Peritonitis is inflammation of the peritoneum leading to fluid and inflammatory cell accumulation in the peritoneal cavity. It may be primary (spontaneous), but is most commonly secondary to insult or injury to the gastrointestinal tract, other visceras within the abdominal cavity, or injury to the body wall. It can result from chemical irritation, but bacterial infection is the most common etiology. Specific causes include iatrogenic injury to the gastrointestinal tract from diagnostic or surgical procedures, trauma from abdominal wounds and breeding or foaling injuries, ischemic events within the gastrointestinal tract such as those from infarction, parasitic migration, or advanced strangulating intestinal disease, gastrointestinal rupture, penetrating metallic foreign bodies, perforating ulcers, anastomotic or enterotomy leakage, intra-abdominal abscessation, neoplasia, hepatic lobe torsion or cholelithiasis. Endotoxemia, septicemia, hypovolemia, hemorrhage, gastrointestinal ileus, intra-abdominal hypertension from fluid accumulation in the peritoneal cavity, and adhesion formation all have the potential to contribute to the clinical manifestations of septic peritonitis in horses. Bacterial contamination of the peritoneal cavity leads to rapid increases in serosal capillary permeability with subsequent losses of fluid, protein, and electrolytes into the peritoneal cavity. Gram negative bacteria are common etiologic agents arising from gastrointestinal or reproductive tract contamination. Their presence allows absorption of endotoxin through the peritoneum and leads to hypotension, shock, DIC (disseminated intravascular coagulation) and SIRS (systemic inflammatory response syndrome) characterized by tachycardia, tachypnea, leukopenia, toxic changes in the mucous membranes, and fever. Clinical signs of peritonitis in horses are nonspecific and highly variable and may be manifest by one or more of the following: colic, depression, anorexia, fever, acute death, shock, abdominal distension, diarrhea, ileus, endotoxemia, and splinting of the abdomen. Third spacing of fluids within the peritoneal cavity often combined with reduced fluid intake and further potential losses from ileus or diarrhea often lead to dehydration and hypovolemia. The urgency of treatment for peritonitis, its management and prognosis differ considerably depending on the source of the peritonitis and its associated pathogens. Regardless of the source, the primary means of treatment remains the same; identify the source, correct it, and remove accumulated inflammatory debris when it is contributing to patient morbidity.

**Diagnosis**

Diagnosis of peritonitis in horses is based on clinical signs, results of CBC and blood chemistry, peritoneal fluid analysis, peritoneal fluid culture, and abdominal ultrasound. Abdominal ultrasound and abdominal paracentesis with fluid analysis often provides enough information to confirm the diagnosis. Ultrasonographic evaluation of the abdomen will reveal a large accumulation of free peritoneal fluid that will vary in echogenicity based on WBC content, and in more advanced cases, may include the presence of free floating strands of fibrin. The underlying etiology of the peritonitis may be a bit more challenging in those horses with peritonitis not associated with recent surgery or foaling and may require more costly diagnostics such as abdominal radiography (for penetrating metallic foreign bodies), surgical exploration, or serum assays for titers of pathogens associated with internal abscessation (e.g. *Streptococcus equi*, *Rhodococcus equi*, or *Corynebacterium pseudotuberculosis*). Diagnosing septic peritonitis in the post-operative colic patient also may present challenges, as fluid accumulation and elevated WBC counts in the peritoneal cavity are expected in the early post-operative period. Exploratory celiotomy alone without septic peritonitis results in marked increases in peritoneal fluid WBC count (200,000 cells/µl) and total protein (6 gm/dL) in the first post-operative week, and therefore may complicate the diagnosis. Special diagnostic tests on peritoneal fluid samples in combination with clinical findings may help determine whether peritoneal contamination during surgery or leakage from an anastomotic or enterotomy site is occurring. These tests include comparisons of peripheral blood and peritoneal fluid glucose and lactate, peritoneal fluid pH, and peritoneal fluid cytology looking for the presence of degenerate neutrophils and intra- and extracellular bacteria. Peritoneal fluid glucose will be lower than peripheral blood glucose (<30mg/dL) or a differential of at least 50 mg/dL would be expected in the presence of bacterial peritonitis. Peritoneal fluid lactate should also be higher than peripheral blood lactate, peritoneal fluid pH should be <7.3, and >90% neutrophils should be identified with or without
the presence of degenerate neutrophils on peritoneal fluid cytologic exam. The presence of intra- and extracellular bacteria on cytologic exam confirms the diagnosis, but they are commonly not identified unless substantial contamination has occurred. These findings combined with ultrasonographic and clinical evidence of peritonitis in a post-operative colic would be an indication for immediate relaparotomy. In horses that have not undergone surgery, an increase in neutrophil count (>5000 cells/µl) and total protein (>2 gm/dL) combined with increases in peritoneal fluid volume would be suggestive of peritonitis.

Treatment

Treatment for septic peritonitis is ideally tackled by correcting the inciting cause. Depending on the case, this may or may not be feasible, as an inciting cause is not always identified. Correction of fluid and electrolyte abnormalities is an essential component of therapy, as many of these horses have extensive fluid deficits as a result of both reduced fluid intake and losses into the peritoneal cavity. Broad spectrum antimicrobial therapy should be instituted immediately following peritoneal fluid sample collection with culture and sensitivity. Use of non-steroidal anti-inflammatory agents such as flunixin meglumine or firocoxib is also recommended once initial fluid deficits have been addressed. More invasive treatments for septic peritonitis include the use of abdominal drains and repeated abdominal lavage as well as exploratory celiotomy to determine a source of the peritonitis, correct the cause, provide a more accurate prognosis, and perform a thorough abdominal lavage with the option of surgical placement of a lavage system. If an abdominal lavage system is to be used, surgical omentectomy will facilitate proper function of the drain in the post-operative period, as omentum tends to occlude the openings in the drain. A 32-french chest drain with trochar with 5-6 additional fenestrations added using a scalpel blade works well as a lavage system in the author’s experience. This is secured to the abdominal wall using a Chinese finger trap suture pattern and may be placed intra-operatively or in the standing horse using ultrasound guidance to avoid penetration of viscera (Figure 1). A Heimlich valve can be aseptically attached to the end of the drain and a high-flow large-bore IV fluid administration set can be connected to the chest drain using an Argyle 5-in-1 tubing connector. Five to 10-liter volumes of warmed isotonic fluids can be administered using gravity flow and drained shortly thereafter. Lavage and drainage of the abdomen is most essential in those horses with marked abdominal fluid accumulation and clinical evidence of endotoxemia and SIRS. Horses with peritonitis involving a single organism may often be successfully managed with more conservative measures. Methods for adhesion prevention may in instituted in some cases such as systemic heparin therapy or low dose DMSO (20mg/kg IV q12hrs in IV fluids).

Prognosis

Prognosis in horses with peritonitis is strongly dependent on the cause. Acute septic peritonitis secondary to gastric, cecal or colonic rupture is uniformly rapidly fatal, whereas treatment of peritonitis secondary to Actinobacillus equuli is highly effective with a reported success rate of 100% with procaine penicillin therapy alone. The fatality rate in horses developing septic peritonitis following ventral midline celiotomy exceeds 50% and would be most positively impacted by the speed of diagnosis and ability to repair the source of contamination as quickly as possible. Conversely, medical management of many cases of peritonitis not secondary to surgical treatment or acute gastrointestinal rupture is reported to have a high rate of success. Success rates for treatment of horses with peritonitis of various causes in recent reviews indicate survival rates as high as 94% in medically managed cases. Horses undergoing surgical treatment of diffuse peritonitis have a poorer prognosis for survival than those treated with more conservative measures, but it is likely the surgically-managed cases were more severe. Horses with large internal abscesses and secondary peritonitis have more variable success rates, with reports describing survival as low as 25% and as high as 67% in a recent report describing surgical drainage of large abdominal abscesses in 6 horses using a Foley catheter.

References available upon request.