

Management of a iatrogenic cecal perforation after abdominal drain placement on a horse

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Abstract

Summary: A 16-year-old, French Saddlebred was referred for colic signs, diagnosed with incarceration of the jejunum in a mesoduodenic rent and subsequently treated surgically (with an end-to-end anastomosis of the jejunum and an enterotomy of the pelvic flexure). The horse recovered uneventfully, but the next day developed moderate signs of endotoxemia and severe sero-sanguineous discharge from the abdominal wound. Substantial peritoneal effusion was assessed on abdominal ultrasound and required an abdominal drain placement. The site was at first checked with ultrasound, and insertion of a redon drain was performed. Immediately, a brown smelly liquid drained in large quantities (figure 1), and examination of this liquid revealed it to be enteral fluid. The drain was pushed in the viscera and the horse brought to surgery. Placement of an embolectomy catheter was performed before induction and as the horse was induced the balloon catheter was inflated. The drain was pulled out of the viscera and traction on the embolectomy catheter was kept until a repeat laparotomy was performed (figure s2). Moderate contamination of the abdominal cavity occurred during the iatrogenic perforation of the cecum. The balloon catheter effectively occluded the breach in the cecum and revealed to be strong enough to pull on the viscera without tearing it. The abdominal cavity was then lavaged with 80 L of ringer lactates and another abdominal drain was placed. The horse recovered uneventfully and did not display any further complication during the rest of his hospitalization. The horse returned within 6 months to its intended use. **KEY POINTS** Abdominal drain placement carries risks of complication, one of them being enteric placement of the drain Temporary occlusion of the defect is feasible using an embolectomy catheter pending surgery If swift action is taken, contamination of the abdominal cavity can stay moderate.

Iatrogenic cecal perforation after abdominal drain placement on a horse

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A 16-year-old, French Saddlebred was referred for colic signs, diagnosed with incarceration of the jejunum in a mesoduodenic rent and subsequently treated surgically (with an end-to-end anastomosis of the jejunum and an enterotomy of the pelvic flexure). The horse recovered uneventfully, but the next day developed moderate signs of endotoxemia and severe sero-sanguineous discharge from the abdominal wound. Substantial

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The balloon catheter effectively occluded the breach in the cecum and revealed to be strong enough to pull on the viscera without tearing it. The abdominal cavity was then lavaged with 80 L of ringer lactates and another abdominal drain was placed. The horse recovered uneventfully and did not display any further complication during the rest of his hospitalization. The horse returned within 6 months to its intended use.

KEY POINTS

Abdominal drain placement carries risks of complication, one of them being enteric placement of the drain

Temporary occlusion of the defect is feasible using an embolectomy catheter pending surgery

If swift action is taken, contamination of the abdominal cavity can stay moderate.

1/ Introduction:

In the literature there has been several reports of intestinal rupture, caused by parasitism (Beroza *et al.* 1983, Lapointe *et al.* 2003), spontaneous or secondary to foreign objects (Walker *et al.* 1993, Saulez *et al.* 2009, Anderson *et al.* 2014, Marley *et al.* 2018). The prognosis of any of those perforation is poor to desperate (Elce *et al.* 2003, Tabar and Cruz 2009, Marley *et al.* 2018), mainly because of the delay between the perforation and the surgical management, causing a severe contamination and a subsequent septic peritonitis. There have been sporadic cases of successful surgical management (Hogan *et al.* 1995, Anderson *et al.* 2014), but they do not seem to be the normality.

Drain placement is a quite common procedure after laparotomy when abdominal exudation is apparent. The procedure is deemed safe and relatively easy (Carmalt 2010). In a rare case of a previous formation of a third sector in the colon or the cecum, the placement of a drain can be trickier as a perforation of a viscera can rarely occur (ROWE 2009) and in that case swift actions need to be taken to avoid abdominal contamination.

2/ Case history

A 16-year-old, leisure, French Warmblood, was referred for signs of colic occurring for 4 hours. Upon arrival the horse was obtunded, with 4 liter of spontaneous reflux, and cardiovascular parameters within normal limits. Abdominal ultrasound revealed distended and amotile loops of small intestine in the left cranial quadrant. An abdominal paracentesis yielded sero-sanguineous liquid with a lactate concentration of 4,2 g/L. Broad spectrum anti microbial was initiated perioperatively. As the horse was not up to date with his tetanus vaccination a SAT was administered subcutaneously prior to surgery.

The horse was pre-medicated with Detomidine and Morphine, induced with intra venous Ketamine 2,2 mg/Kg, Diazepam 0,05 mg/kg followed with Isoflurane mechanical ventilation and placed in dorsal recumbency. The abdomen was prepared aseptically, and a ventral midline exploratory laparotomy was performed. The jejunum was exteriorized, and an oral portion was found to be incarcerated in a mesoduodenic rent. The rent was enlarged by hand and the 3.5m incarcerated portion of the jejunum was exteriorized and a resection of this portion was decided. A hand sutured end to end anastomosis was performed. As the colon was mildly impacted, a pelvic flexure enterotomy was executed and the colon was emptied and lavaged. The abdominal cavity was instilled with ampicillin, colistin and dexamethasone and the muscular layer was closed with simple continuous pattern (5 Polyglycolic acid). Subcutaneous closure was achieved with cushioning pattern (2-0 glyconate) and skin was closed with staples (6.9mm x 4.2mm, Manipler AZ-35W®). A povidone drape was placed on the incision for the recovery.

The horse was assisted (head and tail rope) during recovery, and the abdominal wound dressing was changed for a compressive bandage (adhesive and cohesive bandage) as soon as the horse was standing. Intravenous fluid administration was initiated in the stable), and Lidocaine was started (1.3 mg/kg in 15 min followed with 0.05mg/kg/min as CRI).

3/ Clinical findings

On the first day after surgery, the horse displayed mild signs of endotoxemia (moderate tachycardia: 52 bpm, moderate tachypnea: 22 mvts/min, congestive mucous membranes, and mild digital pulses on both forefeet). Preventative digital cryotherapy was initiated (ice boots changed every 2 hours). Throughout the day the quantity of reflux increased from none to 1.5 L/h. At the end of the first day severe exudation of sero hemorrhagic fluid from the bandage was observed. An abdominal ultrasound revealed large amount of oedema and liquid in the subcutaneous space and substantial accumulation of exudate in the abdomen. A left and declive right para-median zone was aseptically prepared and a 30 French redon Drain was inserted directed caudally around a steel trocar. The instant the trocar was removed abundant flow of a green-brown fetid liquid was observed. Enterocentesis was confirmed with visualization of fiber material within the liquid. 15 L of enteral fluid was recovered, and the Redon drain was pushed in the viscera to avoid abdominal contamination. A first attempt to occlude the defect was performed using a homemade toggle pin, but remained unsuccessful, as the toggle did not slide in the redon drain easily. A vascular Fogarty embolectomy catheter (6Fr, 80cm) was then easily introduced in the drain and the cuff was inflated with 5 mL of saline when the tip of the catheter reached the viscera, the drain was then pulled. The cuff of the Fogarty catheter allowed a mechanical pressure on the breach when tension was applied.

The horse was then prepared for repeat laparotomy and induced with ketamine and diazepam (same protocol as previously described). As soon as the horse was recumbent a permanent traction on the balloon catheter was applied to keep the breach in the cecum closed and in an upward position to prevent further contamination of the abdomen. The light traction was kept during transport, preparation of the surgical area and draping. The previous incision was opened, and the tip of the cecum was visualized and exteriorized, the Fogarty embolectomy catheter was in place in the cecum, occluding the breach efficiently. The drain was removed, the perforation of the caecum was closed in 2 layers with a Polydioxanone® 2-0 suture with an inverting pattern in the first layer and with a cruciate pattern with the second layer after deflating the cuff of the Fogarty embolectomy catheter. Abdominal contamination with cecal fluid was deemed mild to moderate. An abundant lavage with 15L infusion of RL in the abdominal cavity followed by surgical aspiration was repeated 6 time to achieve a drastic decrease of the abdominal contamination. The rest of the digestive tract was observed, and the anastomosis site was checked, and no leakage or signs of dehiscence was noted. Correct jejunal motility was detected proximal and distal to the enterectomy site. The pelvic flexure enterotomy was mildly inflamed with no signs of leakage or dehiscence. Carboxymethyl Cellulose was infused in the abdominal cavity, along with ampicillin, colistin and dexamethasone. A new 30 French Redon Drain was inserted in a declive position and directed in a caudal portion of the abdominal cavity and secured with a Chinese finger trap suture with Nylon 0. The muscular layer of the laparotomy incision was closed with cruciate interrupted sutures. Subcutaneous closure was achieved with Cushing pattern and skin was closed with skin staples. A povidone sticking drape was apposed on the incision for the recovery, and the drain was closed to avoid contamination and fluid drainage that could make the floor slippery during recovery.

The same procedure and bandage were instated for recovery as previously. A Heimlich valve was installed on the abdominal drain to provide a passive drainage and avoid contamination of the abdominal cavity.

Intravenous fluid therapy was continued with complemented Hartmann's and a CRI of lidocaine was installed. To prevent laminitis from a possible endotoxemia, digital continuous cryotherapy was started preventively, and heparin (50 000 IU BID) was continued.

Antimicrobial therapy was prolonged with penicillin procaine (22 000 UI/kg BID), gentamicine (6,6 mg/kg SID) and metronidazole (30 mg/kg rectally TID). Pain control was completed with flunixin (1,1 mg/kg BID). As the horse was fasting for more than 3 days, omeprazole (4,4 mg/kg) was added to avoid further

gastric ulcerations.

The horse evolved positively over the next 3 days, with no sign of ileus, abdominal discomfort, or signs of endotoxemia. The drain was flushed with ampicillin, colistin and dexamethasone daily and the bandage changed every other day. The drain production decreased rapidly (from 1L/hour to none in 48h). The subcutaneous oedema resolved quickly, and the laparotomy wound remained dry and clean. The gelding was given gradually grass, at first accompanied with aluminum phosphate every 4h then replaced by wetted hay over the next 3 days. Serial measurement of SAA (Serum Amyloid A) showed a swift return to normal values. As no further complication occurred and as the horse displayed a normal transit, he was discharged from the hospital 9 days post-surgery.

After discharge from the hospital the horse resumed moderate activity (hacking), with no further colic sign at this day (1 year post operatively).

4/ Discussion

The problematic of visceral perforation is scarce in the veterinary literature , and the few clinical cases and series of cases reported poor outcome (Hunter 1975, Elce *et al.* 2003, Saulez *et al.*2009). Those tears are more extensive and have a worse prognosis than our case due to extensive contamination and delay between the tear and the diagnosis. In our case the major challenge was to keep the abdominal contamination to a minimum, hence the occlusion of the breach until a grasp on the viscera was available. We elected to insert an embolectomy catheter in the drain to allow partial occlusion of the defect. A total closure of the drain could not be achieved as the Redon drain had several fenestrations on its last portion. The aim was at first to keep the drain pushed in as far as possible in the cecum for the whole drainage time while the horse was standing to avoid fluid extravasation in the abdominal cavity as the drain had multiple fenestrations. When the horse was induced the topography of the abdomen switched upside down and the passive drainage inverted, the redon drain emptied back in the cecum. The drain could then be pulled out of the cecum and the tip of the balloon catheter closed the defect and kept the cecal wall in proximity of the abdominal wall. Continuous traction was essential to keep the balloon catheter close to the breach. In surgery, the balloon catheter seemed to occlude efficiently the breach and allowed the cecum to be pulled proficiently. The construct was much stronger than anticipated and, retrospectively, the balloon catheter could have been inserted sooner thus occluding the defect and allowing the removal of the drain standing pending laparotomy.

A swift reaction and a short delay between the incident and the surgery permitted minimal contamination of the abdominal cavity combined with a thorough lavage and aspiration was paramount. Lavage is debated in human medicine, as it can disseminate bacteria that was localized to one area to the whole abdominal cavity, (Whiteside *et al.* 2005) and several retrospectives and prospective studies are currently carried out to obtain more reliable information (Cioffi *et al.* 2019, Zhouet *al.* 2020). For moderate peritonitis, intra operative abdominal lavage is not superior than suction only in humans (Hajibandeh *et al.* 2018). In the veterinary literature, peritoneal lavage is shown to decrease bacterial count, but bacteria is still present in the lavage liquid in most of the cases (Sl *et al.* 2012). For the horses intra operative abdominal lavage is done occasionally as targeted aspiration is difficult or even impossible to perform as visualization and exteriorization of viscera is not achievable.

General antimicrobial therapy was already started for two days and limited bacterial growth after this moderate iatrogenic contamination. Local antimicrobials were also added and might have had a limiting contamination role. The use of gentamycin and procaine penicillin is routine in laparotomy surgeries for equine and covers a large spectrum and are the antimicrobials the most widely used for first line response. As the contamination was moderate and the lavage efficient, there was scarce need of antimicrobials. The SAA, rectal temperature, and behavior was thoroughly followed the days after surgery and several abdominal ultrasounds were performed to make sure no peritonitis developed.

The horse recovered fully and was discharged within normal time frame for a repeat laparotomy. No incisional infection or dehiscence appeared despite several complicating factors (repeat laparotomy, and abdominal lavage).

This visceral placement of a drain happened despite care to direct the trocar caudally and medially with a operator used to this type of procedures. A possible cause of this issue was the distension of the cecum with enteral fluid coupled with severe sub cutaneous oedema impeding on a correct visualization of the abdominal wall of the cecum on the preliminary ultrasound.

This issue has not been reported previously in the veterinary literature, possibly because of its rarity and / or an under reporting of this issue. Maybe an ultrasound guided insertion of the drain could have prevented this occurrence, and it raises concerns about our usual blind placement of such devices.

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