EQUINE VETERINARY EDUCATION
Equine vet. Educ. (2009) **21** (8) 396-400
doi: 10.2746/095777309X448953

Case Report

Colonic volvulus with defects of the mesenteric attachments in a yearling Friesian colt

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Keywords: horse; colic; colon volvulus; mesentery; Friesian

Summary

This report describes an unusual case of colonic volvulus associated with multiple mesenteric abnormalities. A yearling Friesian colt presented with signs of colic that persisted despite analgesia. The colt showed signs of circulatory compromise and had abnormal findings on rectal palpation. An exploratory laparotomy was performed. A complete volvulus of the ascending colon was identified associated with multiple mesenteric anomalies of unknown aetiology. The colt was subjected to euthanasia due to the extent of the intestinal damage and the likelihood of recurrence. The authors speculate that the anomalies may have been of genetic aetiology associated with a restricted gene pool.

Introduction

Volvulus of 360° or greater of the ascending colon (large colon) is one of the most painful and rapidly fatal causes of colic in the horse; without intervention, death occurs in a matter of hours. Reported survival rates for horses with this condition range from 35–86% (Barclay *et al.* 1980; Harrison 1988; Embertson *et al.* 1996; Johnston *et al.* 2007). Risk factors include recent parturition, recent dietary changes and recent access to a lush pasture (Harrison 1988; Snyder *et al.* 1989). The condition is unusual in young, immature horses (Singer and Livesey 1997). This report describes an unusual case of a yearling Friesian colt with colonic volvulus associated with multiple mesenteric abnormalities.

History

A 10-month-old Friesian colt was referred to Bell Equine Veterinary Clinic for evaluation of violent signs of abdominal pain that had been present for <4 h. The signs of colic had been unresponsive to analgesic treatment with flunixin meglumine (Finadyne)[1] and butylscopolamine bromide with metamizole (Buscopan Compositum)[2] given by the referring veterinary surgeon. The owner was not aware of any previous episodes of abdominal pain or other medical problems and there had been no recent dietary changes.

Clinical examination and surgery

On admission, the colt was in good bodily condition and showed intermittent signs of abdominal pain. He was tachycardic (60 beats/min), his mucous membranes were pale, peripheral pulse quality was reduced and his extremities were cool. Skin abrasions were present around the eyes and over the *tubera coxae*. Audible borborygmi were absent on the left side and reduced on the right. There was moderate abdominal distension, and rectal examination revealed marked large intestinal distension with taut taenial bands. There were no fresh faeces in the rectum. A nasogastric tube was passed but no gastric reflux was obtained.

Routine haematology revealed a normal packed cell volume of 37.1% (reference range [rr] 32.0–46.0%). The total nucleated cell count was within normal limits but revealed a mild stress leucogram with a granulocytosis (granulocytes 7.9 x 10^9/l, rr 1.2–6.8 x 10^9/l) and slight lymphopenia (lymphocytes 1.1 x 10^9/l, rr 1.2–3.2 x 10^9/l). Transabdominal ultrasonography revealed normal (i.e. small) volumes of peritoneal fluid and a mild reduction in small intestinal motility. The large intestine appeared distended, had mild mucosal oedema and showed reduced motility. Abdominocentesis was not performed as it was considered unlikely to have altered the decision of whether to proceed with an exploratory laparotomy.

In light of the abnormal rectal findings and persistent signs of pain that were unresponsive to analgesic drugs, an immediate exploratory laparotomy was performed. Prior to surgery the colt received sodium benzyl penicillin (Crystapen[1] at 20,000 iu/kg bwt i.v.) and was

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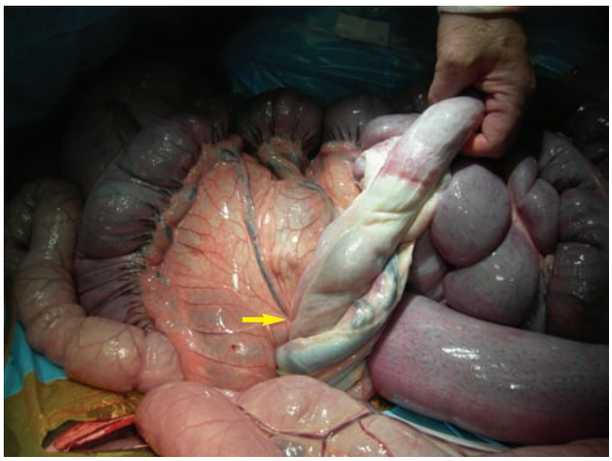

Fig 1: Regions of the gastrointestinal tract exteriorised from the abdominal cavity immediately post mortem illustrating the torsion of the thickened colonic mesentery (arrow).

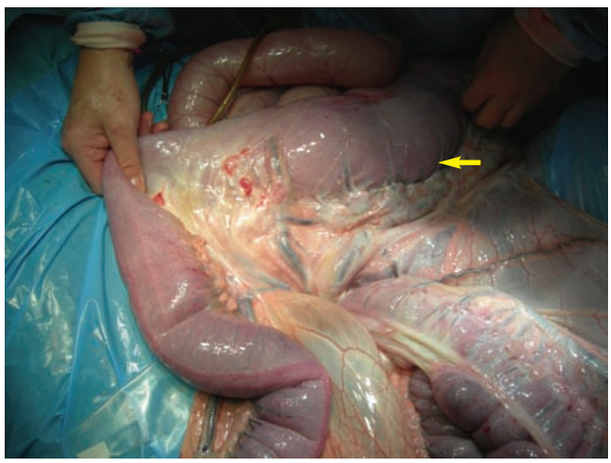

Fig 2: Regions of the gastrointestinal tract exteriorised from the abdominal cavity immediately post mortem. Unusually the transverse colon (arrow) and proximal small colon (being held by the surgeon) could be exteriorised due to the abnormal length of the mesenteric attachments.

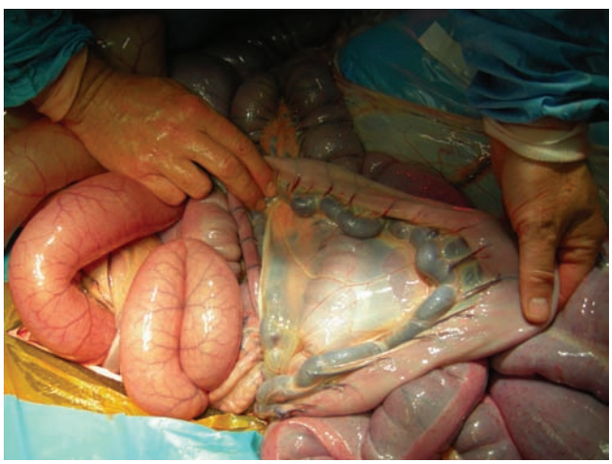

Fig 3: Severe dilation of small intestinal mesenteric vessels.

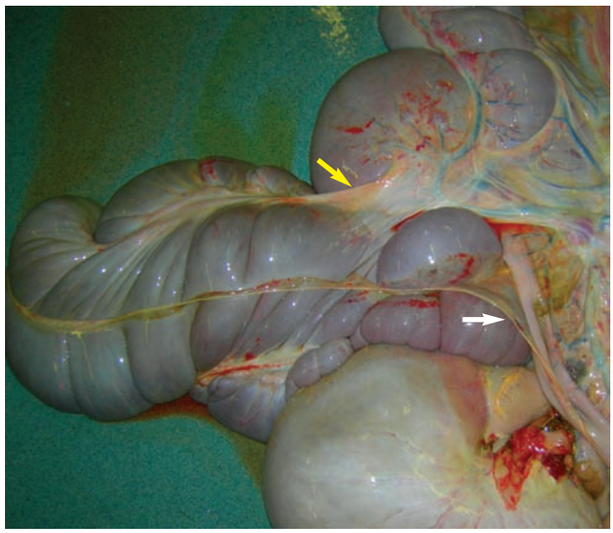

Fig 4: The caecum after removal of the digestive tract post mortem showing the abnormally short caeco-colic ligament (yellow arrow) and ileo-caecal ligament (white arrow).

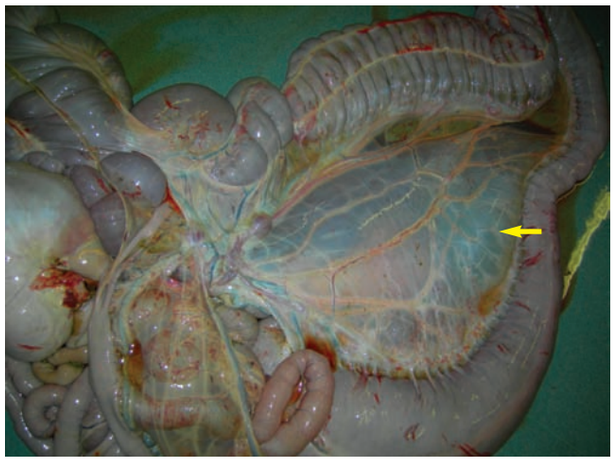

Fig 5: The gastrointestinal tract post mortem after removal showing the wide ascending mesocolon (arrow).

premedicated with romifidine hydrochloride (Sedivet[2] at 0.07 mg/kg bwt) and butorphanol (Torbugesic[3] at 0.02 mg/kg bwt). Anaesthesia was induced with ketamine (2.2 mg/kg bwt i.v. Narkaten[4]) and diazepam[5] (0.2 mg/kg bwt i.v.), and maintained using isofluorane (Isoflo)[6] in oxygen administered by a semi-closed system.

The colt was positioned in dorsal recumbency and a ventral midline celiotomy was performed. Exploration of the abdominal cavity revealed a 360° volvulus of the large colon, which was distended and oedematous, with congestion and cyanosis of the serosal surfaces. In addition there were multiple abnormalities of the mesentery. Following discussion with the owner, and in view of the poor long-term prognosis, the colt was subjected to euthanasia whilst under general anaesthesia.

Post mortem findings

A *post mortem* examination was performed immediately after death. The large colon was markedly gas distended and there was a 360° volvulus of the entire ascending colon about the mesentery of the right dorsal colon (**Fig 1**). The volvulus was anticlockwise when viewed from the surgeon's perspective, or dorsomedial as classified by Harrison (1988). The serosal surface of the colon showed signs of acute inflammation and cyanosis. The mesenteric attachments of the right dorsal colon to the dorsal body wall were abnormally long and fibrosed. The mesenteric abnormality extended to the mesocolon of the transverse colon and the small colon such that the entire right dorsal colon (RDC), transverse colon and proximal small colon were unusually mobile and were easily exteriorised from the abdomen (**Fig 2**). The mesenteric attachments of the transverse colon to the ventral surface of the pancreas, the base of the caecum and the lateral ligament of the liver were also unusually long. Mesenteric vessels of both the large and small intestine showed signs of chronic congestion (**Fig 3**), and colonic lymph nodes appeared oedematous and enlarged.

The caeco-colic ligament was very narrow, attaching to less than one-fifth of the length of the caecum (**Fig 4**). In the normal horse this attaches to the majority of the caecum leaving only the apex unattached (Sisson and Grossman 1953). The ileo-caecal ligament was also smaller than normal. The attachment of the caecum to the dorsal body wall was normal and the caecum had not rotated about its long axis. The attachment of the right dorsal colon to the caecum was also very long. The ascending mesocolon, between the ventral and dorsal portions of the large colon, was oedematous and wide, measuring over 40 cm in places (**Fig 5**) (normal width approximately 15 cm: Sisson and Grossman 1953). The duodeno-colic fold of peritoneum was absent.

Histology was performed on intestinal tissues. The right ventral colon and caecum showed mixed mucosal inflammation and sections of the pelvic flexure and transverse colon had mucosal haemorrhage. A section of colonic lymph node was normal to reactive with prominent cortical secondary follicles. Sections of oesophagus, duodenum and small colon were normal. The histological changes evident in these sections were relatively mild considering the haemorrhage and oedema evident grossly. Histology was not performed on sections of mesentery.

Discussion

Complete volvulus of the large colon is a serious condition causing severe unrelenting abdominal pain. It is most common in *post partum* broodmares and is not commonly reported in yearlings (Harrison 1988; Snyder *et al.* 1989). The condition has been associated with a poor prognosis although survival rates have improved with advances in gastrointestinal surgery and prompt surgical intervention (Embertson *et al.* 1996). Volvulus may occur in either direction but dorsomedial rotations predominate, (Harrison 1988; Snyder *et al.* 1989). Volvulus may also occur anywhere along the length of the colon although it is reported most commonly at the level of the caeco-colic fold. The clinical effects of the volvulus and prognosis depend on the degree of rotation and resulting ischaemia. Partial rotation (<270°) may cause milder or even no clinical signs (Hackett 2002).

The normal ascending colon has few attachments. The right dorsal colon is fixed, with attachments to: the dorsal body wall, the pancreas, the base of the caecum and the root of the mesentery (Sisson and Grossman 1953). The right ventral colon is attached to the lesser curvature of the caecum by the caeco-colic ligament. The ventral and dorsal limbs of the ascending colon are connected by the ascending mesocolon. Otherwise the ascending colon is free within the abdominal cavity and as such is susceptible to displacement or rotation (Dyce *et al.* 2002).

The abnormal mesenteric attachments seen in this colt may have afforded a greater degree of movement to the ascending colon than normal. In particular, the wide ascending mesocolon (between the ventral and dorsal ascending colon) may have predisposed the ascending colon to rotation about its long axis. The immediate factors influencing the mobility of the ascending colon have not been fully elucidated, although accumulations of gas, fluid or ingesta are likely to be involved (Hackett 1983). In the 14 days prior to the presentation of this colt there had been no known significant changes in management.

It is suggested that volvuli may progress from the left limbs of the colon to the right; the caeco-colic fold then presents the first resistance to further rotation and consequently is often the site of strangulation (Harrison 1988). In this case the abnormally narrow caeco-colic fold would have presented little resistance such that any rotation could progress dorso-caudally to cause strangulation at the dorsal mesenteric attachments of the right dorsal colon. This is an unusual anatomical location for an ascending colon volvulus and twists close to the root of the mesentery would normally involve the caecum (Hackett 2002).

Colic associated with mesenteric abnormalities is uncommon. A review of the literature since 1985 revealed 8 cases (Suann and Livesey 1986; Harrison 1989; Steenhaut *et al.* 1991; Ross and Bayha 1992; Latimer *et al.* 1999; Brommer *et al.* 2002; Bosch and van der Velden 2004; Alzidjali *et al.* 2005). These cases presented with a variety of signs and a diverse range of abnormalities were identified. They do not represent a single specific condition. The combination of mesenteric abnormalities in this colt has not been previously described.

Reported cases show some similarities with this case. Ross and Bayha (1992) describe multiple mesenteric anomalies with volvulus of the ascending colon and

caecum, (perhaps because the caecum lacked any dorsal attachments). Brommer *et al.* (2002) describe a lack of dorsal caecal attachments (amongst other anomalies) but colic was caused by tension on the vasculature rather than a torsion. Harrison (1989) describes caecal volvulus as a consequence of caeco-colic fold hypoplasia. In contrast, this case had normal dorsal caecal attachments and caecal volvulus did not occur.

It is unclear how long this torsion had been present or whether it was a recurrence of a previous torsion. Grossly, the mesenteric attachment of the RDC was thickened and fibrosed suggesting chronic inflammatory change, the colonic vessels showed signs of chronic congestion and the colonic lymph nodes were enlarged. The histological changes to the intestinal wall were acute and it is unfortunate that the mesentery itself was not examined histologically. Complete torsions are characterised by acute pain and a severe progression (Snyder *et al.* 1989). As discussed above, this colt had shown no previous signs of colic and was in good bodily condition, it is therefore unlikely that a complete torsion (>360°) had occurred prior to this incident. In light of the chronic dilation of the colonic blood vessels and oedema of the colonic lymph nodes, the authors suggest that partial torsions could have occurred previously. The marked dilation of the mesenteric vessels of the distal duodenum and ileum suggest that they had also been chronically obstructed, possibly due to tension on the mesojejunum and mesoileum caused by twisting of the mesocolon. Any previous partial torsions must have been sufficiently minor and transient that clinical signs were not apparent and histologically detectable changes to the intestinal wall did not occur.

The aetiology of the mesenteric abnormalities is unclear. There are anecdotal reports of a high incidence of genetic abnormalities amongst Friesian horses including retained placenta, dwarfism, dissecting aortic aneurism and oesophageal dysfunction. The English language literature is relatively sparse although dwarfism has recently been described in some detail (Back *et al.* 2008). There is evidence of several drastic reductions in the size of the Friesian gene pool over the last century and the incidence of retained placenta in this breed has been associated with the high levels of inbreeding (Sevinga *et al.* 2004). No genotype data were available for this horse and no specific genetic abnormalities have been associated with equine mesenteric defects.

The authors speculate that the mesenteric abnormalities in this horse may have been congenital abnormalities due to an abnormal genotype. This view is supported by the apparently chronic changes in the large mesenteric vessels and by the absence of evidence for any other aetiology. Most other cases of colic associated with mesenteric anomalies have been assumed to be congenital. Ross and Bayha (1992) discuss both congenital and a possible traumatic aetiology in a horse in which the dorsal mesenteric attachments of the caecum were absent; however, no conclusion was reached by these authors.

Congenital abnormalities of the gastrointestinal tract appear to be uncommon in the horse. In a survey of 608 deformed equine foals or fetuses, Crowe and Swercek (1985) found gastrointestinal abnormalities comprised just 3.1% of congenital defects. *Atresia coli* and *atresia ani* were most common. The figure of 3.1% is likely to underestimate the true incidence of congenital gastrointestinal abnormalities as some defects are asymptomatic and are thus undetected (Edwards 2004).

An alternative aetiology is that the extraordinarily long mesentery and dorsal attachments may not have been a congenital deficiency *per se*, but may have stretched disproportionately under the weight of ingesta during post natal development. In this case, an underlying defect of their integrity must have been present and it is unfortunate that histology was not performed on mesenteric tissues. This hypothesis may explain why the colt appeared to grow normally and showed no signs of colic until age 10 months. In a similar case Bosch and van der Welden (2004) describe abnormal traction on the root of the mesentery in a case that lacked any dorsal attachments of the caecum or RDC.

Unfortunately, in the present case the colon showed such damage and the risk of recurrence was considered to be sufficiently high that treatment was not considered to be appropriate. Had this case presented earlier, and with less significant mesenteric abnormalities, the question of whether treatment was appropriate would have been pertinent. In a routine case, after correction of the volvulus, the surgeon must decide between closure of the abdomen, a colopexy to reduce the risk of recurrence or a large colon resection (Rakestraw and Hardy 2006). In horses that have suffered one previous volvulus, the reported incidence of recurrence is 5% in nonbroodmares and 15% in broodmares (Hackett 2002). In the present case the risk of recurrence would have been very high. In a case with similar mesenteric defects a routine closure was performed but the volvulus recurred 6 months after surgery (Ross and Bayha 1992). A colopexy of the left ventral colon could have been considered but the risks of complications following this procedure are high (Hance and Embertson 1992), and may have precluded the horse being used as a riding/jumping horse. The merits of large colon resection are also controversial and the procedure is prone to complications; a survival rate of 57% to discharge from hospital was recently reported (Driscoll *et al.* 2008).

This case illustrates the potential for marked gastrointestinal abnormalities to remain clinically silent in the horse and the need to consider unusual disease presentations in breeds with restricted gene pools.

Manufacturers' addresses

[1]Schering Plough Animal Health, Milton Keynes, Buckinghamshire, UK.
[2]Boehringer Ingelheim Ltd, Bracknell, Berkshire, UK.
[3]Fort Dodge Animal Health, Southampton, Hampshire, UK.
[4]Vetoquinol UK Ltd, Great Slade, Buckinghamshire, UK.
[5]Hameln Pharmaceuticals Ltd, Gloucester, UK.
[6]Abbott Laboratories, Maidenhead, Kent, UK.

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