

Retooling Nephrology with Ultrasound

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Reductions in the size and cost of ultrasound equipment have transformed sonography from a referral procedure into an examination that can be performed by clinicians and it has been argued that ultrasound should become the fifth pillar of the physical examination (1). Many specialties have embraced point-of-care ultrasound and made it an integral part of their training and practice. Yet nephrology has not been among them despite the manifold applications of ultrasound in our field (2). Most of our patients require sonography of the kidneys. Ultrasound is the standard of care for guiding kidney biopsies and placing dialysis catheters, and it is the preferred method for diagnosing urinary retention. Limited sonography of the chest has the potential to improve assessment of intravascular volume, and cardiac function, lung and pleural fluid, and dysfunctional arteriovenous fistulae and grafts can be noninvasively evaluated at the bedside.

Potential advantages of point-of-care ultrasound include patient and physician convenience, expedited and less fragmented care, and physician and trainee satisfaction. Not surprisingly, training in sonography was listed as an area for improvement in a recent survey of nephrology trainees (3). Nephrologists as positive role models strongly influences internal medicine residents to choose nephrology as a career (4) and residents will likely take notice when nephrologists use portable ultrasound to make timely decisions that affect patient care.

Although nephrology has been slow to adopt ultrasonography, many other specialties have embraced it. Besides cardiology, other specialties for which training in focused ultrasound examinations is routine and required by the Accreditation Council for Graduate Medical Education include emergency medicine, pulmonary and critical care medicine, obstetrics and gynecology, urology, anesthesiology, and endocrinology. In each case, this was accomplished through the concerted effort of professional societies, training programs, and certifying bodies to develop competency parameters and train faculty.

Although proficiency in ultrasonography is currently not a requirement for nephrology training, it has been incorporated into a small but growing number of training programs. Performance and interpretation of kidney and bladder sonograms, as well as ultrasound guidance for kidney biopsy, has been a formal rotation for trainees at Emory University since 1994, and this

program also offers comprehensive training for other nephrologists. Several other programs have begun training in kidney ultrasound and sonographic assessment of intravascular and extravascular volume status over the past 5 years. The experience at these programs has been that sonography can be feasibly integrated into nephrology practice, is not a difficult skill to master, and greatly enhances training and patient care.

Potential obstacles include our traditional focus on physiology and biochemistry rather than anatomy, the lack of skilled faculty and guidelines for training and competence, concerns about proficiency and liability, costs, and competition with other specialties (turf battles). These obstacles, which are more perceived than real, were faced by other specialties that have successfully incorporated ultrasound training, and their approach provides a road map for nephrology.

Nephrologists must move beyond biochemical assessments and realize that anatomy can be just as important and potentially more informative. This is clearly the case with obstructive uropathy and polycystic kidney disease, but even in anatomically normal kidneys, a simple measurement of size can often provide more information than GFR. Why depend solely on clinical assessments of intravascular volume and lung water when they can be directly visualized? And why rely on functional evaluation of grafts and fistulae when they can be readily imaged? We believe that nephrologists can improve their clinical skills by performing timely diagnostic and procedural ultrasound studies.

Faculty training is the key to adopting new procedures and has been accomplished by society-sponsored courses in other specialties. The American College of Chest Physicians established an annual didactic and hands-on course that covers vascular, lung, abdominal (including kidney), and cardiac ultrasound, and has had >2000 attendees since 2007. Efficacy was demonstrated by a mean postcourse test score of 90% (5). The American Association of Clinical Endocrinologists offers training courses in neck ultrasound at their annual meetings, complemented by a certification process, and the American Urological Association also has training courses and a pathway for credentialing in kidney ultrasound. The Society of Hospital Medicine offers regional courses on cardiac, lung, abdominal, and vascular ultrasound, supplemented by online modules that, once completed, result in certification. Although

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training specifically for nephrologists is available, this will need to be expanded and promoted by national and international societies so that faculty in training programs can become proficient. This could be accomplished through comprehensive courses at yearly meetings or offered regionally throughout the year. Courses, although not comprehensive, have begun to appear at national nephrology meetings. Guidelines for training in kidney ultrasound have already been established by the American Society of Diagnostic and Interventional Nephrology (ASDIN), but these will need to be expanded to include other uses of ultrasound by nephrologists.

The feasibility and efficacy of ultrasound procedures performed by nephrologists has been amply demonstrated (6–8). Proficiency is not difficult to achieve, as evidenced by the 95% sensitivity and 87% specificity for diagnosing hydronephrosis by emergency physicians with training (9), and even medical students can accurately diagnose kidney abnormalities by sonography (10). Numerous studies have shown a high degree of accuracy for a wide range of focused ultrasound examinations performed and interpreted by clinicians. Concerns about liability in point-of-care ultrasound are unfounded (reviewed in Niyar and O'Neill [2]) and should not be considered an obstacle. Rather, failure to perform point-of-care ultrasound has been a more common scenario for liability.

The cost of equipment is not excessive (\$20,000–\$40,000, and as little as \$2000 for simple hand-held devices) and, in the case of kidney examinations, is easily recovered by reimbursement (one to three studies per week). Greater volumes will provide reimbursement for physician time. For limited studies performed as part of the physical examination, physician time is minimal. There are also savings in time through increased efficiency (completing patient work-ups in one visit, performing procedures at the bedside), as well as institutional savings related to expedited patient care. For example, bedside evaluation for urinary obstruction or lung water is much faster than referral to the radiology department.

Some would argue that there is not enough room in fellowship training to accommodate ultrasound, but we maintain that this can be addressed with careful restructuring, as has been done in several programs. There are diminishing educational returns from each additional case of AKI or hospitalized patient with ESKD, and trainees would learn more by performing ultrasounds in these patients. Point-of-care ultrasound also enhances training in kidney biopsy and placement of dialysis catheters, as well as evaluation of hemodialysis fistulae and grafts—an aspect of training that is often deficient. It has been our experience that trainees can master basic skills in kidney sonography in several weeks and that even less time is required for other applications. In programs that have incorporated ultrasound, training has been accomplished through a combination of lectures and clinical experience. The latter is obtained through a dedicated inpatient and outpatient ultrasound rotation after the first year, dedicated outpatient ultrasound clinics, or incorporation into existing clinical rotations.

Competition with other specialties is a perceived rather than a true obstacle because point-of-care ultrasound is

rapidly becoming the standard of clinical care. A total of 27% of medical schools in the United States now have a formal ultrasound curriculum (11), and sonography is increasingly being incorporated into internal medicine residency. Many prospective nephrology trainees will already have basic training in ultrasound and will expect to be using this skill in their fellowship.

In terms of a specific roadmap toward incorporating ultrasound into nephrology training, we propose the following steps:

1. Establishment of criteria for training and competence of faculty, primarily through adoption of existing guidelines.
2. Training of faculty through society-sponsored courses, with subsequent hands-on training at designated centers of excellence.
3. Establishment of guidelines for training nephrology fellows and assessing their proficiency.
4. Development of criteria for adequacy of training programs in ultrasound, again drawing on established criteria such as those for ASDIN accreditation.
5. And eventually, inclusion of ultrasound in the skill set required for certification in nephrology.

This would be best accomplished by a designated task force that includes nephrologists with expertise in sonography as well as national nephrology leadership.

We should not continue to practice nephrology and train future nephrologists the same way we did 25 years ago. Point-of-care ultrasound is rapidly becoming a standard component of patient care and failure to embrace it will leave us further behind, akin to physicians who never adopted the stethoscope. The difficulty in attracting trainees to our specialty is one symptom of this and a call to action. Point-of-care ultrasound is an exciting clinical tool and incorporating it into nephrology training is one way to improve the care of our patients and to attract future nephrologists. As demonstrated by other specialties and a growing number of nephrology training programs, this can be accomplished, but it will require a coordinated effort on the part of nephrology leadership, training programs, and certifying organizations.

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