

Prevention of Urolithiasis in Livestock
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Introduction

Urolithiasis (urinary calculi, water belly) is a disease of intact and castrated male ruminants (sheep, cattle, and goats) and pigs. Uroliths (literally, urinary stones) are solid aggregates of minerals that precipitate out of the fluid phase of urine to form one or more pebble-like stones in the urinary tract. These stones may remain undetected for the duration of an animal's life; however, they can cause physical trauma to the lining of the bladder and may, on occasion, move into the urethra within the penis, where they cause irritation, pain, and even complete obstruction. When the urethra becomes obstructed, urine continues to be produced in the kidneys and moves down the twin tubes, the ureters, to the bladder. Since the animal cannot urinate through the obstructed urethra of the penis, the bladder becomes overly distended with urine, causing significant pain. Affected animals go off feed and may posture to urinate without success. Goats and pigs may vocalize while attempting to urinate. The affected animal may show a base-wide stance with the front legs positioned far in front of the animal and the hind legs positioned far behind the animal; the back may be bowed downwards (see photos below).



Within 12-24 hours, the bladder can over-expand and rupture, releasing urine into the abdominal cavity, which causes shock and eventual death. In other cases, the urethra can rupture at the site of obstruction, which releases urine into the subcutaneous tissues of the inguinal area and abdomen. Shock and infection typically ensue. Rarely, the back-pressure from retained urine can cause kidney damage in addition to rupture of the bladder or urethra. Females of these species may develop uroliths, but because the female urethra is short and flexible, these typically pass in the urine without any signs of disease.

Although most often an occasional disease, urolithiasis can occur in clusters or become a recurrent problem on a ranch, farm, or feedlot. Dietary and environmental factors strongly influence the risk for development of urolithiasis, so this is a disease that all sheep, goat, beef, and dairy cattle producers should understand and act to prevent.

Prevention

For prevention of urolithiasis in livestock, two important components of a production system warrant close evaluation: ***the mineral balance of the ration and the availability and palatability of the water supply.***

Dietary minerals: Multiple factors influence the development of urinary calculi, but of primary importance is the development of high urinary concentrations of soluble minerals which, under appropriate conditions, may aggregate to form insoluble crystals. Oversaturation of the urine with mineral ions – particularly, calcium, magnesium, phosphate, and silicate – can trigger precipitation of solid mineral aggregates, which gradually grow over time as more urinary minerals are deposited on them. Dietary mineral content is of paramount importance - maintenance of appropriate dietary levels of calcium, phosphorus, and magnesium for the age and developmental status of the animal is critical in prevention. Rations that are rich in grains (concentrates) may provide excessive amounts of phosphorus (phosphate) relative to the amount of calcium present, triggering development of phosphatic calculi. Your veterinarian can help you to determine the amount and ratio of these minerals in the animal's ration, and can make recommendations for alteration of the ration to bring the levels of each into line. For adult-age male ruminants kept for breeding or castrated male ruminants kept as pets, a good-quality grass hay and a trace mineral-supplemented salt block (formulated for the particular species of ruminant) is often adequate for their dietary needs. Mature swine should receive a pelleted complete ration or mixed ration formulated for adult pigs; miniature or pot-bellied pigs should be fed a complete feed formulated for miniature pigs.

Several authors list **castration**, particularly castration at an early age, as a risk factor for development of urolithiasis. Slaughter plant studies indicate that calculi form to a similar extent in the urinary tracts of bulls and steers. However, a bull may be able to pass a calculus that would likely obstruct the urethra of a steer. Owing to the trophic effect of testosterone, the urethral caliber (diameter) of yearling bulls was found to be approximately 25% greater than that of yearling steers. Urethral obstruction by calculi was a more common event in the steers of this study. However, other factors may influence the trend for urolithiasis to be more common in castrates than intact males. First, there are more castrated male ruminants than male ruminants being fed calculus-promoting diets; therefore, there are more castrated males at risk of urolithiasis. Second, males kept for breeding service are generally of greater individual value than castrated males, and better dietary and water management might place males at lower risk than castrated males.

The risk of urolithiasis may vary by **season**. In North America, the incidence of urolithiasis in ruminants increases in the late fall and winter. Limited water availability and a larger population of susceptible animals receiving high-grain diets during this time of year may be factors that influence this trend. In warmer climates, urolithiasis is more common during the warmer months of the year, underscoring the critical role of water intake in the pathogenesis of this disease.

Unlike the situation in dogs, infection of the urinary tract is not considered to be a common predisposing factor for urolithiasis in ruminants.

Dilution of minerals in the urine is of primary importance in prevention of urolithiasis in ruminants. The **salt content** of the diet should be gradually increased to **promote water intake** and formation of large volumes of dilute urine. Higher salt intake may result in an increased urinary concentration of chloride ion, which has been postulated to inhibit some forms of calculogenesis. Salt can be mixed in moistened feed or sprayed as a saturated solution directly onto hay. In Canadian studies, loose or lick salt provided free choice proved inadequate for prevention of urolithiasis in animals at risk for silica calculosis. Thus, mixing the salt directly into the feed is the most effective means of delivery.

Sodium chloride can be gradually added to the diet to a final level of 3-5% of daily dry matter intake. For an animal weighing 100 kg and ingesting 2% of its bodyweight in dry matter per day, this would translate to feeding 60-100 grams of sodium chloride daily. Range calves at risk for silica calculosis can be fed heavily salted creep feeds, containing as much as 15% sodium chloride on a dry matter basis. To ensure that the calves eat the feed, one should gradually increase the salt content of creep feed. When feeding heavily salted rations, it is critical that a **reliable source of clean water** be available nearby to avoid salt intoxication.

Alternatively, ammonium chloride can be fed at a level of 0.5-1% of dry matter in the diet. At this level, ammonium chloride may induce modest reduction in urine pH (acidification), which may increase the solubility of certain minerals in the urine and keep them from forming solid aggregates. Ammonium chloride is unpalatable. For pet animals fed on an individual basis, molasses should be avoided as a flavoring additive for ammonium chloride in rations, as its high potassium content may diminish the acidifying effect of ammonium chloride. Table sugar works well for covering up the flavor of ammonium chloride.

Encouraging increased water consumption is an important preventive measure. Canadian researchers determined that the dissolved mineral content, or hardness, of water is unlikely to play a significant role in urolithiasis in cattle. Water palatability is vital – animals drink more when the water is clean than when it is dirty (they have taste buds, just like us). Water containers should be cleaned and filled with fresh water on a regular basis – the water should be so clean that the owner would be tempted to drink it on a hot day! The photo below shows a well-cleaned water trough.



Providing water in white containers can help the owner recognize when water has become soiled with dirt, feed, and/or manure. If automatic waterers are used, stagnation of water can be limited by using shallow tubs with spigots adjusted for rapid refill. Provision of shade over the water in the summer and heating the water during cold weather makes the water more attractive. For large groups of animals, provision of multiple watering sites allows for more frequent water intake. This is particularly important for sheep, as individuals are usually reluctant to separate from the flock to travel to distant watering sites.