

Ultrasonographic Evaluation of Acute Urinary Tract and Male Genitourinary Pathology

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KEYWORDS

- Ultrasonography • Emergency • Urinary tract
- Male genitalia

ASSESSMENT OF THE URINARY TRACT

In the emergency setting, computed tomography (CT) is usually the imaging study of choice for evaluation of the kidneys and bladder with respect to calculi, infections, and trauma. However, in certain populations, such as children, young adults, pregnant women, or people with acute exacerbations of chronic disease, a somewhat less sensitive study without ionizing radiations may be more appropriate. Benefits of ultrasonography include portability, relatively low cost, and ability to localize pain in real time. In patients who cannot receive intravenous contrast, the sensitivity of CT decreases for diagnoses such as pyelonephritis or renal vein thrombosis and ultrasonography may become a better alternative. This section discusses the use of ultrasonography for acute flank pain and suspected nephroureterolithiasis, urinary tract infection, trauma, and several miscellaneous applications.

Urinary Tract Calculi and Acute Flank Pain

Although noncontrast CT is the gold standard for the diagnosis of urolithiasis, with sensitivities of 95% to 98% and specificities of 96% to 100%,¹ ultrasonography with modern equipment and techniques may, in certain situations, achieve a similar degree of accuracy. The challenge in performing ultrasonography is to image the entire collecting system, to detect or potentially exclude an

obstructing calculus. The intrarenal collecting system, renal pelvis, and urinary bladder are most easily accessed by sonography for the presence of calculi. Although the normal ureter is too small to image with ultrasonography, when dilated because of obstruction it may be more easily visualized unless obscured by overlying bowel gas. The distal ureter can often be imaged using the distended bladder as a sonographic window (**Fig. 1**).

There are few studies of direct comparison between noncontrast CT and ultrasonography for renal and ureteral calculi. Sheafor and colleagues² reported 96% and 61% sensitivities for CT and ultrasonography, respectively, in 23 patients with flank pain who were ultimately diagnosed with ureteral calculi. Park and colleagues³ reported an ultrasonographic sensitivity of 98% for the detection of ureteral calculi among 296 patients who fasted for 8 hours and received vigorous intravenous hydration to optimize the sonographic exam. Patlas and colleagues⁴ reported on 62 patients with suspected renal colic who prospectively underwent both ultrasonography and non-contrast-enhanced CT. Using stone recovery or urological interventions as the gold standard, the sensitivity and specificity of ultrasonography were 93% and 95%, respectively, for the detection of calculi when compared 91% and 95%, respectively, for CT. The ultrasonographic examinations were performed transabdominally after ingestion

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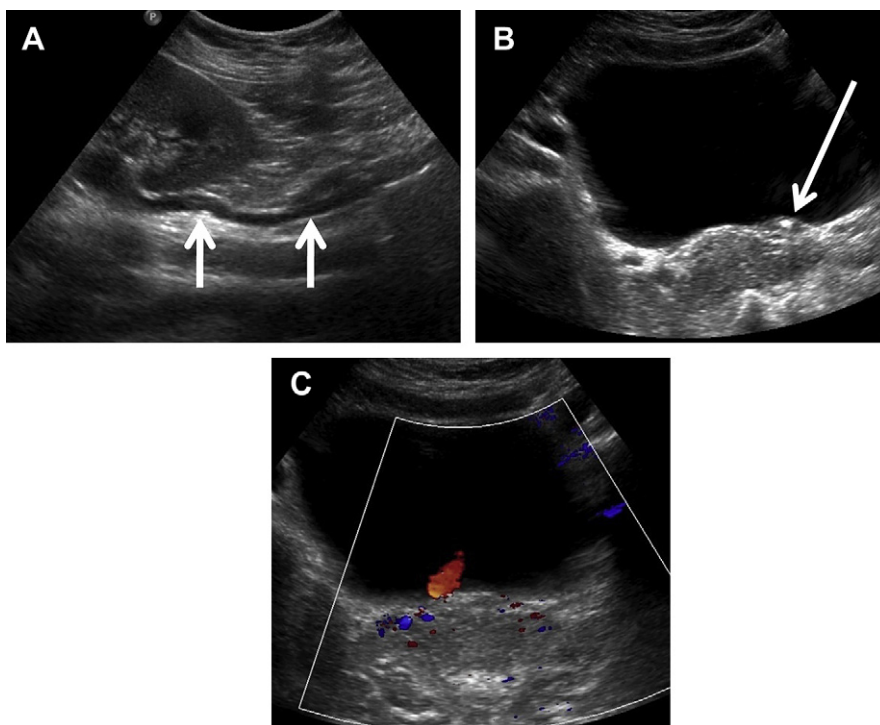


Fig. 1. Acutely obstructing calculus at ureterovesical junction. (A) Longitudinal view of the lower of the pole left kidney shows dilated renal pelvis and ureter (arrows). (B) Transverse view of distended bladder with calculus at left ureteropelvic junction (arrow). (C) Transverse view of bladder with color Doppler only showed jets from right ureteral orifice.

of 400 mL of water. In addition, ultrasonography detected 6 of 7 alternative diagnoses to explain the patient's pain, only missing 1 case of appendicitis detected by CT. A slightly lower sensitivity of ultrasonography was found in the prospective study of Ripolles and colleagues.⁵ In 66 patients, the ultrasonographic sensitivity for ureteral calculi was 79% compared with 93% for CT. Hydration was used when the ureter could not be visualized initially, or the bladder was empty. There were 2 false-negative cases on CT reported as phleboliths that were correctly identified as ureteral calculi on ultrasonography. Direct visualization of a distal ureteral calculus can be significantly improved by using alternative types of scanning. Mitterberger and colleagues⁶ found a sensitivity of 55% for distal ureteral calculi using standard transabdominal techniques. The sensitivity improved to 100% by using transrectal imaging in men and transvaginal imaging in women. Median size of the calculi was 4.4 mm.

Urinary tract calculi typically appear as echogenic foci with posterior acoustic shadowing. Renal calculi in kidneys without hydronephrosis may be more difficult to perceive within the echogenic sinus. In addition, posterior shadowing may be weak or absent depending on the composition

and size of the calculus and the amount of attenuating retroperitoneal and renal sinus fat. Depending on the size and extent of shadowing, it can also be difficult to adequately determine the number and size of the calculi on ultrasonography. Posterior shadowing can be accentuated by careful sonographic technique including increased transducer frequency, narrow focal zone, harmonic imaging, and removal of smoothing algorithms. Vascular calcifications can be confounding on both ultrasonography and CT. Other mimics of renal calculi include gas, milk of calcium cysts, cortical and medullary calcifications, a prominent junctional parenchymal line, catheters, and small echogenic tumors.⁷

Theoretically, bladder calculi should be easier to appreciate because they are surrounded by anechoic urine but could be overlooked if the bladder is not well distended. Maneuvers such as rolling the patient into a decubitus position may also be necessary to facilitate identification of stones. Difficulties may be encountered with gas in the bladder, calcified tumors, or stones located in bladder diverticula.

Color and power Doppler twinkling or comet-tail artifacts may improve the sensitivity for calculi. This poorly understood artifact consists of a rapidly

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