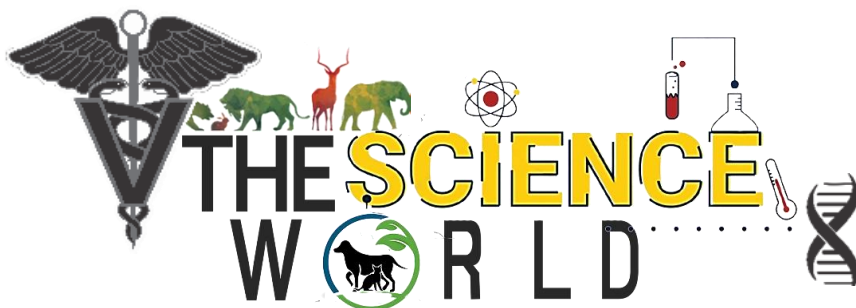




A Monthly e Magazine

ISSN:2583-2212

Popular article

June, 2026 Vol.6(6), 1815-1819

Urolithiasis in Small ruminants-Anatomical factors and Surgical Management

Nandha Menon¹, Sajin S V¹, Vaishnav R¹, and N S Sunilkumar²

¹BVSc&AH graduate students

²Assistant Professor, Department of Veterinary Anatomy

College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala, India

Kerala Veterinary and Animal Sciences University

doi.org/10.5281/ScienceWorld.21261202

Abstract

Urolithiasis is an important urinary tract disorder of sheep and goats that frequently results in life-threatening urethral obstruction, particularly in males. The condition develops due to interactions among nutritional, metabolic and management factors, including high-concentrate diets, mineral imbalances, inadequate water intake and early castration. Male small ruminants are especially predisposed because of unique anatomical features such as the narrow pelvic urethra, sharp bend at the ischial arch, sigmoid flexure and urethral process, which favour entrapment of urinary calculi. Affected animals exhibit colic, repeated straining and inability to urinate, requiring prompt diagnosis and surgical intervention. Common surgical procedures include urethral process amputation, tube cystostomy and perineal urethrostomy, selected according to the site and severity of obstruction. Since treatment can be challenging and recurrence is common, emphasis should be placed on preventive strategies including balanced nutrition, adequate water intake, appropriate calcium-to-phosphorus ratio, sufficient roughage and proper castration practices.

Introduction

Urolithiasis is a metabolic and nutritional disease characterised by the formation of solid mineral concretions or calculi within the urinary tract, from the renal pelvis to the distal end of the urethra. Under normal circumstances, these crystalline aggregates pass out of the body without noticeable clinical consequences. However, when a stone lodges in the narrow passages of the lower urinary tract, it causes partial or complete urinary tract blockage, resulting in obstructive urolithiasis—a peracute, life-threatening emergency. While both male and female small ruminants produce stones, clinical obstruction is predominantly seen in male sheep and goats. This gender predisposition is mainly dictated by distinct anatomical features, coupled with intensive management practices like high-grain feeding.



Etiology and Risk Factors

The three most common factors that contribute to Urolithiasis are factors that favour development of nidus, precipitation of solutes on the nidus and concentration by cementing precipitated salts to developing calculus.

1. **Nidus Development:** The baseline matrix or "nidus" originates from the sloughing and accumulation of desquamated epithelial cells from the urinary bladder wall. This desquamation is heavily accelerated by severe Vitamin A deficiency (which causes squamous metaplasia of the urothelium) or localised urinary tract infections (UTIs).
2. **Precipitation of Solutes:** Ruminant urine is naturally highly saturated with mineral ions. Reduced water intake, high ambient temperatures, or excessive mineral excretion can tip the system toward supersaturation, causing minerals to precipitate directly onto the organic nidus. If fed with high quantities of concentrates especially to breeding rams and goats, rich in phosphorus deficient in Ca, or high in Mg can also lead to stone formation.
3. **Calculi Growth:** The organic component in calculi formed is usually a mucoprotein which acts as a cementing agent. It favours formation of calculi when precipitates are present.

The amount of calculus material, size of individual calculi and diameter of urethra determine the risk of the condition to the animal.

Anatomical predisposition in male small ruminants

Male small ruminants are usually more predisposed to obstructive urolithiasis than females due to anatomical differences. Females have short and wide urethra whereas males have longer, narrower and has three other significant peculiarities which are absent in females. These are the sharp curve of pelvic urethra at ischial arch, sigmoid flexure and the urethral process.

Common obstruction sites

- a) **The Ischial Arch and Pelvic Urethra:** As the pelvic urethra exits the caudal floor of the pelvis, it curves sharply ventro-cranially over the ischial arch to continue into the penile urethra.
- b) **Sigmoid flexure:** it is an S shaped bend in the penile urethra. Because of this bend and relatively narrow lumen calculi may become trapped here.



- c) **Urethral process/Vermiform appendage:** It is a thin tubular extension present at the tip of penis in sheep and goat. Even very small calculi can obstruct this site.

The Castration Effect: Castrating male animals at a very early age (under 4 months) removes testosterone-driven updates to the urogenital tract. Deprived of testosterone, the penile urethra fails to grow to its full potential diameter, leaving the animal with an permanently hypoplastic, narrow lumen that increases the risk of early stone obstruction.

Pathogenesis and Risk Factors

The urolith formed may lodge within the narrow portions of urinary tract creating obstruction. As urine accumulates behind the level of obstruction bladder becomes distended and painful. In severe cases there may be rupture of bladder or urethra.

Clinical signs and Diagnosis

Affected animals show clear signs of abdominal discomfort (colic). They pull up their bellies, kick at their abdomens, continuously shake their prepuce, twitch their penis and make frequent, unproductive straining efforts to urinate (stranguria/anuria). Goats, in particular, will loudly vocalize due to distress.

On physical assessment, deep trans-abdominal palpation of the caudal abdomen reveals a tense, spherical, basketball-like distended bladder, provided it hasn't already ruptured. Diagnostic confirmation can be supplemented via transabdominal ultrasonography to evaluate bladder diameter and check for free fluid in the peritoneal space.

Surgical management

Treatment of obstructive urolithiasis is primarily surgical. Most commonly performed surgeries are Urethral Process amputation, perineal urethrostomy and tube cystostomy.

1) Urethral process amputation

This procedure is carried out if the obstruction occurs in the urethral process. The obstructed urethral process is cut off proximal to the site of obstruction. This allows the calculi to escape and urine flow is restored temporarily. This is a simple and minimally invasive procedure but the likelihood of recurrence is high because the remaining calculi may still be present further inside the urethra.

2) Tube cystostomy

This procedure is done in breeding bucks. A paramedian abdominal approach is made. The bladder is exteriorised. A catheter is placed in the bladder. Urine bypasses the obstructed urethra allowing time for inflamed urethra to heal. The pressure inside the bladder is relieved



and calculi may pass spontaneously. One major advantage is that breeding capacity can be retained. However blockage of the tube may occur as a complication.

3) Perineal urethrostomy

When there are recurrent cases of repeated obstructive urolithiasis and when preserving the breeding ability of the animal is not important, perineal urethrostomy is performed. This provides immediate restoration of urine flow. In this surgery a permanent opening is created in the urethra at the perineal region. Urine exits through this opening instead of passing through the distal penis.

There may be abnormal narrowing of the new opening created due to build up of scar tissue called stricture formation. Another complication is urine scalding, which means skin irritation and inflammation caused by constant urine contact with surrounding tissues. Breeding ability is also usually lost after this surgery.

Prevention

Prevention of urolithiasis is more effective and economical than treatment. Proper nutritional management plays a major role in reducing the incidence of urinary calculi in small ruminants. Maintaining an appropriate calcium-to-phosphorus ratio (approximately 2:1) in the diet helps prevent mineral imbalances that favour stone formation. Adequate access to clean drinking water should be ensured at all times, as increased water intake dilutes urine and reduces the risk of crystal precipitation. Excessive concentrate feeding should be avoided, and diets should contain sufficient roughage. Delaying castration until the urethra has developed adequately may also reduce the risk of urinary obstruction in male animals. Regular monitoring of feeding practices and animal health can further help in preventing the occurrence of urolithiasis.

Conclusion

Urolithiasis is a significant urinary tract disorder of small ruminants, particularly affecting male sheep and goats because of their unique anatomical features. The long and narrow urethra, the sharp bend of pelvic urethra at the ischial arch, sigmoid flexure and urethral process predispose these animals to urinary obstruction. A clear understanding of these anatomical factors is essential for accurate diagnosis and selection of appropriate surgical treatment. Procedures such as urethral process amputation, tube cystostomy and perineal urethrostomy are commonly employed depending on the site and severity of obstruction. Since prevention is more effective than treatment, proper nutritional



management, ad libitum supply of water and appropriate husbandry practices are important for reducing the incidence of the disease.

References

- Mejia, S., McOnie, R. C., Nelligan, K. L., & Fubini, S. L. (2022). Small ruminant urinary obstruction: decision trees for treatment. *Journal of the American Veterinary Medical Association*, 260(S64-S71). <https://doi.org/10.2460/javma.22.02.0071>
- Islam, R., Ahmed, S. S. U., Faruk-Miazi, O., Kibria, A. S. M. G., Faruq, A. A., & Uddin, M. M. (2021). Gross anatomy of urethra and penis in uncastrated and castrated buck of Black Bengal goat. *International Journal of Morphology*, 39(1), 138-142. <https://doi.org/10.4067/s0717-95022021000100138>
- Riedi, A. M., Nathues, C., Knubben-Schweizer, G., Nuss, K., & Meylan, M. (2018). Variables of initial examination and clinical management associated with survival in small ruminants with obstructive urolithiasis. *Journal of Veterinary Internal Medicine*, 32(6), 2105-2114. <https://doi.org/10.1111/jvim.15336>

