Urinary Blockage in Llamas and Alpacas

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A recent inquiry asked about the possibility of commercial llama feeds being associated with urinary blockage, or what is technically termed urolithiasis. The kidneys are responsible for filtering metabolic wastes from the blood and excreting them from the body via urine. Urinary excretion is a common pathway for the body to manage body mineral status and acid-base balance. Urine pH and mineral concentration can lead to formation of mineral crystals in the kidney (kidney stones) or urinary bladder. Crystallized minerals, termed uroliths, can pass from the urinary bladder and become lodged in the urethra, thus resulting in urinary tract blockage. The blockage can be partial or complete, but in either case it is a significant health concern for the animal and one that needs to be addressed immediately.

Clinical signs associated with urolithiasis will depend upon the degree of blockage and severity of surrounding tissue reactions. If blockage is complete, retrograde pressure will build in the bladder to the point of rupture and subsequent death of the animal. Two reports of bladder rupture secondary to urethral blockage have been reported in a llama (McLaughlin and Evans, 1989) and alpaca (Dart et al., 1997), although mineralized stones were not specifically identified in either animal. Incomplete blockage results in variable stages of stranguria (straining to urinate), exaggerated and prolonged urination posture, urine dribbling and blood-tinged urine. Affected animals may be depressed and lethargic, grind their teeth and show signs of abdominal distention and pain. Therapeutic approach will depend on severity of blockage, duration and secondary complications. Unfortunately in more than 95% of blockage cases, normal urinary flow cannot be restored and the animal succumbs or is euthanized. Part of this poor outcome can be attributed to the greater propensity in llamas and alpacas for stricture formation in the traumatized urethra. Though urolithiasis is a serious disease concern, it is not very prevalent disease. Clinicians at Oregon State University's Veterinary Teaching Hospital report seeing approximately two referral cases per year. This low prevalence is reflected by only four published reports of urinary blockage in llamas and alpacas (see reference list). The extremely poor outcome in these cases underscores a need to understand the disease process and have appropriate preventive measures in place.

As a consequence of differences in genito-urinary anatomy, male llamas and alpacas are at greater risk for urethral blockage than females. Based on published reports, male llamas may be slightly more prone to blockage than male alpacas. Intact males comprise the greatest number of reported cases, though neutered males can also be affected. Value of intact males most likely warrants an attempt at correction.

Urolithiasis is a common problem encountered in male sheep, goats and cattle. Various calcium salts, phosphatic complexes, silica and oxalates are all potential mineral sources causing uroliths. In most cases from these species, struvite (magnesium-ammonia-phosphate) crystals secondary to high grain feeding and low dietary calcium-to-phosphorus ratio caused the blockage. Inadequate water intake and

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vitamin A deficiency have been implicated in predisposing to urolithiasis. Reduced water intake can result in decreased flushing action in the kidney tubules and induce supersaturation of soluble minerals thus causing their precipitation. Vitamin A deficiency can result in changes to the epithelial cells of the urinary tract and cause sloughing of cells becoming a nidus for mineral crystallization. Alkaline urinary pH, often resulting from consumption of plants high in potassium, is associated with formation of calcium phosphate and struvite uroliths. Slightly acidic to neutral urinary pH is associated with silicate and calcium oxalate uroliths. Although not a common disorder in llamas and alpacas, silicate and struvite crystals have been reported (Kock and Fowler, 1982; Kingston and Stäempfli, 1995).

Little is known about how urolithiasis occurs in llamas and alpacas and it is assumed that the disease process is similar to other ruminants. Llamas are noted for having lower water intake per unit of metabolic body size and lower urinary output, which may naturally predispose them to urinary calculi. Other potential predisposing factors include high alfalfa feeding, excessive grain intake and inappropriate dietary calcium to phosphorus ratio. Alfalfa contains soluble oxalates and high concentration of calcium. Excessive grain feeding can result in low dietary calcium to phosphorus ratio. A number of weedy or browse plants (Rumex spp., sorrels and dock) contain large amounts of soluble oxalates that when consumed in excess under the right conditions may result in oxalate urolith formation. Mature range grasses may contain large amounts of oxalates and silicates, which can potentially contribute to urolith formation. One can measure acid insoluble ash content in an effort to estimate silica content of forages. Based on these observations, there does not seem to be any significant factor in commercial llama feeds that would suggest they predispose consuming animals to urolithiasis. This is not to say that inappropriate consumption of some commercial products may result in altered dietary nutrient content consistent with some of the predisposing factors identified.

Nutritional alterations are the primary concern and focus of prevention. Goals of a dietary prevention program are to increase water consumption with addition of salt to the diet and maintain appropriate amounts of calcium and phosphorus in the diet with a calcium-to-phosphorus ratio between 2-to-4:1. On the other hand, excessive calcium intake should be avoided. Excessive vitamin D intake could potentially lead to hypercalcemia or hypercalcuria and predispose to calcium urolith formation. Excessive supplementation of protein and magnesium should also be avoided. These points emphasize the need to provide a properly balanced diet, but no nutrient in excess. This challenges us to better characterize actual nutrient requirements for llamas and alpacas. A new National Research Council (NRC) report has been recently published describing nutrient requirements for llamas and alpacas, but that is a topic for another column.

Struvite crystals can be prevented by dietary modification to induce urine acidification in dogs, cats, sheep and goats. Traditionally, dietary supplementation (5-10 g/kg of dry matter) of ammonium chloride has been used. More palatable commercial products capable of acidification are available as they are commonly used in dairy cattle rations prior to calving to prevent milk fever. However, little data are available to validate the efficacy and safety of prolonged feeding of such products to llamas and alpacas. Given the predilection for oxalate and silicate uroliths in acidic pH, routine urinary acidification to prevent

struvite crystals in llamas and alpacas is not warranted.

In summary, little is truly known about urolith formation in llamas and alpacas other than the fact we need to prevent the problem as a result of the high risk of a poor outcome. Provide a properly balanced diet that has an appropriate ratio of calcium to phosphorus and is not excessive in key nutrients identified as predisposing to urolith formation. Most importantly, ensure adequate availability of high quality water and encourage water intake with providing free choice salt. As always, comments or questions to stimulate further topics for this column are greatly appreciated.

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