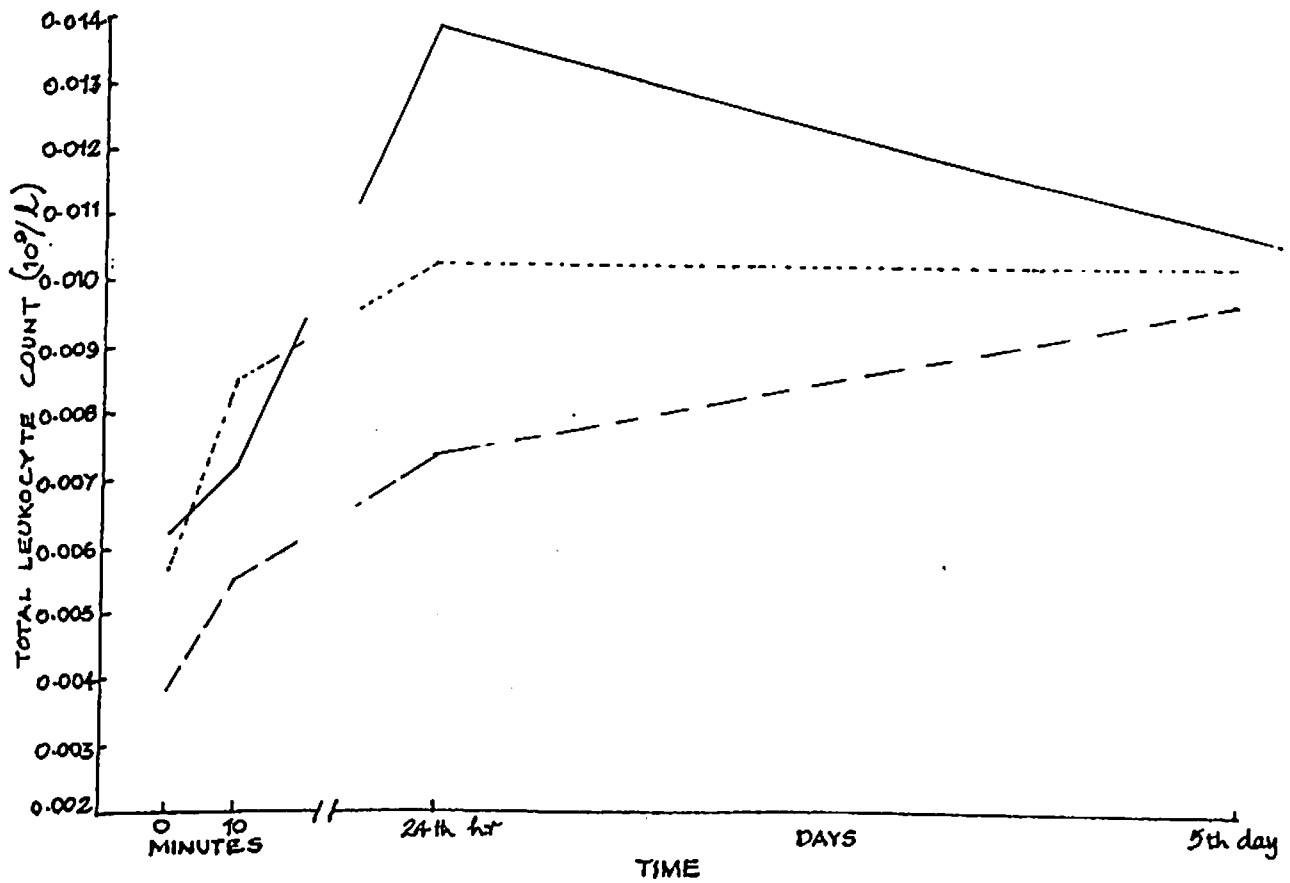


Fig.24





The heterophil count was increased at 10 min. in all the sub-groups and was significant only in sub-group C. Thereafter the count decreased and became near normal by the 5th day in all the sub-groups (Fig. 26).

These observations are in agreement with the earlier observations of Soliman et al. (1965), Nara et al. (1979) and Sharma et al. (1983 a&b) in dogs; Kumar et al. (1974) in sheep, and Pfeil and Duesterberg (1987) in cats.

The eosinophil count recorded a significant increase at the 24th hour in all the sub-groups but decreased gradually by the 5th day (Fig. 27).

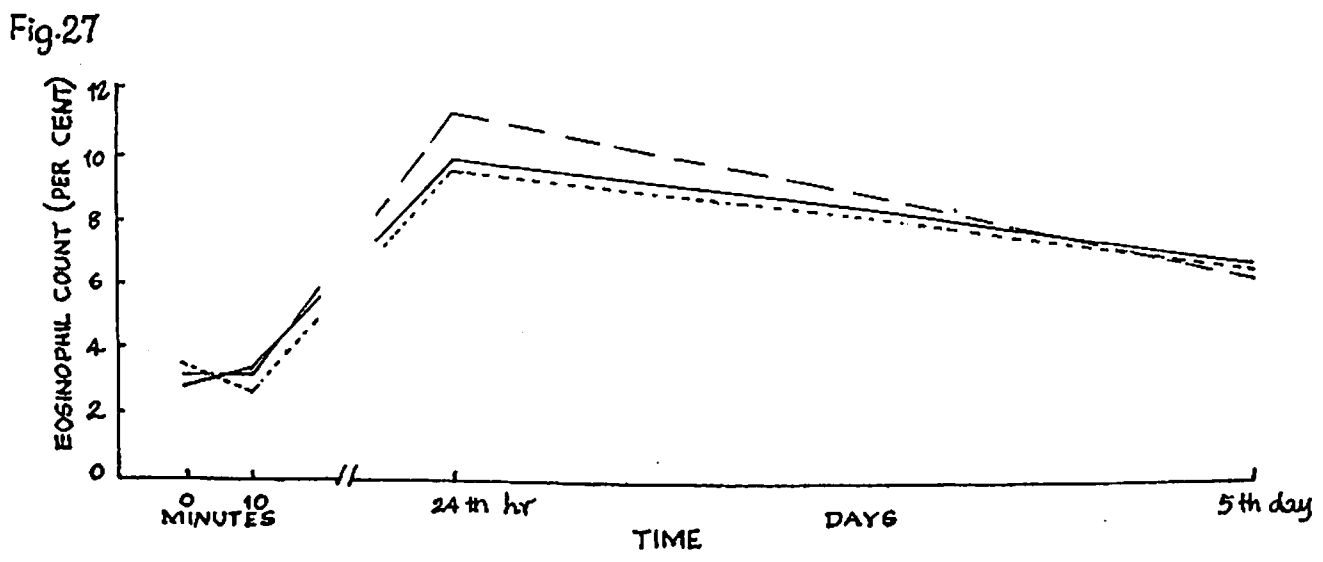
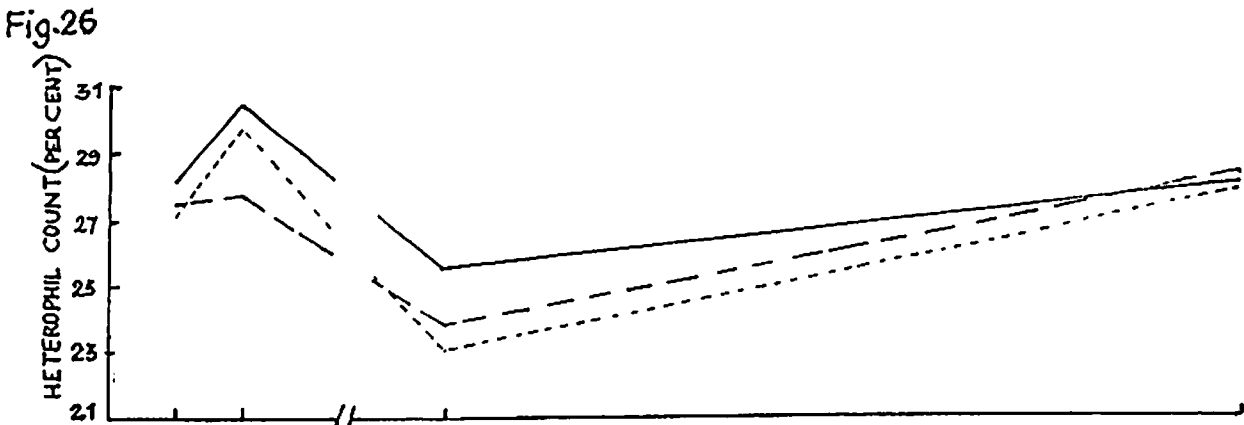
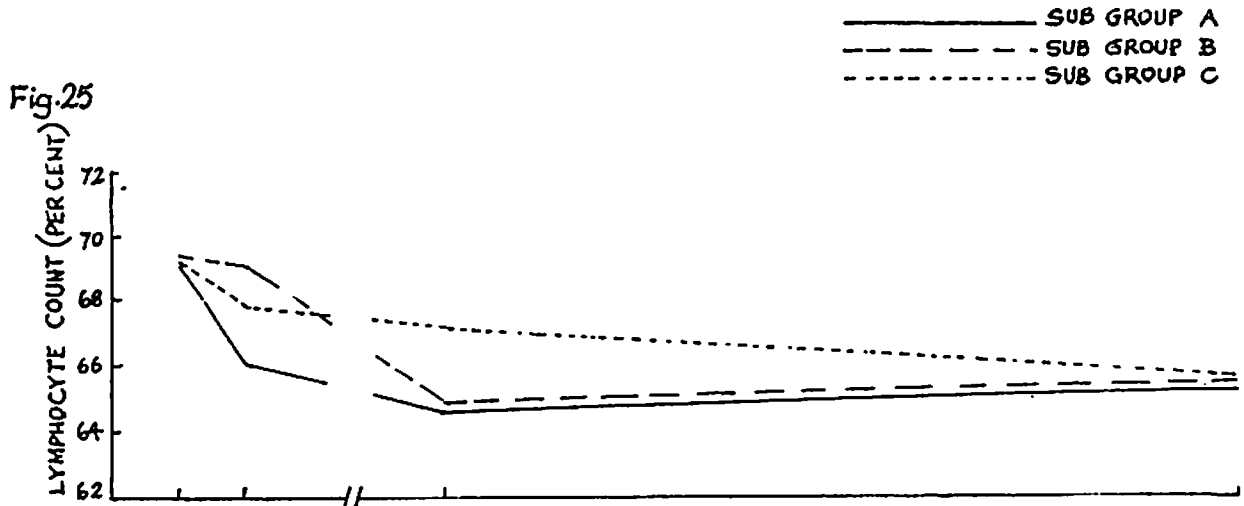
The haemoglobin content was reduced in all the sub-groups and the reduction at 10 min. and the 24th hour was significant in sub-group B (Fig. 28). Reduction in the haemoglobin content had been recorded by Soliman et al. (1965); Nara et al. (1979) and Sharma et al. (1983 a&b) in dogs; Kumar et al. (1974) in sheep, and Pfeil and Duesterberg (1987) in cats.

The erythrocyte sedimentation rate showed increase in all the sub-groups. The increase at the 24th hour was significant in sub-group B (Fig. 29). Soliman et al. (1965) recorded increase in erythrocyte sedimentation rate during barbiturate anaesthesia in dogs.

Fig. 25. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Lymphocyte count in ducks (sub-groups A, B and C respectively)

Fig. 26. Graph showing the effects intraperitoneal administration of Ketamine hydrochloride, Thiopentone, sodium and Ketamine hydrochloride followed by Thiopentone sodium on Heterophil count in ducks (sub-groups A, B and C respectively)

Fig. 27. Graph showing the effects intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Eosinophil count in ducks (sub-groups A, B and C respectively)





The packed cell volume showed gradual reduction upto 24th hour in all the sub-groups (Fig. 30). Earlier observations of Soliman et al. (1965); Nara et al. (1979) and Sharma et al. (1983 a&b) in dogs; and Kumar et al. (1974) in sheep are in agreement with the findings of the present study.

In all the sub-groups no sensation of pain was noticed upon incision on skin, muscles and peritoneum. While in sub-group A, mild degree of struggling was observed on incising the skin. Suturing the peritoneum, muscles and skin did not evoke any painful response.

In all the sub-groups focal areas of congestion were observed on the liver and kidney. Mild degree of inflammatory reaction on the parietal peritoneum was noticed at the point of entry of needle into the peritoneal cavity in sub-group B.

From the results of present study, it could be found that intraperitoneal administration of ketamine hydrochloride at the rate of 100 mg per kg, thiopentone sodium (2.5 per cent solution) at the rate of 15 mg per kg





Fig. 28. Graph showing the effects of intraperitoneal administration of ketamine hydrochloride, thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Haemoglobin content in ducks (sub-groups A, B and C respectively)

Fig. 29. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Erythrocyte sedimentation rate in ducks (sub-groups A, B and C respectively)

Fig. 30. Graph showing the effects of intraperitoneal administration of Ketamine hydrochloride, Thiopentone sodium, and Ketamine hydrochloride followed by Thiopentone sodium on Packed cell volume in ducks (sub-groups A, B and C respectively)

Fig.28

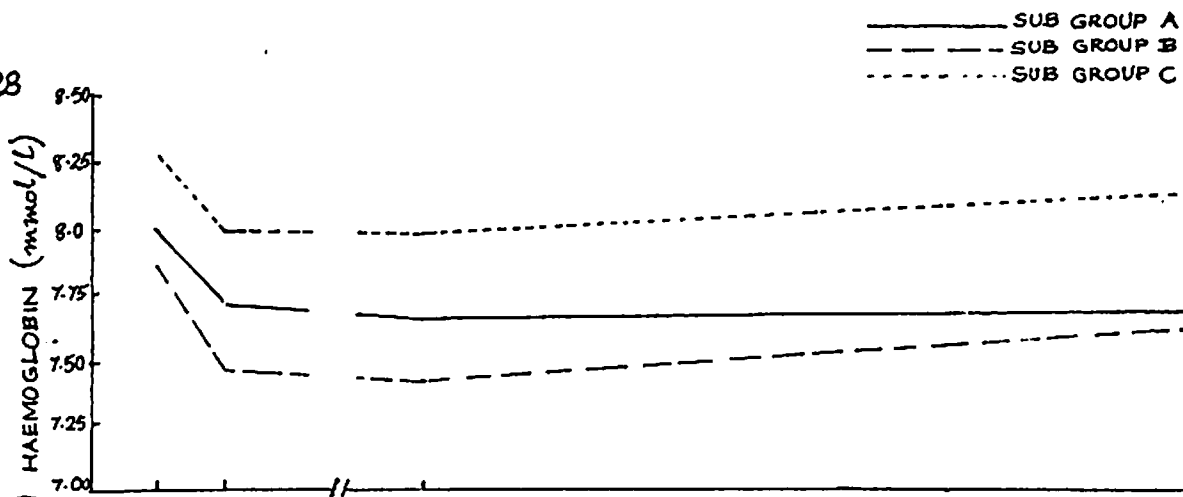


Fig.29

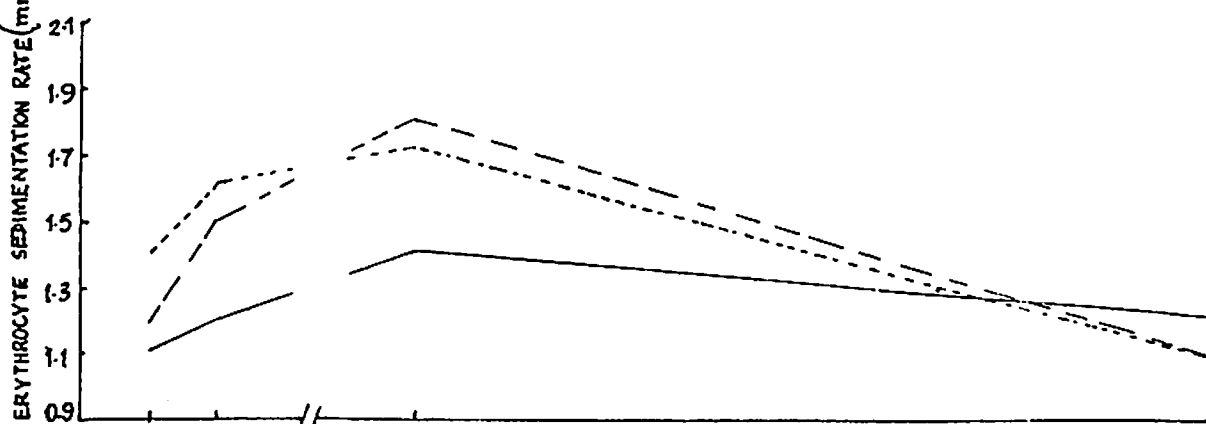
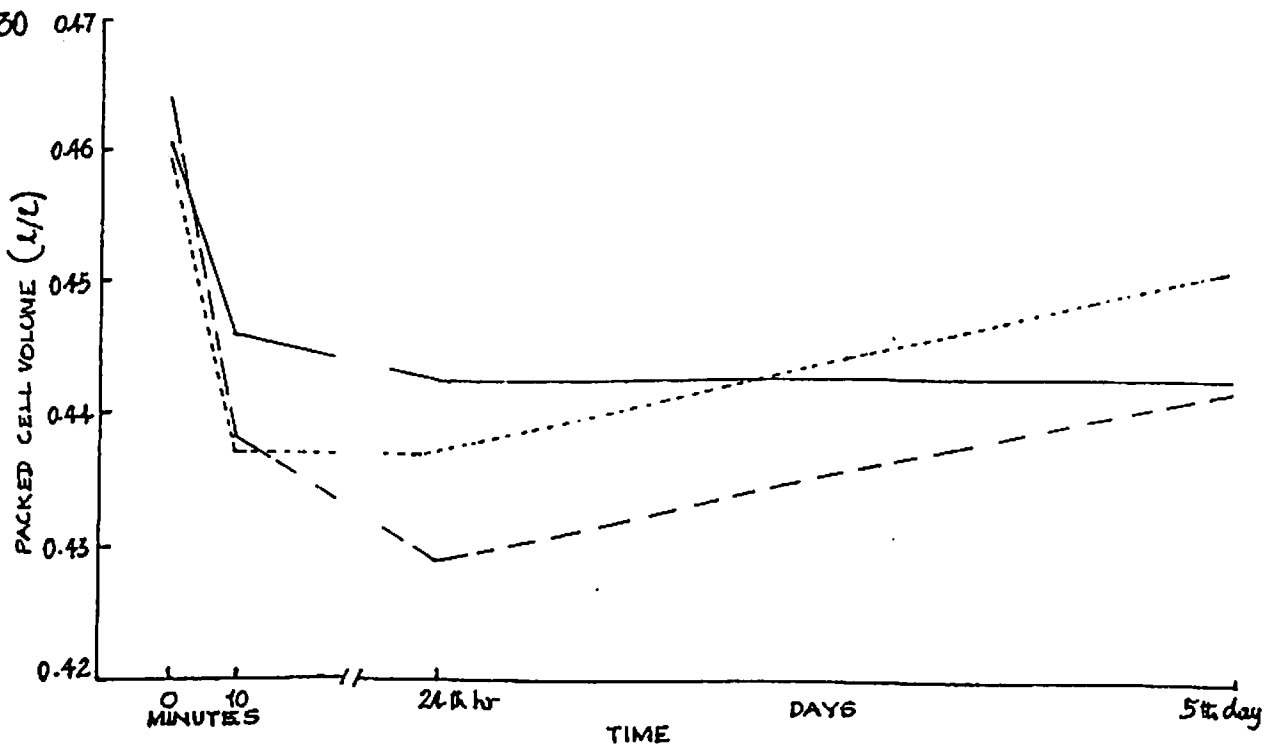


Fig.30



and ketamine hydrochloride at the rate of 50 mg per kg followed by thiopentone sodium (2.5 per cent solution) at the rate of 7.5 mg per kg resulted in satisfactory surgical plane of anaesthesia in chicken and ducks.

For chicken, ketamine hydrochloride is preferred because of the comparatively least time for induction, prolonged duration of anaesthesia and recovery. Post anaesthetic complications were not found. In ducks the duration of anaesthesia was more, when ketamine hydrochloride was administered, but vigorous shaking of the head was seen during the period of recovery. Hence, for ducks, ketamine hydrochloride followed by thiopentone sodium is preferred because of the comparatively least time for induction and satisfactory duration of anaesthesia and recovery.

# Summary

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## SUMMARY

Thirty cocks (Group I) and thirty drakes (Group II) were used for the present study. Groups I and II were divided into three sub-groups viz. A, B and C with ten birds in each. The bodyweight of the birds of group I were  $1.438 \pm 0.058$ ,  $1.440 \pm 0.070$  and  $1.686 \pm 0.051$  kg in sub-groups A, B and C respectively. The bodyweight of the birds of group II were  $2.015 \pm 0.018$ ,  $1.838 \pm 0.037$  and  $1.886 \pm 0.043$  kg in sub-groups A, B and C respectively.

Ketamine hydrochloride at the rate of 100 mg per kg bodyweight was administered in sub-group A, thiopentone sodium (2.5 per cent solution) at the rate of 15 mg per kg in sub-group B, and ketamine hydrochloride at the rate of 50 mg per kg followed by thiopentone sodium (2.5 per cent solution) at the rate of 7.5 mg per kg in sub-group C, in both the trials. The drugs were administered intraperitoneally.

During the onset of anaesthesia, when ketamine hydrochloride was administered, loss of balance, unsteadiness of head, cyanosis of comb and wattles, defaecation and vocalisation were noticed in chicken, but in ducks

defaecation was not present. Ruffled feathers, dropping of wings, fluttering and wagging of tail were noticed as additional symptoms in ducks. When thiopentone sodium was administered, loss of balance, unsteadiness of head, cyanosis of comb and wattles, ruffled feathers and dropping of wings were noticed in chicken, but in ducks vocalisation and fluttering were noticed in addition. When ketamine hydrochloride followed by thiopentone sodium was administered, loss of balance, unsteadiness of head, cyanosis of comb and wattles, dropping of neck and wings, and closing of eyelids were noticed in chicken and ducks. In ducks the onset was very quick. All the birds assumed sternal recumbency followed by lateral recumbency after the onset of anaesthesia.

As the effect of anaesthesia deepened, pedal reflexes were abolished in both the groups. However, other reflexes such as corneal, pupillary, palpebral and reflexes of the third eyelid, comb and wattles were persisting in chicken and ducks. During ketamine hydrochloride anaesthesia eyes were kept open, and when thiopentone sodium or ketamine hydrochloride followed by thiopentone sodium were administered, eyes were kept closed. In ducks, the

reflexes of the third eyelid were abolished when ketamine hydrochloride followed by thiopentone sodium was administered.

The induction was smooth and uneventful in chicken and ducks. The time for induction was  $7.30 \pm 0.53$  min.,  $9.30 \pm 0.38$  min. and  $8.00 \pm 0.58$  min. in sub-groups A, B and C respectively in chicken, and  $9.20 \pm 0.58$  min.,  $10.20 \pm 0.87$  min. and  $4.60 \pm 0.70$  min. in sub-groups A, B and C respectively in ducks. The time for induction was the least in chicken when ketamine hydrochloride was used, and in ducks when ketamine hydrochloride followed by thiopentone sodium was used.

The duration of anaesthesia was  $63.40 \pm 2.16$  min.,  $31.40 \pm 1.82$  min. and  $40.20 \pm 3.99$  min. in sub-groups A, B and C respectively in chicken, and  $35.90 \pm 2.43$  min.,  $18.90 \pm 0.99$  min. and  $20.20 \pm 0.89$  min. in sub-groups A, B and C respectively in ducks. The duration of anaesthesia was maximum when ketamine hydrochloride was administered and minimum when thiopentone sodium was administered in both the groups.

The duration of recovery was  $135.50 \pm 9.24$  min. in sub-group A,  $149.60 \pm 8.32$  min. in sub-group B and  $131.20 \pm 5.10$  min. in sub-group C in chicken, and  $84.50 \pm 7.31$  min. in

sub-group A,  $64.40 \pm 8.33$  min. in sub-group B and  $113.10 \pm 6.15$  min. in sub-group C, in ducks. The duration of recovery was the least when ketamine hydrochloride followed by thiopentone sodium was used in chicken, and when thiopentone sodium was used in ducks. The recovery from anaesthesia was smooth and uneventful in both the groups. Vigorous shaking of the head was seen when ketamine hydrochloride was administered in ducks.

There was reduction in cloacal temperature during anaesthesia. Respiration rate showed an initial rise followed by gradual reduction.

The total erythrocyte count was decreased during anaesthesia. The total leukocyte count was decreased in sub-groups A and B, and increased in sub-group C, in chicken. There was an increase in total leukocyte count in ducks. Lymphocyte count was decreased, but heterophil count and eosinophil count were increased.

There was reduction in haemoglobin content. There was an increase in erythrocyte sedimentation rate except when ketamine hydrochloride was administered in chicken. The packed cell volume was reduced.

There was no response to pain on incising and suturing the skin, muscles and peritoneum except for slight movement while incising the skin during ketamine hydrochloride anaesthesia.

Focal congestion of liver and kidney were noticed on the 5th day. Mild degree of inflammatory reaction on the parietal peritoneum was noticed at the point of entry of the needle wherein thiopentone sodium was administered.

From the results of present study, it could be found that intraperitoneal administration of ketamine hydrochloride at the rate of 100 mg per kg, thiopentone sodium (2.5 per cent solution) at the rate of 15 mg per kg, and ketamine hydrochloride at the rate of 50 mg per kg followed by thiopentone sodium (2.5 per cent solution) at the rate of 7.5 mg per kg resulted in satisfactory surgical plane of anaesthesia in chicken and ducks.

For chicken, ketamine hydrochloride is preferred because of the comparatively least time for induction, prolonged duration of anaesthesia and recovery. Post anaesthetic complications were not found. In ducks the duration of anaesthesia was more, when ketamine hydrochloride was administered, but vigorous shaking of the head was seen during the period of recovery. Hence, for

ducks, ketamine hydrochloride followed by thiopentone sodium is preferred because of the comparatively least time for induction and satisfactory duration of anaesthesia and recovery.

## *References*

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## REFERENCES

- Boever, W.J. and Wright, W. (1975). Use of ketamine for restraint and anaesthesia of birds. Vet. Med. Small Anim. clin., 70 (1): 86-88.
- Borzio, F. (1973). Anaesthesia of wild fowl with ketamine hydrochloride. Vet. Med. Small Anim. clin., 68: 1364.
- Church, L.E. (1957). Combuthal as an anaesthetic for baby chicks. Poult. Sci., 36(4): 788-791.
- Desforges, M.F. and Scott, H.A. (1971). Use of anaesthetics in the Ayelsbury domestic duck. Res. vet. Sci., 12: 596-598.
- Donovan, C.A. (1958). Restraint and anaesthesia of caged birds. Vet. Med., 53: 541-543.
- \*Fretz, V.C. (1932). Anaesthetising poultry. Vet. Med., 27: 109. Cited by Church, L.E. (1957).
- Gandal, C.P. (1956). Satisfactory general anaesthesia in birds. J. Am. vet. med. Ass., 128: 332 - 334.
- Gandini, G.C.M., Keffen, R.H., Burroughs, R.E.J. and Ebedes, H. (1986). An anaesthetic combination of ketamine, xylazine and alphaxalone-alphadolone in ostriches (Struthio camelus). Vet. Rec., 118(26): 729-730.
- \*Harvey, P.B., Kubena, L.F., Lovering, S.L. and Philips, T.D. (1985). Ketamine/xylazine anaesthesia for chicken. Avian Exo. Pract., 2(2): 6 - 7. (Cited in Vet. Bull. (1986), 56(1): Abstr. No. 531).



- \*Heidenreich, M. (1978). Anaesthesia of birds of prey (including owls) with ketamine hydrochloride. Praktische Tierarzt., 59(9): 672 - 680. (Cited in Vet. Bull. (1979), 49(7): Abstr. No. 4169).
- Jordan, F.T.W., Sanford, J. and Wright, A. (1960). Anaesthesia in the fowl. J. comp. Path., 70(1): 437-448.
- \*Klimes, B. (1962). Thiopentone anaesthesia in fowls and ducks. Vet. Cas., 11: 174 - 176. (Cited in Vet. Bull. (1962), 32(9): Abstr. No. 3211).
- Kumar, A. and Sharma, A.K. (1986). Thiopentone sodium with and without xylazine premedication in buffaloes. Indian J. Anim. Sci., 56(10): 1022 - 1029.
- Kumar, A. Thurmon, J.C. and Dorner, J.L. (1974). Haematologic and biochemical findings in sheep given ketamine hydrochloride. J. Am. vet. med. Ass., 165: 284 - 287.
- \* Kummerfeld, N. and Ganter, M. (1986). Anaesthesia of pigeons with ketamine combined with climazolam. Deutsche Veterinar medizinische Gesellschaft. 1 - 18. (Cited in Vet. Bull. (1986), 56(11): Abstr. No.8189).
- Lee, C. (1953). Experimental studies on the actions of several anaesthetics in domestic fowls. Poult. Sci. 32(4): 624 - 627.
- Mandelker, L. (1973). A toxicity study of ketamine hydrochloride in parakeets. Vet. Med. Small Anim. clin., 68 (5): 487 - 488.

- Miale, J.B. (1967). Laboratory Medicine Haematology. The C.V. Mosby Company, Saint Louis, 3rd Ed. pp. 1143-1144.
- Nara, R.R.S., Mathew, E., Panwar, B.S. and Kathuria, J.D. (1979). Ketamine hydrochloride anaesthesia in dog: An experimental study. J. Rem. Vet. Corps , 18 (1): 7-14.
- Natt, P.M. and Herrick, A.C. (1952). A new diluent for counting the erythrocytes and leukocytes of the chicken. Poult. Sci., 31(4): 735-738.
- Neal, L.A., Cluster, R.S. and Bush, M. (1981). Ketamine anaesthesia in pigeons (Columbia livia): arterial blood gas and acid - base status. J. Zoo Anim. Med., 12(2): 48-51.
- \*Pfeil, R. and Duesterberg, J. (1987). Effect of immobilisation with ketamine on the peripheral blood picture of cats. Zeitschrift fur Versuchstierkunde. 29(5/6): 271 - 276. (Cited in Vet. Bull. (1987), 51 (12): Abstr. No. 8122).
- Redig, P.T. and Duke, G.E. (1976). Intravenously administered ketamine and diazepam for anaesthesia of raptors. J. Am. vet. med. Ass., 169 (9): 886 - 888.
- Samour, J.H., Jones, D.M., Knight, J.A. and Howlatt, J.C. (1984). Comparative studies on the use of some injectable anaesthetic agents in birds. Vet. Rec., 115 (1): 6 - 11.
- Sanger, V.L.* and Smith, H.R. (1957). General anaesthesia in birds. J. Am. vet. med. Ass., 131(1): 52-55.

- Sato, K. and Sekiya (1965). Cited by Valsala, K.V. (1968). Reproductive Pathology in the hen. Thesis submitted to the Univesity of Kerala.
- Sharma, A.K., Kumar, A. and Singh, H. (1983 a). Procaine hydrochloride as maintenance agent in thiopental sodium anaesthesia in dogs. Indian J. Anim. Sci., 53 (9): 1002 - 1007.
- Sharma, A.K., Kumar, A. and Singh, H. (1983 b). Chlorpromazine hydrochloride as maintenance agent in thiopental sodium anaesthesia in dogs. Indian Vet. J., 60 (9): 714 - 719.
- Singh, J., Ramakumar, V. and Khalid, M.B. (1988). Repair of compound long bone fractures in birds under ketamine anaesthesia. Indian Vet. J. 65 (7): 632 - 633.
- Snedecor, G.W. and Cochran, W.G. (1967). Statistical Methods. The Iowa State University Press, U.S.A., 6th Ed. pp. 91 - 296.
- Soliman, M.K., Amrousi, S. and Khamis, M.Y. (1965). Influence of tranquilisers and barbiturate anaesthesia on the blood picture and electrolyte of dogs. Vet. Rec., 77 (43): 1256 - 1257.
- \*Warren, D.C. and Scott, H.M. (1935). The time factor in egg formation. Poult. Sci., 14: 195 - 207. Cited by Church, L.E. (1957).
- Wintrobe, M.M. (1961). Clinical Haematology. Lea and Febiger, Philadelphia, 5th Ed. P. 381.

\*Originals not consulted

**A COMPARATIVE STUDY OF  
KETAMINE HYDROCHLORIDE AND THIOPENTONE  
SODIUM ANAESTHESIA IN BIRDS**

By

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**ABSTRACT OF A THESIS**

Submitted in partial fulfilment of the  
requirement for the degree

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## ABSTRACT.

The present study was undertaken to assess the efficacy of (i) ketamine hydrochloride, (ii) thiopentone sodium, and (iii) ketamine hydrochloride followed by thiopentone sodium, for anaesthetising domestic chicken and ducks. Thirty apparently healthy White Leghorn cocks, aged 18 - 20 weeks and weighing 1.120 - 1.920 kg (Group I) and thirty apparently healthy White Pekin drakes, aged 20 - 22 weeks and weighing 1.700 - 2.100 kg (Group II) were used. Group I and II were further divided into three sub-groups, viz., A, B and C consisting of ten birds each.

Ketamine hydrochloride at the rate of 100 mg per kg bodyweight was administered in sub-group A, thiopentone sodium (2.5 per cent solution) at the rate of 15 mg per kg in sub-group B, and ketamine hydrochloride at the rate of 50 mg per kg followed by thiopentone sodium (2.5 per cent solution) at the rate of 7.5 mg per kg in sub-group C, in both the trials. The drugs were administered intraperitoneally.

During the onset of anaesthesia, when ketamine hydrochloride was administered, loss of balance, unsteadiness of head, cyanosis of comb and wattles,

defaecation and vocalisation were noticed in chicken, but in ducks defaecation was not present. Ruffled feathers, dropping of wings, fluttering and wagging of tail were noticed as additional symptoms in ducks. When thiopentone sodium was administered, loss of balance, unsteadiness of head, cyanosis of comb and wattles, ruffled feathers and dropping of wings were noticed in chicken, but in ducks vocalisation and fluttering were noticed in addition. When ketamine hydrochloride followed by thiopentone sodium was administered, loss of balance, unsteadiness of head, cyanosis of comb and wattles, dropping of neck and wings, and closing of eyelids were noticed in chicken and ducks. In ducks the onset was very quick. All the birds assumed sternal recumbency followed by lateral recumbency after the onset of anaesthesia.

As the effect of anaesthesia deepened, pedal reflexes were abolished in both the groups. However, other reflexes such as corneal, pupillary, palpebral and reflexes of the third eyelid, comb and wattles were persisting in chicken and ducks. During ketamine hydrochloride anaesthesia eyes were kept open, and when thiopentone sodium or ketamine hydrochloride followed by thiopentone sodium were administered, eyes were kept

closed. In ducks, the reflexes of the third eyelid were abolished when ketamine hydrochloride followed by thiopentone sodium was administered.

The induction was smooth and uneventful in chicken and ducks. The time for induction was  $7.30 \pm 0.53$  min.,  $9.30 \pm 0.38$  min. and  $8.00 \pm 0.58$  min. in sub-groups A, B and C respectively in chicken, and  $9.20 \pm 0.58$  min.,  $10.20 \pm 0.87$  min. and  $4.60 \pm 0.70$  min. in sub-groups A, B and C respectively in ducks. The time for induction was the least in chicken when ketamine hydrochloride was used, and in ducks when ketamine hydrochloride followed by thiopentone sodium was used.

The duration of anaesthesia was  $63.40 \pm 2.16$  min.,  $31.40 \pm 1.82$  min. and  $40.20 \pm 3.99$  min. in sub-groups A, B and C respectively in chicken, and  $35.90 \pm 2.43$  min.,  $18.90 \pm 0.99$  min. and  $20.20 \pm 0.89$  min. in sub-groups A, B and C respectively in ducks. The duration of anaesthesia was maximum when ketamine hydrochloride was administered and minimum when thiopentone sodium was administered in both the groups.

The duration of recovery was  $135.50 \pm 9.24$  min. in sub-group A,  $149.60 \pm 8.32$  min. in sub-group B and  $131.20 \pm 5.10$  min. in sub-group C, in chicken, and  $84.50 \pm 7.31$  min. in sub-group A,  $64.40 \pm 8.33$  min. in sub-group B and  $113.10 \pm 6.15$  min. in sub-group C, in ducks.

The duration of recovery was the least when ketamine hydrochloride followed by thiopentone sodium was used in chicken, and when thiopentone sodium was used in ducks. The recovery from anaesthesia was smooth and uneventful in both the groups. Vigorous shaking of the head was seen when ketamine hydrochloride was administered in ducks.

There was reduction in cloacal temperature during anaesthesia. Respiration rate showed an initial rise followed by gradual reduction.

The total erythrocyte count was decreased during anaesthesia. The total leukocyte count was decreased in sub-groups A and B, and increased in sub-group C, in chicken. There was an increase in total leukocyte count in ducks. Lymphocyte count was decreased, but heterophil count and eosinophil count were increased.

There was no response to pain on incising and suturing the skin, muscles and peritoneum except for



slight movement while incising the skin during ketamine hydrochloride anaesthesia.

Focal congestion of liver and kidney were noticed on the 5th day. Mild degree of inflammatory reaction on the parietal peritoneum was noticed at the point of entry of the needle wherein thiopentone sodium was administered.

From the results of present study, it could be found that intraperitoneal administration of ketamine hydrochloride, thiopentone sodium, and ketamine hydrochloride followed by thiopentone sodium resulted in satisfactory surgical plane of anaesthesia in chicken and ducks.

For chicken, ketamine hydrochloride is preferred because of the comparatively least time for induction, prolonged duration of anaesthesia and recovery. Post anaesthetic complications were not found. In ducks the duration of anaesthesia was more, when ketamine hydrochloride was administered, but vigorous shaking of the head was seen during the period of recovery. Hence, for ducks, ketamine hydrochloride followed by thiopentone sodium is preferred because of the comparatively least time for induction and satisfactory duration of anaesthesia and recovery.