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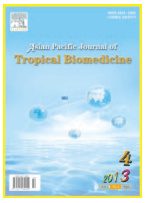

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A report of left dorsal displacement of the large colon in a tropical horse

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PEER REVIEW

Peer reviewer

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Comments

This is a neatly designed case report which evaluated the left dorsal large colon volvulus in a tropical horse. Furthermore, this is the first report in Iran. Since it scarcely take place in horse, such report may be an effective approach for volvulus treatment and prevention.
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ABSTRACT

We report one such case which was diagnosed intraoperatively as left dorsal colon volvulus due to multiple mesenteric abnormalities. A 17-year-old castrated male horse was taken to the Tehran University Veterinary Hospital for treatment of metacarpal wound accompanied by severe abdominal distension and acute colic. The treatment and measurement were taken for a month, and the prepared biopsy indicated that the healing trend was obvious. Unfortunately, prior to discharge, the clinical colic manifestations emerged and the animal suddenly died. Dilated large intestine was palpated per rectum and a ventral midline exploratory laparotomy was performed, a complete volvulus of the ascending colon was identified with multiple mesenteric anomalies of unknown aetiology. The pathologic changes observed in this study accurately reflect those changes reported in horse with naturally occurring colonic volvulus and can serve as a reference for subsequent studies on attenuating bowel injury. The present study results can be used to make a scientific assessment of prognosis in the pre-operative, operative, and post-operative management of horses with large colon volvulus.

KEYWORDS

Large colon, Horse, Pathology, Volvulus, Laparotomy

1. Introduction

The large colon, measuring between 3 and 4.5 m, is composed of the right ventral colon, the left ventral colon, the left dorsal colon, and the right dorsal colon, and begins at the cecocolic orifice and ends at the transverse colon. The large colon forms a long U-shaped loop, which is attached to the dorsal body wall at the right dorsal colon and right ventral colon. This wall developed, voluminous loop is mobile, predisposing the bowel to anatomic displacements and physical obstructions. The diameter of the large colon varies, with narrowing occurring at the pelvic flexure and formed between the left ventral colon and the left dorsal colon. The right dorsal colon narrows before entering the transverse colon. The narrow areas are prone to obstruction by digesta or foreign materials[1,2]. Large colon volvulus is a common cause of surgical colic in horses and has a high mortality[3]. Even resection does not remove all ischemic colon and recovery of the remaining mucosa can determine the severity of post-operative endotoxaemia and outcome[3]. Because most horses with gastrointestinal diseases are routinely treated with non-steroidal antiinflammatory drugs (NSAIDs), such as flunixin meglumine and these drugs can be toxic to normal equine gastrointestinal mucosa[4], the effects of NSAIDs on repair of equine intestinal mucosa are important[5]. Equine large colon volvulus is an acute, severe abdominal crisis. Reported survival is low, ranging from 35%-65%[6]. It has been shown that histologic changes observed at the pelvic flexure are uniformly distributed throughout all colonic tissue involved in the volvulus[7].

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Morphologic changes, specifically percentage loss of the surface and glandular epithelial layer and the interstitial crypt ratio have been shown to reliably predict survival[7]. Colic has been identified by veterinarians. A national survey reported colic as a leading health concern and a major cause of death in horses[9-11]. Strangulating large-colon volvulus can account for 11% to 27% of surgical cases of colic[and fatality of affected horses can approach 34% to 65.3% without resection[1,12]. The absolute twist of the intestine around the mesenteric attachment is named volvulus. This sort of disease is one of remarkable cause of severe colic of equine abdominal cavity.

We report the historical, physical, signalment and clinical factors that may affect mortality in horse with colon volvulus unrelated to other causes (*e.g.*, incarceration, bacterial infection, lipoma, *etc.*).

2. Case histories

In October 2012, A 17-years-old gelding male horse was referred to the Tehran University Veterinary Hospital for treatment of metacarpal wound accompanied with severe abdominal distension and acute colic. The treatment was taken for a one-month period, and the prepared biopsy indicated that the healing trend was obvious. Unfortunately, prior to discharge, the clinical colic manifestations emerged and the animal suddenly died. Dilated large intestine was palpated per rectum and a ventral midline exploratory laparotomy was performed. A post mortem examination was performed immediately after death (Figure 1). On opening of the abdominal cavity, a large quantity of sanguineous and foul-smelling fluid with pus exited the perforated bowel wall was found in the abdominal cavity (Hemoperitoneum) (Figure 1A). Additional signs of an acute diffuse peritonitis were visible. The blood vessels of the stomach and intestines were distended. Displacement of the left dorsal colon was occurred as length about 3 meters. In colon the distention and inflammation was observed due to gas and serosanguineous fluids. The intestinal mucosa was dark-red along with infarction. The large colon was markedly gas distended and there was a 360° volvulus of the entire ascending colon at the mesentery of the left dorsal colon (Figures 1B and 1C). The serosal surface of the colon indicated signs of acute inflammation and cyanosis (Figure 1A). The mesenteric attachments of the left dorsal colon to the dorsal body wall were abnormally long and fibrosed (Figures 1B and 1C). The mesenteric abnormality extended to the mesocolon of the transverse colon and the small colon such as the entire left dorsal colon, transverse colon and proximal small colon were unusually mobile and were easily exteriorised from the abdomen. 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 revealed signs of chronic congestion 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. The ileo-caecal ligament was also smaller than normal (Figure 1F). The attachment of the caecum to the dorsal body wall was normal and the caecum had not rotated around its long axis. The attachment of the left 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 35 cm in places (Figure 1H and 1I). Also, invasion of the putrefactive bacteria to the bowel wall was seen (an infarcted gangrenous intestinal wall is readily permeable to putrefactive bacteria) (Figure 1E). Sectioning of the lungs discloses a dark red-blue, moderately congested and edematous parenchyma (Figure 1D).

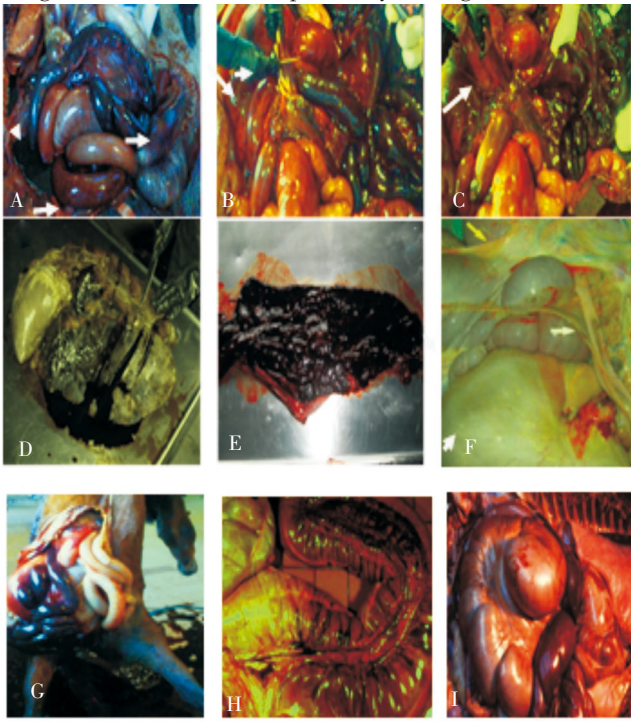

Figure 1. A post mortem examination of the dead horse.
A: The gastrointestinal tract post mortem showing a large quantity of sanguineous and foul-smelling fluid with pus exited the perforated bowel wall in the abdominal cavity (Hemoperitoneum) (head arrow) and the serosal surface of the colon indicated signs of acute inflammation and cyanosis (arrow); B and C: Regions of the gastrointestinal tract exteriorised from the abdominal cavity immediately post mortem. The mesenteric attachments of the left dorsal colon to the dorsal body wall were abnormally long and fibrosed (arrow); D: Sectioning of the lungs disclosed a dark red-blue, moderately congested and edematous parenchyma (pulmonary edema occurs when the pressure in blood vessels in the lung is raised because of obstruction to remove blood via the pulmonary veins) (arrow); E: The mucosa was ulcerated and enterohemorrhagic enteritis was obvious (arrow). F: The abnormally short caeco-colic ligament (yellow arrow) and ileo-caecal ligament (white arrow); G: A post mortem examination was performed immediately after death; H: The colon has twisted on itself which is also called a volvulus, and the affected bowel is severely congested and somewhat edematous due to the constriction of the blood supply. I: Both segments of the large colon and pelvic flexure are seen to be markedly congested and when cut open, demonstrate some edema in the colon wall. A relatively sharp line of demarcation is seen through the right ventral colon and right dorsal colon.

Histology was performed on intestinal tissues. Histopathologically, the colon showed diffuse hemorrhage, necrosis and infarction in mucosa and submucosa, whereas no hemorrhage was observed in intestinal muscles. The heart demonstrated hyperemia, the kidney developed severe granular and interstitial was hyperemic along with acute tubular necrosis. Regarding metacarpal cutaneous some lesions as diffuse dermal hemorrhage, thick fibrosis layer formation, healing with no inflammation, mild acanthosis and hyperkeratosis were visible. The histological changes evident in these sections were relatively mild considering the haemorrhage and oedema evident grossly. Although, the mucosa was ulcerated and necrohemorrhagic enteritis was obvious (Figure 1E). On handling these loops, the affected intestinal loops, easily identifiable by its red-brown discolouration and dark-coloured fluid could be rubbed off the serosal layer. Multiple ecchymotic hemorrhages were diffusely present throughout the small intestine,mesentery,and large intestines. The horse death was due to volvulus, tissue ischemia, hypoxia, necrosis along with infarction and finally septicaemia shock (probably due to necrosis or/and hypovolemic). The microbiology tests demonstrated the possible role of proteus mirabilis, especially clostridium perfringens, inducing toxemia or septicaemia. Furthermore, the test result was negative for EVA virus. However the necropsy findings indicate a diagnosis of death due to complications arising from volvulus such as neurogenic and/or hypovolemic shocks, intestinal perforation and peritonitis. It seems that this mare suffered from colic overnight and this contributed to her death.

3. Discussion

There is little reported information on the clinicopathology features of a horse with left dorsal large colon volvulus. We attempted to derive this information, based on a retrospective analysis of 1 horse admitted to Veterinary Teaching Hospital (VTH) of the Tehran Regional College of Veterinary Medicine, Karaj Campus, Iran.

The outcome and prognosis for horses after surgery for colic can be difficult to predict and is highly dependent on the nature and severity of the lesion[12]. To our knowledge, few studies report outcome in horses with left dorsal large colon volvulus (defined as volvulus unrelated to other apparent causes like incarceration, lipoma, mesenteric rent, *etc.*). Thus, our purpose was to investigate historical data, signalment, clinical signs, physical examination findings, results of laboratory analysis, surgical, necropsy and histopathological examinations of horse with a diagnosis of left dorsal large colon volvulus at surgery or necropsy, in relation to outcome (survival or non-survival). Our goal was to determine clinical and clinicopathologic factors associated with hospital mortality for large colon volvulus.

The prognosis for horses with large colon volvulus has been reported to be 30% to 60%[1,13,14]. A recent study reported a survival rate of 83%; however, this study was performed in a region of the UK with early referral and surgery[11]. A recent study reported that horses with large colon volvulus and plasma lactate less than 6.0 mmol/L can be predicted to survive based on a sensitivity and specificity of 84% and 83%[7]. 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[1,13]. The condition has been associated with a poor prognosis although survival rates have improved with advances in gastrointestinal surgery and prompt surgical intervention[11]. Volvulus may occur predominately in dorsomedial rotations[1,13]. 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[15]. Colic is one of the most difficult diseases to study with epidemiologic methods due to the large number of diseases, cause colic (abdominal pain) as a clinical sign. Historically, there has been concern that analgesics administered before referral might mask signs of surgical colic on admission to referral hospitals[16]. We were unable to find evidence to support this. The increased frequency of severe pain on admission associated with previous butorphanol administration may reflect the fact that the most painful horses were administered butorphanol, and by admission, this failed in effectively control of their pain. Two factors should be considered when trying to prevent colic; farm factors and horse factors[17,18]. Farm factors include management, use, feeding, and environment. The associated risks on farms with high rates of colic include poor parasite control, high concentrated levels in the diet, multiple sources of concentrates (including supplements which contain higher than suspected amounts of soluble carbohydrates), chronic deficiency in water, excessive use of NSAIDS, acute changes in hay or grain, and horses in training that are confined and fed large amounts of soluble carbohydrates and lesser amounts of roughage. Altering these risks with management has decreased the incidence of colic on farms with a annual colic rate higher than average. On farms with a high incidence of colic (>10 colic cases per 100 horses per year) careful monitoring of the daily management and measurement of the energy, protein and fiber in the diet should be the first steps in assessing the farm for colic risk. Colic has been identified by veterinarians and a national survey as a leading health concern and a major cause of

death in horses[8-10]. Strangulating large-colon volvulus can account for 11% to 27% of surgical cases of colic[11], and fatality of affected horses can approach 34% to 65.3% without resection[1]. Even resection does not remove all nonviable colon, and integrity of the remaining mucosa can determine the outcome[19]. Probability of survival can be influenced by loss of the epithelial barrier, which allows transmucosal leakage of endotoxin, bacterial chemotactic peptides, and bacteria[13]. Rapid repair of the epithelium is important for recovery and involves 2 processes that are usually completed within hours: mucosal restitution and tightening of paracellular pathways between remaining cells[20,21]. Restitution involves sealing the mucosal defect with remaining viable cells before final repair through cell division and proliferation[22]. Anatomically, the ascending colon is of relatively large size and has minimal dorsal attachments, thereby predisposing it to strangulating and non-strangulating displacements. Horses with strangulating large colon volvulus have been reported to have a relatively low rate of survival[13]. However, another study reported a survival rate of 83%, which is likely due to early recognition and surgical correction of the strangulating volvulus[11]. This earlier identification and resolution of the problem was probably facilitated by more frequent monitoring and closer observation of the expensive horses on the farms located in this geographic region and the proximity of the farms to the referral hospital. Despite these encouraging results, morbidity and mortality of horses with strangulating large colon volvulus generally remains high. Hypoxemia and ischemia caused by strangulating volvulus causes transmural colonic damage, especially causing disruption of the mucosal barrier. This mucosal damage occurs subsequent to ischemia and secondary to reperfusion injury. Reperfusion injury is initiated by the production of oxygen free radicals and perpetuated by neutrophils and phospholipid-derived inflammatory mediators[23]. Our study had several limitations. Incomplete data was a particular problem, and some assumptions were made. Where a specific historical factor, physical finding, or treatment was not recorded. In this horse, the variable may have been measured, but not recorded. Similarly, there was more detail in surgical reports compared with other studies. The case reported here was assumed to be the most common form of volvulus where the mesentery twists the intestine into distinct spirals. Another weakness of retrospective studies is that the circumstances surrounding clinical decisions are not always evident from the record. Therefore economic decisions regarding euthanasia, treatments administered, and the length of postoperative hospitalization are not always apparent and can influence the data. The horse in our study that did not survive was euthanatized. Although there was good clinical evidence in some cases other studies that survival was unlikely (*e.g.*, ruptured intestine), the historical data recorded may be less accurate than the data directly recorded at the clinic as it relies on information reported by third parties, and additionally, in the case of duration of pain, owner observation of the horse. The major weakness of our study was the lack of longterm outcome data. We believe that this data demonstrates that information on hospital outcome is still very relevant to clinicians and owners, making decisions at the time surgery is recommended. These findings can be used to make a scientific assessment of prognosis in the pre-operative, operative, and post-operative management of horses with colon volvulus.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgement

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Comments

Background

Volvulus of 360° or greater of the ascending colon (large colon) is one of the most painful and rapidly fatal causes of colic in horse; without intervention, death ccurs in a matter of hours. Reported survival rates for horses with this condition range from 35%-86%. Risk factors include recent parturition, recent dietary changes and recent access to a lush pasture. The condition is unusual in young, immature horses. This report describes an unusual case of a yearling Friesian colt with colonic volvulus associated with multiple esenteric abnormalities.

Research frontiers

A 17-year-old castrated male horse was referred to the Tehran university veterinary hospital of for metacarpal wound treatment and with severe abdominal distension and acute colic. The treatment was performed for a one-month period, and the prepared biopsy indicated that the healing trend was significant. Unfortunately, prior to ermission, the clinical colic manifestations emerged and the animal suddenly died. Dilated large intestine was palpated per rectum and a ventral midline exploratory laparotomy was performed, a complete volvulus of the left dorsal colon was identified associated with multiple mesenteric anomalies of unknown aetiology.

Related reports

This study is nearly in agreement with Harrison, 1988 that reported equine large intestinal volvulus. A review of 124 cases (Abutarbush, 2006) reported use of ultrasonography to diagnose large colon volvulus in horses. However, our research focuses more on a complete volvulus of the ascending colon that was identified with multiple mesenteric anomalies of unknown aetiology.

Innovations and breakthroughs

This report emphasizes on volvulus incidence and diagnosis. Since it occurs hardly in horses, this report may be an effective step for treatment and prevention of volvulus.

Applications

Apparently, the distribution of left dorsal colon volvulus in horses should be noted. The results of the present report suggest that the left dorsal large colon volvulus was diagnosed through clinical and pathomorphological findings.

Peer review

This is a neatly designed case report which eva luated the left dorsa llarge colon volvulus in a tropical horse. Furthermore, this is the first report in Iran. Since it scarcely take place in horse, such report may be an effective approach for volvulus treatment and prevention.

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