Managing Urolithiasis

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Editor's Note: The Expert Clinical Management series consists of shorter, practical review articles focused on the optimal approach to a specific sign, symptom, disease, procedure, technology, or other emergency department challenge. These articles—typically solicited from recognized experts in the subject area—will summarize the best available evidence relating to the topic while including practical recommendations where the evidence is incomplete or conflicting.

Introduction

Urolithiasis is a common disease, estimated to affect 11% of men and 7% of women in their lifetime.1 Ureteral stones can cause acute unilateral flank pain radiating to the groin, often accompanied by nausea, vomiting, and urinary symptoms.2 More than 1 million patients with suspected urolithiasis present to an emergency department (ED) each year in the United States.3 This review will describe ED evaluation, therapies, and the identification of patients who require urgent urologic intervention, with recommendations based on clinical trials; on guidelines from the American College of Emergency Physicians (ACEP), American College of Radiology, and American Urologic Association; and on anecdotal experience.

Goals of the Evaluation

When ureteral stone is suspected, our foremost goal is to identify those patients who require urgent, and in some cases, emergency treatment, either for important alternative diagnoses (eg, appendicitis, cholecystitis, ovarian torsion)4 or “stone-related emergencies” (Figure 1).2,5 Approximately 10% of ED patients with suspected urolithiasis are admitted,6-8 with prospective research identifying a 3.7% and 5.3% prevalence of important alternative diagnoses.8,9

Our secondary goal of confirming the presence of urolithiasis is of lesser importance because patients with an uncomplicated stone are almost always managed expectantly.

Risk Assessment for Clinically Important Diagnoses

Ureterolithiasis causes severe unilateral colicky flank pain, and patients usually present soon (within hours) of onset. The pain may radiate from the flank anteromedially toward the groin into the genitals and may be accompanied by nausea, vomiting, and hematuria.2,8 Lower urinary tract symptoms such as dysuria and urgency suggest distal ureteral stones. The classic appearance is that of a patient in distress, unable to find a position of comfort. Vital signs are often normal. Atypical clinical features such as hypotension or abnormalities on abdominal, testicular, or pelvic examination suggest alternative diagnoses. Complicated urolithiasis should be suspected if there is persistent pain, vomiting, fever, pyuria, elevated creatinine level, anuria, or a history of a solitary or transplanted kidney. A history of urolithiasis decreases the risk of important alternative diagnosis.10

Although hematuria is common in urolithiasis, it does not by itself exclude or reliably identify the diagnosis, with reported sensitivities ranging from 71% to 95% and specificities ranging from 18% to 49% for urolithiasis.11-13 A positive pregnancy test result should lead to consideration of ectopic pregnancy as a cause of pain and also limits the choice of imaging to ultrasonography. With urolithiasis, the absence of pyuria cannot exclude a complicating urinary tract infection, with a reported sensitivity and specificity of 86% and 79%, respectively.14 Accordingly, stone patients at higher risk (female patients and those with pyuria or urinary tract infection symptoms) should receive a urine culture.14

Selection of Appropriate Imaging

The need for and type of imaging vary with underlying risk of important alternative diagnosis, ureteral stone, or a stone-related emergency (Figure 2). Emergency physicians should use clinical judgment to make this assessment. The
STONE score is a clinical decision rule that sorts patients with suspected ureterolithiasis into low-, moderate-, and high-risk groups, with those with a high score in the original study having an 89% probability of a stone and a 1.6% probability of alternative diagnosis. In an external validation, the sensitivity and specificity of a high score were 53% and 87%, with a 1.2% probability of important alternative diagnosis (upper 95% confidence interval of 3.6%). Thus, the STONE score alone cannot rule in or rule out stones or exclude clinically important diagnoses. Its role for imaging decisions remains undefined but has the potential to be used as part of an algorithm for suspected urolithiasis.

**Moderate to High Risk of a Clinically Important Diagnosis**

Patients at moderate or high risk of a stone emergency or a clinically important alternative diagnosis should receive an unenhanced computed tomography (CT) scan. The accuracy of CT scan for ureteral stones is excellent, and CT scan can identify hydronephrosis, characterize stone size and location, and detect important alternative diagnoses. The American College of Radiology gives their highest appropriateness rating for CT in patients with first-time acute flank pain, and 70% of patients who received a diagnosis of urolithiasis received a CT scan in 2007. Despite this, routine CT does not appear to improve outcomes. A national survey found no change in the diagnosis of kidney stone, alternative diagnoses, or hospitalization despite a 10-fold increase in CT use between 1995 and 2007. The ability of CT to characterize stone size and location at the initial ED visit is not routinely necessary, and this imaging increases costs, incidental findings, length of stay, and the risk of subsequent cancer. Thus, CT should be reserved for patients who would most benefit by increasing diagnostic certainty for clinically important diagnoses or experience less harm from radiation exposure. ACEP recommends avoiding CT scan in patients younger than 50 years and with a history of kidney stones presenting with recurrent symptoms. There is promise for reduced-dose CT scan protocols.

**Low Risk of a Clinically Important Diagnosis**

Patients at low risk of a stone emergency or a clinically important alternative diagnosis should receive ultrasonography, performed by either an emergency physician or the radiology department. Ultrasonography is less sensitive (24% to 57%) than CT for the identification of ureteral stone, especially small stones, and missed occasional occurrences of hydronephrosis in older studies, perhaps in dehydrated patients. In a more recent prospective study, it was shown to accurately identify hydronephrosis. Ultrasonography is first line for a number of important alternative diagnoses, such as cholecystitis and ovarian torsion, and is an acceptable initial test in appendicitis and aortic aneurysm.

ACEP has identified urinary tract point-of-care ultrasonography as a core application since 2001. Its main limitation is operator skill; fellowship-trained emergency medicine physicians or radiologists should perform the examination.
physicians have excellent sensitivity and good specificity for hydronephrosis, whereas those without fellowship training have modest accuracy. In a multicenter randomized trial of point-of-care ultrasonography versus radiology ultrasonography versus CT scan, there was no significant difference in missed serious diagnosis or adverse events. A CT scan may be obtained if the clinician is still uncertain about the presence of a clinically important diagnosis after ultrasonography; in the randomized trial, 25% of patients in the radiology ultrasonography arm and 40% of those in the point-of-care ultrasonography arm ultimately received a CT scan. Ultrasonography is preferred in patients at highest risk for complications from ionizing radiation (pregnant or pediatric patients) or who are less likely to benefit from CT (history of kidney stones).

### Very Low Risk of a Clinically Important Diagnosis

In my opinion, well-appearing, afebrile patients with mild or transient symptoms could receive ultrasonography or instead be discharged without imaging, with a plan to return for persistent or worsening symptoms. In a national survey of ED imaging in 2005 to 2007, approximately half of patients with suspected urolithiasis did not receive either
ultrasonography or CT. These may have been patients who had an alternative diagnosis that did not require imaging (such as pyelonephritis or low back pain) or had transient or straightforward renal colic.

**Treatment of Ureteral Stone**

**Pain relief**: Provide analgesia, antiemetics, and intravenous hydration as needed at the evaluation. Nonsteroidal anti-inflammatories (eg, ketorolac 15 to 30 mg intravenously) can provide effective analgesia, with opioids administered either concurrently for rapid relief or if the nonsteroidal anti-inflammatory effect is insufficient. Use oral nonsteroidal anti-inflammatories with or without opioids for patients who are less symptomatic or for analgesia after discharge.

Intravenous hydration will benefit patients who are dehydrated or have been unable to drink as a result of vomiting; however, this use of such fluids to “flush out” a stone has not been shown to improve clinical outcomes.33

**Patient Disposition**

Patients at risk for a stone-related emergency should be admitted and receive urology consultation (Figure 1).

When an obstructing stone is accompanied by sepsis, the urinary collecting system should be decompressed as quickly as possible.5 Given the limitations of pyuria for the diagnosis,14 patients with a suspected urinary tract infection in the absence of hydronephrosis, fever, or ill appearance could be discharged with oral antibiotic treatment, a urine culture, and close follow-up.5 Among patients receiving a diagnosis of urolithiasis, 20% are admitted.7,20,34

**Expectant Management for Stone Passage**

Patients with urolithiasis and no indications for urgent intervention can be discharged home with a plan of observation for spontaneous stone passage. Large and proximally located stones are less likely to pass spontaneously; stones less than 5 mm and 5 to 10 mm have been noted to pass in 68% and 47% of cases, respectively.35,36 Urologists typically offer ureteroscopy or shock wave lithotripsy to patients with retained stones and persistent symptoms.5

The American Urologic Association recommends urology consultation for stones greater than 10 mm and medical expulsive therapy (most commonly tamsulosin) for smaller stones.5 Tamsulosin was reported as effective
in enhancing stone passage in a recent Cochrane review of 28 randomized controlled trials (risk ratio 1.5; 95% confidence interval 1.3 to 1.6).37 Two subsequent multicenter randomized trials have yielded conflicting results; one found no benefit, and one restricted to distal stones noted benefit in patients with larger stones (>5 mm).38,39 Given that larger stones are less likely to spontaneously pass, it seems logical that these patients may actually benefit more from tamsulosin.35,39 The principal adverse effect of these α-blockers is orthostatic hypotension (number needed to harm 19), although in most studies this did not require cessation of therapy.37 Dosing just before bedtime can mitigate the risk. Despite conflicting results between the Cochrane review and the trial with negative results, I believe currently the preponderance of the evidence suggests a benefit, and I would provide tamsulosin to patients who received a diagnosis of a ureteral stone.

Finally, patients who receive a diagnosis of a ureteral stone should be instructed to follow up with a urologist and given appropriate instructions to return for worsening symptoms.

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