

# **A STUDY ON ETIOLOGY OF PERITONITIS AND PROGNOSTIC INDICATORS IN GASTROINTESTINAL STASIS IN BOVINES**

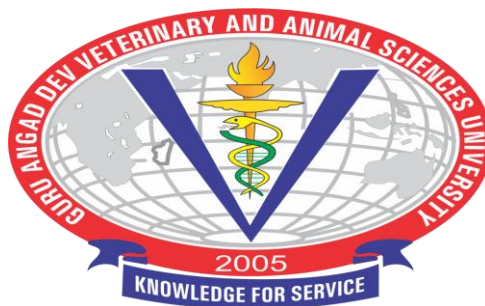
**Thesis**

**Submitted to the Guru Angad Dev Veterinary and Animal Sciences University  
in partial fulfillment of the requirements for the degree of**

**MASTER OF VETERINARY SCIENCE  
in  
VETERINARY MEDICINE  
(Minor Subject: Veterinary Microbiology)**

**By**

**Abdul Qader Pooyan  
(L-2015-V-41-M)**



**Department of Veterinary Medicine  
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Ludhiana – 141 004**

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## **CERTIFICATE – I**

This is to certify that the thesis entitled, “**A study on etiology of peritonitis and prognostic indicators in gastrointestinal stasis in bovines**” submitted for the degree of **M.V.Sc.**, in the subject of **Veterinary Medicine** (Minor Subject: **Veterinary Microbiology**) of the Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, is a **bonafide research work carried** out by **Abdul Qader Pooyan (L-2015-V-41-M)** under my supervision and that no part of this thesis has been submitted for any other degree.

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

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#### ABSTRACT

This study was conducted in two groups of dairy animals. Etiology of peritonitis was determined in 33 cattle and buffaloes by laprorumenotomy. Clinical observations, haematology and radiographic signs were determined before surgery. Sixty two cattle and buffaloes suffering from gastrointestinal stasis were selected to determine prognostic indicators. History, clinical observations, haemato-biochemical parameters were determined. Peritoneal fluid was analyzed for total and differential cell count, total protein and bacterial culture was done. Traumatic reticuloperitonitis was the cause of peritonitis in 42.4 per cent, sharp potential foreign bodies were lying freely in reticulum of 39.4 per cent and peritonitis was not associated with sharp metallic foreign bodies 18.1 per cent of animals. All the 7 cranioventrally and 4 of 5 midcranially placed sharp metallic foreign bodies in close contact to reticular wall detected on radiography were confirmed to be penetrating during laprorumenotomy. Eleven of 12 caudoventrally and central located foreign bodies were not penetrating the reticular wall. Leukogram was inflammatory in 42.4 per cent of animals characterised by regenerative or degenerative left shift and neutrophilic leukocytosis with toxic changes. Anorexia, history of fever and abnormal rumen consistency were significantly ( $p < 0.05$ ) more common in TRP as compared to non-TRP affected animals. Sixty two dairy cattle and buffaloes manifesting gastrointestinal stasis were selected after excluding traumatic reticuloperitonitis, reticular abscess, diaphragmatic hernia and intestinal obstruction. Post treatment recovery rate was 58.8 per cent in buffaloes and 35.7 per cent in cattle. Anorexia, foul smelling faeces, intestinal distention and loss of defecation were significantly ( $p < 0.05$ ) more common in died animals. No significant difference was observed in haematological parameters between surviving and dying animals. Leukogram was inflammatory in 40 per cent of survived buffaloes, 35.7 per cent of died buffaloes, 50 per cent of survived cattle and 55.5 per cent in died cattle. Clinical observations viz, history of fever, foul smelling faeces, abnormal rumen consistency, intestinal distention and left shift were found to be most useful in determining prognosis. Probability of survival was 85 per cent with the disease score of  $< 3$  and probability of mortality was 85.7 per cent with disease score  $\geq 3$  in buffaloes. Similarly, probability of survival was 80 per cent with the diseased score of  $< 3$  and probability of mortality was 88.9 per cent with disease score  $\geq 3$  in cattle.

**Keywords:** Gastrointestinal stasis, peritonitis, prognostic indicators, laprorumenotomy, cattle, buffalo, radiography.

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Signature of Major Advisor

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## LIST OF ABBREVIATIONS

%	:	Percentage
@	:	At the rate of
<	:	Less than
>	:	Greater than
±	:	Plus minus
µl	:	Microliter
°C	:	Degree Celsius
°F	:	Degree Fahrenheit
ALP	:	Alkaline phosphatase
ALRP	:	Acute local reticuloperitonitis
AST	:	Aspirated aminotransferase
CLRP	:	Chronic local reticuloperitonitis
cm	:	Centimeter
DCC	:	Differential cell count
DH	:	Diaphragmatic hernia
DLC	:	Differential leukocyte count
e.g.	:	For example
<i>et al</i>	:	and co worker
<i>et al</i>	:	et alia (Latin – and others)
Etc	:	Et cetera
FBS	:	Foreign body syndrome
Fig.	:	Figure
G	:	Gram
g/ dL	:	Gram per deciliter
GADVASU	:	Guru Angad Dev Veterinary and Animal Sciences University
GGT	:	Gamma glutamyl transferase
Hb	:	Hemoglobin
i.e.	:	That is
INR	:	Indian rupees

IU/L	:	International unit per liter
K <sub>2</sub> EDTA	:	Dipotassium ethylenediaminetetraacetic acid
Kg	:	Kilogram
L	:	Liter
mEq/L	:	milliequivalents of solute per litre
Mg	:	Milligram
mg/dl	:	Milligram per deciliter
ml	:	Milliliter
mM/L	:	Millimol per liter
NO	:	Negative outcome
Non-TRP	:	Non-Traumatic reticule peritonitis
PCV	:	Packed cell volume
RBC	:	Red blood cell
SE	:	Standard error
SFBS	:	Sharp Foreign body syndrome
TCC	:	Total cell count
TLC	:	Total leukocyte count
TP	:	Traumatic pericarditis
TRP	:	Traumatic reticule peritonitis
U/L	:	Unit per liter
USG	:	Ultrasonography
WBC	:	White blood cell

## **CHAPTER I**

### **INTRODUCTION**

The gastrointestinal indigestion is one of the most commonly encountered clinical complaints in ruminants. From clinical perspective, ruminant indigestion is broadly categorized as primary and secondary indigestion. The primary indigestion is mainly caused by abnormal fermentation or by abnormal motor functions of diseases causing lesions of reticulo-rumen wall (traumatic reticulo-peritonitis, diaphragmatic hernia, rumenitis, etc). The other cause of primary indigestion may be the abnormal fermentation in the reticulo-rumen (simple indigestion, ruminal acidosis, ruminal impaction). Secondary indigestion comes as a sequel of many systemic diseases in other organ systems which indirectly affect the reticulo-ruminal motility and decrease microbial fermentation. Often, secondary indigestion in bovines proves out to be a diagnostic and therapeutic challenge to veterinary practitioners. Clinical experience and detailed review of the recorded data suggest that peritonitis is a frequent and important differential diagnosis for secondary indigestion in bovines (Kumar 2009).

Peritonitis is an inflammatory process that involves the peritoneal cavity and its serosal surface the peritoneum. It may occur as a primary condition or more commonly as secondary complication and may be associated with either infectious or non-infectious causes (Ricketts 1987). It is characterized by exudation of serum fibrin and proteins into the peritoneal cavity (Semrad 1990). There are many causes of peritonitis however traumatic perforation of reticulo- rumen is thought to be most common followed by perforation of uterine wall during intra uterine medication/artificial insemination, abdominal surgery, perforating abomasal ulcers, intestinal rupture, spontaneous uterine rupture during dystocia, intra-abdominal abscess rupture or haematogenous localization or infection. Previous clinical studies showed that peritonitis is a cause of chronic indigestion in 39 per cent of referred clinical cases of dairy animals and peritonitis was due to penetrating foreign body in 62 percent of the cases and cause was obscure in rest of the cases (Kumar 2009). In other study, peritonitis was associated with potential foreign bodies in 48 per cent

cows and etiology was obscure in 53 per cent of cases (Hussain and Uppal 2015). So there is need to determine the other prevalent causes of peritonitis in bovines.

Under referral clinical set up, clinical diagnosis of peritonitis is often possible in many cases based on history, physical examination, leukogram, peritoneal fluid analysis, radiography and ultrasonography of abdomen, however, specific diagnosis is elusive in many cases. Radiographic examination is the most reliable diagnostic aid in diagnosis of traumatic reticuloperitonitis in bovines. Radiographic diagnosis of traumatic reticuloperitonitis is very obvious if a metallic foreign body is located cranial to reticulum. However, it is difficult to predict foreign body penetration when it is located within the reticulum. Under this circumstances, there is need to improve radiographic evaluation and the interpretation for more accurate diagnosis of traumatic reticuloperitonitis. In veterinary medicine, a wide variety of pathogenic agents including mechanical, chemical and infectious have been attributed to the etiology of peritonitis. Gynecological manipulation, injury at parturition, foreign body penetration, septic abdominal surgery, parasitism and urolithiasis are some of the commonly attributed causes of peritonitis. The resulting toxemia is the most important factor in the production of clinical illness. However, its genesis and nature are still not known fully and there are major gaps in our knowledge regarding etiopathogenesis of peritonitis (Radostits *et al* 2000).

The gastrointestinal stasis is primarily caused by traumatic reticulo peritonitis followed by diaphragmatic hernia, reticular abscesses, adhesions and motility disturbances. All these diseases are manifested by similar or somewhat closely related set of signs such as anorexia, dullness, recurrent or persistent tympany and abdominal distension, etc. which are common and difficult to differentiate from each other clinically. Furthermore, these disorders cause huge economic loss to farmers in the form of animal mortality and loss of production. The magnitude of loss to dairy industry can be assessed from the fact that abomasal diseases and resulting peritonitis which are part of these forestomach disorders had been responsible for more than 15 per cent of all the natural deaths in dairy animals. Determination of prognosis is very important in a disease for economic reasons (Sharma *et al* 2015a).

Accurate assessment of prognosis of a disease may avoid unnecessary treatment and minimize unwarranted treatment costs. For bacterial peritonitis, the

treatment cost of an animal may range between INR 5000-7000 per animal depending upon the choice of antibacterial agents. Present data reveals that recovery rate in peritonitis is around 70 per cent of curable infections (Kumar 2009). Therefore, to minimize these economic losses, prognosis index should be established. At present few studies have been directed to determine the prognosis based on biochemical parameters (Sharma *et al* 2015b). However, to our knowledge, prognosis indicators based on clinical observations has not been explored. Therefore, the present study was planned with the following objectives:

1. To determine etiological factors in bovine peritonitis.
2. To establish prognostic indicators in gastrointestinal stasis in bovines.

## CHAPTER II

### REVIEW OF LITERATURE

The literature has been reviewed to understand the subject matter with regard to etiology of peritonitis and prognostic indicators of gastrointestinal stasis in bovines. The literature regarding this condition is too scanty but the efforts have been made to incorporate maximum of the available references related to this subject.

#### 2.1 Etiology of peritonitis:

Peritonitis is an important cause of morbidity and mortality in cattle and buffaloes. It either occurs as a primary disease or is associated with many gastrointestinal and urogenital affections in bovines (Mohanty and Sahay 1985). Vaughan (1980) has classified the etiology of peritonitis into four categories: (1) mechanical, (2) chemical, (3) infectious and (4) others, which includes allergies, neoplasms, cysts, drugs, and other irritants. Kunesh (1984) has reported that peritonitis in cattle was usually secondary to a diffuse or localized primary condition. The mortality has been reported to be high in diffuse peritonitis, and internal abscesses, foreign body penetration, septic intra peritoneal injections, perforations, septic abdominal surgery, trauma to urinary reproductive tract, intestinal infarct, gangrene of the intestine and neoplasms. Blood *et al* (1989) has reported that peritonitis may occur as a primary disease or secondarily as part of an etiologically specific disease. As primary disease it has been reported to result most commonly by rupture of or spread of infection from an abdominal site or less commonly by perforation of the abdominal wall from the exterior. Other common causes responsible have been mentioned as traumatic reticuloperitonitis, rumenitis of cattle subsequent to acute carbohydrate engorgement, hepatic abscess of black disease, intraperitoneal injection of non-sterile or irritant solutions. As a part of specific disease, tuberculosis and sporadic bovine encephalomyelitis has been the cause of peritonitis.

Some of the common individual causes of peritonitis are listed below have been discussed in details (Radostits *et al* 2000).

1. Traumatic reticulo-peritonitis.
2. Perforation or leakage of abdominal ulcer.
3. Necrosis and rupture of abdominal wall after abomasal volvulus.
4. Rumenitis subsequent to acute carbohydrate indigestion.

5. Complication of caesarean section.
6. Rupture of vagina in young heifers during violent coitus with a young active bull.
7. Deposition of semen into the peritoneal cavity by any means.
8. Intra venous injection of sterile hypertonic solutions.
9. Transection of small intestine which becomes pinched between the uterus and the pelvic cavity at parturition.
10. Intraperitoneal injection of non-sterile solution.
11. Spontaneous uterine rupture during parturition or during manual correction of dystocia.
12. Spontaneous rupture of rectum at calving.
13. As a part of specific disease such as tuberculosis.

Traumatic reticuloperitonitis is a relatively common disease in adult cattle caused by the ingestion and migration of a foreign body in the reticulum. Cattle are more likely to ingest foreign bodies than small ruminants since they do not use their lips for prehension and are more likely to eat a chopped feed. Often the offending foreign body such as a piece of wire or a nail, often greater than 2.5 cm in length (Andrea 2004). Traumatic reticulo peritonitis is caused by fragments of metal inadvertently eaten by cattle, which then progress into the reticulum and may penetrate the rumeno-reticular wall and migrate through the surrounding areas of the abdomen and thorax, thus producing clinical signs of local peritonitis or pericarditis. In recent years, radial steel wire from disintegrating tyres on silage clamps has been incriminated most frequently, but other metallic fragments such as nails, bits of fencing or other wire and metal sharps have all been implicated (Orpin and Harwood 2008). Radiography was a useful tool to detect the foreign body and position of foreign body in the in reticulum (Braun *et al* 1994). Partington and Biller (1991) reported common radiographic sign of TRP as foreign bodies greater than one centimeter in length, unattached to a magnet within the reticular outline, presence of focal perireticular gas collections, thoracic lesions and splenic abscessation and they also concluded the sensitivity and specificity of radiography in detecting traumatic reticule peritonitis or pericarditis as 83 per cent and 90 per cent, respectively. Increased reticular size was associated with vagal indigestion. Twentr five of 35 (71

per cent) cattle presented for radiographic examination with a 1 cm or longer metallic reticular foreign body unattached to a magnet had traumatic reticulo-peritonitis. Braun *et al* (1993) suggested typical position of foreign bodies, abnormal gas density in the reticulum and depression in the cranioventral margins of reticulum were diagnostic for TRP. Abu-Seida and Al-Abbadi (2016) concluded that indiscriminate feeding habits, feed scarcity, industrialization and mechanization of agriculture were predisposing factors for FBS in bovines. They also concluded that laboratory diagnosis and imaging techniques like radiography and ultrasonography can be of high diagnostic value in detecting the condition, to determine whether the reticulum is currently perforated, the foreign object must be visible beyond the reticular border unattached to the magnet, or positioned off the floor of the reticulum. Other reliable radiographic findings of penetration included; a depression in the cranioventral aspect of the reticulum, gas accumulation outside the reticulum, soft-tissue masses, or a fluid line in the cranial abdomen. Aref and Abdel-hakim (2013) evaluated clinically and under laboratory condition the sharp foreign body syndrome (SFBS) in buffaloes with special emphasis on the diagnostic value of radiography, ultrasonography and blood gases and acid-base balance. They reported sharp metallic foreign bodies in different position and close contact with the diaphragmatic surface of the reticulum and abdomino-reticular adhesion and phrenicoreticular adhesion. Abdelaal and Flöck (2009) documented the clinical and ultrasonographic differences between cattle and buffaloes with various sequelae of traumatic reticuloperitonitis (TRP) and the importance of ultrasonography in detection of such sequelae. The results revealed that the classical symptom of pain and systemic reactions were common in most sequelae of TRP in cattle and less common in buffaloes. No specific findings were recorded for reticular abscesses in the both species. Brisket oedema and distended jugular veins have been shown in both cattle and buffaloes with pericarditis and also in four buffaloes with thoracic abscesses. Athar *et al* (2010) compared clinical, haematobiochemical, radiographic and ultrasonographic features of traumatic reticuloperitonitis in bovines. Haematology revealed neutrophilic leucocytosis with left shift and blood biochemical status showed elevated levels of total protein, albumin, and fibrinogen. Decreased plasma concentration of sodium, potassium and chloride was observed in majority of the cases. Radiographic examination revealed presence of multiple metallic foreign densities in the reticulum of the bovines.

Ghanem (2010) concluded that traumatic pericarditis cows had more significant changes in hematology, biochemistry, ultrasonography, and histopathology than the traumatic reticuloperitonitis cows. They reported arched backs, a sharp decrease in milk yield, and a reluctance to move, with abduction of the fore limbs in traumatic reticuloperitonitis cows. Edema of the brisket and submandibular region, with jugular vein distension and pulsation in traumatic pericarditis cows. Traumatic reticuloperitonitis cows had a significant increase in PCV, leukocytes, and neutrophils, and a significant decrease in RBC, hemoglobin, and lymphocytic counts, as compared to the control group. traumatic pericarditis cows had significant erythrocytopenia, leukocytosis, neutrophilia, monocytosis eosinopenia, and basopenia and a significant decrease in the hemoglobin, lymphocytes as compared to the controls. Al-Abbadi *et al* (2014) concluded that administration of a rumen magnet is an effective prophylaxis for hardware disease and reapplication of a second new magnet is recommended four years later in healthy buffaloes at high risk. The incidence of developing a hardware disease during the first 4 years after the use of magnet was zero per cent. Reddy *et al* (2014) investigated the haematological alterations in cattle suffering from traumatic reticuloperitonitis. Haematology revealed significant ( $P<0.05$ ) erythrocytopenia, higher packed cell volume, lower haemoglobin concentration, lower mean corpuscular haemoglobin concentration, higher mean corpuscular volume, significant ( $P<0.05$ ) leucocytosis with neutrophilia, presence of more number of immature neutrophils and decreased lymphocyte count.

## **2.2 Diagnosis of Peritonitis**

### **2.2.1 Clinical signs**

Hosgood and Salisbury (1989) reported clinical signs of animals suffering from peritonitis as non-specific, but suggestive of gastrointestinal dysfunction viz, abdominal rigidity, fever, anorexia, sudden reduction in milk production, abdominal pain and GIT stasis. They observed diarrheic faces, subacute abdominal pain, decreased plasma volume, endotoxemia, persistent tachycardia. They concluded that clinical signs of peritonitis depend on the primary disease process, infectious agents involved and extent of disease. A study conducted on 42 dairy cows reported that disturbances of digesta passage in cow with TRP develop in 3 phases. During first phase rumen motility decrease, in second phase digesta passage through reticulo-

omasal orifice decrease and in third transpyloric digesta flow is inhibited (Semrad 1990).

### **2.2.2 Physical examination**

Rebhun *et al* (1988) reported varying heart rate, respiratory rate and rectal temperature in animals suffering from traumatic reticuloperitonitis. Penetration of cranio medial wall of reticulum by foreign body results in perireticular inflammation, abscessation and adhesions leading to vagal indigestion. Fubini *et al* (1989) reported common clinical features as anorexia, hypogalactia, weak and frequent ruminal contractions in 29 cows. There was distension of left paralumbar fossa with bilateral distension of the ventral aspect of abdomen in 23 caattle. Four of these cows were febrile ( $>39^{\circ}\text{C}$ ), fifteen had bradycardia ( $<61$  beats per minute) and fourteen had evidence of cranial abdominal pain on elicitation in xiphoid region. Fubini *et al* (1989) recorded anorexia, hypogalactia and abdominal distension as the most common complaints in abdominal disorder special in case of reticular abscess along with distension of left paralumbar fossa and bilateral distension of the ventral aspect of abdomen were the important physical findings recorded in 79 per cent cows. Rumen contractions were weak and more frequent than normal ( $>2/\text{min}$ ) in 16 cows (55per cent), 4 cows had fever of ( $>39^{\circ}\text{C}$ ) and 15 had heart rate below 61 beats per minute. Fourteen out of 29 (48 per cent) cows elicited pain by manual pressure applied to the xiphoid region. Turkar (2004) observed that majority of the buffaloes with peritonitis were depressed with suspended rumination, dehydrated, abdominal distension, constipated faeces and increased heart rate. Shah (2010) reported that majority of animals with peritonitis had scanty faeces, varying forms of ruminal distension, absence of rumen motility, fever and mushy rumen consistency. The recorded abdominal pain characterized by kicking, frequently lying down and getting up, prolonged standing tendency, black faeces, abdominal discomfort, bilaterally distended abdomen and continual movement from one foot to another. Rectal palpation is one of the most reliable methods of diagnosing rumen impaction in cattle (Grymer and Ames 1981).

### **2.2.3 Peritoneal fluid examination**

Dehghani *et al* (2000) reported crystal clear and straw coloured to yellow in peritoneal fluid in healthy animals. Turbidity indicates the presence of leukocytes and

increased protein. In goat exploratory celiotomy and omentopexy resulted in an increase in total nucleated cell count by a factor of 5-8, minor increase in cell specific gravity and total protein by a factor of 2. Wilson *et al* (1985) reported large volumes of peritoneal fluid in parturient cows while less than 0.5 mL fluid obtained in normal cows, colour varied from clear to yellow, turbidity was also variable. The fluid clotted on standing, the fluid obtained from cattle with peritonitis varied from less than 1 mL to more than 10 liters. Colour and turbidity were highly variable. Mean fibrinogen level of normal peritoneal fluid has been reported to be 1.4 g/l, while in peritonitis had been reported to be 3.5g/l. Hirsch and Townsend (1982) reported peritoneal fluid total protein content of greater than 3 g/dl as consistent with the diagnosis of peritoneal inflammation in 80 per cent of the cases. Similar values were enlisted by Radostits *et al* (2000) reported normal specific gravity, total protein and nucleated cell count (1.005-1.075, 1.6 g/dl and 300-500/pl respectively) peritoneal fluid. Peritoneal fluid values recorded by them during inflammation for these parameters were 1.016-1.040, 2.8-5.8 g/dl and 2700-4070/cumm, respectively. The presence of degenerated neutrophils, bacteria were ingesta and phagocytosed bacteria were indicative of peritonitis and are also useful to differentiate post-surgical peritoneal fluid reaction. Kopcha and Schultze (1991) reported peritoneal fluid differential cell count as more accurate method to diagnose peritonitis than total cell count. A neutrophil count of more than 40 per cent of the cells and eosinophils less than 10 per cent of the cells was indicative of peritonitis. Physical characteristics of peritoneal fluid (quantity, viscosity, colour, smell and turbidity) were evaluated macroscopically and then peritoneal fluid was examined microscopically for the presence of leukocytes, erythrocytes and bacteria. Based on laboratory examinations, it was concluded that peritoneal fluid examinations have a significant diagnostic and prognostic value for several acute and chronic abdominal diseases (Zadnik 2000). Marked increase in the neutrophilic count was characteristic of traumatic reticulo-peritonitis, which could be highly useful tool in differentiating TRP from other abdominal disorders (Magesh 1988). In a similar study a significant increase in neutrophil count ( $61.9 \pm 1.28$  per cent) in TRP was recorded (Ramprabhu *et al* 2002). Safarchi *et al* (2015) found that peritoneal fluid analysis did not have the required efficiency for the diagnosis of peritonitis in many cases and to reach the diagnosis with high accuracy and validity in bovine peritonitis, simultaneous use of laparoscopy and abdominocentesis is

recommended. Hussain and Uppal (2015) reported altered consistency and colour; increased volume, specific gravity and total protein concentration; and presence of degenerated neutrophils, bacteria and gut contents in peritoneal fluid of peritonitis. Hosgood and Salisbury (1989) isolated most common bacteria viz, *Escherichia coli* and other *enterobacteria*, *Streptococcus species* and *Proteus*. In cattle with traumatic reticuloperitonitis from the peritoneal cavity after large bowel contamination.

#### **2.2.4 Radiography**

Samad *et al* (1994) suggested that radiological examination or exploratory rumenotomy was considered as the 'field-standard' test. Chronic tympany was found to have highest sensitivity and specificity followed by brisket oedema, which had a high specificity but low sensitivity. Tripathi *et al* (2016) performed radiography in 3 animals suffering from rumen impaction where survey radiographs were found undiagnostic for rumen impaction. However, radiographically foreign bodies were visualized in few cases which are incidental in bovines and could be due to the incessant feeding nature of the animals where they consume food without selection. Braun *et al* (1994) compared radiographic and ultrasonographic findings in cattle. The greatest advantage of a radiographic examination was that metallic foreign bodies could be visualized, in contrast radiography failed to identify any of metallic objects while ultrasonography provided excellent data about reticular motility, fibrous adhesions and abscess. Ramprabhu *et al* (2003) concluded that radiography was able to detect foreign bodies but unable to detect any tissue reaction. However, radiography had not been considered as a reliable tool for diagnosis of reticular abscess (Saini *et al* 2005). Kumar *et al* (2008) performed radiography in 11 cases but diagnosis of an abscess could be made in only five cases (45.4 per cent) based on radiographic signs of oval or round radiolucent density to the diaphragmatic line or with or without penetrating metallic foreign body. Shah (2010) reported radiography in 55 animals suffering from peritonitis, diaphragmatic line was clearly demarcable in 43 (78.2 per cent) and foreign bodies were present in 24 of 55 (43.6 per cent) of animals.

#### **2.2.5 Haematology**

Murthy (1980) reported hematological findings associated with range from a completely normal hemogram to severe leucopenia with degenerative left shift and

presence of toxic neutrophils, depending on severity of peritoneal contamination. In peritonitis, the increase in leukocytes and neutrophils is inconsistent because cattle do not have a large pool of mature neutrophils in bone marrow to support and maintain an immediate demand for increase in circulating neutrophils in response to a developing inflammation. It was also reported that during the first 24-48 hours of the severe, inflammatory process leucopenia might be anticipated (Amstutz 1980). Leucocytosis and neutrophilia was observed by Mohanty and Sahay (1985) in experimental peritonitis. Edward and Rouff (1991) advocated simultaneous estimation of cell count and fibrinogen for better diagnosis and assessment of severity of peritonitis. Hailat *et al* (1996) found TLC, neutrophilia and low Hb, TLC and PCV in TRP cases. Hirvonen and Pyrorala (1998) found TLC  $8.8 \pm 0.7 \times 10^3$  per  $\mu\text{l}$  with neutrophils 49 per cent, lymphocyte 31 per cent and neutrophil to lymphocyte ratio of 1:7. Radostits *et al* (2000) described leukopenia, neutropenia degenerative left shift and toxic changes in neutrophils as a common hematological change in acute diffuse peritonitis. Leukogram was characterized by regenerative left shift and neutrophilia in acute form and blood picture was either normal or showing leukocytosis in chronic cases. Costa *et al* (2002) reported neutrophilic leukocytosis with left shift in a bull suffering from abomasal ulceration and abomaso-pleural fistula. Palmer and Whitlock (1984) observed leukocytosis and left shift in diffuse peritonitis associated with perforated abomasal ulcers but surprisingly none of the cows had leucopenia.

### **2.3 Prognostic indicators of gastrointestinal stasis**

Sharma *et al* (2015a) observed massive neutrophilia with marked left shift as a poor prognostic indicator in cattle and buffaloes suffering from peritonitis and presence of bacteria, large number of degenerative neutrophils was associated with bad prognosis. Palmer and Whitlock (1984) reported the survival of 10 of 17(58.8 per cent) cows with local peritonitis, whereas only 2 of 22 (9.1 per cent) of the cows with diffuse peritonitis survived. Perforated abomasal ulcer may account for 1.5 per cent of the natural deaths of dairy and beef cattle when it leads to diffuse peritonitis. Hussain *et al* (2013) reported in negative prognostic signs omasal impaction viz, neutrophilic leukocytosis with marked left shift and toxic changes in neutrophils, chloride levels below 70 mmol/L, potassium below 2 mmol/L, lactate above 9 mmol/L, and highly distended omasum on rumenotomy. Constable *et al* (1991b)

concluded that preoperative determination of heart rate, hydration status, and period of inappetence appears superior to routinely used laboratory tests in determining the prognosis of cattle with abomasal volvulus. They concluded that preoperative anion gap calculation could reliably predict the outcome of cows with abomasal volvulus and was more accurate than either serum chloride concentration or base excess value. Cattle with omasal-abomasal volvulus had a significantly ( $P < 0.05$ ) worse prognosis than cattle without omasal involvement. Large abomasal fluid volume, venous thrombosis, and blue or black abomasal color before decompression were all indicative of a poor prognosis. Kopcha (1990) reported 1-32 per cent non-segmented neutrophils in 93 per cent of died animals suffering with peritonitis compared to 1-13 percent segmented neutrophils in 60 per cent of survived animals. Constable *et al* (1991a) reported that cattle with omasal- abomasal volvulus had a significantly worse prognosis than those without omasal involvement. Large abomasal fluid volume, venous thrombosis, and blue or black abomasal colour before decompression were all indicative of a poor prognosis (Abe *et al* 1995). In another study extent and location of adhesions might be factors that determine further course of syndrome. Accordingly, prognosis is poorer as disease progress (Rehage 1995). Toor and Saini (2008) evaluated 46 female buffaloes with abdominal disorders and 12 buffaloes were diagnosed with omasal impaction. However, two buffaloes that later died had lower levels of plasma chloride, no reticulo-omasal orifice tone and were in an advanced stage of pregnancy. The level of total protein in peritoneal fluid was higher than normal, but the total white cell count was within the normal range. The presence of reticulo-omasal orifice tone and a plasma chloride level above 75 mmol/l were indicators of a good prognosis.

## **CHAPTER III**

### **MATERIALS AND METHODS**

#### **3.1 Selection of animals**

##### **3.1.1 Experiment I**

Thirty three adult dairy cattle and buffalos of 2-10 years of age suffering from peritonitis were selected in this study in Large Animal Unit of Teaching Veterinary Hospital, GADVASU, Ludhiana. Diagnosis of peritonitis was confirmed by laprorumenotomy.

##### **3.1.2 Experiment II**

Animals presented for clinical signs of constipation or loss of defecation at Large Animal Clinic, GADVASU, Ludhiana were screened. Complete history was recorded and physical examination, abdominocentesis, radiography and ultrasonography were performed to rule out traumatic reticuloperitonitis, reticular abscess, diaphragmatic hernia and intestinal obstruction. Thereafter, sixty two dairy animals (28 cattle and 34 buffaloes) manifesting gastrointestinal stasis were selected for this study.

#### **3.2 Signalment and anamnesis ( experiment I and II)**

Patient data with regards to species and age was recorded. History of illness, pregnancy status, feed intake, weight loss, history of fever, history of bloat, signs of abdominal pain, fecal output, quality and colour of faeces and any evidence of external or internal trauma were recorded.

#### **3.3 Physical examination**

##### **3.3.1 Experiment I**

General physical examination viz, temperament, body condition, hydration status, posture, mucous membrane were recorded. Vital signs (rectal temperature, heart rate, respiration rate) were recorded. Ruminal motility and consistency were noted.

##### **3.3.2 Experiment II**

General physical examination and vital signs were recorded as per experiment no 1. Special examination of gastrointestinal tract was performed as below:

- a) Rumen for fill, consistency and motility.

- b) Rectal examination for faecal characteristics, rumen size and consistency, intestines.
- c) Abdominocentesis for collection of peritoneal fluid.
- d) Right abdominal succussion for presence of fluid/gas in the intestines.

### **3.4 Sampling and analysis**

Blood samples were collected by jugular venipuncture in K<sub>2</sub>EDTA vials. Hemoglobin (Hb), packed cell volume (PCV) and total leukocyte count (TLC) were determined by Automatic laser Based Hematology Analyser (ADVIA® 2120 hematology system, Siemens healthcare diagnostic Inc., USA). Differential leukocyte count (DLC) was determined on Leishman stained smears manually by the method described by Jain (1986).

### **3.5 Biochemical profile (experiment II)**

Six mL of blood was collected in clot activator tubes, which was centrifuged to extract the serum. Serum thus collected was refrigerated at -20°C for biochemical estimation. Virtos 350 biochemistry Ortho-clinical Diagnostic analyzer was used for estimation of following parameters.

- Gamma glutamyl transferase (GGT, U/L).
- Serum glutamate oxaloacetate transaminase (SGOT) Aspartate transaminase (AST, U/L).

### **3.6 Peritoneal fluid analysis (experiment II)**

Peritoneal fluid was collected from 28 cattle and buffaloes although was performed in 62 animals suffering from gastrointestinal stasis after a detailed clinical examination. The following parameters were analyzed from peritoneal fluid samples:

- Cytology: peritoneal fluid samples were analyzed for total cell count (TCC) and differential cell count (DCC) using same method as used for blood (Jain 1986).
- Biochemical parameter: Total proteins.
- Culture: Peritoneal fluid (1-2 mL) was collected in sterilized test tube transferring it in nutrient broth for 6-8 hours and then cultured by standard aerobic methods.

### **3.7 Abdominocentesis ( experiment II)**

Abdominocentesis was performed in all animals suffering with gastrointestinal stasis. The animal was restrained in standing position and peritoneal fluid was collected using 16 G, 1.5 inch long hypodermic needle in K<sub>2</sub>EDTA vials from the following sites:

- i. Caudal to the xiphoid of sternum and 4-10 cm lateral to midline.
- ii. Left to midline 3-4 cm medial and 5-7 cm. cranial to the foramina from the left subcutaneous abdominal vein.
- iii. Just anterior to the base of udder on right and left side.

### **3.8 Radiography**

For experiment no I radiography of reticular region in 30 cattle and buffaloes suffering from peritonitis was performed in right lateral standing or right lateral recumbency. Radiography was evaluated for position of foreign body, any change at interface of diaphragm and reticulum or visible radiographic abnormalities. Radiography in 10 healthy animals was performed in 3 views (right and left lateral standing, right lateral recumbency) and evaluated for type and position of foreign bodies.

For experiment no II radiography was performed on right lateral standing or right lateral recumbent of reticular region to rule out traumatic reticuloperitonitis, diaphragmatic hernia and reticular abscess.

### **3.9 Laparorumenotomy**

Thirty three animals diagnosed for peritonitis were subjected for laparorumenotomy. Peritoneal cavity was palpated for presence of peritoneal fluid and/or adhesions or any abnormality before opening rumen. After opening and evacuation of reticulo-rumen, reticulum was explored for free lying or penetrating foreign bodies. Position of penetrating foreign bodies was recorded. Reticulum was again checked for adhesions or reticular abscess (Fig. 2).

### **3.10 Criteria for disease severity score for assessment of prognosis**

Follow up of these cases was done for 3 months to determining their outcome. Clinical observations for assessment of prognosis were selected on the basis of clinical experience and previous research studies performed on gastrointestinal stasis. The selected clinical observations included (a) degree of appetite loss (b) history of fever prior to presentation (c) loss of defecation (d) foul smelling faeces (e)

abdominal distention (f) abnormal rumen consistency (mushy) (g) intestinal distention (h) left shift in leukogram. The score for each observation was assigned as per Table 1.

**Table 1. Criteria for disease severity score**

<b>Anorexia</b>	Absent	Present	-	-
<b>Score</b>	0	1	-	-
<b>History of fever</b>	Absent	103°F	104-105 °F	>105 °F
<b>Score</b>	0	1	2	3
<b>Loss of defecation</b>	Absent	Present	-	-
<b>Score</b>	0	1	-	-
<b>Foul smelling faeces</b>	Absent	Present	-	-
<b>Score</b>	0	1	-	-
<b>Abdominal distention</b>	Absent	Mild	Moderate	Severe
<b>Score</b>	0	1	2	3
<b>Mushy rumen</b>	Absent	Present	-	-
<b>Score</b>	0	1	-	-
<b>Intestinal distention</b>	Absent	Present	-	-
<b>Score</b>	0	1	-	-
<b>Left shift in leukogram</b>	Absent	Mild	Moderate	Severe
<b>Score</b>	0	1	2	3

### 3.11 Statistical analysis in experiment I and II

Means and standard error values were calculated by using MS-Excel computer program. All statistical analysis was done by Statistical Analysis System 9.3 software, Chi square and student t-test were used to compare means of various parameters to test the significant change of different groups as recommended by Snedecor and Cochran (1994).



**Fig. 1: Peritoneal fluid collection from post xiphoid by abdominocentesis**



**Fig. 2: Examination of peritoneal cavity during laprorumenotomy**

## **CHAPTER IV**

### **RESULTS AND DISCUSSION**

#### **4.1 Etiology of peritonitis**

##### **4.1.1 Laprorumenotomy findings**

The etiology of peritonitis was determined by laprorumenotomy. Peritoneal cavity was palpated for the presence of effusions/adhesions or any abnormality or any inflammatory adhesions before opening rumen. Approachable organs like uterus, spleen and intestines were palpable. Exploratory rumenotomy was performed in 33 animals suffering from peritonitis. Traumatic reticuloperitonitis was the cause of peritonitis in 14 of 33 (42.4 per cent) animals. Sharp potential foreign bodies were lying freely in reticulum and there was no evidence of penetration in 13 of 33 (39.4 per cent), whereas non-potential foreign bodies were detected in 3 of 33 (9.1 per cent) cases. Foreign bodies were absent in 3 of 33 (9.1 per cent) animals. Therefore, traumatic reticuloperitonitis was the major cause of peritonitis in 42.4 per cent and peritonitis was non-traumatic in rest of the animals. Traumatic reticuloperitonitis was focal purulent in 4 (28.6 per cent), diffused purulent in 2 (14.3 per cent), focal adhesive peritonitis in 4 (28.6 per cent) and diffused adhesive peritonitis in 4 of 14 (28.6 per cent) cases. Peritonitis associated with non-traumatic reticuloperitonitis was focal purulent in 6 (31.6 per cent), diffused purulent in 5 (26.3 per cent), focal adhesive peritonitis in 5 (26.3 per cent) and diffused adhesive peritonitis in 3 of 19 (15.8 per cent) of cases. Rumen and peritoneum were adhered in 2 of 14 cases and reticulo-phrenic adhesions were observed in 1 case and reticulo-abdominal adhesions in 6 of 14 cases. Peritoneal effusions were present in all the 14 animals with traumatic reticuloperitonitis. Effusions were massive in 2 of 14 and focally present cranioventral to the reticulum in 12 of 14 cases. However, in non-traumatic reticuloperitonitis group, adhesions were reticulo-abdominal in 4 of 19 and abdominal-adhesions in 4 of 19 cases. Peritoneal effusions were evident in 16 of 19 cases. Effusions were massive in 4 of 19 and focally present cranioventral to reticulum in 12 of 19 cases in this group. Rumen content was not well digested in 2 of 14 cases of TRP, omasum impaction was observed in 1 of 14, and abomasum was impacted in 1 of 14 cases. Omasum impaction was detected in 1 of 19 non-traumatic reticuloperitonitis. In 8

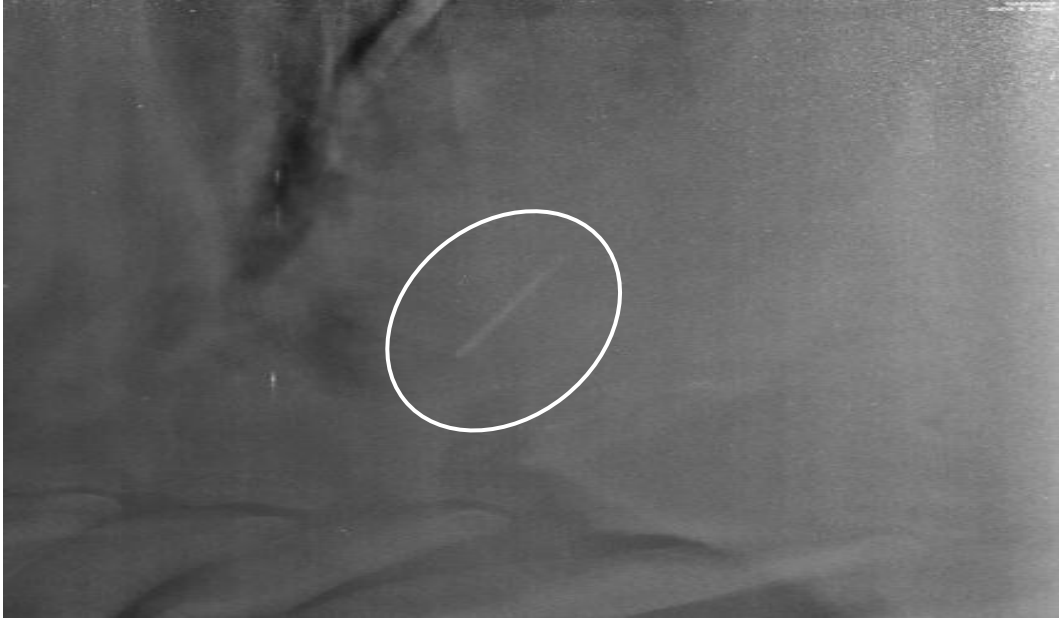
cases reticulo-phrenic or reticulo-abdominal lesions, the likely cause could be transitory trauma to reticulomucosa which might have initiated reticulitis to involve peritoneum. In animals with rumen-peritoneal adhesions, rumenitis was the possible cause of peritonitis. The ruminal wall injury could be associated with spoiled feed or abomasal reflux reported as per (Garry and McConel 2015). The cause of peritonitis was difficult to explain where no sharp foreign body detected during laprorumenotomy. However, reported that reticulo ruminal injury might occurred without any apparent of predisposing factors (Chihaya *et al* and 1992 and Jensen *et al* 1991).

#### **4.1.2 Radiography of traumatic reticuloperitonitis**

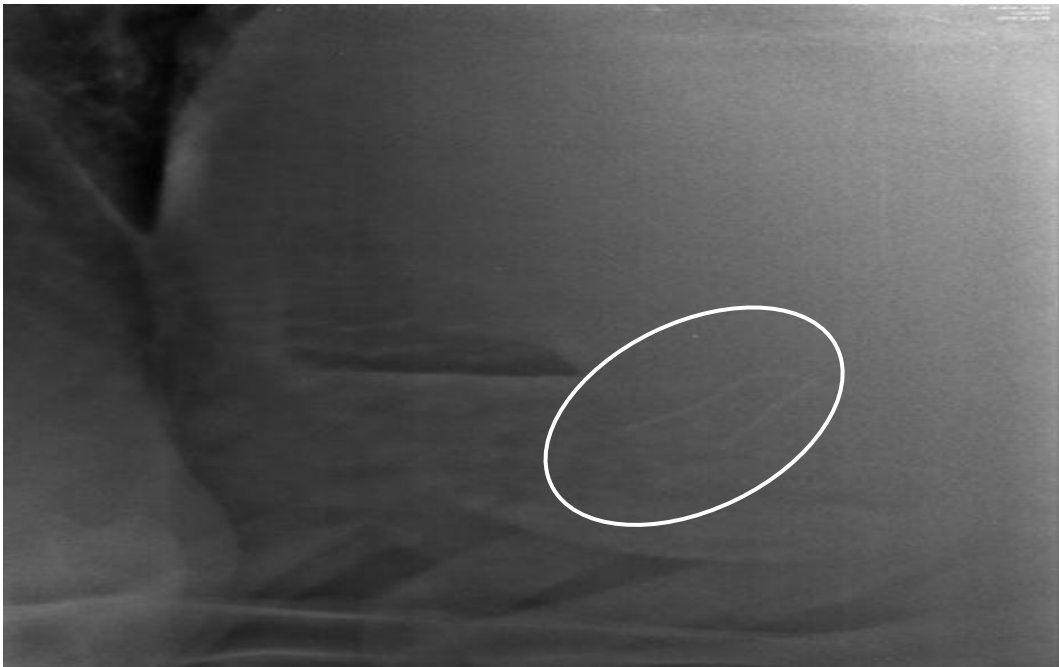
Diaphragmatic line was clearly visible in most (11/12; 91.7 per cent) of the cases, sharp potential foreign bodies were detected in all 12 cases that were radiographed, and position of foreign bodies were cranioventral in 7 (58.3 per cent), midcranial in 4 (33.3 per cent) and caudoventral in 1 of 12 (8.3 per cent) of cases, and all sharp potential foreign bodies were visible in close contact with the reticular wall. Reticulophrenic adhesions were observed in one animal and focal gas/fluid density was seen in reticular region in 3 of 12 cases. Similar to this study, close contact of foreign body with diaphragm surface or focal perireticular gas collections had been described as a common radiographic sign in TRP (Partington and Biller 1991, Aref and Abdel-Hakim 2013 and Braun *et al* 1994). Other radiographic signs like depression in the cranioventral aspect of the reticulum, soft-tissue masses, or a fluid line in the cranial abdomen reported by Abu-Seida *et al* (2016) were not observed in the present study. Compared to our study, Shah (2010) reported clearly visible diaphragmatic line in relatively less number of cases (91.7 per cent Vs 72.1 per cent).

#### **4.1.3 Radiography of non-traumatic reticuloperitonitis**

Diaphragmatic line was not clearly demarcable in 6 of 18 (33.3 per cent) and sharp potential foreign bodies were detected in 12 of 18 (66.7 per cent) of non-TRP cases. Sharp potential foreign bodies were placed caudoventrally in 4 (33.3 per cent), midcranially in 1 (8.3 per cent) and centrally in the reticulum in 7 of 12 (58.3 per cent) cases. Sharp potential foreign bodies were in close contact to the reticular wall in 3 cases, focal gas/fluid density seen in reticular region in 3 of 19 (15.8 per cent)



**Fig. 3: Sharp potential penetrating foreign body placed cranioventrally to the reticulum**



**Fig. 4: Sharp potential non-penetrating foreign body placed caudoventrally to the reticulum**

cases and reticulum appeared lifted (3 cm) dorsally in one case. Results suggested that clarity at the interface of diaphragm and reticulum was not a characteristic radiographic sign of peritonitis. The result showed that although foreign bodies were very common (75 per cent) findings in radiography, however, it was found associated with TRP in 50 per cent of the cases.

#### **4.2 Radiography of healthy animals**

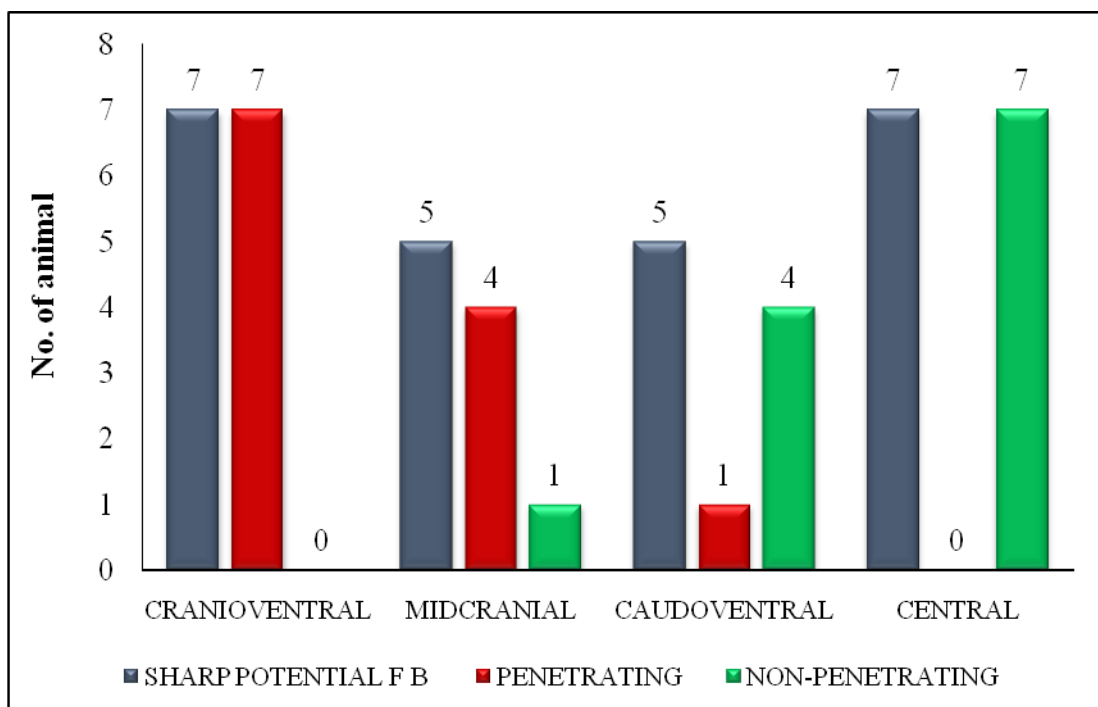
Radiography was performed in 10 healthy animals in three views, right and left lateral standing and right lateral recumbency. Diaphragmatic line was not clearly demarcable ventrally in right and left lateral view of 1 of 10 (10 per cent) animal and foreign bodies were present in reticulum in 5 of 10 (50 per cent) being sharp potential 3 of 10 (30 per cent) cases. Position of sharp potential foreign bodies were caudoventral in 2 and central of the reticulum in one radiograph. From the results, it was inferred that sharp potential foreign body was not always associated with TRP to cause peritonitis.

#### **4.3 Comparison of radiographic examination and laprorumenotomy findings in TRP cases**

Radiography detected sharp potential foreign bodies placed cranioventrally in 7 (58.3 per cent), midcranially in 4 (33.3 per cent) and caudoventrally in 1 of 12 (8.3 per cent) of cases, and all foreign bodies were in close contact with the reticular wall. However, in rumenotomy all 12 cases were confirmed for TRP and same position of sharp potential foreign bodies was located as suggested by radiography report except in one case.

The most significant finding was that all the 7 cranioventrally and 4 of 5 midcranially placed sharp metallic foreign bodies detected by radiography were confirmed to be penetrating on laprorumenotomy. However, from 5 caudoventrally placed foreign bodies detected by radiography, only 1 was confirmed to be penetrating on laprorumenotomy (Fig. 5). It was thus, concluded that probability of a foreign body penetration could be determined from the position of foreign body in the radiograph. Kumar (2009) reported that reticular region radiograph revealed evidence of penetrating foreign bodies in half (9/19; 47.4 per cent) of the animals. Diaphragmatic line was clear in radiographs of 11 of 12 animals and indistinct in one

animal, tentatively suggesting that effusions, tissue reaction or diaphragmatic hernia were unlikely in these cases. However, on laprorumenotomy, reticulophrenic adhesions were confirmed in 1 of 12, reticular-abdominal in 4 of 12 and rumeno-abdominal in 2 of 12 TRP cases. From these results, it appeared that radiography was not useful in detecting adhesions. Gas and fluid density were reported as radiographic signs of reticular abscess in 3 of 12 of TRP cases. However, in rumenotomy there was no evidence of abscess, but it was inflammatory and suppurative reaction was evident at the site of foreign body perforation.



**Fig. 5: Position of potential foreign bodies in radiograph in relation to probability of penetration in reticular wall**

#### **4.4 Comparison of radiographic examination and laprorumenotomy findings in non-TRP cases**

Radiographically, sharp potential foreign bodies were placed caudoventrally in 4 (33.3 per cent), midcranially in 1 (8.3 per cent) and in centre of the reticulum in 7 (58.3 per cent) of 12 non-TRP cases. In contrast, foreign bodies were visible in close contact with the reticular wall in the radiographs of 3 of 12 cases. However, in rumenotomy there was no evident of penetration. Foreign bodies in all 12 animals were lying freely in reticulum. Therefore, the findings of this study suggested that caudoventrally and centrally placed foreign bodies were unlikely to be penetrating.

Diaphragmatic line was not clearly distinct in radiograph of 6 of 18 of non-TRP cases. Confirmatory diagnosis by laprorumenotomy in these cases was diaphragmatic hernia in 4, and effusions and adhesions in 2 cases. Reticulo-abdominal adhesions in 4 and rumeno-abdominal adhesions in 4 were observed by rumenotomy which were not apparent by radiography. From this study, radiography was also not useful in detecting adhesions in non-TRP cases as had also been observed in TRP cases. Similar results had been documented by Braun (2005) and Kumar (2009).

Lifted reticulum (3cm) observed in radiography of one animal was due to adherence of left reticular wall with abdomen. Peritoneal effusions, distended abomasum or severe ruminal impaction were the other possible causes of lifted reticulum (Personal communication).

#### **4.5 Traumatic reticuloperitonitis (TRP)**

##### **4.5.1 Signalment and history**

The observations on signalment and history in cattle and buffaloes suffering from traumatic reticuloperitonitis are presented (Table 2). Traumatic reticuloperitonitis was diagnosed in 9 cattle and 5 buffaloes. Mean age of affected cattle was  $3.83 \pm 0.46$  years with a range of 2-6 years, and mean age of affected buffaloes was of  $7.0 \pm 1.0$  years with a range of 4-10 years. Thus, mean age was higher in buffaloes as compared to cattle. From the results, it appeared that TRP could be common in older buffaloes. The mean duration of illness was  $5.86 \pm 0.96$  days and duration of illness varied 2-6 days in 9 (64.3 per cent) and 6-15 days in 5 (35.7 per cent) animals. About half (5/14; 42.8 per cent) of the animals were in first parity and 3/14 animals were (21.4 per cent) in third parity. Similar to this study, Kumar (2009) had also reported higher prevalence of traumatic reticuloperitonitis during first parity. Anorexia was a more common presenting clinical sign (8/14; 57.1 per cent) than inappetence (5/14; 35.7 per cent). Similarly, Bhutia (2012) had also reported anorexia in 80 per cent of dairy animals suffering from TRP. Sudden fall in milk yield was recorded in half (7/14; 50 per cent) of the animals followed by gradual fall in 21.4 per cent (3/14) which was similar to the report of Fubini and Divers (2007) and Sharma *et al* (2015b). More than half (8/14; 57.1 per cent) of the affected animals were non pregnant where as only 1/14 (7.1 per cent) animals was in advanced pregnancy. Earlier a report by Blood and Hutchins (1955) had also observed that pregnancy was not risk factor in TRP. Therefore, advanced pregnancy was not

considered a risk factor in TRP. About half of the animals (6/14; 42.8 per cent) with traumatic reticuloperitonitis were in 3-6 months of lactation, 5 in 1-3 months and only one animal was recently calved. This finding also suggested that recent calving was not very closely associated with the occurrence of TRP. It was supported by Radostits *et al* (2007), where median day of occurrence of TRP was 113 days post-calving.

History of fever was noted down in 71.4 per cent (10/14) of animals, suggesting that fever at the onset of illness should be considered as a classical sign of TRP. Tympany was observed in 4 of 14 (28.6 per cent) animals, being persistent or recurrent in 2 animals each. Previous reports differed in the frequency of occurrence of tympany as a clinical sign. Sharma *et al* (2015b) reported tympany in 56 per cent of cases where as Bhutia (2012) recorded tympany in 70 per cent of cases. Therefore, it was concluded that tympany appeared to be a typical sign of TRP. Moderate abdominal pain was reported in 3 of 14 (21.4 per cent) animals, it was similar to the results of Bhutia (2012) and Sharma *et al* (2015b). Faeces was constipated in majority (11/14; 78.5 per cent) of animals followed by loss of defecation (2/14; 14.3 per cent). The most common physical abnormalities in faeces was melena (6/14; 42.8 per cent) or clay coloured faeces in (2/14; 14.3 per cent) of animals. Changes in faecal characteristics and defecation status were similar to Francoz and Guard (2015), Athar *et al* (2010) and Hussain *et al* (2011).

#### **4.5.2 Physical examination**

General demeanour was normal in 8 (57.1 per cent), mild depression in 2 (14.3 per cent) and moderate depression in 4 (28.6 per cent) of the TRP cases (Table 2). Moderate to severe dehydration was observed in 5 (35.7 per cent) animals. This was in concurrence with earlier reports of Randhawa *et al* (1996), Kumar (2006), Turkar and Uppal (2007) and Shah (2010). Rectal temperature varied from 100-103.2°F with a mean of  $101.4 \pm 0.28^\circ\text{F}$ , heart rate ranged from 50-132 beats per minute with a mean of  $77.7 \pm 5.75$  beats per minute and respiration rate ranged from 12-60 breaths per minute with a mean of  $26.8 \pm 3.53$  per minute. Fever and increased heart rate were recorded in 2 of 14 (14.3 per cent) animals and increased respiration rate in 3 of 14 (21.4 per cent) of animals. The increased heart and respiration rate might be due to abdominal pain, ruminal distention and or fluid imbalance. This findings were similar to Radostits *et al* (2007), Kumar (2006) and Shah (2010). Mean rumen motility was  $1.43 \pm 0.48$  per 2 min. Rumen motility was absent in 6 of 14 (42.9 per cent) TRP

cases, decreased (<3/2min) in 5 (35.7 per cent), increased (>3/2minutes) in 2 (14.3 per cent) and normal in 1 (6.8per cent) case. Therefore altered ruminal motility was a common clinical finding. However, ruminal stasis, considered as a classical clinical finding in TRP was observed in less than half of the animals. Similar findings were reported by Bhutia (2012). Rumen consistency was mushy in more than half (8/14; 57.1per cent), doughy in 5/14 (35.7 per cent) and fluid filled in 1/14 (7.14 per cent) animals. Thus, abnormal ruminal contents were recorded in 62.4 per cent of the animals which was supported by the inference of Braun *et al* (1993) that abnormal ruminal contents were the most common of seven signs useful for the diagnosis of functional forestomach disorders. Normal abdominal contour was recorded in 12 of 14 (85.7 per cent) cases, mild abdominal distention in 2 (14.28 per cent) and fluid filled intestines were palpable rectally in 1 (7.1 per cent) animal. Similar to the present findings, varying degrees of abdominal distension, ranging from mild to severe in the gastrointestinal disorders have been reported by Radostits *et al* (2007) and Hussain *et al* (2011).

#### **4.5.3 Haematology**

Mean Hb in cattle was  $10.26 \pm 1.26$  g/dL with a range of 6.4-19 g/dL where as mean Hb in buffaloes was  $12.1 \pm 0.75$  g/dL that varied from 9.5-13.6 g/dL (Table 2). Anemia was recorded only in 1 cattle. Mean of PCV value was  $29.1 \pm 1.54$  per cent with a range of 23-37 per cent in TRP cases. The results suggested no significant alteration in red cell parameters which was similar to the comments of Garry and McConel (2015) that haematological abnormalities generally were not significantly affected in fore stomach disorders. Mean TLC value was  $14724.29 \pm 1843.94$  cells/ $\mu$ L with a range of 5540-24920 cells/ $\mu$ L and leukocytosis was recorded in 9/14 (64.3 per cent) of animals. Leukogram was inflammatory in 7 of 14 cases which was showing regenerative left shift in 2 of 14 (14.3 per cent), degenerative left shift in 4 of 14 (28.6 per cent) and neutrophilic leukocytosis with toxic changes in 1 (7.1 per cent) of 14 cases. Neutrophilic leukocytosis without any frank evidence of inflammatory response was present in 4 (28.6 per cent) of 14 cases either suggestive of stress or chronic inflammatory response. Neutrophilia with left shift observed in 7 cases were classical changes in leukogram of acute TRP as had been reported by Francoz and Guard (2015). Less marked changes in leukogram observed in 4 of 14 animals were according to report of (Francoz and Guard 2015).

**Table 2: Comparison of clinical observations in TRP and non-TRP affected animals**

Observations	TRP (n=14)	Non-TRP (n=19)	Observations	TRP(n=14)	Non-TRP (n=19)
Anorexia	8 <sup>a</sup> (57%)	4 <sup>b</sup> (21%)	Temperature 99-102.5°F	12 <sup>a</sup> (85.7%)	14 <sup>a</sup> (73.7%)
Inappetenc	5 <sup>a</sup> (35.7%)	14 <sup>a</sup> (21%)	Temperature >102.5 °F	2 <sup>a</sup> (14.3%)	4 <sup>a</sup> (21%)
Reduced water intake	12 <sup>a</sup> (85.7%)	13 <sup>a</sup> (68.4%)	Heart rate bpm	77.71±5.75 <sup>a</sup>	79.89±4.31 <sup>a</sup>
Milk reduction	10 <sup>a</sup> (71.4%)	15 <sup>a</sup> (78.9%)	Respiration rate bpm	26.79±3.53 <sup>a</sup>	30.89±3.81 <sup>a</sup>
Non pregnant	8 <sup>a</sup> (57%)	12 <sup>a</sup> (63.2%)	Rumen motility <3/2min	5 <sup>a</sup> (35.7%)	6 <sup>a</sup> (31.6%)
Advance pregnant	1 <sup>a</sup> (7.1%)	0	Rumen motility >3/2min	2 <sup>a</sup> (14.3%)	4 <sup>a</sup> (21%)
History of fever	10 <sup>a</sup> (71.4%)	7 <sup>b</sup> (36.8%)	Rumen motility absent	6 <sup>a</sup> (42.9%)	5 <sup>a</sup> (26.3%)
History of tympany	4 <sup>a</sup> (28.6%)	8 <sup>a</sup> (42.1%)	Doughy rumen	5 <sup>a</sup> (35.7%)	14 <sup>a</sup> (73.7%)
History of abdominal pain	3 <sup>a</sup> (21.43%)	7 <sup>a</sup> (36.8%)	Abnormal rumen consistency	9 <sup>a</sup> (64.3%)	5 <sup>b</sup> (26.3%)
Complete loss of defecation	2 <sup>a</sup> (14.3%)	2 <sup>a</sup> (10.5%)	Mild abdominal distention	2 <sup>a</sup> (14.3%)	2 <sup>a</sup> (10.5%)
Constipated	11 <sup>a</sup> (7.1%)	13 <sup>a</sup> (68.4%)	Moderate abdominal distention	0	2 <sup>a</sup> (10.5%)
Black colour faeces	6 <sup>a</sup> (42.9%)	12 <sup>a</sup> (63.2%)	Severe abdominal distention	0	1 <sup>a</sup> (5.2%)
Clay colour faeces	2 <sup>a</sup> (14.3%)	2 <sup>a</sup> (10.5%)	Intestinal distention	1 <sup>a</sup> (7.1%)	2 <sup>a</sup> (10.5%)
Foul smelling faeces	1 <sup>a</sup> (7.1%)	0	Hb (g/dL)	10.27±0.61 <sup>a</sup>	9.25±0.48 <sup>a</sup>
Mild depression	2 <sup>a</sup> (14.3%)	2 <sup>a</sup> (10.5%)	PCV(%)	29.12±1.54 <sup>a</sup>	26.13±1.18 <sup>a</sup>
Moderate depression	4 <sup>a</sup> (28.6%)	5 <sup>a</sup> (26.3%)	TLC (cells/μL)	14724.29±1843.94 <sup>a</sup>	11563.68±737.57 <sup>a</sup>
Mild dehydration	9 <sup>a</sup> (64.3%)	12 <sup>a</sup> (63.2%)	Neutrophil (cells/μL)	10619.56±1600.07 <sup>a</sup>	7856.95±720.48 <sup>a</sup>
Moderate dehydration	4 <sup>a</sup> (28.6%)	7 <sup>a</sup> (36.8%)	Lymphocyte (cells/μL)	3978.64±576.45 <sup>a</sup>	3491.36±366.80 <sup>a</sup>
Severe dehydration	1 <sup>a</sup> (7.1%)	0	Regenerative left shift	2 <sup>a</sup> (14.3%)	2 <sup>a</sup> (10.5%)
Anemic mucous membrane	6 <sup>a</sup> (42.9%)	7 <sup>a</sup> (36.8%)	Degenerative left shift	4 <sup>a</sup> (28.6%)	4 <sup>a</sup> (21%)
Congested mucous membrane	4 <sup>a</sup> (28.6%)	3 <sup>a</sup> (15.8%)	Neutropilic leukocytosis	4 <sup>a</sup> (28.6%)	3 <sup>a</sup> (15.8%)
Temperature <98 °F	0	1 <sup>a</sup> (5.2%)	Neutrophilic leukocytosis with toxic changes	1 <sup>a</sup> (7.1%)	1 <sup>a</sup> (5.3%)

Values in parenthesis depict percentage

Values having different superscript in same row differ significantly at P<0.05

## 4.6 Non-traumatic reticuloperitonitis (non-TRP)

### 4.6.1 Signalment and history

The observations on signalment and history in cattle and buffaloes are presented in Table 2. Mean age of non-traumatic reticuloperitonitis affected cattle was  $4.25 \pm 0.37$  years with a range of 3-6 years and the mean age of affected buffaloes was  $4.56 \pm 0.41$  years with a range of 3-7 years. No remarkable difference was observed between the age of cattle and buffaloes. Duration of illness extended from 3-30 days with a mean of  $11.0 \pm 2.20$  days. About half (8/19; 42.1 per cent) of the animals were in first parity, 7 of 19 (36.9 per cent) in second parity, 3 (15.8 per cent) in third parity and 1 (5.3 per cent) was heifer. Majority (14/19; 73.7 per cent) of the animals were presented for inappetence and 4 of 19 (21.1 per cent) for anorexia. Anorexia was significantly less common in non-TRP affected animals as compared to occurrence of anorexia in 8 (57.1 per cent) of 14 TRP affected animals. Similar to this study, Sharma *et al* (2015b) reported inappetence in higher proportion (50 per cent) of animals as compared to anorexia (38.9 per cent). Gradual decrease in milk yield was more common (9/19; 60 per cent) as compared to sudden fall in 6 of 19 (40 per cent) animals as was earlier observed by Kumar (2009). In contrast in other study, decline in milk yield was in higher portion of animals than gradual fall in animals suffering from peritonitis (Hussain *et al* 2011).

More than half (12/19; 63.2 per cent) of the affected animals were non-pregnant and only 2 of 19 were in late gestation. This finding was similar to Hussain *et al* (2011). Majority (8/12; 66.7 per cent) of non-pregnant animals were reported in between 1-3 months of lactation and 3 of 12 (25 per cent) animals between 3-5 months of lactation. No variation was recorded in physiological status of TRP and non-TRP affected animals. History of fever was significantly ( $p \leq 0.05$ ) less common (7/19; 36.9 per cent) in non-TRP group as compared to TRP group (10/14; 71.4 per cent). Similar to our finding, Sharma *et al* (2015a) reported that history of fever was less common in animals suffering from peritonitis. In contrast, fever had been stated to be common sign of peritonitis by Hosgood and Salisbury (1989). This difference might be due to infrequent or non recording of rectal temperature in early stage of

illness. History of tympany was reported in 8 of 19 animals (42.1 per cent); it was recurrent in 2 (25 per cent), persistent in 2 (25 per cent) cases and single episode of tympany in 4 (50 per cent) animals. Similar observations had been reported by Kumar *et al* (2008), Shah (2010) and Hussain *et al* (2011) in bovines peritonitis. Mild pain was reported in 5 of 19 (26.3 per cent) and moderate in 2 (10.5 per cent). Similarly, Hussain *et al* (2011) reported history of pain in 40.6 per cent cases, Bhutia (2012) in 41.9 per cent and Sharma *et al* (2015a) in 50 per cent of animals suffering from peritonitis. Constipation was reported in more than half (13/19; 68.4 per cent) animals and loss of defecation in 2 of 19 (10.5 per cent). Guard (2002) reported constipation in acute and diarrheic faeces in chronic peritonitis. Faeces were black coloured in 12 of 19 (63.1 per cent) and clay coloured in 2 (10.5 per cent) cases. Similar to present study, black and clay coloured faeces in animals suffering from peritonitis were reported by Bhutia (2012) and Shah (2010).

Altered quantity and physical appearance of faeces in forestomach dysfunction were commonly associated with derranged forestomach fermentation or decomposition of faecal matter/intestinal mucosal tissues or inflammatory products (Garry and McConel 2015).

#### **4.6.2 Physical examination**

General demeanour was unaffected in 12 of 19 (63.6 per cent) as presented in Table 3. There was mild depression in 2 of 19 (10.5 per cent) and moderate depression in 5 (26.3 per cent) of animals. In contrast, Sharma *et al* (2015a) reported that 62.5 per cent of animals suffering from peritonitis were depressed at the time of presentation. Moderate to severe dehydration was observed in 7 of 19 (36.9 per cent) animals. This was in concurrence with earlier reports by Turkar and Uppal (2007) and Shah (2010) who reported moderate to severe dehydration in these disorders. Rectal temperature varied from 97-104.6°F with a mean of  $101.5 \pm 0.39^\circ\text{F}$ , heart rate ranged from 52-104 beats per minute with a mean of  $79.9 \pm 4.31$  beats per minute and respiration rate ranged from 44-67 breaths per minute with a mean of  $30.9 \pm 3.81$  breaths per minute. Fever was recorded in 3 of 19 (15.8 per cent) animals at the time of presentation. Thus, no significant difference was observed in vital parameters viz.

rectal temperature, heart rate and respiration rate between TRP and non-TRP animals. Increased heart and respiration rate was recorded in 6 of 19 (31.6 per cent) animals. The increased heart and respiration rate might be due to abdominal pain, ruminal distention and/or fluid imbalance. These findings were similar to the results of Nwity and Chaudhary (1995) and Radostits *et al* (2007).

Rumen motility was affected in 78.9 per cent (15/19) of non-traumatic reticulo peritonitis animals. Ruminal stasis or decreased ruminal movements were recorded in 57.9 per cent and ruminal hypermotility was recorded in 21.1 per cent (4/19) of the cases. Release of catecholamines and abdominal pain due to peritoneal inflammation were the expected causes of decreased ruminal movements as had been stated by (Fecteau 2005). Hypermotility in few animals was attributed to over distention of reticulo-rumen probably caused by reticulo-omasal transport failure due to longer course of diseases. No significant difference was appreciable in rumen motility between TRP affected and Non-TRP animals.

Rumen consistency was doughy in majority (14/19; 73.7 per cent) of the animals, mushy in 2 (10.5 per cent) and fluid filled in 3 (15.8 per cent) of 19 animals. In contrast, abnormal rumen consistency was reported in more (59 per cent) number of animals suffering from peritonitis (Hussain *et al* 2011). This difference might be attributed to longer duration of illness or decreased function of reticulo-ruminal canal (Constable *et al* 1991a). Abnormal rumen consistency was a less common (5/19; 26.3 per cent) clinical finding in non-TRP affected animals compared to 64.3 per cent (9/14) in TRP affected animals. Mild abdominal distention was recorded in 2 (10.5 per cent), moderate distention in 2 (10.5 per cent), severe distention in 1 (5.3 per cent) and intestinal distention in 2 (10.5 per cent) of 19 animals. However, 63 per cent (12/19) of animals showed normal abdominal contour. Similar to present findings, varying degrees of abdominal distension, ranging from mild to severe in the gastrointestinal disorders have been reported by Radostits *et al* (2007) and Hussain *et al* (2011).

#### **4.6.3 Haematology**

Mean Hb in cattle was  $8.41 \pm 0.59$  g/dL, with a range of 7.1-12.5 g/dL where as mean Hb in buffaloes was  $10.2 \pm 0.68$  g/dL that varied from 7.8-13.6 g/dL (Table

2). Mean PCV value was  $26.1 \pm 1.18$  per cent with a range of 20.9-37.1 per cent. Anemia was recorded in 50 per cent of cattle as compared to 22 per cent in buffaloes. No significant difference was observed in mean Hb and PCV values between affected TRP and non-TRP animals which were supported by Garry and McConel (2015) and Hussain *et al* (2011) who could not find significant alteration in red cell parameters in animals suffering from peritonitis and forestomach disorders. Mean TLC value was  $11563.7 \pm 737.6$  cells/ $\mu$ L with a range of 7160-17060 cells/ $\mu$ L in non-TRP animals. No significant difference was observed in TLC values of TRP and non-TRP affected animals. However leukocytosis was less common (5/19; 26.3 per cent) in non-TRP as compared to (9/14; 64.3 per cent) in TRP animals.

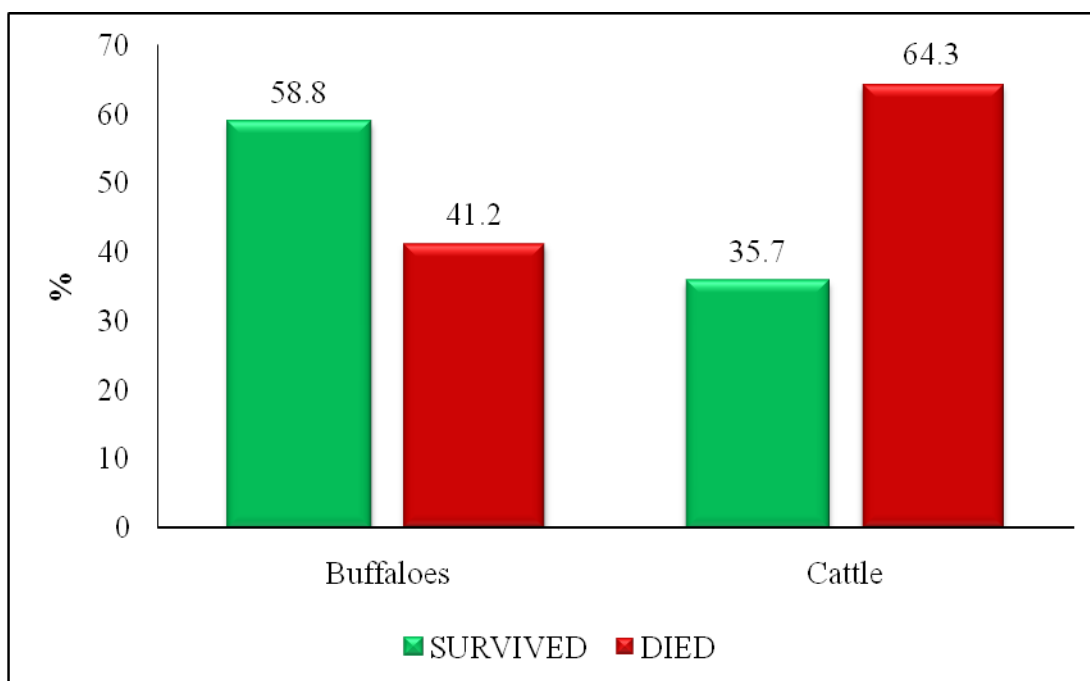
Leukogram was inflammatory in 7 of 19 animals characterised by regenerative left shift in 2 (10.5 per cent), degenerative left shift in 4 (21 per cent) and neutrophilic leukocytosis with toxic changes in 1 (5.3 per cent) animals. Radostits *et al* (2007) described leukopenia, neutrophilia, degenerative left shift and toxic changes in neutrophils as common hematological changes in acute diffuse peritonitis.

Neutrophilic leukocytosis or no remarkable changes in leukogram in 12 of 19 animals (63.2 per cent) might be due to chronicity as per Francoz and Guard (2015). On comparison of TRP and non-TRP groups, inflammatory leukogram was more common clinical feature in TRP cases.

## EXPERIMENT NO. II

### 4.2 Prognostic indicators in gastrointestinal stasis

The follow up of 62 animals (34 buffaloes and 28 cattle) suffering from gastrointestinal stasis was done for three months. To evaluate prognosis, animals suffering from gastrointestinal stasis were categorised into surviving and non-surviving animals. Comparisons were made on the basis of clinical examination, haematology, biochemical profile and peritoneal fluid changes. In this study, twenty buffaloes survived and fourteen died, where as ten cattle survived and eighteen died. The recovery rate was 58.8 per cent (20/34) in buffaloes and 35.7 per cent (10/28) in cattle (Fig. 6). Suggesting that cattle with gastrointestinal stasis had poorer recovery rate as compared to buffaloes.



**Fig. 6: Mortality rate in cattle and buffaloes suffering from gastrointestinal stasis**

#### 4.2.1 Signalment and disease history

The observations on signalment and history in surviving and non-surviving cattle and buffaloes are presented Table 3. The mean age of survived buffaloes was  $6.18 \pm 0.47$  years. Half of the animals were  $\leq 5$  years and other half  $>5$  years of age. Mean age in died buffaloes was  $6.89 \pm 0.49$  years, and most (12/18; 85.7 per cent) of the dying buffaloes were above 6 years of age. Although mean age of dying and

surviving buffaloes was not different; age distribution suggested that mortality was high in buffaloes above 6 years. Mean age of survived cattle was  $5.50 \pm 0.64$  years and it was observed that 6 (60 per cent) of survived cattle were  $\leq 5$  years and 4 (40 per cent) were  $>5$  years. However, mean age in died cattle was  $5.28 \pm 0.53$  years. It was observed that 11 (61.1 per cent) of died cattle were below 6 years and 7 (38.9 per cent) were above 6 years, suggesting that mortality was high in young as compared to cattle of higher age group. The mean duration of illness in survived buffaloes was  $6.70 \pm 0.84$  days. Duration of illness was 2-7 days in 12 (60 per cent) and 7-14 days in 8 (40 per cent) animals. On the other hand, mean duration of illness in died buffaloes was  $8.29 \pm 1.07$  days. Also more number (9/14; 64.3 per cent) of dying buffaloes were showing illness of 7-15 days, suggesting longer duration of illness might contribute to mortality in gastrointestinal stasis. Similarly, mean duration of illness was higher ( $5.66 \pm 0.61$  days) in dying cattle as compared to surviving cattle ( $4.20 \pm 0.42$  days). Also, more number (10/18; 55.6 per cent) of dying cattle were above 5 years as compared to (1/10; 10 per cent) surviving cattle. Therefore, duration of illness more than 5 days could be a risk factor for mortality in cattle and buffaloes suffering from gastrointestinal stasis.

Anorexia was recorded in 7 of 20 (35 per cent) animals, inappetence in 13 (65 per cent) survived buffaloes. In contrast, anorexia was reported in 10 of 14 (71.4 per cent) and inappetence in 4 (28.6 per cent) of died buffaloes. Similarly, anorexia was less common (2/10; 20 per cent) clinical sign in survived cattle as compared to occurrence of anorexia (13/18; 72.2 per cent) in died cattle. Anorexia was significantly ( $p \leq 0.05$ ) more common in died cattle and buffaloes as compared to survived cattle and buffaloes. Therefore, animals with complete anorexia might be considered as an unfavourable clinical sign. Sharma *et al* (2015a) recorded anorexia and reduced water intake in majority of animals suffering from peritonitis. However, Hussain *et al* (2013) reported anorexia as the most common primary complaints. Constable *et al* (1991a) observed shorter duration of anorexia (3 days) as a good prognostic sign in cattle surgically treated for abomasal volvulus.

**Table 3: Comparison of signalment and history in surviving and non-surviving cattle and buffaloes with gastrointestinal stasis**

Signs	Buffaloes		Cattle	
	Survived (n=20)	Died (n=14)	Survived (n=10)	Died (n=18)
Anorexia	7 <sup>a</sup> (35%)	10 <sup>b</sup> (71.4%)	2 <sup>A</sup> (20%)	13 <sup>B</sup> (72.2%)
Inappetence	13 <sup>a</sup> (65%)	4 <sup>a</sup> (28.6%)	8 <sup>A</sup> (80%)	5 <sup>A</sup> (27.8%)
Reduced water intake	11 <sup>a</sup> (55%)	11 <sup>a</sup> (78.6%)	6 <sup>A</sup> (60%)	11 <sup>A</sup> (61.1%)
Sudden fall milk yield	7 <sup>a</sup> (35%)	4 <sup>a</sup> (28.6%)	3 <sup>A</sup> (30%)	3 <sup>A</sup> (16.7%)
Gradual fall milk yield	9 <sup>a</sup> (45%)	10 <sup>a</sup> (71.4%)	4 <sup>A</sup> (40%)	9 <sup>A</sup> (50%)
Non pregnant	14 <sup>a</sup> (70%)	10 <sup>a</sup> (71.4%)	1 <sup>A</sup> (10%)	7 <sup>A</sup> (38.9%)
Advance pregnant	2 <sup>a</sup> (10%)	0	4 <sup>A</sup> (40%)	6 <sup>A</sup> (33.3%)
Early lactation	4 <sup>a</sup> (20%)	1 <sup>a</sup> (7.1%)	1 <sup>A</sup> (10%)	2 <sup>A</sup> (11.1%)
History of Fever	8 <sup>a</sup> (40%)	9 <sup>a</sup> (64.3%)	1 <sup>A</sup> (10%)	9 <sup>A</sup> (50%)
History of tympany	1 <sup>a</sup> (5%)	1 <sup>a</sup> (7.1%)	2 <sup>A</sup> (20%)	6 <sup>A</sup> (33.3%)
Mild abdominal pain	4 <sup>a</sup> (20%)	1 <sup>a</sup> (7.1%)	6 <sup>A</sup> (60%)	3 <sup>A</sup> (16.7%)
Moderate abdominal pain	1 <sup>a</sup> (5%)	3 <sup>a</sup> (21.4%)	2 <sup>A</sup> (20%)	5 <sup>A</sup> (27.8%)
Complete loss of defecation	4 <sup>a</sup> (20%)	7 <sup>a</sup> (50%)	3 <sup>A</sup> (30%)	13 <sup>B</sup> (72.2%)
Constipated	14 <sup>a</sup> (70%)	7 <sup>a</sup> (50%)	7 <sup>A</sup> (70%)	5 <sup>A</sup> (27.8%)
Black colour faeces	10 <sup>a</sup> (50%)	7 <sup>a</sup> (50%)	5 <sup>A</sup> (50%)	8 <sup>A</sup> (44.4%)
Clay colour faeces	3 <sup>a</sup> (15%)	3 <sup>a</sup> (21.4%)	4 <sup>A</sup> (40%)	4 <sup>A</sup> (22.2%)

Values in parenthesis depict percentage

Values having different superscript in same row differ significantly at P<0.05

Half of the (15/30; 50 per cent) surviving cattle and buffaloes were non pregnant and 20 per cent (6/30) were in advanced pregnancy. Similar observations were recorded in dying animals. Non pregnant animals constituted 53.1 per cent (17/32) and advanced pregnant animals 18.8 per cent (6/32) of the non-surviving animals suggesting effect of advance pregnancy on prognosis in this study. Of the surviving animals, 9 of 30 were in first parity, 8 in second parity, 6 in third parity and 7 were in fourth parity. In comparison, out of 32 dying animals, 7 animals were in first parity, 11 in second parity, 7 in third parity, 2 in fourth parity, 3 in fifth parity and 2 in sixth parity; thus suggesting some of the dying animals were in higher parity as compared to surviving animals. Thus, direct effect of advanced pregnancy to mortality in gastrointestinal stasis can not be ruled out. History of fever was more common (18/32; 56.3 per cent) in dying as compared to surviving animals (9/30; 30 per cent), thus might be considered as a bad prognostic clinical sign.

So, it was inferred that complete anorexia, higher age and longer duration of illness might be considered as risk factors for poor survival rate. In contrast, Sattler *et al* (2000) did not find significant association between the clinical signs on the day prior to death in cattle with gastrointestinal dysfunction.

Faeces was constipated in 14 of 20 (70 per cent), complete loss defecation in 4 (20 per cent) in survived buffaloes. Melena was recorded in 10 of 20 (50 per cent) and clay coloured faeces in 3 (15 per cent) of survived buffaloes. However, defecation was constipated in 7 of 14 (50 per cent) and completely loss of defecation in 7 (50 per cent) in died buffaloes. Black coloured faeces was recorded in 9 of 14 (64.3 per cent) and clay coloured 3 (21.4 per cent) in died buffaloes. Decreased or absent fecal output was the most common initial owner complaints reported by Hussain *et al* (2013), Toor and Saini (2008) and Turkar and Uppal (2007).

In survived cattle, defecation was constipated in 7 of 10 animals (70 per cent), complete loss of defecation in 3 (30 per cent). Melena was observed in 5 (50 per cent) and clay coloured faeces in 4 (40 per cent) of 10 survived cattle. However, defecation was constipated in 5 of 18 (27.8 per cent) and complete loss of defecation in 13 (72.2 per cent) died cattle. Melena was recorded in 8 (44.4 per cent) and clay coloured faeces in 4 (22.2 per cent) of 18 died cattle. Loss of defecation was significantly ( $p < 0.05$ ) more in died cattle as compared to survived cattle. Complete loss of defecation was

reported in 66 per cent of the animals (Toor and Saini 2008). As compared to these observations, the animals which had complete loss of defecation had high mortality risk and the prognosis was poor. Similar to this study, period of inappetence and hydration status were reported to be superior preoperative prognostic indicators compared to routine laboratory tests in cattle with abomasal valvulus (Constable *et al* 1991b).

#### **4.2.2 Physical examination of surviving and non-surviving cattle and buffaloes**

General demeanour was normal in 12 (60 per cent), mild depression in 4 (20 per cent) and moderate depression in 4 (20 per cent) of 20 survived buffaloes, where as respective values in died buffaloes were 6 (42.9 per cent), 6 (42.9 per cent) and 2 (14.3 per cent) of 14 cases (Table 4). Similarly in surviving cattle, general demeanour was normal in 4 of 10 (40 per cent), mild depression in 2 (20 per cent) and moderate depression in 4 (40 per cent), where as died cattle showed normal demeanour in 10 (55.6 per cent), mild depression in 3 (16.7 per cent) and moderate depression in 5 (27.8 per cent) of 18 cases. There was no association in the general demeanour of surviving and non-surviving of cattle and buffaloes. The animals were having varying degrees of dehydration irrespective of the condition.

Moderate dehydration was evident in 6 (30 per cent) and severe in 2 (20 per cent) of 20 surviving buffaloes, and in died buffaloes dehydration was moderate in 5 of 14 (35.7 per cent) and severe in 1 (7.1 per cent) buffalo. So, hydration status was normal in 12 of 20 (60 per cent) surviving and 8 of 14 (57.1 per cent) dying buffaloes. In surviving cattle, moderate dehydration was recorded in 3 of 10 (30 per cent) and severe in 2 (20 per cent) where as in dying cattle the respective values were 7 of 18 (38.9 per cent) and 2 (11.1 per cent). Hydration status was thus normal in 5 of 10 (50 per cent) surviving and 9 of 18 (50 per cent) dying cattle. From these observations, it was inferred that hydration status did not differ with the outcome of diseases. Moderate to severe dehydration in forestomach disorders had also been reported by Kumar (2006), Turkar and Uppal (2007) and Shah (2010). No remarkable difference in colour and circulation of visible mucous membrane was observed in surviving and non-surviving cattle and buffaloes. Similar observations had been reported in primary ruminal or omasal impaction (Prasad and Joshi 1975, Nwity and Chaudhary 1995).

Rectal temperature varied from 96.8-104°F with a mean of  $101.0 \pm 0.40^\circ\text{F}$ , heart rate ranged from 40-90 beats per minute bpm with a mean of  $62.9 \pm 2.89$  beats per

minute and respiration rate ranged from 11-36 breaths per minute with a mean of  $24.0 \pm 1.43$  breaths per minute in survived buffaloes. However, in died buffaloes mean rectal temperature varied from 99.2-104.6°F with a mean of  $101.4 \pm 0.56$  °F, heart rate ranged from 42-90 beats per minute with a mean of  $65.0 \pm 3.70$  beats per minute and respiration rate ranged from 12-38 breaths per minute with a mean of  $21.7 \pm 2.40$  breaths per minute in died buffaloes. One (5 per cent) of survived buffaloes and 3 (21.4 per cent) died buffaloes showed fever ( $>103$  °F). Similarly, rectal temperature varied from 99.2-104 °F with a mean of  $101.3 \pm 0.46$  °F, heart rate ranged from 70-108 beats per minute with a mean of  $88.8 \pm 4.05$  beats per minute and respiration rate ranged from 15-37 breaths per minute with a mean of  $28.4 \pm 2.4$  breaths per minute in survived cattle. However, in died cattle mean rectal temperature varied from 98.6-104.6 °F with a mean of  $101.4 \pm 0.30$  °F, heart rate ranged from 46-120 beats per minute with a mean of  $84.3 \pm 5.58$  beats per minute and respiration rate ranged from 12-36 breaths per minute with a mean of  $25.7 \pm 1.65$  breaths per minute. Fever was present in 1 (10 per cent) of the survived cattle and 1 (5.6 per cent) died cattle.

Thus, no significant difference was observed in vital parameters viz. rectal temperature, heart rate and respiration rate between survived and non-survived cattle and buffaloes. No difference in vital parameters were similar to the findings of Sattler *et al* (2000) while determining the prognosis of gastrointestinal dysfunctions resembling vagal indigestion in cattle. No difference of fever between two groups was attributed to the affect to chronicity of the disease conditions or physiological dysfunctions (Garry and McConnel 2015) as the cause of gastrointestinal stasis.

The mean rumen motility was  $1.65 \pm 0.35$  per 2 minutes. Rumen motility was absent in 7 (35 per cent), decreased ( $<3/2$ min) in 7 (35 per cent), increased ( $>3/2$ minutes) in 4 (20 per cent) and normal in 3 (15 per cent) of 20 survived buffaloes. On the other hand, mean rumen motility was  $0.79 \pm 0.32$  per 2 minutes. Rumen motility was absent in 8 of 14 (57.1 per cent), decreased in 5 (35.7 per cent) and increased in 1 (7.1 per cent) in died buffaloes. No significant difference was appreciable in rumen motility between two groups. Similarly, mean rumen motility was  $1.00 \pm 0.42$  per 2 minutes. Rumen motility was absent in 5 (50 per cent), decreased in 4 (40 per cent) and increased in 1 (10 per cent) of 10 survived cattle. However in died cattle rumen motility was  $1.50 \pm 0.32$  per 2 minutes. Rumen motility was absent in 5 of 18 (27.8 per cent), decreased in 10 (55.6 per cent) and increased in 3 (16.1 per cent). From these results it

appeared that ruminal stasis was more common in died buffaloes as compared to the survived buffaloes, however, this difference was lacking in cattle. Absence of ruminal motility and hard rumen consistency had been reported by Hussain and Uppal (2012).

Rumen consistency was doughy in 14 (70 per cent) and mushy in 6 (30 per cent) of 20 survived buffaloes as compared to died buffaloes where the rumen consistency was doughy in 7 of 14 (50 per cent) and mushy in 7 (50 per cent) cases. On the other hand, in survived cattle rumen consistency was doughy in 4 of 10 (40 per cent) and mushy in 6 (60 per cent) cases as compared to died cattle the rumen consistency was doughy in 12 of 18 (66.6 per cent) and mushy in 6 (33.3 per cent) of animals. It appeared from these findings that dying cattle or buffaloes with mushy rumen were less likely to survive.

Loss of stratification of rumen contents resulted in mushy rumen which often appeared as a result of reticulo-omasal transfer failure (Garry 2002). Observation of Fubini *et al* (1989) also showed that reticulo-omasal transfer failure was difficult to treat with medical treatment and surgical intervention improved recovery rate in cattle.

Fluid filled intestines (intestinal distention) were palpable rectally in 7 (50 per cent) of non-surviving buffaloes in contrast to 1 of 20 (5 per cent) in surviving buffaloes. On the other hand, fluid filled intestines were detected in 2 of 10 (20 per cent) survivor cattle versus 6 of 18 (33.3 per cent) died cattle. There was significant difference in surviving and non-surviving buffaloes. No such comparison was available in scientific literature. However, in contrast to present study fluid filled intestines were less commonly observed in vagal indigestion (3.2 per cent) or TRP (6 per cent) cases (Kumar 2009).

From these observations, it appeared that fluid filled intestines were more common in dying buffaloes. However, this difference was less marked in cattle. An outstanding finding in surviving and dying cattle and buffaloes was the difference in physical features of faeces observed during rectal examination. Faeces were very offensive smelling and black or clay in colour in half (7/14; 50 per cent) of the died buffaloes compared to 15 per cent (3/20) of survived buffaloes. Identical findings were apparent in cattle where 9 of 18 (50 per cent) died cattle had offensive smelling faeces against 2 of 10 (20 per cent) in surviving cattle.

**Table 4: Comparison of physical examination in surviving and non-surviving cattle and buffaloes with gastrointestinal stasis**

Observations	Buffalo		Cattle	
	Survived (n=20)	Died (n=14)	Survived (n=10)	Died (n=18)
Alert	12 <sup>a</sup> (60%)	6 <sup>a</sup> (42.9%)	4 <sup>A</sup> (40%)	10 <sup>A</sup> (55.6%)
Mild depression	4 <sup>a</sup> (20%)	6 <sup>a</sup> (42.9%)	2 <sup>A</sup> (20%)	3 <sup>A</sup> (16.7%)
Moderate depression	4 <sup>a</sup> (20%)	2 <sup>a</sup> (14.3%)	4 <sup>A</sup> (40%)	5 <sup>A</sup> (27.8%)
Moderate dehydration	6 <sup>a</sup> (30%)	5 <sup>a</sup> (35.7%)	3 <sup>A</sup> (30%)	7 <sup>A</sup> (38.9%)
Severe dehydration	2 <sup>a</sup> (10%)	1 <sup>a</sup> (7.1%)	2 <sup>A</sup> (20%)	2 <sup>A</sup> (11.1%)
Congested mucous membrane	4 <sup>a</sup> (20%)	4 <sup>a</sup> (28.6%)	0	1 <sup>A</sup> (5.6%)
Pale mucous membrane	4 <sup>a</sup> (20%)	2 <sup>a</sup> (14.3%)	4 <sup>A</sup> (40%)	7 <sup>A</sup> (38.9%)
Rectal temperature °F	101±0.40 <sup>a</sup>	101.44±0.56 <sup>a</sup>	101.35±0.46 <sup>A</sup>	101.43±0.30 <sup>A</sup>
Fever	1 <sup>a</sup> (5%)	3/14(21.4%) <sup>a</sup>	1 <sup>A</sup> (10%)	1 <sup>A</sup> (5.6%)
Heart rate (bpm)	62.9±2.89 <sup>a</sup>	65.0±3.70 <sup>a</sup>	88.8±4.05 <sup>A</sup>	84.33±5.58 <sup>A</sup>
Respiration rate (bpm)	24.1±1.43 <sup>a</sup>	21.7±2.40 <sup>a</sup>	28.4±2.39 <sup>A</sup>	25.67±1.65 <sup>A</sup>
Rumen motility (/2min)	1.6±0.35 <sup>a</sup>	0.79±3.74 <sup>a</sup>	1.00±1.15 <sup>A</sup>	1.38±0.33 <sup>A</sup>
Absence of rumen motility	7 <sup>a</sup> (35%)	8 <sup>a</sup> (57.1%)	5 <sup>A</sup> (50%)	5 <sup>A</sup> (27.8%)
Decreased rumen motility (>3/2min)	7 <sup>a</sup> (35%)	5 <sup>a</sup> (35.7%)	4 <sup>A</sup> (40%)	10 <sup>A</sup> (55.6%)
Increased rumen motility (>3/2min)	4 <sup>a</sup> (20%)	1 <sup>a</sup> (7.1%)	1 <sup>A</sup> (10%)	3 <sup>A</sup> (16.7%)
Doughy rumen	14 <sup>a</sup> (70%)	7 <sup>a</sup> (50%)	4 <sup>A</sup> (40%)	12 <sup>A</sup> (66.6%)
Mushy rumen	6 <sup>a</sup> (30%)	7 <sup>a</sup> (50%)	6 <sup>A</sup> (60%)	6 <sup>A</sup> (33.3%)
Mild abdominal distention	3 <sup>a</sup> (15%)	2 <sup>a</sup> (14.3%)	2 <sup>A</sup> (20%)	4 <sup>A</sup> (22.2%)
Moderate abdominal distention	1 <sup>a</sup> (5%)	3 <sup>a</sup> (21.4%)	0	2 <sup>A</sup> (11.1%)
Severe abdominal distention	0	0	0	1 <sup>A</sup> (5.6%)
Intestinal distention	1 <sup>a</sup> (5%)	7 <sup>b</sup> (50%)	2 <sup>A</sup> (20%)	6 <sup>A</sup> (33.3%)
Foul smelling faeces	3 <sup>a</sup> (15%)	7 <sup>b</sup> (50%)	2 <sup>A</sup> (20%)	9 <sup>B</sup> (50%)

Values in parenthesis depict percentage

Values having different superscript in same row differ significantly at P<0.05

### 4.2.3 Haematology

Mean Hb in survived buffaloes was  $11.0 \pm 0.49$  g/dL, with a range of 5-14 g/dL where as mean Hb was  $10.7 \pm 0.67$  g/dL varying from 6.2-15.3 g/dL in died buffaloes (Table 5). Anemia was recorded in 1 of survived buffaloes and 2 of died buffaloes. In survived cattle, mean Hb was  $9.76 \pm 0.91$  g/dL with a range of 3.4-13.5 g/dL and the respective values in died cattle were  $10.8 \pm 0.54$  g/dL and 6.9-15.8 g/dL. Anemia was observed only in one survived and died cattle. Mean of PCV value in survived buffaloes was  $29.6 \pm 1.33$  per cent and it varied from 24-41 per cent. In comparison, mean PCV value of died buffaloes was  $30.5 \pm 1.90$  per cent, with a range of 20-42.5 per cent. In survived cattle, mean PCV was  $34.4 \pm 1.85$  per cent, with a range of 27.4-43 per cent and in died cattle, it was  $31.7 \pm 1.60$  per cent with a range of 22-45.5 per cent. No significant difference was observed in mean Hb and PCV values between survived and died cattle and buffaloes. Constable *et al* (1991b) also did not find any difference in PCV value between survivor and non-survivor cattle treated for abomasal volvulus. Mean TLC value in survived buffaloes was  $10997.5 \pm 755.8$  cells/ $\mu$ L and leukocytosis in 7 of 20 animals. Mean TLC value of died buffaloes was  $9327.9 \pm 680.0$  cells/ $\mu$ L and leukocytosis observed only in 1 of 14 cases. On the other hand, TLC in survived cattle was  $11108.0 \pm 1516.2$  cells/ $\mu$ L and leukocytosis was recorded in 3 of 10 animals. However, in died cattle mean TLC was  $14393.9 \pm 1415.0$  cells/ $\mu$ L and leukocytosis was recorded in 10 of 18 cases.

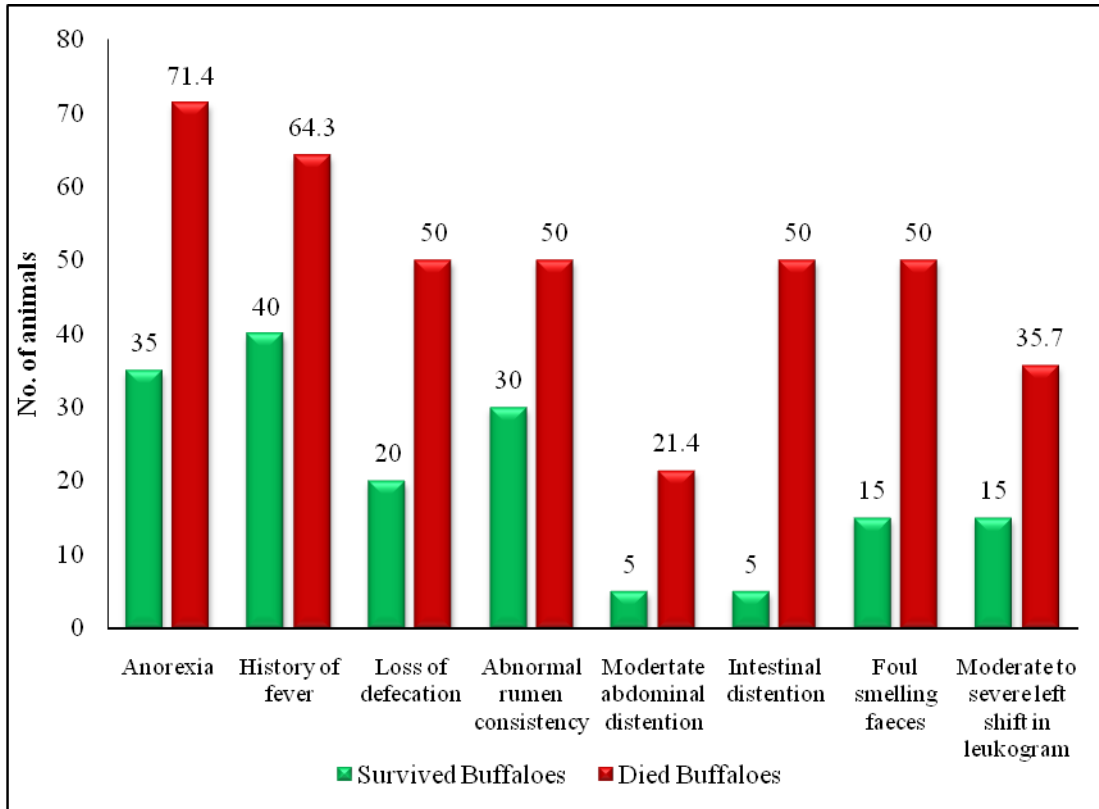
Leukocytosis was observed in more number of surviving than non-surviving buffaloes, suggesting that it was not having relevance in prognosis. However, leukocytosis was more common in died cattle. No parallel study on the differences in haematology values between surviving and dying cattle or buffaloes suffering from gastrointestinal stasis could be traced in literature. No significant difference was observed in neutrophil and lymphocyte count between surviving and non-surviving buffaloes. However, neutrophil counts were significantly high in died cattle. The absorption of toxic substances by liver due to GIT stasis could have resulted in probable toxemia and increase in TLC and neutrophilia (Divers 1992). Regenerative left shift in 2 (10 per cent) and degenerative left shift in 6 (30 per cent) of 20 survived buffaloes was apparent in comparison to degenerative left shift in 5 of 14 (35.7 per cent) died buffaloes. In survived cattle, regenerative left shift appeared in 1 (10 per cent) and degenerative left shift in 6 (60 per cent) of 10 cases. On the other hand, regenerative left shift was observed in 2 (11.1 per cent) and degenerative left shift in 8 (44.4 per cent) of 18 died cattle.

**Table 5: Comparison of haemato-biochemical parameters in surviving and non-surviving cattle and buffaloes with gastrointestinal stasis**

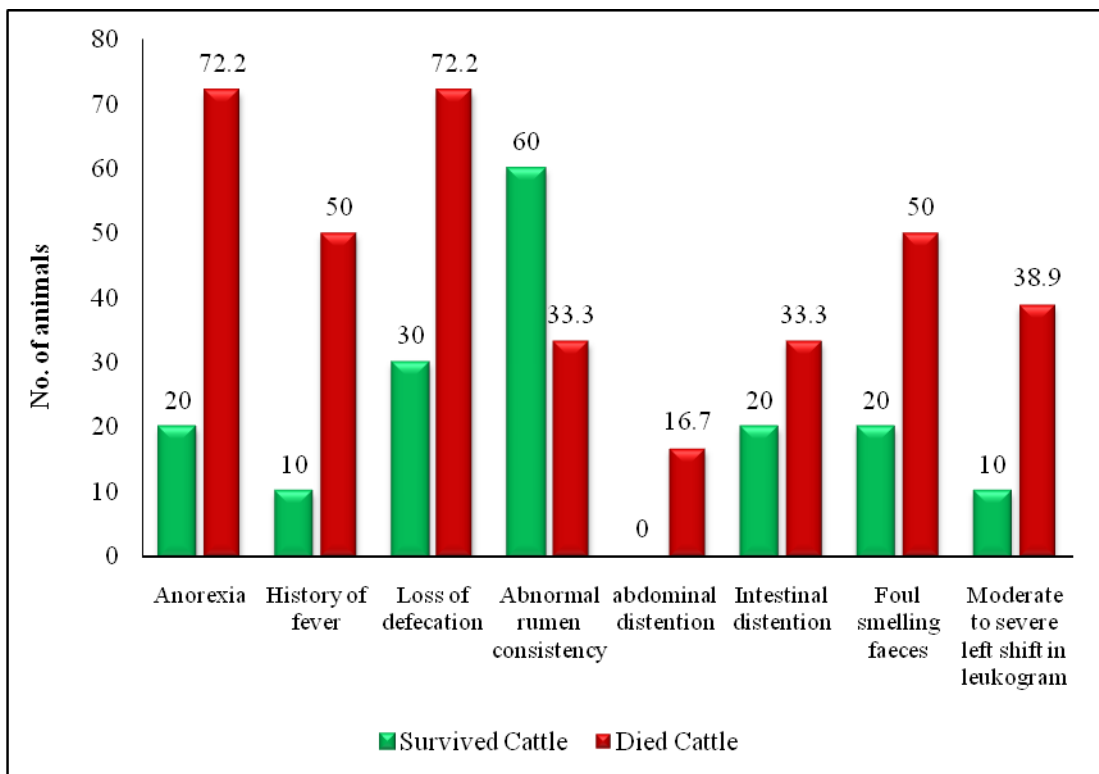
Observations	Buffaloes		Cattle	
	Survived (n=20)	Died (n=14)	Survived (n=10)	Died (n=18)
Hb(g/dL)	11.0±0.49 <sup>a</sup>	10.7±0.67 <sup>a</sup>	9.76±0.91 <sup>A</sup>	10.8±0.54 <sup>A</sup>
	(5-14)	(6.2-15.3)	(3.4-13.5)	(6.9-15.8)
PCV(%)	29.6±1.33 <sup>a</sup>	30.5±1.90 <sup>a</sup>	34.4±1.85 <sup>A</sup>	31.7±1.60 <sup>A</sup>
	(24-41)	(20-42.5)	(27.4-43)	(22-45.5)
TLC (cells/μL)	10997.5±755.8 <sup>a</sup>	9327.9±680.0 <sup>a</sup>	11108.0±1516.2 <sup>A</sup>	14393.9±1415.0 <sup>A</sup>
	(5570-16180)	(5530-13620)	(5220-20790)	(6910-25250)
Neutrophil (cells/μL)	7897.3±782.0 <sup>a</sup>	6548.1±652.5 <sup>a</sup>	6659.6±1056.3 <sup>A</sup>	10654.7±1309.9 <sup>B</sup>
	(2250-16478.8)	(3304-12258)	(2905-13721)	(4685-22977.5)
Lymphocyte (cells/μL)	3375.6±203.9 <sup>a</sup>	2734.8±269.8 <sup>a</sup>	4448.4±754.2 <sup>A</sup>	3771.7±456.4 <sup>A</sup>
	(1764.8-4708.2)	(1362-4006)	(2905-10169.6)	(828-7867.6)
AST (U/L)	453.1±97.6 <sup>a</sup>	319.6±96.1 <sup>a</sup>	169.8±54.0 <sup>A</sup>	204.4±52.2 <sup>A</sup>
	(197-668)	(85-801)	(67-379)	(79-686)
GGT (U/L)	78.6±32.5 <sup>a</sup>	84.9±37.4 <sup>a</sup>	29.6±3.66 <sup>A</sup>	81.5±28.1 <sup>A</sup>
	(17-260)	(36-308)	(18-41)	(23-288)

Values in parenthesis depict range

Values having different superscript in same row differ significantly at P<0.05



**Fig. 7: Comparison of clinical observations in survived and died buffaloes**



**Fig. 8: Comparison of clinical observations in survived and died cattle**

From these findings, it was inferred that regenerative or degenerative left shift in haemogram did not affect the outcome in gastrointestinal stasis in cattle or buffaloes which was in contrast to the results of Hussain *et al* (2013) in assessment of prognosis in bovine peritonitis. A significant finding in leukogram of this study was the difference in neutrophil count of died and survived cattle which might help in making prognosis. No significant difference was observed in plasma activity of AST and GGT between surviving and non-surviving cattle as well as buffaloes (Table 6). It was observed that plasma AST activity was above normal range in all the survived buffaloes as compared to 5 (71.4 per cent) of 7 died buffaloes. On other hand, plasma AST activity was above normal in 2 (40 per cent) of 5 survived cattle as compared to 6 (54.5 per cent) of 11 died cattle. Since plasma AST activity was high in survived buffaloes it can not be taken as a prognostic index parameter. In cattle also there was no remarkable difference in AST activity between died and survived cattle. Plasma GGT activity was increased in 3 (42.8 per cent) out of 7 survived buffaloes as compared to 4 out of 7 (57.1 per cent) died buffaloes. On the other hand plasma GGT activity was within the normal range in all survived cattle as compared to 7 of 11 died cattle (63.6 per cent). No remarkable difference was appreciable in plasma GGT activity in died and survived buffaloes. However, higher activity of GGT in cattle might contribute to higher mortality in cattle by adversely affecting liver functions. Increased levels of liver enzymes was attributed to hepatitis and could be due to enhanced toxin absorption from GIT stasis (Singh 2015). Hepatic failure may occur in dairy cattle following mastitis or metritis (Sweeney *et al* 1988).

#### **4.2.4 Peritoneal fluid examination**

Peritoneal fluid could be collected from 28 of 62 (45.2 per cent) animals suffering from gastrointestinal stasis. The number of peritoneal fluid samples were 12 in survived and 16 in died animals.

##### **4.2.4.1 Physical examination**

In survived animals, amount of peritoneal fluid was 1-5 mL in 8 and free flowing in 4 cases. Samples were clear without abnormal smell in 8 of 12 (66.7 per cent), turbid with no foul smelling in 2 (16.7 per cent) and foul smelling turbid in 2 (16.7 per cent) survived cattle and buffaloes. In died animals amount of peritoneal fluid was 1-5 mL in 12 of 16 (75 per cent) and free flowing in 4 (25 per cent) cases.

Samples were clear with no abnormal smell in 10 (62.5 per cent), turbid with no abnormal smell in 1 (6.2 per cent) and foul smelling turbid in 5 (31.6 per cent) cases. Thus, per cent peritoneal fluid samples showing physical abnormalities were similar in died and survived groups of animals.

#### **4.2.4.2 Cytological examination**

The observations on cytological examinations in surviving and non-surviving cattle and buffaloes are presented Table 6.

Total cell count was higher ( $>5000 \mu\text{l}$ ) than normal range in 2 of 5 (40 per cent) died buffaloes as compared to 1 of 7 (14.3 per cent) survived buffaloes. Total cell count was higher ( $>5000 \mu\text{l}$ ) than normal range in 5 of 11 (45.5 per cent) died where as cell count was in the normal range in all the survived cattle. Total cell counts in peritoneal fluid of healthy cattle had been reported to be less than  $5000 \mu\text{l}$  (Wittek *et al* 2010). Degenerated neutrophils and numerous bacteria (cocci, bacilli) was observed in 3 of 7 (42.8 per cent) survived buffaloes as compared to 4 of 5 (80 per cent) died buffaloes. On the other hand respective value was 1 of 5 (20 per cent) survived cattle as compared to 7 of 11 (63.6 per cent) in died cattle. From the results, it appeared that considerable overlap was evident in physical characteristics and total cell counts between survived and died cattle and buffaloes. However, this overlap was less remarkable for cytological changes in neutrophils. Therefore, cytological characteristics in peritoneal fluid might be taken as a better index in assessing prognosis. These findings were supported by Hirsch and Townsend (1982) that considerable overlap in cell counts appeared between non-inflammatory and inflammatory peritoneal fluid which was better differentiated by cytological characteristics (degenerated neutrophils, bacteria).

#### **4.2.4.3 Biochemical analysis of peritoneal fluid**

Mean total protein was  $2.27 \pm 0.23 \text{ g/dL}$ , with a range of 1.8-3.3 g/dL in survived buffaloes, in comparison to died buffaloes where mean total protein was  $3.04 \pm 0.24$  with a range of 2.6-3.9 g/dL. However, in survived cattle mean total protein was  $2.38 \pm 0.10 \text{ g/dL}$  as compared to mean total protein in  $3.06 \pm 0.23 \text{ g/dL}$  with a range of 2.3-4.4 g/dL in died cattle. No significant difference was observed in total protein value of peritoneal fluid between surviving and non-surviving cattle and buffaloes (Table 6).

**Table 6: Comparison of cytological profile and total protein in peritoneal fluid of surviving and non-surviving cattle and buffaloes with gastrointestinal stasis**

Observations	Buffaloes (n=12)		Cattle (n=16)	
	Survived (n=7)	Died (n=5)	Survived (n=5)	Died (n=11)
Nucleated cell count (cells/ $\mu$ L)	2660.0 $\pm$ 2208.1 <sup>a</sup>	11648.0 $\pm$ 5926.7 <sup>a</sup>	2100.0 $\pm$ 680.4 <sup>A</sup>	13130.91 $\pm$ 7310.3 <sup>A</sup>
	(250-15900)	(690-32300)	(1200-4800)	(1000-85000)
Poly morphic cells (%)	70.1 $\pm$ 3.16 <sup>a</sup>	78.2 $\pm$ 2.71 <sup>a</sup>	72.8 $\pm$ 1.65 <sup>A</sup>	76.82 $\pm$ 1.74 <sup>A</sup>
	(56-80)	(68-84)	(69-78)	(65-88)
Mono nuclear cells (%)	17.3 $\pm$ 2.33 <sup>a</sup>	12.6 $\pm$ 2.11 <sup>a</sup>	14.4 $\pm$ 1.75 <sup>A</sup>	15.91 $\pm$ 1.48 <sup>A</sup>
	(14-29)	(8-20)	(11-20)	(2-16)
Mesothelial cells (%)	12.6 $\pm$ 1.38 <sup>a</sup>	9.20 $\pm$ 1.2 <sup>a</sup>	12.8 $\pm$ 1.83 <sup>A</sup>	7.27 $\pm$ 0.63 <sup>A</sup>
	(8-18)	(6-12)	(8-18)	(4-11)
Total protein (g/dL)	2.27 $\pm$ 0.23 <sup>a</sup>	3.04 $\pm$ 0.24 <sup>a</sup>	2.38 $\pm$ 0.10 <sup>A</sup>	3.06 $\pm$ 0.23 <sup>A</sup>
	(1.8-3.3)	(2.6-3.9)	(2.1-2.6)	(2.3-4.4)

Values in parenthesis depict range

Total protein value was more than 3g/dL in 1 of 12 (8.3 per cent) surviving and 5 of 16 (31.3 per cent) dying animals, suggesting that high total protein was relatively more common in died animals. Sharma *et al* (2015a) reported mean value of total protein 4.22±0.42 g/dL in peritoneal fluid.

#### **4.2.4.4 Culture of peritoneal fluid**

Culture of peritoneal fluid was done in 10 of 30 (33.3 per cent) survived animals. *Staphylococcus aureus* was isolated from 2 of 10 (20 per cent) samples, *Escherichia coli* in 2 of 10 (20 per cent) and 6 samples were negative for culture. Similarly, culture of peritoneal fluid was done 13 of 32 (40.6 per cent) died animals; *Staphylococcus aureus* was isolated in 5 of 13 (38.5 per cent), *Escherichia coli* in 4 (30.8 per cent), *Proteus* in 3 of 12 (25 per cent) and 1 sample was negative for culture. Similarly, Hosgood and Salisbury (1989) isolated most common bacteria viz, *Escherichia coli* and other *enterobacteria*, *Streptococcus species* and *Proteus*. Sharma *et al* (2015a) reported septic peritonitis in 56 per cent of the cases and 44 per cent had non-septic peritonitis. In cattle with traumatic reticuloperitonitis from the peritoneal cavity after large bowel contamination. Kopcha (1990) classified the peritoneal fluid in cows on the basis of prognosis and used the term degenerative septic exudates in animals with poor prognosis while degenerative non-septic exudates in animals which recovered.

#### **4.2.5 Radiography**

The radiographic findings in surviving and non-surviving cattle and buffaloes are presented Table 7. Lateral radiographs of reticulum was taken after casting the animal in right lateral recumbency. Radiography was done in 59 animals for detection of foreign body and ruloout of TRP and reticular abscess cases. Radiography detected foreign bodies in reticulum of 9 of 19 (47.4 per cent) survived buffaloes, being potential in 5 of 19 (26.3 per cent), non-potential in 4 (21 per cent) and foreign bodies were absent in 10 (52.6 per cent) of survived buffaloes and diaphragmatic line was not clearly demarcable in 4 of 19 (21 per cent) animals.

In died buffaloes, foreign bodies were present in reticulum of 71.4 per cent, being potential in 5 of 14 (35.7 per cent), non-potential in 5 of 14 (35.7 per cent),

absence of foreign body in 4 of 14 (28.6 per cent) animals and diaphragmatic line was not clearly demarcable in 4 of 14 (28.6 per cent) animals. In majority of died buffaloes foreign bodies were presented as compared to the survived animals. Radiography detected foreign bodies in reticulum of 55.6 per cent in survived cattle, being potential in 3 of 9 (15.8 per cent), non-potential in 2 (22.2 per cent), absence of foreign bodies in 4 (44.4 per cent), and diaphragmatic line was not clearly demarcable in 3 of 9 (15.8 per cent) animals. In died cattle foreign bodies were present in 52.9 per cent, being potential in 5 of 17 (29.4 per cent), non-potential in 4 (23.5 per cent), absence of foreign body in 8 (47.0 per cent) animals and diaphragmatic line was clearly distinct in all animals. Shah (2010) reported foreign bodies in 48.1 per cent of animals. In majority of died cattle, foreign bodies were present as compared to the survived cattle.

**Table 7: Comparison of radiographic findings in surviving and non-surviving cattle and buffaloes with gastrointestinal stasis.**

Signs	Buffalo		Cattle	
	Survived	Died	Survived	Died
Potential foreign body	5 (26.3%)	4 (28.6%)	3 (33.3%)	5 (29.4%)
Non-potential foreign body	4 (21%)	5 (35.7%)	2 (22.2%)	4 (23.5%)
Diaphragmatic line was not clearly distinct	4 (21%)	4 (28.6%)	3 (33.3%)	0

Values in parenthesis depict range

#### **4.2.6 Disease severity score in prognosis**

Disease score for each finding was done as per the criterion described in materials and methods (Section 3.10; Table 1). Disease severity score was calculated by taking into account either eight or five clinical observations in surviving and non-surviving cattle and buffaloes separately.

##### **4.2.6.1 Prognosis with eight clinical observations.**

Total disease score in surviving buffaloes (Table 8) and non-surviving buffaloes with eight clinical observations (Table 9) are described.

Table 8: Disease severity score based on eight clinical observations in Survived buffaloes

S. No	Anorexia	Fever	Loss of defecation	Foul smelling faeces	Abdominal distention	Mushy rumen	Intestinal distention	Left shift in leukogram	Total score
1	1	0	0	0	1	0	0	0	2
2	0	1	0	0	0	0	0	0	1
3	1	0	1	0	2	1	1	0	6
4	0	1	0	0	0	0	0	1	4
5	0	0	0	0	0	0	0	0	0
6	1	0	0	0	0	0	0	2	3
7	0	0	0	1	0	1	0	2	4
8	0	0	0	0	0	0	0	0	0
9	0	1	1	0	0	0	0	1	3
10	1	0	0	0	0	0	0	0	0
11	0	1	1	1	0	1	0	1	5
12	1	0	0	0	0	0	0	0	1
13	0	1	0	0	1	1	0	0	3
14	0	0	0	0	0	0	0	0	0
15	0	1	0	0	0	0	0	1	2
16	1	0	0	0	0	0	0	0	1
17	0	0	0	0	1	1	0	1	3
18	0	1	0	0	0	1	0	0	2
19	0	0	0	1	0	0	0	2	3
20	1	1	1	0	0	0	0	0	3
<b>(Mean±SE)</b>									2.3±0.38

**Score 3.** Probability of survival rate was 50 per cent in survived buffaloes .

**Score 4.** Probability of survival rate was 80 per cent in survived buffaloes.

**Score 5.** Probability of survival rate was 90 per cent in survived buffaloes.

**Score 6.** Probability of survival rate was 95 per cent in survived buffaloes.

**Table 9: Disease severity score based on eight clinical observations in died buffaloes**

S. No	Anorexia	Fever	Loss of defecation	Foul smelling faeces	Abdominal distention	Mushy rumen	Intestinal distention	Left shift in leukogram	Total score
1	1	0	1	1	0	0	0	0	3
2	1	0	0	0	1	1	1	0	4
3	0	3	1	0	0	1	1	0	6
4	1	1	1	1	0	0	1	0	5
5	1	2	1	1	1	0	1	0	7
6	0	3	0	0	0	0	0	0	3
7	1	3	1	0	1	1	1	0	8
8	1	1	0	1	0	0	0	3	6
9	1	2	0	1	2	1	1	3	11
10	0	3	0	0	0	1	0	0	4
11	1	2	0	0	0	0	0	2	5
12	0	2	0	1	2	1	0	0	6
13	1	0	1	0	0	1	1	3	7
14	1	0	1	1	0	0	0	2	5
<b>(Mean±SE)</b>									<b>5.71±0.57</b>

**Score 3.** Probability of mortality rate was 100 per cent in died buffaloes .

**Score 4.** Probability of mortality rate was 85.7 per cent in died buffaloes.

**Score 5.** Probability of mortality rate was 71.4 per cent in died buffaloes.

**Score 6.** Probability of mortality rate was 50 per cent in died buffaloes.

Mean total score in survived buffaloes was  $2.30 \pm 0.38$  and in died buffaloes was  $5.71 \pm 0.57$ . A cut off score above the mean value was selected as 3 for calculating probability of survival or death. By this criterion the probability of calculated survival was 50 per cent of the true survival. In died buffaloes true and calculated probability mortality was 100 per cent. With the disease score of 3 the predication was very poor in assessing probability of survival, although this criteria was very accurate for determining mortality. Therefore probability of survival or mortality was calculated by taking value of 4 as a cut off score. The probability of calculated survival was 80 per cent in survived buffaloes and probability of mortality was 85.7 per cent of the true mortality. With 5 as a cut off value, the calculated survival was 90 per cent and mortality was 71.4 per cent. With the disease score of 6 as a cut off value, the probability of calculated survival was 95 per cent and mortality was 50 per cent. However, from these results it appeared that score of 4 as a cut off value is having more effect on survivability and mortality rate in survived and died buffaloes following by score 5.

Total disease score in surviving and non-surviving cattle with eight clinical observations are presented in Table 10 and Table 11.

Mean total score in survived cattle was  $2.8 \pm 0.49$  and in died cattle was  $5.44 \pm 0.42$ . A cut off score above the mean value was selected as 3 for calculating probability of survival or death. By this criteria, the probability of calculated survival was 50 per cent of the true survival. In died cattle true calculated probability mortality was 100 per cent. Although disease score of 3 was very accurate in assessing probability of mortality, but it was very poor in forecasting survivability in recovered cattle. On taking 4 as a cut off disease score, the calculated survival probability was 70 per cent in survived cattle and probability of mortality was 83.3 per cent of the true mortality. With 5 as a cut off value, the calculated survival rate was 90 per cent and mortality rate was 66.7 per cent. On taking 6 as a cut off disease score, the calculated survival rate was 90 per cent and calculated mortality rate was 44.4 per cent of the actual mortality. However, from these results it appeared that score of 4 as a cut off value is having more effect on survivability and mortality rate in survived and died buffaloes followed by score of 5.

**Table 10: Disease severity score based on eight clinical observations in survived cattle**

S. No	Anorexia	Fever	Loss of defecation	Foul smelling faeces	Abdominal distention	Mushy rumen	Intestinal distention	Left shift in leukogram	Total score
1	1	1	0	1	1	1	0	1	6
2	0	0	1	0	1	0	1	0	3
3	0	0	0	0	0	0	0	1	1
4	0	0	0	0	0	1	0	1	2
5	0	0	1	0	0	0	1	1	4
6	1	0	0	0	0	1	0	1	3
7	0	0	0	0	0	1	0	0	1
8	0	0	1	0	0	0	0	1	2
9	0	0	0	1	0	1	0	0	2
10	0	0	0	0	0	1	0	3	4
<b>(Mean±SE)</b>									2.8±0.49

**Score 3.** Probability of survival rate was 50 per cent in survived cattle .

**Score 4.** Probability of survival rate was 70 per cent in survived cattle.

**Score 5.** Probability of survival rate was 90 per cent in survived cattle.

**Score 6.** Probability of survival rate was 90 per cent in survived cattle.

**Table 11: Disease severity score based on eight clinical observations in died cattle**

S. No	Anorexia	Fever	Loss of defecation	Foul smelling faeces	Abdominal distention	Mushy rumen	Intestinal distention	Left shift in leukogram	Total score
1	0	3	0	1	0	0	0	0	4
2	1	0	1	1	0	0	0	0	3
3	0	0	0	1	3	1	1	0	6
4	1	0	1	0	2	1	0	2	7
5	1	1	1	0	0	0	1	1	5
6	0	2	0	1	1	0	0	0	4
7	1	0	1	0	0	1	0	2	5
8	1	0	1	1	0	0	0	2	5
9	1	0	1	1	0	0	1	3	7
10	1	0	1	0	1	1	1	1	6
11	1	0	1	0	1	1	1	3	8
12	0	2	1	0	0	0	1	0	4
13	1	1	0	0	0	0	0	3	5
14	0	3	0	0	0	0	0	0	3
15	1	0	1	1	1	0	0	3	7
16	1	1	1	1	2	1	0	0	7
17	1	1	1	0	0	0	0	0	3
18	1	3	1	1	0	0	0	3	9
<b>(Mean±SE)</b>									<b>5.44±0.42</b>

**Score 3.** Probability of mortality rate was 100 per cent in died cattle.

**Score 4.** Probability of mortality rate was 83.3 per cent in died cattle.

**Score 5.** Probability of mortality rate was 66.7 per cent in died cattle.

**Score 6.** Probability of mortality rate was 44.4 per cent in died cattle.

#### 4.2.6.2 Prognosis-five clinical observations.

Total disease score in surviving and non-surviving buffaloes with five clinical observations are presented in Table 12 and Table 13.

**Table 12: Disease severity score based on five clinical observations in survived buffaloes**

S. No.	Fever	Foul smelling faeces	Mushy rumen	Intestinal distention	Left shift in leukogram	Total score
1	0	0	0	0	0	0
2	1	0	0	0	0	1
3	0	0	1	1	0	2
4	1	0	0	0	1	2
5	0	0	0	0	0	0
6	0	0	0	0	2	2
7	0	1	1	0	2	4
8	0	0	0	0	0	0
9	1	0	0	0	1	2
10	0	0	0	0	0	0
11	1	1	1	0	1	4
12	0	0	0	0	0	0
13	1	0	1	0	0	2
14	0	0	0	0	0	0
15	1	0	0	0	1	2
16	0	0	0	0	0	0
17	0	0	1	0	1	2
18	1	0	1	0	0	2
19	0	1	0	0	2	3
20	1	0	0	0	0	1
<b>(Mean±SE)</b>						<b>1.45±0.29</b>

**Score 2.** Probability of survival rate was 45 per cent in survived buffaloes.

**Score 3.** Probability of survival rate was 85 per cent in survived buffaloes.

**Score 4.** Probability of survival rate was 90 per cent in survived buffaloes.

**Table 13: Disease severity score based on five clinical observations in died buffaloes**

S. No.	Fever	Foul smelling faeces	Mushy rumen	Intestinal distention	Left shift in leukogram	Total score
1	0	1	0	0	0	1
2	0	0	1	1	0	2
3	3	0	1	1	0	5
4	1	1	0	1	0	3
5	2	1	0	1	0	4
6	3	0	0	0	0	3
7	3	0	1	1	0	5
8	1	1	0	0	3	5
9	2	1	1	1	3	8
10	3	0	1	0	0	4
11	2	0	0	0	2	4
12	2	1	1	0	0	4
13	0	0	1	1	3	5
14	0	1	0	0	2	3
<b>(Mean±SE)</b>						<b>4.0±0.44</b>

**Score 2.** Probability of mortality rate was 92.8 per cent in died buffaloes .

**Score 3.** Probability of mortality rate was 85.7 per cent in died buffaloes.

**Score 4.** Probability of mortality rate was 64.3 per cent in died buffaloes.

Mean total score in survived buffaloes was  $1.45 \pm 0.29$  and in died buffaloes was  $4.00 \pm 0.44$ . Considering mean value in survived buffaloes a cutoff score above the mean value was selected as 2 for calculating probability of survival or death. By this criteria the survival rate was accurately determined in 45 per cent of the true survival. In died cattle true calculated mortality rate was 92.9 per cent. Therefore this score did not appear to be accurate in determining survivability. Thereafter probability of survival or mortality was calculated by taking value of 3 as a cut off score. The probability of calculated survival rate was 85 per cent in survived buffaloes and

probability of mortality was 85.7 per cent of the true mortality. On taking 4 as a cut off disease score, the calculated survival probability was 80 per cent in survived buffaloes and probability of mortality was 64.3 per cent of the true mortality. However, from these results it appeared that score of 3 as a cut off value is having more effect on survivability and mortality rate in survived and died buffaloes followed by score of 4.

Total disease score in surviving and non-surviving cattle with five clinical observations are presented in Table 14 and Table 15.

**Table 14: Disease severity score based on five clinical observations in survived cattle**

S. No.	Fever	Foul smelling faeces	Mushy rumen	Intestinal distention	Left shift in leukogram	Total score
1	1	1	1	0	1	4
2	0	0	0	1	0	1
3	0	0	0	0	1	1
4	0	0	1	0	1	2
5	0	0	0	1	1	2
6	0	0	1	0	1	2
7	0	0	1	0	0	1
8	0	0	0	0	1	1
9	0	1	1	0	0	2
10	0	0	1	0	3	4
<b>(Mean±SE)</b>						<b>2±0.36</b>

**Score 2.** Probability of survival rate was 40 per cent in survived cattle .

**Score 3.** Probability of survival rate was 80 per cent in survived cattle.

**Score 4.** Probability of survival rate was 80 per cent in survived cattle.

**Table 15: Disease severity score based on five clinical observations in died cattle**

S. No.	Fever	Foul smelling faeces	Mushy rumen	Intestinal distention	Left shift in leukogram	Total score
1	3	1	0	0	0	4
2	0	1	0	0	0	1
3	0	1	1	1	0	3
4	0	0	1	0	2	3
5	1	0	0	1	1	3
6	2	1	0	0	0	3
7	0	0	1	0	2	3
8	0	1	0	0	2	3
9	0	1	0	1	3	5
10	0	0	1	1	1	3
11	0	0	1	1	3	5
12	2	0	0	1	0	3
13	1	0	0	0	3	4
14	3	0	0	0	0	3
15	0	1	0	0	3	4
16	1	1	1	0	0	3
17	1	0	0	0	0	1
18	3	1	0	0	3	7
<b>(Mean±SE)</b>						<b>3.39±0.32</b>

**Score 2.** Probability of mortality rate was 88.9 per cent in died cattle .

**Score 3.** Probability of mortality rate was 88.9.per cent in died cattle.

**Score 4.** Probability of mortality rate was 33.3 per cent in died cattle.

Mean total score in survived cattle was  $2.0 \pm 0.36$  and in died cattle was  $3.39 \pm 0.32$ . Considering mean value in survived cattle a cut off score of 2 was selected for calculating probability of survival or death. By this criteria, the probability of calculated survival was 40 per cent of the true survival. On the other hand, in died cattle calculated mortality rate was 88.9 per cent. Although disease score of 2 was

very accurate in assessing probability mortality, but it was very poor in forecasting survivability in recovered cattle. On taking 3 as a cut off disease score, the calculated survival probability was 80 per cent in survived cattle and probability of mortality was 88.9 per cent of the true mortality. With 4 as a cut off value, the calculated survival rate was 80 per cent and mortality rate was 33.3 per cent.

From these results suggesting that score of 3 as a cutoff value is having more effect on survivability and mortality rate in survived and died cattle followed by disease score 4.

## CHAPTER V

### SUMMARY AND CONCLUSIONS

Peritonitis is a common cause of chronic indigestion in bovines. Although, traumatic reticuloperitonitis is the most common cause of peritonitis. However, in many clinical cases etiology remains obscure even after radiographic and ultrasonographic examinations of abdomen. So, there is need to determine etiology in such cases. Determining prognosis is an essential part for planning therapy of a disease. At present few studies have been directed to determine the prognosis based on haematological and biochemical parameters in abdominal disorders. However, determining prognosis based on clinical observations have not been attempted, which can help readily in making decision on therapy. This study was conducted on two groups of dairy animals. Laprorumenotomy was performed on 33 cattle and buffaloes to determine etiology of peritonitis. Prognostic indicators were determined in 62 dairy cattle and buffaloes manifesting gastrointestinal stasis after excluding traumatic reticuloperitonitis, reticular abscess, diaphragmatic hernia and intestinal obstructions as the cause.

Peritonitis was due to penetrating foreign bodies in 42.4 per cent, sharp free lying foreign bodies in 39.4 per cent and without sharp metallic foreign bodies in 18.1 per cent of animals. Reticular radiography in peritonitis showed clearly visible diaphragmatic line in 91.7 per cent of the cases. Position of sharp metallic foreign body was cranioventral in 29.2 per cent, midcranial in 20.1 per cent, caudoventrally in 20.1 per cent and central in reticulum in 29.2 per cent of animals. Sharp foreign bodies were visible in close contact with the reticular wall in 15 radiographs. All of the 7 cranioventrally and 4 of 5 midcranially sharp metallic foreign bodies, placed close to reticular wall in radiograph, were confirmed to be penetrating during laprorumenotomy. Eleven of 12 caudoventrally or central located foreign bodies were not penetrating the reticular wall. Mean Hb, PCV and TLC values were  $9.68 \pm 0.38$  g/dL,  $27.4 \pm 0.96$  per cent and  $12904.5 \pm 915.7 \mu\text{L}^{-1}$ , respectively. Mean neutrophil and lymphocyte counts were  $10619.6 \pm 1600.1 \mu\text{L}^{-1}$  and  $3978.6 \pm 576.5 \mu\text{L}^{-1}$  respectively in peritonitis affected cattle and buffaloes. Leukogram was inflammatory in 42.4 per cent of animals, characterized by regenerative left shift in 12.1 per cent, degenerative left shift in 24.2 per cent and neutrophilic leukocytosis

with toxic changes in 6.1 per cent of animals. Anorexia, history of fever and abnormal rumen consistency were significantly ( $p < 0.05$ ) more common in TRP as compared to non-TRP affected animals.

Follow up of 62 dairy animals treated for gastrointestinal stasis was done for three months to evaluate prognosis by recording survival or death. The post treatment recovery rate was 58.8 per cent in buffaloes and 35.7 per cent in cattle. Mean age of dying and surviving cattle and buffaloes was not different, however, mortality rate was high in buffaloes above 6 years. The duration of illness was 7-15 days in 64.3 per cent of died buffaloes as compared to illness of less than 7 days. Anorexia was significantly ( $p < 0.05$ ) more common in died cattle and buffaloes as compared to survived cattle and buffaloes. Loss of defecation was significantly ( $p < 0.05$ ) more common in died cattle as compared to survived cattle. History of fever was more common (56.3 per cent) in dying as compared to 30 per cent surviving animals. Ruminal stasis was more common in died buffaloes as compared to survived buffaloes, however, this difference was not observed in cattle. Fluid filled intestines was a more frequent (50 per cent) clinical observation in died buffaloes in contrast to survived buffaloes (5 per cent). On the other hand fluid filled intestines were observed in 33.3 per cent and 20 per cent in died and survived cattle respectively. Faeces were very offensive smelling and black or clay coloured in half of died buffaloes compared to 15 per cent in survived buffaloes. Identical findings were apparent in cattle where 50 per cent of died cattle had offensive smelling faeces against 20 per cent of survived.

There was no significant difference in mean Hb, PCV and TLC values in survived and died cattle as well as buffaloes. Leukogram was inflammatory in 40 per cent of the survived and 35.7 per cent of died buffaloes. More precisely, leukogram was showing regenerative left shift in 10 per cent and degenerative left shift in 30 per cent of survived buffaloes in comparison to only degenerative left shift in 35.7 per cent of died buffaloes. On the other hand, leukogram was inflammatory in 70 per cent and 55.5 per cent in died and survived cattle, respectively. More precisely, leukogram was characterized by regenerative left shift in 11.1 per cent and degenerative left shift in 44.4 per cent of survived cattle in comparison to regenerative left shift in 10 per cent and degenerative left shift in 60 per cent of died

cattle. No significant difference was observed in mean plasma activity of AST and GGT between surviving and non-surviving cattle as well as buffaloes. However, higher activity of GGT ( $>39$  U/L) was recorded 36.4 per cent in died cattle. Total cell count in peritoneal fluid was high ( $>5000$   $\mu$ l) than normal range in 40 per cent of died buffaloes as compared to 14.3 per cent in survived buffaloes, whereas, total cell count was high in 45.5 per cent of died cattle only. Degenerated neutrophils and numerous bacteria (cocci, bacilli) were observed in 42.8 per cent of survived buffaloes as compared to 80 per cent in died buffaloes. In cattle, respective figure was 20 per cent in survived and 63.6 per cent in died animals.

Disease severity score was calculated by taking either eight or five clinical observations in surviving and non-surviving cattle and buffaloes. Mean disease severity score, with eight clinical observations, was  $2.30\pm 0.38$  in survived and  $5.71\pm 0.57$  in died buffaloes. Mean disease severity score was  $2.80\pm 0.49$  in survived and  $5.44\pm 0.42$  in died cattle. With a cut off score 4, calculated probability of survival was 80 per cent in buffaloes and 70 per cent in cattle and probability of mortality was 85.7 per cent in died buffaloes and 83.3 per cent in died cattle. With disease severity score of 5 calculated probability survival was 90 per cent in buffaloes and cattle and probability of mortality was 71.4 per cent in died buffaloes and 66.7 per cent in died cattle.

Mean disease severity score, with five clinical observations, was  $1.45\pm 0.29$  in survived buffaloes and  $2.00\pm 0.36$  in survived cattle and mean score was  $4.00\pm 0.44$  in died buffaloes and  $3.39\pm 0.32$  in died cattle. A cut off score above the mean as a 3 selected. Probability of calculated survival rate was 80 per cent in buffaloes and 88.9 per cent in cattle and probability of mortality was 92.9 per cent in died buffaloes and 88.9 per cent in died cattle. On taking 4 as a cut off disease score, the calculated survival rate was 80 per cent in survived buffaloes and cattle and calculated probability of mortality was 64.3 per cent in died buffaloes and 33.3 per cent in died cattle.

It was concluded that score 4 followed by 5 as a cutoff value is more accurate in predicting survivability or mortality in cattle and buffaloes with eight observations and a cut off score 3 with five observations.

## **CONCLUSIONS**

- Penetrating foreign body is the cause of peritonitis in 42.4 per cent of animals.
- Cranioventral and midcranial position of sharp foreign bodies are more likely to be penetrating and cause traumatic reticuloperitonitis.
- Clinical observation of history of fever, mushy rumen and foul smelling Faeces and/or intestinal distention and moderate to severe left shift, suggestive of poor prognosis in dairy animals manifesting gastrointestinal stasis.
- Mortality rate in gastrointestinal stasis is higher in cattle than buffaloes.

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