

# Common diagnostic and treatment pitfalls in cats with uroliths



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Uroliths in cats may be associated with clinical signs (stranguria, pollakiuria, hematuria, periuria or a combination of these) or they may be documented as an incidental finding in some cats. Diagnostic evaluation is indicated to estimate mineral composition of the uroliths and confirm their location, which helps guide treatment recommendations. This article reviews some of the common diagnostic and treatment pitfalls for cats with uroliths.

## Urinalysis

For cats with suspected or confirmed uroliths, a baseline urinalysis including sediment examination is advised and urine should be evaluated within 60 minutes of collection to minimize temperature and time-dependent effects on in vitro crystal formation.<sup>1</sup> Studies evaluating urine pH in cats indicate that measurements obtained by a pH meter provide the most accurate results and samples collected at home may also be used.<sup>2</sup> Results of the urinalysis and sediment examination are not specific for urolithiasis in the cat, and must be considered together with all clinical and diagnostic findings. For example, the presence of struvite or calcium oxalate (CaOx) crystals in the urine does not always indicate the presence of uroliths,<sup>3</sup> and may be an incidental finding, or in vitro artifact.<sup>1</sup> Furthermore, crystal type does not always correlate well with urolith type; this means that cats with one crystal type may have uroliths of another mineral type.<sup>4</sup> In addition, cats with uroliths may have no urine crystals identified on sediment examination.

Urate crystalluria in cats might warrant further diagnostics, such as imaging studies and measurement of fasting and post-prandial serum bile acids. The diagnostics selected for a cat with suspected urate uroliths are variable and depend on the cat's age, clinical signs present (including those suggestive for a portosystemic shunt), the presence or absence of abnormalities on a complete blood count and serum biochemical panel, as well as the number of episodes of urate urolithiasis. Cystine crystals are rare in cats and if present, imaging studies are warranted to evaluate for the presence or absence of cystine uroliths.



In addition to being part of the diagnostic evaluation, urinalysis can be helpful for monitoring the effects of the prescribed treatment regimen in patients with urolithiasis. Monitoring the specific gravity is a good parameter to evaluate the cat's moisture intake; anecdotal evidence suggests a urine specific gravity continually  $<1.025$  may help prevent recurrent episodes of urolithiasis; however, this needs further study.

## Imaging studies

Abdominal radiographs are very helpful in cats with suspected uroliths and they should be performed in cats with lower urinary tract signs as well as those with azotemia. It is important to perform imaging studies in cats with azotemia to evaluate the patient for lower as well as upper tract urolithiasis (see below). Although ultrasound examination may be more sensitive for detection of uroliths, radiography provides accurate results of size, shape and radiopacity of the urolith.<sup>5</sup> Knowing the radiopacity and shape of the urolith can aid in identification of the mineral composition prior to removal.<sup>6</sup> CaOx- and struvite-containing calculi are radiopaque and, if present, can often be visualized on plain abdominal radiography. It is important that the entire urinary tract be included in this image, so as not to miss calculi in the urethra (Figure 1) or ureters (Figure 2). Struvite uroliths often occur as single, large, elliptical mineral opacities in the urinary bladder, whereas, CaOx often occurs as multiple uroliths and can have distinct 'jagged edges.' Placing a wooden paddle in the area of the urinary bladder and applying gentle compression can help delineate details in this area.

In one retrospective study, urate uroliths (ammonium hydrogen urate) were often identified in cats when evaluating plain abdominal radiographs, even though they were not as radiodense as struvite or CaOx.<sup>4</sup> However, there was a small percentage of cases where the urolith

was identified only by ultrasonography and not radiographically.<sup>4</sup> Therefore, radiography as well as ultrasonography should be considered when evaluating cats suspected of urolithiasis. Contrast cystourethrograms can be performed for patients suspected of urolithiasis and this study is excellent for evaluating the urethra of male cats. Advanced imaging techniques such as contrast computed tomography (CT) or cystoscopy usually are not necessary for the identification of uroliths in cats. However, removal of small cystic calculi identified during the cystoscopic procedure may be accomplished by performing Ho:YAG laser lithotripsy and/or basket retrieval through the cystoscope in selected cases.

## Ureterolithiasis

The sensitivity of survey abdominal radiography for the diagnosis of ureterolithiasis in cats is 81%.<sup>7</sup> CaOx-containing ureteral calculi are the most common uroliths identified in the upper urinary tract of cats<sup>8</sup> and are most readily identified in the retroperitoneal area on the lateral radiographic projection. Visibility on lateral radiographs alone can lead to difficulty in determining which ureter is involved or whether one or both ureters are affected. Therefore, abdominal ultrasonography is recommended for cats suspected of having ureteroliths; it has a sensitivity of 77%. Although this is lower than plain radiography, ultrasonography can help delineate which ureter is obstructed and the severity of hydronephrosis and hydroureter, if it exists. A combination of survey radiography and ultrasonography has a sensitivity of 90% for the diagnosis of ureterolithiasis, so it is the preferred approach. In subacute ureteral obstructions, ureteral and pelvic dilation may not have yet developed, so it is critical to consider ureteral obstruction as a differential diagnosis in appropriate cases, even when dilation is not present. Additional imaging modalities, such as antegrade pyelography or CT



**FIGURE 1** Lateral radiographic projection of a middle-aged male castrated cat illustrating the importance of including the entire urinary tract in the field of view. A small radiopaque urethrolith was visible on the radiograph but was not detected using ultrasound



**Figure 2** This lateral radiographic projection shows significant renal mineralization as well as a ureterolith. An enema should be performed in this cat to fully evaluate the retroperitoneal area as well as ultrasonography to ascertain if ureteral obstruction is present or not

may be indicated to identify calculi that are not apparent on survey radiography or ultrasonograms. Researchers evaluating imaging techniques in humans<sup>9</sup> reported that CT scan, using the bone window, provided the greatest in vitro accuracy from which actual stone measurements can be estimated; however, the craniocaudal diameter measurement was overestimated. Furthermore, using the soft tissue window overestimated urolith size. Data from our institution confirms that CT (plain or contrast enhanced) did not significantly improve the diagnostic performance for detection of ureteral obstruction in cats.<sup>10</sup>

## Therapeutic considerations for feline urolithiasis

It is important to obtain radiographs (or other imaging studies appropriate for the urolith type) prior to recovering the cat from anesthesia to be certain all the uroliths have been removed during the procedure (eg, surgery, voiding urohydropropulsion, ureterotomy). Small uroliths can be inadvertently missed. Furthermore, periodic monitoring may allow the clinician to visualize recurrence of uroliths when they are small enough to be removed by minimally invasive procedures. The clinician must also keep in mind that struvite cystiouroliths (eg, single elliptical calculus, urinary pH persistently >6.8) can be successfully dissolved with dietary therapy,<sup>11,12</sup> and surgery can be avoided.

When managing ureterolithiasis, conservative non-dietary medical management can be considered, because these are most often comprised of 100% CaOx and no dissolution protocol exists. Therefore, therapies consisting of intravenous fluid diuresis with administration of the diuretic mannitol, with or without other drugs such as alpha antagonists, can be tried. During conservative management it is crucial to critically evaluate patient stability and fluid status. Cats

should be monitored by serial measurements of serum creatinine and blood urea nitrogen (BUN) concentrations, and these are often the most sensitive indicators that the obstruction has improved or progressed. It is important to remember that if significant intrinsic renal damage has occurred, passage of the ureteral obstruction does not always lead to immediate improvement in azotemia; in cases with significant kidney disease prior to obstruction, azotemia may persist. Serial radiography and ultrasonography can be useful in monitoring the success of medical management for ureterolithiasis. It has also been reported that uroliths can spontaneously move retrograde back into the renal pelvis rather than passing into the urinary bladder.<sup>13</sup> For cats that have significant increases in BUN, serum creatinine or potassium, or fluid overload at the time of initial examination, more aggressive intervention such as a ureteral stent placement or subcutaneous ureteral bypass surgery is recommended to relieve the obstruction and hopefully preserve renal function.

## Summary

The key diagnostic tests for detecting urolithiasis in feline patients are often complementary. Each can help provide essential data including urine composition, presence and location of uroliths and their mineral composition, and consequences that can result from this disease (eg, ureteral obstruction, hydronephrosis). The diagnostic test chosen for each individual patient depends on the number of episodes of clinical signs, owner finances, and availability of equipment. In many cats, plain radiography is a non-invasive, cost effective means for identifying both upper and lower urinary tract uroliths. Keeping in mind the various minerals present within feline uroliths (and their radiopacity) is important when choosing the best therapeutic option for each cat.



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