Evaluation of an endoscopically assisted gastropexy technique in dogs

Mauricio Dujowich, DVM, and S. Brent Reimer, DVM

Objective—To evaluate the use of endoscopy in conjunction with a gastropexy technique in dogs as a potential means to aid prevention of gastric dilatation-volvulus.

Animals—12 healthy adult medium- and large-breed dogs.

Procedures—12 adult research dogs that had no abnormal physical examination findings each underwent an endoscopically assisted gastropexy procedure. On completion of the procedure, the dogs were euthanized and exploratory laparotomies were performed to evaluate the surgical site. Data recorded included anatomic location of the gastropexy, gastropexy length, and duration of procedure as well as any complications.

Results—Mean ± SD gastropexy length was 3.3 ± 0.25 cm, and mean duration of surgery was 18 ± 7 minutes. In each dog, the stomach was located in its normal anatomic position and all gastropexies were sutured to the abdominal wall at the level of the pyloric antrum. The only complications during the procedure were needle bending and breakage at the time of stay suture placement.

Conclusions and Clinical Relevance—On the basis of these findings, it appears that endoscopically assisted gastropexy is a simple, fast, safe, and reliable method of performing a prophylactic gastropexy in dogs when undertaken by a person who is skilled in endoscopy. Such a procedure maximizes the benefits of decreased morbidity and shorter duration of anesthesia associated with minimally invasive surgery. Further clinical studies are warranted to evaluate the long-term efficacy of this procedure in dogs at risk for development of gastric dilatation-volvulus. (*Am J Vet Res* 2008;69:537–541)

Gastric dilatation volvulus in dogs is an acute and potentially fatal condition of uncertain etiology that results from a gastric malposition; it primarily affects large- and giant-breed dogs. Risk factors for developing GDV include breed, age, rapid eating, nervousness, and having a first-degree relative with a history of GDV.[1–3] The condition is considered an emergency and requires immediate surgical intervention. In dogs, estimates of GDV-associated mortality rate range from 15% to 43%.[4–6] Early recognition of the condition combined with rapid gastric decompression, appropriate treatment for hypovolemic shock and reperfusion injury, and management of cardiac dysrhythmias decreases the risk of death associated with the disease.[4–6] If untreated, intragastric pressure will increase and, in turn, often result in cardiogenic shock and eventual death. Medical treatment alone is inadequate, and as many as 81% of affected dogs die within a year of initial treatment if surgery is not performed.[7,8] Additionally, during the surgical procedure to reposition the stomach, it is necessary to permanently affix the stomach to the body wall with one of several available gastropexy techniques to prevent recurrence. Failure to perform a gastropexy at the time of surgery results in a recurrence rate > 50%; when a gastropexy is performed, the recurrence rate is 6% to 10%.[7,9,10] Given the unacceptably high risk of recurrence without gastropexy, it is considered the standard of care to perform that procedure at the time of surgical treatment of GDV.[8] The lifetime risk of certain predisposed dogs to develop GDV has been estimated to be 4% to 37%.[8] Because GDV is such a serious disease and a certain subset of dogs are predisposed to the disease, the recommendation of many veterinarians is that gastropexy should be performed prophylactically in predisposed breeds.[10–15]

As with surgery in humans, veterinary surgery has slowly made progress toward developing minimally invasive surgical techniques to decrease postoperative complications such as pain, hospitalization time, incision size, and inflammation.[16–18] Typically, techniques used to perform gastropexies during emergency surgeries are also used for prophylactic gastropexies. These procedures have the inherent disadvantage of requiring a relatively large laparotomy. To date, there are few less-invasive alternative methods of performing a gastropexy currently available to veterinarians; these include a grid gastropexy and a laparoscopically assisted gastropexy. However, both of these procedures are relatively time consuming and the laparoscopically

ABBREVIATION

GDV	Gastric dilatation-volvulus

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From the Department of Veterinary Clinical Sciences, College of Veterinary Medicine, Iowa State University, Ames, IA 50011-1250. Dr. Reimer's present address is Animal Emergency and Referral Center of Central Iowa, 6110 Creston Ave, Des Moines, IA 50321.
Address correspondence to Dr. Dujowich.

assisted gastropexy requires a considerable amount of instrumentation.[12,13,19–21]

By use of endoscopically assisted gastropexy, veterinarians can potentially perform an otherwise invasive procedure in a shorter period of time, compared with that required for other gastropexy procedures. The development of such a procedure would establish a quick, inexpensive, repeatable, and minimally invasive method of performing a prophylactic gastropexy. This technique would also have the advantage of requiring less equipment in contrast to that required for currently used gastropexy procedures. The purpose of the study reported here was to evaluate the use of endoscopy in conjunction with the gastropexy technique in dogs as a potential aid in prevention of GDV.

Materials and Methods

Dogs—Twelve healthy mixed medium- and large-breed dogs that weighed 10 to 36 kg (mean ± SD weight, 23.1 ± 8.6 kg) were used for the study. Among the dogs, there were 7 neutered males and 5 spayed females. All dogs were to be euthanatized for reasons unrelated to the study. For each dog, PCV and total plasma protein concentration were assessed prior to inclusion in the study; findings were within reference limits. The study was performed with the approval from and under the guidelines of the Institutional Laboratory Animal Care and Use Committee of Iowa State University.

Surgical technique—Food was withheld from each dog for 12 hours before anesthesia. Each dog was premedicated with acepromazine (0.02 mg/kg, IM) and butorphanol (0.4 mg/kg, IM). Anesthesia was induced with thiopental sodium (12 mg/kg, IV) and maintained with isoflurane in oxygen. The hair on the abdomen was clipped, and the area was scrubbed in preparation for surgery. The dog was also placed on a warm-water recirculating blanket to reduce hypothermia, and routine monitoring was performed throughout the procedure. Lactated Ringer's solution was administered IV at a rate of 10 mL/kg/h.

The dog was positioned in a left oblique recumbency at approximately 30 degrees to the plane perpendicular to the operating table (**Figure 1**). A video-gastroscope[a] (insertion tube, 103 cm long; outer diameter, 8.6 mm) was used. The scope was passed orally to the stomach, and the stomach was then insufflated with room air until rugal folds were minimally visible and adequate distension was achieved. Occasionally, the cervical portion of the esophagus was compressed by an assistant to help achieve gastric distension. External palpation across the body wall was then performed with a curved Rochester-Carmalt hemostatic forceps while the pyloric antrum was viewed to identify the chosen anatomic site. The stomach was briefly evaluated for any masses or lesions. Once orientation was achieved, size-0 or size-2 polypropylene suture[b] on a cutting needle (needle length, 36 and 76 mm, respectively) was passed through the right lateral aspect of the body wall (immediately caudal to the 13th rib); the needle and suture were viewed endoscopically as they entered and exited the stomach at the level of the pyloric antrum and then exited the body wall again through the skin. The suture was then pulled tight and temporarily secured in place with mosquito hemostats. An additional length of suture was then passed approximately 4 to 5 cm from the initial suture in the region of the pyloric antrum aborad to the first suture position. An incision was performed through the layers of the abdominal musculature between the 2 stay sutures until the stomach was visible. The incision differed in orientation but was commonly parallel to the 13th rib. Two Gelpi retractors were placed perpendicular to each other in the incision to assist with viewing. A longitudinal incision (approx 3- to 4-cm long) was then made through the serosal and muscular layers of the pyloric antrum (**Figures 2 and 3**). The seromuscular layer was sutured to the transversus abdominis muscle in 2 individual continuous patterns with size-0 polypropylene suture.[b] The length of the gastropexy was measured to the nearest millimeter by use of the millimeter scale on the body of a scalpel handle. The obliquus externus abdominis muscles were then approximated with 2-0 polydioxanone suture[b] in a simple interrupted pattern. The subcutaneous tissues and skin were closed in routine fashion. The stay sutures previously placed were removed while the stomach was endoscopically evaluated and decompressed. Afterward, the dog was euthanatized via an IV overdose of pentobarbital sodium, and direct examination and inspection of the surgical site was immediately performed.

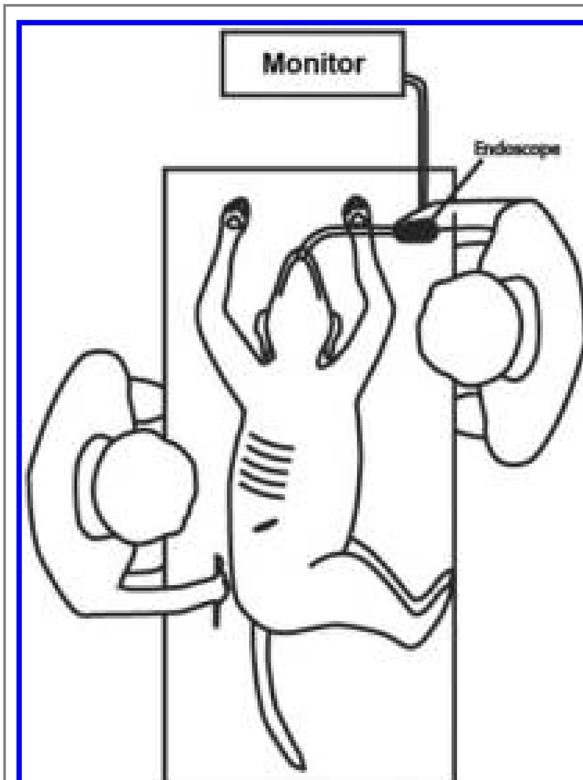

Figure 1—Drawing of the position of a dog undergoing an endoscopically assisted gastropexy. The dog is placed in left oblique recumbency at approximately 30 degrees to a plane perpendicular to the operating table. One incision is made on the right side of the dog, just caudal to the 13th rib.

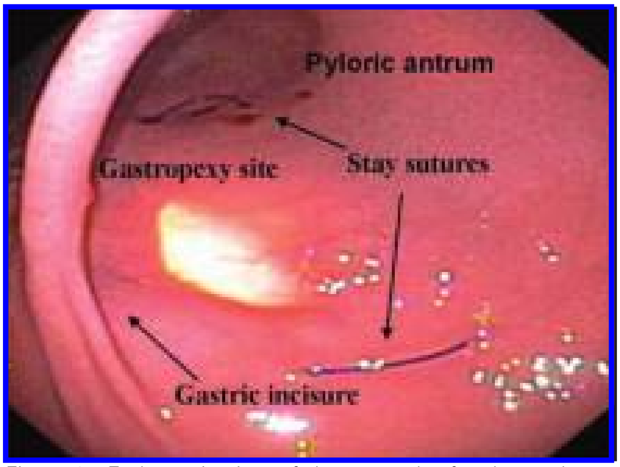

Figure 2—Endoscopic view of the stomach of a dog undergoing endoscopically assisted gastropexy after stay sutures were placed in the pyloric antrum and the seromuscular layer was incised. The stay sutures are placed on the lateral portion of the abdomen just caudal to the 13th rib.

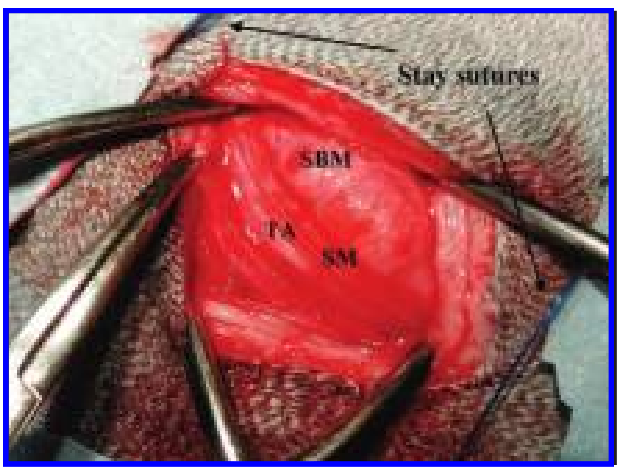

Figure 3—Photograph of the approach made in a dog undergoing endoscopically assisted gastropexy. The initial 3- to 4-cm-long skin incision is made between stay sutures. The transversus abdominis (TA) muscle is also incised. Gelpi retractors are placed approximately 5 cm apart at the ends of the planned incision in the seromuscular (SM) layer of the stomach. The incision through the SM layer has exposed the gastric submucosa (SBM), and a dissection plane is created between these 2 layers. The SM layer is then sutured to the peritoneum and the TA muscle.

Statistical analysis—Mean, median, range, and SD values of duration of surgery, gastropexy length, and body weight were calculated.

Results

Among the 12 dogs, mean ± SD duration of surgery was 18 ± 7 minutes (median, 7 minutes; range, 11 to 30 minutes). The 2 procedures that required 30 minutes for completion were those in which technical difficulties (needle bending and breakage) were encountered. Mean gastropexy length was 3.3 ± 0.25 cm (median, 3.1 cm; range, 3.0 to 3.5 cm). The time for introduction of the gastroscope into the stomach and achievement of adequate insufflation was approximately 1 minute. Mean body weight of the dogs was 23.0 ± 8.6 kg (median, 22.7 kg; range, 9.5 to 35.5 kg).

After insertion of the needle into the pyloric antrum, a minimal amount of hemorrhage was detected endoscopically. Minor hemorrhage was associated with the body wall incision and gastropexy procedure. The only complications recorded during the procedure were needle bending (1 dog) and needle bending and breakage (1 dog). These complications were associated with use of size-0 polypropylene suture on a cutting needle; needle bending occurred 5 times during the procedures in the 2 aforementioned dogs, and complete breakage of the needle shaft occurred twice in the latter dog. On 1 occasion in which the needle broke, we were unable to retrieve the broken end of the needle. After the fifth procedure (in which needle breakage occurred), the remaining procedures were performed by use of size-2 polypropylene suture on a cutting needle (needle length, 76 mm), and there were no additional incidents of needle bending or breakage.

On physical inspection, all gastropexies were positioned at the level of the pyloric antrum. There was no evidence of improper surgical technique, damage to other organs, or entrapment of viscera.

Discussion

In the short-term period following GDV surgery, mortality rates among dogs can reach approximately 15% to 33%.[6,10,22] Until recently, recommendations for prophylactic gastropexy were largely empirical. Ward et al[11] reported that the lifetime risk of development of GDV ranges from 4% to 37% in predisposed breeds of dog. In contrast, the lifetime risk of development of GDV if a prophylactic gastropexy is performed is 0.3%. Depending on the breed of dog, prophylactic gastropexy results in a 2- to 30-fold reduction in lifetime mortality rate.[11] Additionally, there is a 92% reduction in risk for development of GDV when a prophylactic gastropexy is performed.[10] On the basis of those findings, prophylactic gastropexy can be suggested for dogs of predisposed breeds because it decreases GDV-associated mortality rates. However, there are several considerations that must be taken into account before performing a prophylactic gastropexy in a dog. Prophylactic gastropexy has not been proven to decrease the incidence of GDV; the procedure is invasive, requires a considerable amount of time to perform, and is not always cost effective (assuming a cost of US $400).[11]

In the field of human gastroenterology, surgeons have been challenged with 2 surgical advancements: laparoscopic and endoscopic surgery.[23] In veterinary medicine, surgeons have predominately embraced laparoscopic techniques rather than endoscopic techniques to date. The ability to perform an endoscopically assisted gastropexy successfully minimizes the number and size of surgical incisions. This theoretically should result in decreases in duration of anesthesia, degree of postoperative pain and requirements for analgesia, incidence of incisional complications, duration of hospitalization, and cost. Additionally, this minimally invasive technique allows for a decrease in the amount of equipment necessary to perform the procedure, compared with that required for other currently used minimally invasive laparoscopically assisted gastropexy procedures.[12,13,19,21] For the procedure described in this report, a veterinarian only requires a flexible endoscope, thereby obviating the need for expensive laparoscopic equipment. Although a cost analysis was not performed in the present study, we assume that as a result of decreased equipment requirements and time necessary to perform the procedure, it would be plausible to imagine that the cost of an endoscopically assisted gastropexy may well be reduced, compared with the costs of other minimally invasive methods. Further, it is our observation that endoscopes seem to be far more commonly available in private practice, compared with laparoscopic equipment. It is our hope that this procedure will result in greater owner acceptance of prophylactic gastropexies as a means for preventing GDV among predisposed breeds.

An increased awareness and understanding of GDV has led to an increased number of owners pursuing prevention of this disease in their dogs. Presently, GDV is prevented most successfully by maintaining the stomach in its normal anatomic location via a prophylactic gastropexy. This, in turn, has contributed to the development of less invasive prophylactic gastropexy procedures.[12,13,19–21] The ideal gastropexy technique is simple to perform, permanently and predictably attaches the stomach to the abdominal wall in a correct anatomic position to prevent volvulus, does not interfere with gastric function, is associated with minimal intraoperative and postoperative complications, and requires minimal postoperative management of the treated dog.[15] There are many gastropexy techniques, including incisional gastropexy, tube gastrostomy, circumcostal gastropexy, belt-loop gastropexy, and laparoscopically assisted gastropexy. These techniques have been assessed, and each has been found to be an acceptable method of performing a gastropexy.[24–31] Any of these techniques can be performed prophylactically; however, all but the laparoscopically assisted gastropexy and the grid approach require a laparotomy.[12,13,16–21] The procedure described in this report is essentially an adaptation of already validated invasive techniques, in particular the incisional gastropexy and tube gastropexy. The endoscopically assisted procedure is assumed to be superior to a tube gastropexy because it does not involve many of the risks associated with the latter, such as extended nursing care, premature dislodging of the tube, peritonitis, subcutaneous cellulitis, and persistent stoma drainage.[4] Advantages of the incisional gastropexy are that the stomach lumen is not entered, and fibrous connective tissue cojoins the rectus abdominis muscle and stomach wall to form a strong, mature adhesion.[24] This is an important feature because an intact mesothelium at the interface of stomach wall to body wall prevents gastropexy adhesion.[32] In the development of the procedure described in this report, we also incorporated the findings of previously described noninvasive gastropexy techniques. Given the similarities in the actual surgical procedure itself (suturing the seromuscular layer of the stomach to the transversus abdominus muscle), it is appropriate for one to assume that immediate tensile and long-term adhesion strengths of the endoscopically assisted gastropexy should be similar to those previously reported[19,21] for gastropexies performed in the same anatomic region. Compared with other techniques, the endoscopically assisted procedure may help avoid accidental duodenopexy and decrease the number of incisions necessary to perform the procedure and duration of surgery.[12,13,19–21]

The endoscopically assisted gastropexy in the present study was performed by an experienced surgeon quickly and without major complications. The results indicated that duration of surgery was typically < 20 minutes (range, 11 to 30 minutes). The duration of surgery was the longest (30 minutes) for the 2 dogs in which the needles bent or broke (a reflection of poor needle selection [36-mm-long needle; size-0 polypropylene suture]). Needle breakage and an inability to retrieve the loose needle end were complications in 1 dog. For the remaining 7 dogs, a 76-mm-long needle[b] with size-2 polypropylene suture was used and no complications were associated with that suture and needle combination. With minimal experience, the endoscopically assisted gastropexy procedure requires 10 to 15 minutes to perform, compared with other currently available minimally invasive procedures that typically require > 45 minutes to complete.[20,21] However, endoscopic equipment and experience are a necessity. Use of an endoscope simplifies the procedure and adheres to the principles of minimally invasive surgery. There are several important factors to ensure a simple and successful gastropexy by use of this endoscopically assisted technique; these include adequate withholding of food from the dog prior to surgery and proper patient positioning, needle selection, and insufflation. Withholding of food for an adequate period is necessary to view the pyloric antrum when performing the gastropexy. Without proper positioning, there is a possibility of accidental damage to another organ or entrapment of a loop of intestine during placement of the stay sutures in the stomach wall. Furthermore, a large and strong cutting needle is critical to avoid bending and breaking of the needle. Finally, during the present study, we determined that occlusion of the cervical portion of the esophagus makes observation of the pyloric antrum and, thus, passage of the needle more predictable. We suspect that a limitation to this procedure might be inaccessibility of the pyloric antrum as a result of obstruction of the proposed gastropexy site by the caudal ribs. However, in the limited number of dogs included in the present study, this problem was not encountered.

In the present study, a rapid, inexpensive, and reliable method for performing an endoscopically assisted gastropexy in dogs was developed and assessed. Given the similarities to other gastropexy procedures, this technique likely results in a strong fibrous adhesion.[19] The endoscopically assisted gastropexy potentially maximizes the benefits associated with minimally invasive surgery, including reduced incision size, decreased postoperative pain and analgesic drug requirements, and more rapid restoration of normal intestinal tract function.[23,33] Future studies to evaluate the long-term efficacy of the endoscopically assisted gastropexy procedure in dogs predisposed to GDV are warranted.

a. GIF-160 gastrointestinal videoscope, Olympus, Tuttlinger, Germany.
b. Ethicon, Somerville, NJ.

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