Silica urolithiasis in a male llama

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A 7-month-old, intact male llama was referred to the Ontario Veterinary College with a 3-d history of lethargy, anorexia, tenesmus, and signs of abdominal discomfort. Initial therapy had included mineral oil and dioctyl sodium succinate (Dioctol, rogar/STB, London, Ontario), PO, and a soapy water enema. The following day the llama continued to strain and show signs of abdominal discomfort and these treatments were repeated. He did not clinically improve, and several hours later, 60 mg of flunixin meglumine (Banamine, Schering Canada, Ponte-Claire, Quebec) was administered, IM, resulting in an alleviation of clinical signs. However, the clinical improvement was only temporary (2 to 3 h) and the llama continued to strain and appear colicky. At the time of referral, he had not been observed to pass feces or urine for 36 h.

At presentation, the llama was in good body condition, appeared anxious, and had mild abdominal distention. The oral mucous membranes were pink with a capillary refill time of less than 2 s, the heart rate was 100 beats/min, the respiratory rate was 25 breaths/min, and the rectal temperature was 38.5°C. Palpation of the abdomen elicited a pain response (vocalization) and tympany was evident on auscultation and percussion of the abdomen. Digital palpation per rectum revealed some soft, mineral oil-soaked feces. Initial laboratory tests revealed a packed cell volume of 0.34 L/L (normal = 0.22–0.44 L/L), a total protein of 67 g/L (normal = 47–73 g/L), sodium, potassium, and chloride concentrations of 158.4 mmol/L (normal = 148–158 mmol/L), 4.9 mmol/L (normal = 3.6–6.2 mmol/L), and 114.3 mmol/L (normal 98–120 mmol/L), respectively. A small amount of gas was removed following passage of a stomach tube; however, there was no excessive fluid accumulation noted in the first stomach compartment. Two liters of a balanced electrolyte solution were administered through the tube. Immediately following this treatment, the llama ruminated and passed a large pile of soft, oily feces. He was observed to eat hay and showed no signs of abdominal discomfort.

The following morning the llama was again uncomfortable and the abdomen was quite painful when palpated. A serum biochemical profile showed the following abnormalities: a urea concentration of 33.1 mmol/L (normal = 9.3–17.9 mmol/L), a creatinine concentration of 1638 μmol/L (normal = 132.6–291.7 μmol/L), and a phosphorus concentration of 3.13 mmol/L (normal = 1.94–2.28 mmol/L). An attempt to obtain peritoneal fluid, at this stage, was unsuccessful. Radiographs of the abdomen were suggestive of fluid accumulation and ultrasound examination revealed a substantial volume of free fluid and a large, fluid-filled bladder. Abdominal paracentesis, with ultrasound guidance, yielded free-flowing, straw-colored fluid. Biochemical analysis of this fluid indicated a creatinine concentration of 9451 μmol/L and a urea concentration of 54 mmol/L. These findings were considered consistent with uroperitoneum, and due to the poor prognosis (1,10), the llama was euthanized.

At necropsy, the abdominal cavity was filled with approximately 5 L of blood-tinged fluid that contained clumps of clotted fibrin. The bladder wall was diffusely thickened by edema and discolored by congestion and hemorrhage. A pin-point, full-thickness perforation was present in the dorsal bladder wall. Both ureters were grossly dilated and there was mild hydronephrosis of the left kidney. There was a focal, gritty, tan-colored calculus, approximately 4 mm in diameter, occluding the lumen of the distal penile urethra, 10 cm from the urethral orifice. The site of calculus lodgment was surrounded by intermuscular hemorrhage and free blood was within the urethral lumen, proximal to the site of the obstruction. Results of analysis of the calculus indicated that it was 100% silicate (silicon dioxide).

Urethral obstruction has been extensively reported in ruminant species; however, there is minimal information about its incidence in llamas and other camelids. The etiology is unknown but is believed to parallel that for domestic ruminants (1). Previous reports of obstructive urolithiasis in llamas have suggested mineral imbalance, castration, and inflammation of the urinary tract as possible contributing factors (2–4). In 2 reports, the calculi contained a large proportion of calcium (2,3), and in another report, the calculus contained necrotic inflammatory cells with no detectable mineral constituents (4). There have been no reports of primary silica calculi in camelids. In ruminants, silica urolithiasis has been associated with a high dietary calcium to phosphorus ratio, grazing on semiarid ranges in the northern great plains of North America and parts of Australia, increased feed intake of silica, and reduced water intake (5,6). Typically, a number of animals are affected and changes in management are necessary to reduce the occurrence of the problem. This llama was from a well-managed breeding herd with no previous history of problems associated with urinary calculi. There were no recent feeding or management changes that may have predisposed to calculi formation. However, cold ambient conditions in the 3 mo before presentation may have resulted in decreased water intake.

In ruminants, obstructive urolithiasis can be successfully treated if recognized early in the clinical course. However, long-term survival of small ruminants requiring urethrostomy is poor, due to recurrence of the problem necessitating repeated surgeries (7). The most likely reason for the high frequency of recurrence in small ruminants is the narrow diameter of the urethra, which is further narrowed by scarring of the urethrostomy site during the healing process (8). The llama has a relatively narrow urethral diameter and is, therefore, likely to suffer the same frequency of recurrence. In the cases reported, there has been a high postoperative frequency of recurrence of the obstruction and urethral

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stricture (1,10). An added difficulty in treating urethral obstruction in male llamas is the anatomy of the reproductive tract. In the llama, there is a penile-preputial attachment that holds the penis within the prepuce during and beyond prepubertal life. It is reported that only 8% of intact males have detachment of this membrane at 12 mo of age. At 2 y of age, 70% have a detached membrane, and by 3 y of age, all have a detached membrane (9). Following euthanasia, we were unable to extrude the penis to pass a urinary catheter. Camelids have a fold of mucus membrane attached to the spicule of the penis that is an extension of the urethra from the body of the penis. The urethral orifice is located two-thirds of the way along the spicule and is formed by the fold of membrane (2). Camelids also have a fibroelastic penis with a sigmoid flexure and a urethral recess at the ischial arch (1). As a result, catheterization is difficult, and passage of a catheter into the bladder is virtually impossible because of the urethral recess. Reports indicate that the most common site for urethral obstruction in the llama is where the urethra narrows near its distal end at the site of preputial reflection, the next most common site is the sigmoid flexure (10). Surgical intervention is necessary, if the obstruction cannot be relieved via catheterization.

We do not know what factors may have predisposed this llama to silica urolithiasis. If the etiology is similar to that in domestic ruminants, the most likely factors include dietary imbalance and reduced water intake. To reduce the likelihood of other animals being affected recommendations include a well-balanced diet, salt (sodium chloride) supplementation, and the provision of clean fresh water of a desirable temperature at all times CVJ

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