

# 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.<sup>1</sup> Ureteral stones can cause acute unilateral flank pain radiating to the groin, often accompanied by nausea, vomiting, and urinary symptoms.<sup>2</sup> More than 1 million patients with suspected urolithiasis present to an emergency department (ED) each year in the United States.<sup>3</sup> 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)<sup>4</sup> or “stone-related emergencies” (Figure 1).<sup>2,5</sup> Approximately 10% of ED patients with suspected urolithiasis are admitted,<sup>6-8</sup> with prospective research identifying a 3.7% and 5.3% prevalence of important alternative diagnoses.<sup>8,9</sup>

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.<sup>2,8</sup> 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.<sup>10</sup>

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.<sup>11-13</sup> 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.<sup>14</sup> Accordingly, stone patients at higher risk (female patients and those with pyuria or urinary tract infection symptoms) should receive a urine culture.<sup>14</sup>

### 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-related emergencies: obstructing ureteral stone with 1 or more of the following<sup>1</sup>:**

- Proximal urinary tract infection as evidenced by sepsis/fever, ill appearance, or markedly elevated WBC count
- Deterioration in renal function
- Intractable pain, vomiting, or worsening symptoms despite treatment
- Solitary or transplanted kidney, particularly if anuric

**Clinically important alternative (nonurolithiasis) diagnoses\***

- Aortic aneurysm with leak or rupture, aortic dissection
- Malignancy/mass concerning for malignancy (ie, renal cell carcinoma or ovarian malignancy)
- Diverticulitis
- Appendicitis
- Cholecystitis/choledocholithiasis
- Bowel obstruction or ileus
- Colitis/ileitis, inflammatory bowel disease
- Ovarian/testicular torsion
- Ectopic pregnancy
- Traumatic injury (ie, hematoma)
- Vascular thrombosis/infarct (ie, renal artery thrombosis)
- Pulmonary embolism/DVT
- Pneumonia/pleural effusion

\*This list of clinically important alternative diagnoses is adapted from previous publications, as well as experience from a recent randomized trial.<sup>2-4</sup>

**Figure 1.** Clinically important causes of acute flank pain that require urgent treatment. *DVT*, Deep venous thrombosis.

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.<sup>8</sup> 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%).<sup>9</sup> 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.<sup>15-18</sup> The American College of Radiology gives their highest appropriateness rating for CT in patients with first-time acute flank pain,<sup>19</sup> and 70% of patients who received a diagnosis of urolithiasis received a CT scan in 2007.<sup>3</sup> 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.<sup>20</sup> 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.<sup>21-23</sup> 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.<sup>24,25</sup>

**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.<sup>26-28</sup> In a more recent prospective study, it was shown to accurately identify hydronephrosis (Figure 3).<sup>28,29</sup> 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.<sup>30</sup> Its main limitation is operator skill; fellowship-trained emergency

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