Lower Urinary Tract Surgery: Tips and Tricks for a Successful Outcome
Katrin Saile, DVM, MS, DACVS
Louisiana State University
Baton Rouge, LA

Urologic surgery is commonly performed in small animals in general and referral practice. Lower urinary tract procedures such as cystotomy and urethrotomy and urethrostomy are performed on an emergency or routine basis. This presentation will include indications and steps to successfully perform lower urinary tract surgery.

Clinical diagnostics
A complete history should be obtained on all patients presenting with urinary tract problems. Important factors include whether the patient is polyuric and polydipsic, is incontinent, has a history of hematuria, stranguria, or pollakiuria. Other questions to answer include the onset, duration, timing and frequency of the problem, as well as response to medications. A complete physical examination should be performed. The heart rate and rhythm should be assessed. Renal palpation should be attempted although this can be difficult in large or obese patients. The bladder should be palpated to assess whether it is large on small, thickened, and flaccid or turgid. Abdominal distension should be noted. A minimum database including complete blood count, serum chemistry (including electrolytes), electrocardiogram and urinalysis and culture should be obtained.

Patients that present with urinary tract obstruction or rupture may have significant life threatening electrolyte imbalances and acid base disturbances. Hyperkalemia can cause an array of ECG disturbances including increase in the T wave amplitude, decrease in amplitude of the R wave, prolonged QRS and P–R intervals, and S–T segment depression; decreased amplitude of the P wave, increased P wave duration, and prolongation of the Q–T interval, lack of P waves (atrial standstill) and sinoventricular rhythm. Azotemia may lead to metabolic acidosis, which can result in shock.

Therapy
Triage is vital for animals presenting with urinary tract obstruction or rupture. Intravenous fluids (balanced electrolyte crystalloids) should be administered even if the animal is obstructed to help correct dehydration, electrolyte abnormalities and acidosis. Urine outflow must be established via catheterization, cystocentesis, peritoneal dialysis catheter, or cystostomy tube. If the potassium is significantly elevated and causing ECG disturbances, Calcium gluconate is administered IV as a cardio protectant. Insulin and dextrose can also be administered to help drive potassium intracellularly. It is rare to need to take patients to surgery as an emergency for urinary tract obstructions. Ideally, emergency medical stabilization is performed and surgery is performed electively on a stabilized patient.

Surgery of the urinary bladder
The urinary bladder is a hollow musculomembranous organ that lies within the abdomen (when full) or pelvic cavity (when empty). It has a median and paired lateral ligaments and received its blood supply from the cranial and caudal vesicular artery. The urinary bladder’s drainage is to the internal pudendal vein and lymphatic drainage is via the hypogastric and sublumbar lymph nodes. The layers of the urinary bladder are the mucosa (made of transitional epithelium), submucosa, detrusor muscle, and the serosa. The urinary bladder has the capacity to regain 100% of its pres-injury strength within 21-28 days after injury.

A cystotomy is an incision into the urinary bladder. A cystectomy is removal of part of the urinary bladder and a cystostomy is creation of a permanent stoma into the urinary bladder. Indications for cystotomy include cystolith removal, polyp removal, biopsy, ectopic ureter surgery and bladder rupture. Diagnosis is made based on history, physical exam, minimum database and imaging. Radiographs and ultrasound can be used to detect cystoliths although stones less than 3 mm in diameter may not be detected. Small stones and sediment may be removed with voiding hydropulsion while larger stones and those present in female dogs are generally removed via lithotripsy or surgery.

For any urologic surgery, the penis and prepuce, or vulva should be aseptically clipped and prepared as well as the abdomen. At surgery, a standard ventral midline approach from umbilicus to pubis is made. The bladder is isolated using moistened laparotomy sponges and stay sutures are placed in the apex of the bladder. A ventral midline incision is made into the urinary bladder using a #11 or #15 scalpel blade. It can be helpful to place stay sutures on either side of the incision to aid with manipulation. The bladder is suctioned and stones and debris are removed using thumb forceps or a gallowbladder spoon. A urinary catheter is passed normograde and retrograde and the urethra is flushed copiously. A stone or small mucosal biopsy should be submitted for culture. Stones should be submitted for stone analysis. A single-layer, simple continuous appositional pattern is used for closure of the cystotomy. Monofilament absorbable sutures such as 3-0 or 4-0 poliglecaprone 25 should be used, as non-absorbable sutures can act as a nidus for stone formation.
Postoperatively, radiographs should be obtained to document removal of all stones and debris. Animals are maintained on twice maintenance fluids for 12-24 hours after surgery and discharged with an Elizabethan collar and instructions for exercise restriction. It is important to notify owners that patients may exhibit pollakuria and hematuria for several days after surgery. Patients will frequently need dietary or medical management depending on the type of urolith removed.

A cystostomy is performed to provide temporary or permanent urinary tract diversion. Indications include trauma, urethral obstruction or rupture, as well as detrusor atony, neoplastic outflow obstruction and neurologic injury. To place a cystostomy tube, a midline or inguinal incision is made. Once the bladder is located, a purse string suture is placed in the urinary bladder, and a stab incision is made through the body wall and the center of the purse string suture. A Foley of Pezzer catheter is placed through the incisions and the purse string is tightened around the catheter. Four mattress sutures are placed between the body wall and urinary bladder around the stoma site. All sutures are placed using a longer-lasting absorbable suture material such as polydioxyanone or non-absorbable suture such as polypropylene. The catheter is placed flush with the urinary bladder wall and secured with a finger trap suture to the skin on the ventral abdomen using non-absorbable suture. The tube should be maintained for at least seven days post-operatively to allow the stoma to mature. Premature removal (by the patient or clinician) increases the risk of uroabdomen. If removal is required, the animal is sedated and the tube is removed using firm traction. The external portion of the tube should be clamped off. Owners are instructed to empty to urinary bladder 3-4 times daily. The patient MUST wear an Elizabethan collar while the tube is in place to prevent inadvertent chewing or removal of the tube. If the tube is maintained long term, it may need to be occasionally replaced, which can often be done under sedation. The presence of a cystostomy tube increases the risk for recurrent urinary tract infections and ascending pyelonephritis.

**Surgery of the urethra**

Urethral surgery is performed for urethral trauma, urethrotomy or urethrostomy for stone removal and urethral prolapse correction. Urethral trauma is most often associated with blunt trauma and pelvic fractures (hit by car) or iatrogenic tearing during catheterization. Animals with urethral trauma may still be able to pass some urine, but extravasation of urine causes significant tissue trauma, pain, and electrolyte imbalances. Diagnosis of urethral trauma is based on history and clinical signs. A minimum database as well as abdominocentesis may indicate urinary tract damage, and at this point imaging of the urinary tract is needed to determine the location and extent of the damage. An excretory urogram is performed to assess the kidneys and ureters, while a retrograde cystourethrogram is performed to assess the urinary bladder and urethra.

The urethra has an amazing capability to heal after injury, as long as it is not torn/transected in a 360° fashion. Tears are usually managed by placing a urinary catheter and maintaining it for 7-10 days. If the urethra is transected circumferentially, an open approach and surgical repair are performed. This procedure may require splitting the pelvis, or removal of the floor of the pelvis, depending on the location of the tear. After placing full thickness, simple interrupted sutures to re-anastomose the urethra, a urinary catheter is placed and maintained for 7-10 days. The catheter should be maintained until a recheck contrast study confirms patency of the urethra. Animals should receive proper analgesia, and are discharged from the hospital with an Elizabethan collar and instructions for 10-14 days of exercise restrictions (or 4-6 weeks with pelvic split). Owners should be warned that stricture is common with suturing of urethral tears.

Urethral obstructions are most commonly caused by stones. If an animal presents with a urethral stone, retropulsion should be tried to flush the stone back into the urinary bladder so a simple cystotomy can be performed. Animals must be under a deep plane of general anesthesia for retropulsion to be successful. Warm sterile saline is mixed with copious amounts of sterile lube. The animal is placed in dorsal recumbency and the penis is extruded. The largest size red rubber catheter possibly is used to catheterize the patient. One person places a gloved and lubed finger in the rectum to occlude the urethra. With the penis extruded the red rubber catheter is passed and while the urethra is occluded saline is injected though the red rubber to distend the urethra. Once the urethra has been distended adequately, the finger in the rectum is removed and the catheter is advanced while flushing the urethra in a pulsatile manner. This should be repeated until the stones are flushed into the urinary bladder and the catheter can be passed easily.

If stones cannot be retropulsed, a urethrotomy may have to be performed. Most common sites for urethrotomies are proximal to the os penis and at the pelvic flexure. At surgery, a red rubber catheter is passed to the site of obstruction and a skin incision is made of the site and catheter. The retractor penis muscle is identified and retracted and a midline incision is made into the urethral. All stones are carefully removed and the urethra is flushed vigorously. If stones are flushed into the urinary bladder a cystotomy is performed. The urethrotomy incision is left open to heal by second intention. Post-operatively radiographs are obtained to document stone removal. The animal is maintained on twice maintenance fluids. Patients are discharged with an Elizabethan collar and strict exercise restriction for 10-14 days. Owners should be warned that urethrotomy sites could bleed vigorously, especially at the end of urination, or during erections in intact dogs. Stones should be submitted for analysis.

A urethrostomy is a permanent stoma into the urethra. Indications for urethrostomies include recurrent or intractable urinary obstructions from conditions such as uroliths, strictures, neoplasia or recurrent feline lower urinary tract disease (FLUTD). The most common sites for urethrostomies are scrotal in dogs and perineal (PU) in cats. Other locations that can be utilized are pre-pubic, trans-
pubic and prescrotal. The most important surgical considerations for a urethrostomy are that there should be no tension on the mucosa-skin interface, there has to be perfect mucosa to epithelium apposition to allow primary healing without granulation tissue formation and scarring, and an adequate urinary tract diameter must be present at the end of surgery.

In perineal urethrostomy surgery in cats, the ischiocavernosus muscles and medial pelvic ligament must be transected to ensure a tension-free PU. A hemostat should be able to be passed comfortably into the urethra to the box lock. Urethrostomy sites should be sutured using 4-0 to 5-0 monofilament absorbable suture such as poliglecaprone 25 in a simple continuous or simple interrupted pattern. Use of a continuous pattern can decrease bleeding but may have a purse string effect if not carefully performed.

Following urethrostomy, patients must wear an e-collar from recovery until suture removal to prevent any licking/chewing at the stoma. The veterinarian or owner should not clean the stoma as this may disrupt sutures and healing of the stoma. After PU in cats, all litter boxes in the house should be lined with paper litter until suture removal. Dogs may bleed intermittently from their stoma for 7-10 days post-operatively, longer in intact male dogs, especially during an erection or after urination. Patients should be sedated for suture removal.

Prognosis is good after urethrostomy unless second intention healing occurs, in which case the stoma may stricture. Strictures will happen if there is too much tension, if not enough dissection is performed, and if there is not perfect mucosa to epithelium apposition. In cases or stricture, revision surgery may be needed.

Urethral prolapse is a protrusion of urethral tissue from the tip of the penis. Urethral prolapse looks like a small donut of red tissue protruding from the tip of the penis and owners of dogs with urethral prolapse may complain of penile bleeding or hematuria. It is predominantly seen in brachycephalic dogs. To reduce the prolapse, a catheter is placed in the urethra and the urethra is transfixed with a needle. The protruding urethral tissue is resected and the penile mucosa is sutured to the urethral mucosa using 4-0 to 5-0 monofilament absorbable suture material such as poliglecaprone 25. The patient should also be castrated if intact. Patients are discharged with an Elizabethan collar and strict exercise restriction for 10-14 days. Owners should be warned that prolapse sites could bleed vigorously, especially at the end of urination, or during erections in intact dogs. Re-prolapse is not uncommon.

Take home points
In conclusion, lower urinary tract surgery is commonly performed in private practice. Patients should be stabilized as much as possible prior to surgery to achieve the best outcome. Cystotomies are easy to perform and animals generally recover quickly. It is important to always radiograph the patient pre and post operatively to ensure all stones have been removed and to submit the stones to a lab for analysis. Urethrotomies are rarely needed if retropulsion is performed with a patient under general anesthesia and a team that is working well together. Urethrostomies are usually reserved for patients who have failed medial management and have had 2-3 cystotomies in the past.

References