CHAPTER 3.13

Ileal Impaction

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Ileal impaction is the most frequently reported cause of nonstrangulating obstruction of the small intestine in adult horses and is seen predominantly in the southeastern United States. This condition is most likely associated with the feeding of coastal Bermudagrass hay harvested in tall stands or late summer cuttings. The lignin and crude fiber content of this hay increases markedly in these conditions and substantially decreases the digestibility factor. Differentiating ileal impactions from strangulating obstructions and duodenitis/proximal jejunitis with adynamic ileus may be difficult. In retrospective studies of acute abdominal disease, ileal impaction has been reported to have a prevalence of 0.5% to 10.8%.

ANATOMY AND PHYSIOLOGY

The ileocecal junction is situated in the right dorsal quadrant of the abdomen; because of the short mesenteric attachments to the cecum and right dorsal colon, the junction is relatively immobile. The ileal orifice is partially inverted into the cecum, thereby placing the orifice in the center of a slight elevation formed by an annular fold of mucous membrane that contains a network of veins. The network of veins and the muscle coat of the ileum serve as a functional ileal sphincter. When the ileum is relaxed, it is difficult to distinguish from the jejunum. In contrast, when the ileum contracts it can be easily distinguished from the jejunum by its thicker muscular wall and narrow lumen.

Liquid digesta is rapidly propelled through the ileum into the cecal base, moved to the cecal apex, mixed with cecal contents, and then propelled into the right ventral colon. The migration action potential complex (MAPC) is a prominent myoelectric complex and is a normal event in the equine ileum but has not been recognized in the equine jejunum. These motility patterns are stimulated by the presence of liquid digesta and are responsible for its aboral transport. Data suggest that the MAPC rather than other migrating myoelectric complexes of the ileum may be responsible for the transit of digesta through the ileum into the cecum and is the only ileal event related to cecal motility patterns. Although the cranial and caudal aspects of the cecal base are capable of generating independent retrograde (base to apex) spiking activity, this activity also may in part be initiated by the MAPC of the ileum. Thus ileal and cecal filling may be more important in regulating ileocecal motility events than are the nervous or endocrine stimuli associated with eating.

Because the progressive myoelectric activity from the cecum to the right ventral colon is initiated from an electrical pacemaker near the cecal apex, surgically removing or bypassing the ileum does not adversely affect the motility of the large intestine. However, bypassing the ileocecal valve disrupts the normal MAPC progression from the ileum to the cecum and right ventral colon and may allow bacterial overgrowth within the small intestine, resulting in mucosal cell damage. Therefore the ileocecal orifice should be preserved if possible.

ETIOLOGY

Ileal impactions occur most commonly in the southeastern United States and in Europe. The cause of ileal impactions is unknown, although feeding horses hay with high fiber content has been associated with ileal impaction in the United States. Coastal Bermudagrass hay—which is often dry, fine, and populated with many stems—is commonly fed to horses in the southeastern region of the United States. When coastal Bermudagrass pastures mature (as seen in tall stands or late summer cuttings), the lignin and crude fiber content increases markedly. When the mature grass is cut and fed as hay, the additional fiber can result in a predisposition to impaction colic, a condition that is aggravated further by a combination of hot, stressful conditions; limited consumption of digestible roughage; ingestion of pelleted feeds; and limited twice-daily feeding patterns. Ileal impactions have a low incidence rate in other parts of the United States, where legume or other hay combinations are the primary sources of roughage.

A significantly higher risk for ileal impaction in horses exists in the southeastern United States during the fall season (September-November). Several possibilities exist for the apparent association between time of year and ileal impaction. An increased feeding of cured hays occurs in the southeastern United States as pastures become sparse from long, hot, and dry summers and the onset of cooler weather. Changes in the nature of the hay available at this time of year (higher lignin and crude fiber content) and changes in feeding practices may alter intestinal motility patterns. In addition, changes in the metabolic activity of the intestinal microflora also can occur with an altered feeding pattern to induce ileal impaction. These alterations may result in impaction colic disorders, especially if they are associated with decreased water consumption. An outbreak of ileal impaction in seven horses associated with the recent introduction of coastal Bermudagrass hay, where the horses had limited water intake because of cooler temperatures, has been described.

In Europe, ileal impactions are primarily idiopathic in nature and associated with vascular thrombotic disease.

Verminous arteritis caused by *Strongylus vulgaris* larvae occurs most frequently in the ileal branch of the cranial mesenteric artery. When *S. vulgaris* larvae penetrate the ileal mucosa and migrate in the submucosa, ileal migrating myoelectric complex spike activity decreases and MAPC frequency increases. This increase in MAPC frequency indicates that a relationship may exist between *S. vulgaris* larval infection and spasmodic colic seen in horses. Most or all of the responses to live L_3 larvae may have little to do with penetration and migration into the wall of the ileum but may be caused by elaboration of chemical agents by the larvae. Disruption of normal ileal motility occurs when the larval antigens are present in the ileal lumen. These lesions further predispose the ileum to episodes of hypoperfusion and segmental atony. The ileum's blood supply and fixed nature within the intestinal tract may be important reasons why the ileum is affected by obstructive disease more frequently than the rest of the small intestine.

Anoplocephala perfoliata is pathogenic for horses because heavy burdens of the parasites may be associated with severe histologic changes at the ileocecal junction. Several clinical reports have linked tapeworm infections with intestinal diseases in horses, including ileal thickening, obstruction and intussusception, and colonic volvulus. In addition to macroscopic thickening of the ileocecal valve, morphometric analysis of the mucosa reveals that in horses with more than 100 tapeworms the mucosa is significantly thicker than that of healthy horses. The mucosa and submucosa are infiltrated with eosinophils. The severity of these changes at the ileocecal junction supports the view that appropriate anthelmintic treatment for tapeworms would be beneficial in minimizing lesions in the ileum.

Hypertrophy of the muscular layer of the ileum produces luminal narrowing and partial obstruction. Muscular hypertrophy occurs in two forms—idiopathic (primary) and compensatory (secondary). With idiopathic hypertrophy, no detectable stenosis of the distal intestine occurs to cause the proximal intestinal muscularis to hypertrophy. With the compensatory form of muscular hypertrophy, the muscular layer of the small intestine hypertrophies in response to chronic distal intestinal stenosis. The hypertrophied muscle narrows the intestinal lumen, causing partial obstruction and distention of the intestine proximal to the obstruction, which causes abdominal pain. A common historical finding is partial anorexia and chronic weight loss of 1 to 6 months' duration. Exploratory celiotomy is the only definitive method used to diagnose ileal muscular hypertrophy as a cause of colic. Full-thickness rupture of the ileum with subsequent diffuse, septic peritonitis has been reported in horses with idiopathic muscular hypertrophy.

Trauma to the body wall can result in abdominal wall hernias in which an ileal impaction can develop subcutaneously. Ileal impactions associated with internal hernias involving mesenteric rents or the epiploic foramen, incarcerated scrotal-inguinal hernias, and intraabdominal adhesions are usually complicated by the incarceration of small intestine.

CLINICAL SIGNS

Impaction of the ileum initially causes abdominal pain as a result of small intestinal distention and spasm at the site of impaction. Abnormal intestinal contractions extrude water from the accumulated mass of ingesta to create a drier, firmer, obstructing mass. Because fluid losses are minimal, few systemic effects arise during this stage of the condition. Proximal to the obstruction of the intestine, absorption of water is impaired and secretion of fluid is increased, resulting in loss of fluid into the intestinal lumen. The pain becomes more severe as the intestine proximal to the impaction distends with gas and fluid. The reduction in circulatory function arises secondary to dehydration caused by the sequestration of fluid in the intestine, insensitive metabolic fluid loss, and a reduced oral intake of fluid. Progressive deterioration in circulatory function with concurrent intestinal distention is associated with a decrease in survival.

DIAGNOSIS

Impactions of the ileum may be detected on transrectal palpation of the abdomen and are typically located in the midabdomen adjacent to the cecum, with limited mobility of the impacted intestine in the abdominal cavity (Figures 3.13-1 and 3.13-2). Because of complete intraluminal obstruction of the ileum, distention of the small intestine develops early in the course of the condition, which prevents successful palpation of the impaction in many cases. Therefore an impaction of the ileum can be most readily identified when examination is performed before onset of distention of the small intestine. As a result of excessive distention of the small intestine, ileal impactions were identified by transrectal examination in only 12 of 93 horses in two retrospective studies.

An increased heart rate (>60 bpm), nasogastric reflux, and decreased intestinal sounds are additional signs of impaction of the ileum. The packed cell volume (PCV), plasma protein, serum anion gap, and protein concentration in the peritoneal fluid are usually increased. In contrast, the white blood cell count, serum urea nitrogen, sodium, potassium, chloride, and peritoneal fluid white blood cell count are normal. A mild metabolic acidosis is usually present. Significant differences in anion gap and plasma protein concentration have been reported between survivors and nonsurvivors of ileal impaction, with higher values reported for nonsurvivors. These findings, although variable for individual cases, are indicative of a nonstrangulating obstruction of the small intestine. Gastric reflux on nasogastric intubation and the presence of small intestinal distention on rectal examination are consistent with small intestine obstruction or proximal enteritis, although other diseases infrequently cause these clinical findings. Peritoneal fluid analysis can help to differentiate simple obstruction from strangulating obstruction of the small intestine. Abnormal findings in peritoneal fluid occur earlier in the course of the obstruction with strangulation obstruction than with simple obstruction.

TREATMENT

Successful medical treatment of horses with ileal impactions may be facilitated by a combination of intravenously administered fluids, sedatives, analgesics, or nonsteroidal antiinflammatory drugs (NSAIDs). Goals of initial management of horses with ileal impaction colic

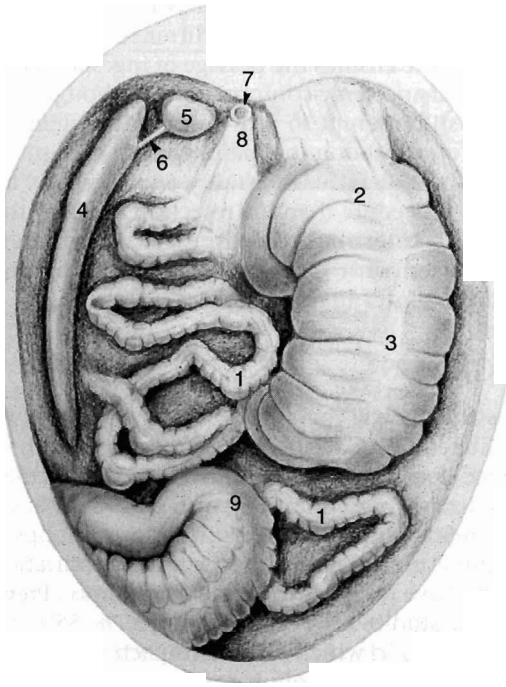

Figure 3.13-1 Structures that can be identified during rectal examination of a normal horse: small colon with distinct fecal balls *(1);* cecal base containing some gas *(2);* cecal ventral taenia band *(3);* spleen *(4);* kidney *(5);* renosplenic ligament *(6);* aorta *(7);* cranial mesenteric root *(8);* pelvic flexure and parts of left large colon *(9).* The ileum normally cannot be palpated and therefore was not included in this illustration of normal rectal findings. (From Hanson RR, Baird AN, Pugh DG: Ileal impaction in horses. Comp Cont Educ Pract Vet 1995; 17:1287.)

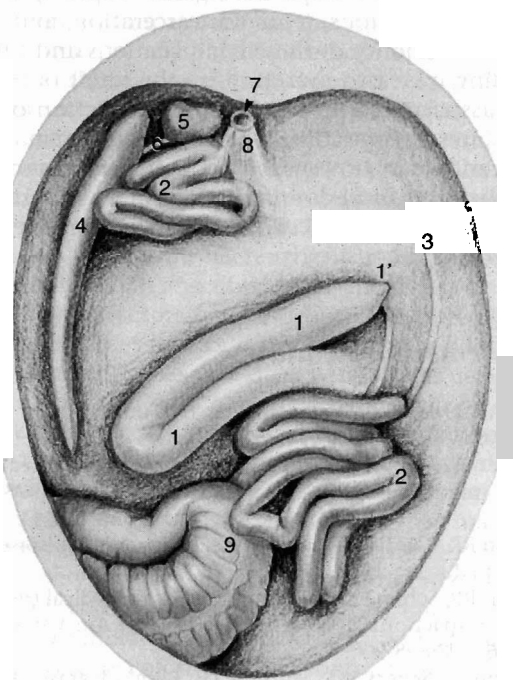

Figure 3.13-2 Structures that can be identified during rectal examination of a horse with ileal impaction: enlarged ileum containing doughy ingesta *(1);* ileocecal orifice *(1');* distended loops of small intestine, fluid-filled or tympanic without thickening of the bowel wall *(2);* cecal ventral taenia band *(3);* spleen *(4);* kidney *(5);* renosplenic ligament *(6);* aorta *(7);* cranial mesenteric root *(8);* pelvic flexure and parts of left large colon *(9).* (From Hanson RR, Baird AN, Pugh DG: Ileal impaction in horses. Comp Cont Educ Pract Vet 1995; 17:1287.)

are pain control, reduction of intestinal spasm in the area around the impaction, hydration of the patient and luminal contents to allow passage of ingesta, and restoration of normal intestinal function. Ileal impactions may resolve spontaneously with aggressive medical therapy. The most useful indicators for separation of surgical from nonsurgical candidates are deteriorating cardiovascular status, the persistence of abdominal pain after nasogastric decompression, poor response to analgesic drugs, and progressive distention of loops of small intestine as evaluated on transrectal examination.

With the current state of knowledge about this disease, surgery is now performed only on horses with signs of progressive abdominal disease and unrelenting pain. Retrospective studies have shown that the mean duration of clinical signs before surgery ranges from 13 to 17 hours for survivors and 18 to 25 hours for nonsurvivors. Progressive deterioration of the horse's circulatory function, combined with progressive intestinal distention, are primary reasons for the decrease in survival rate, with increasing time from onset of the condition to surgical intervention. Therefore early surgical intervention with

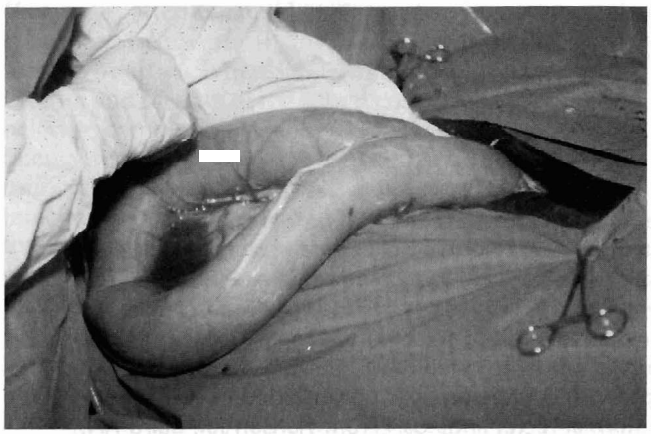

Figure 3.13-3 Impaction of the ileum revealed during exploratory celiotomy. The impaction was caused by occlusion of the lumen with coastal Bermudagrass hay.

these associated clinical signs may decrease mortality and postsurgical complications associated with this disease.

If surgical intervention is indicated, extraluminal massage of the impaction (Figure 3.13-3) and passage of ingesta into the cecum should be considered as the desired means of correction because of the less successful results associated with bypass procedures. Direct infusion of the impaction with 60 ml of dioctyl sodium sulfosuccinate diluted in 1.5 L of saline or direct infusion of 500 ml of carboxymethylcellulose may soften the obstruction to allow gentle massage to mix and extrude the ingesta through the ileocecal orifice. It is important to note, however, that excessive manipulation of the small intestine may cause serosal damage and predispose the horse to adhesion formation. Because of the potential for this serious complication, carboxymethylcellulose is also applied to the serosal surface of the ileum and the surgeon's hands to decrease trauma associated with manipulation of the impaction. Once the ileal contents have been moved into the cecum, the ileum and ileocecal valves are usually edematous and moderately thickened because of the previous obstruction. Unless the thickening is thought to involve the muscular portions of the ileum or is severe, bypass procedures are not performed, thus minimizing postoperative complications.

Ileal impactions have been previously associated with muscular hypertrophy of the ileum and ileal dysfunction. As a result, jejunocecostomies have been routinely performed to prevent reimpaction of the ileum. Except in cases in which hypertrophy of the muscular layers or ileal ischemia is suspected, jejunocecostomy has been abandoned. If muscular hypertrophy of the ileum is present with associated ileal dysfunction, then a bypass between the distal jejunum and cecum without ileal resection should be created to prevent recurrence of the impaction; this procedure ensures the passage of ingesta and preserves the original anatomic conformation. Although feed material may still attempt to pass through the ileum and potentially create abdominal pain, clinical case surveys suggest that postoperative morbidity and mortality are lower after this procedure than if a resection and anastomosis is performed. Intestinal resection should be reserved for those horses with small intestinal obstruction compounded by intestinal ischemia.

PROGNOSIS

Successful medical therapy of horses with ileal impaction is facilitated by an accurate early diagnosis of the disease. Softened ileal impaction, improved cardiovascular status, reduced signs of abdominal pain, decreased amounts of gastric reflux, and decreased distention of loops of small intestine during repeated transrectal examinations indicate a positive response to medical treatment. Previous retrospective studies have reported that 39%, 55%, 64%, and 95% of horses in which an ileal impaction was diagnosed by an exploratory celiotomy survived long-term (5 months to 6 years). Reasons for death or euthanasia include ileus, shock, impaction, gastric rupture, laminitis, intestinal adhesions, jejunal incarceration, and/or peritonitis. A majority of these complications and the corresponding increased mortality are the result of complications associated with the intestinal resection or bypass procedures. Reimpaction of the ileum after manual reduction can occur, however. Although ileus is a common complication of abdominal surgery, no difference has been reported in the occurrence of postoperative ileus for survivors and nonsurvivors.

Supplemental Readings

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