

Surgical Reduction of Ileal Impactions in the Horse: 28 Cases

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Objective—To evaluate the seasonal influence, signalment, type of hay consumed, clinical examination findings, and outcome after surgery for horses with ileal impaction.

Study Design—A retrospective study.

Results—Between 1988 and 1993, 28 horses had surgical correction of ileal impaction. There was a significantly higher rate of ileal impaction during the Fall (September-November, $P = .0041$). Mean duration of clinical signs of abdominal pain before referral was 15 hours. Transrectal palpation was used to localize the impaction in 11 horses. The ileal impaction was reduced by extraluminal massage aided by admixing of intestinal fluid oral to the impaction or injection of fluids intraluminally and then movement of the ingesta into the cecum alone in 24 horses. A total of 26 horses recovered from surgery; 24 horses were discharged from the hospital and eventually returned to previous use. Two horses had fatal postoperative complications: jejunocecostomy dehiscence and development of extensive small intestine adhesions after manual reduction of the impaction. One horse initially treated by manual reduction required jejunocecostomy twice for management of recurrent ileal impaction. Follow-up information was obtained for 21 horses, of which 20 were alive 1 year or longer after surgery. A total of 27 of 28 horses were fed Coastal Bermudagrass hay as the primary type of hay consumed. A total of 9 horses continued to be fed Coastal Bermudagrass hay as the only roughage source, whereas 6 horses were fed Coastal Bermudagrass with at least 50% other hay, and in 6 horses, Coastal Bermudagrass hay was entirely eliminated from the diet.

Conclusion and Clinical Relevance—Ileal impactions can be successfully reduced by celiotomy and extraluminal massage and injection techniques to soften the ingesta for passage into the cecum without enterotomy or bypass techniques in most horses. Changes in weather and feeding practices in the Fall may account for an increased risk of ileal impaction in horses in the southeastern United States at that time of year.

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ILEAL IMPACTION is the most frequently reported cause of small intestinal nonstrangulating obstruction in adult horses.¹⁻⁴ In retrospective studies of acute abdominal disease, ileal impaction has been reported to have a prevalence of 0.5% to 10.8%.^{1,2,4-8} In a retrospective survey of surgical diseases of the ileum, impaction of the ileum accounted for more than 41% of the cases.²

Horses with ileal impactions tend to exhibit biphasic signs of abdominal pain.⁹ The initial episode of

pain is thought to be caused by small intestinal distention and spasm at the site of the impaction.⁹⁻¹¹ Few systemic signs are seen during this time. The impacted small intestine may be identified by transrectal abdominal palpation early. With progressive small intestine distention, however, the impaction may be obscured and the diagnosis must be based on other criteria.^{9,12,13} Subsequent intestinal and gastric distention cause the signs of pain to become more pronounced and small intestine disten-

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tion is a consistent finding in advanced cases.^{5,9,14-16} Sequestration of fluids in the intestinal tract eventually leads to hypovolemic shock.^{9,14}

Increased postoperative morbidity and mortality has been associated with enterotomy, intestinal resection and jejunocostomy for horses undergoing celiotomy for ileal impaction.^{12,17} Intestinal resection is normally performed when the ileal obstruction is associated with idiopathic muscular hypertrophy or ischemia.^{12,17}

The purpose of this study was to evaluate the seasonal influence, signalment, type of hay consumed, clinical signs, physical examination findings, results of laboratory analysis, and outcome after ileal manipulation or jejunocostomy in horses with ileal impaction.

MATERIALS AND METHODS

Medical records of 449 horses evaluated for clinical signs of acute onset of abdominal pain between January 1988 and December 1993 were reviewed. Information obtained from the medical records included signalment, duration of signs of abdominal pain, treatment administered before hospital admission, physical examination findings, severity of abdominal pain, results of abdominal auscultation, transrectal examination, and volume of nasogastric reflux on admission. Results of laboratory analysis of samples obtained at admission were also evaluated including results of complete blood count and peritoneal fluid analysis. Horses were selected for inclusion in this study if an ileal impaction was identified during celiotomy. Two outcomes were examined. Short-term survival was defined as horses that were discharged from the hospital whereas long-term survival was defined as those horses that were alive 1 year or more after hospital discharge. Follow-up information (survival, postoperative complications, and type of hay fed) was obtained from owners by using a telephone questionnaire. Seasonal influences were evaluated using the chi-square test for heterogeneity. Breed, gender, and age distribution of horses with ileal impaction were compared with horses admitted with colic and all other horses admitted. Differences were considered significant at a value of $P < .05$.

RESULTS

Signalment. A total of 28 horses that had celiotomy for ileal impaction were identified. All horses had been examined and treated by a referring veterinarian before admission. Horse age ranged from 1 to 20 years (median, 7 years). There were 14 females, 13 geldings, and 1 stallion. Breed distribution was similar to that of the general hospital population and

included 13 quarter horses, 6 thoroughbreds, 2 Morgans, 2 Arabians, and 1 each of Tennessee walking horse, Paso Fino, paint, Mule, and Warmblood-Cross.

History. Colic duration before admission was 3 to 96 hours (mean, 15 hours). The duration of abdominal pain was 6 hours or less in 6 horses, 7 to 12 hours in 10 horses, 13 to 18 hours in 6 horses, 19 to 24 hours in 3 horses, and more than 24 hours in 3 horses. Medical treatments administered by referring veterinarians included mineral oil, intravenous (IV) fluids, flunixin meglumine, xylazine hydrochloride, butorphanol tartrate, dipyrone, and detomidine hydrochloride. For 27 horses, Coastal Bermudagrass hay was the only type of hay fed.

Physical exam findings. Of 28 horses, 4 had signs of mild abdominal discomfort, 18 had signs of moderate pain, and 6 had evidence of severe or unrelenting pain. Rectal temperature ranged from 36° to 38.8°C (mean, 37.5°C), and heart rate was 32 to 120 beats/min (median, 62 beats/min). Mucous membranes were pink in 23 horses, blanched in 2, and cyanotic in 3 horses. Borborygmi were not detected in 4 horses, whereas 23 horses had decreased borborygmi, 1 had normal intestinal sounds. Impaction was localized to the small intestine by transrectal examination in 11 horses; 20 horses also had gas and fluid distention of the small intestine. Nasogastric reflux was obtained in 15 horses and the initial volume of refluxed fluid ranged from 2 to 21 L.

Clinical laboratory findings. For all horses, packed cell volume ranged from 26% to 56% (mean, 43%) and total protein concentration was 3.6 to 9.4 gm/dL (mean, 7.9 gm/dL). For 11 horses, leukocytes ranged from 4,800 to 17,900 cells/ μ L (mean, 11,427 cells/ μ L) and differential counts were indicative of neutrophilia and lymphocytopenia in 4 horses. Peritoneal fluid obtained from 15 horses was clear in 8, cloudy in 4, and serosanguinous in 1. Enterocentesis occurred in two horses without subsequent complications. Peritoneal fluid protein concentration was measured in 13 horses and ranged from 1 to 3.8 g/dL. Nucleated cells counts in the peritoneal fluid of seven horses ranged from 1,100 to 18,200 cells/ μ L (mean, 4,957 cells/ μ L).

Seasonal influence. There was a significantly higher rate of impaction of the ileum during the Fall (September-November, $P = .0041$, Table 1).

Surgical treatment. Exploratory celiotomy was

Table 1. Rate of Ileal Impaction by Season

| Season | No. of Horses | Total Clinic Accessions | Ileal Impaction Rate/1,000 Accessions |
|----------------------------|---------------|-------------------------|---------------------------------------|
| Spring (March-May) | 6 | 2,209 | 2.7 |
| Summer (June-August) | 4 | 1,629 | 2.4 |
| Fall (September-November) | 14 | 1,417 | 9.9* |
| Winter (December-February) | 4 | 1,257 | 3.2 |
| Total | 28 | 6,512 | 4.4 |

* Seasonal distribution was significant ($P = .0041$), Chi square test for heterogeneity.

performed because of uncontrollable abdominal pain, prolonged abdominal pain, deteriorating cardiovascular status, transrectal palpation of impacted small intestine, or bowel degeneration characterized by changes in peritoneal fluid. Surgical preparation, anesthesia, and postoperative care were similar for each horse with an ileal impaction. Appropriate IV fluid therapy was administered preoperatively depending on hydration and cardiovascular status for each horse. Procaine penicillin G (22,000 IU/kg body weight intramuscularly [IM] every 12 hours), alone or in combination with gentamicin sulfate (4.4 mg/kg, IV, every 12 hours) and flunixin meglumine (0.5 mg/kg, IV, every 8 hours) was administered preoperatively and for 3 to 5 days postoperatively. Horses were sedated with xylazine (1.1mg/kg, IV) and anesthesia was induced with guaifenesin in combination with ketamine hydrochloride or thiamylal sodium and maintained with isoflurane or halothane in oxygen using a semiclosed anesthesia circuit. IV fluids were administered intraoperatively and postoperatively as needed to maintain and promote volume expansion. After ventral median celiotomy, an impacted mass of ingesta was identified in the ileum of all horses that extended orally from the ileocecal orifice for 15 to 91 cm. The intestine oral to the impaction was distended with gas or fluid or both in all horses. Two horses were euthanatized during surgery because of strangulation obstruction and necrosis of the small intestine that was considered to have occurred secondary to ileal impaction.

A total of 26 horses were recovered from surgery. Of those, 22 horses had the ileal impaction reduced extraluminally by massage and softening of the impaction with intestinal fluid oral to the impaction, then manipulation of the ingesta into the cecum. Saline solution (1.5 L) mixed with 60 mL of DSS

(Diocytinate Oral Solution; Butler Co, Columbus, OH) was injected through an 18-gauge 3.8-cm hypodermic needle into the impaction in two horses when massage alone did not result in timely reduction of the impaction. Fluid and gas sequestered in the small intestine were then decompressed into the cecum. Two horses treated by one surgeon had a jejunocecal bypass performed with stapling instrumentation as a primary means of management rather than massage and intraluminal infusion because of excessive edema and thickening of the ileum. One horse managed by extraluminal manipulation of the ileum subsequently had two jejunocecostomies because of recurrent ileal impaction.

Short-term outcome. A total of 24 horses recovered from surgery and were discharged from the hospital. One horse was euthanatized 36 hours after surgery because of peritonitis subsequent to impaction at, and dehiscence of, a jejunocecostomy. Another horse, treated by manual reduction of the impaction, was euthanatized because of signs of pain associated with extensive small intestinal adhesion formation 11 days postoperatively.

Long-term outcome. Follow-up information was obtained for 21 horses; 20 of these were alive 1 year or longer after surgery. Of those, 19 were treated by extraluminal manipulation of the impaction and 18 had survived at least 1 year after discharge and had returned to their previous activity, including 8 show horses, 6 broodmares, and 4 horses used for pleasure riding. The remaining horse died 8 months postoperatively because of injuries unrelated to the abdomen. One horse that had a jejunocecostomy and one that had ileal manipulation then jejunocecostomy returned to their previous activities as a broodmare, and as a show horse. Signs of intermittent chronic abdominal pain or recurrence of the ileal impaction were not reported for these 21 horses. Coastal Bermudagrass hay continued to be fed to 9 horses without other modifications in their diet. For six horses, Coastal Bermudagrass hay was fed in combination with Timothy or Alfalfa hay. The remaining six horses had Coastal Bermudagrass hay eliminated from their diet.

DISCUSSION

Ileal impactions in horses have been associated with foreign body obstruction, ileal muscular hypertrophy,^{6,18-20} tapeworm (*Anoplocephala perfoliata*)

infections at the ileal cecal junction,^{17,21,22} mesenteric vascular thrombotic disease,² feed with a high fiber content,^{9,12,16,23} and idiopathic causes.¹⁵ Because feces were not examined for tapeworm ova, it was not possible in our report to correlate tapeworm infections with the prevalence of ileal impaction. It was apparent from this study that ileal impactions could develop in horses of any age and are not restricted to old horses that commonly have mastication problems.

Ileal impaction is encountered more commonly in the southeastern United States, perhaps because of an association with the feeding of Coastal Bermudagrass hay,²⁴ which is produced from the high-yielding warm season perennial grass grown extensively in the Piedmont and Coastal Plains of the southern United States.^{1,5,9,12,17,25,26} In the western United States where legume hays are the primary source of roughage, ileal impaction rarely occurs.²⁷ Ileal impactions have been reported to occur within 4 weeks of changing the hay ration to Coastal Bermudagrass hay.¹² This grass is typically a stemmy, fine hay that increases markedly in its lignin content and consequently, crude fiber content, as it matures.^{24,26} As the crude fiber content of the hay increases, the dry matter, protein, and energy digestibility decreases.²⁴ The type of soil, amount and type of fertilization, kind of storage and length of time in storage before feeding all affect the digestibility of the hay.^{24,28} Moreover, recent studies have shown that digestion of hemicellulose of Coastal Bermudagrass pastures or Coastal Bermudagrass hay is more efficient in mature horses than in yearlings.^{29,30}

Although a relationship between the feeding of Coastal Bermudagrass hay and ileal impaction has been discounted,^{2,6} others have incriminated it as a predisposing cause of ileal impaction.^{9,12,23,25,26,31} It has been hypothesized that feeding a horse a high-fiber diet with a reduced water intake may induce spasmodic or violent peristaltic waves around an obstructing fiber bolus or mass of feed.²⁶ Intestinal contractions may extrude water from the mass, resulting in a drier, firmer mass.^{9,23} For postoperative management, most horses in this study, had Coastal Bermudagrass hay diluted or eliminated from their diet. Nine horses, however, continued to consume the same amount of Coastal Bermudagrass hay without complications after surgery and experienced no further episodes of abdominal pain. Although ileal impactions are associated with the consumption of

Coastal Bermudagrass hay, other factors (quality of Coastal Bermudagrass hay, decreased water intake or weather change) are probably important factors associated with the disease.²⁶

It is interesting that there was a significantly higher risk for ileal impaction during the Fall of the year (September- November) in this study population. Several possibilities exist for the apparent association between time of year and ileal impaction. There is an increased feeding of cured hays in the southeastern United States during the Fall 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 content) and changes in feeding practices may have altered intestinal motility patterns.^{26,32} Changes in the metabolic activity of the intestinal microflora also can occur with an altered feeding pattern to induce ileal impaction.^{26,32} These alterations may result in impaction colic disorders, especially if associated with decreased water consumption.^{26,32} 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.²⁶

All horses in our study were treated with a combination of IV administered fluids, sedatives, analgesics, or nonsteroidal anti-inflammatory drugs and surgery. Goals of initial management of horses with impaction colic 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.¹³ The most useful indicators for separating surgical from nonsurgical candidates are deteriorating cardiovascular status, the persistence of abdominal pain after nasogastric decompression response to analgesic drugs, and progressive distention of loops of small intestine as evaluated on transrectal exam.^{9,12,13,23} As we have learned more about this disease, we now reserve surgery for those horses with progressive signs of abdominal disease and unrelenting pain. Although 11 of 28 horses had a palpable small intestinal impaction on transrectal exam, surgical intervention was chosen because it has been reported that prognosis for ileal impaction is influenced by the duration of colic before definitive correction.^{5,12,23} We therefore

chose to surgically intervene early in the course of the disease.^{5,12} Poor circulatory function occurs because of dehydration caused by the sequestration of fluid in the small intestine, insensitive fluid loss, and reduced oral intake of fluids.³³ Therefore, early surgical intervention in suspected cases of ileal impaction may decrease mortality and postsurgical complications associated with this disease.

Historically, jejunocecostomy has been performed because it was thought that ileal impaction was associated with ileal dysfunction.^{2,12,27} Ileal bypass was performed to prevent reimpaction. Because of the poor results with this technique and the apparent success of extraluminal breakdown and passage of the ingesta into the cecum, this procedure has been abandoned at our hospital except for those cases in which ileal ischemia or hypertrophy is suspected.^{2,12} Contamination with ingesta at the time of the anastomosis or subsequent leakage at the anastomotic site, serosal trauma, and the presence of foreign material (suture) are the most likely reasons for failure associated with entering the intestinal lumen. Errors in the application of surgical stapling equipment can be a potential cause of anastomotic leakage, peritonitis, adhesions, and death.³⁴

Extraluminal massage of the impaction and passage of ingesta into the cecum should be considered as the desired means of correction during surgery because of the disappointing results associated with bypass procedures.^{2,12} Direct infusion of the impaction with 60 mL of DSS diluted in 1.5 L of saline may soften the obstruction to allow gentle massage to mix and extrude the ingesta through the ileocecal orifice. Excessive manipulation of the small intestine may cause serosal damage and predispose to adhesion formation and was associated with the cause of death in one horse in this report.⁵ Because of the potential for this serious complication, most horses with ileal impactions that undergo surgery at this hospital are now managed by injection of DSS into the bowel lumen. 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.

We concluded there was a significantly higher risk for ileal impaction during the Fall in our study popu-

lation. The surgical method associated with intraluminal injection of DSS or delicate massage and softening with intestinal fluid oral to the impaction and manipulation of the ingesta into the cecum for the management and repair of ileal impaction results in decreased postoperative complications and increased short- and long-term survival compared with previously reported intestinal bypass techniques.^{2,5,12}

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