MANAGEMENT OF CANINE LOWER URINARY TRACT DISEASE

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Introduction

Veterinary technicians play a crucial role in aiding the veterinarian with diagnosis and treatment of canine lower urinary tract disease (LUTD). The information discerned from the owner aids in the diagnosis of LUTD, and the discussion of the diagnostic and treatment plan with the client is crucial to the client's understanding and compliance with the veterinarian's recommendation and ultimately the health of the pet. Canine lower urinary tract disease (LUTD) signs are seen in 2 to 3% of dogs per year. Urinary tract infections and uroliths are seen most commonly[1]. The most common uroliths in dogs are struvites (magnesium, ammonium, phosphate) and calcium oxalates; these two make up 90+% of uroliths seen in dogs[1].

Prevalence

In 1981, 78% of canine uroliths were composed of struvite and only 5% were calcium oxalate. In the mid- to late-1980s, the occurrence of calcium oxalate uroliths began to increase. In 2015 the Minnesota Urolith Center analyzed 48,404 uroliths, with calcium oxalates making up 42%, struvites 36%, "other" (mixed and compound) uroliths 14%, and purines 4%.[2].

Clinical signs

Regardless of underlying cause, LUTD is characterized by dysuria, pollakiuria, stranguria, hematuria, and/or periuria (urination in inappropriate places). It is important that veterinary technicians are aware of signs of LUTD when talking with clients[3].

Diagnostic Evaluation

Diagnostic evaluation of dogs with recurrent or persistent lower urinary tract signs should include a urinalysis, culture (if inflammatory cells are evident or if struvites are suspected) and diagnostic imaging, hematology and serum chemistry. If the urolith is removed, urolith analysis is imperative to proper management of the patient[3].

Urinalysis is an important element of evaluating patients with signs of lower urinary tract disease. Ideally, the veterinary technician should perform the urinalysis in-house, since fresh urine samples analyzed within 30-60 minutes of collection are preferred. Urine specimens evaluated after this time may form crystals that are not present in the patient, and casts as well as inflammatory cells may break down and be less visible on older samples. Samples may be refrigerated for up to 8 hours and then evaluated (after the sample has returned to room temperature). This method is not best for evaluating crystalluria and should be avoided as much as possible by the veterinary technician. It is very important to perform a complete urinalysis, including urine specific gravity and sediment evaluation.

Survey radiographs are helpful for identifying radiopaque uroliths and crystalline-matrix urethral plugs. Remember during positioning to include the caudal abdomen (urethra) in the radiograph, or you risk missing potentially important information. Normal survey radiographs do not exclude radiolucent uroliths (urate/purine, cystine), small uroliths (< 2 mm), neoplasia, blood clots, or anatomic defects. Abdominal ultrasonography and/or contrast urethrocystography is helpful in these cases.

Struvite Uroliths

Risk Factors

Females (~85%) are affected more often than males (~15%). The median age is 6 years old, but the range is 1 month to 24 years[4]. They are usually found in the lower urinary tract 99% compared to 1% found in the upper urinary tract. Recurrence is common, especially if the bladder infection is not taken care of; in one study 21% recurred[5].

Struvites can form within a few days to a few weeks when a dog has a urease-producing microbial urinary tract infection[6]. More than 95% of dogs with struvite urolithiasis have infection as an underlying cause for the urolith growth[5]. It has been demonstrated many times in a variety of studies that the formation of struvite uroliths in dogs are caused by urease-producing bacteria- eg. *Staphylococcus* and *Proteus spp*. That is why struvites are sometimes identified as infection stones. The urease producing bacteria release ammonia which causes the urine to be more alkaline or basic. Struvite crystals are precipitated in a basic pH. Also, bacterial infection produces inflammation and protein debris which may serve as a nidus for urolith formation. *E.coli* and other non-urease-producing microbes have not been linked with struvites[4].

Surgery vs, Dissolution

Treatment options for dogs with struvite uroliths include physical removal of uroliths or dissolution via nutritional management. For dogs with suspected struvite uroliths, it is appropriate to transition to feeding a canned calculolytic food over a 7-day period. The appropriate antibiotics should be given to treat the UTI. Dogs should be re-evaluated every 2-4 weeks (urinalysis and abdominal radiographs). Urine pH should remain < 6.1 and specific gravity should be < 1.040, if canned food is being fed exclusively. Nutritional management (dissolution) and antibiotics should be continued 1 month beyond radiographic resolution of the urolith. As the stone dissolves, viable bacteria released from the urolith could allow the infection to persist and cause a urolith to reform, so it is important to keep the patient on antibiotics while the dog is on the dissolution food.

Nutritional Management

After dissolution or removal of struvite uroliths nutritional management can reduce the building blocks of struvite crystals. Food can decrease the risk factors or building blocks of a struvite urolith. Monitoring for future urinary tract infection is also important for managing urolith recurrence.

Key Nutritional Factors

Water

Water should be increased in both dissolution and management of struvite uroliths. It is recommended to feed canned food; if feeding dry, adding water to dry food should be considered. Increased water intake will help achieve a specific gravity of 1.020 or less. In addition, increased water intake will increase urination, reducing crystal retention time and minimize crystal growth. Adequate water intake may be the single most important factor in determining whether or not uroliths recur[4].

Protein

To dissolve struvite uroliths, protein should be more restricted than when only management is the objective. Restricted protein can increase urine volume by contributing to obligatory polyuria due to decrease in renal medullary urea concentration resulting from a reduction of hepatic urea production. A low USPG with increased urine output will assist with dissolution. For dissolution, protein should be 8% DMB (dry matter basis) or less.
As an aid to the management of struvite uroliths where there is high risk, protein content of food should be less than 25%DMB to decrease urinary concentration of urea. Also, high protein foods may be high in phosphorus--another nutrient that should be controlled[4].

Phosphorus

For dissolution, phosphorus should be restricted to 0.1% DMB or less and for management of struvite uroliths, phosphorus should be less than 0.6% DMB[4].

Magnesium

Struvite crystals will form when there is excess magnesium in the urine. Avoiding excess magnesium can decrease the concentration of magnesium in the urine. Magnesium should be less than 0.02% DMB for dissolution; for management magnesium should be 0.06% DMB[4].

Urinary pH

Struvite management foods may help notify the veterinarian that there is a possible infection even if the dog is not showing signs. Struvite urolith management foods produce an acid urine pH of 6.2-6.4 or below. If a dog is on a struvite management food and has urine a pH of 8, it warrants further testing for a urinary infection. For dissolution, the pH target is 5.9-6.1 and for management 6.2-6.4[4].

Calcium oxalate uroliths

Risk factors

Breed: schnauzers have been shown to have a higher urinary excretion of calcium; this may explain why we see a higher number of calcium oxalate uroliths in schnauzers. The most common breeds affected are both the miniature and standard schnauzer, lhasa apso, Yorkshire terrier, bichon frise, shih tzu, and miniature and toy poodle. The golden retriever, German shepherd dog and cocker spaniel are at lowest risk for calcium oxalate uroliths. Age and sex: The median age of calcium oxalate urolith removal is 8.7 years. Less than 1% of uroliths are retrieved from dogs less than 1 year of age. Males were affected 74% more than females. Neutered males, overweight and pet dogs were affected the most. Recurrence for calcium oxalates is common: 25-48% will recur[5.]

Surgery

Calcium oxalate stones cannot be nutritionally dissolved as of yet. Uroliths can be surgically removed, or more clinicians are choosing to perform nonsurgical retrieval of the stones. Voiding urohydropulsion is gaining in popularity.

Nutritional Management

After stones are removed, it is important to manage or eliminate the risk factors for reforming. Calcium oxalate uroliths are considered metabolic stones and can recur. With nutrition we can hopefully minimize risk factors for the uroliths reforming and slow the rate of recurrence.

Key nutritional factors

Water

Managing water intake is the same as already discussed for struvite managment[7].

Protein

Eating foods high in protein could contribute to calcium oxalate uroliths by increasing calcium excretion and decreasing urine citrate excretion. Hypercalciuria can occur in healthy dogs fed high protein foods. Excessive protein should be avoided in a dog's food with a history of calcium oxalate uroliths. The recommended protein should be 10-18% DMB[7].

Calcium and oxalic acid

Reduction of both calcium and oxalate in the food are important for the management of calcium oxalates. Calcium should be reduced to 0.4-0.7% DMB[7].

Phosphorus

Phosphorus should be 0.3-0.6% DMB and the calcium/ phosphorus ratio should be 1.1:1 to 2:1[7].

Sodium

Sodium chloride can increase thirst and urine volume. However, excess sodium increases urine calcium excretion and therefore is a risk factor for calcium oxalate and calcium phosphate urolithiasis, especially if the urinary pH is highly basic. High sodium level in foods can also contribute to hypertension in salt- sensitive dogs. For active calcium oxalate urolith formers, <0.3% DMB is advised for sodium[7].

Magnesium

There has been some indication for supplementing magnesium in humans, but more studies need to be completed for dogs. Currently it is not recommended to supplement calcium oxalate dogs with magnesium. Magnesium should be 0.4-0.15% DMB[7].

Vitamin C

Acidifying urine is not recommended for dogs with calcium oxalate uroliths, so currently it is not recommended to give ascorbic acid. Ascorbic acid is also a precursor of oxalates[7].

Urinary pH

Acid load is reflected in a healthy dog's urinary pH. A pH of not less than 7 is recommended to manage dogs with calcium oxalates[7].

Urine alkalinizing agents

Potassium citrate can be used to obtain the desired pH. A desirable pH is 7.1-7.57.The

potassium citrate also gets excreted into the urine and may be a stone inhibitor for calcium oxalates.

Vitamin B6

A deficiency of vitamin B6 should be avoided, because it promotes endogenous production of oxalic acid. Healthy dogs should get 1.5mg/kg DMB[7].

Vitamin D

Vitamin D excesses should be avoided for dogs with a history of calcium oxalate uroliths. Excessive vitamin D promotes intestinal absorption of calcium. For dogs with a history of calcium oxalate uroliths 500 to 1500 IU/kg DMB is recommended[7].

Follow up

All dogs should be monitored for recurrence, including urinalysis, potentially with a culture, every 3 months to detect struvites or calcium oxalate crystalluria, with diagnostic imaging every 6 months to detect uroliths. If uroliths recur, less-invasive procedures such as voiding urohydropropulsion are more likely to be effective when uroliths are smaller.

Summary

Increased understanding of specific causes of LUTD has allowed diagnostic and therapeutic efforts to be directed toward identification, removal and management. The most common types of uroliths are struvites and calcium oxalates.

Veterinary technicians play a critical role in the treatment of LUTD. The history obtained from discussions with the owner aids in the diagnosis of LUTD. The technicians' discussion of the treatment plan with the client is crucial to the client's understanding and compliance with the veterinarian's recommendation and ultimately the health of the pet.

References/Suggested Reading

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