O

er the past four decades, ultra-
songraphy has become an indis-1
pensable tool because of its safety, avail-
ability, and low cost. Accordingly, many specialties have incorporated ul-
tasonography into their core training
programs for visualization of relevant organs and guidance of procedures (e.g., echocardiograms in cardiovascular med-
icine, pelvic ultrasonography in gynecology and obstetrics, thyroid ultrasonography in endocrinology, abdominal ultrasonography in trauma and emergency medicine).

In nephrology, ultrasonography is ideally suited for visualizing the kid-
neys, urinary tract, and some blood vessels and is essential for the diagnosis and treatment of patients with kidney diseases. How-
ever, formal training in ultrasonography is rarely included in nephrology training programs. This article discusses the rea-
sons why modern nephrologists should acquire this skill and how they can in-
corporate it into their daily practice.

Owing to their acoustic properties, the kidneys and urinary bladder are easily visualized by ultrasonography and present a limited spectrum of anatomic variations and pathologic conditions. The renal cortex, medulla, and collect-
ing system are usually easily discernible, and pathologic changes correlate well with histologic findings (1). Sonogra-
phy is indicated in the evaluation and diagnosis of renal failure (acute and chronic), hematuria, severe hyperten-
sion, pain, refractory urinary tract in-
fections, and nephrolithiasis and in the screening for hereditary cystic diseases. It is particularly useful in the evalua-
tion of chronic renal failure, where the findings of small kidneys or cortical thinning usually indicate irreversible damage, thereby avoiding further un-
necessary evaluation and biopsy (2, 3).

Obstructive uropathy and polycystic kidney disease (as causes of renal failure) can be easily diagnosed or excluded, and other disorders such as nephritis, amy-
loidosis, and chronic pyelonephritis can be suspected. The utility of sonog-
raphy is more limited in the evaluation of acute renal failure in native kidneys, when clinical and urinary sediment features strongly point toward acute tubular necrosis, volume depletion, and urinary obstruction (4). However, ultrasonography remains indicated for acute renal failure in known soli-
tary kidneys and transplanted kidneys, where urinary obstruction is a common and unpredictable cause of renal failure (5). Sonography also plays a central role in the management of hemodialysis patients, monitoring of ultrafiltration rates, blood pressure, and patient hydration.

Traditionally, performing ultrasonography into nephrology practices streamlines the evaluation of the patient and increases the physician’s efficiency. In the out-
patient setting, delays associated with scheduling ultrasonography and obtain-
ning results can be avoided because the sonogram can be performed and inter-
preted during the patient’s visit.

Ultrasonography also enhances the ability of nephrologists to perform im-
portant procedures on our patients. It is indispensable for guiding central venous catheter insertion, substantially shorten-
ing the required time and significantly reducing the risks of complication. Sonography is the imaging modality of choice for performing percutaneous re-
nal biopsies because of its low cost and lack of radiation. It also enables biopsies to be performed by nephrologists at the bedside, enhancing patient and physician convenience. Most renal biopsies are per-
formed under computed tomographic guidance during the increased cost and radiation exposure and the lack of data showing any advantage over ultrasound guidance (7). An additional advantage of ultrasound in this setting is that a patient whose condition is otherwise stable can be safely discharged after observation without an overnight hospital stay if a postbiopsy ultrasound is normal (8).

Knowledge of patients’ personal and family histories, clinical presentation, and complementary test results enables nephrologists to appropriately focus the imaging study and also correlate ultra-
sound and clinical findings on a real-time basis. Visualization of dilated calyces with or without bladder distension may point toward radically different patho-
logic processes such as prostatic enlarge-
ment or ureteral obstruction. Absence of calyceal dilation almost invariably rules out obstruction as a cause of acute renal failure. The finding of enlarged renal cor-
tex may be consistent with acute tubular necrosis, interstitial pneumonitis, gran-
ular casts) or nephritis (in the presence of proteinuria and hematuria).

Renal enlargement with increased cortical echogenicity may evoke renal vein thrombosis if new-onset hematuria and flank pain are present and should direct the imaging study toward visuali-
zation of the renal veins. The same sono-
graphic findings may also point toward amyloidosis in the presence of other cardiac or hematologic features. Major renal asymmetry with unilateral corti-
al atrophy in the context of severe hyper-
tension and bland urinary sediment strongly suggests the possibility of ren-
al artery stenosis.

Ultrasonography can usually identify the basis for dysfunc-
tional or poorly maturing arteriovenous fistulae.

Finally, renal ultrasonography is an enjoyable and relatively easy skill to ac-
imulate, and incorporating it into the diagnostic and procedural modalities can improve the attractiveness of a career in nephrology. The relatively low cost of the equipment, which can be recovered with as few as two outpatient studies per week, and the availability of good-
quality portable scanners should make this modality practical for any nephrol-
ogy practice.

Unfortunately, very few nephrology programs offer comprehensive training in ultrasonography. The Renal Divi-
sion at Emory University was the first program to provide such training, with all fellows receiving training since 1994. Since 1997, Emory has offered continu-


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