The gastrosplenic ligament in horses is a band of omentum that extends from the hilus of the spleen to the left part of the greater curvature of the stomach (Figure 1). It is confluent with the greater omentum, and its blood supply is derived from the gastroepiploic arteries. Herniation through the ligament, although uncommon, has been reported with prevalence rates ranging from 0.3% to 2% in horses. Although the most common segment of the intestine to become incarcerated through the ligament is the small intestine, herniation of the small or large colon has also been reported.

In a recent retrospective study of 300 horses that underwent surgical management of acute abdominal conditions, approximately half of the horses had lesions affecting the small intestine. Strangulating lipomas and epiploic foramen entrapments were the most common small intestinal lesions reported, representing 27% and 10% of cases, respectively. Although the most common segment of the intestine to become incarcerated through the ligament is the small intestine, herniation of the small or large colon has also been reported.

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The purpose of the study reported here was to determine prevalence, clinical findings, and long-term survival rate after surgery associated with incarceration of the small intestine through the gastrosplenic ligament (ISIGL) in horses. We hypothesized that ISIGL is rare but associated with a good survival rate.
Criteria for Selection of Cases

The surgery log of the Hospital for Large Animals at the Cummings School of Veterinary Medicine, Tufts University was reviewed to identify horses that underwent exploratory celiotomy between January 1, 1994, and December 15, 2006. Medical records of all such horses were reviewed, and horses with ISIGL were included in the study.

Procedures

Medical records of all horses that underwent exploratory celiotomy because of colic were obtained, and breed, sex, and age were recorded. For horses with ISIGL, rectal temperature, heart rate, and respiratory rate at the time of hospital evaluation; clinical laboratory values; presence or absence of nasogastric reflux with nasogastric intubation; results of abdominocentesis and fluid analysis; and findings identified through palpation per rectum were also recorded. If abdominal ultrasonography was performed, results were reviewed. Intraoperative data recorded included segment of intestine entrapped (jejunum, ileum, or both), length of intestine resected, surgical procedure performed, and whether the rent in the gastroplenic ligament was left open or surgically closed. Postoperative complications were categorized and recorded as none, diarrhea, ileus, incisional infection, laminitis, or the presence of more than 1 complication. Ileus was defined as the presence of nasogastric reflux without a known mechanical obstruction. Follow-up information was obtained via telephone interviews with the owner, trainer, or referring veterinarian from 17 to 103 months after surgery. Data obtained included current use of the horse and complications that occurred after discharge, including but not limited to recurrence and severity of colic episodes. Long-term survivors were defined as those horses alive at least 1 year after surgery.

Statistical analysis—Data regarding breed, sex, and age of horses with ISIGL were compared with values for the population of horses without ISIGL that underwent exploratory celiotomy during the same period. An independent t test was used to identify differences in age between groups. A Pearson χ² test was used to identify differences in sex between groups. Because of small sample numbers, a Fisher exact test was used to determine differences in breed between groups. Analyses were performed with standard software; a value of P < 0.05 was considered significant for all comparisons. All data are reported as median and range, unless otherwise noted.

Results

A total of 1,084 horses underwent exploratory celiotomy for colic between January 1, 1994, and December 15, 2006. Thirty-two percent (n = 351) were determined to have a small intestinal lesion. Prevalence of ISIGL was 1.5% (16/1,084) of all horses undergoing exploratory celiotomy and 4.6% (16/351) of all horses with primary small intestinal lesions. Following diagnosis of ISIGL, surgery was performed in 14 horses. For the remaining 2 horses with ISIGL, the owners elected euthanasia during surgery because of financial limitations despite the presence of a surgically resectable lesion. Of the 14 horses that had surgical correction, 12 were geldings and 2 were mares. Age of those horses ranged from 8 to 23 years with a median age of 13.5 years. There were 4 Quarter Horses, 3 Thoroughbreds, 2 Paint Horses, 2 Morgans, 1 Warmblood, 1 Paso Fino, and 1 Connemara.

At the time of admission, median heart rate was 52 beats/min (range, 36 to 68 beats/min) and median respiratory rate was 16 breaths/min (range, 10 to 56 breaths/min). Gastric reflux was obtained from only 4 horses, with a median volume of reflux of 3.5 L (range, 1 to 10 L). Median PCV was 38% (range, 30% to 46%), and median total protein concentration was 6.2 g/dL (range, 5.4 to 7.6 g/dL). Peritoneal fluid was obtained via abdominocentesis in 9 horses, and all 9 samples were serosanguineous in color. Total protein concentration was greater than the upper reference limit (2.0 g/dL) in 8 samples, with a median value of 3.2 g/dL (range, 2.6 to 3.6 g/dL). Cytologic analysis was performed on 6 samples, and the total nucleated cell count was greater than the upper reference limit (5,000 cells/µL) in 2 samples (6,100 and 21,600 cells/µL).

Abdominal palpation per rectum was performed in all horses, and in 10 horses, there was palpable distention of the small intestine. In the other 4 horses, distention of the large colon was detected. Transabdominal ultrasonographic evaluation was performed in 11 horses. In 8, small intestine dilation (> 3 cm diameter) was confirmed. In 1 of the 4 horses in which distention of the small intestine was not palpable per rectum, distention was identified during transabdominal ultrasonographic evaluation.

All surgeries were performed by board-certified surgeons or surgical residents. Before surgery, all horses were administered gentamicin (6.6 mg/kg [3 mg/lb], IV, q 24 h). In addition, horses received either potassium penicillin (22,000 U/kg [10,000 U/lb], IV, q 6 h [8 horses]), ampicillin (20 mg/kg [9.1 mg/lb], IV, q 8 h [3 horses]), or cefotiofur (2.2 mg/kg [1 mg/lb], IV, q 12 h [3 horses]). Horses were also administered fluimixin meglumine (1.1 mg/kg [0.5 mg/lb], IV, q 12 h). On the basis of vaccination histories of the horses, tetanus toxoid was not administered.

The segment of incarcerated small intestine identified during exploratory celiotomy was jejunum (n = 8 horses), jejunum and ileum (5), or ileum (1). In all horses, the segment of intestine had passed in a caudal to cranial direction through a rent in the gastroplenic ligament. Gentle traction on the segment of intestine on the caudal side of the ligament was used to reduce the incarceration. All 14 horses required resection and anastomosis of the small intestine, which was performed with routine instrumentation and techniques.11-13 The types of anastomosis performed included stapled side-to-side jejunojejunostomy (6/14 horses), stapled side-to-side jejunoojejunostomy (5), hand-sewn end-to-end jejunoojejunostomy (2), and stapled side-to-side jejunooileostomy (1). Median length of resected small intestine was 2 m (range, 0.3 to 7.6 m). Because of poor accessibility of the defects in the gastroplenic ligament, none of the defects were closed. The defects were only...
enlarged sufficiently to permit reduction of the incarceration, and none of the defects were extended to the free margin of the ligament.

A second exploratory celiotomy was performed in 2 horses because of recurrence of colic signs. In both cases, the horses had signs of abdominal pain, gastric reflux, and dilation of the small intestine as determined via palpation per rectum. In 1 horse that underwent a second surgery 5 days after the initial surgery, the site of the side-to-side jejunojejunostomy had become impacted with ingesta. This site was resected, and a new side-to-side jejunojejunostomy was created. In the second horse, repeat celiotomy was performed 46 days after the initial surgery, after the horse had initially been discharged. Adhesions between the jejunum and the site of the side-to-side jejunooileostomy were identified and manually broken down.

In the 14 horses that recovered from anesthesia, postoperative complications included ileus (3 horses), incisional infection (4), diarrhea (3), and laminitis (1). An incisional hernia occurred subsequent to infection in 1 horse that was 10 months pregnant at the time of surgery. Median duration of ileus was 4 days (range, 1 to 5 days). Horses with ileus were treated via repeated nasogastric decompression, IV administration of fluids to maintain hydration, and administration of prokinetic agents.

After surgery, horses continued to receive antimicrobials IV and analgesics IV as described. Horses received fluids (120 mL/kg/d [54.5 mL/lb/d], IV), with administration rate gradually tapered off over several days as food and water were reintroduced. Except in 1 case, horses with signs of ileus were treated with prokinetic agents either singly or in combination. These included constant rate infusion of lidocaine (loading dose of 1.3 mg/kg [0.59 mg/lb], IV, with maintenance dose of 0.05 mg/kg/min [0.022 mg/lb/min] for 1 horse) or lidocaine in combination with erythromycin (2 mg/kg [0.9 mg/lb], IV, q 6 h [3 horses]). In addition, 8 horses were treated with heparin (40 U/kg [18.2 U/lb], SC, q 12 h) to reduce the risk of adhesions.

Of the 14 patients that recovered from anesthesia, 13 were discharged from the hospital a median of 13 days after surgery (range, 5 to 30 days). In the horse that did not survive until the time of discharge, feeding following surgery was not tolerated. A second celiotomy was not an option, and at necropsy, stricture at the hand-sewn end-to-end jejunojejunostomy anastomotic site was seen.

Overall, of the 14 horses treated surgically, 13 survived until the time of discharge. Subsequently, one of the horses was lost to follow-up, and one was euthanized for colic 21 days after hospital discharge (no necropsy was performed). There were 11 confirmed long-term survivors, giving a long-term survival rate of 11 of 14.

There were no significant differences between breed or age of horses with ISIGL and those of the population that underwent exploratory celiotomy. Geldings were at increased risk (P = 0.029) for ISIGL.

**Discussion**

In horses, ISIGL is an uncommon finding. In the present study, ISIGL was diagnosed in only 1.5% of horses that underwent exploratory celiotomy and accounted for only 4.6% of the horses with small intestinal lesions. Although only the small intestine was incarcerated in the gastroplenic ligament in this study, involvement of the large colon and small colon has been previously reported.8,7 Geldings were significantly more likely than mares to develop ISIGL in the study reported here. Mariën and Steenhaut9 previously reported that 4 of 5 affected horses were Warmblood geldings, yet Warmbloods represented only 50% of the horses undergoing exploratory celiotomy and geldings represented only 20.5% of the horses with colic. In the present study, no breed predilection was identified.

The cause of a rent in the gastroplenic ligament is unknown. Defects may be congenital or traumatic in origin. In other species, including humans, incarceration of intestine in the gastroplenic ligament has not been reported. Although no traumatic events were seen by the owners prior to referral, such an event could not be ruled out.

Unfortunately, no consistent or unique findings of the initial examination were identified that would allow ISIGL to be differentiated from other surgical lesions of the small intestine. The availability of a definitive diagnosis would not change treatment because all horses in which ISIGL was identified required surgical management.8,9

During the initial evaluation, nasogastric reflux after nasogastric decompression was detected in <30% of horses, a value inconsistent with typical small intestinal strangulating lesions. This may reflect a short duration of intestinal incarceration, the hydration status of the horses, recent gastric decompression prior to referral, or the presence of a lesion involving the distal aspect of the small intestine that might cause delay in accumulation of gastric fluid.

The long-term survival rate of horses with ISIGL was 11 of 14. This was slightly greater than that recently reported for horses with small intestinal strangulation caused by mesenteric rents, epiploic foramen entrapment, and mixed lesions that required small intestinal resection and anastomosis, for which long-term survival rates of 40%, 70%, and 56%, respectively, were reported.14,16

In the horses reported here, no attempt was made to surgically repair the defect in the gastroplenic ligament because of its inaccessibility in the dorsally recumbent horses. In this small population, failure to close the defect or extend the defect to the free margin of the ligament was not associated with long-term outcome. Reinarceration of small intestine through the gastroplenic ligament after initial surgical management has not been reported. In horses with other types of small intestinal incarceration, such as epiploic foramen entrapment, reincarceration of the intestine has been detected after surgery.15 Laparoscopic visualization of the gastroplenic ligament has been reported in standing horses; therefore, subsequent repair of the defect may be possible.17 Alternatively, if possible, the defect in the gastroplenic ligament may be extended to the nearest free margin to eliminate the potential for reincarceration, as has been reported by Mariën and Steenhaut.9 Results of the present study suggest a fair to good long-term prognosis for horses that undergo surgical treatment of ISIGL.
References