

A Single Static Breast Model Education of Ultrasound Skill in Final Year Medical Students of Burapha University

Sornsupha Limchareon^{1*}, Sutasinee Kongprompsuk¹

¹Division of Radiology and Nuclear Medicine, Faculty of Medicine, Burapha University, Chonburi, Thailand

Abstract

Background: Ultrasound (US) is widely used among physicians. There has been no standardized curriculum in US for undergraduate medical students. This study aimed to assess the US image acquisition skill of final year medical students after adding 2 weeks dedicated radiology rotation. **Methods:** At our institution, there are two hospital affiliations. Two-week radiology rotation was added for the final-year students of one affiliation. These students had a chance to do the US in real-life clinical settings proctored by radiologists. At the end of the academic year, US image acquisition skill was assessed by objective structured clinical examination (OSCE) in students from both affiliations. **Results:** From 48-final-year medical students, 28 students finished the 2 week radiology rotation. OSCE mean score of the students who received radiology rotation was significantly higher than other groups with a score of 65.5 compared to 53.3, respectively ($P = 0.006$). The student background characteristics had no relationship with the OSCE score ($P = 0.565$). **Conclusion:** Results showed that exposure through a dedicated radiology rotation in only 2 weeks is helpful to improve the US skill of the medical students regardless of their background performances. Exposure to live patients is essential for students' experiences. OSCE can be used as a standardized assessment tool.

Keywords: Medical education, teaching, ultrasound

INTRODUCTION

The use of ultrasound (US) has been growing rapidly in terms of patient care. A teaching of radiology in the undergraduate medical curriculum has not evolved at an equivalent pace across the world, despite 88% of students answered that radiology had the substantial impact on patient care.^[1] Some institutions teach in clinical years, another institution teach in preclinical years whereas the others have no formal radiology teaching but incorporate in another course of preclinical years or in another clinical rotation.^[1-5] Surveys of the medical students showed that the majority of students recognized the importance of radiology and 63%–77% of them planned to take a radiology rotation as an elective during their medical schools.^[1,3] The standardized radiology curriculum has not been developed. Surveys of deans and chairs revealed that most of their radiology curricula developed from their own creations.^[6] The teaching of US has been variable as well.^[2] The use of US has expanded to nonradiologists widely and rapidly to provide appropriate and timely patient care. The focused US has used as

an adjunct to the physical examination in some departments.^[7] Therefore, the need of US teaching for undergraduate students has increased to prepare them to be a competent physician or for postgraduate training. The teaching of US skill requires dedicated educators, but there has been no consensus about the timing and methodology of training.^[8-10] The objective of this study was to determine the effectiveness of an US teaching model by adding a dedicated 2-week radiology rotation for final year medical students.

Our institution is a discipline-based curriculum, 6-year medical school, 3 years in pre-clinic, and the others three in the clinic. There are two affiliated hospitals for clinical year rotations. Radiology is formally taught as a standalone course in the 4th year of one affiliated hospital while the other has no formal radiology teaching. US teaching is included in the standard

Address for correspondence: Dr. Sornsupha Limchareon, Division of Radiology and Nuclear Medicine, Faculty of Medicine, Burapha University, 169 Longhard Bangsaen Road, Sansook Sub-District, Muang District, Chonburi Province 20131, Thailand.
E-mail: sornsupha@hotmail.com

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radiology course of the first hospital. US education consists of two sessions: didactic lecture and scanning session. The didactic lecture is delivered to all students for 30 min about knobology, scanning technique, and example of US images. Scanning session is conducted in a 1 h period in a small group (8 students in each group). Radiology staffs provided the demonstration in scanning technique. Students developed their scanning techniques by practicing on one another proctored by radiology staffs. Following the radiology curriculum, students might have an opportunity to observe or practice US scans in informal training supervised by interns or ward staffs during their clinical rotations.

METHODS

Study design

A retrospective cohort design was used to test the hypothesis that the objective structured clinical examination (OSCE) scores taken by the final year students who participated in a 2-week radiology rotation were not significant difference statistically, compared with those students who did not participate. An official permission to perform this work was achieved by the Burapha University Institutional Review Board, No. 134/2560 and the requirement for informed consent was waived owing to retrospective design.

Setting

During the academic year 2015, a dedicated 2-week radiology rotation was added to final-year medical students from the first affiliated hospital that has formal radiology education. During radiology rotation, the students exposed to real-life radiology works interpreted and discussed plain radiographs and special studies such as mammography and computed tomography in person with radiology staffs in a reading session and performed US in US room. For US session, students were instructed in the use of US machine, then observed radiology staffs performing the US and practiced the US scans in real-life patients proctored by radiologists. However, the number of cases was by chance according to routine studies in the department. No didactic lecture was delivered.

Testing

OSCE was used to assess the US acquisition skill of final year students from both affiliates at the end of the academic year. The student was instructed to find the breast lesion in the breast simulation phantom within a 5 min period. The breast simulation phantom was created using gelatin, and the artificial breast lesion was created using a piece of Chinese pear. The US machine was presented along with two different probes. After the probe selection, they performed the US. The assessment was completed by a radiology staff while observing this exercise. We used a modified checklist of seven items to assess the acquisition of technical skills as demonstrated in Table 1. The OSCE scores and students' background characteristics as determined by grade point average (GPA) were collected.

Statistical analysis

The outcomes of the OSCE scores were presented as the mean and standard deviation. Independent *t*-test was used to compare OSCE scores between participants and nonparticipants.

The relationship between students' background characteristics, measured in terms of GPA and the OSCE scores, were determined by Pearson's correlation. $P < 0.05$ was considered as statistically significant. The data were analyzed by SPSS Statistics for Windows, version 17 (SPSS, Inc, Chicago, IL).

RESULTS

There were 48-final-year medical students. A total of 28 students participated in a 2-week radiology rotation, discretely divided into two to four students per rotation. Demographic data of both groups showed no statistical difference. The participated students' mean score was significantly higher than the nonparticipants' mean score ($P < 0.05$) as shown in Table 2. Table 3 reveals the differences in seven items in the modified checklist of OSCE between medical students who received a 2-week dedicated US teaching and another group. The students were classified into two groups: above and below mean GPA, as high- and low-performance backgrounds. A total of 21 were in the low-performance background group while 27 students were in the high-performance background group. There was no difference in mean OSCE scores among students with a low-performance background compared with high-performance backgrounds according to their GPA as illustrated in Table 4.

DISCUSSION

US skill comprises two consequential skills which include image acquisition, followed by image interpretation. We have been reported the effectiveness of a dedicated 2-week radiology rotation on the US image interpretation skill

Table 1: Technical skills checklist

Skill	Yes	No
1. Selects correct ultrasound probe		
2. Applies gel on probe or on patient		
3. Correctly identifies probe orientation		
4. Adjust image depth or contrast to optimize view of lesion		
5. Correctly identifies lesion		
6. Measures the lesion		
7. Saves and stores the image		

Table 2: Objective Structured Clinical Examination mean scores between participated students and nonparticipated students

	Mean	SD	P
Participants	65.5	14.4	0.006*
Nonparticipants	53.3	14.6	

*Statistical significance. SD: Standard deviation

Table 3: Number of students performed in seven items in the modified checklist of Objective Structured Clinical Examination

	Participants (n=28)	Nonparticipants (n=20)	P
1. Selects correct ultrasound probe	21	10	0.077
2. Applies gel on probe or on patient	27	19	0.809
3. Correctly identifies probe orientation	22	8	0.007*
4. Adjust image depth or contrast to optimize view of lesion	7	7	0.457
5. Correctly identifies lesion	26	16	0.189
6. Measures the lesion	18	16	0.243
7. Saves and stores the image	24	15	0.354

*Statistical significance

Table 4: Objective Structured Clinical Examination mean scores between low-performance background students and high-performance background students

	Mean	SD	P
Low-performance background	59.0	15.2	0.565
High-performance background	61.6	16.1	

SD: Standard deviation

elsewhere.^[11] In that study, the students who got better scores chose radiology rotation as an elective rotation, and selection bias was questioned. The present study confirms that either interested or noninterested students could get better scores if they received dedicated teaching. Although previous literature has revealed that a mainstay of radiology education was self-learning, the technology could not replace the dedication of human educators.^[12] Similar results have been demonstrated by Cawthorn *et al.*^[7] They compared US image acquisition quality between the simulator-trained group and sonographer-trained group and found that mean quality scores of the simulator-trained group were significantly lower than those of sonographer-trained group.^[7] US skill needs human teaching in a dedicated way. Our study also shows that dedicated 2-week radiology rotation significantly improves students' US performance. There have been several models for the optimum timing to educate the use of US for undergraduate students.^[13-15] Our study reveals that final year students were able to achieve acquisition skill quickly and effectively, in concordance with the previous literature.^[7,16] Cawthorn *et al.*^[7] have demonstrated that the 3rd year students had much higher postintervention scores than the 1st year students, and they explained that the lack of fundamental knowledge may result in US skills in the short period of teaching. Some medical schools have integrated US education into the preclinical years so as to expose students to the US early and also have demonstrated the good results of the teaching model as well.^[17,18] Our teaching model is providing US education in the 4th year and hands-on practicing in the final year. We suggest that the US curriculum should be set in the clinical years, and a longitudinal curriculum is better than a stand-alone course. Teaching and evaluation of US skills require patients. A live patient is the best, but it is limited in availability. Simulation has been developed for this purpose. The results by Zhang *et al.*^[19] have shown that clinical skills training with simulators improved the learning ability of the medical student.

This is in a good agreement with study obtained by Chalouhi *et al.*^[20] They compared between simulators and pregnant volunteers for testing the obstetrics US performance of trainees and found that the test scores among two groups showed no statistical significance ($P = 0.31$). However, the mannequin is very costly in our country. Previous literature has proposed a cadaver as a US model.^[21-22] Apart from the use of cadaver for the demonstration of normal anatomy, it can be used for the demonstration of pathologies^[21] and provided US-guided procedures.^[22]

There were several limitations in the present study. First, a small group of students may impact on the statistical results. We evaluated only image acquisition skill, but we did not attempt to evaluate the image quality because of limited time in assessment. We used a phantom as a model for evaluation. These phantoms cannot accurately represent patients. The small sample and single model of breast narrowed the effect of this article. Further studies which assess all aspects of US skill in a real-life patient would yield more precise assessment, but it may be impractical in a large group of students. A standardized patient is another option. A number of US experiences in both groups was not collected. Nevertheless, our previous study has shown that US experience has no impact on the US test score.^[11] Our program offered to students are intended for interactive sessions, and thus, the number of students per rotation was limited. This type of education may not be established in some institutions where the radiologists are a shortage or have a greater number of students.

CONCLUSION

Our cohort data show that adding a 2-week radiology rotation for final year medical students is an effective model for US teaching. Trained students had a significantly higher score than untrained students. With the need of US skill in physician today, US teaching should be added to the radiology curriculum for ensuring that medical students are prepared for a competent physician.

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Conflicts of interest

There are no conflicts of interest.

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