TREATMENT OF TRAUMATIC RETICULOPERITONITIS IN BUFFALOES WITH SPECIAL REFERENCE TO FLUID THERAPY

BY

ASHWANI KUMAR
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CERTIFICATE-I

This is to certify that thesis entitled "***Treatment of Traumatic Reticuloperitonitis in Buffaloes with special reference to fluid therapy***" submitted in partial fulfillment for the degree of **Master of Veterinary Science** in the subject of **Veterinary Surgery and Radiology** of the Chaudhary Charan Singh Haryana Agricultural University, Hisar is a bonafide research work carried out by **Ashwani Kumar** under my supervision and that no part of thesis has been submitted for any other degree.

The assistance and help received during the course of this investigation have been duly acknowledged.

16/1/03

(Dr. S.K. Chawla)
Major Advisor
Professor
Department of Veterinary
Surgery and Radiology
CCS, HAU
Hisar-125 004 (INDIA)

CERTIFICATE-II

This is to certify that thesis entitled "***Treatment of Traumatic Reticuloperitonitis in Buffaloes with special reference to fluid therapy,*** submitted by **Ashwani Kumar** to the Chaudhary Charan Singh Haryana Agricultural University, Hisar in partial fulfillment for the award of the degree of Master of Veterinary Science in the subject of Veterinary Surgery and Radiology, has been approved by the student's Advisory Committee after an oral examination on the same.

HEAD OF DEPARTMENT

MAJOR ADVISOR

DEAN, POSTGRADUATE STUDIES


Dedicated
to
my beloved family

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Ashwani Kumar

CONTENTS

CHAPTER-I

INTRODUCTION

Traumatic reticuloperitonitis is a common surgical condition of bovine gastrointestinal tract. This problem occurs due to indifferent manner of prehension, mastication and deglutition. Ingestion of foreign bodies is quite common among buffaloes (Sobti *et al.*, 1987). Metallic foreign bodies may be present in the reticulum up to 90% of normal animals and traumatic lesions may be present in as many as 70% of the cases (Blood and Hutchins, 1955). With the advancement of mechanization of agriculture, consequent increase in metallic debris and practice to maintain cattle and buffaloes under stable conditions for longer periods during the year has increased the incidence of this disease. Peculiar anatomical structure of the reticulum predisposes this species of animal to this disease. Among clinically affected animals, about 25% develop incurable complications, other 75% can be expected to recover completely either with conservative treatment or routine surgical intervention (Radostits *et al.*, 2000). In one study on 220 she-buffaloes suffering from rumenoreticular dysfunction, 75% cases were positive for TRP (Singh *et al.*, 1983).

Acute local TRP is clinically characterized by sudden anorexia, fall in milk yield, mild fever, ruminal stasis and local pain in the abdomen. Rapid recovery may occur or the disease may persist in a chronic form, which is clinically manifested by recurrent tympany, complete or partial anorexia, retarded or suspended rumination, reduced milk yield, weight loss, scanty faeces. However, temperature, pulse and respiration rate may remain normal. Stiffness of forelimbs and abducted elbows have been reported in some cases (Blood and Hutchins, 1955).

This disease leads to heavy economic loss to farmers in terms of poor milk yield, loss of body weight and reproductive ability and animal death. To treat such cases laparorumenotomy is done to remove foreign bodies. In case, if any extrareticular abscess is present, it is drained. Postoperative treatment includes administration of broad spectrum antibiotics, analgesics, vitamin B-complex and rumenotonics. In some studies, it has been observed that such cases are deficient in chloride, potassium and sodium leading to late recovery (Behl *et al.*, 1997a&b; Singh , 1997; Singh , 2001).

Behl (1997a) observed that buffaloes suffering from functional stomach disorder also suffer from electrolyte deficit and this electrolyte deficit can be corrected by giving 2.7% saline solution along with 5.0g potassium chloride.

Studies of Singh (2001) revealed that most of the buffaloes suffering from TRP also suffer from electrolyte

`imbalance and one time fluid therapy of 2.7% saline solution along with 5.0gm of potassium chloride failed to correct this electrolyte imbalance. A number of cases of TRP also develop functional stomach disorders, therefore, extensive fluid therapy with 2.7% saline solution with 5.0gm of potassium chloride may be required to increase the successful treatment of such cases. Therefore, the work was conducted with the following objective:

- To modify postoperative management of buffaloes suffering from traumatic reticuloperitonitis with special reference to fluid therapy.

CHAPTER-II

REVIEW OF LITERATURE

Bosshart (1926) reported the results of the laparorumenotomy of 25 cases of TRP (traumatic gastritis). Three animals died, two were slaughtered, and 19 did well. The technique of operation was very similar to that used by Obich in 1863.

Bardwell and Udal (1927) described the methods of early diagnosis and operative treatment of traumatic reticuloperitonitis. Rumenotomy was performed on twelve cows for removal of foreign bodies from reticulum. Foreign bodies were recovered in 11 cases. A rubber sheet with ring was used to protect the edges of wound from contamination with the contents. Three died from the effect of perforative injuries where the disease was in advanced condition before the operation was performed. Enhanced success was credited to the use of rubber sleeve to prevent infection.

Churchill (1950) stressed upon the classification of foreign body syndrome. The different categories were:

(i) Acute circumscribed peritonitis

(ii) Acute diffuse peritonitis

(iii) Chronic peritonitis

(iv) Pericarditis and miscellanceous.

Differential leucocytic count (DLC) was suggested as most valuable part of the blood examination. Total leucocytic count (TLC) was also of some value. Laparorumenotomy was indicated for the surgical treatment of the disease. A metal detecting instrument (Berman locator) was used during actual course of operation to detect any metal left beyond reach into the reticulum.

Begg (1950) explained different diseases of the stomach of the adult ruminants and concluded that traumatic pericarditis was the most common cause of inappetance.

Matteson *et al.* (1953) reported the analysis of blood counts in 18 cases of traumatic gastritis, peritonitis and pleuropericarditis in cattle treated at veterinary clinics, university of Missouri. Definite neutrophilic shift to left was observed. Higher to normal eosinophilic percentage was found depending upon degree of stress. The estimation of TEC and Hb was of no diagnostic value.

Maddy (1954) reported through a survey that body perforation are more common in dairy cows than bef cattle or young dairy cattle. Environment and age were indicated as important factors in precipitating the disease. A high white cell

count in combination with characteristic symptoms were observed on ante-mortem examination.

Blood and Hutchins (1955), in a study of traumatic reticular perforation of cattle with particular reference to the efficacy of conservative treatment found that out of 100 cases of TRP presented for the treatment, the recovery rate was 82 percent with conservative anti-infective drugs like sulphamilamide, sulphamethazine and penicillin. The delay in treatment increased the mortality rate. The animals in last trimester of pregnancy did not respond well to this treatment. So, an immediate rumenotomy was indicated for these animals. The most common potential foreign bodies were balling wires. With other common clinical symptoms, haematology mainly, TLC and DLC were of considerable significance in diagnosis of the disease. The most common sequelae of TRP were diaphragmatic hernia, vagus indigestion splenitis and hepatitis.

Kingrey (1955) in an experimental study on 10 healthy cows made to suffer with traumatic gastritis observed that onset of symptoms occurred on an average thirty hours after the ingestion of foreign bodies. The early common clinical manifestations were elevated temperature, neutrophilia (both segmented and non-segmented), disturbed appetite, pain in the area of the xiphoid cartilage, suppression of milk yield, atony of the rumen and constipation. Every diagnostic feature had some tendency to fluctuate, so a repeated examination was of value.

These signs tended to subside after 48-72 hours. It was also concluded that if surgical removal of foreign bodies was accomplished within two days after onset of symptoms, nearly 100% recovery is anticipated.

Williams (1955a&b) in a study of reticulo-ruminal motility in adult cattle with reference to the eructation of ruminal gases and bloat devised a method of auscultation of reticulum and palpation of rumen with palm through flank for correlating the movements of the reticulum and rumen in adult cattle. He observed two types of ruminal movements. A primary contraction which immediately followed a two stage contraction of reticulum and an extra-ruminal contraction which was independent of reticulum and was responsible for eructation of gases. The later type of contraction was absent in cases of ruminal fistula or froathy bloat. In a survey of 64 cases suffering with traumatic reticulitits he reported a new method of diagnosis of traumatic reticulitis i.e. by observing "reticular grunt". This method was based on correlation of pain, manifested in the form of grunt, with reticular movement which was indirectly tested by noting primary ruminal contraction which was not associated with eructation of gases at the left flank. The grunt should be heard 2-3 second before the peak of primary ruminal movements.

Hansen (1953) reported the postsurgical status of 100 cows operated for removal of foreign bodies during practice

in field conditions. The recovery rate was 92 percent, though the average duration of clinical symptoms prior to the surgery was more than two days. Cows returned to feed intake and at least 90% of the production in six days. It was concluded that the days required for recovery roughly parallel the days of preoperative illness and relative depth of penetration of foreign bodies.

Hutchins *et al.* (1957) revealed that residual defects in stomach motility as a sequelae to TRP of cattle, i.e. pyloric stenosis, diaphragmatic hernia and indigestion, occured due to adhesions between serous surfaces of reticulum and diaphragm. Indigestion due to reticular adhesions and diaphragmatic hernia was clinically indistinguishable while pyloric stenosis is slowly developing syndrome. A systolic, cardiac murmur and slowing to heart rate was common clinical finding in former two conditions.

Carroll and Robinson (1958) in an observation based on preoperative and postoperative findings in 500 dairy cattle on which rumenotomy were performed for the reason of traumatic gastritis found that to confirm the diagnosis of traumatic gastritis, and to provide a prognosis for surgery, the differential leucocytic count (DLC) was of great value while the total leucocytic count was of little value. The normal values were calculated in 200 normal diary cattle of same region and found rectal temperature (101.5^{0}F), neutrophils (33%), lymphocytes (62%), monocytes (2%), eosinophils (3%) while basophils (0%).

The cattle with early traumatic gastritis with peritonitis had rectal temperature (103-107^{0}F), neutrophils (68%), lymphocytes (29%), monocytes (1%) and eosinophils (2%). The cattle with traumatic reticulitis with localized peritonitis and adhesions had rectal temperature (102.0-104.0^{0}F), neutrophils (57%), lymphocytes (38%), monocytes (2%), eosinophils (3%), while cattle with TRP and extensive adhesions had rectal temperature (101.5-102.6^{0}F), neutrophils (46%), lymphocytes (45%), monocytes (6%) and eosinophils (3%). The cattle with traumatic pericarditis had rectal temperature (105.0-107.0^{0}F), neutrophils (71%), lymphocytes (15%), monocytes (9%), eosinophils (5%) and had grave prognosis. A monocyte percentage of 5 or over in case of leveling neutrophil-lymphocyte ratio, had poor prognosis for surgical intervention.

Holmes (1960) in a study on 15 clinical cases of traumatic pericarditis in cattle recovered foreign bodies from 14 animals either on laparorumenotomy or on post-mortem examination. Total leucocytic count in these cases was suggesting leucocytosis and the character of pus varied from being fluid to thick cheese like and the colour of pus varied from yellow to grey or black. All cultures of pericardial pus revealed *Corynebacterium pyogenes* and sometime also *Escherichia coli.*

Pinset (1962) presented the view that a cattle having less that 10000 white blood cells per cumm and neutrophils percentage less than 50 should not be a case of traumatic

reticulitis. The TLC was used by him for elimination of diagnosis rather than it's confirmation.

Said (1963) in an experimental study showed that camels may swallow sharp foreign bodies which could cause traumatic reticulitis. The affected camels could successfully be treated by rumenotomy in sitting position. The site of operation was the short space between the transverse process of lumbar vertebrae and ventral wall of abdomen, and 5 cm backward and parallel to the last rib. The tenchique was almost same as that used in cattle.

Fisher and Pirie (1965) reported that cattle with typical traumatic pericarditis having subcutaneous oedema as a usual feature showed evidence of hemodilution with lowered PCV. Leucocytosis was common feature. The sodium and potassium concentration was lowered due to haemodilution in some animals while all animals had high plasma globulin and low plasma albumin. The level of SGOT was elevated while alkaline phosphatase and SGPT was not elevated indicating the muscle tissue damage.

Neal and Edwards (1968) studied 52 clinical cases of cattle in which vagus indigestion was diagnosed on the basis of clinical features. Post-mortem examination was carried out in 43 cases. In 9 animals there was direct physical injury to the vagus nerve also demonstrated by histopathological examination. In 30 clinical cases, adhesions or abscesses were present involving

reticulum. The result of the treatment by laparorumenotomy was disappointing as only four animals recovered completely.

Deshpande *et al.* (1977) studied 470 animals with typical symptoms of foreign body syndrome during 1972-1977. Among 470 animals 383 were positive for traumatic reticuloperitonitis and 87 were positive for diaphragmatic hernia.

Rebhun (1980) mentioned that the cattle with chronic vagal indigestion had hypochloremia, hypokalemia and metabolic alkalosis due to forestomach dysfunction. Presence of metallic foreign body in the reticulum made traumatic reticuloperitonitis the most likely primary cause of vagal indigestion.

Kushali *et al.* (1981) studied eleven cases of Iraqi adult cattle with chronic foreign body syndrome. The results of haemograms revealed a normal picture except for an increase of haematocrit value. The mean leucogram indicated moderate increase in the total leucocytic count. Neutrophilia was also observed in few cases.

Samad *et al.* (1981) reported an unusual case of foreign body in a bullock. Animal was having history of anorexia, suspended rumination and stiff gait. Clinical examination revealed oedematous limbs with rectal temperature 105^{0}F and heart rate 102 per minute. Paracentesis abdominosis revealed peritoneal transudate. Blood estimation revealed haemoglobin (11.5gm/100ml) total leucocyte count (8000/cumm) and packed

cell volume (27%). The differential leucocyte count revealed neutrophils (28%), eosinophils (1%), lymphocytes (71%), monocytes (0%) and basophils (0%).

Kohli *et al.* (1982) analysed 308 cases suspected for foreign body syndrome. They revealed radio opaque foreign bodies of various types located in lower cranial, lower caudal and mid central part of reticulum in 179 animals. Other lesions such as phrenic abscess, reticular abscess, thoracic abscess, cardiophrenic adhesions and pneumothorax were also observed.

Krishnamurthy *et al.* (1985) in a study observed that out of a total of 834 cases of buffaloes suspected for foreign body syndrome, 325 (39%) were positive for traumatic reticuloperitonitis and 316 (38%) cases were positive for diaphragmatic hernia (DH). In 70% cases suffering from DH, potential foreign bodies were confirmed to be present in the reticulum.

Sobti *et al.* (1987) reported a case of traumatic reticulitis in a buffalo. The clinical examination revealed rumen motility of 2/2minute. The blood picture showed, haemoglobin 11.8%, total leuccocytic count 7300/cumm and the differential leukocytic count revealed neutrophils 60%, lymphocytes 37%, monocytes 2% and eosinophils 1%. The buffalo was suspected for reticular/diaphragmatic hernia and hence was subjected to rumenotomy. The rumenotomy was performed in the standing position through left paralumbar fossa under local infiltration

anaesthesia using 2% lignocaine HCl. One sharp penetrating foreign body was recovered from reticulum. The palpation of reticular wall revealed a large and a hard extra reticular mass having a small hard tubular tract which appeared to be communicating with reticulum. There was no herniation of reticulum with the thoracic cavity. The pH of ruminal contents was found to be 6.0. The hard fibrous extra reticular mass was removed through the post xiphoid incision under halothane anaesthesia.

William *et al.* (1990) reported a case of traumatic reticuloperitonitis and endocarditis by a tough fiber of the sheath of palymrah palm (*Borassus flabellifer*) leaf (25cm long). The leaf was surrounded by granulation tissue which contained purulent exudate and detritus. The anterior reticular wall showed a number of granulomatous inflammatory zones. Suppurative inflammation was noticed on pleural and peritoneal surfaces of diaphragm which involved adhesions of pericardium and reticulum respectively. Pericardial effusion was copious, fibrinopurulent, putrid and blood stained. The left ventricle on the apical portion of left papillary muscle was perforated and about one cm of the fiber was projecting in the left ventricle. The perforation was surrounded by a zone of inflammation. The surface of heart revealed 2cm long laceration just above the apex and 7cm below the point of perforation.

Bose *et al.* (1991) treated a case of bullock with multiple abscesses at right flank intercostal spaces caused by a migratory metallic foreign body. An unusual foreign body consisting of an umbrella wire measuring 45.6cm in length with a thickness of 2.1mm threaded with a nylon wire and bent in L shape was removed from the rumen and the fistulous tract.

Braun *et al.* (1990) studied clinical haematological and biochemical findings in cattle with acute functional pyloric stenosis and observed following: haematocrit varied from 25-38%, leucocyte count were between 4000 and 32100 cells/cumm. Plasma protein varied from 56-104gm/L. the concentration of fibrinogen varied between 3 and 16gm/L.

Ward *et al.*, 1993 in a study on nine adult female sheep diverted abomasal outflow to induce hypokalaemic, hypochloraemic metabolic alkalosis, accompanied by hyponatremia and dehydration. Each sheep was subjected to three treatment trials, each predicted by a 24 hours prediversion period and a diversion period during which syndrome of hypochoramia, hypokalaemia, hyponatremia and metabolic alkalosis was induced. Treatment consisted of 0.9% NaCl (300mosm/l), 3.6% NaCl (1200mosm/l) and 7.2% NaCl (2400mosm/l) administered over a period of two hours, with the administered volume determined by the estimated total extracellular fluid chloride deficit. Significant difference was not found among treatments, with all solutions resulting in return of

clinicopathologic and physical variables to prediversion values within 72 hours of treatment. It was concluded that rapid intravenous replacement of chloride, with small volumes of hypertonic saline solution, is safe and effective for correction of experimentally induced hypochloraemic, hypokalaemic metabolic alkalosis in sheep.

Bansal *et al.* (1994) reported a case of reticular fistula in a buffalo. A hard metallic rod 37cm long and 1cm in diameter was retrieved from the fistulous tract between 11^{th} and 12^{th} rib on the left side.

Samad *et al.* (1994) observed various symptoms of traumatic reticuloperitonitis in bovines which could be helpful in diagnosis of the case. They were of the opinion that using various laboratory tests were other possible ways to further confirm the diagnosis.

Toenniessen and Losonsky (1994) reported a case of traumatic reticuloperitonitis in a five year old Holstein cow. The cow was slightly dehydrated and its rumen motility was decreased. White blood cell count was 10000/µl (N=4000-12000), with 7200 segmented neutrophils (N=600-4000), 1800 lymphocytes (N=2500-7500), 900 monocytes (N=300-900) and 100 eosinophils (N=7.0-8.4) and plasma fibrinogen concentration was 1200mg/dl (N=300-600). Serum chemistry abnormalities included a low albumin: globulin ration (0.6; N=0.8-0.9) with low normal albumin (2.7gm/dl; N=2.5-3.5) and high normal protein

(7.5gm/dl; N=6.7-7.5), low calcium (7.6mg/dl; N=9.4-12.2) and low potassium (2.9meq/l; N=4.1=5.3). The leukon was consistent with stress. The high fibrinogen and low albumin : globulin ratio indicated chronic active inflammation. The hypocalcaemia and hypokalemia were attributed to decreased dietary intake associated with anorexia.

Naik and Rao (1995) reported a case of traumatic reticulitis with suppurating abscess in heart of a crossbred cow. Postmortem examination revealed ramiform congestion of the skin of abdominal and thoracic regions, atrophy of subcutaneous fat with anasarca. Carcass was greatly debilitated and dehydrated, thoracic cavity was filled with serosanguinous fluid. A sharp needle was found in the reticulum penetrating its mucosa and numerous abscesses were seen all along the reticulum with presence of large amount of pus. Spleen and liver also revealed numerous small abscesses measuring 1cm in diameter to fairly big ones measuring 5-6cms in diameter. Adhesions were seen between spleen, liver, reticulum and external thoracic wall. However, the conspicuous feature was hypertrophy of right side of the heart with presence of a pyremic embolus vegetative endocarditis in the right auricle. Associated lesions were ascitis, hydrothorax and congestion of gall bladder mucosa.

Rehage *et al.* (1995) found that damage of thoracic and abdominal parts of the main vagal branches were not

evident in cows with TRP. Parareticular inflammatory adhesions were more extensive in cows with TRP-AD (disturbances of digesta passage through reticulo omasal orifice) and in cows with TRP-PD (disturbances of digesta passage through pylorus) than in cows with uncomplicated TRP. Reticular motility was decreased in cows with TRP-AD and TRP-PD, compared with cows with uncomplicated TRP and control cows. In contrast to cows with uncomplicated TRP and cows with TRP-AD the abomasum was impacted with large amounts of long fibrous material in most of the cows with TRP-PD.

Behl *et al.* (1996) described that traumatic reticulitis could be the possible cause of vagal indigestion in bovine as a result of dysfunction of low-threshold reticular tension receptors present on the medial wall of reticulum.

Chander *et al.* (1997) did radiological evaluation of lesions of the cranio ventral abdomen in 212 buffaloes suspected for traumatic reticuloperitonitis. They found that 174 cases had foreign bodies in the reticulum of which 18 percent cases had non potential foreign bodies. Fifty one cases had abnormal gas pockets but foreign bodies were associated with these in 3 cases only. Abnormalities in the size, shape and location of the reticulum were also detected in 21 cases and were associated with foreign body syndrome. Diaphragmatic lesions were detected in 12 cases. Diaphragmatic hernia was not included in this series of 212 cases.

Studies of Singh *et al.*, (1997) on 35 clinical cases of diaphragmatic hernia in buffaloes revealed that animals with abomasal reflux were hypochloraemic and hypokalaemic. The buffering capacity of the rumen in these animals was considerably reduced without any significant change in the pH. The packed cell volume was slightly higher than normal. Neutrophils were higher than normal and lymphocytes were lower than normal. One time correction of plasma chloride deficit with 2.7% saline solution was not sufficient to rectify electrolyte imbalance that existed in these cases.

Behl *et al.*, 1997a in a study on 15 buffaloes with functional stomach disorders of stomach found caudal functional disorder in nine cases on the basis of development of hypochloraemic hypokalaemic alkalosis and abomasal reflux (plasma chloride < 75mmol/l, plasma potassium < 3.5mmol/l, plasma bicarbonate > 28mmol/l and rumen fluid chloride > 30mmol/l). Two of these were in advanced pregnancy and two were positive for traumatic reticuloperitonitis, peritonitits and metritis were present in one case each. Only three of these cases had papple shaped appearance of abdomen when viewed from behind. Six of the clinical cases had no hypochloraemic hypokalaemic alkalosis and there was no evidence of abomasal reflux and there was slight reduction in buffering capacity of rumen fluid. They were categorized to have cranial functional disorder. None of them had papple shape appearance though left

side distention was present. Treatment of these clinical cases included laparorumenotomy alongwith administration of broadspectrum antibiotics, vitamin B complex and intravenous fluid therapy with five liters of 2.7% saline solution. Five of the animals suffering from caudal functional disorder and all the six animals suffering from cranial functional disorder recovered completely.

Behl *et al.*, 1997b in a study on 15 clinical cases of diaphragmatic hernia in buffaloes found that six buffaloes had evidence of considerable abomasal reflux alongwith development of hydrochloraemic, hypokalaemic alkalosis. The buffering capacity of rumen in these cases was considerably reduced. Based upon these findings, it was suggested that preoperatively, each case of diaphragmatic hernia should be examined for chloride concentration of plasma and rumen fluid and appropriate fluid therapy with chloride rich solution should be given in those cases which had evidence of abomasal reflux.

Balicki and Yilmaz (1999) investigated blood electrolytes (Na^+, K^+, Cl^-, Ca^{++}, inorganic P and Mg^{++}) and electrocardiogrphic findings in cases of traumatic reticuloperitonitis. They observed slight hypokalaemia, hyponatremia, hypochloraemia and hypocalcaemia.

The study conducted by Singh (2001) in thirty two buffaloes suffering from traumatic reticuloperitonitis revealed that most of the buffaloes had hypokalaemai,

hyponatremia and hypoproteinemia. But plasma chloride concentration in these buffaloes was found to be normal and no change in the electrolyte status of these animals was observed after one time fluid therapy with 5.0 liters of 2.7% saline solution supplemented with 5.0gm of potassium chloride intravenously.

CHAPTER-III

MATERIALS AND METHODS

The present study was undertaken in twenty adult she-buffaloes admitted to Teaching Veterinary Clinical Service Complex (TVCSC) of the college. All these cases were suspected to be suffering from traumatic reticuloperitonitis (TRP). They had clinical signs like anorexia, hard faeces/absence of defecation, decrease in water intake, fall in milk yield and suspended rumination. These cases were not responding to routine treatment and were confirmed to be cases of TRP on the basis of lateral radiographic observation of reticular area. Out of twenty clinical cases, nineteen were divided into two groups depending upon concentration of chloride in plasma and evidence of abomasal reflux. One of the cases had highly abnormal findings and so was not included in any of the group.

1. Group A

It included ten TRP cases which were hypochloraemic with evidence of abomasal reflux. Animals were considered hypochloraemic when plasma chloride concentration was

≤ 80 mmol/l. Increased rumen fluid chloride concentration indicated abomasal reflux.

2. Group B

It included those nine TRP cases which were not hypochloraemic and there was no evidence of abomasal reflux.

In all these twenty animals laparorumenotomy was done under paravertebral anaesthesia using 2% lignocaine hydrochloride with standard surgical technique. Three-fourth of the ruminal contents were evacuated manually or siphoned out and foreign bodies, if any were removed. In two cases extrareticular abscesses were drained out. Postoperatively, all the animals received Steptopenicillin[1], analgesics[2], vitamin B-complex with liver extract[3], yeast culture[4] and five liters of 2.7% saline solution with five grams of potassium chloride administrated intravenously immediately and at 24 hours of surgery.

Sampling procedures and protocol

For haematological and biochemical observations, blood samples were collected from jugular vein in heparinized vials using 16 gauze hypodermic needle just before surgery and at 24 and 48 hours of surgery. Plasma was harvested from the heparinized blood by centrifuging the blood samples at 3000 rpm

[1] Inj. Dicrystacin – S (veterinary), Sarabhai Chemicals, Veterinary division, Bombay-I
[2] Inj. Novalgin, Hoechst India Ltd., Bombay-21
[3] Inj. Belamyl (veterinary), Sarabhai Chemicals, Veterinary division, Bombay-I
[4] Yea sac 1026 bolus, Vetcare, Division of Tetragon Chemicals Pvt. Ltd., Banglore.

for 15 minutes and stored at -20°C for estimation of total proteins, sodium, potassium and chloride concentration in plasma.

Rumen fluid samples were collected in beaker immediately after opening rumen. It was sieved through a double layer of muslin cloth. Buffering capacity, pH and protozoal motility of rumen fluid were determined immediately after this. The remaining rumen fluid was filtered through Whatman filter paper and filtrate thus received was stored in deep freeze for estimation of its chloride concentration.

Parameters Investigated

Various clinical, haematological and biochemical parameters were recorded/estimated just before surgery and then 24 and 48 hours after surgery.

A. Clinical parameters

After obtaining detailed history, clinical parameters like rectal temperature, respiratory rate and heart rate were recorded.

B. Haematological parameters

Haemoglobin (Hb) was estimated by Sahli's method, whereas packed cell volume (PCV), total erythrocytic count (TEC), erythrocytic sedimentation rate (ESR), total leucocytic count (TLC) and differential leucocytic count (DLC) were done by methods as described by Schalm *et al.* (1986).

C. Blood biochemical parameters

Blood glucose was estimated by making protein free filtrate from whole blood by method of Folin and Wu (Hawk *et al.*, 1954). Total plasma protein and plasma chloride concentration were estimated by autoanalyzers (end point estimation) with the use of readymade reagent kits. Sodium and potassium concentrations were estimated by flame photometry principle using Systronic 128 flame photometer after making serial dilutions of plasma (100-250), and comparing with standards of known concentrations i.e. having 100, 150, 200, 250 mmol/l of sodium and 3, 4, 5 and 6 mmol/l of potassium

D. Rumen fluid parameters

All rumen fluid parameters except chloride were estimated in fresh samples. Rumen fluid protozoal motility was done under students microscope by using low power magnification. Nature of rumen contents was also recorded. Rumen fluid pH was recorded by digital pH meter. Buffering capacity of rumen fluid was determined by titrating rumen fluid against 0.1N HCl till pH came down to 4.0. Chloride concentration of rumen fluid was estimated by autoanalyzers (end point estimation) with the use of readymade reagent kit[5].

[5] Bayer's Kit

E. Microbial status and antibiotic sensitivity test

The swabs taken from peritoneal cavity and extrareticular abscesses were cultured on agar plates for microbial growth. Antibiotic discs were applied on culture plates and these plates were incubated for 72 hrs and sensitivity to antibiotics was recorded.

F. Analysis of data

Statistical analysis of data was done by using Duncan's multiple range test at 1% and 5% level of significance.

CHAPTER-IV

RESULTS

Results of the present study on twenty clinical cases of traumatic reticuloperitonitis (TRP) were compared with normal values described by Behl *et al.*, 1997 and Vegad , 2000. Out of twenty clinical cases, nineteen were divided into two groups depending upon concentration of chloride in plasma and evidence of abomasal reflux. One of the cases had highly abnormal findings and so was not included in any of these two groups.

1. Group A

It included ten TRP cases which were hypochloraemic with evidence of abomasal reflux. Animals were considered hypochloraemic when plasma chloride concentration was ≤ 80 mmol/l. Increased rumen fluid chloride concentration indicated abomasal reflux.

2. Group B

It included those nine TRP cases which were not hypochloraemic and there was no evidence of abomasal reflux.

Group A

Clinical observations and history of animals of this group are summarized in Table 1.

All the animals had history of anorexia and suspended rumination for a varying period of 1-4 weeks. 50 percent of the cases had anorexia for 3-4 weeks (Fig. 1). Three (30%) animals were passing hard faeces, one (10%) animal was passing pasty faeces and there was suspension of defecation in six (60%) animals (Fig. 2). Water intake was reduced in all the animals. The rumen motility was reduced in two (20%) animals while in remaining eight (80%) animals it was absent (Fig. 3). Nine (90%) animals had the history of tympany(Fig. 4).

Eight (80%) animals were pregnant, one (10%) had parturated a month ago and remaining one (10%) was non-pregnant (Fig. 5). There was moderate to considerable decrease in milk yield in nine (90%) animals (Fig. 6). One (10%) animal was in 1-3 years of age group, four (40%) in 4-6 years of age group and remaining five (50%) animals were in 7-10 years of age group (Fig. 7). Four (40%) animals were in third lactation and one (10%) each in first, second, fourth, fifth and sixth lactation and remaining one (10%) was non-lactating (Fig. 8).

The data on rectal temperature, heart rate and respiration rate are shown in Table 2. Preoperatively, these parameters were within the normal range except slight rise in respiration rate. Statistically significant decrease was observed

Table 1: Clinical observations and history of buffaloes suffering from TRP with abomasal reflux (Group A, n = 10)

Characteristic	Findings	Number of animals
Heart rate (/min)	Normal (40 – 60)	8
	Increased (> 60)	2
Respiration rate (/min)	Normal (15 – 20)	6
	Increased (> 20)	4
Rectal temperature (^{0}F)	Normal (101 – 102.5)	8
	Increased (> 102.5)	2
Days of anorexia	Upto 1 week	1
	1-2 weeks	1
	2-3 weeks	3
	3-4 weeks	5
Defecation	Reduced	4
	Absent	6
Faecal consistency	Hard	3
	Pasty	1
Rumen motility (/5min)	Reduced (< 8)	2
	Absent	8
History of tympany	Yes	9
	No	1
Pregnancy status	Recently calved	1
	Pregnant	8
	Non-pregnant	1
Milk yield	Moderate decrease	4
	Considerable decrease	5
	Non lactating heifer	1
Age (years)	1-3	1
	4-6	4
	7-10	5
Lactation	First	1
	Second	1
	Third	4
	Fourth	1
	Fifth	1
	Sixth	1
	Non lactating animal	1

Table 2: Mean ± S.E. of heart rate, respiration rate and rectal temperature of buffaloes suffering from TRP with abomasal reflux (Group A, n = 10)

Parameters (units)	Preoperative	Postoperative		Normal values
		24 hours	48 hours	
Heart rate (/min)	56 ± 2.0[a]	56 ± 1.0[ab]	52 ± 1.0[a]	40 – 60
Respiration rate (/min)	21 ± 2.0[a]	19 ± 1.0[a]	19 ± 1.0[a]	15 – 20
Rectal temperature (^{0}F)	102.22 ± 0.29[a]	101.44 ± 0.18[b]	101.22 ± 0.24[b]	101-102.5

Values with same subscript are statistically non significant.

Table 3: Mean ± S.E. of ruminal motility of buffaloes suffering from TRP with abomasal reflux (Group A, n = 10)

Parameters (units)	Preoperative	Postoperative		At the time of discharge*
		24 hours	48 hours	
Ruminal motility (/5 min)	1 ± 0.7	1 ± 0.6	2.20 ± 0.88	6.30 ± 0.45

* Time of discharge varied from 4-6 days after surgery for different animals.

Normal value of ruminal motility in a healthy adult buffalo is 8/5min (Behl *et al.*, 1997).

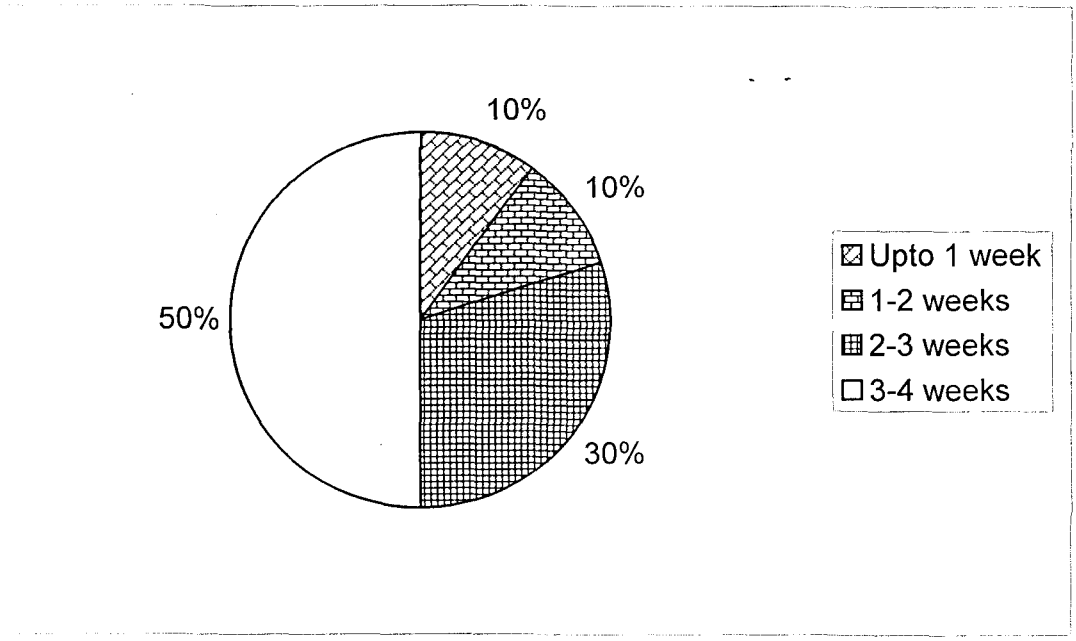

Figure - 1: Showing period of anorexia due to TRP in animals of group A.

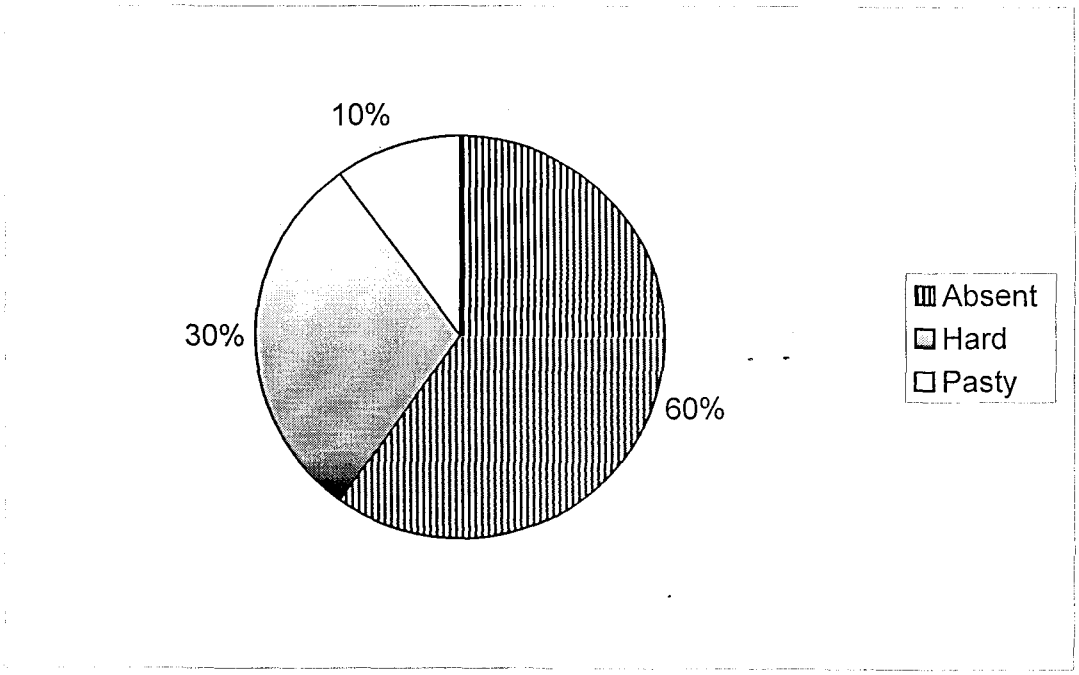

Figure - 2: Showing effect of TRP on defecation in animals of group A.

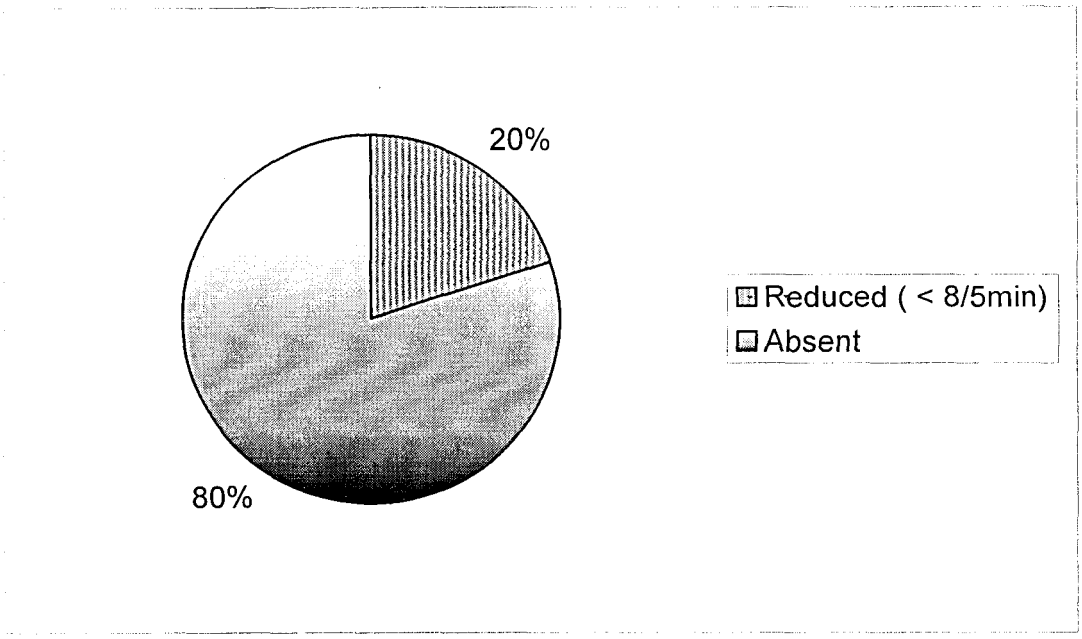

Figure - 3: Showing effect of TRP on rumen motility in animals of group A.

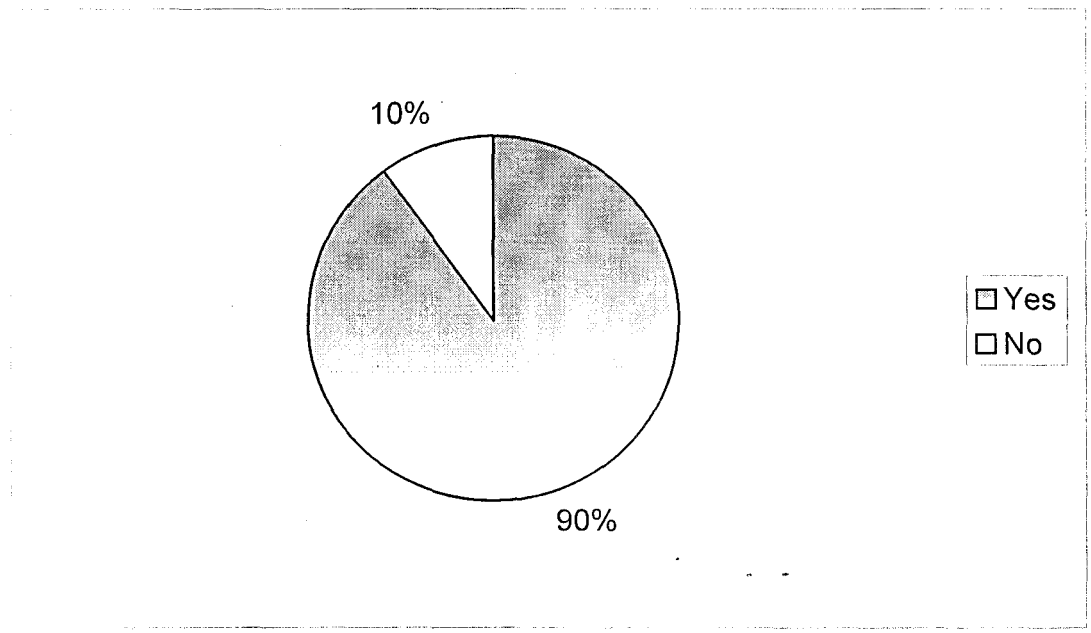

Figure - 4: Showing history of tympany in animals of group A.

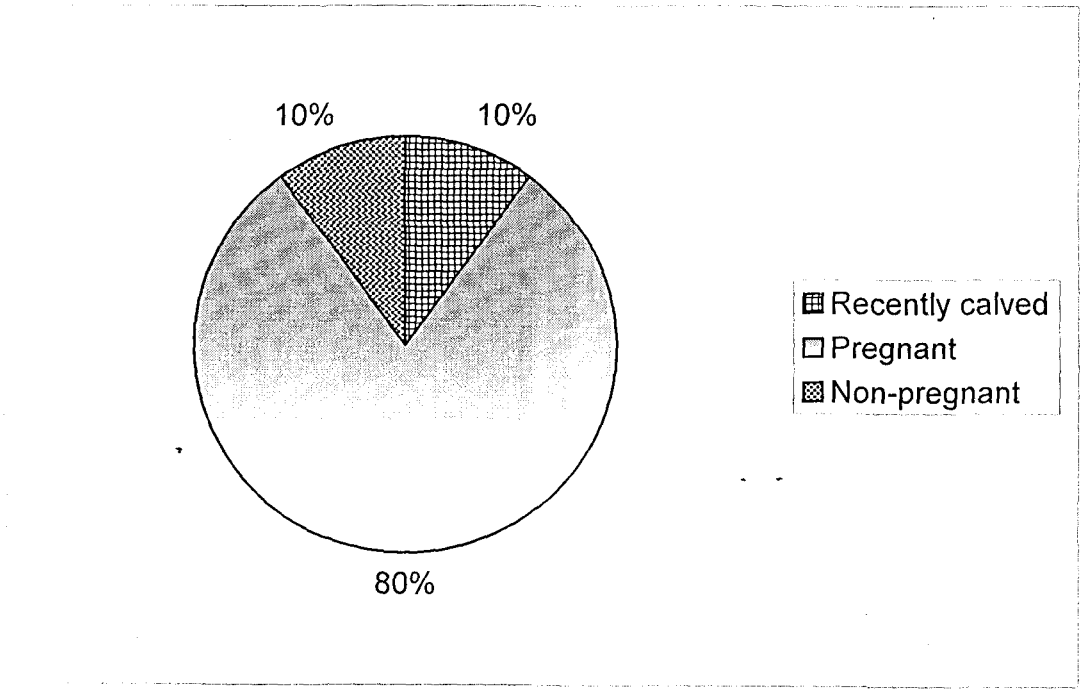

Figure - 5: Showing pregnancy status of cases of TRP in group A.

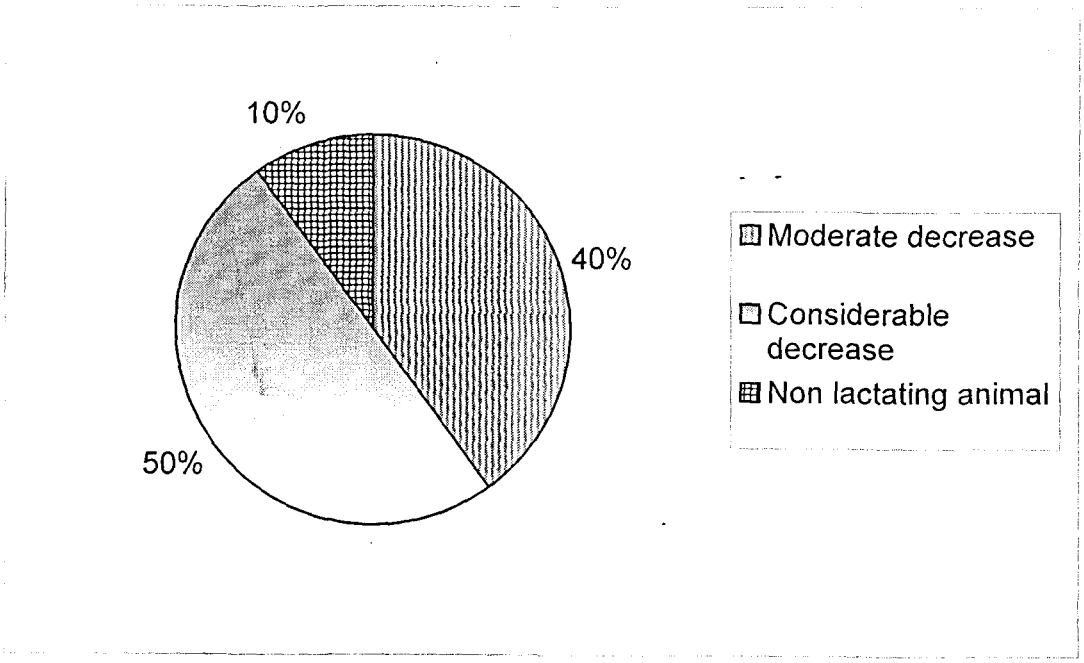

Figure - 6: Showing effect of TRP on milk yeild in animals of group A.

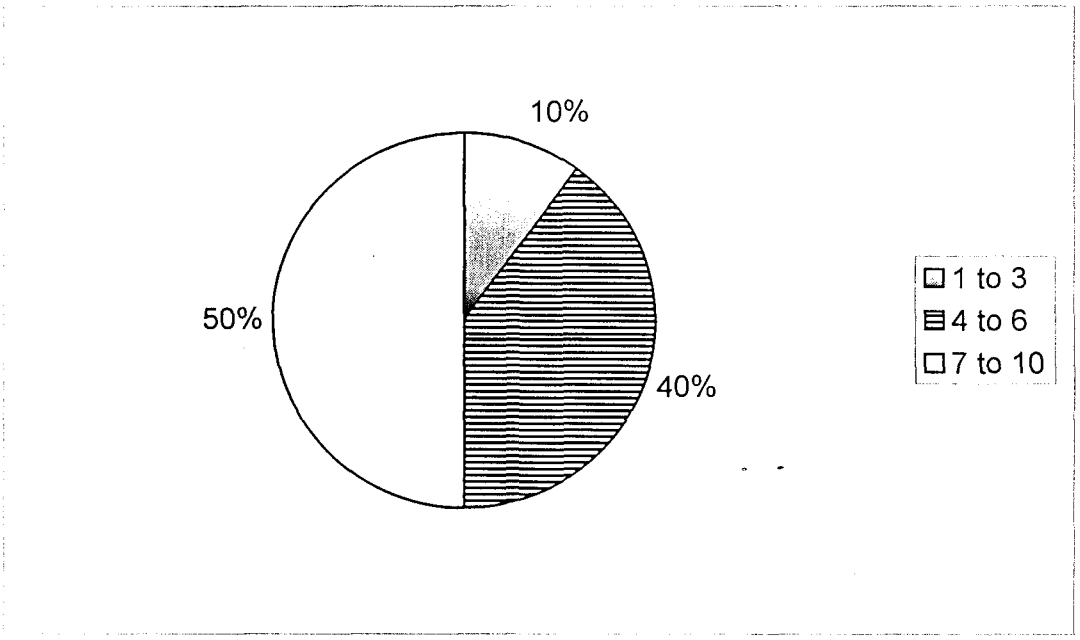

Figure - 7: Showing agewise distribution of cases of TRP in group A.

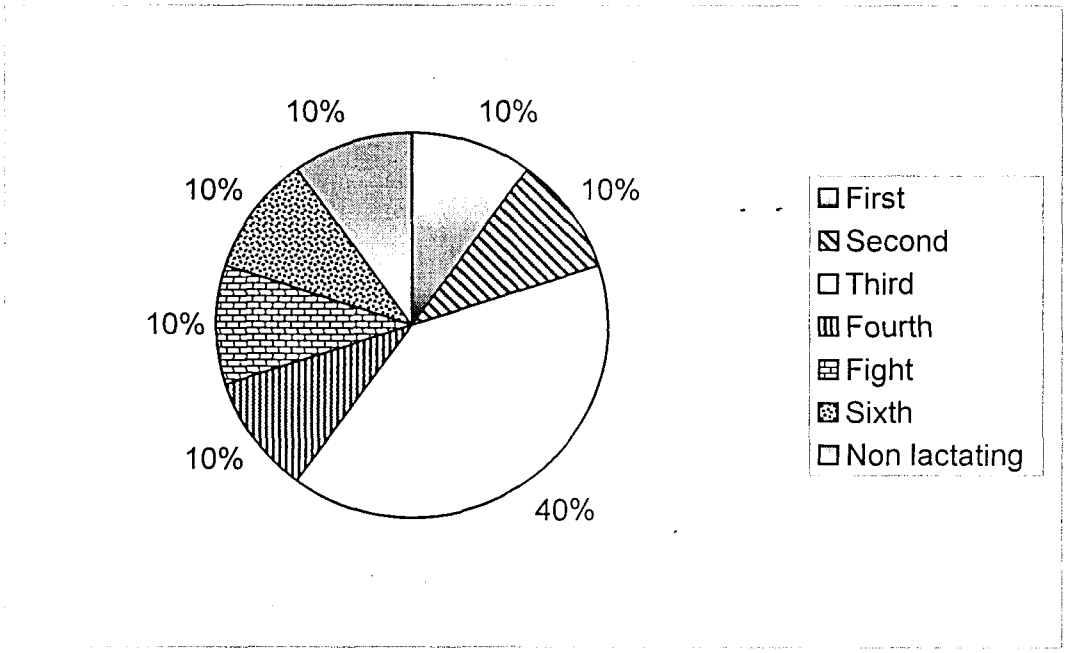

Figure - 8: Showing percentage of cases of TRP in different lactations in group A.

in rectal temperature at 24 hours of surgery. Preoperatively, rumen movements were reduced which improved marginally at 48hours of surgery but were slightly lower than normal even at the time of discharge (Table 3).

Laparorumenotomy findings of this group of animals are shown in Table 4.

On laparorumenotomy, mild adhesions of the rumen and peritoneum were observed in three (30%) cases, while in seven (70%) animals adhesions were severe (Fig. 9) and there was foul smell. Moderate to extensive reticular adhesions were observed in all the ten animals. Ruminal contents were watery with flakes in six (60%) cases, dry in two (20%) cases and semisolid/undigested in remaining two (20%) cases (Fig. 10). Atrophy of the ruminal papillae was observed in seven (70%) animals (Fig. 11). In seven (70%) animals sharp potential foreign bodies were found to be embedded in reticulum while in remaining three (30%) animals these were lying free in the reticulum (Fig. 12). Abomasum was impacted in four (40%) animals while in remaining six (60%) animals it was normal (Fig. 13). Extrareticular abscess was present in one (10%) case (Fig. 14). Swab from this abscess revealed mixed infection of *Pseudomonas sp* and *Corynebacterium pyogens.* Swab from the peritoneal cavity did not reveal infection in any animal of this group. The pH of rumen fluid was lower than normal and its buffering capacity had reduced considerably. Chloride

Table 4: Laparorumenotomy findings of buffaloes suffering from TRP with abomasal reflux (Group A, n = 10)

Characteristic	Findings	Number of animals
Adhesion of rumen with peritoneum	Mild	3
	Severe	7
Adhesions of reticulum with diaphragm	Moderate to extensive	10
Ruminal contents	Watery with flakes	6
	Dry	2
	Semisolid/undigested	2
Atrophy of ruminal papillae	Yes	7
	No	3
Sharp potential foreign bodies in reticulum	Embedded	7
	Unembedded	3
State of abomasum	Impacted	4
Extrareticular abscess	Present	1

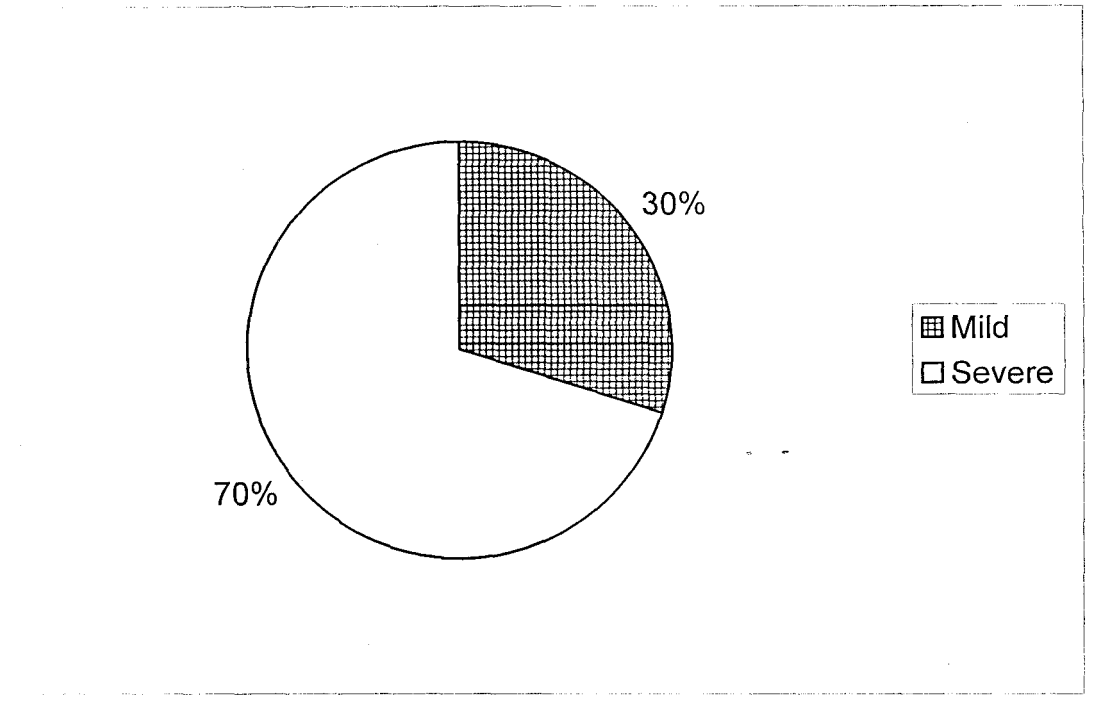

Figure - 9: Showing severity of adhesions of rumen with peritoneum in animals of group A.

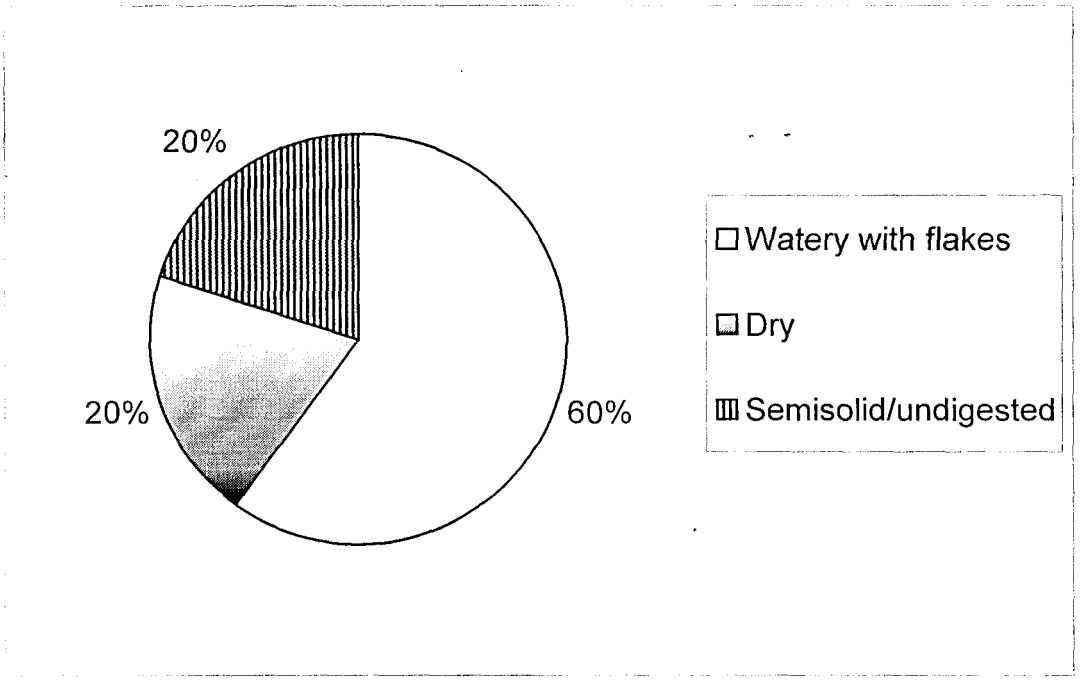

Figure - 10: Showing nature of ruminal contents in animals of group A.

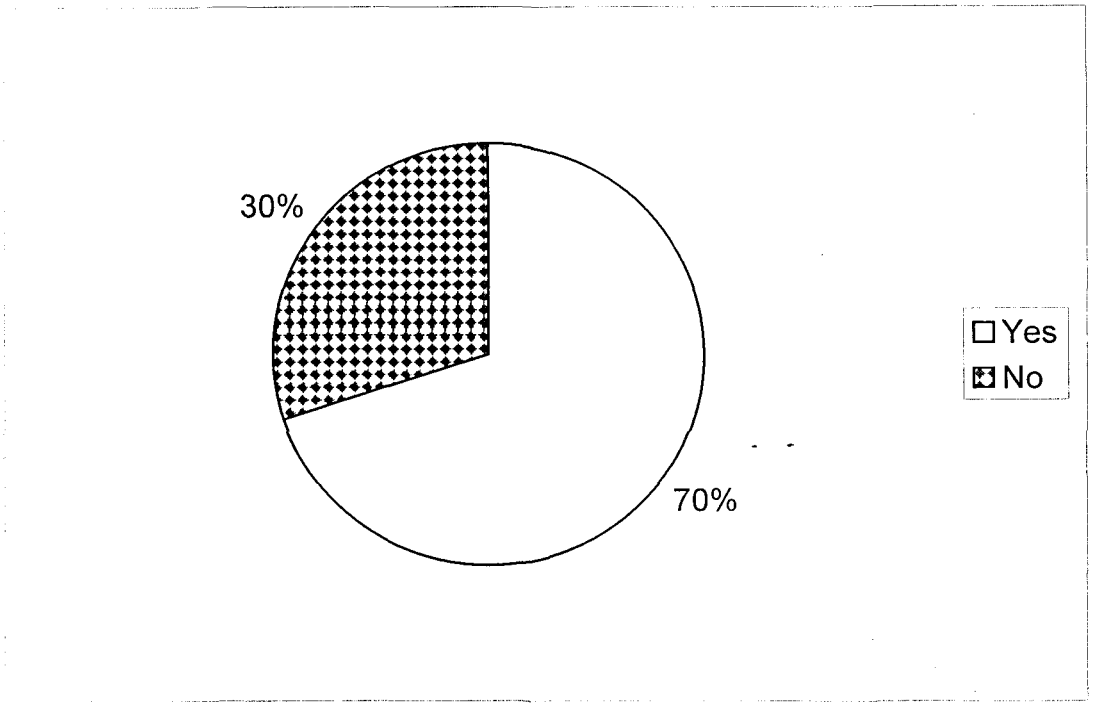

Figure - 11: Showing percentgae of ruminal papillae atrophy in animals of group A.

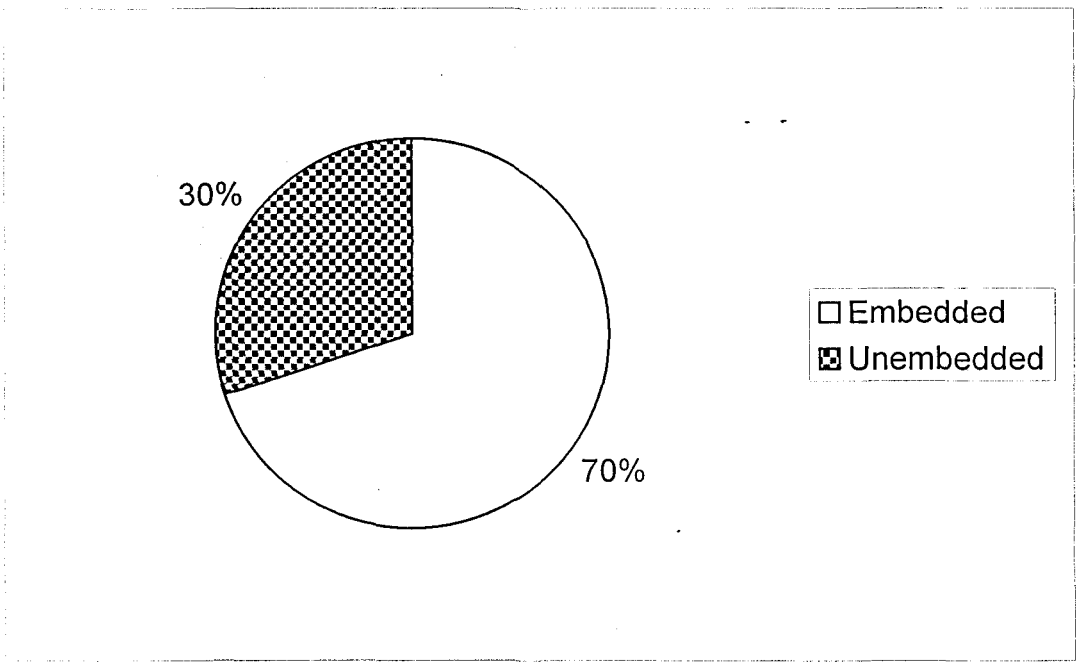

Figure - 12: Showing status of sharp potential foreign bodies in reticulum in animals of group A.

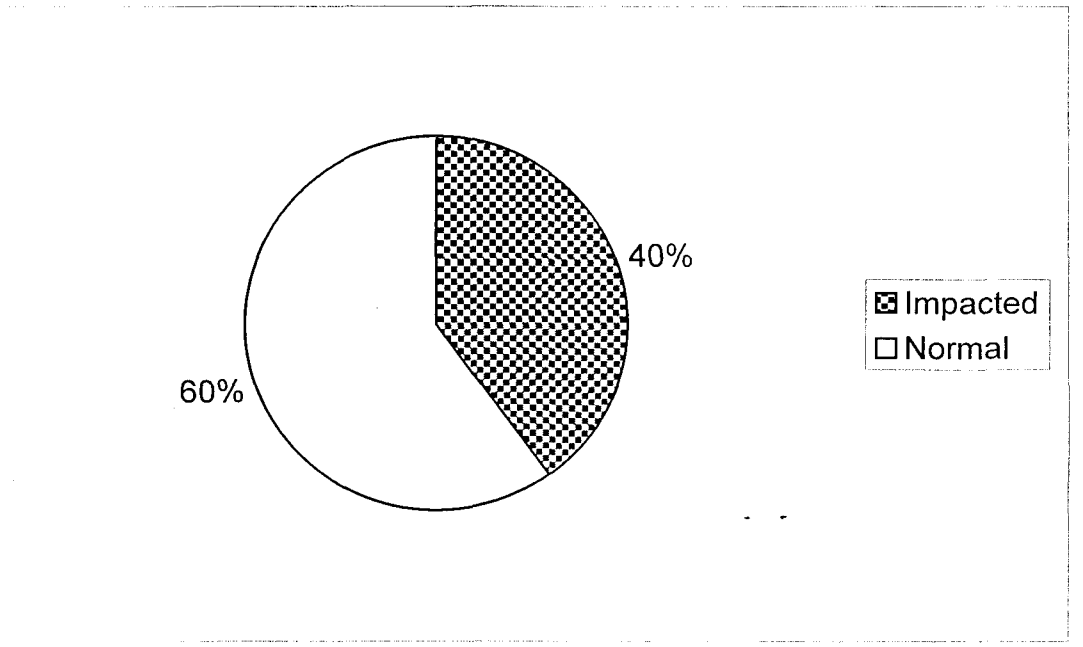

Figure - 13: Showing status of abomasum in animals of group A.

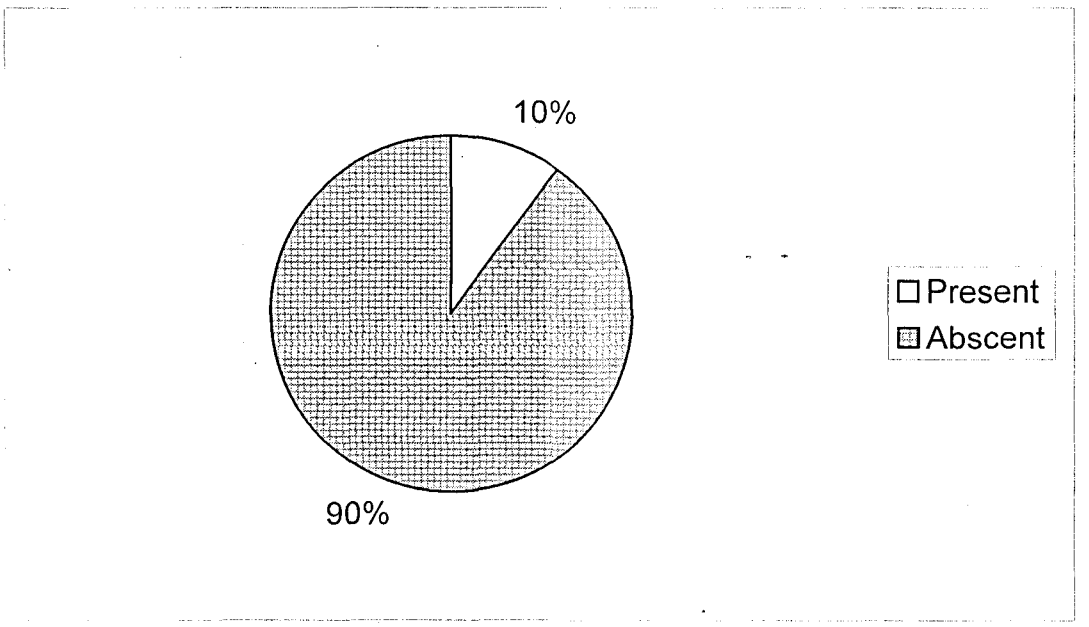

Figure - 14: Showing percentage of extrareticular abscesses in animals of group A.

concentration of rumen fluid was higher than normal (Table 5). Protozoal motility was not satisfactory (zero to ten motile protozoa per field).

Pre- and post-operatively haemoglobin, TEC and TLC were within the normal range (Table 6). Preoperatively, PCV was higher than normal and its significant decrease was observed at 48 hours of surgery. Preoperatively, neutrophils were marginally higher than normal and postoperatively its mean values were within normal range.

Preoperatively, concentration of sodium, potassium and chloride in plasma was lower than normal. Significant increase was observed in these parameters after treatment (Table 7). Pre- and post-operative changes in blood glucose and total plasma protein were not significant.

In all animals, there was considerable improvement in feed and water intake, ruminal movements, rumination and faecal output within 4-6 days of treatment.

Group B

Clinical observations and history of this group of animals are summarized in Table 8.

There was history of anorexia and suspended rumination for a varying period of 1-3 weeks in animals of this group. In 56% cases anorexia was for a period of 1-2 weeks (Fig 22). Faces were pasty in four (45%), hard in one (11%) and

Table 5: Comparison in mean ± S.E. of packed cell volume, biochemical and rumen fluid parameters of buffaloes suffering from TRP with (Group A, n=10) and without (Group B, n=9) abomasal reflux

Parameters (units)	Preoperative		24hours Postoperative		48hours Postoperative		Normal values
	Group A	Group B	Group A	Group B	Group A	Group B	
Packed cell volume (%)	36.50 ± 1.25[a]	33.56 ± 1.61[a]	34.50 ± 0.92[a]	32.22 ± 1.58[a]	31.00 ± 0.76[a]	29.44 ± 1.34[a]	22-30 (25.2 ± 0.93)
Plasma sodium (nmol/l)	131.97 ± 4.46[a]	142.78 ± 3.40[a]	137.55 ± 4.04[a]	147.38 ± 3.44[a]	147.89 ± 3.76[a]	152.82 ± 3.54[a]	135-155 (146.1 ± 2.24)
Plasma chloride (mmol/l)	70.45 ± 2.19[a]	91.18 ± 3.90[b]	78.08 ± 2.89[a]	97.62 ± 4.29[b]	87.92 ± 3.91[a]	106.47 ± 4.00[b]	80-100 (89.2 ± 2.92)
Plasma potassium (mmol/l)	2.59 ± 0.18[a]	3.19 ± 0.17[b]	2.99 ± 0.18[a]	3.58 ± 0.21[b]	3.52 ± 0.18[a]	4.17 ± 0.20[b]	3.5-4.8 (4.24 ± 0.14)
Rumen fluid chloride (mmol/l)	36.14 ± 2.02[a]	25.27 ± 0.38[b]	-	-	-	-	22-30 (25.5 ± 0.95)
Buffering capacity of rumen fluid (mmol/l)	103.6 ± 8.25[a]	128.56 ± 1.61[b]	-	-	-	-	120-132 (127.9 ± 1.31)
pH of rumen fluid	6.63 ± 0.09[a]	7.12 ± 0.04[b]	-	-	-	-	6.8-7.5 (7.08 ± 0.08)

Values with same subscript are statistically non significant.

Table 6: Mean ± S.E. of haematological parameters of buffaloes suffering from TRP with abomasal reflux (Group A, n = 10)

Parameters (units)	Preoperative	Postoperative		Normal values
		24 hours	48 hours	
Haemoglobin (gm/dl)	11.80 ± 0.48[a]	11.50 ± 0.41[a]	11.00 ± 0.46[a]	10.5 – 14.0
Packed cell volume (%)	36.50 ± 1.25[a]	34.50 ± 0.92[a]	31.0 ± 0.76[b]	22 – 30
Erythrocytic sedimentation rate (mm/hr)	45.60 ± 1.84[a]	47.0 ± 1.06[a]	49.4 ± 1.41[a]	17 – 69
Total erythrocytic count (millions/cumm)	8.15 ± 0.29[a]	7.98 ± 0.24[a]	7.66 ± 0.19[a]	5.5 – 8.5
Total leucocytic count (/cumm)	9250 ± 664.71[a]	9110 ± 590[a]	8830 ± 577.12[a]	6000 – 12000
Neutrophils (%)	49.0 ± 2.56[a]	46.8 ± 2.25[a]	42.31 ± 1.76[a]	25 – 45
Lymphocytes (%)	45.20 ± 2.59[a]	48.70 ± 2.73[a]	52.50 ± 2.30[a]	45 – 65
Monocytes (%)	4.10 ± 0.43[a]	3.10 ± 0.46[a]	3.50 ± 0.40[a]	3 – 8
Eosinophils (%)	1.10 ± 0.23[a]	0.90 ± 0.18[a]	1.10 ± 0.23[a]	1 – 3
Basophils (%)	0.60 ± 0.16[a]	0.05 ± 0.17[a]	0.60 ± 0.16[a]	0 – 3

Values with same subscript are statistically non significant.

Table 7: Mean ± S.E. of blood biochemical parameters of buffaloes suffering from TRP with abomasal reflux (Group A, n = 10)

Parameters (units)	Preoperative	Postoperative		Normal values
		24 hours	48 hours	
Plasma chloride (mmol/l)	70.45 ± 2.19[a]	78.08 ± 2.89[a]	87.92 ± 3.91[b]	80 – 100
Plasma sodium (mmol/l)	131.97 ± 4.46[a]	137.55 ± 4.05[ab]	147.89 ± 3.76[b]	135 – 155
Plasma potassium (mmol/l)	2.59 ± 0.18[a]	2.99 ± 0.18[a]	3.52 ± 0.18[b]	3.5 – 4.8
Total plasma protein (gm/dl)	7.16 ± 0.35[a]	7.30 ± 0.32[a]	7.42 ± 0.34[a]	6 – 8
Blood glucose (gm/dl)	47.90 ± 2.83[a]	51.00 ± 2.49[a]	54.40 ± 2.0[a]	40 – 65

Values with same subscript are statistically non significant.

Table 8: Clinical observations and history of buffaloes suffering from TRP without abomasal reflux (Group B, n = 9)

Characteristic	Findings	Number of animals
Heart rate (/min)	Normal (40 – 60)	6
	Increased (> 60)	3
Respiration rate (/min)	Normal (15 – 20)	4
	Increased (> 20)	5
Rectal temperature (^{0}F)	Normal (101 – 102.5)	6
	Increased (> 102.5)	3
Days of anorexia	Upto 1 week	2
	1-2 weeks	5
	2-3 weeks	2
Defecation	Normal	2
	Reduced	5
	Absent	2
Faecal consistency	Normal	2
	Hard	1
	Pasty	4
Rumen motility (/5min)	Normal (8)	1
	Reduced (< 8)	7
	Absent	1
History of tympany	Yes	4
	No	5
Pregnancy status	Recently calved	4
	Pregnant	5
Milk yield	Normal	3
	Moderate decrease	4
	Considerable decrease	2
Age (years)	4-6	3
	7-10	6
Lactation	Second	3
	Third	2
	Fourth	1
	Fifth	3
Other signs	Nasal discharge /coughing	2

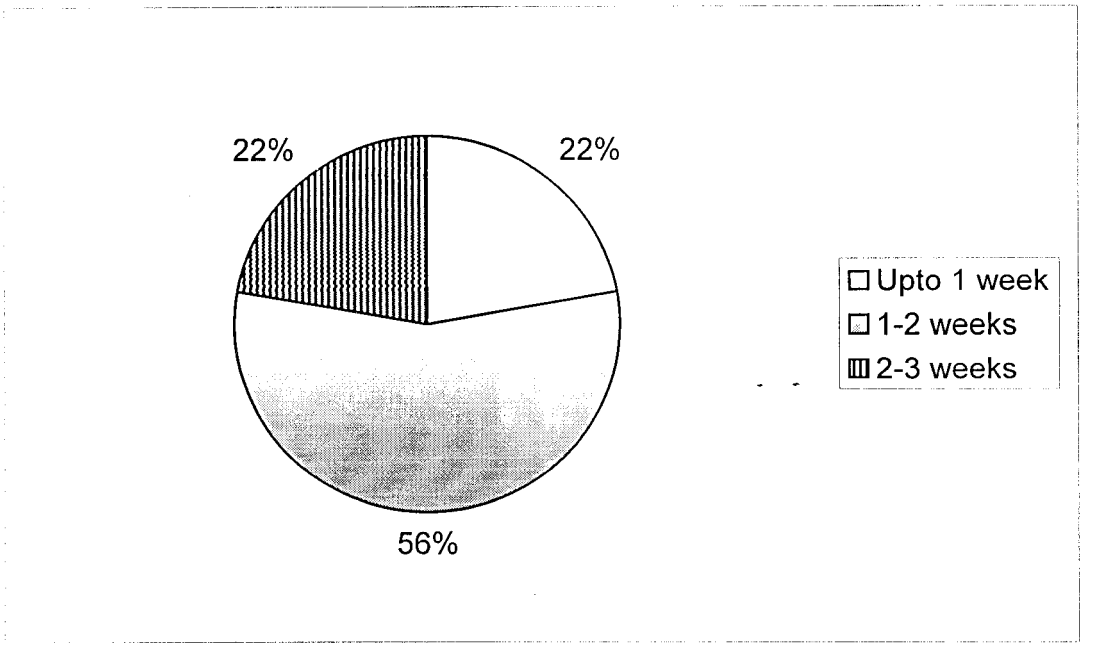

Figure - 22: Showing history of anorexia in animals of group B.

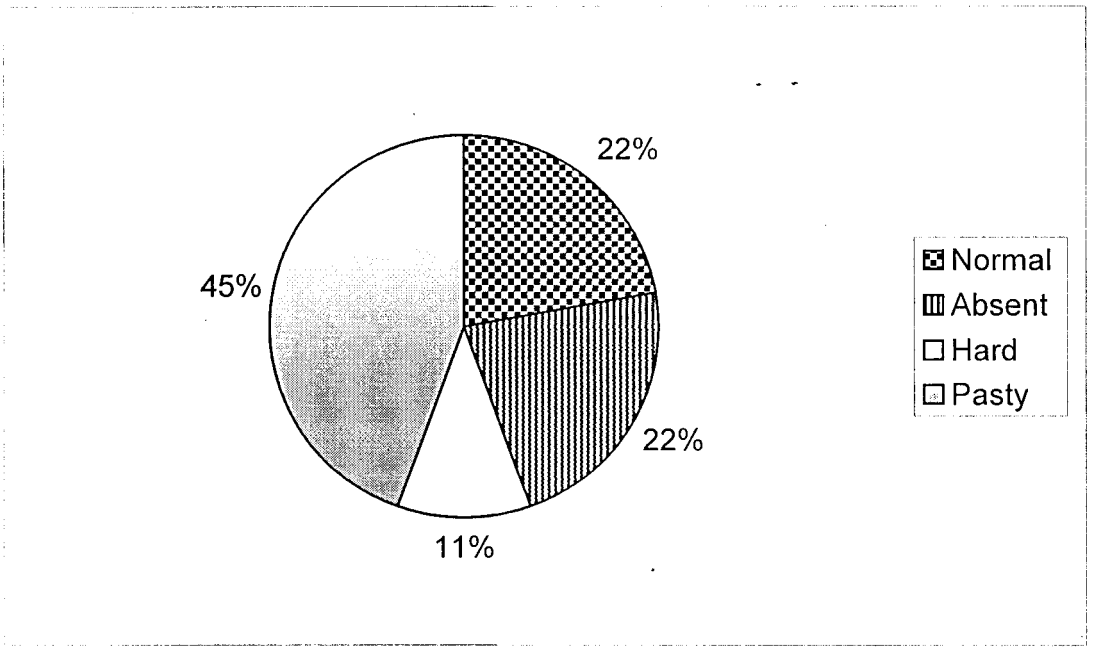

Figure - 23: Showing status of defecation in animals of group B.

normal in two (22%) animals while defecation was suspended in remaining two (22%) animals (Fig. 23). Water intake was reduced, in all the animals. The ruminal motility was reduced in seven (78%) cases, absent in one (11%) case and normal in remaining one(11%) (Fig. 24). Four (44%) animals had the history of tympany while in remaining five (56%) tympany was not reported (Fig. 25). Five (56%) animals were pregnant and remaining four (44%) had parturated about 1-2 months back (Fig. 26). Milk yeild was reduced moderately in four (45%) animals, considerably in two (22%) animals and normal in remaining three (33%) animals (Fig. 27). Three (33%) animals were in 4-6 years of age group and remaining six (67%) were 7-10 years old (Fig. 28). Three animals (each) were in second and fifth lactation, one (11%) in fourth and two (22%) in third lactation (Fig. 29). Signs of chronic cough and nasal discharge were observed in two cases. Swab from peritoneal cavity did not reveal infection in any animal of this group.

The variations in rectal temperature, heart rate and respiration rate are shown in Table 9. Preoperatively, respiration rate was higher than normal and significant reduction occurred postoperatively. Preoperatively ruminal movements were slightly reduced which increased marginally at 48hours of surgery but were slightly lower than normal even at the time of discharge (Table 10).

Table 9: Mean ± S.E. of heart rate, respiration rate and rectal temperature of buffaloes suffering from TRP without abomasal reflux (Group B, n = 9)

Parameters (units)	Preoperative	Postoperative		Normal values
		24 hours	48 hours	
Heart rate (/min)	59.0 ± 2.0[a]	56.0 ± 1.0[b]	53.0 ± 1.0[b]	40 – 60
Respiration rate (/min)	22.0 ± 1.0[a]	20.0 ± 1.0[ab]	18.0 ± 1.0[b]	15 – 20
Temperature (^{0}F)	102.43 ± 0.25[a]	101.24 ± 0.21[b]	101.16 ± 0.27[b]	101-102.5

Values with same subscript are statistically non significant.

Table 10: Mean ± S.E. of ruminal motility of buffaloes suffering from TRP without abomasal reflux (n = 9)

Parameters (units)	Preoperative	Postoperative		At the time of discharge*
		24 hours	48 hours	
Ruminal motility (/5 min)	6.77 ± 0.81	6.44 ± 0.78	7.11 ± 0.59	7.55 ± 0.24

* Time of discharge varied from 4-6 days after surgery for different animals.

Normal value of ruminal motility in a healthy adult buffalo is 8/5min (Behl *et al.*, 1997).

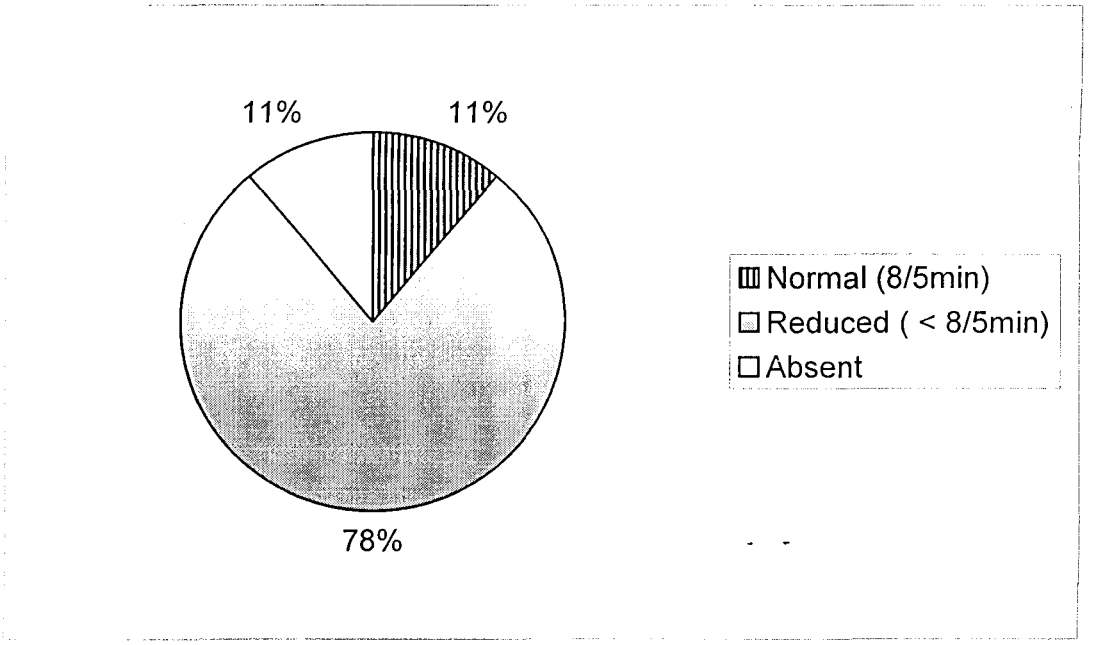

Figure - 24: Showing effect of TRP on ruminal motility in animals of group B.

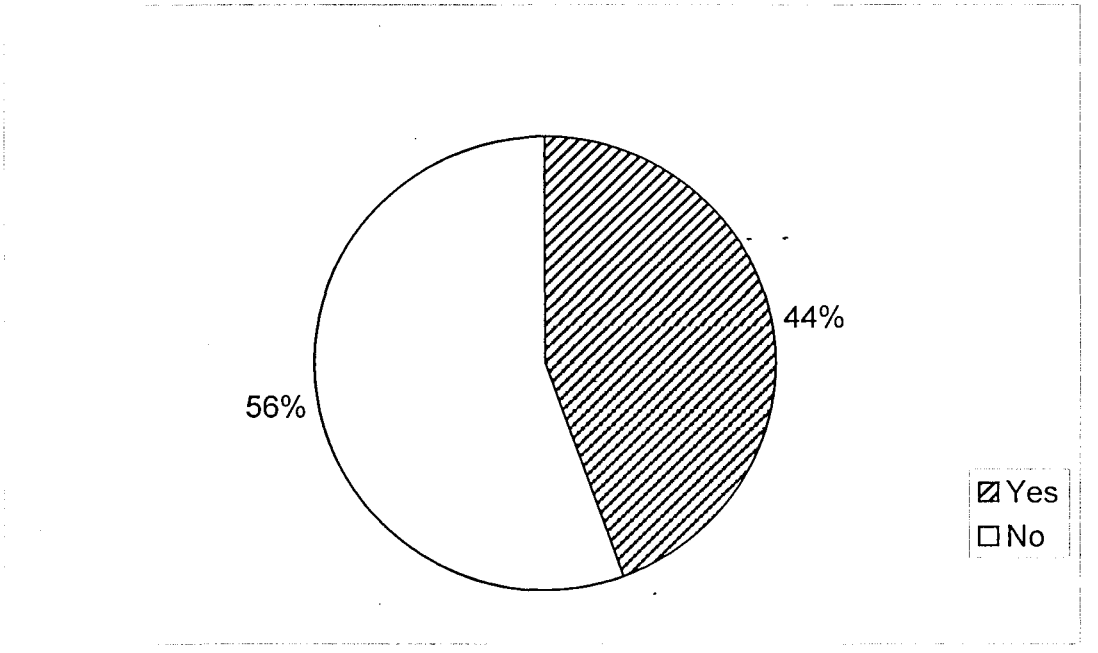

Figure - 25: Showing history of tympany in animals of group B.

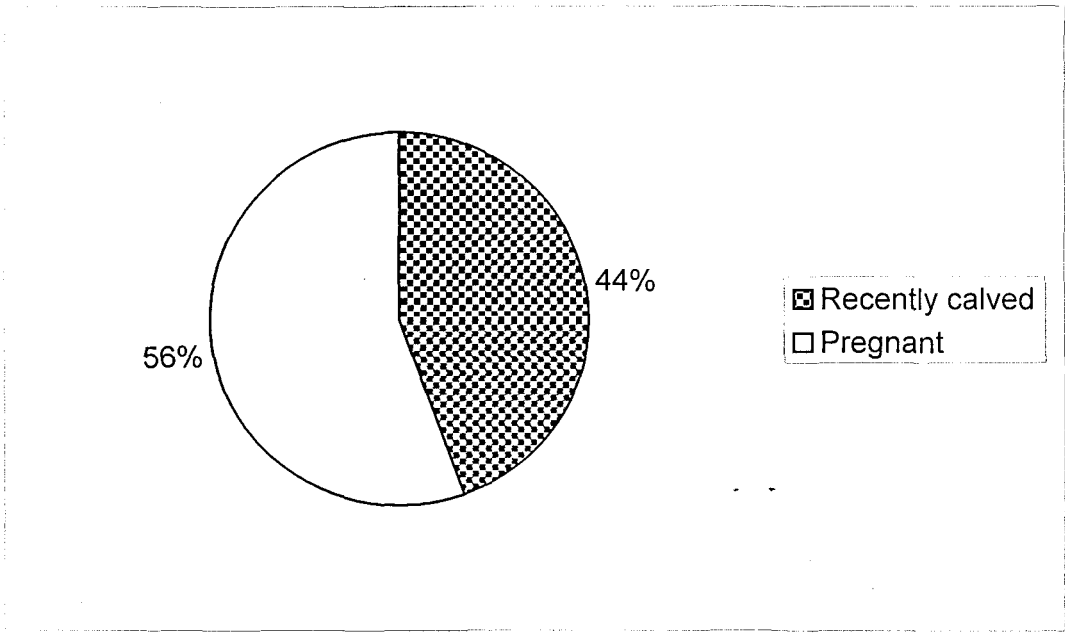

Figure - 26: Showing pregnancy status of cases of TRP in group B.

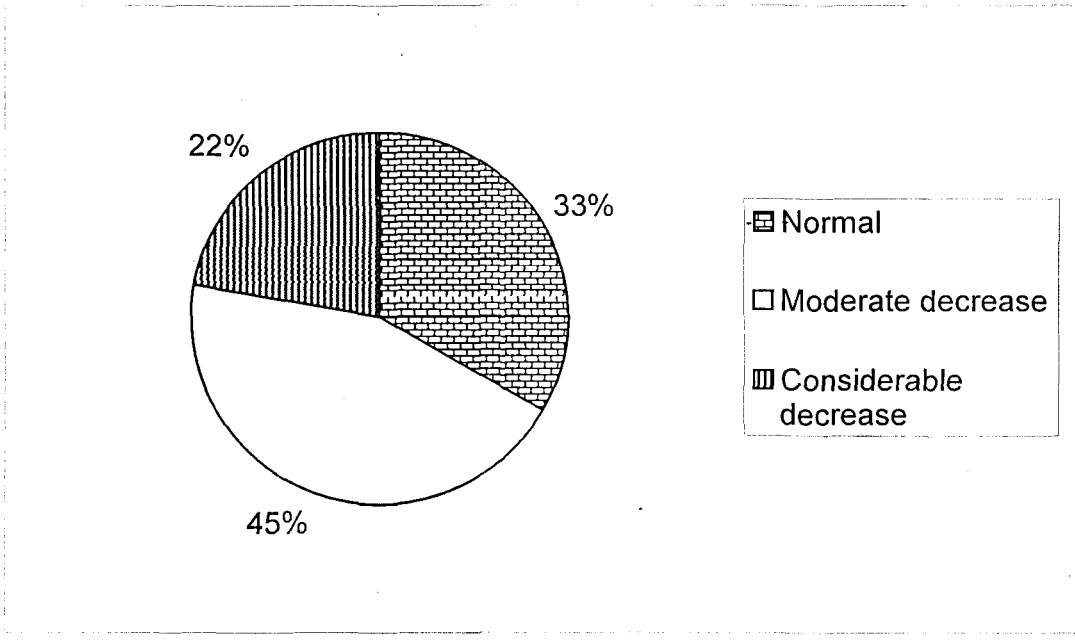

Figure - 27: Showing effect of TRP on milk yeild in animals of group B.

Laparorumenotomy findings of this group of animals are shown in Table 11.

On laparorumenotomy, in one (11%) case mild, in two (22%) cases moderate adhesions of rumen with peritoneum were observed while in remaining six (67%) cases no such adhesions were observed (Fig. 30). Mild to moderate adhesions of reticulum with diaphragm were observed in all the cases. Ruminal contents were watery with flakes in two (22%) cases, dry in one (11%) case and frothy in one (11%) animal. In rest of the five (56%) animals semisolid/undigested ruminal contents were noticed (Fig. 31). Atrophy of ruminal papillae was observed in two (22%) animals (Fig 32). In six (67%) animals, sharp foreign bodies were found to be embedded in reticulum. In remaining three (33%) animals these were found lying free on the reticular surface (Fig. 33). Omasum was found empty in three cases. The pH, chloride concentration and buffering capacity of ruminal fluid were within normal limits (Table 5). Protozoal motility was satisfactory (more than 10 motile protozoa per field).

The mean ± S.E. of various haematological parameters before and after laparorumenotomy are shown in Table 12. All these parameters except PCV and neutrophils were within normal range preoperatively as well as postoperatively. PCV and neutrophils were higher preoperatively and became normal at 48 hours of surgery.

Table 11: Laparorumenotomy findings of buffaloes suffering from TRP without abomasal reflux (Group B, n = 9)

Characteristic	Findings	Number of animals
Adhesion of rumen with peritoneum	Mild	1
	Moderate	2
	No adhesions	6
Adhesions of reticulum with diaphragm	Mild to moderate	9
Ruminal contents	Watery with flakes	2
	Dry	1
	Frothy	1
	Semisolid/undigested	5
Atrophy of ruminal papillae	Yes	2
	No	7
Sharp potential foreign bodies in reticulum	Embedded	6
	Unembedded	3
State of omasum	Empty	3

Table 12: Mean ± S.E. of haematological parameters of buffaloes suffering from TRP without abomasal reflux (Group B, n = 9)

Parameters (units)	Preoperative	Postoperative		Normal values
		24 hours	48 hours	
Haemoglobin (gm/dl)	10.89 ± 0.51[a]	10.56 ± 0.49[a]	9.89 ± 0.45[a]	10.5 – 14.0
Packed cell volume (%)	33.56 ± 1.61[a]	32.22 ± 1.58[a]	29.44 ± 1.34[a]	22 – 30
Erythrocytic sedimentation rate (mm/hr)	46.56 ± 2.24[a]	47.44 ± 1.42[a]	49.00 ± 1.57[a]	17 – 69
Total erythrocytic count (millions/cumm)	7.24 ± 0.46[a]	7.28 ± 0.38[a]	6.96 ± 0.21[a]	5.5 – 8.5
Total leucocytic count (/cumm)	9000 ± 681.55[a]	8905.56 ± 643.89[a]	8672.22 ±563.66[a]	6000 – 12000
Neutrophils (%)	46.22 ± 3.33[a]	45.11 ± 3.30[a]	41.67 ± 2.71[a]	25 – 45
Lymphocytes (%)	48.78 ± 3.27[a]	49.56 ± 3.26[a]	53.0 ± 2.69[a]	45 – 65
Monocytes (%)	3.22 ± 0.46[a]	3.67 ± 0.41[a]	3.67 ± 0.47[a]	3 – 8
Eosinophils (%)	1.33 ± 0.23[a]	1.0 ± 0.24[a]	1.11 ± 0.20[a]	1 – 3
Basophils (%)	0.44 ± 0.18[a]	0.67 ± 0.17[a]	0.67 ± 0.17[a]	0 – 3

Values with same subscript are statistically non significant.

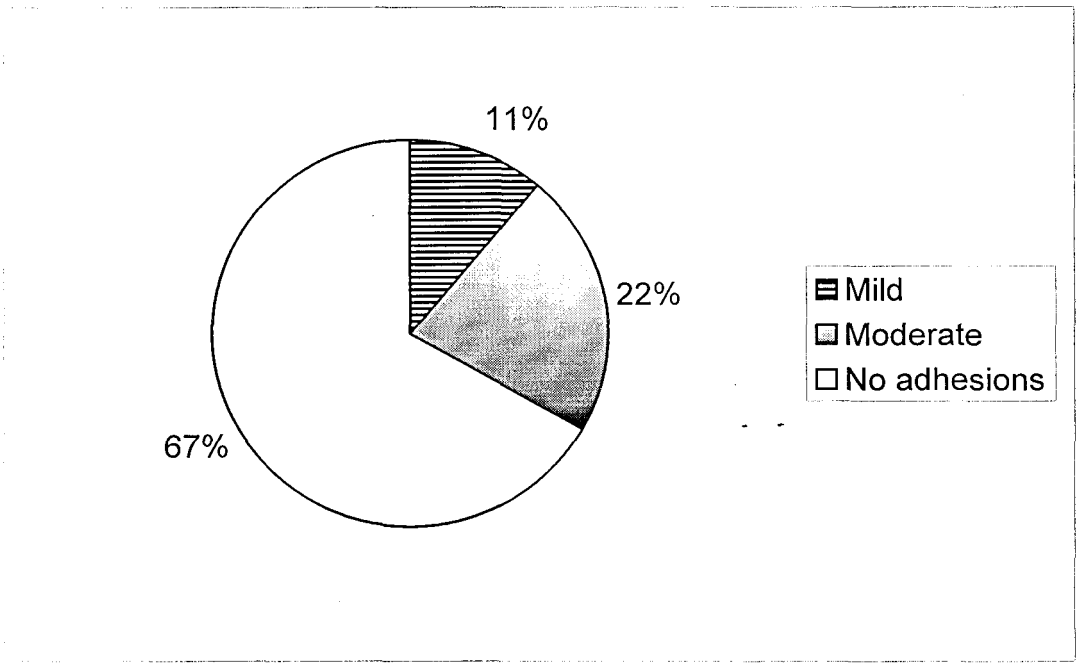

Figure - 30: Showing severity of adhesions of rumen with peritoneum in animals of group B.

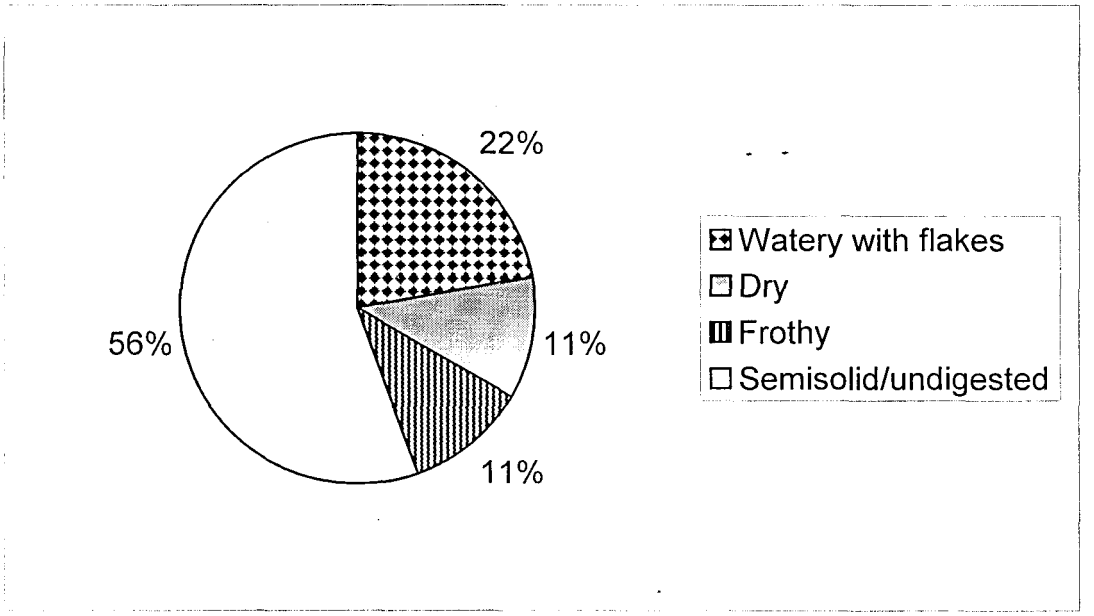

Figure - 31: Showing nature of ruminal contents in animals of group B.

The mean ± S.E. of various blood biochemical parameters are shown in Table 13. Preoperatively, plasma concentration of sodium and chloride; total plasma protein and blood glucose were within the normal limits. Non significant increase was observed in these parameters at 48 hours of surgery; except for chloride where increase was statistically significant. Preoperatively, plasma potassium concentration was lower than normal and there was significant increase in its concentration at 48 hours of surgery.

There was improvement in feed and water intake, ruminal movements, rumination, faecal output and abdominal distension within 4-6 days of treatment.

Comparison between two groups of animals (Table 5) showed that pH (Fig. 15) and buffering capacity (Fig. 16) of rumen fluid of animals of group A were significantly lower than that of animals of group B. However, the chloride concentration (Fig. 17) of rumen fluid of animals of group A was significantly higher than that of group B. PCV of animals of group A was nonsignificantly higher than that of group B preoperatively as well as postoperatively (Fig. 18). Plasma concentration of chloride (Fig. 19) and potassium (Fig. 20) were significantly lower in animals of group A as compared to that of group B preoperatively as well as postoperatively. Plasma concentration of sodium in animals of group A was non significantly lower than that of group B (Fig. 21).

Table 13: Mean ± S.E. of blood biochemical parameters of buffaloes suffering from TRP without abomasal reflux (Group B, n = 9)

Parameters (units)	Preoperative	Postoperative		Normal values
		24 hours	48 hours	
Plasma chloride (mmol/l)	91.18 ± 3.90[a]	97.62 ± 4.29[ab]	106.47 ± 4.00[b]	80 – 100
Plasma sodium (mmol/l)	142.78 ± 3.40[a]	147.38 ± 3.44[a]	152.82 ± 3.54[a]	135 – 155
Plasma potassium (mmol/l)	3.19 ± 0.17[a]	3.58 ± 0.21[a]	4.17 ± 0.20[b]	3.5 – 4.8
Total plasma protein (gm/dl)	7.54 ± 0.28[a]	7.70 ± 0.27[a]	7.97 ± 0.26[a]	6 – 8
Blood glucose (gm/dl)	50.78 ± 2.20[a]	55.0 ± 1.61[a]	55.44 ± 1.52[a]	40 – 65

Values with same subscript are statistically non significant.

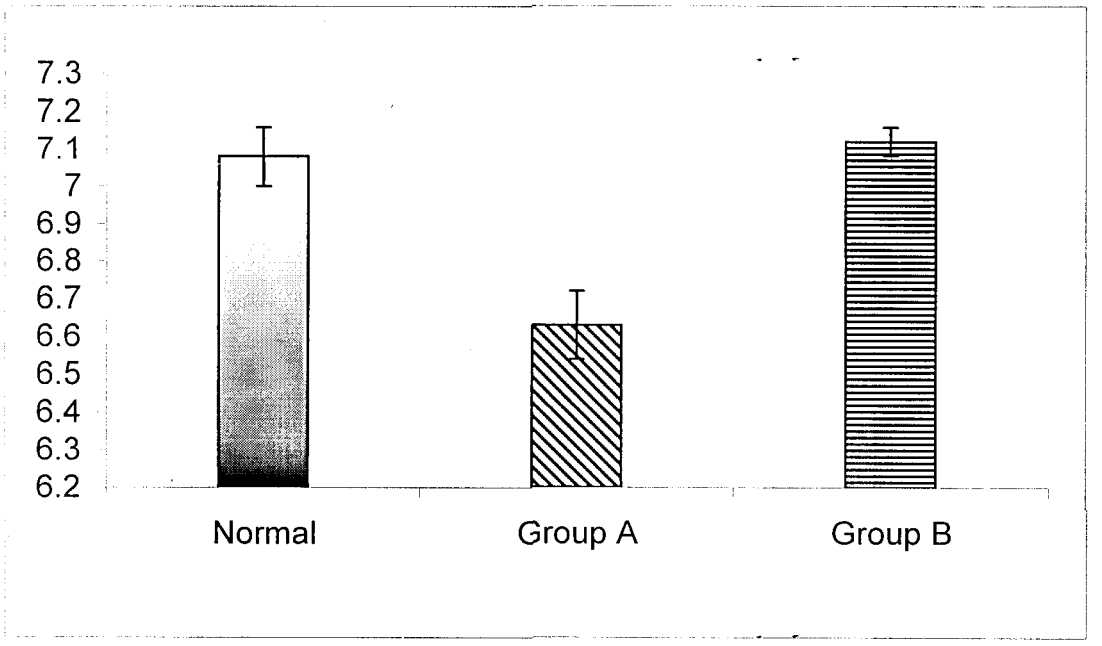

Figure - 15: Comparison of rumen fluid pH in buffaloes suffering from TRP with abomasal reflux (Group A, n=10) and without abomasal reflux (Group B, n=9)

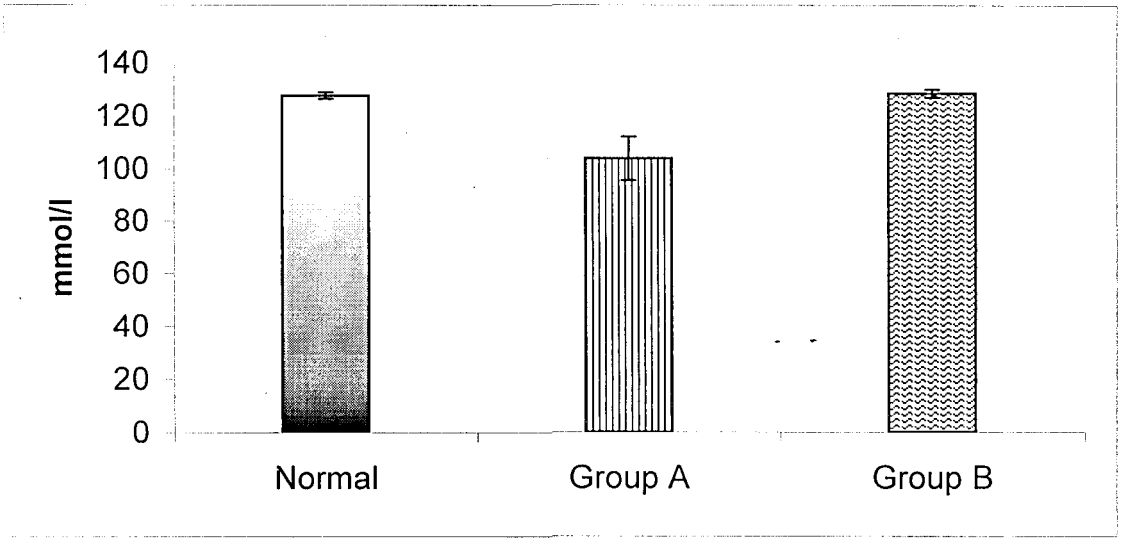

Figure - 16: Comparison of rumen fluid buffering capacity in buffaloes suffering from TRP with abomasal reflux (Group A, n=10) and without abomasal reflux (Group B, n=9)

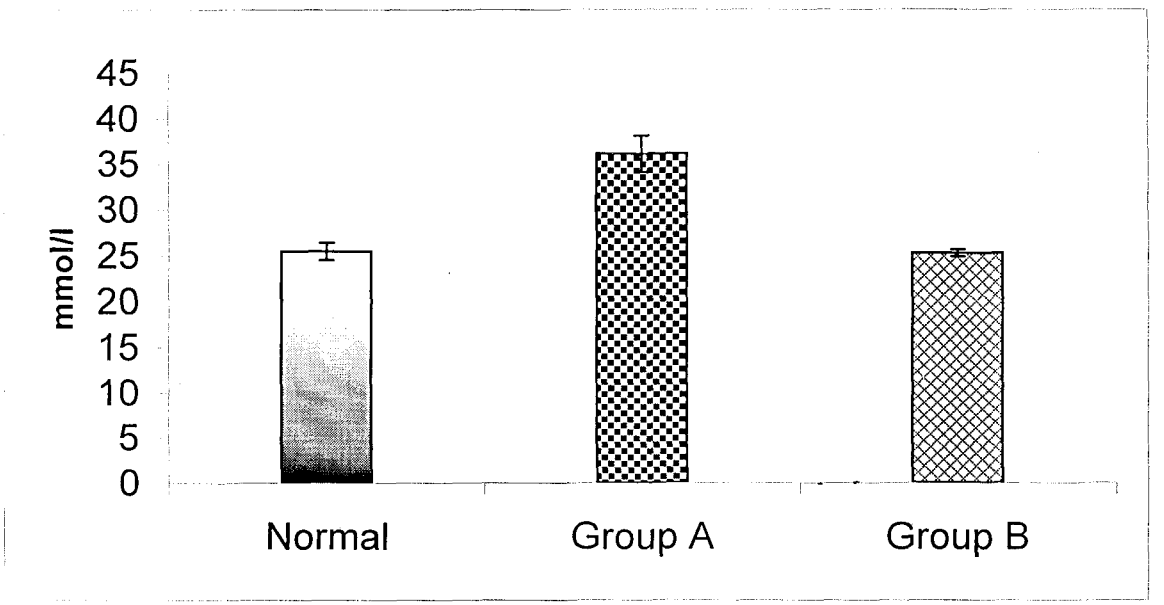

Figure - 17: Comparison of rumen fluid chloride concentrations in buffaloes suffering from TRP with abomasal reflux (Group A, n=10) and without abomasal reflux (Group B, n=9)

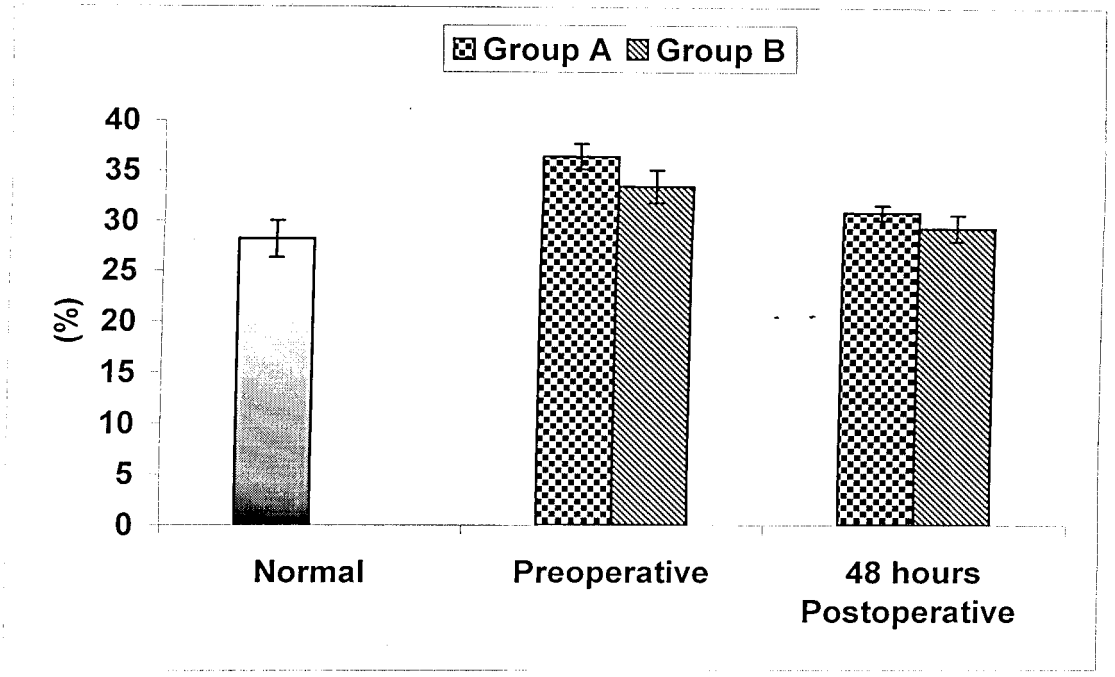

Figure - 18: Comparative effect of treatment on mean (± S.E.) of packed cell volume of buffaloes suffering from TRP with abomasal reflux (Group A, n=10) and without abomasal reflux (Group B, n=9)

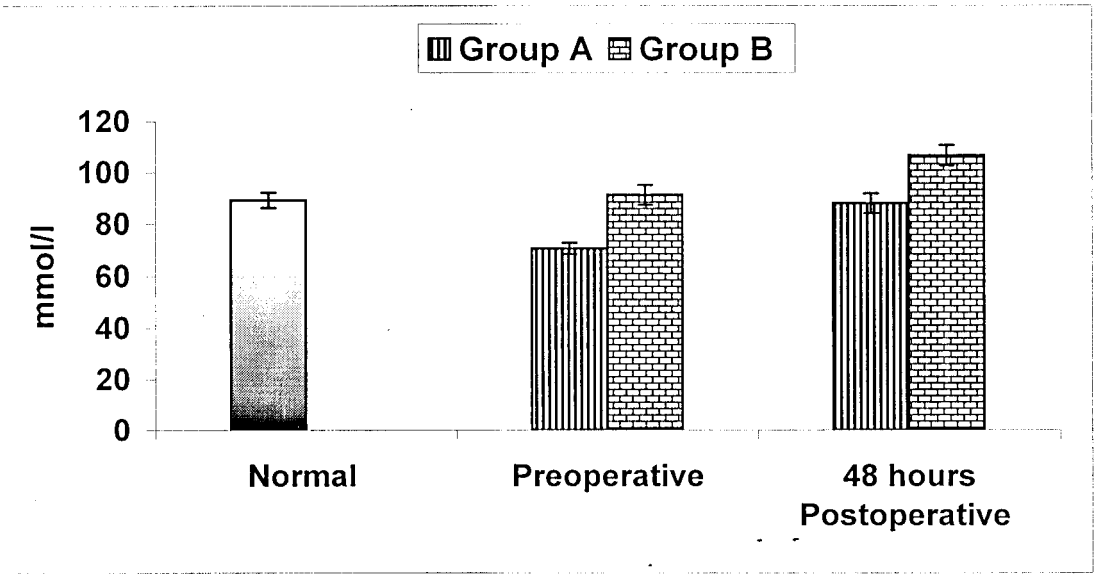

Figure - 19: Comparative effect of treatment on mean (± S.E.) of plasma chloride concentraitons in buffaloes suffering from TRP with abomasal reflux (Group A, n=10) and without abomasal reflux (Group B, n=9)

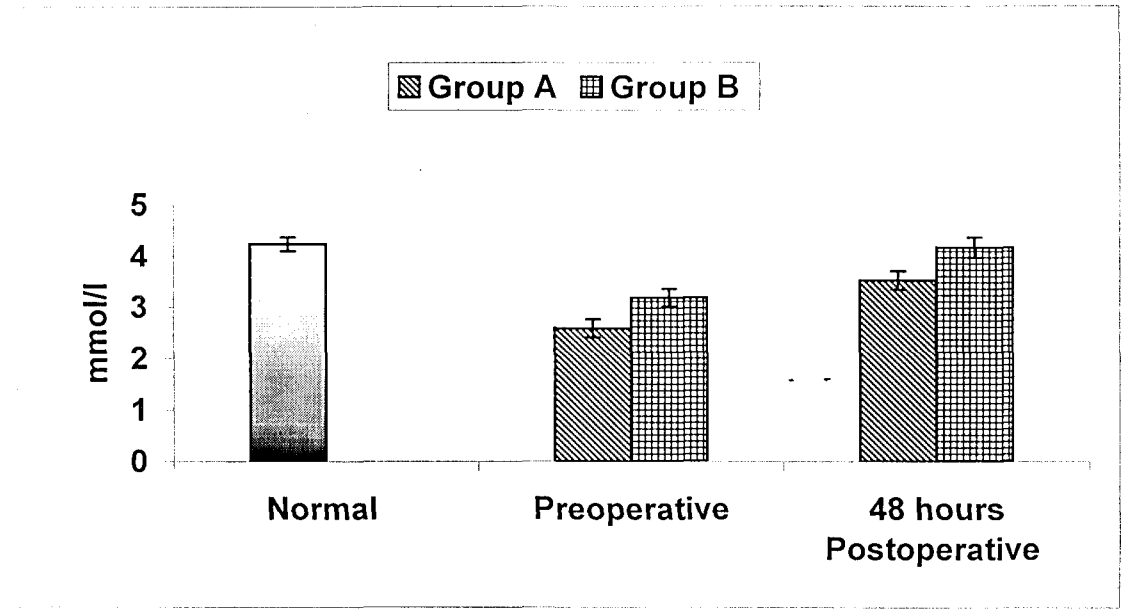

Figure - 20: Comparative effect of treatment on mean (± S.E.) of plasma potassium concentraitons in buffaloes suffering from TRP with abomasal reflux (Group A, n=10) and without abomasal reflux (Group B, n=9)

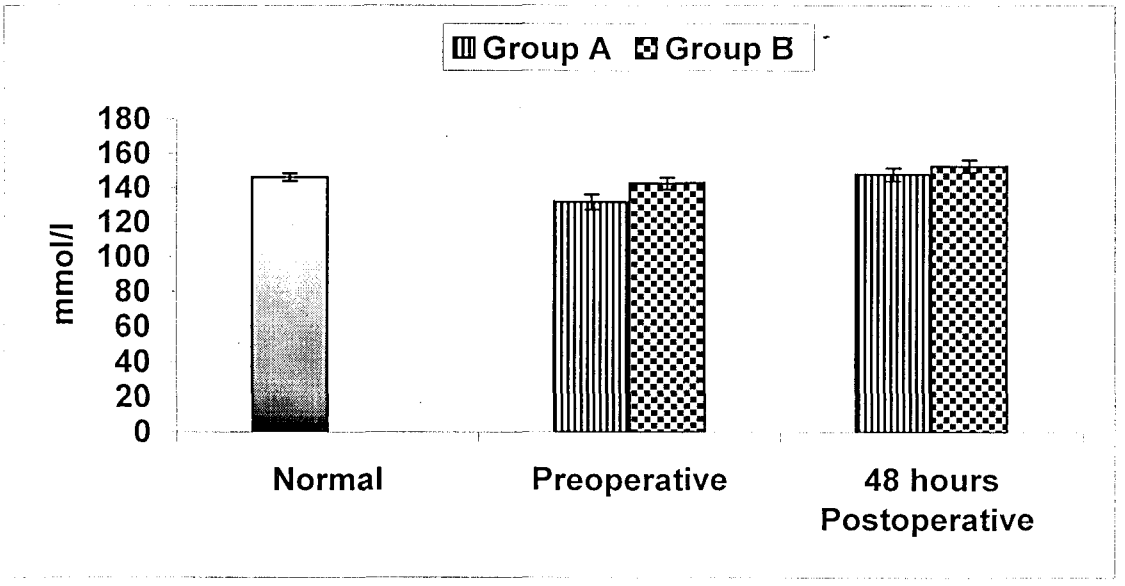

Figure - 21: Comparative effect of treatment on mean (± S.E.) of plasma sodium concentraitons in buffaloes suffering from TRP with abomasal reflux (Group A, n=10) and without abomasal reflux (Group B, n=9)

Observations on various parameters of remaining one clinical case where certain values were highly abnormal are presented in Table 14. Heart rate, respiration rate, rectal temperature, haemoglobin, PCV, TEC, TLC, neutrophils and total plasma proteins were much higher than normal range. Lymphocytes were much lower than normal range. ESR, monocytes, eosinophils and basophils were within normal range. No change was observed in these parameters at 48 hours of surgery. Plasma concentration of sodium, potassium and chloride was lower preoperatively. After treatment, plasma concentration of sodium and chloride increased to normal limit but plasma concentration of potassium remained below the normal range. Buffering capacity and pH of rumen fluid was lower than normal while chloride concentration of rumen fluid was higher. Extrareticular abscess was also found in this case. Swab from this abscess revealed mixed infection of *Klebsiella sp* and nonlactose fermentor gram negative rods.

There was no improvement in feed and water intake, faecal output, ruminal movements even after seven days of surgery and this animal was discharged at owner's request.

Table 14: Profile of buffalo suffering from TRP with unusual findings.

Parameters (units)	Pre operative	Postoperative 24 hours	Postoperative 48 hours	Normal values
Heart rate (/min)	120	110	105	40 – 60
Respiration rate (/min)	48	46	45	15 – 20
Rectal temperature (^{0}F)	104.0	104.0	103.0	101-102.5
Haematology				
Haemoglobin (gm/dl)	15.50	15.00	14.00	10.5 – 14.0
PCV (%)	46	42	50	22 – 30
ESR (%)	37	40	38	17 – 69
TEC (million/cumm)	10.25	10.45	10.00	5.5 – 8.5
TLC (/cumm)	28000	30000	31000	6000– 12000
DLC				
Neutrophils (%)	79	83	76	25 – 45
Lymphocytes (%)	15	15	18	45 – 65
Monocytes (%)	3	2	2	3 – 8
Eosinophils (%)	2	0	3	1 – 3
Basophils (%)	1	0	1	0 – 3
Blood biochemistry				
Chloride (mmol/l)	69.2	74.1	81.3	75 – 100
Sodium (mmol/l)	117.3	128.2	134.6	135 – 155
Potassium(mmol/l)	2.35	2.80	3.15	3.5 – 4.8
Total plasma protein (gm/dl)	10.7	10.5	11.2	6 – 8
Blood glucose (gm/dl)	38	43	45	40 – 65
Rumen fluid				
Chloride (mmol/l)	37.2	–	–	22 – 30
Buffering capacity (mmol/l)	92	–	–	120 – 132
pH	6.4	–	–	6.8 – 7.5
Protozoal motility	+	–	–	

CHAPTER-V

DISCUSSION

In a study conducted in our department by Singh (1997), it was shown that conventional fluid therapy with 0.9% as well as with 2.7% saline solution routinely instituted in diaphragmatic hernia cases was inadequate to correct electrolyte imbalance, especially hypokalaemia. It was irrespective of the fact whether abomasal reflux was present or absent. It was further suggested that study be made to find the effects of repeated therapy with chloride rich solutions supplemented with potassium.

It has been convincingly shown in cattle as well as buffaloes that repeated administration of chloride rich solutions has a high success rate in the treatment of cranial and caudal functional stomach disorders (Kuiper and Breukink, 1986a&b; Braun *et al.*, 1990; Behl *et al.*, 1996).

In another study conducted by Singh (2001) it was shown that one time fluid therapy with 2.7% saline solution supplemented with 5.0g of potassium chloride given in buffaloes suffering from TRP failed to correct electrolyte imbance in these

buffaloes. It was further suggested that such animals should be given more fluid therapies with chloride rich solutions supplemented with potassium. In a parallel study conducted in our department on TRP cases of buffaloes (Chowdhary, 2003), it was observed that without fluid therapy in the postoperative period electrolyte imbalance is not restored and clinical improvement is delayed.

Therefore, in present study emphasis was given mainly on intravenous fluid therapy to correct electrolyte imbalance in cases of traumatic reticuloperitonitis in adult buffaloes. For this purpose, five liters of 2.7% saline solution with 5.0g of potassium chloride was intravenously administered soon after surgery and repeated at 24 hours of surgery. Clinical, hematological and blood biochemical parameters were observed preoperatively and again 24 hours after each fluid therapy. To know the clinical status of each animal after treatment, clinical signs of feeding, drinking, rumination, rumen motility and defecation were also noticed because there was no way to know, except from the clinical signs which case would respond and which would not. This corroborates the statement of Radostits *et al.* (2000) that in functional disorders of ruminant stomach, there is no reliable method of knowing which case will respond and this becomes known only after few days of treatment.

In the present study most of the changes observed in the various plasma and rumen fluid parameters are possibly

related to abomasal reflux in animals of group A. The sequestration of hydrochloric acid and its retension in abomasum basically occurs because of functional disorder of pylorus. In such situation there is continuous outpouring of the gastric secretions which, however, cannot pass on to the duodenum. This results into accumulation of secretions in the abomasum and forestomach leading to abomasal and ruminal distension and subsequent development of hypochloraemic alkalosis (Popadopolus, 1985a&b; Kuiper and Bruinik, 1986; Braun *et al.*, 1990 and Behl *et al.*, 1997). However, in animals of group B abomasal reflux was absent because abomasal secretions could pass to duodenum. Therefore, plasma and rumen fluid parameters were within the normal range in these animals.

Several factors may be responsible for the development of hypokalaemia. In reality, plasma concentration of potassium does not consistently reflect total body potassium and hypokalaemic patient may infact have normal total body potassium (Brobst, 1986). Nevertheless, very low levels of potassium in these animals do indicate a hypokalaemic state especially in the face of chronic starvation and development of hypochloraemia. In such situation hypokalaemia may develop because of reduced intake of feed alongwith continued renal loss of potassium. Further, redistribution of potassium from

extracellular fluid to intracellular compartment may also contribute the same (Whitlock, 1980; Brobst, 1986).

Hypokalaemic alkalosis does not get corrected unless sufficient chloride ions are infused into the body (Gulyassy *et al.*, 1962). However, Ward *et al.* (1993) suggested that chloride rich solutions have the potential to correct hypokalaemia without potassium supplementation. The observation of Singh (1997) in buffaloes was contrary to it as therapy with only chloride rich solution failed to correct hypokalaemia. To correct electrolyte imbalance in case of functional stomach disorders in adult large ruminants, large quantities of fluid (25-30 liters), rich in chloride ion are not only essential to correct hypochloraemia (Fubini *et al.*, 1991; Behl *et al.*, 1996) but also to correct hypokalaemia (Fubini *et al.*, 1991). Thus 2.7% saline solution can thus reduce the amount of the solutions to be infused to one third as large quantities are cumbersome to be infused in large animals.

In the present study it was observed that after treatment with chloride rich solutions supplemented with potassium, there was considerable improvement in clinical status and various clinical, haematological and blood biochemical parameters. In most of the animals blood electrolyte concentrations were within the normal range by 48 hours of surgery. Clinical signs like feeding, drinking, rumination, ruminal motility and defecation were normal after 4-6 days of second fluid therapy in most animals of both groups. Therefore,

from the findings of present study it can be stated that two times fluid therapy of five liters of 2.7% hypertonic saline solution supplemented with 5.0gm of potassium chloride was sufficient to correct hypochloraemic, hypokalaemic alkalosis. This corroborates the findings of Fubini *et al.* (1991) and Ward *et al.* (1993), where in hypertonic saline solutions (up to 7.2%) in small quantities were found to be effective to correct metabolic alkalosis in sheep without correcting total body fluid deficit. The findings of the present study also corroborates the findings of Behl *et al.* (1997a&b) wherein buffaloes suffering from functional stomach disorder receiving five liters of 2.7% saline solution alongwith small quantities of potassium chloride recovered from hypochloraemic hypokalaemic alkalosis.

The findings of the present study suggest that some potassium supplementation must be considered to correct hypokalaemia. It was also observed that two times five liters of 2.7% saline therapy supplemented with 5.0gm of potassium chloride was equally effective for better recovery of those buffaloes, which were not hypochloraemic. But it does not explain why such fluid therapies are so effective in treating the animals in absence of any hypochloramia.

In one of the study conducted in our department out of a total of 834 cases of buffaloes suspected for foreign body syndrome, 325 (39%) were positive for TRP. In 70% cases suffering from diaphragmatic hernia, potential foreign bodies

were confirmed to be present in the reticulum (Krishnamurthy *et al.*, 1985). In another study, out of 220 buffaloes suffering from dysfunction of forestomach, 75% were positive for TRP (Singh *et al.*, 1983).

The clinical manifestations observed in present study appeared to depend upon number and extent of penetration of foreign bodies, anatomical and physiological considerations of the organs affected and prior treatment animal had received before admitting at TVCSC, CCS HAU, Hisar. Similar observations have been made previously by others in buffaloes and cattle (Pinset, 1962; Singh *et al.*, 1983; Kumar *et al.*, 1983 and Sobti *et al.*, 1987). The clinical signs observed in such cases are due to pain and inflammation and effect on reticular contractions. If serosal surface of reticulum is not injured the penetrating foreign bodies does not produce any detectable changes (Radostits *et al.*, 2000). In some buffaloes clinical signs were present but on laparorumenotomy the foreign bodies were freely lying on the floor of reticulum. In such cases the damage caused by foreign bodies leads to necrosis of reticular wall and foreign bodies are thrown back to be lying free in the reticulum (Radostitis *et al.*, 2000). The moderate increase in respiration and pulse rate observed in many cases can be related to systemic reaction of pain caused by penetration of foreign bodies in the forestomach wall. After removal of foreign bodies during rumenotomy pain is expected to subside and this may be one of

the reasons of return of feed intake. Initial fever in many cases occurs in response to inflammation that develops to check the spreading infection caused by contamination as a result of penetrating foreign bodies.

Tympany in fourteen out of twenty cases occurred generally after feed and water intake as the level of ruminal content increases due to increase in passage time of ingesta and decrease in motility of forestomach in cases of TRP (Rehage *et al.*, 1995; Kaske *et al.*, 1994). In such cases the level of fluid and feed reaches above cardia. Although a rise in gas tension in the region of cardia triggers the reflux opening of the cardia and other events involved in eruction but reflux cardiac opening does not occur if cardia is covered with fluid (including foam), irrespective of the degree of tension in the cardiac region (Leek, 1969). So the process of expulsion of gases is hampered leading to tympany. This condition is also aided by adhesions, abscesses or many other complications in TRP leading to incomplete relaxation of reticulum which does not allow the fluid level to fall below the cardia.

Evidence is now also emerging that to produce clinical signs as produced in cases of TRP penetration by sharp foreign bodies is not necessary. Experimentally induced immobilization of reticulum by inserting a heavy object into the reticulum of sheep leads to anorexia, increase in ruminal volume and a four fold increase in the mean retention time of heavy

particles and also an increase in abomasal volume (Kaske *et al.*, 1994). Similar signs occur in cows suffering from TRP associated with disturbance of digesta passage through reticulo-omasal orifice. Metallic cylinders containing deworming bolus located in reticulum also produced iatrogenic reticulitis with typical signs of TRP. Therefore, adhesions of reticulum or any other factor which reduces or disturbs the reticular contractions may produce clinical signs like TRP. The liquid consistency of abomasal content is important to ensure physiologic transpyloric flow. In cattle with uncomplicated TRP, the fluid flow through reticulo-omasal orifice remains enough to flush even large sized particles out of abomasum (Rehage *et al.*, 1995) and consequently faeces contain large undigested particles as observed in three cases (group B) in present study. The impacted abomasum in four cases of group A indicate either lack of fluid or some complications. The varying consistency of faecal matter and suspended defecation in most of these cases confirm the previous observations of Singh *et al.* (1983).

In the present study, localized peritonitis with adhesions were present surrounding the site of penetration of the foreign bodies in most of the cases of both groups. In group A generalized peritonitis with mild adhesions were present in three cases while generalized peritonitis with strong adhesions were observed in seven cases. In group B generalized peritonitis with mild adhesions were present in only one animal. While

generalized peritonitis with moderate adhesions were present in two cases. The peritonitis may be either localized or diffused depending on the extent of contamination and immune status of the animal (Pinset, 1962; Radostits *et al.*, 2000). The adhesions have very important role in causing the symptoms of inappetence to anorexia and indigestion in ruminants (Hutchins *et al.*, 1957; Rehage *et al.*, 1995). The formation and destruction of adhesions have systemic effects as reflected by increase in TLC (total leucocytic count) during evening after muscular activity of the day (Matteson *et al.*, 1953).

In three cases of group B empty omasum was observed. It suggests that either rumeno-reticular movements had ceased or there was cranial stomach functional disorder. Behl *et al.* (1997a) also reported such findings in buffaloes suffering from functional stomach disorders. In the present study extrareticular abscesses were found in two cases. Swab from one extrareticular abscess revealed mixed infection of *Pseudomonas sp* and *Corynebacterium pyogens* which were sensitive to Amikacin. Swab from the other extrareticular abscess revealed mixed infection of *Klebsiella sp* and nonlactose fermenter gram negative rods which were sensitive to Gentamycin. Similar findings have been reported by Maddy (1954). *Corynobacterium pyogens* and gram negative rods like *Escherichia coli* have also been reported by Holmes (1960) from the exudate of pericardium as a sequelae to TRP. Extrareticular

abscess exterts pressure on vagus nerve leading to functional stomach disorders. Therefore, drainage of these abscesses allows for return of forestomach motility (Fubini *et al.*, 1989). One buffalo of the present study with extrareticular abscess regained forestomach motility after its drainage.

Higher packed cell volume indicates moderate degree of dehydration in both the groups. Some of these animals also had higher plasma protein concentration. Similar observations have been reported by Kushali *et al.* (1981) and Braun *et al.* (1990). PCV is not a true indicator of dehydration in buffaloes as it may even decrease in face of dehydration as a result of haemodilution due to absorption of water from the gut and intestinal space (Rathor *et al.*, 1993). ESR (erythrocyte sedimentation rate) was within the normal range in both the groups.

Preoperatively TLC within the normal range was observed in both the groups. It did not give any evidence of acute inflammatory process in the body. Neutrophilia was observed in 70% of cases of group A and in 44% of cases of group B. Lymphocytopenia was observed in 40% of cases of group A and group B each indicating severe stress or chronic inflammation. Values of both was returning towards normal postoperatively. These changes indicate chronicity of the condition and effect of treatment including that of fluid therapy and antibiotics. In a previous study on cases of TRP in buffaloes (Singh *et al.*, 1983)

neutrophilia was observed in most cases with relative increase in leucocytes in 28% cases. The variation in haematological values in such cases wholly depends upon the stage and extent of damage caused by foreign bodies or associated conditions.

In most of the cases of group A buffering capacity of rumen fluid was reduced considerably. Rumen fluid pH was not as low as buffering capacity. This confirms the findings of Behl *et al.* (1997a&b) that in such cases where abomasal reflux occurs, the buffering capacity in more reliable than pH.

The rumenoreticular motility was more adversely affected in animals of group A as compared to group B. It may be due to adhesions of the reticulum with diaphragm and rumen with peritoneum, reticular abscesses and compression of the vagus nerve (Fubini *et al.*, 1989). Reticulo-ruminal atony in these animals can be ascribed to lack of normal excitatory sensory inputs arising from rumeno-reticulum tension receptors activation during rumenoreticulum distension (Leek, 1993).

The altered environment of rumenoreticulum due to disturbances in the passage of digesta and low buffering capacity of rumen fluid in animals of group A makes the ruminal environment unsuitable for protozoa and microbes to grow and help in digestion. This condition is also supported by atony of forestomach and nonmixing of contents. So protozoa may be deficient of nutrients which lead to their reduced motility and eventual death. After removal of three-fourth of ruminal content

and treatment it is quite possible that ruminal environment becomes suitable for protozoal growth and normal digestion is again restored.

Therefore, from the findings of the present study it can be suggested that recovery of buffaloes suffering from TRP can be made faster if conventional treatment (laparorumenotomy along antibiotics) is supported by two times intravenous fluid therapy with five liters of 2.7% saline solution supplemented with 5.0gm of potassium chloride as it satisfactorily improves the electrolyte imbalance in such cases after treatment.

CHAPTER-VI

SUMMARY AND CONCLUSIONS

The present study was conducted in twenty adult she-buffaloes confirmed to be suffering from traumatic reticuloperitonitis. In all these animals laparorumenotomy was performed under local anaesthesia using standard surgical technique. The foreign bodies were recovered from reticulum in all the cases. Out of twenty clinical cases, nineteen were divided into two groups (A and B) depending upon plasma chloride concentration and evidence of abomasal reflux. One case had highly abnormal findings and so was not included in any of the group.

Group A included ten TRP cases which were hypochloraemic with evidence of abomasal reflux. Group B included those nine TRP cases which were not hypochloraemic and there was no evidence of abomasal reflux.

Postoperatively, all the animals received Novalgin, Streptopenicillin, vitamin B complex with liver extract, and yeast culture. Five liters of 2.7% saline solution with 5.0g of potassium

chloride was administered intravenously immediately and 24 hours after surgery.

Parameters investigated were: rectal temperature, heart rate, respiratory rate, ruminal movements, Hb, PCV, TEC, TLC, DLC, blood glucose, total plasma protein, plasma concentration of sodium, potassium and chloride. Buffering capacity, pH, chloride concentration and protozoal motility of rumen fluid.

In group A, rectal temperature, heart rate, respiratory rate were normal preoperatively as well as postoperatively. Preoperatively, ruminal movements were reduced which improved slightly at 48 hours of surgery. In one animal extrareticular abscess was drained. Rumenoreticular adhesions were found in all the ten animals. Ruminal contents were watery with flakes in six cases, dry in two cases and normal in remaining two cases. Atrophy of ruminal papillae was observed in seven cases. Abomasum was found impacted in four cases.

Preoperatively, packed cell volume was higher. It decreased, but remained slightly higher than normal at 48 hours of surgery. All other haematological parameters were normal pre- and post-operatively except neutrophils which were higher preoperatively and became normal after 48 hours of surgery. Plasma concentration of sodium, potassium and chloride were lower than normal preoperatively and these were within normal range at 48 hours of surgery. Total plasma protein and blood

glucose were within the normal range pre- and post-operatively. Buffering capacity and pH of rumen fluid were lower than normal while its chloride concentration was higher than normal. Protozoal motility was not satisfactory.

In group B animals, rectal temperature and heart rate were normal pre- and post-operatively. Respiration rate was slightly higher preoperatively, but it was within normal range at 48 hours of surgery. Preoperatively, ruminal movements were slightly reduced which increased marginally after 48 hours of surgery.

Packed cell volume was higher preoperatively, but it returned to normal range at 48 hours of surgery. All other haematological parameters except neutrophils were normal pre- and post-operatively which was slightly higher preoperatively and became normal at 48 hours of surgery.

Adhesions of rumen with peritoneum were present in three cases while reticular adhesions were present in all the cases. Ruminal contents were watery with flakes in two cases, dry and frothy (in one case each) and normal in rest of the five cases. Atrophy of ruminal papillae was observed in two cases.

Preoperatively, plasma potassium concentration was lower in all the animals which came to normal limits after 48 hours of surgery. All other biochemical parameters were normal pre- and post-operatively. Chloride concentration, buffering

capacity and pH of rumen fluid were normal in all the animals. Protozoal motility was satisfactory.

There was satisfactory improvement in feed and water intake, ruminal movements, rumination, faecal output and abdominal distension in all the animals of both groups within 4-6 days of treatment.

When results of both the groups were compared, it showed that pH and buffering capacity of rumen fluid of animals of group A were significantly lower than that of group B. However, the chloride concentration of rumen fluid of group A was higher than that of group B. Plasma concentration of chloride and potassium were significantly lower in group A as compared to group B, preoperatively as well as postoperatively.

The observations of remaining one animal were quite different and this animal was not included in any of two groups. Its findings have been described separately. An extrareticular abscess was also found in this case. Swab from this abscess revealed mixed infection of *Klebsiella sp* and nonlactose fermenter gram negative rods. There was no improvement in feed and water intake, faecal output, ruminal movements even after seven days of surgery and this animal was discharged on owner's request.

From persual of observations of the present study, the following conclusions are drawn:

1. Most of the buffaloes suffering from traumatic reticuloperitonitis have electrolyte imbalance.
2. Two times intravenous fluid therapy with five liters of 2.7% saline solution supplemented with 5.0g of potassium chloride satisfactorily improves the electrolyte imbalance.

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