Impact of Point-of-Care Ultrasound Training on Surgical Residents' Confidence

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OBJECTIVE: Point-of-care ultrasound (POCUS) is a vital tool for diagnosis and management of critically ill patients, particularly in resource-limited settings where access to diagnostic imaging may be constrained. We aimed to develop a novel POCUS training curriculum for surgical practice in the United States and in resource-limited settings in low- and middle-income countries and to determine its effect on surgical resident self-assessments of efficacy and confidence.

DESIGN: We conducted an observational cohort study evaluating a POCUS training course that comprised 7 sessions of 2 hours each with didactics and proctored skills stations covering ultrasound applications for trauma (Focused Assessement with Sonography for Trauma (FAST) examination), obstetrics, vascular, soft tissue, regional anesthesia, focused echocardiography, and ultrasound guidance for procedures. Surveys on attitudes, prior experience, and confidence in point-of-care ultrasound applications were conducted before and after the course.

SETTING: General Surgery Training Program in Seattle, Washington.

PARTICIPANTS: A total of 16 residents participated in the course; 15 and 10 residents completed the precourse and postcourse surveys, respectively.

RESULTS: The mean composite confidence score from pretest compared with posttest improved from 23.3 (±10.2) to 37.8 (±6.7). Median confidence scores (1-6 scale) improved from 1.5 to 5.0 in performance of FAST ($p < 0.001$). Residents reported greater confidence in their ability to identify pericardial (2 to 4, $p = 0.009$) and peritoneal fluid (2 to 4.5, $p < 0.001$), to use ultrasound to guide procedures (3.5 to 4.0, $p = 0.008$), and to estimate ejection fraction (1 to 4, $p = 0.004$). Both before and after training, surgical residents overwhelmingly agreed with statements that ultrasound would improve their US-based practice, make them a better surgical resident, and improve their practice in resource-limited settings.

CONCLUSIONS: After a POCUS course designed specifically for surgeons, surgical residents had improved self-efficacy and confidence levels across a broad range of skills. (J Surg 72:e82-e87. © 2015 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: education, ultrasound

COMPETENCIES: Medical Knowledge

INTRODUCTION

In interdisciplinary settings throughout the United States, point-of-care ultrasound (POCUS) use has grown tremendously over the past 2 decades. Initially developed for specific indications such as the Focused Assessment with Sonography for Trauma (FAST) examination or in the evaluation of obstetric patients, portable ultrasound has expanded to be used in virtually every clinical environment.[1-3] Given its utility and prevalence, and with the recognition that ultrasound proficiency is operator dependent, some specialties have developed rigorous training requirements in point-of-care ultrasound.

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In emergency medicine, the Residency Review Committee (RRC) and Council of Residency Directors (CORD) have mandated minimum standards for ultrasound training during residency, which includes a core lecture series and an ultrasound rotation of 2-4 weeks with dedicated hands-on experience.[4,5] Other specialties have developed ultrasound curricula for critical care physicians focused on chest and procedural ultrasound, as well as ultrasound for patients in shock.[2] Several medical schools have undergraduate curricula integrating ultrasound into the preclinical years, with the belief that early exposure to ultrasound may improve understanding of functional anatomy and familiarize students with the clinical utility of point-of-care ultrasound.[6,7] Like emergency medicine and critical care physicians, general surgeons frequently use ultrasound in their practice for both diagnostic purposes (such as hemoperitoneum and abscesses) and procedural guidance (such as placement of a central venous catheter or paracentesis).[8]

Recognizing the importance of ultrasound training for surgeons, in 1996, the American College of Surgeons developed an educational program specifically for ultrasound use for trauma, vascular surgery, head and neck surgery, and intraoperative applications.[1] The ACS course is an opportunity for surgeons to develop their hands-on skills, and 65% of participants surveyed reported using ultrasound in their practice after the course.[1] Additionally, several studies have demonstrated that surgeons can effectively perform and interpret ultrasound examination results after POCUS training programs.[9-11] Despite the increasing use of POCUS within surgical practice, there are no standardized training recommendations from accreditation bodies for general surgery residencies.

Within the United States, surgical residents identify ultrasound as crucial for their training.[12,13] General surgery residents increasingly indicate an interest in working in resource-limited settings, where ultrasound proficiency is invaluable.[14,15] POCUS skills, although important in the United States, are even more crucial in resource-limited settings where ultrasound is often the only diagnostic imaging modality available to evaluate patients presenting with conditions related to trauma, pregnancy, and acute undifferentiated abdominal pain. The World Health Organization has stated that plain radiography and ultrasound could be used to meet two-thirds of all imaging needs in resource-limited settings.[16]

In light of the increase in surgical residents interested in working in resource-limited settings and the value of ultrasound across settings, we sought to develop a novel POCUS course specifically designed for surgical residents interested in working in resource-limited settings, modeled off of similar courses in emergency medicine as well as the core curriculum taught to general practitioners in resource-limited settings, and to evaluate resident confidence with point-of-care ultrasound for a variety of applications. The curriculum represents one of only a handful of POCUS courses designed for surgical residents. It was novel in its focus on ultrasound modalities of particular use in resource-limited settings, and in that, it was designed and taught by a multidisciplinary faculty group.

METHODS

Study Design

We conducted a prospective observational cohort study to test the hypothesis that a novel POCUS training program composed of didactic training and hands-on practice would improve confidence of general surgical residents in their facility with ultrasound for a variety of clinical applications.

Setting and Population

The study was conducted at an urban academic general surgical training program, using a convenience sample of 16 interested general surgery residents (R1-R5). The only previous ultrasound training that residents had was training in ultrasound guidance for central venous catheter placement and a brief FAST training session for senior residents. Training was provided by a multidisciplinary faculty with expertise in point-of-care ultrasound from the Departments of Surgery, Radiology, and Anesthesia and the Division of Emergency Medicine.

Intervention and Outcome

Residents completed a precourse survey regarding their confidence in using ultrasound for different applications. Participants then attended 7 sessions of 2 hours each over the course of 3 months. Sessions included lecture-based didactics by faculty instructors, immediately followed by proctored hands-on workshops using live models. Course topics included ultrasound physics and artifacts, the FAST examination, skin and soft tissue ultrasound, obstetrical ultrasound (early and late pregnancy), focused echocardiography and volume assessment (using aorta: inferior vena cava (IVC) ratio and collapsibility index), ultrasound for procedural guidance (paracentesis, thoracentesis, and pericardiocentesis), vascular ultrasound (evaluation of the abdominal aorta and diagnosis of deep vein thrombosis), and ultrasound-guided regional anesthesia (Table 1).

The primary outcome was the change in self-assessment scores on a series of measures regarding attitudes, confidence, and assessment of the value of ultrasound before and after the educational intervention. The self-assessment scores were measured using a 6-point Likert scale for each question. This study was approved by the University of Washington's Institutional Review Board.