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INTUSSUCEPTION OF THE SMALL INTESTINE AND COMPACTION OF THE GREATER COLON IN A MINI HORSECASE REPORT

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Abstract: Colic in horses is a very common pathology among the species, especially in times of drought, when the food supply decreases and hay, silage and feed are added to the animals' diet. When not diagnosed in time, it leads to a poor prognosis or even death. Over the years, many scientific studies have been carried out on colic in horses, highlighting how their anatomy contributes to the predisposition to colic syndrome. Anatomically, the structure of the equine cardia has well-developed musculature, which prevents food from returning to the esophagus and, consequently, prevents the animal from vomiting. In addition, their small intestines are extremely long, which can increase the likelihood of obstructions and other intestinal complications. The aim of this paper is to report the case of a male mini horse who was referred to Unifran's veterinary hospital with severe abdominal pain, dehydration, apathy, low body temperature and no bowel movements. An abdominal ultrasound was carried out and showed distension of the small intestine. The diagnosis of small bowel intussusception was detected during exploratory laparotomy, where in addition to distension, intussusception was observed, along with compaction of the greater colon. The treatment for this pathology was exploratory laparotomy, which involved enterectomy of a part of the small intestine that was already necrotic and later anastomosis, as well as enterotomy in the pelvic flexure to wash and remove the mass obstructing the colon. After the surgery, the animal remained in hospital recovering from intensive treatment, where it improved its clinical condition and was discharged after 15 days in hospital.
Keywords: Distension, enteroanastomosis, enterectomy,laparotomy,colic syndrome.

INTRODUCTION AND LITERATURE REVIEW

Colic syndrome is characterized by the manifestation of abdominal pain, agitation, altered behaviour, haemodynamic instability and dehydration, which can range from a temporary disorder to a complex condition with several complications. As it is considered an emergency situation, the veterinarian must act quickly to prevent the animal's death (NUNES, 2020).

Equines have a natural predisposition when they are subjected to incorrect handling, due to their anatomical characteristics and mechanisms that prevent regurgitation, such as the presence of flexures in the intestine, high peristalsis, low pain threshold and insertion of the esophagus in relation to the stomach with a well-developed cardia. In addition, there is an absence of the vomiting center in the central nervous system of these animals (SILVA, 2018).

Thus, the main causes are sudden changes in diet, a diet rich in concentrates and low--quality roughage, dental problems, parasitic infections, stereotypies, low water intake and limited exercise (SILVA E TRAVASSOS, 2021). Over the years, one of the most serious consequences has been the "artificialization" of food, which has caused a higher incidence of digestive tract disorders in horses, most often resulting in colic syndrome (THOMASSIAN, 1996).

The types of colic are characterized according to where the condition begins and the primary causes, which are differentiated into: stomach origin, large or small intestine, food compaction, inguinal or umbilical hernias, intestinal obstruction, spasmodic colic, sablosis, enterolithiasis, displacement of the right or left colon, among other factors. Among them, the most common are compaction of the large intestine, which causes obstructions due to an excess of poor quality fibrous food; gas colic, generally associated with the consumption of grains, which causes the large intestine to stretch; gas colic, linked to a large accumulation of gases in the digestive tract. As well as displacements and twists, commonly known as volvulus, which is the formation of a loop or incorrect position of the intestine (ALMEIDA, 2005; CAMPELO; PICCININ, 2008).

Some types of colic are more prevalent in younger animals, such as intussusception in foals due to parasitosis or diarrhea, colic of the following types spasmodic tumors in adult animals and tumors such as pedunculated lipomas in elderly animals (LARANJEIRA, 2009).

When there is no significant clinical improvement in the animal, surgical correction is indicated, especially in cases where the compaction is not broken up clinically, when the animal's pain is not controlled, cardiovascular functions are impaired and also when there are already changes in the peritoneal fluid (BROMERSCHENKEL & NUNES, 2017).

Equine colic has a very negative impact on the country's economy, with sporting and breeding animals becoming more valuable every year and consequently insurance costs increasing. The high zootechnical value of animals in Brazil has been increasing, and so has the demand for life insurance for these animals, making the post-mortem clinical examination of these animals more and more careful, so that the insurance companies can indemnify the owner of these horses (WUTKE *et al.*, 2016).

RISK FACTORS

There are several factors that predispose horses to colic, such as anatomy, where the stomach has a well-developed cardia, which in turn makes it impossible for the horse to vomit, as well as having a small gastric capacity, and the small intestine is long and loose in the cavity, the mesentery associated with the jejunum favors torsions, the cecum is a blind sac, the colon has no fixed position, the right dorsal colon inserts into the narrow lesser colon, in addition to the retrograde movement of food and the narrowing of the pelvic flexure. All of these characteristics, together with changes in management, extreme physical activity, diets and parasitic infestations, lead to a predisposition to colic syndrome (PEDROSA, 2008; MARIANO *et al.,* 2011).

ANATOMY AND PHYSIOLOGY OF THE GASTROINTESTINAL TRACT

Equines are classified as non-ruminant herbivores, with a fermenting caecum and colon, which in turn ferment the food after it has passed through the stomach. Diets are provided with a composition that is sufficient to meet their nutritional requirements, knowing that horses are very selective animals when it comes to learning and cutting food, using their sight, smell and taste, sensitivity and lip motility. It is also known that grazing animals feed 60% of the time they are loose, while stabled animals spend only 15% of the time, thus posing a challenge for stabled animals, as stress factors and deprivation of freedom can favor the development of colic syndrome (FIELDING, 2018; SCHIAVO, 2011; SALEM *et al.*, 2017; QUEIROZ, SOUZA 2019).

The anatomy of horses allows them to have a high capacity to select their diet in pastures, having the ability to maintain their nutritional demand when fed good quality grasses. However, grazing time and different types of vegetables are extremely important, as the animal's ability to ingest is slow, and it preferably chooses leaves, shoots and tender stems (PEREIRA,2018; QUEIROZ, SOUZA,2019).

Maintaining good oral health is extremely important if food is to be properly ground and eaten. We can emphasize that it is extremely important for the equine gastrointestinal tract (GIT) to consume good quality water (SALEM *et al.,* 2017; PEREIRA, 2018).

The GIT of horses is divided into three segments: Anterior (esophagus and stomach), middle (small intestine) and posterior (cecum, colon and rectum). In the oesophagus, stomach and small intestine, the food passes continuously to reach the large intestine, where it must remain for a longer time for fermentation to take place correctly (FIELDING, 2018).

The equine esophagus is about 1.5 meters long and extends from the pharynx to the stomach, passing through the thorax and diaphragm. Peristaltic movements are carried out by the circular muscles, which in turn form constriction rings in the esophageal wall, reducing the lumen and pushing the food bolus downwards. At the end of the esophagus, the distal sphincter opens and the food enters the stomach (DANIELS *et al.,* 2019).

The stomach is divided into three regions, the blind sac, fundic and pyloric parts. It also has a glandular and aglandular portion (Figure 1). The cardia is the sphincter located at the entrance to the stomach, which closes the opening associated with the esophagus, preventing regurgitation due to its very strong musculature, while the pylorus is the sphincter at the exit of the stomach, connected to the duodenum. The stomach is relatively small and bean-shaped, with an average capacity of 11 to 17 liters, but it can increase this volume in cases of adaptation to the diet, it can reach up to two thirds of this volume through food and secretions, depending on physiological conditions (QUEIROZ, 2019).

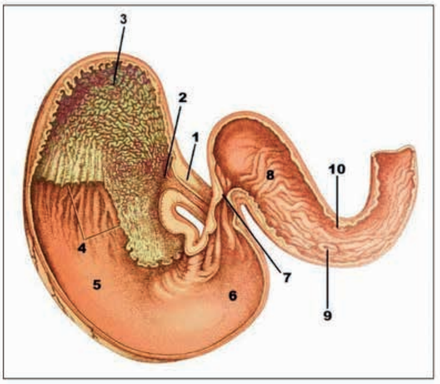

Figure 1: INTERIOR OF THE STOMACH. 1- Esophagus; 2- cardia, 3- blind sac; 4- pleated margin; 5- body; 6- pyloric part; 7- pylorus; 8- part cranial to the duodenum; 9- major duodenal papilla inside the hepatopancreatic ampulla; 10- minor duodenal papilla.

Source: Treatise on veterinary anatomy, Dyce, Sack and Wensing - 5th edition 2019.

The small intestine is on average 20 meters long and is divided into the duodenum, jejunum and ileum. The duodenum is located in the abdomen and positioned dorsally on the right side. The mucosa of the entire small intestine has villi measuring 0.5 to 1 mm, which are lined by epithelial cells with microvilli that increase the absorptive surface, mucus-secreting goblet cells and enteric juice-secreting glandular cells (DANIELS *et al.,* 2019; RIBEIRO *et al.,* 2019). The smooth muscle layer of the intestine is located below the mucosa, where it is responsible for peristalsis, which propels the transit of food to the aboral direction by means of rhythmic contractions (FIELDING, 2018). The pancreas continuously produces low concentrations of enzymes equivalent to 5 to 10% of the animal's body weight (RIBEIRO *et al.,* 2019).

The release of bile is constant in horses, as they naturally don't have a gallbladder, because during evolution their habit of eating several times a day acquired this characteristic. Chemical digestion in the small intestine is carried out by the enzyme lipase present in the bile liquid, which emulsifies the fats in the diet, dissociating them into smaller particles. The enterocytes, in turn, also produce enzymes that are destined for the digestion process.

specific dissociation of particles into smaller units for better absorption (FILDING, 2018; DANIELS *et al.,* 2019; QUEIROZ, 2019).

The large intestine consists of all the sections distal to the ileocecal valve, the cecum, the greater colon (ascending colon), which is divided into the dorsal and ventral colons, and the rectum, which is approximately seven meters long. Its structures are essential for the equine GIT, as it contains microorganisms (MO) capable of fermenting fibers and nutrients that have not been fully absorbed in the small intestine (RIBEIRO *et al.,* 2019).

The cecum is the fermentation chamber, has a capacity of 27 to 33 liters, and can measure 1.2 to 1.5 meters in length depending on the size of the animal. It is a virgula-shaped structure (Figures 2 and 3), its base inserts on the right side, at the pelvic inlet, and goes to the floor of the abdominal cavity, where the apex is caudal to the diaphragm, close to the xiphoid process (BERTO, 2016; RIBEIRO *et al.,* 2019).

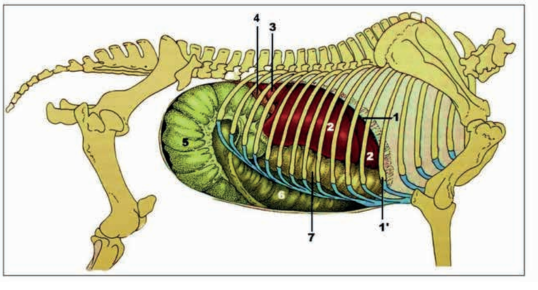

Figure 2: Right antimer view - 1. sectioned margin of the diaphragm; 1' sixth rib; 2. liver; 3. right kidney; 4. duodenum; 5. body of the caecum; 6. right ventral colon; 7. right dorsal colon.

Source: Treatise on veterinary anatomy, Dyce, Sack and Wensing - 5th edition 2019.

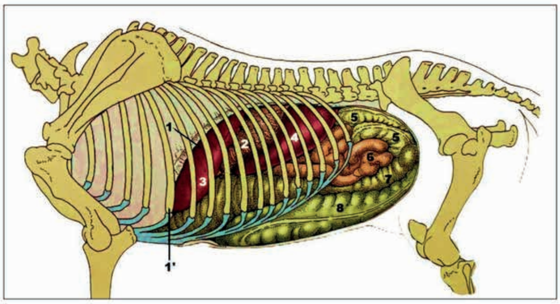

Figure 3: Left antimer view - 1. sectioned margin of the diaphragm; 1'. sixth rib; 2. stomach; 3. liver; 4. spleen; 5. colon; 6. jejunum; 7.left dorsal colon; 8. left central colon.

Source: Treatise on veterinary anatomy, Dyce, Sack and Wensing - 5th edition 2019.

The greater colon begins in the cecum and runs cranially along the ventral part of the right abdominal wall, then suddenly turns to the left to form the sternal flexure and continues caudally along the left abdominal wall towards the animal's pelvis, where it tapers and makes a 180-degree dorsal turn, giving rise to the pelvic flexure. The colon continues in a cranial direction, being called the left dorsal colon, and in the region of the diaphragm, it forms the diaphragmatic flexure, going to the caudal region as the right dorsal colon, after which it is called the transverse colon (REED and BAYLY, 2000; FRANDSON; WILKE; FAILS, 2011).

The smaller colon (descending colon) continues to the end of the transverse colon and ends inside the pelvic cavity as the rectum. The rectum is around 35 to 40 cm long and its function is to store the feces formed in the saccules and the anal sphincter completes the GIT (FRANDSON; WILKE; FAILS, 2011).

The microbiota of the large intestine is similar to the rumen microbiota, both in number and species. As in the rumen, the microorganisms there require an ideal environment to develop and carry out their metabolic functions, requiring a pH of around 6.5. Any alteration, altering the acidity in the normal pH, can reduce the activities of the microorganisms and can lead to colic syndrome conditions. Factors such as nutrition, the way the diet is offered, management, supplements and physical exercise can all interfere with the microbiota. We can also mention the use of certain medications, such as microbials, anesthetics and anthelmintics can alter the existence of the gastroenteric microbiota (QUEIROZ, 2019).

The microorganisms of the *Lachnospiraceae* and *Ruminococcaceae* families are related to the homeostasis of the equine GIT. When there is a reduction in the diversity and quantities of these MO, the GIT is destabilized, and consequently, the number of *Lactobacillus and Streptococcus* increases, the lactic acid metabolizing and butyrate-producing bacteria decrease, which are considered sources of local anti-inflammatories (GARBER; HASTIE; MURRAY, 2020).

Diseases such as diarrhea, gastric ulcers, laminitis and colitis also unbalance the animals' microbiota, and in addition to colic, we can cite weaning and transportation stress as other factors that can trigger colic (GARBER; HASTIE; MURRAY, 2020).

INTUSSUSCEPTION OF THE SMALL INTESTINE

Intussusception is the condition that occurs when a portion of the oral part of the small intestine invaginates into the aboral part of the intestine. The part of the intestine that is invaginated is called the intussuscept and the portion that encompasses it is called the intussuscept (Figure 4). Young horses (foals and animals under 3 years of age) are generally the most predisposed to this pathology, although it has been described in the literature in older animals (THOMASSIAN, 2005).

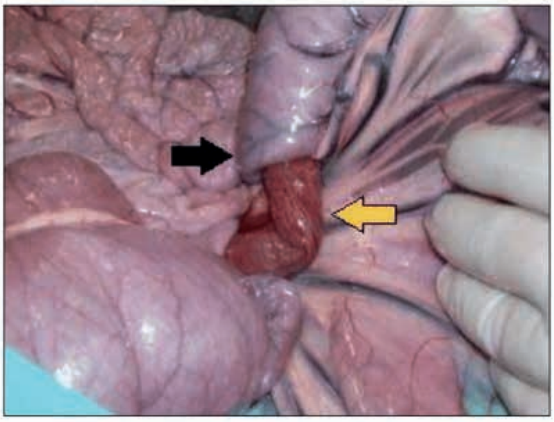

Figure 4: Black arrow indicates the intussuscept. Yellow arrow indicates the intussuscept. **Source:** Clinica equina Bagnola, 2020.

The causes of intussusception are usually related to changes in the peristalsis of the small intestine, for example hyperperistalsis due to dysfunctions neurogenic, enteritis, chronic diarrhea, changes in diet, high infestation by ascarids or tapeworms (*Anaplocephala perfoliata*), mesenteric arteritis, foreign bodies, use of anti-helminthic drugs, coarse and poorly digested food (THOMASSIAN, 2005). In this type of obstruction there is a vascular occlusion, and it may only be venous,

resulting in hemorrhagic obstruction, or it can be arterial and venous, which will result in systemic obstruction. Venous obstruction is more common than arterial obstruction, as a result of which there is venous congestion. After a short time of obstruction, the venules and venules become distended due to the accumulation of blood, and the segment of the intestine turns a dark red color. If there is concomitant arterial occlusion, the intestine becomes cyanotic (PEDROSA, 2008).

When the intestinal lumen is obstructed, the passage of saliva, air and secretions from the stomach, bile, pancreatic fluid and secretions from the intestine itself are orally blocked. The action of bacteria is facilitated because they are in a static and easily-multiplying environment, thus favoring the production of gases. With the secretion of fluids and the continuous accumulation of gas, the intraluminal pressure increases, thus successively increasing the distension of the intestine. Through distension, pain receptors are activated, and consequently the intensity of the pain increases, making it constant. As the intestinal lumen is distended, the peristaltic waves decrease until they cease completely. When there is an increase in hydrostatic pressure, water absorption stops and the flow of water from the mucosa to the intestinal lumen begins, with the increase in pressure and expansion of fluid volume, enterogastric reflux may occur (ALLEN & TYLER, 2009).

The villi of the intestinal mucosa are very sensitive to hypoxia, and in a short time without oxygenation, the epithelial cells begin to detach. As the condition progresses, the mucosal barrier becomes permeable and gram-negative bacteria and endotoxins penetrate the lamina propria and submucosa of the intestine, gaining free access to the circulation. The greater the extent of intestinal damage, the more severe endotoxemic shock becomes (ALLEN & TYLER, 2009).

CLASSIFICATION OF INTUSSUSCEPTION

The classification of small intestine intussusception involves obstruction by strangulation, which is defined by the entry of the intestine segment into the aboral segment, which can be jejuno-ileal, ileo-ileal, jejuno-jejunal and ileocecal. Thus, ileocecal intussusception is the most common in horses under the age of 3 years. Ileocecal intussusception tends to be a complete obstruction (FRANKNEY et. al., 1995; FREEMAN, 2006).

DIAGNOSIS

During rectal palpation of a patient with suspected intussusception, it is possible to detect distended intestinal loops. Intussusception, when palpable (which is rare), manifests itself as a firm, tubular and painful structure. During painful crises, hypertrophy of the proximal small intestine can be seen, with signs of obstruction characterized by an increased diameter, as well as progressively dilated loops with thickened walls (REED & BAYLY, 2000).

Among the diagnostic methods available, McAuliffe (2004) highlights the use of ultrasound to detect intussusceptions in foals, where it is possible to visualize a characteristic image in the shape of a "bull's eye" or "target" (Figure 5). This pattern is observed when performing a cross-sectional scan at the apex of the intussusception, showing the intussuscept surrounded by fluid and the intussuscept. Ultrasound can identify jejuno-jejunal and ileocecal intussusceptions. In addition, abdominal radiography, both plain and contrasted, is used in foals to observe distended small intestinal loops (SMITH, 1994).

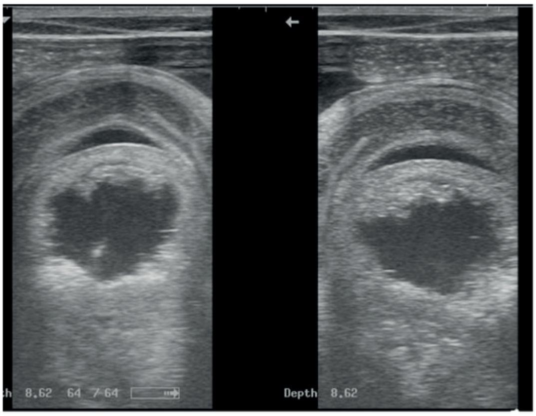

Figure 5: Ultrasound image of intussusception of the small intestine in a 4-month-old foal. The centralized portion is called the intussusception or invaginated portion of the intestine. Bull's eye.

Source: Equivet, 2024.

TREATMENTS

The choice of surgical intervention to treat intussusception is complex, as surgeons are often uncertain about the vitality of the intestinal loops and the involvement of the abdominal cavity, making the diagnosis of irreversible alterations only possible during the surgical procedure. For this reason, the decision must be based on a comprehensive clinical assessment, patient history and complementary tests, such as nasogastric probing, rectal palpation and analysis of the peritoneal fluid (BACCARIN *et al.,* 1995).

In cases of small bowel obstruction with vascular strangulation, the approach is surgical. The method of enteric correction for intussusception will depend on the compromised portion and the viability of the loops involved. If the condition is recent, and there are no significant adhesions between the intussuscepted portions, manual reversal of the intussusception can be attempted to re-establish transit and vascular flow, without major systemic consequences. However, if an extensive segment is compromised by necrosis and adhesions, it will be necessary to perform an enterectomy with enteroanastomosis (THOMASSIAN, 2005).

Predisposing factors to this intussusception include enterotomy, laterolateral anastomosis, lateroterminal anastomosis and pedunculated masses in the mucosa, such as cryptococcal papilloma, leiomyoma, granuloma of unknown cause and carcinoma (FREEMAN, 2006).

In the preoperative period for intussusception in horses, routine procedures are carried out, including fasting, stabilization of the animal, trichotomy and prophylactic antibiotic therapy administered immediately before surgery. Under general inhalation anesthesia and with the patient in dorsal decubitus, access to the abdominal cavity is made via celiotomy or exploratory laparotomy. The ventral midline approach provides the best exposure of the horse's peritoneal cavity (TURNER, 1989).

Incision through the linea alba is common due to its fibrous structure and low vascularization, which results in less bleeding during the incision and greater resistance to the tension forces of the suture and the weight of the abdominal viscera during healing. These factors make the linea alba the preferred choice for the surgical incision (PAGLIOSA & ALVES, 2004).

LARGE INTESTINE COMPACTION

Large colon compactions often occur in areas where the intestinal lumen is narrowed, such as in the pelvic flexure, at the transition from the right dorsal colon to the transverse colon and/or in the smaller colon (BERMEJO *et al.,* 2008; FERREIRA *et al.,* 2009). Although ischemia is rare in primary compactions, in some cases the progressive distension of the intestinal lumen can compromise the blood vessels, resulting in changes in blood perfusion (REED and BAYLY, 2000).

Dehydration can occur both in the intestinal lumen and in the abdominal cavity, due to changes in the acid-base and electrolyte balance. As a result, fecal production is reduced, and stools can become hardened, dry and covered in mucus. This is because, when intestinal motility is reduced, food transit is prolonged, increasing the time it takes to absorb liquids, which gives the feces these characteristics (REED and BAYLY, 2000; RADOSTITS *et al.,* 2012).

DIAGNOSIS

The diagnosis of compaction, based on rectal palpation, is made by identifying a mass in the colon segment. However, in some cases, the compacted material may not be detected due to its more cranial location. Hematological evaluation may indicate hemoconcentration, which occurs due to dehydration of the organism in an attempt to resolve the compaction. The peritoneal fluid obtained by paracentesis is usually normal in cases of primary compaction (AUER and STICK, 2012).

In ultrasound diagnosis, compactions are characterized by distended and rounded viscera, with no visible sacculations. Peristalsis is absent and the thickness of the intestinal wall is usually normal or slightly increased. The compactions appear as a hyperechoic line, generating an acoustic shadow. On the other hand, when small hyperechoic particles are observed, this may indicate compactions caused by sand (DESROCHERS, 2005).

TREATMENT

Most compactions respond to clinical treatment, which involves dietary restriction, pain control, softening and hydration of food intake, maintenance of general hydration and reduction of spasms in the intestinal muscles of the affected area (RADOSTITS *et al.,* 2012).

Initial fluid therapy is carried out with the aim of correcting electrolyte and acid-base imbalances. Hyperhydration aims to improve cardiovascular function and increase the amount of fluid in the intestinal lumen, helping to hydrate the compacted mass (RADOSTITS *et al.,* 2012). In cases of partial obstruction, without gastric reflux, enteral hydration is indicated; in cases of total obstruction, with gastric reflux present, fluid therapy should be carried out intravenously (PEDROSA, 2008).

Most cases of colonic compaction resolve within 48 hours of starting treatment; however, some cases may take several days to improve, and in others, clinical treatment may not be sufficient to resolve the condition (MOORE, 2005).

Surgical treatment is indicated for refractory cases, when compaction is not resolved with clinical treatment or when there is intense and uncontrollable abdominal pain, deterioration in cardiovascular function and/or alterations in the peritoneal fluid. The procedure involves performing an enterotomy followed by enterorrhaphy. During surgery, the compacted intestinal segment is pulled out of the abdomen and isolated. The intestinal wall is then incised longitudinally on the antimesenteric side. From this opening, the compaction is massaged and drained, using running water to help remove the impacted material (MOORE, 2005; RADOSTITS *et al.,* 2012; AUER and STICK, 2012).

SURGICAL TECHNIQUES

For this intervention, a trichotomy is performed from the pubis area in females or from the foreskin in males, extending to the xiphoid process, approximately 30 cm either side of the midline. After induction of anesthesia, the horse is placed in a supine position on the operating table (MORA, 2009).

The incision begins above the umbilical scar and extends cranially, with an approximate length of 30 to 40 cm. The size of the incision must be sufficient to allow manipulation of the viscera without causing damage to them. Initially, the subcutaneous tissue is incised, followed by dissection of the linea alba, which exposes the retroperitoneal adipose tissue, the peritoneum and the abdominal cavity (MORA, 2009).

ENTEROTOMY, ENTERECTOMY AND ENTEROANASTOMOSIS

Enterotomy consists of an incision in the intestine and is indicated for cases of compaction, removal of enteroliths or foreign bodies. This procedure is commonly performed in the pelvic flexure during exploratory laparotomies in horses with colic, with the aim of increasing intestinal motility and improving the animal's comfort in the post-operative period (ELLIS *et al.,* 2007).

The enterotomy area can be sutured using different techniques, depending on the surgeon's preference. Generally, enterorrhaphy is performed using a Lembert suture, followed by a Cushing suture, with synthetic 2-absorbable thread. 0. Throughout the process, the enterotomy site is washed with sterile saline solution to ensure asepsis (FREEMAN, 2006).

Enterectomy involves the removal of an intestinal segment and is indicated when the vascularization of the intestine is compromised (FIGURE 5 A and B). Surgeons assess the viability of the loop based on factors such as color, motility, wall thickness and color of the intestinal mucosa. This surgical intervention can significantly increase the risk of complications and reduce survival rates (MARTENS, 2004).

Enteroanastomosis, in turn, aims to re-establish continuity between the sectioned ends of the intestine (FIGURE 5 C). Small bowel anastomoses are often associated with the formation of adhesions, and some techniques are used to minimize this complication, such as inverted sutures at the seromuscular closure. However, this technique can predispose to obstruction or stenosis due to the reduced intestinal lumen. The use of simple hemicircumferential continuous sutures for the serosal and muscular layers has been shown to be an approach that does not generate significant complications in the short term (LOESCH *et al.,* 2001).

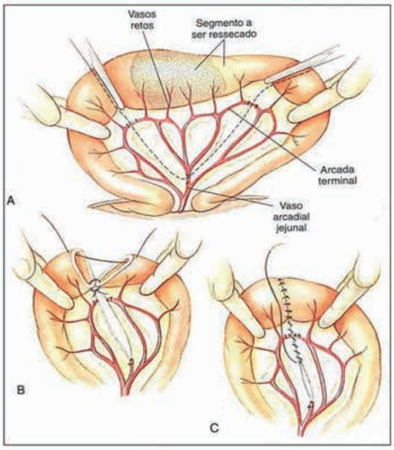

Figure 6: *Procedure for resection of the small intestine with placement of the clamps and ligation of the vessels.* ***A.*** *Occlusion of the injured intestinal segment with forceps; the dashed line indicates where the intestine and mesentery should be sectioned.* ***B****. The mesenteric border is sutured first, followed by the antimesenteric border.* ***C****. Simple interrupted suture and apposition of the mesentery in a simple continuous pattern.*

Source: *FOSSUM, 2014.*

Various techniques for performing anastomoses in the small intestine have been described, including end-to-end, side-to-side and end-to-side anastomoses, which can be performed manually or with staples, depending on the location and extent of the affected segment (LOESCH *et al.,* 2001). The end-to-end anastomosis is recommended when the diameters of the sectioned parts are similar, and is most commonly used in the jejunum (ADAMS & FESSLER, 2000).

CASE REPORT

A 78 kg male mini horse, eight years old, with a brown coat, was seen at the Veterinary Hospital of the University of Franca on February 27, 2024. In the anamnesis, the owner reported that the animal had changed environment and after arriving at the new property it had been fed corn silage, without prior adaptation and after a few hours it showed abdominal discomfort. At the property, 10 ml of flunixin meglumine was administered, but there was no clinical improvement. The patient was seen by an independent veterinarian and nasogastric probing was carried out, as well as drug therapy (fluid therapy and metoclopramide), but there was no improvement in the clinical signs, and the animal was referred to the veterinary hospital at the University of Franca.

After the patient was admitted to hospital, physical and laboratory examinations were carried out. The findings were: heart rate 52 beats per minute (bpm), respiratory rate 24 movements per minute, rectal temperature 34.9 ºC, capillary refill time (CRT) 3", hypocolored mucous membranes, hypomotility in all four quadrants and slight abdominal distension (Figure 6).

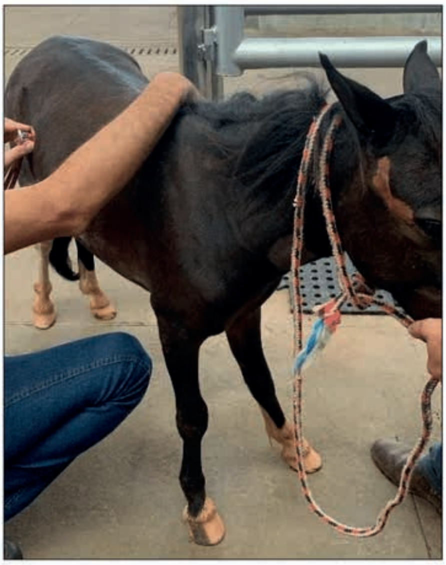

Figure 7: Patient immediately after admission to the veterinary hospital and abdominal auscultation.

Source: Personal archive, 2024.

Laboratory tests showed no alterations in the red series, but the leukogram showed slight lymphocytosis and anisocytosis, fibrinogen 900.0 mg/dL, AST 380 U/L, GGT 18.0 U/L, urea 57 mg/dL, creatinine 1.4 mg/dL, lactate 3.63 mmon/L. On imaging, ultrasound (Figure 7) showed distension of the small intestine with a large amount of fluid in the intestinal lumen.

Figure 8: The ultrasound shows distension of the small intestine due to anechoic contents (liquid). **Source:** Personal archive, 2024.

Following clinical, laboratory and imaging *examinations*, the animal underwent an exploratory laparotomy procedure. Anesthetic induction was carried out with detomidine 8μg/kg, EGG 50 mg/kg, ketamine 2.2 mg/kg and midazolam 0.05 mg/kg intravenously and the patient was then positioned in dorsal decubitus on the operating table and trichotomy and skin antisepsis were carried out (figure 8).

Figure 9: Patient in dorsal decubitus on the operating table with trichotomy of the ventral region of the abdomen.

Source: Personal archive, 2024.

After the incision, the abdominal cavity was explored and colonic compaction was noted, as well as distension and intussusception of the small intestine in the distal portion of the ileum, close to the caecum. Exposure of the intussusception was difficult and at this point petechiae were observed around the affected intestinal segment. After inspecting the viable region of the intestinal loop, the blood vessels were ligated (Figure 9) with a 2-0 polyglactin absorbable suture in order to resect the mesentery. Enterectomy was carried out (Figure 10) with two Doyen forceps placed in an oral and aboral direction between the intussusception, and approximately 50 cm of the small intestine was removed (Figure 11).

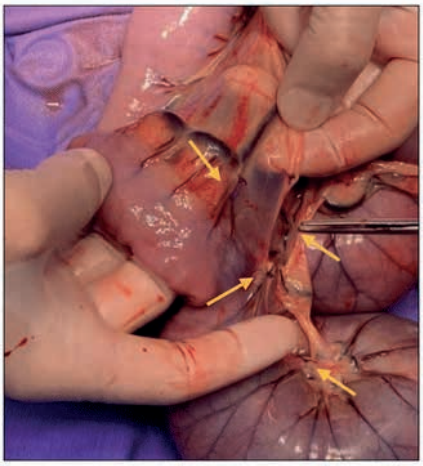

Figure 10: Yellow arrows showing simple sutures with 2-0 polyglactin thread in veins and arteries of the small intestine.

Source: Personal archive, 2024.

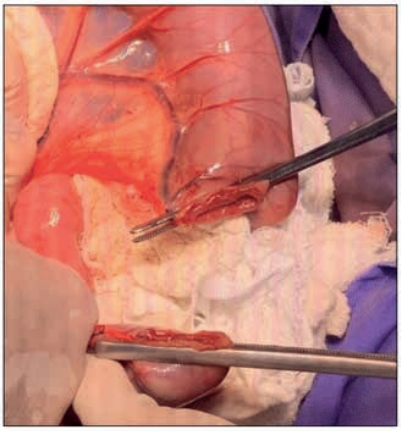

Figure 11: Small intestine enterectomy technique.

Source: Personal archive, 2024.

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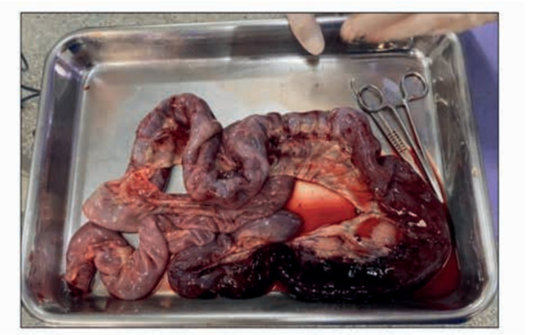

Figure 12: Segment of small intestine removed, measuring approximately 50 cm.

Source: Personal archive.

Immediately after excising the segment, enteroanastomosis was performed (Figure 12) using a 2-0 polyglcaprone absorbable suture, a simple separate suture pattern on the mucosa, and a Cushing pattern on the serosa using a 2-0 polyglcaprone absorbable suture, after which the borer test was performed to analyze the viability of the suture. Rifampicin spray was then applied to the suture line and the organ was repositioned in its anatomical position.

Figure 13: Enteroanastomosis of the small intestine. **Source**: Personal archive, 2024.

A compacted large intestine was then detected in the region of the pelvic flexure. A five-centimeter incision was made at the antimesenteric edge of the pelvic flexure and the greater colon was emptied by means of a continuous flow of water through a millimeter-diameter probe. After all the compacted masses had been removed, the intestine was sutured using 2- 0 polyglcaprone suture in the simple separated pattern in the mucosa and the Cushing pattern in the serosa. After suturing

A 1% gentamicin solution was instilled in the entire region near the suture and the intestine was repositioned in the abdominal cavity. At the end, the rectus abdominis muscle was sutured using polyglactin 1 with a separate simple suture pattern, followed by suturing the subcutaneous tissue with polyglactin 0 using the Cushing pattern and finally with separate simple sutures using nylon 1 on the skin. The dressing was completed with rifampicin, gauze, microporous tape and elastic tubular mesh.

A bolus of morphine at 0.1mg/kg, dimethylsulphoxide (DMSO) 0.25g/kg, ranitidine 0.2 mg/kg, Gentopen® (24,000 IU/kg of potassium benzylpenicillin and 2.0 mg/kg of gentamicin), antitetanus serum 1500 IU/animal were used in the trans-operative period.

After recovery from anesthesia, the patient remained stable (Figure 13 A and B), with slightly hyperemic mucous membranes, TPC of 2”, respiratory rate of 12 mpm, rectal temperature of 37.7ºC, and no intestinal motility in the 4 quadrants.

Figure 14: A - Immediate post-operative period. **B** - Post-anesthetic recovery.

Source: Personal archive, 2024.

After 12 hours of post-surgery, the animal showed slight signs of intestinal motility again, with vital parameters returning to normal. On the second day, the animal gradually began to receive green fodder (Figure 14). During this period, the patient presented digital pulses in the limbs, so cryotherapy was carried out as a treatment (Figure 15) for 72 hours, with breaks for rest. The digital pulses then improved. In the hematology test carried out on the second day after surgery, the animal showed "Donut Cell" (Figure 16), platelet aggregations with thrombocytopenia.

Figure 15: Patient's first meal after 36 hours of fasting.

Source: Personal archive, 2024.

Figure 16: Animal in the cryotherapy trunk.

Source: Personal archive, 2024.

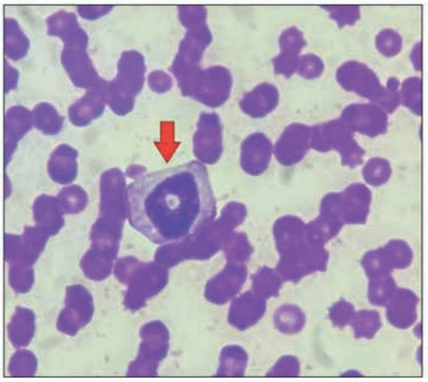

Figure 17: Red arrow points to the "Donut Cell".

Source: Personal archive, 2024.

During hospitalization, dipyrone sodium 25 mg/kg intravenous (IV) three times a day (TID) for 3 days, on the fourth day this was increased to twice a day (BID), DMSO 0.25 g/kg IV once a day (SID) for 3 days, bromhexine hydrochloride 75 mg/animal IV BID for 3 days, vitamin complex ½ bottle IV BID for 7 days, flunixin meglumine 0.5 mg/kg IV BID for 2 days, omeprazole ¼ tube orally (VO) SID for 15 days, metronidrazole 15 mg/kg BID IV for 3 days, mercepton 10 ml/day IV SID for

3 days, Gentopen® (24.000 IU/kg potassium benzylpenicillin and 2.0 mg/kg gentamicin) IV BID for 5 days, lidocaine infusion 1.3 mg/kg (bolus) and 0.05mg/kg/hour (infusion) IV when necessary, probiotic ¼ paste VO for 15 days, vitamin supplement 10 ml VO after 3 days post-surgery, 5 days post-surgery Buscofin® (dipyrone 50 g / hyoscine 0.4 g) 5 ml IV TID for 4 days.

On the seventh day of hospitalization, new hematological tests were carried out, which revealed anemia and thrombocytopenia, revealing the possibility of hemoparasitosis. In view of this, the following therapeutic protocol was instituted: administration of diminazene diaceturate at a dose of 3.5 mg/kg intramuscularly (IM), in two applications on alternate days; application of 5 ml of Phenodral® intravenously (IV), diluted in ringer's lactate, also in two alternate doses; vitamin B12 at a dose of 1000 mcg/animal once a day (SID) for 4 days; and oxytetracycline at a dose of 10 mg/kg intravenously (IV), diluted in ringer's lactate, administered for 5 consecutive days.

Finally, the patient was discharged after 15 days in hospital, with the recommendation to use a proprietary intestinal flora replenisher. He was also advised to adjust his diet and take a break from physical activity for at least 60 days.

DISCUSSION

The etiology of colic syndrome is controversial because there are multiple causes. Among them, grain overload or foreign body obstructions are often evident, which corroborates the case reported here, in which corn silage was introduced and consequently may have contributed to the disruption of intestinal motility (GODOY et al., 2007).

The decision to proceed with surgical treatment is based on vital parameters, clinical status and diagnosis directly related to the intensity of the animal's pain. It is an important parameter to examine, but it should be associated with mucosal assessment, respiratory rate, rectal temperature, gastrointestinal motility, abdominal distension and capillary refill time (CPT) Francellino (2015). The approach mentioned by the author was also decisive in resolving the case reported.

According to Pedrosa (2008), intussusception occurs mainly in foals between 3 months and 3 years of age, which is at odds with the case of the animal mentioned, since it was 8 years old, but it has already been described in the literature in older animals according to Thomassian (2005).

Horses that show colonic compaction usually show signs of moderate to severe abdominal pain, with low bowel movements. However, some compactures do not resolve with clinical treatment and surgical intervention is necessary, as was the case with the mini horse reported here (FERREIRA et al., 2009).

During exploratory laparotomy, the identification of an intussusception in the distal portion of the ileum associated with intestinal necrosis led to a careful surgical approach. The technique of enterectomy followed by enteroanastomosis was performed with a cushing suture pattern, which is recognized for providing a secure closure, minimizing the occurrence of dehiscence. In addition, the borer test was carried out to check the accuracy of the suture, which is the recommended procedure to ensure the integrity and sealing of the anastomosis (FOSSUM, 2014).

Lidocaine is an analgesic adjuvant widely used in horses, administered by continuous infusion. It provides visceral and somatic analgesia and is effective in relieving the pain associated with post-laparotomy surgery. Lidocaine has a prokinetic effect, improving intestinal motility (ROBERTSON and SANCHES, 2010). The administration of lidocaine in a bolus dose of 1.3 mg/kg, followed by a continuous infusion of 0.05 mg/kg/min for 60 minutes, did not promote clinical changes, ileal compliance or visceral analgesia in the patient in question.

The diet imposed on the horse was adapted to restore nutrition in a balanced way and prevent future complications as a result of the resection and anastomosis (BARCELOS, 2003).

Donut Cells" according to Hawkins (2003) and Allenspach (2004), after surgery, the presence of these cells in the blood count can be a reflection of temporary changes in the hematological system, usually associated with physical stress and the regenerative processes that the animal's body is going through while it recovers.

Mini horses can have platelet aggregation problems due to a condition known as "platelet aggregation syndrome" or "thrombopathy", which affects the ability of platelets to aggregate properly during blood clotting. This condition is usually hereditary and may be more prevalent in small horse breeds, such as mini horses (MCDONELL & KIRKPATRICK, 1996).

CONCLUSION

Colic syndrome in horses represents a significant challenge in veterinary practice, and is a condition often associated with inadequate management, excessive use of medication and dietary changes. The case described demonstrates the importance of early diagnosis and appropriate intervention in cases of intussusception of the small intestine and compaction of the large colon. Exploratory laparotomy, enterectomy and enteroanastomosis enabled the animal to recover, and post-operative management and treatment were fundamental to the success of the case.

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