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Bedside renal ultrasound (US) can be utilized to evaluate for nephrolithiasis, renal failure, urinary retention or decreased output, and hematuria (Figs. 28.1, 28.2, 28.3, 28.4, 28.5, 28.6, 28.7, 28.8, 28.9, 28.10, 28.11, and 28.12, Videos 28.1, 28.2, 28.3, 28.4, and 28.5). Although CT scan has classically been used to diagnose kidney stones, US has gained favor owing to its rapid application at the bedside, cheaper cost, and avoidance of ionizing radiation [1]. Larger kidney stones are more likely to be seen on US [2, 3], but more frequently it is the visualization of hydronephrosis as a secondary sign

that can help point toward the diagnosis and guide management [4, 5].

Measurement of bladder diameter using US (see also Chap. 33) can reliably confirm urinary retention [6–8]. This finding can be helpful for those patients with benign prostatic hypertrophy or another obstructive process, concern for a neurogenic bladder, assessment of Foley catheter patency, and successful micturition in postoperative patients (Figs. 28.13, 28.14, and 28.15, Videos 28.6 and 28.7).

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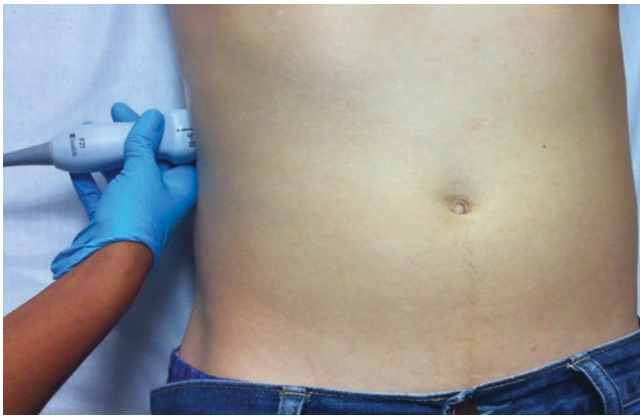


Fig. 28.1 Ultrasound probe position for visualizing the right kidney. To obtain sagittal views, point the probe marker toward the patient's head, and scan in the posterior axillary line at the level of the costal margin. Sweep both anterior-posterior and rostral-caudal to visualize the entire kidney. To obtain transverse views, point the probe marker toward the patient's posterior and scan in the posterior axillary line at the level of the costal margin. Sweep both rostral-caudal and anterior-posterior to visualize the entire kidney. (Image courtesy of Bret Nelson.)

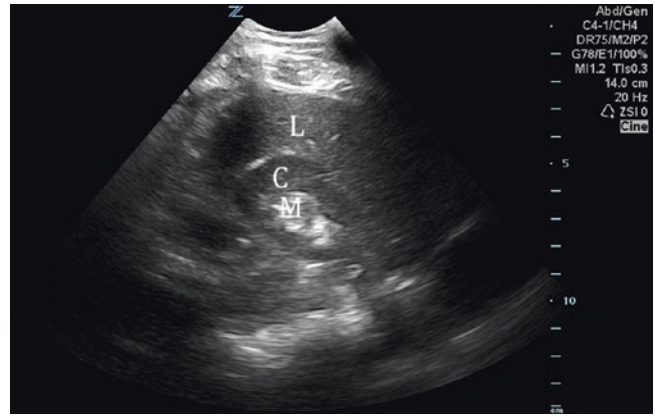


Fig. 28.3 Ultrasound image of the right kidney in the transverse plane. This view similarly demonstrates the cortex (C) and medulla (M) of the kidney. The liver (L) can be seen superior to the kidney. See Video 28.2. (Image courtesy of Stephen Alerhand.)

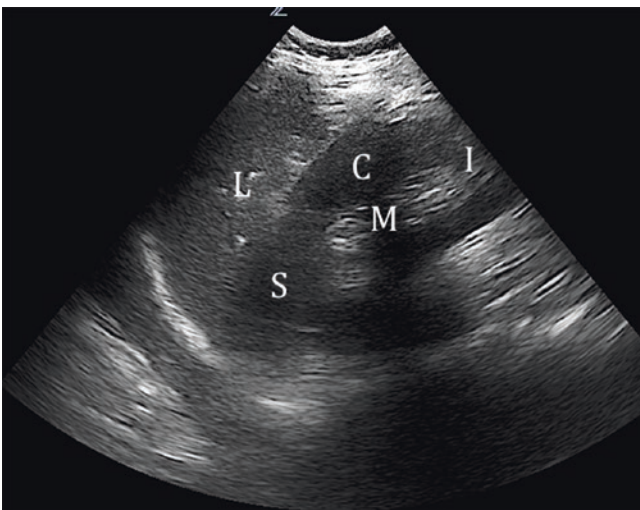


Fig. 28.2 Ultrasound image of the right kidney in the longitudinal plane. This view should demonstrate the superior (S) and inferior (I) poles, cortex (C), and medulla (M) of the kidney. The liver (L) can be seen superior to the kidney. See Video 28.1. (Image courtesy of Stephen Alerhand.)



Fig. 28.4 Ultrasound probe position for visualizing the left kidney in the longitudinal plane. For longitudinal imaging, a similar process is repeated for the left kidney as for the right, keeping in mind that the left kidney is located more superior and posterior than the right. This view can best be obtained by placing the knuckles of the right hand on the patient stretcher and aiming the probe anteriorly toward the kidney. For transverse imaging, point the probe marker anteriorly and scan in the posterior axillary line at the level of the costal margin. Sweep both rostral-caudal and anterior-posterior to visualize the entire kidney. (Image courtesy of Bret Nelson.)

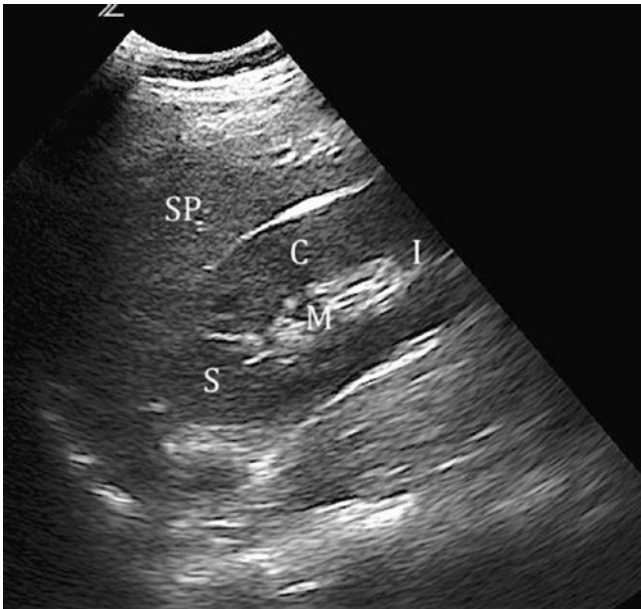


Fig. 28.5 Ultrasound image of the left kidney in the longitudinal plane. A longitudinal view of the kidney should demonstrate the superior (S) and inferior (I) poles, cortex (C), and medulla (M) of the kidney. The spleen (SP) can be seen superior to the kidney. See Video 28.3. (Image courtesy of Stephen Alerhand.)

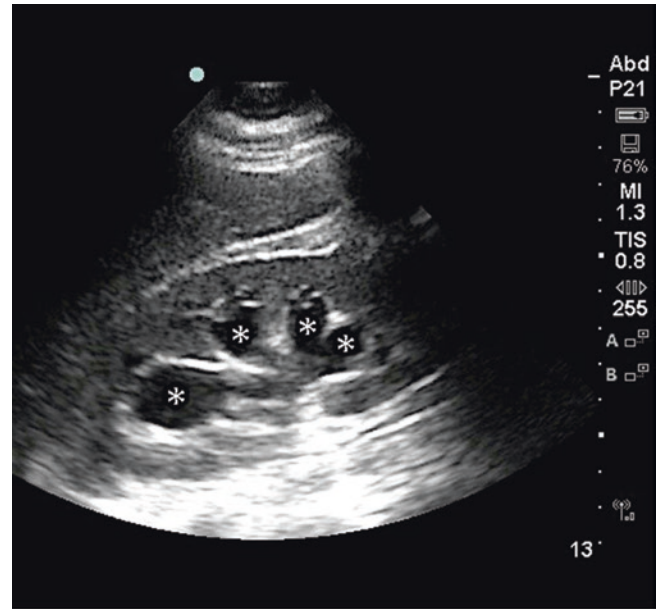


Fig. 28.7 Ultrasound image of right-sided hydronephrosis in the longitudinal plane. Multiple anechoic (black) structures represent the renal calyceal system (*asterisks*), which is dilated due to renal stone obstruction at the ureteropelvic junction. Hydronephrosis can be categorized as mild (calyceal enlargement with preservation of renal papillae), moderate (calyceal rounding with obliteration of papillae, as in this image), or severe (calyceal ballooning with cortical thinning). See Video 28.5. (Image courtesy of Bret Nelson.)

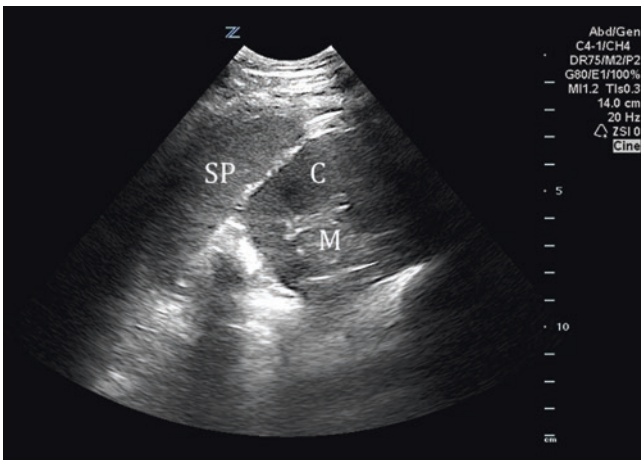


Fig. 28.6 Ultrasound image of the left kidney in the transverse plane. This view similarly demonstrates the cortex (C) and medulla (M) of the kidney. The spleen (SP) is once again visible superior to the kidney. See Video 28.4. (Image courtesy of Stephen Alerhand.)

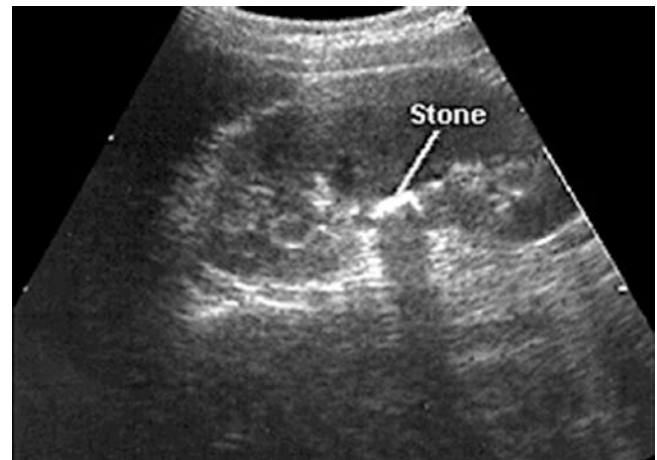


Fig. 28.8 Ultrasound image of a stone in the renal medulla. Though seen with less sensitivity than hydronephrosis, kidney stones can also be visualized in the collecting system. They appear as hyperechoic structures 1–15 mm in size, which cast a posterior shadow. (Image courtesy of Bret Nelson.)

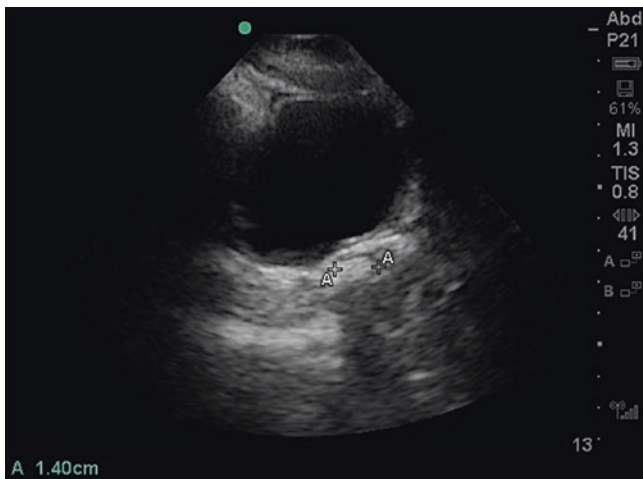


Fig. 28.9 Ultrasound image of a renal stone in the ureterovesicular junction (UVJ). This is the most common site of renal stone obstruction. (Image courtesy of Bret Nelson.)

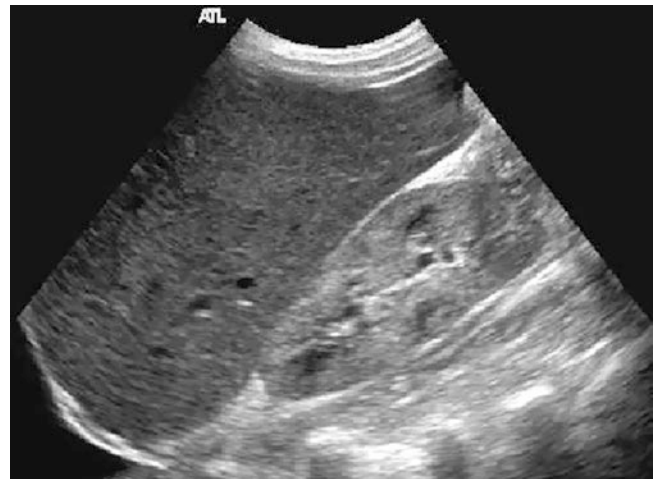


Fig. 28.11 Ultrasound image of acute renal failure. Kidneys in acute failure can appear enlarged and diffusely hyperechoic, with loss of differentiation between the cortex and medulla. This appearance is often referred to sonographically as “medical renal disease.” (Image courtesy of Bret Nelson.)

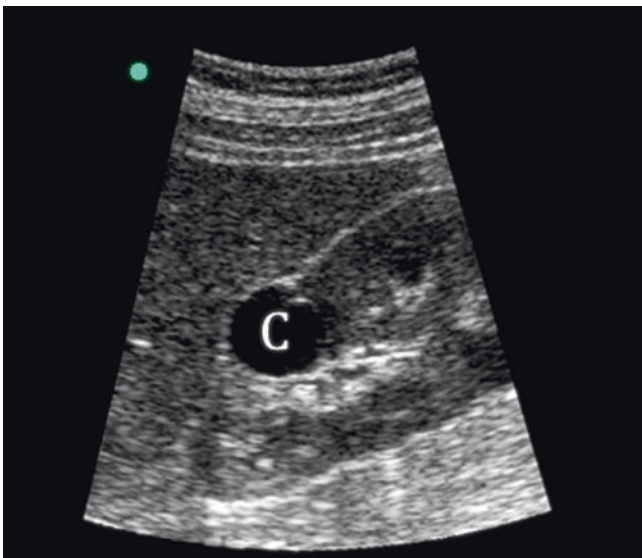


Fig. 28.10 Ultrasound image of a renal cyst (C) in the longitudinal plane. Simple cysts are smooth and oval-shaped, with a well-circumscribed border and posterior acoustic enhancement. Their center is anechoic and without septations. Cysts that do not fulfill these criteria are categorized as complex cysts. (Image courtesy of Bret Nelson.)

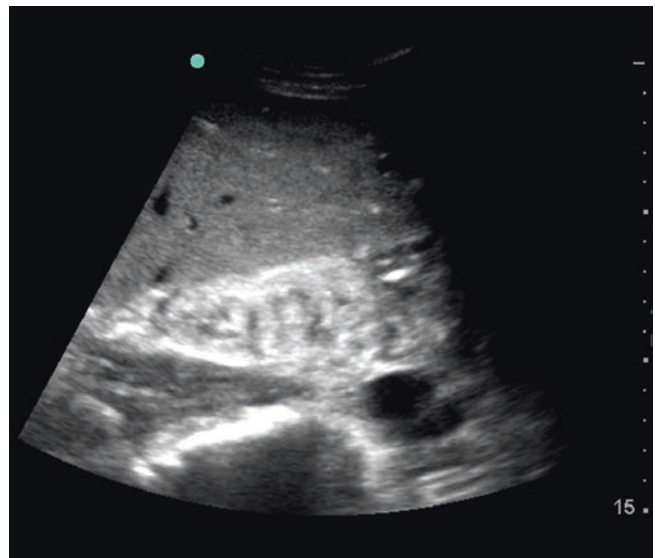


Fig. 28.12 Ultrasound image of chronic renal failure. Kidneys in chronic failure appear shrunken and demonstrate cortical thinning. (Image courtesy of Bret Nelson.)



Fig. 28.13 Ultrasound position for visualizing the bladder. For longitudinal imaging, direct the probe marker superiorly and place the probe just above the level of the pubic symphysis, with the beam directed inferiorly, into the pelvis. Scanning in both the right-left and superior-inferior planes will allow visualization of the entire bladder. For transverse imaging, the probe marker is turned toward the patient's right. Scanning in the superior-inferior and right-left planes will allow visualization of the entire bladder. (Image courtesy of Bret Nelson.)



Fig. 28.15 Ultrasound image of bladder distention in the transverse plane. Once again, the dimensions of the anechoic fluid-filled bladder can be measured in order to calculate volume. See Video 28.7. (Image courtesy of Stephen Alerhand.)

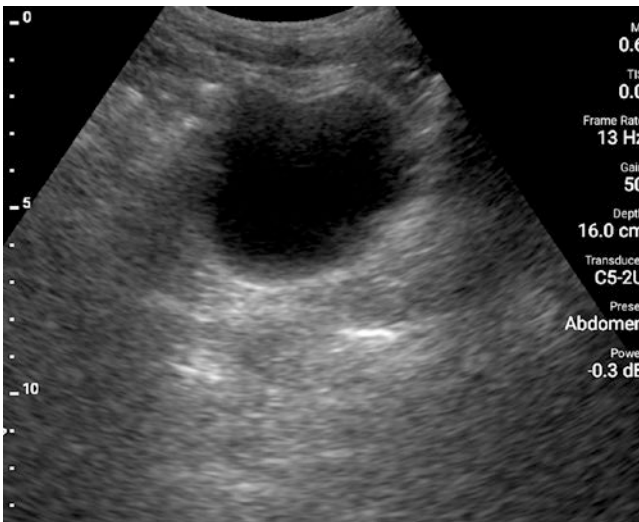


Fig. 28.14 Ultrasound image of bladder distention in the longitudinal plane. The dimensions of the anechoic fluid-filled bladder can be measured in order to calculate volume. See Video 28.6. (Image courtesy of Stephen Alerhand.)

References

1. Watkins S, Bowra J, Sharma P, Holdgate A, Giles A, Campbell L. Validation of emergency physician ultrasound in diagnosing hydronephrosis in ureteric colic. *Emerg Med Australas*. 2007;19:188–95.
2. Moak JH, Lyons MS, Lindsell CJ. Bedside renal ultrasound in the evaluation of suspected ureterolithiasis. *Am J Emerg Med*. 2012;30:218–21.
3. Riddell J, Case A, Wopat R, Beckham S, Lucas M, McClung CD, Swadron S. Sensitivity of emergency bedside ultrasound to detect hydronephrosis in patients with computed tomography-proven stones. *West J Emerg Med*. 2014;15:96–100.
4. Rosen CL, Brown DF, Sagarin MJ, Chang Y, McCabe CJ, Wolfe RE. Ultrasonography by emergency physicians in patients with suspected ureteral colic. *J Emerg Med*. 1998;16:865–70.
5. Goertz JK, Lotterman S. Can the degree of hydronephrosis on ultrasound predict kidney stone size? *Am J Emerg Med*. 2010;28:813–6.
6. Ding YY, Sahadevan S, Pang WS, Choo PW. Clinical utility of a portable ultrasound scanner in the measurement of residual urine volume. *Singap Med J*. 1996;37:365–8.
7. Daurat A, Choquet O, Bringuier S, Charbit J, Egan M, Capdevila X. Diagnosis of postoperative urinary retention using a simplified ultrasound bladder measurement. *Anesth Analg*. 2015;120:1033–8.
8. Coombes GM, Millard RJ. The accuracy of portable ultrasound scanning in the measurement of residual urine volume. *J Urol*. 1994;152:2083–5.