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Research Article

Efficacy of Ultrasound in Diagnosis and Management of Internal Abscessations in Egyptian Buffaloes (*Bubalus Bubalis*)

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Abstract

Background and Objective: Diagnosis of the internal abscesses is important to relieve the cost burden on animals' owners that comes from long duration of unspecific and conservative medications and to nourish the animals welfare and hence their productivity. Therefore, this study aimed to evaluate the role of ultrasound, as non-invasive and decision-making tool, in addressing this issue. **Materials and Methods:** Nineteen buffalo cases were employed in this study and subjected to critical clinical and ultrasonographic examination: pre- and post-therapeutic interventions. **Results:** Emaciation, inappetance, scanty feces, ruminal atony, systemic disturbances and dull demeanor were found general clinical findings. Specifically, recurrent tympany and abdominal pain (n = 9; 47.4%) and abdominal distension (n = 2; 10.5%) were observed in abdominal abscesses, while respiratory manifestations (n = 6; 31.6%) and cardiac manifestations (n = 4; 21.1%), were recorded in thoracic abscesses. Ultrasonographically, abdominal (n = 13; 68.4%) and thoracic (n = 6; 31.6%) abscesses were diagnosed and the treatment strategies were consequently determined. Of 19 cases, 10 animals (52.6%) were of bad prognosis and advised to undergo slaughter, 6 cases (31.6%) were locally and systemically treated and 3 buffaloes (15.8%) were only subjected to systemic treatment. Of 9 treated animals, 4 cases (44.4%) responded and showed a clear improvement post-treatment. **Conclusion:** This study concludes that abdominal and thoracic ultrasound is a beneficial tool in diagnosis of buffaloes in which the internal abscessations are obscured. Additionally, it could efficiently provide clinicians with the therapeutic decision for a proper and economical intervention.

Key words: Internal abscesses, ultrasonography, pericardial effusion, ascites, reticulitis, paracentesis

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Classical diagnosis of surgical body swellings (e.g., hematomas, abscesses, hernias, neoplasms, bursitis and cysts) depends mainly on anamnesis and clinical examination¹. However, in some clinical cases the local pain, skin thickness and critical body location (e.g., submandibular region) may hinder the clinical decision. Therefore, there is a necessity to employ other additional diagnostic tests to help with clinical decision. Besides, diagnosis of certain clinical cases in which deep or internal body swellings as a reason of illness, such as inflamed gallbladder and hepatic abscess, may be suspicious because of un-specific experiencing clinical symptoms. Thus, ultrasound, as an accurate, of low cost, non-invasive and well applicable could be used as an auxiliary tool to reach the ultimate diagnosis of the vague internal surgical swellings^{2,3}, either alone or combined with ultrasound-based biopsies⁴. Moreover, the ultrasound is used as a valuable tool for determining the extent and nature of accumulating fluid inside various circumscribed swellings (edema, blood, pus, fibrin, serous and urine)⁵⁻⁷, as well as lesion architecture. In veterinary sector, there are very scarce scientific reports that have recently discussed the role of ultrasound in diagnosis and characterization of various external swellings in cows^{5,6,8} and buffaloes⁶⁻⁸. On the other hand, so far, there is also scarcity of papers that have addressed the potentiality of ultrasound in diagnosis of abdominal abscessations in cows⁹⁻¹¹ and there are few research papers have studied the internal purulent collections in buffaloes^{11,12}. Therefore, in order to fill this gap and expand the relevant knowledge, the purpose of this retrospective study was to portray and fully describe the potential role of ultrasound as an adjunctive and readily available tool in diagnosis of different internal abscessations in buffaloes and to evaluate its role in determination of the proper therapy for those cases.

MATERIALS AND METHODS

Animals: Nineteen buffalo cases were enrolled in this study. These animals were investigated at Veterinary Hospital, Zagazig University from July, 2016-June, 2017. On presentation, all animals had chronic weight loss, indigestion and scanty feces as well as history of recurrent fever (10-30 days ago). These animals were females, weighted 400-600 kg (Mean \pm SD: 507.36 \pm 105.66) and aged 2-10 years. These animals were also recorded as 9 pregnant, 6 recently calved and 4 non-pregnant.

Clinical examination: All animals were subjected to thorough clinical examination as previously described¹³. In all cases, assessment of the vital parameters, [body temperature, pulse rate and respiratory rate], pain tests and rumen, lung and heart auscultation were fulfilled, as well as, their experiencing clinical findings were also recorded.

Ultrasonography: Abdominal and thoracic ultrasounds were conducted in all animals under investigation. Three topographic seats were evaluated by abdominal ultrasound: Left abdominal scanning, right abdominal scanning and ventral abdominal scanning. The left and right seats were dorsoventrally scanned at 6th-12th intercostal spaces as well as left and right flanks, while the ventral scanning was performed craniocaudal from xiphoid cartilage to base of udder. The thoracic ultrasound was conducted dorsoventrally at left and right intercostal space (3rd-6th intercostal spaces). These examinations were done, while animal in standing position, using ultrasound machine (Sonoscape, A5V, China) with 3.5 and 5 convex transducers after application of clipping, shaving and coupling gel at the examined site. When convenient, ultrasonography based aspiration was afterwards carried out then the obtained samples were aseptically collected and submitted to sensitivity test.

Interventions: Of note, the abscesses diagnosed here were confirmed based on paracentesis procedures performed in all cases, except one case in which the abscess localization was confirmed after necropsy procedure.

Medical and surgical interventions were performed based on the results of ultrasonographic examination. When decided, buffaloes were received local and systemic therapy (n = 6) or only systemic (n = 3).

The local intervention of intra-lesional lavage with sterile normal saline and followed by intra-lesional injection of metronidazole 0.5% (Flagyl®; Amireya, Egypt) was initially performed. The animals were received systemic course of a combination of gentamycin and amoxicillin (Gentamox® intramuscular; Hipra, Spain) and metronidazole drip for successive 7 days.

The aspiration technique was conducted under ultrasonographic guidance after aseptic preparation of the entry seats with alcohol 70% and local infiltration anesthesia with lidocaine HCL (2%). When required, the animals were intravenously sedated with xylazine HCL 2% (Xylaject®; ADWIA, El-Obour, Egypt, 0.1 mg kg⁻¹).

Additionally, oral administration of magnetic bare was applied in 13 cases (68.4%) with peri-reticular and thoracic abscesses.

Clinical and ultrasonographic examinations were re-assessed after finishing the course of treatment.

RESULTS

Clinical findings: Emaciation, inappetence, scanty feces, ruminal atony, systemic disturbances and dull demeanor were the most common recorded findings for animals had either abdominal or thoracic abscesses. Nine animals (47.4%) with abdominal abscesses experienced abdominal pain and recurrent tympany, while abdominal distension was observed in 2 cases (10.5%). Cough, mouth breathing, abducted elbows and abnormal lung sound (wheezes and cracking) (n = 6; 31.6%) and jugular pulsation, brisket edema and muffled heart sound (n = 4; 21.1%) were the observed clinical findings for the animals suffered thoracic abscess (Table 1).

Ultrasonography: Location, size, number and stages of detected abscesses are depicted in Table 2.

Abscesses were found in thoracic cavity (n = 6; 31.6%) (Fig. 1a), perireticular (n = 7; 36.8%) (Fig. 1b-e), hepatic (n = 3; 15.8%), splenic (n = 2; 10.5%) (Fig. 2) and between rumen and abdominal wall (n = 1; 5.3%) (Fig. 1f). Fourteen cases (73.7%) had single and 5 cases (26.3%) had multiple abscesses. All abscesses appeared circumscribed with hypochogenic to hyperechogenic wall and the contents were varied from anechoic (n = 6; 31.6%) (Fig. 1-e), hypoechoic to echogenic, (n = 10; 52.6%) (Fig. 1a, f) and hyperechoic with distal acoustic shadowing, either clear or dirty (n = 3; 15.8%) (Fig. 2a-c). Echogenic wall-derived septa invaded the content of abscess were observed in only one case (5.3%) (Fig. 1b). The size of abscesses were variably recorded from ≤ 2 - ≥ 10 cm. Based on their size, the abscesses were categorized into small (≤ 2 cm; n = 6), medium (3-9 cm; n = 8) and large (≥ 10 cm; n = 5). Four cases (21.1%) with thoracic abscesses had pleural and pericardial effusion and hepatic congestion. Reticulitis was observed in 13 cases (68.4%): 6 thoracic and 7 abdominal. Ultrasonographic description of these lesions is displayed in Fig. 3 and Table 3.

Table 1: Recorded clinical findings of buffaloes with abdominal and thoracic abscesses

Clinical findings	Abdominal abscesses (n = 13)	Thoracic abscesses (n = 6)	Total numbers (n = 19)	Percentage
Emaciation	13	6	19	100.0
Inappetence	13	6	19	100.0
Loss of demeanor	10	6	16	84.2
Scanty feces	13	6	19	100.0
Ruminal atony	13	6	19	100.0
Recurrent tympany	9	0	9	47.4
Abdominal pain (gait stiffness, grunting)	9	0	9	47.4
Abdominal distension	2	0	2	10.5
Cough, mouth breathing and abducted elbows	0	6	6	31.6
Abnormal lung sound (wheezes and cracking)	0	6	6	31.6
Brisket edema	0	4	4	21.1
Jugular pulsation	0	4	4	21.1
Abnormal heart sound (muffled)	0	4	4	21.1
Systemic disturbances*	10	5	15	78.9
Recumbency	2	0	2	10.5
Icterus	1	0	1	5.3

*Systemic disturbances include elevation of body temperature above 39°C, respiratory rate above 30 min⁻¹ and pulse rate above 80 min⁻¹ 13

Table 2: Ultrasonographic findings (location, size, number and stages) of internal abscesses in buffaloes

Location	Size			Number		Stages		
	Small (≤ 2 cm)	Medium (3-9 cm)	Large (≥ 10 cm)	Single	Multiple*	Unripened	Ripened	Calcified
Thoracic	0	2	4	6	0	3	3	0
Reticulum/rumen	0	4	0	4	0	1	3	0
Reticulum/liver	0	0	1	1	0	0	1	0
Reticulum/spleen	1	0	0	1	0	1	0	0
Reticulum/abomasum	0	1	0	1	0	1	0	0
Hepatic	3	0	0	0	3	0	1	2
Splenic	2	0	0	0	2	0	1	1
Rumen/abdominal wall	0	1	0	1	0	0	1	0
Total (%)	6 (31.6)	8 (42.1)	5 (26.3)	14 (73.7)	5 (26.3)	6 (31.6)	10 (52.6)	3 (15.8)

*Multiple abscesses were described, when there was more than one abscess per US-image or single abscess (per each image) of different US-images of the same organ

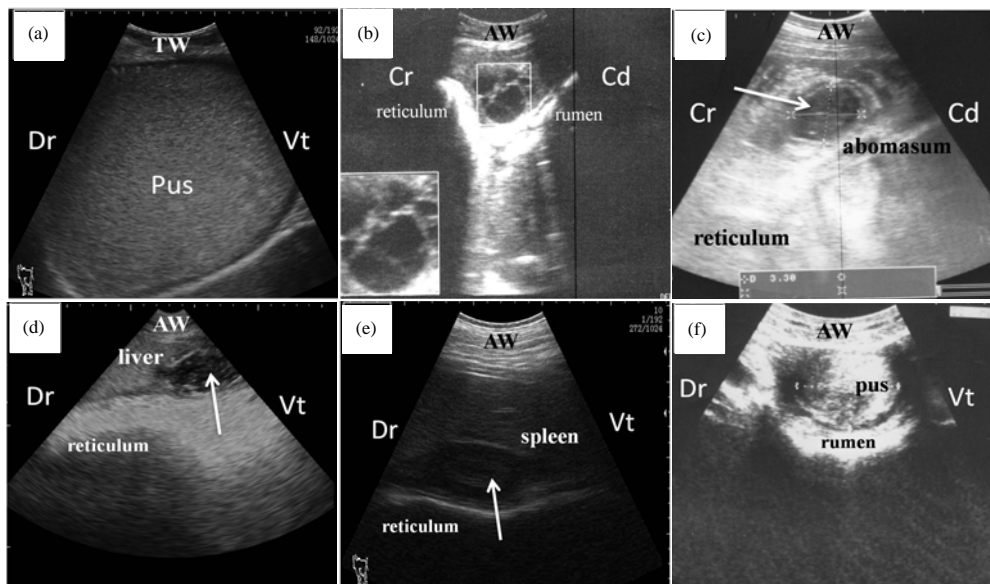


Fig. 1(a-f): Ultrasonographic findings of abdominal and thoracic abscesses, (a) Note large-size thoracic abscess imaged at right 4th ICS with echogenic appearance of its content indicating ripened stage, (b) Medium-size abscesses with anechoic content (unripened) imaged from ventral abdomen, these abscesses were located between reticulum and rumen with the echogenic septations, (c) Reticulum and abomasum (arrow), (d) Reticulum and liver (arrow), (e) Reticulum and spleen (arrow) and (f) Medium-size ripened abscess with echogenic content located between rumen and abdominal wall and imaged from left flank region

TW: Thoracic wall, AW: Abdominal wall, ICS: Intercostal space, Dr: Dorsal, Vt: Ventral, Cr: Cranial, Cd: Caudal

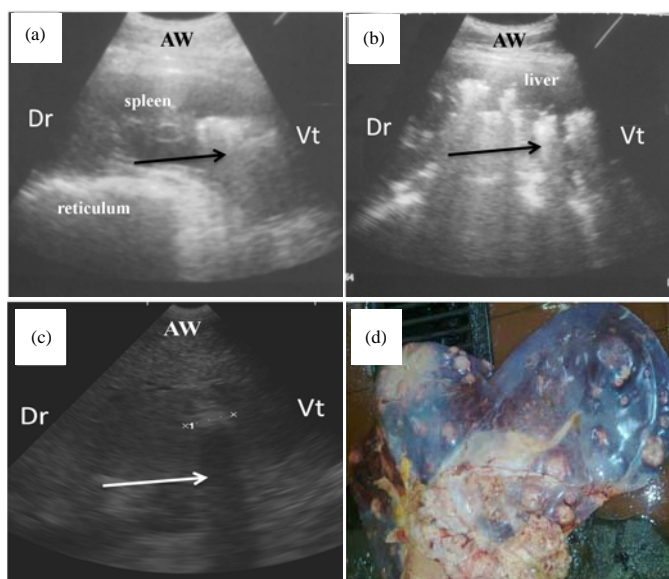


Fig. 2(a-d): Ultrasound images of hepatic and splenic abscesses, (a) Note a small-size abscess observed at left 6th ICS with hyperechogenic appearance of its content with distal dirty acoustic shadowing (gases, arrow) located intra-splenic, (b) small-size multiple intra-hepatic abscesses imaged from right 9th ICS dirty acoustic shadowing (gases, arrow), (c) Note the distal acoustic shadowing (arrow) appeared distally to calcified abscess and (d) Note the necropsy finding of liver abscesses that confirms the ante-mortem ultrasonographic examination

AW: Abdominal wall, ICS: Intercostal space, Dr: Dorsal, Vt: Ventral

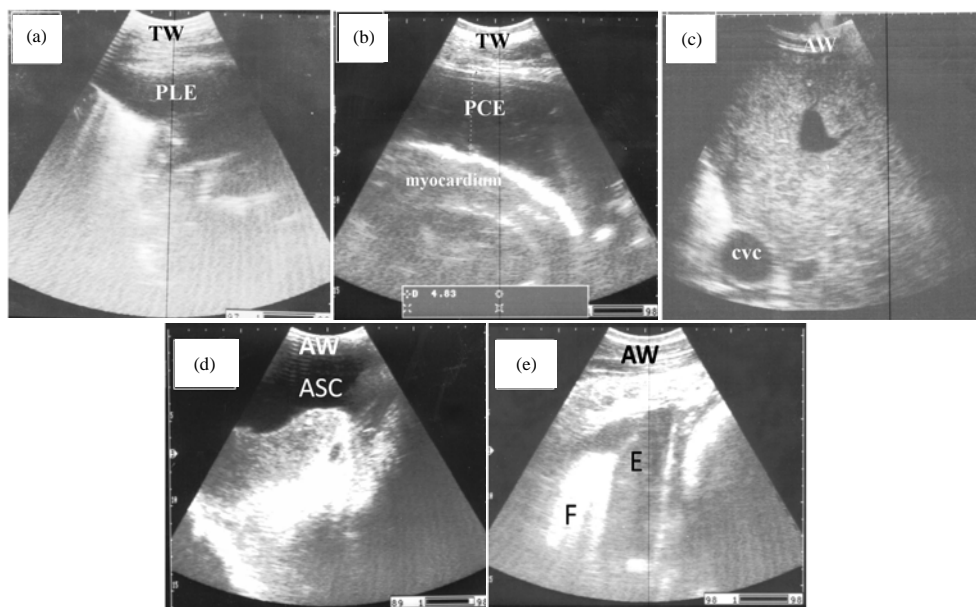


Fig. 3(a-e): Ultrasonography of some lesions that were combined with internal abscessations, (a) Note presence of clear anechoic fluid into the pleural cavity (pleural effusion, (b) as well as pericardial cavity (pericardial effusion, (c) Dilated Caudal Vena Cava (CVC) indicates hepatic congestion is also shown and (d) Peritoneal cavity (ascites) appeared clear anechoic and (e) Peritonitis with echogenic bands represents fibrin interspersed with hypoechoic exudates
 PLE: Pleural effusion, PCE: Pericardial effusion, ASC: Ascites, F: Fibrin; E: Exudate, TW: Thoracic wall, AW: Abdominal wall

Table 3: Ultrasonographic description of the associated lesions with internal abscesses

Type of lesion	No. of cases*	Ultrasonographic description	Abscess location
Pleural/pericardial effusion	4	Clear anechoic fluid in pleural/pericardial sacs	Thoracic
Hepatic congestion	4	Dilated portal vein and rounded appearance of caudal vena cava with more echogenic appearance of hepatic parenchyma	Thoracic
Reticulitis	13	Thickening of reticular wall with absence of biphasic contraction of the reticulum	Thoracic (n = 6) Perireticular (n = 7)
Diffuse peritonitis	1	Echogenic band of fibrin interspersed with hypoechoic fluid distributed in whole abdominal cavity	Perireticular
Ascites	1	Clear anechoic fluid in distributed in whole abdominal cavity	Hepatic
No lesions	5	-	Splenic (n = 2) Hepatic (n = 2) Between rumen and abdominal wall (n = 1)

*Same case had more than one associated lesion

Therapeutic interventions: Three out of 6 cases responded to local and systemic therapy and only 1 out of 3 cases responded to systemic therapy (Table 4). Unfortunately and owing to detected bad prognostic parameters, the owners of 10 cases were advised to slaughter their animals.

DISCUSSION

The most important finding of this study is that ultrasonography is the most valuable tool for confirmatory diagnosis of internal abscessations in buffaloes.

It is well known that clinical findings of internal abscessations of buffaloes are not specific¹⁴. At this regards,

the clinical findings, as reported in this study, were found variable according to origin of abscessation¹¹.

Herein, for abdominal abscesses, we observed recurrent tympany and abdominal distension and abdominal pain, while in case of thoracic abscessations, cough and abnormal lung sound (wheezes and cracking), jugular pulsation, brisket edema and muffled heart sound were experienced by the examined animals^{15,16}. Relying on these clinical signs and/or laboratory tests were actually not reliable to have an ultimate confirmatory diagnosis; this due to these signs could be observed in other various chronic inflammatory diseases^{9,10}. Therefore, ultrasonography, as non-invasive imaging tool, is clinically worth for diagnosing such conditions. In addition,

Table 4: Types of intervention and number of the improved cases with initial and post-treatment evaluation

Type of interference	No. of cases	Initial clinical findings	Initial ultrasonographic findings	Re-evaluated clinical findings	Re-evaluated ultrasonographic findings
Slaughter after initial examination	10	Inappetence, loss of demeanor, emaciation, ruminal atony, systemic abdominal pain (n = 10) Recurrent tympany, recumbence (n = 2) Icterus, abdominal distention (n = 1) Respiratory and cardiac manifestation (n = 4)	Single large size thoracic abscess located at mediastinal region with pleural and pericardial effusion, hepatic congestion (n = 4) Multiple small size, abscesses located intra hepatic parenchyma (n = 3) with intra-splenic tissue (n = 2) Medium size, ripened abscess between reticulum and rumen with diffuse peritonitis (n = 1)	-	-
Improved after local and systemic treatment	3	Inappetence, loss of demeanor, ruminal atony, recurrent tympany, emaciation, (n = 3) and systemic disturbances (n = 2)	Single medium size abscess between reticulum and rumen (n = 2); reticulum and abomasum (n = 1)	Improvement of general condition and appetite	Small size abscesses with the same locations
Slaughter after local and systemic treatment	3	Inappetence, loss of demeanor, emaciation, ruminal atony (n = 3) Respiratory manifestations, systemic disturbances (n = 2)	Medium size thoracic abscess (n = 2) Large-size abscess between reticulum and liver (n = 1)	Inappetence, loss of demeanor, systemic disturbances, emaciation, ruminal (n = 3) Cardiac manifestations (n = 2)	Recurrence of abscess with the same initial size and location
Improved after systemic treatment	1	Inappetence, emaciation, ruminal atony, recurrent tympany, systemic disturbances	Small size abscess between reticulum and spleen	Good health condition, ruminal motility and appetite	Disappearance of abscess
Slaughter after systemic treatment	2	Inappetence, recurrent tympany, ruminal atony (n = 2) Abdominal distention (n = 1)	Medium size, ripened abscess between reticulum and rumen (n = 1) and between rumen and abdominal wall (n = 1)	Same signs of initial assessment	Abscess with the same size and location

herein, ultrasound provided us with profitable records about exact location, size, content and stages of the abscess that were helpful in determination of the efficient way for their treatment^{7,8,17}.

As ultrasonography has an important role in the diagnosis of abscesses in other animals including equine^{18,19} and cows^{10,20}, we became interested in its role in imaging of internal abscessations in buffaloes. However, there are only very scarce reports in the ultrasound-based diagnosis of internal abscesses in buffaloes¹¹. On the other hand, data of such imaging technique that is not only in diagnosis of internal abscessations but also in constructing an ultimate decision for treating the affected animals properly, is also still required.

The current study demonstrated that, peri-reticular (n = 7; 36.8%), between rumen and abdominal wall (n = 1; 5.3%), splenic (n = 2; 10.5%) and hepatic (n = 3; 15.8%) abscesses were ultrasonographically diagnosed. Interestingly, we also found that the peri-reticular abscesses were variably imaged in regards to their boundaries: Reticulum/rumen (n = 4; 21.1%), reticulum/liver (n = 1; 5.3%), reticulum/spleen (n = 1; 5.3%) and reticulum/abomasum (n = 1; 5.3%), that gives an explanation of why there were merged clinical findings of both affected organs^{11,21}.

In addition, in conjunction with data obtained by ultrasonography, the critical aspiration of the content of abscess under the guide of ultrasound was also helpful in determining the nature and volume of their content to give information about the stage of abscess^{4,7}. Based on this, it was found that abscesses were varied from unripened (n = 6; 31.6%), ripened (n = 10; 52.6%) and caseated/calcified (n = 3; 15.8%) nature according to their stage of maturation. Moreover, in this study, the most common locations of the imaged abscesses were peri-reticular (n = 7; 36.9%) and thoracic (n = 6; 31.6%), in which they appeared medium to large size and single. It is also important to mention that the hepatic and splenic abscesses were herein recorded in 3 and 2 cases, respectively and appeared small to medium size and multiple. In a previous study, only 2 and 3 cases out of 11 cases were found reticular and thoracic abscesses, respectively¹¹.

The abscesses in the current study were circumscribed as shown by others^{7,9}. The thicknesses of the capsule may vary according to their acuteness or chronicity nature of abscesses. However, in some situations, thickness may increase in both cases due to edema or fibrosis, respectively⁵. Specifically, by ultrasound, the edematous capsule appeared isoechoic to hypoechoic, while the fibrosed one appeared hyperechoic⁵. Herein, the ultrasonographically examined capsules were

mostly appeared hypochogenic to hyperechogenic. In the present study, acoustic shadowing, either clean or dirty, were detected in 3 cases medial to abscess that is indicative of calcification or gases into the abscess core²². Moreover, the appearance of a dirty shadowing or a comet tail artifact during ultrasonographic examination indicates foreign bodies inside the lesion^{23,24}.

Further, pleural and pericardial effusion and hepatic congestion were observed in the present study in 4 cases (21.1%). These lesions were indicative of right side congestive heart failure, as noticed in this study, due to mechanical compression of a large abscess on the heart tissue and this was considered as bad prognostic finding²⁵. Reticulitis, as an additional lesion, was found in 13 cases indicating that the abscesses in these cases were formed due to traumatic reticuloperitonitis's complications²⁶.

Based on the information provided by ultrasound, the local and systemic treatment were afterwards performed. From these present results, the owners were advised to slaughter the diseased animals (n = 10; 52.6%) due to their bad prognosis and, as we found, there was no any sense of treatment of such cases. On the other hand, 4 cases showed a clear improvement in their general conditions, after they received local and/or systemic treatment.

CONCLUSION

As revealed in this study, depending only on clinical findings is not sufficient to reach exact diagnosis of internally localized abscesses particularly in buffaloes. Ultrasound, as employed in this study, could efficiently confirm diagnosis of these risky abscesses (e.g., hepatic, reticular, splenic and thoracic abscesses), in which the clinical findings are highly confusable. Indeed, it could efficiently help in gaining appropriate decision for the definite treatment and prognosis of such cases.

SIGNIFICANCE STATEMENT

This study highlights the pivotal role of ultrasonography in diagnosis, localization and treatment of some critical internal abscesses as well as their combined lesions in buffaloes. As discussed here, employing ultrasound and clinical examination, this study will provide the clinicians with the roadmap by which they can properly diagnose such cases. Consequently, they can also direct the buffaloes' owners to the definite line of treatment and prognosis of these risky abscesses.

REFERENCES

1. Misk, N.A., T.N. Misk and M.A. Semieka, 2016. Field diagnosis and differential diagnosis of body surface swellings in different domestic animals. Proceedings of the 13th Congress of Egyptian Society for Cattle Diseases, February 1-4, 2016, Hurghada, Egypt, pp: 55-71.
2. Abdelaal, A., S. Gouda, A. Ismail and M. Goma, 2014. Reticular diaphragmatic hernia in Egyptian buffaloes: Clinical, hemato-biochemical and ultrasonographic findings. Pak. Vet. J., 34: 541-544.
3. Manjunatha, D.R., B. Bhagavanthappa, D. Jahangirbasha, D. Dilipkumar, R.K. Vivek and B.V. Shivaprakash, 2016. Diagnosis of thoraco-abdominal disorders by ultrasonography in bovine. Indian J. Vet. Surg., 37: 10-13.
4. Abdelaal, A.M., S.M. Gouda and M. Tharwat, 2014. Clinico-biochemical, ultrasonographic and pathological findings of hepatic abscess in feedlot cattle and buffaloes. Vet. World, 7: 306-310.
5. Seyrek Intas, D., N. Celimli, O.S. Gorgul and G. Cecen, 2005. Comparison of clinical, ultrasonographic and postoperative macroscopic findings in cows with bursitis. Vet. Radiol. Ultrasound, 46: 143-145.
6. Ali, M.M. and M.A.H. Abd El-Hakim, 2012. Ultrasonographic differential diagnosis of superficial swellings in farm animals. J. Adv. Vet. Res., 2: 292-298.
7. Abouelnasr, K., E.S. El Shafaey, E. Mosbah and S. El Khodery, 2016. Utility of ultrasonography for diagnosis of superficial swellings in buffalo (*Bubalus bubalis*). J. Vet. Med. Sci., 78: 1303-1309.
8. Kumar, A., J. Mohindroo, V. Sangwan, S.K. Mahajan, K. Singh, A. Anand and N.S. Saini, 2014. Ultrasonographic evaluation of massive abdominal wall swellings in cattle and buffaloes. Turk. J. Vet. Anim. Sci., 38: 100-103.
9. Braun, U., N. Pusterla and K. Wild, 1995. Ultrasonographic findings in 11 cows with a hepatic abscess. Vet. Rec., 137: 284-290.
10. Braun, U., U. Iselin, C. Lischer and E. Fluri, 1998. Ultrasonographic findings in five cows before and after treatment of reticular abscesses. Vet. Rec., 142: 184-189.
11. Mohamed, T. and S. Oikawa, 2007. Ultrasonographic characteristics of abdominal and thoracic abscesses in cattle and buffaloes. J. Vet. Med. Ser. A, 54: 512-517.
12. Gouda, S.M., 2015. Ultrasonographic identification of abdominal and thoracic lesions resulting from foreign body syndrome in buffaloes. Res. J. Vet. Pract., 3: 41-46.
13. Rosenberger, G., 2012. Die Klinische Untersuchung des Rindes. 3rd Edn., Verlag Paul Parey, Hamburg, Berlin.
14. Ogilvie, T., J.R. Pringle, S.L. Ihle and J. Lofstedt, 1998. Large Animal Internal Medicine. Wiley, New York, ISBN: 9780683180336, Pages: 512.
15. Anderson, N.V., 1992. Veterinary Gastroenterology. 2nd Edn., Lea & Febiger Inc., Pennsylvania, PA., ISBN-13: 978-0812111705, Pages: 873.
16. Constable, P.D., K.W. Hinchcliff, S.H. Done and W. Gruenberg, 2017. Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats. 11th Edn., W.B. Saunders Company, Philadelphia, USA., ISBN-13: 9780702070600, Pages: 1025.
17. Steiner, A. and B. Lejeune, 2009. Ultrasonographic assessment of umbilical disorders. Vet. Clin. N. Am.: Food Anim. Pract., 25: 781-794.
18. Pratt, S.M., S.J. Spier, S.P. Carroll, B. Vaughan, M.B. Whitcomb and W.D. Wilson, 2005. Evaluation of clinical characteristics, diagnostic test results and outcome in horses with internal infection caused by *Corynebacterium pseudotuberculosis*: 30 cases (1995-2003). J. Am. Vet. Med. Assoc., 227: 441-448.
19. Valdes, A. and J.R. Johnson, 2005. Septic pleuritis and abdominal abscess formation caused by *Rhodococcus equi* in a foal. J. Am. Vet. Med. Assoc., 227: 960-963.
20. Voros, K., Z. Bakos, Z. Lukacs, J. Toth, L. Szeredi and F. Vetesi, 1997. Paraintestinal mesenteric abscess and chronic peritonitis in a bull. J. Am. Vet. Med. Assoc., 211: 1571-1572.
21. Abdelaal, A.M., M. Floeck, S. El Maghawry and W. Baumgartner, 2009. Clinical and ultrasonographic differences between cattle and buffaloes with various sequelae of traumatic reticuloperitonitis. Veterinarni Medicina, 54: 399-406.
22. Chen, M.J., M.J. Huang, W.H. Chang, T.E. Wang and H.Y. Wang *et al*, 2005. Ultrasonography of splenic abnormalities. World J. Gastroenterol., 11: 4061-4066.
23. Abdelaal, A. and M. Floeck, 2015. Clinical and sonographical findings in buffaloes (*Bubalus bubalis*) with traumatic reticuloperitonitis. Veterinarski Arhiv, 85: 1-9.
24. Goma, M. and A. Abdelaal, 2015. Ultrasonography versus radiography in detection of different foreign bodies in a cadaveric calf thigh specimen. Res. J. Vet. Pract., 3: 83-88.
25. Buczinski, S., D. Francoz, G. Fecteau and R. DiFruscia, 2010. Heart disease in cattle with clinical signs of heart failure: 59 cases. Can. Vet. J., 51: 1123-1129.
26. Mostafa, M.B., A.M. Abu-Seida, A.M. Abdelaal, O.S. Al-Abbadi and S.F. Abbas, 2015. Ultrasonographic features of the reticulum in normal and hardware diseased buffaloes. Res. Opin. Anim. Vet. Sci., 5: 165-171.