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A case report: Characteristic plain radiographic findings of a displaced abomasum in a heifer

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Abstract: A 9-month-old Holstein heifer with a history of severely poor growth presented with diarrhoea. On physical examination, a metallic pinging sound was heard on the simultaneous percussion and auscultation of the left trunk. On the cranial abdominal radiography, the contour of a gas-filled balloon-like abomasum wall was delineated, which elevated to the dorsal abdomen. Radiopaque sand at the bottom of the abomasum had been pulled up caudodorsally by the gas-filled abomasum. After surgery, the gas-filled balloon-like appearance of the abomasum wall disappeared and the radiopaque sand was located in the normal position. To our knowledge, no reports on a displaced abomasum on plain radiographs are available. The radiographic findings described herein are characteristic imaging findings of a displaced abomasum. Abdominal radiography could be a new option as an auxiliary diagnostic approach for a displaced abomasum.

Keywords: cow; displacement of the abomasum; radiography

Displacement of the abomasum (DA) in cows, a condition wherein the abomasum becomes enlarged with fluid and/or gas causing the subsequent left or right and dorsal migration of the abomasum in the abdominal cavity (Coppock 1974), had initially been reported in 1950 (Begg 1950; Ford 1950). DA occurs primarily in high-producing dairy cows during the postpartum period (Geishauser et al. 2000), with approximately 90% of the cases occurring within six weeks following calving (Antanaitis et al. 2020). DA is traditionally diagnosed through the simultaneous auscultation and percussion of the mid-flank area (Song et al. 2020). Cows presenting with a metallic pinging sound on the percussion and auscultation of the left or right abdomen are diagnosed as having DA (Wang et al. 2019). Recently, the use of ultrasonography for the visualisation of DA has been reported (Braun 2003; Li et al. 2018; Gouda et al. 2020). Moreover, a method for visualising DA using a laparoscope has been introduced (Janowitz 1998; Newman et al. 2008). Regarding X-ray examinations, it is reported that the abomasum is identified by radiopaque sand within an elongated viscus caudoventral to the reticulum (Partington and Biller 1991). As the X-ray beam hardly penetrates through the wide trunk of large animals, imaging of the abdominal organs, such as the abomasum, has been considered quite difficult. To address this problem, it was reported that, although plain radiographs cannot detect abnormalities in a calf, DA could be diagnosed through a gastrointestinal examination with barium sulfate (Hawkins et al. 1986). Another report found that migration of the abomasum could be observed

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through successive fluoroscopy with barium sulfate (Itoh et al. 2017). These reports indicate that visualising DA using plain radiographs remains challenging. To the best of our knowledge, there is no report of DA visualisation in cows using plain radiographs.

Case description

A 9-month-old Holstein heifer with a history of severely poor growth presented with diarrhoea for at least one month. It was referred to the Large Animal Veterinary Educational Center at Azabu University, Sagamihara, Japan. At the time of admission, the heifer weighed 182 kg, was emaciated and exhibited diarrhoea. The rectal temperature, heart rate and respiratory rate were 38.1 °C, 54 beats/min and 24 breaths/min, respectively. No abnormalities, such as a metallic pinging sound on the physical examination, were noted. The haematology revealed decreased haemoglobin levels (76 g/l; reference range: 90–150 g/l), a decreased platelet count (68 000/µl; reference range: 100 000–800 000/µl) and an elevated white blood cell count (18 700/µl; reference range: 4 000–12 000/µl). The blood chemistry analyses revealed decreased serum total protein (59 g/l; reference range: 67–75 g/l), total cholesterol (1.06 mmol/l; reference range: 2.07–3.10 mmol/l) and triglyceride (0.29 mmol/l; reference range: 0.34–0.79 mmol/l) levels. The results for the serum electrolytes analyses were as follows: sodium, 144.3 mmol/l (reference range: 138–146 mmol/l), potassium, 5.65 mmol/l (reference range: 3.6–4.9 mmol/l), and chloride,

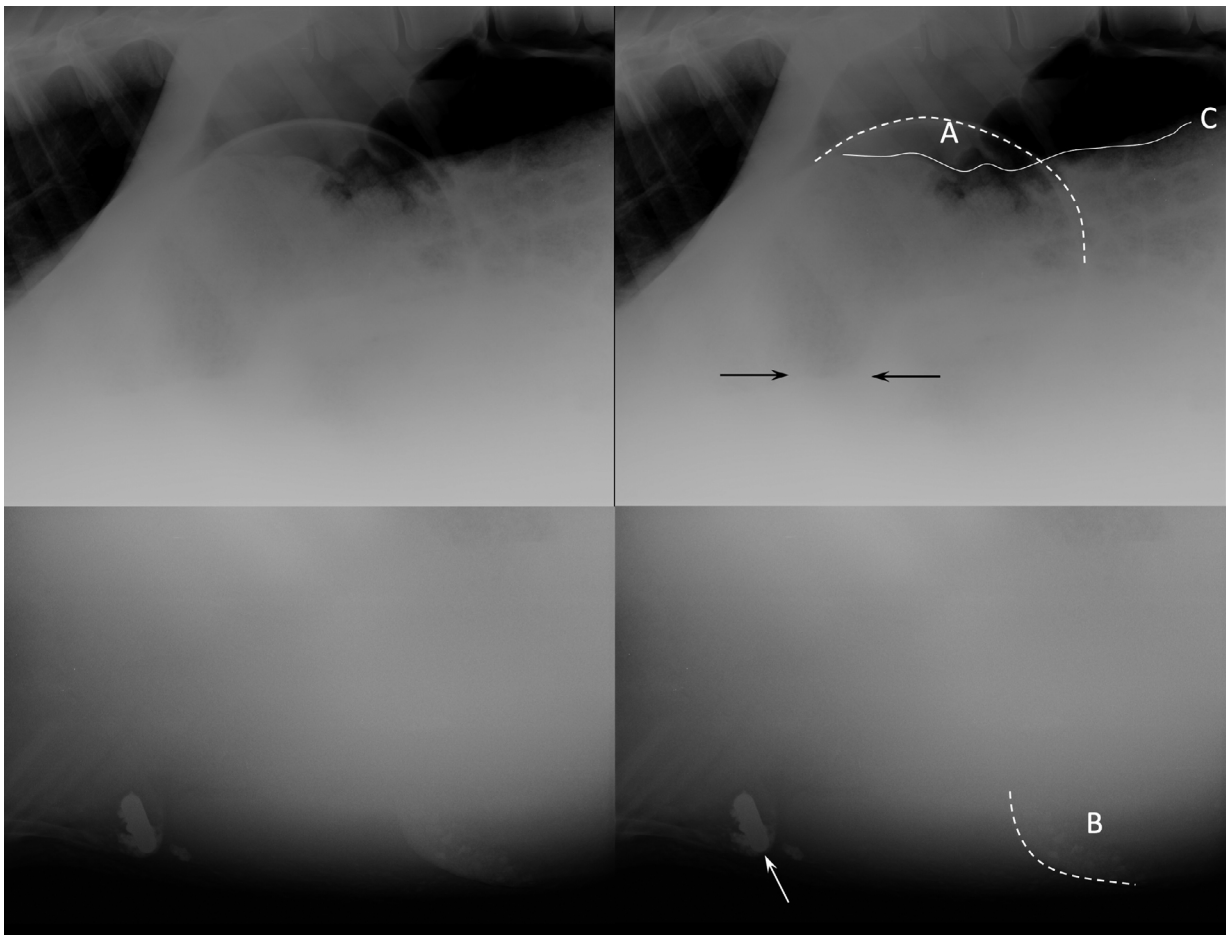

Figure 1. Cranial abdominal radiographs before surgery

The contour of the gas-filled balloon-like abomasum wall was depicted, which elevated to the dorsal abdomen. The fluid level was observed in the middle abdomen (black arrows). Radiopaque sand in the bottom of abomasum had been pulled up caudodorsally by the gas-filled abomasum. The dorsal surface of the contents of the rumen was below the lumbar vertebrae, which indicated that the amount of feed intake was insufficient. Furthermore, there was a magnet in the reticulum, with a metallic foreign body sticked to it (white arrow)

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103.3 mmol/l (reference range: 99–109 mmol/l). In this case, the haematological examination suggested anaemia and malnutrition; no haematological abnormalities suggestive of DA were observed.

Although the heifer had a moderate appetite during hospitalisation, a metallic pinging sound was heard on the 2nd day from the left rib during the simultaneous percussion and auscultation. Although DA was suspected due to the presence of the metallic pinging sound, the haematological examination did not support the diagnosis of DA. Moreover, incidences of DA in a 9-month-old heifer are quite rare. Therefore, an abdominal radiography was performed to exclude ruminal tympany and/or a pneumoperitoneum. To confirm the location of the abomasum, radiographs in the standing position were taken using an X-ray unit (MRAD-A80S/A3; Canon, Ohtawara, Japan) with the following parameters: 120 kV, 20 mAs. Images were acquired using a computed radiography unit (Regius Sigma; Konica Minolta, Tokyo, Japan). In the cranial abdominal radiographs, the contour of a gas-filled balloon-like abomasum wall was delineated, which was elevated to the dorsal abdomen, and a fluid level was observed in the middle abdomen (Figure 1A). Radiopaque sand in the bottom of abomasum had been pulled up caudodorsally by the gas-filled abomasum (Figure 1B). These were considered the characteristic findings of DA. Also, there was a magnet in the reticulum with a metallic foreign body attached to it. The dorsal surface of the content of the rumen was below the lumbar vertebrae, which indicated that the amount of feed intake was insufficient (Figure 1C). Moreover, the presence of an abomasum adjacent to the rumen just under the left abdominal wall was confirmed through the left 11th intercostal space via ultrasonography using a 13.0-MHz linear probe (MyLab One VET; Esaote, Maastricht, The Netherlands) (Figure 2).

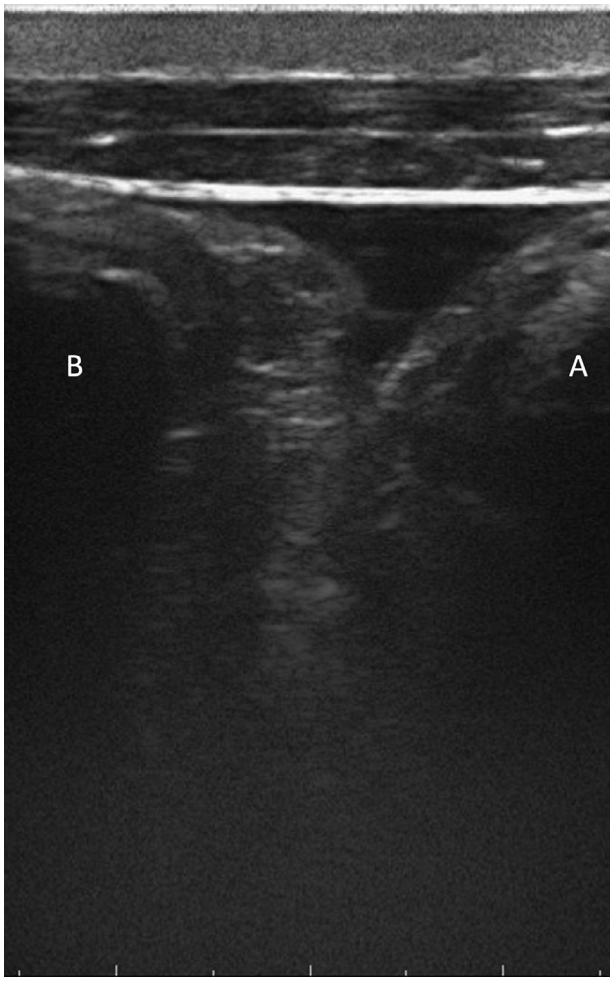

Figure 2. The presence of the abomasum (A) adjacent to the rumen (B) just under the left abdominal wall was confirmed through the left 11th intercostal space via ultrasonography

However, although the haematological examination did not support the diagnosis of DA, the radiography and sonography results prompted us to perform a laparotomy. After placing the heifer in the dorsal recumbent position, a right paramedian incision was made after administering a local anaesthesia with procaine hydrochloride (Kyoritsu Seiyaku, Tokyo, Japan). The abomasum was atonic, with the length of the greater curvature reaching approximately 110 cm (Figure 3). The curvature of the abomasum and abdominal wall was fixed using a USP 5/0 poly-

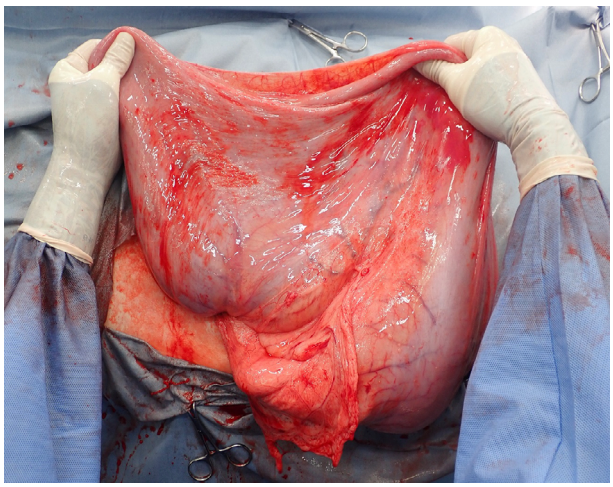

Figure 3. The abomasum pulled out of the surgical incision by pulling the curvature
The abomasal atony was observed; moderate gas and juice were stored in the abomasum

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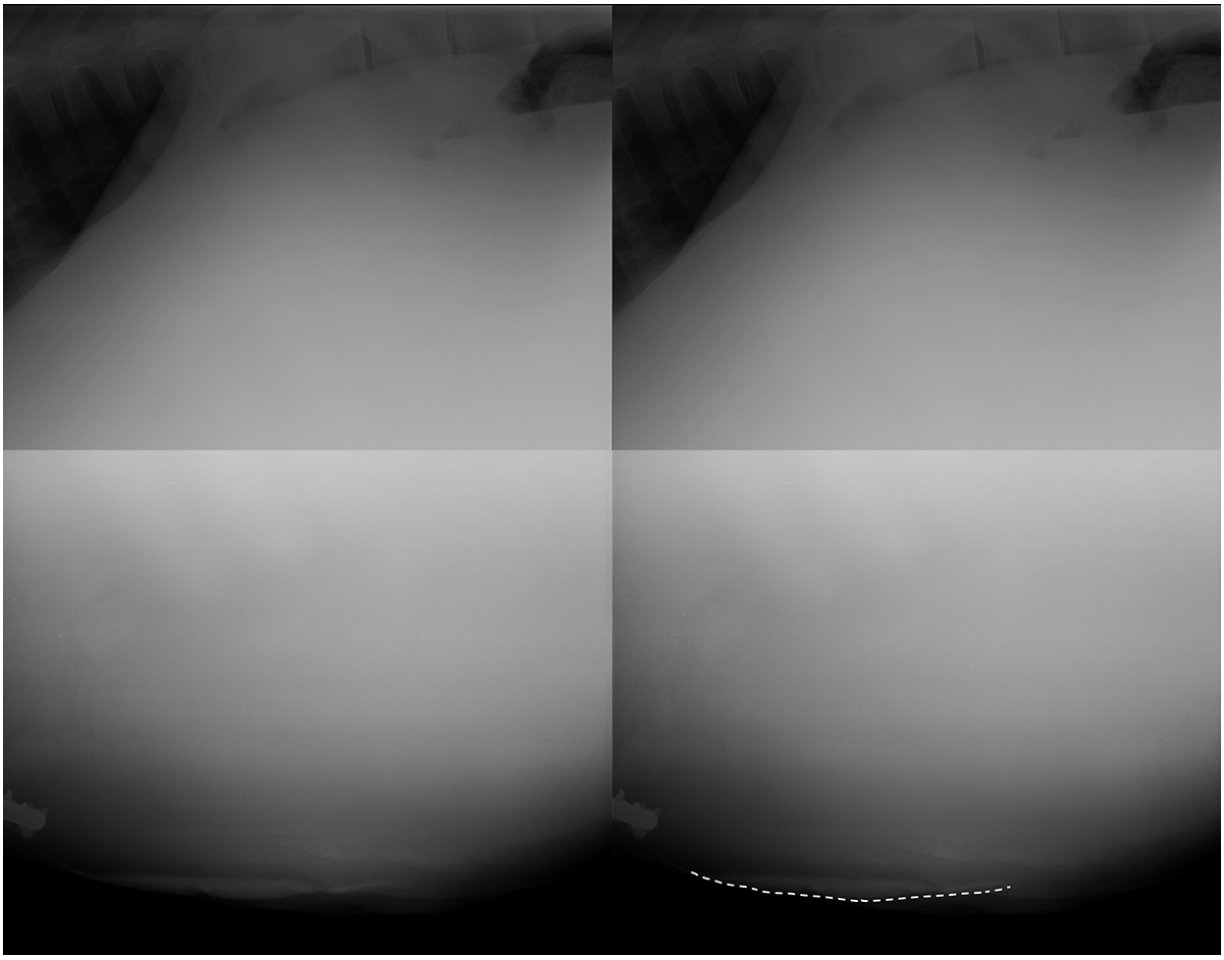

Figure 4. Cranial abdominal radiographs after the surgery
The contour of the gas-filled balloon-like abomasum wall had disappeared in the dorsal abdomen. The radiopaque sand in the bottom of abomasum had located in the normal position on the abdominal floor (dotted line). The dorsal surface of the contents of the rumen has recovered normally

glycolic acid synthetic absorbent thread (Vömel SyntheSorb; Kawasaki Seibutsu, Tokyo, Japan). The general condition after the operation was good, and 5 000 IU/kg body weight procaine penicillin G (Kyoritsu Seiyaku, Tokyo, Japan) was intramuscularly administered twice per day for 5 days to prevent infection. For the treatment of loose stools, 30 g of a probiotic product (Bio-Three; TOA Biopharma, Tokyo, Japan) was orally administered twice per day for 3 days. The roughage intake increased steadily after the surgery. On days 11 and 18, follow-up abdominal X-ray examinations were performed. The gas-filled balloon-like abomasum wall disappeared, and the radiopaque sand in the bottom of abomasum, which had been pulled up, was located in the normal position on the abdominal floor. The dorsal surface of the contents of the rumen had recovered normally (Figure 4).

DISCUSSION AND CONCLUSIONS

In the past, the abomasum visualized by radiograph with barium sulfate was from an 8-week-old calf (Hawkins et al. 1986).

DA is usually not visualised in radiographs because of the thickness of the animal's trunk. In this case, a characteristic image of the DA was obtained by an X-ray examination. These characteristic findings showed us the location of the abomasum pre- and post-surgery in a 9-month-old heifer weighing 182 kg, which is smaller than most dairy cows. In addition, the content of the rumen was low, and the dorsal side of the rumen was filled with air, which allowed the X-ray beam to penetrate through the abdomen easily. Furthermore, a high radiation dose imaging technique was used with a stationary X-ray unit; this imaging technique would not be possible

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with a portable X-ray unit. The authors think that their radiographic findings, such as the gas-filled balloon-like wall, were able to be elucidated upon because of the combination of the three mentioned conditions (air in the rumen; high radiation dose with a stationary unit; animal weighing much less than normal animals of the same age). As the X-ray examination is a non-invasive inspection performed in a natural standing position, the burden on the animal is considered to be low.

Given that DA is generally diagnosed through physical examinations, such as hearing a metallic pinging sound on percussion and auscultation, veterinarians do not have experience regarding abdominal radiography for DA. The X-ray examination was useful in confirming the location of the abomasum with an atypical DA, such as the one in the current case. An abdominal radiography could be a new option for an auxiliary diagnostic approach for DA. To the best of our knowledge, this is the first report of the visualisation of DA through plain radiography.

Conflict of interest

The authors declare no conflicts of interest.

REFERENCES

Antanaitis R, Juozaitiene V, Televicius M, Malasauskienw D, Merkis M, Merkis E, Baumgartner W. Preliminary experiment using sensors for cow health monitoring after surgical treatment for the left displacement of the abomasum. Sensors (Switzerland). 2020 Aug;20(16):4416-26.

Begg H. Diseases of the stomach of the adult ruminant. Vet Rec. 1950 Dec 23;62(51):797-808.

Braun U. Ultrasonography in gastrointestinal disease in cattle. Vet J. 2003 Sep;166(2):112-24.

Coppock CE. Displaced abomasum in dairy cattle: Etiological factors. J Dairy Sci. 1974 Aug;57(8):926-33.

Ford EJH. A case of displacement of the bovine abomasum. Vet Rec. 1950 Dec;62(49):763-4.

Geishauser T, Leslie K, Duffield T. Metabolic aspects in the etiology of displaced abomasum. Vet Clin North Am Food Anim Pract. 2000 Jul;16(2):255-65.

Gouda SM, Abdelaal AM, Gomaa M, Elgioushy MM, Refaai W, Mouncey RR, Salem SE. Diagnostic performance of ultrasonography in clinical management of dairy cattle identified with left-sided ping sounds. J Adv Vet Anim Res. 2020 Apr 25;7(2):308-13.

Hawkins CD, Fraser DM, Bolton JR, Wyburn RS, McGill CA, Pearse BHG. Left abomasal displacement and ulceration in an eight-week-old calf. Aust Vet J. 1986 Feb;63 (2):53-5.

Itoh M, Aoki T, Sakurai Y, Sasaki N, Inokuma H, Kawamoto S, Yamada K. Fluoroscopic observation of the development of displaced abomasum in dairy cows. J Vet Med Sci. 2017 Dec 6;79(12):1952-6.

Janowitz H. Laparoskopische Reposition und Fixation des nach links verlagerten Labmagens beim Rind [Laparoscopic reposition and fixation of the left displaced abomasum in cattle]. Tierarztl Prax Ausg G Grosstiere Nutztiere. 1998 Nov;26(6):308-13. German.

Li XW, Xu QS, Zhang RH, Yang W, Li Y, Zhang YM, Tian Y, Zhang M, Wang Z, Liu GW, Xia C, Li XB. Ultrasonographic findings in cows with left displacement of abomasum, before and after reposition surgery. BMC Vet Res. 2018 Feb 12;14(1):44-52.

Newman KD, Harvey D, Roy JP. Minimally invasive field abomasopexy techniques for correction and fixation of left displacement of the abomasum in dairy cows. Vet Clin North Am Food Anim Pract. 2008 Jul;24(2):359-82.

Partington BP, Biller DS. Radiography of the bovine cranioventral abdomen. Vet Radiol. 1991 Jul;32(4):155-68.

Song Y, Loor JJ, Zhao C, Huang D, Du X, Li X, Wang Z, Liu G, Li X. Potential hemo-biological identification markers to the left displaced abomasum in dairy cows. BMC Vet Res. 2020 Dec 2;16(1):470-8.

Wang Y, Huo P, Sun Y, Zhang Y. Effects of body condition score changes during peripartum on the postpartum health and production performance of primiparous dairy cows. Animals (Basel). 2019 Dec 17;9(12):1159-73.

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