Received: 5 June 2020 | Revised: 16 September 2020 | Accepted: 17 October 2020
DOI: 10.1111/vsu.13541

SHORT CASE SERIES

WILEY

Laparoscopic correction of sliding hiatal hernia in eight dogs: Description of technique, complications, and short-term outcome

Eric Monnet DVM, PhD, DACVS, DECVS

Department of Clinical Sciences, Colorado State University, Fort Collins, Colorado

Correspondence
Eric Monnet, Colorado State University, Department of Clinical Sciences, 300 W Drake Rd, Fort Collins, CO 80523.
Email: eric.monnet@colostate.edu

Abstract

Objective: To describe a novel laparoscopic technique to treat sliding hiatal hernia in dogs.

Study design: Retrospective case series.

Animals: Eight dogs with sliding hiatal hernia treated with laparoscopy.

Methods: Surgery reports were reviewed for technique description and animal outcomes.

Results: Six dogs were brachycephalic. Dogs were placed in right lateral oblique recumbency. Four dogs were placed in a reverse Trendelenburg position to visualize the esophageal hiatus. A single port was placed 2 cm caudal to the last rib on the left side. An extra cannula was added in four dogs. A large-bore orogastric tube was introduced in five dogs and used in four dogs to reduce the hernia. A unidirectional nonabsorbable barbed suture was used for the closure of the esophageal hiatus and the esophagopexy. A left-sided gastropexy was performed for all the cases. The gastropexy was performed with a gastrostomy tube to bypass the esophagus in four dogs. Intraoperative complications included pneumothorax in three dogs. Conversion was elective in three cases and emergent in one case. Clinical signs were recorded as improved in each dog. The median follow-up time was 16.5 days (range, 9-264).

Conclusion: Hiatal hernia repair was performed laparoscopically in this population. Repair included a combination of esophageal plication, esophagopexy, and left-sided gastropexy. Reverse Trendelenburg animal positioning and orogastric tube placement facilitated the reduction of the hernia.

Clinical significance: Laparoscopy is an option for the treatment of sliding hiatal hernia in dogs.

1 | INTRODUCTION

Hiatal hernia is a cause of gastroesophageal reflux in dogs and cats.[1-6] It can be congenital, but most hiatal hernias are acquired and are related to upper airway obstruction.[3,7-10] Hiatal hernias are usually sliding hernias in dogs, with the lower esophageal sphincter moving in and out of the thoracic cavity exposing the distal esophagus to negative pressure.[1-6] Paraesophageal hernia with a megaesophagus has been reported in dogs.[11,12]

Medical treatment and correction of any underlying conditions are usually attempted first to prevent gastroesophageal reflux.[13] In a study in 51 brachycephalic dogs, the upper airway disease treatment resulted in the improvement of the gastrointestinal signs in 91.4% of the cases.[13] However, in that study, medical treatment for esophagitis and gastritis was instituted at the time of surgery, so it is not clear how the surgical treatment of the upper airway obstruction influenced the outcome of the esophagitis. When the refluxes are not well controlled with medical treatment, surgical corrections of the sliding hiatal hernia have been recommended.[1] In contrast, Mayhew et al[5] reported a significant improvement of the hiatal hernia severity score after surgery without previous treatment of the upper airway obstruction in brachycephalic dogs. The goal of the surgical treatment in dogs is to bring the lower esophageal sphincter back into the abdominal cavity. The surgical treatment consists of plication of the esophageal hiatus, esophagopexy, and left-sided gastropexy with or without a gastrostomy tube.[1,5,11,14] Those procedures are routinely performed with a midline laparotomy.

In man, gastroesophageal reflux and hiatal hernia are currently treated with laparoscopy.[15,16] Nissen fundoplication is commonly added to the plication of the esophageal hiatus and the pexy in human patients. The goal of the fundoplication is to reinforce the lower esophageal sphincter. Compared with an open approach, laparoscopic treatment of gastroesophageal reflux is associated with a shorter surgical time and reduced morbidity.[15] The long-term outcome seems similar between laparoscopy and laparotomy, which makes laparoscopy a viable option for treating hiatal hernia and gastroesophageal reflux.[16] Laparoscopy has not been reported in the veterinary surgery literature for the treatment of hiatal hernias. Just as it does in man, laparoscopy should provide a less invasive approach to the treatment of sliding hiatal hernia without affecting the outcome. However, the technique must be described and established before it can be evaluated and compared with a laparotomy approach.

The objective of this study was to report our initial experience with laparoscopic technique to treat sliding hiatal hernia in dogs.

2 | MATERIALS AND METHODS

2.1 | Study design

Medical records from the Veterinary Teaching Hospital at Colorado State University were reviewed to identify hiatal hernia cases that were treated with laparoscopy. Signalment, clinical signs, and medical history were retrieved from the medical record. Operative reports were reviewed to collect information on the surgical technique. Intraoperative and postoperative complications were recorded. Conversion to laparotomy was recorded and reported as emergent or elective. Conversions deemed required by the surgeon to complete the correction of the sliding hiatal hernia were consider elective. Conversions required for a life-threatening event that could not be controlled without a laparotomy were considered emergent.

2.2 | Surgical technique

Dogs were placed in right lateral recumbency (Figure 1). A single-port access (SILS port; Medtronic, Minneapolis, Minnesota) was placed first, 2 cm caudal to the last rib in the middle of the distance between the dorsal spinal process and the midline (Figure 1). The abdominal cavity was insufflated with CO_2 at a pressure of 12 mm Hg.

FIGURE 1 One dog placed on right lateral oblique recumbency with the left hind leg pulled back. The dog is in reverse Trendelenburg position. The curved black line illustrates where the last rib is located. The single-port access (A) was introduced 2 cm caudal to the last rib and additional cannulas (B and C) were placed on the left or the right side of the single-port access

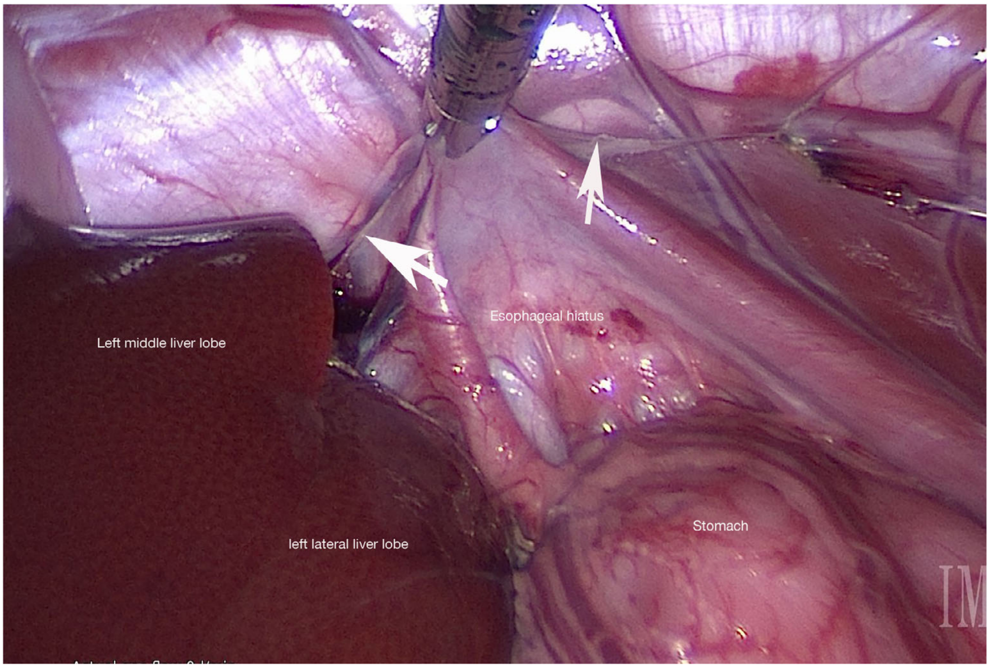

FIGURE 2 The 5-mm fine-teeth grasping forceps is holding the ventral part of the esophageal hiatus at the triangular ligament of the left lateral liver lobe. The triangular ligament has already been transected (arrows). The esophageal hiatus can be seen

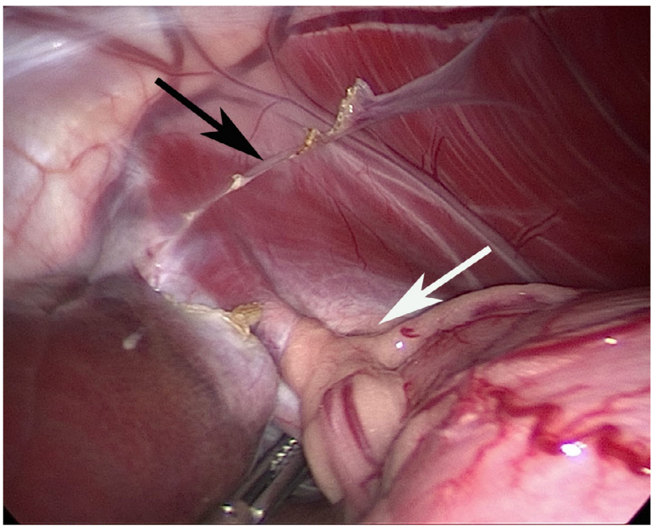

FIGURE 3 The lower esophageal sphincter (white arrow) is now back in the abdominal cavity after pulling on the fundus of the stomach with 5 mm fine teeth grasping forceps. The black arrow is pointing at the triangular ligament that has been transected. The forceps in the picture are only retracting the left lateral liver lobe to improve the exposure of the esophageal hiatus

A 5-mm 0° telescope placed in one of the cannulas of the single-port access system was used during the procedure. After visualization of the esophageal hiatus, a 5-mm fine-teeth grasping forceps (Babcock forceps; Karl Storz, Goleta, California) was used to grab the triangular ligament of the left lateral liver lobe (Figure 2). A 5-mm vessel sealant device (Maryland; Medtronic) was used to divide the triangular ligament. Caudal traction was placed on the stomach's fundus to bring the lower esophageal sphincter into the abdominal cavity with the 5-mm fine-teeth grasping forceps (Figure 3). A large-bore orogastric tube was placed to deflate the stomach, and it was maintained during the entire procedure to provide a guideline for the plication of the esophageal hiatus. The ventral part of the esophagophrenic ligament was dissected from the esophagus.

The esophageal hiatus was plicated with intracorporeal suturing. A continuous Lembert suture pattern with 3-0 nonabsorbable unidirectional barbed suture (VLOC PBT; Medtronic) was applied with 5-mm laparoscopic needle holders (Karl Storz; Figure 4). The simple continuous suture was started at the most ventral aspect of the esophageal hiatus. The continuous suture was extended on the right side of the esophagus to complete the esophagopexy. A left incisional laparoscopy-assisted gastropexy was completed at the site of the single port.[17,18]

3 | RESULTS

Four English bulldogs, one French bulldog, one pug, one Weimaraner, and one German shorthair pointer were included in the study. The median age at the time of surgery was 29 months (range, 6-151). Five dogs were castrated male, and three were spayed females. The median body weight was 16.5 kg (range, 6.6-38.4).

All dogs were presented for a history of vomiting and gastroesophageal reflux. Five dogs had a history of aspiration pneumonia that was resolved at the time of the presentation. Three dogs were treated with a

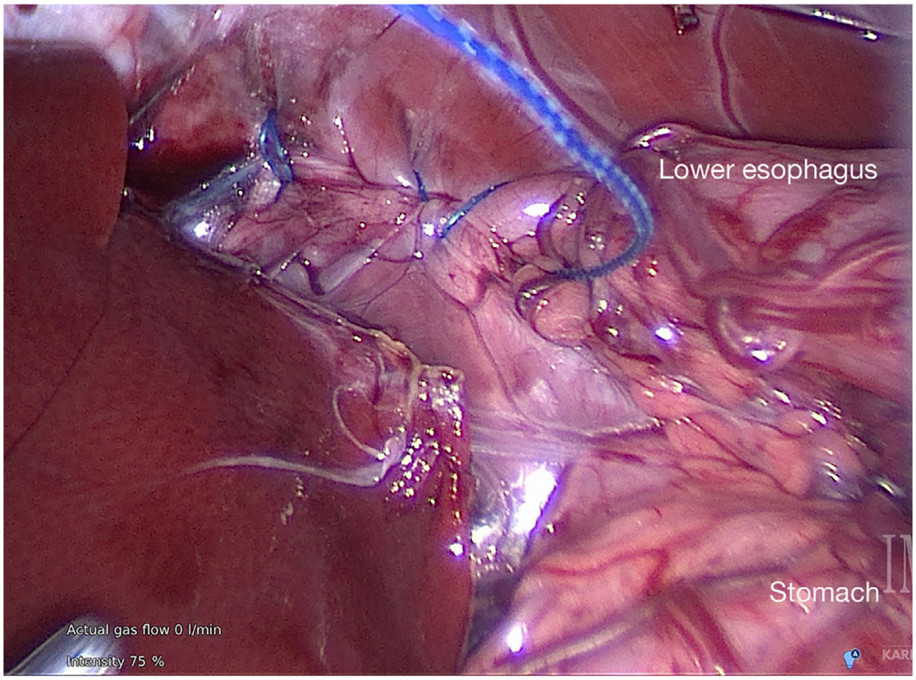

FIGURE 4 The esophageal hiatus has been reduced in diameter with a simple continuous suture with a 3-0 nonabsorbable unidirectional barbed suture

combination of metoclopramide, cisapride, sucralfate, famotidine, or omeprazole. Four dogs had a staphylectomy and nares wedge resection 2 months before the correction of the hiatal hernia. Two dogs had a staphylectomy and nares wedge resection at the time of the hiatal hernia correction.

None of the dogs had signs of aspiration pneumonia according to thoracic radiographs, and one dog had a megaesophagus. Hiatal hernia was diagnosed according to plain radiographs in three dogs. An esophagram under fluoroscopy was performed in three dogs with liquid and solid phases. Flexible endoscopy of the esophagus and the stomach was performed in two dogs to establish the diagnosis of hiatal hernia.

3.1 | Surgical technique

The first dog was placed in right lateral recumbency. All other dogs were placed in right lateral oblique (20° to 30°) position. Reverse Trendelenburg position was used in the final four dogs to improve visualization with retraction of the spleen by gravity (Figure 1). In two dogs, a 5-mm cannula was added on the left side of the single-port access. Two 5-mm cannulas were added in two dogs, one on each side of the single-port access system (Figure 1).

A 15-mm diameter orogastric tube was used in all dogs, and it was used in four dogs to deflate the stomach to improve the reduction of the hernia. The orogastric tube was rigid enough to apply pressure along the greater curvature of the fundus and the body of the stomach to push the stomach distally in the abdominal cavity to expose the lower part of the esophagus in the abdominal cavity. The ventral part of the esophagophrenic ligament was dissected from the esophagus in only two dogs because it resulted in a pneumothorax that required placement of a 16F percutaneous thoracostomy tube (Argyle trocar catheter; Medtronic) in one of these two dogs.

The esophagopexy was completed on the right side of the esophagus in four dogs. An esophagopexy was also performed on the left side of esophagus with a second continuous suture pattern in two dogs (Figure 5). A left incisional gastropexy was completed with laparoscopic assistance at the single-port site after removal in four dogs or with a gastrostomy tube in four dogs.

3.2 | Intraoperative complications and conversion

A pneumothorax developed in three dogs during the surgery. A thoracostomy tube was placed percutaneously to pursue the procedure safely. The pneumothorax was evident because the diaphragm became flaccid. One pneumothorax was related to the dissection of the esophagophrenic ligament. Continuous suction was applied to the thoracostomy tube to maintain negative pressure in the pleural space during the remainder of the procedure. The two other cases were related to the needle hole during suture placement. The intra-abdominal pressure was reduced to 8 mm Hg, and

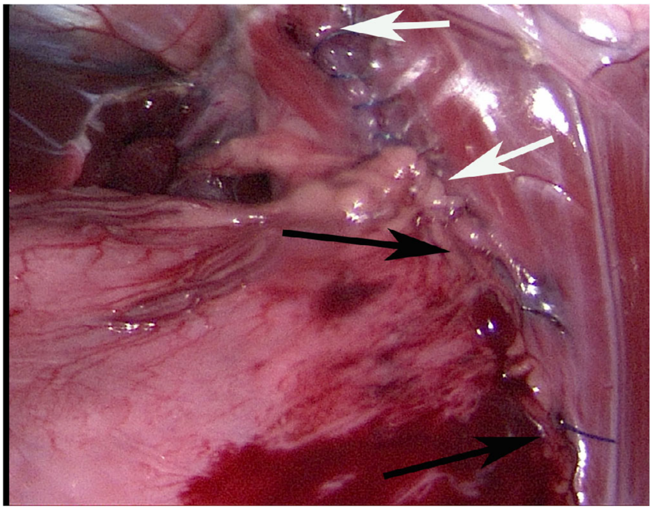

FIGURE 5 View of the esophageal hiatus from the left side of the hiatus. The size of the esophageal hiatus has been decreased with a simple continuous suture (white arrows). An esophagopexy, including the edge of the cardia, was performed with a second line of suture (black arrows)

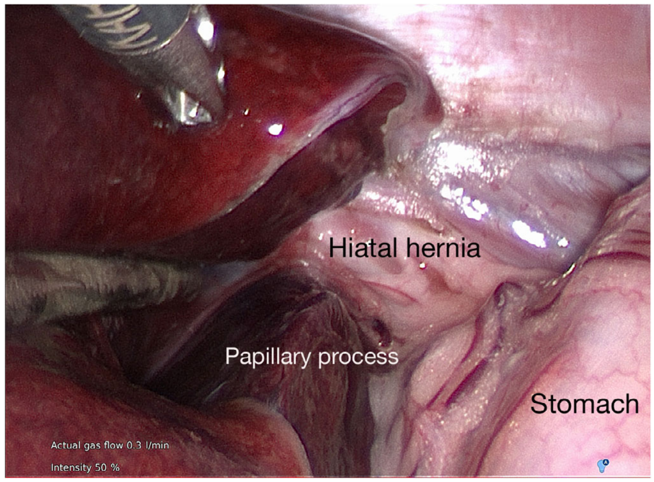

FIGURE 6 A segment of the papillary process of the caudate liver lobe was entrapped in the hiatal hernia. The reduction was not possible with laparoscopy

the thoracostomy tubes were used as required to maintain negative pressure in the pleural space.

One dog developed cardiac arrest after completion of the suturing of the esophageal hiatus and the esophagopexy. This dog did not develop a pneumothorax. An emergency conversion was elected to perform open cardiac massage. The dog recovered quickly, with stable hemodynamic parameters.

In three dogs, the laparoscopy was electively converted to a laparotomy. The visualization of the esophageal hiatus was difficult in one dog. The dog was in right lateral recumbency, and the left lateral and medial liver lobes were challenging to retract. In two dogs, a segment of the papillary process of the caudate liver lobe was wedged in the hernia (Figure 6). The reduction of the liver lobes was not possible because the liver parenchyma was tearing with traction. It was reduced with a laparotomy after an extension of the esophageal hiatus and dissection of adhesions.

The median surgical time for the four dogs that were not converted was 77.5 minutes (range, 60-120). The median time until discharge was 2 days (range, 1-4) after surgery for dogs that did not require conversion and 2 days (range, 2-3) after surgery for dogs that required a conversion. All dogs were discharged with ondansetron, cisapride or metoclopramide, and sucralfate for 10 days. According to the owners, all dogs had improved clinical signs at the median time of follow-up 16.5 days (range, 9-264) after surgery. An esophagram was repeated in one dog 2 weeks after surgery because the owner reported some nausea. The repair of the hiatal hernia was intact, but a megaesophagus was still present. After a modification of the diet, the nausea was not observed by the owner.

4 | DISCUSSION

Sliding hiatal hernias were treated in dogs with laparoscopy. A plication of the esophageal hiatus, an esophagopexy, and a left-sided assisted gastropexy were possible with laparoscopy and intracorporeal suturing. Half of the cases were converted to a laparotomy mostly because of anatomical difficulties that prevented the laparoscopic reduction of the hernia. When a segment of a liver lobe was wedged in the hernia, it was challenging to reduce the hernia content.

Most of our cases involved brachycephalic dogs, similarly to cases reported in previous studies.[1-6,11,19] Two large breed dogs were presented for chronic gastroesophageal refluxes that were not responding to medical treatment. Dogs in our study were 29 months of age, which is older than the age reported in most of the studies.[1-6,11,19] The two large breed dogs in our study were 151 and 125 months of age at the time of surgery, explaining the difference with our small sample. Correction of the upper airway was not always attempted first in the brachycephalic breeds, following Mayhew et al.[5]

Fifty percent of the cases were converted to an open laparotomy. In two cases, the elective conversion was performed without attempting to treat the hernia with laparoscopy because a liver lobe was entrapped in the hernia. In a study in 400 patients with gastroesophageal reflux treated with laparoscopy,[20] the conversion rate was between 2% and 14%, depending on the surgeon's level of experience. The most common reason for conversion was bleeding of the short gastric vessels that must be dissected for the Nissen fundoplication. A Nissen fundoplication is used in human patients to reinforce the lower esophageal sphincter, making it difficult to compare with the technique used in this study. In our study, three conversions were elective. Difficult visualization of the esophageal hiatus as a cause of elective conversion was eliminated by using the reverse Trendelenburg position. One conversion was emergent because of cardiac arrest after completion of the plication of the esophageal hiatus and esophagopexy. The cause of cardiac arrest was not identified.

Positioning in right lateral oblique recumbency allowed visualization of the esophageal hiatus. An elective conversion was required in the first dog most likely because it had not been placed in an oblique position, making it difficult to retract the left lateral liver lobe out of the surgical field. An additional cannula was not placed in this dog to help the retraction of the liver. The reverse Trendelenburg position further helped visualize the esophageal hiatus, mostly by moving the spleen out of the surgical field. A reverse Trendelenburg position is used in human surgery to help visualize the esophageal hiatus.[16] Deflation of the stomach with a large-bore orogastric tube was also helpful to visualize the lower esophageal hiatus, and it facilitates the esophagopexy. The insufflation pressure at 12 mm Hg allowed visualization of the indentation of the esophageal hiatus in the pleural space and made the edges of the hiatus easily identifiable. However, a pressure higher than 8 to 10 mm Hg might increase tension during the closure of the esophageal hiatus.[16] Therefore, a pressure of 12 mm Hg can be used at the beginning of the procedure to confirm the hiatal hernia and then reduced to 8 to 10 mm Hg to complete the plication of the hiatus.

A single-port approach was used for each case in this study. One or two additional cannulas were added to facilitate the procedure. A multiple-port approach could have been used to help reduce the herniation and perform the intracorporeal suturing. Because a left-sided gastropexy is recommended for the treatment of sliding hiatal hernias,[5,14] the approach for the single-port placement was used at the end of the surgery to complete a laparoscopy-assisted left-sided gastropexy. Placement of supplemental cannulas was required in four cases to facilitate the procedure, especially the intracorporeal suturing. The additional cannula was also required to apply traction on the fundus of the stomach during the plication of the hiatus and the esophagopexy. Placement of a large-bore orogastric tube facilitates retraction of the stomach by pushing the stomach in a distal direction. It may eliminate the requirement for a grasping forceps for traction on the fundus to reduce the hernia. A latex drain is placed around the lower esophageal sphincter in human patients to allow traction on the stomach.[16] This technique requires a complete dissection around the distal esophagus, which might increase the risk of iatrogenic trauma to the vagus nerve or short gastric vessels.

The hernia sac is dissected and excised in human surgery.[16] Dissection of the esophagophrenic ligament resulted in a tension pneumothorax that was controlled with a thoracostomy tube in one case. In human patients, the hernia sac and the pleura are not in close contact; therefore, the dissection of the hernia sac and esophagophrenic ligament does not seem to result in a pneumothorax.[16,21] If a pneumothorax develops, it is recommended to reduce the pressure of insufflation and place a thoracostomy tube during the rest of the procedure.[16,21] The hernia sac did not seem to interfere with the closure of the esophageal hiatus or the esophagopexy in our cases. Therefore, it is the authors' preference not to incise the esophagophrenic membrane.

The plication of the hiatus is challenging because of the ergonomics related to the orientation of the incision and the range of motion of the needle holder during laparoscopy. Because the diaphragm is underneath the last three or four ribs and is in a vertical position, suturing is performed at an unfavorable angle.[22] Each suture was placed full thickness in the diaphragm to prevent the tearing of the diaphragm. Therefore, the suture holes allowed the induction of an iatrogenic pneumothorax in two dogs. Use of an endoscopic suturing device should palliate this problem. Endoscopic suturing devices have been shown to facilitate suturing in challenging situations and allow a more precise suture placement.[22,23] Plication of the hiatus was performed with unidirectional barbed suture and needle holders. This suture material seems to facilitate the procedure because the barbs are getting anchored in the hiatus to maintain apposition during suturing. Therefore, maintaining constant tension during suturing is not required. The esophageal hiatus has been plicated with either simple continuous sutures or simple interrupted sutures with an open approach.[1,5,11,14] Simple interrupted sutures could be placed with laparoscopy but would probably increase the surgical time. Nonabsorbable sutures were used as commonly described for the plication of the esophageal hiatus.[1,5,11,14] In man, it has been recommended to reinforce the plication of the esophageal hiatus with mesh to prevent tearing of the crural closure.[16]

It is important not to induce an esophageal stricture during the plication of the esophageal hiatus. During open surgery, the diameter of the hiatus can be appreciated by palpation or by placing a large-bore orogastric tube.[1,5,11,14] During laparoscopy, we used a large-bore orogastric tube to help gauge the diameter of the closure of the hiatus without creating a stricture around the distal esophagus. None of the dogs developed any clinical signs of stricture. An esophagram was performed in one dog that had persistence of nausea after surgery but did not reveal any signs of compression of the lower esophagus. The rate of postoperative stricture requiring a balloon dilation varies between 0% and 18%, depending on the surgeon's experience level.[20] Stricture can develop in the immediate postoperative period or up to 10 months after surgery. The stricture can result from the Nissen fundoplication commonly used in man with hiatal hernia and gastroesophageal reflux, which was not used in this case.

The esophagopexy required a good exposure of the distal esophagus. It requires retraction of the stomach either with a grasping forceps or a large-bore orogastric tube. The esophagopexy was performed with unidirectional barbed suture and needle holders. The presence of the large-bore orogastric tube gave some support to the esophagus during suturing.

All dogs were discharged from the hospital with the same medical treatment that has been reported in the literature.[1,5] The goal of medical treatment after surgery is to treat the esophagitis commonly associated with hiatal hernia. Esophagram or endoscopy was not repeated in each dog after surgery to document anatomical resolution of the hiatal hernia. However, the owners reported a significant improvement in the clinical signs after surgery and discontinued medical treatment. Only one dog had an esophagram repeated 1 month after surgery because of the persistence of regurgitation. It revealed a megaesophagus, and the hiatal hernia was reduced. The dog was then placed on a different diet that helps to resolve the clinical signs.

This was a retrospective study and had some limitations. There was no control group treated with a laparotomy to compare complication rates, surgical time, and outcome. This report describes a laparoscopic technique and conversion rate. The learning curve could not be evaluated in this study because the technique has not yet been established. All dogs went home with a medical treatment targeting reflux esophagitis, vomiting, and gastritis. The improvement of the clinical signs could have been related to the medical treatment. However, most of those dogs were already receiving some medical treatment components before surgery and still had some clinical signs related to a sliding hiatal hernia. Some of our cases were treated for upper airway obstruction at the same time as the laparoscopic correction of the sliding hiatal hernia. Therefore, the improvement could also have been related to the correction of the upper airway. However, the trend seems to recommend surgical treatment of the sliding hiatal hernia before the upper airway obstruction is treated, even in brachycephalic dogs.[5]

Laparoscopy can be used to treat sliding hiatal hernia in dogs. Repair included a combination of esophageal plication, esophagopexy, and left sided gastropexy. Placing animals in reverse Trendelenburg position and orogastric tube placement facilitated the reduction of the hernia. The conversion rate was elevated. All dogs survived the procedure and were discharged a median of 48 hours after surgery. Improvements in clinical signs were noted in all dogs in this case series.

ACKNOWLEDGMENT

AUTHOR CONTRIBUTION

Monnet E, DVM, PhD, DACVS, DECVS: Collected and analyzed the data and wrote the manuscript.

CONFLICT OF INTEREST

The author declares no conflicts of interest related to this report.

ORCID

Eric Monnet https://orcid.org/0000-0002-0058-2210

REFERENCES

1. Lorinson D, Bright RM. Long-term outcome of medical and surgical treatment of hiatal hernias in dogs and cats: 27 cases (1978-1996). *J Am Vet Med Assoc.* 1998;213:381-384.
2. Sivacolundhu RK, Read RA, Marchevsky AM. Hiatal hernia controversies—a review of pathophysiology and treatment options. *Aust Vet J.* 2002;80:48-53.
3. Poncet CM, Dupre GP, Freiche VG, Estrada MM, Poubanne YA, Bouvey BM. Prevalence of gastrointestinal tract lesions in 73 brachycephalic dogs with upper respiratory syndrome. *J Small Anim Pract.* 2005;46:273-279.
4. Guiot LP, Lansdowne JL, Rouppert P, Stanley BJ. Hiatal hernia in the dog: a clinical report of four Chinese shar peis. *J Am Anim Hosp Assoc.* 2008;44:335-341.
5. Mayhew PD, Marks SL, Pollard R, Culp WTN, Kass PH. Prospective evaluation of surgical management of sliding hiatal hernia and gastroesophageal reflux in dogs. *Vet Surg.* 2017;46:1098-1109.
6. Phillips H, Corrie J, Engel DM, et al. Clinical findings, diagnostic test results, and treatment outcome in cats with hiatal hernia: 31 cases (1995-2018). *J Vet Intern Med.* 2019;33:1970-1976.
7. Callan MB, Washabau RJ, Saunders HM, Kerr L, Prymak C, Holt D. Congenital esophageal hiatal hernia in the Chinese shar-pei dog. *J Vet Intern Med.* 1993;7:210-215.
8. Keeley B, Puggioni A, Pratschke K. Congenital oesophageal hiatal hernia in a pug. *Ir Vet J.* 2008;61:389-393.
9. Broux O, Clercx C, Etienne AL, et al. Effects of manipulations to detect sliding hiatal hernia in dogs with brachycephalic airway obstructive syndrome. *Vet Surg.* 2018;47(2):243-251.

10. Reeve EJ, Sutton D, Friend EJ, Warren-Smith CMR. Documenting the prevalence of hiatal hernia and oesophageal abnormalities in brachycephalic dogs using fluoroscopy. *J Small Anim Pract.* 2017;58:703-708.
11. Ellison GW, Lewis DD, Phillips L, Tarvin GB. Esophageal hiatal-hernia in small animals—literature-review and a modified surgical technique. *J Am Anim Hosp Assoc.* 1987; 23:391-400.
12. Kirkby KA, Bright RM, Owen HD. Paraoesophageal hiatal hernia and megaoesophagus in a three-week-old Alaskan malamute. *J Small Anim Pract.* 2005;46:402-405.
13. Poncet CM, Dupre GP, Freiche VG, Bouvy BM. Long-term results of upper respiratory syndrome surgery and gastrointestinal tract medical treatment in 51 brachycephalic dogs. *J Small Anim Pract.* 2006;47:137-142.
14. Prymak C, Saunders HM, Washabau RJ. Hiatal hernia repair by restoration and stabilization of normal anatomy. An evaluation in four dogs and one cat. *Vet Surg.* 1989;18:386-391.
15. Lei X, Ren Q, Yang Y, Bai T. Outcome evaluation of laparoscopic and open Nissen fundoplication in children-a systematic review and meta-analysis. *Am Surg.* 2017;83:90-97.
16. Siegal SR, Dolan JP, Hunter JG. Modern diagnosis and treatment of hiatal hernias. *Langenbecks Arch Surg.* 2017;402:1145-1151.
17. Rawlings CA, Foutz TL, Mahaffey MB, Howerth EW, Bement S, Canalis C. A rapid and strong laparoscopic-assisted gastropexy in dogs. *Am J Vet Res.* 2001;62:871-875.
18. Runge JJ, Mayhew PD. Evaluation of single port access gastropexy and ovariectomy using articulating instruments and angled telescopes in dogs. *Vet Surg.* 2013;42:807-813.
19. Hardie EM, Ramirez O 3rd, Clary EM, et al. Abnormalities of the thoracic bellows: stress fractures of the ribs and hiatal hernia. *J Vet Intern Med.* 1998;12:279-287.
20. Gill J, Booth MI, Stratford J, Dehn TC. The extended learning curve for laparoscopic fundoplication: a cohort analysis of 400 consecutive cases. *J Gastrointest Surg.* 2007;11:487-492.
21. Ru W, Wu P, Feng S, Lai XH, Chen G. Laparoscopic versus open Nissen fundoplication in children: a systematic review and meta-analysis. *J Pediatr Surg.* 2016;51:1731-1736.
22. Hart S. The benefits of automated suturing devices in gynecologic endoscopic surgeries: the Endo stitch and SILS stitch. *Surg Technol Int.* 2012;22:159-164.
23. Hart S, Sobolewski CJ. The benefits of using barbed sutures with automated suturing devices in gynecologic endoscopic surgeries. *Surg Technol Int.* 2013;23:161-165.

How to cite this article: Monnet E. Laparoscopic correction of sliding hiatal hernia in eight dogs: Description of technique, complications, and short-term outcome. *Veterinary Surgery*. 2020;1–8. https://doi.org/10.1111/vsu.13541