



RESEARCH ARTICLE

Ultrasonographic imaging of normal reticulum and traumatic reticuloperitonitis
in crossbred cows

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Özet

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Amaç: Çalışmada, sağlıklı melez ineklerde retikulumun ultrasonografik olarak incelenmesine dayalı gözlemlerin tanımlanması ve travmatik retikiloperitonitisli ineklerle karşılaştırılması amaçlanmıştır.

Gereç ve Yöntem: Ultrasonografik incelemeler gebe olmayan 10 adet inekte gerçekleştirildi. Retikulum median, sağ paramedian ve sol paramedian bölgelere ilaveten sol 7. ile 5. interkostal aralıkta ve sağ 7. ile 6. interkostal aralıkta dirsek seviyesinde görüntüldü. Aynı zamanda travmatik retikiloperitonitisli inekler, klinik olarak sağlıklı ineklerle karşılaştırmak için ultrasonografik olarak değerlendirildi.

Bulgular: Retikular duvar, diyaframın kaudalinde ve bitişik kalın ekojenik bir hat olarak görüldü. İlk retikuler kontraksiyonun genişliği 5.6'dan 10.4 cm'ye kadar değişmekteydi. Retikulum ve diyafram arasındaki ekojenik bandlar ve retikulum, rumen, dalak, karaciğer ve omasumun yüzeyinde gözlenen heterojen ekoyapıların (ekojenik fibrin ve hipoejojenik sıvıdan meydana gelen) tabakaları lokal peritonitisli göstermektedir.

Öneri: Ultrasonografinin daha fazla rutin kullanımı sadece klinik inceleme ile tespit etmesi zor olan travmatik retikiloperitonitisin ve onun yol açtığı hasarın erken teşhisine yardımcı olabilir.

Abstract

Imran S, Sharma S, Bhat AA. Ultrasonographic imaging of normal reticulum and traumatic reticuloperitonitis in crossbred cows. *Eurasian J Vet Sci*, 2012, 28, 4, 214-219

Aim: To describe observations based on ultrasonographic examination of the reticulum in healthy crossbred cows and to compare with cows suffering from traumatic reticuloperitonitis.

Materials and Methods: Ultrasonographic examinations were performed on 10 non-pregnant cows. The reticulum was scanned at the level of elbow in the left 7th to 5th intercostal spaces (ICs) and the right 7th to 6th ICs as well as in the median, the right paramedian, and the left paramedian regions. Crossbred adult cows suffering from traumatic reticuloperitonitis were also evaluated ultrasonographically for comparison with the clinically healthy cows.

Results: The reticular wall was seen as a thick echogenic line adjacent and caudal to diaphragm. The amplitude of the first reticular contraction ranged from 5.6 to 10.4 cm. Echogenic bands between the reticulum and the diaphragm, and deposits of heterogeneous echostructures (consisting of echogenic fibrin and hypoechogenic fluid) on the surfaces of reticulum, rumen, spleen, liver, and omasum were observed, representing local peritonitis.

Conclusions: More routine use of ultrasonography may aid in early diagnosis of traumatic reticuloperitonitis and detection of its sequelae, which are difficult to detect by clinical examination alone.

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► Introduction

A knowledge of the topographic relations of the reticulum to the body wall is essential for its clinical and ultrasonographic examinations from the exterior or as well as for laparotomy. External palpation and observation of the reticulum is not possible because of its mainly intrathoracic position and the tension of the abdominal wall around the xiphoid cartilage. Acoustic percussion and auscultation are of minor importance in comparison with foreign body tests for sensitivity to pain. Diagnostic aids include the metal detector and exploratory rumenotomy. Radiography and reticulography may be useful in doubtful cases, though their use is confined to suitably equipped clinics. Laparoscopic observation of the reticulum is of no practical importance (Dirksen 1979). Ultrasonography has been proposed as a noninvasive and helpful method for the assessment of contour and motility of the reticulum in healthy cows (Braun and Götz 1994, Braun et al 2008), and also for the diagnosis of traumatic reticuloperitonitis in bovines (Braun et al 1993, Braun et al 1994, Ramprabhu et al 2003, Abdelaal et al 2009, Athar et al 2010).

The purpose of the present study was to describe observations based on ultrasonographic examination of the reticulum in healthy Indian Jersey/Red Sindhi crossbred cows and to compare these results with the ultrasonographic findings in cows suffering from traumatic reticuloperitonitis.

► Materials and Methods

• Healthy cows

Ultrasonographic examinations were performed on 10 non-pregnant, clinically healthy crossbred Jersey/Red Sindhi cows. The cows were considered to be clinically healthy based on the results of routine physical examination and a complete blood count (CBC). The cows were between 4–12 years old and weighed approximately 300–450 kg. Ultrasonography was performed on non-sedated, standing animals using a BPL US 9101 ultrasound machine with a 3.5 MHz curvilinear transducer. The reticulum was scanned at the level of elbow in the left and the right 7th to 5th intercostal spaces (ICSs) as well as in the median, the right paramedian, and the left paramedian regions as per Braun and Götz (1994).

• Cows with traumatic reticuloperitonitis

Seven Jersey/Red Sindhi crossbred adult cows with traumatic reticuloperitonitis were evaluated ultrasonographically for comparison with the clinically healthy cows. Ultrasonography was performed in a manner similar to that of the healthy cows. The cows were referred to the teaching veterinary clinical complex, CSKHPKV, Palampur for evaluation of suspected forestomach disorders. Generally, the history included relapsing fever, inappetence, ventral edema,

progressive abdominal distention, diarrhea, and fall in milk yield ranging from 20 days to 2.5 months. All the animals were refractory to various symptomatic medical treatments attempted at the field level. On clinical examination, the cows were found to be mildly depressed, dehydrated and reluctant to move. Tachycardia, kyphosis, bruxism, and painful respiratory grunt on tracheal auscultation were also seen. Ruminal motility was reduced in 5 cows and absent in rest of the 2 cases. The results of a CBC included polycythemia, leukocytosis with mature neutrophilia, and lymphopenia, consistent with dehydration and stress. Various clinical parameters recorded have been tabulated (Table 1).

Table 1: Clinical parameters recorded in cows with traumatic reticuloperitonitis.

Parameters	Reference range	Mean values
Rectal temperature	101-102 °F	101
Respiration rate	25 breaths/min	35.7
Hematocrit	23-36%	32.4
Neutrophils	28%	61.2
Heart rate	60-80 beats/min	97.0
Hemoglobin	7.5-12.5 g/dL	7.94
Leukocytes	4-20 ×10 ³ /μL	22.7
Lymphocytes	58%	36.8

Upon radiographic examination, multiple potential metallic foreign bodies were observed inside the area of reticulum and thorax in only 3 cows; whereas, no foreign body was detected in rest of the 4 cases. Diaphragmatic adhesions with thoracic organs were seen in 3 of 7 animals, and poor thoracic details which included indistinguishable diaphragmatic outline and cardiophrenic silhouette were observed in rest of the 4 cows.

Exploratory laparotomy was done in 2 cows. Surgical intervention was limited to evacuation of 3/4th of the reticulo-ruminal contents and removal of the foreign bodies. Potentially penetrating and non-penetrating foreign bodies were recovered from the reticulum. Mild reticulophrenic adhesions were also recorded.

► Results

• Healthy cows

The reticular wall was seen as a thick echogenic line adjacent and caudal to the diaphragm (Figure 1). The wall was smooth with a curvature towards its caudal end on the dorsal side. The diaphragm was identified as a curvilinear echogenic band just adjacent to the spleen and the reticulum. The abdominal wall could be differentiated from the diaphragm easily as former consisted of layers of alternating echogenicities. The musculophrenic vein was seen as a longitudinal anechogenic band running through the diaphragm, optimally in paramedian position, with transducer placed parallel to the longitudinal axis of the cow.

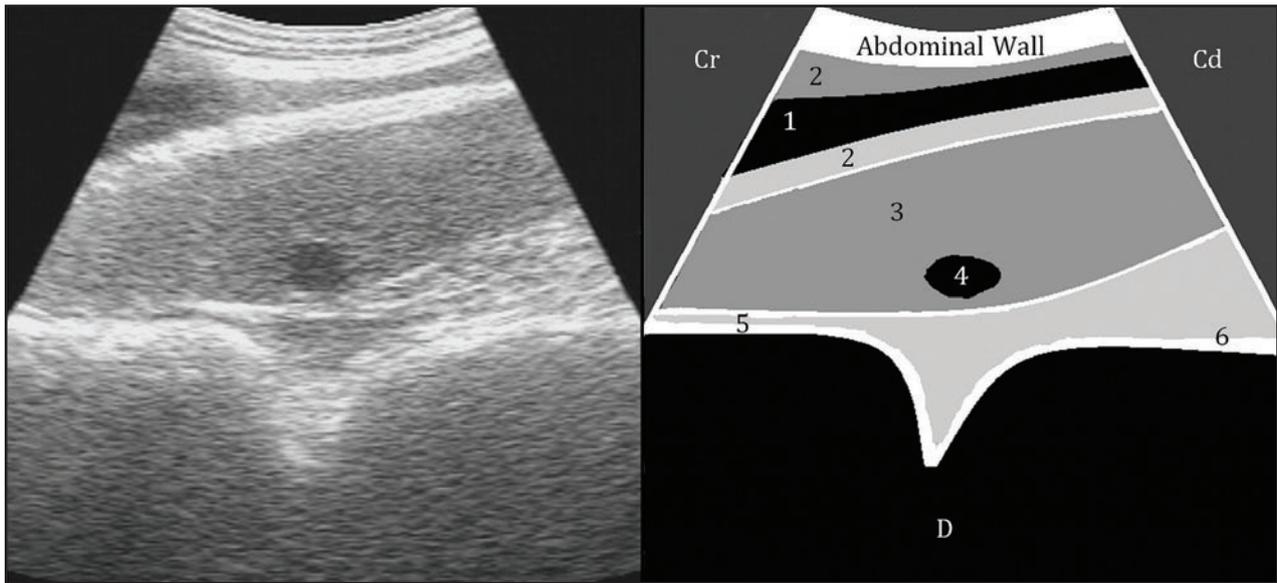


Figure 1. Ultrasonogram of the reticulum and spleen obtained by placing the transducer just ventral to the costal arch of the left 6th to 7th ICS and parallel to the longitudinal axis of the cow. 1: Musculophrenic vein, 2: Diaphragm, 3: Spleen, 4: Splenic vein, 5: Wall of reticulum, 6: Atrium ruminis. Cr: Cranial, Cd: Caudal, D: Dorsal.

Reticular motility was observed for 4-5 minutes and recorded for 2 minutes in each cow. The reticular wall contracted gradually away from the body wall in a pulse-like pattern and then returned towards the abdominal wall with a brief pause, indicating its partial relaxation. A second bigger contraction immediately used to follow in which the reticulum tended to disappear from the screen at the ultrasonic penetration depth of 12 cm. This used to be followed by reappearance of the reticulum within a few seconds until it rested against the body wall in a relaxed state. This contraction pattern recurred approximately every minute. The amplitude of the first reticular contraction ranged from 5.6 to 10.4 cm (7.09±0.50 cm).

Other organs often seen in association with the reticulum were atrium ruminis, ventral ruminal sac, spleen, lungs, abomasum, liver and omasum. The ventral end of the spleen and the reticular wall could be scanned in the left 7th to 6th ICSs in all animals (Figure 2), and in the left 5th ICS in 5 of 10 cows. On the other hand, ventral end of the liver and portion of the omasum were imaged along with the reticulum from the right 6th ICS in all cows (Figure 3), and in the 5th ICS in 5 of 10 animals. A portion of the lung characterized by internal reverberation pattern along with the reticular wall could also be imaged from both the (left/right) sides in all animals, and up to the 5th ICS in 6 of 10 cows.

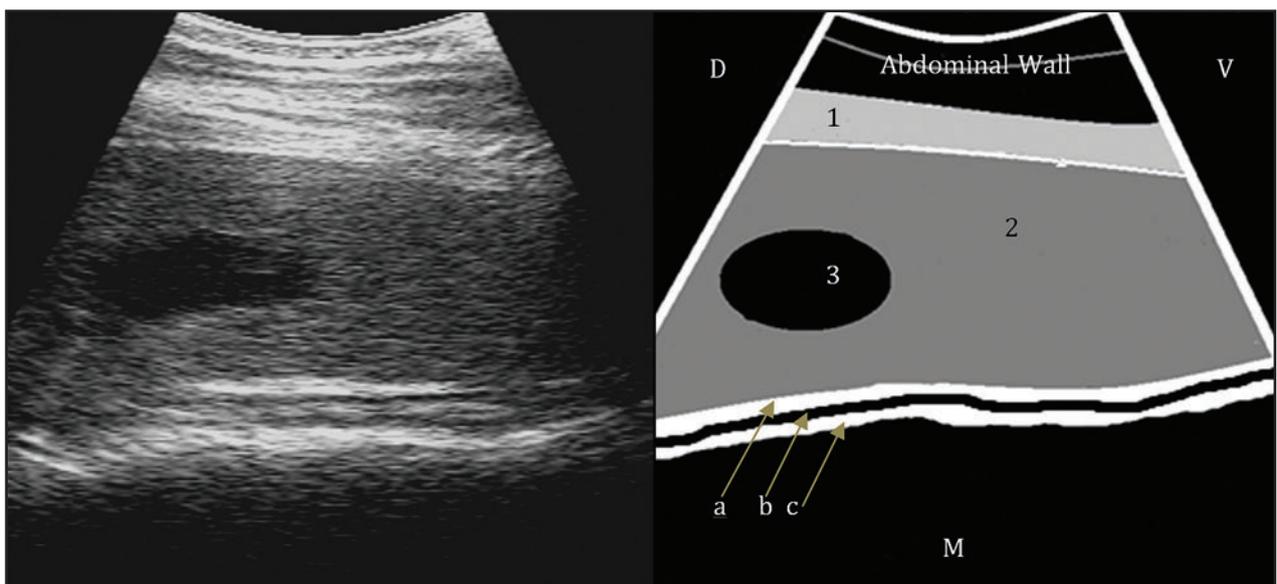


Figure 2. Ultrasonogram of the reticulum and spleen obtained from the left 7th ICS by placing the transducer parallel to the ribs. 1: Diaphragm, 2: Spleen, 3: Splenic vein, a: Tunica serosa of reticulum, b: Tunica muscularis of reticulum, c: Tunica mucosa of reticulum, D: Dorsal, V: Ventral, M: Medial.

• *Cows with traumatic reticuloperitonitis*

Echogenic bands between the reticulum and the diaphragm, and deposits of the heterogeneous echostructures (consisting of echogenic fibrin and hypoechogenic fluid) on the surfaces of reticulum, rumen, spleen, liver, and omasum were also observed, representing local peritonitis (Figures 4 and 5). In 2 animals, reticulum moved with each respiration, indicating the presence of reticular adhesions with the diaphragm. Reduced amplitude and frequency (approximately 1 per 2 minutes) of first reticular contraction was observed in 4 of 7 cows, and the atonic reticulum was seen in the rest of the 3 cows. Foreign bodies seen by radiography could not be imaged ultrasonographically.

► **Discussion**

• *Healthy cows*

The reticulum appeared as a half moon shaped structure with an even contour, situated immediately adjacent to the diaphragm and the ventral abdominal wall in all animals. Reticular motility was characterized by a biphasic contraction pattern with transducer placed on the left ventral thoracic region. However, Braun and Götz (1994) reported invisibility of the reticulum in a few obese animals. This could be due to the fact that the body wall did not attenuate the ultrasound waves as all the animals used in the present study were lean and thin. Braun and Götz (1994) also reported mean amplitude of the first reticular contrac-

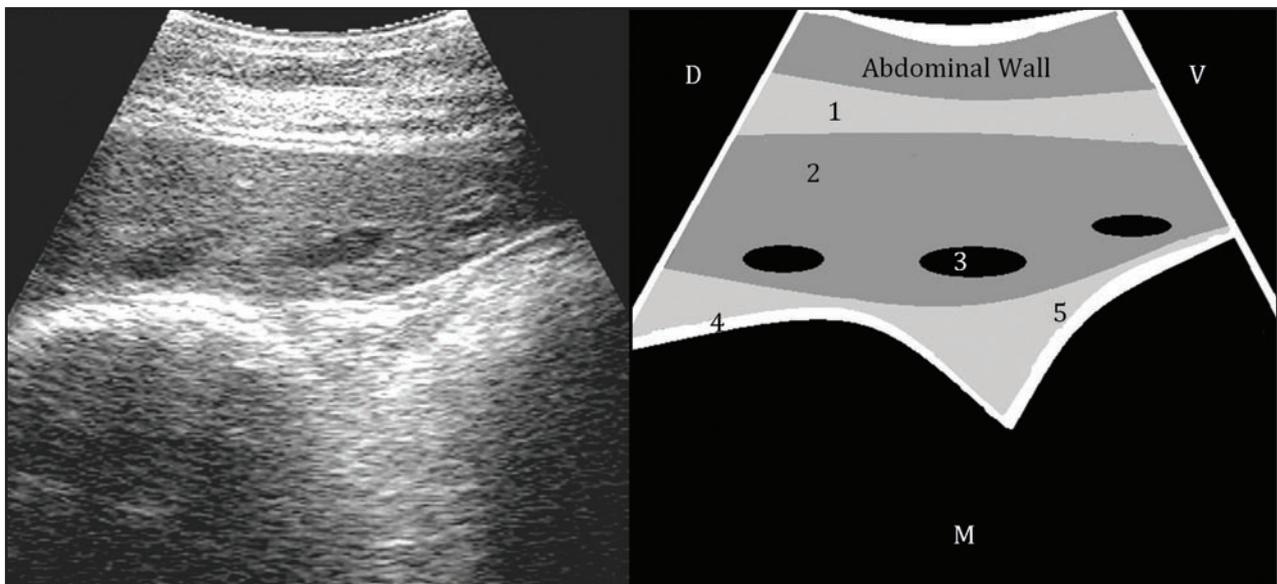


Figure 3. Ultrasonogram of the reticulum, omasum, and liver obtained from the right 6th ICS by placing the transducer parallel to the ribs. 1: Diaphragm, 2: Liver, 3: Hepatic vein, 4: Omasum, 5: Reticulum, D: Dorsal, V: Ventral, M: Medial.

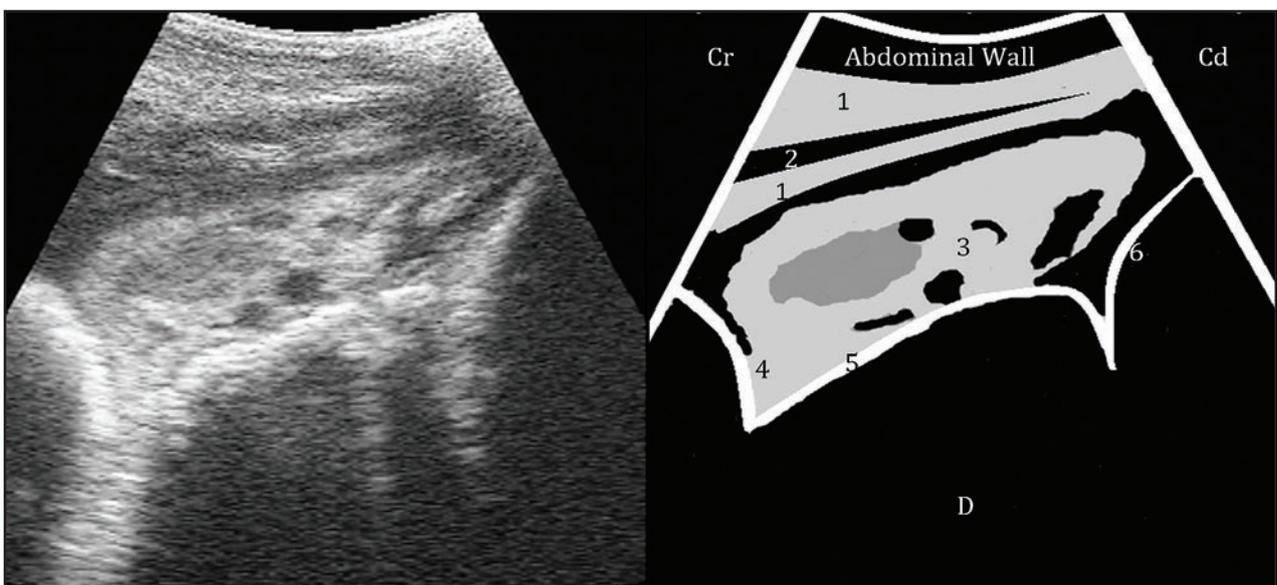


Figure 4. Ultrasonogram of the reticulo-rumen showing adhesions with the diaphragm imaged from the left paramedian side in a cow suffering from traumatic reticuloperitonitis. 1: Diaphragm, 2: Musculophrenic vein, 3: Heterogeneous echostructure consisting of echogenic fibrin and hypoechogenic fluid, 4: Reticulum, 5: Atrium ruminis, 6: Ventral sac of rumen, Cr: Cranial, Cd: Caudal, D: Dorsal.

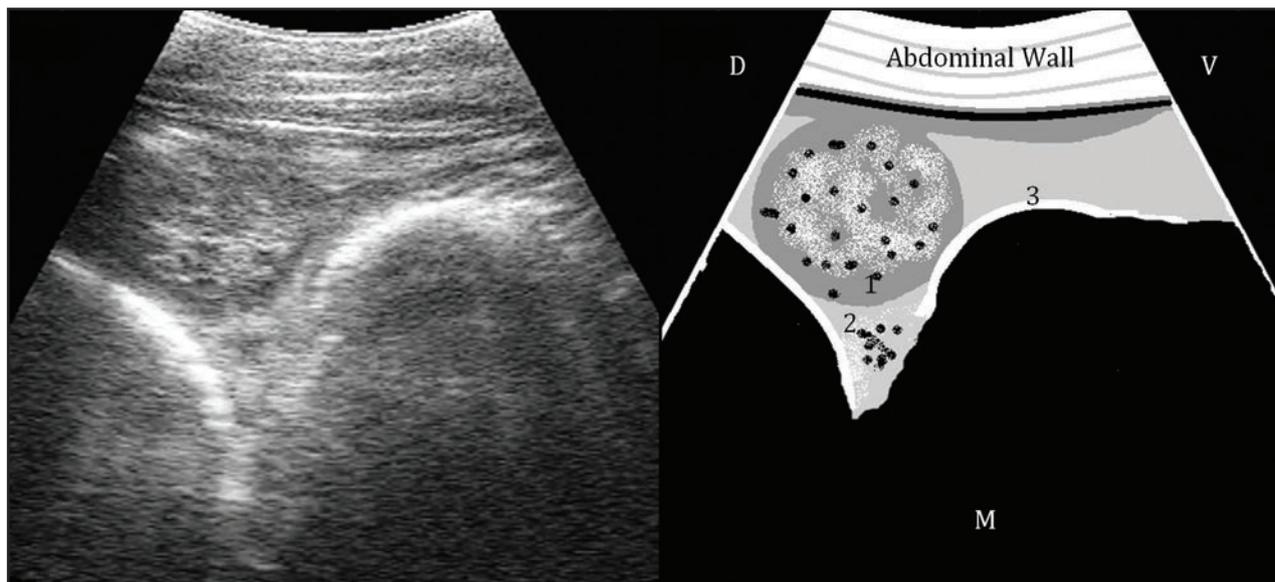


Figure 5. Ultrasonogram of the reticulum and omasum showing adhesions with the body wall imaged from the right 6th ICS in a cow suffering from traumatic reticuloperitonitis. 1: Heterogeneous echostructure consisting of echogenic fibrin and hypoechogenic fluid, 2: Omasum, 3: Reticulum, D: Dorsal, V: Ventral, M: Medial.

tion in the healthy cows as 7.2 ± 2.3 cm. Extra reticular contraction associated with the rumination as reported by Braun and Götz (1994) and Braun et al (2008) could not be recorded in this study. Perhaps, the cows secured in the crate did not ruminate during the examination period due to non-acclimatization with the surroundings of the ultrasonographic examination room. Moreover, in the present study, the reticular mucosal cells or its mucosal projections could also not be observed in any of the cows. This might have been due to smaller sample size in the present study; however, Braun and Götz (1994) reported honeycomb structure of the reticular mucosa with its 1.5-cm-thick cellulae reticuli in a few cows. According to Braun and Götz (1994), the reticulum and ventral part of the spleen could usually be imaged from the 6th and the 7th ICSs on left side of the cow. On the contrary, in our study, the reticulum was imaged in the right and the left 5th ICSs in 5 of 10 animals, which may be attributed to variation in the topographic anatomy of different cattle breeds. Normalization of these parameters based on cow size would be a useful way to compare studies and develop criteria that could be applied to cows of different breeds and body weights.

• *Cows with traumatic reticuloperitonitis*

Perforation of the reticular wall by a sharp foreign body initially produces an acute local peritonitis which may recover, spread to cause acute diffuse peritonitis, become persistent to cause chronic peritonitis, or may extend beyond the peritoneum and cause involvement of other organs such as pericardium to cause acute pericarditis (Radostits et al 2007). Ultrasonography made it possible to determine the location and extent of the lesions accurately. Reduced or absent biphasic reticular contractions and deposition of inflammatory materials on its serosal surface

were the classical ultrasonographic findings in traumatic reticuloperitonitis, according to Braun et al (1993). Ramprabhu et al (2003) also reported that ultrasonography was an excellent tool in assessing the reticular motility and fibrinous adhesions/deposits around the reticulo-rumen; however, the foreign bodies could not be visualized. Further, Abdelaal et al (2009) investigated 29 cows and 33 buffaloes with traumatic reticuloperitonitis to document the clinical and ultrasonographic differences between cattle and buffaloes with various sequelae of traumatic reticuloperitonitis and the importance of ultrasonography in detection of such sequelae. Ultrasonography provided exact information concerning the various sequelae of TRP in both of the species. Moreover, ultrasonography made it possible to determine the location and extent of the lesions accurately, and the site best suited for abdomino- and thoraco-centesis. Braun et al (1994) compared ultrasonographic and radiographic findings in 26 cows with traumatic reticuloperitonitis. Metallic foreign bodies were not visualized by ultrasonography. They concluded that although either radiography or ultrasound alone provides a limited amount of information, the two techniques complement one another well.

► **Conclusions**

The normal reticulum appears as a half-moon-shaped structure with a smooth contour. It normally has one biphasic contraction per minute. The contour of reticulum, reticular contractions, fibrinous adhesions, and involvement of organs adjacent to the reticulum can be assessed via ultrasonography. More routine use of ultrasonography may aid in early diagnosis of traumatic reticuloperitonitis and detection of its sequelae, which are difficult to detect by clinical examination alone.

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