Small Intestinal Strangulation or Obstruction vs. Proximal Enteritis

Small intestine can be obstructed by mechanical obstructions (strangulations, intraluminal masses) and functional obstructions (proximal enteritis, anterior enteritisi, duodenitis-jejunitis). Despite some differences between proximal enteritis and surgical diseases of the small intestine, there is no single distinguishing feature. Borborygmi are usually diminished or absent in all small intestinal diseases. Abdominal distention is negligible or mild in adult horses with small intestinal obstruction, but can be pronounced in foals.

The following are guidelines that might be helpful in distinguishing between proximal enteritis and mechanical obstructions that require surgery.

- Small intestinal strangulation obstruction can affect a horse of any age whereas proximal enteritis is rare in horses under 1.5 years.

- Heart rate can be markedly elevated and other cardiovascular changes are pronounced with both diseases, but horses with proximal enteritis can have a fever and leukocytosis.

- Color and odor of gastric reflux can be similar, although the volume tends to be greater with proximal enteritis. With a mechanical obstruction, the amount of gastric reflux will vary from none in the early stages of a lesion in the distal part of the small intestine to several liters with a longstanding lesion or a lesion in the proximal part of the small intestine.

- Horses with small intestinal strangulation-obstruction usually exhibit signs of acute, severe abdominal pain and hypoperfusion.

- Heart rate and packed cell volume are generally elevated and acidosis develops in horses with strangulating lesions.

- Horses with proximal enteritis may suffer from severe abdominal pain initially and this progresses to depression and less pain than in horses with strangulation obstruction.

- After gastric decompression, horses with proximal enteritis usually improve in overall attitude and heart rate decreases, whereas horses with strangulation or mechanical obstruction will not improve.

- On examination per rectum, distended loops of small intestine frequently are palpated in horses with small intestinal obstruction from any cause and in horses with proximal enteritis. Tightly distended loops are suggestive of strangulating lesions.
High Risk Groups for Colic

Some diseases seem to be specific for certain types of horses, and knowledge of this can be helpful. The following is a list of loose associations with certain types of colic.

- Male intact Standardbreds and Saddlebreds: inguinal hernia.
- Miniature horse, Shetland pony of any age, foal: fecolith.
- Horse > 10 years: strangulating lipoma.
- Horse < 3 years: intussusceptions.
- Mare in late pregnancy: uterine torsion.
- Previous small intestinal surgery: adhesions.
- Postpartum mare in severe pain: large colon volvulus.
- Postpartum mare with mild colic, peritonitis: small colon ischemia.
- Postpartum mare with mild colic, peritonitis: ruptured uterus.
- Feeding coastal Bermuda grass hay: ileal impaction.
- Recurrent colic in a young horse: ileocecal intussusception.
- Foal <48 hours old: meconium impaction.
- Thoroughbred gelding: strangulation in epiploic foramen.
- Weight loss in a young horse: chronic intussusceptions.
- Nonsteroidal anti-inflammatory drugs: gastric, colonic ulcers, dorsal colitis.
- Mild recurrent colic and poor condition: gastric ulcers.
- Parasitized weanling or foal after worming: ascarid impaction.
- White foal: lethal white/hypoganglionosis.
- Arab recently moved from California: enteroliths

Advanced Diagnostic Procedures

The following are diagnostic procedures that are more likely to be used in the decision for surgery than the decision for referral. Therefore, they are not used for colics seen in the field, although one or two could become useful for the referral decision in the future.

Peritoneal Fluid Analysis

Peritoneal fluid analysis can provide useful information in the horse with colic, but has its limitations, and should be used in selected cases. Bear in mind that the goal is to perform surgery before changes have developed in peritoneal fluid, not afterwards. This is difficult to accomplish. Abdominocentesis should not be used in adult horses and in foals with obvious signs of intestinal distension (unless absolutely necessary and with ultrasound guidance), as a field procedure, and if the results will not influence the course or selection of treatment. Although abdominocentesis is useful in diagnosis of a strangulating small intestinal lesion and ruptured viscus, normal fluid does not rule out these lesions. Abdominocentesis can be used to obtain prognostic information, but is often misleading and should therefore be used with caution for this purpose, if at all.
An 18-gauge 1.5–inch needle is inserted in the ventral midline in a site prepared by clipping and surgical scrub. Longer needles might be needed for fat horses. The best site is on the midline in the most dependent part of the abdomen, behind the xiphoid cartilage. Restraint by twitch is usually sufficient. The operator stands on the right side of the horse if right handed, close to the front leg, and inserts the needle with a deliberate but steady motion into the skin. The operator should not place his or her head under the abdomen close to the hind legs and must gauge the horse’s response as the needle is inserted. The needle is then advanced slowly until fluid is obtained. Movement of the needle is caused by bowel wall movements along its tip and by respirations, and typically indicates that the peritoneum has been penetrated. Do not insert beyond this point. If fluid does not drain from the needle, the needle can be rotated or primed by injection of air or by aspiration through a syringe. Additional needles can be inserted as needed until fluid is found. Abdominal ultrasonography can identify fluid pockets to be sampled and help avoid enterocentesis.

An alternative method that could reduce the risk of enterocentesis involves use of a no. 15 blade to incise skin and stab into the linea alba. Local anesthetic must be infiltrated into the skin beforehand. A teat cannula (7.5 cm) or bitch catheter is then pushed into the abdominal cavity through the stab incision until it punctures the peritoneum. The abdominal fluid should be collected into a serum tube without ethylenediamine-tetra-acetic (EDTA) for total protein (total protein can be elevated when collected into an EDTA tube), and into an EDTA tube for cytology and cell counts.¹

Normal peritoneal fluid is clear, pale and amber. Fluid from most horses with nonstrangulating lesions or with uroperitoneum is normal on gross inspection, but fluid from horses with strangulated small intestine is usually serosanguinous.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Color</th>
<th>Turbidity</th>
<th>Total protein (g/dl)</th>
<th>RBC (cells/µL)</th>
<th>WBC (cells/µL)</th>
<th>Cytologic findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>SISO</td>
<td>Serosanguinous</td>
<td>Opaque</td>
<td>4.5</td>
<td>200/000</td>
<td>35,000</td>
<td>Degenerate neutrophils</td>
</tr>
<tr>
<td>Peritonitis from abscess</td>
<td>White with pink tinge</td>
<td>Opaque</td>
<td>6.1</td>
<td>120,000</td>
<td>175,000</td>
<td>Degenerative neutrophils with rare intracellular cocci</td>
</tr>
<tr>
<td>Abdominal exploratory only</td>
<td>Yellow</td>
<td>Cloudy</td>
<td>5</td>
<td>12,000</td>
<td>193,000</td>
<td>Mostly neutrophils with little degeneration</td>
</tr>
<tr>
<td>Bowel necrosis and leakage</td>
<td>Orange</td>
<td>Opaque</td>
<td>6.3</td>
<td>3,000</td>
<td>240,000</td>
<td>Cellular, mostly neutrophils with many intracellular and extracellular bacteria</td>
</tr>
<tr>
<td>Full thickness rectal tear 8 hours’ duration</td>
<td>Yellow</td>
<td>Cloudy</td>
<td>5.3</td>
<td>36,300</td>
<td>2,100</td>
<td>Numerous yeasts, bacteria and protozoa and degenerate neutrophils</td>
</tr>
<tr>
<td>Proximal enteritis</td>
<td>Yellow</td>
<td>Slightly cloudy</td>
<td>5.1</td>
<td>27,200</td>
<td>5,400</td>
<td>Numerous RBCs neutrophils not degenerate</td>
</tr>
</tbody>
</table>

A fluid sample from horses with a ruptured viscus is cloudy and green-tinged, but can be normal if diluted out by a large volume of peritoneal fluid or if intestinal contents are entrapped by omentum or bowel close to the site of rupture (hence the importance of cytological examinations).² Peritoneal fluid with nucleated cell counts greater than 1,500 cells/µl should be considered elevated in foals, whereas the normal adult can have between 5,000 to 10,000 cells/µl. Peritoneal fluid protein is within the same range in foals as in adults, usually below 2.0 g/dL. Cytologic evaluation should detect degeneration of cells and bacteria (rarely, except in rupture), and allow classification of cell populations.² Interpret with awareness that many horses that need an exploratory celiotomy can have normal peritoneal fluid, and the reverse can be true (normal horse with abnormal peritoneal fluid).¹ Interpretation of peritoneal fluid analysis is complicated in horses that have recently undergone an exploratory celiotomy, castration, or laparoscopy, because they have elevated white blood cell counts and total proteins.¹ Dystocias can also cause an increase in WBC count and percentage of neutrophils.³

Although complications of enterocentesis are rare, peritonitis and abdominal wall cellulitis can occur after puncture or laceration of distended bowel in horses with colic. Accidental amniocentesis can complicate the procedure in the term mare.¹ Enterocentesis is more likely in foals than adults, because the bowel wall is so thin, especially if the bowel is distended. Additionally, omentum can prolapse through the puncture site if an 18-gauge needle or larger is used in a foal. Horses with heavy sand accumulations are particularly at risk of enterocentesis, because the weight of the colon brings it in contact with the ventral body wall.¹ Abdominal ultrasonography can be used to localize accumulations of abdominal fluid and select alternative abdominocentesis sites. The presence of different varieties of bacteria suggestive of enteric
origin in a sample with otherwise mild changes indicates enterocentesis and resultant contamination of the sample.

Uroperitoneum can be diagnosed in foals largely on the basis of clinical signs, age at presentation, and ultrasound examination, without the need for abdominocentesis. However, abdominocentesis might be more supportive of the diagnosis in the rare adult horse that presents with this condition. On abdominocentesis, an abundant, clear yellow, hypocellular fluid is obtained with a creatinine concentration that is at least twice the serum creatinine concentration. A 20-gauge needle is recommended for abdominocentesis in foals because their omentum can prolapse through a larger needle hole. In horses with a small colon impaction that is receiving medical treatment, serial abdominocenteses can be used to determine if the affected segment of colon is undergoing pressure necrosis. However, there is little evidence that this approach is clinically sound.

The major problem with interpretation of abdominocentesis is that the changes typically associated with strangulation are most apparent when the disease process is at an advanced stage, when resection is needed, and the prognosis for survival starts to decline. In horses with large colon volvulus that have incurred advanced ischemic changes, peritoneal fluid color, nucleated cell count, and total protein can be within normal ranges. Therefore, peritoneal fluid is not a sensitive indicator of vascular occlusion in the large colon. In a study that tested reliability of peritoneal fluid analysis to determine treatment and predict lesion type and outcome for horses with colic, most peritoneal fluid variables were found to have low sensitivity, specificity, and predictive value for 1) determining lesion type; 2) whether medical or surgical treatment was indicated; 3) and outcome. In another study, color and protein were more valuable as predictors of the need for medical treatment (negative predictive value) than those requiring surgery, except when the fluid was serosanguinous. Undoubtedly, this approach would be valid in most cases, but unfortunately these findings were offered to support using abdominocentesis as a field procedure (no cytologic examination). This is a disastrous recommendation that carries a high risk of delayed referral of a horse with an early strangulating lesion if the fluid color and protein findings were supportive of continued medical therapy, as proposed. There appears to be widespread agreement that abdominal fluid analysis cannot be used alone in the evaluation of horses with colic.

Recent studies have examined biochemical changes in peritoneal fluid and plasma to improve our ability to more accurately assess the horse with colic. In one such study, peritoneal fluid lactate was a better predictor of intestinal ischemia secondary to a strangulating obstruction (ISSO) than blood lactate, and therefore could be used for early detection of such lesions, and even rupture. Horses with ISSO had a higher peritoneal lactate value (8.45 mmol/l) than those with nonstrangulating obstruction (2.09 mmol/l). Factors with the strongest correlations with the presence of ISSO were changes in the gross appearance of the peritoneal fluid and values of peritoneal fluid chloride, pH and log10 lactate. Another study demonstrated that peritoneal fluid lactate is a more useful and sensitive prognostic indicator than plasma lactate in horses with colic. A portable analyzer can be suitable for biochemical analysis of samples of blood and peritoneal fluid from horses with colic and provides comparable lactate measurements as an in-hospital analyzer (Table 2).

Another potential peritoneal marker of severe intestinal damage is myeloperoxidase (MPO), which is produced by neutrophils and would be expected to indicate neutrophil activation during strangulating intestinal obstruction in horses. A specific enzyme-linked immunosorbent assay for equine MPO was used to show that horses with strangulating obstruction of the large intestine, strangulating obstruction of the small intestine, and inflammatory bowel disease had significantly higher MPO levels in plasma and PF than did those in the other 2 groups. High peritoneal fluid MPO indicated necrotic bowel.


7. Latson KM, Nieto JE, Beldomenico PM, Snyder JR. Evaluation of peritoneal fluid lactate as


Abdominal Ultrasound

Ultrasonography of the equine abdomen has gained in popularity as its value has been demonstrated in horses with colic. Ultrasonography is useful for diagnosis of intestinal strangulation (distended, thick-walled bowel), peritonitis (increased volume of peritoneal fluid and decreased intestinal motility), intussusceptions, and displacements. Also renosplenic entrapment of the large colon, peritoneal effusion, jejunojejunal intussusception, ileocecal intussusception, cecolic and cecococcal intussusceptions, diaphragmatic hernia, cholelithiasis, ruptured bladder, ascarid impactions, inguinal and scrotal hernias, and abdominal neoplasia can all be detected by abdominal ultrasound. Intussusceptions are recognized by a target or “bull’s eye” appearance. Entrapment of the large colon in the renosplenic space is recognized when a gas-filled viscus is imaged dorsal to the spleen, enveloping its dorsal aspect. A false positive arises if the left kidney is obscured by gas in the colon, and this will also happen after a recent rectal examination. The dorsal border of the spleen will be horizontal in horses with entrapment. In one study, ultrasonography was correct in diagnosis of this disease in 88% of cases, compared with 32% after rectal examination. Superior to rectal palpation for diagnosis of small intestinal lesions. Ultrasonography is not useful for diagnosis of enteroliths as these can be easily confused with gas shadows.

The horse’s abdomen is prepared by spraying it with alcohol to improve acoustic coupling, and both sides of the horse are examined systematically from the line of the diaphragmatic reflection to the ventral midline. A low-frequency probe (2 to 3.5 MHZ) is employed in adult horses to demonstrate deeper structures, although the resolution is low. Higher-frequency probes (5 to 10 MHz) can be used in small horses and foals for more detail, but with less penetration. Ultrasonography is more accurate than abdominal palpation per rectum for identification of small intestinal strangulation. It can also allow assessment of quantity and nature of fluid in the abdomen so that peritonitis and rupture can be detected. The normal small intestinal wall thickness is 3 mm or less, and ultrasonography can be used to detect small intestinal movement, mural thickness, and dilation. The strangulated segment of small intestine is usually found in the ventral abdominal cavity. Small intestinal intussusception will also gravitate towards the ventral abdomen, where it can be identified by ultrasonography. Large colon torsions can be diagnosed
by imaging the large colon from the ventral abdomen, with a high degree of accuracy and reproducibility. A colon wall thickness ≥ 9 mm can accurately predict large-colon torsion with a sensitivity of 67%, and can correctly predict absence of torsion with a specificity of 100%. Although diagnosis of LCV has been made based on ultrasonographic detection of a colon segment that lacks sacculations, this approach has not been adequately tested. Ultrasonography is less useful for the detection of enteroliths because of their location and because the acoustic echo from a stone and a gas shadow are similar.

**Gastroscopy**

Horses with gastric ulcers and other gastric lesions can demonstrate signs that are indistinguishable from clinical signs of recurrent or chronic colic. Endoscopic examination of the esophagus, stomach, pylorus and proximal duodenum is readily accomplished in mature horses with 3-meter flexible videendoscopes. Mature horses are held off feed and water for 8-12 hours prior to gastroscopy to allow emptying of the stomach. Gastric impaction, ulceration, squamous cell carcinoma, and foreign body ingestion can be diagnosed with endoscopy. Response to anti-ulcer therapy is best evaluated by serial gastroscopy. Do not ignore the possibility that gastric ulcers are secondary and that the horse has another gastrointestinal disease that is the primary problem.

**Colonic Displacements**

Horses with abdominal pain should be allowed to roll at will if they are considered to have a colonic displacement, contrary to owner’s desires to keep them walking. They might need to be placed in a round pen or paddock for this purpose to minimize the risk of injury. Although unsubstantiated, the impression is that vigorous rolling can correct some colonic displacements.

Horses with large colon trapped over the nephrosplenic or renosplenic ligament can have pain of variable intensity and mild to moderate abdominal distension. Treatment by “wait and see” approach, phenylephrine injection, or rolling the horse while anesthetized with short acting intravenous anesthetic are successful, depending on severity. The spleen can be effectively reduced in size by phenylephrine at 3µg/kg/minute for 15 minutes. The horse is then lunged for
10 to 15 minutes or rolled. Lunging is less effective than rolling under anesthesia and phenylephrine does carry a small risk of fatal hemorrhage in old horses.

References