Recurrence of renosplenic entrapment after renosplenic space ablation in a seven-year-old stallion

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Case Description—A 7-year-old mixed-breed stallion was admitted because of colic.

Clinical Findings—Entrapment of the left colon in the renosplenic space was diagnosed via rectal palpation and ultrasonographic examination, despite a renosplenic space ablation 6.5 years earlier.

Treatment and Outcome—The renosplenic entrapment was corrected with a combination of phenylephrine administration, rolling, and ballottement of the horse’s abdomen during general anesthesia. The following week, left flank laparoscopic renosplenic space ablation was performed with the horse standing. On examination of the previous surgical site, only 4 bands of fibrous adhesion remained of the original space ablation. The renosplenic space was again closed by suturing the perirenal fascia and renosplenic ligament to the splenic capsule. The horse was discharged from the hospital and recovered at home. No complications or recurrence of entrapment was reported following the procedure.

Clinical Relevance—There have been no previous reports of recurrence of renosplenic entrapment following procedures to permanently ablate the renosplenic space. Recurrence in this patient may be attributed to the horse’s young age at the time of initial surgery or inadequate size or spacing of the sutures through the perirenal fascia and splenic capsule. (J Am Vet Med Assoc 2011;239:504–507)
exploratory surgery performed, the abdomen was desulfated. The splenic capsule was sutured to the visceral peritoneum overlying the left kidney by use of 0 polyglyconate in a continuous pattern. The ablation site was evaluated prior to closure. The muscle layers were closed in the large cannula incision with 0 polyglyconate in 2 layers of simple continuous sutures. The skin was closed with 2-0 nylon monofilament suture in a cruciate pattern for the small portal sites; a continuous pattern was used for the large portal site. Following the procedure, the horse was administered flunixin meglumine (1.1 mg/kg, IV, once). It was discharged, and the owners were instructed to administer phenylbutazone tablets (1.8 mg/kg [0.8 mg/lb], PO) every 12 hours for 5 days with a recommendation to keep the horse confined in a box stall until suture removal. The horse was reported to recover well at home.

Nearly 7 years after the renosplenic space ablation, in October of 2009, the horse was now 7 years of age with a body weight of 554.5 kg (1,220.0 lb) and was again referred to the veterinary teaching hospital with signs of colic including inappetence, decreased defecation, and attempting to roll. The referring veterinarian performed rectal palpation of the horse and diagnosed a renosplenic entrapment of the left colon. The horse was administered flunixin meglumine (1.1 mg/kg, IV), buscopan (0.17 mg/kg [0.077 mg/lb], IV), sedatives (xylazine, 0.3 mg/kg [0.14 mg/lb], IV; butorphanol tartrate, 0.01 mg/kg [0.005 mg/lb], IV; and acepromazine maleate, 0.2 mg/kg [0.09 mg/lb], IV), and ephedrine (20 mg in 60 mL of saline [0.9% NaCl] solution, over 5 minutes IV), but the displacement did not resolve. The horse was referred to the Veterinary Teaching Hospital and, upon admission, was sweating and shaking and appeared uncomfortable. Abdominal ultrasound by use of a 5.0-MHz probe revealed a ventrally deviated spleen with rounded edges and a lack of visualization of the left kidney. On rectal palpation, the large colon was identified as lying dorsolateral to the spleen and the presence of an impacted right dorsal colon was detected. The left kidney and renosplenic ligament could not be palpated. Abdominocentesis was performed, and the sample was of normal color with total protein concentration < 2 mg/dL (reference range, 0.0 to 2.5 g/dL). On the basis of rectal palpation and ultrasound findings, a diagnosis of renosplenic entrapment was made. The horse was initially administered a 5-L bolus of polyionic electrolyte fluids IV followed by 5 mg of phenylephrine (0.009 mg/kg [0.004 mg/lb]) in 1 L of a polyionic electrolyte solution via a jugular catheter. It was moved into an induction stall; the horse was premedicated with xylazine (0.8 mg/kg [0.36 mg/lb]), and general anesthesia was induced by use of ketamine (2.2 mg/kg [1 mg/lb]) and diazepam (0.1 mg/kg [0.05 mg/lb]). General anesthesia was maintained with 1 g of ketamine and 500 mg of xylazine in 1 L of 5% guaifenesin administered IV to effect. Following induction of anesthesia, the horse was placed in right lateral recumbency and hobbles were applied to its hind limbs. A hoist was used to raise the horse's hind end off the ground and position the horse in dorsal recumbency. The abdomen was then ballotted in an attempt to dislodge the left dorsal colon from the renosplenic space. After ballottment was complete, the horse was rolled another 90° and positioned in left lateral recumbency for recovery. Once the horse had recovered from anesthesia, the left abdominal and retroperitoneal regions were re-examined via ultrasound and a rectal examination was again performed. On the basis of the examination findings, the entrapment was believed to have been resolved and the horse was returned to its stall at the Veterinary Teaching Hospital. A polyionic electrolyte solution containing 400 mg of magnesium sulfate/L and 20 mEq of potassium chloride/L was then administered IV via the jugular catheter. Additionally, the horse was administered 4 L of mineral oil through a nasogastric tube. The tube was left in place, and 5 L of oral fluids with electrolytes was given every 2 hours for a total of 15 L. The horse passed multiple piles of normal feces overnight, and on rectal palpation the following morning, the right colon impaction was no longer palpable. The horse was subsequently discharged and recovered uneventfully at home.

Approximately 2.5 weeks later, the owners elected to have the abdomen explored laparoscopically and the renosplenic space ablation repeated as necessary. The stallion was readmitted to the hospital, and food was withheld for 24 hours prior to the surgery. A jugular vein catheter was placed, and the horse was administered gentamicin (6.6 mg/kg, IV) and procaine penicillin G (22,000 U/kg, IM) prior to surgery. The horse was placed in stocks, sedated with 5 mg of detomidine hydrochloride and 5 mg of butorphanol IV, and administered 1-L of saline solution containing 20 mg of detomidine as a continuous infusion IV to maintain a desired state of sedation. Laparoscopy was performed as described by Farstvedt and Hendrickson and differed from the first ablation procedure in that portal 3 served as the large bore cannula site and portals 1 and 2 were used as the laparoscope and instrument portals. On examination with the laparoscope, adhesions between the splenic capsule and the perirenal fascia were observed to be incomplete. Rather than the sheet of adhesion expected (Figure 1), all that remained of the fibrous tissue were 4...
bands between the splenic capsule and the visceral peritoneum of the kidney (Figure 2). The renosplenic space ablation was repeated by use of size 0 polyglyconate in a simple continuous pattern, incorporating the bands of fibrous tissue from the first surgery into the closure. The skin in all 3 portals was closed with size 0 polyglyconate in a simple continuous pattern. The skin in all 3 portals was closed with size 0 polyglyconate in a simple continuous pattern, incorporating the bands of fibrous tissue from the first surgery into the closure. The skin in all 3 portals was closed with size 0 polyglyconate in a simple continuous pattern, incorporating the bands of fibrous tissue from the first surgery into the closure. The skin in all 3 portals was closed with size 0 polyglyconate in a simple continuous pattern, incorporating the bands of fibrous tissue from the first surgery into the closure.

The diagnosis of renosplenic entrapment is often made solely on the basis of combined findings on rectal palpation and abdominal ultrasound. Although rectal palpation is a somewhat nonspecific diagnostic tool and confirmation of renosplenic entrapment could be made via laparoscopy or exploratory laparotomy, the authors were confident that entrapment was the most likely cause of the initial recurrent episode of colic in this patient. Renosplenic entrapments have been reported to comprise between 2.9% and 6% of cases of colic in horses, and the incidence of recurrence has been found to be between 3.2% and 21%. Survival rates after left dorsal displacement of the colon are reported to be as high as 93%, but for horses with a history of recurrence, the cost of repeated correction, the lost training time, and the potential for complications following surgery can be considerable obstacles for many owners. Thus, surgical intervention may be a viable option for management of patients with recurrence. Several techniques exist to permanently prevent renosplenic entrapment, including colopexy, colon resection, and ablation of the renosplenic space. These can be accomplished either laparoscopically through the left flank in standing animals (with or without hand assistance) or through a celiotomy with the horse in right lateral recumbency under general anesthesia. Each technique presents its own unique advantages and disadvantages, but all serve to create permanent ablation of the renosplenic space, preventing recurrence. To our knowledge, this is the first documented instance of renosplenic entrapment following surgery to obliterate the renosplenic space.

It is suspected that the shape and depth of the renosplenic space vary among horses, with deep clefts predisposing some to recurrent entrapments and narrow shelves reducing this likelihood. Additionally, it has been reported that the morphology of the renosplenic space may change as an animal ages. The horse in the present report was 7 months old at the time of the initial ablation surgery, and it is of note that renosplenic ablations are not commonly performed on animals of such a young age. In this case, the treating clinicians thought that renosplenic entrapment at such a young age might have indicated a predisposition to future entrapments and thus elected, with the owner’s consent, to perform the ablation on the weanling. It is unknown whether the young age of this colt may have contributed to the failure of the ablation. Previous studies have only included horses ≥3 years of age. It is possible that as this colt continued to grow, the ablation became stretched or the shape of the renosplenic space changed naturally with growth, either of which may have created space for potential entrapment. Further research may be warranted to determine whether suture closure of the renosplenic space should be postponed in young, growing horses.

Previous reports detailing necessary size requirements and spacing for suture bites through the splenic capsule and perirenal fascia are limited. Mariën et al suggested bite sizes of at least 1.5 cm narrowly spaced 1 to 2 cm apart to reduce tension across the suture line and prevent tearing of the splenic capsule. In the patient in the present report, it is possible that the bite sizes used in the initial procedure in 2002 were too small in depth, spaced too far apart, or a combination of both, resulting in failure of most of the suture line over time.

Recently, Epstein and Parente described the laparoscopic placement of a nonabsorbable mesh to obliterate some to recurrent entrapments and narrow shelves reducing this likelihood. Additionally, it has been reported that the morphology of the renosplenic space may change as an animal ages. The horse in the present report was 7 months old at the time of the initial ablation surgery, and it is of note that renosplenic ablations are not commonly performed on animals of such a young age. In this case, the treating clinicians thought that renosplenic entrapment at such a young age might have indicated a predisposition to future entrapments and thus elected, with the owner’s consent, to perform the ablation on the weanling. It is unknown whether the young age of this colt may have contributed to the failure of the ablation. Previous studies have only included horses ≥3 years of age. It is possible that as this colt continued to grow, the ablation became stretched or the shape of the renosplenic space changed naturally with growth, either of which may have created space for potential entrapment. Further research may be warranted to determine whether suture closure of the renosplenic space should be postponed in young, growing horses.
erate the renosplenic space, an alternative to the previously described suture closure.\textsuperscript{1,2,9} The authors postulated that advantages may include less requirement for surgical expertise and less potential for tearing of the splenic capsule under tension of the sutures. In that study,\textsuperscript{8} 5 horses underwent 2 laparoscopic procedures: the first to place the mesh and the second, 4 weeks later, to determine healing and evaluate the renosplenic space. All horses were subsequently euthanatized, and measurements of the implants and renosplenic space were taken at necropsy. It was found that although the procedure subjectively took a longer amount of time to complete than would a traditional laparoscopic suture closure method, closure of the renosplenic space with fibrous tissue was complete in all 5 horses. Problems encountered\textsuperscript{8} included difficulty introducing larger-sized pieces of mesh for horses with large spaces, and in 1 horse, a mesenteric adhesion to the mesh was noted. Although the finding of an adhesion is disconcerting, few animals that have undergone laparoscopic renosplenic space ablation have had documented reevaluation,\textsuperscript{4,8,9} making it possible that adhesions have gone undetected with traditional suture closure methods. Polypropylene mesh may serve as a larger scaffold for fibrous tissue and offers more complete coverage of the renosplenic space than the traditional suture closure method. It may be more useful in younger animals, as larger pieces of mesh could be used to offset potential growth of the animal and widening of the space.

Until now, laparoscopic renosplenic space ablation was thought to be 1 method of permanently preventing entrapment of the large colon. However, the horse in this report has shown that this procedure may not always provide a lasting solution. Laparoscopic ablation is an efficient, minimally invasive procedure with decreased risk during anesthesia to the patient, reduced cost to the owner, and quick recovery times, compared with celiotomy performed in dorsal recumbency. However, placing sutures more closely together or use of a mesh may be necessary to prevent gapping and inadequate renosplenic space ablation in a young horse.

\begin{enumerate}
\item a. Normosol R, Abbott Laboratories, Abbott Park, Ill.
\item b. Vicryl, Ethicon Inc, Somerville, NJ.
\item c. Maxon, Ethicon Inc, Somerville, NJ.
\item d. Plasma-lyte A, Baxter Healthcare, Deerfield, Ill.
\item e. Dermalon, Ethicon Inc, Somerville, NJ.
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\section*{References}
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\item Parker MK, Rodgerson DH. Hand-assisted laparoscopic approach to ablation of the nephrosplenic space in standing horses: four cases. In: Proceedings. 53rd Annu Conv Am Assoc Equine Pract 2007;442–444.
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