Renal Tubular Acidosis in Horses

Etiology:

- Type 1 renal tubular acidosis (RTA) is a sporadic disorder in horses.
- The RTA may be preceded by drug therapy for another condition or renal injury, or there may be no predisposing cause.
- RTA may be transient or recurring. Genetic predisposition is unproved but possible in some cases.

Clinical Findings and Diagnosis:

- Signs include acute onset of depresson, anorexia, muscle trembling, and tachycardia and/or arrhythmia.
- There are many differential diagnoses for these clinical signs, so serum chemistry testing and urinalysis are necessary.
- There is a severe metabolic acidosis, marked hyperchloremia, and hypokalemia with equine RTA.
- The urine pH is neutral to alkaline.

Treatment:

- Administration of sodium bicarbonate IV and PO is generally successful in correcting the metabolic acidosis.
- Potassium supplementation may be critical if the serum potassium concentration is <2.5 mEq/L or if the horse is trembling or has cardiac arrhythmias.
- Treatment throughout a few days may result in complete resolution in some horses, but others may require continued supplementation with sodium bicarbonate administered PO.

Urethral Defects Causing Hematuria in Adult Male Horses

Etiology:

- The cause of the urethral defects is not proved, but they are believed to occur because of high pressure in the corpus spongiosum at the end of urination in geldings or during ejaculation in stallions.
- This high pressure may cause a "blow-out" tear in the urethral mucosa.

Clinical Findings and Diagnosis:

- The clinical signs are limited to hematuria at the end of urination, associated with contractions of the bulbourethral muscle in geldings or with hemospermia and decreased fertility in stallions.
- All breeds may be affected, although the disorder seems more common in Quarter horses.
- Diagnosis is based on clinical signs and urethral endoscopic findings. The urethral defect is seen in most cases on the dorsal convex surface of the urethra at the level of the ischial arch.

Treatment:

- Some cases may heal spontaneously, but most continue with intermittent hemorrhage; anemia is rare.
- Breeding rest is recommended for stallions. Subischial urethrostomy or subischial incision into the spongiosum penis reduces vascular pressure in the corpus spongiosum during urination, allowing the defect to heal.
- A buccal mucosal graft was used to repair the defect in a stallion.

Urolithiasis in Large Animals

- Uroliths in cattle, sheep, and goats are common. Although uroliths can be found anywhere within the urinary tract, urethroliths are responsible for most clinical problems. Obstruction induced by urethroliths causes urine retention and leads to bladder distention, abdominal pain, and eventual urethral perforation or bladder rupture, with death from uremia or septicemia.
- It is an important disease of feeder animals but is also seen in mature breeding animals. Urolithiasis is seen most often during winter in steers and wethers on full feed, or on range during severe weather conditions with limited water intake, especially when the water has a high mineral content.

- Obstructive uroliths are common in male goats, regardless of feed, season, or other risk factors.
- Urolithiasis has no specific geographic distribution, and the different urolith types reflect the mineral distribution of the feed.
- Uroliths occur in either sex, but obstructive urolithiasis develops primarily in males because of anatomic differences.

Etiology and Pathogenesis:

- Ruminant urolithiasis is considered primarily a nutritional disease. The prevalence of urolithiasis in the USA is highest in calves, lambs, and kids castrated at an early age and fed high-grain diets with roughly a 1:1 calcium:phosphorus ratio or a diet high in magnesium.

- Ruminants fed high-grain diets with a low calcium:phosphorus ratio are at increased risk of developing struvite uroliths, whereas ruminants grazing on silica-rich soil are predisposed to form silica uroliths

- Diets high in calcium (eg, subterranean clover) may result in calcium carbonate uroliths, while plants such as halogeton or tops from the common sugar beet may be a factor in calcium oxalate formation
- The mineral composition of water, in concert with dietary mineral imbalances, probably contributes more to initiating urolith formation than does the lack of water itself. A definitive diagnosis of urolithiasis in a single animal suggests that all males in the population are at risk of the disease.
- Struvite calculi have the apperance of sand, whereas calcium carbonate calculi and calcium oxalate are distinct, round stones.

- The distal aspect of the sigmoid flexure of cattle and the sigmoid flexure and urethral process of sheep and goats are the most common sites for uroliths to lodge.
- Irritation at the site of lodging causes inflammation and swelling that contributes to urethral occlusion.
- Castration of young males also predisposes to urolith-induced urethral obstruction by removing hormonal influences necessary for mature development of the penis and urethra.

Clinical Findings:

- Clinical signs may be associated with partial or complete urethral occlusion. Animals with partial obstruction dribble blood-tinged urine after prolonged, painful (stranguria) attempts at urination; before complete occlusion occurs, urine may dry on the preputial hairs and leave detectable mineral deposits.
- Animals with complete urethral obstruction exhibit tenesmus, tail twitching, weight shifting, and signs consistent with colic. Inappetence, bloat, depression, and rectal prolapse also may be seen.
- Affected steers may elevate the tail and show urethral pulsations just ventral to the rectum. Goats may vocalize

- Common sequelae of complete urethral obstruction include urethral perforation, hydronephrosis, or urinary bladder rupture.
- Bladder rupture often results in death from uremia.
- The disease course may be 5–7 days. Although urethral perforation may also cause uremia and death, it is not uncommon for the ventral abdominal skin to necrose and slough, allowing a pseudourethra to develop.

Diagnosis:

- Diagnosis based on the history, clinical signs, and physical examination is usually straightforward.
- Hypersensitivity in the region of the sigmoid flexure may be evident. Palpation may identify abnormal pulsations of the urethra and tissue swelling associated with the obstruction.
- Rectal palpation may reveal an enlarged, distended bladder, or the bladder may be nonpalpable, consistent with bladder rupture.
- Examination of the urethral process in sheep and goats may reveal the occluding urolith.

- In small ruminants, the distended bladder can be felt by abdominal palpation and visualized on ultrasound examination.
- Calcium carbonate and calcium oxalate calculi can be seen on radiographs of the urethra in small ruminants; struvite calculi are not seen on radiographs.
- If early clinical signs of obstructive uropathy are missed, the animal may show only inappetence, depression, subcutaneous swelling along the penis, or uroperitoneum; abdominal distention due to uroperitoneum must be differentiated from ruminal tympany, peritonitis, peritoneal tumors, uterine hydrops, and GI tract obstructions.

Treatment and Control

- Treatment of obstructive urolithiasis generally involves establishing a patent urethra and correcting fluid and electrolyte imbalances.
- In many instances, surgical management of the obstruction is all that is necessary; however, severely uremic and depressed animals require rehydration and correction of acid-base and electrolyte abnormalities, especially hyperkalemia or hyperammonemia.
- If a rupture of the urinary tract has occurred, hyponatremia, hypochloremia, hyperphosphatemia, and metabolic alkalosis with variable potassium concentrations are found

- Animals with an intact urethra and bladder that have early clinical signs of obstructive urethral disease may benefit from conservative therapy using antispasmodics and tranquilizers.
- This is believed to relax the retractor penis muscles with straightening of the sigmoid flexure.
- However, conservative therapy is only rarely beneficial in small ruminants and is warranted only in cases of acute or partial obstruction without evidence of urethral or bladder damage; it should not be used in complicated or advanced cases.

- Uroliths trapped within the urethral process of sheep and goats may be removed by gentle manipulation or by amputation of the urethral process.
- Proper restraint, tranquilization, and a regional anesthetic are necessary. The techniques vary, but the typical procedure requires exteriorization of the penis.
- Although amputation may be effective, relief is typically temporary (<2 days) in most animals, because obstruction recurs due to the presence of multiple uroliths.

- Cystotomy followed by dietary management is believed to be a more effective longterm solution to urolithiasis in sheep and goats than is perineal urethrostomy.
- Cystotomy allows removal of multiple urocystoliths, permits bidirectional urethral flushing, and poses less risk of urethral stricture.
- Tube cystotomy is generally considered the treatment of choice, allowing time for the calculi to be expelled spontaneously. An intact urethral process, absence of abdominal fluid, and serum potassium concentration <5.2 mEq/L have all been associated with improved survival after tube cystotomy in small ruminants.

- If the bladder is ruptured, the ability to urinate must be restored and uremia corrected. In animals with substantial uroperitoneum, the peritoneal cavity should be slowly drained using a teat tube or trocar. Urine removal may also reduce the severity of peritonitis and make the animal more comfortable.
- Fluid, electrolyte, and acid-base homeostasis normally returns within 24 hr after restoration of a patent urinary system. Persistent uremia indicates the possibility of hydronephrosis or ascending pyelonephritis or both.
- A urethrostomy should be performed to provide unobstructed passage of urine. Attempts to surgically repair the ruptured bladder have been largely unsuccessful because of the chronic distention before the rupture