Characteristics and long-term outcomes of dogs with gastroesophageal intussusception

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Abbreviations

- **GV** Gastric dilatation-volvulus
- **GEI** Gastroesophageal intussusception
- **PEG** Percutaneous endoscopic gastrostomy

**Objective**

To determine long-term outcomes and factors associated with those outcomes in dogs with gastroesophageal intussusception (GEI).

**Animals**

36 dogs with GEI evaluated at 16 veterinary hospitals from January 2000 through January 2018.

**Procedures**

Medical records of included dogs were reviewed to collect information regarding signalment, clinical signs, physical examination findings, blood work and diagnostic imaging results, surgical findings, and outcome. Factors were evaluated for associations with various outcomes.

**Results**

Median age of dogs with GEI was 13.2 months, and males (72% [26/36]) and German Shepherd Dogs (33% [12/36]) were most common. Vomiting (67% [24/36]) and regurgitation (33% [12/36]) were the most common clinical signs. Ten of 36 (28%) dogs were euthanized without treatment, and 26 (72%) underwent treatment (25 surgically and 1 endoscopically). Twenty-three of the 26 (88%) treated dogs survived to discharge; median survival time was 995 days. At last follow-up, 15 of the 23 (65%) surviving dogs remained alive and 8 (35%) had died for reasons related to persistent regurgitation (n = 6) or reasons unrelated to GEI (2). Of the 10 dogs for which owners were contacted, 7 had persistent regurgitation, the severity of which was reduced through managed feedings. Dogs with acute (< 7 days) clinical signs or a previous diagnosis of megaeosophagus were more likely to have persistent regurgitation than were dogs without these factors.

**Conclusions and Clinical Relevance**

Treatment should be considered for dogs with GEI given the high rate of survival to discharge and median survival time. Although persistent regurgitation was common after treatment, a satisfactory outcome was possible with medical management, including managed feedings and medications. (J Am Vet Med Assoc 2020;256:914–920)

Gastroesophageal intussusception is an uncommon condition in dogs in which the stomach invaginates into the esophagus, causing severe patient morbidity. Unlike hiatal hernia, the gastroesophageal junction remains in its normal anatomic position. A review of the existing English veterinary medical literature on the subject reveals that most reported cases of GEI in dogs involve dogs ≤ 6 months of age (28 of 38 [74%] cases for which age was reported) and males are over-represented (20 of 27 [74%] cases for which sex was reported).1-28 German Shepherd Dog is the most commonly reported breed, accounting for 57% (21/37) of reported cases for which breed was reported.

Clinical signs of GEI in dogs include dyspnea, regurgitation, and vomiting and may be acute or chronic in duration or represent an acute flare-up of a chronic condition (ie, acute on chronic). No specific underlying cause has been found for this condition; however, abnormalities of the esophagus, including megaeosophagus, dysmotility disorders, and laxity of the esophageal hiatus are believed to predispose dogs to GEI, with 50% of dogs in 1 study having preexisting esophageal abnormalities.
The diagnosis of GEI can often be made through abdominal radiography, which typically reveals a soft tissue mass within the cranial portion of the esophagus and no evidence of the stomach within the cranial portion of the abdomen. Megaeosophagus and aspiration pneumonia are common concurrent findings. Oral administration of positive contrast medium may help to highlight the invaginated stomach and may reveal rugal folds within the esophagus. Endoscopic evaluation of the esophagus may also assist with diagnosis when rugal folds can be seen in affected dogs.

Treatment of GEI requires reduction of the intussusception with left-sided or bilateral gastroscopy to prevent recurrence. Surgery is the most common method of treatment, although there are 2 case reports of endoscopic reduction of the intussusception with PEG tube placement to achieve gastroscopy. In the largest report of dogs with GEI to date, 95% (21/22) of dogs died or were euthanized, many of which did not undergo surgical treatment. More recent case reports have documented successful treatment with long-term patient survival after prompt diagnosis and aggressive treatment. The objectives of the study reported here were to characterize a large group of dogs with GEI and determine long-term outcomes and risk factors for those outcomes.

Materials and Methods

Animals

Case information on dogs with GEI was requested from members of the Society of Veterinary Soft Tissue Surgery through an email sent to all members via a listserv on January 20, 2018. Those participating in the study entered detailed information from cases at their institution into a provided data collection form. Records at individual institutions were searched for dogs with a diagnosis of GEI between January 1, 2000, and January 30, 2018.

Data collected from each medical record included patient signalment; date of initial evaluation; clinical signs; history of any documented esophageal abnormalities; physical examination findings; CBC, serum biochemical, and urinalysis results; diagnostic imaging findings (including endoscopy); surgical findings; postoperative clinical signs; persistence of esophageal dysmotility; cause and date of death and necropsy results, if applicable; and follow-up information. The duration of clinical signs prior to initial evaluation was defined as acute (≤ 7 days), chronic (> 7 days), or acute on chronic. Follow-up information for dogs that remained alive at the end of the study was obtained via telephone conversation with the primary care veterinarian, dog owner, or both.

Statistical analysis

Data were analyzed with the aid of a statistical software program. Descriptive statistics were generated. The data distribution for each continuous variable was evaluated with the Shapiro-Wilk test.

Results

Dogs

Thirty-six dogs from 16 veterinary hospitals were identified with GEI during the study period. Median age at initial evaluation was 13.2 months (range, 0.9 to 181.2 months). Twenty-six (72%) dogs were male; 18 were intact and 8 castrated, and 10 (28%) were female (8 spayed and 2 sexually intact). Dogs were classified as German Shepherd Dog (n = 12 [33%]), mixed-breed dog (6 [17%]), Great Dane (5 [14%]), English Bulldog (2 [6%]), and various other breeds (1 [3%] each).

The most commonly reported clinical signs at initial evaluation for the 36 dogs were vomiting (n = 24 [67%]), regurgitation (12 [33%]), anorexia (10 [28%]), and hematemesis (9 [25%]). The duration of these clinical signs was classified as acute (25 [69%]), chronic (8 [22%]), or acute on chronic (3 [8%]). Thirteen (36%) dogs were reported to have had documented megaeosophagus prior to evaluation for GEI. The most commonly reported physical examination findings were poor body condition (n = 14 [39%]), dehydration (10 [28%]), signs of lethargy or depression (10 [28%]), tachypnea (8 [22%]), and dyspnea (8 [22%]).

Diagnostic imaging findings

Thoracic radiography was performed for 33 of the 36 (92%) dogs. Findings were reported to be consistent with GEI for 29 (88%) of these dogs (Figure 1), and aspiration pneumonia was noted in 11 (33%) dogs. Of the 4 dogs for which GEI was not mentioned in the thoracic radiography findings, 1 had a normal-appearing thorax, 1 had evidence of multiple pulmonary nodules and a possible pulmonary abscess or neoplasia, 1 had evidence of a hiatal hernia, and 1 had suspected inflammatory or infiltrative disease of the caudal thoracic portion of the esophagus with possible hiatal hernia. In all 4 of these dogs, the GEI was diagnosed at surgery. Positive contrast esophagography was performed for 7 of 36 (19%) dogs. Results were consistent with GEI for 5 of these dogs (Figure 2), results were unremarkable for 1 dog, and the remaining
dog had evidence of gastroesophageal reflux of barium.

Results of abdominal radiography were available for 16 of the 36 (44%) dogs and were consistent with GEI for all 16 dogs. Abdominal ultrasonography was performed for 8 (22%) dogs, and results were consistent with GEI for 5 of these dogs. Esophageal endoscopy was performed in 7 (19%) dogs, and results were consistent with GEI for all 7 dogs (Figure 3).

Treatment

Twenty-five of the 36 (69%) dogs underwent open abdominal surgery to address the GEI. The stomach was confirmed to have intussuscepted into the esophagus in all dogs. Other organs involved in the intussusception in the 25 dogs included the spleen (n = 6 [24%]), duodenum (5 [20%]), and pancreas (3 [12%]). In 1 dog, gastroduodenal intussusception was noted in addition to GEI. Reduction of the GEI was recorded as difficult in 6 (24%) dogs, 3 of which required enlargement of the esophageal hiatus or opening of the diaphragm to facilitate the reduction.

Information on intraoperative procedures performed was available for 22 dogs, all of which underwent left-sided gastropexy. Concurrent right-sided gastropexy was performed in 14 of these 22 (64%) dogs, and a gastrostomy tube was placed on the left side in 8 (36%) dogs. In 10 dogs, additional procedures were performed including ovariohysterectomy (n = 2), intestinal biopsy (2), splenectomy (1), phrenoplasty (1), rhinoplasty (1), laryngeal sacculectomy (1), partial left cranial lung lobectomy (1), bilateral inguinal herniorrhaphy (1), cutaneous mass removal (1), gastrostomy (1), fundoplication (1), gastropexy of the cardia to the diaphragm (1), and repair of a prolapsed gland of the third eyelid (1), with some dogs having more than 1 additional procedure.

Attempts were made to reduce the intussusception endoscopically in 6 of the 7 dogs that underwent esophageal endoscopy. Endoscopic reduction was successful in only 1 dog. In this dog, the GEI was an incidental finding on the diagnostic workup for gastrointestinal signs (ie, weight loss, anorexia, and vomiting) and panhypoproteinemia with a transudative abdominal effusion.
Outcome

**Short-term**—Ten of 36 (28%) dogs were euthanized without treatment. For all of these dogs, the GEI had been diagnosed by means of thoracic radiography, with some dogs having undergone additional imaging that confirmed the GEI, including abdominal radiography (n = 4), endoscopy (2), positive-contrast esophagography (1), and abdominal ultrasonography (1). The reason for euthanasia was the poor prognosis associated with GEI (n = 7, along with financial concerns for 3 dogs), unknown (2), and the owner (a breeder) deciding not to proceed with treatment owing to the other puppies in the litter being healthy (1).

One of the 25 (4%) dogs that underwent open abdominal surgery died intraoperatively from a caval laceration. Another dog (4%) was euthanized during surgery owing to necrosis of the distal portion of the esophagus and 80% of the stomach after a difficult reduction of the GEI requiring median sternotomy. A third dog died in the postoperative period because of dyspnea and dull mentation unresponsive to treatment. The remaining 22 (88%) surgically treated dogs survived to discharge from the hospital, of which 6 (27%) had regurgitation and 1 (5%) had vomiting during the postoperative period prior to discharge. Information on the date of hospital discharge was available for 17 of the 22 dogs, with a median duration of hospitalization of 4 days (range, 1 to 31 days). The dog that underwent endoscopic reduction of the GEI was discharged 2 days later, with plans to treat for lymphangiectasia and protein-losing enteropathy. No form of gastropexy was pursued. Overall, of the 26 dogs that underwent treatment for GEI, 23 (88%) survived to discharge from the hospital.

**Long-term**—Median follow-up time for dogs surviving to discharge from the hospital was 360 days (range, 2 to 4,451 days), and median survival time after treatment was 995 days. The endoscopically treated dog was lost to follow-up immediately after discharge. Recurrence of GEI was not reported in any dog. By the end of the study follow-up period, 8 of 23 (35%) dogs were confirmed to have died. Six of these dogs died a median of 663 days (range, 66 to 995 days) after treatment for reasons related to continued problems with megaesophagus leading to persistent regurgitation, aspiration pneumonia, or both. The other 2 dogs died of reasons unrelated to the GEI: one from cardiac hemangiosarcoma and concurrent chemodectoma at 270 days and the other from unknown cancer at 4,451 days after treatment for GEI.

The remaining 15 of the 23 (65%) surviving dogs were confirmed to be alive at time of last contact with the owner or primary care veterinarian at a median of 228 days (range, 2 to 1,544 days) after treatment. Ten of these dogs were noted to have persistent regurgitation at time of last contact, and 5 had no reported regurgitation. One of the dogs with persistent regurgitation was reevaluated 34 days after surgical treatment of the GEI. At that time, the regurgitation was reportedly severe enough that the owner was considering euthanasia, but whether the dog was euthanized could not be confirmed.

Contact information was available for the owners of 19 of the 23 dogs that survived to discharge. Owners of 5 of these dogs were not contacted because the dog was known to have since died, and owners of the remaining 14 dogs were contacted to obtain follow-up information, with 10 owners providing follow-up information. The median time to this contact was 896 days (range, 228 to 4,451 days) after treatment. Seven dogs were alive at this point, and 3 had been euthanized owing to megaesophagus and aspiration pneumonia (n = 2) or unknown cancer (1).

Regurgitation was reported in 7 dogs, with no regurgitation in 3 dogs. Regurgitation was reported to occur with varying frequencies, ranging from 1 to 2 times/mo to multiple times a day. In 2 of the dogs with no reported regurgitation, no medical management of regurgitation (ie, no change to feeding habits and no medications) was provided after surgical treatment of the GEI. In the third dog with no reported regurgitation, medical management successfully controlled the regurgitation. Seven owners had made changes to how their dog was fed by feeding the dog from a Bailey chair (n = 4) or using another approach for elevated feeding (3), and 3 owners had not made any changes to how the dog was fed. Four owners fed the dog a pureed diet, 3 fed a kibble-only diet, 2 fed a mix of canned and dry food, and 1 fed canned meatballs. Three owners specifically commented that generally their dog did not regurgitate unless it had eaten something other than its usual diet and manner of eating. Eight owners reported that the clinical signs had improved since surgical treatment for GEI, 1 reported that the signs had remained the same, and 1 reported that the signs had worsened. Four dogs were receiving medications for regurgitation or vomiting, including sildenafil prior to feedings (n = 1); a probiotic, enzyme powder, and sucralfate as needed (1); sucralfate and esomeprazole (1); and famotidine (1). Three dogs reportedly had at least 1 instance of aspiration pneumonia following surgical treatment for GEI, and the remaining 7 dogs had no reported episodes of aspiration pneumonia.

Among the owners of the 7 dogs alive at time of last contact, 6 owners commented that they were happy with the procedure and how their dog was doing but stressed proper management of feedings to control regurgitation through elevated feedings or changing the consistency of the diet until it was tolerated with minimal regurgitation. In the remaining surviving dog, no regurgitation was noted, no medical management was being performed (either changes to feeding habits or medications), and the owner was happy with the outcome.

Of the 10 dogs for which owners were contacted, all 5 dogs with a history of documented megaesophagus prior to GEI had persistence of megaesophagus after surgical treatment, with 4 of the 5 dogs having persistent regurgitation. The 1 dog with megaesophag-
The primary treatment for the dogs in the present study was surgical reduction of the GEI and left-sided gastropexy with or without concurrent right-sided gastropexy. In dogs with GEI, the fundus of the stomach intussuscepts into the esophagus and, therefore, left-sided gastropexy should prevent recurrence. Right-sided gastropexy may have been performed to prevent future GDV in German Shepherd Dogs, Great Danes, and other breeds at risk for GDV. Nevertheless, no dogs had reported recurrence of GEI, indicating that left-sided gastropexy alone may be sufficient to treat GEI. It should be noted that in many dogs, a lack of clinical signs during the remainder of the dog’s life was interpreted as a lack of recurrence of GEI and that this interpretation was not radiographically or endoscopically confirmed. In the authors’ experience, dogs with GEI often have intractable vomiting and regurgitation, and although several dogs continued to regurgitate after surgical treatment, the clinical signs were not severe enough to warrant additional investigation; thus, the GEI was unlikely to have recurred in those dogs. Studies have shown that incisal gastropexy is highly successful in the prevention of GDV, and it follows that gastropexy would be similarly successful in the prevention of GEI.

One dog in the present study underwent endoscopic reduction of the GEI without permanent gastropexy or PEG tube placement. Endoscopic reduction with PEG tube placement has been previously reported as a treatment for GEI and was successful in both of those cases. One study showed that the tensile strength of the gastrecutaneous adhesion formed by PEG tube placement was significantly less than that of the adhesion formed by incisal gastropexy. The tensile strength required to prevent GEI is unknown, and with appropriate medical management of chronic regurgitation and vomiting, the propensity for intussusception may be reduced, indicating that the adhesion formed by PEG tube placement may be sufficient to prevent recurrence. Placement of a PEG tube was not pursued in the dog of the present report for unknown reasons. This particular dog had chronic gastrointestinal problems that were ultimately attributed to lymphangiectasia, and the dog was subsequently lost to follow-up after discharge so whether the GEI recurred remains unknown.

An additional benefit of surgical treatment of GEI over endoscopic treatment is the ability to assess stomach viability and esophageal hiatus laxity, which could be assessed surgically. Surgical treatment also allows for a gastropexy to be performed, which would form a stronger adhesion than a PEG tube would provide. In the present study, surgical reduction of the GEI was noted to be difficult in 6 dogs, requiring opening of the esophageal hiatus to allow for reduction of the intussusception in 3 dogs;
therefore, endoscopic reduction would likely not have been successful in these dogs and was only successful in 1 of the 6 dogs in which it was attempted. Careful case selection is required when considering endoscopic reduction of a GEI, and if endoscopic reduction is not possible, surgery should be performed to reduce the GEI.

The pathogenesis of GEI is unclear, but this condition has been postulated to occur as a result of megaesophagus, esophageal dysmotility disorders, or laxity of the esophageal hiatus, all of which increase the likelihood of gastric invagination into the esophagus. Megaesophagus was documented prior to GEI in 36% of dogs in the present study. The presence of megaesophagus may have led to dilatation of the lower esophageal sphincter; this, coupled with the motion applied to the stomach during regurgitation and vomiting, may have allowed for intussusception of the stomach into the esophagus. Another related condition is hiatal hernia, the most common of which in dogs is type 1, in which the gastroesophageal junction slides through the esophageal hiatus into the thorax. Two dogs were suspected to have had a hiatal hernia given their preoperative radiography findings, but at surgery these dogs were found to have GEI. A previous report describes a single Pug with a history of hiatal hernia that developed intermittent GEI. The link between hiatal hernia and GEI is unclear, but these conditions may be related given the abnormal anatomy of the esophageal hiatus or gastroesophageal junction in affected dogs. Treatment for hiatal hernia also consists of left-sided gastropexy; consequently, treatment of GEI with left-sided gastropexy should prevent hiatal herniation in dogs affected by both conditions.

Dogs with a shorter duration of clinical signs or clinical signs classified as acute were more likely to have persistent postoperative regurgitation than were dogs with a longer duration of clinical signs or clinical signs classified as chronic in the present study. Dogs with a history of documented megaesophagus were more likely to have acute versus chronic clinical signs. The link between the presence of acute or shorter duration of clinical signs and persistent regurgitation may be explained by this finding. Although dogs with megaesophagus would be expected to have chronic clinical signs, many of the included dogs were young and megaesophagus may not have been diagnosed prior to development of GEI. Not surprisingly, dogs with a history of documented megaesophagus were more likely to have persistent postoperative regurgitation than were dogs without such a history. This suggested that dogs in which megaesophagus has not been previously identified may have a better long-term outcome with less risk of chronic regurgitation than these other dogs. It may also be prudent to perform additional diagnostic tests to rule out acquired causes of megaesophagus in dogs without a history of megaesophagus. Given the young age of most dogs in the present study, the presence of megaesophagus may not always be known before GEI is diagnosed. Therefore, owners should be counseled about the risk of lifelong regurgitation and the related management needs that may persist after surgical correction of GEI.

In some dogs of the present study, GEI was seemingly a chronic, intermittent problem, which was less common than the severe, acute manifestation. Dogs with a chronic history were not more likely to be older or have documented megaesophagus. In these dogs, some form of hiatal hernia may have been present, resulting in gastrointestinal signs until the stomach invaginated into the esophagus, leading to GEI. The chronic signs may have been due to undiagnosed megaesophagus, and it was not until GEI occurred that the dog rapidly decompensated. Another possible explanation for dogs with a lax esophageal hiatus or lower esophageal sphincter is that intermittent GEI self-corrected prior to requiring surgical intervention. This is consistent with the 1 dog in which findings of thoracic radiography and barium esophagography were unremarkable, despite GEI being diagnosed at surgery. In cases such as this, resolution of the underlying cause of the stomach invaginating into the esophagus, such as vomiting or regurgitation, could reduce the risk of GEI.

Because of the low numbers of deaths among treated dogs in the present study, factors associated with survival to discharge from the hospital could not be analyzed. However, all 4 dogs with preoperative aspiration pneumonia survived to discharge, indicating that with appropriate management, a diagnosis of aspiration pneumonia should not preclude surgical intervention for GEI. No variables were associated with survival time or the hazard of death over the study period. Ultimately, 6 dogs were confirmed to have died because of chronic regurgitation and aspiration pneumonia and 10 treated dogs had persistent regurgitation after surgery as reported by owners. Given the long survival time for those 6 dogs (median, 663 days after treatment) and the number of dogs with persistent regurgitation that remained alive at the end of the study period, it may be possible for these dogs to live for an extended period, provided owners are aware of the propensity for continued regurgitation and are able to manage it appropriately. Counseling of owners on treatment strategies to minimize the amount of regurgitation in dogs with persistent megaesophagus appeared paramount to a successful outcome in these cases. Use of a Bailey chair or another approach to elevated feedings, maintaining the dog in an upright position for a certain period after a feeding, adjusting the physical consistency of the food to a level that is tolerable for the dog, and use of adjunctive medications should all be discussed. Most contacted owners were adept at managing their dog's feeding schedule and regimen to minimize the potential for regurgitation, and few dogs had ongoing problems with aspiration pneumonia. It is important to note that the optimal feeding regimen differs by individual dog, and determination of that optimal regimen may take time, but with owner dedication,
the frequency of regurgitation can be limited and a successful outcome is possible.

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Footnotes