MINNESOTA UROLITH CENTER
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## CANINE STRUVITE UROLITH MEDICAL DISSOLUTION

In almost all dogs, struvite forms as a consequence of a urinary tract infection with bacteria that produce urease (e.g. Staphylococcus sp.). Benefits of dissolution over cystotomy include simultaneous resolution of unrecognized struvite nephroliths, avoidance of abdominal contamination with infected urine during cystotomy, and prevention of suture nidus, which is a risk for recurrent stones and recurrent infection. Urethral obstruction during dissolution is rare when infection and pain are effectively controlled. Dissolution is contraindicated for dogs with urinary obstruction (e.g.urethroliths, ureteroliths), but may be possible after obstruction is corrected (gentle retropulsion of urethral stones, ureteral stent, etc.).

### DISSOLUTION

| DIAGNOSTIC CONSIDERATIONS | MEDICAL CONSIDERATIONS | NUTRITIONAL CONSIDERATIONS | MONITORING CONSIDERATIONS |
|---|---|---|---|
| Medical Imaging (e.g. X-ray)<br>Urine culture<br>MUC App*<br>Urinalysis | Penicillin's (e.g. amoxicillin) are usually effective.<br>Administer antibiotics throughout most, if not the entire dissolution time (i.e. 2 to 3 months). | Feed struvite dissolution foods (e.g. Hills s/d, c/d multicare, others).<br>Canned struvite dissolution foods may shorten dissolution time compared to dry foods. | X-ray every 6 weeks.<br>Reduced urolith size/density indicates effective therapy and accurate mineral prediction, and is an indication to continue therapy.<br>No change in urolith size - verify compliance (urine culture, urinalysis) or consider other urolith removal strategies. |

*MN Urolith for Apple devices and Minnesota Urolith Center on Androids

** Review manufacturer's therapeutic food literature to determine indications/contraindications. For pets with multiple health concerns, consult a veterinary nutritionist to select an optimal food.

*Support from Hills Pet Nutrition, veterinarians, and pet owners make our work possible.*

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# CANINE STRUVITE UROLITHS: MEDICAL DISSOLUTION

In almost all dogs, struvite forms as a consequence of urinary tract infection with bacteria that produce urease (e.g. Staphylococcus sp.). Urease is responsible for over-production of urine ammonia and subsequent urine alkalinization. Female dogs (85%) are over represented presumably because they are at greater risk for urinary tract infection.[1] Sterile struvite stones are rare, and have been diagnosed more often in males. Benefits of dissolution over cystotomy include simultaneous resolution of unrecognized struvite nephroliths, avoidance of abdominal contamination with infected urine during cystotomy, and prevention of suture nidus (a risk for recurrent stones and recurrent infection). Urethral obstruction during dissolution is rare when infection and pain are effectively controlled. Dissolution is contraindicated in dogs with urinary obstruction (e.g. urethroliths or ureteroliths), but maybe possible after the obstruction is corrected (gentle retropulsion of urethral stones back into the urinary bladder, ureteral stents, etc.).

**Medical Considerations:**

- Urinary tract infection by urease-producing bacteria is the underlying cause of most canine struvite stones. Therefore, culture urine prior to antimicrobic administration to accurately classify and effectively manage uroliths.
- In some dogs, struvite formation occurs in the absence of urinary tract infections (i.e. sterile struvite stones). However, risk factors (distal renal tubular acidoisis, hypoxemia, chronic diuretic use, administration of antacids, and hyperaldosteronism) promoting persistent alkalinuria, hyperphosphaturia and hyperammoniauria are rarely detected. Sterile struvite stones can be dissolved with dietary therapy without the addition of antibiotics.

**Nutritional Considerations:**

- Diets with moderate reduction in protein, phosphorus and magnesium that promote formation of acidic urine (i.e. pH$\leq$ 6.5) reduce struvite precipitation and promote struvite dissolution (Hills Prescription Diets c/d and s/d fit these criteria).
- Extreme and prolonged reductions of some risk factors that minimize struvite urolith formation, (e.g. acidic urine), may increase risk for calcium oxalate uroliths in some breeds (e.g. Bichon, Miniature schnauzer, Shih Tzu, Lhasa Apso, miniature poodle and others at risk for CaOx).
- Both dry and canned struvitolytic foods are have been associated with successful infection-induced struvite dissolution.

**Pharmacological Considerations:**

- While waiting for urine culture results, consider antimicrobics (e.g. beta-lactam) with high efficacy for eradicating common, urease-producing uropathogens (e.g. staphylococcal sp.).
- Consider dl-methionine (100mg/kg q12 hr) or ammonium chloride to acidify urine and assist urolith dissolution in patients unable to consume therapeutic diets and in dogs whose urine remains alkaline following appropriate therapy.[2]

**Consider These Facts:**

Some veterinarians prefer to remove uroliths surgically due to the perception that surgical management is more effective, less expensive, alleviates clinical signs quicker, and will not be associated with urethral obstruction that could occur as uroliths decrease in size with medical dissolution. These are more often misperceptions. Surgery is a feasible option;

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however, medical dissolution with Hills Prescription diet s/d ® was 100% effective after just 3 to 6 weeks for sterile struvite uroliths[3] and 8 to 12 weeks with antimicrobics for infection-induced struvite uroliths.[4] Noninvasive medical dissolution is an effective and compassionate choice for the majority without urinary obstruction.

Although low-protein, dissolution diets are not recommended for immature growing dogs, their short-term use in conjunction with antimicrobics has rapidly dissolved infection-induced struvite uroliths in 9 to 12 days without adverse events.[5]

When feeding Hills Prescription Diet s/d, owner/patient compliance is easily and rapidly determined with a urine specific gravity (mean = 1.008 ± 0.003) and pH (mean = 6.2 ± 0.7).[6] If urine is inaccessible, the serum concentration of urea nitrogen is also a reliable marker (mean = 3.5 ± 2.4 mg/dl) of dietary compliance.

Some struvitolytic diets are relatively high in fat (e.g. s/d) in order to maintain calorie intake while providing lower quantities of protein to reduce urolith precursors (e.g. phosphorus and urea) important for dissolution. High dietary fat is a risk factor for pancreatitis in susceptible dogs (e.g. miniature Schnauzers (and some other breeds) and dogs with hyperadrenocorticism). Be aware of these associations and know how to respond (e.g. discontinue high fat struvitolytic diet, maintain hydration) to adverse events (vomiting/pancreatitis) if they occur. Then consider low-fat alternatives that also acidify urine to assist correction of both diseases (e.g. i/d low fat).

Twenty-six percent of canine nephroliths are composed of struvite.[7] As with bladder stones, struvite kidney stones can be dissolved medically. Dissolution times are typically longer due to possible reduced kidney function, reduced urine production, and reduced nephrolith dwell time in therapeutically undersaturated urine. In some cases, stenting the ureter may assist clearing an infection from the kidney.

The duration of antibiotic administration to dissolve infection-induced struvite is unknown. Discontinuing antibiotics before complete dissolution may promote recrudescence of infection and stones.

Several case reports have demonstrated struvite dissolution using antibiotics without a struvitolytic diet.[8] The addition of a struvitolytic diet will likely accelerate dissolution, reduce disease period and shorten duration of antibiotic administration.

1. Osborne CA, et. al. Canine struvite uroliths in Small Animal Clinical Nutrition 5th edition, The Mark Morris Institute, Topeka Kansas, 2010, p891.
2. Bartges JW, et. al. Evaluation of d.l-methionine and antimicrobial agents for medical dissolution of spontaneously occurring infection-induced struvite urocystoliths in dogs, Proceedings of the 2010 ACVIM Forum.
3. Bartges JW, et. al. Recurrent sterile struvite urocystolithiasis in three related English Cocker spaniels. JAAHA. 1992;28:459.
4. Osborne CA, et. al. Medical dissolution of canine struvite uroliths. VCNA. 1986;16:349.
5. Lulich JP, et. al. Non-surgical correction of infection-induced struvite uroliths and a vesicourachal diverticulum in an immature dog. J Sml An Pract 1989;30:613.
6. Abdullahi SU, et.al. Evaluation of a calculolytic diet in female dogs with induced struvite urolithiasis. JAVMA. 1984;45:1508.
7. Osborne CA, et. al. Analysis of 451,891 canine uroliths, feline uroliths, and feline urethral plugs from 1981 to 2007. VCNA 2009: 39:183.
8. Rinkardt NE. et al. Dissolution of infection- induced struvite bladder stones by using a noncalcuolytic diet and antibiotic therapy. CVJ 2004;45:838
9. Dear JD et al. Evaluation of a dry therapeutic urinary diet and concurrent administration of antibacterial for struvite cystolith dissolution in dogs. BMC Vet Res. 2019;15:273.

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