FELINE STRUVITE UROLITHS

In almost all cats, struvite (magnesium ammonium phosphate hexahydrate) forms without a urinary tract infection (i.e. sterile struvite uroliths). Culture urine prior to antibiotic administration if you suspect infection (urease-producing bacteria) as the cause of struvite formation.

PREVENTION

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<tr>
<td>Culture urine.</td>
<td>Urine Culture and susceptibility testing provides the most accurate method for selecting an antimicrobial if needed to manage infection-induced struvite uroliths.</td>
<td>Foods with lower phosphorus and magnesium that promote formation of acidic urine (e.g. Hill’s c/d multicare, w/d, others).</td>
<td>Repeat urinalyses every 6 months and medical imaging annually. Culture urine every 3-6 months for infection-induced struvite uroliths.</td>
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** 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.

In depth recommendations and references are available on our website: urolithcenter.org under the resources tab.
FELINE STRUVITE UROLITHS

Cats between 2 to 10 years old are at greatest risk for struvite urolith formation.\(^1\) Although common in the urinary bladder, struvite is rare in the kidney. By reducing urinary phosphorus, magnesium, and pH, therapeutic foods are very effective at dissolving and preventing sterile struvite uroliths in cats.

### Medical Considerations:
- Sterile struvite uroliths are common in cats. If urinary infection is considered, avoid empiric antimicrobics and culture urine first.
- Metabolic risk factors promoting alkalemia (renal tubular acidosis, hypoxemia, chronic diuretic use, administration of antacids, chronic vomiting, and hyperaldosteronism) and subsequent alkalinuria are rarely diagnosed.

### Nutritional Considerations:
- Diets restricted in phosphorus and magnesium that promote formation of acid urine (i.e. pH \(\leq 6.4\)), minimize formation of sterile struvite uroliths.
- Extreme and prolonged reductions of some risk factors to minimize struvite urolith formation, including formation of acidic urine, may increase risk for calcium oxalate urolith formation. Therefore, we do not recommend long-term feeding of foods promoting urine pH < 6.2.\(^1\)
- High moisture foods (i.e. canned formulations) maybe more effective because increased water consumption is associated with decreased urine concentrations of calculogenic minerals and increased crystal evacuation. With persistent struvite crystalluria, feed canned foods and/or add increasing amounts of water to food until specific gravity is less than 1.030.

### Pharmacological Considerations:
- Consider methionine or ammonium chloride to acidify the urine of patients consuming alternative diets that do not promote urine acidification.

### Consider These Facts:
Some veterinarians prefer to remove struvite stones surgically instead of medical dissolution due to the perception that medical dissolution is less effective, more expensive, associated with prolonged discomfort, and will be associated with urethral obstruction as uroliths decrease in size. These are misperceptions. Medical dissolution of sterile struvite uroliths was not associated with increased expense, urethral obstruction, or increased discomfort, and was more effective than surgery.\(^2,3,4\) Medical dissolution is an effective and compassionate choice for cats without a urethral obstruction.

Dissolution of sterile struvite uroliths with Prescription Diet\textsuperscript{\textregistered} s/d\textsuperscript{\textregistered} Feline pet food was 100% effective; in as quick as 6 days (range 6-28 days).\(^4\) Prescription Diet\textsuperscript{\textregistered} c/d\textsuperscript{\textregistered} Multicare Feline, a maintenance food specially formulated for long-term feeding, was also 100% successful in dissolving sterile struvite uroliths in as quick as 7 days (range 7 - 52 days).\(^4\) Consider feeding the maintenance food formulated to prevent struvite uroliths until cats are at least 9-10 years old and older if needed.\(^1\)

Struvite is the most common mineral in urethral plugs; following retropulsion or removal of urethra plugs feed therapeutic maintenance foods formulated to dissolve struvite.

Struvite crystalluria is common in cats with idiopathic cystitis. To eliminate risk for urethral obstruction, urolith formation, and bladder irritation from larger crystal aggregates; feed therapeutic maintenance foods formulated to dissolve and prevent struvite.

\(^1\) Lekcharoensuk C. Association between patient-related factors and risk of calcium oxalate and magnesium ammonium phosphate urolithiasis in cats. JAVMA 2000; 217: 520.
\(^2\) Osborne C. Medical dissolution of feline struvite urocystoliths: prospective clinical study of 30 cases. JAVMA 1990;196:1053.
PREVENTION OF STERILE STRUVITE UROLITHS IN CATS

Therapy: Long-term use of a struvitolytic maintenance diet with reduced levels of phosphorus and magnesium that promote formation of acidic urine (e.g. Prescription Diet® c/d® Multicare Feline fits these criteria).

Monitor: Urinalysis in 1 month and then every 3 to 6 months
Medical imaging every 6 to 12 months

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<table>
<thead>
<tr>
<th>Urine pH ≤6.4 and no struvite crystalluria</th>
<th>Urine pH &gt; 6.5</th>
<th>Struvite Crystalluria</th>
<th>Calcium Oxalate Crystalluria</th>
<th>Uroliths</th>
</tr>
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<tbody>
<tr>
<td>These parameters are ideal for successful struvite prevention</td>
<td>• To verify, measure using pH meter</td>
<td>• Verify persistent, in vivo crystalluria by reevaluating an appropriately collected (in hospital) fresh urine sample analyzed within 30 minutes</td>
<td>• If persistent CaOx crystalluria avoid high-sodium diets that promote formation of concentrated acidic urine and consult recommendations for calcium oxalate urolith prevention which includes additional water to minimize both mineral types</td>
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<tr>
<td>• Continue therapy and monitor every 3 to 6 months, or sooner with recurrent signs</td>
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<td>With persistent struvite crystalluria</td>
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<td><strong>Encourage consumption of diets with proven success to eliminate struvite (Prescription Diet® c/d® Multicare Feline)</strong></td>
<td><strong>Verify (urine culture) and eliminate infections with urease-producing bacteria (e.g. Staph)</strong></td>
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<td><strong>Consider dissolution for recurrent struvite uroliths and minimally invasive techniques or surgery for other urolith types or uroliths associated with urinary obstruction.</strong></td>
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PREVENTION OF INFECTION-INDUCED STRUVITE UROLITHS IN CATS

Infection-induced struvite uroliths are uncommon, except in cats with perineal urethrostomies or systemic immunosuppression. Do not confuse infection-induced struvite uroliths which are often caused by Staphylococcus sp., with UTI’s secondary to urolithiasis which are often caused by bacteria other than Staphylococcus sp.

**Therapy:**
1. Antimicrobials: When needed, antimicrobics should be selected on the basis of culture and susceptibility results
2. Diet: When needed, consider foods with reduced phosphorus and magnesium that promote formation of acidic urine (e.g. Prescription Diet® c/d® Multicare Feline fit these criteria). Therapeutic foods are helpful, but cannot be used as a substitute for appropriate control of urinary tract infections.

**Monitor:**
1. Urine culture and urinalysis in 1 month and then every 3 to 6 months
2. Consider medical imaging every 6 months, or sooner in patients with recurrent urinary signs.

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**Positive Culture**

- Consider dissolution for recurrent struvite uroliths. Consider minimally invasive techniques or surgery for other types of uroliths.
- Submit retrieved uroliths for analysis
- Identify and eradicate structural (vaginourethrocystoscopy, contrast vaginourethrocystography, and ultrasonography) and functional (serum biochemical and thyroid profiles, and neurological exam) risk factors for recurrent infections
- Initiate antimicrobial therapy based on susceptibility results.
- Verify antimicrobial effectiveness (culture urine during therapy)
- With additional recurrent infections, administer full dose antimicrobics for 7-14 days and then consider low-dose (1/3 to 1/2 daily dose), long-term (9 to 12 months), nightly antimicrobics; monitor with periodic (e.g. every other month) urine cultures. Although not substantiated with controlled studies in cats, this regimen is clinically successful in dogs.

**Negative Culture**

- Repeat Culture and UA every 3 to 6 months.
- Repeat culture with any signs of emerging infection (e.g. excessive licking of perineum, urinating in house, pollakiuria, hematuria, etc.)
- Consider maintenance foods (e.g. Prescription Diet® c/d® Multicare Feline) that minimize struvite crystalluria and uroliths.

**Struvite Crystalluria**

- Consider dissolution for recurrent struvite uroliths. Consider minimally invasive techniques or surgery for other types of uroliths.
- Submit retrieved uroliths for analysis

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