The Not So Rolling Stones

A Case Report

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A 14-month-old 490 kg Brangus bull presented with a two-day history of lethargy, recumbency, and hematuria. The referring veterinarian diagnosed urolithiasis based on an enlarged bladder on rectal palpation and referred the owner to Mississippi State University-College of Veterinary Medicine (MSU-CVM) Food Animal Department. The bull's intended use was for breeding and passed a breeding soundness exam two weeks prior at MSU-CVM. Additionally, the bull was genetically valuable and being prepared for auction. Therefore, he was fed a high concentration diet of free choice soy hull/corn gluten and pasture grass.

On initial presentation, the bull was quiet, alert, and responsive. He was tachycardic (heart rate of 100 beats per minute), overweight (body condition score of 7 out of 9) and 5% dehydrated based on prolonged skin tent. Other vital parameters were within normal limits. Hematuria with mucous plugs was noted upon examination of his prepuce and sheath. On rectal palpation, a very large, firm, distended bladder was palpated. On ultrasonography, the bladder was also visually very distended. Kidneys appeared to be within normal limits.

Complete blood count revealed a mild neutrophilic leukocytosis (WBC 24.2 K/ul; reference interval, 4.00-12.00 K/ul; Segs 20328 /ul; reference interval, 600-4000 /ul) and monocytosis (1210 /ul; reference interval, 0-800 /ul). Chemistry panel revealed a mild alkalosis with an increase in total carbon dioxide (35.6 mEq/L; reference interval, 21.0-32.0mEq/L), mild hyperglycemia (130 mg/dl; reference interval, 61-102 mg/dl), hyperproteinemia (9.1 g/dl; reference interval, 7.0-8.9 g/dl), hyperglobulinemia (6.7 g/dl; reference interval, 2.5-4.4 g/dl), and hypermagnesemia (3.8 mg/dl; reference interval, 2.0-2.8 mg/dl). He was azotemic with a moderate increase in blood urea nitrogen (BUN) (50 mg/dl; reference interval, 6-25 mg/dl) and creatinine (6.22 mg/dl; reference interval, 1.00-2.10 mg/dl). There was a mild hypochloremia (87.6 mmol/L; reference interval, 97.0-111.0 mmol/L). Urinalysis revealed isosthenuria (1.008), moderate proteinuria (2+ on dipstick with 3+ SSA), and severe hematuria (TNTC RBCs). Bloodwork results were consistent with hemoconcentration from dehydration and post-renal azotemia.

Primary differential diagnoses included obstructive urolithiasis and/or cystitis based on clinical signs and laboratory results. An aseptically collected urine culture and sensitivity was submitted. The result was received 6 days after presentation, which revealed a high number of gram-negative rods being *Klebsiella pneumoniae* ssp pneumoniae.

Due to the bull's high value and the owner's reproductive goals for the bull, an emergency standing tube cystotomy was elected in order to restore urethral patency. The patient's surgical area was clipped and aseptically prepared with chlorohexidine solution and alcohol. An inverted L regional block was performed, infusing 120mL of 2% lidocaine. An additional line block with 60mL of 2% lidocaine was performed. A 30cm vertical incision was created in the left ventral paralumbar fossa over the lidocaine line block. Access to the peritoneal cavity was obtained through a stab incision in the abdominal parietal peritoneum. The urinary bladder was identified by palpation. The serosal layer of the urinary bladder palpated rough, thick, and severely distended. On exploration of the abdomen, the left kidney felt enlarged. A second incision, measuring approximately 4 cm in length was created caudoventrally to the ventral aspect of the primary abdominal incision. A 30 French Foley catheter was inserted retrograde through the second incision. Using curved Kelly hemostats, a blind stab incision was created through the bladder wall into the lumen of the bladder simultaneously introducing the Foley catheter into the lumen of the bladder. The balloon was inflated with 30cc of saline. By applying traction to the external portion of the Foley catheter, the bladder was manipulated laterally towards the body wall. Unfortunately, bladder adherence to the body wall could not be obtained. The bladder was about 4 cm away from the body wall. The Foley catheter was periodically flushed with sterile saline to dislodge blood clots and to allow urine voiding. The Foley catheter was secured to the skin with four Braunamid suture material in a Chinese finger trap pattern. The parietal peritoneum and transversus abdominis musculature were closed with Three Catgut suture material in a simple continuous pattern, followed by closure of the internal and external abdominal oblique musculature with the same suture and suture pattern. The skin was closed with four Braunamid suture material in a Ford interlocking pattern, leaving room at the ventral aspect of the incision for two cruciate sutures. Four Braunamid suture material was implemented to create a loop of suture two fingers wide to secure the remaining length of the Foley catheter. A section of umbilical tape attached the catheter to the suture loop, further securing the catheter to the external abdomen.

During surgery, an enlarged, painful left kidney was palpated, and significant gross hematuria was present throughout the approximate 20 liters of urine. With these findings and absence of uroliths pyelonephritis was added to the differential list. Creatinine was monitored at two and three days post-operation to monitor renal damage. The creatine values decreased significantly from the day of presentation (presentation, 6.22 mg/dl; 2 days post-op, 2.63 mg/dl; 3 days post-op, 2.39 mg/dl). With the steady decline in creatinine, significant kidney damage was not likely. Post-operation Banamine (1.1 mg/kg intravenously) and Procaine Penicillin G (44,000 iu/kg subcutaneously) were given. Fluid therapy with 0.9% Saline at double maintenance (2 L/hr) was started for diuresis, followed by Ringers solution at maintenance (1L/hr). Fluid therapy was discontinued two days post-operation. Medications included Meloxicam at 1.1 mg/kg orally every 24 hours and Procaine Penicillin G 44,000 iu/kg subcutaneously every 24 hours. Procaine penicillin G was discontinued five days post-operation after the urine culture and sensitivity results were revealed ineffective bacteria activity of penicillins. Florfenicol was administered 40 mg/kg subcutaneously every four days. The Foley catheter was monitored daily and was flushed with saline periodically to dislodge any sludge obstructing urine flow. A salt block was placed in the stall to encourage water consumption. Eight days post-operation, uroliths were seen on the tip of the Foley catheter. Due to the history of a high grain ratio and the fine, sandy appearance of the uroliths, the uroliths were presumed to be struvite. SoyChlor is an anionic supplement that acidifies urine commonly used in prevention of hypocalcemia in dairy cattle. This was added to the feed (mixture of commodity and sweet feed) at 0.25 lb twice a day. Urine pH did not acidify appropriately in the beginning (goal pH of 6.5), therefore the amount of SoyChlor was increased to 0.5 lb twice a day. A urine pH of 6 was finally obtained seven days post-administration. A subcutaneous abscess formed at the Foley catheter site. The abscess was lanced and flushed with diluted betadine solution. It did not enter the abdomen or involve the bladder.

The Foley catheter was challenged ten days post-operation after normal urination was seen from the urethra. While being challenged, the urine flowed from the urethra normally during urination. Ultrasound was used to ensure the bladder was normal size. The tube was removed 13 days post-operation. The bull was discharged with instructions to continue the florfenicol every four days for two more weeks, continue feeding 0.5 lb of SoyChlor twice a day, modify the diet to consist of 70% grass and hay and 30% grain to prevent another occurrence of urolithiasis, ensure adequate water consumption, and flush the abscess at least twice a week. Approximately six months post-operation, the bull was reported to cover 90 cows for the season and was doing well with no other complications.

DISCUSSION

Obstructive urolithiasis is a common problem affecting sheep, goats, and cattle. It occurs in both sexes, but it occurs more frequently in males rather than females due to the anatomical configuration of the male urinary tract. Males have a narrow urethra and sigmoid flexure. Common locations for a urolith to lodge are the sigmoid flexure, ischial arch, and urethral process (small ruminants). The etiology is multifactorial, and the exact mechanism of the stone formation and growth is unknown. However, the first step for development is the presence of a nidus such as urinary tract debris, casts, mucoprotein, cells, or bacteria. This is followed by precipitation of minerals, which is favored by concentrated urine.[5] Formation of a stone usually is a result from a combination of physiological, nutritional, and management factors. Geographical and seasonal influences also play an important role.[2]

The most common types of uroliths in ruminants are magnesium ammonium phosphate (struvite), calcium carbonate, and silica. Silica uroliths will typically occur in the western United States where pastures are high in silicate concentrations. Calcium carbonate uroliths typically occur in animals that are fed forage or grass containing oxalate.[5] Struvite uroliths typically occur from a low dietary calcium to phosphorus ratio seen with high grain diets. Struvite are the most common stone seen in cattle, especially feedlot cattle that are being fattened with feeds that are high in phosphorus and magnesium but low in calcium and potassium. These types of feeds cause the urine excreted by the animal to be high in phosphate. However, one study shows that individual influence in phosphorus excretion may be of importance indicating a possible genetic factor.[3] Several other contributing factors of stone formation include limited intake or deprivation of water, dehydration, alkaline urine, mineral composition of the water, excess sodium bicarbonate in the diet, vitamin imbalance, and high protein rations.[2] In some studies of bull calves, a change in diet from milk to roughages has been shown to cause obstructive urolithiasis.[1]

Clinical signs will typically depend on the degree and length of obstruction. Initial clinical signs typically include anorexia, decreased rumination, decreased water intake, dribbling of blood tinged urine, and painful attempts to urinate. Further clinical signs of prolonged disease include bilateral abdominal distention, tenesmus, colic, weight shifting, grinding teeth, and urethral pulsation. Less specific signs include rectal prolapse, rumen stasis, tachycardia, and tachypnea. Complete obstruction can result in severe uremia and death if not treated.[2]

Bloodwork findings include an increase in neutrophils and leukocytes, an increase in BUN and creatinine, hypoproteinemia with elevated alkaline phosphate, hyperphosphatemia, hyperkalemia, and hypoglycemic. Metabolic acidosis or alkalosis can occur. Urethral obstruction eventually leads to damage of the bladder and kidney when left untreated. Pressure and distention of the bladder due to urine retention leads to inflammation, pressure ischemia, devitalization, thinning, trabeculae formation, and herniation of mucosa through the musculature of the urinary bladder leading to seepage of urine into the peritoneal cavity. This results in a uroperitoneum and peritonitis. Secondary kidney damage, such as hydronephrosis, occurs due to retrograde intracystic pressure.[2] Urethral necrosis and rupture is also a possible sequela.

Diagnosis should be made based on history, clinical signs and physical examination findings. Radiographs and ultrasound may also be required for additional information about the patient. Although it is difficult to obtain in adult cattle, radiographs can help determine the location of the uroliths. Ultrasound is used more commonly in cattle and is beneficial in diagnosing a rupture of the urethra or the urinary bladder, as well as noting any visible damage to the kidney, such as hydronephrosis. Urethral stones can also possibly be localized with ultrasonography.[2]

Obstructive urolithiasis can either be treated medically or surgically, with surgery being the primary approach. For medical management, the animal should be stabilized by correcting any metabolic derangements, as well as administering intravenous fluids for diuresis either after the stones are removed or an alternate route of urination is established. Struvite stones can be dissolved using a urine acidifying agent, such as ammonium chloride. Several surgical methods include amputation of the urethral process in small ruminants, cystocentesis with bladder irrigation with an acidic solution, a tube cystotomy, bladder marsupialization, prepubic urethrostomy, perineal urethrostomy, prescrotal urethrotomy, and penile amputation.[5] Cystotomy tubes are very beneficial for creating an alternate urinary route when radical surgery is not ideal. Several types of tubes are available to use, including Foley catheters, Mushroom tip catheters, percutaneous catheters, and low profile gastrotomy tubes. It is suggested that the tube remains in place for at least 14 days for adequate adhesions between the bladder and the body wall to form and reduce the possibility of urine leakage or peritonitis. Complications could include, urine leakage, wound infection or dehiscence, irritation at the stoma site, obstruction or accidental dislodgement of the tube, ascending infection, or recurrence of obstructive urolithiasis.[2] Urethrotomies and bladder marsupialization have limitations, such as recurrent urolithiasis, damaged urethra, atonic bladder, severe cystitis, and urine scald.[1]

Prognosis for obstructive urolithiasis in cattle remains unpredictable. Preventative measures should be taken to avoid urolithiasis. The mineral balance of the ration and the availability and palatability of the water supply are two very important aspects in animal management that should be closely evaluated.[4] A strict calcium to phosphorus ratio of 2:1 in the complete ration should be followed.[2] Over saturation of the urine with mineral ions can trigger solid mineral aggregates that grow over time. The incidence of urolithiasis increases usually in the late fall and winter in North America. This is likely attributed to limited water availability and a large population of susceptible animals. Dilution of the urine with adequate water intake is possibly the most important aspect of prevention.[4] Increasing the salt levels in the ration will aid in stimulating more water consumption. Salting moistened grass hay may be better than a voluntary salt block. Maintenance of adequate and abundant water supplies by providing clean water at multiple sites on the farm is very important. Struvite crystals can be prevented by increasing the acidity of the urine, which could include removing alfalfa feeding, reduce grain feeding, make grass hay the primary forage, and feeding anionic products.

A tube cystotomy, along with acidification of the urine, has been a very promising treatment for obstructive urolithiasis. The results for this treatment plan have been reported mostly in goats, however very few reports have been published for this treatment in young adult bulls. This case shows that a tube cystotomy, in addition to acidifying the urine, is likely the most ideal treatment for an adult bull to maintain its breeding potential.

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