Section: Radiodiagnosis

Case Series

IMAGING SPECTRUM OF UROLITHIASIS: A CASE SERIES HIGHLIGHTING THE COMPLEMENTARY ROLES OF ULTRASONOGRAPHY AND NON-CONTRAST CT

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ABSTRACT

Background: Urolithiasis remains one of the most common obstructive causes of hydronephrosis. Ultrasonography is widely used as the initial imaging modality because it is inexpensive, radiation-free and portable, but its performance may be limited by small calculus size, distal ureteric location, bowel gas and patient body habitus. The colour Doppler twinkling artifact has emerged as a useful adjunct in the detection of urinary calculi, while non-contrast computed tomography (NCCT) remains the reference standard when ultrasound findings are equivocal.

Case Series: We present a series illustrating a tiered imaging approach in which grayscale ultrasonography, supplemented where necessary by the colour Doppler twinkling artefact, resolved the cause and level of obstruction in the majority of patients, while NCCT retained a decisive problem-solving role in technically limited examinations. In the first and eighth cases, the twinkling artefact confirmed and precisely localised mid-ureteric and vesicoureteric junction calculi that were only faintly conspicuous on grayscale imaging, thereby obviating CT. In thin and average-build patients, the obstructing ureteric calculus and its upstream hydronephrosis were demonstrated within a single ultrasound examination. In obese patients, grayscale imaging established the presence and side of hydronephrosis but failed to reveal the obstructing calculus, which was subsequently demonstrated on NCCT in the upper, mid and distal ureter. An adequately distended bladder served as a valuable acoustic window for vesicoureteric junction and large vesical calculi, and a non-obstructing lower-pole renal calculus with characteristic shadowing was diagnosed on ultrasound alone.

Conclusion: The series supports a rational, radiation-sparing algorithm: grayscale ultrasonography augmented by the twinkling artefact as the first-line investigation for suspected obstructive urolithiasis, with NCCT reserved for obese patients, technically limited studies and cases where the level or cause of obstruction remains undetermined.

Keywords: Hydronephrosis; urolithiasis; ultrasonography; twinkling artifact; non-contrast computed tomography.

INTRODUCTION

Hydronephrosis can be defined as dilatation of the renal collecting system resulting from impaired urinary drainage. It is a frequent radiological finding in patients presenting with flank pain, urinary tract infection and hematuria. Its clinical significance lies not only in identifying pelvicalyceal dilatation but also in determining the underlying cause and level of obstruction. This is important as delayed diagnosis may lead to infection and progressive renal damage. Urolithiasis remains one of the most common causes of obstructive hydronephrosis and its prevalence increasing over recent.[1] Other causes include

pelviureteric junction obstruction, ureteric strictures, malignancy and bladder outlet obstruction. Therefore, an accurate and widely available imaging approach is essential for timely diagnosis and appropriate management.

Ultrasonography is widely used as the initial imaging modality for suspected hydronephrosis because it is inexpensive, radiation-free, portable, and suitable for repeated follow-up. Gray-scale ultrasound reliably demonstrates renal pelvic and calyceal dilatation, cortical thinning, renal size, bladder distension, and, in many cases, the obstructing lesion itself. In stone disease, conventional gray-scale signs include an echogenic focus, posterior acoustic shadowing, and upstream dilatation. However, the diagnostic performance of gray-scale ultrasound alone may be limited by small calculus size, distal ureteric location, bowel gas, patient body habitus, and operator dependence. Consequently, adjunct sonographic techniques that improve calculus conspicuity are clinically valuable, particularly when a radiation-sparing diagnostic pathway is preferred.

Color Doppler twinkling artifact has emerged as a useful adjunct to gray-scale ultrasound in the detection of urinary calculi. It appears as a rapidly alternating red-blue color signal posterior to a strongly reflecting rough interface, such as a calculus, and may be visible even when posterior acoustic shadowing is absent. Many studies have reported that that B-mode ultrasound may be more sensitive and twinkling artifact may add specificity for detection of ureteric calculi. These findings support their combined use rather than reliance on one technique alone.[2] Some Clinical studies have also reported that twinkling artifact can improve confidence in identifying urinary calculi. This is particularly in cases of small calculi that are difficult to characterize on gray-scale imaging.[3] Therefore it can be said that combining gray-scale findings with Doppler twinkling may increase diagnostic yield in patients with hydronephrosis due to urolithiasis.

Despite these advantages, ultrasound is not universally definitive. Non-contrast computed tomography (NCCT) remains highly accurate and reliable for ureteric calculi. It is often considered the reference standard when ultrasound findings are equivocal. Its utility is particularly important in cases where complications are suspected or alternative diagnoses must be excluded.[4] This is especially relevant in obese patients, in whom ultrasound beam attenuation by adipose tissue, increased depth of target structures, and suboptimal acoustic windows may reduce image quality and diagnostic confidence. In such patients, the obstructing calculus or ureteric level may not be clearly visualized despite the presence of hydronephrosis. Therefore, while ultrasound with twinkling artifact can diagnose the cause of hydronephrosis in most cases, computed tomography retains an important problem-solving role in technically limited examinations.

The existing knowledge gap lies in defining the practical diagnostic value of gray-scale ultrasound aided by twinkling artifact in routine evaluation of hydronephrosis, particularly in distinguishing cases where ultrasound is sufficient from those requiring computed tomography. Although individual studies have evaluated ultrasound, twinkling artifact, and CT for urinary calculi, fewer have focused specifically on their integrated role in identifying the cause of hydronephrosis across variable patient body habitus. This study intends to address this gap by evaluating whether gray-scale ultrasound combined with Doppler twinkling can diagnose the etiology of hydronephrosis in most patients, while identifying clinical and technical scenarios—especially obesity—in which CT remains necessary for definitive diagnosis.[5]

Case 1: Right hydronephrosis secondary to a right mid-ureteric calculus

A 41-year-old man presented to the department with a two-day history of intermittent, colicky pain in the right loin that radiated anteriorly towards the groin, and this was the first such episode in an otherwise healthy individual. The pain came in waves, was severe enough to make him restless during each episode, and was accompanied by increased urinary frequency; he reported no fever, no vomiting, and no prior history of stone disease. On examination he was in evident discomfort during bouts of colic, his vital signs were stable, and he had tenderness in the right renal angle without guarding or rigidity. Urinalysis revealed microscopic haematuria with 20 to 25 red blood cells per high-power field and no significant pyuria, and his renal function was within normal limits.

Grayscale ultrasound of the abdomen was performed with a C6-2 curvilinear probe. Examination of the right kidney demonstrated dilatation of the pelvicalyceal system with an anechoic, branching central collection, indicating moderate hydronephrosis, while the renal cortex remained preserved in thickness. Interrogation along the course of the right ureter revealed an echogenic focus in the mid-ureter which showed faint posterior acoustic shadowing and was of limited conspicuity on grayscale imaging alone because of overlying bowel gas [Figure 1].

Figure 1: Grayscale ultrasound of the right kidney demonstrating moderate hydronephrosis with dilatation of the pelvicalyceal system. Renal cortical thickness is preserved.

On colour Doppler evaluation, the echogenic focus generated a prominent twinkling artefact, seen as a rapidly alternating mosaic of red and blue signal posterior to the reflective interface, which confirmed the presence of the calculus and localised it precisely within the mid-ureter. The combination of upstream hydronephrosis and a demonstrable mid-ureteric calculus established the level and cause of the obstruction in a single sitting [Figure 2].

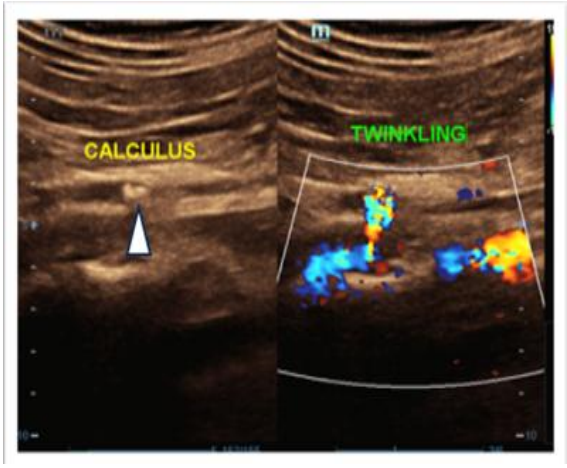

Figure 2: Grayscale and colour Doppler ultrasound of the right mid-ureter. (Left) Grayscale image demonstrates an echogenic ureteric calculus with subtle posterior acoustic shadowing. (B) Colour Doppler image demonstrates a prominent twinkling artefact arising from the calculus, confirming its location within the mid-ureter.

Computed tomography was not performed, because ultrasound had already demonstrated both the obstructing mid-ureteric calculus and its upstream consequences clearly, and the colour Doppler twinkling artefact provided confirmatory localisation without the need for additional ionising radiation. The final diagnosis was right moderate hydronephrosis secondary to an obstructing right mid-ureteric calculus.

Case 2: Renal calculus (nephrolithiasis)
A 45-year-old man who worked as a manual labourer presented with a one-week history of dull, aching, non-radiating pain in the left flank, accompanied by a single episode of gross haematuria. He was non-diabetic and had a past history of spontaneous passage of a urinary stone two years earlier.
On examination he had mild tenderness in the left renal angle, his vital signs were stable, and there was no fever or vomiting; urine routine microscopy showed 15 to 20 red blood cells per high-power field. Grayscale ultrasound of the left kidney, performed with a GE C1-5 curvilinear probe, demonstrated an echogenic focus measuring 4.8 mm in the lower pole of the left kidney. Posterior acoustic shadowing was present. There were no obstructive changes seen on ultrasound. Further, cortical thickness was preserved and corticomedullary differentiation was maintained [Figure 3].

Figure 3: Grayscale ultrasound of the left kidney showing a lower pole renal calculus with posterior acoustic shadowing and no hydronephrosis.

Computed tomography was not done, as the diagnosis was established confidently on ultrasound and clinical grounds. The final diagnosis was a left lower pole renal calculus.

Case 3: Right hydronephrosis with an obstructing upper ureteric calculus identified on CT after an inconclusive ultrasound
A 52-year-old man with a high body mass index presented with a three-day history of dull, persistent right-sided flank pain associated with a vague dragging discomfort in the right upper abdomen. The pain was less colicky and more constant in character, he reported mild nausea without vomiting, and he was afebrile throughout. On examination he had a large body habitus, mild tenderness in the right renal angle, and stable vital signs; urinalysis showed microscopic haematuria, and his renal function was preserved.

Figure 4: Grayscale ultrasound of the right kidney demonstrating hydronephrosis without visualization of the obstructing calculus due to technical limitations.

Grayscale ultrasound of the right kidney was performed but was technically limited by the patient's obesity and by overlying bowel gas. The examination demonstrated dilatation of the pelvicalyceal system with anechoic, communicating spaces in the central sinus, indicating hydronephrosis. Despite careful

interrogation along the expected course of the ureter, the cause of the obstruction could not be identified sonographically, as the proximal ureter was obscured by bowel gas and the deep location of structures in a large habitus degraded image quality. The ultrasound therefore established the presence and side of the hydronephrosis but left the level and cause of obstruction undetermined [Figure 4].

In view of the unexplained hydronephrosis and the technically limited ultrasound, plain (non-contrast) computed tomography of the abdomen and pelvis was performed. The CT demonstrated a calculus in the right upper ureter, with upstream dilatation of the pelvicalyceal system consistent with the sonographic finding of hydronephrosis. The calcific density of the focus and its location within the proximal ureter were clearly depicted on the reformatted images, establishing both the level and the cause of the obstruction that ultrasound had been unable to resolve.

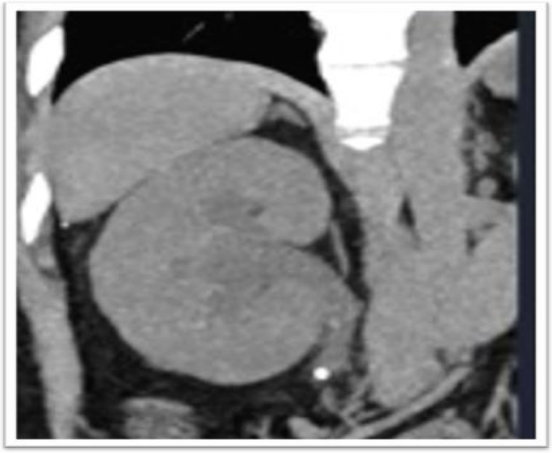

Figure 5: Non-contrast coronal CT image demonstrating a right upper ureteric calculus with upstream hydronephrosis, confirming the cause and level of obstruction.

The final diagnosis was right hydronephrosis secondary to an obstructing right upper ureteric calculus, confirmed on plain computed tomography.

Case 4: Left hydronephrosis with an obstructing lower ureteric calculus identified on CT after an inconclusive ultrasound

A 48-year-old man with a raised body mass index presented with a two-day history of left-sided flank pain that radiated towards the left iliac fossa and groin, associated with increased urinary frequency and a sensation of incomplete voiding. He reported no fever or vomiting, and his symptoms were more persistent than sharply colicky. On examination he had a large body habitus, tenderness in the left renal angle and left iliac fossa, and stable vital signs; urinalysis demonstrated microscopic haematuria, and his renal function was within normal limits.

Grayscale ultrasound of the left kidney was performed with a C6-2 curvilinear probe, and the study was technically limited by the patient's obesity and by overlying bowel gas. The examination showed dilatation of the pelvicalyceal system with anechoic, communicating spaces in the central sinus, consistent with left hydronephrosis, while the renal cortex was preserved in thickness. Careful interrogation along the course of the left ureter did not reveal the obstructing lesion, because the distal ureter was obscured by bowel gas and by the depth of the pelvic structures in a large habitus. The ultrasound therefore confirmed the presence and side of the hydronephrosis but was unable to demonstrate its cause or level [Figure 6].

Figure 6: Grayscale ultrasound of the left kidney demonstrating hydronephrosis without visualization of the obstructing calculus due to technical limitations.

Because the cause of the hydronephrosis remained undetermined on a technically limited ultrasound, plain (non-contrast) computed tomography of the abdomen and pelvis was performed. The CT demonstrated a calculus in the left lower (distal) ureter, in its pelvic segment as it coursed towards the vesicoureteric junction, with upstream dilatation of the left pelvicalyceal system and ureter proximal to the calculus. The location and calcific density of the focus were clearly depicted on the reformatted images, establishing both the level and the cause of the obstruction [Figure 7].

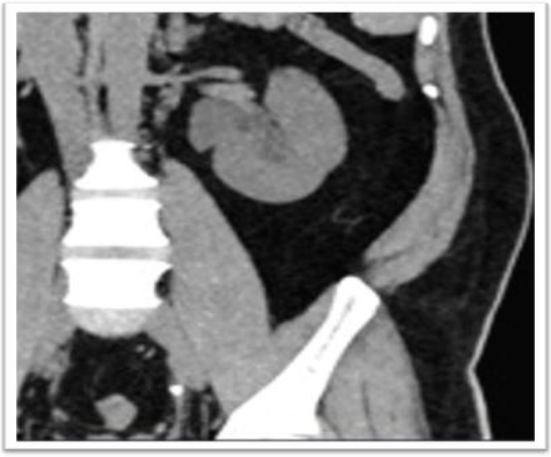

Figure 7: Non-contrast coronal CT image demonstrating a left distal ureteric calculus with upstream hydroureteronephrosis, confirming the cause and level of obstruction.

The final diagnosis was left hydronephrosis secondary to an obstructing calculus in the left lower ureter, confirmed on plain computed tomography.

Case 5: Left grade I hydronephrosis secondary to a left vesicoureteric junction calculus

A 38-year-old man presented with a one-day history of intermittent colicky pain in the left lower abdomen that radiated towards the groin, accompanied by increased urinary frequency and mild dysuria. The pain occurred in waves, he reported no fever or vomiting, and there was no prior history of urinary stone disease. On examination he had mild tenderness in the left iliac fossa, his vital signs were stable, and urinalysis demonstrated microscopic haematuria; his renal function was within normal limits.

Grayscale ultrasound of the abdomen and pelvis was performed with the urinary bladder adequately distended. Examination of the left kidney showed mild dilatation of the pelvicalyceal system with slight separation of the central sinus echoes and preserved cortical thickness, in keeping with grade I hydronephrosis [Figure 8].

Figure 8: Grayscale ultrasound of the left kidney demonstrating mild hydronephrosis with preserved renal cortical thickness.

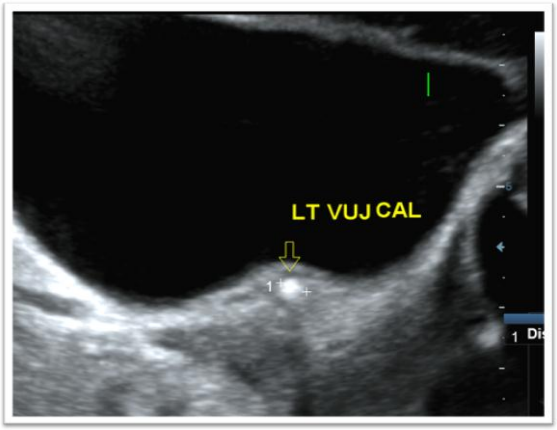

Figure 9: Grayscale ultrasound of the urinary bladder demonstrating a left vesicoureteric junction (VUJ) calculus with posterior acoustic shadowing.

Interrogation of the region of the left vesicoureteric junction, aided by the acoustic window of the filled bladder, demonstrated a small echogenic focus with posterior acoustic shadowing at the left vesicoureteric junction. The echogenic focus at the vesicoureteric junction accounted for the mild upstream pelvicalyceal dilatation, establishing both the cause and the consequence of the obstruction within the same examination [Figure 9].

Computed tomography was not performed, because ultrasound had clearly demonstrated the calculus at the vesicoureteric junction together with its mild upstream effect, and the well-distended bladder provided an adequate acoustic window for confident localisation without the need for additional imaging or ionising radiation. The final diagnosis was left grade I hydronephrosis secondary to an obstructing calculus at the left vesicoureteric junction.

Case 6: Left hydronephrosis with an obstructing mid-ureteric calculus identified on CT after an inconclusive ultrasound in an obese post-menopausal woman

A 57-year-old post-menopausal woman with a raised body mass index presented with a three-day history of dull, persistent pain in the left flank that radiated towards the left iliac fossa. The pain was more constant than colicky, she reported mild nausea without vomiting, and she remained afebrile. On examination she had a large body habitus, tenderness in the left renal angle, and stable vital signs; urinalysis showed microscopic haematuria, and her renal function was within normal limits.

Grayscale ultrasound of the left kidney demonstrated dilatation of the pelvicalyceal system with anechoic, communicating spaces in the central sinus, consistent with left hydronephrosis, while the renal cortex was preserved in thickness. Despite careful interrogation along the expected course of the left ureter, the obstructing calculus could not be located sonographically, as the ureter was obscured by overlying bowel gas and by the depth of the retroperitoneal and pelvic structures in a large habitus. The ultrasound therefore confirmed the presence and side of the hydronephrosis but was unable to demonstrate its cause or level [Figure 10].

Figure 10: Grayscale ultrasound of the left kidney demonstrating hydronephrosis without visualization of the obstructing calculus.

In view of the unexplained hydronephrosis and the technically limited ultrasound, plain (non-contrast) computed tomography of the abdomen and pelvis was performed. The CT demonstrated a calculus in the left mid-ureter, with upstream dilatation of the left ureter and pelvicalyceal system proximal to the calculus, in keeping with the sonographic finding of hydronephrosis. The location and calcific density of the focus were clearly depicted on the reformatted images, establishing both the level and the cause of the obstruction that ultrasound had been unable to resolve [Figure 11].

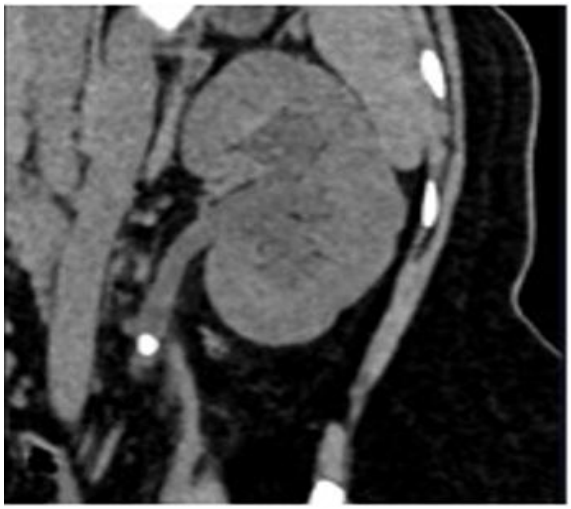

Figure 11: Non-contrast coronal CT image demonstrating a left mid-ureteric calculus with upstream hydroureteronephrosis, confirming the cause and level of obstruction.

The final diagnosis was left hydronephrosis secondary to an obstructing left mid-ureteric calculus, confirmed on plain computed tomography.

Case No 7:

A 34-year-old man of thin build presented with a one-day history of acute colicky pain in the right lower abdomen that radiated towards the groin, accompanied by increased urinary frequency. The pain came in waves and was severe during episodes, and he reported no fever or vomiting and no previous history of stone disease. On examination he had a lean body habitus, tenderness in the right iliac fossa, and stable vital signs; urinalysis demonstrated microscopic haematuria, and his renal function was within normal limits.

Grayscale ultrasound of the abdomen and pelvis was performed with a C6-2 curvilinear probe, and the patient's thin build provided an excellent acoustic window with good visualisation of the retroperitoneal and pelvic structures. Examination of the right kidney demonstrated dilatation of the pelvicalyceal system consistent with hydronephrosis, with preserved cortical thickness [Figure 12].

Interrogation along the course of the right ureter, which was well seen owing to the favourable habitus, revealed an echogenic focus with posterior acoustic shadowing in the lower ureter, located just distal to the point at which the ureter crosses the iliac vessels. The demonstration of the calculus together with the upstream hydronephrosis established both the cause and the level of the obstruction within a single ultrasound examination [Figure 13].

Figure 12: Grayscale ultrasound of the right kidney demonstrating hydronephrosis with preserved renal cortical thickness.

Figure 13: Grayscale ultrasound demonstrating a right lower ureteric calculus with posterior acoustic shadowing and associated upstream hydronephrosis.

Computed tomography was not performed, because the thin habitus had allowed ultrasound to demonstrate the obstructing lower ureteric calculus and its upstream effect clearly and to localise and measure the stone with confidence, so that additional imaging with ionising radiation was not required. The final diagnosis was right hydronephrosis secondary to an obstructing calculus in the right lower ureter, situated just distal to the iliac crossing.

Case 8: Left grade I hydronephrosis secondary to a left vesicoureteric junction calculus, confirmed with the colour Doppler twinkling artefact

A 42-year-old woman presented with a one-day history of intermittent colicky pain in the left lower abdomen that radiated towards the groin, associated with increased urinary frequency and mild dysuria. The pain occurred in waves, she reported no fever or vomiting, and there was no prior history of urinary

stone disease. On examination she had mild tenderness in the left iliac fossa, her vital signs were stable, and urinalysis demonstrated microscopic haematuria; her renal function was within normal limits.

Grayscale ultrasound of the abdomen and pelvis was performed with a C6-2 curvilinear probe, with the urinary bladder adequately distended to provide an acoustic window. Examination of the left kidney showed mild dilatation of the pelvicalyceal system with slight separation of the central sinus echoes and preserved cortical thickness, in keeping with grade I hydronephrosis [Figure 14].

Figure 14: Grayscale ultrasound of the left kidney demonstrating mild hydronephrosis with preserved renal cortical thickness.

Interrogation of the region of the left vesicoureteric junction demonstrated an echogenic focus with posterior acoustic shadowing at the junction which measured approximately 0.63 centimetres. On colour Doppler interrogation, the focus generated a characteristic twinkling artefact, seen as a rapidly alternating mosaic of colour signal posterior to the reflective interface, which confirmed the calcific nature of the focus and localised it precisely at the vesicoureteric junction. The demonstration of the calculus, its measurement, and the corresponding twinkling artefact, together with the mild upstream pelvicalyceal dilatation, established both the cause and the consequence of the obstruction within a single examination [Figure 15].

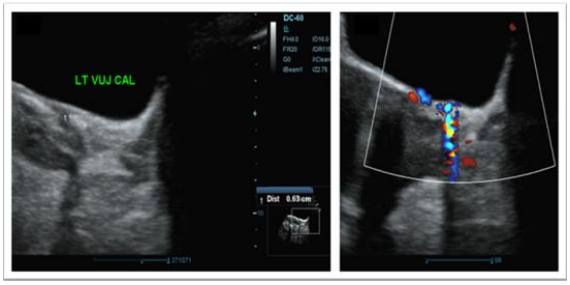

Figure 15: Grayscale and colour Doppler ultrasound of the left vesicoureteric junction. (Left) Grayscale image demonstrating a left vesicoureteric junction calculus. (Right) Colour Doppler image demonstrating the characteristic twinkling artefact confirming the calculus.

Computed tomography was not performed, because ultrasound had clearly demonstrated the vesicoureteric junction calculus with its mild upstream effect, and the colour Doppler twinkling artefact had provided confirmatory localisation without the need for additional imaging or ionising radiation. The final diagnosis was left grade I hydronephrosis secondary to an obstructing calculus at the left vesicoureteric junction.

Case 9: Large vesical (bladder) calculus in an elderly man presenting with dysuria

A 60-year-old man presented with a several-month history of lower urinary tract symptoms that had recently worsened, the most troublesome of which was dysuria, accompanied by a poor urinary stream, straining to void, intermittent interruption of flow, and a sensation of incomplete bladder emptying. He reported no fever and no gross haematuria. On examination he had mild suprapubic discomfort on palpation, his vital signs were stable, and clinical assessment suggested an element of bladder outlet obstruction; urinalysis showed a few red blood cells, and his renal function was within normal limits.

Grayscale ultrasound of the pelvis was performed using with a C6-2 curvilinear probe, with the urinary bladder distended. The examination demonstrated a large, brightly echogenic focus within the dependent portion of the bladder lumen, with a convex, strongly reflective leading edge and prominent posterior acoustic shadowing, features characteristic of a vesical calculus. The echogenic focus measured approximately 4.81 centimetres, indicating a large stone. On real-time examination the focus was mobile and changed position with alterations in the patient's posture, which distinguished it from an adherent clot or a bladder wall mass. The bladder wall was assessed for associated changes of chronic outlet obstruction [Figure 16].

Figure 16: Grayscale ultrasound of the urinary bladder demonstrating a large vesical calculus with prominent posterior acoustic shadowing.

Computed tomography was not performed, because the ultrasound appearances of a large mobile shadowing intravesical focus were diagnostic of a vesical calculus, and the diagnosis and its clinical

implications were established on ultrasound alone. The final diagnosis was a large vesical calculus, measuring approximately 4.81 centimetres, in a patient with clinical features of bladder outlet obstruction; a stone of this size is not amenable to spontaneous passage and warrants surgical management.

DISCUSSION

Urolithiasis is among the most frequent causes of obstructive hydronephrosis, and the imaging strategy chosen for its evaluation directly influences the speed of diagnosis and subsequent management strategies. The present case series illustrates a tiered approach in which grayscale ultrasonography, supplemented where necessary by the colour Doppler twinkling artefact, resolved the cause and diagnosed level of obstruction in the majority of patients. Whereas Non-contrast computed tomography (NCCT) retained a decisive problem-solving role in technically limited examinations.

The twinkling artefact, first described by Rahmouni et al appears as a rapidly alternating red–blue colour signal posterior to a strongly reflecting granular interface such as a calculus, and may be evident even when posterior acoustic shadowing is equivocal.[6] In our first and eighth cases, the artefact confirmed and precisely localised mid-ureteric and vesicoureteric junction calculi that were only faintly conspicuous on grayscale imaging, thereby obviating CT. This is concordant with Ripollés et al who reported a sensitivity and specificity of 90% and 100% respectively for Doppler ultrasound in symptomatic ureteric stones.[7] The authors also observed that the twinkling sign was especially valuable in the mid-ureter which is traditionally the most difficult segment to interrogate sonographically. Chelfouh et al further demonstrated in vitro that the artefact is governed by stone surface architecture and composition which explains its variable strength across calculi and underscores why it should be treated as a confirmatory adjunct rather than a stand-alone criterion for ureteric calculi.[8-10]

Nevertheless, the diagnostic reach of ultrasound was clearly constrained by body habitus. In four patients — three obese men and one obese post-menopausal woman — grayscale imaging established the presence and side of hydronephrosis but failed to reveal the obstructing calculus, which was subsequently demonstrated on NCCT in the upper, mid, and distal ureter respectively. Beam attenuation by adipose tissue, increased target depth and overlying bowel gas degrade acoustic access in such patients and reduce diagnostic confidence. This selective reliance on CT accords with Abdel-Gawad et al who found that colour Doppler ultrasound with twinkling, although useful, remained inferior to NCCT for definitive stone characterisation.[11] It also reflects the broader evidence base: in the landmark trial by Smith-Bindman et al who concluded that initial ultrasonography lowered cumulative radiation exposure and supported an ultrasound-first pathway in which CT is reserved for equivocal or non-diagnostic studies.[12]

The series also highlights the value of an adequately distended bladder as an acoustic window. In cases 5 and 8, the filled bladder permitted confident identification of vesicoureteric junction calculi, and in the elderly man with a large mobile shadowing vesical calculus, real-time demonstration of positional mobility distinguished the stone from clot or a bladder mass and directed surgical management without further imaging. Conversely, case 2 confirmed that a non-obstructing lower-pole renal calculus with characteristic shadowing can be diagnosed on ultrasound alone when clinical correlation is unambiguous.[13,14]

Several limitations temper these observations. As a descriptive case series without a consecutive denominator, our experience cannot generate sensitivity or specificity estimates, and case selection is inevitably shaped by referral patterns. The twinkling artefact is operator- and machine-dependent, varying with pulse repetition frequency, colour write priority, and gain settings, so its reproducibility across departments is uncertain.[9] Finally, ultrasound cannot reliably exclude alternative or coexisting pathology, which remains an argument for CT when the clinical picture is atypical.[13]

Taken together, these cases support a rational, radiation-sparing algorithm: grayscale ultrasonography augmented by the twinkling artefact as the first-line investigation for suspected obstructive urolithiasis and NCCT reserved for obese patients, technically limited studies and situations in which the level or cause of obstruction remains undetermined or alternative diagnoses must be excluded. Such a strategy preserves diagnostic accuracy while limiting ionising radiation, and is particularly suited to younger patients, to follow-up imaging, and to resource-conscious settings where judicious use of CT is desirable.[15]

CONCLUSION

This case series demonstrates that grayscale ultrasonography, particularly when complemented by the colour Doppler twinkling artefact, serves as an effective first-line imaging modality for diagnosing urolithiasis and localising the site of urinary tract obstruction in most patients. Non-contrast CT remains indispensable in obese individuals and technically limited examinations where ultrasound is inconclusive. A selective ultrasound-first, CT-as-problem-solving approach optimises diagnostic accuracy, reduces unnecessary radiation exposure, and represents a practical imaging strategy for routine clinical practice.

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