

The Ultrasound Challenge 2.0

Introducing Interinstitutional Competition in Medical Student Ultrasound Education

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Received June 24, 2013, from the Department of Emergency Medicine, The Ohio State University, Columbus, Ohio USA (E.J.C., C.T.B., E.J.A., D.P.B.); Department of Emergency Medicine, University of Arkansas for Medical Sciences, Little Rock, Arkansas USA (T.E.); Department of Emergency Medicine, Christiana Health Care Systems, Newark, Delaware USA (E.G.); and Department of Emergency Medicine, Indiana University, Indianapolis, Indiana USA (K.P.). Revision requested July 22, 2013. Revised manuscript accepted for publication March 11, 2014.

We thank the Clinical Skills Education and Assessment Center of The Ohio State University for use of the center and David Amponsah, MD, and Wayne State University School of Medicine for their participation in the event.

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Abbreviations

B-QUIET, Brightness Mode Quality Ultrasound Imaging Examination Technique; FAST, focused assessment with sonography for trauma

doi:10.7863/ultra.33.12.2193

The Ultrasound Challenge was developed at The Ohio State University College of Medicine to introduce focused ultrasound to medical students. The goal was to develop experience in ultrasound through practice and competition. Initially this competition was held between Ohio State University College of Medicine students from years 1 through 4. The Ultrasound Challenge 2.0 was held in 2013. The event expanded on the previous structure by including students from the Wayne State University College of Medicine. The goal of this article is to describe our experiences with expansion of our interinstitutional ultrasound event. The challenge consisted of 6 stations: focused assessment with sonography for trauma, aortic ultrasound, cardiac ultrasound, pelvic ultrasound, musculoskeletal ultrasound, and vascular access. The participants were given a handbook outlining the expectations for each station ahead of time. Vascular access was graded in real time using the Brightness Mode Quality Ultrasound Imaging Examination Technique (B-QUIET) method. The remainder were timed, saved, and graded after the event by 3 independent faculty members using the B-QUIET method. The highest score with the fastest time was the winner. The Ultrasound Challenge 2.0 included 40 participants: 31 from The Ohio State University College of Medicine and 9 from the Wayne State University College of Medicine. The makeup of the winners in all categories consisted of 1 first-year medical student, 7 second-year medical students, 3 third-year medical students, and 10 fourth-year medical students. The Ultrasound Challenge 2.0 was a success for those who participated. It provided the first known interinstitutional medical student ultrasound competition. Students from both institutions were able to practice their image acquisition skills, demonstrate abilities in a competitive environment, and develop collegiality and teamwork.

Key Words—competition; medical education; ultrasound; ultrasound education

In the current theater of medicine, many clinicians practice in an environment with increasing concerns regarding efficiency, patient safety and outcomes, patient satisfaction, and delivery of cost-effective health care. Focused bedside ultrasound allows physicians to answer specific clinical questions while meeting these parameters. Many fields of medicine have introduced bedside ultrasound as the standard of care in the evaluation and treatment of patients. Some examples include central venous cannulation,¹ trauma resuscitation,² global cardiac function, thoracic evaluation, and volume responsiveness.³

The American Institute of Ultrasound in Medicine has published guidelines for training attending physicians in the use of focused ultrasound.⁴ Recommendations also exist for emergency

medicine residency training in ultrasound⁵; however, the literature describing medical student ultrasound education is rather limited. Introducing ultrasound education in the first year of medical school and maintaining a vertical approach to knowledge and skill development appears to be the most effective method.³ Many advantages to early ultrasound education exist, including improvement in physical examination techniques,^{6,7} increased ability to acquire and interpret ultrasound images,⁸ and a solidified desire to continue ultrasound training.⁹

The Ultrasound Challenge was developed at The Ohio State University College of Medicine to introduce focused ultrasound to medical students. In 2012, the Ultrasound Challenge consisted of 33 medical students from The Ohio State University College of Medicine competing in 6 ultrasound events. The goal of the event was to develop an enhanced experience in ultrasound through practice and competition in a controlled, safe environment.¹⁰

In addition to early ultrasound education, the Ultrasound Challenge introduces competition, sportsmanship, and personal responsibility into the undergraduate medical student curriculum.¹⁰ The use of competition in ultrasound education is a novel concept, but other specialties have successfully incorporated competitive events to supplement their educational processes. Samalia and Stringer¹¹ described a successful dissecting competition for medical students in New Zealand. In addition to the educational benefits, the authors noted the development of professional skills such as teamwork, planning, and time management as a result of the competition. Sward et al¹² described a Web-based competition in a third-year medical student pediatric clerkship at the University of Utah. Students participating in the game group were compared with self-study students, and no difference in mastery of the core content was noted. Perhaps more important than core content retention was the authors' observation that students involved in the competition used data analysis, critical thinking, and innovation more than the self-study group.¹²

The Ultrasound Challenge 2.0 was held at The Ohio State University Wexner Medical Center (a tertiary care academic medical center) in 2013. In addition to students from The Ohio State University College of Medicine, the Ultrasound Challenge included medical students from the Wayne State University College of Medicine. The goal of this article is to describe our experiences with the successful expansion of our competitive, interinstitutional ultrasound event. The Ohio State University College of Medicine's Ultrasound Interest Group, a student-led organization designed to promote ultrasound education at the medical student level, sponsored the competition.

Materials and Methods

The Ultrasound Challenge was first described in the literature in 2012.¹⁰ The 2013 Ultrasound Challenge 2.0 event consisted of 6 stations: focused assessment with sonography for trauma (FAST), aortic ultrasound, cardiac ultrasound, pelvic ultrasound, musculoskeletal ultrasound, and vascular access. At each station, a dedicated ultrasound machine (M-Turbo; SonoSite, Inc, Bothell, WA) was supplied in the power-on screen. Participants were required to position models, adjust ultrasound settings, and choose the correct probe.

Trained simulated ultrasound patients were used for the FAST, cardiac, and aortic stations. The same trained simulated ultrasound patient was used for all scans within the same station to control for variability. For example, one trained simulated ultrasound patient was the FAST patient for the entire event, while another was the cardiac model, and a third was the aortic model for the entire event. A first-trimester transvaginal phantom model (Blue Phantom, Redmond, WA) was supplied for the pelvic station. The vascular access event was performed using a standard phantom model of a vessel (Blue Phantom). Image acquisition for the musculoskeletal station was performed via a self-scan of the median nerve at the level of the flexor digitorum superficialis and flexor digitorum profundus. Station images and instructions were described in a previous study.¹⁰ As previously described, the students were given a handbook ahead of time and a detailed list of images to obtain. See Table 1 for details of image acquisition.

The vascular access event was graded in real time using a modified Brightness Mode Quality Ultrasound Imaging Examination Technique (B-QUIET) model,¹³ and the time to completion was used as a tiebreaker. The event was graded by one of the authors (E.J.C.) with supervision provided by a registered sonologist (D.P.B.). For the remaining events, participants were required to save acquired images for grading. Grading was based on the modified B-QUIET model,¹³ which includes the following components: correct patient identification and labeling, appropriate depth and gain, appropriate anatomy in the near and far fields, appropriate resolution, and overall grade. The time to completion was used as a tiebreaker. Three authors performed the initial grading of images using the modified B-QUIET version for image quality (E.J.C., D.P.B., and C.T.B.). For each event (excluding vascular access), the top 5 images were collected, and a secondary grading assessment session was performed by a registered sonologist (D.P.B.). During this session, all requisite images were viewed side by side and compared for quality. On the basis of a consensus opinion, the top 3 images were chosen for first, second, and third place based on over-

all image quality and adherence to the principles of the B-QUIET quality tool.

The Ultrasound Challenge 2.0 was open to medical students at The Ohio State University College of Medicine and the Wayne State University College of Medicine. The Ultrasound Interest Group provided participating students with a nominal gift. Students were given the option to participate in 1 or more events. Each event was awarded a first-, second-, and third-place finisher. The overall prize (The Sonographer's Cup) was only available to students participating in all 6 stations.

As a means to further advance the learning environment of the Ultrasound Challenge 2.0, a slide show of interesting ultrasound images was presented to the participants between stations. Participants answered questions related to the slides, and the 3 students with the most correct answers were awarded prizes. The Ultrasound Challenge 2.0 also featured a guest lecturer, who is a leading educational figure in the field of emergency ultrasound. Eight premedical undergraduate students from The Ohio State University attended the event to gain exposure to ultrasound, network with current medical students and faculty, and attend the guest lecture.

Results

A total of 40 medical students participated in the Ultrasound Challenge 2.0. There were 31 participants from The Ohio State University College of Medicine and 9 from the Wayne State University College of Medicine. Most of the students participated in all stations, but some did not adequately save images or were unable to complete all stations; these incomplete data were not included in the results. There were winners from both institutions. First-, second-, and third-place winners by level of education are displayed in Table 2.

Discussion

Overall, the Ultrasound Challenge 2.0 was a success for those who participated and an opportunity to promote ultrasound excellence at the undergraduate medical education level. To our knowledge, the event represents the first interinstitutional medical student ultrasound competition involving medical schools from different states. Students from both institutions were able to practice their image acquisition skills, demonstrate abilities in a compet-

Table 1. Images to be Acquired at Each Station of the Event

Station	Images
FAST	Subxyphoid Hepatorenal Splenorenal Posterior cul-de-sac/bladder
Cardiac	Parasternal long axis Parasternal short axis
Pelvic	Sagittal uterus Coronal uterus Measure crown-rump length Dual screen right ovary (long and short axes) with measurements Dual screen left ovary (long and short axes) with measurements
Aortic	Celiac trunk Superior mesenteric artery Iliac bifurcation
Vascular	Short-axis cannulation
Musculoskeletal	Median nerve Flexor digitorum superficialis Flexor digitorum profundus

Table 2. Station Winners by Level of Training

Rank	FAST	Cardiac	Aortic	Pelvic	Vascular	MSK	Overall
1st place	MS2	MS2	MS4	MS4	MS4	MS1	MS4
2nd place	MS2	MS2	MS3	MS4	MS4	MS4	MS2
3rd place	MS3	MS4	MS2	MS3	MS4	MS4	MS2

MSK indicates musculoskeletal; MS, medical student; and number, training level.

itive yet controlled environment, and develop collegiality and teamwork.

The event was enlightening to us as to the various methods of exposing medical students of all levels to ultrasound. Throughout the day, we observed the students sharing these experiences and sharing ways to expand on their current curricula at their respective institutions. The microcosm of this event also elucidates some of the challenges in ultrasound education that many educators are grappling with, such as consistency in terminology and labeling, focused acquisition protocols, and standardized methods for teaching ultrasound imaging.

Competition in medical student ultrasound education, especially in an interinstitutional format, is a relatively novel concept that has the potential to influence the cultural acceptance of ultrasound education in undergraduate medical education. Rather than create direct competition between institutions, the Ultrasound Challenge 2.0 developed a competitive environment by increasing the number of participants, diversifying the baseline ultrasound knowledge and techniques of the participants, and encouraging advanced thought and critical thinking.

The Ultrasound Challenge 2.0 incorporated several learning theories into one event to maximize education, ultimately allowing the student to apply this knowledge in the clinical setting. According to Krathwhol's taxonomy of higher education,¹⁴ cognitive abilities exist on a spectrum that includes remembering, understanding, applying, analyzing, evaluating, and creating. Through preparation and competition, the Ultrasound Challenge 2.0 transitions students from remembering/understanding to the higher-order processes of doing and performing. The manual skills and competitive nature of the event provide opportunities for students to mature in the psychomotor and affective domains of adult learning as well.

Future goals of the Ultrasound Challenge include inviting students from additional institutions, organizing formal competitions at state and national ultrasound conferences, and expanding the inclusion criteria to include residents and fellows in various training programs. Awards were not given for the collegiality and teamwork categories, as most of the day was an individual competition. However, this aspect is something to consider for future iterations of this event. The possibility of including team-based events and case-based simulation into the competition has also been considered. Additionally, it would be beneficial to survey participants after the event to gain better insight into their experience and continue to improve the event. Future goals include standardization of the grading process between experts from different institutions,

standardization of trained simulated ultrasound patients at different institutions, and accounting for diversity in ultrasound education between universities.

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