

## Urolithiasis In Ruminants

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### Introduction

Urolithiasis is common as a subclinical disorder among ruminants raised in management systems where the ration is composed primarily of grain or where animals graze certain types of pasture. In these situations, 40-60 % of animals may form calculi in their Urinary tract. Urolithiasis becomes an important clinical disease of castrated male ruminants when calculi cause urinary tract obstruction, usually obstruction of the urethra. Urethral obstruction is characterized, clinically by complete retention of urine, frequent unsuccessful attempts to urinate and distension of the bladder. Urethral perforation and rupture of the bladder can be sequelae. Mortality is high in cases of urethral obstruction and treatment is surgical. As a result, prevention is important to limit losses from urolithiasis.

### Etiology

Urinary calculi, or uroliths, form when inorganic and organic urinary solutes are precipitated out of solution. The precipitates occur as crystals or as amorphous, deposits. Calculi form over a long period by a gradual accumulation of precipitate around a nidus. An organic matrix is an integral part of most types of calculus.

### Epidemiology

Urolithiasis occurs in all ruminant species but is of greatest economic importance in feeder steers and wethers (castrated lambs) being fed heavy concentrate rations, and animals on range pasture in particular problem areas. These range

areas are associated with the presence of pasture plants containing large quantities of oxalate, estrogens, or silica.

When cattle graze pasture containing plants with high levels of silica, uroliths occur in animals of all ages and sexes.

Females and bulls usually pass the calculi and obstructive urolithiasis is primarily a problem in castrated male animals.

Obstructive urolithiasis is the most common urinary tract disease in breeding rams and goats.

When large numbers of animals are affected it is probable that some other factor, such as a deficiency of vitamin A or the administration of estrogens, is the cause of excessive epithelial desquamation and nidus formation.

The pH of urine affects the solubility of some solutes, mixed phosphate and carbonate calculi being more readily formed in an alkaline than an acid medium.

Ammonium chloride or phosphoric acid added to the rations of steers increases the acidity of the urine and reduces the incidence of calculi.

An excessive intake of minerals may occur from highly mineralized artesian water, or from diets containing high concentrations, particularly of phosphates in heavy-concentrate diets. In cattle, sediment begins to appear in urine when concentrates reach 1.5% of the body weight, and urolithiasis formation begins when concentrates have been fed for 2 months at the rate of 2.5% of the animal's body weight.

In range animals a high intake of mineralized water, or oxalate or silica in plants, are most commonly associated with a high incidence of urinary calculi, but again other predisposing factors, including deprivation or excessive loss of water, may contribute to the development of the disease.

Calcium, ammonium, and magnesium carbonate are common constituents of calculi in cattle and sheep at pasture. Once calculi form, the most important factor contributing to the occurrence of obstruction is the diameter of the urethra.

Wethers (castrated lambs) and steers (castrated cattle) are most commonly affected because of the relatively small diameter of the urethra in these animals.

### Occurrence

Urethral obstruction may occur at any site but is most common at the sigmoid flexure in steers and in the vermiform appendage or at the sigmoid flexure in wethers or rams, all sites where the urethra narrows.

Urolithiasis is as common in females as in males, but obstruction rarely if ever occurs because of the shortness and large diameter of the urethra.

However, generally, a single calculus causes obstruction in cattle whereas multiple calculi are common in sheep.

The incidence of obstructive urolithiasis is highest during the early part of the feeding period and during cold weather, when the consumption of water may be decreased.

### Clinical Findings

Calculi in the renal pelvis or ureters are not usually diagnosed antemortem although obstruction of a ureter may be detectable on rectal examination, especially if it is accompanied by hydronephrosis.

Occasionally the exit from the renal pelvis is blocked and the acute distension that results may cause acute pain, accompanied by stiffness of the gait and pain on pressure over the loins. Calculi in the bladder may cause cystitis and are manifested by signs of that disease.

Obstruction of the urethra by a calculus - This is a common occurrence in steers and wethers and causes a characteristic syndrome of abdominal pain with kicking at the belly, treading with the hind feet and swishing of the tail.

Repeated twitching of the penis, sufficient to shake the prepuce is often observed, and the animal may make strenuous efforts to urinate, accompanied by straining, grunting and grating of the teeth, but these result in the passage of only a few drops of blood stained urine.

Clinical examination must include inspection of the ventral abdomen for edema, inspection and palpation of the preputial orifice for crystals, palpation of the penis in the area of the sigmoid flexure, and inspection and palpation of the urethral process (vermiform appendage) of the exteriorized penis.

### Diagnosis

Diagnosis is based on clinical signs. Rectal examination or abdominal ultrasonography is imperative to assess an intact bladder.

In calves, as in small ruminants, radiography may be helpful to evaluate the number, location, and size of calculi within the urinary tract before surgery.

Laboratory examinations may be useful in the diagnosis of the disease in its early stages when the calculi are present in the kidney or bladder.

The urine usually contains erythrocytes and epithelial cells and a higher-than-normal number of crystals, sometimes accompanied by larger aggregations described as sand or sabulous deposit.

Bacteria may also be present if secondary invasion of the traumatic cystitis and pyelonephritis has occurred.

### Treatment

The treatment of obstructive urolithiasis is primarily surgical. Cattle or lambs with obstructive urolithiasis that are near the end of their feedlot feeding period and close to being marketed can be slaughtered for salvage if the result of an antemortem inspection is satisfactory.

In early stages of the disease or in cases of incomplete obstruction, treatment with smooth muscle relaxants such as phenothiazine derivatives (aminopromazine, 0.7 mg/kg of BW) has been tried to relax the urethral muscle and permit passage of the obstructing calculus; however, treatment efficacy is unknown.

## Prevention

A number of agents and management procedures have been recommended in the prevention of urolithiasis in feeder lambs and steers. First, and probably most important, the diet should contain an adequate balance of calcium and phosphorus to avoid precipitation of excess phosphorus in the urine. This is the major difficulty in controlling urolithiasis in feedlot ruminants, because their diets are grain (and therefore phosphorus) -rich.

The ration should have a Ca:P ratio of 1.2:1, but higher calcium inputs (1.5-2.0:1) have been recommended. Every practical effort must be used to increase and maintain water intake in feeder steers that have just been moved into a feedlot situation.

The addition of salt at the level of 4% of the total ration of feeder calves has been shown experimentally to have this effect on both steers and lambs. Under practical conditions salt is usually fed at a concentration of 3-5 %, higher concentrations causing lack of appetite.

It is thought that supplementary feeding with sodium chloride helps to prevent urolithiasis by decreasing the rate of deposition of magnesium and phosphate around the nidus of a calculus, but it is possible that salt-related diuresis may also play an important role.

Feeding of pelleted rations may predispose to the development of phosphate calculi (such as struvite or apatite) by reducing the salivary secretion of phosphorus. The control of siliceous calculi in cattle which are fed native range grass hay, which may contain a high level of silica, is dependent primarily on increasing the water intake.

The feeding of alfalfa hay is considered to increase urine flow and lower the incidence of urolithiasis but the important reason may be that it contains considerably less silica. As in feedlot animals, water intake can be promoted by supplementing the ration with salt.

For yearling (300 kg) steers the daily consumption of 50 g of salt does not prevent the formation of siliceous calculi; at 200 g daily intake the occurrence of calculi is significantly reduced, and at 300 g daily calculus formation is almost eliminated.

For range animals, ammonium chloride can be incorporated in a protein supplement and fed at about two-thirds of the above dosage. An acidic urine (pH < 7.0) favors the formation of silicate stones, so ammonium chloride manipulation of urine pH is not indicated in animals at risk of developing siliceous calculi.

Adequate water supplies should be available and highly saline waters should be regarded with suspicion.

Although the importance of vitamin A in the production of the disease has been decried in recent years an adequate intake should be insured, especially during drought periods and when animals are fed grain rations in feedlots.

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