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Colonic torsion and volvulus in dogs is associated with a low mortality rate and good long-term outcome

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OBJECTIVE
To describe clinical findings, complications, and short- and long-term outcomes associated with colonic torsion and volvulus in dogs.

ANIMALS
28 client-owned dogs.

CLINICAL PRESENTATION
Multi-institutional, retrospective study. Medical records were searched for dogs of any age, body weight, sex, and breed that underwent surgery for colonic torsion and volvulus. Collected data included signalment, previous history, preoperative findings, time until surgery, intraoperative findings, postoperative complications, length of hospitalization, survival to discharge, and outcomes.

RESULTS
28 dogs were included. Thirteen of 28 dogs (46.4%) had preexisting gastrointestinal conditions. Nine of 28 dogs (32.1%) had a gastropexy performed prior to presentation. Ten dogs (35.7%) were found to have a resolution of colonic torsion and volvulus at the time of the surgery. All but 1 dog (27 of 28 [96.4%]) survived to discharge. Two dogs died during the postoperative period, yielding a mortality rate of 7.1%. Postoperative complications were noted in 9 dogs (9 of 28 [32.1%]). Long-term follow-up information was available in 16 of 28 dogs (57%). Among 16 dogs with at least 6 months' follow-up, all dogs (16 of 16 [100%]) were alive at 6 months postoperatively. Two dogs developed mesenteric torsion after the initial surgery.

CLINICAL RELEVANCE
Dogs with colonic torsion and volvulus undergoing surgery can have an excellent survival-to-discharge ratio with a low mortality rate. Surgeons should not be prompted to euthanize or assume a guarded prognosis solely on the basis of the intraoperative appearance of the bowel and should consider all factors prior to making decisions. Owners should be informed of the risk of developing further torsional diseases after surgery.

Keywords: dogs, torsion, colonic, colonic torsion, colonic volvulus

Intestinal torsion and volvulus are surgical emergencies that can lead to ischemia of the intestinal segments, necrosis, endotoxemia, sepsis, shock, and death.[1–3] Intestinal torsion is the pathologic twisting of the intestinal segment around its longitudinal segment, while intestinal volvulus is the rotation around its mesenteric axis.[1,2] Although both conditions can occur simultaneously, the terms volvulus and torsion are frequently used interchangeably and the distinction may be unclear in the literature.[2,4–8]

Large intestinal torsion and volvulus are less frequently reported than small intestinal torsion in dogs.[1,3] While the exact etiology for canine colonic torsion and volvulus remains elusive, some authors have investigated and suggested certain factors that could be related to the condition including sex, breed, preexisting or concurrent gastrointestinal disease such as exocrine pancreatic insufficiency, lymphoplasmacytic enteritis, history of resection and anastomosis for foreign body obstruction, and previous gastropexy.[3–6,9–11] Recognition of clinical signs is crucial to decreasing the affected dogs' morbidity

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and mortality.[8] Reported clinical signs from previous studies include lethargy, vomiting, retching, tenesmus, diarrhea, abdominal pain, and distension.[1–11] However, prompt diagnosis of the condition can be challenging sometimes, as reported by a few case studies describing "dynamic torsion," which can lead to chronic, nonspecific gastrointestinal signs.[10,12]

While initial reports in dogs with colonic torsion and volvulus have indicated a high mortality rate and grave prognosis, more recent case series have reported more favorable outcomes.[1–3,6–10,13] However, the literature is limited to a small number of case series and reports with minimal long-term follow-up data. One case series[9] retrospectively evaluated outcomes in 13 dogs and found a markedly improved survival compared to previous reports; however, only 9 of 13 were available for long-term follow-up. The largest study[10] to date described radiographic findings in 14 dogs but did not include clinical outcomes or long-term follow-up.

The objective of this study was to describe the clinical presentation, complications, and short- and long-term outcomes associated with colonic torsion and volvulus in dogs.

Methods

Medical records from 2 private practices and 1 academic institution were searched for dogs of any age, body weight, sex, and breed with a surgical or radiographic diagnosis of colonic torsion and volvulus between January 2014 and April 2024. Dogs were included if they were diagnosed with colonic torsion and volvulus on the basis of radiographic or surgical findings, received surgical treatment for colonic torsion and volvulus, and had at least 6 months of postoperative follow-up data recorded. Dogs were excluded if the owner opted for euthanasia prior to surgery and no follow-up data were available. Preoperative information extracted from the medical record included signalment (age, sex, breed, and weight), onset of clinical signs, previous history, presenting complaint, physical examination findings, clinicopathologic findings, diagnostic imaging, and time until surgery. Intraoperative information collected included surgical treatment for colonic torsion and volvulus, concurrent surgical findings, degree of torsion if documented, intraoperative complications, and additional surgical procedures. Postoperative information collected included any major or minor complications, length of hospitalization, survival to discharge, follow-up time, and long-term outcome. A long-term outcome was defined as a follow-up at least 6 months postoperatively. For any dog that died prior to discharge, the cause of death was recorded. Owners or referring veterinarians were contacted as needed to collect follow-up information, including survival status and date and cause of death if known.

Statistical analysis

Descriptive statistics were computed with Excel (version 16.89.1; Microsoft Corp). Categorical variables were presented as frequencies and percentages and nonparametric data as medians along with minimum and maximum values when applicable.

Results

Demographics

Twenty-eight dogs met the inclusion criteria. The median age and weight were 7 years (range, 1 to 11 years) and 40.7 kg (range, 21.8 to 66.6 kg), respectively, with 16 males (16 of 28 [57.1%]; 14 neutered, 2 intact) and 12 females (12 of 28 [42.8%]; 11 spayed, 1 intact). The breeds represented were Labrador Retriever (9 of 28 [32.1%]), Great Dane (8 of 28 [28.6%]), German Shepherd Dog (5 of 28 [17.9%]), Labrador Retriever mix (2 of 28 [7.1%]), mixed breed (2 of 28 [7.1%]), Alaskan Malamute (1 of 28 [3.6%]), and French Mastiff (1 of 28 [3.6%]).

Clinical presentation and history

Most patients (25 of 28 [89.3%]) had an acute onset of clinical signs, while 3 dogs (3 of 28 [10.7%]) had acute worsening with a history of chronic gastrointestinal signs. The most common presenting clinical signs were vomiting (22 of 28 [78.5%]), inappetence (11 of 28 [39.2%]), lethargy (10 of 28 [35.7%]), diarrhea (10 of 28 [35.7%]), tenesmus (8 of 28 [28.5%]), restlessness/pacing (4 of 28 [14.2%]), abdominal distension (3 of 28 [10.7%]), abdominal pain (3 of 28 [10.7%]), labored breathing (1 of 28 [3.5%]), and a prayer position (1 of 28 [3.5%]). All dogs (100%) had a painful or tense abdomen on presentation. Other physical examination findings included dehydration (5 of 28 [17.8%]), ptyalism (4 of 28 [14.2%]), tachycardia (4 of 28 [14.2%]), abdominal distension (3 of 28 [10.7%]), firm and dilated intestinal loops (3 of 28 [10.7%]), mucus on rectal examination (2 of 28 [7.0%]), and heart murmur (1 of 28 [3.5%]). Thirteen of 28 dogs (46.4%) had preexisting gastrointestinal disease or procedures. More specifically, 6 dogs (21.4%) had prophylactic gastropexy prior to presentation, 4 dogs (14.2%) had chronic gastrointestinal signs, 3 dogs (10.7%) had a history of gastric dilatation and volvulus (GDV) and subsequent gastropexy, and 1 dog each had the following conditions: inflammatory bowel disease, dietary indiscretion, and hemorrhagic gastroenteritis. A total of 9 of 28 dogs (32.1%) had gastropexy performed prior to presentation.

Preoperative diagnostics

The most common clinicopathological findings were hemoconcentration (10 of 28 [35.7%]), leukocytosis (7 of 28 [25.0%]), hyperlactatemia (7 of 28 [25.0%]), increased ALT (5 of 28 [17.8%]), and hyperglycemia (4 of 28 [14.2%]). All dogs had preoperative diagnostic imaging, most commonly abdominal radiograph (26 of 28 [92.8%]). All dogs (100%) had moderate to severe gas distension of the colon, and 13 dogs had malposition of the cecum and/or colon. Five dogs had abrupt termination of the descending colon, all of which were located at the caudal aspect of the descending colon. Two dogs had initial

abdominal radiographs showing colonic malposition and narrowing leading to the diagnosis of colonic torsion and volvulus, but the subsequent study showed spontaneous resolution of the radiographic findings **(Figure 1)**. One dog had a severe gastric dilatation and dorsally located pylorus, which led to an initial radiographic diagnosis of GDV. Two of 28 dogs (7.2%) had abdominal ultrasound without radiograph. One dog had a midjejunal foreign body and a heterogeneous population of bowel with a segmental dilatation. Another dog was initially diagnosed with gastroenteritis on the basis of sonographic findings; however, despite aggressive supportive treatment, the clinical signs continued to progress and an exploratory laparotomy was pursued. The median time to surgery was 5.8 hours (range, 2 to 34 hours).

Surgical procedure

All but 2 dogs (26 of 28) received left-sided colopexy as surgical treatment for colonic torsion and volvulus. Two dogs had subtotal colectomy due to extensive colonic wall necrosis and thrombosis of the colonic vasculatures. Other surgical procedures performed included right-sided incisional gastropexy (4 of 28 [64.2%]), gastrocolopexy (5 of 28 [17.8%]), jejunal biopsy (4 of 28 [14.2%]), enteropexy (2 of 28 [7.0%]), enteroplication (2 of 28 [7.0%]), splenectomy (2 of 28 [7.0%]), mesenteric lymph node biopsy (2 of 28 [7.0%]), and liver biopsy (1 of 28 [3.5%]). In total, 24 out of 28 dogs (85.7%) either already had gastropexy performed prior to the presentation or at the time of the correction for colonic torsion.

All dogs had moderate to marked gas distension of the colon, with varying degrees of inflammation and congestion. The degree of torsion is reported in 20 dogs: 90° in 1 dog, 180° in 4 dogs, 270° in 1 dog, and 360° in 4 dogs. Ten dogs (10 of 28 [35.7%]) were found to have a resolution of colonic torsion and volvulus at the time of the surgery and were reported to have 0° of torsion; all of these dogs had varying degrees of localized serosal bruising and hemorrhage along the colon and colonic vasculatures that was strongly suspicious of prior torsion. Five dogs (5 of 28 [17.8%]) also had small intestinal dilatation and congestion. One dog had a concurrent partial mesenteric volvulus involving the distal third of the small intestine along with the colonic torsion and volvulus affecting the ascending, transverse, and descending colon. After derotation, the bowel was deemed to be viable, and gastropexy, gastrocolopexy, enteroplication, and enteropexy were performed in this dog. Other intraoperative findings included abdominal effusion (n = 10), nonobstructive colonic foreign body (2), enlarged mesenteric lymph nodes (2), thrombosis in the colonic vasculature (1), splenic mass (1), fracture of the splenic body with active hemorrhage (1), hematoma present at the ileocolic junction (1), and colonic entrapment at the previous gastropexy site (1). Three intraoperative complications (3 of 28 [10.7%]) were reported, including 1 major complication and 2 minor complications. Two dogs had accelerated idioventricular rhythm and hypotension during anesthesia. In 1 dog, the descending colon was inadvertently entered during the incisional colopexy, resulting in a 4-mm full-thickness defect. The defect was primarily repaired, and a left-sided colopexy was performed in a routine manner. No other major or minor intraoperative complications were noted.

Postoperative period

The median hospitalization time to discharge was 2 days (range, 1 to 5). Overall, all but 1 dog (27 of 28

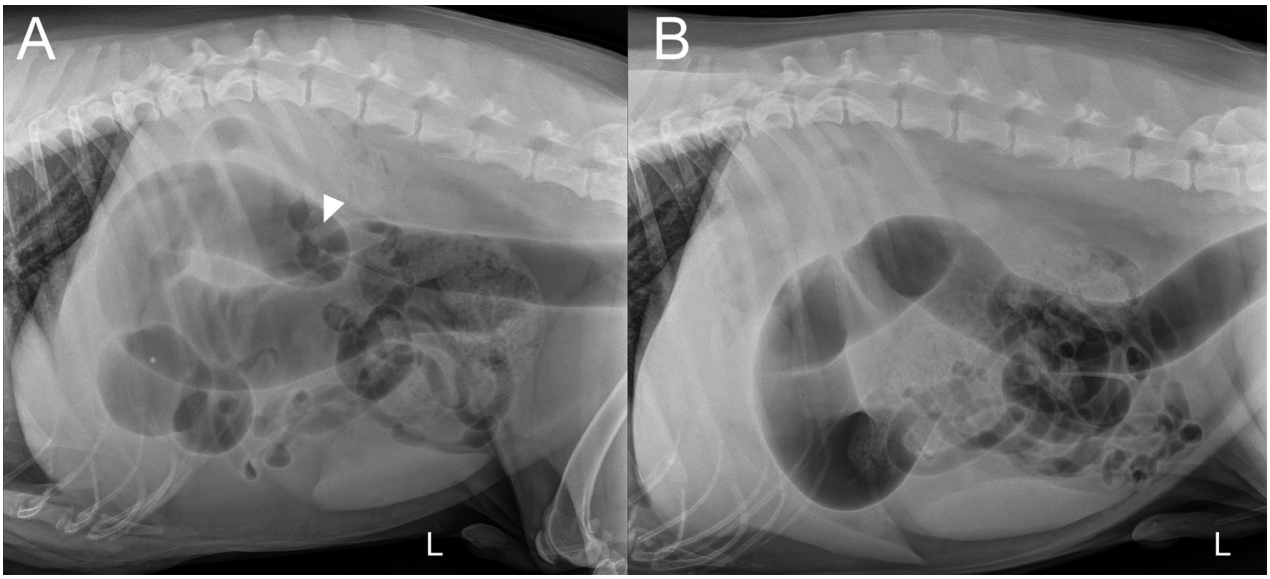

Figure 1—Left lateral radiograph of the abdomen of a 7-year-old castrated male Labrador Retriever with a radiographic diagnosis of colonic torsion on the initial study (A) followed by spontaneous resolution (B) in a study of 28 dogs that underwent surgery for colonic torsion and volvulus. A—A markedly distended colon with a "pinching" of the proximal colon (white arrowhead) is seen at the level of L2. B—The subsequent study shows resolution of the narrowing of the colon.

[96.4%]) survived to discharge. Postoperative complications were noted in 9 dogs (9 of 28 [32.1%]). Major complications occurred in 7 dogs (7 of 28 [25.0%]), including hypoalbuminemia along with pitting edema (n = 2), superficial surgical site infection (2), mesenteric torsion (1), hemoperitoneum (1), and prolonged hypotension (1). Two dogs developed hypoalbuminemia and pitting edema of the limbs postoperatively. Both dogs responded well to supportive care at the hospital and were discharged 3 and 5 days after surgery. One dog exhibited abdominal pain, regurgitation, and nausea and developed azotemia 3 days postoperatively. Further diagnostics were declined by the clients, and the patient was treated with aggressive supportive care with a presumptive diagnosis of pancreatitis. Azotemia and all clinical signs resolved after 5 days of hospitalization. Two dogs developed superficial surgical site infections 8 and 17 days postoperatively. Both dogs were treated with oral antibiotics, and the clinical signs resolved by the recheck examination. Two dogs (2 of 28 [7.1%]) had minor complications including tenesmus (n = 1) and regurgitation (1), all of which were self-limiting and resolved without any treatment.

Of 27 dogs that survived to discharge, 1 dog was euthanized 8 days postoperatively. Overall, 2 dogs (2 of 28) died during the postoperative period, yielding a mortality rate of 7.1%. One dog was found to have a diffuse distension and congestion of the small and large intestines and received a left-sided colopexy and right-sided incisional gastropexy. This dog developed severe hematochezia postoperatively, which improved with supportive care. The dog was discharged 4 days postoperatively with a normal appetite and energy level; however, the dog continued to have hematochezia and developed hyporexia. The dog was presented to the emergency service 8 days postoperatively for an acute onset of lethargy and dry heaving. On the basis of repeated abdominal radiography, mesenteric torsion was suspected. Exploratory laparotomy was recommended, but due to poor prognosis and financial concerns, the owner opted for euthanasia. One dog had hemoperitoneum along with a 180° colonic torsion at the time of the surgery. Abdominal exploration revealed active bleeding from the splenic vessel and fractured spleen. After derotation, all tissues were deemed to be viable and routine splenectomy with a left-sided colopexy was performed. The dog recovered uneventfully from surgery but became acutely lethargic, pale, and hypotensive immediately before the scheduled discharge. Abdominal ultrasound revealed hemoperitoneum and a right lateral hepatic mass that was not noted during surgery. This dog had a small mediastinal mass on the preoperative chest radiograph, and the owner opted to proceed with surgery after being informed about the possibility of the underlying neoplastic process. Due to the possibility of metastatic disease and poor prognosis, the dog was euthanized.

Histopathology results for intestinal biopsy were available for 2 dogs. One dog was diagnosed with lymphoplasmacytic enteritis on the basis of intraoperative small intestinal biopsies. Another dog had a histopathology of the resected colon after subtotal colectomy. The result showed a regional full-thickness necrosis, diffuse hemorrhage and edema, and changes consistent with torsion. No underlying gastrointestinal disease process was found in this dog.

Long-term outcome

Long-term follow-up information was available for 16 of 28 dogs (57%). The median long-term follow-up time was 20.5 months (range, 7 to 88 months). Among 16 dogs with at least 6 months' follow-up, all dogs (16 of 16 [100%]) were alive at the time of the follow-up and 15 of 16 dogs had no reported concerns. One dog was reported to have an intermittent tenesmus after discharge. This dog had a preexisting history of chronic gastrointestinal signs including tenesmus prior to surgery. The owner reported that tenesmus resolved after dietary changes and medical management, and the dog survived 44 months after surgery before passing away at home. Among 14 dogs with at least 12 months' follow-up, all dogs (14 of 14 [100%]) were alive 12 months postoperatively with no reported long-term major or minor complications. At the time of writing this manuscript, 8 dogs were still alive and 8 dogs were euthanized or died. Two of 8 dogs died from gastrointestinal-related causes, and 6 dogs died from non–gastrointestinal-related causes. The recorded cause of death included neoplasia (n = 3), mesenteric torsion (1), gastrointestinal obstruction leading to euthanasia (1), and obtundation (1) and was unspecified in 2 dogs. One dog developed a mesenteric torsion 34 months postoperatively, and the owner opted for euthanasia. Dogs that were still alive at the time of the study were doing well at home, with no reported concerns or long-term major or minor complications.

Discussion

The results of the current study indicate that dogs with colonic torsion and volvulus can have excellent survival to discharge with a relatively low mortality rate. Furthermore, most patients had good short- and long-term outcomes, although the development of additional intestinal torsion and volvulus can be of concern. Approximately one-third of the dogs diagnosed with colonic torsion and volvulus based on radiographic findings experienced spontaneous resolution during subsequent studies or at the time of surgery. While the diagnoses were not confirmed surgically in these dogs, all dogs had multiple radiographic findings that were indicative of colonic torsion and volvulus, as well as intraoperative findings that were supportive of prior torsion, suggesting that spontaneous resolution of torsion and volvulus is a common finding. As all previous literature on colonic torsion and volvulus in dogs is limited to a small number of case series[9,10,12] and case reports,[1–3,5,13] this retrospective study describes the largest number of colonic torsion and volvulus dogs with short- and long-term outcomes to date.

The demographics of the population from the current study are closely in line with those of previous reports, with Labrador Retrievers, German Shepherd Dogs, and Great Danes found as overrepresented breeds.[2,5,9,10] While the absence of the control population precludes any conclusion to be drawn regarding breed predisposition, these 3 breeds comprised nearly 80% of the study population, with Labrador Retrievers representing 32% of the group, supporting the previous speculation that these breeds are commonly overrepresented in clinical settings. Some authors also suggest a sex predisposition of the condition because 31 out of 43 dogs reported in the literature were male dogs.[9,10] Interestingly, while male dogs were still higher in number in the current study, female dogs comprised nearly half of the population; thus, a clear sex predisposition was not seen in our data.

In the current study, all but 1 dog survived to discharge. The dog that was euthanized prior to discharge had a splenectomy and left-sided gastropexy, as active hemorrhage from a fractured spleen was noted intraoperatively. This dog initially recovered uneventfully from surgery but collapsed immediately prior to discharge. Subsequent abdominal ultrasound found a hemoperitoneum suspected to be secondary to a ruptured liver mass. In addition, a small mediastinal mass was noted on the preoperative chest radiograph of the dog, which influenced the owner's decision to perform an additional procedure; thus, the cause of death in this dog was mostly unrelated to the diagnosis of colonic torsion. Another dog had a significant diffuse distension and congestion of the bowel, but all parts of the intestine recovered normal circulation after derotation and were deemed to be viable. This dog received a left-sided colopexy and prophylactic gastropexy. The dog recovered well from surgery but continued to have hematochezia, then developed mesenteric torsion 8 days postoperatively. Both dogs were euthanized during the perioperative period, yielding a survival to discharge rate of 92% and a perioperative mortality rate of 7.1% in the current study. These results are in contrast with those of earlier reports, which suggest a high mortality rate and guarded prognosis in dogs with colonic torsion and volvulus.[1,2,4,13] Although more recent case series have found better short-term outcomes, with survival rates ranging between 71% and 100%, most of these reports also described the number of dogs that were euthanized intraoperatively due to perceived guarded prognosis on the basis of intraoperative findings.[6,9,10] The current study also included dogs with significant circulatory compromise and inflammation of the colon, which were deemed questionable in viability or nonviable. While the degree of vascular compromise and viability of intestines can be a subjective assessment, all cases either resolved with derotation and decompression of the bowel or were treated with subtotal colectomy when deemed necessary by the surgeon. It is a notable finding that, regardless of the surgical method chosen by the surgeon, most dogs survived to discharge and were reported to have good long-term outcomes with no further complications.

Dogs undergoing intestinal resection for colonic torsion and volvulus have been suggested to have worse outcomes in previous reports.[1,2,13] While the number of dogs that underwent resection and anastomosis was too low to draw a definitive conclusion, both dogs that had a subtotal colectomy for colonic wall necrosis and thrombosis of the vasculature in this study had good long-term outcomes. Our results suggest that surgeons should not be prompted to euthanize or assume a guarded prognosis solely on the basis of the intraoperative appearance of the bowel. The affected segments of the bowel should be reassessed for viability after derotation, and all factors including comorbidities, concurrent surgical findings, and financial feasibility should be considered prior to making a terminal decision on the basis of clinical impression.

Some authors have suggested that prolonged time to surgery seems to be associated with a worse outcome.[1,9] Most dogs in this study had acute onset of clinical signs, and the median time to surgery in the current study was about 6 hours, ranging from 2 to 34 hours, which was relatively longer than most other available reports. The relatively prolonged time to surgery in this study may have been because some of the dogs were deemed to be relatively stable at the time of presentation. As a result, some dogs received medical management and supportive care prior to surgery, resulting in the delay. This is in contrast to previous reports, in which all or most of the patients were in shock with acute progression at presentation.[9] One case report[14] described a dog with colonic torsion confirmed on CT scan that had resolved at the time of surgery. The dog was bright, alert, and responsive, with normal vital parameters on presentation and only mild abdominal discomfort. The author of that case report suggested that there may be 2 populations of dogs presenting for colonic torsion: dogs in hypovolemic shock and dogs that are stable with vague clinical signs.[14] Our results support the observation that not all dogs with colonic torsion present in critical states and may be hemodynamically stable or have vague clinical signs. Although the exact correlation between the time to surgery and the outcome could not be determined due to the low number of deaths in this study, these results suggest that dogs can present with a wide range of clinical statuses and a delay in surgery does not always correlate with a poor outcome of the case.

In the current study, 35% of dogs were found to have a spontaneous resolution of colonic torsion and volvulus at the time of the exploratory surgery. Two of these dogs had malposition and a "pinched" appearance of the colon in the initial radiograph supporting the diagnosis of colonic torsion, both of which were resolved in subsequent radiographs acquired prior to surgery. This is in line with a previous case series[10] that found 36% of the dogs that had radiographically confirmed colonic torsion were found to have a resolution of the torsional component at the time of surgery. In this report, all dogs had a grossly abnormal appearance and congestion, supporting the diagnosis of prior torsion. While the

true specificity or sensitivity of the radiographic diagnosis of the condition is unknown due to the rarity of the condition, 1 study[10] investigated the common radiographic features of surgically confirmed colonic torsion and volvulus cases. The most common radiographic findings included segmental distension and displacement of the colon and focal narrowing of the colon, which were seen in 100% and 78% of the dogs, respectively.[10] In the current study, all but 1 dog, which only had an abdominal ultrasound prior to surgery, had 2 or more of these radiographic findings. Furthermore, all dogs had significant distension of the colon with focal mesenteric edema and serosal hemorrhage, strongly supportive of prior colonic torsion. These results suggest that dynamic colonic torsion and spontaneous resolution can be relatively common findings in clinical cases. Authors have suggested the utilization of a CT scan, barium enema, or pneumocolonogram to increase diagnostic sensitivity in dogs with inconclusive radiographic signs.[10,12] Only 1 dog had a pneumocolonogram performed in the current study, as all dogs had more than 1 definitive radiographic sign such as abrupt tapering of the colon and clear malposition of the colon or cecum. While additional diagnostics can be helpful in those dogs with nebulous history or clinical findings, they may not always be feasible and can pose a significant delay in acutely decompensating emergency surgical cases. The benefits of additional diagnostics or procedures in clinical decision-making should be carefully weighed and compared to the benefit of early surgical intervention, as prolonged course of disease can potentially lead to an increased risk of vascular compromise, necrosis, and peritonitis.[1]

Colonic torsion and volvulus in dogs have been associated with preexisting or concurrent gastrointestinal disease and prior gastrointestinal surgery.[3–6,9–11] In the current study, nearly half of the population had preexisting gastrointestinal conditions or surgery, which is consistent with previous reports. Similarly, acute or chronic conditions such as megacolon, chronic constipation, Hirschsprung disease, Chagas disease, previous abdominal surgery, and abdominal adhesions have been implicated as risk factors for developing colonic volvulus in humans.[15–17] Although the exact pathophysiology of the condition is not clear in dogs, authors have suggested that altered gastrointestinal motility due to these conditions may lead to gastrointestinal displacement disorders such as GDV or colonic torsion and volvulus.[2,9,13] In fact, about one-third of the dogs in the current study had either a prophylactic gastropexy or gastropexy for the treatment of GDV. Those that did not have previous gastropexy had concurrent prophylactic gastropexy at the time of surgical management of colonic torsion and volvulus, and none of them developed GDV during the short- and long-term follow-up periods. Along with previous reports that describe the occurrence of GDV before and after colonic torsion and volvulus, our results support performing a concurrent gastropexy at the time of surgical correction for colonic torsion and volvulus to decrease the risk of further gastrointestinal displacement disorder. One dog in this study also had concurrent GDV and colonic torsion and volvulus at the time of surgery, indicating that multiple gastrointestinal displacement diseases can occur simultaneously.

Previous reports have described dogs with entrapment of the large intestine around the previous gastropexy site.[6] Some authors have suggested a potential relationship between the previous gastropexy site and the development of colonic torsion, as the gastropexy may have impaired normal gastrointestinal motility, leading to the development of the disease or preventing spontaneous resolution of the intestinal torsion and volvulus.[6,18,19] However, only 1 of the 9 dogs that had a previous gastropexy was found to have entrapment of the colon at the gastropexy site in the current study. The exact cause and effect between the two are difficult to determine, as most of the affected dogs were large or giant breeds that were known to be predisposed to both GDV and colonic torsion and volvulus. It is possible that the progressive distension and malposition of the large intestine from colonic torsion led to displacement of the bowel and subsequent entrapment at the gastropexy site, rather than entrapment at the gastropexy site primarily causing the pathologic distension and strangulation of the colon. As GDV has been a significantly more common cause of death or euthanasia in large and giant breeds that are predisposed to gastrointestinal displacement disorder, we remain supportive of the procedure to prevent the occurrence of GDV postoperatively. Further studies to investigate the association between prophylactic gastropexy and colonic torsion and volvulus may help to elucidate the benefits and risks of the procedure.

In this study, 2 dogs developed mesenteric torsion after correction of the colonic torsion and volvulus. One dog had partial involvement of the distal small intestine at the time of the surgery and received prophylactic procedures at the surgeon's discretion. This dog did very well until it developed mesenteric torsion 34 months postoperatively and was euthanized. Mesenteric torsion and volvulus are known to have a grave prognosis with a very high mortality rate.[3,4] While the number of cases was too low to draw a definitive conclusion, these cases along with the reported occurrence of GDV at the time of or after surgery for colonic torsion suggest that there is a risk of developing further torsional diseases after surgery. Although not seen in the current study, recurrence of colonic torsion and volvulus after colopexy has been described in previous reports.[20] In addition to having a discussion with clients about the risk of developing other torsional diseases, clinicians should inform clients that the prophylactic procedure does not completely prevent the recurrence of the colonic torsion and volvulus itself.

There were several limitations in this study. Due to its retrospective nature, the pre- and postoperative treatment and surgical methods were not standardized and data were limited to available records. Specifically, not all patients had long-term follow-up information available, which may have induced a bias in the long-term outcome interpretation. Medical records were collected from multiple institutions, and surgeons with variable experience operated on

the patients. Thus, variable surgical procedures were employed on the basis of the surgeon's discretion, which may have influenced the outcome. Surgical methods other than left-sided colopexy, such as gastrocolopexy or double-line colopexy, have been suggested by some authors to decrease the risk of recurrence. Regardless of the surgical method, all but 1 patient survived to discharge and yielded an overall excellent outcome. Due to the small number of total cases and deaths, statistical analysis for factors influencing the outcome could not be performed. Some dogs did not have surgically confirmed diagnoses of colonic torsion and volvulus, as they were presumed to have spontaneous resolution prior to surgery. However, these dogs had multiple radiographic findings that were all strongly suggestive of the diagnosis along with intraoperative findings supportive of the previous torsion.

In conclusion, dogs with colonic torsion and volvulus undergoing surgical treatment can have excellent short- and long-term outcomes. In this study, 92% of the dogs survived to discharge, with an overall perioperative mortality rate of 7.2%. Similar to previous reports, many dogs had a previous history of gastrointestinal disease and received gastropexy prior to presentation. As most of the breeds were known to be predisposed to gastrointestinal displacement disorders such as GDV or mesenteric torsion, owners should be informed of these risks and prophylactic gastropexy should be considered at the time of the surgical treatment. Spontaneous resolution or "dynamic torsion" seemed to be a common finding in this population.

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