Key Points:
- Initial patient stabilization is often necessary prior to surgical treatment of emergencies.
- Urethral catheterization is a relatively easy stabilization method for uroabdomen in both cats and dogs.
- Perineal urethrostomy is a meticulous surgery that can offer excellent outcomes to feline urethral obstructions.
- There are multiple surgical options for ureteral obstructions in both species.

Introduction
Urinary emergencies are the result of multiple etiologies including trauma, migrating foreign body, neoplasia, iatrogenic during surgery or catheterization, and obstructive calculi to name a few. The location of the urinary tract rupture may occur anywhere from the kidneys, ureters, urinary bladder, or urethra. The source of urinary tract rupture occurs in the urinary bladder (56%), urethra (26%), kidney (5%), ureter (2%), urinary bladder and kidney (2%), and undetermined sites (9%) in cases of uroabdomen.¹

Stabilization
Initial treatment should focus on patient stabilization. If a traumatic cause, investigate for fractures, pulmonary contusions, and herniations to develop an overall patient assessment and treatment plan. Depending on duration and severity of the urinary emergency, life-threatening acid-base and electrolyte abnormalities may need correction prior to surgical intervention. Metabolic acidosis, hyperkalemia, azotemia, and dehydration are the primary abnormalities requiring correction in most urinary emergencies. An electrocardiogram should be monitored for the cardiac effects of hyperkalemia. Intravenous isotonic crystalloids will correct hyperkalemia over time. However, 10% calcium gluconate (0.25-0.5 mL/kg IV) administered slowly over 5-10 minutes and/or 25% dextrose solution (0.7-1 gram/kg IV) over 3-5 minutes +/- regular insulin (0.1-0.25 units/kg) may be used in cases of severe hyperkalemia and electrocardiogram changes. Sodium bicarbonate may also be considered in cases of severe acidemia. For severe azotemia, a urinary catheter with fluid diuresis is a great way to stabilize the patient overnight prior to surgery. Even in cases of a ruptured bladder, the catheter will drain the abdomen and usually improve patient status while on IV fluids. Due to the chemical peritonitis, pain management is also an important part of the treatment regimen. Diagnosis of a uroabdomen hinges on sampling the abdominal fluid. Potassium ratio of 1.4:1 (abdominal fluid:serum) and creatinine of the abdominal fluid 2x the concentration of the serum are highly suggestive of an uroabdomen.² The presence of bacteria should also be evaluated as this will increase the emergent need for surgical intervention if a septic abdomen is present. Septic abdomen is a surgical emergency but uroabdomen is a medical emergency.

Diagnosis
Radiographs may reveal other injuries such as pulmonary contusions, pelvic fractures, or herniation. However, they are often less useful for determining the location of urine leakage without contrast. Ureteral or urethral calculi may be visible and provide suspicions to the cause. Visualization of a urinary bladder on radiographs does not rule it out as a source of leakage. More frequently, contrast studies can be quite helpful in evaluating the entire urinary tract. Intravenous pyelography evaluates the kidney and ureters. A positive contrast retrograde cystourethrogram will evaluate the urinary bladder and urethra as the catheter is removed.

Urinary Bladder
The urinary bladder is the most common site of rupture following trauma. An abdominal explore should be performed to search for the area of leakage. Areas of rupture should be debrided and closed with an absorbable monofilament in an appositional pattern monitoring for location of the ureteral openings to prevent incorporation into the suture line. Following closure, the bladder may be leak tested with a large syringe of saline and 22-25 gauge needle by holding off the proximal urethra with thumb and finger or compressed against the pubis if no fractures are present. Copious lavage is necessary to remove as much urine as possible. An indwelling urinary catheter may be placed to maintain bladder decompression. If more than 50% of the urinary bladder is resected or there is severe pelvic fractures, I would recommend an indwelling catheter. Otherwise, it likely is not necessary and may cause more inflammation.

Urethra
Partial or complete urethral tears may result from trauma and secondary to pelvic fractures. Many partial urethral tears can be managed with placement of a urethral catheter and maintaining it for 5-14 days. In our hospital, it is maintained for the shorter duration due to finances and concern for secondary ascending infections. The catheter may be placed retrograde or normograde with a surgical approach. One catheter may first be passed normograde from the bladder and tied with a small suture to the tip of a second catheter intended to be indwelling if retrograde advancement is complicated. Primary suturing of the urethra can be performed with small monofilament suture over a urethral catheter. Urinary diversion via a urethral catheter or a cystostomy tube should be performed with any repair technique. The concern with primary closure of urethral tears is stricture formation so decreasing inflammation as much as possible is crucial. Dependent on location of the urethral rupture, scrotal urethrostomy, perineal urethrostomy, or prepubic urethrostomy are possible permanent urinary diversion techniques if the trauma is distal to the location of the stoma.

Ureter
Ureteral injury leads to a loss of retroperitoneal and peritoneal detail. Treatment is dependent on location of injury. The distal ureter may be re-implanted following removal of the obstructed/damaged portion and spatulated. Proximal and middle ureteral injury requires primary closure (with/without ureteral stent), ureteral anastomosis, ureteronephrectomy, or subcutaneous ureteral bypass (SUB) placement.

Kidney
Trauma to the kidneys requiring repair is rare. For simple laceration of the renal capsule or pelvis, primary closure is sufficient. If significant damage to the kidney and proximal ureter, ureteronephrectomy is elected.

Specific Conditions:
Feline Lower Urinary Tract Disease (FLUTD)
FLUTD is a common condition in our feline patients. There are many different management protocols for this life-threatening condition. Medical management often includes low stress housing, increased water intake (fountains, wet food, etc.), anti-inflammatories, multiple litter boxes, and anxiolytics. During an acute obstruction where the clinician is unable to express the urinary bladder, initial stabilization treatments are initiated as mentioned above while preparing for urinary catheter placement under anesthesia. To prevent any resistance and promote relaxation of the perineum and urethra, general anesthesia is often required. Placement of an indwelling soft, flexible silastic catheter is recommended for 3-5 days with intravenous fluids to allow inflammation to decrease and removal of any other debris. Initial flushing following catheter placement if there is grit present is clinician preference. Decompressive cystocentesis can decrease resistance for catheter placement and does not seem to increase risk of urinary bladder rupture. A perineal urethrostomy is the surgical procedure to create a larger opening to prevent mucus plug formation and obstruction. It is best to perform this when there is little to no inflammation to
decrease the risk for stricture formation. Following this rule, medical management or cystostomy tube placement may be elected for 3-5 days prior to a perineal urethrostomy. Keys to a successful outcome are complete dissection, meticulous tissue handling, stoma location, and direct apposition of urethral mucosa to skin. Home management to not allow the cat or others to irritate the urethrostomy site is also important for the duration of the patient’s life to prevent stricture formation. This procedure has an excellent outcome if performed under ideal conditions.

Urethral obstruction with stone
Partial or complete urethral obstructions due to a stone are most common in male dogs. It becomes an emergency if it is a complete obstruction and a urinary catheter is unable to be placed. A large catheter is preferred to push the stone back into the urinary bladder and perform a simple cystotomy. However, a small catheter may slip past a stone better for initial stabilization in the emergency setting. The surgical approach is the same as a cystotomy with the urethra properly prepped and draped into the surgical field. There are many techniques for dislodging a urethral stone. I prefer to perform a cystotomy and remove any stones in the bladder. Then pass a large stiff polypropylene catheter retrograde connected to a large syringe of saline to retropulse the stone into the bladder. Following multiple unsuccessful attempts of retropulsing and gentle pushing of the stone with the catheter, I will use another catheter placed normograde and alternate saline flush from the normograde and retrograde catheter to dislodge the stone. *These surgeries often require persistence and patience.* Other techniques such as occluding the urethra proximal to the obstruction while retropulsing is used if unsuccessful. As a last resort, a urethrotomy may be performed to remove the stone and left open to heal by second intention. The urethrotomy may be closed primarily with direct apposition of urethral mucosa if there is minimal trauma to the urethra.

Ureteral obstruction
Feline ureteral obstruction is becoming more recognized as a cause of acute azotemia. Occasionally the ureteroliths may be noted on radiographs but may be confused with end-on vessels. There are multiple specialty procedures that are possible and offered at Iowa State University. These include subcutaneous ureteral bypass (SUB), microsurgery, and ureteral stents. The decision for the specific treatment is dependent on many different variables including clinician preference.

References:

Recommended Reading: