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Full Length Article

Clinical, laboratory and ultrasonographic findings in Egyptian buffalo (*Bubalus bubalis*) with caecal and colonic dilatation

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KEYWORDS

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Abstract The present study was conducted to describe the clinical, laboratory and ultrasonographic findings of caecal and colonic dilatation in Egyptian buffalo (*Bubalus bubalis*). A total number of forty buffaloes were included in the study and divided into two groups: control group ($n = 20$) and diseased group ($n = 20$). Diseased buffalo were admitted to the Veterinary Teaching Hospital at Assiut University-Egypt. Each of the diseased animals was subjected to clinical, rectal, laboratory and ultrasonographic examinations. Clinically, buffalo with dilated caecum/colon showed reduced appetite, distended right abdomen, abdominal pain and tensed abdomen. Rectal examination indicated empty rectum with the presence of mucus and dilated loop of caecum and/or colon. Buffalo with dilated caecum/colon showed significant ($P < 0.05$) hypoproteinemia and hypoalbuminemia with significant ($P < 0.05$) increase in blood serum activities of aspartate aminotransferase (AST) and alkaline phosphatase (ALK). Ultrasonographically, the dilated caecum and proximal loop of colon occupied the last right three intercostal space (ICSs) particularly their ventral part, intertangled with the liver dorsally in these ICSs. Dilated colon did not hinder the visibility of the liver. The dilated caecum/colon also filled the whole right flank region, with hiding of right kidney, loops and peristaltic movement of the small intestines. The closest wall of the dilated caecum and proximal loop of the colon was imaged as thick semi-circular echogenic line. The furthest wall and contents of dilated caecum/colon were not imaged. In conclusion, buffalo with caecal and/or colonic dilatation have non-specific clinical and laboratory findings; however the affected animals show characteristic ultrasonographic findings.

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1. Introduction

Caecal dilatation occurs mainly in dairy cattle during the first few months of lactation. The caecum may be dilated with gas or distended with ingesta, and consequently volvulus may occur. Clinically it is characterized by inappetence, drop in milk production, decreased amount of feces, a ping over the right upper flank, distended right abdomen and easily recognizable viscus on rectal palpation. The prognosis is usually good if the diagnosis is made early [1].

In caecal dilatation without volvulus, there are varying degrees of anorexia, mild abdominal discomfort, a decreased milk production for few days and a reduced feces output [2,3]. In some cases there are no clinical signs and the dilated caecum is found coincidentally on rectal examination. Moreover, in simple dilatation, the temperature, heart rate and respiration are usually within normal ranges. A distinct ping is heard on percussion and simultaneous auscultation in the right flank region, extending forward to the 10th intercostal space (ICSs) [2].

In caecal volvulus, anorexia, ruminal atony, reduced amount or complete absence of feces, distended right flank, dehydration and tachycardia are evident, depending on the severity of the volvulus and the degree of ischemic necrosis. There may be some evidence of mild abdominal pain characterized by treading of the pelvic limbs and kicking at the abdomen. The ping is centered over the right paralumbar fossa and may extend to the 10th and 12th ICSs. Fluid-splashing sounds are usually audible on ballottement and auscultation of the right flank [1,2].

In cattle with caecal dilatation, there is a distension of the caecum, which may be accompanied by displacement, torsion or retroflexion of the organ and additional distension of the spiral colon [4]. With distension alone, the apex of the caecum is displaced toward or into the pelvic inlet. With torsion, the distended caecum rotates about its longitudinal axis, and with retroflexion, the caecum folds dorsally or ventrally in the ileocaecal region, resulting in a cranial orientation of the apex. Caecal dilatation is associated with partial or complete cessation of the passage of intestinal contents [5,6].

Rectal findings in case of caecal dilatation revealed an empty rectum. At the pelvic inlet, the dilated caecum is usually palpable and sometimes protrudes into the pelvic cavity [7].

In apparently healthy cows, ultrasonographic features of healthy and dilated caecum/colons have been well illustrated. A dilated caecum can always be imaged from the lateral abdominal wall [5,8] and in some cases, may be seen from the 12th, 11th and 10^{th} ICSs. The dilated caecum and the proximal loop of the colon are always immediately adjacent to the abdominal wall. The wall of the dilated caecum and proximal loop of the colon closest to the transducer was imaged ultrasonographically as thick, echogenic, semicircular lines [8,9].

To the authors' knowledge, there are scarce studies on disorders of large intestines in buffalo. Therefore, the present study was conducted to describe the clinical, laboratory and ultrasonographic findings in Egyptian buffalo (*Bubalus bubalis*) with caecal and colonic dilatation

2. Materials and methods

2.1. Animals

A total number of 40 animals were enrolled in this study. They were divided into two groups; control group ($n = 20$) and diseased group ($n = 20$). The control group was selected from healthy non-pregnant buffalo belonged to a herd at the Veterinary Teaching Hospital, Faculty of Veterinary Medicine, Assiut University, Egypt. The age of these animals ranged between 1 and 7 years. The diseased buffalo were admitted to the Veterinary Teaching Hospital with an age ranged from 3 to 7 years. They included 6 males and 14 females. The diseased animals were admitted with a history of anorexia, decreased fecal output and abdominal pain. The various degrees of abdominal distention, mucoid scanty faces and reduction of milk production separately or collectively were also reported in the diseased cases. All Institutional and National Guidelines for the care and use of animals were followed.

2.2. Clinical examination

All buffalo underwent a thorough clinical examination described by Jackson and Cockcroft [10]. The general condition and demeanour, rectal temperature, heart rate, respiratory rate and lung sounds were determined. Swinging and/or percussion auscultation on both sides of the abdomen and rectal palpation were also performed. Animals were treated in accordance with guidelines established by the Faculty of Veterinary Medicine, Assiut University Committee of Animal Care.

2.3. Blood sampling

Whole blood and serum samples were collected and all precautions of sample collections and preparation for accurate evaluation of hematological and biochemical indices were taken into consideration according to Coles [11].

2.4. Complete blood count (CBC) assessment

A fully automated blood cell counter machine (Medonic CA620 Vet hematology analyzer – Sweden) was used to determine various hematological parameters. Differential leukocytic count (DLC) was determined using four field meander method.

2.5. Biochemical assays

Spectrophotometer (UV/Visible Spectrophotometer, Optizen32220 UV, Korea) was adopted to determine serum concentrations of aspartate aminotransferase (AST), γ-glutamyltransferase (GGT), alkaline phosphatase (ALK), total protein, albumin, cholesterol and triglycerides (TG). Serum globulin was determined by subtraction of albumin from total protein and its value was used to calculate albumin/globulin ratio (A/G ratio). All kits and reagents were obtained from Spectrum Reagents (Egyptian Company for Biotechnology, Egypt).

2.6. Ultrasonographic examination

Diseased and healthy buffalo were examined ultrasonographically according to the previous studies in cattle [9,12,13–17] by using a 3.5 MHz Sector transducer of ultrasound device (FF Sonic, Model UF-4000, Tokyo, Japan) to detect either the normal organs in the control animals or the affected one in diseased buffalo. It was performed on standing non-sedated buffalo after clipping of the hair and application of ultrasound coupling gel at the examined area. The examined organs included heart, reticulum, rumen, abomasum, omasum, spleen, liver, gall bladder, right kidney, small intestine (SI) and large intestine (LI). Dorsal and ventral parts of the right flank and the last 3 right ICSs were screened for determination of intestinal disorders.

2.7. Statistical analysis

All statistical analyses were performed using Computer Software (SPSS version 16.0, Chicago, USA). All data were presented as mean ± standard deviation (SD). Independent-Sample T test of the obtained data was done and significance level was set at $P > 0.05$. The significance of differences between the means at control group and diseased group was evaluated [18].

3. Results

3.1. Clinical findings

The most common clinical signs associated with dilated caecum/colon included reduced appetite, distended abdomen especially in the right side, associated with pain sensation on palpation and tensed abdomen. Many cases ($n = 11$) expressed colic pain associated with constipation and straining. Rectal examination indicated empty rectum with the presence of mucus and dilated loop of caecum and/or colon. Body temperature, heart rate and respiration were normal with reduced ($n = 12$) to absent ($n = 8$) ruminal motility.

3.2. Blood picture and serum biochemical analysis

The hematological profiles are collected in Table 1. The diseased buffalo showed lymphocytic leucocytosis. The blood serum biochemical levels are shown in Table 1. Compared to the control group, buffalo with dilated caecum/colon showed significant ($P < 0.05$) hypoproteinemia and hypoalbuminemia with significant ($P < 0.05$) increase in blood serum activities of AST and ALK.

Table 1 Mean values ± standard deviation of blood picture and serum biochemical indices in control ($n = 20$) and diseased buffalo ($n = 20$).

	Control group	Diseased group
T.WBCs (G/L)	6.71 ± 1.63	14.69 ± 4.16*
Neutrophiles (%)	26.4 ± 9.13	15 ± 3.63*
Lymphocytes (%)	60.80 ± 7.73	79.34 ± 8.14*
Monocytes (%)	7.80 ± 4.63	3.37 ± 0.42
Eosinophiles (%)	3.60 ± 2.07	1.29 ± 0.26
Band cells (%)	1.40 ± 0.52	1 ± 0.3
Total proteins (g/L)	94.7 ± 10.7	64.34 ± 6.36*
Albumin (g/L)	55 ± 8.4	28.84 ± 2.14*
Globulin (g/L)	45.7 ± 4.6	36.5 ± 3.3
GGT (U/L)	14.95 ± 5.23	20.10 ± 4.26
ALK (U/L)	36.11 ± 8.40	62.48 ± 5.95*
AST (U/L)	32.92 ± 4.77	90.38 ± 9. 41*
Cholesterol (mmol/L)	10.68 ± 1.10	9.90 ± 0.93
TG (mmol/L)	3.62 ± 0.2	3.06 ± 0.82

ALK: alkaline phosphatase, AST: aspartate aminotransferase, GGT: γ-glutamyltransferase, TG: triglycerides, T.WBCs: Total white blood cells count.
* = significant ($P < 0.05$).

3.3. Ultrasonographic findings

Ultrasonographic examination of the control group revealed normal reticulum, rumen, abomasums, omasum, spleen, heart, liver, gall bladder, large intestine and small intestine.

In healthy buffalo, the caecum and proximal loop of the colon (Fig. 1a), and the spiral colon (Fig. 1b) could be clearly imaged from the right flank region (ventrally). They were usually imaged medially to the loops of small intestine. The wall of the proximal loop of colon and caecum close to the transducer was imaged as continuous echogenic line, slightly curved or gar-land like appearance [spiral colon]. Meanwhile, the furthest wall of caecum and colon could not be imaged.

Ultrasonographic findings in diseased buffalo had a very important diagnostic significance in the evaluation of caecal and/or colonic dilatation. These findings are summarized in Table 2. It was difficult to differentiate between the dilated caecum and proximal loop of the colon by ultrasound. The dilated caecum and proximal loop of colon occupied the last right three ICSs particularly their ventral part and intertangled with the liver dorsally in these ICSs (Fig. 2). The dilated loop was situated immediately adjacent to the right flank region and masked the right kidney, loops and peristaltic movement of the small intestine (Fig. 3). The closest wall of the dilated caecum and proximal loop of the colon was imaged as thick semicircular echogenic line (Fig. 2). The furthest wall and contents of dilated caecum/colon were not imaged due to the reverberation artifacts at the soft-tissue gas interface. Dilated colon did not hinder the visibility of the liver (Fig. 2). They also filled the whole right flank region (Fig. 3).

4. Discussion

The present study aimed to describe the clinical, laboratory and ultrasonographic findings in buffalo with dilated caecum/-colon. The reported clinical signs associated with caecal dilatation in buffalo were in agreement with that reported in cattle by Radostits et al. [1], Steiner [4] and Braun et al. [19]. On rectal examination, the distended caecum can usually be palpated. In simple dilatation, with minimal quantities of ingesta, the caecum was enlarged and easily compressible on rectal palpation. In caecal volvulus, the viscus is usually distended with ingesta and tense on rectal palpation [1].

The hematological profiles in buffalo with caecal dilatation revealed lymphocytic leucocytosis. On contrast, a previous study reported that hematological values are normal in most

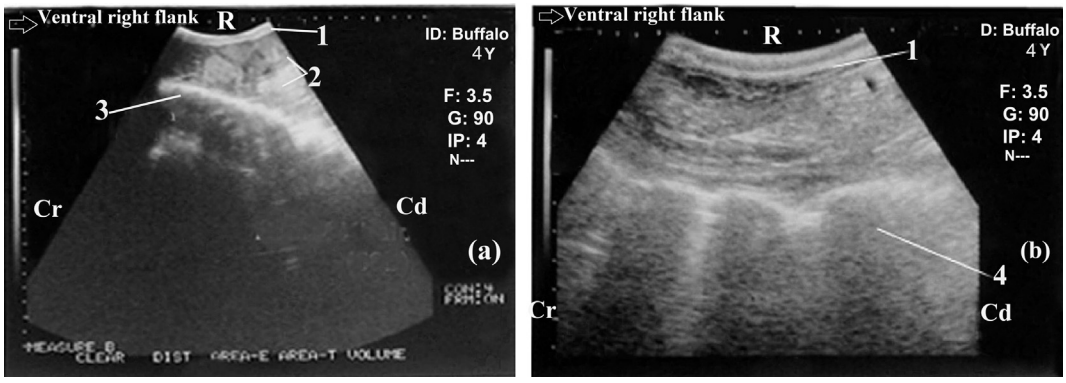

Fig. 1 Ultrasonograms in a 4-year-old healthy buffalo imaged from the ventral right flank region showing cross section in caecum or proximal loop of colon (a), and spiral colon (b). The wall of proximal loop of colon or caecum close to the transducer was imaged medial to the loops of small intestine as a continuous echogenic line, slightly curved (a) or gar-land like appearance [spiral colon] (b). R: Right. Cr: Cranial. Cd: Caudal.1: Abdominal wall. 2: Loops of jejunum and ileum 3: Caecum or proximal loop of colon. 4: Spiral colon.

Table 2 Ultrasonographic findings of buffalo with dilated caecum or colon ($n = 20$).

Organs	Findings
Heart	Normal
Liver	Intertangled with the dilated caecum or colon
Spleen	Normal
Rumen	Normal
Reticulum	Normal
Omasum	Normal
Abomasum	Normal
Duodenum	Not imaged
Jejunum and ileum	Not imaged
Peristaltic movement of small intestines	Absent
Caecum/colon	Imaged immediately adjacent to the right flank region with a thick semi-circular echogenic wall (closest wall). Invisualization of the contents and the furthest wall of the caecum and colon.
Right kidney	Not imaged

cattle affected with caecal dilatation unless there is caecal necrosis accompanied with peritonitis [19].

In the current study, the blood serum biochemical levels of the diseased buffalo showed significant hypoproteinemia and hypoalbuminemia. The previous studies reported that in nearly all animal species, albumin represents the major negative acute phase protein (APP). During the acute phase response (APR), albumin concentration decreases in the blood and maybe represent either selective loss of albumin due to renal or gastrointestinal changes or a decrease in hepatic synthesis [20].

Buffalo with dilated caecum/colon showed a significant increase in the serum activities of AST and ALK meanwhile serum concentration of cholesterol and triglycerides showed insignificant changes. However, Rosenberger [21] reported that the total serum cholesterol level decreases during acute inflammatory degenerative disease and enteritis. The results of hematological and blood biochemical analyses are not diagnostic for caecal dilatation but might be serve as indicators for severity of the disease.

Recently, ultrasonography had been used for diagnosis of several gastrointestinal tract affections in buffalo [22–25]. Therefore, this study tried to use ultrasound in the diagnosis of dilated caecum/colon in buffalo.

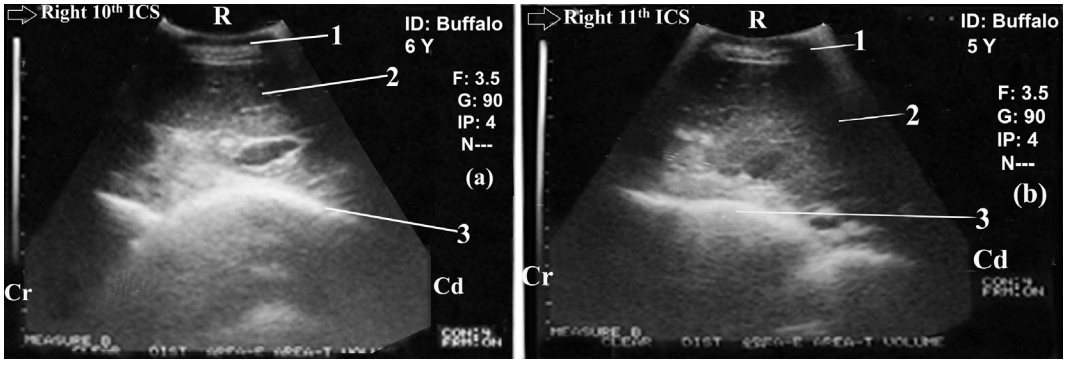

Fig. 2 Ultrasonograms in buffaloes with caecal or colonic dilatation imaged from the right 10th ICS of a 6-year-old buffalo (a) and 11th ICS of a 5-year-old buffalo (b). The dilated caecum or proximal loop of colon occupied the last right three ICSs and intertangled with the liver dorsally in these ICSs. The closest wall of the dilated caecum or colon appeared as a thick semi-circular echogenic line. R: Right. Cr: Cranial. Cd: Caudal. 1: Abdominal wall. 2: Liver. 3: Dilated loop of caecum or colon.

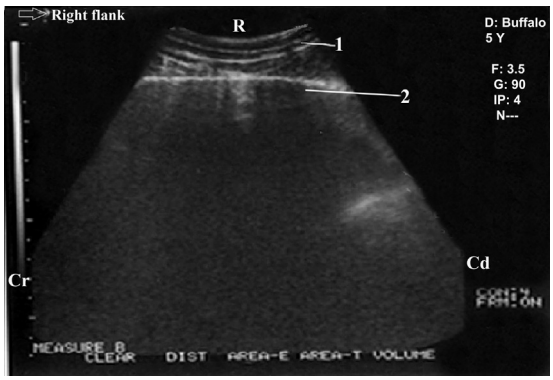

Fig. 3 Ultrasonogram in a 5-year-old buffalo with caecal or colonic dilatation imaged from the right flank region. The dilated caecum or proximal loop of colon filled the whole right flank region and situated immediately adjacent to the abdominal wall with invisible loops of small intestine and right kidney. R: Right. Cr: Cranial. Cd: Caudal. 1: Abdominal wall. 2: Dilated loop of caecum or colon.

In healthy buffalo, caecum and proximal loop of the colon, and the spiral colon could be clearly imaged from the ventral aspect of right flank region. The closest wall (To the transducer) of the proximal loop of colon and caecum was imaged as a continuous echogenic line or slightly curved, meanwhile, the furthest wall of caecum and colon could not be imaged due to the huge content of the caecum and colon. These finding are in agreement with that reported in cattle by Braun and Amrein [9].

The obtained results revealed that ultrasonography has an important diagnostic significance in evaluations of caecal and colonic dilatation in buffalo. In case of caecal and/or colonic dilatation, the dilated caecum and proximal loop of colon occupied the last right three ICSs particularly their ventral part and intertangled with the liver dorsally in these ICSs. They also filled the whole right flank region. The dilated loop is situated immediately adjacent to the right flank region resulting in hiding of the right kidney, loops and peristaltic movement of the small intestine. The closest wall of the dilated caecum and proximal loop of the colon was imaged as a thick semicircular echogenic line with invisible content and furthest wall due to the reverberation artifacts at the soft- tissue gas interface. The right kidney could not be imaged through the right paralumbar fossa acoustic window. The other reports in cattle mentioned that the dilated caecum can always be seen from the lateral right flank region [6,8] and sometimes, may be imaged from the last right ICSs [26]. In cattle, the dilated caecum and the proximal loop of the colon were situated immediately adjacent to the right abdominal wall. The wall of the dilated caecum and proximal loop of the colon closest to the transducer was visualized only by ultrasound and appeared as thick, echogenic, semi-circular lines [26]. Due to the nearly similar ultrasonographic appearance of the caecum and proximal loop of the colon, it was difficult to differentiate between them in both normal and diseased buffalo.

5. Conclusion

In conclusion, buffalo with caecal and/or colonic dilatation have nonspecific clinical and laboratory findings; however the affected animals show characteristic ultrasonographic findings.

Authors' contribution

Authors have conducted the study equally and discussed the results, read and approved the final manuscript.

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