Lo-Bo's Low Blow

By

Noah G. Zazulak

Mississippi State University

College of Veterinary Medicine

Class of 2022

Clinicopathologic Conference

February 18, 2022

Advisor: Heath King, DVM

Introduction

Obstructive urolithiasis in cattle, often termed water belly, is the fifth most common cause of death in feedlot cattle. It results in significant economic losses in the livestock industry. This disease is a severe, often fatal condition that affects all cattle, though castrated males are most often affected (Makhdoomi & Mohsin, 2013). The disease is caused by concretions of mineral and organic compounds, known as uroliths, that lodge in the urinary tract, causing an obstruction (Veterinary Handbook for Cattle, Sheep and Goats, 2022). Obstruction can occur anywhere along the urinary passages. The formation of uroliths is multifactorial, as physiologic features, management practice and mineral imbalance all play a role. (Kalim, et al. 2013). If a complete obstruction occurs, urine is no longer able to freely pass. If left untreated, obstructive urolithiasis can lead to pressure necrosis, bladder rupture, urethral rupture, kidney failure, uremia and death of the animal (Rush & Grotelueschen, 1979).

Pathophysiology

Formation of a urolith results from stony precipitates forming anywhere in the urinary passages (Hardisty & Dillman, 1971). The formation of urinary calculi is a multifaceted process that occurs in several phases. A nidus is formed and allows for the accumulation of soluble minerals to precipitate upon it (Makhdoomi & Mohsin, 2013). The environment of the urinary tract plays a large role in the formation of uroliths. Stones such as struvite, apatite and calcium carbonate tend to precipitate in alkalotic urine (Ratkalkar & Kleinman, 2011). Supersaturation of urine due to inadequate water

intake or a dietary mineral imbalance both predispose and expedite formation of urinary calculi. Diet greatly influences the formation of urinary calculi as well. High protein feeds and hays increase matrix components in the urine, providing more opportunity for a urolith to form (Waltner &Meadows, 1980). The calcium to phosphorus ratio of the feed should be carefully considered as well.

The anatomy of the urinary tract is directly related to the disease process. When compared to a male, the urethra of a female is short, wide, and straight. This gives uroliths little opportunity to become lodged. The long thinner urethra of a male provides much more opportunity for obstruction. The sigmoid flexure is a particularly common place for an obstruction due to its tight curvature (Makhdoomi & Mohsin, 2013). The prevalence of uroliths is equal in males and females. The prevalence of obstructive urolithiasis, however, is far greater in males.

Testosterone has been shown to impact the development of the urethra. Generally, the earlier a calf is castrated, the narrower its urethra. Because of this, urolithiasis must be taken into consideration when determining age of castration in cattle (Simpson & Streeter, 2017). Delaying castration until at least 6 months of age has been shown to be the most beneficial (Hardisty & Dillman, 1971). Though exact values differ between studies, it has been shown that bull calves that were not castrated until they reached seven months of age could pass a stone 13% greater in diameter than calves castrated at one month of age. When left intact, bulls can pass a stone 44% larger than a steer of the same age castrated at one month (Hardisty & Dillman, 1971).

When a urolith becomes lodged in the urinary passages and blocks urine flow, it is termed obstructive urolithiasis. If the obstruction is neither passed nor removed, urine

will continuously accumulate because urine production does not cease. This can lead to distension of the urethra and bladder. Pressure necrosis soon follows, decreasing the integrity of affected tissues, leaving them prone to ruptures (Simpson & Streeter, 2017). When the urethra or bladder rupture and urine accumulates in the subcutaneous space, it is termed “water belly.” This condition causes a characteristic swelling that initially occurs just caudal to the preputial sheath. In the case of bladder rupture, the swelling may not be as easy to identify because the urine can accumulate in the peritoneal cavity rather than subcutaneously (Simpson & Streeter, 2017).

Obstructive urolithiasis must be on the differential list for all ill male ruminants. History, diet and progression of signs should be considered during examination. Common symptoms of obstructive urolithiasis include general signs of discomfort such as anorexia, bruxism, increased heart rate, increased respiratory rate, depression and vocalization (Meredyth, 2021). More specific signs include straining to urinate, distension of the abdomen, swelling caudal to or around the prepuce and pitting edema along the caudal ventrum (Simpson & Streeter, 2017). Note that general signs of discomfort may be alleviated after rupture of the bladder or urethra, because the pressure is relieved. If a rupture has already occurred the prognosis is greatly reduced in cattle. With no treatment, the animal will likely pass away from sepsis in 4-5 days (Waltner & Meadows, 1980).

History

LO-BO is a four-month-old Red Gelbvieh bull calf who presented to Countryside Veterinary Clinic on 11/10/2021. LO-BO was a C-section calf that struggled in his first days. He was then bottle fed and became more of a pet. Approximately two days prior to presentation, the owner noticed that LO-BO was straining to defecate but seemed otherwise healthy. Lo-Bo then began to act lethargic, so the owner decided have him examined by a veterinarian. At presentation, the owner states that Lo-Bo had not been seen passing feces in two days but may have had a movement that was not observed. Lo-Bo is kept on pasture and has been fed a large amount of grain for several weeks.

Diagnostic approach

On presentation Lo-Bo was restrained in a hydraulic chute and a thorough physical exam was performed. Lo-Bo had a heart rate of 150, a respiratory rate of 20 and a temperature of 102.0. He was not lame when walking. His nose and eyes were clear of discharge and his hair coat appeared normal for his age. A large swelling caudal to and along the preputial sheath was observed. There was a large amount of gritty sand-like material cemented to the preputial hair. The swelling was soft on palpation. A soft spot on the ventral portion of the swelling was identified. The area was clipped, scrubbed, and cleaned with a 2% Chlorohexidine solution and then 70% alcohol. Wearing gloves, a 1 inch 18-gauge needle was inserted into the center of the clipped area, and a syringe was attached and aspirated. A thin red tinged fluid was aspirated and examined. The fluid had a distinct ammonia smell. A urine dipstick was used to determine the PH of the fluid was 8.0. The fluid was examined under a microscope and a large number of struvite crystals were identified. Although a serum

chemistry was not analyzed in Lo-Bo's case, it commonly reveals hyperkalemia, hyponatremia and hypocalcemia. BUN and creatinine are also normally high due to post-renal azotemia (Makhdoomi & Mohsin, 2013).

Treatment

Obstructive urolithiasis in cattle is best treated via prevention. Several components can be addressed for prevention of obstructive urolithiasis. Delaying castration in bull calves has been shown to directly increase urethral diameter, thus making it less likely for an obstruction to occur (Makhdoomi & Mohsin, 2013). Ensuring adequate water intake is beneficial in that it dilutes the urine, allowing less matrix and mineral components to congregate and form stones. Urination flushes much of the matrix and mineral components out of the body as well (Meredyth, 2021). Increasing salt in the diet to 4% has been shown to increase water consumption, and thus urine excretion (Rush & Grotelueschen, 1979). Free access to grazing is suspected to increase water intake in cattle as well. Adequate water must always be readily available.

Mineral and matrix components in the urine can be decreased by reducing the amount of protein in the diet. Feeding large amounts of grain should be avoided, as it is high in phosphorus and magnesium and may lead to the development of struvite (magnesium ammonium phosphate) or apatite (calcium phosphate) stones. Alfalfa and other legumes are exceptionally high in calcium. A diet high in legumes predisposes cattle to calcium carbonate stones. The calcium to phosphorus ratio (Ca:P) of the diet should be maintained between 1.5:1 and 2:1 (Veterinary Handbook for Cattle, Sheep

and Goats, 2022). Disruption to this ratio in either direction leaves cattle more apt to develop urinary calculi (Ratkalkar & Kleinman, 2011). Cattle consuming grasses high in silica are prone to develop silicate uroliths. Cattle may develop oxalate stones if they consume oxalate-containing plants, though it is not commonly seen (Simpson & Streeter, 2017).

Urinary calculi such as struvite, apatite and calcium carbonate tend to form in alkaline urine. Because of this, a urolith prevention plan should include measures to acidify the urine. This is normally accomplished by adding ammonium chloride to the feed, which effectively decreases the pH of the urine (Rush & Grotelueschen, 1979).

When preventative measures do not suffice, surgical interventions may be required. In production animals the cost of intervention must not be greater than the animal's value; therefore, surgical options may be limited unless the animal is a valuable breeding animal. Surgical options are normally limited in production cattle, though more costly treatments may be pursued if the patient is a valuable breeding animal.

A perineal urethrostomy is the most common treatment for obstructive urolithiasis. It is a salvage procedure most often performed on feedlot steers. After a perineal urethrostomy, the patient will not be viable for breeding. The primary purpose of this procedure is to keep the animal alive and growing prior to slaughter. The procedure commonly performed under standing sedation, a caudal epidural and local anesthetic blocks. An incision is made in the perineal area along midline to the urethra. The urethra is then incised, and the urethral mucosa is sutured to the skin (Jones, 2021). In the event of urethral rupture, a catheter can be temporally placed while the

urethra heals. This procedure can be performed just caudal to the sigmoid flexure (low) or at the level of the tuber ischii just ventral to the rectum (high) (Simpson & Streeter, 2017). It is imperative that the procedure be performed proximal to the obstruction. Palpation and ultrasonography may be utilized to identify the location of the obstruction. Urethral stricture and reobstruction is a very common complication of this procedure.

Urethrotomy is occasionally performed if the location of the obstruction can be identified. An incision is made caudal to the scrotum and the affected portion of penis exteriorized (Kalim, et al. 2013). Manual crushing of the urolith is often sufficient to allow it to pass. If the obstruction is not cleared via crushing, an incision is made into the urethra and the stone is removed (Kalim, et al. 2013). The incision must be made distal to the obstruction in healthy urothelium. A temporary catheter is often placed to allow for the urethra to heal (Kalim, et al. 2013).

Laser lithotripsy has been described, though most practitioners do not have the equipment necessary to perform this procedure. This procedure is good in breeding bulls, as the prognosis to return to service is good. An endoscope is passed through the urethral opening and advanced to the level of the obstruction. The laser is then pulsated until the stone fragments enough to pass (Simpson & Streeter, 2017).

Another option for breeding bulls is a tube cystostomy. For this procedure, a ventral celiotomy is performed and the bladder is exteriorized. A Foley catheter is then passed through the body wall via a stab incision (Jones, 2021). Another stab incision is made near the apex of the bladder and the catheter is sutured into place. Urine is passed through the catheter while the urethra heals. Once adequate healing has occurred, the catheter is removed, and the animal can urinate normally (Simpson &

Streeter, 2017). This procedure is beneficial in that there is opportunity to remove stones and debris directly from the bladder. Of course, if the urethra is obstructed, the obstruction must be located and removed as well.

Other surgical options described for obstructive urolithiasis include basket catheter and urolith retrieval, cystotomy and urinary bladder marsupialization. All of these methods may preserve breeding capabilities (Simpson & Streeter, 2015).

Case Outcome

It was determined that the urethra had ruptured, and a vast amount of urine had accumulated subcutaneously. Given Lo-Bo's current condition, it was determined that, even with medical and surgical intervention, he had a very poor long term prognosis. Lo-Bo was humanely euthanized with pentobarbital administered intravenously and taken home to be buried.

Works Cited

Hardisty, Jerry R. and Dillman, R. C. (1971) "Factors Predisposing to Urolithiasis in Feedlot Cattle," Iowa State University Veterinarian: Vol. 33 : Iss. 2 , Article 7

Jones, Meredyth, DVM, MS, DACVM E. " Urolithiasis in Ruminants." *The Merck Veterinary Manual*, Merck & Co., Inc., Kenilworth, NJ, 2021.

Kalim, M, et al. "Surgical Management of Obstructive Urolithiasis in a Male Cow Calf." *Veterinary World*, 2011, p. 213., https://doi.org/10.5455/vetworld.2011.213-214.

Makhdoomi, D, and Mohsin Gazi. "Obstructive Urolithiasis in Ruminants – a Review." *Veterinary World*, vol. 6, no. 4, 2013, p. 233., https://doi.org/10.5455/vetworld.2013.233-238

Rush, Ivan G. and Grotelueschen, Dale, "G79-465 Urinary Calculi (Waterbelly) in Cattle and Sheep" (1979). Historical Materials from University of Nebraska-Lincoln Extension. 333.

Ratkalkar, Vishal N., and Jack G. Kleinman. "Mechanisms of Stone Formation." *Clinical Reviews in Bone and Mineral Metabolism*, vol. 9, no. 3-4, 2011, pp. 187–197., https://doi.org/10.1007/s12018-011-9104-8.

Simpson, Katharine M, and Robert N Streeter. "Bovine Urolithiasis." *Veterian Key*, 24 Aug. 2017, https://veteriankey.com/bovine-urolithiasis/.

"Urinary Tract Obstruction." *Veterinary Handbook for Cattle, Sheep and Goats > Diseases*, 1 Jan. 2022, http://www.veterinaryhandbook.com.au/Diseases.aspx?diseasenameid=274&id=115.

Waltner, D, and D H Meadows. "Urolithiasis in a Herd of Beef Cattle Associated with Oxalate IngestionD." *The Canadian Veterinary Journal*, 21 Feb. 1980, https://doi.org/PMC1789668.