Assessment of Abdominal Pain in Foals (21-Nov-2003)

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1. Introduction
Abdominal pain in the foal can be a frustrating diagnostic challenge because the differential diagnoses are extensive. However, armed with thorough knowledge of the more common causes of pain, complete physical examination findings, use of the diagnostic tools available, and common sense, the clinician can reduce the list of possible causes to a short list of differentials. From this list, a diagnosis can generally be made through exclusion and careful monitoring of progress or lack of response to therapy.

Before developing a diagnosis, the treatment of colic and/or associated shock, if present, must be addressed. If necessary, an expedient decision regarding the need for surgery must be made; time required for correction of a surgical lesion greatly influences the prognostic outcome of surgical intervention. If, however, the decision for surgery is made without careful consideration of "non-surgical" conditions, the outcome may be compromised by an unnecessary procedure. Thus, the need for surgical intervention often becomes the conundrum of the colicky foal.

2. Signalment
The age of the patient, at both presentation and onset of clinical signs, can provide useful information toward establishing the differential diagnosis. Foals with congenital abnormalities generally exhibit clinical signs within hours of birth. Meconium impactions are invariably painful within the first 24 - 48 h of life, whereas pain resulting from uroperitoneum is typically, although not invariably, seen at 2 - 5 days of age. Breed predilection for certain lesions is evident in many congenital abnormalities and with conditions such as fecaliths, as in the miniature horse.

3. History
Historical information can provide clues to the cause of a patient's pain. Questions that can elicit information from clients may include:

- Have there been or are there currently any problems, such as fevers or diarrhea, with other animals on the farm during the current or previous breeding season? For example, outbreaks of diarrhea are common, and abdominal pain often precedes obvious signs of diarrhea.

- Has the patient in question had previous or current problems or therapies that might predispose itself to gastrointestinal disease? Antibiotic therapy can frequently lead to disruption of normal flora with subsequent gastrointestinal tract upsets.

- Have there been changes in management including feeding practices?

- When was the last time the individual was observed before noticing the abdominal pain? Foals with severe prolonged colic may be "beyond pain" in a state of severe depression to stupor.

- What were the signs of pain, and were any other signs noted? Neurologic signs can sometimes manifest as abdominal pain, and bruxism may be considered characteristic of gastrointestinal ulcers or at least a lower grade "grinding" pain.

4. Examination of the Foal with Abdominal Pain
When presented with a colicky foal, the main objective is to determine whether a surgical or non-surgical lesion exists. The neonatal foal does not respond as rapidly or as effectively to systemic compromise as the adult horse. Therefore, rapid diagnosis and resolution of a strangulating lesion is imperative. The causes of abdominal pain in the foal range broadly from
severe lesions, such as volvulus, to skin irritation from excessive iodine treatment of the umbilicus. A complete physical
examination in combination with ancillary tests helps distinguish between many surgical and non-surgical causes of colic.
If abdominal pain is severe and uncontrollable, there may not be adequate time available for simple observation of the patient.
However, when conditions allow, observation of the patient from a distance is an invaluable portion of the physical exam.
Careful observation may not only provide information regarding the etiology and characteristics of the pain but may also
elucidate a different set of differentials such as musculoskeletal, neuromuscular (white muscle disease or botulism), or
neurologic disorder. Foals that are excited (restrained) may not exhibit the true character of their abdominal pain. Other than
the obvious severity and duration of pain, factors such as presence and duration of suckle, swallowing, muscle tremors,
lameness, and other musculoskeletal abnormalities may be otherwise missed if the observation portion of the physical exam is
skipped.
Characterization of pain such as rolling up in dorsal recumbency, dropping to the ground in one rapid motion, and straining to
defecate or urinate may provide clues as to the source of the pain.
However, the foal is less tolerant of abdominal pain than the adult horse. Therefore, the degree of pain (rolling, looking at the
side) is not a sensitive indicator of the severity of abdominal disease, nor is it specific for the cause of colic (Fig. 1).

Figure 1. Colicky foal. - To view this image in full size go to the IVIS website at www.ivis.org . -

Although pain exemplified by rolling up on the back and grinding the teeth is usually associated with gastric ulceration, other
causes of abdominal pain, such as intussusception, should be considered until a definitive diagnosis is made. Persistent pain
that is non-responsive to analgesics is more consistent with a surgical, usually strangulating, lesion. Mild abdominal pain,
which persists or progresses to more severe colic, is compatible with enteritis, gastrointestinal ulceration, and simple
obstruction. Pain resulting from strangulating or non-strangulating obstructions as well as enteritis is likely mediated through
the same pathophysiologic mechanisms [1]. Stimulation of stretch-sensitive receptors in the mesentery, inflammation or
ischemia resulting in edema of the intestinal wall, and stretching of the serosal surface can result in abdominal pain [1].
Alterations in intestinal motility with decreased strength or frequency of contraction result in ingesta or gas accumulation,
bowel distension, and subsequent stimulation of stretch mechanoreceptors in the gut wall resulting in pain [1].

Vital signs may not always differentiate between surgical and non-surgical colic. Changes in mucous membrane color
resulting from distributive shock (endotoxemia, septicemia, splanchnic ischemia) can be present in a variety of
gastrointestinal diseases. Severe toxic changes in mucous membranes are more typical of a strangulating lesion but can also
be seen with severe, acute bacterial enteritis or peritonitis. Tachycardia and/or tachypnea are invariably present with severe
abdominal pain. Marked, persistent tachycardia (>120 beats/min) generally suggests a surgical lesion.

Intestinal strangulation of any duration is associated with an elevated nucleated cell count and protein concentration in the
peritoneal fluid. Peritoneal fluid analysis is usually normal in enteritis and simple early obstruction. As these diseases
progress, increases in peritoneal fluid cell count and protein can occur but typically are not as dramatic as those seen with
strangulating obstructions. Intracellular bacteria, plant material, and degenerated neutrophils may be identified in patients
with a ruptured viscus.

Nasogastric intubation may provide additional information useful in developing a differential diagnosis. A large quantity of
gastric reflux is most typical of a strangulating small intestinal lesion, although moderate quantities of reflux can be obtained
with other abdominal diseases, including enteritis. Persistent reflux suggests severe, small intestinal obstruction caused by a
volvulus, stricture, or intussusception.

Abdominal radiography helps determine the location, but not necessarily the cause of gas or fluid distention. Adequate
radiographs are obtained in foals up to 500 lb if available radiographic equipment includes a grid, rare earth screens, and
sufficient mAs (5 - 28) and kVp (75 - 95). Gaseous distention of the small intestine, characterized radiographically by intra-
luminal gas-fluid interfaces, can be seen in foals with enteritis, peritonitis, or small intestinal obstruction. Multiple intra-
luminal gas-fluid interfaces or vertical U-shaped loops of distended small intestine are compatible with small intestinal
obstructive disease. With enteritis, the small intestinal loops are smaller and concomitant large bowel distention may be seen.
During large bowel obstruction, the large intestine is more distended, and the colon may seem displaced within the abdomen.
Contrast studies using gravity barium enemas (1 - 2 l barium mixed with warm water) are useful in identifying meconium impactions.

Abdominal ultrasonography permits characterization of small intestinal motility (absent, normal, hyper), distention (minimal, moderate, marked), and wall thickness. In older foals (~4 mo), sonographic visualization of the small intestine is often limited to the caudal abdomen (inguinal region). Flaccid, fluid-filled loops of small intestine are seen in the healthy foal. As these loops become rounded and larger, ileus, enteritis, or small bowel obstructive disease is likely to exist. Small-intestinal intussusception appears as targetog Doughnut-shaped patterns with the telescoping of one segment of bowel into another segment. Large-intestinal gaseous distention results in reflection of sound waves, resulting in a poor ultrasonography view of the abdomen. Abdominal fluid can be identified, quantified, and characterized. If excessive peritoneal fluid is detected, peritonitis, ruptured viscus, or uroperitoneum may be present. Increased peritoneal fluid echogenicity is associated with increased cellularity.

Specific Causes of Abdominal Pain in the Foal - A list of conditions resulting in abdominal pain in the foal is provided below (Table 1). The conditions resulting in pain in the neonate overlap those conditions causing abdominal pain in the older foal; however, a few diseases are quite specific to the neonate. A brief description of these conditions in both the neonate and foal follows.

<table>
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<th>Table 1. Differential Diagnoses of the Foal with Abdominal Pain</th>
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<td><strong>More Common</strong></td>
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<tr>
<td>Meconium retention*</td>
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<tr>
<td>Enterocolitis</td>
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<tr>
<td>Herniation* (external and internal)</td>
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<tr>
<td>Uroperitoneum*</td>
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<td>Small intestinal volvulus</td>
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*Indicates conditions that are more common in the neonate.

**Meconium Retention** - The initial passage of meconium usually begins in the first few hours after birth. Meconium passage is generally complete at 24 h of age, although it can take up to 48 h. Abdominal pain can be mild to severe. Retention may be high, in the transverse or right dorsal colon, or low, in the large colon. Contrast radiography through barium enema can be diagnostic (Fig. 2).

**Enterocolitis** - Diarrhea has been reported to occur in 70 - 80% of foals, often during the first few weeks of life [2]. Foal diarrhea is often of short duration and self-limiting. In severe cases, mortality can be high. Causes of foal diarrhea are numerous; other than the "foal heat" diarrhea, infectious agents are the most common cause of enterocolitis. Generally, the abdominal pain is of mild degree and brief duration. Alternatively, acute enterocolitis can result in severe, progressive abdominal pain.

**Herniation (External and Internal)** - Herniation of abdominal contents can occur either externally (outside the body wall proper) or internally (through internal structures). Gastrointestinal herniation can result in abdominal pain as a result of either strangulating or non-strangulating obstructions. Herniation can be a result of acquired or congenital conditions. Inguinal and umbilical hernias are the more common external hernias, whereas diaphragmatic is the more common internal hernia [3].
Traumatic diaphragmatic hernias can be the result of blunt trauma, but are more frequently caused by laceration induced by fractured ribs. Other internal herniation includes rents in the gastrointestinal mesentery of small intestine, small colon, and the mesodiverticular band [3].

Uroperitoneum - Ruptured bladder and urachus are the more common causes of uroperitoneum. Abdominal pain may ensue with progression of abdominal distention. In long standing cases, central nervous system signs such as uremic encephalopathy and deficits secondary to hyponatremia may be observed. Diagnosis can be based on typical electrolyte patterns in combination with peritoneal creatinine and abdominal ultrasound examination (Fig. 3).

Figure 3. Uroperitoneum. - To view this image in full size go to the IVIS website at www.ivis.org.

Small Intestinal Volvulus - Volvulus of the small intestine is one of the more common causes of the surgical abdomen in the foal. Presentation generally includes severe, progressive abdominal pain that is non-responsive to analgesics. When the strangulating lesions have been present for an extended period of time, these patients may present recumbent with abdominal pain and in varying degrees of cardiovascular collapse. Ultrasonographic evaluation identifies amotile loops of distended small intestine (Fig. 4).

Figure 4. Small intestinal distention. - To view this image in full size go to the IVIS website at www.ivis.org.

Ileus - Ileus is defined as an absence of gastrointestinal motility with subsequent gastrointestinal distention. Possible causes may include electrolyte abnormalities, impaired autonomic nerve function, or inflammation caused by peritonitis or enteritis [4]. Ileus can be particularly life threatening in the neonate or weak foal. Radiographs or abdominal ultrasound identify gas- or fluid-distended bowel.

Gastric Outflow Obstruction - Gastric outflow obstruction can result from functional or mechanical disease. Mechanical obstruction is usually secondary to cicatrix formation subsequent to pyloric or duodenal ulceration. Functional obstruction is generally consequent to gastric or pyloric ulceration; the resultant inflammation interferes with coordinated gastric contraction and effective emptying of the stomach. Outflow obstruction of the stomach can be identified with contrast radiography performed by administering liquid barium through nasogastric tube. Surgical bypass, gastro-jejunostomy, and related procedures can be performed.

Intussusception - Invagination of the small intestine into itself or into the cecum can result in edema, compromised vascular supply, and mild to severe abdominal pain. Suggested etiologies include parasitic infestation and alterations in motility secondary to enteritis [5]. Abdominal ultrasound can be diagnostic: a target or bull's eye sign is characteristic.

Necrotizing Enterocolitis - Necrotizing enterocolitis is a condition resulting from hypoxemia or ischemia of the bowel wall. The disease is either diffusely or focially distributed throughout the gastrointestinal tract. The generalized condition is secondary to systematic hypoxemia and colonization of the bowel wall with micro-aerophilic gas forming bacteria or to bacterial invasion with pathogens such as clostridia [6]. Focal necrosing lesions can be caused by local bacterial invasion or by infarcts resulting from thromboembolism. Ultrasonographic evaluation may identify pneumatosis intestinalis (gas lucency in the wall of the bowel). Surgical resection of the affected areas may be beneficial.

Large Colon Volvulus - The strangulating lesions of the large colon are not as commonly identified in the foal as they are in the adult horse. Fermentation in the large bowel of the young foal has not reached adult capacity, and the foal is not as aggressively managed as the adult. Diagnosis is based on the degree and persistence of pain (identification of a surgical abdomen) and observations of large bowel distension through radiography or ultrasonography.
Large Colon Displacement - As with large colon volvulus, displacement of the large colon is not a common cause of abdominal pain in the foal. The degree of pain in this condition is not as severe as for the strangulating lesion.

Gastric Ulceration - Gastroduodenal ulceration can result in mild to severe abdominal pain in the foal. The classic clinical signs of ulcerative diseases are bruxism, ptyalism, and dorsal recumbency. The only accurate method of diagnosis is gastroscopy. Effective therapy includes proton pump inhibitors and anti-secretory drugs.

Peritonitis - Inflammation of the peritoneal lining of the abdominal cavity can result in abdominal pain. Other clinical signs are dependent on the stage and severity of the disease. In acute disease, signs of endotoxemic and/or hypovolemic shock typically overshadow signs of abdominal pain, whereas in chronic disease, signs of pain may be mild and intermittent. Diagnosis is based on centesis and analysis of peritoneal fluid. Ultrasonography may identify echogenic abdominal fluid.

Small Intestinal Impaction - Impactions of the small bowel with parasites, primarily ascarids, can occur, particularly subsequent to the use of efficacious anthelmintics in heavily infested foals. A parasite load can be visualized in the lumen of the small bowel using ultrasound. Gastric reflux may occasionally contain ascarids. Surgical correction of these impactions is usually required.

References


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