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Ultrasonographic Findings in Hardware Diseased Buffaloes *(Babulus babilus).*

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ABSTRACT

Hardware disease is one of the most important forestomach diseases in buffaloes. This research describes the most common ultrasonographic findings in buffaloes with hardware disease. Sixty hardware diseased buffaloes were examined by ultrasound at three views; ventral abdominal view just behind xiphoid cartilage, left and right lateral views from 5th to 8th intercostal spaces (ICSs). All ultrasonographic findings of the reticulum and surrounding organs were reported. The reticular wall, distance between reticulum and abdominal wall and relaxation period in hardware diseased buffaloes were significantly increased ($P \leq 0.05$) and the reticular motility and the amplitude of contraction were significantly reduced ($P \leq 0.05$) when compared with normal values. Local peritonitis was observed in 44 buffaloes and showed echogenic strands interspersed with anechoic fluid represented the inflammatory reactions . Moreover, abscesses with different sizes were seen in 16 cases and appeared with anechoic to hypoechoic center surrounded by echogenic wall. Peritonitis and abscesses were observed between the reticulum, rumen, diaphragm and or abomasum. Liver, spleen and whole abdomen were involved in the complications of hardware disease in 11, 8 and 13 buffaloes, respectively. In conclusion, ultrasonography is a reliable technique for diagnosis and prognosis of hardware disease in buffaloes.

Keywords: Buffaloes, hardware disease, reticulum, sharp foreign body syndrome, traumatic reticuloperitonitis, ultrasonography.

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INTRODUCTION

Buffaloes as well as cattle have unselective feeding habit that results in consumption of foreign objects among their own food. Contractions of the reticulum promote penetration of the wall by the foreign object. Perforation of the reticular wall allows leakage of ingesta and bacteria, which contaminates the peritoneal cavity resulting peritonitis [1,2]. Hardware or sharp foreign body syndrome remains the primary disease of buffaloes and cattle rather than other ruminants resulting in high economic losses [3,4]. The affected animals generally showed variable clinical sings which depends upon the severity of disease, individual sensitivity and the species of the animal [5].

Hardware disease still represents a challenge in veterinary practice. On last decade, several advanced techniques have been used for management of hardware disease in bovine including; radiography, ultrasonography, laparoscopy, electrocardiography and laboratory diagnosis [6].

Ultrasonography provides direct views of frequency, duration, speed and amplitude of reticular contractions [7]. The motility of the reticulum has been evaluated by ultrasonography in healthy cows at rest [8-11], cows and buffaloes with traumatic reticuloperitonitis (TRP) [12-14], buffaloes with acute and complicated TRP [15,16] (Khalphallah *et al.,* 2016a&b), reticular abscesses [17,18], vagal indigestion [19] and reticular diaphragmatic hernia [20,21]. Other studies have investigated the effects of atropine, xylazine and scopolamine [22] and neostigmine [23] on reticular motility. The motility of the reticulum during rest, eating, rumination and stress in healthy cows has also been described [24].

On the basis of our previous researches [5,7,21, 25-27] we concluded that it was necessary to conduct such research to describe more data concerning the most common ultrasonographic findings of the reticulum and its neighboring organs in hardware diseased buffaloes.

MATERIALS & METHODS

During March, 2012 to March, 2016, sixty female buffaloes aged 2.5 to 10 years and weighted 450-650 Kg were admitted to veterinary clinics at Zagazig and Cairo Universities, Egypt. Out of 60 buffaloes, 20 were recently calved, 25 were heavy pregnant and 15 were non pregnant. On admission, the buffaloes suffered from anorexia, weight loss, tympany and scanty feces. All diseased buffaloes submitted to thorough clinical examination, mine detector and ultrasonographic examination. Based on ultrasonographic examination the condition was diagnosed as hardware disease.

Ultrasonographic examination was carried out on standing, non-sedated animals as described previously [8] using two types of ultrasound machines (Toshiba Just Vision 200, Japan and Pie-Medical 240, Parus ultrasound machine, Maastricht, Netherlands). A convex 3.5 - 5.0 MHz transducer with a penetration depth 20 cm was applied. The reticulum was first examined from point just behind xiphoid cartilage at ventral midline (linea alba), then from left and right sides between $5^{th.}$ to $8^{th.}$ intercostal spaces at the level of elbows. In left and right sides, the examination was carried out from dorsal to ventral with the transducer held parallel to the ribs to determine the location of neighboring organs. Reticular shape, contour and motility were assessed. All abnormal ultrasonographic findings of the neighboring organs were also recorded.

Weingarth's ring rumenotomy was carried out as a confirmatory technique on 15 buffaloes with hardware disease. Meanwhile, abscesses were confirmed in 16 cases through aspiration under ultrasonographic guidance using an 18-G needle as described previously [17]. Unfortunately, the other 29 cases were not confirmed.

The statistical significance between means was compared using Student's t-test; and ($P \leq 0.05$) was considered significant. All data are presented as means ± standard deviation (SD) of the means. All tests were performed using computer package of the statistical analysis system SPSS.

RESULTS

In hardware diseased buffaloes, the thickness of the reticular wall, the distance between reticular and abdominal walls and the relaxation period were significantly increased when compared to the normal

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measurements. In contrast, the reticular motility and the amplitude of contraction were significantly decreased. Meanwhile, the contraction period showed no significant change. The reticulum had uneven surface and corrugated contour in 35 cases (74.47%) and had a half-moon shape in 12 cases (25.53%). The foreign body was seen by ultrasonography and confirmed via rumenotomy in 11 cases. Ultrasonographically, the foreign body appeared as hyperechogenic structure penetrates the reticular wall with comet tail artifacts (Figure 1a).

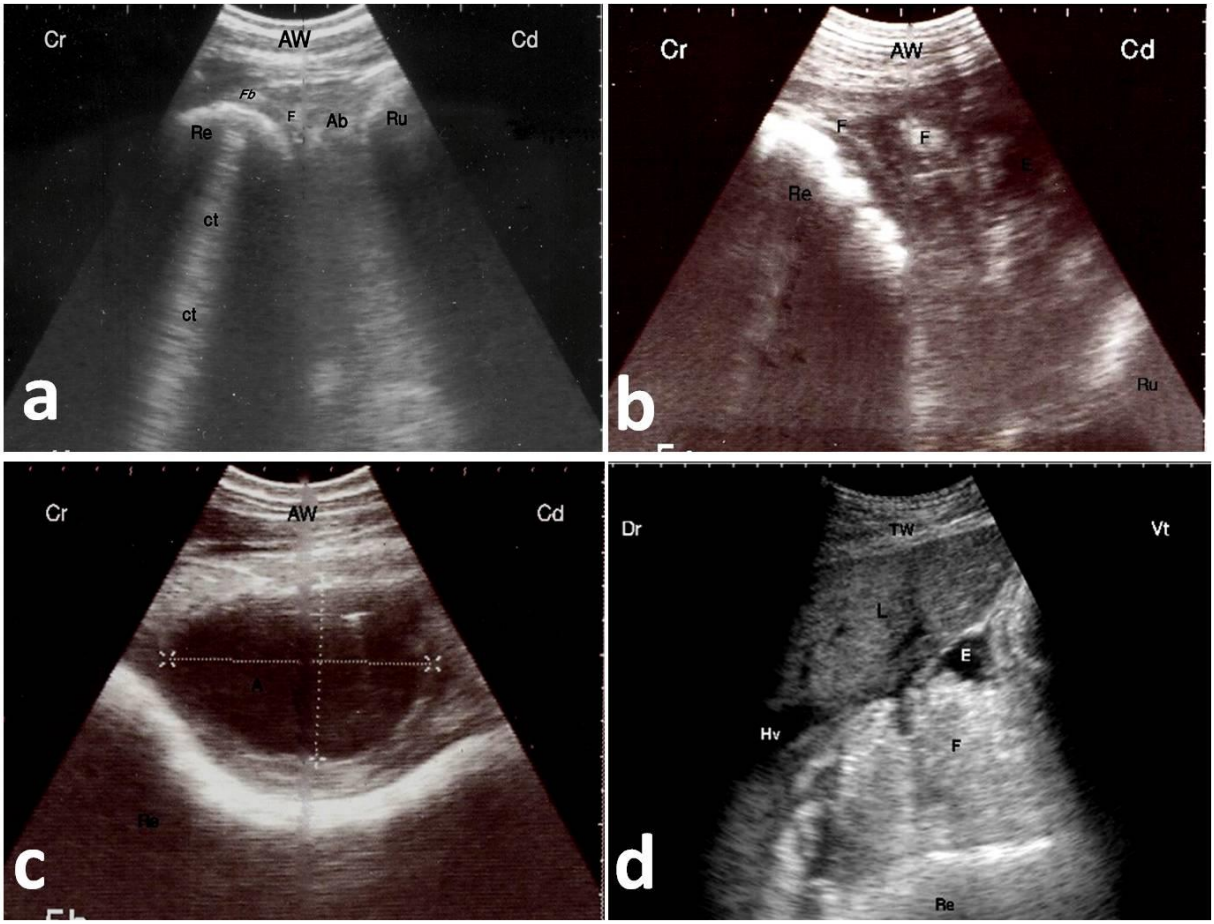

Figure 1. (a) Ultrasonogram of the reticulum in a hardware diseased showing corrugated contour and a penetrating hyperechogenic foreign body with comet tail artifact. AW: Abdominal wall, Ab: Abomasum, Re: Reticulum, Ru: Rumen, F: fibrin, E: exudates, Fb: Foreign body, ct: comet tail artifact, Cr: cranial, Cd: caudal.

(b) Ultrasonogram of buffalo's reticulum with hardware disease from ventral midline region showing corrugated contour and echogenic fibrin threads interspersed with anechoic exudates. AW: Abdominal wall, Re: Reticulum, Ru: Rumen, F: fibrin, Cr: cranial, Cd: caudal.

(c) Ultrasonogram of buffalo's reticulum with hardware disease from ventral midline region showing circumscribed hypoechoic abscess with echogenic wall. AW: Abdominal wall.

(d) Ultrasonogram of buffalo's reticulum with hardware disease at right 7$^{th.}$ ICS showing liver involvement. Notice the echogenic fibrin and anechoic exudates between the reticulum and liver. TW: Thoracic wall, Re: Reticulum, F: fibrin, E: exudates, L: liver, Hv: Hepatic vein, Dr: Dorsal, Vt: Ventral.

During the five-minute observation period, biphasic reticular contraction was seen in 16 buffaloes. Monophasic contraction was seen irregularly between biphasic contractions in 4 cases while monophasic contraction was seen without biphasic one in 6 cases. The duration and amplitude of monophasic contractions were 2.54 ± 0.45/seconds and 3.0 ± 1.2/ cm, respectively. The overall mean of reticular contractions frequency per 5 minutes was 1.3 ± 0.6. Twenty one buffaloes had non motile reticulum, 22 cases had hypomotile reticulum (1 to 3 contraction/ 5 minutes) and 4 cases had normal motility (4 to 6 contractions/ 5 minutes). All ultrasonographic features of the reticulum were collected in (Table 1).

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Table 1. Ultrasonographic features of the reticulum in hardware diseased buffaloes in comparison with normal measurements.

Criteria	Normal measurements (Mostafa *et al.*, 2015)	Hardware diseased buffaloes (N= 47)
Frequency of reticular motility/ 5 minuttes	4.95 ± 0.15	1.3 ± 0.5*
Thickness of reticular wall	0.45 ± 0.07	1.6 ± 0.68*
Distance between reticulum and abdominal wall	2.08 ± 0.06	7.87 ± 3.1*
Duration of first contraction/ second	2.00 ± 0.12	2.39 ± 0.6
Duration of second contraction/ second	3.9 ± 0.22	3.60 ± 0.9
Total duration of contraction/ second	5.9 ± 0.25	6.07 ± 1.2
Relaxation period/ second	60 ± 1.8	161.53 ± 81.01*
Amplitude of first contraction/ cm	5.46 ± 0.32	3.9 ± 0.8*
Amplitude of srcond contraction/ cm	16.67 ± 0.32	12.06 ± 2.9*

* Significant difference at $P \leq 0$.

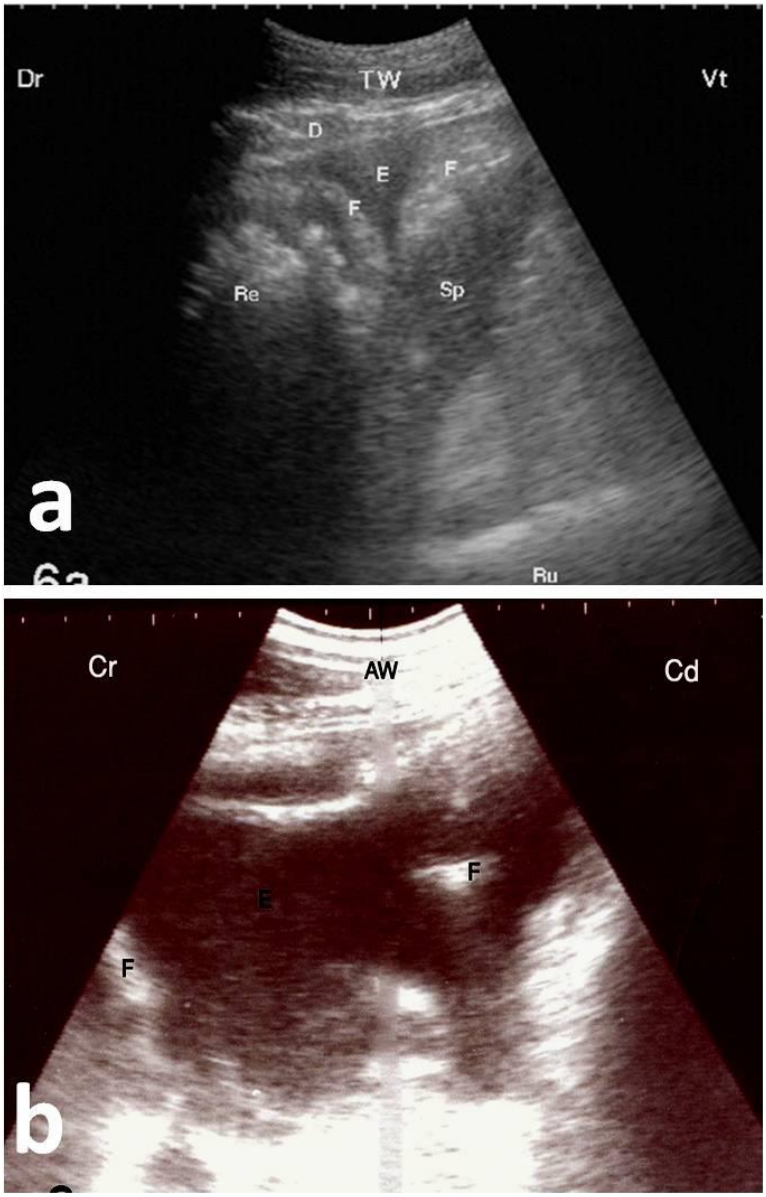

Figure 2. (a) Ultrasonogram of buffalo's reticulum with hardware disease at left 7th. ICS showing spleen involvement. Notice the echogenic fibrin between the corrugated reticulum and spleen. TW: Thoracic wall, Re: Reticulum, Ru: Rumen, F: fibrin, E: exudates, S: spleen, Dr: Dorsal, Vt: Ventral.
(b): Ultrasonogram of a hardware diseased buffalo showing diffuse peritonitis. Notice the echogenic fibrin threads interspersed with anechoic exudates. AW: Abdominal wall, F: fibrin, Cr: cranial, Cd: caudal.

Various complications with different ultrasonographic findings were seen in hardware diseased buffaloes. Local peritonitis was observed in 44 buffaloes and showed echogenic strands interspersed with anechoic fluid represented the inflammatory reactions (Figure 1b). Moreover, abscesses with different sizes were seen in 16 cases and appeared with anechoic to hypoechoic center surrounded by echogenic wall (Figure 1c). Peritonitis and abscesses were observed between the reticulum, rumen, diaphragm and or abomasum. Liver (Figure 1d), spleen (Figure 2a) and whole abdomen (Figure 2b) were involved in the complications of hardware disease in 11, 8 and 13 buffaloes, respectively.

DISCUSSION

The reticulum is the main target organ for the ingested foreign bodies in buffaloes and ultrasonography is the most useful tool for diagnosis of hardware disease in buffaloes either in acute [15] or chronic form [28]. Therefore the present study aimed to investigate the abnormal ultrasonographic features of the reticulum and surrounding organs in hardware diseased buffaloes.

In healthy condition, the normal reticulum appeared as a half-moon shaped structure with smooth surface, situated immediately behind the xiphoid cartilage with a wall thickness of 0.45 ± 0.07 cm [7]. Moreover reticular motility was characterized by a biphasic contraction pattern in all healthy buffaloes [29]. The frequency of reticular contractions in five-minutes period was 4.95± 0.6 [7]. The duration of first and second reticular contractions was (2.48 ± 0.56/ second) and (4.48 ± 1.1/ second) [30].

In the present study, out of 60 hardware diseased buffaloes, the reticulum was assessed only in 47 cases because the reticulum moved beyond the penetration depth of the ultrasound waves due to the accumulation of large amount of inflammatory exudates induced by diffuse peritonitis.

Significant ($P \leq 0.05$) increase in the reticular wall thickness, the distance between reticular and abdominal walls and the relaxation period associated with significant ($P \leq 0.05$) reduction in the reticular motility and the amplitude of contraction were detected in the hardware diseased buffaloes compared with normal values. The characteristic reduction or absence of reticular contractility and increase thickness of reticular wall are considered to be the characteristic ultrasonographic findings of different sequelae of traumatic reticuloperitonitis in cows and buffaloes [5,29, 31].

In the present study, the affected reticulum had corrugated contour in 35 buffaloes. This result is in consistent with those reported before [13]**.** The uneven surface of cattle with traumatic reticuloperitonitis could be attributed to the inflammatory reaction and deposition of inflammatory debris on the reticular serosal surface. This means that the other 12 cases with half-moon reticular contour had early stage of hardware disease and less severe inflammation.

In our study, biphasic reticular contraction was seen in 16 diseased buffaloes. In this respect, the biphasic contraction pattern is maintained even in cattle with reticular abscesses [17]. Moreover, monophasic contractions were reported in 10 diseased buffaloes. Monophasic contraction has not been previously reported in healthy condition but were observed in two of 144 cows with vagal indigestion [19].

The ultrasonographic examination yields precise information about lesion of hardware disease. The inflammatory reactions appeared as echogenic strands interspersed with anechoic inflammatory exudates in 44 buffaloes. Moreover, abscesses appeared in 16 cases as circumscribed masses with echogenic fibrous capsule and their content varied from anechoic, hypoechoic or echogenic material. These varying degrees in the echogenicity depend upon the density and amount of pus cells and inflammatory exudates inside the abscess. High content of pus cells gives more echogenicity and indicates long development. These results are in agreement with those obtained before [5,17,18,25,32]. The inflammation was observed between reticulum, rumen and or abomasum and extended to involve spleen, liver and whole abdominal organs. Involvement of neighboring organs was described as diffuse peritonitis [5,16]. Splenitis was previously recorded at post-mortem examination in cattle as a rare complication of foreign body syndrome [33].

The interesting result in the present study was the detection of foreign body in 11 cases as hyperechogenic structure with comet tail artifact. This result was confirmed by rumenotomy. Generally, the comet-tail artifacts originate from small reflective surfaces as gas bubbles or metallic objects [34]. In contrast, no foreign body was seen by ultrasound in any hardware diseased animal in a previous study[16].

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CONCLUSION

Ultrasonography of the reticulum and neighboring organs is a valuable tool for diagnosis and prognosis of hardware disease in buffaloes.

REFERENCES

[1] Andrews AH, Blowey RW, Boyd H, et al. Bovine Medicine, Diseases and Husbandry of Cattle. 2nd ed. Ames, Iowa: Blackwell Science Ltd. 2004; 835-839
[2] Radostits OM, Gray CC, Hinchcliff KW, et al. Veterinary Medicine A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats. 10 edn, Saunders Elsevier, Philadelphia. 2007; 430–432.
[3] Orpin P, Harwood D. In Pract. 2008; 30: 544-51
[4] Abu-Seida AM, Al-Abbadi OS. Asian J Anim Sci. 2015; 9 (3): 128-33.
[5] Abdelaal AM, Floeck M, Maghawry S, et al. Vet Medicina. 2009; 54: 399–6.
[6] Abu-Seida AM, Al-Abbadi OS. Pak Vet J. 2016; (accepted article).
[7] Mostafa MB, Abu-Seida AM, Abdelaal AM, et al. Res Opin Anim Vet Sci. 2015; 5: 165-71.
[8] Braun U, Götz, M. Am J Vet Res. 1994; 55: 325-32.
[9] Kaske M, Midach A, Rehage J. J Vet Med-A. 1994; 41: 748-56
[10] Streeter RN, Step, DL. Vet Clin North Am Food Anim. Pract. 2007; 23: 541-74.
[11] Imran S, Sharma S, Bhat AA. Eurasian J Vet Sci. 2012; 28 (4): 214-21
[12] Braun U, Götz M, Marmier O. Vet Rec. 1993; 133: 416-22.
[13] Braun U. Vet Clin North Am Food Anim Pract. 2009; 25: 567-90.
[14] Aref NM, Abdel-Hakiem MA. Vet World. 2013; 6: 586-91.
[15] Khalphallah A, Abu-Seida AM, Abdelhakiem M, et al. Asian J Anim Vet Adv (accepted article).
[16] Khalphallah A, Elmeligy E, Elsayed, HK, et al. Asian J Anim Vet Adv. 2016; 11 (6): 319-30.
[17] Braun U, Iselin U, Lischer C, et al. Vet Rec. 1998; 142: 184-89.
[18] Braun U. Vet Clin North Am Food Anim Pract. 2005; 21: 33-53.
[19] Braun U, Rauch S, Hässig M. Vet Rec., 2009; 164: 11-13.
[20] Kumar A, Saini NS. Vet Rec. 2012; 171: 381-82.
[21] Abdelaal A, Gouda S, Ismail A, et al. Pak Vet J. 2014; 34(4): 541-44.
[22] Braun U, Gansohr B, Hässig M. J Vet Med Assoc. 2002; 49: 299-302
[23] El-Khodery SA, Sato, M. Vet Res Commun. 2008; 32: 473-80.
[24] Braun U, Rauch S. Vet. Rec. 2008; 163: 571-74.
[25] Abdelaal AM, Gouda SM, Tharwat M. Vet World. 2014; 7: 306-10.
[26] Al-Abbadi S, Abu-Seida AM, Al-Hussainy S. Vet World. 2014; 7: 408-11
[27] Abu-Seida AM, Al-Abbadi OS. Thai J Vet Med. 2014; 44: 147-51.
[28] Abu-Seida AM. Asian J Anim Vet Adv. 2016; 11: 144- 57.
[29] Athar H, Mohindroo J, Singh K, et al. Indian J Anim Sci. 2010; 80: 608-12.
[30] Abouelnasr K, Mosbah E, Karrouf G, et al. J Anim Res. 2014; 42: 153-59
[31] Braun U. Vet. J. 2003; 166: 112–24.
[32] Mohamed T, Oikawa S. J Vet Med- A. 2007; 54: 512 – 17.
[33] Balasundara KR, Shekya GN, Ananda KJ. Vet World. 2012; 5: 373-75.
[34] Blond L, Buczinski S. Vet Clin Food Anim, 2009; 25: 553–65.