



# THE UNIVERSITY *of* EDINBURGH

## The Royal (Dick) School of Veterinary Studies

### WHAT IS YOUR DIAGNOSIS?



A three year old, male neutered domestic shorthair cat was presented to the R(D)SVS Internal Medicine service for investigation of vomiting, anorexia and lethargy of 24 hours duration. Physical examination revealed mild dehydration, moderate mid-abdominal pain and firm kidneys. The bladder was small, soft and comfortable. Blood testing revealed marked azotaemia and hyperkalaemia (urea 59 mmol/l ref. 2.8-9.8; creatinine 1089  $\mu$ mol/l ref. 22-162; potassium 7.1 mmol/l ref. 4-5).

**1) *What are your differential diagnoses for the azotaemia?***

**2) *How would you evaluate this case further?***

**3) *What treatment options are available for this cat?***

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## 1. Differential diagnosis for azotaemia

- a) Pre-renal due to dehydration, hypovolaemia, cardiac disease, local ischaemia
- b) Renal due to acute kidney injury, acute-on-chronic kidney disease
- c) Post-renal due to obstruction of ureters, bladder or urethra

To differentiate pre-renal causes from possible renal causes, urinalysis was performed which revealed a specific gravity of 1.045, making renal causes unlikely. The presence of marked hyperkalaemia with azotaemia is most common with urinary tract obstruction, acute kidney injury with anuria/oliguria or end-stage chronic kidney disease. The patient had been clinically well prior to the twenty-four hours, making end-stage chronic kidney disease unlikely, and was not supported by the urine specific gravity. While pre-renal causes may have been contributing to the azotaemia, it is unlikely to get such high renal parameters with mild dehydration, and hyperkalaemia would not be typical of pre-renal azotaemia. Therefore, urinary tract obstruction was considered most likely, at a level above the urinary bladder and urethra since the bladder was not overly filled or uncomfortable. Bilateral obstruction of the kidneys or ureters was suspected.

## 2. Further evaluation

Medical imaging was indicated to investigate for possible urinary tract obstruction (Figures 1-3).

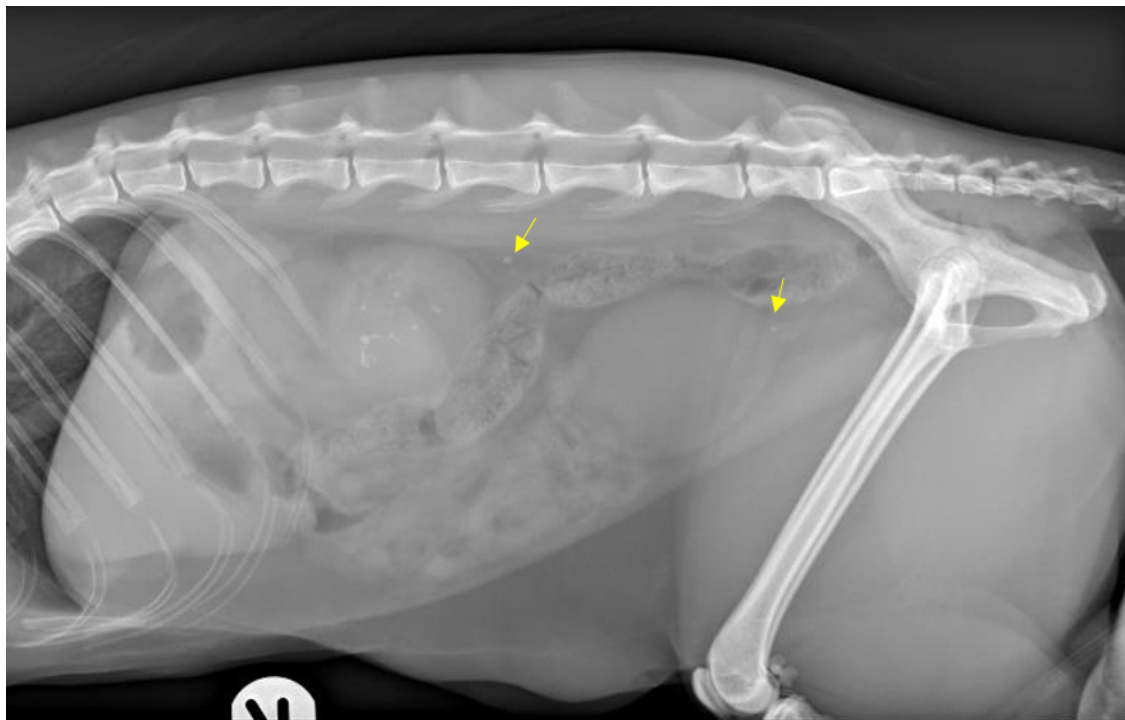


Figure 1. Lateral abdominal radiographs demonstrating multiple small nephroliths and two ureteroliths (arrows)

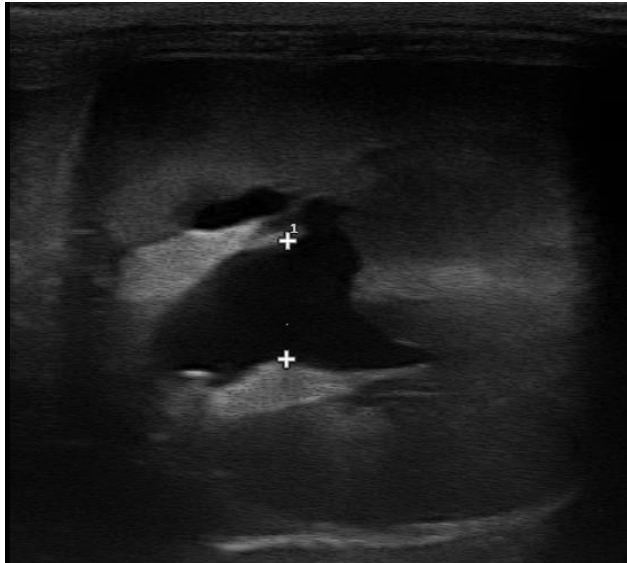


Figure 2. Transverse ultrasound image demonstrating dilation of the renal pelvis (7mm).

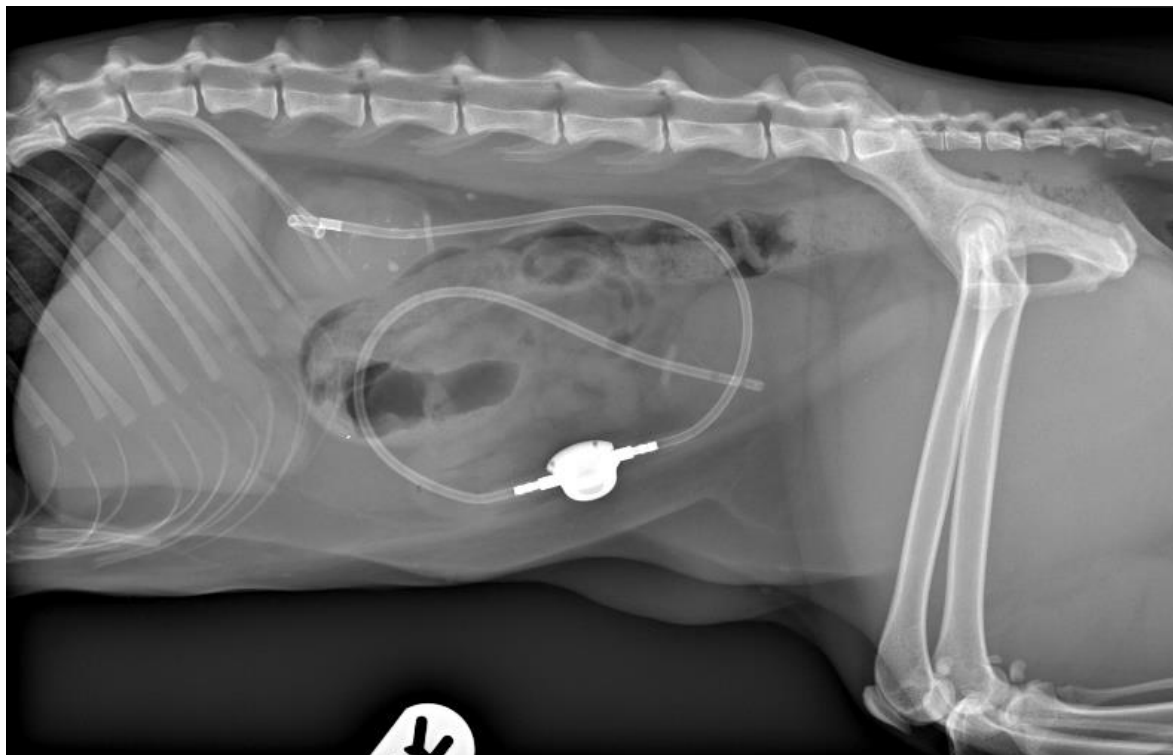


Figure 3. Ultrasound image demonstrating a ureterolith with proximal dilation of the ureter and distal narrowing to normal diameter.

Imaging revealed bilateral ureteroliths (proximal left ureter and distal right ureter at ureterovesicular junction) causing bilateral hydroureter and hydronephrosis. Since the majority of nephroliths are calcium oxalate, total and ionised serum calcium was measured as this would need to be investigated and managed if elevated to prevent recurrence; values were within reference ranges. Urine culture was also performed because up to 34% of cats are reported to have positive cultures at initial assessment. Urine culture revealed no growth in this case.

### 3. Treatment options

Treatment options include medical management, ureteral stents, subcutaneous ureteral bypass (SUB) or traditional surgical ureteromy. Medical management typically consists of aggressive fluid therapy, diuretics, analgesics and smooth muscle relaxants. This case was treated with isotonic NaCl fluids at 6ml/kg/hour, methadone, frusemide and prazosin which resulted in resolution of hyperkalaemia, marked improvement in azotaemia and resolution of clinical signs. Repeat imaging studies after 48 hours showed that the ureterolith on the right side had passed and the hydroureter and hydronephrosis had resolved. However, the left ureterolith had not moved significant and there was still distension of the kidney and ureter on that side. A SUB device was placed on the left side (figure 4) and resulted in complete resolution of azotaemia, hydronephrosis and hydroureter.



### Discussion

This case demonstrates that post-renal azotaemia due to urinary tract obstruction can occur without the classical signs of dysuria, anuria and a palpable hard and painful bladder if there is bilateral obstruction of the kidneys or ureters. Around 15-20% of cats with uroliths in the upper urinary tract are bilaterally obstructed at first presentation. If relief of the obstruction is performed as early as possible, there is the potential for full recovery of renal function. Medical management is often attempted for 24-48 hours unless the patient is severely hyperkalaemic, in severe pain or anuric. The patient in this case responded rapidly to fluid

therapy due to some urine getting past the obstructions and hyperkalaemia resolved within three hours. Most regimes for medical management include aggressive fluid therapy, diuretics (typically mannitol but frusemide is also used), alpha-adrenergic blockage to cause smooth muscle relaxation (normally prazosin) and analgesia. Some clinicians also use amitriptyline, although there is not strong evidence to support its use. Medical management is only successful in 8-17% of cats, so surgical or interventional radiology approaches are often necessary.

Traditional surgeries such as ureteromy are technically challenging, especially in small patients such as cats, and can result in stricture formation or urine leakage. Both ureteral stents and SUB devices can be used to overcome ureteral obstructions and both are placed surgically in this species. The stents are multi-fenestrated with a double pigtail, one in the renal pelvis and one in the bladder. These are well tolerated but transient dysuria or urinary tract infections are relatively common. Stent migration, re-obstruction and chronic mild haematuria are also possible consequences. Generally, SUB devices are tolerated better in cats longer term and is considered to be the preferred option in felines. It consists of a nephrostomy catheter which connects to a cystostomy catheter via a shunting subcutaneous access port, which allows both flushing of the device and urine sampling to monitor for infection. In our patient, the SUB device was well tolerated and allowed preservation of the function of the left kidney. Follow up is required, with flushing of the SUB under ultrasound guidance and urine culture every three months for the first two years then every six months thereafter.

## References

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