LOBECTOMY IN GOATS

By

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THESIS

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requirement for the Degree

Master of Veterinary Science

Faculty of Veterinary and Animal Sciences
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Department of Surgery
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1989

To my parents

DECLARATION

I hereby declare that this thesis entitled 'LOBECTOMY IN GOATS' is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship, or other similar title, of any other University or Society.

Mannuthy,
28-4-1989.

(JOHN JOSEPH)

CERTIFICATE

Certified that this thesis entitled 'LOBECTOMY IN GOATS' is a record of research work done independently by Dr. JOHN JOSEPH, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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Introduction

INTRODUCTION

Thoracotomy in veterinary practice is difficult because of the anatomical peculiarities especially of the mediastinum. In some species viz., cattle, sheep and goats, it is imperforate while in dogs it is very thin. Positioning of the animal for thoracotomy also is important. In cattle, if thoracotomy is performed after controlling the animal in a position of lateral recumbency, the lung on the exposed side collapses and the lung on the other side will not be able to meet the tidal air requirements because of orthostatic pressure.

It is necessary to maintain artificial respiration during thoracotomy. Negative pressure in the thoracic cavity is to be ensured at the time of completion of surgery. Suitable physical facilities like endotracheal tubes for the different species, respiratory pumps and facilities for oxygenation are not within the reach of the field veterinarians.

Lobectomy as a surgical treatment is indicated in lung injuries, abscesses and neoplasms. Since it is not a routine procedure, literature on lobectomy in goats is scanty. Moreover goats are considered to be poor risk subjects for general anaesthesia and major surgery. In spite of all the care and meticulous surgery, the chance of survival of the animals is poor.

The present study is undertaken with the objectives of finding out;

i) a suitable anaesthetic procedure for thoracotomy in goats,

ii) feasibility of lobectomy in goats, and

iii) the effect of lobectomy in goats.

Review of Literature

REVIEW OF LITERATURE

Screening the available literature, lobectomy as a surgical procedure in goats could not be found. Hence the available literature pertaining to thoracotomy in other animals has been reviewed.

Lumb *et al.* (1955) removed a neoplastic diaphragmatic lobe, in a canine patient under aurital-ether anaesthesia. A subperiosteal resection of the left sixth rib combined with transection of the seventh, gave access to the thoracic cavity. The vessels were doubly ligated and bronchi sutured using 3/0 catgut.

Fowler *et al.* (1963) performed intrathoracic surgery in forty horses. A combination of ether, nitrous oxide and oxygen was used for anaesthesia and respiration was maintained with positive pressure ventilation. The periosteum was removed from the sixth rib with periosteal elevators and the rib was removed by cutting the dorsal end with an obstetrical saw and disarticulating at the costo-chondral junction. Either No.3 chromic catgut or No.3 braided silk was used to suture the surgical wound. The first layer of sutures was placed in the intercostal muscles. Negative pressure was established in the thorax while applying the final stitches. Fascial layers and the skin were sutured, separately.

Little (1964) did pericardiotomy in a cow after resecting the sixth rib to gain access to the thoracic cavity.

Rubin and Brooks(1964) performed ventriculotomy in twentyone dogs through the midsternal approach. The dogs were anaesthetised with pentobarbital sodium. Oxygen 100% was administered through the endotracheal tube, during surgery.

Petit (1965) advocated rib resection technique for better exposure and less trauma. A continuous suture pattern was adopted for suturing the periosteum as it gave a superior air seal than the interrupted type. Simple interrupted sutures around the adjacent ribs using 1/0 or heavier surgical catgut, along with a continuous suture of the intercostal muscles using 3/0 catgut were employed to close the intercostal incision.

Lawson (1968) reported that intercostal incisions provided less exposure. He advised interrupted sutures around adjacent ribs for intercostal incisions and continuous sutures for periosteal incisions for closing the wound.

Mitchell (1968) reported that in anaesthesia for intrathoracic surgery, it was essential to ventilate the animal along with measures to maintain an adequate cardiac output. Hypovolemia and dehydration must be corrected before the operation.

but the exposure was greater. The most frequently used sites were from the fourth to the ninth intercostal space.

Bojrab (1975) reported that the bronchial stump of pulmonary artery and pulmonary vein must be identified, isolated and doubly ligated with 3/0 catgut or silk during lobectomy.

Clarke (1977) advocated the necessity of having an intravenous infusion system to administer fluids, drugs and anaesthetic agents during thoracotomy. Mechanical ventilation of lungs was also recommended.

Lamb and Butterfield (1977) performed an embolic thoracotomy in pigs. The animals were premedicated with fentanyl, droperidol and atropine and anaesthetised with halothane and nitrous oxide. Positive pressure ventilation was employed during surgery. The fourth to ninth ribs were resected and bent at the costal cartilages to expose the thoracic cavity.

Surgical Anatomy

SURGICAL ANATOMY

Thoracic cavity

The thoracic cavity is bounded dorsally by the first to 13th thoracic vertebrae, the sternum ventrally and 13 pairs of ribs on the lateral aspect. The lateral walls are compressed leaving the cavity a narrow, oval outline from the first to the sixth or seventh rib, the width gradually increasing from the second to the eleventh rib. The thoracic outlet as indicated by the costal attachment of the diaphragm is oblique. The endothoracic fascia is a well developed elastic tissue. The pleura is relatively thick and the pleural sacs are completely seperate. The right pleural sac is considerably larger than the left.

The lungs are paired and occupy much of the space in the thoracic cavity. The right lung is twice as large as the left lung, because it has an extra lobe and a much larger apical lobe. Each lung is invaginated in the ipsilateral pleural sac. It is covered by pulmonary pleura and is free to move in the sac, since it is attached only by its root and pulmonary ligament.

The left lung is divided into an apical lobe and a diaphragmatic lobe by an interlobular fissure. Apical lobe has two parts, a smaller pointed, cranially directed apical portion and a larger three sided ventrally directed cardiac portion. These two portions are partially divided by a small fissure. The pulmonary pleura has a relatively well developed subserous

layer and is continuous with pulmonary interlobular connective tissue.

The trachea bifurcates into the right and the left principal bronchi, after giving off an apical bronchus at the level of the third rib.

The muscles of the thoracic wall are the cutaneous trunci, the external and internal intercostal, rectus thoracis, serratus dorsalis, transverse thoracis, latissmus dorsi and two scalenus muscles.

Blood supply

From the heart, the pulmonary artery transports blood to the lungs. The pulmonary veins return most of the blood from the lungs and pulmonary pleura. The arterial blood supply to the lungs is through the branches of the bronchial artery from the aorta.

The main arterial supply to the thoracic wall is by the thoracodorsal artery, the superior intercostal artery, the internal thoracic artery and dorsal intercostal artery.

Nerve supply

The skin on the lateral thoracic wall and the cutaneous trunci are innervated by the lateral thoracic nerve. The latissmus dorsi is innervated by the thoracodorsal nerve. The serratus ventralis thoracis is innervated by the long thoracic nerve. There are 13 pairs of thoracic nerves, from the spinal cord, supplying the thorax.

Materials and Methods

MATERIALS AND METHODS

The present study was conducted on 24 apparently healthy male goats, aged six to nine months. They were divided into two groups of 12 animals each viz. Group I and Group II.

Of the 12 animals of Group I, in six animals (Group IA) thoracotomy alone was done by left intercostal incision, whereas in the remaining six animals (Group IB) lobectomy also was done by the same approach.

Of the 12 animals of Group II, in six animals (Group IIA) thoracotomy was performed by rib resection technique on the left side, whereas in the remaining six animals (Group IIB) lobectomy also was done by the same approach.

The animals were maintained under identical conditions of feeding and management throughout the period of experiment.

Pre-operative preparations

Food and water were withheld for 24 hours prior to surgery. The left thoracic region from the third to the seventh rib was clipped, shaved, washed, cleaned and liq. Iodi mitis was painted. The animal was controlled in the right lateral recumbency.

At the commencement of the experiment, under local infiltration anaesthesia using 2% solution of lignocaine hydrochloride*, the left jugular vein was exposed to a

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* Xylocaine 2% - Lignocaine hydrochloride - Astra-IDL Ltd., Bangalore, India.

length of two centimeters after incising the skin over the jugular furrow to a length of four centimeters and deflecting the muscles. The vein was ligated at the distal end and was catheterised (Fig. 1 and 2). The tip of the catheter was pushed upto the anterior vena cava and retained therein by a ligature. This catheter was connected to a three way valve, to the dextrose saline infusion set. This served also for the administration of the anaesthetic and for the collection of samples of venous blood.

Blood samples, 10 ml at a time, were collected before anaesthesia, immediately after surgery and on 3rd, 6th and 21st day post-operatively.

Anaesthesia

Anaesthesia was induced by slow intravenous administration of six per cent solution of chloral hydrate, followed by 10 per cent solution of thiopentone sodium. Chloral hydrate was administered at the rate of 1 ml/3 kg body weight. After five minutes, thiopentone sodium was administered till surgical plane of anaesthesia was attained. Further administration of thiopentone sodium, if necessary, was done by instilling it directly into the thoracic cavity.

The animals were intubated. The endotracheal tube was connected to a variable rate variable speed respiration pump. Respiratory rate and stroke volume were adjusted. In case of emergency endotracheal tube was connected to the Boyle's apparatus, and oxygen was administered.

Technique

Group I

Thoracotomy was performed by the intercostal approach, in six animals and these animals served as the control group (Group IA). A skin incision eight centimeter long was made on the left thoracic wall between the fourth and fifth rib cutting through the subcutaneous tissue, the intercostal muscles and the pleura, to expose the thoracic cavity (Fig. 3). The thoracic cavity was kept exposed for 15 minutes i.e. approximately the time required for performing lobectomy.

Three to four interrupted sutures using cotton thread were taken around the fourth and fifth ribs and the thread was secured. The wound edges of the intercostal muscles were sutured using black silk in a continuous fashion and before the knot is made, the lungs were inflated maximally to expel the air from the thoracic cavity. The sutures encircling the ribs were knotted afterwards. The subcutaneous tissue was sutured using silk in continuous fashion. The skin wound was apposed using monofilament nylon with vertical mattress sutures.

The venous catheter was withdrawn and the vein was ligated. The incision on the jugular furrow was closed with interrupted sutures using monofilament nylon.

In six animals i.e. Group IB, thoracotomy was performed

adopting the same technique as above. Lobectomy was performed after exteriorising the cardiac lobe of the lungs (Fig. 4, 5 and 6). The branch of the pulmonary artery to the lobe was ligated first using cotton thread. Then, the vein and the entire bronchus were ligated and transfixed. The lobe was transected distal to the ligature. The cut end was checked for air leaks and haemorrhage. The thoracic cavity was swabbed off blood. The thoracotomy incision was closed as in Group IA (Fig.7).

Group II.

Thoracotomy was performed by the rib resection technique in six animals and these animals served as the control group (Group IIA).

In six animals i.e., Group IIA, a skin incision, 10 centimeters long, was made from just behind the scapula, over the fourth rib upto the costo-chondral junction. The subcutaneous tissue and the muscles were reflected and the periosteum was exposed. A linear incision of 7 to 8 centimeters was made on the periosteum and the periosteum was separated from the rib by blunt dissection (Fig.8). After the separation of periosteum a piece of rib 5 centimeters in length was cut and removed using a rib shear (Fig. 9). The thoracic cavity was then entered by incising the periosteum and the parietal pleura.

The thoracic cavity was kept exposed for 15 minutes,

i.e., approximately the time required for performing lobectomy.

The thoracotomy incision was closed in four layers. The two layers of periosteum were sutured separately using silk in a continuous fashion (Fig. 10). Before tightening the last periosteal suture the lungs were inflated maximally to expel the air from the thoracic cavity and the knots of the periosteal sutures were tightened. The muscles and subcutaneous tissue were sutured with continuous sutures using silk (Fig. 11). The skin wound was apposed by vertical mattress sutures using monofilament nylon (Fig. 12).

The jugular catheter was withdrawn, the vein ligated and the skin incision on the jugular furrow was closed as in group IA.

In six animals i.e., Group IIB, thoracotomy was performed as in Group IIA and lobectomy was performed as in Group IB. The thoracotomy incision was closed as in Group IIA.

Post operative care

The skin wound was sealed with Tr. Benzoin, Chlorphenaramine maleate* (4 mg/kg), analgin** (130 mg/kg) and benzathine penicillin*** (12,00,000 i.u.) were given

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* Avil vet - Chlorphenaramine maleate (22.75 mg/ml) Hoechst India Ltd., Bombay, India.

** Novalgin - Analgin (0.5 g/ml) - Hoechst India Ltd., Bombay, India.

*** Penidure LA 12 - Benzathine Penicillin - 12 lakhs i.u. Geoffrey manners and Company Ltd., Bombay, India.

intramuscularly after the operation. Inhalation using Tr. Benzoin and Ol. Eucalyptus was given daily for the first six days. The skin sutures were removed on the sixth postoperative day. The animals were kept under observation for 21 days.

Parameters recorded

The following parameters were recorded. Temperature, pulse rate and respiratory rate were recorded pre- and post-operatively. The following haematological values were estimated.

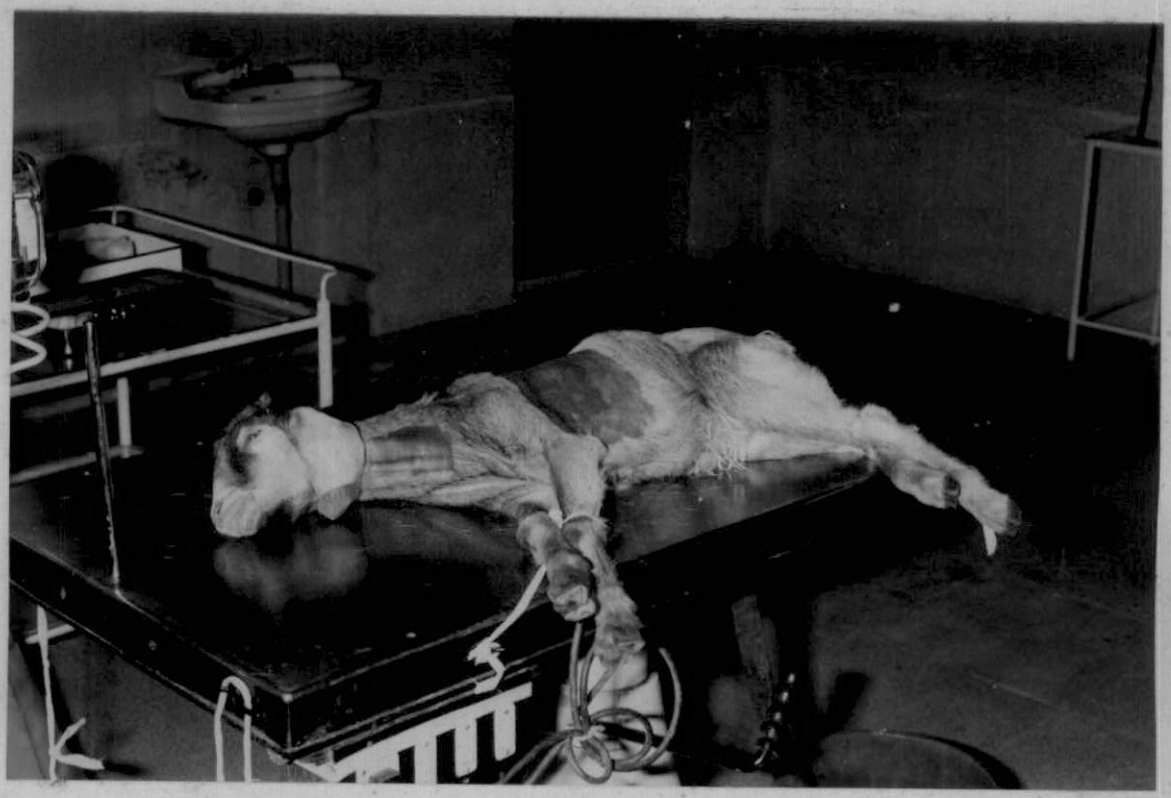
1. ESR employing Wintrobe's method (Wintrobe, 1961). The values were recorded at 24 hrs.
2. Blood pH employing pH meter.
3. Differential leucocyte count (Schalm, 1975).
4. Plasma bicarbonate by the method of Vanslyke (1922).
5. Haemoglobin by the method of Drabkin (1944).
6. Serum chloride by the method of Schales and Schales (1941).

Radiographic examinations of the chest was done immediately after surgery and on the twentyfirst day post-operatively.

The observations were analysed statistically using student's 't' test (Snedecor and Cochran, 1967) and test of significance was done between the pre-operative and the immediate post-operative observations only.

Fig. 1. Goat prepared for thoracotomy and lobectomy

Fig. 2. Goat anaesthetised with endotracheal tube in position. The jugular vein has been catheterised



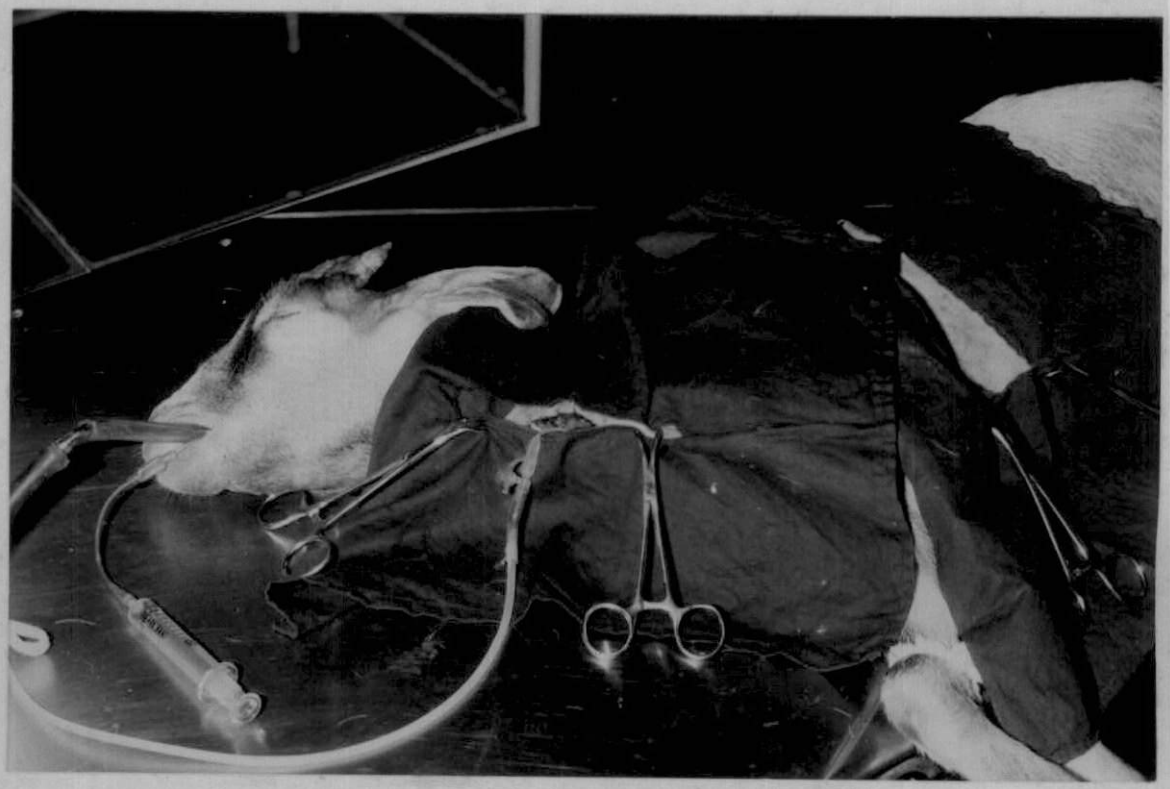


Fig. 3. Thoracotomy through intercostal approach. The muscles and pleura have been divided

Fig. 4. Cardiac lobe of lungs being exposed

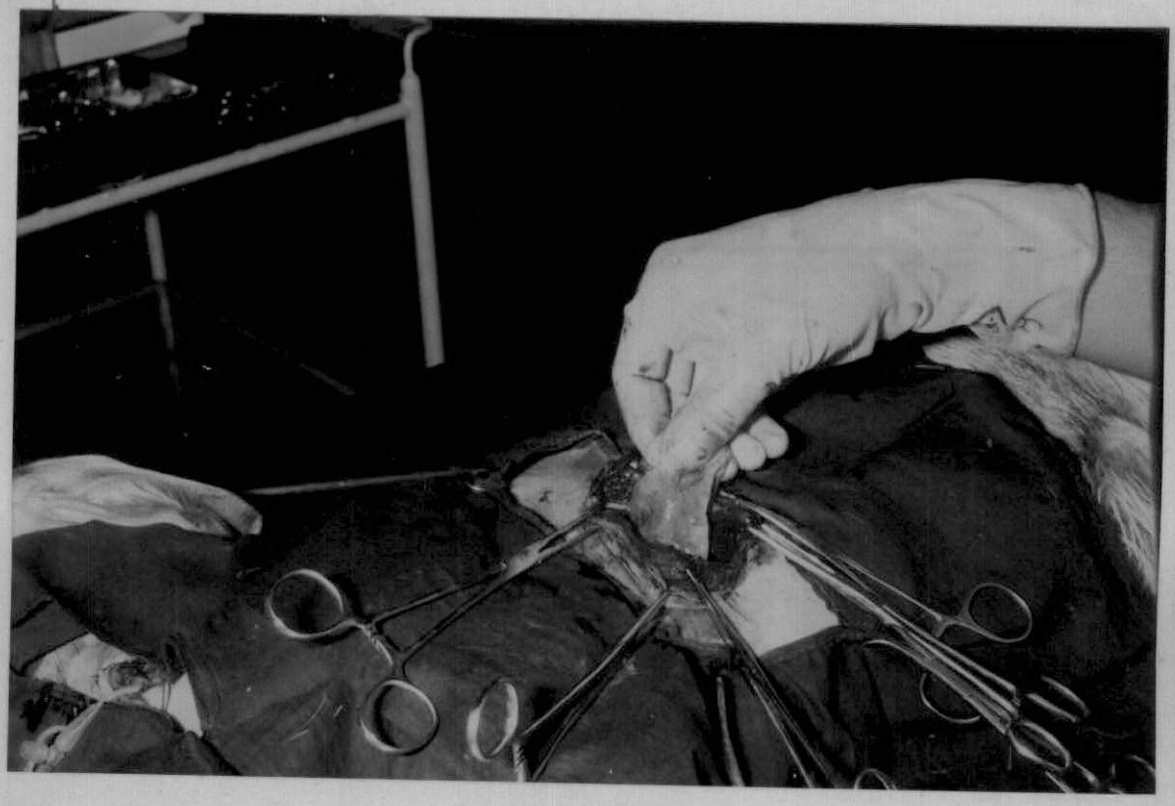
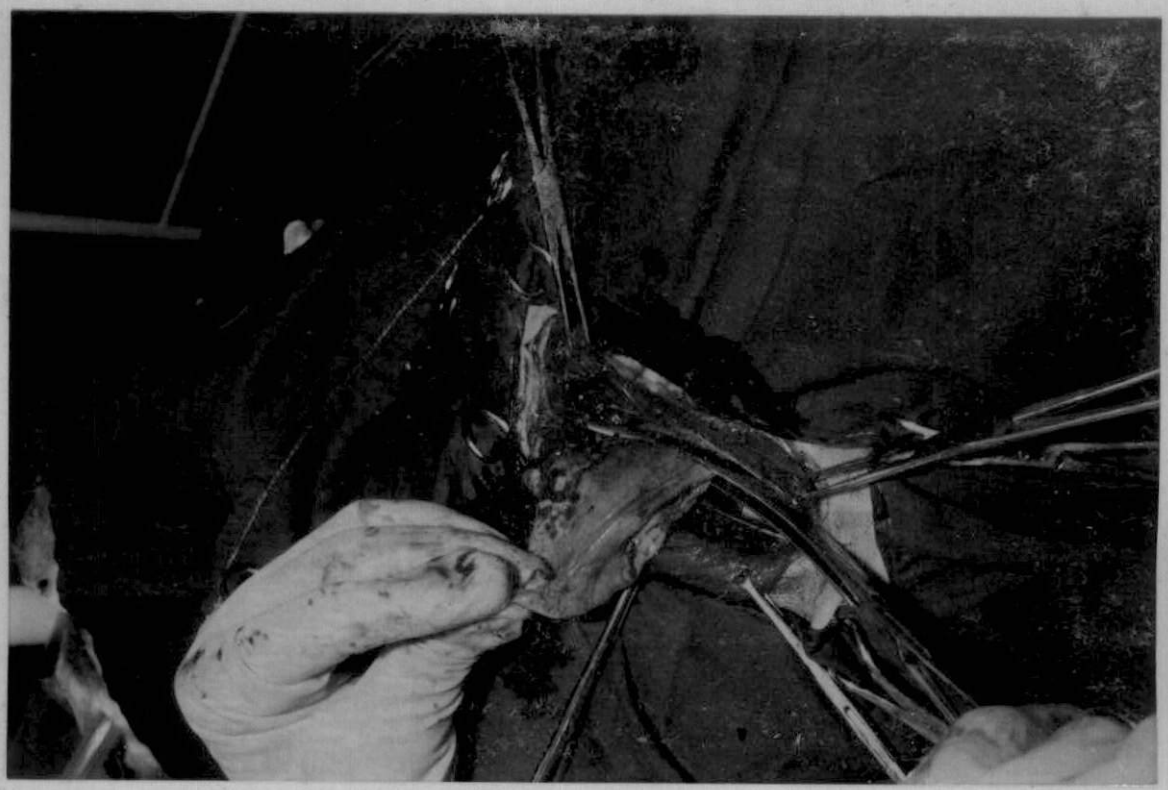


Fig. 5. The exposed lobe being clamped at the base

Fig. 6. The lobe being cut and removed



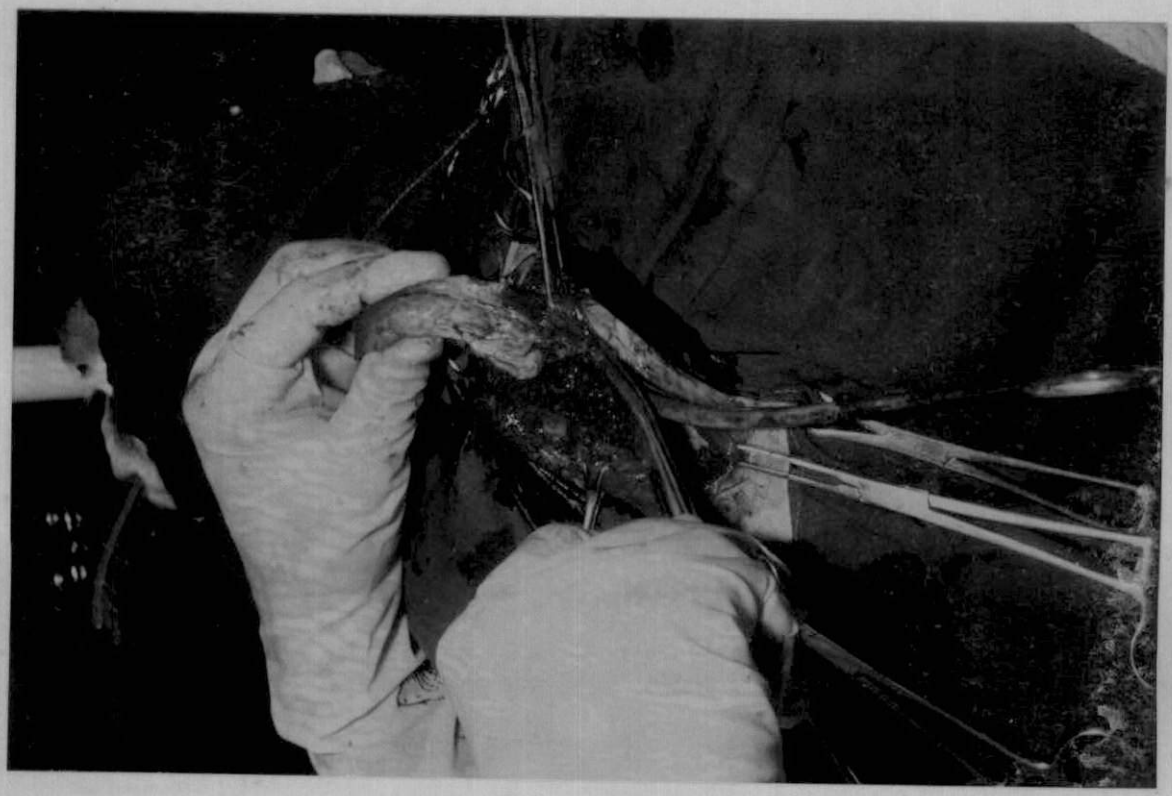
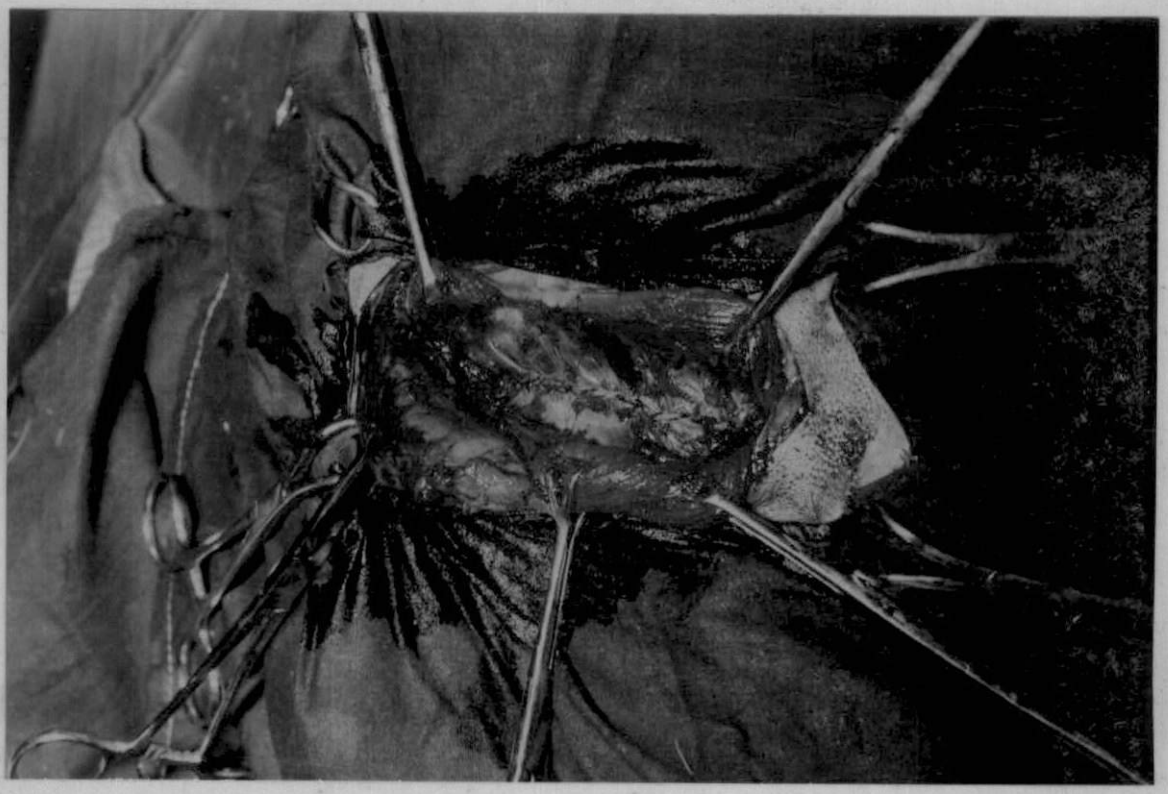


Fig. 7. Intercostal incision after suturing

Fig. 8. Thoracotomy by rib resection technique. After periostectomy, the periosteum has been reflexed to expose the rib



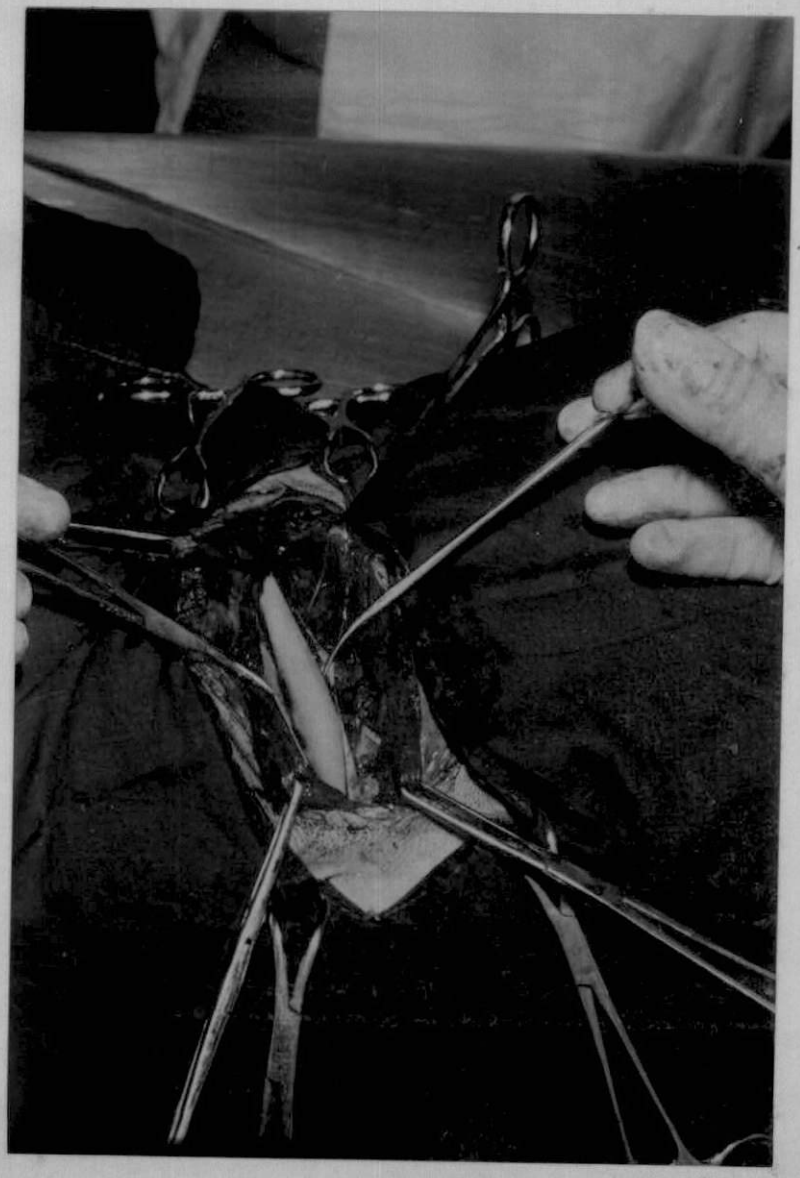
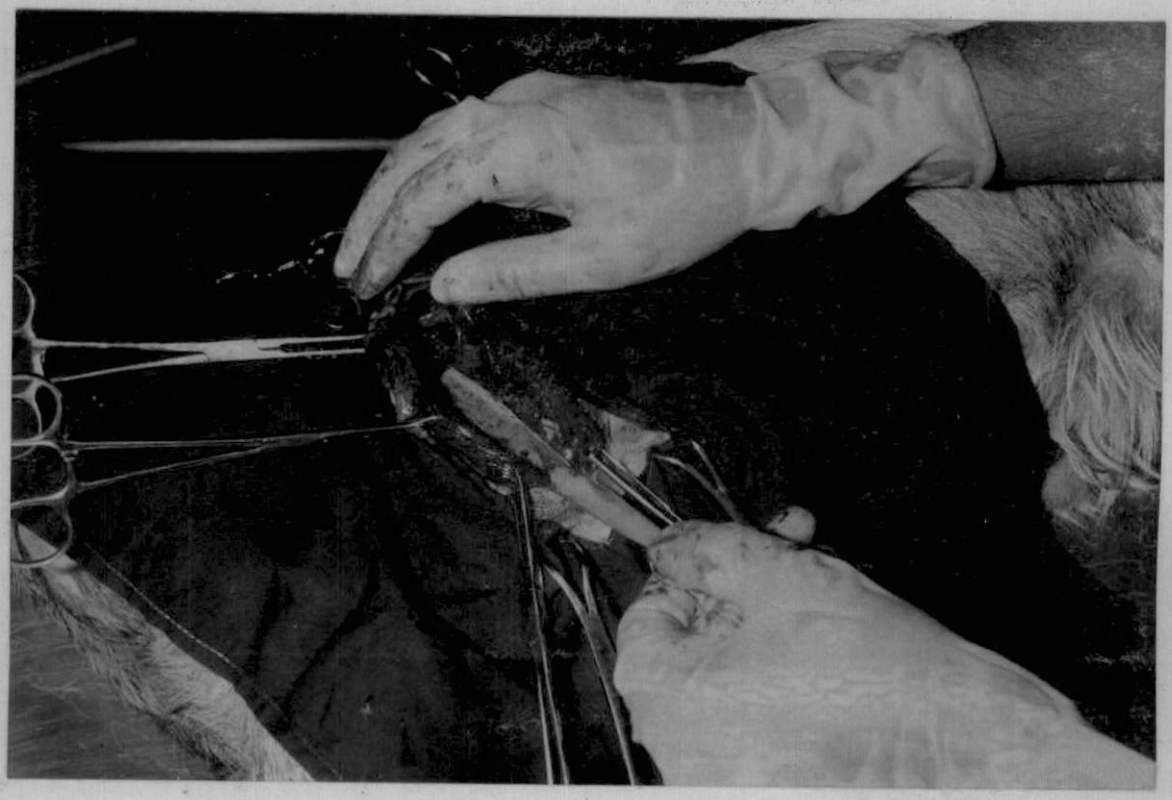


Fig. 9. The exposed rib has been cut and is being detached at the costochondral junction

Fig. 10. The periosteal incision has been sutured



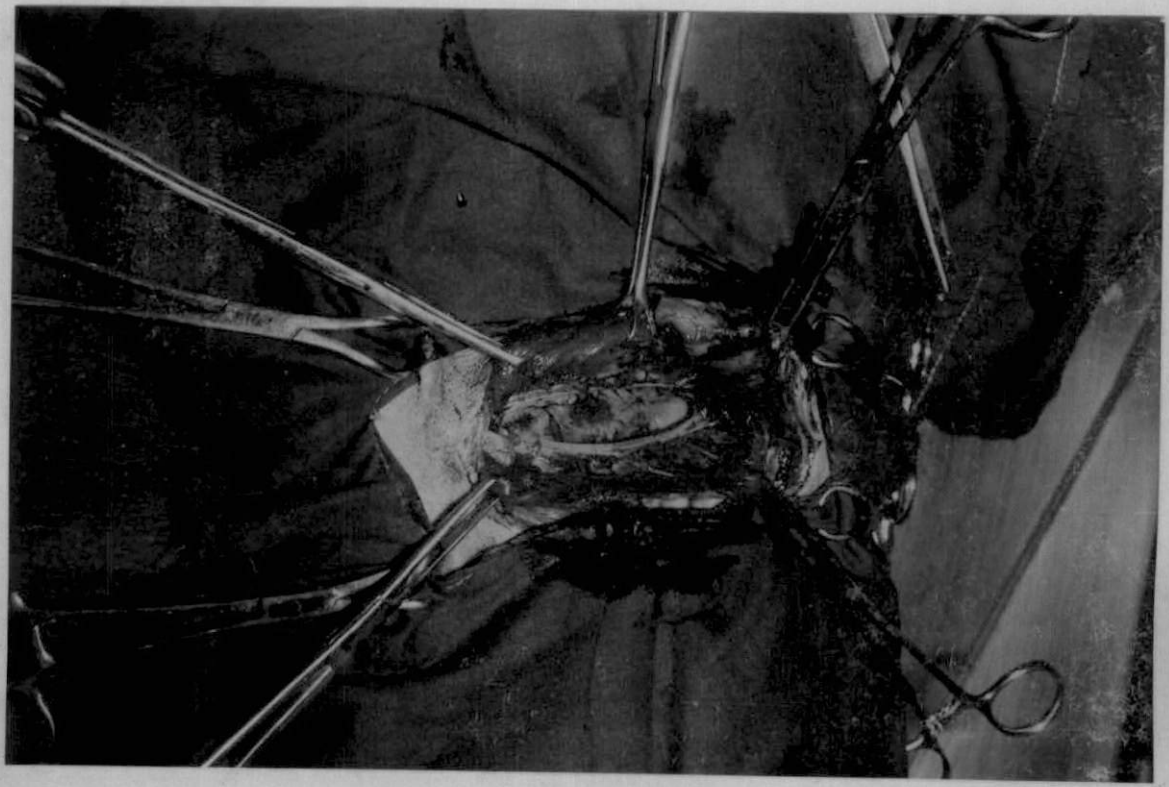
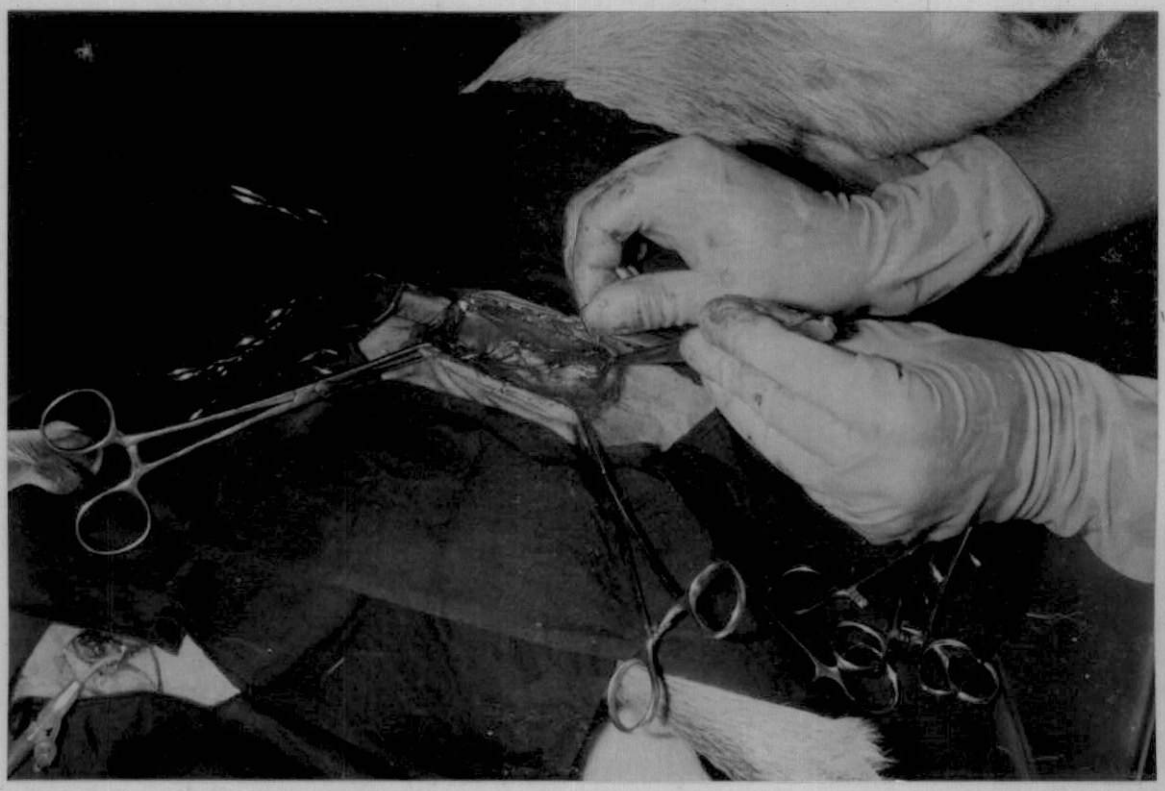


Fig. 11 . The muscles of the thorax is being sutured

Fig. 12. The skin wound after suturing



Results

RESULTS

Anaesthesia

In the present study, intravenous administration of chloral hydrate, 6% solution at the rate of 1 ml/3 kg body weight followed by thiopentone sodium, 10% solution to effect anaesthesia, was found to be satisfactory for the surgical procedure in all the animals. Surgical plane of anaesthesia persisted for about 30 minutes. Incoordinated movements of the head, paddling of legs, rolling on the ground and frequent micturition were also seen during the recovery phase. They could stand up by about $4\frac{1}{2}$ -5 hours but exhibited wobbling gait and slight tympany.

All the animals had bilateral mucous discharge from the nostril and cough for the first 2-3 days except two animals in group I and three in group II. Postoperative oedema was observed at the surgical site in all the animals which subsided by the third day. Animals started taking food and water normally from the second day onwards and slight subcutaneous emphysema was observed in two animals in group I which subsided on fomentation.

Abscesses at the suture site were noticed in four animals of group I and two animals of group II which were cured subsequently.

Group I

Lobectomy by intercostal approach

Rectal temperature (Table 5)

In group IA, the rectal temperature was 38.57 ± 0.28°C before surgery and 37.28 ± 0.30°C after surgery.

In group IB rectal temperature was 39.08 ± 0.11°C before surgery and 37.34 ± 0.23°C after surgery. The reduction was significant in both the groups.

Pulse rate (Table 5)

In group IA, the pulse rate per minute was 105.67 ± 4.79 before surgery and 131.40 ± 10.46 after surgery.

In group IB, the pulse rate per minute was 111.33 ± 5.22 before surgery and 132.00 ± 6.71 after surgery. The increase was significant.

Respiratory rate (Table 5)

In group IA, the respiratory rate per minute was 24.67 ± 0.38 before surgery and 26.40 ± 1.73 after surgery.

In group IB, the respiratory rate per minute was 28.33 ± 1.79 before surgery and 26.60 ± 1.98 after surgery. The variation was only marginal and not significant.

pH of blood (Table 6)

In group IA, the blood pH was 7.16 ± 0.22 before surgery, 7.08 ± 0.05 after surgery, 7.10 ± 0.06 on third day, 7.16 ± 0.03 on the sixth day and 7.19 ± 0.04 on the 21st day.

In group IB, the pH was 7.20 ± 0.03 before surgery, 7.15 ± 0.05 after surgery, 7.17 ± 0.03 on the third day, 7.17 ± 0.03 on the sixth day and 7.21 ± 0.01 on the 21st day. The variations are only marginal and not significant.

Haemoglobin content (Table 7)

In group IA, the haemoglobin content (mmol/l) was 5.93 ± 0.55 before surgery, 4.50 ± 0.43 after surgery, 4.28 ± 0.83 on the third day, 4.72 ± 0.88 on the sixth day and 5.22 ± 1.14 on the 21st day.

In group IB, the haemoglobin content (mmol/l) was 6.18 ± 0.57 before surgery, 4.78 ± 0.63 after surgery, 4.60 ± 0.50 on the third day, 4.82 ± 0.37 on the sixth day and 5.34 ± 0.42 on the 21st day.

Haemoglobin values recorded reduction, though not significant after surgery but reached near normal values by the 21st day.

Serum chloride (Table 8)

In group IA, the serum chloride values (meq/l) were 80.42 ± 0.93 before surgery, 68.97 ± 3.18 after surgery, 76.88 ± 7.23 on the third day, 79.55 ± 0.94 on the sixth day and 81.32 ± 4.09 on the 21st day. The reduction was significant.

In group IB, the serum chloride values (meq/l) were 74.14 ± 1.45 before surgery, 76.92 ± 3.48 after surgery, 76.25 ± 3.58 on the third day, 71.46 ± 1.77 on the sixth day and 75.72 ± 3.15 on the 21st day. The variations were not significant.

Erythrocyte sedimentation rate (ESR) (Table 9)

In group IA, the ESR (mm/24 hours) was 4.50 ± 0.20 before surgery, 8.00 ± 0.94 after surgery, 5.50 ± 0.35 in the third day, 5.00 ± 0.71 on the sixth day and 5.00 ± 0.71 on the 21st day.

In group IB, the ESR (mm/24 hours) was 5.00 ± 0.41 before surgery, 9.20 ± 0.82 after surgery, 6.60 ± 0.46 on the third day, 6.00 ± 0.63 on the sixth day and 5.40 ± 0.46 on the 21st day.

The increase was significant in both the groups.

Plasma bicarbonate (Table 10)

In group IA, the plasma bicarbonate levels (mmol/l) were 34.22 ± 2.07 before surgery, 36.63 ± 2.01 after surgery, 31.20 ± 3.56 on the third day, 35.22 ± 4.98 on the sixth day and 35.22 ± 2.14 on the 21st day.

In group IB, the plasma bicarbonate levels (mmol/l) were 28.68 ± 0.88 before surgery, 30.99 ± 1.85 after surgery, 30.19 ± 1.51 on the third day, 29.79 ± 1.05 on the sixth day and 29.79 ± 0.88 on the 21st day.

Plasma bicarbonate levels showed marginal increase postoperatively but reached near normal values by the 21st day.

Differential leucocytic count

Neutrophils (Table 11):

In group IA, the neutrophil count (per cent) was

44.03 ± 2.48 before surgery, 45.40 ± 2.85 after surgery, 46.50 ± 6.01 on the third day, 48.00 ± 5.66 on the sixth day and 45.00 ± 4.95 on the 21st day.

In group IB, the neutrophil count (per cent) was 39.03 ± 2.14 before surgery, 40.80 ± 1.34 after surgery, 40.80 ± 0.91 on the third day, 41.60 ± 2.07 on the sixth day and 42.20 ± 1.34 on the 21st day.

Lymphocyte (Table 12):

In group IA, the lymphocyte count (per cent) was 54.50 ± 2.75 before surgery, 53.40 ± 2.85 after surgery, 50.50 ± 5.30 on the third day, 52.00 ± 5.66 on the sixth day and 53.00 ± 4.95 on the 21st day.

In group IB, the lymphocyte count (per cent) was 59.03 ± 1.30 before surgery, 58.40 ± 1.43 after surgery, 58.00 ± 1.26 on the third day, 57.40 ± 1.82 on the sixth day and 57.00 ± 0.98 on the 21st day.

Eosinophil (Table 13):

In group IA, the eosinophil count (per cent) was 0.67 ± 0.38 before surgery, 1.20 ± 0.72 after surgery, 3.00 ± 0.71 on the third day, 0.00 ± 0.00 on the sixth day and 2.00 ± 0.00 on the 21st day.

In group IB, the eosinophil count (per cent) was 1.33 ± 1.22 before surgery, 0.80 ± 0.44 after surgery, 1.20 ± 0.72 on the third day, 1.00 ± 0.40 on the sixth day and 0.80 ± 0.72 on the 21st day.

The variations were not significant.

Radiographic findings (Fig. 13)

No changes indicating lobectomy were observed in radiographs. Rotation, sclerosis with vacuolation and mild proliferative changes were apparent on the ribs adjacent to the point of insertion of the suture line. Abscess formation at the suture line was also observed.

Survival rate

When thoracotomy was done by the intercostal approach, two animals survived in group IA and five animals in group IB.

Group II

Lobectomy by the rib resection approach

Rectal temperature (Table 5)

In group IIA, the rectal temperature was 38.80 ± 0.05°C before surgery and 36.96 ± 0.56°C after surgery.

In group IIB, the rectal temperature was 38.68 ± 0.18°C before surgery and 37.47 ± 0.49°C after surgery. The reduction was significant in both the groups.

Pulse rate (Table 5)

In group IIA, the pulse rate per minute was 107.33 ± 4.07 before surgery and 149.60 ± 11.40 after surgery. The variations were significant (P 0.05).

In group IIB, the pulse rate was 102.33 ± 7.56 before surgery and 134.33 ± 8.06 after surgery. The increase was significant in both the groups.

Respiratory rate (Table 5)

In group IIA, the respiratory rate per minute was 26.33 ± 1.79 before surgery and 27.40 ± 3.53 after surgery.

In group IIB, the respiratory rate per minute was 23.67 ± 1.10 before surgery and 25.50 ± 2.64 after surgery.

pH of blood (Table 6)

In group IIA, the pH of blood was 7.12 ± 0.03 before surgery, 7.02 ± 0.05 after surgery, 7.08 ± 0.04 on the third day, 7.16 ± 0.02 on the sixth day and 7.18 ± 0.01 on the 21st day.

In group IIB, the pH of blood was 7.14 ± 0.03 before surgery and 7.02 ± 0.03 after surgery, 7.14 ± 0.05 on the third day, 7.17 ± 0.02 on the sixth day and 7.18 ± 0.00 on the 21st day. The decrease was significant.

Haemoglobin content (Table 7)

In group IIA, the haemoglobin content (mmol/l) was 5.82 ± 0.34 before surgery, 5.04 ± 0.29 after surgery, 4.59 ± 0.34 on the third day, 4.87 ± 0.44 on the sixth day and 5.06 ± 0.42 on the 21st day.

In group IIB, the haemoglobin content (mmol/l) was 5.24 ± 0.21 before surgery, 4.24 ± 0.28 after surgery, 4.76 ± 0.22 on the third day, 4.73 ± 0.09 on the sixth day and 4.72 ± 0.16 on the 21st day. The decrease was significant.

Serum chloride (Table 8)

In group IIA, the serum chloride level (meq/l) was 78.32 ± 0.56 before surgery, 76.97 ± 6.40 after surgery, 71.99 ± 0.31 on the third day, 71.99 ± 1.30 on the sixth day and 76.43 ± 1.89 on the 21st day.

In group IIB, the serum chloride level (meq/l) was 71.99 ± 0.96 before surgery, 70.36 ± 3.32 after surgery, 76.21 ± 2.82 on the third day, 70.55 ± 4.33 on the sixth day and 78.66 ± 4.76 on the 21st day.

The variations were not significant in both the groups.

Erythrocyte sedimentation rate (ESR) (Table 9)

In group IIA, the ESR (mm/24 hr) was 3.67 ± 0.30 before surgery, 6.80 ± 0.33 after surgery, 4.75 ± 0.41 on the third day, 4.25 ± 0.54 on the sixth day and 4.00 ± 0.61 on the 21st day.

In group IIB, the ESR (mm/24 hr) was 4.17 ± 0.28 before surgery, 7.67 ± 0.61 after surgery, 5.00 ± 0.35 on the third day, 5.00 ± 0.50 on the sixth day and 4.50 ± 0.25 on the 21st day.

There was significant increase in the ESR values after surgery but showed a decreasing trend by the third day and reached near normal values by the 21st day in both the groups.

Plasma bicarbonate (Table 10)

In group IIA, the plasma bicarbonate level (meq/l) was 29.85 ± 2.09 before surgery, 34.61 ± 2.98 after surgery, 30.69 ± 0.83 on the third day, 31.20 ± 0.87 on the sixth day and 29.69 ± 1.10 on the 21st day.

In group IIB, the plasma bicarbonate level (meq/l) was 28.51 ± 1.80 before surgery, 32.20 ± 1.96 after surgery, 28.42 ± 1.75 on the third day, 28.68 ± 1.10 on the sixth day and 30.69 ± 0.83 on the 21st day.

Plasma bicarbonate level showed marginal increase post-operatively but reached near normal values by the 21st day in both the groups.

Differential leucocyte count

Neutrophil (Table 11):

In group IIA, the neutrophil count (per cent) was 35.00 ± 2.47 before surgery, 35.00 ± 3.92 after surgery, 34.25 ± 2.56 on the third day, 34.00 ± 2.42 on the sixth day and 34.00 ± 2.55 on the 21st day.

In group IIB, the neutrophil count (per cent) was 43.67 ± 1.50 before surgery, 44.00 ± 2.03 after surgery, 42.50 ± 2.66 on the third day, 42.00 ± 2.37 on the sixth day and 38.75 ± 3.99 on the 21st day.

Lymphocyte (Table 12):

In group IIA, the lymphocyte count (per cent) was 62.83 ± 2.95 before surgery, 63.80 ± 3.88 after surgery,

63.75 ± 2.88 on the third day, 62.25 ± 3.13 on the sixth day and 64.50 ± 2.77 on the 21st day.

In group IIB, the lymphocyte count (per cent) was 55.17 ± 1.55 before surgery, 55.00 ± 1.51 after surgery, 57.00 ± 2.37 on the third day, 57.00 ± 2.45 on the sixth day and 61.00 ± 3.77 on the 21st day.

Eosinophil (Table 13):

In group IIA, the eosinophil count (per cent) was 3.17 ± 0.98 before surgery, 1.20 ± 1.07 after surgery, 2.00 ± 0.61 on the third day, 3.75 ± 1.43 on the sixth day and 1.50 ± 0.83 on the 21st day.

In group IIB, the eosinophil count (per cent) was 1.17 ± 0.60 before surgery, 1.00 ± 0.62 after surgery, 0.50 ± 0.43 on the third day, 1.00 ± 0.35 on the sixth day and 0.25 ± 0.22 on the 21st day.

The variations were not significant.

Radiographic findings

Proliferative changes were observed at the cut ends of the ribs, and over the zone of periosteum, by the third week (Fig. 14 and 15). No change indicating lobectomy was observed in radiographs.

Survival rate.

When thoracotomy was done by the rib resection technique four animals survived in group IIA (Table 3) and four in group IIB (Table 4).

Table 1. Clinical observations

Group IA - Thoracotomy by intercostal incision

Sl.No.	Symptoms	Survival
1	Incordination of movements of the head - paddling of limbs - slight tympany - frequent micturition - bilateral nasal discharge - did not stand up.	Did not recover from anaesthesia - died after 24 hours of operation.
2	Incordination of movements of the head - paddling of limbs - slight tympany - frequent micturition - bilateral nasal discharge - did not stand up.	Did not recover from anaesthesia - died after 24 hours of operation.
3	Incordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - bilateral nasal discharge - occasional cough - stitch abscesses.	Survived
4	Incordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema.	Could stand up but died on the second day.
5	Died immediately after the operation.	Died
6	Incordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - bilateral nasal discharge - cough.	Survived

Table 2. Clinical observations

Group IB - Thoracotomy by intercostal incision and lobectomy

Sl.No.	Symptoms	Survival
1	Incordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - bilateral nasal discharge with occasional cough - diarrhoea which was cured by third day on treatments - subcutaneous emphysema of the left thoracic wall near the site of operation	Survived
2	Incordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - bilateral nasal discharge with occasional cough - diarrhoea which cured on treatment by the third day - subcutaneous emphysema of the thoracic wall on the left thoracic wall	Survived
3	Animal died during operation	Died
4	Incordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - bilateral nasal discharge with occasional cough - suture abscesses which got cured on treatment.	Survived

(contd.)

Cl.No.	Symptoms	Survival
5	Incoordination of movements of the head - paddling of limbs - frequent micturition - wobbling gait - slight tympany - post-operative oedema - bilateral nasal discharge with occasional cough - suture abscesses without wound dehiscence which cured on treatment	Survived
6	Incoordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema and bilateral serous nasal discharge with occasional cough.	Survived

Table 3. Clinical observations

Group IIA. Thoracotomy by rib resection technique

Sl.No.	Symptoms	Survival
1	Incoordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - bilateral nasal discharge with occasional cough.	Survived
2	Incoordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - diarrhoea which cured by third day on treatment.	Survived
3	Incoordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - diarrhoea which cured by the third day on treatment.	Survived
4	Incoordination of movements of the head - paddling of limbs - frequent micturition - slight tympany.	Died during the period of recovery
5	Animal died during operation	Died
6	Incoordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - bilateral serous - nasal discharge with occasional cough.	Survived

Table 4. Clinical observations

Group XIB. Thoracotomy by rib resection technique and lobectomy

Sl.No.	Symptoms	Survival
1	Incordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - bilateral nasal discharge with occasional cough - suture abscesses - no wound dehiscence.	Survived
2	Incordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema at the operated site - bilateral nasal discharge with occasional cough - suture abscesses - no wound dehiscence.	Survived
3	Incordination of movements of the head - paddling of limbs - frequent micturition - slight tympany - wobbling gait - post-operative oedema - recovery from anaesthesia not complete.	Animal died on second day
4	Incordination of movements of the head - paddling of limbs - frequent micturition - wobbling gait - slight tympany - post-operative oedema - suture abscesses which cured on treatment	Survived
5	Slight tympany - paddling of limbs - animal died during recovery from anaesthesia.	Died during the phase of recovery

(contd.)

Sl.No.	Symptoms	Survival
6	Incoordination of movements of the head - paddling of limbs - frequent micturition - wobbling gait - slight tympany - post-operative oedema at the site of operation - bilateral nasal discharge with occasional cough.	Survived

Fig. 11. Radiograph of thorax after thoracotomy and lobectomy by intercostal approach

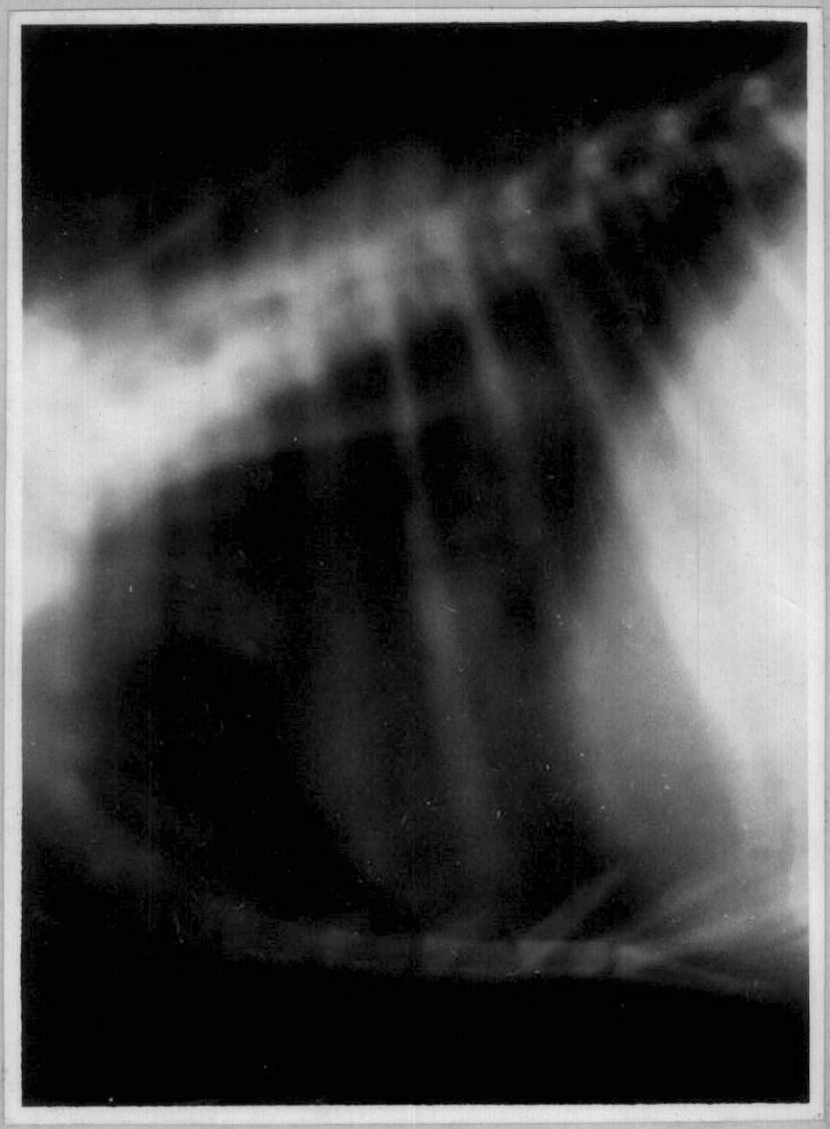


Fig. 14. Radiograph of thorax after thoracotomy and lobectomy by rib resection technique. Cut end of the rib is marked.

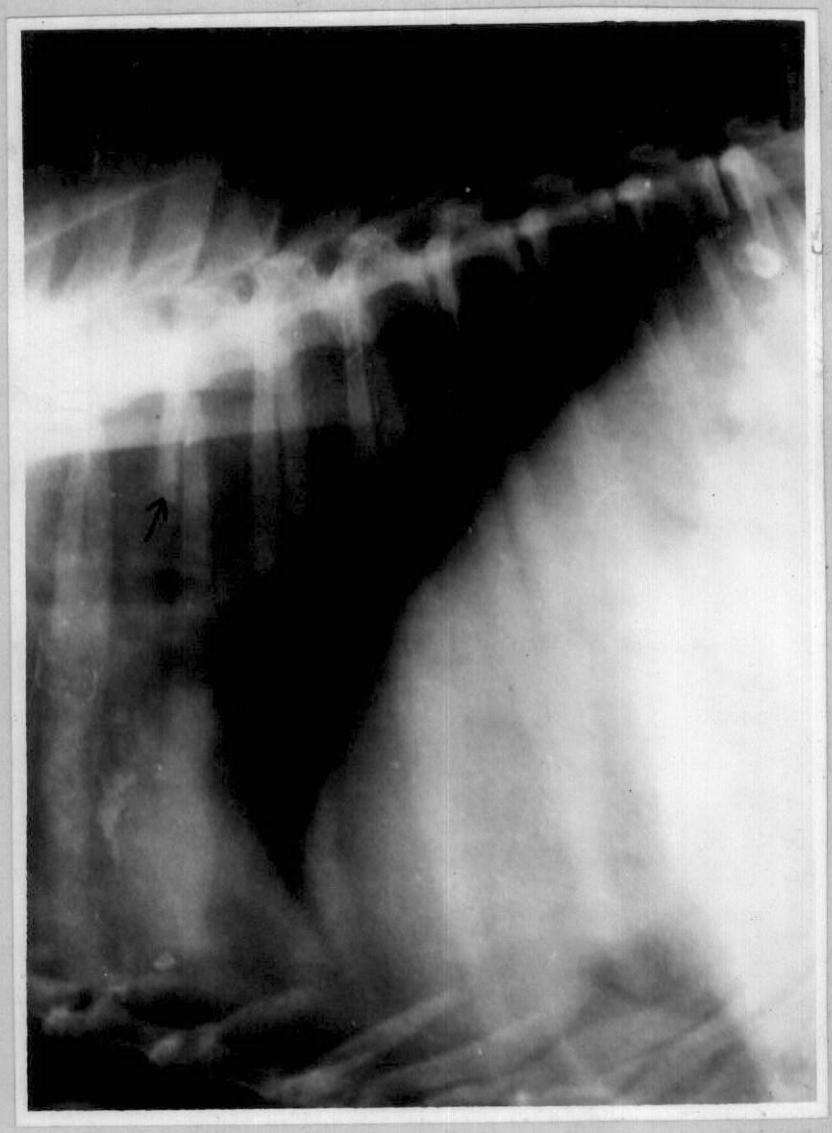


Fig. 15. Radiograph of thorax after thoracotomy and lobectomy by rib resection technique. Proliferation of periosteum and new bone formation are seen

Discussion

DISCUSSION

Anaesthesia

For thoracotomy in canine patients, Lamb et al. (1955) advocated ether anaesthesia while Cordon (1973) suggested hypothermia, Rubin and Brooks (1964) suggested pentothal sodium, Krishnamoorthy and Angelo (1971) suggested nembutal anaesthesia.

In horses a combination of ether, nitrous oxide and oxygen with positive pressure ventilation was recommended by Fowler et al. (1963).

In calves while Donawick et al. (1969) recommended halothane alone, Gates et al. (1971) recommended halothane and 10% thiamylal sodium.

In pigs, Lamb and Butterfield (1977) suggested premedication with fentanyl, droperidol and atropine and anaesthesia with halothane and nitrous oxide under positive pressure ventilation.

In the present study, anaesthesia was induced by using chloral hydrate and thiopentone sodium. Positive pressure ventilation was maintained during thoracotomy.

In the present study cotton thread was used for the ligation of bronchial stump and for sutures to fix the adjacent ribs, silk for the closure of the periosteal/intercostal incisions and monofilament nylon for the skin wound. Abscesses were noticed at the suture line in five

animals. Wound dehiscence was not observed in any of the animals.

For thoracotomy the suture materials recommended by the previous workers were chromic catgut or braided silk (Fowler et al., 1963); catgut (Petit, 1965); cotton and black silk (Krishnamoorthy and Angelo, 1971) and catgut or silk (Bojrab, 1975).

In the present study continuous sutures were inserted for the closure of pericosteal and the intercostal muscles and interrupted sutures around the adjacent ribs.

Petit (1965) adopted continuous suture pattern for suturing the periosteum and simple interrupted sutures around the adjacent ribs along with continuous sutures for intercostal muscles; while Lawson (1968) advised interrupted sutures around adjacent ribs and continuous sutures for periosteal incisions.

Bilateral nasal discharge with slight cough was observed in all the animals except two animals in Group IA.

Rectal temperature

There was reduction in the rectal temperature following thoracotomy which was significant in all the groups, except when lobectomy was performed by rib resection technique. This is in agreement with the observations of Gates et al. (1971), and Krishnamoorthy and Angelo (1971).

Pulse rate

There was an increase in the pulse rate postoperatively in all the groups which was significant in all the groups except in Group IA. This is in agreement with the observation of Krishnamoorthy and Angelo (1971) while Gates et al. (1971) recorded a reduction in the pulse rate postoperatively.

Respiratory rate

The respiratory rate was fluctuating, but within the normal range and variations were not significant.

These observations are in agreement with the observations of Gates et al. (1971) and Krishnamoorthy and Angelo (1971).

pH of blood

There was reduction in blood pH immediately after thoracotomy but increased to near normal values by the third day. However, when lobectomy was done by the rib resection technique the reduction in blood pH was significant.

This is in agreement with the observations of Gates et al. (1971).

Haemoglobin content

Haemoglobin content recorded a reduction immediately after surgery and also postoperatively which reached near normal values by the 21st day. When lobectomy was done by the rib resection technique the reduction in haemoglobin content was significant.

Serum chloride

Variations in serum chloride values were not significant except when thoracotomy was performed by intercostal approach.

Erythrocyte sedimentation rate

The increase in the ESR value immediately after operation was significant which showed a decreasing trend by the third day and reached near normal values by the 21st day.

Plasma bicarbonate

Plasma bicarbonate level showed marginal increase postoperatively but reached near normal values by the 21st day. Gates et al. (1971) had reported an increase in the P Co_2 level following thoracotomy.

Differential count

Differential leucocyte count did not show any significant variation.

Survival rate

When thoracotomy was performed by the intercostal approach i.e., Group IA, only two animals survived. In Group IB, wherein lobectomy was performed through the intercostal incision five animals out of six survived.

In Group II, when thoracotomy was performed by rib resection, four out of six animals survived in both the control and in the lobectomised group.

In the present study, for anaesthesia, intravenous administration of chloral hydrate 6 per cent solution followed by thiopentone sodium .5 per cent solution to

effect and maintenance of positive pressure ventilation during surgery, was found satisfactory.

Rib resection technique requires careful separation of the periosteum which is a delicate surgical procedure, while intercostal incision is simple, easy and may necessitate the ligation of one or more bleeding points. Suturing the periosteum can be done easily while it is more time consuming after the intercostal incision because of tying up of adjacent ribs.

From the results of the present study, it appears that neither the intercostal approach nor the rib resection technique for lobectomy in goats has any special advantage while considering the rate of survival. It was also found that lobectomy in goats does not interfere with the function of lungs.

Summary

SUMMARY

The present study was conducted on 24 apparently healthy, male goats, aged six to nine months. They were divided into two groups of 12 animals each viz., Group I and Group II.

In Group I, thoracotomy alone was performed by left intercostal incision in six animals (Group IA), while thoracotomy and lobectomy were done in six animals (Group IB).

In Group II, thoracotomy alone was performed by rib resection technique in six animals (Group IIA), while thoracotomy and lobectomy were done in six animals (Group IIB).

Administration of chloral hydrate 6 per cent solution at the rate of 1 ml per 3 kg body weight, followed by thiopentone sodium 2.5 per cent solution, with positive pressure ventilation had given satisfactory anaesthesia for the surgical procedure. The anaesthetic effect persisted for about 30 minutes though the animals were recumbent for 4½ to 5 hours. During the recovery phase, incoordination of movements of the head, paddling of legs, rolling on the ground and frequent micturition were seen.

Nasal discharge and cough were observed post-operatively.

Suture materials used for thoracotomy operations were, cotton for ligation of the bronchial stump and for the ribs, silk for periosteal/intercostal and monofilament nylon for the skin incisions. Continuous sutures were inserted for

six animals in the control as well as lobectomised group survived when thoracotomy was performed by rib resection technique.

From the results of the present study, it appears that neither the intercostal approach nor the rib resection technique for lobectomy in goats has any special advantage while considering the rate of survival. It was also found that lobectomy in goats does not interfere with the function of lungs.

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LOBECTOMY IN GOATS

By

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ABSTRACT OF A THESIS

submitted in partial fulfilment of the
requirement for the Degree

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Mannuthy, Trichur

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ABSTRACT

The present study was undertaken with the objectives of finding out a suitable anaesthetic procedure for thoracotomy, feasibility and the effects of lobectomy in goats.

The study was conducted on 24 apparently healthy, male goats, aged six to nine months. They were divided into two groups of 12 animals each viz., Group I and Group II.

In group I, thoracotomy alone was performed by left intercostal incision in six animals (Group IA), while thoracotomy and lobectomy were done in six animals (Group IB).

In Group II, thoracotomy alone was performed by rib resection technique in six animals (Group IIA), while thoracotomy and lobectomy were done in six animals (Group IIB).

Administration of chloral hydrate 6 per cent solution at the rate of 1 ml per 3 kg body weight, followed by thiopentone sodium 2.5 per cent solution, with positive pressure ventilation had given satisfactory anaesthesia for the surgical procedure. The anaesthetic effect persisted for about 30 minutes though the animals were recumbent for $4\frac{1}{2}$ to 5 hours. During the recovery phase, incoordination of movements of the head, paddling of legs, rolling on the ground and frequent micturition were seen.

Nasal discharge and cough were observed post-operatively.

Sutures materials used for thoracotomy operations were, cotton for ligation of the bronchial stump and for the ribs.

silk for periosteal/intercostal and monofilament nylon for the skin incisions. Continuous sutures were inserted for the closure of the periosteum and the intercostal muscles, interrupted sutures for the adjacent ribs. Abscesses at the suture line were seen in a few animals, but wound dehiscence was not observed.

There was reduction in the rectal temperature, increase in the pulse rate and no variation in the respiratory rate.

There was reduction in the pH following thoracotomy, immediately after the operation, which became normal subsequently. The reduction in the haemoglobin content following thoracotomy and during post-operative period which reached near normal values by the 21st day. Serum chloride levels though varying were within the normal range. There was considerable increase in the ESR values, post-operatively, which reached near normal values by the 21st day. The increase in the plasma bicarbonate level was only marginal.

The differential leucocyte count did not show any significant variation.

In the present study, for anaesthesia, intravenous administration of chloral hydrate 6 per cent solution followed by thiopentone sodium 2.5 per cent solution to effect and maintenance of positive pressure ventilation during surgery, was found satisfactory.

When lobectomy was performed by the intercostal approach five out of six animals survived and when thoracotomy alone

was performed, only two animals survived. Four out of six animals in the control as well as lobectomised group survived when thoracotomy was performed by rib resection technique.

From the results of the present study, it appears that neither the intercostal approach nor the rib resection technique for lobectomy in goats has any special advantage while considering the rate of survival. It was also found that lobectomy in goats does not interfere with the function of lungs.