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Urolithiasis in Sheep

James Jorgenson and Ronald King*

INTRODUCTION

Ovine urolithiasis is a relatively common condition occurring both in growing feedlot lambs and in older rams being kept on pasture. Although morbidity is usually low, the condition may affect enough animals in a flock to become of real economic importance. Early diagnosis of this condition is important since the longer the condition is allowed to persist the less favorable the prognosis becomes. This report outlines the etiologic factors, the clinical signs and post-mortem lesions, the treatment, and the prevention of urinary calculi in sheep.

INCIDENCE

The incidence of urolithiasis is highest in the midwestern and western United States where sheep are confined to feedlot, are castrated at an early age, and are wintered on pasture under natural conditions. The incidence varies depending on the concentrate: roughage ratio and the quality of the roughage and concentrates. Wethers seem to have the higher incidence. This may be due to the fact that the urethra of the ram is larger in diameter and, therefore, passage of the small calculi is not as easily impeded. However, the clinical signs may not be seen as frequently in wethers since they are often marketed before the calculi have become of sufficient size to cause obstruction. The mortality rate may reach 10 per cent in certain instances depending on the cause. Mortality has reached 20 per cent in some experimental cases.1

A survey of the urolithiasis cases referred to the Iowa State University Veterinary Clinic in 1966 and 1967 revealed one wether and 22 rams. About 60 per cent of the rams were yearlings. Most were to be used for breeding purposes.

ETIOLOGY

There are two basic types of uroliths occurring in sheep. One type, the mineral calculi (primarily phosphates and carbonates), occurs primarily in growing lambs in the feedlot. The other type, the silicious calculi, is primarily a problem in older rams kept on pasture with a high silica content.

There are a number of factors which contribute to the development of urinary calculi in feedlot lambs. Perhaps of prime importance is the high grain rations which these animals are receiving. It is common to find a Ca:P ratio of 1:1 in these high concentrate rations. Romanowski2 has noted that with a high concentrate ration the amount of colloids (mucoproteins and glycoproteins) in the urine is increased. It is thought that these colloids serve as a matrix upon which the phosphates and carbonates may crystallize.

The high concentrate rations given to lambs in the feedlot are often deficient in vitamin A. This may play a role in the development of urinary calculi, for vitamin A is important in the maintainence of

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healthy epithelium. Desquamated epithelial cells could serve as a nidus for the formation of calculi.

There is still some confusion as to the role played by diethylstilbestrol (DES) in predisposing an animal to urolithiasis. Apparently, using DES at the presently recommended levels for sheep (3 mg. implanted subcutaneously or 2 mg. daily in the feed) will not increase the incidence of urolithiasis, but implants of 15–30 mg. have greatly increased the incidence in experimental trials.³

As stated earlier, castration may predispose an animal to urinary calculi due to failure of the urethra to develop as well as in the non-castrated animal. Rams and wethers are both more subject to urinary calculi than are ewes, simply because the greater length and tortuosity of the male urethra allow more sites for calculi to lodge.

Swingle and Cornelius⁸ claim that animals on a high grain ration often show up to a 60 per cent decrease in urine output with a corresponding decrease in water intake. As a result, their urine is much more concentrated and crystallization of the minerals present is more likely to occur.

Urolithiasis in pastured sheep, especially rams, is often found to occur on pastures with a high silica content or a high oxalate content in the forage. Some of the clovers have been incriminated in the development of urinary calculi due to their high estrogen content.

**CLINICAL SIGNS**

The clinical signs of urolithiasis vary depending on the locations and size of the calculi. Some cases will not be diagnosed ante-mortem because clinical signs will not be evident. In other cases, symptoms may develop quite rapidly and be quite characteristic.

Calculi forming and lodging in the renal pelvis may often go unnoticed especially if unilateral. Calculi lodging in the ureter and causing complete urinary obstruction will lead to a distention of the proximal ureter and renal pelvis, and eventually hydronephrosis. In such a condition the animal may show tenderness and acute pain over the kidney area and may be reluctant to move. Should this condition occur bilaterally, uremia would be expected to follow. Calculi which are small enough to allow the passage of urine and are located in ureters, occasionally make themselves manifested by recurrent attacks of acute pain in the loin area as the calculi move down the ureter.

In the ovine, blockage most commonly occurs in the urethral process. The sigmoid flexure is the second most common site for the lodging of calculi. Restlessness, uneasiness, treading of the hind legs, anorexia, and twitching of the tail are manifestations of urethral calculi. Frequent urination attempts and excessive amounts of straining with each attempt will be noted. If there is only a partial urethral obstruction, small amounts of blood stained urine may be passed. Examination of the area around the preputial opening may reveal small calculi precipitated on the hair and wool. As the blockage becomes more complete the animal shows more abdominal distress. This will be evident by treading or stamping of the hind legs, kicking at the abdomen, frequently lying down and getting up, or rolling on the ground. The tail may be extended from the body. Again, frequent urination attempts are made but no urine is passed. Palpation of the urethra during this time may reveal a pulsating urethra. This is considered characteristic of urolithiasis.⁶

If the obstruction is complete and is not relieved in 24–36 hours, pressure from the retained urine together with the presence of the calculi causes the epithelial lining of the urethra to become inflamed, swollen and hemorrhagic. This weakens the urethra and predisposes it to rupture. If the urethra does rupture, an immediate relief of urethral and abdominal discomfort are shown. The bladder empties and the urine infiltrates into the subcutaneous connective tissue spaces along the ventral abdominal wall. This results in a large edematous swelling on the ventral abdominal wall along the sheath, and in some instances may be the first indication to the livestock owner that something is wrong.

Iowa State University Veterinarian
Palpation of the area reveals a cold edematous swelling. Aspiration of urine from the subcutaneous tissue is diagnostic. If left untreated the urine will be absorbed and cause an elevated B.U.N., and uremia may be seen. If the urine is not drained from the subcutaneous tissues in conjunction with other treatment, ventral abdominal skin necrosis may occur.

A far more serious complication of urolithiasis is rupture of the urinary bladder. Here, too, there is a sudden relief of abdominal discomfort and the appetite improves for several days. Then uremia and general toxicity develop as the urine in the abdominal cavity is absorbed. The abdomen appears enlarged and the animal becomes depressed and anorexic. Ballottement of the abdomen will give the characteristic fluid waves. Paracentesis yields a urine smelling fluid which may or may not look like urine, depending on the degree of peritonitis. The B.U.N. will be elevated. If the uremia and peritonitis are allowed to develop following rupture of the bladder, death will often follow in 24–48 hours.

Diagnosis of urolithiasis is dependent upon history, clinical signs, blood urea nitrogen, paracentesis, and palpation. Palpation of the urethral process and area of the sigmoid flexure may reveal the location of urinary calculi. The location of the calculi, their size and number, along with any complications which have or might shortly develop should all be taken into consideration when giving a prognosis.

**PATHOLOGY**

At necropsy, the entire urinary tract should be examined. Some of the calculi may merely be sand grain size, therefore, close examination must be made. Calculi may be found in the renal pelvis and bladder of normal healthy animals. Unilateral calculi in the ureter may be accompanied by hydronephrosis and dilatation of the renal pelvis and proximal ureter. Hemorrhagic cystitis is often seen when calculi are present in the bladder. If the bladder is small and has retracted into the pelvic cavity it should be examined closely for any evidence of rupture. Urine will be found in the peritoneal cavity in cases of rupture of the bladder. If the bladder has not ruptured, it will be distended, thin walled, and hemorrhagic.

An inflamed and thickened urethra will be found in cases in which the calculi have lodged in the urethra. Erosions and tears of the urethra will be expected if urine has accumulated in the subcutaneous tissue of the abdominal cavity. Calculi most likely will be found at the urethral process, sigmoid flexure, or at the ischial arch. However, they may be found lodging at any site along the ureter, urethra, or in the bladder.

**TREATMENT**

Basically, treatment of urolithiasis is aimed at providing normal urine passage from the animal. This is accomplished in a variety of ways depending upon the severity of the condition. For early cases of urethral blockage where the urethral tissue is still intact, smooth muscle relaxants are often successful. The urethra itself has little or no smooth muscle, so the action of these smooth muscle relaxants is not one of directly increasing the urethral diameter. Rather they produce relaxation of the retractor penis muscle with subsequent straightening of the sigmoid flexure, which enables the calculi to be flushed out. If the obstruction is at the distal end of the urethra, the urethral process may be amputated.

In cases where the urethra has ruptured and there is subcutaneous accumulation of urine a urethrostomy should be performed to allow passage of urine. Lancing several of the largest areas of subcutaneous urine collections may help prevent reabsorption of this urine, with the accompanying risk of uremia decreased.

If the condition has progressed to the point where the urinary bladder is ruptured, more extensive treatment will be necessary. Urethrostomy will often be needed to provide normal urine elimination. Consideration must be given to the bladder tears. It may be necessary to suture these. The abdominal collections

Continued on page 62
of urine are usually removed by abdominal centesis, and it may be necessary to use fluids and electrolytes in selected cases to aid in correction of the uremia.

**PREVENTION**

There are numerous rations proposed which claim to reduce the incidence of urinary calculi in sheep. All, however, are aimed at two basic principles—correction of mineral imbalance and assuring adequate water intake so that the urinary system is flushed regularly and thoroughly.

Increasing the calcium level in the diet of feed-lot sheep has been shown to markedly decrease the incidence of urolithiasis. This can be accomplished with supplemental mineral mixtures or by the addition of some alfalfa to the ration.

There are a number of compounds which are used to increase water consumption in sheep. Some of these compounds also claim additional benefit from being urinary acidifiers; however, there is still some question as to whether or not urine pH is significantly related to the development of calculi. Examples of compounds used to cause increased water consumption are NaCl, NH₄Cl, NaHCO₃, Na₂HPO₄, dilute HCl, and chlorotetracycline (20g./T.). NaCl and NH₄Cl are by far the most common. The content of NH₄Cl should be 0.5%, while the content for NaCl should be at least 4–5%, but not over ten percent. There is some dispute as to whether these higher concentrations of NaCl lower the palatability of the ration.

An adequate vitamin A intake should be assured, primarily in feedlot sheep since vitamin A deficiency may predispose an animal to urinary calculi.

Finally, when animals are to be pastured, the type of forage in the pasture should be considered. It is possible that there may be plants with a high oxalate content or a high silica content, and these can certainly predispose an animal to urinary calculi.

**REFERENCES**


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Dr. Philpp T. Pearson presented a paper on "Canine Stifle Joint Surgery" to veterinarians in the Miami, Florida, area on February 27 and veterinarians in the Fort Lauderdale, Florida, area on February 28.

Dr. Vaughn Seaton has been named Chairman of the newly organized Story County Board of Health. The Board is essentially a policy and planning board with a staff of nurses and sanitarians to carry out the policy.