

A retrospective study on prevalence of traumatic reticuloperitonitis (TRP) and its sequelae in cattle

FAISAL RASHEED PARRAY¹, SYED ASHAQ HUSSAIN^{2✉}, SHAFAYAT AHMAD BEIGH³,
RAJA AIJAZ AHMAD³, ZAHID AMIN KASHOO⁴, YASIR AFZAL BEIGH⁵ and HAKIM ATHAR⁶

*Sher-e-Kashmir University of Agricultural Sciences &
Technology of Kashmir Srinagar 190 011 Jammu and Kashmir India*

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Traumatic reticuloperitonitis (TRP) is a common abdominal disorder of cattle caused by penetration of the reticulum by foreign metallic objects (Constable *et al.* 2017). Due to increased intra-abdominal pressure, TRP is more common in advanced pregnant and recently parturated animals. The resolution and progression of TRP depends upon the nature, direction and degree of penetration of the foreign body (Braun *et al.* 2020). Perforation of the reticular wall by foreign object initially produces acute localized peritonitis which may later spread to cause acute diffuse peritonitis or remain localized to cause vagal indigestion or diaphragmatic hernia. Penetration beyond peritoneum results in pericarditis, cardiac tamponade, pleurisy and hepatic or splenic abscess (Constable *et al.* 2017).

The clinical signs of acute TRP are anorexia, fever, reduced milk production, rumen atony, tympany, abdominal pain, arched back, a tucked up abdomen, and spontaneous grunting (Constable *et al.* 2017, Braun *et al.* 2020). Recurrent bloat is the primary indicator of diaphragmatic hernia, as it results from impaired eructation and motility caused by the herniated reticulum (Hussain *et al.* 2021b). Brisket edema, jugular pulsation, coughing and dyspnea indicate cardiovascular involvement (Hussain *et al.* 2018). In chronic cases, the clinical signs of TRP may be unclear or non-specific (Hussain *et al.* 2021a).

TRP is still among the most important gastrointestinal diseases of cattle. Recent studies (Braun *et al.* 2020, Gugjoo *et al.* 2021) on TRP have mentioned the latest reference about its prevalence being 16 years old (Waldner *et al.* 2009), which reported the prevalence to have decreased

from 80% in 1954 (Maddy 1954) to 12.1% (Poulsen 1976), 10% (Cramer *et al.* 2005), 8% (Waldner *et al.* 2009) and 2 to 3% (Starke and Rehage 2000). These studies based upon post-mortem finding with a lack of comprehensive studies about TRP, especially under clinical setting and field level. Further, detailed studies on prevalence, risk factor analysis and various complications and sequelae associated with TRP in India are scarce. Keeping in view the knowledge gap, the study was designed to study the prevalence of traumatic reticuloperitonitis and its sequelae in cattle.

This retrospective study was conducted on cattle presented at Large Animal Medicine Section of Veterinary Clinical Complex, Faculty of Veterinary Science and Animal Husbandry, Shuhama, Jammu & Kashmir, India over a period of one year (November 2023 to October 2024). As this retrospective study utilized clinical records, Institutional Animal Ethics Committee approval was not required; however, informed owner consent had been obtained during clinical management. The available out-patient department registered clinical cases of cattle were evaluated to record total number of cattle presented, number of TRP cases and the month during which TRP cases were examined. A total of 2339 registered cases of cattle > 1 year of age were included in the study. The diagnosis was based on the results of clinical examination, radiography and/or ultrasonography. The cattle underwent a thorough clinical examination (Constable *et al.* 2017). The general health condition was evaluated by determining demeanour and muzzle, skin elasticity, position of the eyes in relation to the sockets and body temperature. Heart and lungs were auscultated for any abnormality. The rumen was assessed for degree of fill, number of contractions and consistency of contents. Swinging and percussion auscultation as well as a rectal examination were also carried out. For all the TRP cases, age, parity, and pregnancy and calving status were noted for each case. The diagnostic radiographic findings for TRP in this study were presence of single or multiple penetrating or potential metallic foreign bodies in reticular area (Fig. 1), and atypical position of foreign bodies

Present address: ¹Veterinary Assistant Surgeon, Department of Animal Husbandry, Govt. of J&K; ²Assistant Professor, Division of Clinical Veterinary Medicine, Ethics and Jurisprudence; ³Assistant Professor, Division of Veterinary Clinical Complex; ⁴Assistant Professor, Division of Veterinary Microbiology and Immunology; ⁵Associate Professor, Division of Animal Nutrition; ⁶Associate Professor, Division of Veterinary Surgery and Radiology, FVSc and AH, SKUAST-Kashmir; ✉Corresponding author email: draashiqhussain@gmail.com

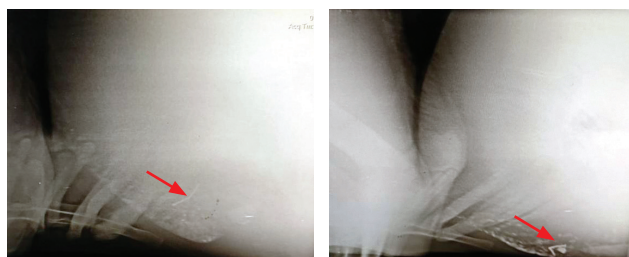


Fig.1. Reticular radiograph showing straight and curved potential nail (Red arrows) in the reticulum

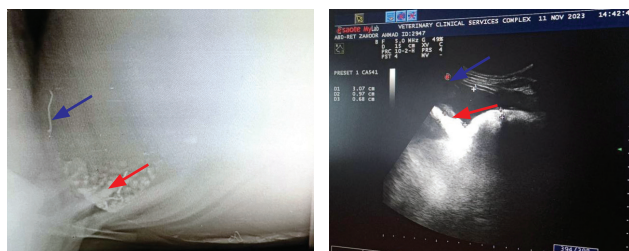
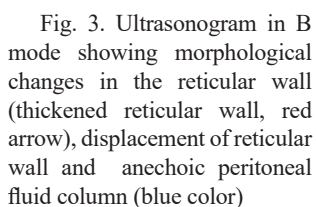


Fig. 2. Radiograph showing sharp metallic foreign body (red arrow) in the ventral aspect of reticulum along with non-potential foreign bodies and abnormally positioned metallic foreign body (blue arrow).



(Fig.2) (Braun *et al.* 2020). The ultrasonographic findings suggestive of TRP induced changes were fluid or fibrinous changes in the peri-reticular area, thickened reticular wall (Fig. 3) and altered reticular motility. Traumatic pericarditis was diagnosed on the basis of presence of potential foreign in the reticular area on radiography and ultrasonography findings (hypoechoic pericardial effusion interspersed with echogenic deposits, representing a fibrin mesh with medial displacement of the heart chambers away from the thoracic wall) (Braun, 2009). Generalized peritonitis was diagnosed on the basis of abdominocentesis findings-presence of turbid free fluid on centesis at multiple sites in the abdomen. Reticular abscess was diagnosed on the basis presence of circumscribed hypoechoic structure with well developed echogenic capsule during ultrasonographic examination of reticulum (Hussain *et al.* 2024). Reticular diaphragmatic hernia was diagnosed, based on the presence of motile reticular wall within the thoracic cavity (Hussain *et al.* 2021b). The prevalence was calculated by dividing

the number of TRP cases by total number of cases presented for each season (Table 1). -

In order to observe any effect of season on the prevalence, the year was divided in to four seasons (Dad *et al.* 2021) , viz. Winter (December to February), Spring (March to May), Summer (June to August), Autumn season (September to November).

Statistical analysis: The significance of prevalence between different groups was determined using χ^2 - test. The differences were regarded significant if p-value was <0.05 . The prevalence was compared for different seasons, age groups, parity and pregnancy status. For statistical comparisons of prevalence, cattle were divided into groups based on age (Group I: upto 3 years; Group II: 4-6 years; Group III: > 6 years). Odds and odds ratios were calculated and compared for different seasons and age groups. Further percent prevalence was presented for different calving statuses.

The present study provided critical insights into the descriptive epidemiology of TRP, contributing valuable data to fill existing knowledge gaps, particularly in the Indian context. To best of our knowledge, this is the first retrospective study to document prevalence of TRP from Kashmir Valley. Out of 2339 cattle, 46 were reported to be suffering from TRP, with an overall prevalence of 1.97% (Table 1). The observed prevalence in the present study may be either underestimated or overestimated, as OPD records for all registered cases were not available for retrospective analysis. The actual prevalence at field level may be higher, owing to the fact that not all TRP are being presented to the Referral Hospital as many cases are being treated at the field level. Moreover, this prevalence should not be generalized to the broader population of cattle, since it is obtained from analysis of passive data collection from a referral-level hospital. However, these findings may be reasonably applicable to similar veterinary healthcare facilities within the Kashmir region. Earlier clinical cases of TRP were reported sporadically from different areas of Kashmir valley and at Veterinary Clinical Complex, Faculty of Veterinary Sciences and Animal Husbandry, Shuhama, Srinagar . However, due to change in husbandry practices towards intensive rearing, TRP is now reported frequently. The available literature also suggested that TRP is a significant abdominal disorder in cattle, particularly in regions where intensive farming practices and access to metallic or indigestible foreign materials are prevalent

Table 1. Prevalence of Traumatic reticuloperitonitis in cattle

Season	TRP Cases	TRP negative	Total	Odds
Winter(Dec, Jan, Feb)	4(1.04) ^a	379(98.96)	383	4/379=0.0106
Spring(March, April, May)	20(3.50) ^b	550(96.5)	570	20/550=0.0364
Summer(June, July, August)	12(1.53) ^a	772 (98.47)	784	12/772=0.0155
Autumn(Sept, Oct, Nov)	10(1.66) ^a	592 (98.33)	602	10/592=0.0169
Total	46 (1.97)	2293(98.03)	2339(100)	

The values in a column with different superscripts differ significantly ($p<0.050$); The numbers in parenthesis represent row percentages

(Cramers *et al.* 2005, Constable *et al.* 2017). It is almost non-existent in cattle reared exclusively on pasture (Constable *et al.* 2017).

Among 46 TRP cases, 11 cattle had complications/ sequelae of TRP (11/46) constituting 23.9% cases of TRP that included traumatic pericarditis (n=7), generalized peritonitis (n=2), reticular diaphragmatic hernia (n=1) and reticular abscess (n=1). These sequelae have been well documented in the standard text books of Veterinary Medicine (Constable *et al.* 2017) and many studies. The commonly reported complications of TRP are traumatic pericarditis (Braun *et al.* 2009, Hussain *et al.* 2018), vagal indigestion (Rebhun *et al.* 1988, Rehage *et al.* 1995), generalised peritonitis (Shah 2010), reticular diaphragmatic hernia (Hussain *et al.* 2015, Hussain *et al.* 2021b), reticular abscess (Hussain *et al.* 2015, Hussain *et al.* 2024) and hepatic inflammation or abscesses (Braun *et al.* 1995).

The prevalence of TRP in this study was lower than the historical reports from Western countries, where prevalence rates were 80% decades ago (Maddy 1954) and then decreased to 8-10% (Cramer *et al.* 2005; Waldner *et al.* 2009). This decline in west could be attributed to improved management practices, such as the use of rumen magnets and better feed quality control (Constable *et al.* 2017). The prevalence in this study was also lower than studies from Ethiopia, where estimates ranged between 17.2% and 40.1% (Farooq *et al.* 2020, Ame *et al.* 2022). This variation may be attributable to regional disparities in husbandry practices, dietary composition, and access to veterinary healthcare services. Furthermore, the comparatively elevated prevalence reported in those studies is likely influenced by their methodological approach, as they were based on post-mortem evaluations. Necropsy-based assessments allow for meticulous examination of the rumen and reticulum, thereby facilitating comprehensive detection of ingested foreign materials. In contrast, the present study relied primarily on radiographic diagnosis. Radiography may fail to identify certain foreign bodies within the reticulum due to variations in their physical characteristics, anatomical positioning, and dimensions. A previous investigation (Starke and Rehage 2000) reported prevalence of TRP (2-3%) similar to our study.

A survey conducted in Denmark reported that over 16% of foreign body occurrence was detected among 1491 slaughtered dairy cattle, whereas routine abattoir-based investigations have documented a markedly lower incidence of less than 2% (Cramers *et al.* 2005). An epidemiological analysis involving 61,124 Ayrshire cattle demonstrated a lactational incidence risk of TRP of 0.6% (Grohn and Bruss

1990). This prevalence exceeded that of several commonly encountered conditions, including uterine and vaginal prolapse, abortion, mammary edema, abomasal disorders, hypomagnesemia, and ruminal acidosis. In the Indian context, such large-scale epidemiological assessments remain limited, and available insights are often derived from clinical case presentations at veterinary hospitals. In one investigation (Shah, 2010), 48.13% (129/268) of cases undergoing radiography and/or rumenotomy were found to have foreign bodies in the reticulum. Another study has reported, annual case incidence of foreign body syndrome in cattle to be 0.78% (Hussain and Uppal 2015).

Seasonal Prevalence: The prevalence was highest during spring season (3.50%) (Table 1). A statistically significant difference ($p < 0.05$) was noted in the prevalence between different seasons, with spring season showing significantly higher prevalence compared to other seasons. Similar to our results, in a previous study from Punjab, most cases of foreign body syndrome were presented during the months of April, May and June (Hussain *et al.* 2015) and in general forestomach disorders were prevalent during summer and rainy seasons (Sharma *et al.* 2015). The exact cause for higher prevalence during spring season could not be established as the data is of a referral hospital, and it is difficult to conclude firmly regarding seasonality because of the low number of cases. However, by this study, it was established that there is certain correlation between TRP and season. One study has reported seasonal trend, where the ingestion of foreign bodies has been associated with specific feeding practices (Kabede *et al.* 2020). The odds of TRP for the four seasons are shown in table 1 and 2. The significantly higher odds of TRP in spring compared to all other seasons indicate that spring was the high-risk season in this study (Table 2). The odds for winter, summer, and autumn were almost similar as there was no significant differences among them. The cattle in spring had approximately 3.4 times higher odds of TRP compared to winter. This seasonal pattern is valuable for veterinary planning i.e. increased monitoring and preventive measures during March–May (spring) would be most impactful.

Distribution with respect to sex, breed, age and parity: In the study, all the TRP affected cattle were females. Most of the cattle were Holsteins Fresian Cross and Jersey breed or its cross, and did not indicate any true breed predisposition, as these breeds constituted majority of the clinical population. Out of 46 TRP cases, majority were observed in group I cattle (47.82%) (Table 3). The prevalence was significantly ($p < 0.05$) higher in group I cattle compared to group III cattle. The prevalence did

Table 2. Odds Ratios for different seasons (Reference: Spring - highest risk season)

Comparison	Odds Ratio	95% CI	p-value	Interpretation
Summer vs. Spring	0.43	0.21-0.86	0.017	57% lower odds (significant)
Autumn vs. Spring	0.46	0.22- 0.97	0.04	54% lower odds (significant)
Winter vs. Spring	0.29	0.10- 0.85	0.023	71% lower odds (significant)

Table 3. Prevalence of traumatic reticuloperitonitis with respect to age of cattle

Age Group	TRP Cases	TRP Negative	Total	Prevalence	Odds
Group I (Upto 3 yr)	22 ^b	434	456	4.82%	22/434 = 0.0507
Group II (4-6 yr)	16 ^{ab}	1185	1201	1.33%	16/1185 = 0.0135
Group III (>6 yr)	8 ^a	674	682	1.17%	8/674 = 0.0119

The values in a column with different superscripts differ significantly ($p < 0.050$)

Table 4. Odds ratios for different age groups of cattle with TRP

Comparison	Odds Ratio	95% CI	p-value	Interpretation
Group II vs. Group I	0.27	0.14 -0.51	<0.001	73% lower odds (highly significant)
Group III vs. Group I	0.23	0.11- 0.51	<0.001	77% lower odds (highly significant)
Group III vs. Group II	0.88	0.36- 2.14	0.78	No significant difference

not differ significantly between group I and group II or between group II and group III cattle. Statistical analysis indicated significant differences among the age groups. So younger animal seemed to be more sensitive to TRP in this study, but the actual reason for this age trend could not be explained with certainty. However, this finding aligned with studies which associated younger animals with exploratory feeding behaviours and a higher likelihood of ingesting foreign materials (Kabede *et al.* 2020). But this contrasts with the findings of Jebessa *et al.* (2018), who reported higher prevalence in older animals, possibly due to cumulative exposure over time.

The odds of TRP for different age groups are presented in table 3 and odds ratios in table 4. Group I (≤ 3 years) had significantly higher odds of TRP compared to both older groups. Groups II and III have roughly 3.5–4 times lower odds than Group I, with no significant difference between them. The pattern is somewhat counterintuitive, one might expect older cattle to have higher TRP prevalence, but this study showed the opposite. The present data indicated that age as a strong protective factor - cattle >3 years have ~73–77% lower odds of TRP. This was an important finding for prevention strategies and it is recommended that targeting management interventions at younger animals might be most effective.

The prevalence differed significantly ($p < 0.05$) among the three parity groups (Table 5). TRP was significantly ($p < 0.05$) higher in cows with 0-2 parity (69.56%). This finding was consistent with the hypothesis that younger, less experienced cows are more prone to ingesting foreign materials. Decreased risk of TRP with increasing parity has also been reported in one previous study (Grohn and Bruss 1990).

Distribution with respect to pregnancy and Calving Status: TRP was more prevalent in pregnant animals (65.21%) than in non-pregnant animals (34.78%), and this difference was statistically significant ($P < 0.05$). These findings suggested that pregnancy status might be an important factor influencing the likelihood of developing TRP and pregnancy significantly increased the risk of TRP. This aligns with the well-documented role of increased

Table 5. Occurrence of traumatic reticuloperitonitis with respect to pregnancy and calving status

Calving Status	No. of Cases	Percentage
Non Pregnant Heifer	1	2.17
Pregnant Heifer	6	13.04
Upto 15 Days	2	4.34
16days- 1 Month	7	15.21
2-4 Months	8	17.39
>4 Months	22	47.82

intra-abdominal pressure during pregnancy in predisposing to reticular perforation (Constable *et al.* 2017). Majority (69.6%) of TRP affected cattle were in heifers, or in 1st-2nd parity, 24% were in 3rd -4th parity and 6.5% were in >4th parity. In this study, TRP was most prevalent in cattle that had calved >2 two months back (65.21%) (Table 5) with 47.82% having calved >4months back. This finding is contrary to the usual pattern where TRP is most common in the early postpartum period. In this study, only nine cases (19.55%) were observed in early postpartum period while another seven cases were recorded in pregnant (2.17%) or non-pregnant heifers (13.04%) heifers.

The findings of this study aligned with, and occasionally challenge, prior literature, offering opportunities for refining clinical practices and preventive strategies. Prevalence was significantly higher in spring months of the year. Young cattle were more susceptible to the disease. The predisposition of young cattle to this disorder needs further substantiation. The prevalence was significantly higher in pregnant cattle than the non-pregnant but parturition seems to play a minor role in development of TRP and its sequelae.

SUMMARY

This retrospective study was carried out to document prevalence of TRP and its sequelae in cattle. The prevalence of TRP was studied over a period of one-year (November 2023 to October 2024). The diagnosis of TRP was based on clinical examination, radiography and/or ultrasonography.

The prevalence of TRP was 1.97%. The sequelae of TRP were traumatic pericarditis, generalized peritonitis, reticular diaphragmatic hernia and reticular abscess. The prevalence of TRP was highest ($p < 0.05$) during spring season followed by summer, autumn and winter seasons of the year. The prevalence was significantly ($p < 0.05$) higher in younger (< 3 year) than older cattle (> 6 year), and significantly ($p < 0.05$) higher in pregnant than the non-pregnant cattle. Due to increased occurrence of TRP in Kashmir and India, prophylactic use of magnets should be promoted as a means to reduce the occurrence of TRP. The prevention strategies targeting interventions at younger animals might be most effective.

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