Zuku Review FlashNotes™

Oxalate and Struvite Urolithiasis

Extended version

Classic case: **Cat or dog with stranguria, hematuria**, +/- polydipsia.

Image courtesy, Wikimedia Commons

Presentation:

- **Signalment**
  - **Dogs: Oxalate**
    - Middle-aged to older neutered males
    - Miniature schnauzer, Lhasa apso, Yorkshire terrier, bichon frise, Pomeranian, shih tzu, miniature poodle
  - **Dogs: Struvite**
    - Any age, females 2X more commonly affected than males (because of urinary tract infections)
    - Miniature schnauzer, shih tzu, bichon frise, miniature poodle, cocker spaniel (may be sterile uroliths), Llasa apso
  - **Cats: Oxalate**
    - Between 7 and 10 years old. Males around 60% affected
    - Ragdoll, British shorthair, foreign shorthair, Himalayan, Havana brown, Scottish fold, Persian, exotic shorthair
  - **Cats: Struvite**
    - Neutered male cats at increased risk, between 4 and 7 years of age
    - Domestic shorthair, foreign shorthair, ragdoll, Chartreux, Oriental shorthair, Himalayan
- **Clinical signs**
  - **Hematuria, pollakiuria, dysuria, stranguria**
  - **Inappropriate elimination** (periuria)
  - ± systemic illness, PU/PD
  - Enlarged, turgid urinary bladder if obstructed
  - Renomegaly if hydronephrosis

DDX: Urinary tract infection, other types of uroliths, urinary neoplasia, behavioral disorder, neurologic dysfunction, anatomic urinary tract defect

Test(s) of choice:

- **Serum biochem**: ± hypercalcemia (oxalate). if obstructed: azotemia, hyperkalemia, metabolic acidosis

- **Urinalysis and culture and sensitivity**:
  If ANY urine sits for more than an hour, oxalate or struvite crystals may precipitate (artifact)
  - Oxalate: acidic to neutral pH, hematuria, ± crystalluria
  - Struvite: neutral or alkaline pH, pyuria, bacteria, ± hematuria, ± crystalluria

  - **Struvite: usually associated with UTI in dogs, but <u>not</u> in cats**

- **Abdominal radiographs** – radiopaque calculi in bladder, urethra, ureter or renal pelvis.
  - Struvite are most radiopaque followed by oxalate uroliths.
  - Oxalates may be smooth, round, spiculated, or jackstone (they look like toy jacks)
  - Struvites are usually smooth and round.

- Abdominal ultrasound – will help confirm location, assess kidneys for pyelonephritis or hydronephrosis

- **<u>Urolith analysis</u>** and culture: analyzed by crystallography, x-ray diffraction, infrared spectroscopy

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Rx of choice:

- ACUTE – Rx depends on location
  - **Relieve urethral tract obstruction – life threatening!**
    - **Cats only**: Gently massage distal urethra to break apart urethral plug and GENTLY compress urinary bladder (usually not effective, but easy, so worth a try)
    - **Decompressive cystocentesis** (use IV tubing and 3-way stopcock so no need to repuncture bladder) – leave about 5-15 ml of urine in bladder to avoid damaging bladder wall
    - **Flush plug** out external urethral orifice (cats only)
      - Use **open-ended catheter**, IV tubing and 35 ml fluid (sterile isotonic solution) filled syringe
      - Flush into urethral lumen and **GENTLY** apply pressure to urinary bladder
    - **Retrograde urethral flushing**
      - Use **open-ended catheter** (**8 Fr feeding tube in dogs**), IV tubing and 3-20 ml fluid-filled syringe (in dogs, may mix saline with sterile water-soluble lubricant 50:50)
      - Insert catheter into distal urethral opening
      - Use moistened gauze sponge to occlude the distal urethra around the catheter and pull penile urethra caudally to extend it parallel to spine
      - Flush vigorously. Repeat if needed (may also need to repeat decompressive cystocentesis)
      - Smaller syringe gives greatest hydropropulsion pressure
    - **Radiograph to verify uroliths are in bladder**
    - **Indwelling transurethral catheters** (3-5 Fr flexible feeding tube in cats; 8 Fr in dogs)
      - Not always indicated – use when poor urine stream after flushing, postrenal azotemia, allow recovery of detrusor contractility, urethral tear
      - Maintain a **closed collection system** and remove as soon as possible
      - No antibiotics if urine is sterile; antibiotics indicated for UTI or other infection
      - No corticosteroids
      - Pain control (eg, buprenorphine)
      - Maintain hydration
  - Urohydropropulsion (avoid in male cats)
  - Catheter-assisted retrieval, or cystoscopic-assisted retrieval
  - Surgical retrieval, or lithotripsy
  - Medical dissolution (struvite only) – may take around 3 months (Hill's s/d)
  - **Repeat radiographs to ensure complete removal**

Oxalate uroliths from a male miniature schnauzer.

Image courtesy, April Williams

- CHRONIC Rx: Determine if underlying disorder (hyperadrenocorticism, urinary tract infection)

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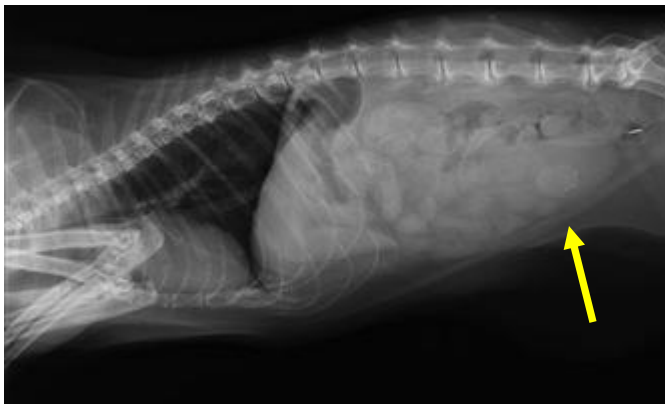
Prognosis:

- **Recurrence is common**
- Prognosis for dietary dissolution of struvite uroliths is good



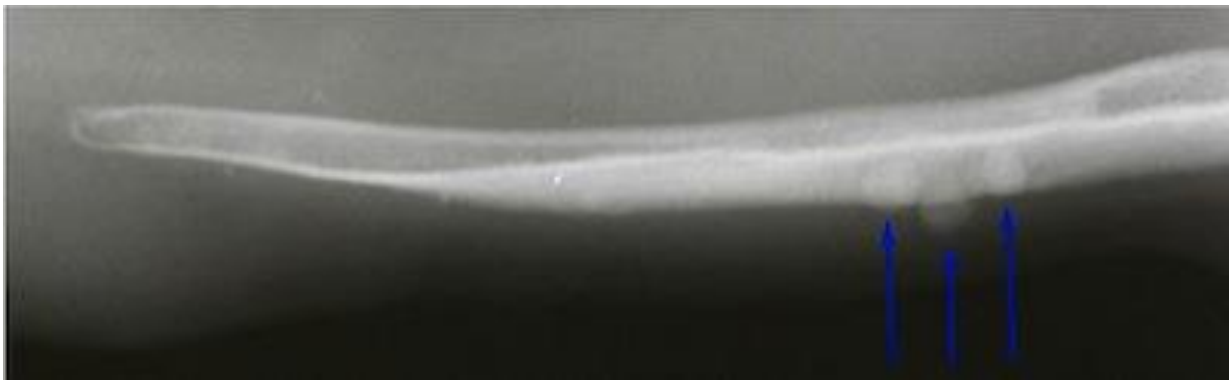
Feline radiograph, radio-opaque urolith in bladder.
Image courtesy, Dr A Stambaugh

Prevention:

- **Oxalate:** diet high in moisture w/ moderate Mg, phosphorus
  - AVOID diets with moderate fat and carbs (Hill's u/d or w/d (dogs) Hill's c/d (cats)
  - Treat hypercalcemia if present
  - **Promote water consumption**, feed canned food
  - Add potassium citrate if urinary pH remains acidic
  - For persistent calcium oxalate crystalluria add hydrochlorothiazide or vitamin B_6
  - Consider perineal urethrostomy in male cats
- **Struvite**
  - AVOID diets high in magnesium, phosphorus, calcium, chloride, fiber, with moderate protein (Cats: Hill's c/d or w/d)
  - **Promote water consumption**

Pearls:

- Oxalate and struvite uroliths are most common form of uroliths in dogs and cats
- **Risk factors for oxalate stones:** hypercalcemia (35% of cats and 4% of dogs), acidic urine, concentrated urine, infrequent urination, chronic metabolic acidosis, obesity, diets designed to minimize struvite formation in cats
- **Risk factors for struvite stones:**
  - **In dogs**, struvite uroliths are **almost always associated with urinary tract infection** involving urease-producing bacteria.
  - In cats, struvite uroliths are typically found in sterile alkaline urine



Urethral obstruction in a male dog, caused by three urinary calculi (blue arrows).

Image courtesy, Dr. Kalumet

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Refs: Cote, Clinical Veterinary Advisor, 2nd ed, pp 1141-1144, 1353-1356; Merck Manual, 10th ed (online): Urolithiasis in Small Animals, Nutrition Disease Management in Small Animals, Obstructive Urolithiasis in Small Animals

My Notes: