

Ultrasonographic Diagnosis of Gastroesophageal Intussusception in a 7 Week Old German Shepherd

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ABSTRACT

This case report describes the ultrasonographic diagnosis of gastroesophageal intussusception in a male 7 week old German Shepherd Dog. The patient had no history prior to being purchased from a breeder 24 hours before presentation. The owners noted persistent intermittent vomiting since that time and a single roundworm was identified once in a vomitus. A gastroesophageal intussusception was diagnosed via thoracic radiographs and trans-abdominal ultrasound. The spleen was noted to be within the distal esophagus in concert with the stomach. Reduction of the intussusception was performed via laparotomy with bilateral gastropexy. The patient recovered uneventfully from surgery and is alive 4 months after discharge. This case highlights the potential advantages of ultrasound in the diagnosis of gastroesophageal intussusceptions. A review of the current literature is presented with discussions of possible etiologies of this rare form of intestinal intussusception.

Keywords: Gastroesophageal; Intussusception; Ultrasound; German Shepherd; Dog; Puppy

INTRODUCTION

Gastroesophageal intussusception (GEI) is a rare condition encountered in veterinary medicine. (1, 2). It was first described in two German Shepherd littermates (3) and has since been sporadically reported in the literature. GEI is most often reported in dogs, typically male German Shepherd Dogs of less than three months of age (1). Other reported breeds include Husky (2), Labrador Retriever (4), Foxhound (5), Afghan Hound (6), Doberman (7), Dalmatian (8), Collie (9), Pug (10), domestic cat (11-13), Leopard (14), and Hedgehog (15). GEI is defined as a retrograde invagination of the stomach into the dilated distal esophagus without displacement of the gastroesophageal junction and differs from hiatal hernia, in that the herniated organs remain within the lumen of the esophagus (2, 16). Other organs, such as duodenum, pancreas, omentum, and spleen, have been found within the esophagus as well (1, 2). Esophageal disease, such

as congenital megaesophagus, abnormal esophageal motility or an enlarged esophageal hiatus is often a concurrent finding. Early reports indicated a high mortality with GEI, but recent literature suggests a much lower mortality with appropriate diagnosis and treatment (2, 4).

This report describes the ultrasonographic diagnosis of gastroesophageal intussusception, along with the clinical presentation and successful surgical treatment in a young German Shepherd Dog.

CASE REPORT

A 7 week old male German Shepherd Dog (GSD) was presented to the Kansas State University Veterinary Health Center Emergency Service (Manhattan, KS, USA) for vomiting. The dog had been purchased from a breeder approximately 24 hours prior to presentation. No historical information related to the dog prior to purchase was available.

The dog had started vomiting on the morning of presentation and had vomited approximately 10 times. The vomitus was described as dark red and liquid consistency with abdominal retching observed during every episode. The owners reported that the dog always vomited after eating or drinking but the vomiting did not always occur immediately after a meal. The most recent vomitus prior to presentation contained multiple grossly visible white roundworms. The owners also described soft stools with normal appetite, thirst, and urination.

On presentation the dog was quiet and responsive but lethargic with a normal hydration status. Temperature (101.0°F) and heart rate (160 beats/min) were within normal limits. Abnormal physical parameters included a thin body condition and mild tachypnea (56 breaths/min). During physical examination, the dog vomited a dark red to brown liquid. Abdominal pain was not detected on palpation.

Initial point-of-care diagnostics included a parvovirus antigen snap test (IDEXX SNAP Parvo Test, Westbrook MA, USA), packed cell volume (PCV), total solids (TS), and blood glucose (BG). Results of these tests were within the normal range, 37%, 5.8, and 113 mg/dL, respectively. A full chemistry panel and complete blood count (CBC) were performed. The total leukocyte count (21,000/ μ L, reference interval (RI) 6,000-17,000/ μ L) was elevated with an increased segmented neutrophil count (16,500 / μ L, (RI) 3,000-11,500/ μ L) and monocyte count (1,700 / μ L, (RI) 100-800/ μ L) consistent with a stress leukogram. The patient had a mild normocytic hypochromic anemia (HCT 34%, (RI) 37-55%) consistent with young age and/or parasitism. Thrombocytosis was present (582,000/ μ L, (RI) 164,000-510,000/ μ L) with moderate clumping. Biochemical abnormalities associated with stress or the young age of the dog included mild hyperglycemia (128 mg/dL, (RI) 73-113), hypoproteinemia (4.3 g/dL, (RI) 5.4-7.6), hypoalbuminemia (2.7 g/dL, (RI) 3.4-4.2), decreased BUN (5 mg/dL, (RI) 9-33), decreased creatinine (0.3 mg/dL, (RI) 0.5-1.5), increased alkaline phosphatase activity (ALP) (216 U/L, (RI) 1-142), and hyperphosphatemia (9.5 mg/dL (RI) 2.4-6.4). Additional biochemical abnormalities included hyponatremia (143 mmol/L, (RI) 147-154), hypochloridemia (106 mmol/L, ref 108-118 (RI)), and elevated creatinine kinase activity (CK) (770 U/L, (RI) 128-328) deemed consistent with acute onset of vomiting.

Abdominal radiographs (Figures 1A and 1B) revealed decreased serosal detail consistent with young age. In the

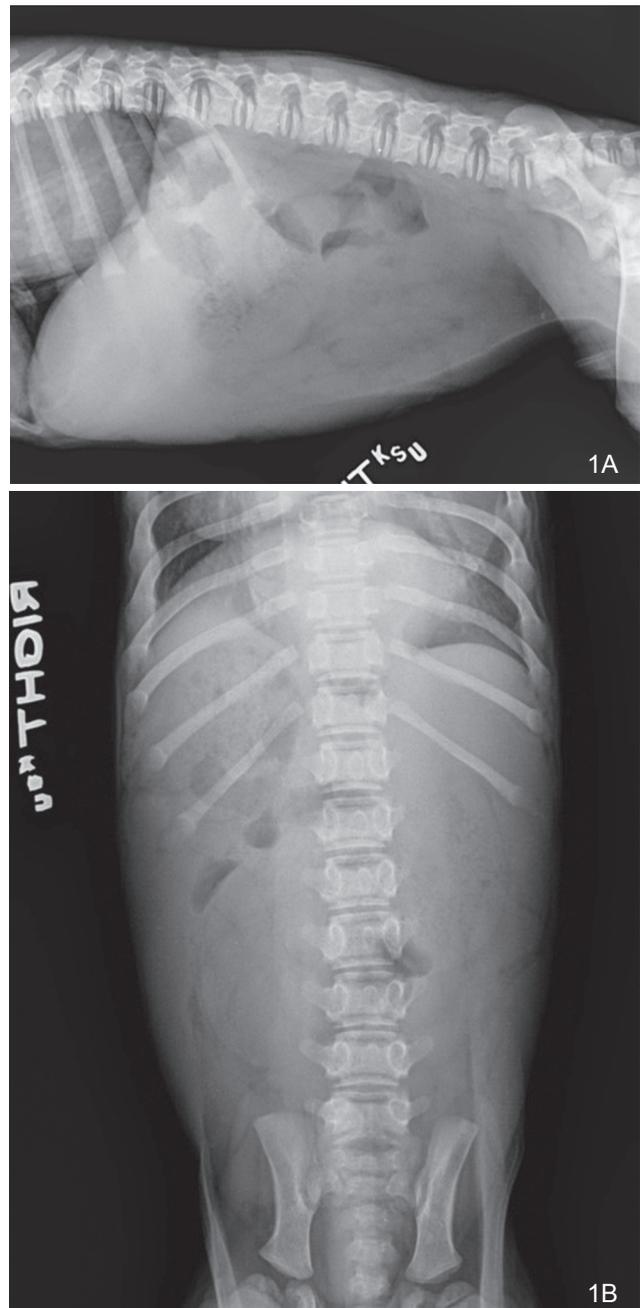


Figure 1: Right lateral (1A) and ventrodorsal (1B) radiographic views of the abdomen. There is decreased serosal detail in the abdomen. The stomach is not visualized. There is a soft tissue opacity mass in the caudodorsal thorax in the location of the caudal thoracic esophagus.

caudal thorax, an enlarged soft tissue opacity was visualized consistent with the distal esophagus. Thoracic radiographs (Figures 2A and 2B) were obtained and showed marked esophageal distension with an intraluminal gas opacity cranially and a large oval shaped soft tissue opacity caudally. The

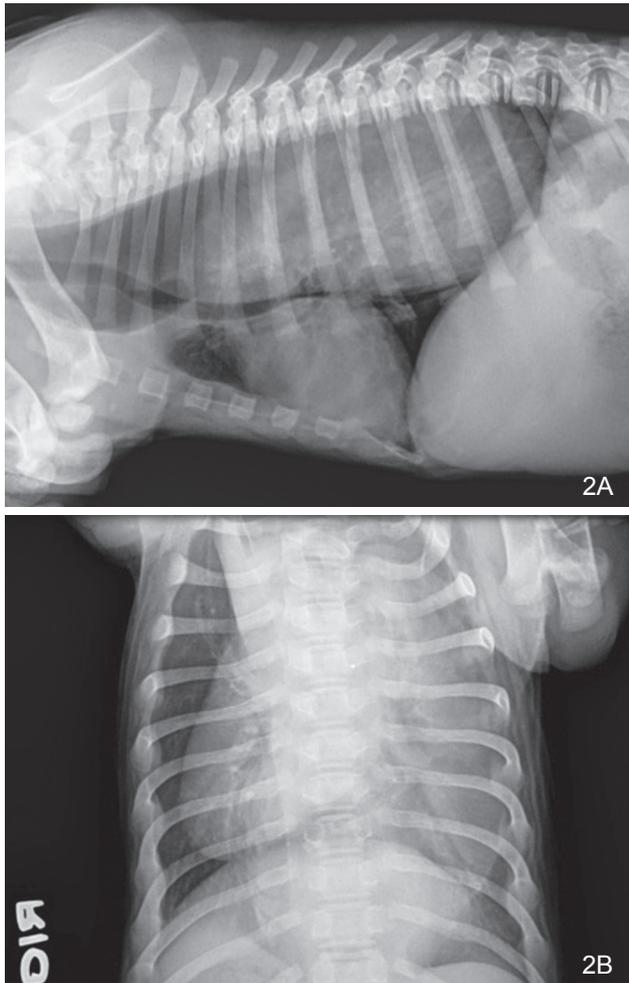


Figure 2: Right lateral (2A) and ventrodorsal (2B) radiographic views of the thorax. The cranial aspect of the thorax is not included in the ventrodorsal image. The thoracic esophagus is uniformly markedly distended with gas opacity from the thoracic inlet to the base of the heart and soft tissue opacity caudal to the base of the heart. The heart and trachea are deviated ventrally and to the right.

trachea and heart were both displaced ventrally. Differentials included gastroesophageal intussusception, hiatal hernia, and megaesophagus.

Abdominal and caudal thoracic ultrasound examination (Figures 3A and 3B) were then performed with the patient in dorsal recumbency (Acuson Sequoia 512, Seimens Medical Solutions USA, Inc., Mountain View, CA). For the abdomen, the ultrasound probe was positioned in both longitudinal and transverse orientation and full sweeps were performed of all abdominal organs as well as the abdomen in general. The caudal thorax was imaged with the patient in the same position and the transducer positioned for evaluation of the

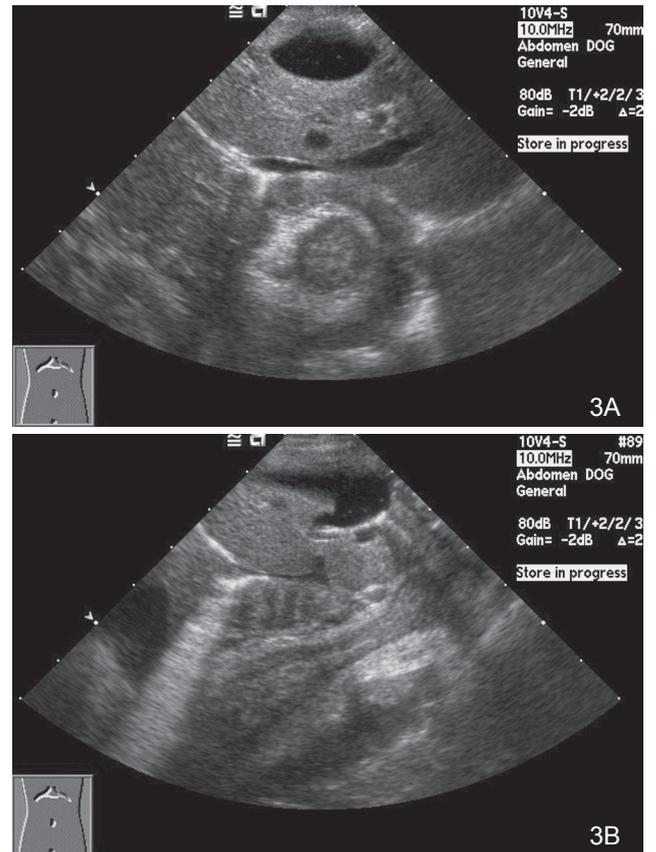


Figure 3: Transverse ultrasonographic images of cranial abdomen. There was a large mass effect in the caudal thorax that consisted of a rounded relatively hyperechoic rim containing hyperechoic material and a tubular segment of gastrointestinal tract consistent with the stomach (3A). The proximal small intestine was seen coursing caudal to the stomach and across the level of the diaphragm into the cranial abdomen (3B).

thorax through the liver and diaphragm. Both transverse and longitudinal views were evaluated. A large mass effect in the caudal thorax was identified with a tubular segment of gastrointestinal tract, consistent with stomach, and the spleen both visualized within this mass. The proximal small intestine was seen coursing caudal to the stomach and across the level of the diaphragm within the cranial abdomen.

Gastroesophageal intussusception with the spleen in the esophagus was diagnosed and the dog was anesthetized for surgery. A catheter was placed in the left cephalic vein. The dog was premedicated with Famotidine 1mg/kg IV (West-Ward Pharmaceuticals, Eatontown, NJ) and Hydromorphone 0.1mg/kg IV (West-Ward Pharmaceuticals, Eatontown, NJ). Anesthesia was induced with Propofol 3.9mg/kg IV

(PropoFlo® Abbott Laboratories, North Chicago, IL) and he was maintained on inhalational Isoflurane gas (IsoFlo® Abbott Laboratories, North Chicago, IL).

An exploratory laparotomy was performed and the entire stomach was identified to be within the distal esophagus and displaced cranially into the thoracic cavity. In addition, the spleen was located within the distal esophagus following the gastro-splenic ligament. The duodenum was identified at the level of the esophageal hiatus but appeared otherwise grossly normal. The remainder of the abdominal exploration was normal. The stomach was reduced with gentle traction back into the abdomen and the spleen was easily reduced by traction on the stomach. The stomach and spleen appeared grossly normal on visual inspection, without evidence of loss of viability, as determined by gross appearance, digital feel of the stomach and spleen, and palpable pulses of the splenic artery. The esophageal hiatus was evaluated and the opening was subjectively deemed to be of an appropriate diameter. Right and left gastropexies were performed as previously described, using 3-0 PDS and 2-0 PDS respectively in simple continuous patterns (2).

The dog was hospitalized in the Intensive Care Unit (ICU) for recovery and post-operative care. Analgesia was administered via Fentanyl 3-5 µg/kg/hr Constant Rate Infusion (CRI) (Hospira Inc., Lake Forest, IL) for the first 32 hours post-operatively. After which, Buprenorphine 0.032 mg/kg transmucosally (Buprenex Injectable® Reckitt Benckiser Pharmaceuticals, Richmond, VA) was administered until discharge. Gastroprotectants were administered due to the red discoloration of the vomitus and included Metoclopramide 1mg/kg/day CRI (Hospira Inc., Lake Forest, IL) until discharge, Famotidine 0.5 mg/kg IV BID (West-Ward Pharmaceuticals, Eatontown, NJ) until discharge, and Sucralfate 250 mg PO QID (Teva Pharmaceuticals, Sellersville, PA) until discharge. Antibiotics were administered due to concern of gastric mucosal integrity and concern for aspiration pneumonia, Ampicillin/Sulbactam 22 mg/kg IV TID (Pauromedics Pharmaceuticals, Dayton, NJ) followed by Amoxicillin/Clavulanate 18.9mg/kg PO BID (Clavamox® Pfizer Inc., New York, NY).

Attempts were made to collect a fecal sample but no bowel movements occurred during hospitalization. Fenbendazole 50 mg/kg PO every 24 hours (Panacur C® Merck Animal Health, Summit, NJ) was administered for 3 days post-operatively. Vital parameters including heart rate,

respiratory rate, temperature, blood glucose, pulse oximetry, and blood pressure were also monitored post-operatively. The patient's appetite remained excellent throughout the entire post-operative period without any signs of vomiting or regurgitation.

The dog was discharged 3 days post-operatively and is reportedly free of clinical signs upon last communication with the owners 4 months after discharge. Instructions were given to the owners at the time of discharge with recommendations to recheck radiographs 7-10 days later, however no follow-up radiographic data is available.

DISCUSSION

The etiology of GEI is not well understood. In humans, GEI seems to occur secondary to increased abdominal pressure, decreased thoracic pressure, or sudden exercise in individuals with mechanical gastrointestinal (GI) disease such as relaxation of the gastroesophageal sphincter, redundancy of the gastric mucosa, or retrograde peristalsis (17, 18). People describe intense pain that radiates from the abdomen up through the neck, and it can often be confused with myocardial infarction (19). The vast majority of GEI reports are in adults, with the first case in a child published in 2004 (20). Typically only a small portion of the fundus invaginates and it is rarely considered a surgical emergency (19). This suggests that the pathogenesis in humans differs from that in animals. Since most cases occur in very young dogs with congenital megaesophagus, most theories suggest that it is either a primary congenital problem, or, more likely, secondary to congenital esophageal disease (4, 17). Not all animals with megaesophagus will develop GEI, making the true pathogenesis unclear. Other conditions that may predispose dogs for the development of GEI include gastrointestinal hypomotility or hypermotility, ineffective esophageal sphincter, or increased abdominal pressure and decreased intrathoracic pressure as in humans (2, 17).

In this puppy, as is the case in other reported instances of this condition, the underlying etiology was not identified. The physical examination findings and bloodwork abnormalities were non-specific with regard to any underlying disease process. Most of the abnormalities detected on CBC and Chemistry analysis, such as mild anemia, thrombocytosis, hypoproteinemia, hypoalbuminemia, decreased BUN and creatinine, increased ALP, and hyperphosphatemia, were

considered normal for a young puppy. Intestinal parasitism may also explain the anemia, hypoproteinemia, and lymphocytosis; although stress secondary to hospitalization and illness was suspected to be the primary cause of the white blood cell abnormalities. Severe vomiting was determined to be the cause of the hyponatremia, hypochloridemia, and increased CK. Given the signalment of this case, a predisposing congenital disease such as megaesophagus provides the most likely etiologic differential for the intussusception. With the finding of an adult roundworm in the vomitus, parasitism as a predisposing condition can also not be ruled out. Small intestinal intussusceptions have been associated with parasitism and acute gastroenteritis, both of which could have played a role in the development of GEI in this puppy (21). One possible explanation for the development of GEI in this case is a sudden onset of increased intra-abdominal pressure caused by vomiting secondary to parasitism, along with a primary gastrointestinal disease such as congenital megaesophagus. It is not possible to determine if the megaesophagus occurred prior to, or secondary to, the intussusception, and, unfortunately, follow up thoracic radiographs were not obtained to determine if the megaesophagus resolved. To date, no reports have identified megaesophagus prior to the development of GEI.

Dogs with GEI most often present after an acute onset of esophageal obstruction with regurgitation, vomiting, dysphagia, hypersalivation and abdominal pain. Acute respiratory distress may also be seen due to a space occupying mass in the thorax and/or aspiration pneumonia. Cardiogenic or endotoxic shock due to decreased venous return or gastric ischemia and necrosis is also possible. Emergency surgery is usually recommended due to the risk of these severe complications (2, 17).

Laparotomy with bilateral gastropexy is the most commonly performed treatment and has been reported to be successful in preventing recurrence in the majority of cases (16). Endoscopic replacement has also been described and can be successful, but some form of gastropexy is required to prevent recurrence (2).

Prognosis seems to be much better than original reports indicated, although it remains guarded, particularly with regard to long term prognosis (2). Prior to 1998, only 3 of 27 (11%) reported cases survived (4). Since that time, more than 50% of case reports indicate survival with appropriate diagnosis and treatment. The increase in survival may

be associated with fewer euthanasias or deaths reported, more prompt diagnosis and treatment, or the use of bilateral gastropexy as the new treatment of choice.

Diagnosis of GEI is usually made with radiographic studies, such as thoracic radiography or esophageal contrast studies. Traditional radiography can be used to provide strong clinical suspicion, and exploratory laparotomy may be performed for confirmation. A contrast esophagram will show a uniformly dilated proximal esophagus with uniform contrast filling to the gas/soft tissue interface. The distal esophagus may or may not contain contrast depending on how the stomach is positioned within the esophagus and if contrast can get through the esophageal sphincter. Gastric rugal folds may or may not be visualized (1). Contrast radiography can be non-diagnostic and carries the risk of aspiration of contrast material. Diagnosis of GEI in humans, along with concurrent treatment, is most often performed via endoscopy (19). This procedure has also been used successfully in veterinary medicine for diagnosis and treatment, particularly in chronic cases (2, 17). Endoscopy, however, has multiple concerns including: risks of general anesthesia, specialized equipment that is often not accessible for general practitioners, need for trained operators, and added expenses. The potential advantage of correcting the intussusceptions at the same time using endoscopes may not be much of an advantage either, since gastropexy is recommended following reduction of the intussusception. Ultrasonography has been rarely reported as a diagnostic tool for gastroesophageal intussusception in dogs.

Ultrasound is used frequently in veterinary medicine for a variety of procedures, particularly for animals with abdominal disease. It is often useful for patients with a history of vomiting or related GI disease and is the diagnostic method of choice for intestinal intussusceptions (22). The characteristic finding of an intussusception is the concentric rings or "ring sign" which is created by the multiple wall layers of the intussusceptum (inner layer) and intussusciens (outer layer) (23). The intussusceptum is typically normal in appearance while the intussusciens can have hypoechoic and thickened walls. The actual appearance can vary somewhat in different patients due to location, length and type of intestinal segment, and orientation of the probe. Ultrasonography can also provide additional information with regard to the presence of additional organ involvement. In this puppy, the spleen was pulled into the

distal esophagus via the gastrosplenic ligament. Additional organs, including the duodenum, pancreas, and omentum, may be pulled into the esophagus (1, 2). In many cases, including the current one, the presence of these organs is likely incidental and emergency surgery is required regardless of their involvement. Additional problems, however, such as torsions, obstructions, and vascular occlusion of these organs would certainly raise concern for additional sequelae and possibly decreased prognosis. While contrast radiography, endoscopy, and ultrasound can all provide a definitive diagnosis of gastroesophageal intussusceptions, ultrasound has multiple advantages including: it is safe and non-invasive, diagnosis can be obtained very rapidly, it does not require general anesthesia, it is often readily available for general practitioners and the cost is reasonable for most clients. In this case, a diagnosis of gastroesophageal intussusceptions was easily made and suggests that this is an effective tool for diagnosis of this condition.

While this disease remains rare in domestic animals, it is one that veterinary practitioners should be aware of. It is an important differential in young dogs, especially GSD, with a history of vomiting or regurgitation. Survey radiographs that show megaesophagus and soft tissue opacity within the esophagus should increase an index of suspicion for veterinarians. Further diagnostics can be pursued and may include contrast esophagrams, endoscopy, or ultrasound. Ultrasound has the advantages of being very rapid, non-invasive, and readily available for most practitioners, and can provide a definitive diagnosis. It does require some familiarity with ultrasonography, but for those veterinarians with the means and experience to perform this procedure; this report indicates it to be an effective diagnostic tool.

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