Elective gastropexy with a reusable single-incision laparoscopic surgery port in dogs: 14 cases (2012–2013)

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OBJECTIVE
To describe the technique, clinical findings, and short-term outcome in dogs undergoing laparoscopic-assisted incisional gastropexy with a reusable single-incision surgery port.

DESIGN
Retrospective case series.

ANIMALS
14 client-owned dogs.

PROCEDURES
Medical records of dogs referred for elective laparoscopic gastropexy between June 2012 and August 2013 were reviewed. History, signalment, results of physical examination and preoperative laboratory testing, surgical procedure, duration of surgery, postoperative complications, duration of hospital stay, and short-term outcome were recorded. All patients underwent general anesthesia and were positioned in dorsal recumbency. After an initial limited laparoscopic exploration, single-incision laparoscopic-assisted gastropexy was performed extracorporeally in all dogs via a conical port placed in a right paramedian location. Concurrent procedures included laparoscopic ovariectomy (n = 4), gastric biopsy (2), and castration (7). Short-term outcome was evaluated.

RESULTS
Median duration of surgery was 76 minutes (range, 40 to 90 minutes). Intraoperative complications were minor and consisted of loss of pneumoperitoneum in 2 of 14 dogs. A postoperative surgical site infection occurred in 1 dog and resolved with standard treatment. Median duration of follow-up was 371 days (range, 2 weeks to 1.5 years). No dogs developed gastric dilation–volvulus during the follow-up period, and all owners were satisfied with the outcome.

CONCLUSIONS AND CLINICAL RELEVANCE
Results suggested that single-incision laparoscopic-assisted gastropexy with a reusable conical port was feasible and effective in appropriately selected cases. Investigation of the potential benefits of this reusable port versus single-use devices for elective gastropexy in dogs is warranted. (*J Am Vet Med Assoc* 2016;249:299–303)

Single-incision laparoscopic-assisted incisional gastropexy and ovariectomy have recently been reported in veterinary surgery.[1] Theoretical advantages of single-incision versus multi-incision laparoscopic procedures in human patients are more rapid recovery, decreased pain, and improved cosmesis.[2] However, many commercially available single-incision ports are single-use devices, such that high cost may preclude or limit their routine use in veterinary patients. Alternatively, comparable reusable devices exist that may be advantageous when used for performing single-incision laparoscopic surgery. Such reusable conical devices have been used in human patients for laparoscopic single-incision nephrectomy without reported complications.[3,4] The objective of the study reported here was to describe the operative technique, clinical findings, and short-term outcome in a series of dogs undergoing single-incision laparoscopic-assisted incisional gastropexy by means of a reusable conical port.

Materials and Methods

Case selection criteria

Medical records of all dogs that were examined at the University of Florida Small Animal Hospital and underwent elective single-incision laparoscopic gastropexy between June 2012 and August 2013 were retrospectively reviewed. Patients were included in the study if a complete medical record was

available including follow-up information (at least 2 weeks) that was collected during recheck examination or via telephone contact with the owner. Dogs were excluded if follow-up information obtained > 2 weeks after surgery was unavailable or if laparoscopic gastropexy was performed with a different port or technique. All owners were informed as to the possible need for additional port placement or the requirement to convert to an open laparotomy if the surgery proved difficult or intraoperative complications developed.

Medical records review

Preoperative data collected from the medical record included history (including any previous surgical procedures), signalment, body weight, duration of clinical signs, physical examination findings, and results of preoperative laboratory testing (PCV, total solids concentration, BUN concentration). Intraoperative data collected included duration of surgery (minutes), surgical complications (if applicable), duration of hospital stay (days), and short-term (≥ 2 weeks) outcome.

Surgical procedures

Anesthetic and analgesic protocols were established by the attending anesthesiologist for all patients. In general, an opioid was administered for premedication and anesthesia induced with an IV induction agent. After endotracheal intubation, anesthesia was typically maintained by means of administration of isoflurane in oxygen. Standard-of-care anesthetic monitoring, including electrocardiography and measurement of oxygen saturation (as determined by pulse oximetry), respiratory rate, blood pressure, and end-tidal partial pressure of CO_2, was performed during surgery.

Patients were positioned in dorsal recumbency, and the ventral aspect of the abdomen was prepared for surgery with standard aseptic technique. A 30-mm right paramedian incision was made extending cranially to the level of the 13th rib, located immediately lateral to the rectus abdominis muscle. The aponeurosis of the oblique abdominal muscles was identified and incised in a cranial-to-caudal direction. A 3.5-inch Gelpi retractor was placed to retract the oblique muscles, and the transversus abdominis muscle was isolated and incised in an oblique orientation. The primary surgeon (JBC) then placed an index finger in the abdomen via the incision to palpate the peritoneal surface and to ensure no adhesions of abdominal viscera were present prior to port insertion. The reusable conical port[a] was inserted in a manner similar to that previously described.[5] Briefly, after removal of the Gelpi retractor, the flange was placed deep to the transversus abdominis muscle and directed craniad toward the costal arch. The port was then rotated in clockwise fashion until the thread of the port became progressively engaged, at which point gentle ventral retraction was applied to the port during the remainder of the clockwise revolution. Stay sutures placed in each side of the incised transversus abdominis muscle provided countertraction for port insertion for the first 4 cases. However, subsequently these were found to be unnecessary when careful attention was paid to avoiding iatrogenic trauma to the underlying viscera. Port placement with the bulkhead detached allowed observation of the viscera during port insertion. Following port insertion, the bulkhead was positioned in the cone and snapped into place (**Figure 1; Supplemental Video S1**, available at http://avmajournals.avma.org/doi/suppl/10.2460/javma.249.3.299).

After port insertion, the peritoneal cavity was insufflated with CO_2 by means of a pressure-regulating mechanical insufflator[b] to a maximum intraabdominal pressure of 8 to 10 mm Hg. A 5-mm, 0°, 29-cm-long laparoscope[c] was inserted via one of the 5-mm valves in the port, and a limited abdominal exploration was performed in each patient. The abdomen was evaluated in clockwise manner commencing at the diaphragm and liver, then continuing to the left cranial abdominal quadrant, caudal abdominal quadrants, and right cranial abdominal quadrant.

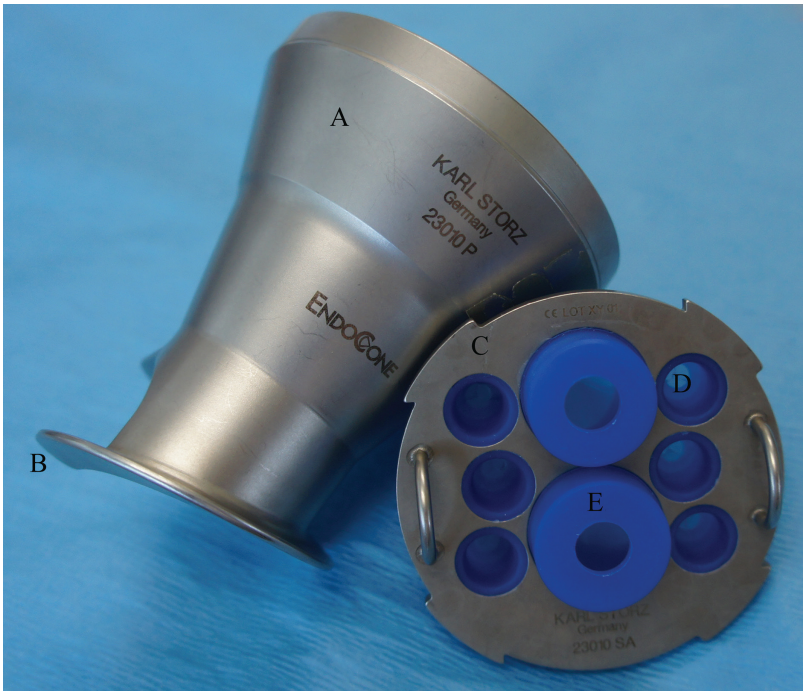

Figure 1—Photograph of a stainless steel reusable conical port[a] with a removable bulkhead and flanged leading edge that was used for elective single-incision laparoscopic-assisted incisional gastropexy in 14 dogs. A = Conical port. B = Flanged edge. C = Detachable bulkhead. D = 5-mm instrument valve. E = 15-mm instrument valve.

An avascular area on the parietal aspect of the pyloric antrum was grasped with 5-mm coaxial deviating laparoscopic Babcock forceps[d] or straight 10-mm laparoscopic Babcock forceps.[e] For the first 7 patients, the 5-mm Babcock forceps was used. For subsequent patients, the 10-mm laparoscopic Babcock forceps was used because the larger size allowed for a more secure grasp of the pyloric antrum. The pyloric antrum was retracted ventrally to a location at the base of the conical port. The valve on the port was used to desufflate the abdomen while visualization of the antrum was maintained with the laparoscope. The port bulkhead was then detached, and the laparoscope was removed. The port was unscrewed and withdrawn around the shaft of the Babcock forceps while minimally exteriorizing the antrum via the port incision (Supplemental Video S1; Figure 1). Two opposing stay sutures (2-0 polydioxanone) were placed in the seromuscular layer of the antrum, and the Babcock forceps and conical port were removed. A routine extracorporeal incisional gastropexy was then performed as described previously.[6]

Two of 14 patients also underwent gastric incisional biopsy at a separate site located more proximally. This was performed prior to gastropexy with separate instruments. Concurrent bilateral ovariectomy was performed in 4 of 14 patients prior to incisional gastropexy. These patients were repositioned to 45° lateral-oblique recumbency by means of a mechanical positioner[f] attached to the surgery table. With the patient repositioned, the proper ligament of the ovary was grasped and the ovarian pedicle elevated ventrally with a coaxial deviating laparoscopic Babcock forceps. A 10-mm vessel-sealing device[g] was used to ligate and divide the proximal uterine horn, ovarian pedicle, and suspensory ligament. The ovary was retracted into the base of the conical port by means of laparoscopic visualization and then removed after removal of the bulkhead from the port. The patient was then rotated into the opposite lateral-oblique recumbent position for contralateral ovariectomy. Both ovarian pedicles were examined for hemorrhage, and the dog was then repositioned in dorsal recumbency. The gastropexy procedure was performed as described. The abdomen was desufflated, the port was removed, and a standard 3-layer closure was performed. A standard prescrotal castration was performed in 7 of 14 patients following laparoscopic-assisted gastropexy. For all patients, duration of surgery was defined as time from the initial skin incision to completion of all surgical procedures and closure of all surgical wounds.

Results

Fourteen dogs met the study selection criteria. Four were sexually intact females, 8 were sexually intact males, and 2 were castrated males. Breeds included Great Dane (n = 5), English Mastiff (3), German Shepherd Dog (3), Weimaraner (1), Standard Poodle (1), and Greyhound (1). Median age was 3.1 years (range, 0.39 to 7.2 years), and median body weight was 43.9 kg (96.6 lb; range, 23.2 to 71.9 kg [51.1 to 158.1 lb]). None of the dogs had a history of previous surgery, and none had abnormalities on the preoperative physical examination or clinicopathologic testing.

Median duration of surgery was 76 minutes (range, 40 to 90 minutes). In 9 of the 14 patients, the gastropexy procedure time was recorded separately, with the gastropexy performed in a median of 40 minutes (range, 29 to 64 minutes). Intraoperative surgical complications included loss of pneumoperitoneum from leakage at the interface of the conical port and the abdominal incision in one patient and from the bulkhead valve in the port in another patient. No other intraoperative complications occurred. Two of 14 patients were discharged the day of surgery; the remaining 12 patients were discharged the day after surgery.

Patients received a single postoperative dose of methadone (0.1 mg/kg [0.045 mg/lb], IV) and carprofen (4 mg/kg [1.82 mg/lb], SC) at the completion of surgery unless a contraindication existed, which was the case for 2 patients. These 2 dogs received postoperative methadone (0.1 mg/kg, IV, q 6 h) only, overnight. Six hours after surgery a small amount of food and water was offered; tramadol (3 mg/kg [1.36 mg/lb], PO, q 8 h), and carprofen (2.2 mg/kg [1 mg/lb], PO, q 12 h) were administered to all patients for postoperative analgesia for a maximum of 4 days as needed.

Median follow-up time was 371 days (range, 2 weeks to 1.5 years). All owners were satisfied with the procedure on the basis of either interview at the time of recheck examination or telephone interview. Clinical signs of gastric dilatation were not reported in any dogs during the follow-up period. One patient developed a surgical site infection, which resolved after lavage with sterile saline (0.9% NaCl) solution and treatment with amoxicillin clavulanic acid (15 mg/kg [6.81 mg/lb], PO, q 12 h) for 14 days. No other postoperative complications were reported.

Discussion

Results of the present retrospective case series suggested that single-incision laparoscopic-assisted gastropexy with a reusable conical port may be performed effectively in dogs. Although intraoperative loss of pneumoperitoneum occurred in 2 of 14 patients described in the present report, surgery was completed without the need for conversion to conventional laparotomy. One dog developed a postoperative surgical site infection but recovered uneventfully following standard treatment (wound lavage and antimicrobial administration). None of the remaining patients developed complications, all had a good short-term outcome, and all owners were satisfied, suggesting that use of the conical port is a feasible choice for clinicians performing laparoscopic-assisted gastropexy in dogs.

The breeds represented in this study were similar to those described in previous studies of dogs reported to have an increased risk for the development of gastric dilatation-volvulus.[7–9] In the present study, 5 of 14 patients were Great Danes, which have been reported to have a 42.4% lifetime risk of developing gastric dilatation–volvulus.[9] Prophylactic gastropexy is often performed at the time of elective gonadectomy in this and similar breeds, as was the case for 4 dogs in the present study. Whereas concurrent gonadectomy and gastropexy have traditionally been performed via open laparotomy, laparoscopic techniques are becoming more common and may decrease postoperative pain.[10,11] In human patients, comparable procedures such as hysterectomy are commonly performed via single-port laparoscopic techniques.[12,13]

Previously reported techniques for laparoscopic gastropexy in dogs include intracorporeal sutured[11] and extracorporeal sutured multiport[6,14] or disposable single-port approaches.[1] Although single-incision laparoscopic-assisted gastropexy has been reported in dogs, we are unaware of prior reports describing the use of reusable, rigid ports for this procedure.

One benefit of the reusable conical port described in the present report was that it allowed for observation of the viscera as the port was inserted with the bulkhead removed. A recent report[1] describes the use of a disposable single-incision laparoscopic surgery port[h] for gastropexy and ovariectomy in dogs. In that report, inadvertent splenic laceration occurred in 1 patient, necessitating conversion to laparotomy to control the resultant hemorrhage. We suggest that the ability to directly observe the viscera during insertion of the conical port used in the present report likely reduced the risk of this type of iatrogenic visceral trauma. Another benefit of the conical port was the ability to retrieve specimens from the peritoneal cavity with the port remaining in place. The reusable conical port has an internal diameter of 34 mm, which allows for abdominal wall retraction and retrieval of tissue samples via the port once the bulkhead is removed.

Overall, we found the conical port easy to place and remove provided that the port incision was of sufficient length (30 mm). However, a technical complication encountered with its use was loss of pneumoperitoneum as a result of gas leakage at the interface of the port and the apices of the incision. The rigid, conical shape of the port when inserted into the linear abdominal incision can create small gaps between the body wall and port, which can leak if the incision length exceeds 30 mm, which was the case in 1 patient in this case series. This complication was successfully managed by the application of gentle counterpressure on the port by an assistant surgeon's hand for the remaining duration of surgery. Because the port is conical, counterpressure advanced the port deeper into the incision and resolved the gas leak. We recommend that accurate attention be paid to incision length if use of this port in dogs is being considered. Although not evaluated in this study, it is our clinical impression that this rigid port is more sensitive to minor variations in incision length, compared with a malleable single-use device such as a disposable single-incision laparoscopic surgery port.[h] When using the reusable conical port, a shorter incision may make port placement more difficult, whereas an excessively long incision (> 30 cm) may result in leakage of insufflation gas from the abdomen (ie, loss of pneumoperitoneum). In contrast, malleable single-use ports allow dynamic conformation to a more ovoid geometry once placed in the linear incision and thus may be more forgiving of small variations in the length of the port incision.

Leakage of insufflation gas also occurred via a damaged instrument valve in the bulkhead during surgery in 1 patient in this case series. This was the patient most recently treated (last patient included in the study), and leakage resulted from damage to the rubber component of the valve. Although the cause of damage to the valve is unknown, we suggest that repeated use and steam resterilization were likely contributing factors. It is also not known how many uses the port was subject to before this damage was evident, but we estimate 40 cases, as use was not limited to the cases described in the present report.[5] Finally, minor intermittent leaking of gas was observed during surgery when the 5-mm instruments were angled sharply through the valves of the bulkhead of the port; however, this minor leakage was easily corrected by reducing the excursion angle of the instruments through the valve.

The reusable conical port is manufactured from stainless steel and is 1 of few currently available approved laparoscopic surgery ports labeled as reusable and resterilizable. However, the valves of this port are composed of a malleable synthetic material, which may limit its reuse. In general, reusable ports are made of more robust materials than disposable parts and are therefore less subject to damage with repeated use.[15] This may potentially offer a considerable financial benefit, compared with use of disposable or single-use devices; however, this was not evaluated in the present study. Currently, disposable ports are often reused in veterinary patients, and it has been reported that ethylene oxide sterilization of certain single-use devices is effective at eliminating bacterial viability in vitro; this fact suggests that reuse of the port may be viable in veterinary patients.[15] In contrast, reuse of single-use devices in human patients is not recommended.[16,17] Currently, it is not known whether a financial or patient safety benefit exists for use of a reusable port such as the conical port used in the present study, compared with the use of single-use devices; future study is indicated to evaluate this.

Median duration of surgery for laparoscopic-assisted gastropexy and concurrent castration, laparoscopic ovariectomy, or gastric biopsy for the 14 dogs in the present study was 76 minutes (range, 40

to 90 minutes), which we suggest is clinically reasonable. This surgery time is similar to the median surgical time of 65 minutes (range, 50 to 225 minutes) recently reported[1] for laparoscopic ovariectomy and gastropexy performed via a malleable port in 18 dogs. Consequently, we suggest that from a technical standpoint, the reusable conical port is comparable to use of a single-use port and articulating instruments.[1] The reusable conical port was designed to alleviate the problem of instrument and hand interference, which is typical with use of straight instruments via a single-incision approach.[1,2,5,18] The curved instruments and expanding conical shape of the port increase the operating space between the surgeon's hands; this increased space in turn reduces interference, increases comfort, and facilitates triangulation.[3,4] Hand interference and instrument clashing were not documented in any of the cases described in the present report.

All 14 patients of the present report were discharged either the day of or 1 day after surgery, suggesting postoperative discomfort to be minimal, although this was not evaluated objectively in this study. In general, dogs were discharged once they were eating and drinking and appeared comfortable with oral analgesia only. In our hospital, we typically discharge patients undergoing laparoscopic procedures at the end of the day of surgery or the next morning according to the criteria described. Postoperative complications were limited to a surgical site infection in 1 dog that the owner noticed approximately 1 week after surgery. Resolution occurred after wound lavage and antimicrobial treatment for 14 days.

Footnotes

a. ENDOCONE, 34 mm, KARL STORZ Veterinary Endoscopy-America Inc, Goleta, Calif.
b. ENDOFLATOR, KARL STORZ Veterinary Endoscopy-America Inc, Goleta, Calif.
c. Hopkins II telescope, 5 mm, 0°, KARL STORZ Veterinary Endoscopy-America Inc, Goleta, Calif.
d. CLICKLINE CUSCHIERI Babcock grasping forceps, KARL STORZ Veterinary Endoscopy-America Inc, Goleta, Calif.
e. CLICKLINE straight Babcock grasping forceps, KARL STORZ Veterinary Endoscopy-America Inc, Goleta, Calif.
f. TT endoscopic positioner, Apexx Veterinary Equipment Inc, Englewood, Colo.
g. Ligasure, Valleylab/Tyco Healthcare, Boulder, Colo.
h. SILS Port, Covidien, Norwalk, Conn.

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