

Case Report: Subcutaneous Ureteral Bypass

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Placement of a Subcutaneous Ureteral Bypass (SUB) for Management of a Complete Bilateral Ureteral Obstruction due to Ureterolithiasis causing Severe Acute Kidney Injury in a Cat.

Case history:

At presentation, Monty was a 13 year old male neutered Devon Rex who was seen after 4 days of vomiting, hyporexia and acute azotemia. The primary care veterinarian performed routine blood work and urinalysis and found a creatinine of 19.6mg/dl and BUN of 206mg/dl with a potassium of 6.4mEq/L. He was noted to have bilateral nephrolithiasis, ureterolithiasis, and cystoliths on radiographs. He was given subcutaneous fluids and antibiotics, and an abdominal ultrasound was performed.

On presenting physical examination, Monty was appropriate and responsive and was in good body condition. There were signs of fluid overload with chemosis and a gallop rhythm with a I/IV systolic parasternal heart murmur. The kidneys were noted to be painful bilaterally on palpation with no evidence of urine production over last 24 hours.

Diagnostics:

Monty had in house blood work performed, which revealed a creatinine of >20.0mg/dl and a BUN of >200mg/dL, potassium of 5.8, ionized calcium of 1.18, urine specific gravity of 1.018, with a PCV/TS of 44/7.8. The ultrasound examination revealed bilateral severe hydronephrosis with hydroureter to ureteroliths in the proximal ureters and pericapsular fluid bilaterally. See Figure 1.



Figure 1. Showing sagittal section of the left kidney with a renal pelvic dilation of 1.27cm and a small volume of pericapsular fluid.

Procedure:

After a prolonged discussion with the owner, it was decided to proceed with ureteral decompression to relieve the acute renal injury. The ureteral bypass device used from Norfolk Medical is composed of a nephrostomy tube (kidney tube) and cystostomy tube (bladder catheter) connected to a prototype male-male vascular access port. The nephrostomy tubes are placed under fluoroscopic guidance and the remainder of the system is placed surgically. The tubes connect outside of the body but under the skin (see Figure 2.)

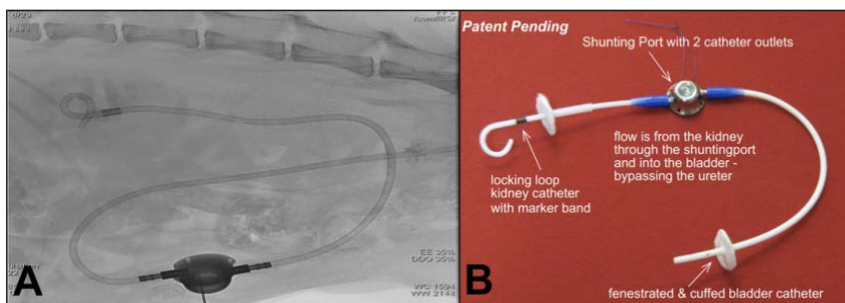


Figure 2. Photo courtesy of *Norfolk Medical Devices website*, showing unilateral SUB in place and system out of patient with descriptive labels of device components.

The procedure duration was 76 minutes and the patient was hemodynamically stable throughout the anesthesia. A triple lumen jugular catheter (*Cook Medical*) was placed in the right jugular and a 14Fr. *Mila* feline esophageal tube was placed in the left cervical region for ease of required multiple blood samplings, enteral feedings, hydration and medications post operatively. The pelvic dilation resolved within 24 hours of SUB placement and perirenal fluid resolved. See figure 3.



Figure 3. Shows the left kidney in sagittal section 24 hours post SUB placement with nephrostomy portion of SUB in the renal pelvis. There is resolution of pelvic dilation and improvement in the perirenal fluid.

Post procedure:

There was a rapid improvement in the azotemia with the creatinine decreasing to 1.6mg/dl within one week post procedure with a normal BUN and potassium. His renal pelvic culture was negative. He was discharged 7 days post operatively with tube feedings, antibiotics and enteral hydration. Monty is now over 12 months post procedure and his kidneys remain decompressed and his values remain at a creatinine under 1.9mg/dl consistently at his 3 month rechecks (IRIS stage 2, non-hypertensive and non-proteinuric). His SUB devices remain in place with regular flushing of the ports every 3 months with bacteriostatic saline, see Figure 4.

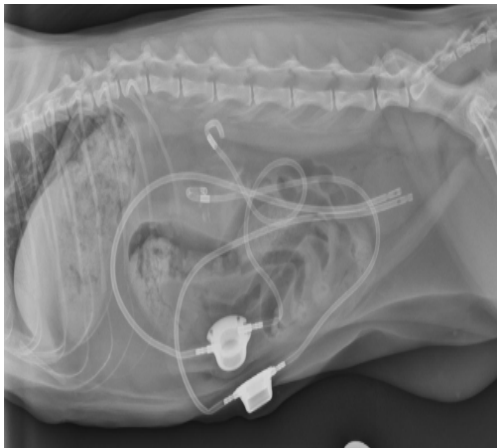


Figure 4. Lateral radiograph of Monty with bilateral SUB devices in place.

This case highlights the importance of renal imaging and rapid response in patients with acute renal injury or any evidence of renal insufficiency. Given the frequency of ureteral obstruction in cats and the epidemic of urolithiasis in our feline patients, imaging is imperative in all feline patients with any evidence of renal disease.

Greater than 98% of feline ureteroliths are composed of calcium oxalate stones. This means that these stones will not dissolve medically, and either need to pass spontaneously, remain in place, or be removed. Once medical management fails (traditionally: intravenous fluid therapy, mannitol CRI and alpha-adrenergic blockade), partial obstructions are often monitored and left in place due to the risk benefit ratio of attempted surgical removal. If there is a complete ureteral obstruction, decompression of the renal pelvis becomes imperative in order to preserve renal function.

Traditional intervention for ureterolithiasis has been accomplished surgically via ureterotomy, neoureterocystostomy, ureteronephrectomy, or renal transplantation. Kyles et al. reported procedure associated complications over 30%, and mortality rates of 18-39% depending on the type of management with 40% recurrence of ureteral obstructions. Medical management is effective in 8-17% of cases, but should be considered prior to any intervention.



A recent abstract on early data on SUB devices for benign ureteral obstructions reported on short and long term SUB data on 137 cats with 174 ureters treated showed that 20% were bilateral obstructions. Intervention was due to ureterolithiasis (67%), stricture (13%), both (20%), or pyonephrosis (0.5%). Median creatinine reduced from 6.6 to 2.6mg/dl, median renal pelvis reduced from 9.1mm to 1.5mm at presentation and at 3 month post SUB device placement. Survival to discharge occurred in 93.7% of cases. Over time 25% of patient would have complications and only 13% would require stent exchange due to re-obstruction. The overall mean survival time was 827 days (1-2397). This data reveals that compared to traditional surgery the SUB device provides a vastly improved survival to discharge (60-80% with surgery and 97.3% with SUB) and reduced recurrence rate of obstruction (40% with surgery vs. 13% with SUB). The SUB device placement is a viable and effective treatment option for feline ureteral obstructions.

Interventional radiology (IR) techniques (ureteral double pigtail ureteral stents, SUB) have allowed successful and efficient stabilization of the patient regardless of the cause of ureteral obstruction. IR techniques are now considered the standard of care for ureteral obstructions (ACVIM Forum 2016). Referral to a facility that can perform ureteral stenting or SUB placement should be offered as a standard of care in any patient diagnosed with ureteral obstruction. In order to diagnose ureteral obstruction any patient with kidney disease should be offered ultrasound of the urinary tract. In the hands of experienced and specialty trained veterinarians, SUB devices can provide a successful alternative therapy to traditional surgery and in many cases euthanasia due to acute renal failure.

References:

1. Kyles, Management and Outcome of Cats with Ureteral Calculi: 153 (1984-2002). *Kyles A, et al. JAVMA 2005; 226(6): 932-936; 937-944.*
2. Berent. Subcutaneous Ureteral Bypass Device (SUB) Placement for Benign Ureteral Obstruction in Cats: 137 cats (174 obstructed ureters) (2009-2015). Berent et al. 2016 abstract presented at *VIRIES 2016 Jackson Hole, WY.*