

Point-of-Care Ultrasonography

Is It Time Nephrologists Were Equipped With the 21th Century's Stethoscope?

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Keywords. ultrasonography, nephrology, kidneys, point-of-care systems

In the past 3 decades, ultrasonography has gifted internal organs visualization to physicians to have a better detection of various diseases. Previously performed solely by radiologists as a method with high feasibility and accuracy, recently ultrasonography is being recommended and used by many other physicians in practice. Ultrasonography not only can be used to diagnose and manage kidney diseases, but also is an essential tool in nephrology for the guidance of invasive procedures. This method of bedside ultrasonography by physicians in real time is called *point-of-care ultrasonography* (POCUS). Given the limitations of collecting information by routine physical examination in kidney diseases and the simplicity of performing ultrasonography to examine kidney location, architecture, and restricted pathologies, nephrologists that have been lagging in this area, should join the spectrum of clinicians using the POCUS to provide safe and rapid diagnosis of common renal abnormalities. Although physicians may imagine POCUS as a difficult tool to use and there has been an initial resistance and reluctance to use ultrasonography by nonradiologists, investigations have shown that learning and doing POCUS was possible even for undergraduate medical students during a short course. According to the collected evidence in the field of POCUS in different branches of medicine, it seems that it should be added to nephrology examination room in the near future.

IJKD 2017;11:259-62
www.ijkd.org

INTRODUCTION

Medical examination had been limited to the inspection and palpation until 200 years ago when Laennec added the auscultation by inventing the stethoscope, which revolutionized the medicine. In the past 3 decades, ultrasonography has gifted internal organs visualization to physicians to have a better detection of various diseases.^{1,2} Previously performed solely by radiologists as a method with high feasibility and accuracy, recently ultrasonography is being recommended and used by many other physicians in practice. This method

of bedside ultrasonography by physicians in real time is called *point-of-care ultrasonography* (POCUS).³ This is not a new concept. In the 1970s, European countries and Japan were the origins of POCUS, and in the early 1990s, it became a method of evaluation in the United States. Cardiologists can be mentioned as the pioneer nonradiologist clinicians who applied ultrasonography (echocardiography) in their bedside practices.⁴⁻⁶ Consequently, in 1990s, the American College of Emergency Physicians encouraged performing POCUS by trained emergency physicians.⁷

Regarding the ability of POCUS for assessing stable and unstable patients, rapid integration into clinical practice, and its role in different branches of medicine, its use has been expanded widely in recent decades. It is a fast, precise, repeatable, cheap, and noninvasive method with no risk of irradiation.⁸ By performing a focused goal-directed POCUS and based on its real-time dynamic images, clinicians can assess patients faster and directly correlate results with the patients' signs and symptoms.⁹

Over the past 20 years, the rate of applying POCUS has been increased rapidly. Regarding the advantages of performing POCUS by undergraduate students and easy accessibility and learning, it seems that by integrating it into clinical practice in the next 20 years, all healthcare providers, including students, nurses, advanced care providers, and physicians should be trained.¹⁰⁻¹³

Clinicians have applied POCUS to assess diverse organs including the brain, heart, vessels, lungs, gastrointestinal tract, liver, intra-abdominal fluid, kidneys, ureters, bladder, pelvic fluid, muscle, and soft tissues.¹⁰ Furthermore, as commonly children become irritable during routine physical examinations, POCUS can be indicated as an ideal method for children whose smaller size and accessible internal organs facilitate sound-wave penetration and image resolution.¹⁴

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The information obtained from routine physical examination are limited in kidney diseases. Kidney location, architecture, and restricted pathologies can simply be assessed using POCUS. In addition, performing POCUS can provide more convenience to the patients by not having to travel from nephrologists office to radiology clinics and consequently can be time saving. Therefore, it seems that nephrologists that have been lagging in this area, should join the spectrum of clinicians such as cardiologists, obstetricians, surgeons, urologists, and ophthalmologists to provide safe and rapid diagnosis of common renal abnormalities. Ultrasonography not only can be used to diagnose and manage kidney diseases, but also is an essential tool in nephrology for the guidance of invasive procedures such as kidney biopsy and ascites paracentesis.¹⁵

Point-of-care ultrasonography can help physicians

to diagnose various emergent and nonemergent diseases by assessing the following urinary tract parameters and abnormalities at the time of adding to routine physical examination: kidney size, hydronephrosis, parenchymal echogenicity, cysts and cyst characteristics, abscess, urinary calculi, medullary nephrocalcinosis, cortical nephrocalcinosis, mass, kidney transplantation, kidney biopsy, postbiopsy hematoma, Doppler study, volume status, pulmonary edema, hepatosplenomegaly, ascites paracentesis, pericardial effusion, pleural effusion, bladder size, bladder diverticula, bladder thickness, postvoiding bladder capacity, ureterocele, suprapubic aspiration, and fluid in the pelvis.

PREREQUISITES AND OBSTACLES

Proficiency in image acquisition, image interpretation, knowing the ultrasonography artefacts, and integration of interpretation into medical decision making are needed for mastery of this skill. For critical decision-making, physicians using ultrasonography in their own practice should pass a credentialing process before using POCUS results.^{8,16} They have to get familiar to the ultrasonography machine and the transducers thoroughly.

Although, there has been an initial resistance and reluctance to use ultrasonography by nonradiologists due to complexity and time-consuming courses,⁸ investigations have shown easy and concise use of POCUS even by undergraduate medical students during short period of learning.¹¹⁻¹³ For instance, comparing the identification rate by first-year medical students and cardiologists, results showed that students and cardiologists could identify 75% versus 49% of cardiac abnormalities, respectively.¹¹ Also, medical students using POCUS more accurately assessed liver size compared with board-certified internists using physical examination.¹² Moreover, performing 25 procedural repetitions of ultrasonography on gall bladder and inferior vena cava resulted in excellent agreement between POCUS and the expert over-read.¹⁷

Point-of-care ultrasonography can also be used for volume assessment in clinical nephrology to evaluate in-patients with acute kidney injury or those on hemodialysis.¹⁵ Nunes and coworkers indicated that even by shorter courses of POCUS, images and nephrology procedures could be

obtained. They mentioned a 16-hour nephrology POCUS training course was sufficient for accurate assessment.¹⁷

Indeed, educational institutions currently recommended integrating POCUS training into their curricula.¹⁸ Although it seems that there are limited investigations that assessed the impact of POCUS in nonemergent patients, various efforts have been done during recent years.^{19,20} For instance investigations showed that the family physicians who encountered with a broad spectrum of clinical problems and outpatients every day could use POCUS for diagnosing various diseases such as abdominal aortic aneurysms, left ventricular hypertrophy, cellulitis and abscesses, deep venous thrombosis, gallstone, and pneumonia.²¹⁻²⁷ According to the mentioned evidence in the field of POCUS in different branches of medicine, it seems that POCUS should be added to physicians' examination room in the near future.

CONFLICT OF INTEREST

None declared.

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Received December 2017
Accepted January 2017