Combined laparoscopic ovariectomy and laparoscopic-assisted gastropexy in dogs susceptible to gastric dilatation-volvulus

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Abstract — This prospective study describes a simple method of combining laparoscopic ovariectomy and laparoscopic-assisted prophylactic gastropexy and determines the duration of surgery, complications, and long-term outcome including prevention of gastric dilatation-volvulus (GDV). Laparoscopic ovariectomy and laparoscopic-assisted gastropexy were performed on 26 sexually intact female dogs susceptible to GDV. The mean surgery time was 60.8 ± 12.4 min. No GDV episode was seen during the study period (mean follow-up: 5.2 ± 1.4 y). All dogs had an intact gastropexy attachment assessed by ultrasonography at 1 y. Post-operative complications were minor and owners were satisfied with the procedure. Combined laparoscopic ovariectomy and laparoscopic-assisted gastropexy appears to be a successful and low morbidity alternative procedure to both ovariectomy/ovariohysterectomy and gastropexy via open ventral-midline laparotomy.

Résumé — Ovariectomie par laparascopie et gastropexie vidéo-assistée combinées chez les chiennes prédisposées au syndrome dilatation torsion d'estomac. Cette étude prospective décrit une méthode simple combinant l'ovariectomie par laparascopie et la gastropexie prophylactique video-assistee. La durée de la chirurgie, les complications et les résultats à long terme incluant la prévention la prévention du syndrome dilatation torsion d'estomac (SDTE) sont déterminés. L'ovariectomie par laparascopie combinée à la gastropexie vidéo -assistée ont été réalisées sur 26 chiennes non stérilisées et de races prédisposées au SDTE. La durée moyenne de chirurgie était de 60,8 ± 12,4 minutes. Aucun épisode de SDTE n'a été observé durant la période de l'étude (suivi moyen : 5,2 ± 1,4 ans). Lors de l'échographie de contrôle réalisée un an postopératoire, la gastropexie était intact. Seules des complications mineures en post-opératoire ont été observées et les propriétaires étaient satisfaits de l'intervention et du résultat. L'ovariectomie par laparascopie combinée à la gastropexie vidéo assistée par donnent des résultats satisfaisants et représente une alternative avec une faible morbidité à l'ovariectomie ou à l'ovariohystérectomie combinée à la gastropexie par laparatomie médiane ventrale.

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Introduction

Canine gastric-dilatation volvulus (GDV) syndrome is an acute condition affecting primarily large and giant-breed dogs. Although numerous mechanisms have been proposed, the etiology of the disorder remains obscure. With prompt treatment, survival approaches 85% (1). Large (akita, bloodhound, collie, Irish setter, rottweiler, standard poodle, weimaraner) and giant breed (great dane, Irish wolfhound, Newfoundland, Saint Bernard) dogs have a 6% incidence of GDV, with GDV accounting for 16% of all the deaths in these breeds (2). Some dogs seem to inherit a predisposition for GDV, as there is an increased likelihood of GDV if a first-order relative (parent or sibling) has had GDV (2–7). Recurrence and death in dogs treated medically for GDV are reported as being between 76% (8) and 80% (9).

Several authors have suggested that a gastropexy should be performed to prevent recurrence in dogs undergoing emergency surgery because of GDV (5,9–11). Without gastropexy, a recurrence rate as high as 55% to 85% has been reported (5,12,13), compared with only 3% to 5% for dogs that did have a gastropexy (5,13). Similarly, even though scientific proof of a beneficial effect is lacking, it seems likely that prophylactic gastropexy would prevent a first episode of GDV in genetically predisposed dogs and prevent a recurrence in dogs in which a first episode was treated medically (14). Results of epidemiologic studies (2–7) of dogs that are susceptible to gastric dilatation-volvulus provide criteria as to which dogs should receive gastropexy. Dogs in which gastropexy to prevent GDV is strongly indicated include those that have a history of gastric dilatation or have a first-order relative that has had gastric dilatation (2,6,7). Other

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indications include a history of splenic volvulus (15) and dogs with a high thoracic depth to width ratio (6).

Techniques commonly used to perform a gastropexy during emergency surgery for GDV can also be used for prophylactic gastropexy. Almost all gastropexy techniques developed for use during a laparotomy can also be performed through laparoscopic or laparoscopic-assisted surgery (14,16,17). The goals for these gastropexy techniques are that they are easy to perform, produce a permanent attachment between the antrum and the right abdominal wall, do not alter gastric function, and have minimal complications.

It seems reasonable to combine elective ovariectomy and prophylactic gastropexy on dogs at risk. In order to decrease morbidity, laparoscopic techniques were used. The purposes of the present study were to describe a simple method of combining laparoscopic ovariectomy and laparoscopic-assisted prophylactic gastropexy and determine the duration of surgery, complications, and long-term outcome including prevention of gastric dilatation-volvulus (GDV).

Materials and methods

Dogs

Sexually intact female dogs ($n = 26$) weighing > 25 kg were selected for our study because of their propensity for GDV as indicated by their breed or a family history of gastric dilatation. The owners provided informed consent for the study and all surgeries were performed by the same board-certified surgeon. The surgeries took place at the National Veterinary School between 2001 and 2006. After hospitalization, each dog underwent a complete physical examination which provided a minimum database that included hematocrit, total serum protein concentration measured with a portable refractometer, a blood glucose assay, and a serum urea nitrogen assay. Any dog judged not to be a good candidate for anesthesia and dogs that had had previous abdominal surgery were excluded from the study.

Surgical technique

All dogs were premedicated with glycopyrrolate (Robinul-V, 0.2 mg/mL; Laboratoire Vétoquinol SA, Lure, France), 0.01 mg/kg body weight (BW), acepromazine maleate (Calmivet, 5 mg/mL; Laboratoire Vétoquinol SA), 0.03 mg/kg BW and morphine (Morphine Aquettant, 10 ng/mL; Laboratoire Aquettant, Lyon, France), 0.1 mg/kg BW administered intramuscularly. Anesthesia was induced with intravenous (IV) diazepam (Valium, Roche, 5 mg/mL; Produits Roche, Neuilly-sur-Seine, France), 0.5 mg/kg BW, and ketamine (Imalgene 1000, 100 mg/mL; Mérial, Lyon, France), 5 to 7 mg/kg BW. The dogs were then intubated and anesthesia was maintained with inhalation of isoflurane in oxygen. Lactated Ringers solution (Ringer Lactate Aquettant; Laboratoire Coophavet, Acenis, France) was administered IV, 10 mL/kg BW/h during each procedure. Following abdominal insufflation with carbon dioxide (CO_2), positive-pressure ventilation was provided at a rate of 12 breaths/min, with a tidal volume of 12 mL/kg; the inflation pressure during inspiration was < 20 cm water. Meloxicam (Metacam, 5 mg/mL; Boehringer Ingelheim, Reims, France), 0.2 mg/kg BW, IV was administered to provide additional intra- and perioperative analgesia.

We used a previously reported laparoscopic approach for dogs (18) with 1 median portal (10 mm) at the umbilicus and 2 lateral portals (5 mm and 10 mm), 1 on each side of the mammary glands (usually between M3 and M4). After insertion of the cannula (Ternamian cannula; Karl-Storz Endoscopy, Guyancourt, France), the correct location of the portal was checked by inflation of a small amount of CO_2 (1 L/min). When no pressure build-up on the insufflator was noted, it was concluded that the cannula had entered the abdominal cavity, and the abdomen was insufflated with CO_2 (6 L/min) to an intraabdominal pressure of 8 to 12 mmHg. A 10-mm zero degree telescope (Hopkins II, Karl-Storz Endoscopy) was inserted in the umbilical portal. The 2 other cannulas (Ternamian cannula, Karl-Storz Endoscopy) were inserted under endoscopic guidance. The surgery table was tilted to place the sacrum above the head, and, if necessary, the surgical table was tilted to the surgeon's side to improve access to the ovaries.

Ovariectomy was performed first. Leaving the ovarian bursa intact, the bursal tissue was grasped with a forceps (Clickline grasping forceps, Karl-Storz Endoscopy) and the proper and suspensory ligaments were divided/coagulated with a bipolar cautery laparoscopic instrument (RoBi grasping forceps, Karl-Storz Endoscopy). The ovarian pedicle was coagulated and cut similarly. The left ovary was placed to the right side of the bladder and the procedure was repeated for the right ovary. Both ovaries were gently removed through the left lateral portal (10 mm), which was closed after removal.

For the gastropexy the table was tilted in order to have the head above the sacrum ("Trendelenburg position"). Insufflation was slightly decreased to reduce the distance between the stomach and the abdominal wall. We kept 2 cannulas for the laparoscopic-assisted gastropexy: the telescope remained in the umbilical cannula, a 5-mm laparoscopic forceps was passed through the right paramedian portal to grasp the antrum of the stomach. The antral site for grasping with the forceps and for the incisional gastropexy was mid-distance between the lesser and the greater curvature, approximately 5- to 7-cm orad from the pylorus. The pyloric antrum was shifted 3- to 4-cm to the right costal arch at the lateral edge of the rectus abdominus and fixed to the abdominal wall with a laparoscopically observed transabdominal suspension suture. The CO_2 was completely evacuated from the abdomen and a 5-cm abdominal wall incision was made just craniomedial to the transfixing suture and parallel to the last rib. The pyloric antrum was grasped with a Babcock forceps and exteriorized. Traction sutures of size 0 polyglactin 910 (Vicryl; Ethicon SAS, Issy les Moulineaux, France) were placed 5 cm apart in the pyloric antrum at each extremity of the gastropexy site, and a 5-cm long longitudinal incision was made through the serosa and the muscular layer of the pyloric antrum. The seromuscular layer was sutured to the transversus abdominus muscle in a continuous fashion with 0 polyglactin 910. The oblique muscles were approximated with interrupted cruciate sutures of 0 polyglactin 910. The pyloric antrum was viewed laparoscopically to ensure that it was not twisted, and the laparoscope, the endoscopic forceps and the remaining cannulas

Table 1. Characteristics of dogs enrolled in the study, surgical time, complications and follow-up

Breed	Age (mo)	Body weight (kg)	Surgical time (min)	Complications	Follow-up (y)
Bernese mountain dog	11	47	49	None	3.1
Bernese mountain dog	14	45	55	None	3.7
Doberman	7	26	57	Seroma (gastropexy site)	4.9
Doberman	13	37	54	None	5.3
German shepherd	10	35	47	None	6.3
German shepherd	15	37	92	None	6.0
German shepherd	20	45	83	None	4.7
Great dane	11	62	57	Seroma (gastropexy site)	8.0
Great dane	12	57	61	None	6.7
Great dane	12	54	55	None	5.0
Great dane	15	69	53	Vomiting 24 h	5.8
Great dane	15	65	62	None	5.3
Great dane	17	63	50	Seroma (gastropexy site)	6.6
Great dane	19	82	60	None	2.7
Great dane	20	73	75	None	4.0
Great dane	31	80	71	None	5.5
Irish setter	8	28	44	None	6.8
Irish wolfhound	14	59	68	Seroma (gastropexy site)	3.8
Labrador	12	28	70	None	5.2
Labrador	14	34	60	None	6.0
Pyrenean mountain dog	17	71	68	None	5.0
Saint Bernard	13	67	83	None	3.9
Saint Bernard	17	77	52	None	4.9
Weimaraner	6	26	47	None	2.6
Weimaraner	10	32	47	None	7.3
Weimaraner	17	36	62	None	6.4
Mean ± standard deviation	14.2 ± 5.0	51.3 ± 18.4	60.8 ± 12.4		5.2 ± 1.4

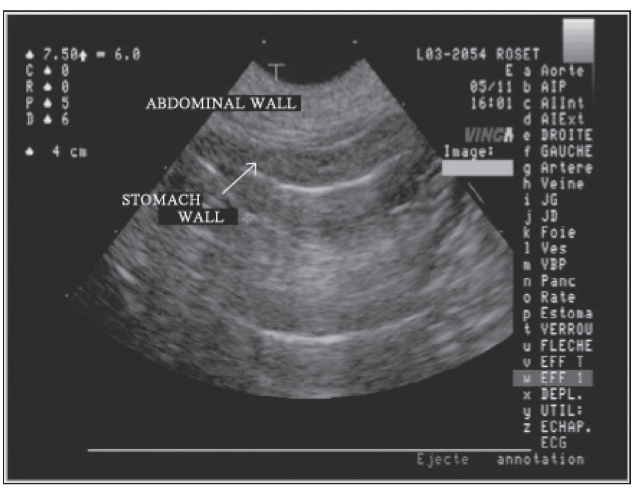

Figure 1. Transverse ultrasonographic appearance of the right cranial part of the abdomen at the gastropexy site in a 2-year-old female spayed great dane 1 y after laparoscopic-assisted gastropexy. The stomach wall is thicker than normal and hypoechoic, and its serosal surface cannot be distinguished from that of the abdominal wall. During ultrasonographic examination, no motion between the stomach and body wall was noticed.

were removed. The cannula sites, the subcutaneous tissues and the skin were closed routinely.

Post-operative care

Patients recovered from anesthesia uneventfully and were given 1 dose of morphine (0.1 mg/kg) approximately 2 h after surgery.

Follow-up

Dogs were evaluated at 10 d and 1 y after surgery. Dogs were examined at 10 d after surgery for suture removal, and the owner was asked questions about feeding, eating and drinking habits, defecation, abdominal discomfort, and complications after surgery. Owners were contacted by telephone 1 mo after surgery and at the end of the study and asked about outcome with specific interest in wound healing, occurrence of bloat, gastric disturbance, excessive salivation, and weight loss. Signs of slight wound dehiscence, infection, and even marked swelling were considered wound complications.

At the 1-year evaluation, a history in relation to GDV was obtained for each dog. Examinations included complete blood (cell) count (CBC), serum biochemical analyses, and abdominal ultrasonography. Ultrasonography was performed after the hair was clipped at the gastropexy site and acoustic coupling gel applied. The gastropexy site was examined ultrasonographically by use of a 10 MHz transducer. The location of the right gastric wall in relation to the abdominal wall and the appearance of the stomach wall and the abdominal wall at the gastropexy site were examined.

Results

Ten breeds were represented. Mean age was 14.2 ± 5.0 mo (range: 6 to 31 mo). Mean body weight was 51.3 ± 18.4 kg (range: 26 to 82 kg). Mean surgical time was 60.8 ± 12.4 min (range: 44 to 92 minutes) (Table 1).

Mean follow-up was 5.2 ± 1.4 y (range: 2.6 to 8.0 y). None of the dogs developed GDV or received veterinary care for gastric dilatation or other gastrointestinal problems during the monitored period. Owners were satisfied with the procedure.

In all dogs, ultrasonographic examination revealed that the right side of the stomach wall was in contact with the right abdominal wall (Figure 1). No sliding motion between the stomach and body wall was seen at the gastropexy site. The stomach wall was thicker and more hypoechoic at the site of the attachment than elsewhere. Contractions of the pyloric antrum were seen in all dogs, but motility was absent at the site of attachment.

Complications

Problems encountered included 1 dog which experienced vomiting; this resolved in 24 h with standard medical management and 4 dogs with seroma of the gastropexy site incision. Dogs with seroma were placed on antibiotics for 10 d (cephalexin; Rilexine, Virbac France SAS, Carros, France), 25 mg/kg BW, PO, q12h and warm packing of the seroma was perfomed by the owners. Follow-up at 6 wk after surgery determined that these initial complications had resolved, and no further complications were seen.

Discussion

We noted a persistent attachment of the stomach to the gastric wall, no episode of GDV and few complications associated with a combined gastropexy/ovariectomy laparoscopic technique. In contrast to previous authors, who rejected the laparoscopic technique because of its prolonged duration when compared with the open technique (19), our findings were in agreement with others who observed surgical times to be comparable when performed by an experienced surgeon (20–21). All surgeries were performed by the same surgeon who had already performed more than 200 laparoscopic interventions before this study, thus minimizing temporal bias associated with learning. The ideal gastropexy technique should be simple to perform, should not alter gastric function, should produce minimal complications and should provide permanent adhesion, between abdominal and stomach walls. The laparoscopic gastropexy technique used in the present study was first described by Rawlings et al (14,22). The surgery could be performed quickly and easily by an experienced surgeon and appeared to cause minimal stress to the dogs. Laparoscopic equipment and expertise were needed, but the extra-abdominal suturing simplified the procedure, compared with other laparoscopic gastropexy techniques that have been described (16,17).

The population of dogs in the present study included mostly deep-chested dogs considered to be at higher risk of developing a GDV (7). Two surgeries were performed on Labrador retrievers. These 2 dogs came from the same litter and 1 sibling had presented with 1 episode of GDV. Although Labrador retrievers were not considered as a breed at risk, a recent study of GDV found that they were significantly overrepresented compared with the hospital population (1).

Two minor complications were encountered which resolved with medical management. One dog vomited 1 d after surgery; this complication was not reported in the original study (14). We hypothesized that excessive manipulation of the stomach with the laparoscopic forceps or repositioning the stomach could have induced a gastritis or impaired gastric mobility. Gastric myoelectric and motor activity seem to be relatively unaffected after gastropexy in dogs (23). However, this study was conducted a week post-surgery and effect of gastropexy on immediate post-operative gastric motility remains unknown. Four dogs developed a seroma at the gastropexy site. This complication is usually self-limiting (24) and explained by the dead space present between the gastric mucosa and submucosal layer and the oblique muscles. Since most seromas occur 3 to 5 d following surgery, they should be treated by warm compress. Warmth encourages blood and lymphatic flow, which evacuates the seroma. Sutures need to be removed if the inflammation does not resolve (25). The incidence of seromas can be reduced by placing cold packs on the incision during the early postoperative period and tacking the gastric submucosa to the oblique muscles (24).

Risks of recurrence of gastric-dilatation volvulus after various gastropexy techniques (gastrostomy tube, incisional gastropexy, circumcostal gastropexy, and belt loop gastropexy) have been reviewed (10,11). Although differences in overall morbidity using different techniques were found, recurrence of GDV after gastropexy was rare. The effectiveness of gastropexy to prevent a first episode of GDV, however, has not been evaluated by controlled trials. Because of ethical and logistical (including sample size) considerations, such trials are unlikely to be conducted. Although none of the dogs in our study developed GDV, the mean follow-up (5.2 ± 1.4 y) was too small to make conclusions about effectiveness of gastropexy to prevent a first episode of GDV. The mean age of occurrence of GDV was 7.3 ± 3.5 y in 1 recent large study (1), whereas most of the dogs in the present study were only followed until they were 6 to 7 y old.

Many hemostatic techniques have been described for laparoscopic ovariectomy or ovariohysterectomy including the use of surgical steel sutures (26), harmonic scalpel (27,28), laser (29), and monopolar and bipolar cautery devices (21,30). Bipolar cautery is preferred to monopolar cautery because it decreases the overall surgical time even further and, more specifically, the time to remove the individual ovaries (21,31). The incidence of perioperative bleeding is decreased by use of bipolar cautery, and, when bleeding occurs, coagulation is facilitated by bipolar cautery (21). Unlike what has been described previously (21), we did not use endoscopic scissors to make the dissection. We performed both coagulation and dissection with the bipolar cautery forceps and there was no significant bleeding which necessitated endoscopic ligature or conversion to laparotomy. One possible explanation may be that dogs in the present study were young (14.2 ± 5.0 mo) and none of them were obese. Obesity is significantly related to the age of the dog and increased surgical time in every stage of the procedure (21).

We used a classic laparoscopic approach for dogs, in which there is 1 median portal at the umbilicus and 2 lateral portals, 1 on each side of the mammary gland (18,32). A variation of the technique has been described with the use of 3 median portals (21). Using exclusively median portals allows good access to both ovarian pedicles and may offer a comfort advantage postoperatively in that less muscle tissue is penetrated, although this remains to be proven (33). Because a main goal of laparoscopy versus laparotomy is to decrease morbidity, we recently performed the same procedures using only 2 median portals with satisfactory results (unpublished data). With this technique, ovaries are transfixed to the abdominal wall to allow their coagulation and dissection.

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The preferred course of action regarding prophylactic gastropexy in several dog breeds has been evaluated by using estimates of the lifetime risk of GDV, procedural costs, and decision analysis (34). Prophylactic gastropexy was cost-effective when the lifetime risk of GDV was ≥ 34%, which occurred only in the great dane (36.7%) (34).

Combined laparoscopic gastropexy and ovariectomy can be used on large breed dogs to minimize the invasiveness of the procedure while maintaining the safety associated with good visibility of abdominal structures. The advantages of the laparoscopic procedure are low morbidity and low risk of suture dehiscence. Dogs with a high probability for development of GDV should be considered candidates for minimally invasive gastropexy and ovariectomy. CVJ

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