www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2019; 8(10): 268-273

www.thepharmajournal.com
Received: 16-08-2019
Accepted: 20-09-2019

Aboli Lakhpati
Department of Veterinary Clinical Medicine, Ethics and Jurisprudence, KNP College of Veterinary Science, MAFSU, Shirwal, Satara, Maharashtra, India

Balaji Ambore
Department of Veterinary Clinical Medicine, Ethics and Jurisprudence, KNP College of Veterinary Science, MAFSU, Shirwal, Satara, Maharashtra, India

Gayatri Wankhede
Department of Veterinary Clinical Medicine, Ethics and Jurisprudence, KNP College of Veterinary Science, MAFSU, Shirwal, Satara, Maharashtra, India

Vishwambhar Patodkar
Department of Veterinary Physiology, KNP College of Veterinary Science, MAFSU, Shirwal, Satara, Maharashtra, India

Ravi Suryawanshi
Department of Veterinary Surgery & Radiology, KNP College of Veterinary Science, MAFSU, Shirwal, Satara, Maharashtra, India

Ajit Mali
Department of Animal Reproduction, Gynaecology & Obstetrics, KNP College of Veterinary Science, MAFSU, Shirwal, Satara, Maharashtra, India

Yogesh Jadhav
Teaching Veterinary Clinical Complex, KNP College of Veterinary Science, MAFSU, Shirwal, Satara, Maharashtra, India

Corresponding Author:
Balaji Ambore
Department of Veterinary Clinical Medicine, Ethics and Jurisprudence, KNP College of Veterinary Science, MAFSU, Shirwal, Satara, Maharashtra, India

Hematological and radiographic findings in cattle with foreign body syndrome

Aboli Lakhpati, Balaji Ambore, Gayatri Wankhede, Vishwambhar Patodkar, Ravi Suryawanshi, Ajit Mali and Yogesh Jadhav

Abstract
The present study was aimed to observe the haematological and radiological findings in cattle affected with foreign body syndrome. Cattle presented in the TVCC, Ambulatory Clinic and during Animal Health Camps showing the signs of either impaction/ recurrent tympany/ brisket oedema/ jugular pulsation/ arched back/ anorexia/ intermittent pain symptoms/ abducted elbows were screened for Foreign Body Syndrome (FBS). Overall incidence of FBS was 49.31%. Further it was more in females (91.66%) than male (8.33%). Haematology showed lymphocytopenia with neutrophilia and increase in band neutrophils. Radiography could efficiently identify the nature and location of the foreign body but could not tell the sequelae of the syndrome or the extent of damage been caused. Hence, it was concluded that for early diagnosis of FBS cases, haematology plays an important role along with radiological examination.

Keywords: Foreign body syndrome, cattle, haematology, radiography

1. Introduction
Animal husbandry is an important allied field to agriculture and livestock plays a very important role in the society. Now a days there is dramatic change in the environmental factors which leads to an irregularity in rainfall hence the farmers contract heavy economic losses. Therefore, milk production from cattle proves to be an important source of income for the farmers, during drought period. Cattle are indiscriminate feeders and they can't differentiate between metallic materials in feed and do not completely masticate the food before swallowing (Aiello *et al.*, 2016) [5]. Hence, they ingest sharp metallic objects like nails or wires. These foreign bodies get settled in the reticulum, due to its honey comb structure. The foreign bodies remain there and starts puncturing the reticulum causing a disease which is known as "Foreign body syndrome". Foreign body syndrome has been recorded in bovine specifically in developing countries due to lack of recycling industrial wastes (Vanitha *et al*., 2010) [18] and due to improper waste management.
The disease has economically a great impact as it causes severe reduction of milk, meat production and death of animals. The magnitude of loss to dairy industry can be assessed from the fact that this complex has been responsible for more than 15 % of all the natural deaths in dairy and beef animals (Sharma *et al*., 2015) [17]. In India, it has a high prevalence ranging from 23% to 87% (Hussain *et al*., 2018) [8]. Economic losses and the number of animals affected are so high that it has driven researchers to go deep in the diagnosis and treatment of this syndrome (Makhdoomi *et al*., 2018) [12].
The common clinical signs observed in foreign body syndrome in cattle included decreased milk production, anorexia, fever, and weight loss. Abnormal or muffled heart sounds associated with pericarditis which is the most common sequela with jugular vein pulsation and oedema of the brisket region (Roth and King, 1991) [15]. The other signs include abduction of elbow, arching of back and other pain symptoms.
There is a great variability in clinical signs of foreign body syndrome. Definitive diagnosis is a necessary pre-requisite to decide on the surgical intervention to be employed. It is a clinical demand to evolve strategies to diagnose and manage traumatic reticulo-peritonitis at an early stage (Rajput *et al*., 2018) [14]. Hence, radiology paired up with haematology helps in early and efficient diagnosis of the disease.
Haematobiology plays an important role to know the extent of damage due to foreign body syndrome, as there is a specific hematobiochemical picture seen. There is erythrocytopenia,

pronounced leukocytosis, with shift to left accompanied with neutrophilia, eosinopenia, monocytosis, lymphocytopenia, basopenia and anaemia are common findings (Ghanem, 2010) [7].

Radiological examination is the gold standard for the detection of foreign body syndrome. Radiological examination detects the metallic (penetrating and non-penetrating foreign bodies) as well as non-metallic foreign bodies such as leather pieces, plastic rope etc, present in the rumen and the reticulum. But there are some limitations to radiography like, the conventional radiography is a time-consuming due to the dark room procedure. Sometimes repeated exposure is required due to artefacts, thus causing more radiation hazard. Although computed X-ray machines have now replaced the conventional X-ray machines, but are costly.

Therefore, considering the above facts it has been decided to carry out a study on the findings of radiology and haematology in cattle affected with foreign body syndrome.

2. Materials and Methods

2.1 Selection of animals

Cattle presented in the TVCC, Ambulatory Clinic and in the Animal Health Camps showing the signs of either impaction / recurrent tympany/ brisket oedema/ jugular pulsation/ arched back/ anorexia/ intermittent pain symptoms/ abducted elbows were screened for FBS.

2.2 Haematological examination

The haematological parameters such as haemoglobin (g/dL), PCV (%), TEC (10^9/µl), TLC (10^3/µl) and Differential Leucocyte Count including Neutrophils (%), Band neutrophils (%), Monocytes (%), Eosinophils (%) and Basophils (%) were estimated in the foreign body syndrome affected as well as healthy control group by using automated haemo-analyzer (Abacus junior vet 5, Diatron MI PLC, Hungary).

2.3 Radiographic examination

The radiographic examination was performed using a 1000 mA multi fusion X-ray machine (Siemens Pvt. Ltd, Mumbai, India). The radiological measurements like the kV (average range between 60-80 kV) and mAs (Average range between 80-110 mAs) were selected as per the body size of the animal. The animals were restrained in a standing position. The cassette was held on the right side at the level of 3rd to 9th intercostal space between the elbow joint and the thoracic region of the body. Then the aperture of the x-ray beam adjusted by the use of the collimators present on the x-ray machine so that the focus of the beam is directed towards the cassette. The film focal distance of 90 cms was maintained and the cassette was exposed. The exposed cassette was then processed in computerized scanner (AGFA Healthcare India Pvt. Ltd., Thane) after which the x-ray appeared on the computer screen which was analyzed.

2.4 Statistical analysis

The collected data was analysed by using standard statistical method (Snedecor and Cochran, 1994) and by standard statistics software WASP 2.0 (ICAR, Goa).

3. Results and Discussion

The cases from February 2019 to July 2019 presented in the Teaching Veterinary Clinical Complex of KNP College of Veterinary Science, Shirwal, Ambulatory Clinics and Animal Health Camps were evaluated. The total number of cases screened were 73, which showed signs of either impaction/ recurrent tympany/ brisket oedema/ jugular pulsation/ arched back/ anorexia/ intermittent pain symptoms/ abducted elbows. Out of 73 screened cases, 36 accounting 49.31% were positive for foreign body syndrome. Breed-Wise incidence was found highest in Holsten Friesian 25 (69.44%) followed by Jersey 3 (8.33%), Gir 2 (5.55%) and of non-descript cattle affected were 2 (5.55%). The incidence in females was higher than in males. Out of 36 animals affected with Foreign Body Syndrome 33 (91.66%) were female and 3 (8.33%) were male.

3.1 Clinical Observations

It has been observed that 34 cases (94.44%) showed inappetence. Rumination was normal and present in 9 (25%) cases, while it was intermittent in 7 (19.44%) and was completely absent in 20 (55.55%) cases of FBS. Recurrent bloat was seen in 15 (41.66%) animals, brisket oedema was in 17 (47.22%) while jugular pulsation was observed in 22 cases (61.11%). Change in heart sound was observed in 28 (77.77%) animals, in most of the cases the heart sound was muffled and it was frictional in the long-standing FBS cases and in cases positive for diaphragmatic hernia. Dyspnoea and coughing were seen in 25 (69.44%) and 22 cases (61.11%), respectively. Arched back and abducted elbows were seen in 9 (25%) and 13 cases (36.11%), respectively. Intermittent pain symptoms like reluctance to move, long standing posture, stiffness and stretching position were seen in 30 (83.33%) cases (Table 1).

Table 1: Clinical observations in cattle affected with FBS (n=36)

Sr. No	Particulars			Number	Per cent
1	Inappetence			34	94.44
2	Rumination	a	Present	9	25.00
		b	Intermediate	7	19.44
		c	Absent	20	55.55
3	Recurrent bloat			15	41.66
4	Brisket oedema			17	47.22
5	Jugular pulsation			22	61.11
6	Change in heart sound (Muffled & Frictional)			28	77.77
7	Dyspnoea			25	69.44
8	Coughing			22	61.11
9	Arched back			9	25.00
10	Abducted elbows			13	36.11
11	Intermittent pain symptoms			30	83.33

In a study by Abdelaal *et al.* (2009) [1] there was inappetence seen in 100% cases of traumatic reticulo-peritonitis affected animals while pain symptoms were seen in 93.10% of the animals. El esawy *et al.* (2015) [6] observed muffled heart sound in 13.5% cases, dyspnoea in 21.6%, coughing in 18.9%, brisket oedema was in 13.5% and jugular vein distension was seen in 13.5% of the cases, these findings are in accordance with the present findings. Abouelnasr *et al.* (2012) [2] found recurrent bloat in 87.5% in the cases with traumatic reticulo-peritonitis. All these findings in FBS affected animals are in support with the findings of present investigation.

The most common signs observed in the FBS affected animals were inappetence, reduction or suspension in rumination and change in the heart sounds. These changes can be attributed to ruminal impaction due to the alterations

caused in rumen-reticular motility, due to foreign body in rumen or reticulum. Recurrent bloat is a common sign seen in the cases of diaphragmatic hernia, as there is hindrance in the eructation (Rajput *et al.*, 2018) [14] and motility because of the herniation of the reticulum in the thorax. Brisket oedema, jugular pulsation, coughing and dyspnoea are the signs of involvement of the cardiovascular system (Ghanem, 2010) [7]. Dyspnoea is also commonly seen when the rumen is distended as it exerts pressure on the diaphragm. The signs of pain like arching of back, abduction of elbows, difficulty while lying down or getting up, reluctance to move may vary greatly in different cases, as it depends on the position of the metallic body penetration. These symptoms can also be exhibited because of impaction due to non-metallic foreign body which also exerts pressure on the vital organs (Rajput *et al.*, 2018) [14].

3.2 Haematological examination

The haematological study was carried in foreign body syndrome positive cases and 10 healthy control animals. The results are given in the table 2.

Table 2: Haematological values (Mean ± SE) in FBS and healthy control.

Parameters	Positive cases of FBS	Healthy Control
Haemoglobin (g/dl)	9.75 ± 0.44	10.82 ± 0.52
PCV (%)	29.71 ± 1.45	34.36 ± 1.64
TEC (10^6/µl)	6.30 ± 039	6.95 ± 0.36
TLC (10^3/µl)	12.48 ± 1.00	9.43 ± 0.49
Neutrophils (%)	52.08 ± 2.23**	27.70 ± 3.94
Band neutrophils (%)	3.12 ± 0.76*	0.30 ± 0.21
Lymphocytes (%)	42.80 ± 2.84**	69.60 ± 2.57
Monocytes (%)	1.08 ± 0.22	1.00 ± 0.21
Eosinophils (%)	1.64 ± 0.34	0.50 ± 0.34
Basophils (%)	0.08 ± 0.06	0.00 ± 0.00

**p<0.01 *p<0.05

The cases positive for foreign body syndrome revealed non-significant change in mean haemoglobin (9.75 ± 0.44 g/dl) level as against healthy control group (10.82 ± 0.52 g/dl). The mean PCV in affected animals was 29.71 ± 1.45% which also did not show any significant difference from the healthy control (34.36 ± 1.64%). The mean total erythrocyte count also showed non-significant difference, as it was 6.30 ± 039 x 10^9/µl in the affected cases as compared to 6.95 ± 0.36x 10^9/µl in healthy control animals. There was marginal but non-significant increase in the leukocyte count (12.48 ± 1.00 x 10^3/µl) in the affected animals as compared to the healthy control (9.43 ± 0.49 x 10^3/µl). Highly significant increase ($p<0.01$) in the neutrophils (52.08 ± 2.23%) was recorded in the FBS affected animals as against healthy control (27.70 ± 3.94%). Also there was a significant increase ($p<0.05$) in the band neutrophils (3.12 ± 0.76%) in the affected animals than healthy control group (0.30 ± 0.21 %). Lymphocyte count was significantly ($p<0.01$) lower (42.80 ± 2.84 %) in the affected animals when compared to the healthy control (69.60 ± 2.57%). The eosinophils, basophils and the monocytes did not show any significant difference as compared to the healthy control animals.

A study was undertaken by Khalphallah *et al.* (2017) [10] they found no change in the mean haemoglobin (118 ± 4.5 g/L), erythrocyte count (7.12 ± 1.32 x 10^6/µl) and PCV (25.81 ± 2.6 %) values, while there was leucocytosis (12.50 ±2.51 x 10^3/ µl) in traumatic pericarditis affected buffaloes as compared to the healthy control corroborating the findings of present study. Sasikala *et al.* (2018) [16] also reported no change in haemoglobin, erythrocyte count and the PCV values but found leucocytosis (19.99 ± 0.84 x 10^3 /µl) and neutrophilia (15.81 ± 0.5x 10^3/µl) in traumatic reticulo-peritonitis as compared to the healthy control. Ghanem (2010) [7] studied cows with traumatic reticulo-peritonitis cattle with significant leucocytosis (13.5± 0.4 x 10^3/µl), neutrophilia (10.3 ± 0.2) and lymphocytopenia (2.5 ± 0.3) and non-significant changes in PCV (38.5 ± 2.1 %) and erythrocyte count (6.2 ± 0.5 x 10^6/ µl) in the affected animals. These findings are also in accordance with the present findings. Further, similar findings were observed by Khalphallah *et al.* (2016) [11] and Rajput *et al.* (2018) [14] in foreign body syndrome cases.

The findings of the haematological study revealed that all the animals were out of risk of anaemia as the haemoglobin concentration, total erythrocyte count and the PCV were in the normal range. There was leucocytosis which may indicate presence of localized infection or inflammatory status of the animal. The presence of neutrophilia with lymphopenia could be due to the presence of the foreign body in the fore stomach leading to tissue injury or purulent exudation (Rajput *et al.*, 2018) [14]. The leukocyte number will vary in between the species and reflects the balance of production, release and consumption from the bone marrow (Weiser *et al.*, 2012) [19]. Cattle has low regenerative capacity and relatively low reserve and hence to sustain the neutrophilia in inflammation or infection an increased number of band cells are seen, especially in chronic state of the disease condition.

3.3 Radiographic examination

Radiograph was taken in the suspected cases for FBS of which 36 cases were positive for foreign body. The radiograph could visualize the reticulum, diaphragm and the cardiac outline. Out of 36 cases diagnosed for FBS, 30 foreign bodies were seen in the reticulum whereas in 6 cases diaphragmatic hernia was observed, where the reticulum was seen in the thoracic region with foreign bodies inside it.

Among these 36 foreign body syndrome cases, in 24 cases the foreign body was metallic and penetrating while 12 were non-penetrating. Out of 24 metallic and penetrating cases, 17 were metallic wire (Image 1) and 7 were nail (Image 2). The metallic penetrating foreign body was visualized as white radio-opaque structure present in the reticulum. Out of 12 non penetrating foreign bodies of various types, 3 cases had plastic (Image 3) in the reticulum and rumen which appeared as irregular radio-opaque structure in the reticulum, 4 had circular metallic foreign bodies (Image 4) in the reticulum which were suspected to be coins, 1 case had an irregular radio-opaque structure seen in the rumen which could be stone and 4 cases had radio-opaque sediment (Image 5) which included multiple irregular radio-opaque foreign bodies like sand and mud. In all the cases the foreign bodies were seen free floating in the reticulum. The cases with diaphragmatic hernia had nail (Image 6) or wire (Image 7) which had penetrated through diaphragm causing herniation of reticulum into the thorax. The types of foreign bodies seen are depicted in fig. 1 and the detailed observations of each case are given in table 3.

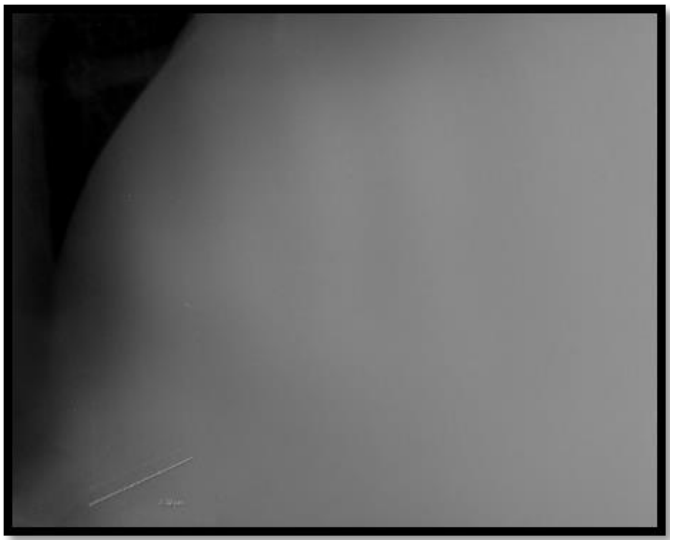

Image 1: Radiograph showing metallic wire in reticulum

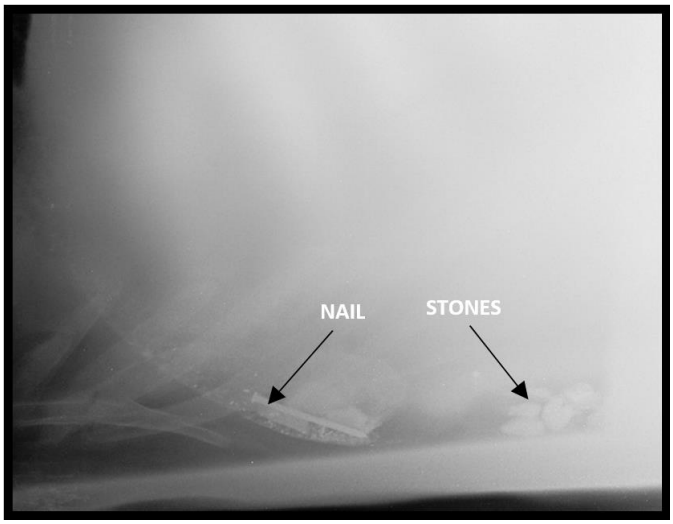

Image 2: Radiograph showing nail and stones in reticulum

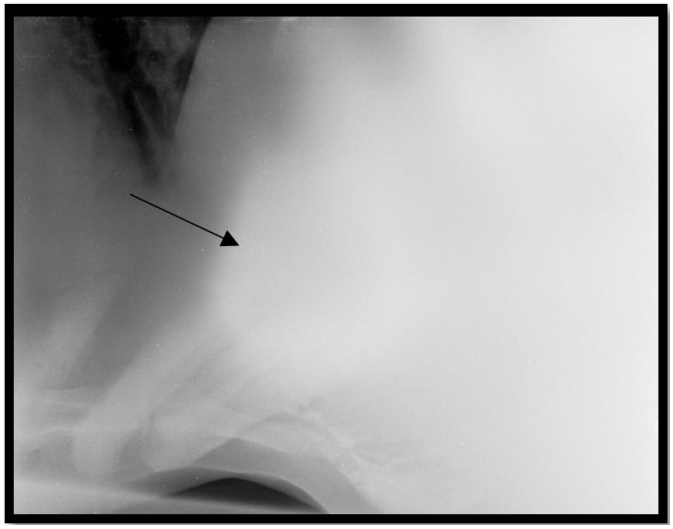

Image 3: Radiograph showing radio-opaque body in reticulum (plastic)

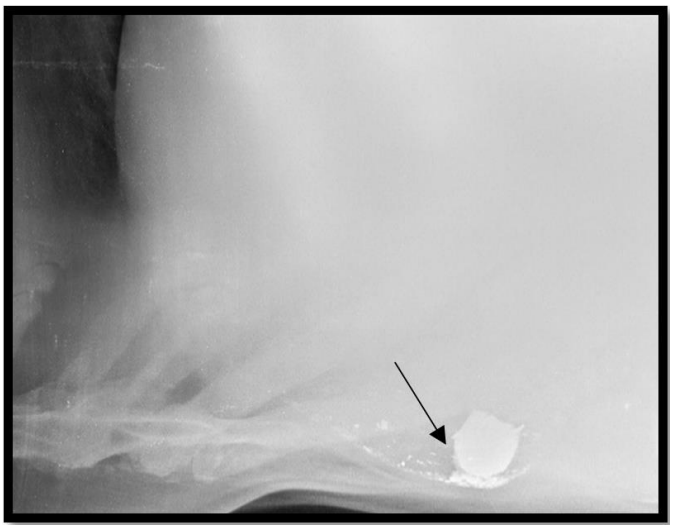

Image 4: Radiograph showing circular foreign body in reticulum

Image 5: Radiograph showing radio-opaque sediment in the reticulum

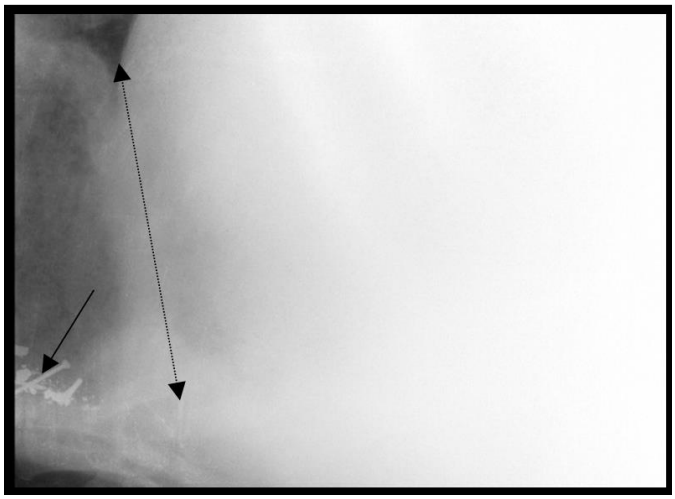

Image 6: Radiograph showing DH with nails in reticulum

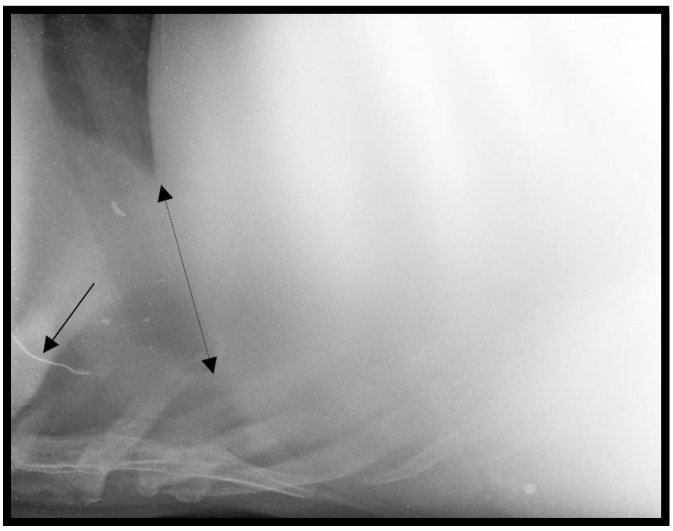

Image 7: Radiograph showing DH with metallic wire in reticulum.

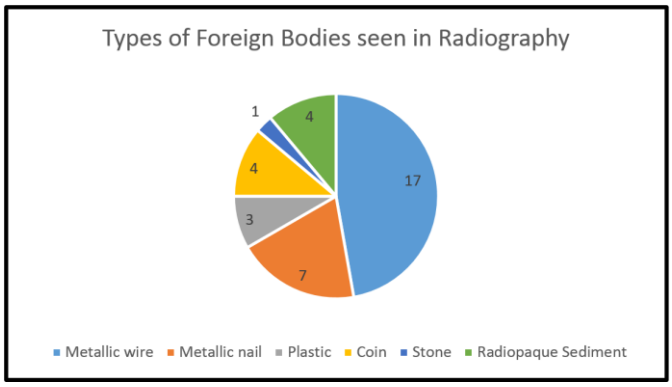

Fig 1: Types of foreign bodies seen in radiography.

Radiography could identify the type of foreign body present and also whether it's metallic or non-metallic. The foreign body is generally seen in the reticulum as it gets lodged there due to its honey comb structure, the metallic foreign body is usually radio-opaque and appears white in colour and the shape, size and its location can be evaluated by a radiograph. Abu-Seida and Al-Abbadi (2015) [3] observed 76.6% sharp foreign bodies, 20.7% mixed foreign bodies and 2.7% blunt foreign bodies retrieved from the FBS affected animals. Similarly, in another study Abu-Seida and Al-Abbadi (2014) found 75.7% sharp metallic objects, 20.7% mixed foreign objects, 2.1% blunt forging objects and 0.9% blunt metallic objects like coins were found. Khalphallah *et al.* (2016) [11] also stated that radiography is useful in the identification of traumatic reticulo-peritonitis and traumatic pericarditis. There was visualization of ropes, nails and wires in the affected animals. In the cases of traumatic pericarditis, the foreign bodies are not seen on a radiograph as much as 76% of the times, due to severe opacity caused by suppurative pericarditis, this is one of the limitations in radiography (Imran *et al.*, 2011) [9]. Nasar- Eldin and Abdel-Hakiem (2013) [13] studied foreign body syndrome cases and identified various radio-opaque foreign bodies like needle, hairpins and wires within the reticulum in various animals, there was diaphragmatic hernia seen in the radiograph as reticulum within the thorax overlying the caudal border of the heart with discontinuation of diaphragm. All these findings are in accordance with the findings of present study. Khalphallah *et al.* (2017) [10] also found metallic foreign bodies in 13 buffaloes and stated that radiography is efficient in identifying metallic foreign objects and it also indicated the nature and the cause of the trauma. He also reported that, radiography failed to identify inflammatory changes on the reticulum, reticular abscess and non-metallic foreign objects like rags and bags.

Radiography was efficient in identifying the nature and location of foreign body i.e. intra-reticular or extra-reticular but could not identify the extent of lesions.

Table 3: Findings of X-Ray in FBS positive cattle (n=36)

Sr. No	Case No	X-ray findings
1	1	Metallic Wire seen in the reticulum (free floating)
2	2	Multiple metallic foreign body present in the reticulum
3	3	Metallic wire seen in the reticulum (free floating)
4	6	Circular non penetrating foreign body seen in the reticulum
5	8	Sharp metallic foreign body seen in the reticulum (wire)-diaphragm not clear
6	10	Non-metallic radio-opaque foreign body seen
7	13	Sharp metallic foreign body seen in the reticulum (nail)-diaphragm not clear
8	14	Metallic wire seen in the reticulum (free floating)
9	15	Metallic wire seen in the reticulum (free floating)
10	16	Metallic wire seen in the reticulum (free floating)
11	17	Diaphragmatic hernia with reticulum in thorax and metallic wire in reticulum seen
12	22	Metallic wire seen in the reticulum (free floating)
13	23	Circular radio-opaque foreign body seen in the reticulum
14	24	Metallic wire seen in the reticulum (free floating)
15	25	Metallic wire seen in the reticulum (free floating)-diaphragm not clear
16	26	Diaphragmatic hernia with reticulum in thorax and two nails in the reticulum seen
17	28	Circular radio-opaque foreign body in the reticulum seen with magnet
18	34	Metallic wire seen in the reticulum-diaphragm not clear
19	35	Non-metallic foreign body seen in the reticulum
20	36	Metallic foreign body (nail) present in the reticulum
21	37	Radio-opaque sediment and multiple radio-opaque small bodies seen in the reticulum
22	38	Multiple radio-opaque bodies seen in the reticulum-diaphragm not clear
23	49	Diaphragmatic hernia seen with reticulum in thorax and nail is seen in reticulum
24	50	Metallic wire seen in the reticulum (free floating)
25	51	Metallic wire seen in the reticulum (free floating)
26	52	Metallic wire seen in the reticulum (free floating)
27	53	Radio-opaque multiple foreign bodies seen in the reticulum (non penetrating) coins, etc

28	64	Metallic wire seen in the reticulum (free floating)
29	66	Multiple radio-opaque foreign bodies present in the reticulum (non-penetrating)
30	67	Metallic foreign body (nail) present in the reticulum
31	68	Metallic foreign body (nail) present in the reticulum.
32	69	Metallic foreign body present in the reticulum (wire) embedded in the wall of reticulum
33	70	Diaphragmatic hernia present with reticulum in the thorax with multiple radio-opaque foreign bodies (plastic removed during surgery)
34	71	Diaphragmatic hernia with reticulum seen in the thorax and nails seen in the reticulum
35	72	Non-metallic radio-opaque foreign bodies seen in the reticulum (stones)
36	73	Diaphragmatic hernia present with reticulum in the thorax and wire is seen

4. Conclusion

1. The common clinical signs in FBS cases included inappetence, change in the heart sound (muffle or friction), dyspnoea, coughing, reduced rumination, jugular pulsation, intermittent pain symptoms, arched back, abducted elbows, change in posture and gait and rumen was normal to distended and in some cases it was impacted.
2. There was Non-significant leucocytosis with significant neutrophilia and lymphocytopenia in FBS affected cattle.
3. Radiography was an efficient technique to diagnose the nature and location of the foreign body, but it does not tell us about the sequalae of the syndrome or the extent of damage been caused.

5. References

1. Abdelaal AM, Floeck M, El Maghawry S, Baumgartner W. Clinical and Ultrasonographic Differences Between Cattle and Buffaloes with Various Sequelae of Traumatic Reticuloperitonitis. Veterinaria Medecinia. 2009; 54(9):399-406.
2. Abouelnasr KS, Mosbah E, Karrouf GI, Zaghloul AE. Comparative Ultrasonographic Findings of Traumatic Reticulitis, Perireticular Abscess and Diaphragmatic Hernia in Buffalo (*Bubalus bubalis*). Journal of American Science. 2012; 8(8):590-595.
3. Abu-Seida AM, Al-Abbadi OS. Studies on Sharp Foreign Body Syndrome in Iraqi Buffaloes and its Impact on Milk Production. Asian Journal of Animal Sciences. 2015; 9(3):128-133.
4. Abu-Seida AM, Al-Abbadi OS. Recent Advances in the Management of Foreign Body Syndrome in Cattle and Buffaloes: A Review. Pak Vet J. 2016; 36(4):385-393.
5. Aiello SE, Moses MA, Allen DG, Constable PD, Dart A, Davies PR *et al*. Traumatic Reticuloperitonitis, The Merck Veterinary Manual: 11thedi. Merck & Co., INC. Kenilworth, NJ, USA, 2016, 230-233.
6. El esawy EE, Adel MS, Ismail SF. Ultasonographic Diagnosis and Clinical Evaluation of Foreign Body Complications in the Compound Stomach of Cattle and Buffalo. Journal of Advanced Veterinary Research, 2015; 5(3):109-120.
7. Ghanem MM. A Comparative Study on Traumatic Reticuloperitonitis and Traumatic Pericarditis in Egyptian Cattle. Turk. J. Anima. Sci. 2010; 34(2):143-153.
8. Hussain T, Kumar A, Bansal BK. Ferroscopy for Detection of Metallic Foreign Body in Traumatic Pericarditis and Pleural Effusions in Cattle and Buffaloes. Journal of Entomology and Zoology Studies. 2018; 6(1):23-26.
9. Imran S, Tyagi SP, Kumar A, Kumar A, Sharma S. Ultrasonographic Application in the Diagnosis and Prognosis of Pericarditis in Cows. Veterinary Medicine International, 2011, Article ID 974785: 1-10.
10. Khalphallah A, Elmeligy E, Elsayed Abedellah BA, Salman D, Al-lethie AA, Bayoumi SA. Ultrasonography as a Diagnostic Tool in Egyptian buffaloes (*Bubalus bubalis*) with Traumatic Pericarditis. International Journal of Veterinary Science and Medicine. 2017; 5:159-167.
11. Khalphallah A, Elmeligy E, Elsayed HK, El-Hawari SF, Elrashidy MH. Diagnostic Significance of Ultrasonography in Complicated Traumatic Reticuloperitonitisin Egyptian Buffaloes (*Bubalus Bubalis*). Asian Journal of Animal and Veterinary Advances. 2016; 11:319-330.
12. Makhdoomi SM, Sangwan V, Kumar A. Radiographic Prediction of Metallic Foreign Body Penetration in the Reticulum of Cows and Buffaloes. Veterinary World. 2018; 11(4):488-496.
13. Nasr–Eldin MA, Abdel-Hakiem MA. Clinical and Diagnostic Methods for Evaluation of Sharp Foreign Body Syndrome in Buffaloes. Veterinary World. 2013; 6(9):586-591.
14. Rajput PK, Parikh PV, Parmar JJ, Mehta TA, Patil DB. Studies on foreign Body Syndrome in Bovines of Anand District of Gujarat. Indian J Anim. Res. 2018; 52(5):744-749.
15. Roth L, King JM. Traumatic Reticulitis in Cattle: A Review of 60 Fatal Cases. J Vet Diagn Invest. 1991; 3(1):52-54.
16. Sasikala K, Vijayakumar G, Sivaraman S, Balasubramaniam GA. Clinico-Pathological Studies on Traumatic Reticuloperitonitis in Cattle – A Review of 110 Cases. International Journal of Livestock Research. 2018; 8(12):150-159.
17. Sharma AK, Dhaliwal PS, Randhawa CS. Epidemiological Studies on Forestomach Disorders in Cattle and Buffaloes. Veterinary World. 2015; 8(9):1063-1067.
18. Vanitha V, Nambi AP, Gowri B, Kavitha S. Rumen Impaction in Cattle with Indigestible Foreign Bodies in Chennai. Tamilnadu. J Veterinary and Animal Sciences. 2010; 6(3):138-140.
19. Weiser G, Thrall MA, Weise G, Allison RW, Campbell TW. Interpretation of Leukocyte Response in Disease. Veterinary haematology and clinical chemistry. Ames: Wiley- Blackwell, 2012, 127-139.