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## Radiographic and ultrasonographic diagnosis as well as surgical treatment of foreign body induced reticular affections in bovines

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### Abstract

The objective of the present study was to evaluate the radiographic and ultrasonographic changes in cattle and buffaloes suffering from foreign body induced reticular affections. The study was conducted in a total of 12 clinical cases of cattle and buffaloes presented to the Department of Veterinary Surgery and Radiology, Veterinary College, Bidar and referral hospitals of Karnataka state. The clinical cases were divided into group I and group II consisting of 6 cattle and 6 buffaloes respectively. Clinical signs dehydration, rumination, tympany, urination, defecation, water intake, scanty faeces and cautious gait were recorded in both the groups. Both group I and group II groups were subjected to clinical, haemato-biochemical followed by radiographic and ultrasonographic screening to confirm the presence of reticular affections like traumatic reticulitis, traumatic reticuloperitonitis, reticular abscess, reticular adhesions, and diaphragmatic hernia due to the presence of metallic foreign body. All the animals showed varying degree of reduced appetite, water intake, defecation, rumination. Clinical examination showed normal heart rate, increased respiratory rate, increased rectal temperature and reduced ruminal motility. Haemato-biochemical estimation revealed anemia, marked neutrophilia, lymphocytopenia, eosinopenia, leucocytosis, hyperproteinemia and normal ALT.

**Keywords:** Ferroscopy, radiography, ultrasonography, reticular affections and laparo-rumenotomy

### Introduction

Reticular affections due to the penetration of metallic foreign bodies are most common in cattle and buffaloes especially in developing countries resulting in high economic losses. Metallic and non-metallic foreign bodies are commonly ingested by cattle and buffaloes due to lack of discrimination against metallic objects and they do not use their lips for prehension of the feed and incomplete mastication before swallowing (Misk and Semieka, 2001 and Ashfaq *et al.*, 2015) [14, 3]. The swallowed metallic objects enter into the reticulum and trapped in honey comb like reticular mucosa. The trapped sharp objects penetrate the reticular wall due to contraction and consequently allow leakage of ingesta and bacteria into the peritoneal cavity leading to traumatic reticuloperitonitis, traumatic reticulitis, reticular adhesions and reticular abscess due to chronic infection (Roth and King, 1991) [16]. These conditions produce devastating economic losses due to severe reduction in milk and meat production, diagnosis and treatment costs, potential fatalities and foetal losses in affected pregnant animals (Nugusu *et al.*, 2013) [15].

Foreign body syndromes are generally diagnosed based on symptoms, clinical examination, haemato-biochemical alterations, thoracic radiography and ultrasonography (Sheikh Imran *et al.*, 2011) [17]. Early diagnosis followed by proper care and surgical intervention decides the survivability of the animal. Ferroscopy is an important diagnostic tool for the detection metallic foreign bodies in thoraco-abdominal region (Sawandkar *et al.*, 2009) [18]. It can detect the location of foreign body in the reticulum or rumen. However, the ferroscopy has the limitations that, it is unable to detect the type of foreign body, direction of foreign body and nature of foreign body, which may be penetrating or non-penetrating. Hence, confirmative diagnosis is not reliable on ferrosopic examination. Confirmative diagnosis can be made on the basis of exploratory laparo-rumenotomy which is considered to be a major surgical intervention and requires diligent post-operative care. Often, owners are reluctant to perform exploratory laparo-rumenotomy solely for diagnostic purpose and hence, it is not routinely practiced in field condition.

**Materials and Methods**

The present study was conducted in a total of 12 bovines presented with foreign body induced reticular affections to the Department of Veterinary Surgery and Radiology, Veterinary College, Bidar, during the period of January 2020 to June 2022. History of illness, age, sex, breed, duration of illness, feed intake, rumination, defecation, pregnancy status, milk yield, coughing, regurgitation, gait and presence or absence of tympany were recorded. Physiological parameters such as, rectal temperature, heart rate, respiratory rate and ruminal motility were noted in all the cases. Haemato-biochemical parameters like Haemoglobin (Hb), Total Erythrocytic Count (TEC), Total Leucocyte Count (TLC), Packed Cell Volume (PCV), Alanine Amino Transferase (ALT), Aspartate Amino

Transferase (AST), Total proteins and Total albumen were estimated in both the groups before treatment. In group I, six cattle with anorexia, suspended rumination, reduced ruminal motility, tympany, reduced milk yield and passing scanty faeces were subjected to clinical, haemato-biochemical, ferrosopic, radiographic and ultrasonographic examinations. After confirmatory diagnosis, all the animals were subjected to therapeutic and surgical management by Laparo-rumenotomy to retrieve the reticular foreign body. Similarly in group II, six buffaloes were subjected to surgical management by Laparo-rumenotomy to retrieve the reticular foreign body. The detailed clinical study is shown in the table no.1 as follows.

**Table 1:** Design of clinical study of bovines with reticular affections

Sl. No	Groups	Species	Animals	Diagnosis	Treatment
1	Group I	Cattle	06	Clinical signs Haemato-biochemical Ferroscopy Radiography Ultrasonography	Therapeutic management Laparo-rumenotomy followed by retrieval of foreign body from the reticulum
2	Group II	Buffalo	06	Clinical signs Haemato-biochemical Ferroscopy Radiography Ultrasonography	Therapeutic management Laparo-rumenotomy followed by retrieval of foreign body from the reticulum

**Group I (Cattle)**



**Plate 1:** ND cow with bilateral abdominal distension



**Plate 3:** Arrow shows presence of reticular contents at 5<sup>th</sup> intercostal space



**Plate 2:** Lateral chest radiography



**Plate 4:** Ultrasonographic examination showing



**Plate 5:** Fixing of rumen to Weingarth's rumenotomy set



**Plate 8:** Skin sutured with simple interrupted pattern by using nylon



**Plate 6:** Photograph showing animal immediately after laparorumenotomy



**Plate 9:** Photograph showing standing animal immediately after herniorrhaphy



**Plate 7:** Diaphragmatic herniorrhaphy with lock stitch using silk no.2



**Plate 10:** Follow up of the animal with normal feeding on day-7

## Results and Discussion

Clinical examination revealed normal heart rate, respiratory rate, rectal temperature (Braun *et al.*, 1993) [7]. Haemato-biochemical values showed anaemia, marked neutrophilia, lymphocytopenia, hyperproteinemia, normal albumen, ALT and AST (Braun *et al.*, 1993) [8]. Pole test was conducted in both the groups. In group I, two (33.33%) animals showed positive result of expiratory grunt out of six animals. Whereas, in group II, three (50%) animals showed expiratory grunt. Similar findings were reported by Blood and Hutchins (1955) [19], Rosenberger (1979) [20] and Braun *et al.* (2018). Similarly wither pinch test was conducted in both the groups. In group I, only one (16.66%) animal elicited the grunt, remaining all the animals were negative. However, in group II, all the animals showed negative (0%) results. Bhor *et al.* (2016) [21] and Sharma and Kumar (2006) also reported the similar findings in cows suffering with foreign body syndrome.

**Table 2:** Mean  $\pm$  SE of physiological parameters in different groups of bovines with reticular affections before and after treatment.

S. No	Parameters	Days	Group I	Group II
1.	Rectal temperature(°F)	Before surgery	102.68 $\pm$ 0.60	100.78 $\pm$ 0.58
		Day-0	101.05 $\pm$ 0.38	100.07 $\pm$ 0.32
		Day-3	100.05 $\pm$ 0.34**	100.28 $\pm$ 0.09
		Day-7	100.35 $\pm$ 0.18**	99.99 $\pm$ 0.38
2.	Heart rate(beats/min)	Before surgery	78.83 $\pm$ 2.33	72.83 $\pm$ 1.58
		Day-0	75.83 $\pm$ 1.25 <sup>a</sup>	70.33 $\pm$ 1.09 <sup>b</sup>
		Day-3	73.83 $\pm$ 0.95	70.33 $\pm$ 1.17
		Day-7	72.23 $\pm$ 0.91	70.16 $\pm$ 0.83*
3.	Respiratory rate (breaths/min)	Before surgery	21.83 $\pm$ 0.86	21.83 $\pm$ 0.79
		Day-0	22.16 $\pm$ 0.76	20.33 $\pm$ 0.56
		Day-3	21.50 $\pm$ 0.65	21.16 $\pm$ 0.43
		Day-7	20.33 $\pm$ 0.56	20.66 $\pm$ 0.30

Ferrosopic examination was performed in both groups by using Hauptner's ferroscope. All the animals were restrained in a wooden trevis and metallic chains attached to them were removed to avoid interference with ferrosopic evaluation. The animals were then examined for the presence and position of metallic foreign bodies in the reticulo-rumen by holding the probe of the instrument against the body wall from 5<sup>th</sup> to 10<sup>th</sup> intercostal space, both laterally and ventrally to pinpoint the exact location of the foreign body. In group I, three (50%) animals showed needle deflection and acoustic sound at 5<sup>th</sup> to 8<sup>th</sup> intercostal space. Similarly, in group II three animals (50%) showed needle deflection and acoustic sound at 5<sup>th</sup> to 9<sup>th</sup> intercostal space. Sawandkar *et al.* (2009) [18] reported that scanning of ventral and lateral thoracic and abdominal wall with metal detector could provide the information about the presence of ferromagnetic foreign bodies in thoraco-abdominal region.

In all the days of observations the rectal temperature was within the normal range. However, there was a significant difference between the intervals on day 3 and day 7 compared to before surgery in group I which might be due to increased infection, inflammation and systemic reaction caused by penetrating foreign bodies. In group I, rectal temperature on day 3 and day 7 was significantly decreased which might be due reduced infection, inflammation and systemic reaction. Similar findings were observed by Ismail *et al.* (2007) [32], Ghanem (2010) and Ashker *et al.* (2013). There was a significant difference between the groups on day 0 and remaining days had the values within the normal limit. Heart

rate on day 7 of group II was significantly different from other intervals. These findings were in resemblance with findings noted by Reddy *et al.*, (2014) [22] and Ghanem (2010). Respiratory rate was within the normal limits on all the days of observation and in all bovines of different groups. There was no significant difference between the groups and between the days of observation.

Radiography, revealed presence of radiopaque metallic foreign bodies in the reticulum, discontinued diaphragmatic line and reticular contents at 5<sup>th</sup> intercostal space, Kumar and Saini (2011) [23], Kumar *et al.* (2017) [24], Misk and Semieka (2001) [14]. Whereas, two animals (33.33%) which were attended at field level without radiography were underwent exploratory laparo-rumenotomy and metallic foreign bodies were retrieved from reticulum of both the cases. Similar findings were observed by Saini *et al.* (2001a), Streeter and Step (2007) [25], Kumar *et al.* (2008) [13], Abouelnasr *et al.* (2014) [26] and Abdelaal *et al.* (2009) [1]. Ultrasonographic examinations of reticulum showed normal crescent shaped reticular wall with 3 biphasic contractions per 4 minutes. Braun and Gotz (1993b) [8], Braun *et al.* (2002b) [27] and 3 biphasic contractions per three minutes. One animal showed presence of reticular motility at 4<sup>th</sup> to 5<sup>th</sup> intercostal space which was indicative of reticular diaphragmatic hernia (Saini *et al.*, 2007) and Athar *et al.* (2010b) [4].

After confirmatory diagnosis of different reticular affections with the help of radiography and ultrasonography both group I and group II were subjected to therapeutic management and Laparo-rumenotomy to retrieve the foreign body. Left flank Laparo-rumenotomy was performed in all the animals as described by Tyagi and Singh (1993) [28] and Singh *et al.* (2006) [29], the ultrasonographic and radiographic findings were confirmed upon Laparo-rumenotomy. In group I, out of six cattle two (33.33%) cattle were diagnosed as traumatic reticuloperitonitis, one (16.66%) as diaphragmatic hernia, one (16.66%) animal had traumatic reticulitis, one case (16.66%) was suffering with reticular adhesion and reticular abscess was observed in one (16.66%) cattle. All the animals were subjected to laparo-rumenotomy and foreign bodies were retrieved from the reticulum. These findings were in accordance with Kuiper and Breukink (1986), Fubini *et al.* (1989) [30], Streeter and Step (2007) [25]. Three animals recovered without any complications and one animal stopped passing dung on 12<sup>th</sup> post-operative day and treated with laxatives. The animal which had (16.66%) diaphragmatic hernia was subjected to diaphragmatic herniorrhaphy under general anaesthesia using isoflurane with IPPV. Animal recovered for one week and stopped passing dung on 15<sup>th</sup> day and died on 17<sup>th</sup> post-operative day. Whereas, the animal (16.66%) which was suffering with reticular abscess did not show any improvement and died on 7<sup>th</sup> post-operative days (Dehghani and Ghadrdani, 1995) [31].

In group II, out of six buffaloes, four (66.66%) buffaloes recovered without any complications. One (16.66%) buffalo which was suffering with traumatic reticuloperitonitis and oesophageal obstruction was subjected to oesophagotomy as well as laparo-rumenotomy with a gap of 24 hours did not show any improvement and died on second day after rumenotomy due to severe bloat. Whereas the animal (16.66%) which was confirmed as diaphragmatic hernia after exploratory laparo-rumenotomy was sold by the owner (Kumar *et al.*, 2017) [24]. According to Horney and Wallace, (1984) standing laparo-rumenotomy is desirable due to the

difficult manipulation of such large organ. The site of laparo-rumenotomy incision, size of the animal and length of the surgeon's arm should be considered to perform successful rumenotomy. Abouelnasr *et al.* (2014) [26] used laparo-rumenotomy as a confirmatory diagnostic tool to demonstrate the importance of ultrasonography for differentiating between various reticular affections in buffaloes and evaluation of reticular motility in the thoracic cavity for diagnosing diaphragmatic hernia.

The cattle and buffaloes of group I and II of reticular affections that underwent left flank laparo-rumenotomy were maintained with intravenous fluids after the procedure. Clinical observations were done on day 0, day 3 and day 7 post-operatively. All the animals were administered with the combination of amoxicillin and cloxacillin intravenously for 5 days consecutively at 10 mg/kg body weight. Meoxicam @ 0.3mg/kg body weight intravenously. The surgical wound was cleaned and dressed with povidone iodine until healing and skin sutures were removed on the 14<sup>th</sup> postoperative day.

**Group II (Buffaloes)**



**Plate 11:** Lateral chest radiographic examination



**Plate 12:** Presence of spoon at cranio-ventral aspect of reticulum



**Plate 13:** Retrieval of spoon from the reticulum



**Plate 14:** Closure of rumen with cushioning followed by lamberts pattern using catgut no. 2



**Plate 15:** Closure of skin with nylon



**Plate 16:** Animal with normal feeding on day-7

**Table 3:** Showing Mean ± SE of biochemical parameters of reticular affections

S. No	Parameters*	Days	Group I	Group II
1.	SGPT/ALT (IU/L)	Before surgery	39.75±8.29	37.51±1.77
		Day-0	40.07±8.55	37.55±1.25
		Day-3	40.13±8.74	38.28±0.91
		Day-7	40.65±8.13	38.45±1.31
2.	SGOT/AST (IU/L)	Before surgery	106.40±16.04	100.16±0.51
		Day-0	107.20±15.35	100.41±0.48
		Day-3	106.20±14.16	101.68±0.51*
		Day-7	107.10±14.58	100.99±1.52
3.	Total proteins (g/dL)	Before surgery	7.08±0.20	6.88±0.083
		Day-0	5.85±0.68	6.83±0.19
		Day-3	6.56±0.25	7.16±0.11
		Day-7	6.86±0.21	7.21±0.09*
4.	Total albumen (g/dL)	Before surgery	2.89±0.19	2.85±0.11
		Day-0	2.56±0.20	3.00±0.09
		Day-3	2.84±0.08	3.10±0.08
		Day-7	2.92±0.14	3.13±0.14

**Table 4:** Table showing Mean ± SE values for hematological parameters in different groups of bovines with reticular affections before and after treatment

S. No	Parameters	Days	Group I	Group II
1.	Haemoglobin (g/dL)	Before surgery	9.28±0.60 <sup>a</sup>	11.54±0.39 <sup>b</sup>
		Day-0	9.30±0.58 <sup>a</sup>	11.60±0.36 <sup>b</sup>
		Day-3	9.56±0.57 <sup>a</sup>	11.80±0.42 <sup>b</sup>
		Day-7	9.83±0.55 <sup>a</sup>	11.88±0.28 <sup>b</sup>
2.	Total Erythrocyte count(×10 <sup>6</sup> /μL)	Before surgery	7.02±0.66	8.33±0.21
		Day-0	7.18±0.64	8.43±0.23
		Day-3	7.28±0.63	8.50±0.27
		Day-7	7.20±0.60	8.67±0.31
3.	Packed cell volume (%)	Before surgery	29.87±2.41	33.78±0.87
		Day-0	28.73±1.44 <sup>a</sup>	33.00±0.39 <sup>b</sup>
		Day-3	29.91±1.73	33.55±0.91
		Day-7	33.01±0.83	33.75±0.75
4.	Total Leukocyte count(×10 <sup>3</sup> /μL)	Before surgery	13.53±1.34	14.23±1.11
		Day-0	12.90±1.27	14.28±0.98
		Day-3	11.67±1.15	13.70±0.87
		Day-7	10.43±0.94	13.03±0.72
5.	Neutrophils (%)	Before surgery	40.00±2.26	39.33±0.60
		Day-0	43.00±2.15	39.66±0.38
		Day-3	42.50±2.41	36.33±1.55
		Day-7	34.66±5.92	37.66±1.30
6.	Lymphocytes (%)	Before surgery	47.66±7.94	60.83±0.54
		Day-0	49.0±8.13	60.33±0.73
		Day-3	49.83±8.38	61.5±1.62
		Day-7	50.33±7.11	62.0±1.31
7.	Monocytes (%)	Before surgery	1.50±0.61	2.83±0.54

		Day-0	2.50±0.69	2.50±0.39
		Day-3	2.33±0.65	2.83±0.59
		Day-7	2.66±0.60	2.83±0.43
8.	Eosinophils (%)	Before surgery	2.16±0.36	1.50±0.39
		Day-0	5.00±0.93	0.60 ±0.19
		Day-3	4.83±0.78	1.30±0.19
		Day-7	5.00±0.76	0.83±0.15
9.	Basophils (%)	Before surgery	0.50±0.20	0.50±0.31
		Day-0	0.50±0.20	0.60±0.19
		Day-3	1.00±0.23	1.16±0.28
		Day-7	1.16±0.72	0.60±0.19

**Table 5:** Results and treatment outcomes of reticular affections

Groups	Case No	Species	Diagnosis	Surgical treatment	Treatment outcome
Group I	1	Cattle	Traumatic reticuloperitonitis	Reticular foreign body retrieved through Laparo-rumenotomy	Recovered without any complications
	2	Cattle	TRP and DH	Reticular foreign body retrieved through Laparo-rumenotomy	Recovered and animal stopped passing dung after 15 days and died on 17 <sup>th</sup> post-operative day
	3	Cattle	Traumatic reticulitis	Reticular foreign body retrieved and adhesions removed through Laparo-rumenotomy	Recovered and animal stopped passing dung on 12 <sup>th</sup> post-operative day and it was treated with oral laxatives
	4	Cattle	Reticular adhesion	Abscess removed and foreign body retrieved through Laparo-rumenotomy	Animal was not recovered and died after 7 days
	5	Cattle	Reticular abscess	Reticular foreign body retrieved through Laparo-rumenotomy	Recovered without any complications
	6	Cattle	Traumatic reticuloperitonitis	Reticular foreign body retrieved through Laparo-rumenotomy	Recovered and sold by owner after 35 days
Group II	1	Buffalo	Traumatic reticulitis	Reticular foreign body retrieved through Laparo-rumenotomy	Recovered without any complications
	2	Buffalo	Traumatic reticulitis	Reticular foreign body retrieved through Laparo-rumenotomy	Recovered without any complications
	3	Buffalo	TRP and oesophageal obstruction	Oesophagotomy done and reticular foreign body retrieved through Laparo-rumenotomy	Died on third day due to severe bloat
	4	Buffalo	Traumatic reticuloperitonitis	Reticular foreign body retrieved through Laparo-rumenotomy	Recovered without any complications
	5	Buffalo	Diaphragmatic hernia	Foreign body retrieved through laparo-rumenotomy and herniorrhaphy was not done	Owner sold the animal after laparo-rumenotomy
	6	Buffalo	Traumatic reticuloperitonitis	Reticular foreign body retrieved through Laparo-rumenotomy	Recovered without any complications

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