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Case Report

Left abomasal displacement between the uterus and rumen during bovine twin pregnancy

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Here, we describe two cases of left displaced abomasum (LDA) in Holstein cattle at 6 and 9 months of twin gestation. Clinical examination revealed signs of proximal ileus with marked abdominal distension, but no ping sounds. An unusually high position of the gravid uterine horn on the left side was observed with ultrasound. Left exploratory laparotomy confirmed that the abomasum was displaced to the left and entrapped between the rumen and twin gravid uterine horn. A left surgical approach was necessary to correct the condition. Both animals recovered and gave birth to healthy twins. The present cases indicate that the subomental position of a heavy twin gravid uterine horn is a possible mechanical cause of LDA.

Keywords: cattle, gestation, left displaced abomasum, twin pregnancy

Left displaced abomasum (LDA) is an economically important pathologic condition of high-yielding dairy cows [5,6,10]. Ninety percent of these cases occur within 6 weeks after parturition whereas only 2～10% develop during gestation almost exclusively within the last 3 weeks before calving [4,10]. In the vast majority of cases, nutrition during the transition period and concurrent metabolic diseases play a crucial role in the multifactorial etiology of LDA [4,10]. Less frequently, mechanical outflow problems or abomasal lesions have been identified as the cause of LDA [4]. The present report describes two cases of mechanically induced LDA during twin gestation. To best of the authors' knowledge, entrapment of the abomasum between the rumen and twin gravid uterine horn has not been previously described in the literature.

The first case was a 3.5-year-old Holstein Friesian cow 6 months into her second gestation. The second case (a Holstein Friesian cow 3 years and 7 months old) was 6 days from the planned parturition date of her second gestation. Both animals had shown intermittent recumbency, loss of appetite, and abdominal distension for several days. Additionally, the first case had a sudden reduction of milk yield, absence of feces for 4 days, and occasional regurgitation. Both cases were referred to us by a local practitioner due to suspicion of hardware disease.

Clinical examination revealed marked abdominal distention of the left dorsal, left ventral, and right ventral quadrants with increased tension of the abdominal wall in both animals. Rectal temperature of the first case was normal [39.0°C (38.0～39.0°C)] and increased for the second case (39.8°C). Heart and respiratory rates of both cows were slightly increased. Ruminal contractions in the first case could still be palpated. In both animals, tympanic but no ping sounds (steel band effect) were heard with simultaneous auscultation and percussion of the left side. No borborygmi or other sounds on the right side were detected. Withers pinch as well as percussion of the 10th rib and xiphoid were negative.

Rectal palpation was not performed for case 1 because fresh blood was present in the rectum due to previous palpation. In case 2, a limited amount of dry feces covered with mucus was present in the rectum. On rectal palpation, the rumen appeared normal and the uterus was found to contain a living fetus in the anterior position. No gas could be evacuated by ruminal tubing and the results of ruminal fluid analysis were normal. Blood examination revealed that both cows were mildly dehydrated [case 1: packed cell volume (PCV) = 0.40 mL/mL; case 2: PCV = 0.37 mL/mL (0.25～0.35)]. Blood gas analysis indicated the presence of very mild metabolic alkalosis [case 1: pH 7.43 (7.35～7.45), PCO_2 = 52.3 mmHg (35.0～45.0), base excess (BE)

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= 7.8 meq/L (−5 to 5), HCO_3^- = 30.6 (23.0 ~ 28.0); case 2: pH 7.48, PCO_2 = 39.4 mmHg, BE = 5.2 meq/L, HCO_3^- = 28.3 mmol/L] and normal electrolyte concentrations [case 1: Na^+ = 137 mmol/L (132 ~ 146), K^+ = 3.7 mmol/L (3.5 ~ 4.0), ionary Ca^{++} = 1.21 mmol/L (1.1 ~ 1.7); case 2: Na^+ = 139 mmol/L, K^+ = 3.6 mmol/L, iCa^{++} = 1.05 mmol/L] in both animals.

Abdominal transcutaneous ultrasound evaluation of both animals using a 2.5 MHz sector probe (Sonos 100; Hewlett Packard, USA) showed the gravid uterus was in a remarkably high position on the left side extending from the pelvic region to the 10th rib and halfway up to the left abdominal wall. The gravid uterus appeared normal and contained a living fetus. The rumen could only be visualized in the dorsal region of the left flank.

In case 1, no reticular contractions or obvious signs of hardware disease (adhesions and free fluid) were observed in the reticular region. In contrast, a transverse image taken at the 12th intercostal space in case 2 showed an echodense structure with fluid contents and structures resembling the *plicae spirales* of the abomasum. Between the abomasum and uterus, both of which occupied the entire ventrolateral part of the left abdomen, a large amount of anechogenic free fluid with several echodense fibrin networks were present. In this animal, an echodense line was identified as both walls of the compressed dorsal portion of the abomasum in the dorsal region of the 12th intercostal space. In both cows, ultrasonography of the right side revealed moderately distended small intestinal loops and a gravid uterus completely occupying the ventrolateral side of the abdomen up to the xiphoid. The abomasum could not be visualized on the right side. Based upon the clinical symptoms and ultrasonography findings, both cases were tentatively diagnosed with an abomasal outflow disorder.

Exploratory laparotomy was performed on both animals while in a standing position under local anesthesia (4% procaine hydrochloride; Eurovet, The Netherlands). For case 1, the abdomen was opened on the left side. The uterus was found positioned underneath the greater omentum and extended from the pelvic region over the ventro-lateral side of the left abdominal wall to the diaphragm. The abomasum had been displaced to the left and was entrapped between the rumen and uterus. The part of the abomasum situated above the pregnant uterus contained only gas whereas fluid was present in the ventral portion of the abomasum. Fibrin deposits were discovered on the abomasal serosa with an increased amount of peritoneal fluid. Several adhesions needed to be removed to allow proper repositioning of the distended abomasum that was fixated afterwards by left paralumbar fossa omentopexy as described by Lagerweij and Numans [8].

Case 2 was surgically approached from the right side. After making an incision, the superficial layer of the greater omentum was found to be under considerable tension. The pregnant uterus occupied the caudoventral aspect of the abdomen and extended dorsally along the left flank up to a height of approximately half of the abdominal wall (Fig. 1). The uterus extended further in the cranial direction ventrally toward the rumen and omentum. The omasum was slightly displaced to the left, but the position of the abomasum could not be determined from the right-sided approach due to the large volume of the gravid uterine horn. A second incision was made through the left flank. Caudal to the incision, the gravid uterine horn could be palpated. Cranial to the incision, the abomasum could be palpated and was ventrally extended between the uterus and rumen, confirming the diagnosis of LDA. The greater omentum was torn in the caudal third of the lateral horizontal groove of the rumen, and a large number of

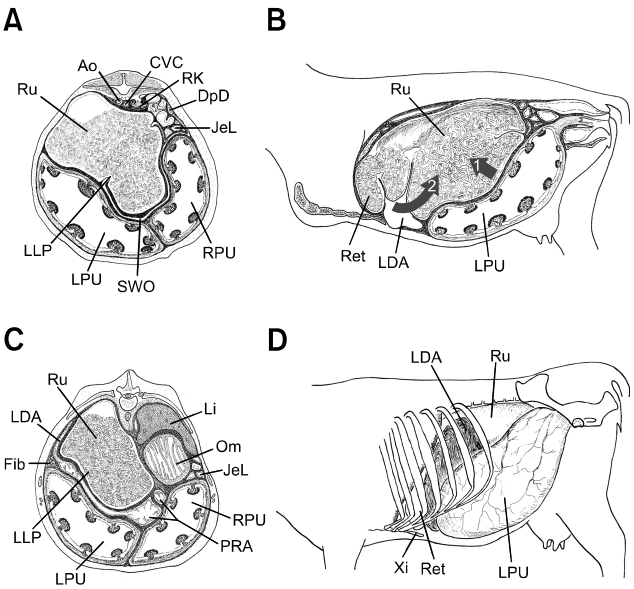

Fig. 1. Schematic drawing (based on case 2) showing the topography of the abdominal organs in the presented cases with left displacement of the abomasum during twin pregnancy. (A) Caudal view of a cross-section at the level of the third lumbar vertebra showing the unusual subomental position of both pregnant uterine horns. (B) Left lateral view of a longitudinal section illustrating the gradual dorsal deviation of the rumen by the expanding uterus (arrow 1) leading to the left displacement of the abomasum (arrow 2) in the space between the reticulum and rumen below the ruminal atrium. (C) Caudal view of a cross-section at the level of the 12th intercostal space of case 2 taken at the moment of admittance to the clinic. (D) Left lateral view of a projection of the abdominal organs observed in case 2 during explorative laparotomy. Ao: aorta, CVC: caudal vena cava, DpD: descending part of the duodenum, Fib: fibrinous deposits, JeL: jenunal loops, LDA: left displaced abomasum, Li: liver, LLP: left longitudinal pillar of the rumen, LPU: left pregnant uterine horn, Om: omasum, PRA: pyloric region of the abomasum, Ret: reticulum, RK: right kidney, RPU: right pregnant uterine horn, Ru: rumen, SWO: superficial wall of the greater omentum, Xi: xiphoid (illustration by P. Cornillie, Ghent University, Belgium).

fibrin clots were present in the exposed omental bursa. Although the abomasum was of medium size, the abomasum and omasum between the rumen (dorsally) and pregnant uterus (ventrally) could be repositioned only with the assistance of a second person applying moderate traction to the omentum from the right side. Once repositioned, right paralumbar fossa omentopexy was performed as previously described [13].

Standard postoperative treatment was administered including polyionic infusion (5% glucose, 413 g NaCl, 18.5 g KCl, 22 g $CaCl_2$, and 10 g MgO_2 in 10 L of distilled water) and delivery of procaine penicillin and neomycin, (Neopen; Shering-Plough, USA), flunixin meglumin (Emdofluxim 50; Emdoka, Belgium), and erythromycin (Erythrocin Vet. 200 mg/mL; Ceva Santé Animale, France) at a prokinetic dose (8.8 mg/kg; intramuscular injection). Both animals produced normal feces and showed normal ruminal motility 3 days after surgery. The milk yield of case 1 was reported to be below normal during the remaining lactation period. Three months after surgery, case 1 gave birth to healthy twins (one male and one female) without complications. Case 2 delivered two healthy male calves with a combined weight of 70 kg 15 days after surgery. The animal remained in good health with a daily milk yield of 24 L 14 days after parturition.

Few case reports on LDA in pregnant cattle are currently available [9,14,15]. In these studies, a mechanical effect of the uterus was suggested to be an unlikely cause of LDA. The two heifers in these previous reports were only 4 to 5 months into gestation, indicating low uterine weight and a more caudal uterine position [14,15]. In a third case (7 months of gestation), adhesive peritonitis due to perforation by a foreign object in the abomasum was proposed to be the primary cause of abomasal displacement [9]. In contrast to these reports, laparotomy findings from the present study suggest that the position and size of the gravid uterine horn played a crucial role in the development of LDA in both cases by mechanically hampering abomasal and intestinal function [4,7].

The pregnant uterus with one calf weighs approximately 20 kg in the 6^{th} month, and between 40 and 80 kg in the 9^{th} month [1]. The calves of case 2 weighed 35 kg each, implicating a very heavy uterus as the cause of LDA. While the uterus is positioned inside the supraomental bursa during most gestations, in the present cases the uterus was positioned underneath the greater omentum (subomental gestation) and extended up to the xiphoid [1,3,10,12]. Most frequently, subomental gestation is directed toward the right due to ruminal resistance [1]. Rarely, the uterus can be in a subomental position to the left. This left subomental positioning was observed in both cows in the present investigation, and it is possible that this position in combination with twin pregnancy was the mechanical cause of LDA. Additionally, laparotomy findings for case 1, which was only 6 months into gestation, showed that this animal had a very large uterus exerting high pressure on the abomasum and rumen, resulting in lethargy and intermittent regurgitation. Aside from subomental positioning which allows the gravid uterine horn to reach the xiphoid region and abomasum more easily, other possible explanations for why a 6-month twin gravid uterine horn could cause this mechanical effect might be the larger bodyweight of Belgian Blue crossbreed calves compared to purebred Holsteins or the presence of a mild form of hydrallantois or hydramnion. It is also unclear whether other underlying factors such as subclinical ketonemia caused initial hypomotility and displacement of the abomasum, after which this organ became entrapped between the gravid uterine horn and rumen.

Ping sounds (steel band effect) on simultaneous auscultation and percussion are the most typical clinical finding associated with LDA, and are often used as the sole diagnostic criterion in practice [4]. In contrast to the three previously published case reports of LDA [9,14,15], no ping sounds were detected in the twin pregnancy cases we examined. This could be due to an absence of direct contact between the gas and fluid layers in the abomasum, or limited contact between the abomasum and abdominal wall. Ultrasound proved to be a valuable tool for diagnosing the second case since the abomasum could be visualized and the obtained image did not differ from those seen in classic cases of LDA [3]. However, no definitive diagnosis could be made by ultrasound for the first case. Extension of the uterus halfway up the abdomen in combination with signs of proximal ileus might be a first indication for this type of abomasal displacement. A left-sided surgical approach to the abdomen was diagnostic in both cases and necessary for surgical correction.

Twin calvings in dairy cattle have a negative influence on milk production, reproductive performance, and survival [2]. Additionally this condition has been identified as a risk factor for postpartum LDA [11]. The possibility of LDA development during pregnancy can be added to the long list of complications associated with twin pregnancies in cattle.

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