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Colic in the Foal: They Are Not Just Small Horses!

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Take Home Message

Foals presented for abdominal pain will often have conditions that are different than the adult, and the pain level is not necessarily reflective of the severity of disease, as foals are often more demonstrative than adults. Conversely, with advancing intestinal devitalization, signs of abdominal pain may subside and foals may become lethargic. Conditions that cause colic in foals include meconium impaction, severe enteritis, umbilical and inguinal hernias, uroabdomen, congenital problems such as aganglionosis and atresia coli and small intestinal problems such as ascarid impaction, small intestinal intussusception and gastric outflow obstruction.

Evaluation of a foal with a painful abdomen can be a diagnostic challenge for the clinician. The causes of abdominal pain in foals are different from that in the adult, and some of the diagnostic modalities applied in the adult, such as rectal palpation, cannot be applied to the foal. However, other techniques, such as abdominal radiographs, are useful in the foal, but require a good understanding of normal anatomy, and the ability to identify problems. The elements of diagnosis of colic in the foal are similar to the adult and include: history, physical examination, nasogastric intubation, and abdominocentesis. Additional diagnostic procedures include ultrasonography, abdominal radiographs, and clinicopathological data.

Initial Assessment of the Colicky Foal

History

Age, signalment and sex can help identify certain causes of colic in foals.

Table 1. Causes of colic in foals of different age groups.

<table>
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<th>Newborn foal</th>
<th>2-5 days old</th>
<th>Older foals</th>
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<td>Ascarid obstruction</td>
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<td>Ileus/Enteritis</td>
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Certain breeds are predisposed to certain types of colic. For example, female Quarter Horses are at risk for umbilical hernia. Male Thoroughbreds have a higher prevalence of ruptured bladder. Miniature foals are more commonly affected with small colon obstruction.

Sex may also increase the risk for certain types of colic. Male foals are at risk for meconium impaction (narrow pelvic inlet) and inguinal hernia. A ruptured bladder in a filly foal occurs more commonly at the urachus. Filly foals are also more at risk for ureteral abnormalities.

A complete history should include information regarding adequacy of passive transfer, and any problems during gestation or parturition. Prior medication, feeding and worming practices should be obtained, and any concurrent or prior disease should be identified. For example, recent worming in an older foal suggests an ascarid impaction. Diarrhea before the colic episode may suggest an intussusception. Foals that are receiving oral nutritional support often colic when fed by bolus, and may benefit from a continuous infusion or from smaller, more frequent feeding volumes.

Physical Examination

Evaluation of Pain

The severity of pain is important. Foals with meconium impaction or ulcers usually have mild intermittent pain that requires minimal medication. In contrast, foals with intussusceptions are often uncontrollably painful. It is important to remember that foals with a strangulating obstruction will be extremely painful initially, but can be mostly depressed and in shock when the bowel is completely devitalized. The manifestation of pain is important. Foals with ulcer disease will often roll up on their backs, in a position of relief. Foals with meconium impaction will be seen to strain to defecate. Foals with small colon obstruction may stretch, strain and flag their tail. The timing of pain is important. Pain immediately after nursing is consistent with proximal disease, as in gastric ulceration. Pain associated with a simple large colon obstruction will be more severe as gas distention progresses.

Pain can be controlled with an alpha-2 agonist such as xylazine (0.5-1 mg/kg). However, the need to repeat such medication is an indication of a severe and unresolved problem. NSAID such as flunixin meglumine are useful, but should be used with caution because of the risk of gastrointestinal ulceration. A maximum dose of 1.1 mg/kg twice a day should be used. However, it is better to use the minimal effective dose, starting with 0.25 mg/kg two to three times a day.

Other techniques can be performed to relieve the pain such as nasogastric intubation, or trocarization. It can sometimes be difficult to obtain reflux on a foal, and the use of a tube with lateral fenestrations may help. Trocarization should be performed only in cases of large colon distention, if extreme abdominal distention is present, and only in experienced hands because of the risk of peritonitis or intestinal bowel laceration. It is essential to determine whether the distention is caused by large colon distention (by radiographs or preferably ultrasound) before trocarizing the foal.
Evaluation of the Cardiovascular Status

Temperature, pulse and respiration should be obtained. Normal temperature in foals is higher than in the adult, and up to 102°F is considered normal. A febrile response may indicate an impending entero-colitis, whereas hypothermia may indicate shock. Cardiovascular parameters are important and reflect the degree of cardiovascular compromise. Although these evaluations do not provide information as to the etiology of the colic, they are needed to address the urgency of the problem and to provide an assessment of prognosis. For this purpose, heart rate, mucous membrane color and capillary refill time should be assessed. If evidence of compromise or shock is noted, immediate intravenous fluid replacement should be initiated.

Examination of the Gastrointestinal Tract

Signs of Gastrointestinal Disease

There are multiple signs of gastrointestinal disease in the foal. An overall examination should first be performed to rule out obvious causes of colic, such as inguinal herniation (nonreducible hernia or ruptured tunic), or strangulating umbilical hernia. Bruxism and rolling on their back is often seen with gastric ulceration. Severe hypersalivation and even spontaneous reflux is more often seen with duodenal ulcers. Regurgitation of feed material is possible in the foal. The presence of feed at the nostril indicates the need for nasogastric decompression. Abdominal distention can be caused by fluid or gas accumulation. Palpation and succussion can help differentiate the two. Typically, gas distention will manifest as tympany in the paralumbar fossa, whereas abdominal fluid will manifest as a pendulous abdomen. In foals, severe abdominal distention can be caused by small intestinal or large colon distention. Auscultation for the presence of borborygmi should be performed. Hypermotility is suggestive of entero-colitis, whereas hypomotility is more indicative of obstructive disease. Digital palpation is useful, particularly if meconium impaction is suspected. The meconium is often palpated at the pelvic inlet. Severe abdominal distention and absence of feces with palpation of mucus only should alert towards the presence of atresia coli.

Abdominocentesis

Abdominocentesis should be performed with caution in foals. The risk of bowel laceration is greater because foals tend to not stand still. For this reason, the author prefers to use a blunt cannula. Abdominocentesis should not be performed if it will not alter the decision making process. Normal values in foals are reportedly lower than that of the adults, with total protein <1.6 g/dl and WBC<1,500 cells/μL.\(^1\) In the face of a strangulating obstruction, the expected changes are: increasing total protein within the first hour; increased TP and RBC within the first 3-4 hours, and increased WBC starting at 5 to 6 hours, with progression of bowel necrosis. For unknown reasons, simple small colon obstructions are often associated with an inflammatory response manifested by an increase in both protein and WBC.
Nasogastric Intubation

Nasogastric intubation should be performed in all colicky foals, particularly if there is regurgitation of feed material, or gastric or small intestinal distention seen on radiographs or ultrasound. If there is reflux, oral fluids or medication should not be given, and appropriate rehydration to account for the fluid loss in the reflux should be administered.

Abdominal Ultrasound

Abdominal ultrasound is now a routine diagnostic procedure in colicky foals. A 3.5 or 5 MHz scan head can be used for overall evaluation of the abdomen and intestinal tract. Examination of umbilical structures is best performed using a 7.5 MHz scan head. Ultrasound can be used to determine the location of abdominal distention. Foals with enteritis will usually have distended but motile loop of small intestine, whereas in small intestinal obstructions thickened, amotile loops are imaged. There is some overlap, however. In cases were intussusception is suspected, ultrasound is useful to identify the intussuscepted loop. Ultrasound is also very useful to identify abdominal effusion or accumulation of fluid in association with uroabdomen. Ultrasound can be used to find fluid prior to abdominocentesis. In cases of uroabdomen, the tear in the bladder can often be imaged.

Abdominal Radiographs

Although ultrasound has almost replaced radiographs in the examination of small bowel disease, radiographs remain more helpful for diagnosis of large colon obstructive disease, such as impaction or sand colic. Contrast radiographs are useful for diagnosis of gastric outflow obstruction, or small colon obstruction (impaction or atresia).

Clinicopathologic Evaluation

In young foals this database should include evaluation of IgG concentration; several stall-side tests are available for this. The CBC is useful for determination of hydration status, remembering that TP values are normally lower in foals (< 5.5 g/dl). The WBC and differential are useful to detect possible enteritis or septicemia (leukopenia, high number of bands). Thrombocytopenia can also be an indication of sepsis. The chemistry profile is useful for evaluation of electrolytes, glycemia, renal function and liver chemistry. The normal creatinine concentration of foals is lower than the adult. Neonates can have an elevated creatinine concentration from several causes, therefore other markers of hydration status are useful. Lactate concentration can help determine and monitor perfusion. It is normal to see a marked elevation in alkaline phosphatase and GGT in neonates. Electrolyte abnormalities can be significant with certain disease processes. Foals with uroabdomen typically have significant hyponatremia, hypochloremia, and hyperkalemia. However, foals that rupture their bladder while hospitalized and receiving intravenous fluids may not show these changes.² Foals with chronic diarrhea can have hyponatremia, hypochloremia, and hypokalemia. Seizures can be observed with severe hyponatremia (Na<110 meQ/L) or hypoglycemia.
Common Causes of Colic in Foals

Meconium Impaction

Meconium impaction is the most common cause of colic in the equine neonate. Affected foals are less than 36 hours, and risk factors include failure of passive transfer, weak, sick foals, and male foals. Clinical signs include abdominal pain, straining to defecate, absence or scant feces and over time abdominal distention. Important rule-outs include atresia coli and aganglionosis. Digital palpation will confirm the presence of a patent anus but will not rule out atresia. In cases of atresia, fecal material will not be present, and only mucus will be obtained. Radiographs and a barium enema can help rule out atresia. The treatment involves supportive care, particularly if the foal has FPT or sepsis, and frequent enemas. Enemas should be performed gently using rubber tubing. Solutions for enemas include soapy water or an acetylcysteine retention enema. An acetylcysteine solution can be made by mixing 200 mls of water, 20 g of bicarbonate and 8 g of acetylcysteine powder.

Atresia coli and Aganglionosis

These foals will initially present and are initially treated for meconium impaction; however, failure to respond to treatment will lead to further investigation. These foals will show continued signs of colic and progressive abdominal distention and will fail to pass any feces. The diagnosis can be made by radiography and a barium enema.1

Enteritis

Foals with severe enteritis can occasionally present for signs of colic, and abdominal distention as a result of severe ileus. In these foals, severe small and/or large intestinal distention is present. The challenge is to differentiate ileus from an acute abdominal obstruction. The presence of fever, leucopenia and neutropenia can help differentiate these cases from a surgical abdomen. Occasionally surgery is recommended in the absence of clear-cut problem identification. Clostridial diseases are the most common organism isolated from these cases, and management includes supportive care, antimicrobials and intestinal rest by providing parenteral nutrition.

Ulcers and Gastric Outflow Obstruction

Gastric ulcers syndrome will be covered separately. Occasionally, ulcers can affect the pylorus, duodenum or distal esophagus (reflux esophagitis). Healing of these ulcers can result in stricture at those sites resulting in gastric and/or hepatic outflow obstruction, or esophageal stricture, depending on the location.

Foals affected with gastric outflow obstruction will present as unthrifty foals with marked bruxism and hypersalivation. Occasionally, spontaneous gastric reflux will be present. The diagnosis is confirmed by radiography and contrast radiography, where a markedly distended stomach with delayed emptying is seen. Filling of the bile duct with contrast is suggestive of a concurrent biliary obstruction. Endoscopic evaluation of the distal esophagus is important as concurrent reflux esophagitis and subsequent esophageal stricture will darken the prognosis.
treatment of gastric outflow obstruction is surgical, and involves a bypass procedure to circumvent the strictured area. This is accomplished by performing one of several procedures, depending on the location of the stricture: esophagostomy, pyloromyotomy, gastroduodenostomy, gastrojejunostomy or if the bile duct is involved, a choledochojejunostomy. The prognosis is guarded to poor particularly if the esophagus or bile duct are involved.

Congenital Problems: Umbilical and Inguinal Hernias

Complicated Umbilical Hernias

Umbilical hernias can become complicated by strangulation of a segment of small intestine (Richter’s hernia) or cecum or large colon. In the latter case, obstruction to intestinal flow is not impaired, and the strangulated segment of bowel can go on and necrose without overt signs of abdominal discomfort, leading to an entero-cutaneous fistula.

The treatment of complicated umbilical hernia is surgical with resection of the segment of bowel.

Inguinal Hernia

Congenital inguinal hernias can present as an incidental finding, and are reducible and do not cause signs of colic. Daily reduction of these hernias will lead to self-correction in approximately 80% of foals by 6 months of age. At that time, if the hernia is still present, surgical management by castration, tunic reduction or laparoscopy are indicated.

Inguinal hernias can become strangulating in which case they are irreducible, and cause signs of colic. In certain instances, rupture of the tunic can occur, with migration of intestinal contents in the subcutaneous space. These types of hernias are a surgical emergency.

Uroabdomen

Uroabdomen in the foal can result from disruption of the ureter, bladder or urachus and can occur in both males and females. Females tend to have a higher incidence of ruptured urachus. There are two populations of affected foals: foals that are admitted for evaluation of a possible ruptured bladder, and foals that sustain a ruptured bladder while hospitalized for another neonatal disease. The difference in population is that foals that rupture their urinary tract while hospitalized do not develop the classic electrolyte changes of a uroabdomen if they are receiving an electrolyte-containing fluid therapy. Therefore in these foals any increase in creatinine or abdominal distention should be investigated. Foals admitted for ruptured bladder have the classic electrolyte changes which are hyponatremia, hypochloremia, hyperkalemia. Signs of colic are present when sufficient urine accumulates in the abdomen to cause peritoneal stretching. Urinations may be normal or decreased. In cases of subcutaneous rupture of the urachus, the skin may be discolored and there may be significant subcutaneous fluid due to urine accumulation. A abdominal/serum creatinine ratio of > 2:1 is diagnostic for ruptured bladder and is an early finding. Ultrasound is useful to confirm the diagnosis and can often be used to identify the tear. Uroabdomen is a medical emergency. Significant uroabdomen causes abdominal distention resulting in abdominal compartment syndrome; in addition hyperkalemia can lead to life-
threatening cardiac arrhythmias. The foal must be stabilized with potassium-free intravenous fluids, abdominal decompression and management of hyperkalemia using dextrose, bicarbonate, insulin or aalpha-2 inhaler. Once the foal is hydrated and the serum potassium is < 5.5 mEq/L, surgical correction can be undertaken.

**Small Colon Obstruction**

Small colon obstruction is particularly prevalent in foals that are 1 to 3 months of age, particularly when they start to explore their environment. They are caused by dietary indiscretions, and can be made of hair, forage, shavings or any other foreign material. Foals cannot chew roughage well so any highly fibrous forage can result in an obstruction.

These foals will not be significantly systemically ill, but they can show significant signs of abdominal pain, distention and straining to defecate. These foals usually can be managed medically, although the dramatic level of pain manifested may lead to surgical intervention.

**Small Intestinal Obstruction**

Small intestinal obstruction is more prevalent in the older foal (2 to 6 months of age). Conditions that can lead to SI obstruction include small intestinal volvulus, intussusception, ascarid impaction, Meckel’s diverticulum and mesodiverticular bands to name a few.

Signs include abdominal pain, small intestinal distention on radiographs and ultrasound, and reflux. Reflux can be difficult to obtain in the foal. Abdominocentesis should be performed with caution because of the risk of enterocentesis. It is important to remember that in early strangulation foals demonstrate marked abdominal pain, but as intestinal necrosis progresses, foals become systemically compromised and the level of pain subsides. The treatment of small intestinal obstruction is surgical. An exception is ascarid impaction, where medical therapy may be attempted.

Foals with abdominal pain accompanied by weight loss, diarrhea and hypoproteinemia should be suspected of proliferative enteropathy caused by *Lawsonia intracellularis*. Several foals may be affected on endemic farms. Transabdominal ultrasound will reveal increased small intestinal wall thickness. The diagnosis is based on PCR analysis of serum or feces, and this condition is responsive to antibiotic therapy such as tetracycline (doxycycline) or macrolides.

**Prognosis Following Abdominal Surgery in Foals**

Foals are at increased risk of developing adhesions following abdominal surgery for colic for several reasons: surgery is often delayed due to delayed identification; lesions are often in the small intestine, with an associated decreased prognosis; the neonate’s bowel is much more fragile than the adult, therefore manipulations lead to more surgical trauma, mesenteric rent and subsequent problems; and foal often suffer from systemic illness such as sepsis, which decreases the prognosis.
The reported prognosis in foals following abdominal surgery is 10% for foals < 14 days old and 45% in foals 15 to 150 days old, with a short term survival of 63 to 65%.4

References