

# Managing Kidney Stone Disease



An often  
challenging  
proposition

By John C. Ramsey, MD

**T**he development of stones in the urinary tract is a very common disorder with a reported instance of 3-10%. The initial clinical episode is usually seen between the ages of 20 and 40, and Caucasian males seem to have the highest risk of development of stone disease. The development of a stone reflects a (perhaps temporary) supersaturation of certain urinary solutes. Calcium stones still represent the majority of stones seen in our practice with calcium oxalate the single most common composition. These stones are radiopaque and tend to form at a normal urine pH of 6.0 to 7.0. Patients with elevated serum calcium levels are at increased risk for the development of these stones. Such disorders include hyperparathyroidism, sarcoidosis, steroid use, Cushing's disease, and certain neoplasms.

Uric acid is the composition of approximately 10% of the stones we see in our practice. Uric acid is a byproduct of purine metabolism. Virtually all mammals, other than humans, possess an enzyme, uricase, that converts uric acid into the freely soluble allantoin. Humans, due to their lack of this enzyme, have serum uric acid levels that are markedly greater than that seen in other mammals. Patients with uric acid stone disease have a persistently acidic (pH 5.0) urine. The pH of uric is

5.3. This results in increased urinary concentration of the relatively insoluble free uric acid (rather than uric acid salts). Stones result from this supersaturation. These stones are considered radiolucent, but are in fact visible on non-contrast CT imaging. Patients with gout, myeloproliferative disorders, and who are receiving chemotherapy are at increased risk for the development of this type of stone. These are the only stones that are truly dissolvable simply by increasing the

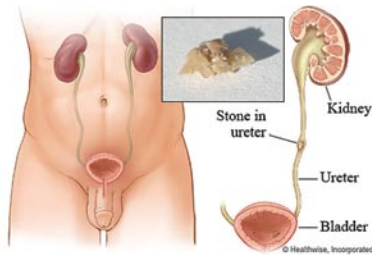
urine pH. Also, uric acid stones may be the initiating nidus of some stones that are composed primarily of calcium.



Struvite is the name given to the crystal composed of magnesium, ammonium, and phosphate. This type of stone develops as a consequence of urinary tract infections that are caused by bacteria that produce urease. Urease splits urea into ammonium. This raises the urine pH to greater than 7.2. Phosphate ions are plentiful at this pH and magnesium is always present. Thus, these stones precipitate in the alkaline urine. Many bacteria can elicit urease, but the most commonly seen is *Proteus mirabilis*. It is for this reason that struvite stones are often called "infection stones." Management of these infections requires eradication of the stone, and management

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Cystinuria is an autosomal recessive disorder that impairs renal tubular reabsorption of cysteine. This results in exorbitant amounts of cysteine in the urine. This supersaturation, along with



a urine pH of less than 7.0, results in crystallization or stone growth. Cysteine stones are relatively radiolucent. The medical management of this concern requires superalkalinization of the urine to a pH of greater than 7.8 and, occasionally, the use of medicines that form soluble complexes with cysteine.

We occasionally see other types of stones. These are much less common and can be composed of thiazide, protease inhibitors, and other compounds often used in the management of AIDS.

### MEDICAL MANAGEMENT

The medical management of all stones begins with hydration. As all stones form as a result of supersaturation in the urine, maintaining a dilute urine is helpful in all patients.

Evaluation of the patient with stones often involves the collection of a 24-hour urine specimen to identify any underlying metabolic abnormalities that may be specifically addressed.

For those who form calcium oxalate stones, we specifically recommend lemonade as the ideal fluid. Tea, dark green vegetables, nuts, and chocolate are high in oxalates and should be limited. There is no value in low-calcium diets in the prevention of calcium stones, but we do discourage calcium supplementation in these patients. For women with

osteopenia or osteoporosis concerns, we generally accept their need for calcium supplementation, but encourage fluid therapy. In addition, we ask patients to avoid excessive vitamin C and limit their sodium intake.

Our goal for patients with uric acid stones is to maintain their urine pH to a level of greater than or equal to 7.0. This serves to dissolve stones and discourage further stone growth.

As mentioned above, the cornerstone of medical therapy for struvite stones is the eradication of the underlying urinary tract infection. “Superalkalinization” of urine to a pH of greater than 7.0 is pursued in patients with cysteine stones for prevention of further stone growth. Thiola and penicillamine are compounds that form soluble complexes with cysteine and can therefore prevent stones. Their utility is, however, limited by their rather poor tolerability.

### PRESENTATION OF STONE DISEASE

The classic presentation of renal colic remains the most common presenting scenario. Acute-onset, severe, unilateral flank pain with or without radiation of pain to the lower quadrant, testicle or labia, is typical. These patients have a very difficult time finding a comfortable position and often look quite “fidgety.” Nausea and vomiting frequently accompany renal colic. Fever is not uncommon and may reflect infection above an obstructing stone.

### EVALUATION OF STONE DISEASE

The non-contrast CT scan has become the most utilized study to assess the urinary tract for stone disease. Virtually all stones will show up with this type of imaging. It is important to remember, however, that this study does not adequately evaluate a patient for hematuria of unknown cause. A patient with hematuria with no apparent stone seen on a non-contrast CT scan should have a contrasted study to adequately rule out any type

of parenchymal disease. The excretory urogram (IVP) remains a good study and is still used in cases of equivocal CT results. The physical exam and urinalysis generally lend supportive evidence of the presence of stone.

### SURGICAL MANAGEMENT

Recently, the specialty of urology has benefited from the development of a rather staggering piece of technology, the operative robot. The ability to now perform radical prostatectomy via robotic laparoscopy has certain, well-established benefits. Although this is a considerable advancement in the management of prostate cancer, it actually pales in comparison to the effects that technological advances have had in the management of urologic stone disease in the last 20 years. The development of extracorporeal shock wave lithotripsy, fiber optic ureteroscopy, and laser lithotripsy has truly revolutionized the surgical approach to kidney, ureteral, and even bladder stones. These technologies did not alter the way we do existing operations, they completely replaced these operations altogether.

More recently, we have seen further refinements of these technologies, in that we now use spaghetti-thin flexible scopes, nanometer laser fibers, and portable lithotripsy units that no longer require the cumbersome and modesty-destroying bathtub plunge.



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