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Investigation of disorders of thoracoabdominal region based on ultrasonography finding and ultrasound guided sample collection in cattle

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Abstract
The present study aimed to characterize thoracoabdominal disorders in bovines using clinical assessment, ultrasonography, and surgical or postmortem confirmation. Forty-one bovine cases were comprehensively evaluated. Each animal underwent detailed clinical examination, transabdominal and transthoracic ultrasonography, and diagnostic interventions including fluid centesis, contrast radiography, and biopsy. Ultrasound findings were compared against exploratory or postmortem outcomes to determine diagnostic reliability. Signalment analysis revealed a predominance of females (85.37%) and a peak incidence in animals aged 3-6 years. Traumatic pericarditis was the most prevalent thoracic disorder, confirmed by ultrasound-guided pericardiocentesis. Concurrent pleural and pericardial effusions were also identified. Diaphragmatic hernia presented as biphasic reticular motility within the thoracic cavity. Gastrointestinal disorders constituted the majority of cases, with ruminal dysfunctions, reticuloperitonitis, and intestinal obstruction frequently diagnosed through ultrasonographic parameters such as loop diameter and motility. Urogenital and umbilical conditions, including omphalitis, urinary bladder rupture, and pervious urachus, were evaluated using targeted imaging and contrast studies. External swellings and hernias were differentiated using transcutaneous ultrasound and fine-needle aspiration. Ultrasonography proved to be a reliable, non-invasive diagnostic modality for detecting thoracoabdominal pathologies in bovines, enhancing clinical decision-making and improving patient outcomes through targeted therapeutic interventions.

Keywords: Cattle, ultrasound, thoracoabdomen

Introduction
Bovine patients presenting with systemic illnesses frequently exhibit non-specific clinical signs, with reduced appetite being a common primary complaint. Initial assessment in such cases necessitates a thorough evaluation of the thoracoabdominal region, as this anatomical compartment encompasses vital organ systems frequently implicated in systemic pathologies. Despite detailed physical examination, encompassing parameters such as altered heart sounds, abdominal distension, abnormal gastrointestinal auscultation, and variations in faecal quantity and consistency etc., the findings often lack specificity. This non-specificity complicates accurate localization of the underlying lesion and hinders early clinical decision-making. Conventional radiographic imaging of thoracoabdominal structures in adult bovines is inherently challenging due to several anatomical and logistical constraints. The large body size, extensive overlap of the rumen, and difficulty in achieving optimal radiographic positioning significantly limit the diagnostic utility of radiographs in this context. In response to these limitations, ultrasonographic imaging has gained prominence as a non-invasive and dynamic diagnostic modality (Braun, 2003; Andersen *et al.*, 2019) [5, 2]. It offers superior visualization of soft tissue structures, facilitates lesion localization, and enhances diagnostic precision in evaluating thoracoabdominal disorders. Ultrasonography allows for targeted examination without the need for sedation or extensive restraint, making it particularly advantageous in field and clinical settings. Therefore, the current study was undertaken to evaluate the diagnostic efficacy of ultrasonography in identifying thoracoabdominal disorders in bovines. Additionally, it aimed to determine the prevalence of various such conditions among the presented cases, thereby contributing to evidence-based diagnostic protocols.

Materials and Methods

The present study was conducted on bovine cases presented to the Department of Veterinary Clinical Complex, Veterinary College, Shivamogga, Karnataka, between January 2015 and December 2016. Cases included for analysis were those that underwent comprehensive evaluation comprising clinical examination, ultrasonographic assessment, and either exploratory surgery or postmortem confirmation

Data pertaining to breed, age, sex, and presenting complaints were recorded. Each animal was subjected to thorough physical evaluations that included auscultation and palpation. Transabdominal and transthoracic ultrasonography was performed using a portable ultrasound unit equipped with 3.0-5.0 MHz convex probe. Various structures in the region were imaged through appropriate anatomical location of ultrasound as described by Gouda, 2015 [10].

The evaluation criteria included assessment of organ location, structural integrity, motility, functional activity, intestinal lumen diameter and wall thickness, as well as the presence of fluid, masses, or adhesions.

Complementary diagnostic procedures included Rumenocentesis, Pericardiocentesis, Thoracocentesis, and Abdomenocentesis for fluid evaluation (Fig 1); Fine needle aspiration for subcutaneous swellings; Contrast radiography for congenital urinary anomalies; Biopsy for hepatic conditions. Cases unresponsive to medical therapy or presenting with diagnostic uncertainty were subjected to exploratory laparotomy or thoracotomy. Postmortem examination was performed in cases of euthanasia to confirm clinical and imaging findings.

The data was analysed using basic comparative tabulation and frequency statistics to identify clinical trends and diagnostic reliability. Figures and tables were constructed using Microsoft Excel to visualize distribution patterns and facilitate interpretation.

Fig 1: Ultrasound guided pericardiocentesis.

Results and discussion

Forty-one bovine clinical cases were evaluated to characterize thoracoabdominal disorders through clinical presentation, ultrasonographic assessment, and exploratory findings in the present study. Various disorders diagnosed with the ultrasound assistance were shown in Fig 2.

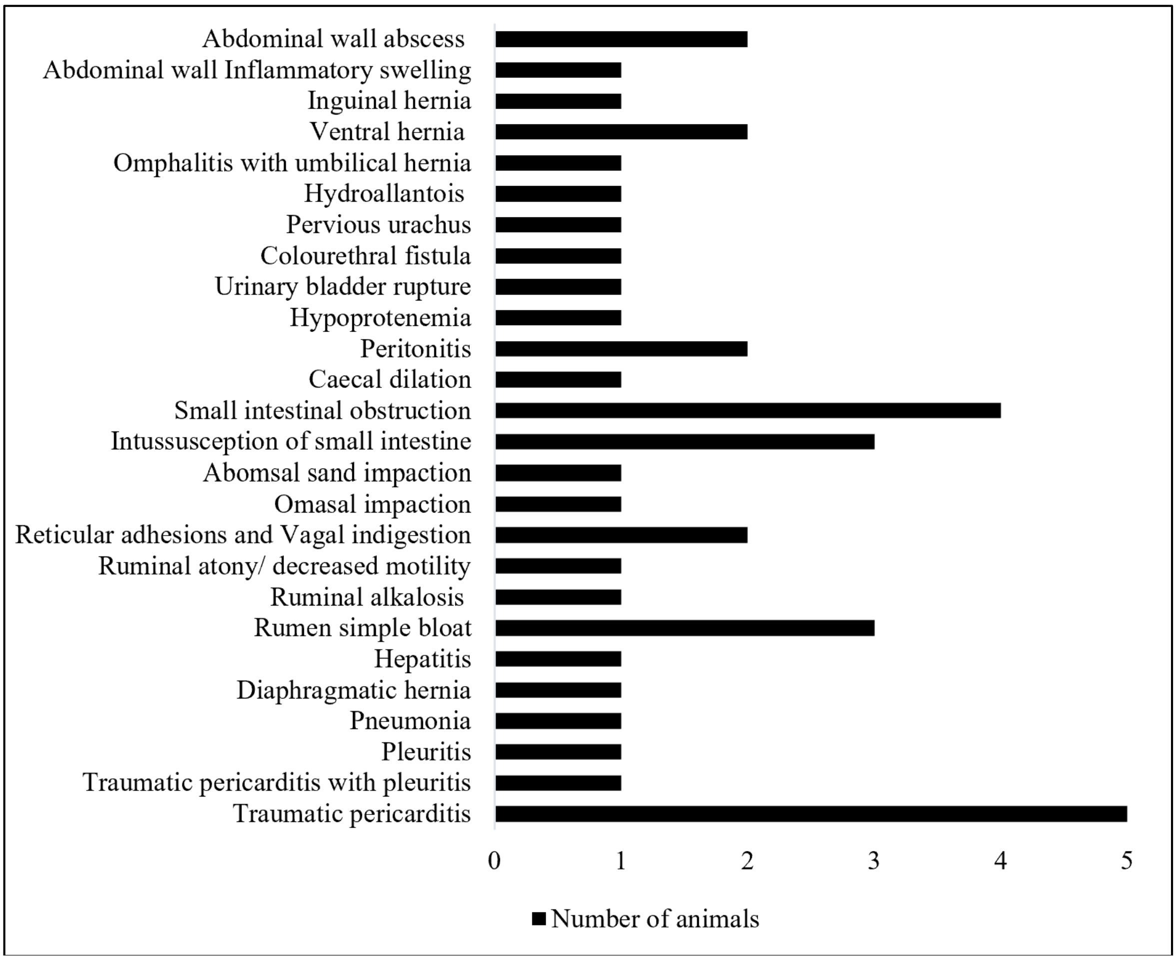

Fig 2: Ultrasound assisted disease diagnosis in thoracoabdominal region in cattle (n=41)

Signalment analysis revealed a strong female predominance (85.37%), with about half of the cases occurring between 3 to 6 years of age (56.10%) (age range 3days to 15years old), corresponding with peak physiological performance and susceptibility to production-related disorders. Breed-wise distribution highlighted Holstein Friesian as the most affected (Table 1). Older Jersey and Holstein Friesian breeds were more prone to cardiothoracic issues, while younger calves faced congenital or umbilical disorders (omphalitis, pervious urachus). This age-specific distribution can support preventive protocols based on breed and life stage.

Table 1: Breed Distribution of cattle affected with thoracoabdominal disorders

Breed	No. of Cases (n=41)	Percentage (%)
Holstein Friesian	16	34.1%
Jersey	13	29.3%
Non-Descript	09	24.4%
Hallikar	02	4.9%
Red Sindhi	01	2.4%

Traumatic pericarditis was the most frequent thoracic diagnosis especially in older cattle. Ultrasonographic features included hypoechoic pericardial effusion (Fig 3), thickened myocardial borders, and loss of cardiac silhouette clarity, often accompanied clinically by muffled heart sounds, brisket oedema, and abducted elbows. Fluid obtained via ultrasound guided pericardiocentesis was foul-smelling and serofibrinous, corroborating septic pericarditis. These echographic patterns are comparable to those documented by Buczinski, 2009 [8] and Tharwat, 2011 [13]. Pleuritis were detected as anechoic fluid in the pleural cavity with consolidated parenchyma (Fig 4). A case with change in the echotexture of lung structures showing hypoechoic zones on the lung surface was diagnosed as pneumonia as described by Babkine and Blond, 2009 [4]. Presence of concurrent pericardial and pleural effusion, highlighting the potential for combined thoracic pathology. Ultrasonography of the bovine respiratory system offers a non-invasive and accessible modality for accurately assessing pleural structures and superficial pulmonary lesions (Babkine and Blond, 2009) [4]. Thoracic ultrasound was also useful for accurate thoracocentesis for further investigation (Braun *et al.* 1997) [7].

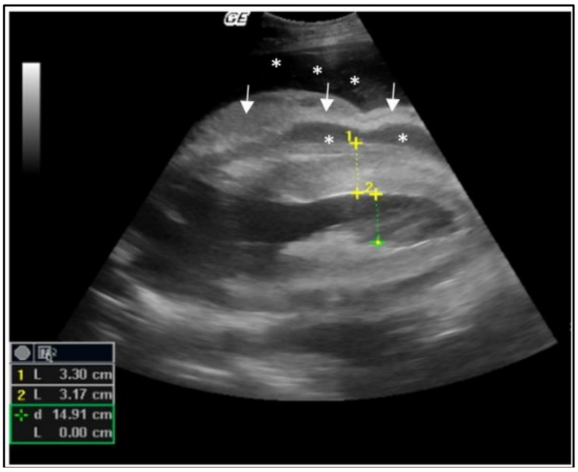

Fig 3: Left 5th ICS transthoracic ultrasound showing anechoic pericardial effusion (*) with hypoechoic thick fibrin strand (arrows).

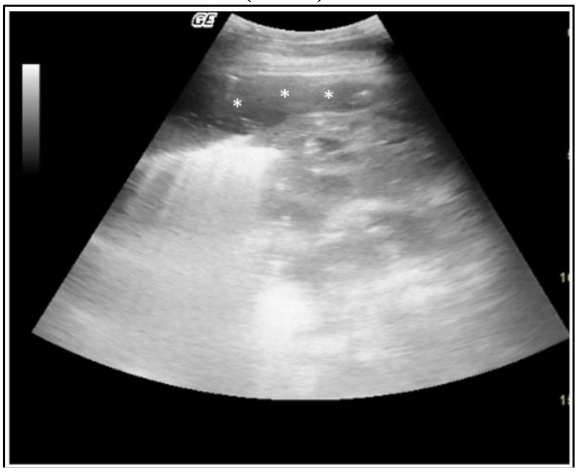

Fig 4: Left 6th ICS transthoracic ultrasound showing anechoic pleural effusion (*)

Diaphragmatic hernia was evident by slow but biphasic contraction of reticulum in thoracic region, assessed as described by Athar *et al.*, 2010 [3]. Biopsy a case with hepatomegaly and congestion on ultrasound was suggestive of hepatitis (Fig 5). Ultrasound study of hepatic structure can be useful for diagnosis of focal lesions, fatty liver, congestion and enlargement (Abdelaal *et al.*, 2019) [1].

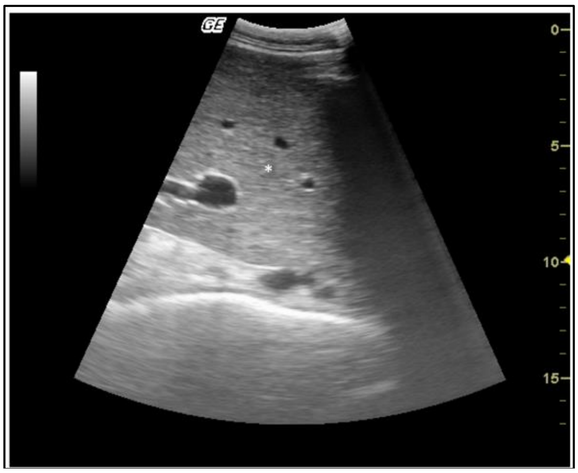

Fig 5: Right 11th ICS transabdominal ultrasound showing congested liver (*)

Gastrointestinal diseases constituted the largest diagnostic group. Ruminal dysfunctions including frothy bloat, ruminal alkalosis, and vagal indigestion were confirmed via rumenocentesis and sonography, demonstrating absent ruminal motility and gas-fluid interfaces extending into the right abdominal quadrant. Reticuloperitonitis and peritonitis showed free echogenic fluid pockets (Fig 6) and fibrin strands between visceral organs similar to Braun, 2003 [5].

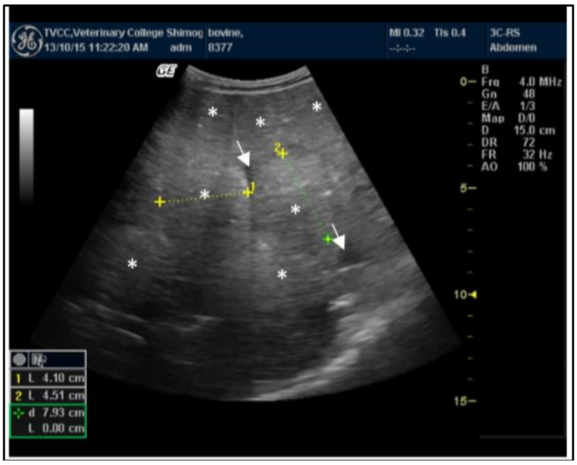

Fig 6: Right lower flank transabdominal ultrasound showing multiple distended intestinal loops (*) with anechoic fluid between the lumen (arrows).

Ruminal distension on left-side and normally contracting empty intestines on right side of the abdomen were ultrasound features in omasal and abomasal impaction, however, diagnosis was made after exploratory laparotomy. Intestinal obstruction and intussusception were characterized ultrasonographically by multiple dilated, non-motile, fluid filled intestinal loops exceeding four centimetre in diameter with hyperechogenic serosa (Fig 7). These findings are consistent with Braun *et al.*, 2012 [6], who identified loop diameter and motility as critical metrics for diagnosing mechanical ileus in cattle. Caecal dilation was identified by gas-filled distension of the caecal region similar findings were documented by Braun *et al.*, 2012 [6].

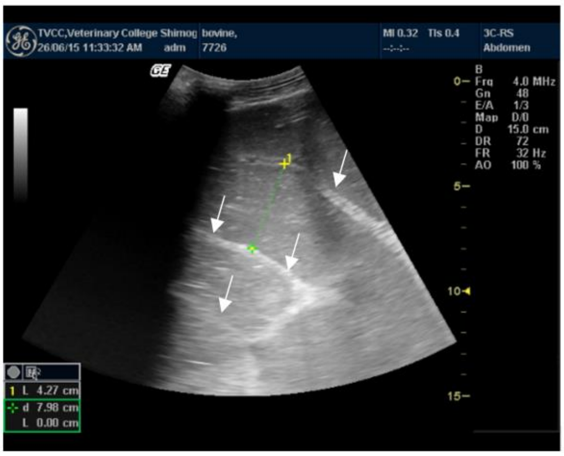

Fig 7: Right lower flank transabdominal ultrasound showing multiple distended intestinal loops with hyperechoic serosa (arrows).

Six cases involved hernias or external swellings. Traumatic ventral hernias were confirmed by transcutaneous ultrasonography showing intestinal loops within subcutaneous tissue planes, especially in the inguinal and right flank regions. Fine-needle aspiration (FNA) differentiated abscesses from herniated structures in two cases. Hydroallantois was diagnosed via detection of excessive foetal fluid with concurrent uterine distension. Urogenital and umbilical disorders cases included omphalitis with hernia, urinary bladder rupture, colourethral fistula, and pervious urachus. Diagnosis was confirmed using ultrasound-guided fluid aspiration and contrast radiography, delineating patent ducts and displaced urinary structures. Transabdominal ultrasound provides high quality images for evaluation of abdominal wall and urogenital structures (O'Brien and Forrest, 1996; Floeck, 2009; Ribadu and Nakao, 1999) [11, 9, 12].

Conclusion
Ultrasound-guided diagnoses showed 92.8% accuracy when validated against exploratory or postmortem findings. Imaging consistently predicted the need for surgical intervention in cases with dilated, immotile loops, fluid accumulations, and displaced organs. Diagnostic confirmation through ultrasonography, paired with targeted centesis procedures, reduced exploratory uncertainty and improved case outcomes.

Conflict of Interest
The authors declare that they have no conflicts of interest.

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