Urolithiasis in Small Ruminants

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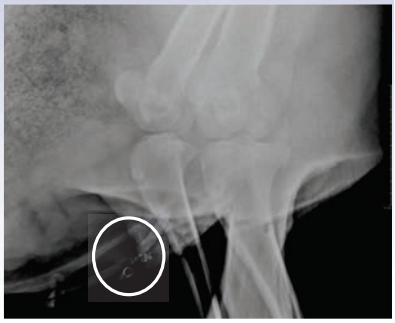
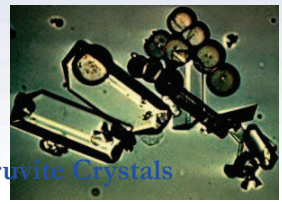


What is a urolith?

- Precipitate of minerals dissolved in urine
  - pure crystaline structure
  - crystals grow around nidus
- Composition (order of frequency)
  - Calcium phosphate
  - Calcium carbonate
  - Struvite: $MgNH_4P0_4$
  - Calcium oxalate
  - Silica



Struvite Crystals

Pathophysiology

- Urine is supersaturated solution
  - Inhibitors of crystallizaton
    - Mucopolysaccharides
    - Organic acids (e.g. citrate)
- ↑ [minerals] $_{urine}$ ➔ ↑ risk crystals forming
  - Dehydration ➔ urine concentration
  - Diet

Diet

- High dietary P➔ ↑ [P] urine ➔ struvite
  - Cereal grains ↑ P
- Pellets➔ ↓ saliva ➔ ↓ [P] $_{manure}$ ➔ ↑ [P] $_{urine}$

Urine pH

- Ruminants normally alkaline (~pH = 8)
- Influenced by DCAD
- pH affects solubility of minerals
  - Low pH improves solubility of
    - Struvite, $CaPO_4$, $CaCO_3$
  - Low pH may improve solubility of silica
  - No effect on calcium oxalate

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Obstructive Urolithiasis

- Sites of occlusion
  - Sigmoid flexure of penis
  - Urethral process

From: The Drost Project

Clinical Signs

- Colic-like signs
  - Restless, shift weight, switching tail, vocalize
- Frequent posturing to urinate
- Straining to urinate
- Dribble urine or no urine flow
- Crystals around prepuce

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Clinical Signs

- HR & RR high
- Pulsation in pelvic urethra (rectal palpation)
- Distended bladder - U/S
  - If not ruptured
  - If obstruction nearly complete/complete

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Photo courtesy of Steve Kneller, University of Illinois CVM

Clin Path w/ obstruction

- ↑ PCV & TP
- ↑ BUN (70 mg/dl) & creatinine (6 mg/dl)
  Vet Surg 2006 35:417
- ↑ Glucose
- P low but variable
  - 67% low vs 37% non-renal dz (JAVMA 2007 230:101)
- K normal, occasionally high (24% >5.2 mg/dl)
  Vet Surg 2006 35:417
- Alkalotic

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Urethral Rupture

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Urethral Rupture

- Pressure necrosis at obstruction
- Urine leaks into peritoneum &/or SC tissue
- Diffuse swelling of ventral abdomen
  - Pitting edema
  - Cellulitis
  - +/- Necrosis of skin
- Clin Path – similar to obstruction

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Bladder Rupture

- Initial relief of discomfort
- Progressive depression by 24 – 36 hrs
- Abdominal distension by 24 – 48 hrs
- U/S – fluid in abdomen
  - Uroperitoneum can exist w/o rupture
    - 12 of 63 cases uroperitoneum & intact bladder

Vet Surg 2006 35:417-422

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AAEP Proceedings 2012

Clin Path w/ Bladder Rupture

- ↑ PCV & TP
- ↑ BUN, creatinine
- ↑$[K]_{serum}$, $[P]_{serum}$ over time
- Alkalotic early, acidotic later
- ↓ $[Na]_{serum}$,$[Cl]_{serum}$ – shifts to perit. Cavity
- Abdominocentesis
  - $[Creat]_{perit}$: $[Creat]_{serum}$ >2:1
    - Detectable within 2-4 hours of rupture

JAVMA 2007 230:101

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Treatment options

- Urethral process amputation
- Penile amputation
- Cystocentesis & instill acidifying solution
- Percutaneous tube cystotomy
- Tube cystotomy
- Bladder marsupialization

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Treatment Considerations

- Short term morbidity/mortality
  - Metabolic derangements 2º to obstruction
  - Stabilize patient first
- Long term survival & function

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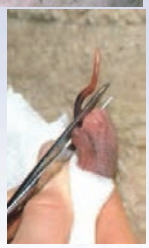
Treatment: Ruptured bladder

- Necrosis = difficult repair
- Euthanasia

Advances in Animal & Veterinary Sciences 2014

Urethral Process Amputation

- Sedate
  - A benzodiazepine or ace
- Exteriorize penis
  - Palpate for cacluli
  - Amputate
- 50% urinate after amputation
- 80% re-obstruct w/in hours-days



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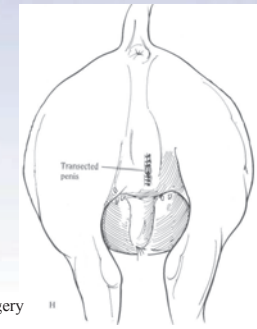
Penile Amputation

- Salvage procedure for production animals
- Advantages
  - Quick
  - Inexpensive
- Disadvantages
  - Loss of breeding ability
  - Urine scald
  - Stricture of urethra



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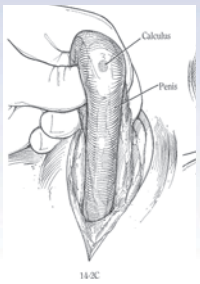
Penile amputation

- Caudal epidural
- Perineal incision
- Dissect penis free
- Transect penis
  - Remove distal portion if possible
    - Necrosis – loose attachments
- Incise urethra & suture mucosa to penis
- Secure penis to incision margin



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Penile Amputation

Cystocentesis & dissolution

- Drain ~ 50% urine
- Instill Walpole's solution to dissolve stones
  - Sodium acetate (1.16%) + glacial acetic acid (1.09%), pH = 4.5
- Repeat process until urine pH= 4-5
- Monitor ~ 24 hrs for improvement
- Repeat once prn
- 80% success…
  - Janke, J., et. al. JAVMA 2009 234:249-252

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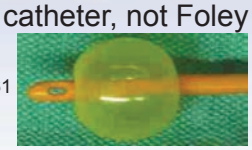
Percutaneous Tube Cystotomy

- U/S guided
- Report of high failure rate
  - 50% dislodged, required 2nd sx
  - Avg 8 days until 2nd sx
  - Used Malecot catheter, not Foley
    - No balloon

Vet Surg 2004 33:661



Percutaneous Foley catheter

Cook Medical

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Percutaneous Tube Cystotomy

- Case report of long term success
  - 3 mos. old intact male Boer goat
  - Used Foley catheter
  - Catheter removed d. 12 after normal urine flow

JAVMA 2002 221:546

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Tube Cystotomy

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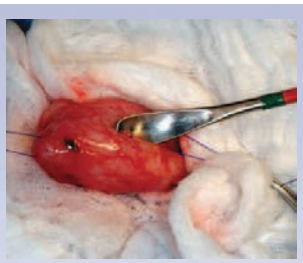
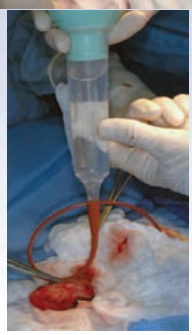
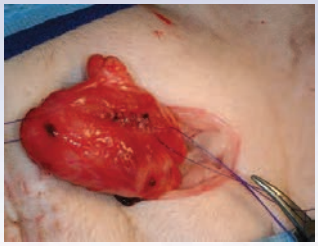

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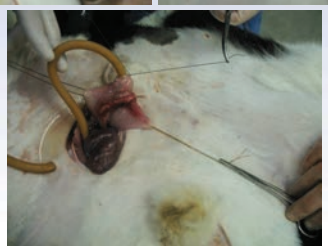
Tube Cystotomy





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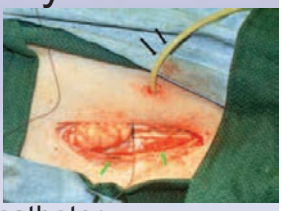
Tube Cystotomy



- Post-op
  - Antibiotics
  - Pain relief – NSAID
  - Day 3 Intermittently occlude catheter
    - Watch for discomfort (bladder distension)
  - Remove catheter when
    - animal can urinate
    - remain comfortable for > 24 hrs with catheter occluded

ACVS: Fubini

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Tube Cystotomy

- Avg. time to urination = 11 ± 8 days
- Avg. period of hospitalization = 13 days
- 75% success rate
- Predictors of survival
  - Serum K < 5.2 mg/dl
  - No fluid in abdomen
  - Species = goat (vs sheep)
    - Vet Surg 2006 35:417

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Post-op Dissolution of Calculi

- Ammonium chloride – acidify urine
  - 100 mg/kg/day
  - Measure urine pH
  - Adjust dose gradually for pH ~6.5
  - 4 weeks

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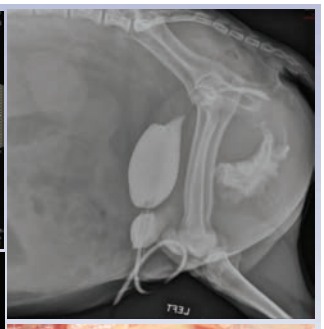
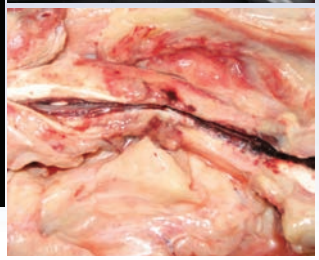
Poor Outcomes





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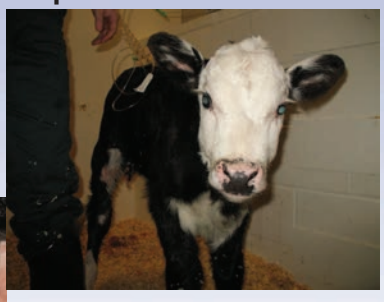
Bladder Marsupialization



Epidemiology

- Species: goats ≥ sheep > cattle
- Gender: M/C > M >> F
  - Females equally likely to ***form*** uroliths
  - Females much less likely to ***obstruct***
    - Lg. diam, short, straight urethra
- Age: $\mu \cong$ 12 mos (R = 2-94 mos) Vet Surg 35:417-422
- Breed: Pygmy & Dwarf Nigerian goats, Merino sheep

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Prevention

- Water: Clean, palatable, available
- Salt: 1-2% DM; up to 4%
  - Promote water intake, dilute urine
- Minimize grain feeding for pets
- Use NRC guidelines for Ca, P & Mg
  - Max P ~ 0.35% DM
  - Max Ca ~ 0.5% DM mature, 1.0% growing
  - Ca:P of ~2:1 – 1.2:1 (growth vs maintenance)
  - Max Mg ~0.35% DM (0.2% adequate)

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Prevention: Urine acidification

- Neg DCAD diet
  - $CaCl_2$, $MgCl_2$
  - BioChlor, SoyChlor
- Short term during periods of risk (~30 d.)
  - Historical season of problem
  - Recent cases
- Long term feeding: ↓ bone density
- Monitor urine pH

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Prevention

- BioChlor in goats (AJVR 2004 65:1391)
  - Product was palatable
  - ↑ water consumption by 40% (1.1 vs 3.2 L/d)
  - ↑ urine volume
  - ↓ blood pH (7.30 vs 7.35)
  - ↑ fx exrection Na, K, Ca, P

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Summary

- High value males: tube cystotomy ASAP
- Pets: tube cystotomy ASAP
- Others: penile amputation
- Feed salt
- Fresh water
- Urinary acidification prn
- Friends don't give friends M/C goats as pets

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Questions

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