Long-Term Outcome and Complications Following Prophylactic Laparoscopic-Assisted Gastropexy in Dogs

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Objective: To characterize the short- and long-term outcome (>12 months), complications, and owner satisfaction following prophylactic laparoscopic-assisted gastropexy (LAG) in dogs.
Study Design: Retrospective study.
Animals: Client-owned dogs (n = 49).
Methods: Dogs that underwent prophylactic LAG at 2 veterinary academic hospitals were studied. Surgical time, anesthesia time, concurrent intra- and extra-abdominal procedures, and intraoperative and postoperative complications were recorded following review of medical records. Veterinarian and/or owner follow-up was obtained to determine outcome and satisfaction with LAG.
Results: Five of 49 dogs (10%) experienced complications related to abdominal access during LAG. Four percent (2/49) of dogs experienced an intraoperative complication. Follow-up information was available for 89% of dogs (44/49). Four dogs died of causes unrelated to LAG or gastric dilatation volvulus (GDV) in the follow-up period. Two dogs experienced major postoperative complications requiring additional veterinary intervention. Thirty percent (13 dogs) experienced a minor postoperative self-limiting wound-related complication. Median follow-up time was 698 days (range, 411–1825). No dogs experienced GDV. One hundred percent of dog owners were satisfied with LAG, would repeat the procedure in a future pet, and would recommend the procedure to a friend or family member.
Conclusion: LAG was an effective procedure for prevention of GDV and was associated with high client satisfaction in this cohort of dogs. A moderate rate of postoperative wound complications occurred that were minor and self-limiting in nature.

Gastric dilatation volvulus (GDV) is a well-described condition of large and giant-breed dogs that is characterized by gastric dilatation with food and/or air, increased intragastric pressure, and abnormal rotation of the stomach along its vertical axis.[1–5] Reported mortality rates associated with GDV range from 10 to 55%.[3–7]

To prevent GDV, prophylactic gastropexy has been recommended for at risk breeds and can be performed at the time of sterilization by open laparotomy.[8–11] In recent years, minimally invasive surgery (MIS) has gained popularity in veterinary medicine and reported advantages include reduced postoperative pain, shorter hospital stays, and possible reduction in surgical site infections.[12–14] Prophylactic laparoscopic-assisted gastropexy (LAG) has been described in dogs and has been reported to result in a strong adhesion between the pyloric antrum and right body wall.[10] Several studies have reported the short-term outcomes of prophylactic LAG; however, only a limited number of studies document long-term outcome (>12 months).[6,10,11] The purpose of this study is to report the short- and long-term outcomes, intraoperative and postoperative complications, and to objectively quantify owner satisfaction following prophylactic LAG in dogs.

MATERIALS AND METHODS

Case Selection

Medical records of dogs that underwent prophylactic LAG at 2 academic institutions (Ontario Veterinary College and Atlantic Veterinary College) between January 2011 and January 2015 were reviewed. Dogs were included if the medical record was complete and multiport LAG was performed using a previously described technique.[10] Dogs were excluded if their medical record was incomplete (e.g., missing surgery report and/or anesthesia record), if surgical technique differed from those described, or if there was a previous history of GDV. Dogs with a previous history of gastric dilatation with no volvulus were included in the study. Data obtained from the medical record included signalment, operative details, operative time (minutes; time from first incision to placement of final skin suture), anesthesia time (minutes; time from induction of anesthesia to recovery), location and size of laparoscopic ports, additional surgical procedures, conversion to open laparotomy, and intraoperative and postoperative complications.

Complications arising during LAG that required considerable deviation from normal surgical procedure were classified as intraoperative complications. Postoperative complications were classified as either minor or major. Minor complications were those that did not require veterinary intervention and resolved with supportive care, such as incisional erythema, seroma formation, and/or incisional swelling/inflammation. Major complications were those that required veterinary intervention at some point during the postoperative period, such as a surgical site infection (SSI) and/or persistent seroma. Incisional complications were further classified using standard SSI definitions created by the Center for Disease Control and Prevention.[15]

Surgical Procedure

LAG was performed by an ACVS board certified surgeon or an ACVS surgical resident directly supervised by a board certified surgeon. The surgical technique was performed as previously described by Rawlings et al.[10] Briefly, dogs were placed in dorsal recumbency and the ventral abdomen aseptically prepared for surgery. Abdominal access was obtained using the Hasson technique[10] or with a Veress needle.[12]

For the Hasson technique, a 1 cm incision was created through the skin and subcutaneous tissues to the level of the external rectus fascia, ~1 cm caudal to the umbilicus. The linea alba was identified and stay sutures were placed on either side to allow for elevation of the external rectus fascia while a stab incision was made into the abdomen using a #15 scalpel blade. A 6 mm smooth laparoscopic trocar/cannula assembly (Karl Storz Endoscopy, Goleta, CA) was introduced into the abdomen and pneumoperitoneum was created using CO_2 with a pressure-regulating mechanical insufflator (Karl Storz Endoscopy) to an intra-abdominal pressure of 12 mmHg. A 5 mm 0° 29 cm laparoscope (Karl Storz Endoscopy) was placed through the cannula and into the abdomen.

For Veress needle abdominal access, a 5 mm skin incision was made at the level of the umbilicus and the Veress needle (Karl Storz Endoscopy) was inserted into the abdominal cavity aiming towards the right caudal abdominal quadrant to avoid lacerating the spleen. Pneumoperitoneum was established at 12 mmHg. The Veress needle was retrieved and a 5 mm port and laparoscope/cannula were placed into the abdomen as described above.

Following superficial exploration of the abdomen, a 10 mm smooth instrument portal (Karl Storz Endoscopy) was then created ~2–4 cm caudal to the last rib and ~2–4 cm lateral to the rectus abdominis muscle under direct laparoscopic guidance. Laparoscopic Babcock forceps (10 mm, Clickline, Straight Babcock Forceps, Karl Storz Endoscopy) were then inserted into the abdomen and an avascular region of the pyloric antrum was grasped between the lesser and greater curvatures of the stomach. The abdomen was deflated and the 10 mm cannula was removed while traction was gently maintained on the stomach with the Babcock forceps. The skin and subcutaneous tissue incisions were enlarged on either side of the instrument portal incision to create an access incision of ~2–3 cm. The approach was continued through the external oblique, internal oblique, and tranversus abdominis muscles. Allis tissue forceps were used to grasp the cranial and caudal edges of the tranversus abdominis muscle to maintain clear identification of these muscles for gastropexy. The stomach was then carefully exteriorized through the access incision with the Babcock forceps and stay sutures were placed at the orad and aborad extent of the proposed gastropexy to maintain appropriate gastric orientation. The seromuscular layers of the stomach were incised and the cranial edges of the transversus abdominis muscle and stomach were sutured together followed by the caudal edges in a simple continuous pattern using 2-0 polydioxanone. Typically, the suture line began laterally, and progressed medially on either the cranial or caudal aspect. When the suture line reached the medial aspect, 5–6 throws were performed and the line continued to the other side. Following gastropexy completion, the internal and external abdominal oblique musculature, subcutaneous tissues, and skin were closed in 3 layers using a simple continuous pattern for each with a 3-0 monofilament, absorbable suture (polydioxanone for muscle and poliglecaprone 25 for subcutaneous tissues and intradermal pattern). Pneumoperitoneum was re-established through the subumbilical portal and the gastropexy was inspected to ensure appropriate gastric orientation.

Hospital Discharge

Dogs were discharged, as deemed appropriate by the attending surgeon, with postoperative analgesia (tramadol 2–4 mg/kg orally every 8–12 hours and meloxicam 0.1 mg/kg orally every 24 hours) for 3–5 days and postoperative instructions that included exercise restriction for 21 days and incisional monitoring.

Follow-Up

Postoperative follow-up was performed in all cases by telephone communication with the family veterinarian and/or owner. A series of questions were asked regarding the postoperative period and whether or not the dog experienced an episode of GDV post-LAG (Appendix S1). Additionally, owners were asked if they were satisfied with the prophylactic LAG technique, if they would proceed with a LAG in future pets, and if they would recommend LAG to family members or friends. For the purposes of standardization, all questions were asked in the same order, and all answers required a yes/no response with the opportunity for explanation if deemed necessary by the family veterinarian and/or owner.

RESULTS

Signalment

Forty-nine dogs met the inclusion criteria. The median age was 20 months (range, 6–160 months) and the median weight was 37.4 kg (range, 17.5–69.0 kg). Breeds represented were Great Dane (17 dogs), German Shepherd (6), Standard Poodle (5), Bernese Mountain Dog (4), Saint Bernard (3), Rough-coated Collie (2), Irish Wolfhound (2), and Bloodhound, Briard, Doberman Pinscher, Mixed Breed, Rottweiler, Scottish Deerhound, Shiloh Shepherd, Yugoslavian Shepherd, Dutch Shepherd, and Newfoundland Dog. The sex distribution was 51% (25/49) male (18 intact, 7 neutered) and 49% (24/49) female (20 intact, 4 spayed).

Prior Medical History

Eighteen percent (9/49) of dogs had at least 1 prior episode of GD with no volvulus. All 9 of these dogs were medically managed for their episode(s) of gastric dilatation, which resolved prior to proceeding with prophylactic LAG.

Operative Data

Median anesthesia time was 165 minutes (range, 90–324) and median surgical time was 90 minutes (range, 44–190). Laparoscopic-assisted gastropexy surgical time was not separated in many cases in the anesthetic record if additional surgical procedures were performed. Median surgical time in cases that had LAG alone (22%, 11/49 dogs) was 60 minutes (range, 44–90). Median surgical time in dogs that had LAG and additional intra-abdominal surgical procedures (43%, 21/49 dogs) was 100 minutes (range, 50–180). Median surgical time in dogs that had LAG and additional extra-abdominal surgical procedures (27%, 13/49 dogs) was 90 minutes (range, 65–190). Median surgical time in dogs that had LAG and both intra- and extra-abdominal surgical procedures (8%, 4/49 dogs) was 97.5 minutes (range, 75–140).

Additional Procedures

Additional intra-abdominal procedures were performed in 43% of dogs (21/49), including laparoscopic ovariectomy (OVH; 13 dogs), laparoscopic-assisted ovariohysterectomy (OHE; 3), laparoscopic cryptorchidectomy (1), laparoscopic liver biopsy (2), laparoscopic vasectomy (1), laparoscopic-assisted splenectomy (1), and laparoscopic-assisted typhylectomy (1). Additional extra-abdominal procedures were performed in 27% of dogs (13/49), including castration (11 dogs), umbilical herniorraphy (2), mass removal (1), and trochleoplasty and tibial tuberosity transposition (1). Additional intra- and extra-abdominal procedures were performed in 8% of dogs (4/49), including laparoscopic OVE/umbilical herniorraphy (1), laparoscopic-assisted OHE/umbilical herniorraphy (1), laparoscopic-assisted cryptorchidectomy/laparoscopic liver biopsy/skin mass removal/castration (1), and unilateral laparoscopic cryptorchidectomy/castration (1).

Outcome

Follow-up data (>12 months postoperatively) were available for 90% of dogs (44/49) by telephone interview with the family veterinarian. Four dogs (8%) died in the follow-up period for reasons unrelated to LAG or GDV. The cause of death in these cases were lymphocytic leukemia, ruptured splenic mass, linear foreign body, and histiocytic disease (1 dog each). These 4 dogs were censored from the follow-up data. Median follow-up was 698 days (range, 411–1,825). None of the 44 dogs available for follow-up developed GDV following LAG.

Eighty percent (36/45) of dog owners were available for follow-up by telephone. All owners surveyed (36/36) were satisfied with the prophylactic LAG procedure, would proceed with prophylactic LAG in a future dog if the breed was considered a risk for GDV, and would recommend a prophylactic LAG to a family member or friend with an at-risk dog breed. Six percent of owners (2/36) commented that the cost of the surgery would be the only deterrent to proceeding with a prophylactic LAG in a future companion animal. One owner (3%), a veterinarian, stated that the ability to perform a gastropexy through open laparotomy at a lower cost than LAG may deter some owners from performing the minimally invasive technique.

Complications

Intraoperative Complications. Intraoperative complications related to gastropexy positioning occurred in 4% of dogs (2/49). In one dog, the gastropexy incision was deemed to be too close to the pylorus at time of laparoscopic reinspection. The gastropexy site was detached, the seromuscular layer of the stomach sutured closed, and a location closer to the antrum was incised and incisional gastropexy repeated. In the second dog, the seromuscular layer of the stomach was sutured to the internal abdominal oblique muscle instead of the transversus abdominis in a portion of the gastropexy. The gastropexy site was detached and sutured to the appropriate layers.

Access-related complications occurred in 10% of dogs (5/49), including 4 dogs experiencing splenic laceration. One dog sustained splenic injury while obtaining abdominal access with the Hasson technique and 1 dog sustained splenic injury at the time of Veress needle insertion. Splenic hemorrhage in both cases was self-limiting and conversion to an open laparotomy was not required. Two dogs sustained splenic lacerations where hemorrhage was not self-limiting and the surgeon deemed conversion to open laparotomy was necessary to facilitate hemostasis. One of the splenic lacerations requiring conversion occurred during Verres needle entry and the second splenic laceration occurred during Hasson technique abdominal access. The 5th dog with an access-related complication sustained a bladder laceration and resultant uroabdomen following Veress needle insertion. The bladder laceration was repaired by open laparotomy with no further complications. Therefore, 3/5 access-related complications (6% of dogs total) required conversion to open laparotomy. The Veress blind-entry technique was performed for abdominal access in 27% (13/49) dogs, with 3 experiencing access-related complications, whereas the Hasson technique in 73% (36/49) dogs with 2 experiencing access-related complications.

Postoperative Complications. Postoperative complications were documented in 34% of dogs (15/44), 87% of which (13/15 dogs) were minor self-limiting wound-related postoperative complications that did not require veterinary intervention. Of these 13 dogs, 10 (77%) were diagnosed with incisional inflammation based on standard definitions for surgical site infections that were described as erythema, bruising, and hard swelling around 1 or more of the incision sites and that resolved spontaneously within 14 days of surgery.[15] The remaining 23% (3 dogs) were diagnosed with an incisional seroma that resolved within 14 days of surgery without veterinary intervention. The specific locations of incisional seromas were not recorded (subumbilical vs. paramedian gastropexy incision).

Major postoperative complications that required further veterinary intervention to achieve resolution were reported in 2 dogs (5%). One dog developed fluid-filled pockets at both the subumbilical and paramedian gastropexy incisions, as noted by the family veterinarian at the 10 day follow-up and suture removal. At 15 days postoperatively, both swellings were larger and the family veterinarian drained serous fluid from both sites. Antimicrobials were prescribed and the swellings did not recur. The second dog with a major postoperative complication returned to the academic institution 23 days postoperatively with a draining wound at the paramedian gastropexy incision site. Owners noted the dog scratching at her incision site with her pelvic limb following suture removal. A small amount of serous fluid was present. The owners were instructed to apply warm compresses to the site and maintain an Elizabethan collar until re-evaluation in 7 days. Upon re-evaluation, the gastropexy site had 2 small draining tracts at the incision with a small amount of serous discharge. Bacterial culture and susceptibility was performed and yielded *Staphylococcus aureus* susceptible to cephalosporins. The dog was prescribed cephalexin orally for 5 days. Owners were instructed to keep an Elizabethan collar on the dog at all times and clean the incision 3–4 times daily with topical chlorhexidine solution. According to the owner by telephone conversation, clinical signs were resolved and the wound appeared healed within a few days. Ten days later, the draining tracts reappeared along with a purulent discharge. The dog was admitted to hospital and a fistulogram under sedation was performed and showed no evidence of communication with the abdominal cavity or the stomach. The following day, the dog underwent general anesthesia and an abbreviated upper gastrointestinal endoscopy was performed to assess gastric integrity at the previous gastropexy site. Endoscopy revealed a diffuse erosive pattern of the gastric mucosa with focal thickening at the gastropexy site, but no evidence of communication with the external draining tract. The dog was then taken to surgery and the draining tract was removed en bloc and no communication between the tract and abdominal cavity was visualized. The dog recovered uneventfully and was discharged the following day. Subsequent re-evaluations reported no further complications with incisional healing.

DISCUSSION

In this retrospective study of 49 dogs, we found that LAG, performed as previously described by Rawlings et al,[10] can be effectively employed as prophylaxis alone or combined with other intra- and/or extra-abdominal procedures to prevent GDV and was associated with a low intraoperative and major postoperative complication rate. Furthermore, owner satisfaction was high for LAG, which may be important for beginning laparoscopic surgeons who are considering offering this procedure for GDV prophylaxis. A moderate minor postoperative complication rate related to the surgical incisions can be expected based on the results of this and previously published studies using the LAG technique.[6,11,16]

Performing prophylactic gastropexy using a minimally invasive laparoscopic-assisted technique allows for smaller incisions compared to gastropexy performed by open laparotomy. In previous studies comparing laparoscopic OVE or laparoscopic-assisted OVH to the traditional open OVE or OVH, it was reported that dogs that underwent the minimally invasive procedure had a more rapid return to normal activity and required less analgesia compared to dogs that had traditional open surgery.[13,17] Although we did not have a comparison group of dogs in our study that underwent open laparotomy for prophylactic gastropexy, we believe that the LAG technique reduces tissue trauma compared to open laparotomy, resulting in a more rapid return to function.

The surgical times in our study reflect the time from the first incision to the time of the final suture placement. The surgical time of LAG itself was not consistently recorded and the surgical times reported in our study include other intra- and/or extra-abdominal procedures performed at the time of surgery. For cases undergoing LAG alone, our median surgery time of 60 minutes was comparable to Gonzalez-Gasch and Monnet[16] and Rivier et al,[11] who reported total median surgical times of 61 and 60.8 minutes, respectively. The median surgery time of LAG alone in this study was greater than the median of 28 minutes for LAG reported by Mayhew and Brown.[18] Comparison of surgical time between LAG and open laparotomy for incisional gastropexy has not been performed; however, we believe that, for surgeons experienced in MIS, surgical times for LAG can be comparable with the open technique once experience is gained.

We reported an access-related complication rate of 10%. Complications during laparoscopy from abdominal access have been previously documented in dogs, with splenic laceration being the most common complication.[12,16] In a study by Pope et al, bladder laceration was also reported in 3 cases during introduction of the caudal instrument portal.[12] In 1 case in this study, bladder laceration occurred during abdominal access, resulting in uroabdomen. The Veress blind-entry technique was performed in 13 of our dogs, with 3 experiencing access-related complications. Two of these dogs required conversion to open laparotomy. Multiple studies have reported that splenic laceration secondary to Veress needle placement was the most common complication associated with laparoscopy.[12,16] According to Whittemore et al, maintaining sharpened trochars avoids having to apply excessive force when entering the abdomen, which in turn, minimizes the risk of inadvertent laceration to abdominal viscera.[19] In addition, it has been previously recommend to ensure the urinary bladder is completely empty prior to surgery to reduce the risk of inadvertent damage during Veress needle and/or trocar placement. It has been recommended using alternative trocar placement techniques, such as the modified Hasson or Hasson technique, to reduce the incidence of splenic laceration with abdominal entry.[19] Furthermore, implementing open methods for pneumoperitoneum by using the Hasson technique may reduce the risk of other intraoperative complications. An additional consideration would be the use of a single port platform on ventral midline, as a recent study has reported the use of these platforms reduces operative time and complication rate.[16] The single port platform can be used for OVE (if being performed concurrently).[20] Following single port OVE, a 10 mm instrument portal can be placed in the right paramedian region as previously described for LAG.[10] Single port access gastropexy and ovariectomy has also been described where a single port platform is placed in the right paramedian region alone[21]; however, caution must be exercised with this technique if not experienced with multiport LAG.

Two dogs (5%) experienced intraoperative complications related to gastropexy positioning in our study. In the first dog, the seromuscular layer was inappropriately sutured to the internal oblique muscle instead of the transversis abdominis muscle. This was visualized at the time of laparoscopic reinspection of the LAG. In the second dog, the gastropexy site was deemed to be in close proximity to the pylorus at time of laparoscopic reinspection. In both these cases, the gastropexy site was revised without complication. Both of these intraoperative complications were identified at the time of laparoscopic reinspection of the LAG and is a purported benefit of the multiport LAG technique. In addition, the authors recommend clear identification of all layers of the body wall during the paramedian approach through the portal incision to the abdomen in order to limit the chances of suturing the incorrect abdominal wall muscular layer to the seromuscular layer of the stomach. Stay sutures placed on either cut edge of the muscle layer of the body wall have been used with success for clear identification.

Three dogs (6%) in our study required conversion to open laparotomy due to splenic hemorrhage (2 dogs) and bladder laceration (1 dog) at time of abdominal access. In all 3 dogs, it was deemed necessary to convert to open laparotomy by the attending surgeon to achieve hemostasis and repair inadvertent organ damage. In our study, LAG was performed by surgeons or a resident under direct supervision of a surgeon, with varying experience in MIS. In human medicine, MIS experience and level of training influences complications and conversion to open laparotomy.[22,23] While cases included in this study may have been part of the learning curve for multiport laparoscopy (and LAG) for some surgeons and/or residents, as evidenced by a high abdominal access complication rate, we believe our procedural complication and conversion rate is low, consistent with previous reports of LAG.[10,16]

We had an overall postoperative complication rate of 34% (15/44). Of these complications, 5% (2/44) of dogs had a major postoperative complication that required veterinary intervention. One of these dogs had an incisional complication classified a superficial SSI, since involvement was limited to the subcutaneous tissues. According to Eugster et al, the risk of infection doubles for every 70 minutes in surgery.[24] This dog had a laparoscopic OVE in addition to the LAG and had surgery and anesthesia times of 135 and 210 minutes, respectively. The increase in surgery and anesthesia time may have increased the risk of developing SSI. It is also important to consider the possibility of communication between the stomach and incisional gastropexy site as the cause of SSI since the gastric mucosa was penetrated at the time of LAG in this dog. The gastric mucosa was sutured closed with an interrupted suture and the surgery was completed without complication. It is possible that a small persistent communication was present between the gastric lumen and body wall, resulting in infection. Flexible endoscopy and fistulography at the time of revision surgery was performed to determine if there was a communication between the gastric lumen and the body; however, none was found. It is conceivable that the mucosal defect, if one was present, had healed. The second major postoperative complication reported was persistent fluid-filled swellings at the subumbilical and gastropexy (paramedian) incision sites that required percutaneous drainage by the family veterinarian >14 days postoperatively. These swellings were presumed to be sterile seromas; however, bacterial culture of the fluid was not performed.

Thirty percent (13/44) of postoperative complications were classified as minor and were self-limiting as they resolved without veterinary intervention. Previous studies have reported a high postoperative incisional complication rate in LAG rather than complications related to the surgical procedure (e.g., dehiscence of the gastropexy site, resultant GDV, septic peritonitis).[6,11,16] In a prospective study, Rawlings et al reported a 9.0% (2/23) incisional complication rate with both cases having delayed suture reactions at the paramedian gastropexy site.[6] Rivier et al reported a 15.4% (4/26) incisional complication rate, with all 4 cases developing seromas at the paramedian gastropexy incision.[11] Gonzalez-Gasch and Monnet reported a postoperative complication rate of 18.4% following single port and multiport LAG and ovariectomy, where all complications were incisional related.[16] It is possible that the smaller incisions and shorter recovery time associated with MIS increase postoperative activity, leading to greater incisional complications; however, further studies are required to investigate this association. We recommend ensuring strict activity reduction in the 21 day postoperative period to reduce the risk of incisional complications. In addition, careful and accurate apposition of muscular layers of the body wall is recommended with obliteration of dead space during closure of the paramedian gastropexy incision.

Follow-up was available for 90% of dogs (44/49) that were alive at the time of follow-up. No dog experienced an episode of GDV within follow-up period. These findings are consistent with Rawlings et al, who reported no episode of GDV in 23 dogs with a follow-up time of 365 days (maximum follow up time of 1,260 days) and with Rivier et al, who reported no episode of GDV in 26 dogs with a mean follow-up time of 1,872 days.[6,11] Although we did not have a control group in our study, our results suggest that the LAG method for GDV prevention is comparable to traditional open gastropexy techniques in terms of effectiveness. Moreover, it has been demonstrated that LAG techniques maintain a secure adhesion to the body wall.[6,10] Although the adhesion strength necessary to prevent GDV remains to be determined, it is evident that the strength of the adhesion created through LAG is sufficient to prevent GDV.

All 36 owners available for follow-up were satisfied with the prophylactic LAG and would consider a LAG for a future at-risk dog and recommend the procedure to family or friends. We believe this is a relevant finding for beginning laparoscopic surgeons who are considering offering this procedure to high-risk dog breeds for GDV. A small number of owners (6%) mentioned cost as the only deterrent in considering a future LAG for another dog or for recommending the procedure to a family member or friend. A decision-tree with a cost-benefit analysis created by Ward et al demonstrated that a prophylactic gastropexy was cost-effective if the risk of GDV for a dog was ≥34%, such as the lifetime risk of 24–43% reported in Great Danes.[2] However, a cost-benefit analysis of LAG vs. an open technique has not been performed. Understanding that procedure cost is a determining factor for some clients, further cost-benefit analysis of prophylactic open gastropexy vs. LAG, may benefit owner and family veterinarian decision making.

Several limitations to our study are acknowledged. Follow-up after surgery was not controlled, as it would have been in a prospective study. The retrospective nature of the study necessitated reliance on medical records of family veterinarians for accurate descriptions of postoperative complications. In addition, in 3 cases, owners described a postoperative complication, but their family veterinarian did not. This resulted in the interpretation of the owners' description of complications at our discretion. In almost all cases with described postoperative wound complications, discrimination between the subumbilical incision and the paramedian gastropexy incision were not made. Anecdotally, the paramedian gastropexy incision has been associated with a greater amount of postoperative complications; however, this could not be definitively determined in our study. Another limitation to our study is the lack of discrimination between gastropexy surgical time and surgery time for additional procedures. Further, surgical times reported in our study reflect a wide range of procedures, including 1 orthopedic procedure, making it difficult to truly interpret median surgical and anesthetic time when evaluating factors associated with LAG.

Our retrospective study demonstrates that LAG is an effective prophylactic procedure for the prevention of GDV and that LAG can be performed with other intra- and extra-abdominal produces with low major intraoperative and postoperative complication rates and high client satisfaction. In concordance with previous reports, a moderate rate of minor self-limiting wound complications can be expected with this technique.

DISCLOSURE

The authors declare no conflicts of interest related to this report.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's website.

Appendix S1 Family veterinarian and/or owner questionnaire.