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Ultrasonography of left displaced abomasum in local cattle breed

O.M. Al-Iraqi

Department of internal and preventive medicine, College of Veterinary Medicine, University of Mosul, Mosul, Iraq

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Correspondence:
O.M. Al-Iraqi
osamamuwafag@uomosul.edu.iq

Abstract

The aims of the current study were a definitive diagnosis of left displaced abomasum by using ultrasonography furthermore determination of abomasal position and measurements. Study includes sixteen local cattle breed, six have anorexia, weakness and drop milk production, on clinical examination there was decrease rumen contractions 3.6 \ 5 minutes, furthermore a pinging sound heard on auscultation of left intercostal spaces there were diagnosed as left displaced abomasum, other ten clinically healthy cows considered as normal control group. Ultrasonographic imaging was performed for stand nonsedated cows by use 3.5-5 MHz transducer at the ventral midline and in the intercostal spaces 9, 10, 11, and 12 from the left side. Ultrasonography revealed a left side displaced abomasum to an area between the abdominal wall and the rumen, which appeared as hypoechoic fluid content ventrally and hyperechoic parallel echogenic lines of gas gap dorsally, abomasal folds appear as filiform echogenic lines. While in healthy cows an abomasum located in the ventral midline and directed mainly to the right side. In conclusion, ultrasonography as a non-invasive technique could be used as a confirmative diagnosis of left displaced abomasal and help for differential diagnosis of left abomasum displacement a well as can be useful for measurement of abomasum in healthy local breed cattle.

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Introduction

Abomasal displacement is considered one of issues facing dairy cattle production worldwide, the main cases occur in countries use highly grain feed for cattle and the lowest number of cases in countries that depend on pasture program for cattle feeding. Heavy losses in dairy farm can occur because left displaced abomasum (LDA) can cause decrease in daily milk especially around highly production period 3 months after calving (1). Many predisposing factors can take part in the occurrence of LDA as hypocalcaemia, ketosis, Fatty liver, dystocia and inflammatory processes (2,3). Development of LDA depends on three factors: abomasal atony, rumen size and postpartum abdominal gap (4). Cows that have large abdomen size may be predisposed to LDA (5). Clinically affected cow shows loss of appetite, a sharp decrease of milk production, scant feces, restlessness, decrease in rumen contraction and ping sound on percussion over 9th to 12th inter costal area (1,6,7).

The abomasum has an elongated sac shape, resting in a horizontal position on mainly right ventral midline begin from the xiphoid process to the eleventh rib, which detached to the ascending duodenum, it is delimited by the abdominal wall from the ventral and lateral aspect and by a ventral sac of the rumen from the medial aspect whereas the liver covered it dorsally. Abomasum is not fixed in position, just suspended locally by the omentum, although the heaviness of the rumen act as mechanical pressure, prevent abomasum displaced to the left side (8,9).

Ultrasonography has been used as a noninvasive technique for evaluation of internal organs location, size, abnormal changes in its contents, and in last century more use in diagnosis of abomasal diseases in adult cattle and calves as an ulcer, lymhposrcoma, displacement (10-13). Abomasal measurements were first done by Braun *et al.* (14),

while abomasal volume and emptying rate first recorded by Wittek *et al.* (15).

Left side abomasal displacement is a metabolic disease occurring in adult cows at postparturiant period or in calves (16) and diagnosis can have made depending on different diagnostic laboratory and clinical examinations as hematology and biochemical (1,17) ping sound during simultaneous percussion with auscultation of the left 10^{th}, 11^{th} and 12^{th} intercostal spaces (7). Mainly in cows with LDA or RDA, ultrasonography of the abomasum is a superior diagnostic and prognostic device. It helpful in definitive diagnosis of cow has doubt LDA with sporadic or ambiguous pings (18). Ultrasonography provides proportionally inexpensive, noninvasive and rapidness of clinically important information (19) and assist in making the correct rule, if the cow should take medical treatment or surgical correction or going to slaughter (20-22). In Mosul there were little researches about displaced abomasum (23). This study aimed to the determined the position and measurements of the abomasum in healthy local cattle and use ultrasonography for diagnosis LDA in cows.

Materials and methods

Animals

A 16 local breed cattle aged 4-12 years were examined, include 10 clinically healthy cows and other 6 cows suffered from loss of appetite and decrease in milk production with body weight loss, scant feces and one animal with recurrent bloat.

Clinical examination

Temperature, heart rate, respiration was recorded during clinical examination, auscultation at the 9^{th}, 10^{th}, 11^{th} and 12^{th} ICS at the left lateral abdominal wall from ninth to twelfth intercostal space. Ultrasonographic examination was done by using Kx5100vet ultrasound unit with a 3.5-5 MHz transducer according to (24). In normal animals, an area between xiphoid cartilage, umbilicus and 5 cm laterally to the both left and right ventral midline were evaluated by ultrasound. Alcohol was sprayed then ultrasound gel was applied at area of test. After fixing of abomasum border by ultrasound and put down on the skin by marker, Measurements were taken by using tape and recorded in special chart and include: Cranial boarder of Abomasum - Umbilicus (M1), Caudal boarder of Abomasum - Umbilicus (M2), Cranial boarder of Abomasum - Caudal end of Sternum (M3), Caudal boarder of Abomasum - Caudal end of Sternum (M4), Abomasum dorsoventral diameter (caursomeasurment) (M5), Abomasum crainodadunal diameter (caursomeasurment) (M6) (Figures 1 and 2).

In animals with LDA, the 10^{th}, 11^{th} and 12^{th} ICS at the lateral abdominal wall of left side, and area behind costal arch was examined by percussion and simultaneous auscultation, then an area of left abdominal wall were prepared for ultrasonography. Transducer was directed toward abdominal wall parallel to the ribs. Scanning was started dorsally and finished ventrally.

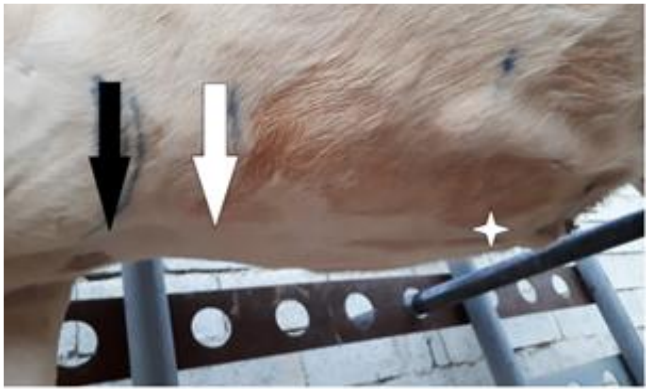

Figure 1: cow abomasal position in the ventral abdominal midline. black arrow: xiphoid process, white arrow: cranial border of abomasum, white star: umbilicus.

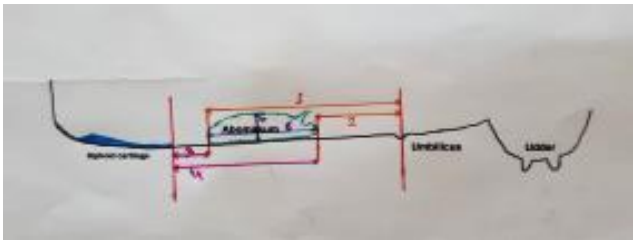

Figure 2: scheme of abomasum measurements by ultrasonography. 1: Cranial boarder of Abomasum - Umbilicus, 2: Caudal boarder of Abomasum - Umbilicus, 3: Cranial boarder of Abomasum - Caudal end of Sternum, 4: Caudal boarder of Abomasum - Caudal end of Sternum, 5: Abomasum dorsoventral diameter (caursomeasurment), 6: Abomasum crainodadunal diameter (caursomeasurment).

Statistical analysis

In this study, two-sample t-test was used to compare the scheme of abomasum measurements between left and right sides in normal animals, and between normal animals and those suffered from LDA (25). The measurements were represented as mean ± standard deviation. The 95% confidence interval and P-value were reported. Measured difference with value of $P \leq 0.05$ (two-tailed) was considered significant. Statistical analysis was performed using STATA 13.0 (StataCrop., College Station, TX, USA).

Results

Cows with LAD showed anorexia, weakness, a drop of milk, scant feces. On percussion and auscultation of the lateral left abdominal wall, all cows have clear audible pinging sound in the 10^{th}, 11^{th} and 12^{th} ICS (Table 1).

There were increases in temperature 39.6°c and heart rate 98.5 beats\minute in cow suffered from left abomasal displacement, and rumen contractions (3.6 / 5 minutes) decrease compared with healthy cattle (Table 2).

The position of abomasum was determined in normal local cattle by using ultrasonography, Abomasum besieged reticulum and craniodorsal rumen sac from the front and upper side respectively and by intestine from behind direction (Figure 3). A white echogenic thin line represents the wall of the abomasum and located adjacent to the internal abdominal wall, with heterogeneous stippling ingesta and echogenic filiform lines represent abomasal folds, there were no gas in any healthy abomasal cow (Figure 3). Pylorus was appeared in 5 healthy cows in right lateral abdominal wall at 50 cm from the ventral midline while could not be seen in cows suffered from LDA (Figures 4 and 5).

Table 1: Clinical sings in cows with LAD

Sings	Frequency	Percentage %
pinging sound	6	100
Anorexia	5	83.33
Drop of milk	5	83.33
Scant feces	4	66.66
Weakness	3	50

Table 2: Vital signs and ruminal contraction of apparently healthy cows and those with LDA

Clinical examination	Control group	LDA cow
Temperature c°	38.95±0.40	39.6±0.12*
Heart rate (beat\minute)	67.5±3.9	98.5±3.6*
Respiratory rate\minute	23±2.1	25±4.5
Rumen contraction/ 5 m	7±2.4	3.6±0.9*

* Significant at P<0.05.

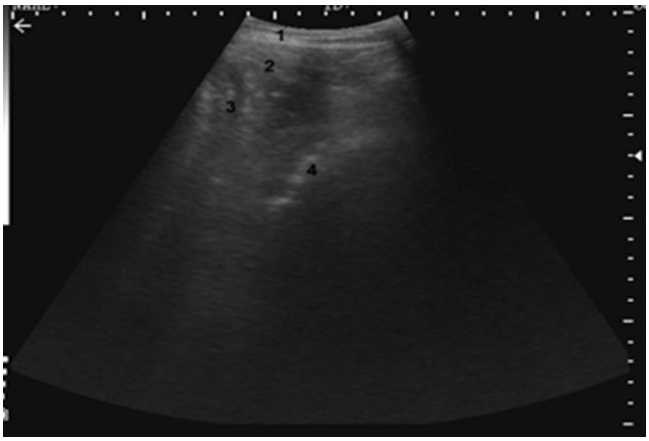

Figure 3: Ultrasonography of cattle abomasum from left paramidline by using 3.5 MHz percatenous convex probe. Abdominal wall 1, abomasum wall 2, abomasum fold 3, reticulum 4.

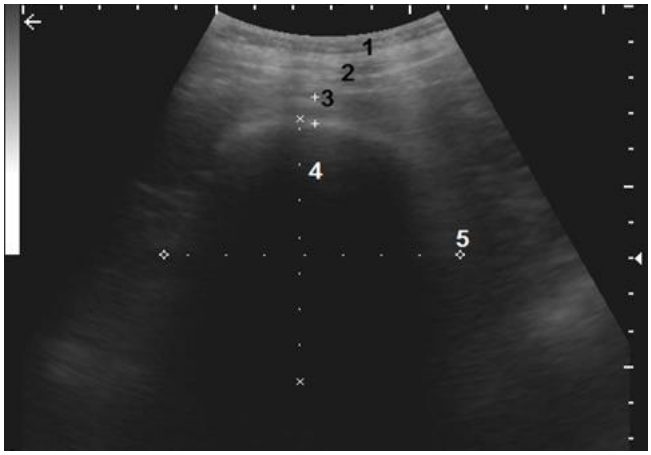

Figure 4: ultrasonography of pylorus in healthy cow, 50 cm from the ventral med line at the right abdominal wall, 1: wall of the abdomen, 2: muscle, 3: wall of the pylorus, 4: vertical diameter, 5: longitudinal diameter.

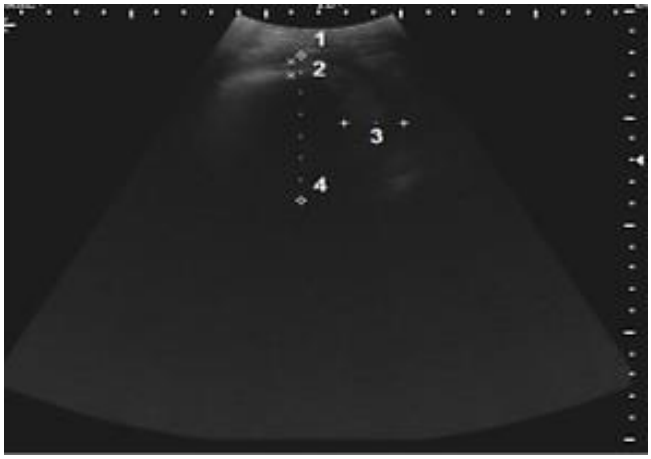

Figure 5: Ultrasonographic appearance of pylorus from the right lateral abdominal wall. 1: wall of the abdomen, 2: pylorus thin wall diameter, 3: Pylorus thick wall diameter, 4: pylorus diameter.

There were differences in the measurements of the abomasum between both sides of the ventral midline in healthy cows and it mainly located to the right side (Table 3). From results of healthy cow there were no significant deference between the mean of right and left measurements of the abomasum in (M1) Cranial boarder of Abomasum - Umbilicus (33.4 32.6) centimeter and (M3) Cranial boarder of Abomasum - Caudal end of Sternum (13.7, 12.6)cm, while significantly different present between the following measurements (M2) Caudal boarder of Abomasum - Umbilicus (6.8, 23.2) cm, (M4) Caudal boarder of Abomasum - Caudal end of Sternum(40.2, 2102) cm, (M5) Abomasum dorsoventral diameter (caursomeasurment) 20.8, 10.7 cm.

Ultrasonographic examination of cows suffered from left displacement abomasum, reveled displaced abomasum to the left lateral abdominal in the 10th, 11th and 12th intercostal space (ICS) between the rumen and the abdominal wall. Displaced abomasum appeared as heterogeneous sac content hypoechoic content ventrally and parallel echogenic line dorsally, abomasal folds appeared as thin white echogenic filiform lines (Figure 6).

Table 3: Abomasal measurements of apparently healthy cows and those with LDA

Measure		Mean	Std. Dev.	95% CI	*P*
M1	Right	33.4	2.46	31.64, 35.16	0.56
	Left	32.6	3.50	30.09, 35.11	
M2	Right	6.8	2.74	4.84, 8.76	<0.01
	Left	23.2	4.37	20.08, 26.32	
M3	Right	13.7	2.45	11.95, 15.45	0.34
	Left	12.6	2.59	10.75, 14.45	
M4	Right	40.2	4.78	36.78, 43.62	<0.01
	Left	21.2	2.86	19.15, 23.25	
M5	Right	20.8 a	1.81	19.50, 22.10	
	Left	10.7 b	2.00	9.27, 12.13	<0.01
	Abnormal	10.67 b	1.21	9.40, 11.94	
M6	Left	9.5	2.17	7.95, 11.05	<0.01
	Abnormal	15.17	1.17	13.94, 16.39	

M1: Cranial boarder of Abomasum - Umbilicus, M2: Caudal boarder of Abomasum - Umbilicus, M3: Cranial boarder of Abomasum - Caudal end of Sternum, M4: Caudal boarder of Abomasum - Caudal end of Sternum, M5: Abomasum dorsoventral diameter (caursomeasurment), M6: Abomasum crainodadunal diameter (caursomeasurment), Different numbers (a,b) : indicate there is a significant difference, Cm: centimeter.

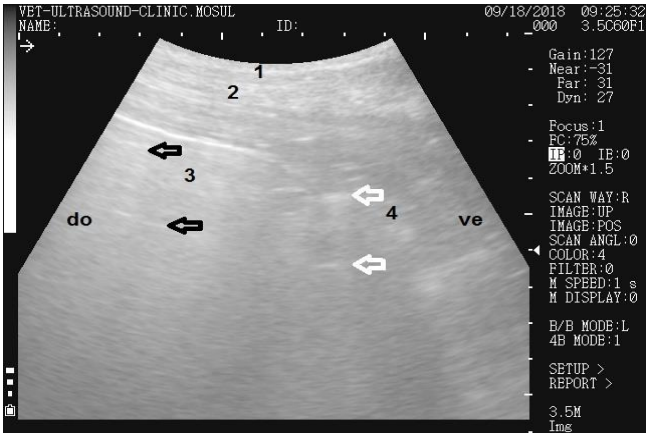

Figure 6: ultrasonography of cow with left displaced abomasum. 1; abdomenal wall, 2: muscls layer, 3: doral part of abomasum, 4: ventral part of abomasum, black arrow: gass rverbiration artifact, white arrow: abomasl folds.

Discussion

Cows suffered from LDA, exhibited clinical signs of anorexia, weakness, drop of milk and scant feces, which agree with other results (17,23,26,27), these occur due to inhibition of rumen abomasal motility as a result to impairment of the enteric nerve system which cause defects in digestion of food material and then lack of volatile fatty acids (5). Ping sound heard on the left abdominal wall during percussion with simultaneous auscultation at the upper third of the 10th, 11th and 12th intercostal spaces, it confirmed by Van Meter *et al*, Aly *et al.* and Ismael *et al.* (8,17,26), although a ping sound could originated from gas trapped as in the ruminal atony or may be obscure for little time after traveling to the clinic, it consider the characteristic clinical signs, re-examination after 24 hours was important to confirm the diagnosis, in LDA a ping sound originated from gases trapped in displaced abomasum (7,27).

Clinical examination of LDA cows revealed a rise in temperature and heart rate, these results disagree with Dezfouli *et al*, Aly *et al*, Ismael *et al.* and Ghazy *et al.* (1,17,26,27). Temperature and pulse rate will have increased in acute case and subsided to normal range in sub-acute affected cows, although fever occurs in concurrent diseases such as mastitis, metritis (7). From results, rumen contraction was decreased which agree with Aly *et al.* and Ismael *et al.* (17,26) hypomotality of rumen could be due to concurrent subclinical hypocalcaemia or depression from concurrent inflammatory process (1).

Our result indicates that ultrasound is a useful technique in detection of abomasal position in local cattle and agree with Braun *et al.* (14), pylorus was easily detected in local cattle which disagree with Wittek *et al.* (28) this may be due to a small size local cattle that have a small abdomen make detect pylorus easy.

From results of ultrasonographic examinations of healthy cows, Abomasum appeared as black hypoechoic sac, due to existences of fluid, with white border represent the wall in ventral area while the dorsal wall could not be sight, folds appear as white echogenic vermiform short lines because they ripple in the lumen, the cranial part of abomasum located mainly to the left sided midline while the caudal part located to the right this result agree with Braun *et al*, Streeter and Step and Wittek *et al.* (14,18,28) abomasal position could be directed transversely to the right by the fill rumen or graved uterus. The abomasal dorsoventral diameter was larger in the right side than left, due to compression of the ventral rumen sac occupy the main space of the left abdominal floor (8).

Abomasum could be viewed in all cows suffered from left abomasum displacement. It appeared at the lateral left 10th ,11th and 12th ICS from the left side, captured between the wall of the abdomen and the rumen these result confirm previously by Ismael *et al.* and Li *et al.* (26,29) ultrasound of abomasal contents make it easily differentiated from

adjacent organs, which appeared as heterogeneous in the ventral part and have a hypoechoic appearance due to presence of fluid and ingest, while dorsally appeared as parallel directed echogenic reverberation artifact due to presence of restrained gas, these results agree with Braun and Li *et al.* (24,29). Pylorus could not see in all diseased cows compared with healthy once, due to directed of abomasal position to the upper left abdominal cavity in which pylorus end slides in the ventral abdominal floor under the rumen (7).

Conclusion

Ultrasonography as a noninvasive technique can be used in detection of the abomasal position of in healthy cows and as a definitive diagnosis of left displaced abomasum.

Acknowledgement

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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الفحص بالأمواج فوق الصوتية لأنزياح الأنفحة نحو اليسار في الأبقار المحلية

أسامة موفق العراقي

فرع الطب الباطني والوقائي البيطري، كلية الطب البيطري، جامعة الموصل، الموصل، العراق

الخلاصة

هدفت الدراسة إلى تشخيص انزياح الانفحة إلى اليسار باستخدام الأمواج فوق الصوتية بالإضافة إلى تحديد موقع وأبعاد الانفحة. اشتملت الدراسة على ١٦ من الأبقار المحلية منها ٦ أبقار عانت من فقدان الشهية والضعف العام وتدني إنتاج الحليب. عند إجراء الفحص السريري تبين ارتفاع في درجة الحرارة ٣٩,٦ ° ومعدل ضربات القلب ٩٨,٥ في حين كان ترداد التنفس ضمن المستوى الطبيعي وانخفضت تقلصات الكرش إلى ٣,٦ \ ٥ دقيقة. إضافة إلى سماع صوت رنان عند القرع مع التسمع في المسافات ما بين الأضلاع من جهة اليسار في حين كانت ١٠ أبقار سليمة سريريا عدت كمجموعة سيطرة. تم إجراء الفحص بالأمواج فوق الصوتية من وضع الوقوف وبدون تخدير باستخدام مجس ذو تردد ٣,٥ - ٥ ميكاهرتز إذ تم الفحص في منطقة خط المنتصف البطني والمسافات بين الأضلاع ٩و١٠ و١١ و١٢ من جهة اليسار. تبين من الفحص بالأمواج فوق الصوتية انزياح الأنفحة إلى جهة اليسار بين الكرش وجدار البطن وظهر بشكل يحتوي على سوائل قليلة الصدى في الجزء البطني وخطوط متوازية شديدة الصدى في الجزء الظهري وظهرت طيات المعدة الرابعة بشكل خطوط خيطية شديدة الصدى، بينما في الأبقار السليمة كانت المعدة الرابعة تقع في خط المنتصف البطني مع توجه الجزء الأكبر إلى جهة اليمين. إستُنتِج من الدراسة أن الأمواج فوق الصوتية كتقنية غير باضِعة تستخدم لتأكيد تشخيص إنزياح المعدة الرابعة وأن قياسات الأنفحة في الأبقار المحلية السليمة ممكن استخدامها كمرجع.