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Clinical, Haematological, Radiographic, Ultrasonographic and Surgical Findings in Bovine Affected with Traumatic Reticulo-peritonitis

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ABSTRACT

Background: Traumatic reticuloperitonitis (TRP) is a frequently observed disorder in the forestomach of bovines, resulting from the ingestion of sharp metallic foreign bodies during feeding due to their indiscriminate eating habits. Under field conditions, distinguishing this disease from other forestomach disorders becomes challenging because of the overlapping clinical signs that are shared by them. The current study aimed to assess clinical, radiological, ultrasonographic, hematological and peritoneal fluid changes to facilitate accurate and early diagnosis along with suitable treatment.

Methods: A total 31 cases of TRP were recorded in the present study period from January 2023-December 2023. The affected animals underwent clinical, ferroscopic, radiographic, ultrasonographic, haematological and peritoneal fluid analysis for the diagnostic purpose which were later managed surgically by standing left laparorumenotomy.

Result: Majority of the affected animals displayed bloat, congested conjunctival mucous membrane, fever, cachexia, grunting and refusal to sit down. Out of the total of 31 animals, 27 tested positive for ferroscopy and 22 animals had at least one visible metallic foreign body on radiographs in the reticulum. Ultrasonographic examination revealed distinctive findings, including an increase in reticular thickness, elevated peritoneal fluid levels and the presence of echogenic deposits. Changes in peritoneal fluid characteristics included alteration of color, elevated total protein levels (>2.5 g/dL) and increased total nucleated cell counts (cells/µL). Hematological analysis indicated that most affected animals showed leucocytosis, neutrophilia and lymphopenia, which returned to normal physiological ranges post-operatively.

Key words: Ferroscopy, Radiography, Sharp foreign body, Traumatic reticuloperitonitis, Ultrasonography.

INTRODUCTION

Bovines are inseparable part of the society which are mainly raised for the milk, meat and hide. They often experience traumatic reticuloperitonitis (TRP) as a result of consuming sharp metallic objects, which are ingested while feeding due to their indiscriminate feeding habits. Factors that increased the likelihood of foreign body ingestion included mineral deficiencies, as well as the effects of industrialization and urbanization (Fesseha, 2020). The dense metallic foreign bodies typically descended into the reticulum, where they became lodged in the reticular honeycomb structure, serving as a blind trapping net for foreign bodies (Reddy *et al.,* 2014). Repeated injury to the reticular wall was caused by these sharp foreign bodies, resulting from piercing or penetration. This was favored by the contraction of the reticulum, the pressure of the gravid uterus on the rumeno-reticulum during advanced pregnancy and the process of parturition (Sharma *et al.,* 2015). The consequences of foreign body perforation are escape of digesta into peritoneal cavity, development of peritonitis (localized or generalized) and formation of adhesions with peritoneal wall or diaphragm finally death of the animal.

MATERIALS AND METHODS

The present study was carried out at the department of Veterinary Surgery and Radiology, Kamdhenu University, Junagadh, during the study period from January 2023 to December 2023. A total of 31 animals involving 25 buffaloes and 6 cattle of age ranging from 4 to 13 years were diagnosed for TRP. Animal details such as age, breed, sex, gestation or time since parturition were recorded.

Clinical examination

A thorough clinical examination was performed by evaluating parameters such as the color of mucous membranes,

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dehydration status, rectal temperature, heart rate, respiratory rate, rumen motility and any clinical signs exhibited by the animal.

Ferroscopy

Metal detector was employed to identify the presence of metallic foreign bodies, which was systematically moved over ventral and lateral surfaces of thoracic and abdominal regions from brisket to udder. The degree of deflection (µA) and region at which the deflection occurred were noted.

Radiography

Radiographic imaging was conducted in standing position in which, left lateral view of thoraco-abdominal region was radiographed using factors kVp 96-125 and mAs 64-86 by extending the left front leg in forward direction. Presence of metallic foreign bodies, nature, type and their precise location were noted.

Ultrasonography

Ultrasonographic examination was carried out on either side of thoracoabdominal region from 5th to 8th ICS after shaving and removal of dirt. A 3.5 to 5 MHz probe was used to scan after applying gel and any abnormalities found were recorded.

Haematology

Haematological analysis was performed on day of surgery and 12th post-operative day to evaluate different parameters like haemoglobin (g/dL), haematocrit (%), total erythrocyte count ($\times 10^6$/µL), total leucocyte count (/µL) and differential leucocyte counts (%) after collecting 2 ml of blood in EDTA vacutainer.

Peritoneal fluid analysis

Peritoneal fluid was collected either by abdominocentesis or intra-operatively directly from abdominal cavity in a EDTA vial to prevent clotting and examined for color, total protein (mg/dL) and total nucleated cell counts (/µL).

Surgical management

Surgical management included performing standing left paralumbar laparorumenotomy under regional anaesthesia techniques like paravertebral nerve block or field block with 2% Lignocaine HCl. Antibiotic and analgesics were used for a duration of 5-7 days and sutures were removed on 12th post-operative day.

Statistical analysis

Haematological analysis before and after the surgery was analyzed using paired 't' test.

RESULTS AND DISCUSSION

In the present study, 31 animals were found to be affected with TRP which included 14 Jaffarabadi buffaloes, 06 non-descriptive buffaloes, 07 Gir cattle, 03 Kankrej cattle and 1 Holstein Friesian cattle. Out of 31 animals, 29 were females and 2 were males. The age of affected animals was ranging from 4 to 13 years with a mean age of 8.18±0.45 years. Reproductive status of the animals revealed, 09 animals were pregnant (above 6 months), 12 were recently parturiated and 7 were non-pregnant and 3 were heifers. Occurrence of TRP is more in the animals above 6 years which was mainly due to the pregnancy (Sharma *et al.,* 2015), parturition (Singh, 2002) acted as predisposing factors for the development of the disease but Hutchins and Blood (1957) reported pregnancy was not major risk factor for development of TRP. However the pregnant animals had poor prognosis.

Anamnesis

Brief history of the affected animals was noted in which, 8 animals were anorectic, feed intake was decreased in 19 animals and normal in 4 animals. Changes in the feeding can be due to reticular adhesions (Athar *et al.,* 2010), pain caused by foreign body, systemic illness and toxaemia (Radostits *et al.,* 2007). Dung output was normal in 15 animals, scanty in 9 animals, diarrhoea in 3 animals and absence of defecation was observed in 4 animals. Bloat was seen in 25 animals in which, recurrent bloat was seen in 10 animals, seen once or twice in 15 animals while no bloat was observed in remaining animals. Prolonged standing was observed in 5 animals and 2 had difficulty in walking.

Clinical examination

The clinical examination (Table 1) revealed, distended left paralumbar fossa, congested conjunctival mucous membrane,

Table 1: Clinical markers of the affected animals.

Parameters	No. of animals
Bloat	15
Rectal temperature	
Increased	13
Normal	12
Decreased	06
CMM	
Normal	06
Congested	15
Pale	10
Respiratory rate (breaths/min)	
Normal	25
Increased	06
Rumen motility (contractions/min)	
Normal (3/2 min)	04
Increased (>3/2 min)	09
Decreased (<3/2 min)	12
Nil (0/3 min)	06
pH of rumen fluid	7.1±0.3
Lachrymation	08
Jugular pulsation	04
Edema	
Brisket edema	03
Ventral abdominal edema	01
Resisting/difficulty walking	03
Foreign body tests	
Slope test	03
Pole test	10

pyrexia, pale mucous membrane, cachexia, difficulty and increased respiratory rate, lachrymation, jugular pulsation, grunting, brisket edema, ventral edema of abdomen, difficulty in walking and foreign body tests like positive slope test, pole test, arched back were seen. Examination of rumen motility at left paralumbar fossa revealed, changes in motility pattern of the rumen such as increased (>3 contractions/2 min), decreased (<3 contractions/2 min) or atony of rumen.

Ferroscopy

Metal detector showed positive results in 27 animals and failed to locate metallic foreign bodies in remaining animals, whichmay be due to the increased distance between ferroscope and foreign body or increase level of effusions and highly dense adhesions which masked the foreign bodies (Hussain *et al.,* 2018). The mean ferroscopic deflection was recorded to be 22.79±1.25 µA. In majority of the animals, deflection in the ferroscopy was noted between 6th to 8th ICS indicating the presence of metallic foreign body in the reticulum.

Radiography

Left lateral radiographic view of reticular region using factors revealed presence of at least one radiopaque metallic foreign body in 22 animals (Fig 1), while in remaining animals, no foreign body was detected during radiography. Failure to detect the metallic foreign bodiescan be due to lack of sufficient metallic density of the foreign bodies to be visualized by radiography and it may be combined with larger body size of the animal (Sasikala *et al.,* 2018). Most of the sharp metallic foreign bodies were present at ventral floor of reticulum, either lying or penetrating. Radiographically detected foreign bodies included potential foreign bodies such as nails, wires, metal pieces, small rods, keys and non-potential foreign bodies like bolts, coins, small stones, washer. Similar findings were noted by Athar *et al.* (2010) and Braun *et al.* (2018).

Ultrasonography

Ultrasonographic examination of the reticular region revealed half-moon shaped reticulum exhibiting either a smooth contour or an undulating wall with or without fibrin deposits. Reticulitis was graded as mild to moderate and severe reticulitis. Presence of reticulitis was due to the repeated injury by sharp penetrating foreign bodies and decreased or atonic reticulum along with fibrin deposition were characteristic findings of TRP (Braun *et al.,* 2018).

Examination of reticular motility revealed different patterns such as characteristic biphasic motility, partial contractions or reduced motility and no motility. Similar motility patterns were also observed by Imran *et al.* (2012). Partial or absence of motility can be due to the reticular adhesions with diaphragm or abdominal wall which hindered the movement. Echogenic fibrin deposits along with accumulation of peritoneal fluid (Fig 2) and formation of fibrin mesh with interspersed hypoechoic fluid (Fig 3) were also noticed. Reticular movements with each respiration were observed in some animals indicated diaphragmatic adhesions which was similar finding to Imran *et al.* (2012). Ultrasonographic findings observed in the present study are tabulated in Table 2.

Haematology

Complete blood count revealed majority of the animals had leucocytosis andneureophilia before surgery (day 0). Post-operatively on day 12, significant decrease in levels of leucocytes and highly significant decrease in neutrophils levels was observed. Lymphocyte levels were in normal range but significantly increased on day 12. Leucocytosis and neutrophilia are were due to inflammatory reactions and exudations in the abdominal cavity (Weiser, 2012; Rajput *et al.,* 2018). Haemoglobin, haematocrit and total erythrocyte count values differed non-significantly between day 0 and day 12 along with remaining parameters. The details of all haematological parameters on day 0 and day 12 are mentioned in Table 3.

Peritoneal fluid

Out of 31 animals, it was possible to collect peritoneal fluid in 26 animals. Failure of collection in remaining animals was attributed to localized peritonitis or severe dehydration (Athar *et al.,* 2010). Different colors of peritoneal fluid obtained were normal straw, yellowish, pinkish and brownish (Fig 4). There was increase in the value of total

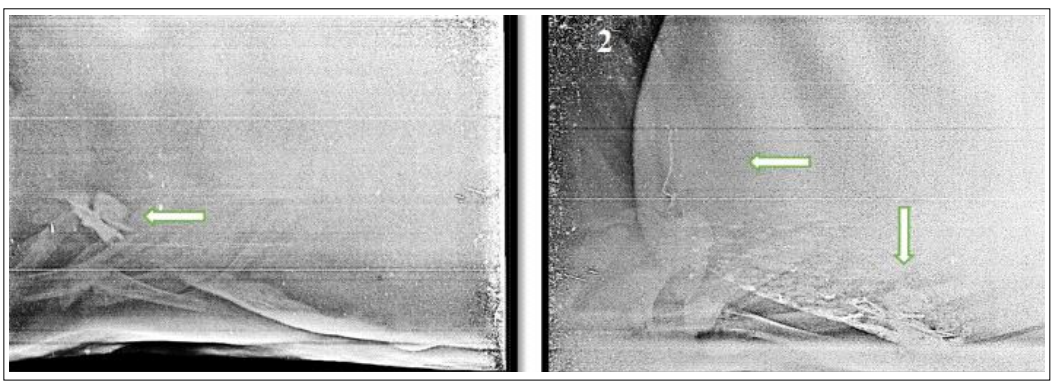


Fig 1: Presence of metallic foreign bodies (arrows).

protein and total nucleated cell counts. Change in color, increase in total protein and total nucleated cell counts was due to the inflammatory process in the abdominal cavity leading to extravasation of proteins (Athar *et al.,* 2010) and increase in the nucleated cells due to peritonitis (Wilson *et al.,* 1985). Similar findings such as increase in total protein and nucleated cells along with change in color of peritoneal fluid were observed by Athar *et al.* (2010); Hussain and Uppal (2014); Dezfouli *et al.* (2012) and Turkar *et al.* (2015). Details of peritoneal fluid characteristics are mentioned in Table 4.

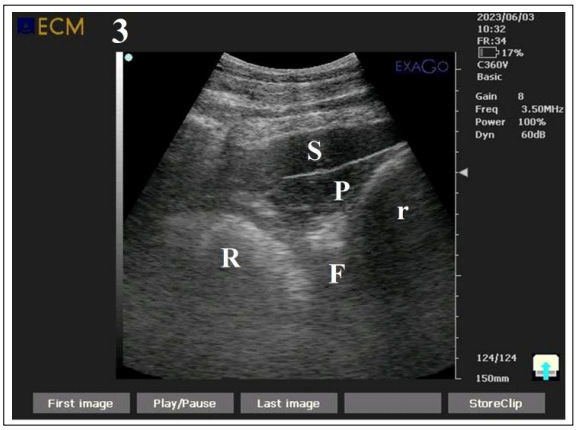


Fig 2: Ultrasonogram showing reticulitis, Echogenic deposits and accumulation of Peritoneal fluid. R (reticulum), r (rumen), S (spleen), P (Peritoneal fluid), F (fibrin deposits).



Fig 3: Ultrasonograpm showing presence of hypoechoic fluid in fibrin mesh. R (reticulum), F (fibrin mesh), P (Peritoneal fluid).

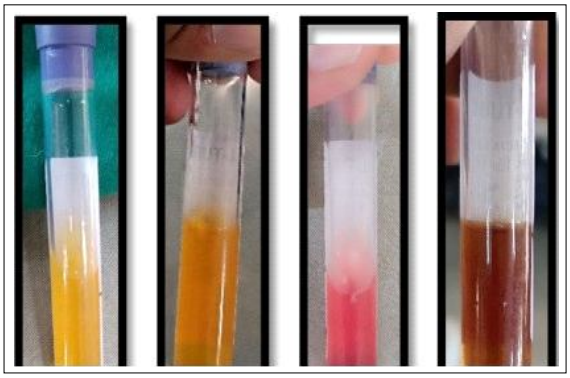


Fig 4: Different colors of peritoneal fluids straw, yellow, pink and brown.

Blood trypsin inhibitor spot test

Test yielded positive results in 23 animals and negative in remaining 8 animals (Fig 5).

Surgical management

In all 31 animals standing left paralumbar rumenotomy was carried out by regional anaesthetic techniques such as paravertebral nerve block or field block with 2% Lignocaine HCl. Rumen fixation was performed by Weingarth's method and 30-40% of rumen content was removed to reduce the bulk. Both reticulum and rumen were explored for the presence of sharp metallic foreign bodies. A magnet was used to find the foreign bodies. In majority of the cases foreign bodies were found at the ventral floor of reticulum either penetrating or lying (Athar *et al.,* 2010; Mersha and Desiye, 2012), followed by cranial surface and near the reticulo-omasal orifice of the reticulum. Common metallic

Table 2: Ultrasonographic findings in animals affected with TRP.

Ultrasonographic findings	No. of animals
Reticulitis	
Mild to moderate	21
Severe	10
Reticular motility pattern	
Biphasic	07
Reduced or partial	11
Absence	13
Fibrin deposition	10
Accumulation of peritoneal fluid	10
Fibrin mesh development	02
Concurrent reticular and diaphragmatic movements	07

Table 3: Haematological analysis.

Parameter	Pre-operative (day 0)	Post-operative (day 12)
Hb (g/dL)	10.66±0.55	10.28±0.45
HCT (%)	37.96±2.02	35.65±1.92
TEC ($\times 10^6$ /µL)	7.55±0.43	8.13±0.55
TLC (/µL)	12219±815	9536±1145*
N (%)	56.12±1.86	35.06±0.73**
L (%)	40.07±2.75	59.61±0.71*
M (%)	2.58±0.38	3.60±0.16
E (%)	1±0.40	1.30±0.14
B (%)	0±0.05	0.43±0.03

The superscripts between the columns are significant at *p<0.05, **p<0.01.

Table 4: Peritoneal fluid analysis.

Parameters	No. of animals
Color	
Straw	5
Yellowish	13
Pinkish	6
Brownish	2
Total protein (g/dl)	4.02±0.5
Total nucleated cells ($\times 10^3/\mu L$)	8.35±3.5

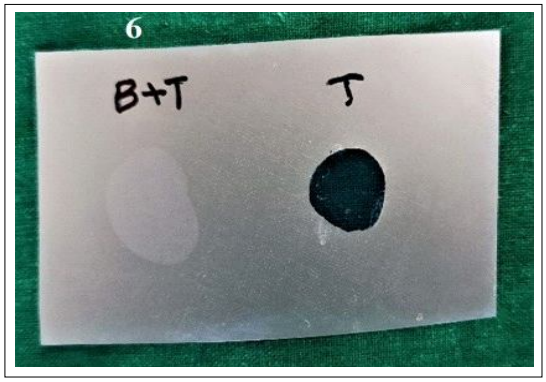


Fig 5: Blood trypsin inhibitor spot test showing absence of gelatin hydrolysis at test region (B+T) and hydrolysis at trypsin region (T). B (blood), T (trypsin solution, 8 mg/ml).

foreign bodies recovered were nails, wires, screws, metal pieces, keys, sewing needle and non-potential foreign bodies like nut, bolt, coins, round metallic structures, pieces of leather and plastic were also recovered in some cases. Reticular adhesions were observed with diaphragm, abdominal cavity, spleen and liver.

Complications observed during the present study included, death of 4 animals, suture line abscess in 4 animals, sub cutaneous emphysema in 2 animals and recurrence of bloat in 5 animals. Similar complications were observed by Balasundara *et al.* (2012) and Nugusu *et al.* (2013). Some other complications like incisional drainage of peritoneal fluid in one animal and complete stoppage of milk production was seen in 5 animals.

CONCLUSION

TRP is a disease of adult dairy animals generally associated with guarded prognosis and is generally characterized by pyrexia, anorexia, bloat and pain responses. Diagnostic techniques like ferroscopy, radiography, ultrasonography and haematology can be used concurrently for better diagnostic capacity. Ferroscopy helped in locating metallic foreign body while, radiography displayed the nature, type and position of it. Ultrasonography can be used to know the status of reticulum and surrounding organs. Leucocytosis and neutrophilia were characteristic findings during haematology and peritoneal fluid examination displayed change in color, increased total protein and total nucleated cell counts. The disease can be prevented by preventing animals from ingesting metallic foreign bodies through magnet checking of feed, stopping urban grazing, proper management techniques like adequate nutrition, preventing deficiencies and negative energy balance.

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Conflict of interest

Authors of the article do not have any conflict of interest.

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