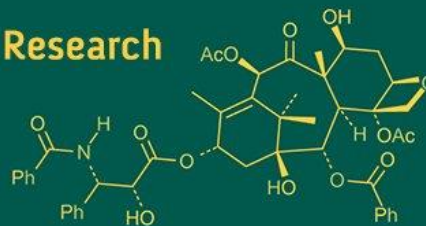


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Clinical evaluation of magnetic bolus as preventive tool for traumatic reticulitis in cattle

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Abstract

Background: Traumatic reticulitis is a significant digestive disorder of cattle that results in economic losses due to reduced productivity, increased treatment costs and mortality. The study was undertaken at Dept. of VSR, COVAS, Udgir on 18 cattle to evaluate the magnetic bolus as a preventive tool in cattle affected with traumatic reticulitis. Animals were selected irrespective of age, sex and breed. The clinical signs exhibited were anorexia (100%), brisket oedema (61.11%), grunting (50%), abducted elbows (38.88%) and reduced ruminal motility. Radiographic examination confirmed the presence of non-penetrating potential metallic foreign bodies in the reticulum in all cases prior to intervention.

Methods: Radiographic reassessment conducted 2-24 hours after oral administration of the magnetic bolus revealed successful attachment of metallic foreign bodies to the magnet in 83.33% of cases, demonstrating its effectiveness in preventing further penetration of the reticulum. Physiological parameters showed significant improvement during the observation period, evidenced by reductions in heart rate, respiration rate, rectal temperature and pulse rate, along with restoration of ruminal motility by 14th day. Haematological evaluation revealed initial mild anaemia and inflammatory response, followed by progressive normalization of haemoglobin concentration, leukocyte counts and differential leukocyte parameters after treatment. Biochemical analysis indicated elevated hepatic enzyme levels during the acute phase, which declined significantly during recovery, suggesting resolution of tissue injury on 14th day.

Results: Observations indicated higher susceptibility in adult cattle (6.41 ± 0.75), particularly females (61.11%) and indigenous breeds such as Deoni (44.44%) and Red Kandhari (33.33%). Traumatic reticulitis can be prevented by using magnetic bolus. Magnetic bolus is not-effective in the cases which are suffering with the ruminal impaction and penetrated foreign body. Radiography proved to be a reliable diagnostic modality for detecting metallic foreign bodies and monitoring therapeutic outcomes. The magnetic bolus was found to be an effective, economical and field-applicable preventive measure for traumatic reticulitis in cattle.

Keywords: Reticulitis, brsiket edema, radiogrph, magnetic bolus

Introduction

Cattle have been integral to Asian agriculture for over 5,000 years, contributing significantly to food production, income generation, and nutritional security. In developing countries, dairy animals represent a major economic resource; however, diseases affecting them cause substantial losses due to reduced productivity, increased treatment costs, and mortality. Advances in ruminant physiology have improved understanding of disease mechanisms and health management. Among production-limiting conditions, disorders of the ruminant forestomach (rumen dysfunctions) are prominent, with traumatic reticulitis (TR) and traumatic reticuloperitonitis (TRP) being important digestive and surgical conditions in cattle and buffaloes. These arise from ingestion of metallic and non-metallic foreign bodies (hardware disease) due to indiscriminate feeding and poor management practices. Traumatic reticulitis occurs when sharp objects such as nails or wires lodge in the reticulum, causing inflammation and possible perforation (Braun *et al.*, 2018). Severe cases may progress to TRP, leading to complications such as peritonitis, pleuritis, pulmonary and visceral abscesses, pericarditis, myocarditis, septicaemia, and death (Al-Abbadi *et al.*, 2014; Kahn and Line, 2005). In India, digestive disorders account for up to 80.20% of ruminant health problems, with economic losses estimated at ₹500 crores annually (Kumar *et al.*, 2003).

TRP is more prevalent in buffaloes than cattle, with higher incidence in regions such as Marathwada, Maharashtra. Diagnosis is primarily based on clinical signs reduced feed intake, decreased rumen motility, mild pyrexia, poorly digested faeces, and abdominal pain supported by haematological and biochemical findings. Advanced diagnostic tools like radiography and ultrasonography facilitate detection of foreign bodies and inflammatory changes (Braun *et al.*, 1994), though their field applicability is limited by cost. Metal detectors provide a practical alternative under field conditions. The condition results from penetration of the reticular wall by sharp objects during reticular contractions, with risk factors including poor feeding practices and mineral deficiencies, especially phosphorus deficiency leading to pica. Perforation allows leakage of ingesta and bacteria into the peritoneal cavity, causing localized or diffuse peritonitis and, occasionally, pleuritis, pericarditis, or abscess formation (Al-Abbadi *et al.*, 2014; Kahn and Line, 2005). It is less common in small ruminants due to selective feeding behaviour.

Metallic foreign bodies commonly originate from silage materials, feed processing equipment, and fencing, and tend to accumulate in the reticulum where contractions promote penetration. Preventive strategies include removal of metallic debris using magnets and oral administration of reticular magnets (magnetic bolus), which trap foreign objects and prevent tissue damage. Treatment involves conservative management with magnets, antimicrobials, anti-inflammatory drugs, and fluid therapy, while rumenotomy is indicated in non-responsive cases (Braun *et al.*, 2020). These interventions improve recovery rates from approximately 60% to 80-90% (Kahn and Line, 2005). However, complications such as vagal indigestion, ruminal tympany, forestomach atony, and omasal impaction may occur (Kahn and Line, 2005; Braun *et al.*, 2018), whereas abomasal obstruction has not been reported as a sequela. Despite widespread use of magnetic boluses, their long-term preventive efficacy remains inadequately documented, particularly in developing countries like India where hardware disease prevalence is high.

Material and methodology

The present study was conducted on eighteen clinical cases of cattle presented to the Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Udgir, District Latur. Most cases were referred from nearby government polyclinics. Animals were presented with clinical signs such as anorexia, suspended rumination, abducted elbows, and respiratory distress; occasional signs included grunting and restlessness. A total of eighteen cattle with a history of anorexia, elevated temperature, suspended rumination, respiratory distress, abducted elbows, and occasional grunting were selected and evaluated for traumatic reticulitis (n = 18).

A detailed clinical history including duration of illness (4-20 days), feeding practices, previous treatment, age, sex, and physiological status was recorded. Particular emphasis was given to signs indicative of foreign body syndrome such as reduced feed intake, decreased rumination, abdominal pain, and respiratory distress. All animals were subjected to routine clinical examination including heart rate (beats/min),

respiratory rate (breaths/min), and rectal temperature (°F) on day 0, 7, and 14. Conjunctival mucous membrane colour was also assessed.

Radiographic evaluation

All suspected cases were subjected to computed radiography of the reticulothoracic region. Radiographs were obtained in right lateral recumbency using an 800 mA Polydorus X-ray unit¹ with a computed radiography system² and a 14" × 17" cassette. Exposure parameters ranged from 77-85 kVp and 18-22 mAs. The cassette was centered over the eighth rib between the shoulder and elbow joints, with the lower border parallel to the ventral abdomen. Imaging was performed at peak inspiration.

Pre-induction radiographs were used to determine the presence, location, size, and penetration status of metallic foreign bodies. Post-induction radiographs were obtained to evaluate attachment of foreign bodies to the magnetic bolus and confirm reticular localization. Approximately 5 mL of blood was collected aseptically from the jugular vein on day 0, 7, and 14. Parameters including haemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leukocyte count (TLC), granulocytes (GRA), and lymphocytes (LYM) were analyzed using a fully automated haematology cell counter about 10 mL of blood was collected, centrifuged at 3000 rpm for 10 minutes, and serum was stored for analysis. Serum glutamic-oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), and alkaline phosphatase (ALP) were estimated. Serum calcium (mg/dL) was estimated using a Calcium (ASIII) reagent kit by UV molybdate method with a semi-automatic biochemical analyzer (Chem-7, Erba). Serum phosphorus (mg/dL) was determined using a Phosphorus reagent kit⁵ by Arsenazo III method using the same analyzer. Baseline haematological and physiological parameters were recorded prior to treatment. Animals were premedicated with Inj. Dicrysticin-DS (10,000 IU/kg, I/M), Inj. Chlorpheniramine maleate⁷ (1 mg/kg, I/M), and Inj. Meloxicam⁸ (0.5 mg/kg, I/M).

Induction of magnetic bolus

A ferrite-based magnetic bolus (Ferri MAX Bullet CAP; 3/4" × 3-3/8") was administered orally using a balling gun. The animal was restrained, the tongue exteriorized, and the bolus placed posterior to the torus linguae to facilitate swallowing. Animals were monitored for 2 hours for regurgitation. Surgical intervention was required in three cases, including two cases of ruminal impaction and one case of adherent non-penetrating foreign body confirmed by exploratory laparo-rumenotomy.

The left paralumbar fossa was prepared aseptically, and local anesthesia (2% lignocaine⁹) was administered using an inverted L block. A standard incision was made to access the rumen, which was secured using a Mackintosh ring. Approximately 40-50% rumen content was evacuated, and the reticulum was explored for foreign bodies. Retrieved foreign bodies were removed, and the rumen was sutured using Cushing and Lambert patterns. Abdominal layers were closed routinely, and skin was sutured using nylon. Post-operative management included regular wound dressing,

administration of broad-spectrum antibiotics, NSAIDs, and intravenous fluid therapy. Data obtained were statistically analyzed using a completely randomized design (CRD). One-way analysis of variance (ANOVA) was applied to evaluate haematological and physiological parameters as per Snedecor and Cochran (1994).

Results and discussion

The present study was conducted on 18 clinical cases of cattle to evaluate the effectiveness of a magnetic bolus as a preventive tool for traumatic reticulitis (TR). Animals were selected irrespective of age, sex, and breed, and exhibited clinical signs such as anorexia, suspended rumination, brisket oedema, and reduced ruminal motility.

Incidence of traumatic reticulitis

All 18 cases presented between February 2024 and December 2025 showed clinical signs of TR. Radiographic examination confirmed the presence of non-penetrating metallic foreign bodies in the reticulum in all cases (100%).

Age-wise incidence

The highest incidence was recorded in cattle aged 2-5 years (50%), followed by 6-9 years (27.77%) and 10-12 years (22.22%), with a mean age of 6.41 ± 0.76 years and mean body weight of 307.83 ± 10.48 kg. Adult cattle were more susceptible, particularly females. These findings align with Jagos (1969), Misra and Angelo (1981), and Tyagi and Singh (1993), who reported higher incidence in adult bovines.

Gender-wise incidence

Females (61.11%) were more affected than males (38.88%), likely due to longer productive life, pregnancy, and lactational stress. Similar findings were reported by Lakhpati *et al.* (2019).

Breed-wise incidence

Higher incidence was observed in Deoni (44.44%) and Red Kandhari (33.33%) breeds, followed by crossbred Holstein Friesian (16.66%) and Holstein Friesian (5.55%). This distribution reflects regional population density. Comparable breed variations were reported by Jagos (1969).

Clinical findings

All animals showed anorexia (100%), with other signs including grunting (50%), brisket oedema (61.11%), abducted elbows (38.88%), and muscle fasciculations (33.33%). Ruminal motility significantly improved from 0.83 ± 0.20 contractions/2 min (day 0) to 2.00 ± 0.00 (day

14) ($P < 0.01$). Similar findings were reported by Roth and King (1991), Misra (1960), Holmes (1960), Kaur and Singh (1994), Tyagi and Singh (1993), and Aiello and Mays (1998) [1].

Physiological parameters

Significant reductions were observed in heart rate (66.06 ± 3.03 to 56.67 ± 1.08 beats/min; $P < 0.01$), Respiratory rate (34.00 ± 3.61 to 25.94 ± 1.07 breaths/min; $P < 0.05$), rectal temperature ($102.14 \pm 0.24^\circ\text{F}$ to $100.98 \pm 0.15^\circ\text{F}$; $P < 0.01$), and pulse rate (78.83 ± 5.31 to 60.78 ± 1.07 beats/min; $P < 0.01$) over the study period, indicating clinical recovery. Similar observations were reported by Radostits *et al.* (2007), Braun (1998), Holmes (1960), Hjerpe (1961), Rao and Selvaraj (1962), and Aiello and Mays (1998) [1].

Hematological findings

Haemoglobin increased significantly from 8.53 ± 0.53 to 11.34 ± 0.43 g/dL ($P < 0.05$), indicating recovery from mild anaemia, consistent with Rao and Selvaraj (1962) and Ghanem (2008). PCV and TEC showed non-significant increases ($p > 0.05$), aligning with Braun *et al.* (1993b, 1998, 2018). TLC showed non-significant decline, contrasting with findings of Holmes (1960) and Kaur and Singh (1994). Differential leukocyte count revealed significant changes: lymphocytes fluctuated ($P < 0.05$), neutrophils decreased significantly ($P < 0.01$), and eosinophils showed marked reduction ($P < 0.01$), indicating resolution of inflammation. Monocytes remained unchanged. Similar findings were reported by Duttagupta *et al.* (1997), El Sebaie *et al.* (1999), Akhtar and Anjum (1997), and Rao and Selvaraj (1962). Platelet count showed transient thrombocytosis on day 7, consistent with Radostits *et al.* (2007).

Biochemical findings

Significant reductions were observed in SGOT (142.62 ± 16.35 to 96.72 ± 4.01 IU/L; $P < 0.01$), SGPT (105.50 ± 25.69 to 51.11 ± 1.86 IU/L; $P < 0.05$), and ALP (132.82 ± 4.92 to 87.61 ± 3.29 IU/L; $P < 0.01$), indicating improvement in hepatic and muscular stress. These findings agree with Lakhpati *et al.* (2019), Kaur and Singh (1994), and Krishnamurthy *et al.* (1982). Serum calcium and phosphorus showed non-significant changes ($p > 0.05$), suggesting minimal impact on mineral metabolism, consistent with Enes Akyüz *et al.* (2022).

CASE 1, 2 & 3 Radiograph Before and After the Induction Of Magnetic Bolus Showing Attachment of metallic foreign body To Magnetic Bolus.

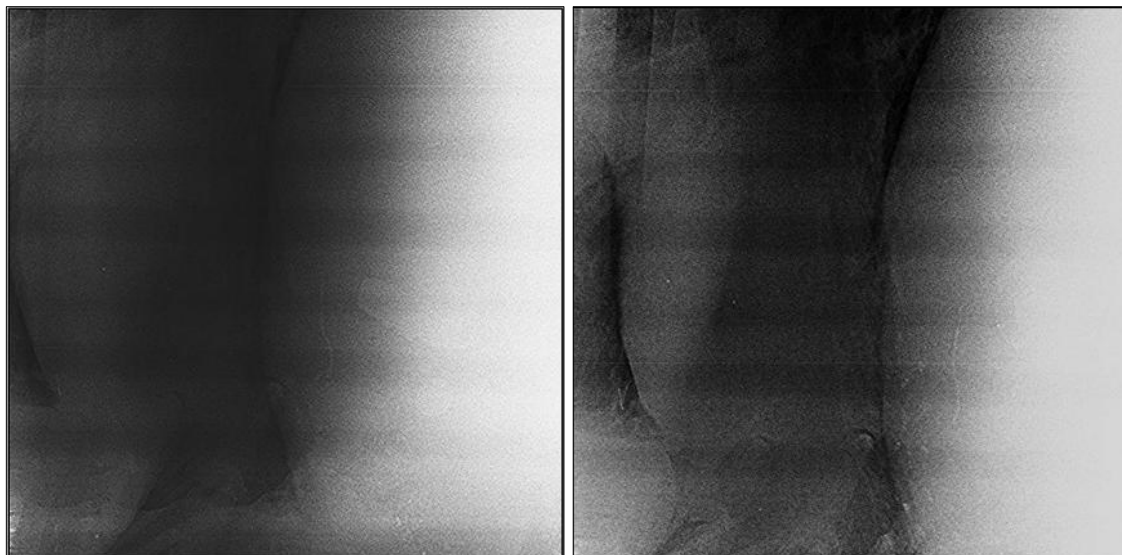


Fig: 1 Radiograph before and after the induction of magnetic bolus showing attachment of bent nail to magnetic bolus

Radiographic findings

Radiography confirmed non-penetrating metallic

foreign bodies in all cases (100%)

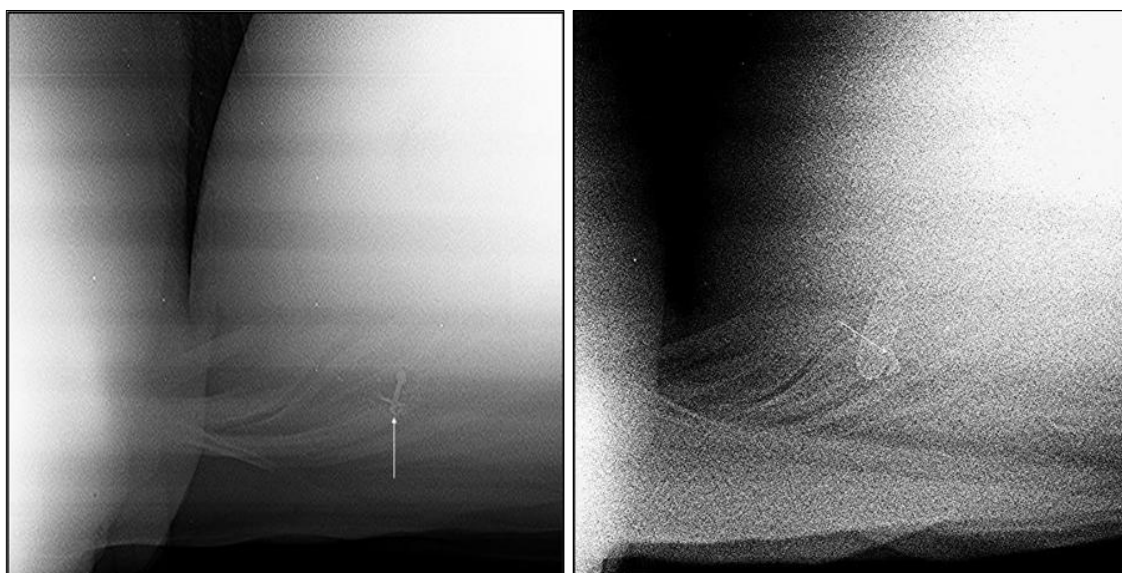


Fig 2: Radiograph showing metallic foreign body before and attached metallic foreign body after the induction of magnetic bolus

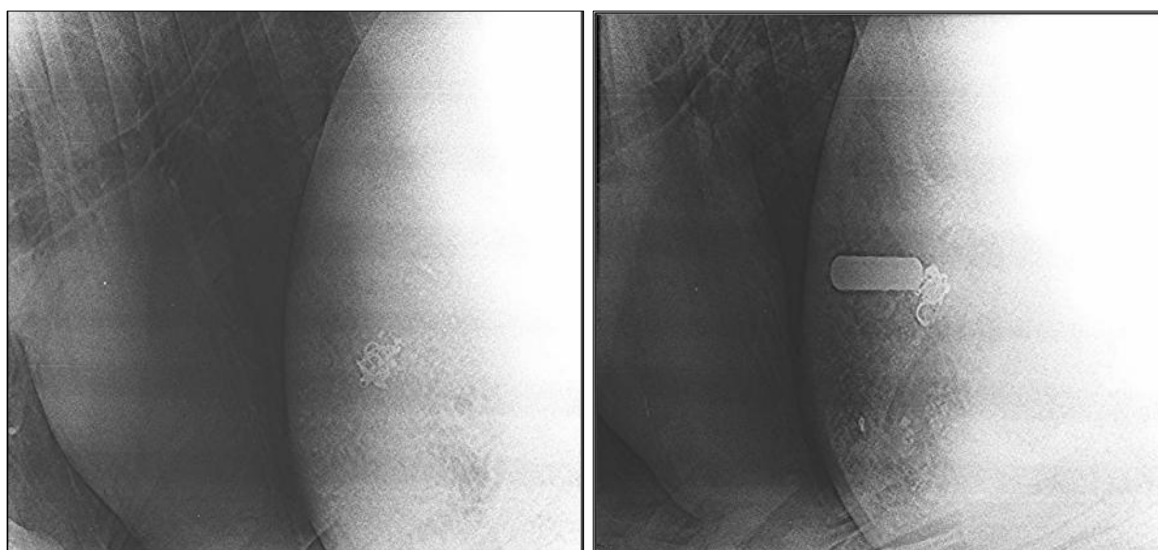


Fig 3: Radiograph before and after the induction of magnetic bolus showing attachment of bent nail to magnetic bolus

Prior to treatment, with sizes ranging from 1.89 to 8.0 cm (mean 4.84 ± 0.38 cm). Equal distribution was observed between cranial and caudal reticulum. Similar findings were reported by Neumann (1979) and Singh *et al.* (1969). Radiography proved effective in detecting foreign bodies, consistent with Braun *et al.* (1993a) and Ducharme *et al.* (1983). Following magnetic bolus administration, 83.33% (15/18) of foreign bodies were successfully attached, while 16.67% (3/18) failed due to ruminal impaction or reticular

adhesion, confirmed via laparo-rumenotomy. These findings demonstrate the effectiveness of magnetic bolus as a preventive and therapeutic tool. Similar observations were reported by Radostits *et al.* (1994). Radiography showed high diagnostic value with reported sensitivity of 76% and specificity of 93% (Braun *et al.*, 1993a). Repeat radiography was recommended in suspected cases where initial imaging is inconclusive.

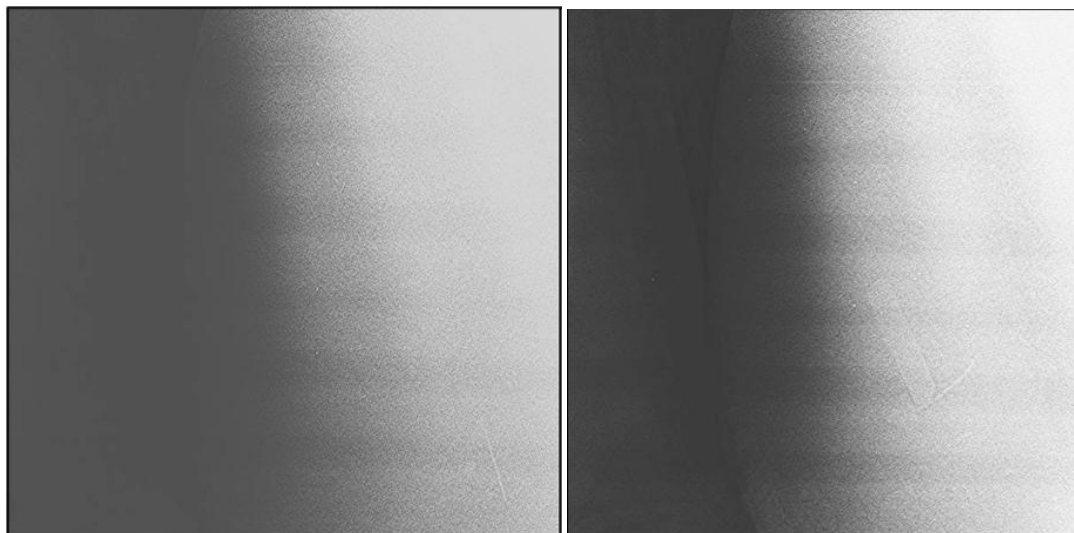


Fig 4: Radiograph before and after showing the attachment of the foreign body to magnetic bolus

Table 1: Radiographic findings in animals suffering from traumatic reticulitis before and after administration of a magnetic bolus

Radiographic findings of the animals suffering with traumatic reticulitis						
Before induction of magnetic bolus				After induction of magnetic bolus (within 2-24hours)		
Sl No	Size(cm)	Location in reticulum	Non-penetrating potential foreign body	Location in reticulum	Attachment to magnet	Relative Distance from Magnet
1	5.5	cranial	✓	cranial	✓	0
2	6.1	cranial	✓	cranial	✓	0
3	2.93	caudal	✓	caudal	✓	0
4	5.42	caudal	✓	caudal	✓	0
5	3.9	cranial	✓	cranial	X	2 cm
6	4.98	caudal	✓	caudal	✓	0
7	1.89	cranial	✓	cranial	✓	0
8	3.2	caudal	✓	caudal	X	3 cm
9	2.6	caudal	✓	caudal	✓	0
10	6.48	caudal	✓	caudal	✓	0
11	5.22	caudal	✓	caudal	✓	0
12	4.27	cranial	✓	cranial	X	6 cm
13	3.7	cranial	✓	cranial	✓	0
14	5.13	cranial	✓	cranial	✓	0
15	8	cranial	✓	cranial	✓	0
16	7.1	caudal	✓	caudal	✓	0
17	4.6	cranial	✓	cranial	✓	0
18	6.1	caudal	✓	caudal	✓	0
	4.84 ± 0.38 cm					

Conclusion

The 83.33% of the animals were successfully treated for traumatic reticulitis with conservative management using a magnetic bolus, showed highly effective in the treatment process. 2. The study, magnetic bolus is essential in order to prevent trauma to the reticulum as a preventive tool. 3.

Induction of magnetic bolus is not fruitful in the cases where the ruminal impaction is evident.

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