Laparoscopy for percutaneous tube cystostomy in dogs

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Objective—To describe a laparoscopic technique for percutaneous tube cystostomy in dogs.

Design—Prospective cohort study.

Animals—8 healthy mixed-breed dogs.

Procedures—A laparoscope portal and 2 instrumental portals were created in the abdomen. Intracorporeal suturing was performed to place 2 simple interrupted sutures between the ventral body wall and urinary bladder. A purse-string suture was placed in the urinary bladder wall approximately 1 cm cranial to the 2 simple interrupted sutures. A stab incision was made into the urinary bladder in the middle of the purse-string suture; an 8F Foley catheter was inserted through the stab incision and into the urinary bladder. Two other sutures were placed between the ventral body wall and bladder 1 cm cranial to the Foley catheter to create a cystopexy. The Foley catheter was secured to the skin with a finger-trap suture and was attached to a closed urine collection bag. All dogs underwent follow-up laparoscopy 1 month later.

Results—Median time for laparoscopic percutaneous tube cystostomy was 85 minutes (range, 72 to 103 minutes); there were no major intraoperative or postoperative complications. On follow-up laparoscopy, focal fibrous adhesions between the ventral body wall and bladder were observed in all dogs and omentum attached to the cystopexy site was observed in 2 dogs.

Conclusions and Clinical Relevance—In this study, a laparoscopic percutaneous tube cystostomy was accomplished in healthy dogs by use of a 3-portal technique and appeared to be an effective and safe procedure. (J Am Vet Med Assoc 2010;236:975–977)

Cystostomy, a common surgical procedure in veterinary practice, provides a method for temporary or permanent diversion of urine. Indications for cystostomy include management of urethral traumatic injuries, postoperative drainage after surgical repair of the urethra, palliative treatment for transitional cell carcinoma, and treatment of neurogenic bladder atony.1–9 In small animal practice, the described surgical approach for a cystostomy is via a celiotomy.1,10

The minimal invasiveness of the procedure, rapid patient recovery, and diagnostic accuracy make laparoscopy an ideal technique. Laparoscopy has not only developed into a diagnostic tool but, more recently, has also become a means for minimally invasive surgical procedures in small animals.11 Laparoscopic cryptorchidectomy,12 ovariolhysterectomy,13,14 gastropexy,15 removal of gastric foreign bodies,17 and cystotomy for urolith removal18 have been reported for dogs. The purpose of the study reported here was to describe a laparoscopic technique for percutaneous tube cystostomy in dogs.

Materials and Methods

Dogs—Eight healthy mixed-breed adult dogs weighing from 15 to 28 kg (33.0 to 61.6 lb) were used for this study. All animal procedures were approved by the Laboratory Animal Care and Use Committee of Heilongjiang Province. Dogs ranged in age from 0.8 to 4 years, and there were 3 sexually intact females and 5 sexually intact males. All dogs were determined to be healthy on the basis of results of physical examination and CBC. Food was withheld for 12 hours and water for 6 hours to decrease risk of damage to viscera during cannula placement.

Anesthetic protocol—Dogs were premedicated with atropine (0.04 mg/kg [0.018 mg/lb], SC) and, 15 minutes later, received xylazine (1.5 mg/kg [0.68 mg/lb], IM) and ketamine (20 mg/kg [9.1 mg/lb], IM). Saturation of oxygen, arterial blood pH, and rectal temperature were measured prior to the induction of anesthesia, 10 minutes after the creation of pneumoperitoneum, and then every 20 minutes until the procedure was finished. Arterial blood samples were obtained by puncturing the femoral arteries.

Surgical technique—Dogs were positioned in dorsal recumbency. The ventral portion of the abdomen (from the xiphoid to the pubis and to each inguinal fold) was shaved, aseptically prepared, and draped for laparoscopy. Three portal sites were used; portal 1 was used for placement of the laparoscope, and portals 2 and 3 were used for placement of laparoscopic surgical instruments. Portal 1 was located at the ventral midline at the midpoint between the xiphoid and umbilicus. Portal 2 was 8 to 10 cm caudal to portal 1 and 8 to 12 cm to the right of ventral midline. Portal 3 was located at the same level and manner as portal site 2 but on the left side of the abdomen. A 10- to 11-mm-diameter trocar-cannula unit

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was inserted through the abdominal wall at portals 1 and 2, and a 5- to 5.5-mm-diameter trocar-cannula unit was inserted at portal 3. A surgeon and 2 assistant surgeons were needed to complete the laparoscopic procedure.

A 10-mm-long skin incision was made at portal site 1, and a Veress needle was inserted perpendicular to the abdominal wall. A 5-mL syringe, containing 5 mL of sterile saline (0.9% NaCl) solution was attached to it. An aspiration and injection test was performed to verify the position of the needle within the abdominal cavity. An automatic high-flow insufflator was connected to the abdominal cavity to maintain an intra-abdominal pressure of 10 mm Hg with carbon dioxide. Once a pneumoperitoneum was created, a surgical table was tilted to an approximately 30° head-down position to facilitate cranial displacement of the visceral contents of the abdominal cavity. Insertion of the accessory trocar-cannula units at the 2 other portal sites was assisted by laparoscopic guidance to avoid visceral injury.

An 18-gauge spinal needle connected to a 60-mL syringe was inserted through the body wall midway between pubis and umbilicus and used to empty the urinary bladder, and the urinary bladder was then moderately distended with sterile saline solution. A three-eighths circle curved needle attached to a 30-cm piece of 2-0 polyglycolic acid suture material was inserted intra-abdominally with a laparoscopic needle holder through portal 2, and a laparoscopic left-curved preparation forceps was introduced at portal 3. The laparoscopic needle holder was used to grasp the needle and pass it through the rectus abdominis muscle in a dorsal to ventral direction, then back to the seromuscular layer of the ventral aspect of the apex of the urinary bladder below its entry site. Intra-abdominal pressure was decreased to 6 mm Hg to reduce tension between the ventral body wall and the urinary bladder. A simple interrupted suture was placed by use of an intracorporeal suturing technique; the first suture was in a transverse direction. The 2 simple interrupted sutures were used to attach the caudal aspect of the urinary bladder to the ventral body wall. A purse-string suture was placed in the ventral part of the urinary bladder wall approximately 1 cm cranial to the fixation point of the urinary bladder. A laparoscopic scalpel replaced the laparoscopic needle holder at portal 2 to make a stab incision in the middle of the purse-string suture into the urinary bladder lumen. A para-median stab incision was then made in the ventral body wall approximately 1 to 2 cm to the side of the ventral midline. An 8F Foley catheter was advanced through a stab incision in the abdominal wall. A laparoscopic left-curved preparation forceps was used to assist with insertion of the Foley catheter into the urinary bladder through the stab incision in the middle of the purse-string suture. The balloon of the Foley catheter was inflated with 3 mL of sterile saline solution to secure it within the urinary bladder, and the purse-string suture was tightened. The Foley catheter was pulled against the body wall, and 2 other sutures were placed between the urinary bladder and the ventral body wall 1 cm cranial to the Foley catheter to create a cystopexy. The urinary bladder was distended by injection of sterile saline solution to check for patency and leakage.

The Foley catheter was secured to the skin with a finger-trap suture and was attached to a closed urine collection bag that was emptied twice a day in a sterile manner. An Elizabethan collar was used to prevent the dog from removing the Foley catheter.

Both 10- to 11-mm-diameter portals were closed in 2 layers, and the 5- to 5.5-mm-diameter portal was closed in 1 layer. Surgery time and intraoperative and postoperative complications were recorded. Surgery time was defined as the time between the initial stab incision and closure of the last portal.

**Postoperative care**—Ampicillin (20 mg/kg, IM, q 8 h) was administered for 5 days after surgery. Postoperative monitoring consisted of subjective assessment of the dog’s attitude and appetite as well as objective measurements of rectal temperature (twice daily) and CBC (once daily). Foley catheters were removed from all dogs 10 days after surgery. Laparoscopic examination to reevaluate the entire abdominal cavity and associated viscera was performed at 1 month after surgery.

**Results**

In this study, the use of laparoscopy to perform a cystostomy was successful in 8 healthy dogs, without signs of major intraoperative and postoperative complications. Laparoscopic cystostomy in dogs resulted in only two 10-mm-diameter and one 5-mm-diameter incisions in the body wall. The median length of surgery was 85 minutes and ranged from 72 to 103 minutes (SD, 11.2 minutes). The intraoperative saturation of oxygen was always > 90% (median, 95.5%; SD, 1.5%; range, 92.5% to 97.3%). However, hypothermia (median rectal temperature, 37.6°C [99.7°F]; SD, 0.5°C [SD, 0.9°F]; range, 36.3° to 38.6°C [97.3° to 101.5°F]) and a decrease in arterial blood pH (median ± SD, 7.35 ± 0.06; range, 7.28 to 7.42) were found during laparoscopy. Rectal temperature returned to within reference range at 24 hours after surgery, and arterial blood pH returned to within reference range at the end of the operation. Sometimes, small amounts of hemorrhage were observed when the urinary bladder was penetrated with a laparoscopic scalpel, but intraoperative bleeding was negligible.

Foley catheters of all dogs were removed by deflation of the cuff at 10 days after surgery. Stomas leaked small amounts of urine after drain removal in 1 dog, but this problem resolved within 5 days after formation of healthy granulation tissue. Irritation at the stoma site and accidental Foley catheter dislodgment or damage did not occur, and there was no indication in any dogs of intraperitoneal urine leakage during Foley catheter placement. Urine samples were not submitted for bac-
terial culture; therefore, it is not known whether any dogs developed urinary tract infections postoperatively. However, all dogs had CBC results that were within reference range at 3 days postoperatively and all dogs had a full appetite at 24 hours postoperatively.

Follow-up laparoscopy was performed at 1 month after surgery in the same manner as the initial laparoscopy but without the inclusion of instrument portals. Except for focal fibrous adhesions between the urinary bladder and the ventral body wall in all dogs and omentum attached the cystocele site in 2 dogs, no other abdominal abnormalities were observed.

**Discussion**

Although percutaneous techniques for cystostomy tube placement have been described for humans, in dogs, the urinary bladder is harder to immobilize, making it difficult to accurately place a cystostomy tube percutaneously. In the present study, a laparoscopic technique for percutaneous tube cystostomy was performed in 8 healthy dogs without intraoperative or immediate postoperative complications. Compared with performing a celiotomy and cystotomy, laparoscopic cystostomy allowed for no exposure of the abdominal viscera to air, completion of all surgical procedures within the abdomen, observation of the urinary bladder in situ, and a less invasive procedure with less bleeding and a quicker recovery.

In the study reported here, a 3-portal technique was necessary to perform laparoscopic cystostomy. The laparoscope portal was located on the ventral midline at the midpoint between the xiphoid and umbilicus, which allowed for an excellent view of the urinary bladder and associated structures. The 2 instrument portals were located (8 to 10 cm) caudal to the laparoscope portal, one each to the right and left of the midline (by 8 to 12 cm). The use of 3 portals resulted in a triangular disposition that facilitated manipulation of the urinary bladder. For the first dog in this study, the laparoscopic portal was placed in the ventral midline 2 cm caudal to the umbilicus (instead of midway between the xiphoid and umbilicus); this resulted in placement of the 2 instrumental portals too close to the urinary bladder, which interfered with the surgical procedure and resulted in a surgical time that was longer than for the other dogs. In performing laparoscopic cystostomy, it is therefore suggested that the laparoscope portal be located at the ventral midline cranial to the umbilicus. An 18-gauge spinal needle connected to a 60-mL syringe was used to empty the urinary bladder, which was then partially refilled with sterile saline solution to aid in manipulation, suture placement, and prevention of intraperitoneal urine contamination when the cystostomy tube was placed.

To successfully perform a laparoscopic cystostomy, accomplished laparoscopic intracorporeal suturing skills are required. In the study reported here, a purse-string suture and 4 simple interrupted sutures were placed within the body cavity during laparoscopic cystostomy. The 4 simple interrupted sutures were used to create a secure fixation between the urinary bladder and the ventral body wall to help reduce the risk of urine leakage into the abdomen. Intra-abdominal pressure of 10 mm Hg satisfactorily separated the abdominal wall from visceral structures and provided enough space to perform surgery. A laparoscopic scalpel with a No. 15 surgical blade was used to penetrate urinary bladder. The use of a No. 15 surgical blade permitted insertion of the Foley catheter into the urinary bladder while minimizing damage to the urinary bladder. This procedure was performed by the same surgeon for each dog, and the median surgery time was 85 minutes. With experience, the surgical time required to complete the laparoscopic procedure decreased by approximately 30 minutes and may have decreased further with additional experience.

In the study reported here, Foley catheters were removed from healthy dogs at 10 days after surgery, which provided only short-term diversion of urine. Further evaluation in clinically affected dogs as well as on long-term placement of a cystostomy tube in dogs by use of the laparoscopic cystostomy technique described here is warranted.

**References**