Case Report Rapport de cas

Ultrasonographic findings in 2 cows with duodenal obstruction

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Abstract — Two cases where clinical findings suggestive of proximal ileus resulting in hypokalemic and hypochloremic alkalosis are presented. Ultrasonographs showed distension of the sigmoid flexure along the ventral border of the liver and between the serosal lamellae of the greater omentum in the flank, allowing exact preoperative obstruction localization.

Résumé — Résultats échographiques chez deux vaches avec une obstruction duodénale. Deux cas où les résultats cliniques suggèrent un iléus proximal causé par l'alcalose hypokaliémique et hypochlorémique sont présentés. Les échographies montrent un ballonnement sigmoïde le long du côté ventral du foie et entre les lamelles séreuses du grand épiploon du flanc, permettant une localisation préopératoire exacte de l'obstruction.

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Two 4-year-old cows were presented to the Clinic for Ruminants, University of Munich, Germany. Cow 1 had a 5-day history of reduced feed intake, severely reduced milk production, and deterioration in general condition. Cow 2 was admitted due to prolonged recumbency and because of abdominal distension.

Case descriptions

On initial examination, both animals were quiet and alert. Cow 1 displayed a saw-horse stance with a distinctly lordotic posture. The ventral part of the abdominal cavity was distended in both patients. Body temperature and heart rate were normal. Cow 1 presented signs of dehydration (sunken eyeballs, reduced skin turgor). Peristalsis of the rumen and intestines was severely decreased in both patients. Ballottement with simultaneous auscultation in cow 2 yielded a soft liquid splashing sound in the right flank, whereas percussion during auscultation was negative in both animals. The tension of the abdominal wall of cow 1 was moderately increased, and there were repeated manifestations of pain in response to percussion of the ventral part of the abdominal cavity. Transrectal examination revealed a distended, L-shaped rumen in both animals. No feces were found in the rectum of cow 1, but small amounts of tarry, dark feces were obtained from cow 2.

Blood chemical analysis of both animals showed the presence of a severe hypokalemic, hypochloremic alkalosis. Both patients were hyperglycemic and had elevated L-lactate levels. The ruminal fluid chloride level was elevated in cow 1 (Table 1).

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Table 1. Results of blood chemical studies on 2 cows with duodenal obstruction

Parameter	Reference range	Cow 1	Cow 2
pH	7.35–7.45	7.52	7.50
HCO_3	22–28 mmol/L	48.7 mmol/L	38.1 mmol/L
Base excess	−2.5–2.5 mmol/L	22.1 mmol/L	13.8 mmol/L
PCV	0.3–0.36 L/L	0.41 L/L	0.30 L/L
Glucose	2.5–3.3 mmol/L	15.3 mmol/L	7.7 mmol/L
L-Lactate	0–2.2 mmol/L	18.8 mmol/L	14 mmol/L
K	4–5 mmol/L	2.0 mmol/L	1.88 mmol/L
Cl	90–105 mmol/L	65 mmol/L	91 mmol/L
Ruminal fluid chloride	25–30 mmol/L	62 mmol/L	—

HCO_3 — bicarbonate; PCV — packed cell volume; K — potassium; Cl — chloride

Based on the clinical and laboratory findings, both animals were diagnosed with a proximal ileus.

Ultrasonography of the right side of the abdominal cavity (Hitachi EUB-8500, 3.5 MhZ, convex probe; Hitachi Medical Systems GmbH, Wiesbaden, Germany) was used in both animals to visualize the duodenum between the serosal lamellae through a window in the mid flank area. In cow 1, the duodenum presented with an oval shape and a vertical diameter of 2.8 cm and a horizontal diameter of 5.8 cm; in cow 2, the diameter of the duodenum was 4.5 cm (Figure 1). The course of the duodenum could be followed along the ventral border of the liver up to the sigmoid flexure, where several distended loops of the flexure were visible (diameter ranged from 4 to 6 cm in cow 1 [Figure 2], and 8.6 to 5.4 cm in cow 2), extending along the wall of the abdominal cavity up to the area of the pylorus of the abomasum. The duodenum showed absolutely no peristaltic activity. All other segments of the small intestine were either abnormally empty or of a normal diameter (up to 3.5 cm).

The ultrasonographic examination confirmed the diagnosis of proximal ileus and localized it to the duodenum. Laparotomy of the right flank was conducted on the standing animals after

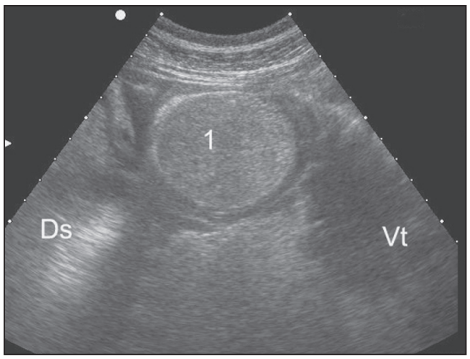

Figure 1. Ultrasonograph of the descending segment of the duodenum of a cow with duodenal obstruction (cow 2).
Ds – Dorsal; Vt – Ventral; 1 – Duodenum

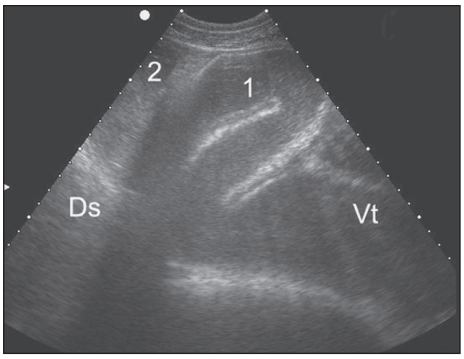

Figure 2. Course of the distended duodenum (diameter 5–6 cm) up to the sigmoid flexure along the ventral border of the liver in cow 1.
Ds – Dorsal; Vt – Ventral; 1 – Duodenum; 2 – Liver

proximal paravertebral anaesthesia with local infiltration of 2% lidocaine (Procasel 2%; Selectavet, Weyarn-Holzolling, Germany).

The descending duodenum of cow 1 was markedly dilated and a coarse, firm mass was palpable in the lumen (Figure 3), which was manually disintegrated and moved along the intestine by massage. The entire duodenal wall appeared to be edematous and thickened. The other parts of the intestine were empty and felt soft. Much of the ventral part of the abdominal cavity was occupied by a severely distended abomasum.

The duodenum of cow 2 was clearly distended and full over its entire length from the abomasum to the jejunum. A section of the lumen about 35 cm aboral from the caudal border of the omentum was filled with a coarse mass. The consistency of this mass and the quality of the feces in the rectum led to the suspicion that this obstruction could consist of coagulated blood. The obstruction was easily moved distally by massage.

Cows 1 and 2 were treated postoperatively with fluids (half maintenance rate either with physiologic saline solution or with a 1:1 mixture of isotonic saline solution and isotonic potassium-chloride solution, and 40 g calciumborogluconate per day, IV), for 2 and 4 d, respectively, and procaine benzylpenicillin (Procain-Penicillin G; WDT, Garbsen, Germany), 20 000 IU/kg bodyweight (BW), SC, q24h for 3 and 5 d, respectively. Flunixin meglumine (Flunidol RP; CP-Pharma, Burgdorf, Germany), 2.2 mg/kg BW, IV, q24h, was administered to both cows for 2 d. Cow 2 was also treated with neostigmine (Konstigmin; Vetoquinol-Chassot, Ravensburg, Germany), 12.5 mg, SC, q8h for 2 d and a single dose of 500 g Epsom's salts, PO.

Cow 1 recovered very rapidly from the operation, showed adequate appetite and normal defecation from day 1 on, and was discharged from the clinic after 4 d. Seven days later, cow 1 was again presented to the clinic with acute deterioration of its general condition and anorexia. Laparotomy revealed gelatinous, edematous alterations in the intestinal wall from the cranial part of the duodenum to the caudal border of the omentum. Large areas of loose adhesions, which could not be removed without tissue damage, had also formed between the omentum near the ascending duodenum and the suture of the abdominal cavity. In light of these grave findings, this cow was euthanized. Dissection of the duodenum revealed, in addition to high-grade subserous edema, a 30-cm segment with major alterations in the duodenal mucosa: irregular, spotted coloration and several ulcers, 2 to 3 cm in diameter, were found.

Cow 2 recovered slowly from the operation. During the first 3 d, the cow showed partial anorexia and dark foul-smelling feces. From the 4th d on, its appetite increased and it passed normal feces. This animal was released 6 d after surgery in good general condition.

Discussion

Intestinal obstructions in cattle occur less frequently in the duodenum than in the jejunum or the ileum (1). Potential causes are mechanical obstruction due to feed boluses or blood clots, narrowing of the duodenal lumen due to liver abcesses in the area of the sigmoid flexure, or adhesions resulting from such abcesses (2–4). Other possible causes are functional disorders in the area of the sigmoid flexure (1).

Cattle with duodenal ileus show unspecific clinical signs, such as moderate to severely decreased body condition, anorexia, reduced or absent peristalsis, and reduced or delayed defecation. Ballottement with simultaneous auscultation and percussion of the right abdominal cavity may reveal positive findings. The animals may be colicky. Transrectal palpation of abdominal viscera is unspecific, and no distended intestinal loops are palpable (2).

Since a proximal intestinal obstruction causes abomasoruminal reflux, chloride levels in ruminal fluid are elevated ($\geq$ 30 mmol/L). This results in hypochloremic, hypokalemic alkalosis (2,5).

Ultrasonographic examination of the right side of the abdominal cavity has been shown to be a useful diagnostic tool when ileus is suspected (3,6,7). Because of its proximity to the liver, gall bladder, and omasum, the cranial part of the duodenum can be identified ultrasonographically. The diameter of the cranial part of the duodenum in 87% of examined cows was found to be between 2.0 and 4.0 cm (8). The descending part of the duodenum can also be identified because of its position between the serosal lamellae of the greater omentum. It's diameter in 76% of examined cows was between 2.0 and 4.0 cm (8). Physiological persistalsis is normally visualized in these 2 segments of the intestine (8). In contrast, the ascending part of the duodenum cannot be visualized ultrasonographically due

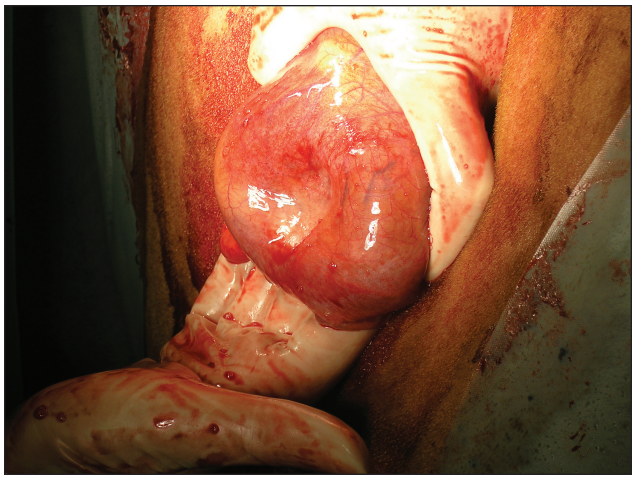

Figure 3. The descending duodenum of cow 1 with a coarse, firm, indentible mass in the lumen.

to its position within the omental recess and its distance from the abdominal wall (9,10).

In both cases, the clinical and blood chemical findings corresponded to those reported in the literature for duodenal obstruction (2). Blood L-lactate levels were elevated in both animals due to circulatory failure and both animals were hyperglycaemic due to stress.

The ultrasonographic findings made it possible to exclude differential diagnoses, such as right abomasal displacement and pyloric stenosis (2). The extent of the duodenal alterations could be estimated. However, it was not possible to determine the cause of the obstruction despite ultrasonagraphic localization of the problem. This situation corresponds to published findings (6) and reflects the fact that the area in which the problem arises is often too distant from the abdominal wall for ultrasonographic examination. Laparotomy was thus unavoidable in both cases.

Both feed boluses, as in cow 1, and blood clots, as in cow 2, have been reported as causes for duodenal obstruction (2). However, blood clots occur more often in the jejunum than in the duodenum (3). Bleeding ulcers in the abomasal mucosa are considered a possible cause for blood clots in the duodenum.

In cow 1, the protracted course of disease, with development of obstruction over a period of 5 d, indicated that the cause of ileus must be an incomplete obstruction allowing the passage at least of liquid intestinal contents. Likewise, the quality of the feces in cow 2 (dark blackish-brown) was suggestive of digested blood, compatible with the blood clot found at surgery. Thus, in both cases, careful consideration of all historical and clinical data led to a precise pre-operative diagnosis. Based on the recurrence observed only 1 wk after release from the clinic, a functional stenosis due to decreased motility in the altered intestinal wall, as described by Van der Velden (1), cannot be ruled out as the cause of intestinal obstruction in cow 1.

The surgical findings in the 2 cases suggest that ultrasonography can be a good adjunctive technique in the preoperative diagnosis of duodenal obstruction in cattle. CVJ

Author contributions

Beatrice Lejeune performed the clinical and ultrasonographic examinations, the surgery, and wrote the manuscript. Ingrid Lorenz supported Dr. Lejeune and proof read the manuscript.

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