A 545-kg (1,200-lb) 8-year-old Thoroughbred multiparous broodmare was admitted to the George D. Widener Hospital of the University of Pennsylvania for evaluation of a rectal tear sustained during parturition.

Clinical Findings—On initial evaluation, the mare had mild signs of abdominal discomfort. A full-thickness rectal tear located 30 cm cranial to the anus and extending approximately 15 cm longitudinally along the surface of the small colon between the 4 and 6 o’clock positions, when viewed from behind, was diagnosed on examination per rectum.

Treatment and Outcome—Laparoscopic evaluation of the abdomen was performed to assess the tear and extent of peritoneal contamination. A hand-assisted repair via a flank incision was performed. The tear was closed in a single-layer, simple continuous pattern with size-0 polydioxanone with a handheld needle holder. Subsequently, a ventral midline celiotomy was performed, and intestinal contents were evacuated via a pelvic flexure enterotomy and a typhlotomy. Following surgery, the mare was managed with IV fluid therapy, partial parenteral nutrition, antimicrobials, and NSAIDs for 5 to 7 days before being gradually reintroduced to a complete pelleted feed and alfalfa hay. Prior to discharge, examination per rectum revealed no stricture formation associated with repair. The mare was discharged from the hospital and performed successfully as a broodmare, with the delivery of a live foal 1 year after surgery.

Clinical Relevance—Successful repair with an excellent outcome was achieved in this mare. Hand-assisted laparoscopic repair should be considered as a possible treatment option in horses with grade IV rectal tears. (J Am Vet Med Assoc 2014;245:816–820)
0.05 mg/kg/min (0.023 mg/lb/min, IV) combined with butorphanol tartrate (0.025 mg/kg [0.011 mg/lb], IV) administered to effect. Hair was clipped from the right side of the abdomen from the 16th rib to 10 cm caudal to the tuber coxae and from the dorsal midline to the ventral aspect of the flank, and the skin was aseptically prepared for surgery. Intended portal and towel clamp sites were infiltrated with 2% mepivicaine hydrochloride (5 to 10 mL/site). A sterile drape was placed, and a 2-cm skin incision was made through the skin and external abdominal oblique fascia in the right paralumbar fossa extending approximately 15 cm orad (Figure 1). Standard laparoscopic instruments (36 cm) could not easily reach the tear from the flank, and a decision was made to perform a hand-assisted repair via a flank approach. The intended incision site was infiltrated with 2% mepivicaine hydrochloride (40 mL), and an oblique 10-cm skin incision was made 3 cm ventral and parallel to the crus of the internal abdominal oblique muscle and was sharply continued through all muscle layers into the peritoneal cavity except the internal oblique, which was bluntly separated along its fibers. The rectal tampon was removed, and an assistant surgeon placed an arm per rectum to assist in stabilizing the small colon for repair. The primary surgeon inserted an arm into the abdomen via the flank incision, and the tear was repaired in a single-layer, simple continuous pattern that included the submucosa but did not penetrate the mucosa with size-0 polydioxanone (Figure 2) on a CT taper needle with a handheld 18-cm Mayo-Hegar needle holder. Additional stabilization of the small colon was required during closure; subsequently, 2 stay sutures were placed with size-0 polydioxanone approximately at the midpoint of the tear. One stay suture was placed at the dorsal aspect of the tear and the other ventrally, and both were tagged with Kelly hemostatic forces. The distal suture pattern were hand tied inside the abdomen, and brief exploration was performed to assess the tear, the extent of peritoneal contamination, and any evidence of mesenteric disruption. Minimal fecal contamination was noted, and some intestinal motility was present. The tear was visualized at the junction of the retroperitoneal reflection and the small colon extending approximately 15 cm orad (Figure 1). The primary surgeon inserted an arm per rectum to assist in stabilizing the small colon for repair. The primary surgeon inserted an arm into the abdomen via the flank incision, and the tear was repaired in a single-layer, simple continuous pattern that included the submucosa but did not penetrate the mucosa with size-0 polydioxanone (Figure 2) on a CT taper needle with a handheld 18-cm Mayo-Hegar needle holder. 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polydioxanone in a simple continuous pattern with a Cushing oversew. The abdomen was lavaged with 20 L of sterile saline oversew. The abdomen was lavaged with 20 L of sterile saline (0.9% NaCl) solution and infused with carbamazepine cellulose, potassium penicillin (20 million U), and gentamicin sulfate (1 g). A 32F abdominal drain was placed in the left paramedian abdomen and secured in place with No. 0 polypropylene followed by the subcutaneous tissue in a subcuticular pattern with 2-0 polyglyactin 910 and the skin was apposed with stainless steel staples. An iodine-impregnated adhesive bandage was placed for recovery. After surgery, the foal was not returned to the mare to decrease the energy demand associated with lactation. The mare was maintained on IV fluid therapy of isotonic crystalloids at 4 mL/kg/h supplemented with potassium chloride (20 mEq/L) and calcium borogluconate (25 mL/L). Enteral fluid therapy (6 L bolus) was administered every 6 hours via nasogastric tube. Antimicrobial treatment consisted of potassium penicillin (22,000 U/kg, IV, q 6 h), gentamicin sulfate (8.8 mg/kg, IV, q 24 h), and metronidazole (25 mg/kg [11 mg/lb], PO, q 8 h). Flunixin meglumine (1.1 mg/kg, IV, q 12 h) and polymyxin B (4,000 IU/kg, IV, q 8 h) were administered, and abdominal lavage via the abdominal drain was performed every 12 hours with 10 L of isotonic fluids. After each lavage, the Heimlich valve was replaced on the end of the drain to allow continued egress of abdominal fluid by gravity flow. The mare’s rectum was manually evacuated every 3 hours for the initial 36 hours after surgery. The patient was held off feed to allow for healing of the tear without challenge from fecal material and placed on partial parenteral nutrition with dextrose (5 g/kg/d [2.3 g/lb/d]) and amino acids (1 g/kg/d [0.45 g/lb/d]) at 0.25 mL/kg/h (0.11 mL/lb/h) to provide caloric supplementation and prevent a catabolic state. In the first 24 hours after surgery, the mare remained mildly tachycardic with a heart rate of 52 to 60 beats/min and had bright pink mucous membranes. Serum PCV, total solids concentration, and plasma lactate concentration were monitored every 6 hours and remained within reference limits. The patient was initially febrile with rectal temperature from 38.6° to 39.6°C (101.6° to 103.4°F) but this returned to normal range within 36 hours after surgery. Over the course of the following 3 days, the mare had normal vital parameters, with increased borborygmi and fecal production. The abdominal drain was removed on day 3, and the patient was slowly reintroduced to food with handfuls of alfalfa leaves, fresh grass, and small amounts of a complete pelleted feed every 4 hours. At day 7 after surgery, IV administration of antimicrobials was discontinued, and the mare was transitioned to chloramphenicol (50 mg/kg [23 mg/lb], PO, q 6 h). The patient was placed on a tapering dose of flunixin meglumine (0.5 mg/kg [0.23 mg/lb], PO, q 12 h) that was discontinued on day 9. Intravenous fluid therapy and partial parenteral nutrition were discontinued on day 7, and feeding was increased gradually until the mare was eating 8 lb of soaked pelleted feed and free-choice alfalfa by day 9 after surgery. The mare continued to appear comfortable, with normal vital parameters and normal fecal production at the time of discharge. Abdominal palpation per rectum was performed, and no obvious stricture formation could be palpated. The patient was discharged with instructions for 30 days of stall rest, followed by 30 days of turnout in a small paddock before transitioning to 30 days in a larger paddock. Chloramphenicol administration was to be continued for an additional 7 days after discharge. One year after surgery, the mare had been sold to a breeding facility and had successfully delivered a live foal without complications.

**Discussion**

Rectal tears in horses are most commonly a direct result of iatrogenic trauma associated with palpation per rectum for evaluation of the reproductive or gastrointestinal tract. Several less common etiologies include dystocia, parturition, misdirected breeding, enema administration in foals, thromboembolism, and impaction at the site of a stricture. Prognosis is generally dependent on the grade and location of the tear, in conjunction with the time between occurrence and treatment. Classification of the tear is based on the tissue layer disrupted, with a grade IV tear being associated with disruption of all layers and extension into the peritoneal cavity. Grade I and II tears rarely require surgical treatment and have been successfully managed with a combination of antimicrobial treatment and dietary changes. Grade III tears usually require surgery; however, there have been several reports of successful medical management with a combination of rectal packing and manual evacuation of the rectum, with reported survival rates ranging from 75% to 100%. Grade IV tears require surgical management. Treatment may be direct repair, fecal diversion techniques, or a combination of the 2. Direct repair has been performed by suturing of the defect with or without prolapsing the rectum closure with staples after prolapsing the rectum and direct suture closure through an antimesenteric enterotomy after ventral midline celiotomy. Fecal diversion can be achieved by placement of a temporary indwelling rectal liner or by performing a loop colostomy and is often performed in conjunction with direct repair. Survival rates for grade IV tears are generally low and range from 0% to 66%, with most affected animals euthanized without repair because of massive fecal contamination of the peritoneal cavity. Reported survival rates for treated animals range between 11% and 66%. An experimental study of the use of laparoscopic repair of rectal tears in anesthetized horses evaluated bursting strength of the repair for a direct suture pattern, an automatic suturing device, and a hernia staple. The direct suture pattern was a single-layer continuous inverting suture pattern with 50-cm-long laparoscopic needle holders and was compared with a 36-cm-long, 10-mm-diameter automatic suturing device and a 10-mm-diameter hernia staple that uses single 4-8-mm staples. The results of that study suggested that the single-layer, continuous inverting suture pattern yielded adequate bursting strength in colonic specimens after 7 days of healing; however, a secure closure was not achieved with a linear stapling device because of insufficient staple length and decreased accuracy of closure.
compared with direct suturing. The automatic suturing device was also found to be unsuitable owing to a decreased accuracy of suturing and an increased amount of intraluminal suture present, compared with the direct suture pattern.

Grade IV rectal tears have a guarded to poor prognosis because of rapid peritoneal contamination with fecal material and subsequent development of septic peritonitis and endotoxemia. There is a common consensus that early referral combined with aggressive initial management has been associated with a better prognosis. \(^2,^4,^5\) In the patient described in the present report, rapid referral and appropriate initial treatment by the referring veterinarian limited peritoneal contamination and improved the mare’s initial prognosis. The close proximity to the hospital (brought to the hospital within 2 hours after injury) also facilitated rapid surgical repair and abdominal lavage. The caudal epidural anesthesia performed by the referring veterinarian limited straining, and placement of a purse-string suture \(^5\) in the anus limited further intestinal prolapse. Additional emergency management that could have been used in this case would have been placement of a rectal tampon to decrease expansion of the tear and decrease risk of peritoneal contamination. \(^2,^3,^9\) However, packing the rectum is not without risk because the tear may still expand if the horse continues to strain and there is a possibility of losing the packing within the abdomen.

The decision to perform a hand-assisted laparoscopic repair was made intraoperatively with this patient for several reasons. Commercially available laparoscopic instruments are not of sufficient length to reach the most caudal region of the abdomen in adult horses and could not have been used successfully for this patient. In a previous experimental study, \(^20\) in which rectal tears were successfully repaired laparoscopically, custom instruments of 50 cm in length were used. The tear in this patient could be manipulated and sutured manually through the flank incision by the surgeon with his dominant (right) hand while facing caudally and without the need for specialized surgical instruments. Because the tear was located slightly toward the right side, it was more accessible via a right flank approach.

A considerable advantage of use of the laparoscope to aid visualization of the repair includes an initial cursory visual assessment of the peritoneal cavity for evidence of fecal contamination and mesenteric damage in standing horses \(^21\) that would likely impact subsequent decisions made about pursuing general anesthesia, surgical repair, or euthanasia. Laparoscopy is a cost-effective method to acquire valuable information regarding placing a horse under general anesthesia or performing standing repair in a horse with a grave prognosis because of severe peritoneal contamination or vascular damage to the bowel. It could be argued that abdominocentesis would offer the same information; however, the values may be difficult to interpret if massive fecal contamination is not evident, and abdominocentesis also does not allow assessment of size of the tear and feasibility of repair. If the rectal tissue is friable and appears grossly edematous, the decision to combine direct repair with a fecal diversion technique can also be made.

Both signalment and tear location are factors that affect the choice of surgical approach. Rectal tears are reportedly more common in young horses and males, \(^3,^8\) with a breed predilection in Arabians, \(^2,^8\) and tears are usually located in a dorsolateral or ventral location. \(^3,^5,^8\) Presumably because of the anatomic narrowing and ventral direction of the rectum at this level. In the mare of the present report, the tear was most likely attributable to the foal’s foot causing trauma to the rectum and small colon during the rapid expulsion of the foal. In postparturient mares, standing repair of the tear by prolapsing the rectum is reportedly a relatively simple and quick technique with moderate success rates (71%) achieved either by stapling (1/1 survival) \(^14\) or by staples oversewn with suture (4/6 survival). \(^13\) Stapling was used for successful repair of a grade IV tear in 1 mare; however, the authors \(^16\) cautioned that cases should be carefully selected, and in a more recent report \(^15\) of 6 mares with grade IV tears repaired with staples oversewn with sutures, 4 patients survived and subsequently became pregnant. It is postulated that postparturient mares have increased laxity of perirectal tissues. \(^13\) This, combined with incising the anal sphincter, improves the ease of rectal prolapse, and tears can subsequently be easily visualized and repaired. \(^14\) Rectal surgery in horses is compromised by a lack of exposure, yet the pneumoperitoneum resulting from a full-thickness tear reportedly facilitates tear exposure and provides increased space to work \(^13\); however, blind suturing may be impossible in patients with a cranially located full-thickness tear. Our hospital is not located in a region with a large population of broodmares. Our patient population includes Arabians and more commonly younger horses. As such, the management of horses with rectal tears referred to our hospital has evolved away from the technique more commonly used in broodmares with prolapse of the rectum. \(^14,^15\) We suggest that the patients we typically treat (eg, younger horses and Arabians) may be at greater risk for mesenteric injury and vascular damage because of less tissue laxity. These considerations led to investigation of alternate techniques, and currently, the blind suture technique is more commonly used as for the patient described in the present report. Because this requires the surgeon to manipulate the needleholder and suture 1-handed in the rectum, some surgeons may be limited in their ability to use this technique, depending on their stature and the size of the patient.

Rectal tear lengths have been reported \(^1\) to range from 4 to 60 cm, and it is possible that even by prolapsing the rectum in these cases, the tear would be inaccessible. Access to the tears with a ventral midline celiotomy is extremely limited. Although successful repair has been reported, \(^4,^16\) a tear located at the junction of the peritoneal reflection as seen in the present case may have been impossible to repair with previously described techniques. With the hand-assisted laparoscopic technique, the tear was fully exposed, access to the dorsal and ventral aspects of the rectum was easily achieved, and there was excellent visibility during suturing. Manipulation was aided by having an assistant surgeon place a hand per rectum and the use of stay sutures. For these reasons, combined with the ability to
make an initial assessment of the abdomen, the hand-assisted laparoscopic technique may have advantages over direct repair as previously reported.

Disadvantages of this technique include the initial cost of the equipment and operator skill. For experienced, board-certified surgeons, we suggest that suturing intra-abdominally with 1 hand does not require additional specialized training or experience. An experienced surgeon with good manual dexterity should be able to perform this procedure, with the aid of an assist surgeon as described. It should also be emphasized that the visual assessment of the abdomen is cursory and that not all aspects of the abdomen can be directly visualized. In this patient, subsequent ventral midline laparotomy under general anesthesia for abdominal lavage and evacuation of the colon contents to minimize surgical stress on the surgical repair were indicated. Hague et al reported that even in the presence of serosal trauma, standing postoperative lavage decreased the number of adhesions formed, and lavage with 10 L of fluid was sufficient to bathe most intestinal serosal surfaces. Adhesion formation was of considerable concern in the present case because of serosal inflammation associated with contamination. The use of carboxymethylcellulose has been advocated because it provides a silicizing effect that decreases contact between serosal fluids and therefore should decrease the risk of adhesions. With this patient, it was decided that the risk of carboxymethylcellulose propagating a septic peritonitis was minimal and outweighed by the advantage of minimizing the risk of adhesion development.

This case report describes the treatment and clinical progression of a broodmare surgically treated for a grade IV rectal tear with a hand-assisted laparoscopic technique. Previously reported surgical treatment options include either direct repair with suture or stapling devices combined with fecal diversion techniques. Laparoscopic repair has been evaluated in an experimental study; however, to our knowledge, there are no reports of successful laparoscopic repair of a grade IV rectal tear in a clinical case. The present report highlights the advantages of use of a hand-assisted laparoscopic surgical repair of a grade IV rectal tear. Successful repair with an excellent outcome was achieved in this mare. This technique should be considered as a treatment option in horses with grade IV tears.

References