

Starbuck's Belly Blues

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Introduction:

Ileal impactions are one of the most common causes of colic in the southeastern United States where coastal Bermuda grass hay is one of the most prevalent roughages fed to adult horses.¹ Out of all potential causes of ileal obstructions, ileal impactions account for 12-42%.² Risk factors for the development of ileal impaction include feeding coastal Bermuda grass hay and failure to deworm for the intestinal tapeworm *Anoplocephala perfoliata*. Ileal impactions also occur in other areas of the United States where coastal Bermuda grass hay is not the most common roughage fed; however, since there is such a strong association of feeding coastal Bermuda grass hay and ileal impactions in the southeastern United States, there is a common denominator suspected.

A presumptive diagnosis of an ileal impaction can be made by imaging modalities such as ultrasonography or by rectal palpation. It is important to gain historical information of the patient's diet and daily activities to further support the diagnosis. Definitive diagnosis is made at surgery or on post-mortem examination. Ileal impactions can be treated medically or surgically, depending on the severity of the impaction and the owner's finances.

History and Presentation:

Starbuck a 15-year-old Quarter Horse gelding who presented to MSU-CVM Equine Emergency Service on 10/29/18 for signs of colic. Starbuck was evaluated by his primary veterinarian earlier that afternoon after the owners found him to be suddenly down, rolling, and painful. He was diagnosed with an impaction and was referred to MSU-CVM for further diagnostics and supportive care. Starbuck was a retired barrel horse that was currently being used for trail rides. He was dewormed one month prior to presentation and was up to date on vaccinations and coggins.

On presentation, Starbuck was irritable, vocal, and was covered in mud from aggressive rolling. Starbuck weighed 460 kilograms, had a temperature of 99°F, had a heart rate of 48 beats per minute, and a respiratory rate of 16 breaths per minute. His mucous membranes were pale and his capillary refill time was slightly prolonged indicating dehydration. There were no crackles or wheezes present on pulmonary auscultation, and cardiac auscultation did not reveal underlying murmurs or arrhythmias. He had decreased gastrointestinal sounds over the cecum in the top right abdominal quadrant. Slight digital pulses were present in all four feet. He was given 200 mg of xylazine intravenously for sedation and pain relief and to further evaluate his condition.

Diagnostic Approach:

After Starbuck was adequately sedated, a nasogastric tube was placed and no net reflux was obtained. On ultrasound of the abdomen, the left inguinal area had two distended loops of small intestine with decreased motility and some portions had a thickened wall of ~ 3 mm. The kidney and spleen were visualized adjacent to one another and the nephrosplenic space was clear. The right ventral flank region contained two populations of small intestine. One population was of normal diameter and had good motility, and the second population contained 2-3 mildly dilated loops of small intestine with decreased motility. The small intestinal wall at this site was slightly thickened at 3.2 mm and was slightly edematous. There was no free fluid appreciated within the abdomen.

Starbuck was given 150 mg of xylazine and 6 mls of Buscopan (butylscopolamine) intravenously for rectal palpation. Rectal palpation revealed a mildly dilated and a firm loop of small intestine of cookie dough consistency in the cranial left ventral quadrant. Mildly dilated

fluid-filled loops of small intestine were palpable on caudal ventral midline. The remainder of rectal palpation was unremarkable.

A peripheral venous blood sample was taken for a complete blood count and chemistry panel. The CBC revealed a mildly elevated segmented neutrophil count of 6391/uL (normal range 2500-6000). The chemistry panel revealed a markedly elevated creatinine kinase (CK) of 1866 U/L (normal range 57-283), which was attributed to his aggressive rolling. Based on the ultrasound and rectal examination findings, the top differential diagnosis was an ileal impaction, with a strangulating small intestinal lesion lower on the differential list. Starbuck was hospitalized for medical management and he did not have the option of surgery.

Pathophysiology:

Horses are hindgut fermenters where the forages containing cellulose are utilized by microbes in the cecum and large colon. The evolution of hindgut fermentation likely resulted from grazing the open plains for up to 18 hours per day while constantly moving, and the natural selection for speed as horses ran from predatory animals, where a large gastrointestinal chamber would not hinder running.⁴ The horse is a grazing animal that performs optimally when a slow steady supply of fermentable material is presented to the microflora. High starch diets such as grains should be spread out over three or more feedings to prevent disruption of the microflora. Ileal impaction is a type of simple intestinal obstruction where there is a physical obstruction of feed material in the lumen that does not directly disrupt mesenteric blood flow. The amount of fluid volume entering the digestive tract of a hindgut fermenter is approximately one third of the horse's body weight or one extracellular fluid volume.^{1,4} The obstructed intestine becomes distended because of this large volume of fluid entering the intestinal lumen on a daily basis.

Progressive and marked distention of the small intestine can result in decreased blood flow and necrosis of the tissue if the impaction persists long enough.

Ingested forage has a rapid transient time of approximately 120-180 minutes from the stomach to the small intestines and then into the cecum and large colon. This rapid passage of ingesta through the small intestines requires a large volume of fluid, which is supplied by the organs of the upper gastrointestinal tract. The large volume of fluid and ingesta is harbored in the hindgut, which is folded into the abdomen as a “double horse-shoe configuration.” Ingesta enters the cecum via the ileo-cecal orifice and leaves the cecum by the ceco-colic orifice. The large colon consists of the ascending, transverse, and descending parts. The ascending and transverse colon constitute the large colon and the descending colon constitutes the small colon.⁵ Ingesta then enters into the ventral colon (the lower horse-shoe), which acts as the primary fermentation chamber. The ventral colon is broken into the right ventral colon, sternal flexure, and left ventral colon. The pelvic flexure is a hairpin turn that connects the larger diameter left ventral colon to the smaller diameter left dorsal colon.⁴ The dorsal colon (the upper horse-shoe) is the primary site of water absorption and consists of the left dorsal colon, diaphragmatic flexure, and right dorsal colon. There is another change in diameter from the large right dorsal colon to the smaller diameter transverse colon. The transverse colon empties into the last segment of large intestine, the descending or small colon.

The term impaction refers to an accumulation of dehydrated ingesta in a portion of the gastrointestinal tract. Impactions most commonly occur at areas where the intestinal diameter decreases, such as the pelvic flexure and transverse colon, and at sites that contain sphincters, such as the ileal-cecal-colic orifice.³ Specific pathogenesis for the development of impactions is not completely understood; however, risk factors have been identified for several types of

impactions. Infection with the equine tapeworm, *Anoplocephala perfoliata*, has been shown to be a risk factor for the development of ileal impaction due to the accumulation of mature tapeworms at the ileo-cecal orifice.⁶ Therefore, routine deworming with a praziquantel product at least annual is recommended. Coastal Bermuda grass hay is a finer grass than other grasses, and it is thought that when this grass is harvested for hay an increased fiber level results in fine softer fibers that are improperly chewed.⁴ This results in the fine fibers becoming lodged at the ileo-cecal orifice, which blocks the passage of ingesta. Acid detergent fiber (ADF) and neutral detergent fiber (NDF) are the measurements of plant material in the forage that is difficult for an animal to digest. ADF and NDF are both used to evaluate forage and formulate rations. These two factors on a hay analysis that a horse can withstand is unknown because it depends on the individual horses dentition and their familiarity with coastal Bermuda grass hay.⁴ Horses with poor dentition are predisposed to impactions because they can not adequately chew the forage, which leads to increased fiber length of the ingesta. Horses that are normally on pasture in the spring and summer that graze green grasses then suddenly switched to coastal Bermuda grass hay in the fall when the grass supply depletes are also at risk for the development of ileal impaction.⁷ Careful management practices are essential and should include a slow introduction to coastal Bermuda grass hay to horses that are not accustomed to the forage and feeding a high quality hay, since hay quality is related to digestibility. Feeding a pelleted concentrate feed in addition to forage instead of grain or a grain mix has also been shown to reduce the risk of developing an ileal impaction.² Feeds that are pelleted increase the rate of digesta through the small intestine, which show a possible correlation that transient time could be involved in the formation of an ileal impaction. Inadequate water intake (lack of desire for or access to available

water) when there is an ambient temperature change is also a predisposing factor since there is not enough liquid volume to push ingested forages through the small intestines.

Clinical signs of a horse with an ileal impaction include mild to severe abdominal pain, which is consistent with a small intestinal obstruction. These horses normally produce a significant amount of nasogastric reflux; however, nasogastric reflux may not be evident in the early stages of an impaction or if the impaction has only recently developed.³ It may also take a considerable amount of time for nasogastric reflux to develop since the ileum is the most distal aspect of the small intestine.¹ Rectal examination usually reveals a palpable “dough-like” mass on the right side of the abdomen medial to the cecum, although it is also common to find moderate to severely dilated loops of small intestine that do not allow one to palpate the impaction. Peritoneal fluid analysis can be beneficial in determining the amount of bowel compromise and whether or not a strangulating lesion is present. However, it is possible to find ischemic bowel in both severe or chronic ileal impactions and strangulating lesions.

Abdominocentesis and peritoneal fluid analysis of horses with ileal impactions are typically clear yellow or straw colored, have normal nucleated cell counts ($< 5,000$ cells/ μL), and have a normal to slightly elevated total protein concentration (< 3 gm/dL).^{3,7}

It is possible for ileal impactions to resolve with medical management alone. Horses that present for clinical signs of intestinal obstruction and have normal peritoneal fluid should be treated medically unless pain is uncontrollable or if additional peritoneal fluid analysis indicates intestinal compromise in which surgery becomes necessary.¹ Medical management involves intravenous fluid rehydration, pain control, serial examinations of small intestinal distention and peritoneal fluid sampling, and gastric decompression by nasogastric reflux. Intravenous rehydration should be accomplished by using isotonic fluids, such as LRS or Hartmann’s

solution, at two or three times the maintenance rates (120-180 ml/kg/day).³ Prokinetic agents such as lidocaine and metoclopramide can also be administered as a constant rate infusion to help combat ileus associated with ileal impactions. Successful medical therapy depends on a stable cardiovascular status, adequate pain control, resolution of small intestine distention, and no changes in the peritoneal fluid.³ The prognosis of horses with ileal impactions is good if they are diagnosed and treated early.

Treatment and Management:

After Starbucks initial emergency workup, an IV catheter was placed in his left jugular vein and he was given a 1 L bolus of hypertonic saline followed by a 10 L bolus of LRS. He was started on 1 L of lidocaine infused with 5 L of LRS that was administered as a constant rate infusion (CRI) at 420 ml/hr. Starbuck was refluxed through the night with 2 L of water every two hours and there was no net gain of reflux. 4 L of electrolyte water was also administered through the nasogastric (NG) tube every 4 hours. He became uncomfortable in the early morning hours of 12/30/18 and was sedated with 150 mg of xylazine, which lasted approximately two hours. He was then given an additional 5 mg of detomidine. Starbuck remained sedated for most of the morning in order to keep him comfortable. After he was adequately hydrated with IV fluids, he was started on IV flunixin meglumine at 1.1 mg/kg every 12 hours for pain control. Abdominal ultrasound revealed that the distended loops of small intestine were still present, and some loops showed evidence of sedimentation with a wall thickness of ~ 3 mm. In the early afternoon, Starbuck became restless and attempted to roll, he was administered 5 mg of detomidine and 5 mg of butorphanol. Administration of IV enrofloxacin at 7 mg/kg every 24 hours as a preventative measure in the event that bacterial translocation was to occur. His net reflux for the day was 15 L. He was maintained on IV LRS at a rate of 1 L/hr at 12 am. His heart rate increase

and peaked at 72 beats per minute in the early morning hours, requiring additional sedation with 5 mg of detomidine and 5 mg of butorphanol.

Starbucks physical exam on the morning of 12/31/18 revealed normal gastrointestinal borborygmi in the right quadrants indicating that fluid/ingesta was moving from the ileum into the cecum. Ranitidine was started at 7 mg/kg PO via NG tube every 8 hours as a gastroprotectant. Abdominal ultrasound revealed dilated loops of small intestine with fair motility on the right side but poor motility on the left. Starbuck was brighter for most of the morning until noon, where there was a spontaneous reflux of 4.5 L. At 10 pm, his heart rate elevated into the low 60s, so he was refluxed and there was a gain of 6 L. The total net reflux for the day was 30 L.

Starbuck was much brighter on the morning of 1/1/19, so his NG tube was pulled and he was offered a mixture of Equine Senior and water. His heart rate began to increase into the low 50s in the early afternoon, so the NG tube was replaced and there was a spontaneous reflux of 6 L. Metoclopramide at 50 mls infused in a 5 L bag of LRS and magnesium sulfate at 1 L (500 mls at 3:15 pm and 500 mls at 7 pm) was started as a CRI along with the lidocaine/LRS mixture. Metoclopramide was added for its prokinetic effects and magnesium sulfate was used to stimulate intestinal secretions into the dehydrated ingesta of the impaction site. His LRS fluid rate was also increased to 2 L/hr and his heart rate dropped into the mid 40s. Enrofloxacin was discontinued at this time. After the adjustments were made to his treatment plan, Starbuck appeared to be outwardly comfortable. The next reflux for the day was 22 L.

Starbuck remained bright during the morning of 1/2/19 and he defecated a normal amount of feces during his morning physical exam. His NG tube was pulled at this time and he was offered another mixture of Equine Senior and water. He remained on the CRI of

metoclopramide and lidocaine as well as the LRS fluid rate of 2 L/hr. His mentation remained static until the early afternoon where his heart rate increased into the mid 70s. The NG tube was replaced and there was a net reflux of 10 L. The net reflux for the day was 18 L. Starbuck's LRS fluids ran out at 4 pm and the metoclopramide/lidocaine/LRS infusion ran out at 6 am the following morning (1/3/19).

Starbucks heart rate began to elevate after the fluids were discontinued and he began showing signs of colic around 6:45 am. His heart rate was 84 beats per minute while standing and 72 beats per minute while laying down, and his respiratory rate was 40 breaths per minute while standing and 28 breaths per minute while laying down. His mucous membranes quickly became hyperemic with a prolonged capillary refill time of 3 seconds. No gastrointestinal sounds could be auscultated in any quadrant at this time. He received a 10 L bolus of LRS and was sedated with 100 mg of xylazine to keep him comfortable. He was also started on 500 mls of lidocaine infused in 2.5 L of LRS at a CRI of 400 ml/hr. Starbuck's owners were contacted immediately to determine the next course of action in his treatment.

Case Outcome

Starbuck's ileal impaction appeared to have been successfully passed by 12/31/19 based on resolution of colic signs and resumption of gastrointestinal motility; however, he continued to reflux large volumes of fluid despite additional days of medical management with supportive care. Starbuck quickly became dramatically hypovolemic when not receiving IV fluids. This would lessen the reflux volume but caused tachycardia, which was evidence of poor perfusion. When the fluid therapy resumed, large reflux volumes would persist. Starbuck was humanely euthanized due to failure to resolve ileus and the development of colic signs on the morning of 1/3/19.

Post-mortem examination revealed the distal jejunum to be moderately distended with gas and fluid. Beginning at the ileo-cecal junction moving orally, approximately 3 feet of the ileum was transmurally green to black, moderately dilated, and thickened. There was approximately 2 feet of palpable firm, granular material present in the ileum. The mesentery and vessels associated with the ileum was hyperemic and congested. The necropsy confirmed the clinical diagnosis of ileal impaction in Starbuck.

References

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