



Original Article

Development of the ultrasonography learning model for undergraduate medical students: A case study of the Faculty of Medicine, Burapha University

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Abstract

Background: Ultrasound technology is generally considered to be reliable and widely used by physicians today. Therefore, given the efficacy and popularity of the technology, the need for quality ultrasound education is evident. Ultrasound training for undergraduate medical students has been increasingly incorporated into school curriculums, but the teaching methods can vary significantly among medical schools. Among many different choices, one effective teaching model was proposed which added hands-on ultrasound experience on live patients that was supervised by radiologists in the last clinical year.

Methods: A 2-week radiology elective course was offered for 6th-year medical students at Burapha University Hospital, Chonburi, Thailand in the academic year 2014. Fourteen medical students participated in the elective course. Additionally, students who chose radiology as their elective were provided an ultrasound experience on live patients in real-life clinical settings. All 6th-year medical students then completed a 25-ultrasound image quiz, and completed a questionnaire at the end of the academic year. The ultrasound test scores were compared between the elective and nonelective students. The students' background characteristics were determined by a grade point average and the ultrasound experience was determined by the number of scans. These were collected, and analyzed to establish their relationship with the ultrasound test scores. The students' opinions were also surveyed.

Results: Fourteen medical students participated in the elective course. The ultrasound test scores in the elective group were significantly higher than those in the nonelective group ($p = 0.013$). The students' background characteristics and ultrasound experience had no significant relationship with the ultrasound test scores.

Conclusion: By adding hands-on ultrasound experience using live patients proctored by radiologists for final year medical students, in the space of 2 weeks, an effective ultrasound learning model for undergraduate medical students can be provided. This model should be considered in the curricular design.

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Keywords: education; medical students; ultrasound background

Conflicts of interest: The authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

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1. Introduction

Ultrasound (US) technology has been rapidly developed insofar now that it generally produces good image quality and a user-friendly modality. Presently, it is a diagnostic mainstay among many physicians, and the utilization of US by

physicians other than radiologists for specific purposes is called focused US or point-of-care US (PoCUS). Focused Assessment with Sonography for Trauma (FAST) performed by a surgeon has proven to have a high level of accuracy¹ and has been incorporated into the Advanced Trauma Life Support (ATLS) course for doctors.² Due to the many advantages of US, the American Academy of Emergency Medicine has a policy statement that ultrasound should be integrated into the core curriculum of undergraduate medical education.³ Sixty-two percent of medical schools in the United States have already incorporated US education into the medical school curriculum.⁴ Unfortunately, approximately one-fourth of interns reported that they never performed bedside US during their medical school education.⁵ In Thailand, US education has been incorporated into the medical curriculum since 2012.⁶ There are a number of articles examining various models of US education for medical students,^{7–9} but there has been no consensus to date as to where and how it should be optimally integrated into the curriculum. In 2014, an article from the United States proposed a national ultrasound curriculum for medical students and suggested that a US curriculum be incorporated both vertically and horizontally.¹⁰

In our country, undergraduate medical school is divided into 3 preclinical years and 3 clinical years. Radiology is included in the undergraduate program of all medical schools, mostly in the clinical years, either the 4th year or the 5th year, depending on the institution. The medical school at Burapha University has been open since 1984, and is located in an urban area of Eastern Thailand, enrolling 32 students per year. The radiology curriculum is taught by radiologists in the 4th year, and US is a part of the standard radiology course subject matter. The US session includes 30 minutes of lectures on US knobology, US scan technique and examples of US images, and a 1-hour hands-on opportunity to practice US scanning skills by using their classroom colleagues as models under the supervision of radiology staff. Following the radiology curriculum, the students might have US exposure in informal training proctored by interns or emergency staff during their clinical rotations.

This study aimed to: (1) test the ultrasonography learning model that is incorporated into the 6th-year medical curriculum; (2) assess the factors that impact US knowledge; and (3) draw out the students' opinions regarding US training.

2. Methods

2.1. Study design

We used a retrospective cohort design to test our hypothesis that the US test scores taken by 6th-year medical students who participated in a 2-week radiology elective were not statistically different, compared with those students who had not taken the elective. A questionnaire was used to survey the demographic variables, US experience, and opinions regarding US education. This study was approved by our Institutional Review Board of Ethics Committee, No. 32/2558, and informed consent was verbally obtained from each participant.

2.2. Setting

The study was conducted at the university-based hospital, where annually ~ 2000 US examinations are performed. During the 2014 academic year, a 2-week radiology elective was offered to the 6th-year medical students. The students who participated in this course received hands-on US experience with patients in a clinical setting at the radiology department, which was proctored by radiology staff. A Toshiba Aplio, XG SSA-790A, US machine (Toshiba, Osaka, Japan) equipped with a 7–12 MHz linear-array transducer and a 3–7 MHz curvilinear transducer was used for all scanning. However, the number of US examinations conducted was by chance, and according to routine patient treatment requirements in the department.

2.3. Testing

The course was concluded with an US quiz that tested the image interpretation ability of each student, followed by a questionnaire at the end of the academic year. The quiz consisted of 25 US images of true negative, true positive, and nondiagnostic images. There were seven normal US anatomy views (Morison's pouch, GB, spleen, bladder, aorta, lung, and subxiphoid view of the heart), four FAST scan views of fluid (Morison's pouch, perisplenic space, cul-de-sac, and pericardial effusion), four abnormal right upper quadrant US images (acute cholecystitis, CBD dilatation, hydronephrosis, and renal stone), two left and right lung base views for pleural effusion, two abnormal bowel images (hypertrophic pyloric stenosis, and acute appendicitis), one abdominal aortic aneurysm, one thyroid nodule, one breast nodule and three nondiagnostic images. An example of an US image and question is shown in Fig. 1.

Additionally, student opinions regarding the US training were surveyed using a tailored questionnaire. A 5-point Likert scale (1 = strongly disagree, and 5 = strongly agree) was used to assess the students' opinions. We also collected information regarding the US experience and competency for each student



Fig. 1. Example of ultrasound question.
 * Question 1: Quality of this image, Answer: Interpretable, nondiagnostic.
 * Question 2: Tell the anatomic landmark, Answer:
 * Question 3: Interpret

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