Lifesaving Sonography Protocols: A Pilot Course Involving Undergraduate Medical Students

Jakub Wisniewski,[1] Hanna Garnier.[1]

Abstract

Background: Ultrasonography protocols are easy to learn, frequently used in emergency medicine, and could be useful for inexperienced doctors. In this field, only a few protocols are needed to give an initial diagnosis and to start fast and proper treatment. Until now, only Focused Assessment with Sonography for Trauma (FAST) protocol training studies have been reported in the medical literature. Our point-of-care course, comprised of extended FAST, lung scan and ocular scan trainings. The students' curriculum usually does not include such ultrasonography courses, thus, we wanted to check its utility for the undergraduate medical students. **Methods:** Training lasted six days and consisted of two parts: 22 hours of theoretical classes and 18 hours of practical activities, all trained and evaluated by six experienced medical doctors. Eighty-five elected students completed pre- and post-study questionnaires about emergency ultrasonography and passed the practical final exam. **Results:** Eighty-five participants of the course were present in the pre- and final test. Final test scores of theoretical and practical exams were significantly higher after the training (58% vs. 87%; n=85; p<0.01). Answers for the questions related to FAST and EFAST (extended FAST) were correct irrespective of completion of the course. A question regarding the sonographic evaluation of body fluid incontinence was found to be the most difficult for students. After the course, 96.5% of participants were able to complete an EFAST scan at an adequate level of performance in under two minutes. **Conclusion:** Results show that medical students significantly extended their knowledge about point-of-care emergency medicine ultrasonography and acquired practical skills during the course. Emergency medicine ultrasonography courses could be included into medical students' curricula.

Keywords: Ultrasonography; Education, Medical, Undergraduate; Education, Medical; Students, Medical (Source: MeSH-NLM).

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Introduction

Medical students' education does not contain regular courses in ultrasonography; this is an easily available, risk-free, and non-invasive imaging method. Ultrasonography becomes a part of the basic patient examination (such as observation, palpation, and auscultation). Therefore, we often call it "a modern stethoscope".[1]

Ultrasound examination and its correct interpretation require significant training and a lot of experience.[2] However, in emergency medicine (EM), only a few protocols are needed to give an initial diagnosis and to start proper treatment. The most common protocol in the EM is Focus Assessment with Sonography for Trauma (FAST), which is only one part of the full ultrasound (US) examination. It gives a fast and accurate evaluation of the hemorrhage in the peritoneal cavity.[3] Though adding ultrasonography to the students' curriculum seems to be time-consuming, it is proven that only two days (16 hours) of the course are needed to complete a correct FAST.[4] Additionally, ultrasound examination of the eye (which allows for the rapid assessment of the cerebral edema) is easy enough to be taught and used by non-expert operators on the International Space Station (ISS).[5,6]

To date, there is an increasing number of ultrasound teaching pilot studies. These kinds of activities, used as a supplement to gross anatomy courses, are beneficial even during the first years of study.[7] Many studies show that teaching ultrasonography to 3rd, 4th, and 5th year students can effectively support and develop their clinical knowledge.[8-11] Ultrasonography use in EM seems to be one of the most important aspects. Some academics do not realize how important it can be in giving the prompt diagnosis, especially for the young doctors, who are still lacking experience. Ultrasonography allows fast clinical assessment of dehydration or can yield a prompt pneumothorax diagnosis.[12,13] Until now, only FAST training studies have been reported in the medical literature.[14] Our point-of-care course, included extended FAST, lung scan and ocular scan training.

We assumed that teaching easy protocols with brief training periods may be successfully included in the students' curriculum. The aim of our study was to check the effectiveness of the six-days course in EM for the medical students of the Medical University of Gdansk, Poland.

Methods

We conducted a six-days facultative course teaching about extended FAST (EFAST), Bedside Lung Ultrasound in Emergency (BLUE), Focus Assessed Transthoracic Echocardiography (FATE), monitoring of central venous access, ocular ultrasound in trauma and sonographic estimation of body fluid status assessment (***Table 1***). The training was held at the Medical University of Gdansk, Poland from October until November 2014.

Ninety-seven medical students of the University were voluntarily enrolled and they were requested to complete the pre-question-

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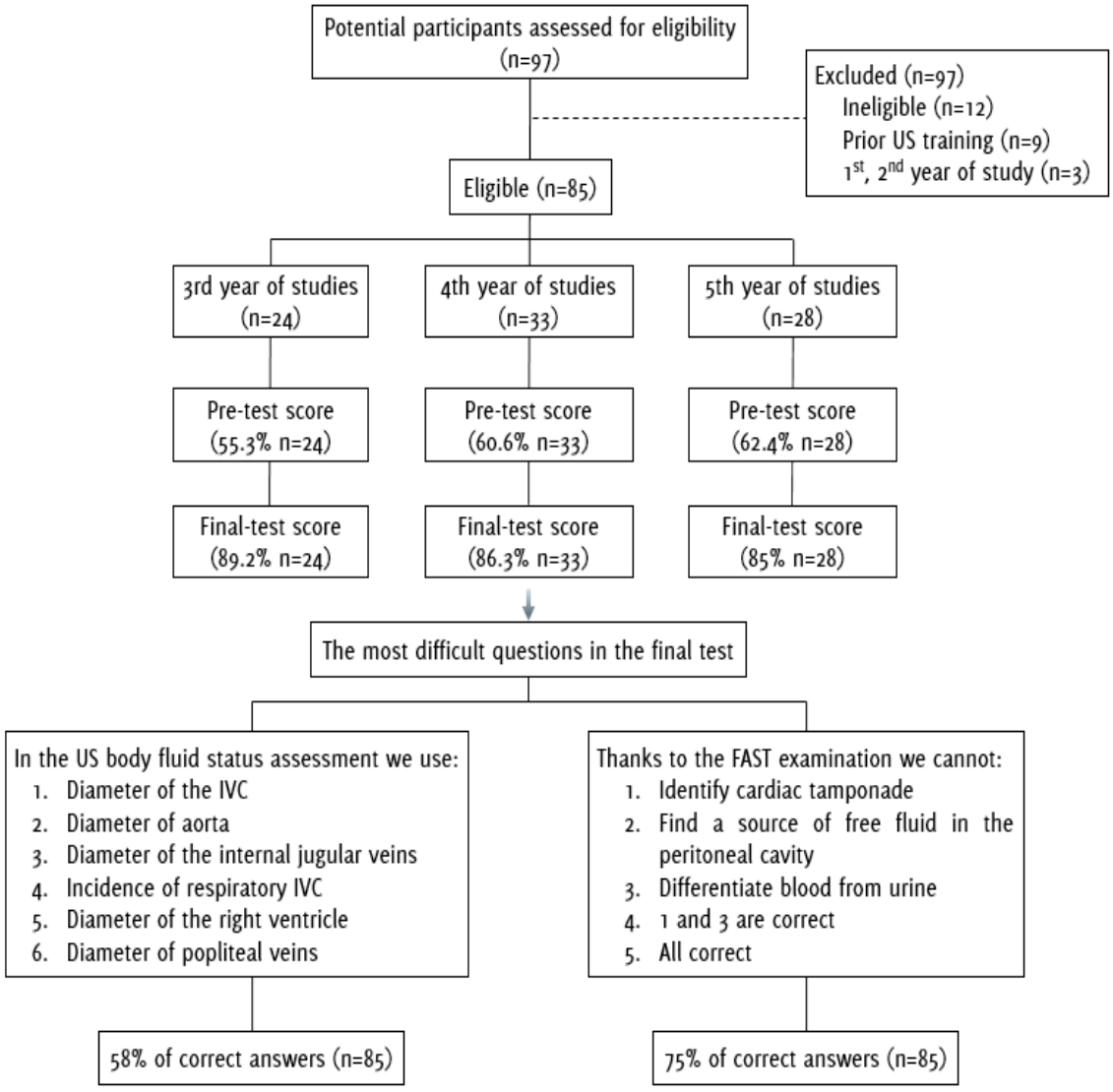
Figure 1. Flow Diagram Showing Characteristics of the Study.



Legend: US - Ultrasound; IVC - inferior vena cava; FAST – Focused Assessment with Sonography for Trauma.

naire asking about their personal data and their previous experience with ultrasonography. Eighty-five from the 3rd, 4th, and 5th years of study with no prior US course (inclusion criteria) were divided into four equal groups for the theoretical classes (***Figure 1***). Twelve students in the 1st and 2nd years of study or those with the prior US training were excluded. They were not informed about the course program in advance. Subsequently, each group was divided into four teams for practical training. We prepared a comprehensive, 6-days course for the medical students, focused on the use of an ultrasound in EM. The course consisted of two parts, 22 hours of the theoretical classes and 18 hours of the practical activities, all trained and evaluated by six experienced medical doctors. Before the course, students completed a multiple choice test of 25 questions about the practical use of ultrasound in EM. Eleven questions from the test involved knowledge about EFAST/FAST, five about ocular ultrasound in trauma, and five about BLUE. The same test was held after the course.

We analyzed all of the results from both of the tests (pre- and post-course) using a paired samples t-test and a 99% confidence interval (CI=99%). Statistical analyses were run using the STATISTICA 10 software (StatSoft Inc, Tulsa, OK).

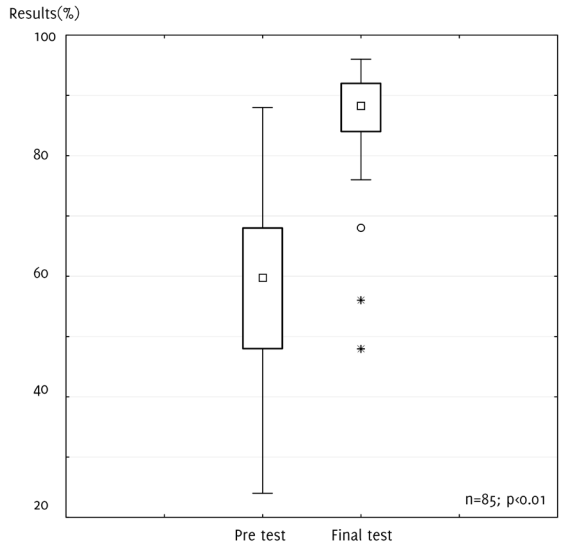
After theoretical classes, students were working at cart-based ultrasonography machines (GE Logiq 7 and Philips: Sparq, ClearView, CX50, iU22). All of them were taught how to perform a proper EFAST, BLUE, FATE, and Ocular protocols. This part was evaluated by the practical test (EFAST scan completed in less than two minutes).

Results

Eighty-five participants in the course (23 from the 3rd, 35 from the 4th and 27 from the 5th year) participated in the pre- and final test.

The pretest mean scores of the students from the 3rd, 4th, and 5th years were 56% (n=24), 61% (n=33), and 62% (n=28), respectively. The mean scores of the final test of the students from the 3rd, 4th, and 5th years were 89% (n=24), 86% (n=33), and 85% (n=28), respectively. There was no statistically significant differences between the scores of the students from the different years (pretest p=0.32; final test p=0.47). The total

Figure 2. Comparison of the Pre And Final Test Results



Legend: Data are presented as median (central square), 25–75% (top and bottom of boxes). Top bar represents 1,5 of the highest interquartile range (IQR). Bottom bar represents 1,5 of the lowest IQR. The dot represents the middle outlier; stars represent two extreme outliers.

Table 1. Course Schedule

Day	Topic
First (Saturday)	1. From FAST* to ABCD ultrasound – introduction. 2. US** in emergency medicine – for and against. 3. I have an ultrasound equipment, what's next? Knobology. 4. FAST 5. E-FAST*** 6. US and a central venous access. 7. Polytrauma – ultrasongraphic diagnostic 8. Patient in shock – ultrasonographic diagnostic 9. Practical activities.
Second (Monday)	1. Hydratation rating – how to use ultrasound. 2. Practical activities.
Third (Tuesday)	1. Other practical aspects of the US use in emergency medicine. 2. Practical activities.
Fourth (Wednesday)	1. BLUE† protocol. 2. Practical activities.
Fifth (Thursday)	1. FATE‡ 2. Practical activities.
Sixth (Friday)	1. Final test. 2. Case presentation. 3. Discussion. 4. Literature overview. 5. Practical exam.

Legend: *Focused Assessment with Sonography for Trauma; **Ultrasonography; ***extended-FAST; †Bedside Lung US in Emergency; ‡Focus Assessed Transthoracic Echocardiography.

mean final score (86%; n=85) was significantly higher ($p<0.01$; at statistical significance of level 0.01) than the mean result before the course (59.7%; n=85) (***Figure 2***).

We found that most of the answers to the questions associated with FAST and EFAST were answered correctly irrespective of completion of the course. A question regarding the sonographic evaluation of body fluid incontinence turned out to be the most difficult. The second most difficult questioin was about the usage of the EFAST examination. After the course, 96,5% (82/85) of participants completed an EFAST scan at an adequate level of performance in under two minutes.

Discussion

Our six-days, intensive, point-of-care ultrasound course in EM turned out to be effective. Results showed that medical students significantly extended their knowledge about point-of-care EM US and acquired practical skills during the course. We can conclude that integrating emergency ultrasonography classes into medical school curriculum should be taken into consideration.

The pre-test results showed that students had elementary knowledge about ultrasonography before the course (acquired during radiology or emergency medicine classes). It suggests that the point-of-care ultrasound courses could be recommended as an additional training tool which helps to order and supplement the students' knowledge.

Ultrasonography, being an inexpensive and easy-to-use tool, can also be a "modern stethoscope" during daily ward rounds. It can have a particular importance, especially in the places where elderly staff have a skeptical opinion about the use of ultrasound in daily practice. More than 6% of the patients delivered to the emergency rooms are diagnosed with pneumothorax,[15] and this diagnosis can be confirmed and localized with comparable efficacy to Computed Tomography in less than four minutes using ultrasound.[16,17] This contributes to modernization and improvement in the hospital departments.

Regardless of numerous reports concerning the usefulness of ultrasonography in different educational stages, from studying anatomy support up to elderly medical students' education, it is still has not been entered into the curriculum.[18] We need more studies (especially prospective) describing the effects of integrated ultrasonographic courses on the clinical practice. Medicine as a rapidly-developing science should pay attention, especially to the constant actualization of the students' curriculum. Thanks to this, young doctors will be able to skillfully use their medical knowledge in their future work.

The point-of-care ultrasound course has been added to the facultative curriculum at our University. Although, further research with longer follow-up should be done, in order to enhance the results and conclusions. According to the Kirkpatrick educational levels, we have evaluated our intervention at the level 2 (change in knowledge). To recommend change in the medical curriculum (which is already overcrowded), it would be necessary to reach at least level 3 evidence (change in behaviour or ability). A longer follow-up could help this stydy reach that level.[19]

Special guidelines are needed to unify both, the theoretical and practical training. There are no such instructions thus far. This is a limitation of our study; although we believe that Ultrasound Associations, such as European Federation of Societies for Ultrasound and Biology (EFSUMB; http://www.efsumb.org/) will publish adequate guidelines. That would help to create repeatable courses and would allow for the comparison of results from different universities in the world. Thus, further research should be done in order to determine whether our conclusions are correct across the globe..

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