Urine Trouble
Common Urinary Emergencies

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Topics To Cover

- Urethral Obstruction and Urolithiasis
- Ureteral Obstruction
- Uroabdomen
- Urethral Prolapse
- Urinary antibiotic use

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Urethral Obstruction and Urolithiasis

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Urethral Obstruction and Urolithiasis

- Features of Urethral Obstruction and Uroliths

- Diagnostics to Consider
  - Labwork
  - Stone Analysis

- Urinary Catheterization
  - Brief overview of catheter types
  - Sedation protocols

- Hospitalization post de-obstruction
  - Fluids
  - In hospital pain/anxiety management

- Surgical Recommendations (brief)

- Nutritional Considerations

Urethral Obstruction

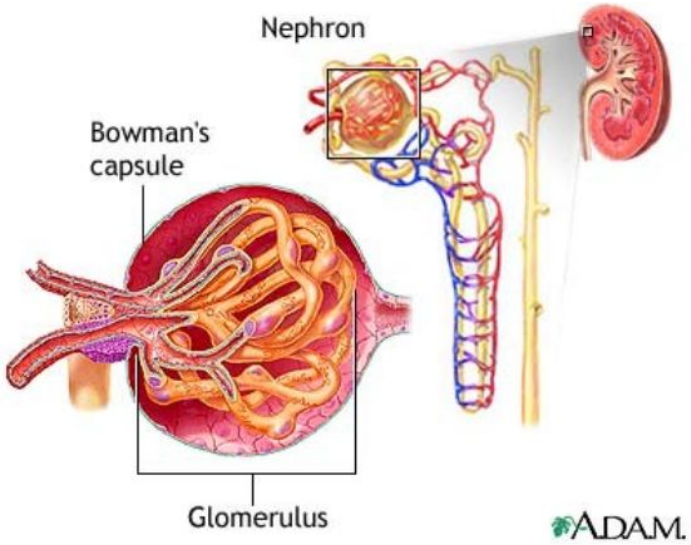
- Male dogs and cats predisposed
  - Longer and more narrow urethra
  - Ferrets, Guinea Pigs
- Functional
  - “Idiopathic” - secondary to urethral spasm and/or edema
    - Up to 50% of obstructed male cats (1,2)
    - Part of the feline lower urinary tract disease complex
- Mechanical
  - Uroliths
  - Blood clots, “plugs,” other
  - Stricture
  - Constipation/Obstipation
  - Masses
    - Urinary bladder masses vs urethral masses vs prostatic masses etc.

Urethral Obstruction - How it becomes an Emergency

- Obstruction leads to increased accumulation of urine in the bladder → increases pressure in the ureters and kidneys → leads to reduced GFR and decreased excretory ability → accumulations in blood of BUN, creatinine, phosphorus, potassium, and H+ ions.

- Accumulation of these products explains common clinical signs
  - Uremia
  - Metabolic acidosis
  - Hyperkalemia

- Together - cardiovascular collapse and death



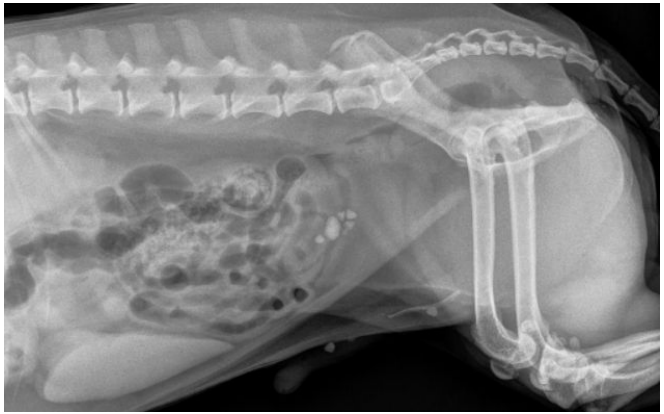
TREAT EVERY SICK MALE CAT LIKE AN OBSTRUCTION UNTIL PROVEN OTHERWISE

Recognizing the Urethral Obstruction

- History
  - Changes to urination - not as obvious for some owners!
  - Decreased appetite, anorexia, vomiting
  - Vocalizing
- Signalment/Physical exam
  - Male Cats! But also male dogs. Then our females.
  - Vocalizing
  - Hard, distended, non-expressible urinary bladder
  - Abdominal pain
  - Visible plug at tip of penis or discoloration of the tip of the penis

Recognizing the Urethral Obstruction

- Laboratory Changes
  - Azotemia
  - Hyperkalemia
  - Various
- Imaging
  - Urinary Bladder distension
  - Visible stones
  - Invisible stones
    - Radiographic superimposition
    - Radiolucent stones

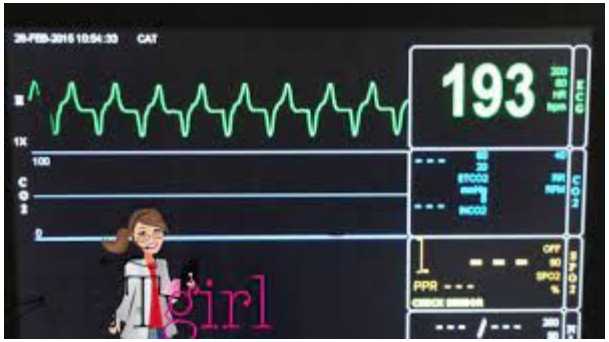


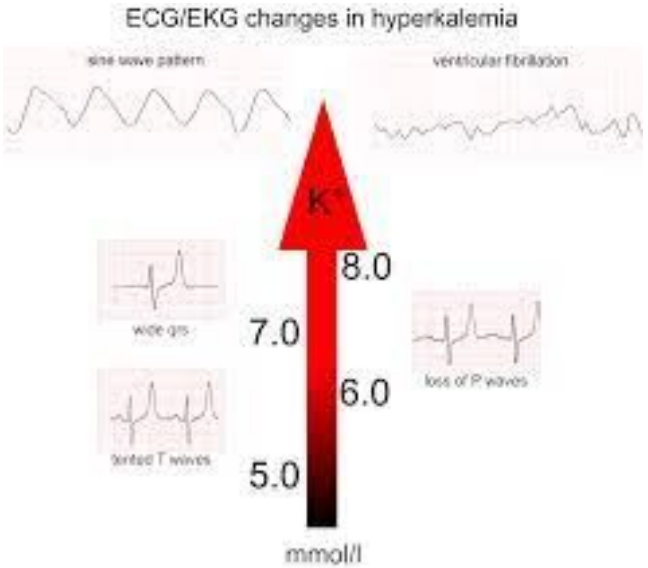
Stabilizing the Urethral Obstruction

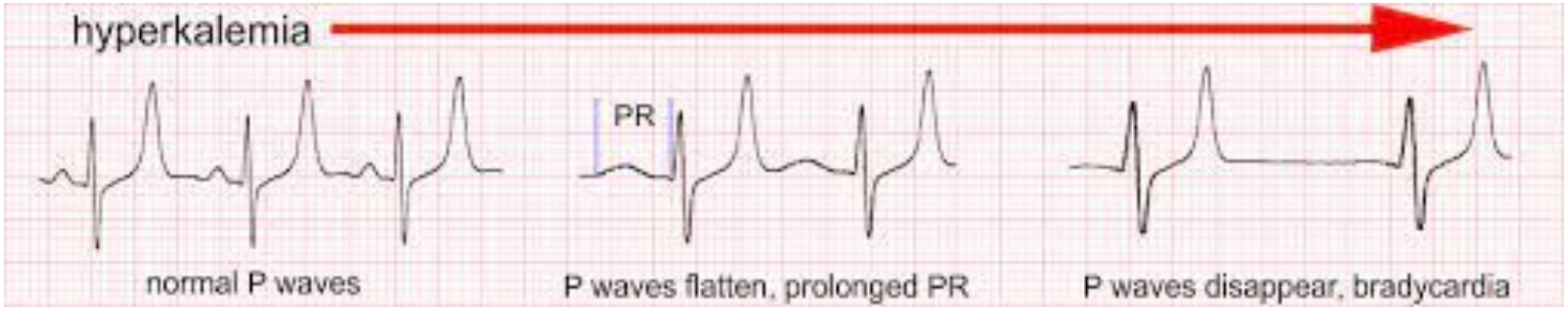
- IV catheterization
  - Get initial blood samples
    - PCV/TS/Electrolytes +/- acid base
    - Kidney values
    - Full CBC/Chemistry
  - Access then used for multiple next steps
    - IV fluids
    - Sedation
    - Emergency drug administration

Stabilizing the Urethral Obstruction

- ECG monitoring







Stabilizing the Urethral Obstruction

- Fluid therapy
  - Balanced electrolyte solution vs sodium chloride
  - Should be instituted REGARDLESS of timing of cystocentesis or deobstruction

The influence of crystalloid type on acid–base and electrolyte status of cats with urethral obstruction

Kenneth J. Drobatz DVM, MSCE, DACVIM (Medicine), DACVECC,
Steven G. Cole DVM, DACVECC, DACVIM (Cardiology)

Conclusions: While both crystalloid solutions appear safe and effective for fluid therapy in cats with urethral obstruction, the use of a balanced electrolyte solution may allow more rapid correction of blood acid–base status within the first 12 hours of fluid therapy. The use of a potassium-containing balanced electrolyte solution does not appear to affect the rate of normalization of blood potassium in treated cats with urethral obstruction.

Stabilizing the Urethral Obstruction

- Decompressive cystocentesis
  - Controversial but overall less risky than previously thought

Outcome of male cats managed for urethral obstruction with decompressive cystocentesis and urinary catheterization: 47 cats (2009–2012)

Jennifer Hall [1], Kelly Hall, Lisa L Powell, Jody Lulich

Affiliations + expand

PMID: 25427645 DOI: 10.1111/vec.12251

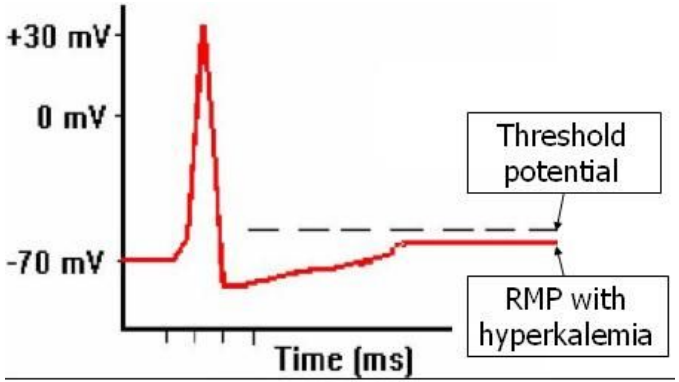
Association of abdominal effusion with a single decompressive cystocentesis prior to catheterization in male cats with urethral obstruction

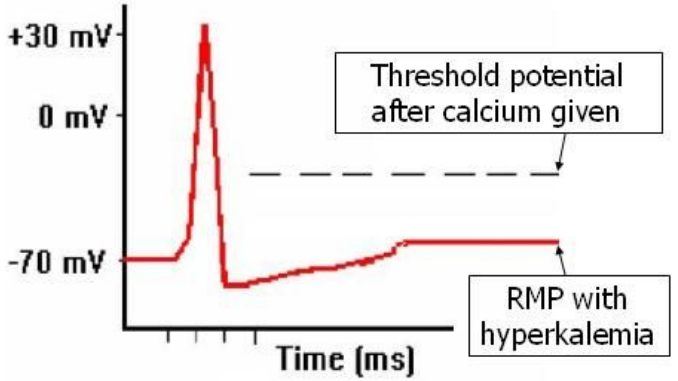
Katherine K. Gerken DVM, Edward S. Cooper VMD, MS, DACVECC, Amy L. Butler DVM, MS, DACVECC, Dennis J. Chew DVM, DACVIM

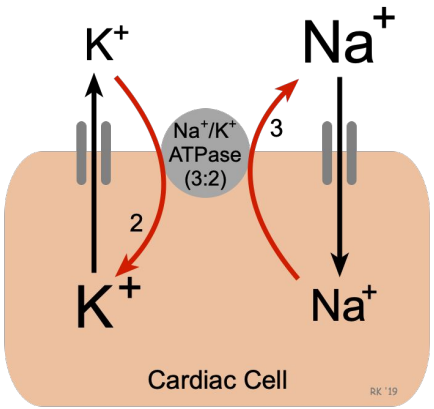
Most important to ensure patient is not moving and the urinary bladder is fully emptied

Stabilizing the Urethral Obstruction

- Potassium Management
  - Dextrose vs combined Insulin/Dextrose
  - Albuterol
    - B-adrenergic receptor agonist
  - Terbutaline
    - Selective beta-2 adrenergic receptor agonist
    - SQ ONLY
  - Calcium Gluconate - NOT treating the potassium, just stabilizing the cardiac membrane





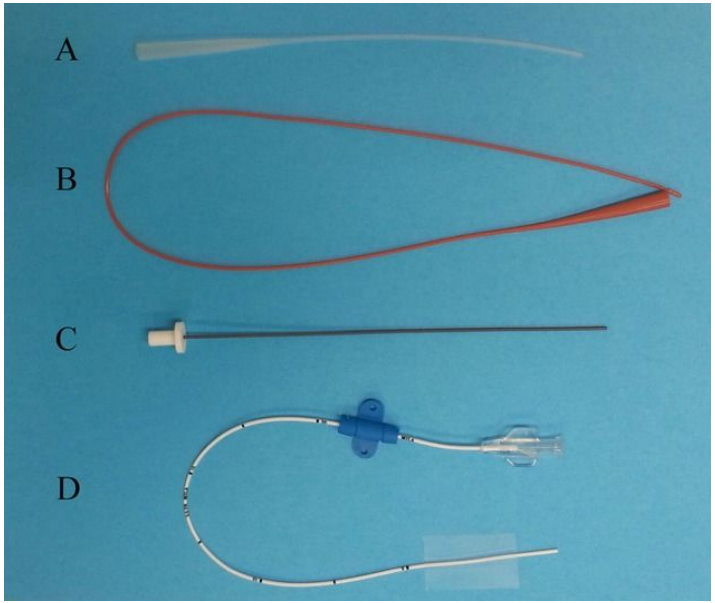


Stabilizing the Urethral Obstruction

- Urinary catheterization
  - Relieve the obstruction!
  - May also get insight into type of obstruction
    - Gritty vs smooth catheter passage
    - Stones
    - Stricture
  - Allow for contrast imaging to be performed
    - Double contrast
    - Contrast cystourethrograms
      - Tears or strictures
  - Allows for monitoring of ins/outs in hospital

Catheterization! Process Considerations

- Catheter choice
  - Polypropylene (tomcat)
  - Polyvinyl (red rubber)
  - Polytetrafluoroethylene (slippery sam)
  - Polyurethane (Mila)
  - Foley - dogs
  - Olive tip catheters
  - 22G or 20G IV Catheters
    - Stylet removed



Dealer’s choice!

Catheterization! Process Considerations

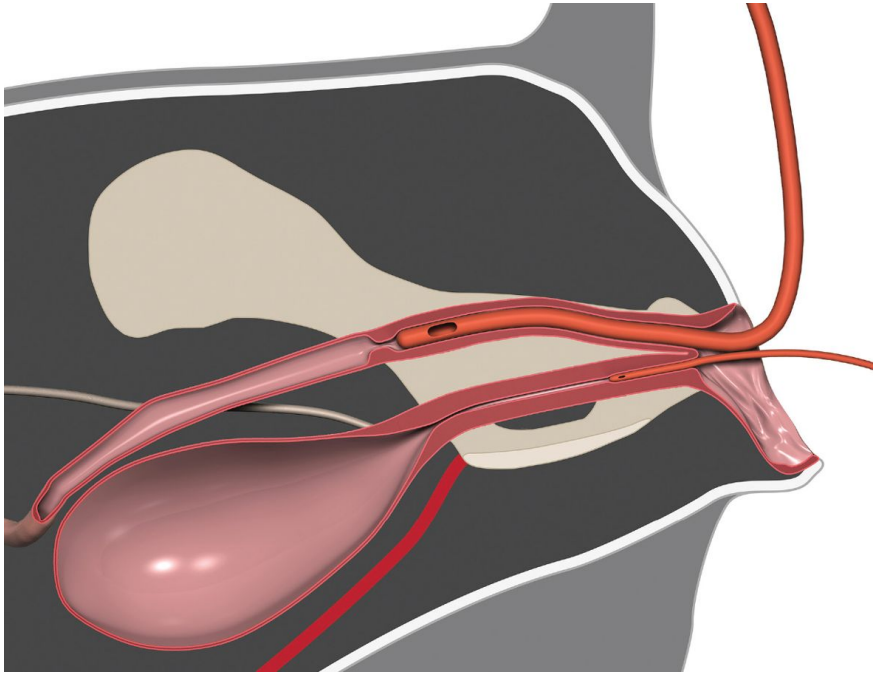
- Heavy sedation or Anesthesia
  - Trying to place catheters in AWAKE patients is asking for urethral trauma
  - Various protocols to consider
    - Methadone/midaz +/- propofol/alfaxalone
    - Ketamine/midaz +/- propofol/alfaxalone
    - Inhalant
  - Local Block
    - Sacrococcygeal
- Monitoring
  - ECG
  - Blood pressure
  - SpO2
  - Consider intubation w/ EtCO2 monitoring
    - Important for difficult or prolonged cases

Catheterization! Process Considerations

- LUBE
  - Physically on catheter
  - In flush
- Positioning
  - Lateral vs dorsal recumbency, leg positioning
  - Pulling prepuce caudally, straightening to the sky - various techniques (cats)
  - Rectal urethral pressure
- Decompression
  - Eliminates back pressure through urinary tract so able to flush more effectively
  - May decrease risk of causing distention related urethral tear or urinary bladder rupture

Catheterization! Female Challenges

- Digital palpation
- “Drag and drop”
- Visualized
  - May be able to see urethral papilla and/or opening in larger dogs with aid of speculum
- 2 catheter technique for small dogs and cats
  - 2022 study in AJVR looking at this technique
  - Larger red-rubber (10F cats, 18F dogs) introduced 1st
  - Appropriately sized indwelling then introduced along midline at a 45 degree angle
  - 79.5% success rate (healthy animals)



Citation: American Journal of Veterinary Research 81, 5; 10.2460/ajvr.81.5.448

Catheterization! Indwelling

- Closed collection system
- Risk of continued inflammation and infection
  - Antibiotics? Not shown to prevent development of catheter associated UTI (in cats)
- Conflicting data about how long to leave urinary catheters in BUT
  - Ensure azotemia and hyperkalemia have resolved
  - Ensure that patient is not experience post-obstructive diuresis and needs continual monitoring of output
  - Ensure (when able) urine is clearing - free of major debris or clots

Evaluation for association between indwelling urethral catheter placement and risk of recurrent urethral obstruction in cats

Marc A. Seitz DVM, Jamie M. Burkitt-Creedon DVM, and Kenneth J. Drobatz DVM, MSCE

Incidence of bacteriuria at presentation and resulting from urinary catheterization in feline urethral obstruction

Edward S. Cooper VMD, MS, DACVECC, Emma Lasley DVM, Joshua B. Daniels DVM, PhD, DACVM, Dennis J. Chew DVM, DACVIM

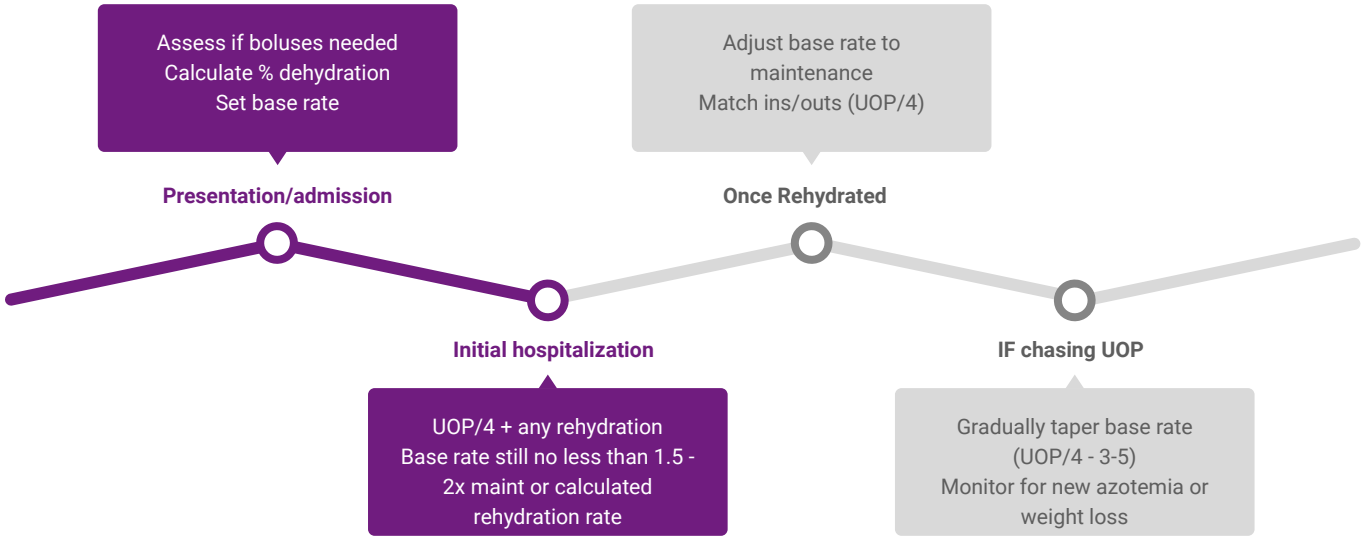
Catheterization! Hospitalized Management

- Post obstructive diuresis (POD) (>2mL/kg/hr UOP)
  - Build-up of osmotically active substances in blood, pressure necrosis, and medullary washout +/- ADH resistance results in massive urine production
  - Also consider that we can drive the medullary washout and create a state of diuresis by having excessive fluid rates
  - Cats presenting hypovolemic, with more severe acid/base and electrolyte abnormalities, and azotemia are predisposed to development
- Inadequate urine production (<1mL/kg/hr UOP)
  - Dehydration
  - Progression to acute renal failure

Hospitalization! Fluid Management

- General UOP/4 + Dehydration
  - Minimum base rate
  - **No maximum rate unless cardiac concerns**
    - Caveat - when being directly monitored
- Maintenance = bw (kg) ^ 0.75 x 70. Divide by 24 for hourly fluid rate
- Dehydration to be corrected over 24 hrs (48 if cardiac concerns).
- If no POD or POD is corrected - match UOP/4 to fluid rate (no less than maintenance).
  - Decrease in increments as needed if ins are driving outs

Hospitalization! Fluid Management



Catheterization! What if I can’t?

- Physically cannot pass catheter
  - Surgical intervention for cystotomy, urethrotomy, emergency PU etc.
  - Medical management with intermittent decompressive cystocentesis
    - Reduce stress (dark, calm environment)
    - Analgesia + Sedation
      - Methadone, Buprenorphine
      - Gabapentin

A protocol for managing urethral obstruction in male cats without urethral catheterization

Edward S. Cooper VMD, MS, DACVECC, Tammy J. Owens DVM, Dennis J. Chew DVM, DACVIM, and C. A. Tony Buffington DVM, Phd, DACVN

Catheterization! What if I can't?

Effect of prazosin on feline recurrent urethral obstruction

Kayla R Hanson[1], Elke Rudloff[1], Lingnan Yuan[2], Jonathan P Mochel[2] and Andrew KJ Linklater[1]

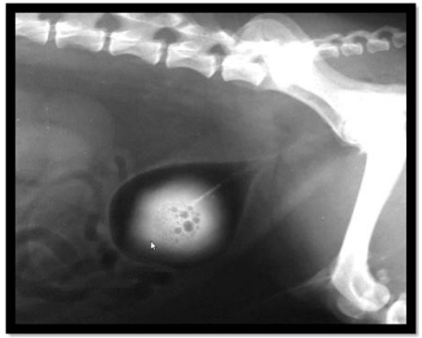
- Financially cannot pass/leave catheter or hospitalize
  - Decompressive cystocentesis and medical therapy
  - Unblock and go
    - Pass catheter to relieve immediate obstruction, supportive care, medical management
      - Fluids - SQ vs IV
      - Analgesia + Sedation
      - Antibiotics?
      - Prazosin?
- Think about who are candidates for this
  - Ideal candidate is the not sick UO - minimal acid/base changes, stable potassium, stable kidney values
  - Not ideal in pets with severe acidosis, severe potassium changes, severe azotemia

Urolithiasis

- Uroliths form secondary to other changes - they are NOT a primary problem
- Diagnosis
  - Clinical signs
    - Incidental finding vs lower urinary signs vs life threatening obstruction
  - Imaging
    - More information to come
- Other diagnostics to consider
  - Urinalysis
    - Crystalluria suggestive but not definitive
    - USG
      - Presence of precursors
    - pH
  - Culture
    - Infection may occur secondary to OR contribute to stone formation
  - Biochemistry

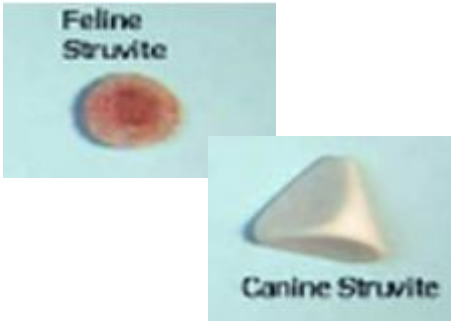
Urolithiasis - Imaging

- Imaging
  - Most definitive diagnostic tool
    - X-rays (w/ and w/o contrast)
      - Not all stones are radiopaque!
    - Abdominal ultrasonography
      - Important for those that are radiolucent



Urolithiasis - General Players

- Struvites (magnesium ammonium phosphate hexahydrate)
  - Form w/ pH > 7.0
  - Presence of infection
    - Dogs, pediatric dogs and cats
  - Absence of infection
    - Cats, very rare in dogs
  - Dissolution diet +/- antibiotics
    - Antibiotics for dogs, pediatrics
    - *Staphylococcus, Proteus, Corynebacterium* spp
- Calcium Oxalate
  - Form w/ pH <7.0
  - Surgical removal



Urolithiasis - General Players

- Urates
  - Form w/ pH <7.0
  - Limited feline information
  - Ammonium urates most common
  - PSS vs error of metabolism (English bulldogs, Dalmations)
  - Dissolution?
    - Not if underlying liver dysfunction cannot be corrected
      - Voiding urohydropropulsion vs cystoscopy/lithotripsy
        - Management of choice in cats
    - Dissolution diet + allopurinol

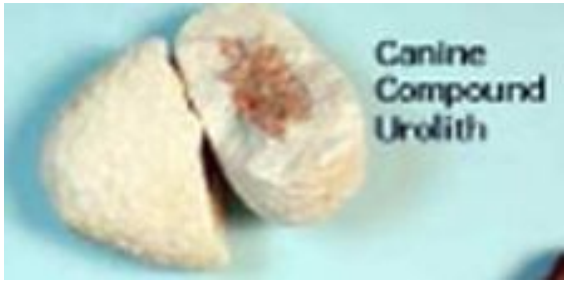
Urolithiasis - General Players

- Xanthine
  - Allopurinol administration w/o purine restriction
  - Rarely reported in cats
    - 3-5 years of age
  - Cavalier King Charles Spaniel
  - No dissolution protocol

- Cystine
  - Proximal renal tubular defect in reabsorption of amino acids
  - Altered intestinal transport of cystine
  - Other genetic mutations
  - Dissolution diet + 2-mercaptopropionylglycine (2-MPG) (not cats!)

Urolithiasis - General Players

- Mixed uroliths
  - 5-15% of stones may be mixed or compound
  - More than one mineral is present
  - Examples
    - Calcium oxalate nidus → infection → struvite layering
    - Ammonium urate → given Allopurinol w/o purine restricted diet → layered w/ xanthine



Urinary Dietary Management

- FLUTD cats
  - The role of pH and crystalluria remains of unknown significance so pH manipulation doesn't carry a clear benefit
  - Cats eating dry food only may be at an increased risk of obstruction
  - Stress diets?

- Dissolution diets
  - Struvites - Acidifying and restricted in protein, Mg, Phos
  - Calcium oxalate - None
  - Urates - Alkalinizing, purine restricted diet that induces diuresis
  - Cystine - Alkalinizing, low protein diet that induces diuresis

Urinary Surgical Management

- Perineal urethrostomy
  - Repeat offender cats - not a cure but reduced risk of recurrence
- Urethrotomy
  - Remove calculi that cannot be flushed back into bladder
  - Prescrotal vs perineal
- Urethrostomy
  - Indications include recurrent obstructive calculi unable to be medically managed, calculi not removed by retrohydropropulsion or urethrotomy, urethral stricture, severe trauma or neoplasia of the urethral and/or penis, and preputial neoplasia w/ penile amputation
  - Prescrotal vs scrotal vs perineal vs prepubic vs others
- Cystotomy
  - Remove calculi located or flushed back into the urinary bladder

Urolithasis - Stone Analysis

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MINNESOTA UROLITH CENTER

- Quantitative mineral analysis
  - Optical Crystallography and Infrared Spectroscopy
- Dogs, cats, rodents, aquatic species, and reptiles are typically accepted
  - No humans or primates
  - Can analyze things as small as a poppy seed!
- Submit largest stone, and representative portion of sizes, shapes, and colors.
  - If from different parts of urinary tract, keep separate!
    - Want to know where they came from, especially if different
- The more you know about the stone the more you know about treating!
  - This lab also has numerous handouts for treating various stone types in dogs and cats

Ureteral Obstruction

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Ureteral Obstruction

- About
- Partial, complete, bilateral obstructions
- Emergency treatment
  - Diuresis, sedation
  - Progress monitoring
  - Hemodialysis
- Very basic overview of long term treatment (SUBS, stenting, etc.)

Ureteral Obstruction

- More of a concern for feline patients
- Obstruction may occur with
  - Ureteroliths
    - >90% of upper urinary stones in felines are calcium oxalate
  - Ureteral strictures
    - Previous surgery or stones
    - Congenital
  - Obstructive pyonephrosis/pyelonephritis
  - Blood clots
  - Neoplasia
  - Ligation
- Varying degrees
  - Unilateral vs Bilateral
  - Partial vs complete

Ureteral Obstruction - Why it's an emergency

- Complete ureteral obstruction → Immediate increase in renal pelvic pressure → decrease in renal blood flow (60% w/n 24 hours, 80% w/n 2 weeks) → decreased GFR in affected, increased GFR in non-affected (if normal and able to compensate).
  - GFR permanently decreased by 35% after 7 days and by 54% after 14 days.
- Bilateral ureteral obstructions may present w/ life threatening azotemia
- Partial ureteral obstructions
  - Less severe and slower nephron destruction

Recognizing ureteral obstructions

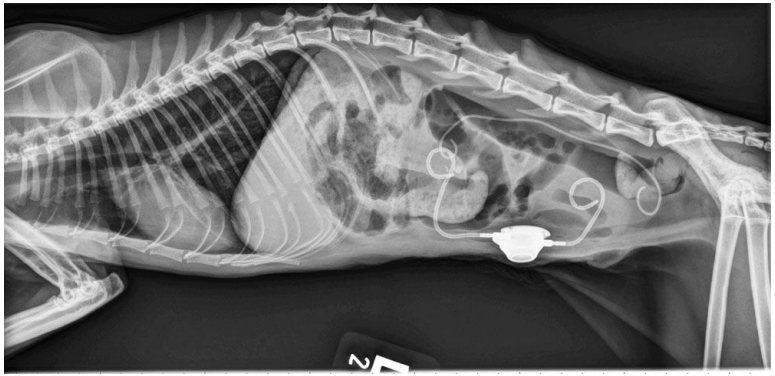
- Acute vs Chronic history
- Similar initial work up to urethral obstructions - depending on degree of illness
- Imaging
  - X-rays
  - Ultrasound
    - Degree of obstruction
    - Location of obstruction
    - Characteristics of obstruction
- Urinalysis
  - Pyuria/Bacteriuria
  - Crystalluria

Ureteral Obstruction - Treatment

- Stabilization and medical management
  - Improve patient condition prior to anesthesia
  - 8-13% of cases (cats) had successful stone management
    - Stone may just change position, risk for re-obstruction
  - Fluid diuresis, ureteral muscle relaxer (ex. prazosin), mannitol *
    - A similar approach to fluids can be used as for the obstructed cat HOWEVER need to be monitoring closely for oliguria/anuria
      - Body weight trends
      - Serial urinary bladder FAST scans
      - Direct urinary output monitoring
    - If no urine production?
      - Refer for surgery, interventional therapy, or dialysis

Ureteral Obstruction - Treatment continued

- No stone and pyuria/bacteriuria - Antibiotics
  - 10-30% of cats w/ ureteral obstruction have positive urine culture
  - Purulent plugs can cause proximal ureteral obstruction
- If no success in 24-48 hours need to move to more aggressive therapies
  - Surgical or Interventional
  - Intermittent Hemodialysis
    - For patients not stable for anesthesia



Ureteral Obstruction - Manual Obstruction Relief (Brief)

- Surgical
  - Ureterotomy, neoureterocystostomy, ureteronephrectomy, renal transplantation
    - 21% mortality ureterotomy
    - But still higher survival rates w/ surgery than medical management alone
- Interventional - often combination of surgical and fluoroscopic
  - Percutaneous Nephrostomy Tube Placement
  - Subcutaneous Ureteral Bypass Device
    - Initially alternative to stents but now becoming primary treatment method
    - Combination locking loop nephrostomy catheter and cystostomy catheter connected to SQ shunting port - re-routes urine around the affected ureter
  - Ureteral Stenting
    - Divert urine from renal pelvis to urinary bladder and encourage passive ureteral dilation
  - Extracorporeal Shockwave Lithotripsy
    - External shockwaves through water medium under fluoroscopic guidance
    - Different energy levels applied for implosion and powdering of the stone

Ureteral Obstruction - After

- Post obstructive diuresis
  - Similar management as in urethral obstruction cats
  - Greater risk for congestive heart failure associated with fluid overload
    - Consider combination of enteral and parenteral fluid therapy
    - Monitor weights carefully
- SUB or other device management
  - Bloodwork
  - Urinary ultrasound
  - SUB flush

Uroabdomen

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Uroabdomen

- Traumatic vs Non-traumatic

- Management
  - Stabilization
  - Diagnostics
    - Fluid Analysis + other labs
    - AFAST
  - Catheterization
    - Urethral
    - Peritoneal

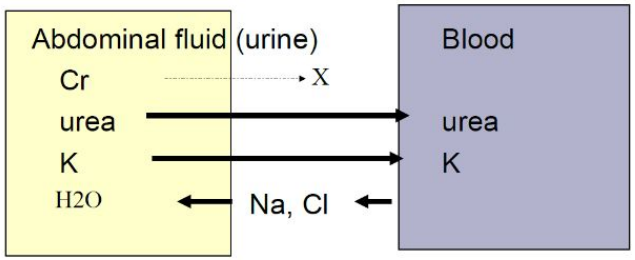
- Extra considerations for the septic uroabdomen

Uroabdomen

- Loss of integrity of urinary tract anywhere from kidneys to distal intra-abdominal urethra
  - Uroperitoneum or uroretroperitoneum depending on site of rupture
- Traumatic
  - Roughly 85-100% of cases
  - Blunt trauma
  - Penetrating trauma
  - Iatrogenic
    - ~50% of traumatic ruptures in cats
- Non-traumatic
  - Urinary obstruction
  - Neoplasia
  - Dehiscence

Uroabdomen - Why it's an emergency

- Rupture of urinary tract → accumulation of hyperosmolar, potassium rich urine in abdomen → osmotic pull of extracellular fluid (ECF) into peritoneal space (due to concentration gradient of Na and Cl) → 3rd spacing combined with decreased fluid intake and increased losses through vomiting → dehydration and shock, chemical peritonitis



Cr (abd) : Cr(blood) > 2:1

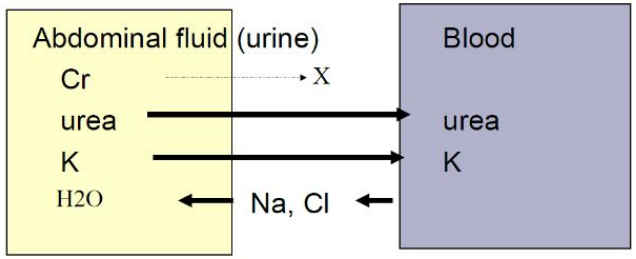
When urine is released into the peritoneal cavity, it is full of water, urea and potassium. The urea and potassium equilibrate with the blood, leading to abnormally higher levels of urea and potassium in the blood. The free water pulls sodium and chloride after it, leading to low levels of sodium and chloride in the blood. Creatinine cannot equilibrate so is useful to measure.

Recognizing a uroabdomen

- History
  - Trauma
  - Non-specific anorexia, vomiting, lethargy
- Signalment/Physical exam
  - Male or Female
  - Abdominal pain
  - Signs of shock/impaired perfusion
  - Palpable fluid wave +/- abdominal distension
  - Dehydration
  - Arrhythmias
  - Concurrent trauma signs

Recognizing a uroabdomen

- Labs
  - Azotemia
  - Hyperkalemia
  - Metabolic acidosis
  - Hyponatremia and hypochloridemia
  - Various others
- Imaging
  - X-rays
  - AFAST/Abdominal ultrasound
  - Contrast studies
  - CT/MRI



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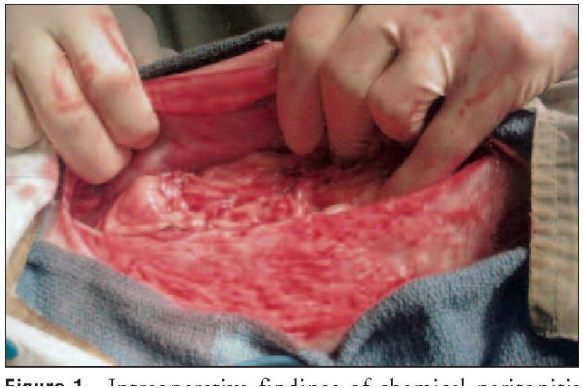
Recognizing a uroabdomen

- Abdominocentesis
  - Doesn’t tell where ruptured but confirms urine
  - Blood creatinine and potassium are compared to the creatinine and potassium of the abdominal fluid
  - Presence of organisms
    - Septic uroabdomen

	Abd Fluid:Peripheral Creatinine	Abd Fluid:Peripheral Potassium
Dog	>2:1	>1.4:1
Cat	>2:1	>1.9:1

Uroabdomen - Stabilization

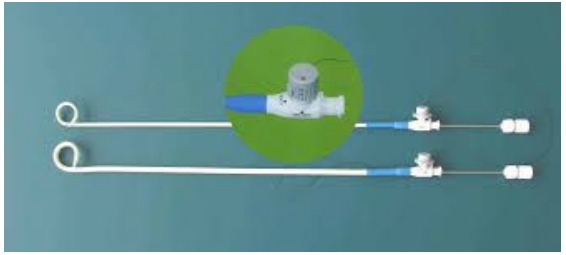
- Fluid therapy
  - Restore perfusion
  - Some of the same principles as UO cats - ok to use balanced electrolyte solutions
- Assess for concurrent injuries/conditions
- Analgesia!
  - Often concurrent trauma
  - Chemical peritonitis is painful
  - Pure mu best choice, careful w/ ketamine due to urinary excretion
- ECG monitoring
- Potassium Management
- Septic Uroabdomen
  - Golden hour for initiating broad spectrum antibiotic therapy
  - Pressor therapy



Uroabdomen - Treatment

Figure 6—A peritoneal drainage catheter pla

- Urinary diversion
  - Urinary catheter placement
    - Keep urinary bladder empty
    - Reduce urine accumulation w/n abdomen
  - Peritoneal drainage
    - Abdominocentesis
    - Placement of peritoneal catheter
      - Keep abdomen free of urine



- Repair of rupture
  - Medical management with diversion to allow time for site to heal
  - Surgical repair

Urethral Prolapse

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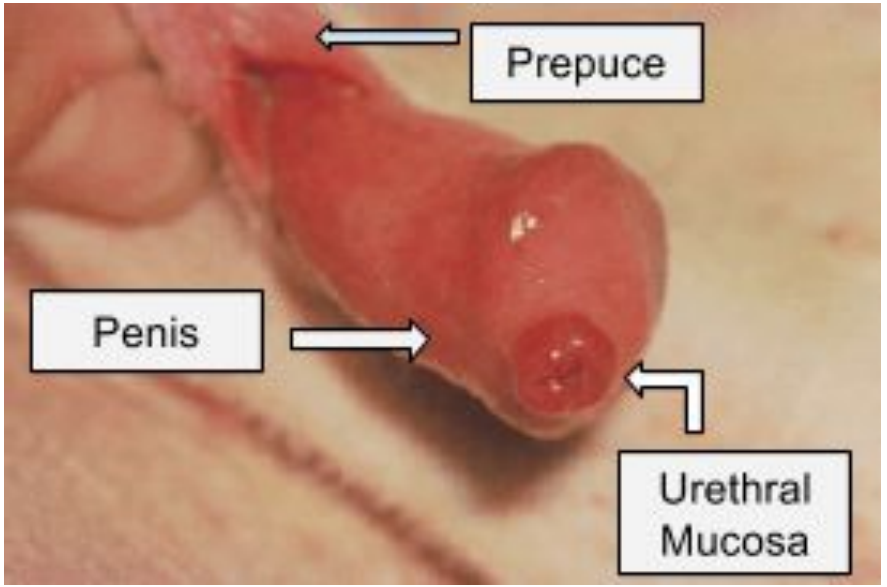
Urethral Prolapse

- Etiology
- Diagnosis
- Treatment



Urethral Prolapse

- Urethral mucosa everts beyond external urethral orifice
  - Susceptible to trauma
- Condition in male dogs
  - English bulldogs + other brachycephalic breeds, Yorkshire terriers
- Why it happens? Not fully understood but many theories
  - Respiratory difficulty
  - Sexual excitement
  - Urogenital/Prostatic disease
    - Prostatomegaly, urinary calculi
  - Developmental disease
  - Increased abdominal pressure causing impaired venous return to the distal urethra
    - Secondary to upper airway obstruction, chronic vomiting, or dysuria

Urethral Prolapse - Diagnosis

- History
  - Dripping blood
  - Urinating blood
- Signalment/Physical Exam
  - Male
  - English bulldog, other brachy, yorkie
  - Often intact
  - Observation of fleshy mass on distal urethral
    - “Cactus flower” vs “doughnut”
    - Can pass catheter through
- Full workup dependent on concern for other conditions
  - Often no underlying cause determined

Urethral Prolapse - Treatment

- Emergent Treatment
  - Hemostasis
    - Sedation
    - Prevention of self trauma
    - Topical vasoconstricting agents
- Definitive - replace prolapsed tissue
  - Sedation w/ manual reduction and placement of purse-string
    - Likely to recur
  - Anesthesia for surgical urethropexy
    - May also involve resection of prolapsed mucosa
- Concurrent castration
  - Often recommended but may not be correlated

Urinary Antibiotics

General considerations

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Urinary Antibiotic Considerations

- Incidence of infection
  - Urinary Tract Infections (UTI) are most common in spayed female dogs and least common in intact male dogs. They are more common in older dogs.
  - Bacterial UTI rare in cats
    - Young/healthy cats have innate resistance
    - Cats >10y and commonly w/ other conditions such as diabetes mellitus, hyperthyroidism, and CKD
  - Females - shorter urethras and closer proximity to anus
    - Males cats having undergone PU surgery

Urinary Antibiotic Considerations

- Causative bacteria
  - Most involve single bacterial species
  - E. Coli most common
  - Others include *Staph, Enterococcus, proteus, Strep,* and *Klebsiella spp.*
    - *Staphylococcus Felis* - unique strain that is normal commensal that can become pathogenic

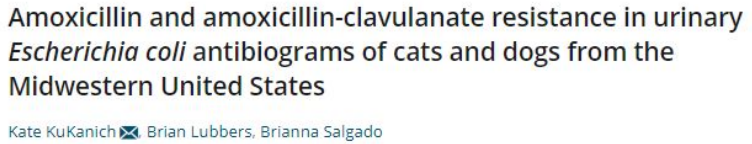
Prevalence of bacterial species in cats with clinical signs of lower urinary tract disease: recognition of Staphylococcus felis as a possible feline urinary tract pathogen

Annette Litster [1], Susan M Moss, Mary Honnery, Bob Rees, Darren J Trott

Urinary Antibiotic Considerations

- Diagnostics
  - Use of urinalysis and culture w/ sensitivity to make antibiotic choices is gold standard
    - Not all bacteriuria requires antibiotics
      - Consider number of colony forming units AND patient signs
        - >10x4cfu/mL is the “cut-off”
    - Bacteriuria + inflammatory cells + red blood cells
  - Culture post-catheterization
    - Ensure good catheter and collection system management to reduce risk
    - Ideally still cystocentesis
    - 2019 ISCAID guidelines for catheter associated bacteriuria
  - Stone and bladder wall cultures

Urinary Antibiotic Considerations


Amoxicillin and amoxicillin-clavulanate resistance in urinary *Escherichia coli* antibiograms of cats and dogs from the Midwestern United States

Kate KuKanich, Brian Lubbers, Brianna Salgado

- Empirical
  - Resistance is a thing (increasing urinary resistance to clavamox, fluoroquinolones, and 3rd generation cephalosporins)
  - Patient considerations
    - Simple?
      - Amoxicillin, cephalexin, trimethoprim-sulfa
      - Starting with 7 days - but overall recommendations for timing vary significantly
      - Culture 7 days post start (if not responding) and again 7 days post course
    - More complicated/septic?
      - Amoxicillin/ampicillin - clavulanic acid
      - Fluoroquinolone - be careful with enro in cats!
        - Cross resistance
      - Treatment may be necessary for weeks

Conclusions!

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Conclusions

- Urinary emergencies can often be saved (or at least significantly helped) by the first person getting hands on them - let it be you!
  - Potassium accumulation is your greatest immediate threat
- Don’t fight the urethra - relaxation/sedation and lubrication
- Medication, Nutrition, and Surgery all have their place
  - As does euthanasia
- Consider your antibiotic use carefully
  - Just because the owners want it, doesn’t mean the patient needs it :)

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QUESTIONS?

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