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Jejunal strangulation and incarceration associated with bilateral perineal hernias in a neutered male dog

Ashley E. Iodence, DVM[1]; Michael Perlini, DVM[2]; Janet A. Grimes, DVM, MS[1]*

[1]Department of Small Animal Medicine and Surgery, College of Veterinary Medicine, University of Georgia, Athens, GA
[2]Department of Veterinary Biosciences and Diagnostic Imaging, College of Veterinary Medicine, University of Georgia, Athens, GA

*Corresponding author: Dr. Grimes (jgrimes@uga.edu)

CASE DESCRIPTION
An 8-year-old 6.8-kg neutered male Dachshund was presented for evaluation of vomiting, diarrhea, anorexia, and swelling over the right perineal region. The dog had a history of a bilateral perineal herniorrhaphy and castration 14 months prior to presentation.

CLINICAL FINDINGS
Bilateral perineal hernias were confirmed by digital rectal examination. Abdominal ultrasonography confirmed the presence of intestine within the right hernia. Three days after admission to the hospital, the region of the right perineal hernia became painful, erythematous, and edematous. Computed tomography revealed jejunal incarceration within the right hernia with dilation of 1 jejunal segment that indicated intestinal obstruction.

TREATMENT AND OUTCOME
Abdominal exploratory surgery was performed, during which irreducible small intestinal incarceration was confirmed. Intra-abdominal jejunal resection and anastomosis was performed, and an approximately 13-cm-long section of the jejunum was resected. Bilateral perineal herniorrhaphies with internal obturator and superficial gluteal muscle transposition were performed. Six months after surgery, digital rectal examination of the dog revealed that the repair was intact. The dog had no perineal hernia–related clinical signs at the time of the recheck examination.

CLINICAL RELEVANCE
For the dog of the present report, surgical management of small intestinal strangulation associated with a perineal hernia was successful. Although a portion of the small intestines can frequently be found within perineal hernias in dogs, perineal hernia-related small intestinal strangulation has not been previously described, to the authors' knowledge. Veterinarians and clients should be aware of this potential complication secondary to perineal hernia and be prepared to perform an abdominal surgical procedure to address small intestinal incarceration in affected dogs.

An 8-year-old 6.8-kg neutered male Dachshund was presented for evaluation of vomiting, diarrhea, anorexia, and swelling over the right perineal region. The dog had a history of bilateral perineal herniorrhaphy with internal obturator muscle transposition (IOMT) and castration performed by a board-certified veterinary surgeon 14 months prior to presentation. Two days prior to presentation, the dog vomited several times and had a decreased appetite. On the day of presentation, the owners noted swelling in the right perineal region. The owners had not noted tenesmus following the previous perineal herniorrhaphy procedure or in association with the new perineal swelling. On examination, the dog was quiet, alert, and responsive and had a right-sided perineal hernia; the abdomen was soft, and no signs of pain were elicited on palpation. Venous blood gas analysis revealed a hypochloremic metabolic alkalosis; blood pH was 7.453 (reference interval, 7.299 to 7.439), chloride concentration was 106.2 nmol/L (reference interval, 110.5 to 118.8 nmol/L), and HCO_3 concentration was 23.4 mmol/L (reference interval, 14.5 to 23.1 mmol/L). The dog also had hyponatremia (136.0 mmol/L; reference interval, 143.0 to 151.1 mmol/L) and hypocalcemia (1.04 mmol/L; reference interval, 1.17 to 1.43 mmol/L); its PCV was 55% (reference interval, 35% to 55%) and total solids concentration was 8.6 g/dL (reference interval, 5.5 to 8.0 g/dL). Abdominal ultrasonography revealed a right-sided perineal hernia with a herniated loop of intestine (suspected to be the descending colon) and focal steatitis and effusion.

The dog was admitted to the hospital (day 0) and transferred to the soft tissue surgery service the following morning. Because the day of admission was a Friday, supportive care was recommended through the weekend and surgery was planned for the following Monday. Treatments administered to the dog included lactated Ringer solution (2.5 mL/kg/h), maropitant citrate (1 mg/kg, IV, q 24 h), trazodone (7.4 mg/kg, PO, q 8 h), and meloxicam (0.1 mg/kg, PO, q 24 h). The dog remained hyporexic in hospital. On the morning

of day 3 of hospitalization (the day of planned surgical repair), the dog was febrile (40.3 °C) and the skin overlying the right-sided perineal hernia was apparently painful, red, and swollen. Swelling of the prepuce and scrotum was also noted. On digital rectal examination, bilateral perineal hernias were detected.

The dog was anesthetized for a CT scan prior to surgery. The dog was premedicated with hydromorphone (0.05 mg/kg, IV), and anesthesia was induced with ketamine (2 mg/kg, IV) and propofol (2 mg/kg, IV). The dog was orotracheally intubated, and anesthesia was maintained by inhalation of isoflurane gas in oxygen. A lidocaine bolus (2 mg/kg, IV) was administered, followed by a lidocaine constant rate infusion (3 mg/kg/h). Abdominal CT was performed with a 64-slice helical scanner (Somatom Sensation; Siemens). Precontrast images were acquired at settings of 120 kVp, an effective mAs of 250, and pitch of 0.8 and were reconstructed in 3-mm slices by use of bone and soft tissue algorithms. Postcontrast arterial, venous, and delayed phase images were acquired by use of the same CT settings after contrast medium (iohexol [600 mg iodine/kg]) was administered IV with a catheter placed in a cephalic vein and a power injector. Positive contrast CT colonography (iohexol [50 mL administered per rectum]) was performed by use of the same CT settings. Images revealed bilateral perineal hernias with a segment of jejunum herniated into the right dorsal perineal region and a portion of the rectum partially herniated into the left dorsal perineal region. The segment of displaced jejunum was moderately enlarged and gas distended, and it abruptly tapered at the level of the defect in the right side of the pelvic diaphragm. The orad portion of the jejunum within the peritoneal space adjacent to the focal narrowing was also severely distended (maximal diameter, 2.2 cm), consistent with small intestinal obstruction and possible strangulation **(Figure 1)**. Additionally, within the right perineal region, there was a large amount of multiloculated gas and non–contrast-enhanced fluid, consistent with small intestinal perforation. Mild non–contrast-enhanced fluid surrounded the herniated rectum in the left perineal region. There was focal dilation of the rectum at the level of the anus. The remaining intraperitoneal small intestinal segments and colon were considered normal. Gas and subcutaneous effusion were also present within the ventral perineal soft tissues to the right of the penile urethra with extension of effusion along the ventral portion of the abdominal body wall. There was no evidence of rectal perforation detectable with positive contrast colonography.

The dog was prepared for a ventral midline celiotomy in addition to bilateral perineal herniorrhaphy procedures, with a plan for evaluation and reinforcement of the previous IOMT, superficial gluteal muscle transposition (SGMT) depending on the status of the previous IOMT, or mesh or small intestinal submucosa reinforcement of any repair. A caudal epidural injection was performed (morphine [0.1 mg/kg] and bupivacaine [0.5 mg/kg]), and perioperative antimicrobial prophylaxis was administered (cefazolin [22 mg/kg, IV, q 90 min]). A ventral midline celiotomy was performed. Exploration of the abdomen revealed

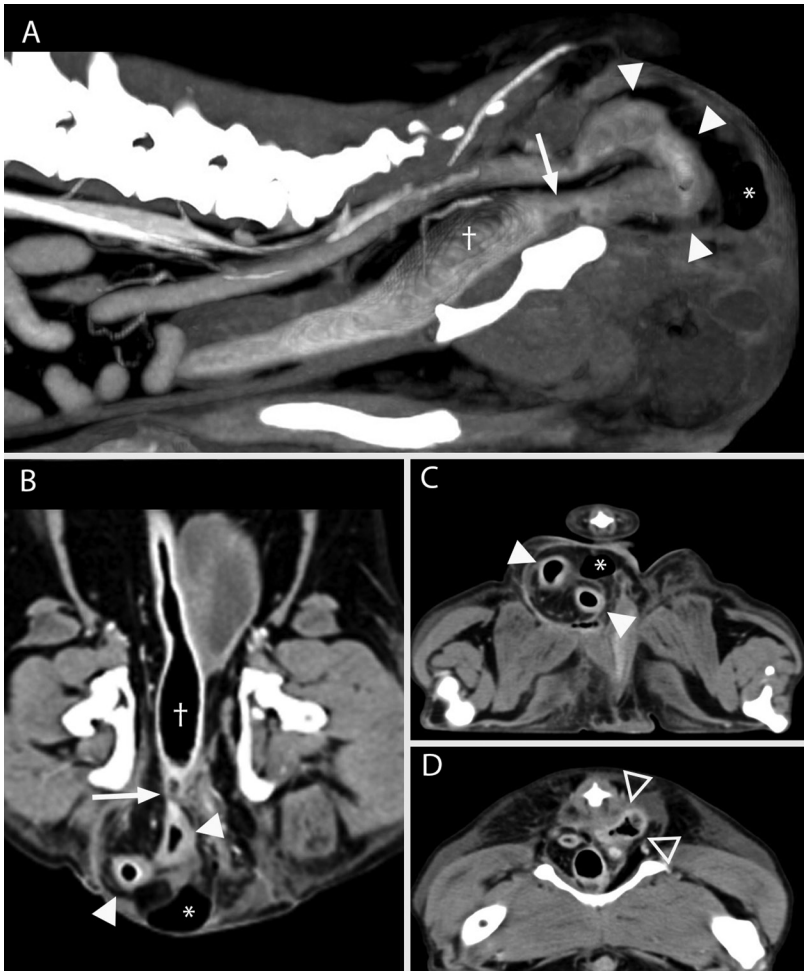

Figure 1—Delayed-phase CT angiographic images of an 8-year-old neutered male Dachshund with bilateral perineal hernias and subsequent intestinal strangulation and incarceration. A—Sagittal plane maximum-intensity image; cranial is to the left. B—Dorsal plane reconstruction; cranial is toward the top and the right side of the dog is on the left side of the image. C and D—Transverse plane images; the right side of the dog is on the left side of the images. In panels A and B, a focal narrowed portion of the jejunum is present at the level of the pelvic diaphragm (arrow) along with the dilated portion of orad jejunum (dagger). In panels A, B, and C, herniated small intestine and mesentery (arrowheads) and free gas (asterisk) are evident in the right perineal region. In panel D, the herniated colon is located in the left perineal region (open arrowheads).

that the jejunum and a portion of the omentum had entered the perineal hernia on the right side and could not be reduced despite multiple attempts; the remainder of the abdominal contents were within normal limits. The abdomen was packed off with moistened laparotomy sponges, and a jejunal resection and functional end-to-end stapled anastomosis was performed. The anastomosis was leak checked, and no leakage was noted. The transected ends of the jejunal section entrapped in the hernia were sutured closed with monofilament absorbable suture in an inverting pattern in preparation for removal of the resected jejunum through the herniorrhaphy approach. A final attempt was made to remove the resected herniated segment through the abdominal approach, which was successful. The previously herniated tissues (an approx 13-cm-long portion of the jejunum) were dark purple to black in several areas with an approximately 1-cm-diameter perforation at the antimesenteric surface in the midportion of the resected jejunal segment. The caudal portion of the abdomen and hernia were lavaged with sterile saline (0.9% NaCl) solution, and local lavage of the anastomosis site was performed. The surgical gloves and instruments were changed. Bilateral ductus deferopexy, cystopexy to the right body wall, and colopexy to the left body wall were performed. The abdomen was copiously lavaged and closed routinely.

The dog was then placed in the perineal position for bilateral perineal herniorrhaphy. On the right side, dark-brown to red fluid was present in the hernia; a sample of the fluid was collected for aerobic bacterial culture. The previous IOMT had failed through the sutures, but the muscle remained intact. Dark-brown and yellow fat, presumed to be attached to the defect in the previously excised jejunal segment, was evident in the hernia sac and was excised. Copious lavage was performed of the area. The IOMT was repeated with 3-0 polypropylene suture material. After herniorrhaphy, a defect remained lateral to the coccygeus muscle. An SGMT was performed by transecting the tendinous insertion on the third trochanter of the femur and rotating the muscle caudally to cover the defect. The muscle was secured to the periosteum of the ischiatic tuberosity caudally and the external anal sphincter and coccygeus medially with 3-0 polypropylene sutures. On the left side, the IOMT had failed by perforation of abdominal fat through the midbelly of the muscle. An SGMT was also performed on this side as described. Ventral to the ischium, considerable pocketing of the subcutaneous space was noted. A closed suction drain was placed in this area to close dead space and provide postoperative drainage. After surgery, a digital rectal examination was performed. No sutures were palpated within the rectum. Palpation on the right side revealed a robust repair with no evidence of a perineal hernia. On the left side, there was a 1-cm^2 area on the ventrolateral aspect in the region of the lost internal obturator muscle that was mildly weakened; otherwise, the repair felt robust.

Aerobic bacterial culture of the fluid obtained at the time of surgery yielded multiple organisms; however, identification was performed for only the 3 more-predominant organisms: *Escherichia coli*, *Enterobacter cloacae* complex, and *Enterococcus faecalis*. An antimicrobial susceptibility profile revealed that these organisms were susceptible to multiple broad-spectrum antimicrobials, including amoxicillin–clavulanic acid and cefpodoxime.

Postoperative care for the dog included administration of lactated Ringer solution (3 mL/kg/h), a constant rate infusion of lidocaine (30 to 40 µg/kg/min), ampicillin-sulbactam (30 mg/kg, IV, q 8 h), hydromorphone (0.1 mg/kg, IV, q 4 to 6 h), maropitant citrate (1 mg/kg, IV, q 24 h), and pantoprazole (1 mg/kg, IV, q 12 h). One day after surgery, the dog developed severe melena, and sucralfate (0.5-g tablet crushed into a slurry, PO, q 8 h) was added to the treatment regimen. Two days after surgery, hydromorphone and lidocaine were discontinued, and the dog was transitioned to buccal application of compounded buprenorphine suspension (0.02 mg/kg, q 8 h). Administration of capromorelin solution (3 mg/kg, PO, q 24 h) was initiated to stimulate the dog's appetite. Three days after surgery, a nasoesophageal tube was placed, and supplemental enteral feeding with a commercially available canine diet blended with water was started; the closed suction drain was also removed on this day. On the fourth postoperative day, the nasoesophageal tube was removed, and the dog was discharged from the hospital. Medications to be administered by the owners at home included barium sulfate (60% [5 mL, PO, q 8 h]), amoxicillin–clavulanic acid (15.6 mg/kg, PO, q 12 h), cefpodoxime (6.25 mg/kg, PO, q 12 h), omeprazole (1 mg/kg, PO, q 12 h), and maropitant (2 mg/kg, PO, q 24 h).

The dog was reexamined 6 months after surgery and was clinically normal. The owners reported that after the second herniorrhaphy procedure, the dog had no tenesmus and no clinical signs related to the perineal hernias. The dog underwent digital rectal examination performed by the same surgeon who completed the second herniorrhaphy, and the repair was confirmed to be intact.

Discussion

In the case described in the present report, a neutered male dog had bilateral perineal hernias with intestinal incarceration and strangulation, a combination of conditions that has not been previously reported, to the authors' knowledge. The clinical findings for this dog were typical of a perineal hernia; however, on the third day of hospitalization, the dog's clinical condition acutely declined, prompting concern for intestinal compromise or perforation. An abdominal CT scan was performed to provide more detailed information; results of the CT scan confirmed incarceration and strangulation of a segment of the jejunum, prompting exploratory laparotomy prior to bilateral herniorrhaphy.

In dogs, perineal hernias are most common in older, sexually intact males,[1] with a prevalence of 0.1% to 0.4%.[2] The exact etiopathogenesis of perineal hernias in dogs is unknown but thought to be multifactorial. Contributing factors include breed predisposition, rectal abnormalities, pathological changes in the prostate leading to straining during urination and defecation, and weakening of the muscles of the pelvic diaphragm.[1] Clinical signs vary but most commonly include perineal swelling and tenesmus.[3] When urinary bladder retroflexion occurs, stranguria may be evident. The dog of the present report did not develop tenesmus following the initial herniorrhaphy procedure 14 months prior to presentation, and the cause of the repair failure was unknown.

Perineal hernias can be unilateral or bilateral; therefore, it is imperative to evaluate both sides of the pelvic diaphragm during rectal examination, even if swelling is apparent only unilaterally. For the dog of the present report, the recurrence of perineal herniation was initially thought to be unilateral but was later found to be bilateral on repeated digital rectal examination, emphasizing the need to perform a thorough physical examination that includes digital rectal examination. The recommended treatment for perineal hernias is herniorrhaphy.

There are several surgical techniques for herniorrhaphy including appositional herniorrhaphy, IOMT, SGMT, and semitendinosus muscle transposition.[1] Reported hernia recurrence rates in dogs vary depending on the type of repair performed, ranging from 15% to 46% for appositional herniorrhaphy,[2,3] ≤ 21% for IOMT,[4] and 12% for SGMT.[5] These repairs may be augmented with implants or biomesh materials. For the case described in the present report, a decision to augment the IOMT repair with an SGMT was made because this augmentation was technically simple to perform and required minimal additional dissection to approach the superficial gluteal muscle. This technique resulted in a robust repair of the hernias. Augmentation with implants or biomesh materials was considered, but given the robustness of the SGMT, such augmentation was not thought to be necessary at the time of surgery. Additionally, by use of native tissues, the risk of a long-term deep surgical site infection may be lessened. Other techniques, such as semitendinosus muscle transposition or fascia lata grafting, could have also been considered for this dog, although semitendinosus muscle transposition is ideal for ventral defects and fascia lata grafting may increase patient morbidity because of the need to harvest the fascia lata graft from a separate body site.

For dogs undergoing herniorrhaphy, some surgeons recommend abdominal pexy techniques including colopexy, ductus deferopexy, and cystopexy to maintain those organs in their correct anatomic positions and improve their visibility during herniorrhaphy, reduce the risk for entrapment of the urinary bladder within the hernia should the herniorrhaphy fail, and reduce pressure of the colon on the repair.[4] Some surgeons recommend abdominal pexy procedures for every dog with perineal herniation, whereas others may consider abdominal pexy procedures only for the more complicated cases that have failed previous herniorrhaphy or have abdominal organ herniation into the perineal hernia.[4,6] The dog of the present report had already undergone previous bilateral IOMT, and the repair had failed; at the time of presentation, concurrent abdominal organ herniation was evident. Thus, abdominal pexy procedures were considered particularly important to reduce the risk of perineal hernia recurrence and eliminate the risk of urinary bladder retroflexion, given the dog's predisposition to organ herniation. Additionally, for any affected dog, the finding of intestinal incarceration should prompt an initial abdominal exploratory procedure, which facilitates access for assessment of the gastrointestinal tract, possible reduction of intestine from the hernia, or tissue resection, if required. If the abdomen is already open for evaluation of organ herniation, it is straightforward to perform organ pexy procedures at the same time. Castration is also recommended at the time of herniorrhaphy; in 1 study,[7] the risk of perineal hernia recurrence for sexually intact male dogs was 2.7 times that for castrated dogs.

Typically, perineal hernias are not considered a surgical emergency unless the urinary bladder is entrapped and unable to be catheterized. If urethral catheterization is possible, surgery can be performed once the dog's condition is stabilized and azotemia has resolved. Long-term nonsurgical management of perineal hernias is rarely successful and puts affected dogs at risk for complications, such as urinary bladder retroflexion. Although intestinal strangulation within a perineal hernia in a dog has not been previously reported, to the authors' knowledge, it is known to be a theoretical risk because portions of the small intestine can extend into the hernia sac. For the dog of the present report, a segment of intestine was located within the perineal hernia at the time of presentation, as determined by abdominal ultrasonography. Although the intestinal segment was fluid filled and surrounded by a small volume of effusion, strangulation was not suspected at that time because the segment was incorrectly thought to be a portion of the large intestine. It was not until the dog's clinical status changed, indicating possible gastrointestinal compromise, and CT was performed that small intestinal strangulation was confirmed. Clinical signs of intestinal strangulation are similar to those associated with intestinal obstruction and include acute abdominal pain, vomiting, and anorexia. Perforation of intestinal segments leads to septic peritonitis, a condition that causes considerable patient morbidity and death. Intestinal strangulation is more commonly encountered with abdominal hernias[8] but is a theoretical concern with perineal hernias. It was unclear when the intestinal segment became strangulated in the dog of the present report; however, strangulation may have occurred prior to presentation, and dilation of the affected segment may have led to

its misclassification as large intestine. The dog's clinical signs acutely worsened on day 3 of hospitalization with signs of pain, swelling, and inflammation of the perineum, prepuce, and scrotal areas, indicating intestinal rupture was likely recent. Additionally, there was no evidence of gross septic peritonitis, which suggested that the rupture had been identified shortly after it occurred and while it was still confined to the hernia.

In the case described in the present report, the dog had recurrence of bilateral perineal hernias following herniorrhaphy and castration 14 months prior to presentation. A complication of the perineal hernia recurrence was intestinal strangulation and incarceration within the hernia. Resection and anastomosis were effective treatments and were performed concurrently with bilateral perineal herniorrhaphy without complication. Veterinarians should be aware of this possible complication of intestinal strangulation and incarceration within perineal hernias in dogs and be prepared to perform abdominal surgery if clinical signs are indicative of a small intestinal obstruction. Veterinarians should also educate their clients to the possibility of intestinal strangulation as a complication of medically managed perineal hernias because of its potential as a source of morbidity in affected dogs.

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