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UROLITHIASIS IN RABBITS AND GUINEA PIGS

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Rabbits and guinea pigs are susceptible to formation of urinary tract calculi. Uroliths can be located anywhere in the urinary tract and are typically composed of calcium salts: calcium phosphate; calcium oxalate. The etiopathogenesis of uroliths in these species is poorly understood but is related to the urinary concentration of ions and crystals, and crystal aggregation. Urine pH is typically alkaline (pH > 8.5) in small hindgut fermenting herbivores and contains varying amounts of calcium crystals. Diet is likely to play a role in calculi formation. Rabbits and guinea pigs are often fed a diet high in calcium-rich alfalfa, and supplemented with greens rich in calcium. Rabbits are unique in that the amount of calcium absorbed is directly proportional to dietary intake and is less dependent on vitamin D. This intestinal hyperabsorption of dietary calcium. may lead to excessive excretion of calcium in the urine. Calcium and oxalates are the main risk factors for stone formation in the guinea pig. High levels of vitamin D in the diet may increase intestinal absorption of calcium in the guinea pig. As in other mammals, infection and mechanical factors (bladder diverticuli, suture material e.g.) may predispose stone formation. The enteric oxalate-utilizing bacterium, *Oxalobacter formigenes*, may play a role in the prevention of hyperoxaluria in some rodent species like the rat and guinea pig.

DIAGNOSIS

Clinical signs are based on location and size of the calculus. Stones in the lower urinary tract (bladder and urethra) may be associated with hematuria, stranguria, and dysuria. Ureteral stones are very painful and the only clinical sign may be inappetance and decreased activity. Some guinea pigs with lower urinary tract stones may appear to be straining to defecate. Prey species like rabbits and guinea pigs are often not demonstrative when in pain or discomfort and clinical signs at home may be subtle or missed. Any change in urinating behavior may be significant.. Urolithiasis can be very subtle in guinea pigs and should be on the differential diagnosis list for any guinea pig that presents “sick”. Most rabbits are litterbox trained and tend to have clinical signs more typical of a urinary tract problem.

On physical examination, rabbits and guinea pigs may be painful on abdominal palpation. Larger calculi can sometimes be palpated in the bladder or in the distal urethra. Diagnosis is based on radiographic findings. Uroliths in these species are composed of calcium salts making them radiodense and readily visible on radiographs. Properly positioned radiographs are extremely important in identifying the location of the stones. Unanesthesized guinea pigs are difficult to restrain for good films and improper positioning can lead to misinterpretation of radiographic findings. Multiple sites and multiple calculi of varying size are possible and their location will ultimately affect therapeutic approach as well as prognosis. Abdominal sonography can provide additional information, e.g., the location of the calculi and architecture of the ureters and kidneys. However, ultrasound may be inconclusive or non-diagnostic if there is a large amount of gas in the gastrointestinal tract. Contrast studies like an excretory intravenous pyelogram (IVP) can be performed to assess renal function in cases where the stones are lodged in a renal pelvis or ureter.

TREATMENT

Uroliths can be treated medically or surgically, depending on species, type of stone, size and location. Very small calculi can be carefully monitored with urine dipstick blood checks at home, periodic radiographs, and dietary adjustments. Surgical removal is currently the treatment of choice for large or painful calculi. Pre-surgical workup should include measurement of kidney values (BUN and creatinine) and an IVP to assess kidney function on the affected side prior to surgery, especially if ureteral calculi are present. Cystotomy is routine, as in the dog or cat. In guinea pigs, ureteral calculi can sometimes be indistinguishable from cystic calculi on pre-operative radiographs and may only be discovered intra-operatively. Stricture formation is likely with ureterotomy; ureteral calculi are "milked" down into the bladder for removal if possible. A section of bladder mucosa should be taken for culture before closing the cystotomy site. Skin closure sutures can be placed subcuticularly to prevent chewing. Intravenous fluid administration is recommended for the surgical procedure and 24 hours post-operatively. Analgesics and extensive supportive care may be necessary for some convalescing guinea pigs. Rabbits tend to tolerate these surgical procedures well. Antibiotics, potassium citrate, and dietary modifications may prevent recurrence of oxalate stones. Prognosis is very good for rabbits, but is guarded in guinea pigs due to the high rate of recurrence.

Medical treatment of urolithiasis in small herbivores has been disappointing. There are no effective stone dissolution diets for guinea pigs or rabbits. Because the exact mechanisms of calculi formation is unknown, dissolution and prevention of calculi has not been possible. Suggested recommendations for medical treatment include antibiotics to control or prevent infection, pain management, and dietary modifications. Dietary modifications are aimed at reducing calcium and oxalate content of the urine. Calcium is reduced by limiting the amount of alfalfa offered (alfalfa is high in calcium). A timothy-based pellet (Cavy Cuisine®, or Bunny Basics T®, Oxbow Pet Products, Murdock, NE) is lower in calcium and higher in fiber than the traditional alfalfa-based feeds and is recommended in adults. Foods containing high levels of oxalates must be avoided particularly in the guinea pig,. Oxalate content is high in dietary supplements like spinach, parsley, celery,

strawberries, and vitamin C. Vitamin C supplementation is important in all guinea pigs and when limited to 25-100 mg/day is unlikely to result in hyperoxaluria (it takes 8-10 grams of vitamin C per day to result in significant hyperoxaluria in people). In rats, cats, and some people, pyridoxine (vitamin B6) deficiency leads to an increase in urinary excretion of oxalates. Potassium citrate has been used successfully to inhibit calcium stone crystallization in species with acidic urine (Polycitra-K®, distributed by Alza Corp, Mountainview, CA or Island Pharmacy Services; Wisconsin) @ 150 mg/kg/divided q 24h. Citrate reduces urinary saturation of calcium salts by binding calcium, reducing ion activity, and alkalinizing the urine. Although not tested in species with alkaline urine like the guinea pig or rabbit, it appears to be well tolerated in the author's experience and should be considered part of medical therapy following calcium oxalate stone removal.

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