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CASE REPORT

Twinkle twinkle little stone: utilizing color Doppler in emergency ultrasound diagnosis of a ureterovesicular stone

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Abstract
Case report A case of a 43-year-old woman presenting with acute left flank pain is reported.
Method and result Point-of-care ultrasound utilizing color Doppler revealed a twinkling artifact at the left ureterovesicular junction, consistent with a ureterovesicular stone. The sonographic findings and significance of the twinkling artifact are described.

Keywords Ultrasound · Point-of-care · Emergency · Urolithiasis · Color Doppler

Case report

A 43-year-old female presented to the emergency department (ED) complaining of acute left flank pain for 1 day. The pain was described as sharp and intermittent, radiating to the left-lower quadrant of the abdomen, and was associated with nausea and vomiting. The patient had no significant past medical, surgical, or family history, and no history of similar pains in the past. She denied any recent lifting or trauma, dysuria, hematuria, frequency, urgency, vaginal bleeding, or vaginal discharge. The patient had normal vital signs, and physical examination was remarkable only for mild left costovertebral angle tenderness. Her abdomen was soft and non-tender.

The patient's urine beta-hCG was negative and urinalysis showed no pyuria but was positive for blood. A focused bedside ultrasound was performed by the emergency physician using a 5–2 MHz curvilinear array transducer (Model HD11XE, Philips, Andover, MA), which revealed mild left hydronephrosis (Fig. 1). The bladder was also examined, which revealed a non-shadowing, hyperechoic focus at the left ureterovesicular junction (UVJ) (Fig. 2), consistent with a UVJ stone. The addition of color Doppler revealed a twinkling sign posterior to the focus, as well as a ureteral jet from the right ureter (Fig. 3; Online Resource 1).

Discussion and conclusion

The twinkling sign is a color Doppler artifact that appears as a rapidly alternating mixture of red and blue Doppler signals distal to strongly reflective granular surfaces [1], such as found on urinary stones. These stones may be difficult to detect due to surrounding echogenic renal sinus fat, mesenteric fat, or bowel [2, 3]. In addition they are not always associated with shadowing [2]. The addition of color Doppler to gray-scale imaging may confirm the presence of a stone by revealing the twinkling artifact, which has been found to be more sensitive than shadowing in detecting stones [2, 3].

Ureteral jets represent urine flowing into the bladder from the ureters. To best visualize jets, the transducer is placed in a transverse position at the level of the trigone [4], which can be estimated by the landmarks of the seminal vesicles or mid-cervix [5]. Ureteral jets typically flow in an anteromedial direction [4]. A continuous low flow or absent jet may be associated with a high-grade obstruction

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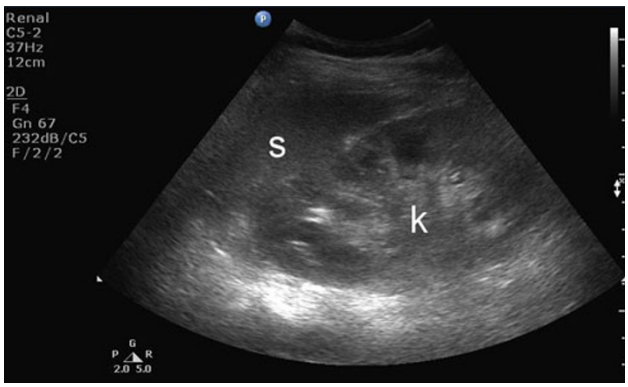

Fig. 1 Coronal view of the left splenorenal window illustrating the spleen (*s*) and the kidney (*k*) with mild hydronephrosis

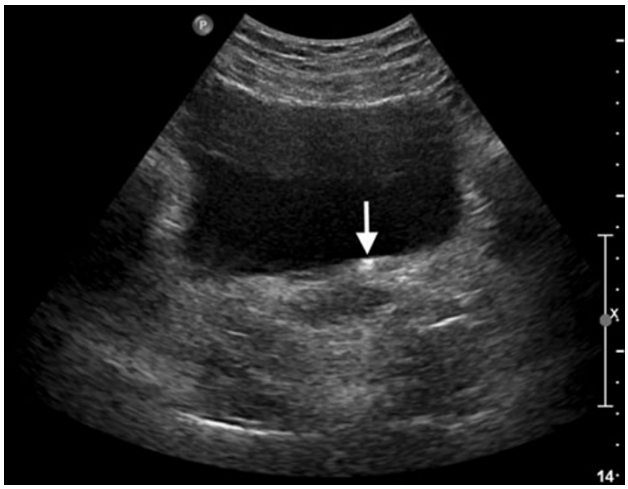

Fig. 2 Transverse view of the bladder, demonstrating a non-shadowing, hyperechoic focus at the left ureterovesicular junction (*arrow*)

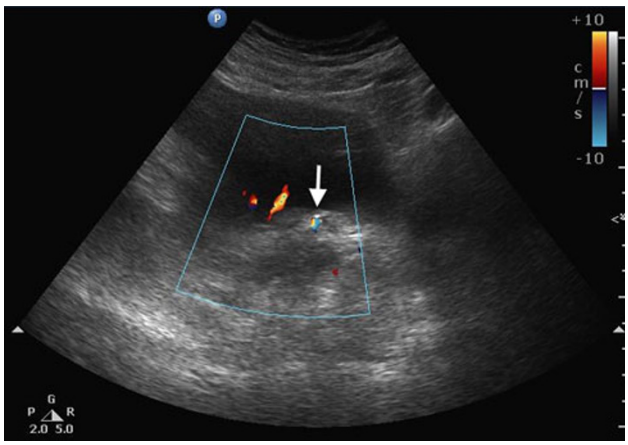

Fig. 3 Transverse view of the bladder with color Doppler applied, revealing a twinkling artifact posterior to the hyperechoic focus (*arrow*), as well as a ureteral jet on the right

[6]. However, jets are not always visualized immediately even in healthy patients, as frequency of ureteral jets may range from seconds to minutes [5], and are influenced by the patient's hydration status [5, 6]. Thus, the absence of a ureteral jet does not define obstruction, but the presence of one helps to rule out a complete obstruction.

As the patient's pain was resolved after a few hours, she was discharged home, and continued to be asymptomatic at her urology clinic follow-up 10 days later. Though this patient had classic signs and symptoms of renal colic and may have been treated successfully without any imaging, the confirmatory findings with point-of-care ultrasound rapidly solidified the diagnosis for the physician and the definitive evidence was reassuring for the patient. Moreover, the greater benefit of point-of-care ultrasound for this particular case is the evaluation for complicated urolithiasis. Severe hydronephrosis, especially if coupled with laboratory evidence of acute kidney injury, would raise concern for an obstructing stone. Another complication of urolithiasis is renal calyx rupture, which secondary to extravasation of urine is suggested on ultrasound by an anechoic perinephric fluid collection [7]. These entities warrant further imaging and/or consultation.

Point-of-care ultrasound may also be beneficial in evaluating for the myriad of disease processes that can cause flank pain and mimic renal colic, including abdominal aortic aneurysm in an elderly patient or gall bladder disease in a patient with right sided pain. Polycystic kidney disease and renal cell carcinoma are disorders of the kidney itself that may also present with flank pain and hematuria. Polycystic kidney disease appears on ultrasound as multiple cysts of varying shapes and sizes that distort the normal renal architecture [8]. Renal tumors can present either as cystic lesions, with smooth borders and anechoic interiors; solid lesions, with irregular borders and low-level internal echoes; and complex lesions, which appear as a mixture of both cystic and solid lesions [9]. Most renal tumors are solid and appear isoechoic, but they may also appear hyperechoic or hypoechoic [9]. While the goal of point-of-care renal ultrasound remains the detection of hydronephrosis, it is important for the physician to be aware of these other pathologies which would prompt further definitive imaging.

Conflict of interest None.

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