



Ultrasonography in Hydronephrosis



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Ultrasound is very sensitive in diagnosing obstruction by demonstrating hydronephrosis (1, 2). Ultrasonography has great advantage over IVU in patients who have azotemia, contrast material-induced allergy, are pregnant, fetal, or pediatric patients with no exposure to radiation. And ultrasonography can nicely visualize the both the renal parenchyma and the collecting system as well as causative lesion itself (both intrinsic and extrinsic). Hydronephrosis is graded as mild (grade 1), moderate (grade 2), or severe (grade 3) (3). Mild hydronephrosis can be simulated by prominent renal vessels and false-positive studies for obstruction are common in patients suspected of having mild hydronephrosis. Doppler or color Doppler ultrasonography will distinguish prominent renal vessels from mild hydronephrosis (Fig 1).

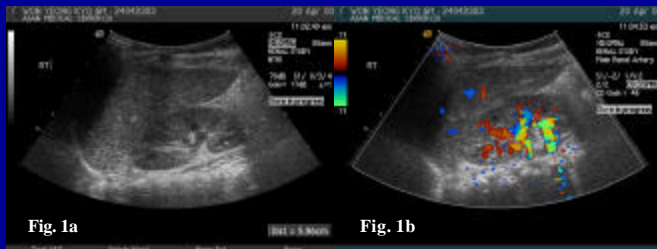


Fig. 1. False-positive study for obstruction, which is suspected of having mild hydronephrosis. Fig 1a. The renal pelvis and calyceal system demonstrate minimal separation of the central sinus echo complex by tubular anechoic structure. Fig 1b. Color Doppler ultrasound demonstrate color flow in the tubular structures.

When hydronephrosis is seen, every effort should be made to determine the level of obstruction. Proximal and distal obstructing lesions will often be visualized, whereas obstruction in the midureter is difficult to delineate. Doppler ultrasound has been suggested as a means to separate obstructive from nonobstructive hydronephrosis. The RI normally is less than 0.7, but in obstructed kidneys is usually increases above this level. Some investigators have demonstrated up to 92% sensitivity and 88% specificity by measuring renal arterial RI (4, 5, 6). Evaluation of ureteral jets has also been suggested to help diagnose obstruction (7) (Fig. 2).

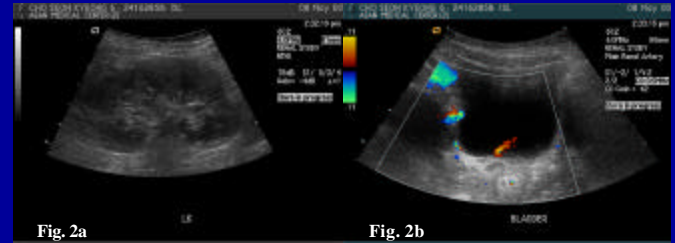


Fig. 2 Ureteral jet has also been suggested to help diagnose obstruction. In mild case, ureteral jet is not demonstrated. Fig 2a. On this image, the renal pelvis and calyceal system become apparent as the collecting system distends mildly with urine. Fig 2b. On the scan at the bladder ureteral jet is noted.

• Ureteropelvic Junction Obstruction

The ureteropelvic junction (UPJ) obstruction is a relatively common congenital anomaly. The US findings include a dilated renal pelvis that ends abruptly at the UPJ (Fig. 3). The amount of residual renal parenchyma will be variable and depends on the degree and duration of the obstruction.

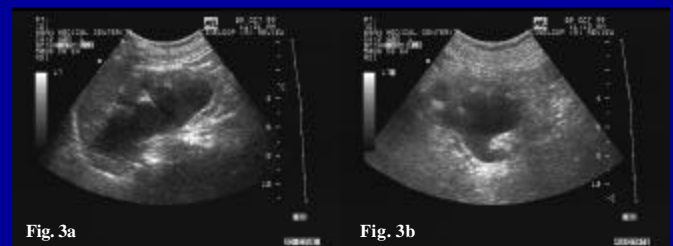


Fig. 3 The ureteropelvic junction (UPJ) obstruction with chronic hydronephrosis. Fig 3a. Longitudinal scan of the kidney shows moderate or severe distention of the collecting system, with thinning of the cortical parenchyma. Fig 3b. On the scan of the renal pelvis, a capacious renal pelvis gives off markedly dilated calyces. The collecting system distension ends abruptly at the UPJ.

• Hydronephrosis of Pregnancy

Sixty to 80% of pregnant patients will develop hydronephrosis on the right and 30% have hydronephrosis on the left (8). Differentiating normal hydronephrosis of pregnancy from obstruction can be clinically and sonographically difficult. If the left is more dilated, an obstructing lesion such as stone should be suspected (Fig. 4). A recent study demonstrated that the RIs of the kidneys in pregnant patients were less than 0.7 and symmetric, even if the right side was significantly more dilated than the left (9, 10).



Fig. 4 pregnant patients with hydronephrosis Fig 4a. The scan on the level of left kidney shows moderate hydronephrosis. Fig 4b. A strong echogenic focus with posterior acoustic shadowing is noted at the ureterovesical junction. The upstream ureter is distended. Fig 4c. Transverse transabdominal sonogram demonstrates the early embryo in the amniotic cavity. Fig 4d. The RIs of the kidneys in pregnant patients were more than 0.7.

• Renal stone disease

Recent studies have demonstrated approximately 80% sensitivity to detect stone. (11, 12) Haddad et al recently reported that US combined with plain radiography may be able to replace intravenous urography in the evaluation of patients with suspected urolithiasis. US will document hydronephrosis and also visualize the stone in many cases, especially those calculi lodged at the UPJ or UVJ. The Plain film can be used to evaluate and follow a suspected stone (13).

• References

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• Reflux nephropathy

Vesicoureteral reflux (VUR) most commonly affect young girls and has a tendency to resolve as the patient gets older. Reflux is graded from mild to severe, grade I through grade V. The affected kidney is shrunken, with irregularly scarred margins, and a dilated collecting system. Sonography will show the small, irregular, scarred kidneys with diffuse irregular cortical loss. With the recent use of contrast material(Levovist®), ultrasonogram (Fig. 5) is a alternative to vesicocystourethrogram (VCUG) for the evaluation for vesicourethral reflux in pediatric patients without exposure of radiation.

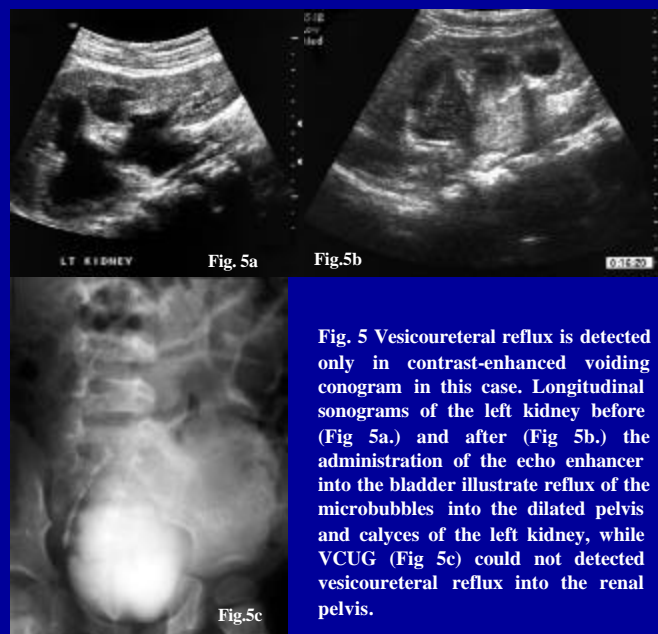


Fig. 5 Vesicoureteral reflux is detected only in contrast-enhanced voiding conogram in this case. Longitudinal sonograms of the left kidney before (Fig 5a.) and after (Fig 5b.) the administration of the echo enhancer into the bladder illustrate reflux of the microbubbles into the dilated pelvis and calyces of the left kidney, while VCUG (Fig 5c) could not detected vesicoureteral reflux into the renal pelvis.