Predisposing Factors for Colonic Torsion/Volvulus in Dogs: A Retrospective Study of Six Cases (1992–2010)

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ABSTRACT

The purposes of this retrospective study were to review cases of colonic torsion/volvulus between July 1992 and August 2010 and to determine if any predisposing factors exist for the development of this condition. Six dogs were diagnosed with colonic torsion/volvulus during the study period. Four dogs had a history of previous gastric dilation-volvulus (GDV) with prophylactic gastropexy. Three of six dogs diagnosed with colonic torsion/volvulus had large intestinal entrapment and strangulation around the gastropexy site at the time of surgery. The history, clinical signs, physical examination, and radiologic findings were not specific for colonic torsion/volvulus in any dog. Early exploratory laparotomy was indicated to confirm the diagnosis and perform surgical correction of the affected bowel segments. Three of five dogs that underwent surgery had a left abdominal wall colopexy performed. All five dogs that underwent surgery in this study survived postoperatively. One patient was euthanized without surgical intervention. Results suggest that colonic torsion/volvulus should be considered in any large-breed dog with nonspecific gastrointestinal clinical signs and a history of previous gastropexy. Early recognition and prompt treatment of this condition may result in a good outcome. (*J Am Anim Hosp Assoc* 2013; 49:169–174. DOI 10.5326/JAAHA-MS-5829)

Introduction

Intestinal torsion describes the pathologic twisting of a segment of the bowel around its longitudinal axis, whereas intestinal volvulus describes a rotation around its mesenteric axis.[1–3] Those pathologic conditions result in either a partial or complete luminal obstruction with possible ischemic injury to the affected segments that can lead to circulatory shock, endotoxemia, and ultimately, cardiovascular failure.[3,4] Both conditions can occur simultaneously.[4,5] Intestinal torsion/volvulus has been described in dogs, cats, horses, cattle, swine, and humans.[1,2] Canine intestinal torsion/volvulus occurs uncommonly, with small intestinal volvulus seen more frequently than large intestinal volvulus.[2,6] Although intestinal torsion/volvulus has previously been associated with parasitic infections, congenital bowel defects, gastrointestinal foreign bodies, ileocolic carcinoma, concurrent gastric dilation-volvulus (GDV), chronic ileocolic intussusceptions, enteritis, recent gastrointestinal surgery, and vigorous exercise, the exact etiology remains unknown.[1,3,7]As with torsion/volvulus of the small intestine, the mortality rate associated with colonic torsion/volvulus is extremely high, and the literature contains only a few reports of successful management.[1,4] Although obtaining a definitive preoperative diagnosis is challenging, early exploratory laparotomy, decompression, anatomic correction of the affected bowel, and supportive care are essential if a successful outcome is desired. Resection and anastomosis may be necessary if tissue viability is questionable.[1,7] The severity of this condition may progress to death even if surgical derotation and reperfusion of the affected segments occurs.[1]

Either pre-existing or concurrent gastrointestinal tract diseases, such as exocrine pancreatic insufficiency and lymphoplasmacytic enteritis, may be present in dogs diagnosed with colonic torsion/volvulus.[1,3,7,8] GDV was previously reported to occur commonly in association with colonic torsion/volvulus; however, colonic entrapment with secondary strangulation around a previously

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GDV *gastric dilation-volvulus*

performed gastropexy has never been reported in the literature.[4,5,8] The objectives of this study were to identify and review all cases diagnosed with colonic torsion/volvulus between July 1992 and August 2010 and to determine potential predisposing factors for the development of this condition. The authors hypothesized that canine torsion/volvulus of the large intestine would occur rarely; however, when seen, it would be found more frequently in medium- to large-breed dogs and could be associated with gastropexy sites.

Materials and Methods

Medical records from the Ontario Veterinary College Health Sciences Center (OVCHSC) of the University of Guelph were searched for dogs that were diagnosed with colonic torsion/volvulus between July 1992 and August 2010. Criteria for inclusion in this study were that medical records were complete and that colonic torsion/volvulus was confirmed in all cases either by exploratory laparotomy or postmortem examination. Each medical record was reviewed, and the following information was retrieved: signalment, previous medical history, presenting complaint, clinical signs, laboratory evaluation (if performed), diagnostic imaging results, treatment, and clinical outcome.

Results

Six dogs (two Great Danes, one German shepherd dog, one Labrador retriever, one bullmastiff, and one German shorthaired pointer) were diagnosed with colonic torsion/volvulus during the study period (**Table 1**). There were three spayed females, two castrated males, and one intact male. The ages of the affected patients ranged from 10 mo to 10 yr (median, 7 yr). Dogs weighed between 35 kg and 84 kg (median, 41.5 kg).

The onset of clinical signs in all dogs was peracute to acute, without history of trauma. All cases were examined by a veterinarian prior to referral to the OVCHSC. In all six dogs, the clinical signs were related to the gastrointestinal tract and consisted of episodes of vomiting and/or acute abdominal pain (with or without distention).

All dogs were lethargic upon presentation, and all cases, except case 1, had signs of hypovolemic shock (i.e., tachycardia, weak peripheral pulses, tacky mucous membranes, and/or clinical dehydration). Cases 2 and 4 were pyrexic. Additional significant findings on physical examination included bilateral tympanic sounds on abdominal percussion in case 2, dilated loops of intestine on abdominal palpation in case 3, and a palpably enlarged spleen in case 5. All cases were admitted to the intensive care unit and supportive care was provided prior to performing further diagnostic tests. Initial treatment consisted of IV resuscitation therapy (90 mL/kg/hr) with crystalloids[a] and analgesia. Fluid rates were adjusted according to the patient's response and assessed using blood pressure, heart rate, mucous membranes color, and capillary refill time. Prophylactic antibiotic therapy with cefoxitin[b] (22 mg/kg IV *q* 8 hr) was administered to cases 1, 2, and 6. Despite aggressive fluid resuscitation, case 3 remained cardiovascularly unstable, and 1 unit of fresh frozen plasma was administered on the basis on a prolonged activated clotting time.

Four of the six dogs (cases 1, 2, 4, and 5) had been treated for GDV 6 mo, 1 mo, 8 mo, and 24 mo, respectively, prior to being diagnosed with colonic torsion/volvulus. All dogs had undergone a right-sided prophylactic gastropexy. A belt loop was performed in cases 1 and 2, and an incisional in cases 4 and 5. Cases 1, 2, and 4 had their GDV surgeries performed by a board-certified surgeon. Case 1 had an 8 yr history of dietary indiscretion that was medically managed with a hypoallergenic diet, and case 4 was diagnosed with idiopathic megaesophagus 10 mo prior to presenting with colonic torsion/volvulus. Case 5 had been treated for hypoadrenocorticism (Addison's disease) for 2 yr before presenting with colonic torsion/volvulus.

Available laboratory data indicated mild clinicopathologic abnormalities in all dogs, except for case 3. In that case, basic

TABLE 1

Summary of Data for Six Dogs Diagnosed with Colonic Torsion/Volvulus Between July 1992 and August 2010

Case	Breed	Age	Sex	Weight (kg)	Previous GDV and gastropexy	Other previous GI tract disease	Diagnosis
1	German shorthaired pointer	10 yr	CM	36.5	Yes (belt loop)	Dietary indiscretion	Colonic entrapment around prior gastropexy site
2	Bullmastiff	7 yr	SF	83.9	Yes (belt loop)	—	Colonic entrapment around prior gastropexy site
3	German shepherd dog	10 mo	M	35	—	—	Colonic volvulus
4	Great Dane	7 yr	SF	55	Yes (incisional)	Megaesophagus	Colonic volvulus
5	Great Dane	4 yr	SF	46.5	Yes (incisional)	Hypoadrenocorticism	Colonic entrapment around prior gastropexy site
6	Labrador retriever	6 yr	CM	36	—	—	Colonic torsion

—, not performed; CM, castrated male; GI, gastrointestinal; M, male; SF, spayed female.

laboratory information was not recorded (**Table 2**). None of the findings were specific for colonic torsion/volvulus in any dogs.

In all six dogs, orthogonal abdominal radiographic views revealed distension of a portion of the intestinal tract, which was supportive of pathologic bowel dilation from either mechanical obstruction or adynamic ileus. Preoperatively, the affected segment of the intestinal tract was identified as the colon in only case 4 (**Figures 1A, B**). Abdominal radiographs of case 5 revealed cranial displacement of the gastrointestinal contents (**Figures 2A, B**). Exploratory laparotomy was elected in cases 1, 2, 3, 5, and 6 on the basis of history, clinical findings, and radiographic signs. Case 4 was euthanized preoperatively because of financial considerations. Consent for a postmortem examination was obtained.

Under general anesthesia, a ventral celiotomy was performed, which revealed entrapment of the large intestine around prior gastropexy sites in cases 1, 2, and 5. None of the gastropexy sites were reported to be abnormal in either location or size. In cases 1 and 5, the entrapped portion of the colon was edematous and hyperemic, but the vascular supply was deemed not to be compromised, and a left lateral body wall colopexy was performed. In case 2, the abdominal exploration revealed severe colonic congestion and cyanosis. The viability of approximately 40–50 cm of the entrapped large intestine was impaired, and a partial colectomy was performed. In cases 3 and 6, the colon was rotated around the mesenteric root and longitudinal axis, respectively, with marked dilation of both the small and large intestines. A partial colectomy with end-to-end anastomosis was performed in both dogs based on the questionable viability of the affected segments. A left lateral body wall colopexy was also performed in case 6.

Postmortem evaluation of case 4 revealed volvulus of the descending colon and marked dilation of the transverse colon, ascending colon, and cecum. The gastropexy site was deemed to be intact, with no mention of whether the bowel entrapment involved the gastropexy site.

Serous abdominal fluid was obtained from the peritoneal cavity of cases 2, 3, and 6 after first entering the abdominal cavity at surgery. Samples were submitted for aerobic and anaerobic culture and sensitivity testing, but revealed no bacterial growth. The degree of colonic rotation around the mesenteric root was only documented in two cases, reported as a 270–360° rotation in case 3 and a 180° rotation in case 4.

All dogs that underwent surgery were monitored in the intensive care unit postoperatively. Supportive care consisted of IV crystalloid therapy, antibiotic therapy (22mg/kg cefoxitin IV *q* 8 hr), and pain management. In addition, a histamine H_2-receptor antagonist[c] (1 mg/kg IV *q* 12 hr) was administered to cases 1 and 4, and a prokinetic agent (0.5 mg/kg *per os q* 8 hr of one agent[d] in case 2, and 2 mg/kg/day as a constant rate infusion of a second agent[e] in case 3) were administered. Based on a prolonged activated clotting time, case 3 received a second unit of fresh frozen plasma postoperatively. All dogs made a satisfactory recovery from surgery and were discharged to the care of their owner 1–4 days postoperatively (median, 2 days).

Discussion

Colonic torsion/volvulus is a rare condition in dogs that has been infrequently described in the literature. Small and large intestinal torsion/volvulus are most commonly seen in humans, horses, cattle, and swine.[1,2] The canine large intestine is short and has a mesentery that runs its entire length, which decreases the incidence of torsion/volvulus compared with the large size and small area of attachment to the body wall in other species.[1,6] Only

TABLE 2

Summary of Abnormalities in the Laboratory Data Recorded for Six Dogs at Time of Presentation*

Case	Blood gas analysis	PCV (reference range, 37–55%)	TS (reference range, 56–75 g/L)	BUN (reference range, 5–15 mg/dL)	ACT (reference range, 90–120 sec)	Complete blood count	Biochemical analysis
1	K^+ (3.7)			15–26		—	—
2	—		49			—	—
3	—	—	—	—	Prolonged	—	—
4	Lactate (4.1)	62	80			Stress leukogram	—
						Elevated band neutrophil count (0.42)	
5	Lactate (3.7)			15–26		—	—
6	K^+ (3.3)			15–26		—	—

*Reference intervals reported by the Animal Health Laboratory of the University of Guelph included the following: K^+, 3.82–5.34 mmol/L; lactate, < 2.5 mmol/L; and band neutrophil count, 0.0–0.3 × 10^9/L. Empty cells indicate that the measured value was within the reference range.
—, not performed; ACT, activated clotting time; BUN, blood urea nitrogen; K^+, potassium ions; PCV, packed cell volume; TS, total solids.

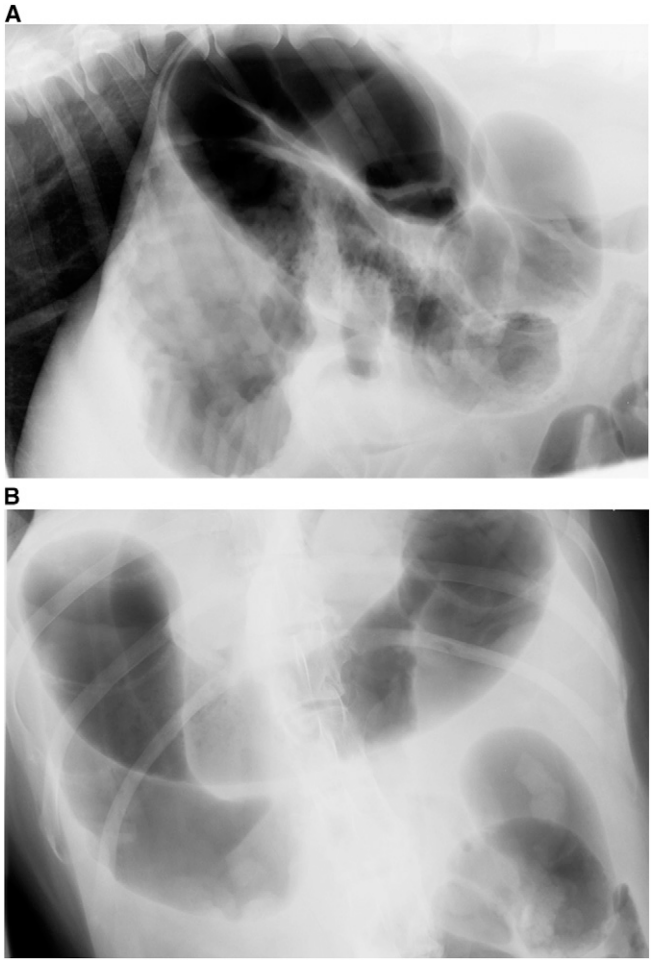

FIGURE 1 *Right lateral (A) and ventrodorsal (B) abdominal radiographs of a 7 yr old spayed female Great Dane (case 4) demonstrating markedly distended, gas-filled loops of large bowel.*

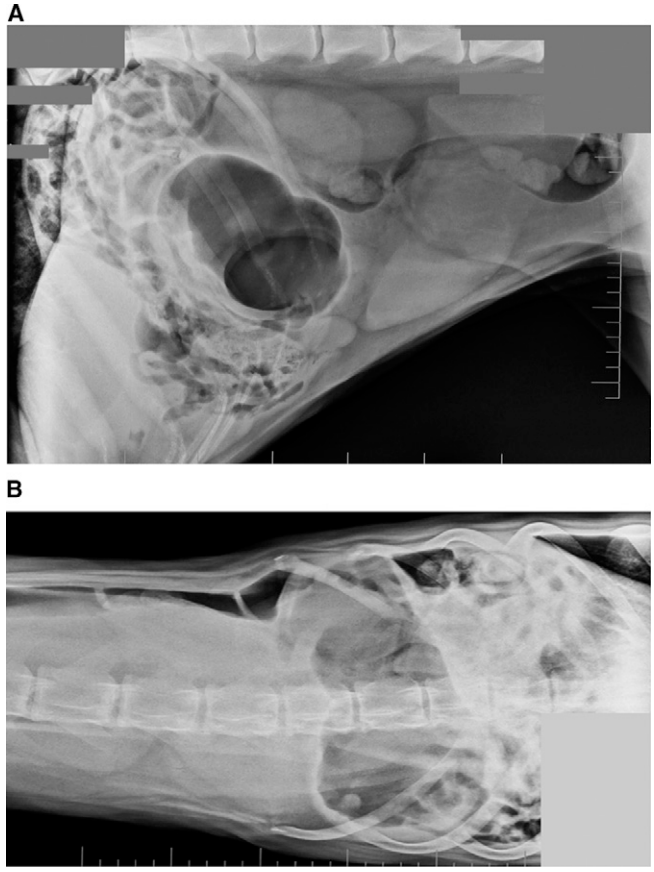

FIGURE 2 *Left lateral (A) and ventrodorsal (B) abdominal radiographs of a 4 yr old spayed female Great Dane (case 5) demonstrating cranial displacement of gastrointestinal contents.*

six dogs were confirmed to have developed colonic torsion/volvulus by either exploratory laparotomy or postmortem examination between July 1992 and August 2010 at the OVCHSC. As in previously reported cases of colonic torsion/volvulus, all six dogs included in this study were young to middle-aged, medium- and large-breed dogs.[1,2,4–6,8,9] Previous studies suggested that males and German shepherd dogs were more commonly affected with this condition.[3,5,6,7,9,10] In the current study, three of six cases occurred in male dogs and only one was a German shepherd dog. Interestingly, the breeds affected with colonic torsion/volvulus reported in another case series were similar to those in this study, which included one German shepherd dog, one Labrador retriever, one Great Dane, and one bullmastiff.[4] Too few cases were available to make statistical conclusions regarding either a sex or breed predisposition.

The history, clinical signs, and physical examination findings in the current study were not specific to colonic torsion. The common signs of acute onset of vomiting, lethargy, abdominal pain, and hypovolemic shock in the included cases were consistent with previous reports of colonic torsion/volvulus in dogs.[1,2,4,6,8] Abdominal effusion was not reported in the six cases described in this study, and preoperative diagnostic abdominocentesis was therefore not performed. In two other reports, the results of the abdominocentesis performed in five dogs revealed no specific findings for colonic torsion/volvulus, but could have reflected the severity of the condition if intracellular bacteria were identified.[1,6] As in other reported cases, four of six dogs (67%) included in this study had a history of gastrointestinal tract disease.[3,5,8] Four dogs had a previous episode of GDV and had undergone a gastropexy prior to presenting for colonic torsion/volvulus. Of those four dogs, one had a chronic history of dietary indiscretion, one was treated for Addison's for 2 yr prior to presenting with colonic torsion/volvulus, and another was diagnosed with idiopathic megaesophagus several mo prior to presenting with colonic torsion/volvulus. Other reports of colonic torsion/volvulus reportedly occur simultaneously with, and subsequent to,

episodes of GDV.[4,5] In a previous report, one dog had been treated for GDV 1 yr before being diagnosed with colonic volvulus.[2] In another study, one dog had been evaluated for chronic diarrhea and poor body condition before developing colonic volvulus and was diagnosed with GDV approximately 1 mo later.[4] No previous reports appear to have described colonic entrapment with secondary strangulation around a gastropexy site. In this study, the exploratory laparotomy revealed entrapment of the large intestine around the site of gastropexy in three of six dogs.

Although the postmortem evaluation in case 4 confirmed colonic volvulus and mentioned an intact gastropexy site, no mention was made regarding whether the gastropexy site was involved in the entrapment. Although one could assume this means the gastropexy site was not involved, it is possible that the entrapment could have involved the gastropexy site, but this was no longer the case at the time of postmortem examination. Finally, two of the three dogs with colonic entrapment around their gastropexy site underwent a left lateral body wall colopexy to prevent possible recurrence of the colonic torsion/volvulus. Although the etiology of canine colonic torsion/volvulus remains unknown, this condition has been previously reported in association with other gastrointestinal tract diseases, such as lymphoplasmacytic enteritis, pancreatic insufficiency, bacterial overgrowth, concurrent GDV, gastrointestinal foreign bodies, intussusceptions, ileocolic carcinoma, and parasites. Colonic entrapment and strangulation caused by either rupture of the duodenocolic ligament or by the presence of intestinal adhesions have also been described in dogs.[6,11,12] Physiologic movement and displacement of the intestine occurs during physical activity and normal peristalsis.[1,11,12] As suggested in other studies, pathologic intestinal adhesions may impair normal gastrointestinal motility.[11,12] It is therefore plausible that the gastropexy site of the dogs in this study may have impaired normal gastrointestinal motility and interfered with the potential for spontaneous resolution of a colonic torsion/volvulus once it had occurred. Neither the surgeons nor pathologists involved in the cases described herein reported that the gastropexy was either in an inappropriate location or had abnormal shape/size, and none of the gastropexy sites were revised at surgery.

Laboratory data findings were not specific to colonic torsion and were not available in all cases; however, the findings of degenerative left shift, hypoproteinemia, hypokalemia, and elevated packed cell volume, total solids, and blood urea nitrogen were similar to previous reports.[1,4,6]

The radiographic findings of generalized loss of serosal detail, gas, and fluid intestinal distention associated with canine intestinal torsion/volvulus have previously been reported.[1,2,4] Most of the time, it is difficult to exactly identify the involved segment of bowel in dogs affected with the condition.[4,8] Indeed, a definitive diagnosis is rarely made based only on radiographic images.[11] In the current study, only case 5 had radiographic evidence of a cranially displaced gastrointestinal tract, which was highly suggestive of intestinal entrapment around the gastropexy site. In the other dogs described in this study, a definitive diagnosis of colonic torsion/volvulus was not made from the available radiographic images, but the findings of gas- and/or fluid-filled intestinal loops were suggestive of either pathologic intestinal dilation or adynamic ileus. Differentiating between causes of mechanical obstruction and adynamic ileus based on abdominal radiographs may be difficult; however, based on history, acute onset of clinical signs, and radiographic findings, an emergency exploratory laparotomy was indicated in all six dogs included in this study.[4,8]

In the published literature and in the author's experience, canine colonic torsion/volvulus is associated with a high mortality rate and the prognosis is considered grave unless immediate diagnosis and treatment are achieved.[1–3,10] In the current study, the short-term survival rate was 100%, which was higher than the survival reported in previous studies. Specifically, all five dogs included in this study that underwent surgery survived postoperatively. Successful management is therefore based on the rapid diagnosis, which may be difficult because of the similarity of clinical signs and radiographic findings with other conditions. The pathologic twisting compromises the blood flow to the cecum, ascending colon, transverse colon, and proximal descending colon.[5,7] Colonic torsion/volvulus typically results in venous and lymphatic obstruction leading to vascular engorgement, ischemia, and necrosis of the affected bowel segment.[1,3] If the condition persists, hypoxia of the intestinal wall results in destruction of the mucosal barrier, and rapid proliferation of the bacterial population occurs. Bacteria, as well as the exo- and endotoxins that they produce, diffuse through the damaged mucosal wall into the peritoneum and are absorbed into the systemic circulation.[1,7] Death typically occurs rapidly secondary to circulatory shock, endotoxemia, and cardiovascular failure if the condition remains uncorrected.[1,3,7] Intestinal torsion/volvulus should therefore be considered a life-threatening emergency. Although the condition was recognized and corrected early in the dogs described in this study, three of five dogs that underwent surgery required a partial colectomy to remove compromised bowel. In the current study, all five dogs that underwent surgery survived and were discharged from the hospital. No long-term follow-up was available in this study. Further clinical studies are required to investigate the incidence,

predisposing factors, treatment, and long-term outcome of canine colonic torsion/volvulus.

Conclusion

Large intestinal torsion/volvulus is uncommon in small animal veterinary medicine, and the exact etiology of this condition is unknown. The causal relationship between colonic intestinal torsion/volvulus and other gastrointestinal disorders in dogs remains obscure, and further studies are required to investigate the etiological basis and predisposing factors associated with this condition. As canine colonic torsion/volvulus is rare, retrospective studies involving multiple referral centers are necessary to achieve significant conclusions. The results of this study demonstrate that gastropexy sites, as previously suggested for rupture of the duodenocolic ligament and the presence of intestinal adhesions, may be associated with colonic entrapment and strangulation in dogs. In this study, three of six dogs were diagnosed with large intestinal entrapment and strangulation associated with a previously performed gastropexy site. Two of those dogs also had concurrent gastrointestinal diseases. Consequently, colonic torsion/volvulus should be considered in any large-breed dog presenting with a history of gastrointestinal disorders, an acute onset of nonspecific clinical signs, and the radiographic findings suggestive of either obstruction or pathologic dilatation of bowel segments. Colonic entrapment and strangulation around the gastropexy site must also be considered in dogs previously treated for GDV.

FOOTNOTES

[a] Crystalloids; Baxter Corp., Mississauga, ON, Canada

[b] Cefoxitin; Baxter Healthcare Corp., Deerfield, IL

[c] Ranitidine hydrochloride; Sanders Canada Inc., Boucherville, QC, Canada

[d] Cisapride; Weller, London, ON, Canada

[e] Metroclopramide; Sanders Canada Inc., Boucherville, QC, Canada

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