# UROLITHIASIS IN SMALL RUMINANTS

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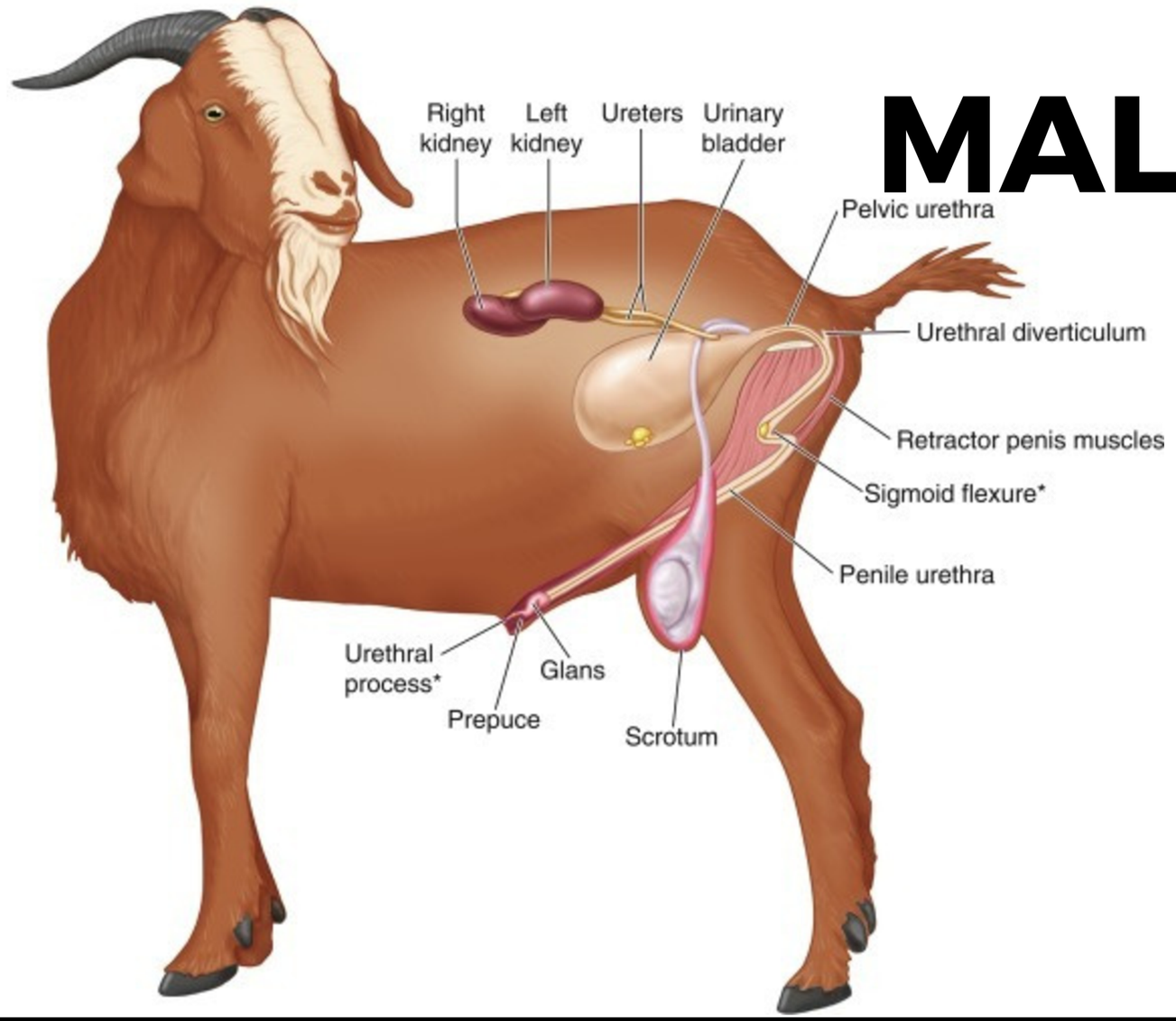
# LEARNING OBJECTIVES

At the end of the lecture, attendees should be able to:

1. Review terminology, physical exam findings and common causes of urolithiasis in small ruminants
2. Discuss stone types and why these are important for prognosis
3. Discuss physical exam, diagnostics and treatment options for urolithiasis in small ruminants

# UROLITHIASIS

- Most common small ruminant emergency (Jones et al. 2012)
- Can be fatal if untreated
- **Multifactorial etiology**
- Treatment is dictated by stone type, economics, animal use, patient status
    - Surgery is often necessary




# MALE ANATOMY

- Top sites:
  - sigmoid flexure—2 tight turns
  - Urethral process (aka vermiform appendage)
  - Pelvic urethra/throughout urethra

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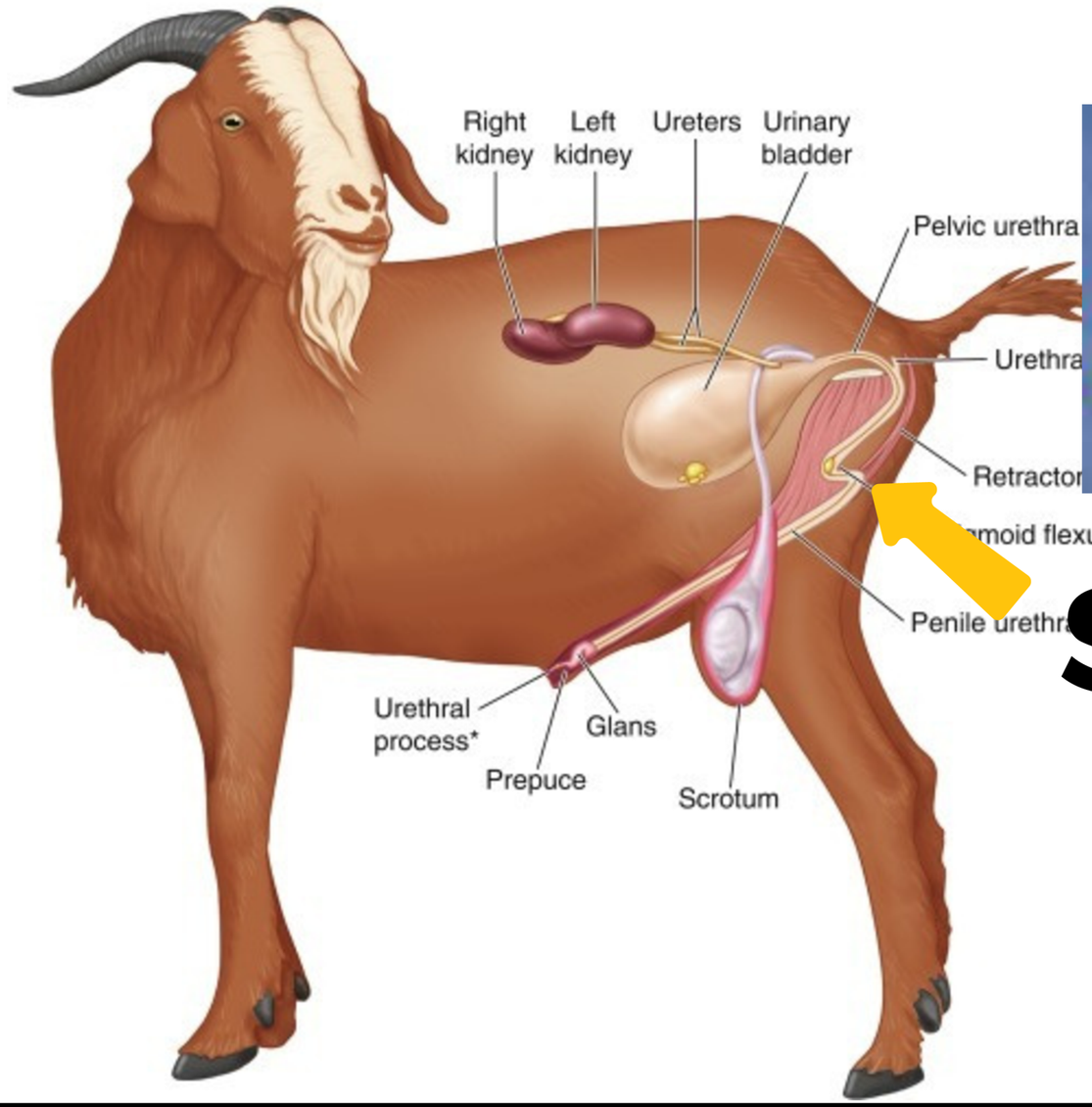


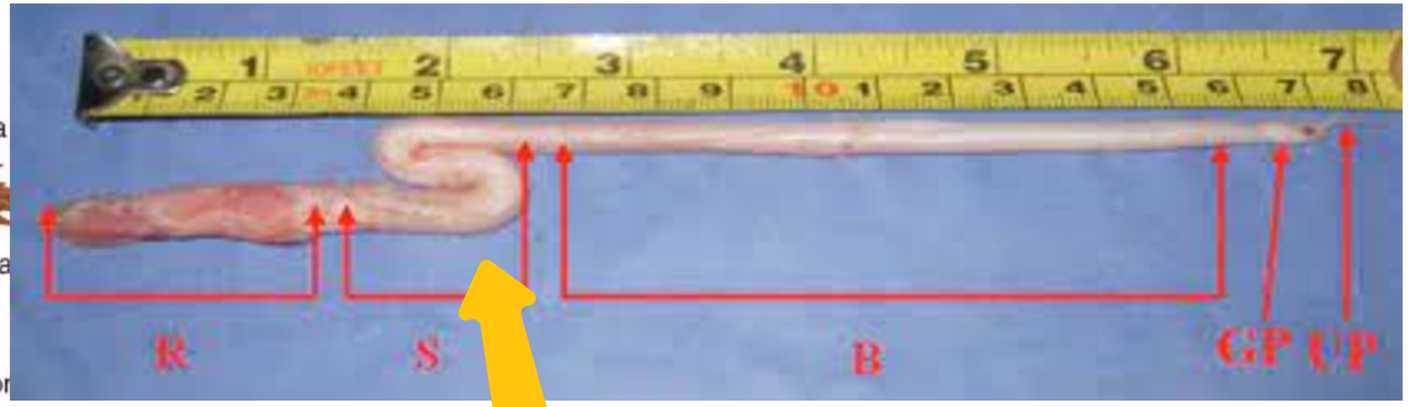


# SIGMOID FLEXURE

- “S” Shaped curves
- Makes retropulsion of stones very difficult

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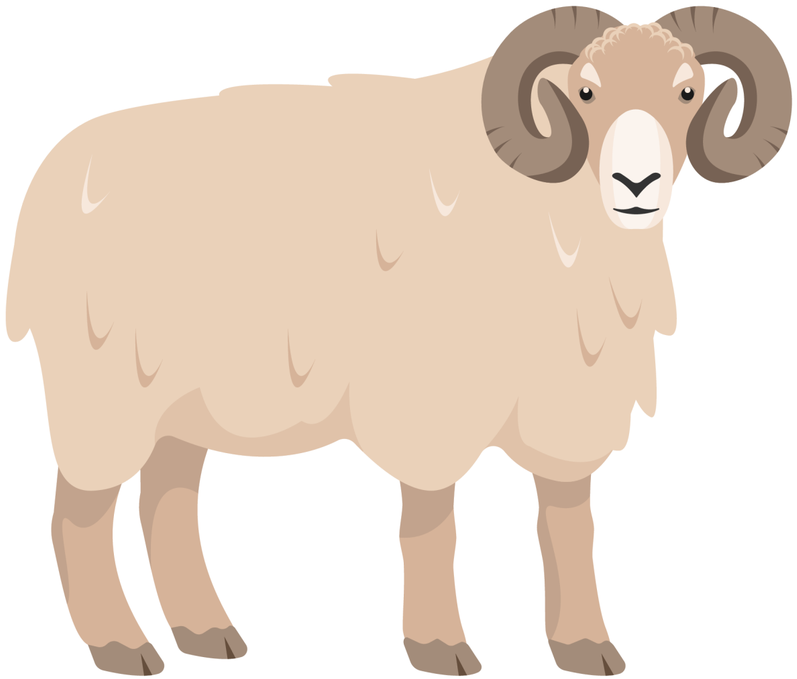
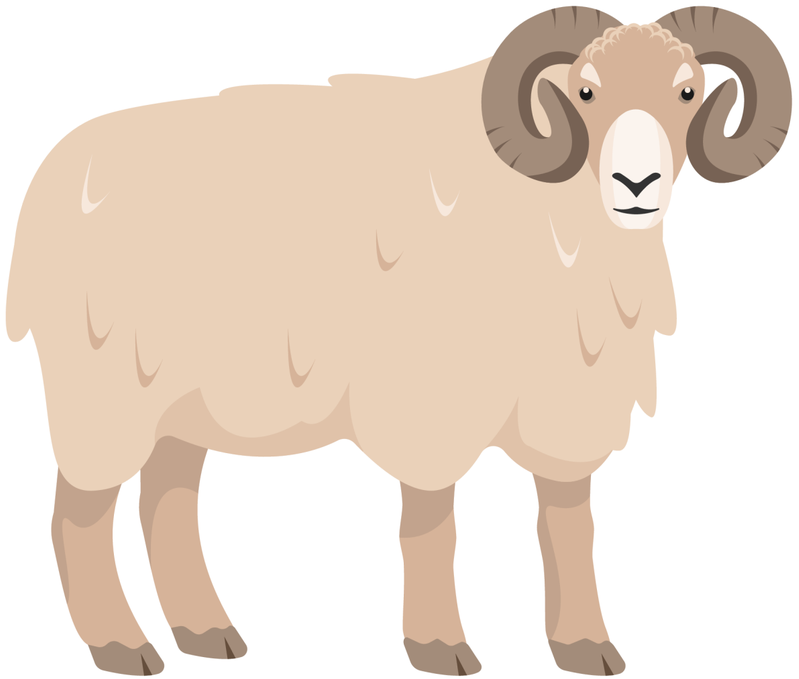


# PREDISPOSING FACTORS

- **Castrated male > intact male > female**
  - Testosterone influences urethral diameter (mostly in sheep)
- Water consumption
- **Diet**
- Urine pH (Normally alkaline due to K+ in forages)
- Stress
- Genetic Factors (?)
  - Confirmed in humans, dogs, cats



# TYPICAL SIGNALEMENT

- Males overrepresented
  - Both males/females are at risk
  - Male anatomy is their downfall
- Age is NOT protective
  - 1 month to 7 years in our clinic

# INFLUENCE OF DIET

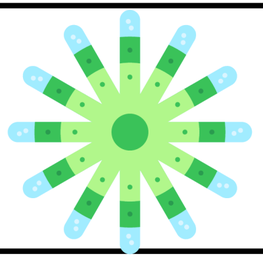
| Struvite and/or Calcium Phosphate | Calcium Carbonate and/or Calcium oxalate |
|---|---|
| High concentration diets (Grains) | Legumes (alfalfa) |
| Diets high in Ca, Mg, and/or P | Apples |
| Low Ca:P Ratio (Ideal: 2:1) | Sweet Potatoes |
| | Pigweed |

# MOST COMMON STONE TYPES

| Magnesium-Ammonium-Phosphate | Calcium Carbonate | Calcium Phosphate |
|---|---|---|
| “Struvite” - Chalky/crumbly | “Copper BBs” | “Apatite” |
| Form in urine pH 7.2 - 8.4 | Form in alkaline pH > 8 | Form in urine pH 6.5 - 7.5 |
|  |  |  |

Peerapen, Paleerath et al.Advances in Nutrition, Volume 14, Issue 3, 555 - 569

# LESS COMMON STONE TYPES

| Calcium Oxalate | Silicate |
| --- | --- |
| “Dumbells, Envelope, ovals, picket fences” | More common in Western US and Canada |
| Formed when grazing oxalate-containing plants | Formed when grazing on high silica soils |
|  | When dehydrated, silica binds to urinary mucoproteins to form stones |
| |  |

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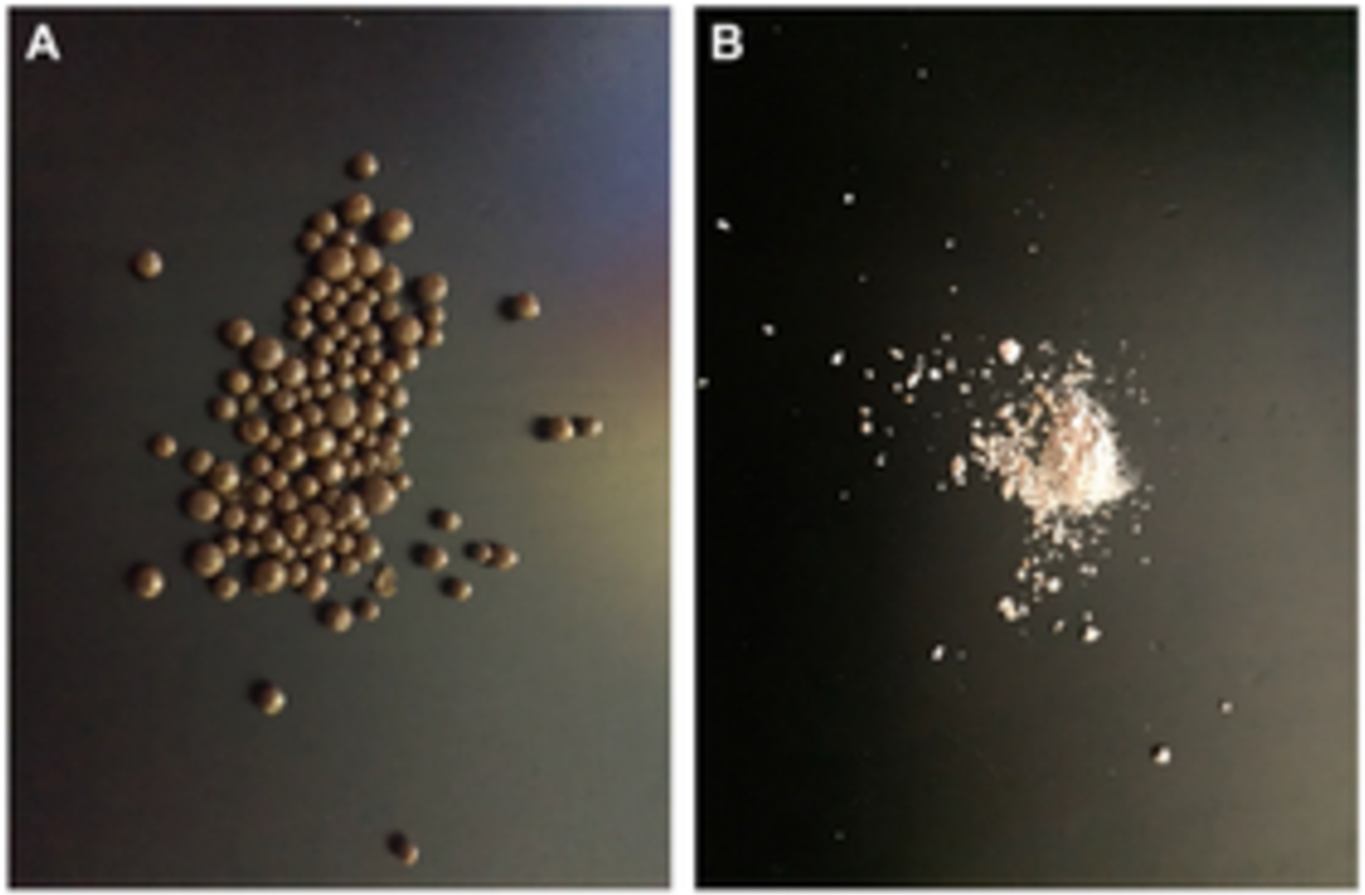



**Fig. 2.** (*A and B*): Typical appearance of calcium carbonate uroliths (gold beads) versus phosphatic uroliths (sand).

# COMMON STONES

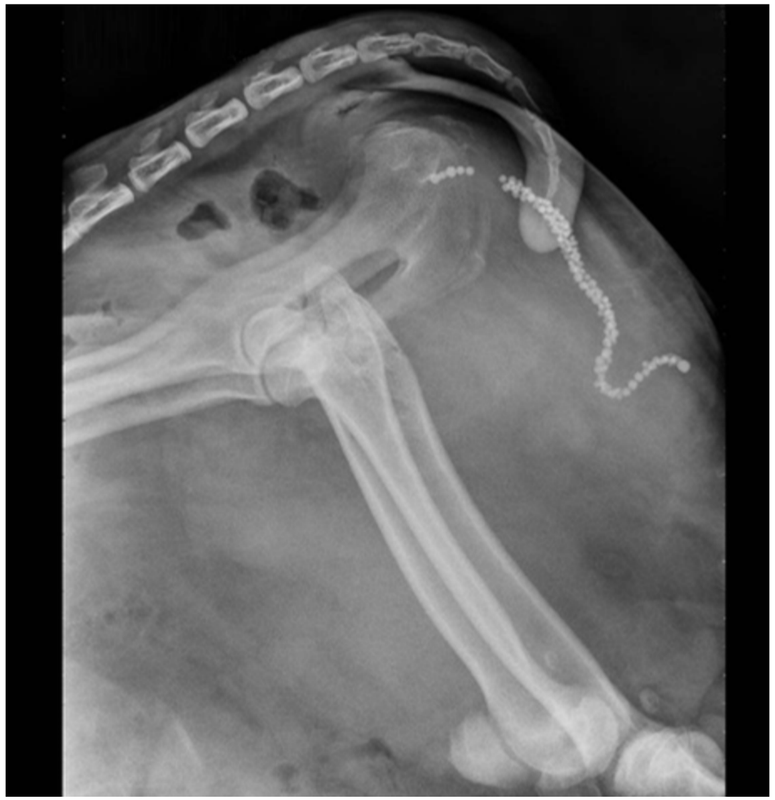
Cook MJ. Urinary Calculi of Small Ruminants. Vet Clin North Am Food Anim Pract. 2023 Jul;39(2):355-370. doi: 10.1016/j.cvfa.2023.02.006. Epub 2023 Apr 7. PMID: 37032300.

# CLINICAL SIGNS

- Variable!
  - **Any wether who is ADR is suspicious!**
  - “Straining to defecate”
- Anorexia, depression, off-feed, **bruxism**, tail wringling
- **Stranguria, straining, stretching**
- Vocalizing, restlessness, pacing
- Abdominal distension, urethral pulsing on rectal
- Crystals on prepuce
- Ventral edema

# CLINICAL MANIFESTATIONS

- Complete/partial urethral obstructions
- Bladder Rupture
- Urethral Rupture
- Hydroureter
- Urethral stricture
- Hydronephrosis
- Ureterolithiasis (rare) +/- nephrolithiasis (rare)
- Kidney rupture (rare)



# URETHRAL RUPTURE

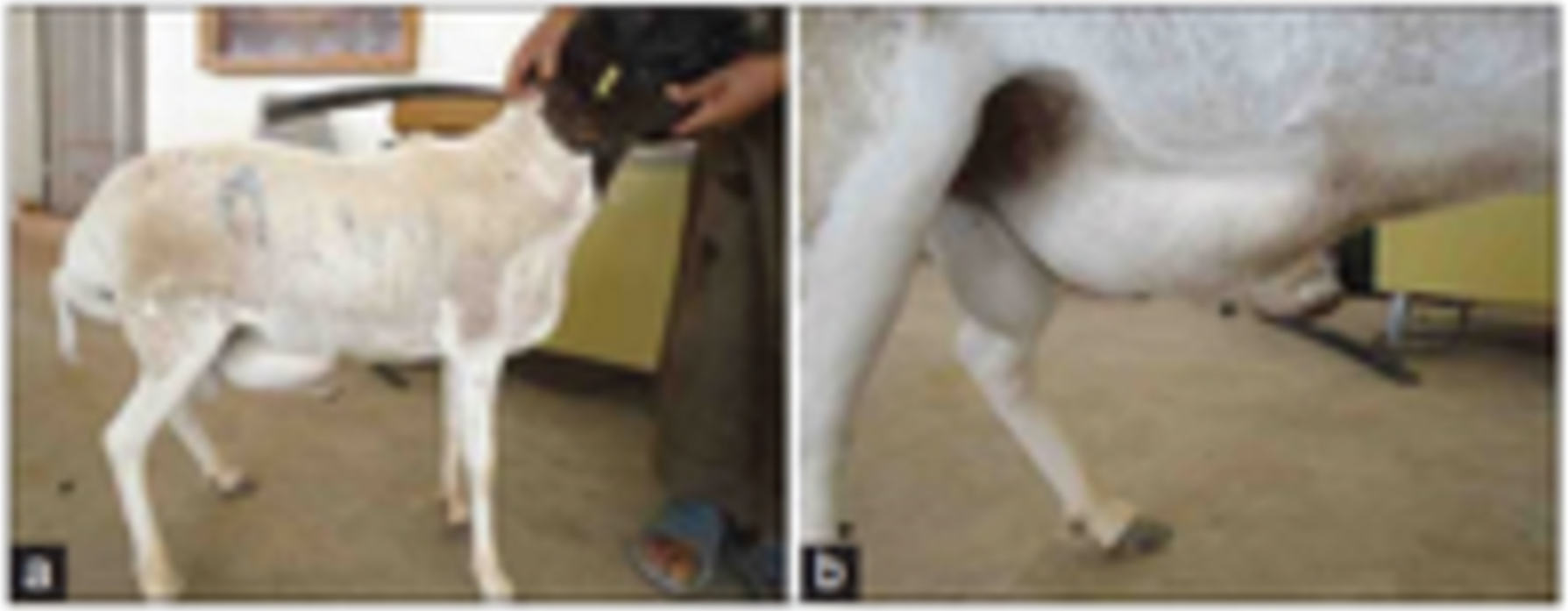


**Figure-8:** (a) Ruptured urethra in a ram; (b) close-up view

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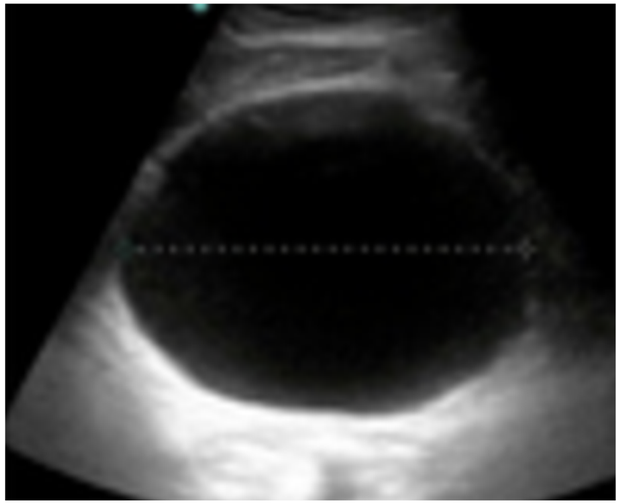
# DIAGNOSIS

- **Palpate Bladder**
  - Abdominal: Small ruminant
- **Palpate urethra**
  - Digital rectal exam
  - Perineal skin ventral to anus
- **Exteriorize penis**
  - Needs heavy sedation or general anesthesia
  - **AVOID ALPHA 2's** (dexmedetomidine/xylazine) due to diruesis
  - Lumbosacral epidural 2% lidocaine
    - Toxic dose lidocaine: 5 mg/kg TOTAL

# DIAGNOSIS

- **Ultrasound**
  - Bladder - > **6-8 cm diameter is enlarged**
  - Urethra
  - Ureters
  - Kidneys
- **Radiographs**
  - Useful for calcium carbonate
  - Struvite typically not visible
- **Bloodwork - electrolytes, creatinine, PCV/TS**
  - **May help prognosticate and guide treatment**



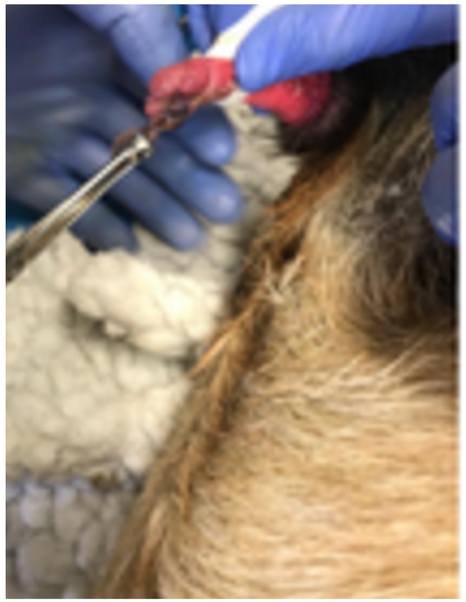
**Enlarged intact bladder**

# CLINICAL PATHOLOGY

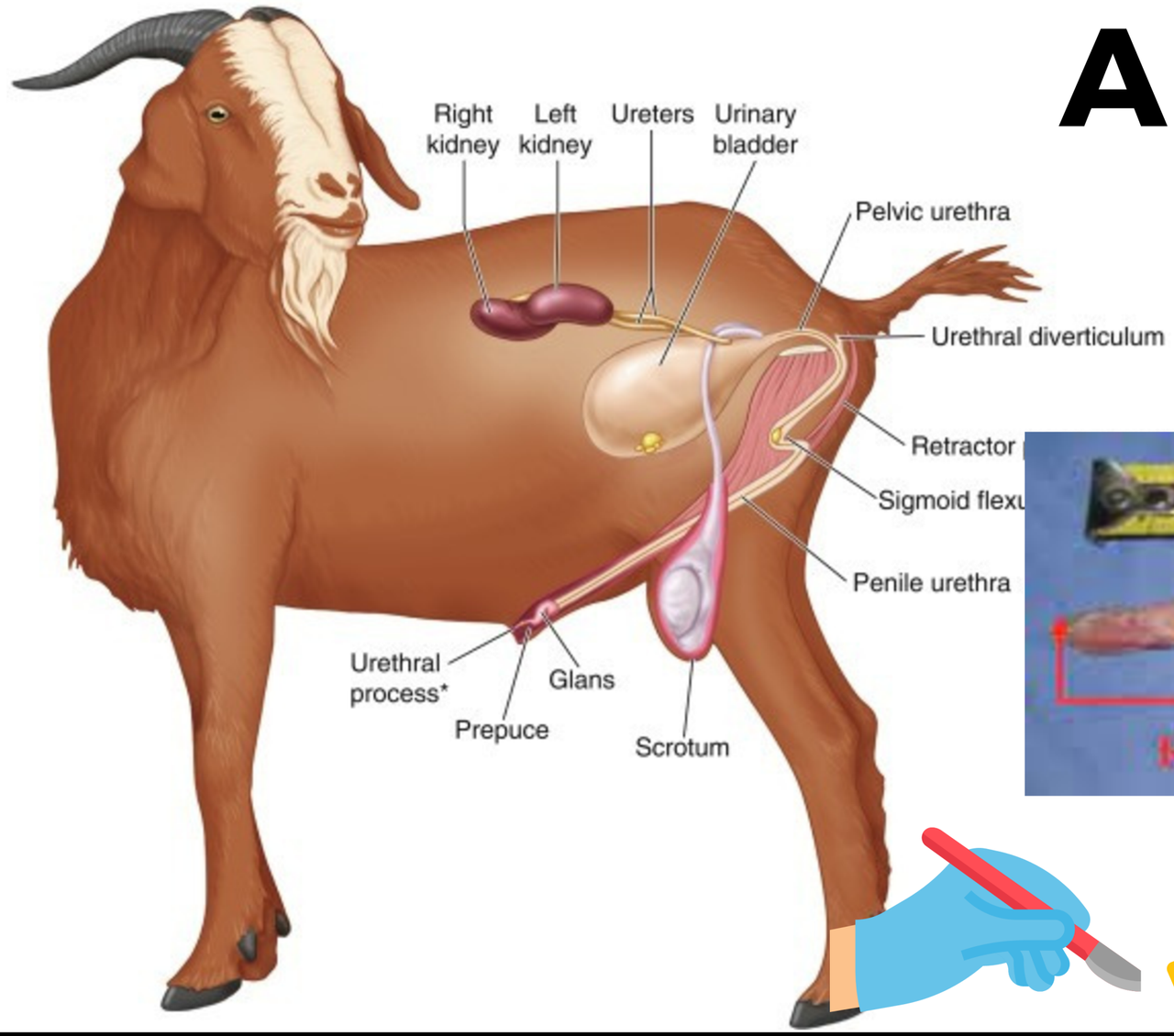
- **May be normal in early cases**
  - Elevated creatinine
  - Hyponatremia
  - Hypochloremia
  - Hyperkalemia
  - BUN normal until late stage
  - Hyperlactatemia
  - Hemoconcentration

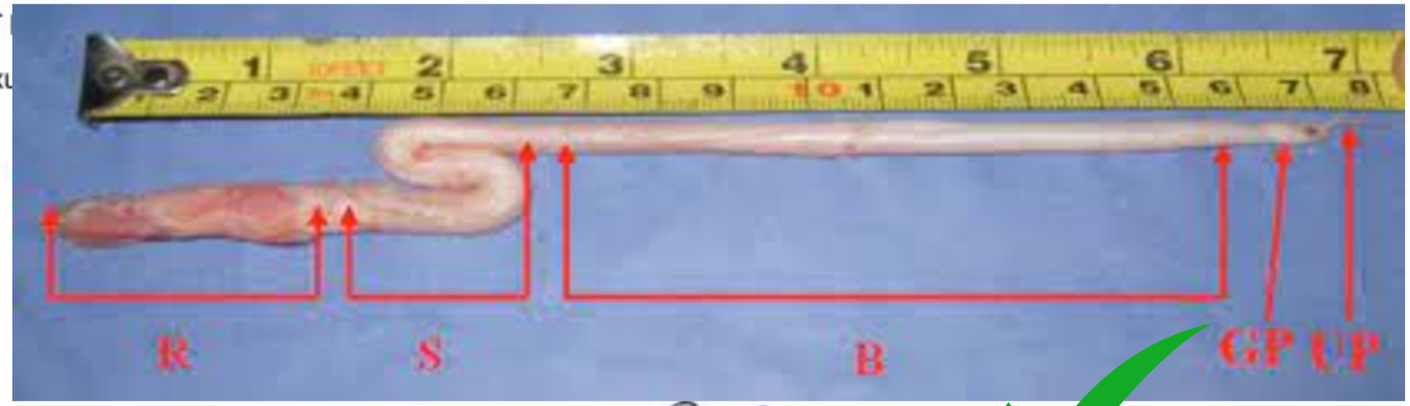
# MEDICAL STABILIZATION

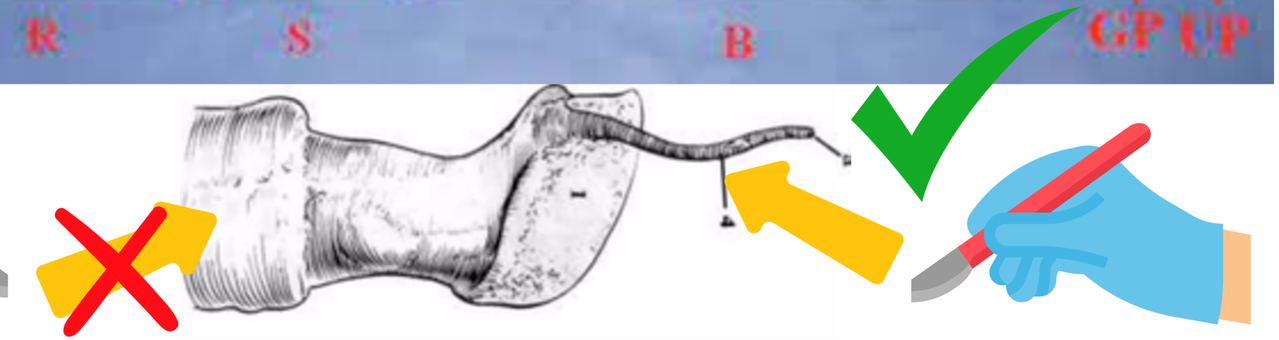
- **Goal: Temporary Relief of Obstruction**
  - Urethral process amputation
    - Scalpel or scissors- 45 degree angle
  - Urinary diversion
    - Temporary percutaneous bladder placement
  - Urinary Acidification
    - Walpole's - pH 4.5 - High risk of mucosal damage
    - Ammonium Chlorhide



# AMPUTATION OF URETHRAL PROCESS



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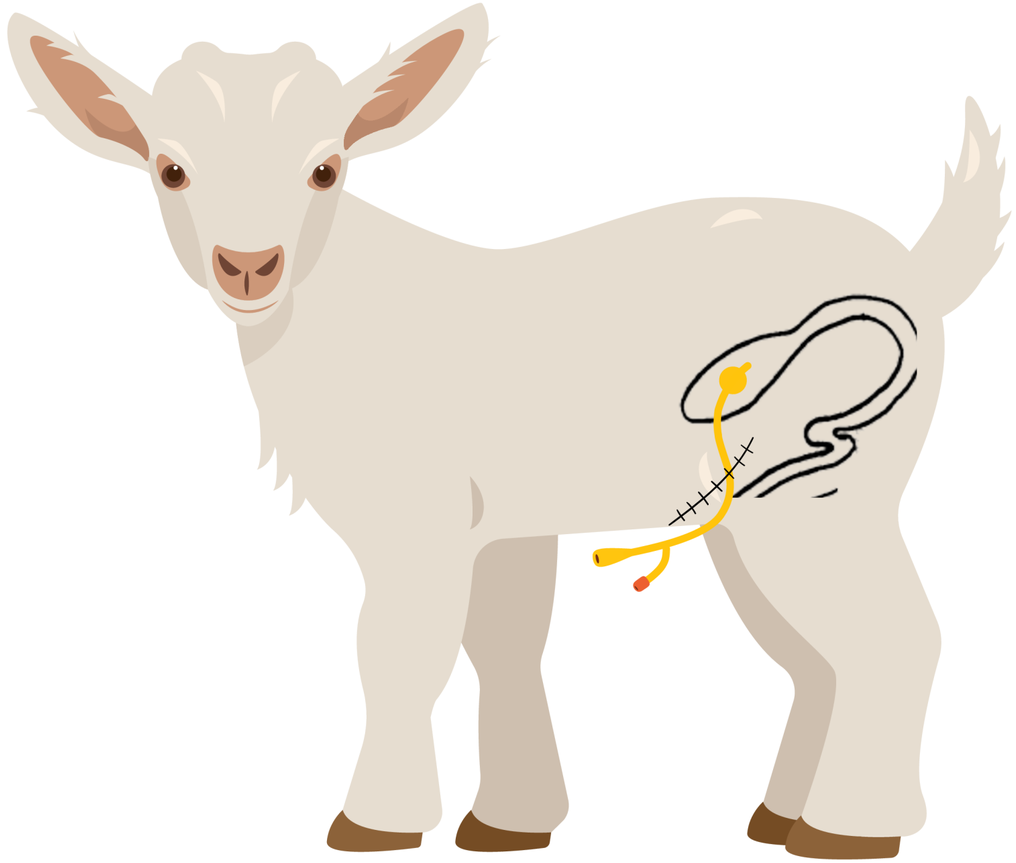
# SURGICAL MANAGEMENT

- **Breeding animals and pets**
  - Urinary diversion: Tube cystostomy
    - +/- Urethrotomy at site of obstruction
    - Bladder marsupialization
    - Vesiculopreputial anastomosis – modified urinary bladder marsupialization



# TUBE CYSTOSTOMY

- Most popular surgical technique
  - **Success rates 48-86%**
- **Goal:** Placement of a Foley catheter into the bladder lumen via a laparotomy to temporarily divert urine, decreasing urethral spasm and inflammation, and allowing spontaneous passage of calculi and acidification of urine
  - Possibility to close the defect in case of bladder rupture

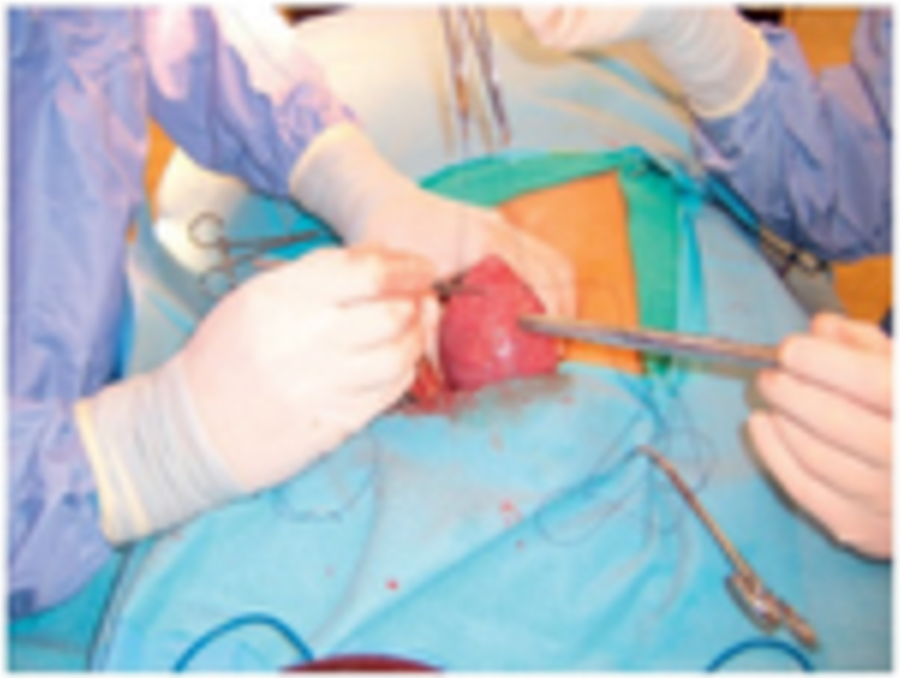
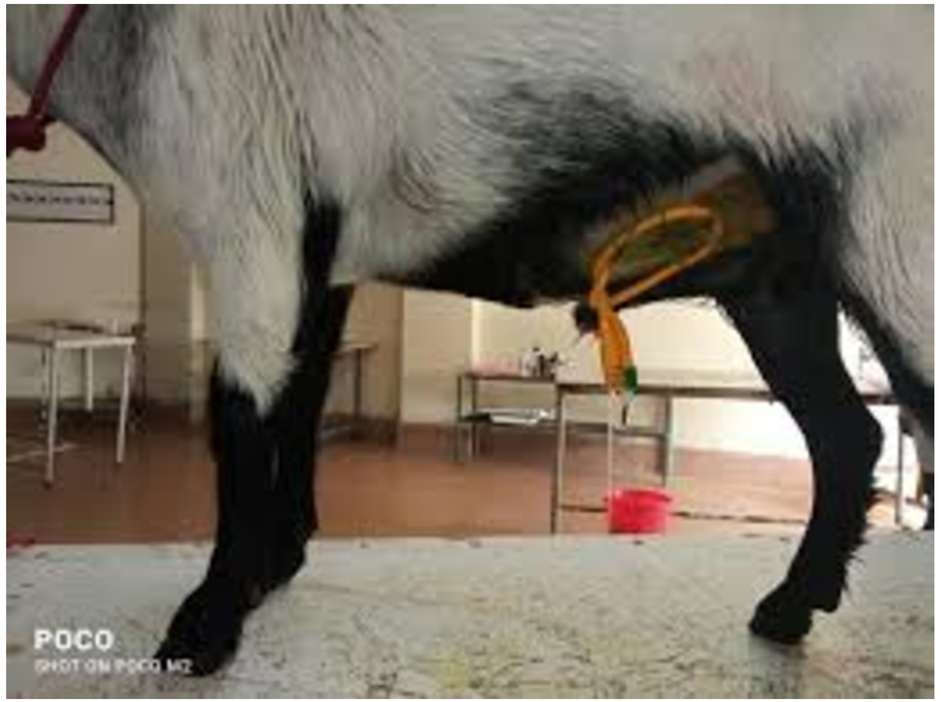


Figure 23-44 Ventral paramedian celiotomy exposing the urinary bladder, which is supported with stay sutures in preparation for cystotomy.

Chapter 23, Farm Animal Surgery, 2nd edition.

# TUBE CYSTOSTOMY

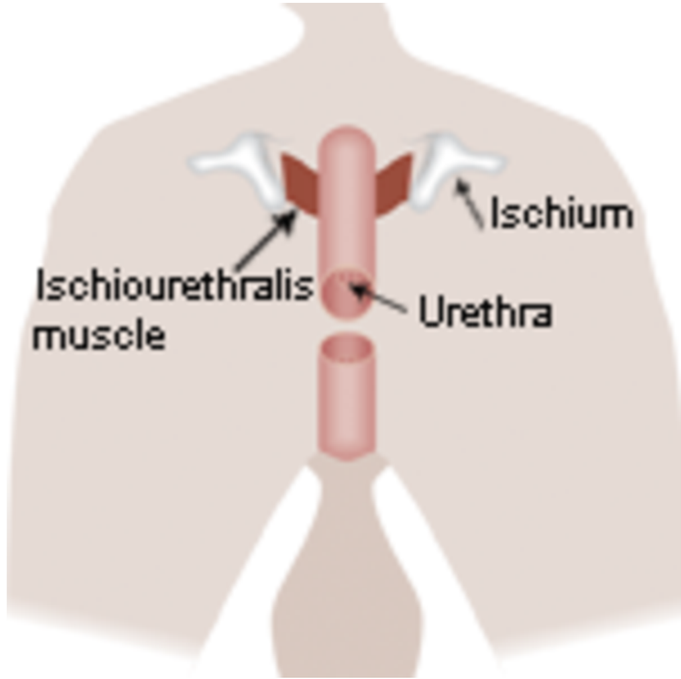
- **Postop management**
  - Foley checked for patency several times per day
  - “Challenge”: catheter clamped shut for a few hours
    - <u>Under direct supervision</u>
    - Increase progressively the length of time the catheter is occluded
    - Catheter removed once urethral patency normal for 1-2 days (with Foley catheter occluded)
  - At least 7 days after surgery
  - **Average of 14 days after surgery**
    - (Rakestraw et al 1995)
- Antimicrobial therapy (beta-lactams)
  - Duration? - Our hospital - while tube is in




**Interested in technique video?**
**https://largeanimalce.com/product/course-46-tube-cystostomy/**

# SURGICAL MANAGEMENT

- **Procedures with limited long-term success (used in production food animals)**
  - Perineal urethrostomy (PU)
  - Modified Proximal Perineal Urethrostomy
    - New technique; longer term success that traditional PU
    - More issues with hemorrhage than traditional PU (Oman et al JVIM 2019)




**High risk of strictures in ruminants**


**Figure 1**—Decision tree for treatment considering finances for referral of small ruminants with urinary obstruction.

Mejia S, McOnie RC, Nelligan KL, Fubini SL. Small ruminant urinary obstruction: decision trees for treatment. JAVMA May 2022.

# PREVENTION

- Depends on type of stone
- **Type of stone difficult to predict in small ruminants**
- Need analysis
  - Minnesota Urolith Center
  - UC Davis Urinary Stone Analysis Laboratory
- Preventive measures will not dissolve stones already formed
    - Struvite?

# PREVENTION

- Delay castration as long as possible
  - > 6 months
- Recommend females for pets
- Water management
  - Clean water, under shelter
  - Warm water in winter
- Urinary Acidifiers
  - Ammonium Chloride
  - Methionine
  - **Must ensure appropriate dose by monitoring urine pH (Goal is 6-6.5)**
  - Recommend “pulse dosing” not continual use (body will adjust)

# PREVENTION

- **Avoid grain and legume hay**
- Maintain on good quality grass hay + loose trace mineral including salt and vitamin A

- **Breeding/Production Animals:**
  - Try to keep grain supplementation < 25%
  - Calcium:Phosphorus ratio of 2:1
  - Proper amounts of Ca, P, Mg
  - Avoid excess protein

# QUESTIONS?

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