HORSES AND OTHER EQUIDS

Surgical management of a proximal duodenal hawthorn impaction in a horse

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Received 5 January 2018
Revised 12 February 2018
Accepted 18 February 2018

SUMMARY

Information available on duodenal impactions is limited. The authors present a case of a horse showing clinical signs likely indicating a small intestinal lesion, with anterior enteritis and a strangulating lesion as the most likely differentials. Due to diagnostics not strongly indicating either, the horse was initially monitored. With no clinical improvement after nasogastric decompression, anterior enteritis was considered unlikely and intervention was required. Exploratory laparotomy revealed an intraluminal obstruction oral to the duodenocolic ligament indicating a duodenal impaction. Manual decompression dislodged, broke apart and pushed the obstruction into the caecum. Postoperatively, ultrasonography revealed numerous intraluminal short linear hyperechoic foci consistent with foreign material, and gastroscopy revealed extensive grade 4 squamous ulceration. From the third day postoperatively droppings were passed containing hawthorn twigs, seeds and husks, concluding that was a duodenal hawthorn impaction. The horse responded well to surgical treatment and rehabilitated with no further abnormalities.

BACKGROUND

To the authors' knowledge this is the first reported case of successful surgical intervention of a hawthorn impaction by means of manual evacuation into the caecum without an enterotomy being required. Duodenal obstruction is rare in horses.[1 2] Causes of duodenal obstructions reported include: wood fragments,[3] trichophytobezoar,[4] persimmon fruit,[5 6] cracked corn,[7] food block mollases,[8] undigested food conglobate[9] and choleliths.[10] Clinical signs associated with duodenal obstructions include mild to severe colic, depression and copious gastric reflux that can be spontaneous.[11] The gastric distension caused by the reflux can be significantly painful in horses with duodenal obstruction and is thought to be due to the obstruction being in close proximity to the pyloric sphincter.[11] Other clinical findings include an elevated temperature, heart rate and respiratory rate, prolonged capillary refill time (CRT) greater than three seconds and dehydration.[12] Ultrasonography may detect duodenal abnormalities, including lack of peristalsis (ileus), abnormal wall thickness or increased luminal size (distension).[13 14] The duodenum is normally visualised on the right side mid-abdomen between the liver and right dorsal colon.[15] Normal duodenal dilation typically does not exceed 5 cm, and duodenal distension has been sonographically described to be present when the duodenum is filled with fluid or ingesta and has obtained a fully round shape.[14 16 17] If the duodenum is dilated, it may indicate the presence of functional or mechanical ileus due to a primary duodenal or more distal small intestinal lesion. Duodenal obstructive lesions inconsistently show dilated small intestine elsewhere ultrasonographically or on rectal palpation.[6 12] In this case the presenting signs, haematological evaluation and diagnostic tests made distinguishing between anterior enteritis and a mechanical small intestinal obstructive lesion[18] challenging. The distinguishing factor in this case was the horse's continual abdominal pain despite gastric decompression indicating a possible small intestinal obstruction, requiring surgical intervention.

CASE PRESENTATION

A 10-year-old Thoroughbred gelding with no history of colic was referred to Rainbow Equine Hospital due to persistent, severe colic of one-hour duration. There were no recent management changes, and the horse had been regularly exercised by the same owner. The horse's pain was non-responsive to analgesia with flunixin meglumine (1.1 mg/kg intravenous; Flunixin; Norbrook) and sedation with detomidine (0.01 mg/kg; Hipnoton; Bimeda) and butorphanol (0.01 mg/kg; Butador; Chanelle), prompting referral for further investigation.

INVESTIGATIONS

On presentation the horse was dull and quiet, with a regular heart rate of 48 beats per minute, respiratory rate of 12 breaths per minute with normal auscultation of both lung fields. The horse was normothermic with no gastrointestinal borborygmi present on abdominal auscultation. CRT was three seconds and mucous membranes were pink and tacky. During examination the horse spontaneously refluxed ingesta. Nasogastric intubation was immediately performed releasing a net volume of 25 litres of ingesta.

Abdominal ultrasonography was performed revealing duodenal dilation (5.5 cm diameter) on the right side (figure 1) and sluggish, though clearly non-distended small intestine inguinally on both sides. Aseptic abdominocentesis yielded a haemorrhagic sample with a slightly raised lactate of 1.7 mmol/l (normal range 0.4–1.2 mmol/l[19]) and a normal white blood cell count. Peripheral haematology revealed a blood lactate of 1.2 mmol/l (normal range 0.2–0.7 mmol/l[19]) and blood gas and electrolyte analysis (epoc®; Siemens Healthineers

To cite: Thomas ILH, Dixon JJ, Fraser B. *Vet Rec Case Rep* Published Online First: [*please include* Day Month Year]. doi:10.1136/vetreccr-2017-000589

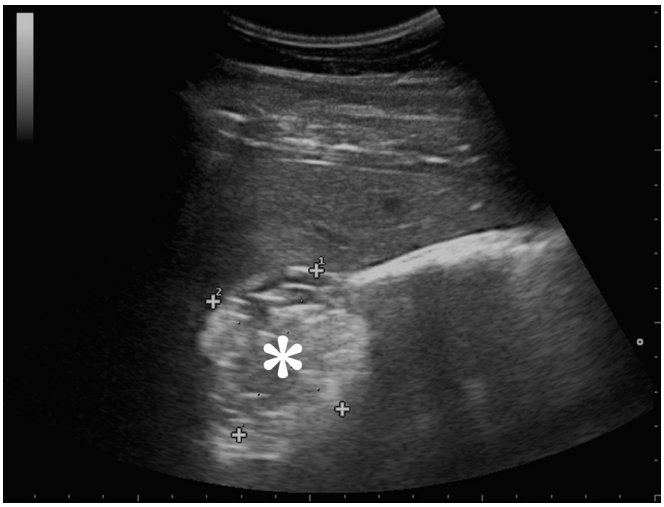

FIGURE 1 Transverse ultrasonographic image of the right hemiabdomen at the level of the duodenum, with the liver in the near field. Dorsal is to the left of the image. A white asterisk (*) is depicted over the distended duodenum, which is outlined using calipers.

Global) showed no abnormal findings. Rectal examination was unremarkable.

Based on the lack of a distinguishing feature indicating a strangulating small intestinal lesion, the horse was initially monitored in a stable for two hours. Despite nasogastric decompression signs of colic returned, indicating that anterior enteritis was unlikely. Emergency exploratory laparotomy was carried out with informed owner consent, with the primary differential diagnosis becoming a proximal small intestinal obstruction.

DIFFERENTIAL DIAGNOSIS

Initial presentation:

- anterior enteritis
- strangulating small intestinal obstruction
- non-strangulating small intestinal obstruction (eg, ileal impaction, duodenal impaction, idiopathic focal eosinophilic enteritis)
- equine dysautonomia (equine grass sickness).

Following investigations:

- strangulating small intestinal obstruction (eg, duodenal volvulus)[20]
- ileal impaction
- duodenal impaction
- idiopathic focal eosinophilic enteritis.

TREATMENT

Following intravenous catheter placement, premedication with romifidine (0.08 mg/kg; Sedivet; Boehringer Ingelheim), procaine penicillin (25,000 iu/kg; Depocillin; Intervet) and gentamicin (8 mg/kg; Genta-ject; Dopharma), the horse was induced with ketamine (2.5 mg/kg; Anesketin; Dechra) and diazepam (0.05 mg/kg; Diazepam; Hameln). Anaesthesia was maintained using isoflurane in 100 per cent oxygen via a closed circle breathing system and administered through an endotracheal tube, along with intravenous fluid therapy of Hartmann's at a two times maintenance rate. Lidocaine (Lidocaine injection with preservative 2%; Hameln Pharmaceuticals) was administered as a constant rate infusion (1.5 mg/kg as a bolus for the first 15 minutes followed by 0.5 mg/kg/minute) until 15 minutes prior to recovery.

After clipping, aseptic preparation and sterile draping, emergency exploratory laparotomy was performed via a 15 cm midline incision. Despite previous nasogastric decompression the stomach was moderately distended upon entering the abdomen. The proximal 30 cm of the duodenum was markedly fluid distended and a firm, irregular, fist-sized intraluminal impaction was palpated oral to the duodenocolic ligament. The duodenal mass could not be exteriorised. The remainder of the small intestine had no abnormalities present and good motility was seen throughout the remaining intestine. The impaction proceeded to be manually broken down and milked through the more aboral small intestine into the caecum (figure 2).

Dexamethasone (0.1 mg/kg; Dexa-ject; Dopharma) was administered intravenously aimed at reducing small intestinal inflammation and preventing postoperative ileus. Following abdominal lavage with warm sterile isotonic fluids and correct repositioning of the abdominal organs, the linea alba was closed using a loop suture of doubled 5 metric glycolide/lactide copolymer (LACTOMER polysorb; Covidien) in a simple continuous pattern. The subcutaneous tissues and skin were closed with a modified subcuticular suture of 3 metric poliglecaprone 25 (Monocryl; Ethicon).

The horse recovered uneventfully from general anaesthesia, and received procaine penicillin and gentamicin for a further 24 hours postoperatively in addition to intravenous flunixin meglumine twice a day at a full dose (1.1 mg/kg) and then half a dose from 72 hours. Intravenous fluid therapy with Hartmann's and a constant rate infusion of lidocaine were also administered. Nasogastric decompression was regularly

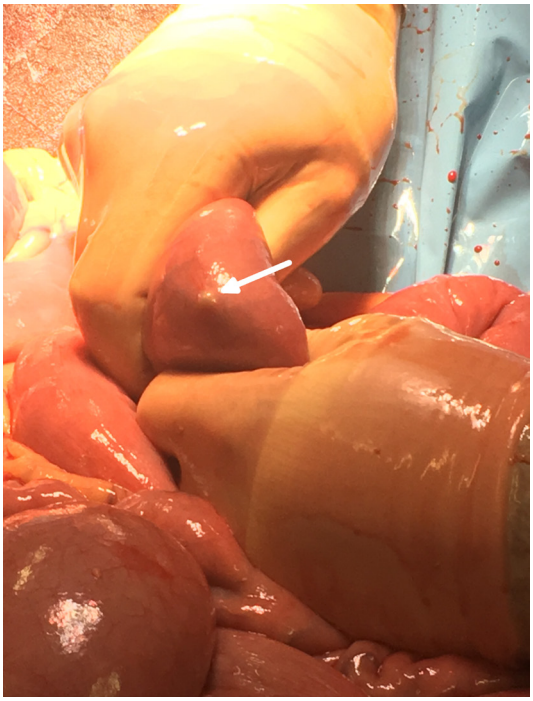

FIGURE 2 Intraoperative photograph of the orad jejunum. White arrow indicates firm luminal material protruding into the wall of the small bowel which is focally convex as a result.

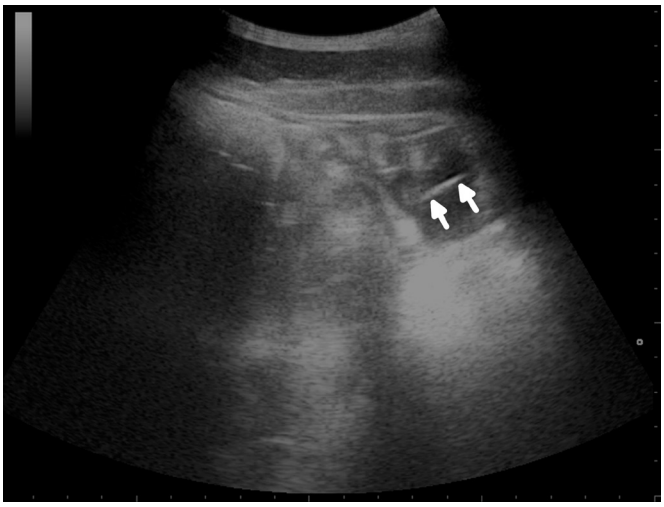

FIGURE 3 Ultrasonographic image from the right inguinal region. White arrows depict a linear hyperechoic structure within a single slightly dilated loop of small intestine. This represents foreign material within the lumen.

attempted for 24 hours postoperatively but no net reflux was obtained.

OUTCOME AND FOLLOW-UP

The horse appeared settled the day after surgery and on ultrasound the duodenum was shown to be thin walled, motile and contracting normally. We attributed the lack of postoperative ileus to careful tissue handling, absence of enterotomy, endotoxaemia or vascular compromise and prophylactic dexamethasone during surgery. Haematology, biochemistry and peripheral blood lactate (epoc®; Siemens Healthineers Global) analysis were within normal limits 12 hours postoperatively. Lidocaine and fluid therapy were discontinued on the second day postoperatively due to normal clinical examinations and blood analysis. Injectable antibiotics were discontinued on the evening of the second day after surgery. Flunixin meglumine was continued 1.1 mg/kg twice daily until the third day postoperatively, then changed to oral suxibuzone (Danilon Equidos; Elanco), one sachet twice a day (3.125 mg/kg). Food was slowly reintroduced 24 hours postoperatively, initially with handfuls of grass, progressing over the next 48 hours to hard feeds and long fibre haylage.

Further re-examination with abdominal ultrasound at 48 and 72 hours showed no wall thickening or distension of the duodenum; however, numerous short linear hyperechoic foci (figure 3) were visible within the lumen of the small intestine (likely the jejunum). On the third day postoperatively the horse showed colic signs when defecating that resolved without intervention. Droppings were collected and examined, revealing numerous hawthorn twigs, seeds and husks (figure 4). It became apparent upon discussion with the owner that the horse had eaten branches of a hawthorn hedge and examination of the horses paddock confirmed this. It was concluded that these colic episodes were likely due to the hawthorn pieces moving through the small colon and rectum. The horse continued to pass pieces of hard and pointed hawthorn material up to eight days postoperatively but no further colic signs were observed. Gastroscopy was performed on the second day postoperatively, revealing extensive grade 4 squamous ulceration. No foreign bodies (hawthorn) were present.

FIGURE 4 Photograph of the collected foreign material (hawthorn remnants) which had been sieved from the collected droppings postoperatively.

The horse was discharged on day 6 postoperatively. The incision was clean and dry with no discharge or swelling. The horse was discharged on suxibuzone (3.1 mg/kg/day for five days) and was advised to avoid access to the aforementioned hedgerow. A period of six weeks on box rest was advised with small walks to grass in hand. This was followed by six weeks turnout into a small paddock. At three months the horse was turned out as normal before returning to work at six months postoperatively, with no further colic signs observed.

DISCUSSION

Duodenal impaction can cause a number of clinical signs, with mild to severe colic, copious gastric reflux and depression being the most frequent.[11] Simple duodenal obstructive impactions are rare in the horse[1 2] and so are considered lower down on differential diagnosis lists, especially when compared with more frequently occurring processes such as strangulating small intestinal obstructions or anterior enteritis.

Simple small intestinal obstructions, with progressive proximal fluid distension, are more challenging to recognise clinically when compared with strangulating lesions.[21] Small intestinal impactions, such as within the ileum, sometimes cannot be distinguished from a strangulating obstruction due to similar clinical findings.[11] Often abdominocentesis confirms a strangulating lesion, typically producing a serosanguinous sample with raised protein, red and white blood cells due to intestinal wall compromise.[5] However, if tested early in the disease process, strangulating lesions may also produce a relatively normal sample[2] and so other tests and clinical appearance will be relied upon. In reported cases of duodenal impaction, peritoneal fluid samples have been largely normal[5] but two reports have noted increased nucleated cell counts, white blood cells and total protein.[6 12] Differing results may be due to the time difference

between disease onset and sample collection, or possibly mural compromise. In this case, abdominocentesis findings were unhelpful in confirming a diagnosis. Cases of anterior enteritis have reportedly lesser elevations of nucleated cell count and total protein concentration when compared with strangulating obstructions[22 23] and this can be important in distinguishing these conditions.

Differentiating between duodenal impaction and anterior enteritis has not been specifically reported. The distinguishing factor may be based on response to nasogastric decompression. Case reports on both diseases have shown that large quantities of net reflux can be obtained[6 12 23 24] however the clinical response differs. Anterior enteritis cases presenting with colic signs and tachycardia will often respond to decompression by becoming quiet, settled, with a reduced heart rate and resolution of pain.[24] This differs from obstructive lesions where the horse will improve for only a short period.[2] This was shown in this case ultimately leading to an exploratory laparotomy for further investigation and definitive diagnosis.

In other reports of duodenal impaction, haematology and biochemistry analysis has shown inconsistent results, suggested to be caused by varying degrees of dehydration and anorexia.[12] In this case, no abnormal findings were observed which may be attributed to the short time period between the event occurring and initial referral workup. Nothing grossly abnormal was palpated rectally which in the authors' opinion was likely due to the duodenal obstruction being located proximally. This has been also found in a report by Gillen *et al*,[12] however small intestinal distension has been felt rectally in others.[6 9] Distension of small intestine in one of these latter cases, described by Kellam *et al*,[6] was hypothesised as a result of persimmon fruit impacting in the jejunum and ventral colon as well as in the duodenum and stomach. Distension may also be a result of generalised ileus related to pain. Cases of anterior enteritis can present with some degree of small intestinal distension that can be felt on rectal[22] but is subjectively less than in cases of small intestinal obstruction such as ileal impactions or strangulations.[11 21]

The location of the obstruction made it difficult to visualise the hawthorn impaction prior to surgery using abdominal ultrasonography. As discussed, the duodenum descends on the right side of the abdomen between the liver and right dorsal colon.[15] In this case, the duodenum was dilated at 5.5 cm in diameter when visualised at the 10th–12th intercostal space indicating an obstruction aboral to the visualised section. Non-distended, thin-walled, sluggish small intestine was also seen inguinally. In a similar case where proximal duodenal obstruction was due to a trichophytobezoar,[12] no small intestinal distension was observed on ultrasound and the duodenum appeared both normal in size and motility. The horse was euthanased and on postmortem findings the duodenum was dilated twice the normal size 40 cm from the pylorus. The current case also had duodenal dilation 30 cm from the pylorus seen at surgery; however, duodenal dilation was observed on abdominal ultrasonography during the initial workup suggesting that this section of the intestinal tract may have been the cause of the colic signs.

Gastroscopy was not attempted during the initial case presentation due to spontaneous reflux. While passage of a gastroscope into the proximal duodenum of a starved horse is possible, we consider it would have been challenging in this horse to visualise the duodenal obstruction due to its more aboral location. Gastroscopy was performed 12 hours postoperatively revealing extensive excoriations and squamous ulceration of the stomach. Visualisation of the pyloric sphincter and the duodenal entrance was within normal limits but further observation of more aboral areas of the duodenum was restricted due to endoscope length (3 m).

The impaction in this horse causing the obstruction was successfully broken down by manual decompression and the contents milked into the caecum aided by warm saline infusion. Alternative treatment options may include a duodenal enterotomy to remove the impaction, which would require an alternative approach either via the 17th intercostal space or a 'J shaped' ventral incision. However, this is not possible via a midline approach due to difficulty of exteriorising the duodenum[25] and duodenal enterotomy has only been described once in a paper by Ross *et al*.[26] Digital palpation was used to assess integrity and viability of the duodenum. Viability can be considered good in cases where oedema and haemorrhage are the predominant clinical findings in the bowel wall[27] and this was seen in this case. Given the obstruction resolved, there was no need for an enterotomy or enterectomy in this case reducing complication risks. Peritonitis and enterotomy site dehiscence are rare postoperative complications in most studies[2] but would still be considered when deciding between enterotomy and manual massage. Mechanical obstruction at the enterotomy site postoperatively could lead to complications that may contribute to postoperative ileus, stricture and adhesion formation.[2] In this case, by choosing to manually decompress the obstruction, such complications were reduced.

In summary, duodenal obstruction due to foreign material, as described here, should be included in the differential diagnosis lists of horses presenting with suspected proximal small intestinal lesions and this may be ultrasonographically identifiable, though surgery may be needed to confirm and treat the lesion.

Contributors All authors contributed to the study performed here which represents a single descriptive case report.

Funding This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

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