**DIAGNOSIS OF COLIC**

**History and Signalment**

The signalment of the colic patient is important when determining the specific information that should be obtained during history taking, and which physical examination and diagnostic procedures are indicated. The signalment itself can often lead to an early differential diagnosis that may be investigated during the subsequent history and physical examination. The information obtained from the owner should include both the medical history and management practices. Details of the medical history related to the current and previous episodes of colic, other illnesses or surgery, and current and previous medications administered are essential. A history of recent nonsteroidal anti-inflammatory drug (NSAID) use may suggest a possible impaction of the ascending colon or right dorsal colitis.Knowledge of all analgesics and sedatives administered before presentation is crucial when interpreting signs of pain and physical examination findings, as they may alter clinical signs. A description of the current management of the horse and any changes to diet, exercise, stabling, and anthelmintic regimen is important in identifying potential risk factors for certain conditions. These include the association between the feeding of coastal Bermuda hay and the risk of ileal impaction, and the association between the behavior of crib biting and epiploic foramen entrapment.

**Physical Examination**

The physical examination of the colic patient should be conducted in a thorough, logical order and should not be limited to the abdomen. The measurement and recording of the temperature and the heart and respiratory rates on initial examination allows the response to medication and therapy to be quantified. The heart rate is an indicator of the physiologic response to pain, dehydration, and endotoxemia and is useful in determining prognosis in both large and small intestinal disease. Conditions associated with pyrexia include anterior enteritis, colitis, and pleuropneumonia and do not generally require immediate surgical intervention. Therefore, complete auscultation of the thorax to rule out conditions of the respiratory tract should be performed. Examination of the oral mucus membranes, including measurement of capillary refill time, aids in the determination of hydration status and the diagnosis of endotoxemia. In the endotoxemic horse, the capillary refill time is prolonged and the mucous membranes develop a brick red or purple color. A dark “toxic line” may be apparent along the gum line of the horse. Auscultation of abdominal borborygmi allows the subjective assessment of large intestinal motility. Cecal motility may be auscultated over the right flank, whereas the pelvic flexure and ascending colon are auscultated over the left flank. Audible movements of the cecum and ventral colon include propulsive, retropulsive, and mixing contractions. Propulsive contractions of the cecum and colon occur approximately every 3 to 4 minutes but are decreased in frequency by conditions including anorexia and sedation (e.g., α2-adrenergic receptor agonists). Ileus of the large or small intestine will result in the absence of intestinal borborygmi and is therefore a significant physical examination finding. Intestinal borborygmi can also be increased in certain conditions, including the early stages of distention and inflammation. A critical aspect of the examination of any horse presented for colic is the assessment of the degree and persistence of signs of pain. It is often easiest to observe a horse in a box stall where it may display signs of pain that are not apparent during handling or restraint in stocks. Obvious signs of pain include pawing at bedding, looking at the flank, kicking at the abdomen, repeated lying down and standing, and rolling. Abdominal pain may also manifest itself by more subtle behavior including a dull appearance, lowered head position, and reluctance to move. The severity of pain is often related to the degree of intestinal injury, which is in turn related to the need for surgical intervention. A large colon volvulus resulting in large colon distention and ischemic injury will cause severe pain that is refractory to treatment with analgesics and sedatives. In contrast, a nonstrangulating obstruction results in lower grade pain that responds to analgesia. O observation of the response to treatment with NSAIDs or sedatives is important when characterizing the type of pain. Mild pain typically responds to treatment with an NSAID alone for a period of 8 to 12 hours. In contrast, moderate pain will respond to analgesia for a limited period and requires repeated administration. Severe pain is manifest by violent behavior and may not respond to analgesia, which is frequently an indicator of the need for immediate abdominal surgery. During the physical examination, when indicated, it may be prudent to place an intravenous jugular catheter and begin fluid therapy while further diagnostic procedures are performed.

**Rectal Examination**

Rectal examination should be performed using a suitable combination of physical and chemical restraint to allow palpation of the cecum, left dorsal and ventral colon, pelvic flexure, descending colon, and reproductive tract. If sedation does not provide adequate relaxation to allow a safe examination, the instillation of lidocaine into the rectum or administration of *N*-butylscopolammonium bromide can reduce straining, improve the quality of the rectal examination, and reduce the risk of rectal tearing. Careful palpation should be performed to prevent rectal tears and allow diagnosis of any existing tear. The position and size of each palpable organ may be assessed as well as the content, which may be ingesta, fluid, or gas. Entrapment of the large colon in the nephrosplenic space may be palpable in the upper left abdominal quadrant. The small intestine is not normally palpable *per rectum* and is therefore an abnormal finding on rectal examination. The small colon is normally distinguished by the presence of fecal balls and a broad antimesenteric band. If these features are not palpable it suggests impaction of the small colon. In the pregnant mare, the broad ligaments should be palpated to diagnose a possible uterine torsion. If a tight broad ligament is palpated, the direction of the torsion should be determined to allow correction.

**Nasogastric Intubation**

The passage of a nasogastric tube should be performed during all colic examinations to allow decompression if necessary and prevent gastric rupture. Water is flushed through the tube to begin a siphoning action, and should be measured to allow the net volume of fluid recovered to be determined. The color and smell of the fluid should be assessed. It is normal to recover up to 2 L of green, nonodorous fluid. Excessive fluid indicates either gastric outflow obstruction or decreased small intestinal motility resulting in an accumulation of fluid in the stomach. Anterior enteritis cases often yield a large volume of malodorous orange or yellow fluid. Large amounts of feed in the gastric fluid may indicate gastric impaction. Gastric outflow obstruction may also be caused by gastroduodenal ulceration or neoplasia. The cause of gastric outflow obstruction may be further investigated by endoscopy. Following decompression of the stomach, the nasogastric tube may be left in place during surgery to prevent fluid aspiration and allow intraoperative decompression.

**Clinical Pathology**

The use of clinical pathology has become a crucial part of the assessment and treatment of the colic patient. The measurement of the blood packed cell volume (PCV) and total protein (TP) can be performed using a centrifuge and refractometer to quickly assess the patient’s hydration status. A high PCV has been shown to be associated with a poor prognosis in horses with both small and large intestinal disease. In contrast, a low TP has been associated with a poor prognosis in horses undergoing surgery for the treatment of small intestinal disease. The introduction of point-of-care analyzers has created widespread availability of blood electrolyte and acidbase balance information. When using a point-of-care analyzer it is important to store and prepare the cartridges for use according to the manufacturer’s instructions to ensure accuracy. Although the majority of changes seen on hematology are nonspecific, it is useful in diagnosing inflammation, endotoxemia, or sepsis. These changes may be evident as leukopenia, neutropenia with appearance of immature and toxic neutrophils, lymphopenia, and thrombocytopenia. The blood electrolyte profile of horses losing fluids through gastric reflux or diarrhea often reveals abnormalities, including low sodium, potassium, calcium, and bicarbonate levels that may be addressed during fluid therapy. Because lactate is a product of anaerobic glycolysis, its measurement may reflect ischemic injury and may aid in determining the prognosis. Among horses with large colon volvulus, a serum lactate concentration greater than 6 mmol/L has been associated with a poor prognosis for survival. Measurement of the anion gap allows the indirect measurement of blood lactate and is of value when determining prognosis. A study of horses with large colon displacement revealed an increased serum γ-glutamyltransferase (GGT) in 49% of right dorsal displacement cases but in only 2% of horses with a left dorsal displacement. This increase in GGT in horses with right dorsal displacement of the large colon is due to obstruction of the bile duct.

**Abdominocentesis**

Peritoneal fluid can be examined as both a diagnostic and prognostic aid. Peritoneal fluid can be collected by clipping and aseptically preparing the most dependant part of the abdomen, on or slightly right of midline to avoid the spleen, and inserting an 18-gauge needle. Alternatively, following local anesthesia, a small incision can be made using a No. 15 scalpel blade and inserting a teat cannula. Care must be taken during the collection of fluid to avoid enterocentesis, particularly in horses with distended viscera, or amniocentesis in the pregnant mare. Where fluid is not easily obtained, abdominal ultrasonography can be performed to identify an area of fluid accumulation for collection. The abdominal fluid should be collected in a plain tube for the measurement of protein concentration and in an EDTA tube for a cell count and hematology. Immediately following collection, the gross appearance of the fluid should be visually assessed. Normal peritoneal fluid has a clear, colorless to light yellow appearance. When a strangulating lesion is present, there is movement of protein followed by red blood cells and finally leukocytes into the peritoneal cavity. This results in the peritoneal fluid becoming turbid and red to brown. The presence of ingesta in the peritoneal fluid suggests a ruptured viscus and a hopeless prognosis. In this situation, care must be taken to ensure that the sample was not obtained by enterocentesis. The normal total protein concentration of abdominal fluid is less than 2 g/dL, but this will increase with intestinal disease. The appearance of red blood cells in the abdominocentesis sample may be the result of an intestinal strangulation or an iatrogenic source. A small amount of blood contamination may occur if a vessel in the abdominal wall is punctured. If the peritoneal fluid is normal, on centrifugation a small pellet of red blood cells will collect, leaving fluid with a normal appearance. It is also possible to insert the needle into the spleen, resulting in the collection of a sample with a PCV similar to blood. Clinical biochemistry may be performed on peritoneal fluid to determine other factors, including fibrinogen, lactate, phosphate, glucose, and pH. A high peritoneal lactate has been shown to be a more sensitive indicator of a strangulating obstruction of the intestine than plasma lactate. In those horses with suspected septic peritonitis, the serum and peritoneal fluid glucose levels can be compared. A difference of greater than 50 mg/dL between the serum and peritoneal fluid glucose level, a low peritoneal fluid glucose level (less than 30 mg/dL), and pH of less than 7.3 are indicators of septic peritonitis.

**Ultrasonography**

Ultrasonography has become an important part of the diagnosis, treatment and management of the colic patient. Abdominal ultrasonography is generally performed using a percutaneous approach following preparation of the skin by clipping and application of alcohol or coupling gel. A low-frequency (2.5 to 5 MHz) linear, curvilinear, or sector transducer will produce a diagnostic quality image while providing sufficient penetration to identify deeper structures. It is possible to identify the stomach, small intestine, cecum, and large colon and determine their size, position, wall thickness, and motility. The stomach may normally be imaged cranially on the left of the abdomen between the 11th and 13th intercostal spaces. The gastric volume can be estimated and stomach decompression confirmed by measurement of the gastric wall height at the 12th intercostal space. The small intestine can be identified in the cranial ventral abdomen and can be examined for wall thickness, diameter, and motility. The normal wall thickness of the small intestine is less than 3 mm, and an increase may indicate enteritis or strangulating obstruction. Obstruction results in distention of small intestinal loops, which can be identified and measured ultrasonographically. The motility of these loops should be assessed, because ileus may be diagnosed as hypomotile small intestine on ultrasonographic examination. Ultrasonography has been demonstrated to be extremely useful for the diagnosis of large colon volvulus in the horse. The colon is identified on the ventral abdominal midline, and the appearance and thickness of the wall and motility are assessed. Normally, the sacculated ventral colon with a wall thickness of less than 5 mm is identified. If a large colon volvulus of 180 or 540 degrees is present, the nonsacculated dorsal colon can be identified on the ventral abdomen. Measurement of the colonic wall thickness has been shown to be useful in the diagnosis of large colon volvulus. A colonic wall thickness measurement of greater than 9 mm had a sensitivity of 67% and a specificity of 100% in diagnosing large colon volvulus. In addition to the diagnosis of large colon volvulus, ultrasonography can be used to monitor postoperative recovery of the colon. The horses in which right dorsal colitis is suspected, a diagnosis can be confirmed using ultrasonography performed between the 10th and 14th right intercostal spaces. Ultrasonographic changes associated with right dorsal colitis include a thickened colon wall and a hypoechoic layer of submucosal edema and inflammatory infiltrate. Left dorsal displacement of the large colon can be diagnosed ultrasonographically through identification of the large colon lateral or dorsal to the spleen. The displaced colon prevents visualization of the right kidney. If nonsurgical management is performed, ultrasonography can be used to confirm correction of the displacement. Although radiography remains the gold standard for diagnosing sand impaction of the colon, ultrasonography can identify sand, which produces a hyperechoic signal and acoustic shadowing of deeper structures. The presence of a sand impaction can also reduce colonic motility.

**Radiography**

In the examination of the adult horse presented for colic, radiography is useful when the presence of radiopaque material is suspected. Therefore, abdominal radiographs are particularly useful for the diagnosis of sand accumulation and enterolithiasis. When performing abdominal radiography, adequate exposure is critical to maximize diagnostic quality and reduce the incidence of false negative examinations. The sensitivity and specificity of radiography for the diagnosis of enterolithiasis have been described as 76.9% and 94.4%, respectively. The improved image quality of abdominal radiography in the foal and small horse allows examination of the stomach and small and large intestines. Radiography can be performed using both plain film and contrast techniques to allow diagnosis of obstruction, intussusception, and radiopaque foreign bodies. Contrast radiography can be performed using 30% wt/vol barium sulfate suspension administered orally or rectally. This technique is useful for identifying delayed gastric outflow obstruction and obstruction of the small, transverse, and large colons.

**ANCILLARY DIAGNOSTIC AIDS**

**Endoscopy**

Examination of the esophagus, stomach, and duodenum can be performed in the adult horse using a 3-m flexible endoscope. During a colic examination, endoscopy can be used to confirm gastric decompression and diagnose gastric ulcer disease, gastric impaction, and gastric squamous cell carcinoma. Endoscopic examination of the rectum allows the minimally invasive investigation of rectal tears.

**Laparoscopy**

The use of laparoscopy has been described for investigation of both the acute and chronic colic patient. Laparoscopy is an option in those patients with controlled abdominal pain. Its use is limited in the horse by the inability to completely visualize the abdominal contents and by the difficulties associated with manipulating the large viscera of the horse. The sensitivity and specificity of laparoscopy as a diagnostic technique are greater in horses with acute colic than chronic colic. When performing laparoscopy in the acute colic patient, care must be taken to prevent penetration of gas-distended abdominal viscera. Although laparoscopy is generally a diagnostic technique in the acute equine colic patient, its use has been described for correcting left dorsal displacement of the large colon. Laparoscopy is suitable for diagnosis of a range of abdominal conditions, including mesenteric tears, uterine rupture, intestinal adhesions, small intestinal strangulating lesions, large colon displacement, and visceral rupture.