Comparative Ultrasonographic Findings of Traumatic Reticulitis, Perireticular Abscess and Diaphragmatic Hernia in Buffalo (*BubalusBubalis*)

Khaled S. Abouelnasr*, EsamMosbah, Gamal I. Karrouf, and Adel E. Zaghloul

Department of Surgery, Anesthesiology and Radiology, Faculty of Veterinary Medicine, Mansoura University, Mansoura 35516, Egypt
aboelnasr_2004@yahoo.com

Abstract:Background The present study aimed at discussing the role of ultrasonography for differential diagnosis of some reticular affections in 18 buffaloes suffered from traumatic reticuloperitonitis, diaphragmatic hernia and perireticular abscess. **Material and Methods** A 3.5 MHz convex transducer was used for examination of the reticular area from left and right side. B and M mode display were used for evaluation of reticular appearance, frequency of biphasic contraction and comparing of reticular motility in the abdominal and thoracic cavity in cases of diaphragmatic hernia. **Results** Normal or reduced frequency with reduced amplitude of reticular contraction was recorded in cases of traumatic reticuloperitonitis and diaphragmatic hernia. While, normal frequency with relatively normal amplitude was visualized in cases of perireticular abscess. The smooth wall of the reticulum was altered by echogenic deposits in most cases of traumatic reticuloperitonitis which is not found in case diaphragmatic hernia and perireticular abscess. **Conclusion** The result of this study presented the significance of ultrasonography for differentiation between various reticular affections in buffalo and the utility of B/M mode of display for detection and evaluation of reticular motility in the thoracic cavity which is mandatory for diagnosis of diaphragmatic hernia.
[K. S. Abouelnasr, E. Mosbah, G. I. Karrouf, and A. E. Zaghloul. **Comparative Ultrasonographic Findings of Traumatic Reticulitis, Perireticular Abscess and Diaphragmatic Hernia in Buffalo (*BubalusBubalis*).** *J Am Sci* 2012;8(8):590-595]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 90

Keywords: ultrasonography, reticuloperitonitis, perireticular abscess, diaphragmatic hernia, buffalo.

1. Introduction

General signs of indigestion including anorexia, ruminaltympany, scanty faeces, reduced milk production and atonized rumen are considered shared signs between different gastrointestinal disturbances especially those of reticulorumen origin like traumatic reticuloperitonitis, perireticular abscess and diaphragmatic hernia (Braun *et al.,* 1998; Saini*et al.,* 2007; Abdelaal*et al.,* 2009). Early and definite diagnosis of those reticular diseases requires advanced diagnostic techniques especially in buffalo as it is mentioned to express less signs of pain than cattle in gastrointestinal disturbances associated with pain (Saleh*et al.,* 2008). Radiography is mentioned as a reliable tool for visualization of the foreign body in cases of traumatic reticuloperitonitis(Braun *et al.,* 1993a) and herniation of the reticulum through diaphragm in cases of diaphragmatic hernia in bovine (Misk and Semieka, 2001). However, ultrasonography is still the method of choice for detecting characteristics of reticular motility, fibrinous deposits and abscessation which cannot be determined using radiography (Braun *et al.,* 1994). Numerous ultrasonograhic studies are applied for diagnosis of such affections in cows (Braun *et al.,* 1993b; Braun *et al.,* 1998;Saini*et al.,* 2007). While, few reports are available for diagnosis of traumatic reticuloperitonitis and diaphragmatic hernia in buffaloes (Mohindroo*et al.,* 2007; Abdelaal*et al.,* 2009). To author's knowledge, there is no available reports comparing ultrasonographic findings of traumatic reticuloperitonitis, perireticular abscess and diaphragmatic hernia in buffalo. Therefore, the aim of the present study is to compare the difference in the ultrasonographic appearance of the reticulum as well as characters of reticular motility in buffaloes suffered from theses affections.

2. Materials and Methods

Animals

Eighteen buffaloes were referred to Mansoura Veterinary Teaching Hospital between January, 2010 and March, 2012 due to anorexia. The animals were 2-5 years of age and their weight ranged between 300 to 450 kg (387±23kg). Four buffaloes were pregnant over 8 months, seven were recently calved (less than 5 weeks) and 7were non pregnant.

Animals were clinically examined as described by Dirksen *et al.* (1990). Testing for foreign body using metal detector and application of pain tests were performed in all examined buffaloes.

Ultrasonographic examination

The reticulum and surrounding structures were examined using 3.5 MHz convex transducer (Mindray DP- 2200 Vet-China) as described by Braun and Gotz (1994). The examined area from 3rd to 8th intercostal space from left and right and ventral midline area was prepared by clipping of hair and application of

coupling gel (Ultragel. Medilab, Egypt). B mode of display was used for examination of reticulum in buffaloes suffered from traumatic reticuloperitonitis and perireticular abscess. While, B/M mode of display was used for evaluation of reticular appearance, frequency of biphasic contraction and comparing of reticular motility in the abdominal and thoracic cavity in buffaloes suffered from diaphragmatic hernia.

Confirmatory tools

Ultrasonographic findings were confirmed using ultrasonographic guiding centesis (in 5 buffaloes), laparorumenotomy (in 5 buffaloes) and postmortem examination (in 8 buffaloes).

3. Results

Traumatic reticuloperitonitis was diagnosed in 8 buffaloes (2 pregnant, 3 recently calved and 3 non-pregnant). Perireticular abscess was diagnosed in 4 non-pregnant buffaloes while diaphragmatic hernia was detected in the other 6 animals (2 was pregnant, 4 recently calved). Clinical findings of the examined animals were shown in Table 1, all buffaloes were anorexic, ruminal motility was reduced in 15 buffaloes and in the other 3 buffaloes there was no ruminal motility, rectal temperature was varied from 39 to 40 ℃ in 13 buffaloes, metal detector and back grip pain test were positive in 10 buffaloes.

Ultrasonographic findings

In buffaloes suffered from traumatic reticuloperitonitis, normal frequency of contraction (3 contractions/ 4 minutes) with reduced amplitude was detected in 5 buffaloes where reticular contraction was weak and the amplitude of the first contraction was 2-3.5 cm (Average 2.8). While low frequency (0-1 contraction/ 4 minutes) with reduced amplitude 2.1-3.4 cm (Average 2.7), slower contraction and relaxation was recorded in 3 buffaloes. The duration of first and second contraction and relaxation interval period were 3.6-5 sec (Average 4.46), 6-8 sec (Average 7.1) and 55-64 sec (Average 59.3) respectively.

Reticulum was normally appeared as a crescent shaped structure with smooth contour in one buffalo. Indentation of reticular wall by fibrinous mass was observed in 4 buffaloes while corrugated appearance by fibrinous deposits was visualized in 3 buffaloes (Fig.1).

Echogenic deposits of varying intensity were viewed at the caudoventral aspect of the reticulum adhered to the reticular wall in 3 buffaloes and extended to the serosa of the anterior dorsal blind sac of the rumen in one buffalo. Echogenic deposits cavitated with hypoechoic or anechoic fluid were recorded in 3 buffaloes (Fig.2). Anechoic fluid accumulation without echogenic capsule was found in one buffalo where peritoneal effusion appeared at the reticular area causing dorsal displacement of reticulum from abdominal wall.

Ultrasonographic findings in cases of traumatic reticuloperitonitis were confirmed through laparorumenotomy in 3 buffaloes, percutaneous ultrasound – guided centesis in one buffalo and after slaughtering of another 4 animals.

Perireticular abscess was diagnosed in 4 buffaloes. It appeared as anechoic to hypoechoic area with a diameter varied from 3 cm to 12 cm, surrounded with echogenic capsule that cause indentation of reticular wall (Fig. 3). Normal frequency of reticular contraction (3-4 contractions/ 4minutes) with slightly reduced amplitude 2.5-3.7 cm (Average 3.1) was observed in the 4 examined buffaloes.

Percutaneous ultrasound guided centesis at the area of reticulum was used for confirmation of ultrasonographic findings where large quantity of brown (in 3 buffaloes) / yellow (in one buffalo) foul smelling fluid was yielded

Reticulum appeared through B mode of display at the level of 6th and 7th intercostal space as a normal crescent shape structure with smooth contour in 6 buffaloes with reticular diaphragmatic hernia. Reticular motility was characterized by biphasic contraction that was imaged using M mode of display, the peak of the first contraction curve could be visualized while the peak of the second contraction was out of the depth capacity of 15.1cm screen (Fig.4). Normal frequency of contraction (2-4 contraction/4minutes) with reduced amplitude (2.3-3.4 cm) was recorded in 2 buffaloes while reduced frequency (1-2 contraction/ 4minutes) and amplitude (1.8- 2.6 cm) was detected in the other 4 buffaloes.

Scanning of reticulum at the level of the 4th and 5th intercostal space revealed a reticular wall like structure that appeared as a relatively straight or undulating line at increased distance from the abdominal wall when viewed at the 6th and 7th intercostal space.

Reticular motility was tracked using B+M mode of display in all animals. Incomplete biphasic reticular contraction was detected at the level of 5th intercostal space in 3 buffaloes (Fig.5). A gliding reticular motility was viewed at the level of 4th intercostal space from the right side in one buffalo (Fig.6). No motility could be identified in the thoracic cavity from both right and left side in the other 2 buffaloes.

Left flank exploratory laparotomy was performed in 2 buffaloes in which reticular motility could not be identified in the thoracic cavity; a reticular diaphragmatic hernia with hernial ring varied from10-15cm was diagnosed. Postmortem examination in the other 4 buffaloes confirmed the ultrasonographic findings.

Table-1: Clinical findings in buffaloes with traumatic reticuloperitonitis, diaphragmatic hernia and perireticular abscess.

Clinical finding	Traumatic reticuloperitonitis (n=8)	Diaphragmatic hernia(n=6)	Perireticular abscess (n=4)
Reduced appetite	8	6	4
Scanty hard faces	6	5	2
Recurrent tympany	7	2	3
Persistent tympany	1	4	1
Dropped milk production	7	3	1
Hypomotile rumen	5	6	4
Static rumen	3	0	0
Increased rectal temperature (> 39℃)	7	2	4
Positive metal detector and pain tests	7	0	3

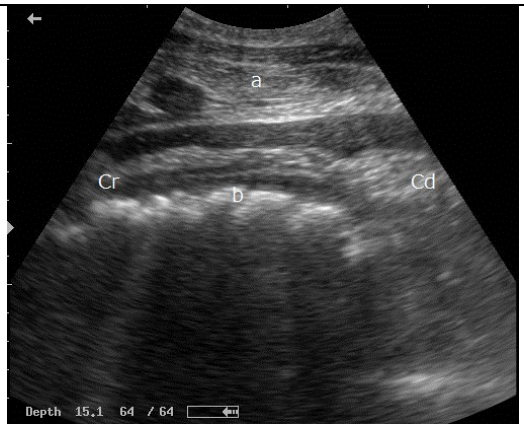

Fig. 1: Ultrasonogram imaged at the left 6th inter costal space of buffalo with traumatic reticuloperitonitis showed echogenic fibrinous deposits on the reticular wall causing its corrugated appearance. a) Abdominal wall, b) Reticular wall, Cr) Cranial; Cd) Caudal.

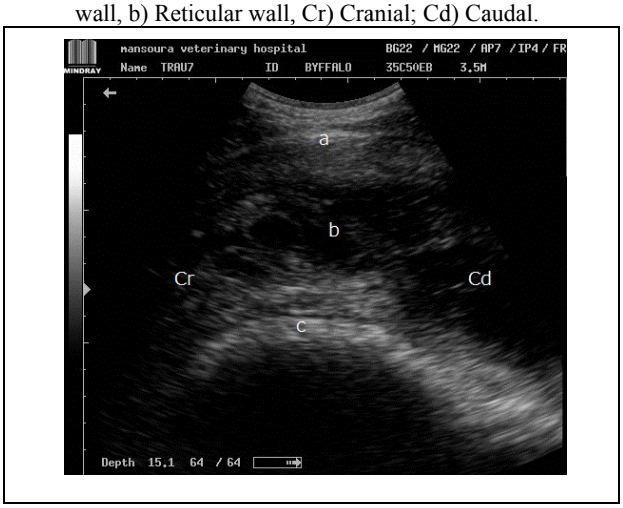

Fig. 2: Ultrasonogram of a buffalo with traumatic reticuloperitonitis imaged at the left paramedian side showed echogenic deposits cavitated with anechoic fluid around the reticulum a) Abdominal wall b) Echogenic deposits with anechoic fluid c) Reticular wall Cr) Cranial; Cd) Caudal.

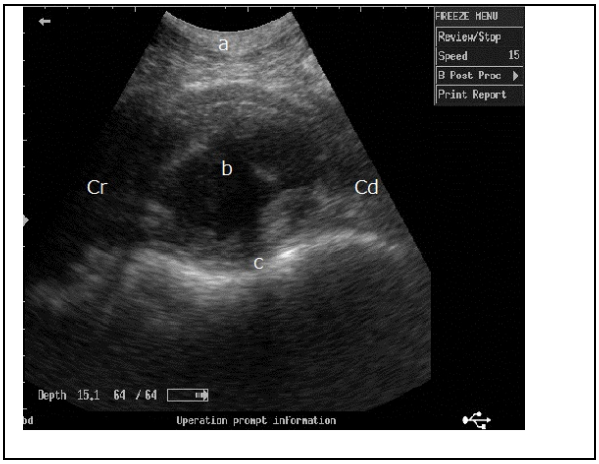

Fig. 3: Ultrasonogram of a buffalo with perireticular abscess imaged at the left paramedian side showed abnormal indentation of the reticular wall by abscess containing hypoechoic fluid and echogenic strands. a) Abdominal wall; b) Abscess c) Reticular wall.Cr) Cranial; Cd) Caudal.

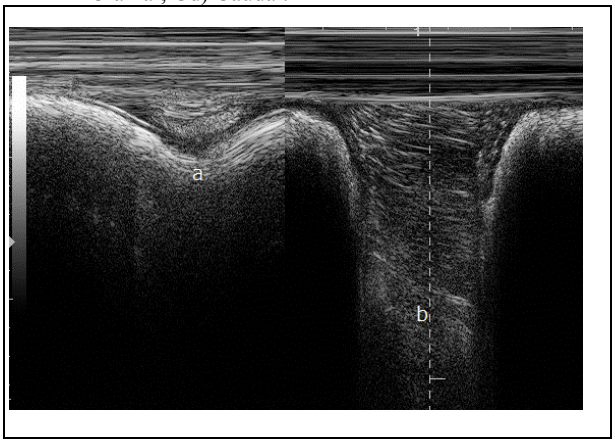

Fig. 4: Ultrasonogram imaged at the left 7th intercostal space using M mode of display in a buffalo with diaphragmatic hernia showed normal first and second reticular contraction. a) curve of the 1st contraction ; b) curve of the 2nd contraction.

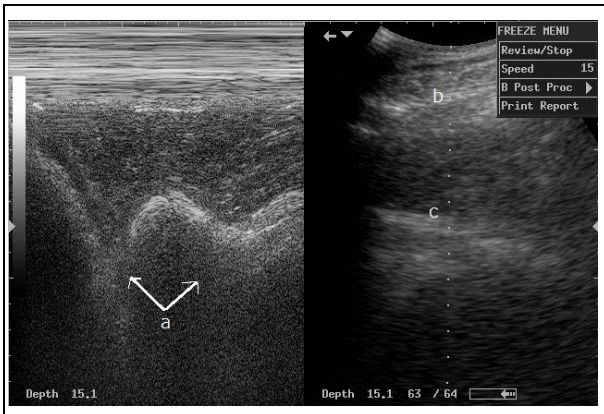

Fig. 5: Ultrasonogram of a buffalo with diaphragmatic hernia imaged at the level of 5th intercostal space using B/M mode showed incomplete biphasic reticular contraction. a) Incomplete biphasic reticular contraction; b) Abdominal wall; c) reticular wall.

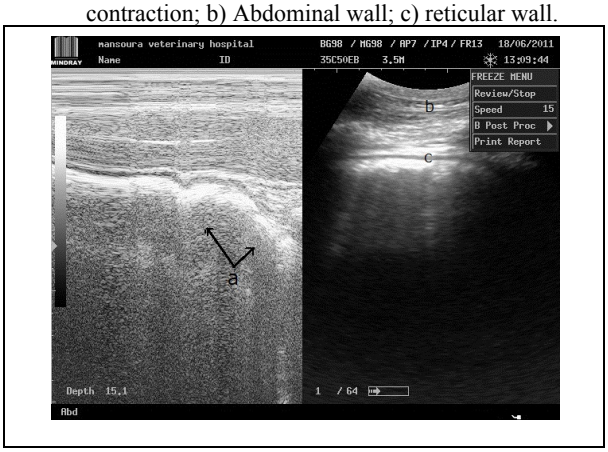

Fig. 6: Ultrasonogram of a buffalo with diaphragmatic hernia imaged at the level of 4th intercostal space using B/M mode showed gliding biphasic reticular contraction. a) Gliding biphasic reticular contraction; b) Abdominal wall; c) reticular wall.

4. Discussion

Clinical findings of the examined buffaloes in this study were nonspecific and could not help in differential diagnosis as it was a shared signs between different gastrointestinal affections as mentioned by Braun *et al.* (1998); Saini*et al.* (2007); Abdelaal*et al.* (2009)

Pain tests and metal detector used in this study were helpful in prediction of reticulo rumen affections of traumatic origin as positive results were recorded in all buffaloes suffered from traumatic reticuloperitonitis and in 3 cases with perireticular abscess while it was negative in all buffaloes with diaphragmatic hernia.

Ultrasonographic findings in cases of traumatic reticuloperitonitis revealed normal frequency with reduced amplitude in 5 buffaloes while in 3 buffaloes, no motility or reduced frequency and amplitude of contraction was recoded. Reduction of the reticular activity could not be considered alone as a reliable sign of traumatic reticuloperitonitis as inhibiting factors such as pain and fever was mentioned by Braun *et al.* (1993b) to reduce the reticulorumen motility.

The examined buffaloes showed reduction of reticular motility was associated with presence of fibrinous deposits of varying degree and peritoneal fluid effusion between reticulum and surrounding structures. These changes cause interference with reticular motility, dorsal displacement of the reticulum from the abdominal wall and change in the normal crescent shape appearance of the reticular wall to be corrugated or indented. Similar appearance was recorded in cows suffered from traumatic reticuloperitonitis (Braun *et al.,* 1994).

Maintenance of reticular contraction even with reduced frequency and amplitude despite of presence of echogenic deposits and fluid accumulation could be considered a good prognostic indicator in the examined buffaloes with traumatic reticuloperitonitis. Braun *et al.* (1994) support the suggestion that cows with good reticular motility even with extensive changes have better prognosis than those with complete reticular stasis.

Several reports were available on diagnosis of reticular abscess in cows through exploratory laparotomy (Stober, 1967); laparoscopy (Wilson and Ferguson, 1984) and with radiography (Fubini*et al.,* 1990) and ultrasonography (Braun *et al.,* 1998). However, little are describing reticular abscess in buffalo (Abdelaal*et al.,* 2009).

In this study, ultrasonographic appearance of perireticular abscess in buffaloes was similar to that described in cows by Braun *et al.* (1998) in which echogenic capsule surrounding hypoechoic or anechoic contents were observed between the reticulum and abdominal wall.

The examined buffaloes with perireticular abscess showed normal frequency of reticular contraction and relatively reduced amplitude 2.5-3.7 cm as normal amplitude of the first reticular contraction in cows was 5-10 cm (Braun and Gotz, 1994). The results showed that the reticular motor function is less affected in buffaloes with perireticular abscess than in case of traumatic reticuloperitonitis probably due to less adhesions between reticulum and surrounding structures. Moreover, maintenance of reticular motility in cases of perireticular abscess support the advice presented by Constable *et al.*(1990) that reduction or elimination of the abscess could be sufficient for restoring normal reticular contraction.

Buffaloes with diaphragmatic hernia in our study were either at late pregnancy or were recently calved; the increased abdominal pressure during these conditions in addition to the mentioned lesser elasticity, collagen content and vascularity of

diaphragm in buffalo (Singh *et al.,* 2006) could be considered the existing cause of diaphragmatic hernia.

The reticulum scanned at the abdominal cavity showed normal crescent shape appearance, no abnormal changes in the reticular wall could be detected which in addition to negative pain tests and metal detector could exclude the possibility of traumatic reticuloperitonitis as a cause of diaphragmatic hernia in our examined buffaloes. However, progressive weakening of the diaphragm due to hardware disease and reticuloperitonitis was mentioned as a common cause of diaphragmatic hernia in cattle (Smith, 2002).

The frequency of reticular contraction in the abdominal cavity was normal in 2 buffaloes and reduced in 4 buffaloes while, the amplitude of contraction was reduced in all animals. The reduction of amplitude of contraction could be attributed to hindrance of reticular motility by the herniated part in the diaphragm; adhesion of the herniated part of the reticulum to diaphragm was also mentioned as a cause of reduction in contraction amplitude (Kumar *et al.,* 2007).

Dorsal displacement of the reticulum from the abdominal wall and its relatively straight appearance when viewed at the 4th and 5th intercostal space could be attributed to adhesion of the reticulum to the hernial ring and to the site of herniation in the diaphragm which could affect the degree of displacement. Braun *et al.* (1994) attributed the changes in the normal appearance of the reticulum to fibrinous deposition and adhesions which cause undulation of the reticular wall.

Diagnosis of diaphragmatic hernia could not be established depending upon imaging of the reticulum at the 4th and 5th intercostal space as visualization of the reticulum at the 5th intercostal space in cases of vagal indigestion due to extreme pressure of the distended abdomen on the diaphragm was recorded by Athar*et al.* (2010).

For accurate diagnosis, tracking of the reticular motility through B/M mode in the thoracic cavity was applied where incomplete and gliding motility recorded in four buffaloes could be attributed to reticular adhesions. In difference with our results, a complete biphasic reticular motility was also detected in the thoracic cavity by Athar*et al.* (2010) in some cases of diaphragmatic hernia in bovine.

In conclusion, ultrasonographic appearance and characteristics of reticular motility could be used for differentiation between various reticular affections where, normal or reduced frequency with reduced amplitude of reticular contraction was recorded in cases of traumatic reticuloperitonitis and diaphragmatic hernia. In cases of perireticular abscess, normal frequency with relatively normal amplitude was visualized. Moreover, the smooth wall of the reticulum was altered by echogenic deposits in most cases of traumatic reticuloperitonitis which is not recoded in cases of diaphragmatic hernia and perireticular abscess. B/M mode of display is a valuable tool for assessment of reticular motility in the thoracic cavity which is mandatory for confirmation of diaphragmatic hernia.

Corresponding author
K. S. Abouelnasr
Department of Surgery, Anesthesiology and Radiology, Faculty of Veterinary Medicine, Mansoura University, Mansoura 35516, Egypt
aboelnasr_2004@yahoo.com

5.References

AbdelaalAM, M Floeck, S El Maghawry and W Baumgartner, 2009. Clinical and ultrasonographic differences between cattle and buffaloes with various sequelae of traumatic reticuloperitonitis. Vet Med., 54: 399–406.

Athar H, J Mohindroo, K Singh, A Kumar and M Raghunath, 2010. Comparison of radiography and ultrasonography for diagnosis of diaphragmatic hernia in bovines. Vet Med Inter., 2010: 7 -14.

Braun U, M Flückiger and M Gotz, 1994.Comparison of ultrasonographic and radiographic findings in cows with traumatic reticuloperitonitis. Vet Rec., 135: 470–478.

Braun U and M Gotz, 1994.Ultrasonography of the reticulum in cows.Am J Vet Res, 55: 325-332.

Braun U, M Gotz and O Marmier, 1993b.Ultrasonographic findings in cows with traumatic reticuloperitonitis. Vet Rec., 133:416–422.

Braun U, M Fluckiger and F Nageli, 1993a.Radiography as an aid in the diagnosis of traumatic reticuloperitonitis in cattle. Vet Rec., 132: 103–109.

Braun U, U Iselin, C Lischer and E Fluri, 1998.Ultrasonographic finding in five cows before and after treatment of reticular abscess. Vet Rec., 142:184-189.

Constable PD, GF Hoffsis and DM Rings, 1990. The reticulorumen: Normal and abnormal motor function. Part I. Primary contraction cycle. Comp ContEducPract Vet., 12:1008-1013.

Dirksen G, H Gruende and M Stoeber, eds.) 1990. The Clinical Examination of Cattle (in German). 3rd ed. Parey/Blackwell Publishing, Berlin.pp 742.

Fubini SL, EA Yeager, HG Mohammed and DF Smith, 1990.Accuracy of the reticulum for predicting surgical finding in adult dairy cattle with traumatic reticuloperitonitis. JAm Vet Med Assoc., 197:1061-1064.

Kumar M, J Mohindroo, A Kumar and SS Singh, 2007. Ultrasonographic diagnosis of

reticulophrenic adhesions in bovines: a report on 15 clinical cases, Ind J Vet Surg, 28 (2): 117–119,.

Misk NA and MA Semieka, 2001.The radiographic appearance of reticular diaphragmatic herniation and traumatic pericarditis in buffaloes and cattle. Vet Radiol Ultras, 42: 426–430.

Mohindroo J, M Kumar, A Kumar and SS Singh, 2007. Ultrasonographic diagnosis of reticular diaphragmatic hernias in buffaloes. Vet Rec, 161(22):757-758.

Saini NS, K Ashwani, KM Shashi and CS Ashish, 2007.The use of ultrasonography, radiography, and surgery in the successful recovery from diaphragmatic hernia in a cow. Can Vet J, 48: 575-578.

Saleh MA, HZ Rateb and AMisk, 2008. Comparison of blood serum proteins in water buffaloes with traumatic reticuloperitonitis and sequelae. Res in VetSci, 85: 208–213.

Singh J, MR Fazili and SK Chawla*et al.,* 2006. Current status of diaphragmatic hernia in buffaloes with special reference to etiology and treatment: a review. Ind J Vet Surg, 27(2): 73–79.

Smith BP, 2002. Diaphragmatic hernia," in Large Animal Internal Medicine, Mosby, St. Louis, Mo, USA, p. 729.

Stober M, 1967. Der diagnostische wert der explorativenlaparo-rumenotomiebeim rind. VetMed Nachr, 213: 191-214.

Wilson AD and JG Ferguson, 1984.Use of a flexible fiber optic laparoscope as a diagnostic aid in cattle. Can Vet J, 25: 229-234.

7/2/2012