Clinical use of low-profile cystostomy tubes in four dogs and a cat

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Diversion of urine via a cystostomy tube is occasionally performed in small animals, but reports of its clinical use are limited in the dog and cat.[1-6] Indications for diversion of urine via temporary cystostomy prior to initiation of definitive treatments include damage to the urethra after trauma or surgery,[3,7] obstruction of the urethra by calculi, and urethral inflammation or strictures. Indications for permanent cystostomy include intraluminal obstruction of some portion of the lower urinary tract (such as that caused by neoplasia of the urethra or bladder[6,8-10]) or extraluminal obstruction (such as that caused by neoplasia, trauma, or accumulation of restrictive scar tissue). Dogs or cats with neurogenic bladder dysfunction, in which the bladder is difficult to manually express, may also be candidates for diversion of urine via a cystostomy tube.[5] Suprapubic cystostomy tubes are commonly used in humans after surgery or trauma of the lower urinary tract; compared with transurethral catheters, the use of suprapubic cystostomy tubes in humans is associated with an absence of iatrogenic urethral trauma, reduced patient discomfort, and lower incidence of urinary tract infection.[11,12]

Urinary catheters that have been used routinely for cystostomy at the University of Georgia Veterinary Teaching Hospital were latex mushroom-tipped catheters[a] or Foley catheters.[b] The shortest mushroom-tipped catheters were 35.2 cm (16 in) long, whereas the Foley catheters were available in 22-cm (10-in) or 55-cm (25-in) lengths. At these lengths, the catheters were cumbersome to stabilize to the caudolateral abdominal wall without sutures or bandaging. In our experience, the inability to adequately protect long cystostomy tubes predisposed them to accidental dislodgement by the animals via biting, scratching, or stepping on the tube and also prevented optimal aseptic care of the distal end of the cystostomy tube. It was theorized that a silicone low-profile system like that used in a study[13] of **low-profile gastrostomy ports** (**LPGPs**) in cats might be adapted for use in cystostomies in both dogs and cats. In this report, the term low-profile refers to a tube that is ≤ 4 cm long and capped with an indwelling antireflux valve. It was proposed that the use of a low-profile system in cystostomies would eliminate the need for bandages, reduce the likelihood of accidental dislodgment of the tube via scratching with the hind paws, and help maintain optimal cleanliness of the distal end of the tube. Furthermore, such a system would be easy to use and durable enough for long-term placement. The objective was to develop a technique for the placement and clinical management of an LPGP system[c] for use as a **low-profile cystostomy tube** (**LPCT**) and to assess owner satisfaction with the LPCT in cats and dogs.

Procedure

The LPGP used here as an LPCT is available as a low-profile conversion kit with a gastrostomy tube[c] (**Fig 1**) or as a low-profile conversion kit alone.[d] In the combination kit, there is one 30-cm (13.6-in) 20-F silicone gastrostomy tube and a rigid obturator for placement. Each kit contains a low-profile conversion component set with a plastic atraumatic tube clamp, scissors to shorten the tube, a tapered antireflux valve, a hinged clip for valve attachment to the tube, a silicone valve cover, and two 79-cm (36-in) extension tubes. The end of the extension tube has a plastic cap that snaps onto the hinged clip with a centered cylindrical metal adaptor that slips between the leaves of the antireflux valve to allow for evacuation. Replacement extension tubes are available in groups of 12.[e]

Low-profile cystostomy tubes were placed in 4

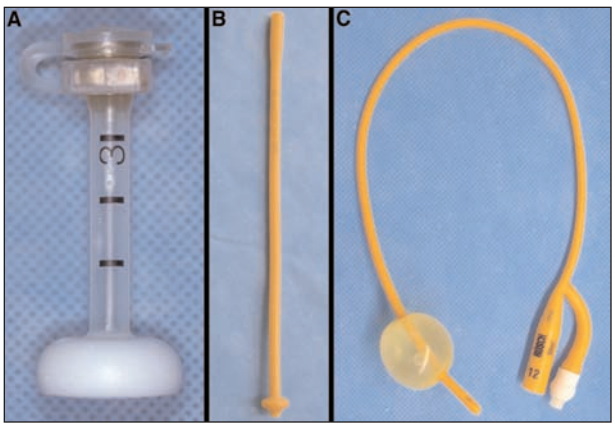

Figure 1—Photographs of a low-profile silicon tube (A), a mushroom-tipped catheter (B), and a Foley catheter (C). The low-profile silicon tube is notably shorter than either of the 2 catheters.

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dogs and 1 cat (all client-owned) during exploratory celiotomy or via a caudal abdominal ventral midline incision; LPCTs were also used to replace traditional cystostomy tubes via mature fistulas that extended from the bladder to the body wall (cystocutaneous) without need for an additional cystotomy. Long silicone cystostomy tubes were converted to LPCTs either during placement or several weeks later. All cystostomy tubes were placed to exit through the right or left caudoventral or caudolateral abdominal wall, depending on the surgeon's preference. Purse-string sutures (3-0 and 4-0 polydioxanone suture in dogs and cat, respectively) were placed in the bladder wall at the exit site of the cystostomy tube. Temporary cystopexy to the ventrolateral peritoneum was performed with either 4 interrupted sutures placed equidistant around the circumference of the tube or a continuous suture pattern (3-0 and 4-0 polydioxanone suture in dogs and cat, respectively). Conversion of the long tube from an original length of 26.4 cm (12 in) to an LPCT that was 1 to 4 cm (0.4 to 1.6 in) from the skin in length was performed by placing the plastic atraumatic tube clamp approximately 1 cm proximal to the desired tube length, cutting the tube to that desired length, inserting the tapered antireflux valve, and securing it in place with the hinged clip (**Fig 2**). The silicone cover was placed over the hinged clip and its cap closed over the valve for protection. A nylon purse-string suture was placed in the skin around all cystostomy tubes. For long tube conversions to the low-profile form that were delayed for 2 to 3 weeks, the antireflux valve, hinged clip, and silicone cap were attached to the distal end of the long tube. Interrupted nylon sutures were placed through the skin on the ventrolateral abdominal wall and secured around the distal cystostomy tube; the tube was bandaged to hold it against the body prior to low-profile conversion. The bladder was emptied via the cystostomy tube every 4 to 6 hours during a period of 24 to 48 hours after surgery.

To evacuate urine, the protective silicone cap was opened, and an extension tube provided with the tube kit was attached to the antireflux valve (**Fig 3**). A 60-mL catheter-tip syringe was aseptically attached to the end of the extension tube for aspiration. At discharge, owners were instructed to clean the antireflux valve and the metal adapter of the extension tube with alcohol before connecting them for urine collection every 6 to 8 hours. They were also advised to lavage or soak the extension tube and syringes in dilute chlorhexidine or tris-EDTA solution between uses. The peristomal skin was cleaned, as needed, with a moistened gauze or towel. Urine volumes were measured and recorded as often as possible.

During the period in which the tubes were in place and up to 1 year after their pet's death or LPCT removal, all owners were contacted (in person or by telephone) and questioned about their experiences with the LPCT. They were asked if the tube was easy or difficult to use, if there was leakage of urine during use, if the tube required bandaging, and if the process of aspiration of urine from the bladder elicited signs of pain in the pet. In addition, they were asked whether positioning the tube flush with the body wall would affect its ease of use and whether their recent experiences would affect their decision to have an LPCT placed in a pet again if the need arose.

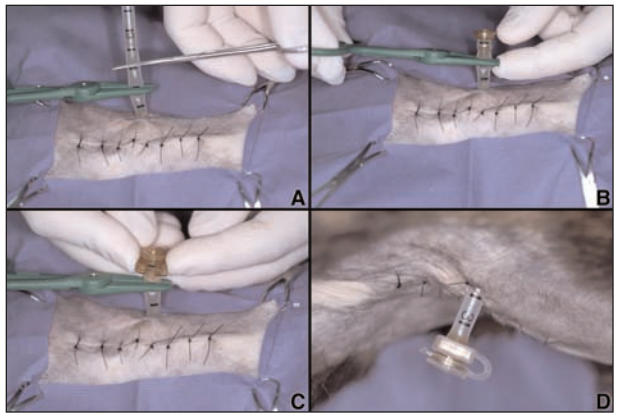

Figure 2—Photographs of a cat (obtained during surgery) illustrating the conversion of a 26.4-cm gastrostomy tube from a low-profile gastrostomy port (LPGP) kit to a low-profile cystostomy tube (LPCT) that is < 4 cm in length. A—The tube that will remain external to the body wall is cut to the desired length. B—The tapered antireflux valve is inserted into the distal end of the tube. C—The antireflux valve is secured in position with the hinged clip. D—A silicone cover is placed over the hinged clip and valve for protection.

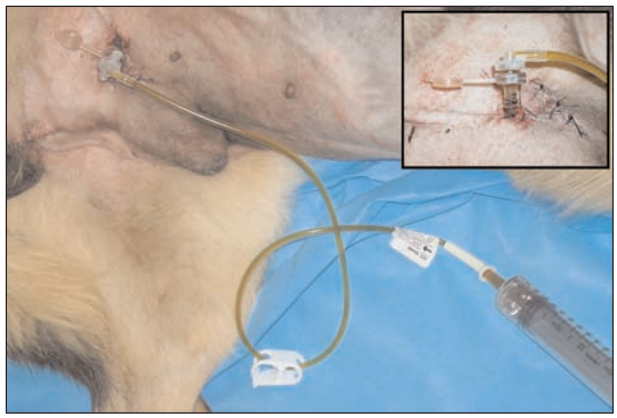

Figure 3—Photographs of a dog with an LPCT in the right caudoventral abdominal wall. Notice the extension tube (provided in the kit) that is attached to the antireflux valve of the LPCT for evacuation of urine from the bladder via syringe. Inset—To connect the extension tube to the LPCT, the silicone cap is opened, and the extension tube is snapped into the antireflux valve.

Results

Four dogs (Border Collie, Labrador Retriever, Miniature Dachshund, and German Shepherd Dog) and a domestic shorthair cat were recipients of LPCTs. Among the dogs, there were 2 spayed females, 1 sexually intact female, and 1 neutered male dog; the cat was a neutered male. The age of these animals ranged from 7 to 15 years (mean ± SD, 11.2 ± 3.13 y) and weights ranged from 5.8 to 32.7 kg (12.7 to 72.0 lb; mean, 17.5 ± 10.86 kg [38.5 ± 23.89 lb]). Reasons for evaluation of these pets at the University of Georgia Veterinary Teaching Hospital included dysuria (1 dog and the cat), dysuria and hematuria (1 dog), and hemorrhagic urethral discharge (1 dog); 1 dog was evaluated at the Veterinary Surgical Associates because of hemorrhagic vaginal discharge. Urethral **transitional cell carcinoma** (**TCC**) was diagnosed in 3 dogs. Carcinoma of the uterus with invasion of the urethra was diagnosed in 1

dog. In the cat, detrusor muscle atony was diagnosed by means of cystometrography; toxoplasmosis was suspected as the cause of this condition on the basis of serum titers for *Toxoplasma gondii* of 256 (IgM) and 1,024 (IgG).[14]

An exploratory celiotomy and cystotomy were performed for lesion evaluation, collection of biopsy specimens, and initial tube placement in all 4 dogs. In the cat, only a small ventral midline incision was required to gain access to the bladder for tube placement. Bilateral ureteroneocystostomies were performed in 2 dogs (dogs 2 and 4) with TCC; transplantation of the ureters cranially in the bladder was an attempt to delay ureteral obstruction by the neoplasm. A partial urethrectomy was performed in the dog (dog 3) with uterine carcinoma.

Silicone cystostomy tubes were the first tubes placed in 2 dogs and the cat. Low-profile conversion was immediate in dog 4 and the cat but delayed for 2 weeks in dog 2. Lengths of LPCTs (external to the body wall) ranged from 1 to 4 cm (mean ± SD, 2.3 ± 1.25 cm [1.0 ± 0.57 in]). If conversion of the tube was to be delayed, the distal tube was secured as previously described. Mushroom-tipped cystostomy tubes were placed initially in 2 dogs (dogs 1 and 3). One of these was converted to an LPCT 3 weeks after surgery by attachment of the valve portion of the low-profile port system to the shortened mushroom-tipped cystostomy tube (dog 1). The wall of this cystostomy tube was slightly thicker than that of the silicone tube; this created a stress point at the hinges of the clip, but the valve functioned without leakage. Six weeks later, the dog stepped on the extension tube while it was attached to the cystostomy tube and externally dislodged the cystostomy tube. A mature cystocutaneous fistula remained through which a silicone LPCT was placed; a caudal ventral midline incision was made to manipulate the bladder and enable tube placement. In the other dog, the mushroom-tipped catheter was removed because of development of a peristomal abscess 3 weeks after placement; a second mushroom-tipped catheter was placed through a new cystostomy site. That tube was removed after 4 months, and a Foley catheter was placed through the mature cystocutaneous fistula. After 4 weeks, the Foley catheter was removed, and a silicone LPCT was placed through the mature fistula as described.

In 3 dogs with TCC, the LPCTs were used until the dog died or was euthanized because of progression of the primary disease; the LPCT was used for 3, 13, and 30 weeks in dogs 2, 1, and 4, respectively. In the dog with uterine carcinoma, the LPCT was used for 4 weeks before the dog was euthanized because of a resistant subcutaneous bacterial infection associated with the initial stoma site. In the cat with detrusor atony, the LPCT was used for 8 weeks until the primary disease improved; the tube was removed with external traction as digital pressure was applied around the stoma.

Complications associated with use and management of LPCTs included **lower urinary tract infection** (**LUTI**; 3 dogs and the cat), leakage of urine from the antireflux valve (3 dogs and the cat), mild peristomal leakage of urine (2 dogs), extension tube leakage (1 dog), and subcutaneous infection at the site of the cystostomy tube (1 dog). Bacteriologic culture of urine from 2 dogs yielded *Pseudomonas aeruginosa*; in these dogs, *Staphylococcus aureus* (dog 1) and enterococci (dog 3) were also identified. In the cat, bacteriologic culture of urine yielded *S intermedius* and *Enterococcus faecalis*. Prior to initial placement of the silicone tube in dog 4, *Escherichia coli* and streptococci were cultured from urine. Temporary resolution of LUTI occurred only in dog 4 after administration of amoxicillin trihydrate-clavulanate potassium[f] (20 mg/kg [9.1 mg/lb], PO, q 8 h) for 3 weeks; in the other 3 animals, LUTI persisted as long as the LPCT was in place. In the dog in which the LUTI temporarily resolved, bacteriologic culture of urine yielded no growth 10 weeks after tube placement; however, *E coli* was again detected in the urine at 19 weeks, and antimicrobial treatment was restarted. All of the animals with LUTI had > 1 organism detected via bacteriologic culture of the urine and were treated long-term with antimicrobials. Two of the 3 dogs with TCC were given piroxicam[g] (0.3 mg/kg [0.14 mg/lb], PO, q 24 h), which is an anti-inflammatory and antineoplastic agent, to improve their quality of life.[15]

Leakage of urine from the antireflux valve was noted in 3 dogs and the cat, which necessitated valve replacement after 6 and 28 weeks of use in dogs 1 and 4, respectively, and after 1 week in the cat. Valve leakage occurred in the third dog (dog 3) after the owner initiated use of a disposable sterile catheter tip[h] that was not designed for use with the valve. Mild leakage persisted, but the valve was not replaced. Leakage of urine in association with the extension tube occurred in dog 4 with each of the 2 tubes provided in the original kit. Investigation of the problem revealed that the metal adapter was not secured within the plastic end of the extension set, resulting in urine leakage during evacuation. After replacement with a new extension tube, no leakage was noted. Peristomal leakage of urine developed in dog 2 immediately after surgery but resolved within 24 hours and was transient in dog 3. In the latter dog, which also had subcutaneous infection at the cystostomy tube site, each of the 3 tube types (mushroom-tipped, Foley, and silicone LPCT) was placed through the same cystocutaneous fistula. The traditional tubes were used for 5 months prior to placement of the LPCT, and intermittent peristomal leakage had been evident since 3 weeks after the first surgery.

All 5 owners were pleased with the cosmetic appearance of the tubes, and 4 of them described it as easy to use. Each owner described attachment of the extension set to the LPCT as awkward at first but increasingly easy with experience. No bandaging was required after conversion of a cystostomy tube to an LPCT, and all owners said that no signs of pain were elicited in their pets during manipulation or evacuation of the device. Mobility of the dogs and cat was excellent. All owners said they would repeat their decision to have the LPCT placed in their pet. Two of 3 owners who had experience with both a long cystostomy tube and the LPCT preferred the LPCT for ease of use and perceived animal comfort; all 3 of these own-

ers preferred the appearance of the LPCT and the extent of their pet's mobility with that device. One dog owner expressed concern about the shortness of the tube, which was protruding 1.0 cm from the skin, because it was difficult to hold the valve to manipulate attachment of the extension tubing. Consequently, that owner required the assistance of another person to restrain the dog during initial attachment. The LPCT in the cat was 3.5 cm in length, and the owner reported that the tube had become kinked when lain upon by the pet; in that instance, the recommendation was to use a shorter tube length.

Discussion

As an alternative to the placement of traditional cystostomy tubes, an LPGP system may be used in a novel application as an LPCT in dogs and cats. In the authors' experience with 4 dogs with neoplasia involving the genitourinary tract and a cat with bladder dysfunction, the technical difficulty of LPCT placement and management was similar to that of traditional cystostomy tubes. Four of 5 owners found the LPCT easy to use, and all owners said they would be comfortable repeating their decision to use the LPCT in their pet. In addition, 3 owners whose pets had both a traditional long cystostomy tube and the short LPCT during the course of their treatment preferred the LPCT for its cosmetic appearance and minimal interference with mobility of their pets.

Pet owners perceived that the lack of bandaging, unhindered mobility, and lack of signs of discomfort associated with the LPCT improved the quality of life of their pets. Quality of life was an important objective for owners of animals in this report, particularly because all 4 dogs had incurable neoplasia. Owners of these dogs wanted their pets to be able to participate in as many of their normal activities as possible during the final few weeks or months of their lives. Owners of the dogs began their grieving process during the period of cystostomy tube placement, and their confidence in the quality of life provided by the LPCT was key to their emotional comfort with their treatment decision.

Initial surgical placement of the cystostomy tube portion of an LPCT is similar to that previously reported for a standard cystostomy tube.[4,16,17] An LPCT can also be positioned through a mature cystocutaneous fistula. If the fistula is too narrow for gentle retrograde tube insertion, a caudal abdominal approach to the bladder is necessary to grasp the bladder as the stretched and lubricated tube is inserted retrograde from the cutaneous surface of the fistula into the bladder. Alternatively, a cystotomy may be used to permit normograde placement of the distal end of the cystostomy tube through the fistula from the bladder to the skin. Conversion of the cystostomy tube to a low-profile form, in a manner similar to that described for LPGPs,[13] can be immediate or delayed. In our study, conversion to low-profile form was immediate in 3 animals and delayed in 2 animals. The delayed LPCT conversions for 2 dogs were our earliest attempts with the technique; conversions were delayed to allow a minimum of 2 weeks of healing of the cystocutaneous fistulas. This decision was made on the basis of experimental data regarding the delayed acquisition of gastrocutaneous fistula strength when percutaneous gastrostomies were not anchored to the skin in dogs.[18] Although surgical cystopexies had been performed in the animals of this report, we were concerned about the rapidity and adequacy of healing, because all the dogs had chronic progressive neoplastic disease. After the successful outcome of the 2 delayed conversions, immediate LPCT conversion was implemented in animals treated subsequently. No differences regarding development of complications, management, or ease of use were detected between delayed and immediate conversion to an LPCT.

Urinary catheters recommended for cystostomy in veterinary medicine have included either latex mushroom-tipped urologic catheters or Foley catheters with a balloon tip.[6,19] The shortest available length for these catheters is 35 cm (mushroom tipped) and 22 cm (Foley), so it is necessary to stabilize them to the caudolateral body wall with sutures or bandaging. Long-term use of Foley catheters is not recommended, because the balloon can deflate or disintegrate with time.[6] Prior to conversion to the low-profile form, the length of a silicone LPCT is similar to that of a latex catheter; both require bandaging and rigorous cleaning. Although the possible advantages of early LPCT conversion have not been completely elucidated, the authors of this report recommend low-profile conversion at the time of placement to minimize the requirement for bandaging and eliminate the need for a recheck evaluation for subsequent conversion to a low-profile form. We also recommend that the length of tube from the skin to the valve is 1 to 3 cm (0.45 to 1.40 in) to maximize the ease of grasping the valve without compromising the low-profile feature of the system. The antireflux valve is designed for attachment to the extension tube, which has a small metal adapter in its end that atraumatically parts the leaves of the antireflux valve. During initial use, snapping the extension tube onto the antireflux valve may be technically demanding for some individuals. Therefore, the owner's ability to manage the system should be considered prior to tube placement in a client-owned dog or cat.

Bandages are frequently applied for animals with standard cystostomy and gastrostomy tubes. Such bandages are necessary to secure the tube during normal activity, prevent damage of the tube, and protect the outer tip of the tube. Bandages that do not remain in position and require repeated replacement have been a common problem for pet owners who are managing gastrostomy tubes.[20] The shortened tube of an LPCT eliminates the need for a bandage and the concern that the tube may be stepped on or dragged on the ground. Although none of the animals in our study attempted to mutilate the tube orally, an Elizabethan collar or side brace should be used for those animals that do.[6]

Cystostomy tubes predispose animals to LUTI,[6,21] but prophylactic administration of antimicrobials is not recommended because of the potential for increased resistance to those agents.[22] Until the incidence and clinical significance of LUTI in dogs and cats with cystostomy tubes are known and the proper management techniques to minimize infection are defined, it may be advisable at least to clean the distal tip of the cystostomy tube with a bactericidal agent. In

humans, urinary tract infections are twice as likely to develop with an indwelling transurethral catheter than with a cystostomy tube.[11,12]

The cause of antireflux valve leakage may have resulted from mechanical failure of the valve leaflets, improper attachment of the extension tubing, poor tube maintenance, trauma, or faulty equipment. Leakage of urine through or around the tube might further predispose the animal to LUTI. In our study, we were unable to determine the clinical significance of this, because LUTI was diagnosed in each animal prior to leakage of urine from the valve. Peristomal leakage of urine has been reported as a complication of cystostomy tube placement but usually ceases within 24 hours. Although the cause is unknown, it may be the result of the presence of a loose purse-string suture in the bladder, failure to keep the bladder adequately decompressed, or placement of a small cystostomy tube through a comparatively large mature cystocutaneous fistula. In the animals of this report, 20-F silicone tubes that were placed through mature cystocutaneous fistulas replaced smaller (12 and 18 F) mushroom-tipped cystostomy tubes.

Our experience with the LPGP used as an LPCT has been encouraging; the LPCTs were associated with minimal complications, required no bandaging, were easy to use, and did not inhibit patient mobility. The complications that developed were consistent with those reported for tube cystostomies. The LPCT appears to offer a simple, well-tolerated option for long-term bladder evacuation in dogs and cats.

[a]de Pezzar urologic catheter, C R Bard Inc, Billerica, Mass.
[b]Bard urologic catheter, C R Bard Inc, Covington, Ga.
[c]Gauderer Genie PEG system with Ponsky non-balloon replacement gastrostomy tube kit (order No. 000394), C. R. Bard Inc, Billerica, Mass.
[d]Gauderer Genie PEG system low profile conversion kit (order No. 000725), C R Bard Inc, Billerica, Mass.
[e]Gauderer Genie PEG system feeding/decompression tube (order No. 000395), C R Bard Inc, Billerica, Mass.
[f]Clavamox, Smith Kline Beecham Pharmaceuticals, Philadelphia, Pa.
[g]Piroxicam, Watson Laboratories, Corona, Calif.
[h]Posi-Grip blunt needle 11 ga × 1, Access Technologies, Skokie, Ill.

References

1. Aultman SH, Betts CW. An unusual case of a prostatic cyst: utilization of a suprapubic catheter. *J Am Anim Hosp Assoc* 1978;14:638–644.

2. Botte RJ. Percutaneous prepubic urinary drainage in normal cats. *Vet Surg* 1983;12:202–205.

3. Cooley AJ, Waldron DR, Smith MM, et al. The effects of indwelling transurethral catheterization and tube cystostomy on urethral anastomoses in dogs. *J Am Anim Hosp Assoc* 1999;35:341–347.

4. Dhein CR, Person MW, Leathers CW, et al. Prepubic (Suprapubic) catheterization of the dog. *J Am Anim Hosp Assoc* 1989;25:261–271.

5. Dhein CR, Person MW. Prepubic (Suprapubic) catheterization of eight dogs with lower urinary tract disorders. *J Am Anim Hosp Assoc* 1989;25:272–276.

6. Smith JD, Stone EA, Gilson SD. Placement of a permanent cystostomy catheter to relieve urine outflow obstruction in dogs with transitional cell carcinoma. *J Am Vet Med Assoc* 1995;206:496–499.

7. Bjorling DE. Traumatic injuries of the urogenital system. *Vet Clin North Am Small Anim Pract* 1984;14:61–76.

8. Krawiec DR. Canine bladder tumors: the incidence diagnosis, therapy and prognosis. *Vet Med* 1991;86:47–54.

9. Norris AM, Laing EJ, Valli VE, et al. Canine bladder and urethral tumors: a retrospective study of 115 cases (1980–1985). *J Vet Intern Med* 1992;6:145–153.

10. Osborne CA, Low DG, Perman V, et al. Neoplasms of the canine and feline urinary bladder: incidence, etiologic factors, occurrence and pathologic features. *Am J Vet Res* 1968;29:2041–2055.

11. Hilton P, Stanton SL. Suprapubic catheterization. *Br Med J* 1980;281:1261–1263.

12. Ingram JM. Further experience with suprapubic drainage by trocar catheter. *Am J Obstet Gynecol* 1975;121:885–891.

13. McCrackin Stevenson MA, Stiffler KS, Schmeidt CW. One-step placement of a percutaneous nonendoscopic low-profile gastrostomy port in cats. *J Am Vet Med Assoc* 2000;217:1636–1641.

14. Lappin M. Feline toxoplasmosis: interpretation of diagnostic test results. *Sem Vet Med Surg (Small Anim)* 1996:11:154–160.

15. Knapp DW, Richardson RC, Chan TC, et al. Piroxicam therapy in 34 dogs with transitional cell carcinoma of the urinary bladder. *J Vet Intern Med* 1994;8:273–278.

16. Cornell KK. Cystotomy, partial cystectomy, and tube cystostomy. *Clin Tech Small Anim Pract* 2000;15:11–16.

17. Mulcahy JJ, Baehler RW, Malvin RL. A cystostomy cannula for dogs. *Invest Urol* 1978;16:33–34.

18. Mellinger JD, Simon IB, Schlechter B, et al. Tract formation following percutaneous endoscopic gastrostomy in an animal model. *Surg Endosc* 1991;5:189–191.

19. Boothe HW. Managing traumatic urethral injuries. *Clin Tech Small Anim Pract* 2000;15:35–39.

20. Seaman R, Legendre AM. Owner experiences with home use of a gastrostomy tube in their dog or cat. *J Am Vet Med Assoc* 1998;212:1576–1578.

21. Barsanti JA, Blue J, Edmunds J. Urinary tract infection due to indwelling bladder catheters in dogs and cats. *J Am Vet Med Assoc* 1985;187:384–388.

22. Barsanti JA, Shotts EB, Crowell WA, et al. Effect of therapy on susceptibility to urinary tract infection in male cats with indwelling urethral catheters. *J Vet Intern Med* 1992;6:64–70.