JAVMA

AVMA

What Is Your Diagnosis?

In collaboration with the American College of Veterinary Radiology

Acute onset of muscle tremors, vomiting, hyporexia, and lethargy in a 6-month-old female spayed Terrier mix

History

A 6-month-old female spayed Terrier mix was referred to the emergency clinic of the Cummings School of Veterinary Medicine at Tufts University for evaluation of acute muscle tremors, vomiting, hyporexia, lethargy, and mild blood work abnormalities. The CBC performed by the referring veterinarian revealed leukocytosis (24 X 10^3 WBCs/µL), characterized by mild lymphocytosis (5.36 X 10^3 lymphocytes/µL) and neutrophilia (16.55 X 10^3 neutrophils/µL) with suspected band neutrophils. Biochemical analysis demonstrated a mild hypoalbuminemia (2.2 g/dL) and a moderate hyperphosphatemia (7.2 mg/dL). The reference ranges from the referring hospital could not be confirmed but were assumed to be similar to those of the Cummings School of Veterinary Medicine hospital.

Initial emergency evaluation revealed moderate dehydration (8%), subtle abdominal discomfort with palpation, mild left hip discomfort, and intermittent tremoring. The remainder of the physical examination was unremarkable. Intravenous lactated Ringer solution was administered at a rate of 120 mL/kg/d initially to correct the dehydration, and Cerenia (Maropitant) was given at 1 mg/kg, IV, every 24 hours. Point-of-care blood work and a recheck CBC were performed and revealed normalized electrolyte and biochemical values and slightly improving leukocytosis (16.63 X 10^3 WBCs/µL; reference range, 4.4 X 10^3 to 15.1 X 10^3 WBCs/µL) with an increased number of bands and 1+ toxic change. The patient was hospitalized for further stabilization procedures and diagnostics, including 2-view abdominal radiographs **(Figure 1)** and an abdominal ultrasound.

Formulate differential diagnoses, then continue reading.

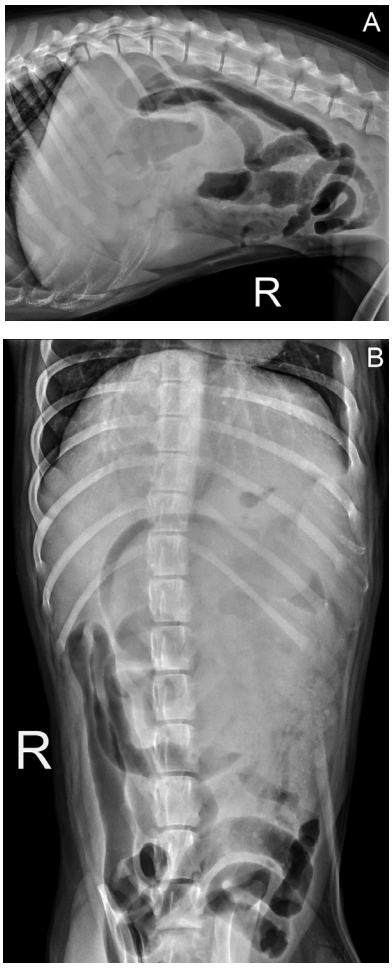

Figure 1—A right lateral cranial abdominal radiograph (A) and a ventrodorsal radiograph (B) of a 6-month-old female spayed Terrier mix presenting for hyporexia and vomiting.

Diagnostic Imaging Findings and Interpretation

On the lateral radiographic view of the cranial abdomen **(Figure 2)**, a tubular soft tissue opacity was noted within a dilated, gas-filled loop of intestine. On the ventrodorsal radiograph at the level of the left twelfth intercostal space, the margin of a rounded, soft tissue opaque structure surrounded by gas was noted within an intestinal loop. This appearance is called a meniscus sign and is compatible with

Nathan R. Biedak, DVM*; Julia L. Graham, DVM, DACVR; Manabu Kurihara, DVM; Amy F. Sato, DVM, DACVR

Department of Clinical Sciences, Cummings School of Veterinary Medicine, Tufts University, North Grafton, MA

*Corresponding author: Dr. Biedak (nathan.biedak@tufts.edu)

doi.org/10.2460/javma.22.10.0456

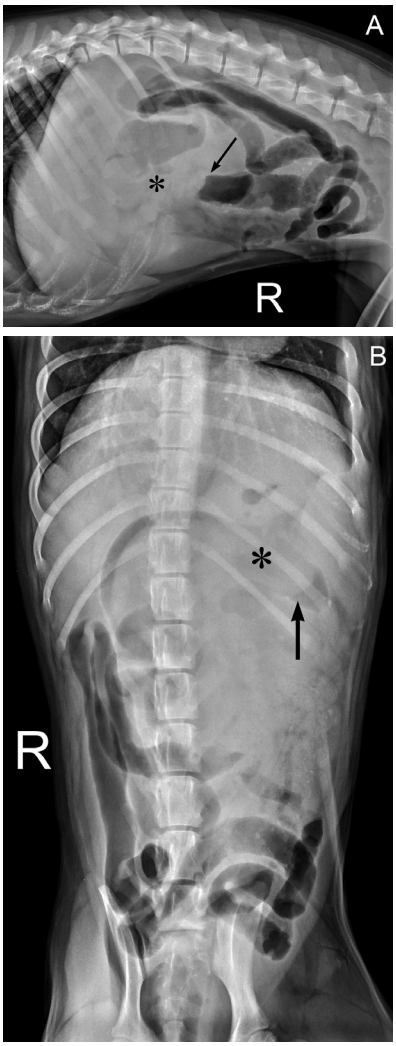

Figure 2—A right lateral cranial abdominal radiograph (A) and a ventrodorsal radiograph (B) that demonstrate an intussusception. The tubular soft tissue opaque intussusceptum (asterisk) is highlighted by gas within the intussuscipiens, termed the meniscus sign (black arrow). The remainder of the abdomen has gas-filled small intestines, with mineral opaque material in the region of the descending colon, but there is no evidence of a complete mechanical obstruction.

an intussusception. The remaining visible abdominal organs appeared normal.

Upon abdominal ultrasound, within the left cranial abdomen, there was a segment of small bowel that was engulfed within a colonic segment, compatible with an intussusception **(Figure 3)**. Hyperechoic mesenteric fat and hypoechoic mesenteric vessels were also noted within the intussuscipiens. In a longitudinal plane, multiple parallel linear echogenicities compatible with bowel wall layers were seen. The small intestines orad to the intussusception were mildly distended with echogenic material. The jejunal lymph nodes near the intussusception were mildly enlarged and exhibited an irregular hypoechoic rim. Scant anechoic peritoneal fluid was noted. The remainder of the abdominal organs appeared normal. The ultrasonographic diagnosis was an enterocolic intussusception without evidence of foreign material. The jejunal lymphadenopathy and scant peritoneal effusion was thought to be either reactive or normal for a juvenile dog.

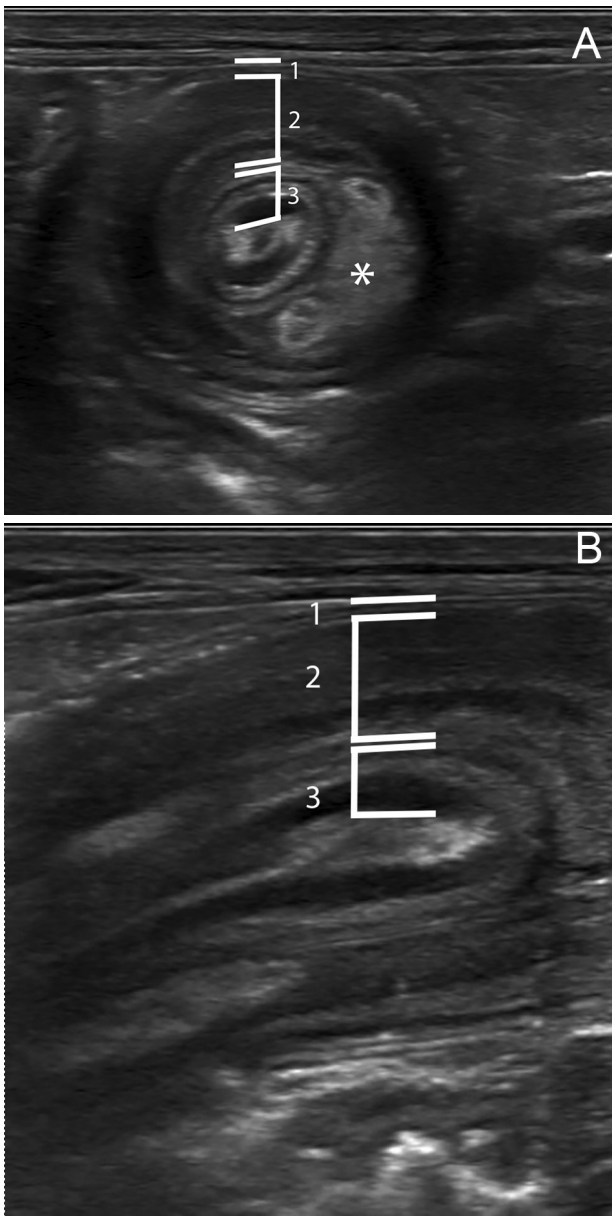

Figure 3—A transverse ultrasonographic image (A) of an intussusception demonstrates multiple full concentric rings of alternating echogenicities (target-like appearance) and a crescent of hyperechoic, entrapped mesenteric fat (asterisk). A long axis ultrasonographic view (B) demonstrates multiple thick parallel lines of alternating echogenicities, corresponding to layers of intussuscepted bowel. There is reverberation artifact from gas within the intussuscipiens seen to the left of the intussusception on the longitudinal view (B). In both images, one can appreciate the thin colonic wall (intussuscipiens) in the near field (1) and the intussusceptum consisting of an inverted, edematous small intestinal loop (the outer intussusceptum, brackets labeled 2) and a more normal-appearing central small intestinal loop (the inner intussusceptum, brackets labeled 3).

Treatment and Outcome

The patient went to surgery, and a ventral midline celiotomy was performed, revealing a large enterocolic intussusception. The involuted portion was almost completely reduced; however, the last 2 cm of small intestine was adhered within the colon and the vitality of the bowel was questionable. The affected segment was transected, and an anastomosis was performed. An enteroplication procedure

was also performed as a precautionary measure prior to closing. Histopathology demonstrated a 7-cm incompletely reducible enterocolic intussusception with no evidence of an infectious or neoplastic process.

The patient remained in the hospital for 1 day postoperatively and was maintained on lactated Ringer solution, 60 mL/kg/d, IV; gabapentin, 8 mg/kg, PO, every 8 hours; pantoprazole, 1 mg/kg, IV, every 12 hours; maropitant, 1 mg/kg, IV, every 24 hours; and methadone, 0.1 mg/kg, IV, as needed for pain. The patient did well and was deemed fit to continue recovering at home. One week after discharge the patient was doing well at home, with normal energy levels and a normal appetite. After this, the patient was lost to follow-up.

Comments

Establishing a definitive diagnosis of an intussusception prior to surgery is a challenge without the aid of diagnostic imaging. An intussusception occurs when 1 portion of the gastrointestinal tract (the intussusceptum) telescopes or prolapses into an adjacent bowel loop (the intussuscipiens).[1–5] The intussusceptum consists of an entering wall (the inner intussusceptum) and a returning wall (the outer intussusceptum); the junction of the 2 walls is termed the apex of the intussusception.[2] Intestinal intussusception is most often seen in younger dogs and most frequently enterocolic, occurring at the ileocolic junction.[2,3] There are documented predisposing factors including linear foreign bodies, alteration in diet, parasitism, enteritis, recent abdominal surgery, mural masses, and other causes of either intestinal inflammation or altered motility.[1–3]

There is speculation about the pathophysiology of intussusceptions, but they are believed to occur due to inhomogeneity (in diameter, texture, or motility) of adjoined bowel segments or mechanical linkage, as seen with linear foreign bodies.[3] Once the invagination begins due to peristalsis, progressive engulfment can occur rapidly.[3] This can result in a partial or complete gastrointestinal obstruction, bacterial overgrowth, ischemia, and peritonitis.[1] Clinical signs include lethargy, inappetence, abdominal pain, vomiting, and bloody, mucoid diarrhea.[1–3] Clinical signs and biochemical alterations are often more severe in upper gastrointestinal intussusceptions.[3] On physical examination, a cylindrical cranial abdominal mass may be palpable.[2,3]

Survey radiographs are considered an insensitive modality for the diagnosis of intussusception.[1,2] Fluid within the intussuscipiens can silhouette with the intussusceptum, causing border effacement and hindering diagnosis. In 1 paper[2] on intussusception in 36 dogs and cats, the definitive diagnosis could be made using plain radiographs in only 2 of 6 cats and 0 of 19 dogs. Although the intussusception itself is rarely seen, there is often an abnormal fluid or gas pattern, indicating a partial or complete obstruction,[2] and decreased serosal detail. In the aforementioned paper,[2] 12 of 19 (63%) dogs had radiographic signs consistent with mechanical obstruction, while 7 (37%) had normal abdominal radiographs.

In some cases, such as the case provided here, gas within the intususscipiens outlines the rounded end of the soft tissue opaque intussusceptum, aiding in its detection. This soft tissue/gas interface is called the meniscus sign and is consistent with an intussusception (Figure 2).[1] In another paper,[1] a meniscus sign diagnostic for intussusception was seen in 1 of 8 (12.5%) dogs. Barium enemas have been used in the past to increase the sensitivity of radiographs for enterocolic intussusceptions,[3] but radiography has largely been replaced by ultrasonography.[5]

Abdominal ultrasound is now considered a sensitive and accurate tool in diagnosing a gastrointestinal intussusception.[1,4,5] On the long axis view of an intussusception, the classic appearance is multiple parallel lines of alternating echogenicities.[1,4,5] In a transverse ultrasonographic view, the intussuscepted bowel walls appear as multiple concentric rings with alternating hyperechoic and hypoechoic echogenicities, creating a target-like lesion.[1,4,5] Mesenteric fat within the center of the lesion appears hyperechoic and forms a G, reverse G, or semilunar shape around the inner intussusceptum.[5]

Other conditions that can mimic this multiple concentric ring sign include postpartum involution of the uterus, any cause of thickening of the bowel wall, enteritis, ileus secondary to a foreign body, and, infrequently, healthy intestine.[4] To avoid mistaking pseudotarget lesions from true intussusceptions, ensure the peripheral portion of the rings are complete.[4] Another technique is to measure the entire diameter of the lesion. Since an intussusception is made up of at least 6 bowel walls that may be edematous, plus any invaginated mesentery, it has been suggested that a total lesion diameter of > 18 mm in dogs or 15 mm in cats is supportive of a diagnosis of an intussusception.[5] Orthogonal plane viewing of the lesion is also important as multiple parallel lines and the observation of the inner intussusceptum is possible in the longitudinal plane.[4] This report offers an example of a case that highlights the multiple concentric ring sign and semilunar mesenteric fat in the transverse plane and the multiple alternating parallel lines seen on the long axis view on ultrasound (Figure 3).

The prognosis for intussusception is considered fair overall but depends on the cause, location, severity, completeness of obstruction, and duration of invagination.[1,2] In severe cases of intussusception, decreased venous and lymphatic drainage in the presence of an intact arterial supply leads to intramural hemorrhage and edema.[3] If intramural pressure exceeds the arterial pressure or if a clot forms, devitalization of the bowel will commence.[3] Perforation can occur but is considered uncommon as the wall of the intussuscipiens usually remains viable.[3]

Though client history and thorough abdominal palpation may be sufficient in achieving a tentative diagnosis of an intussusception,[3,5] diagnostic imaging is an integral part in achieving a definitive diagnosis. As intussusceptions can lead to compromised

bowel and sepsis necessitating intensive surgeries and prolonged hospital stays, being able to correctly interpret the images in a timely manner is crucial in case management and outcome.

Acknowledgments

No external funding was used. The authors declare that there were no conflicts of interest.

References

1. Lamb CR, Mantis P. Ultrasonographic features of intestinal intussusception in 10 dogs. *J Small Anim Pract*. 1998;39(9):437–441. doi:10.1111/j.1748-5827.1998.tb03752.x
2. Levitt L, Bauer MS. Intussusception in dogs and cats: a review of 36 cases. *Can Vet J*. 1992;33(10):660–664.
3. Lewis DD, Ellison GW. Intussusception in dogs and cats. *Compend Contin Educ Pract Vet*. 1987;9(5):523–533.
4. Patsikas MN, Papazoglou LG, Papaioannou NG, Dessiris AK. Normal and abnormal ultrasonographic findings that mimic small intestinal intussusception in the dog. *J Am Anim Hosp Assoc*. 2004;40(2):147–151. doi:10.5326/0400147
5. Patsikas MN, Papazoglou LG, Paraskevas GK. Current views in the diagnosis and treatment of intestinal intussusception. *Top Companion Anim Med*. 2019;37:100360. doi:10.1016/j.tcam.2019.100360