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REDELVE INTERNATIONAL PUBLICATIONS

Evaluation of Self-Guided, Simulation-Based Ultrasound Education Versus Traditional Ultrasound Education for Third Year Medical Students

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Abstract

Point-of-care ultrasound (POCUS) is increasingly incorporated into undergraduate medical education. Students feel that it is a valuable skill they will use in residency and beyond. Ultrasound education can serve to reinforce anatomy and physiology and enhance problem-solving skills. However, limitations exist to implementing ultrasound education in undergraduate medical education (UME). Ultrasound is traditionally taught with a lecture and a hands-on scanning session, requiring machines, instructors, and standardized patients or models. Monetary constraints for universities as well as time constraints from faculty may be potential limitations. New ultrasound simulators are designed to complement ultrasound education with individual, hands-on training. We aim to compare traditional ultrasound teaching to self-guided simulation-based learning in the 3rd year of medical school, focusing on free fluid detection, aorta, cardiac and thoracic exams.

We performed a retrospective review of 3rd year medical students at the Charlotte campus of the University of North Carolina School of Medicine (UNC SOM). Students previously selected to participate in a longitudinal third year curriculum received traditional ultrasound education, consisting of lecture with hands-on instruction. Students in a block curriculum during their third year were invited to participate in self-guided ultrasound education through YouTube® videos and a high-fidelity simulator, SonoSim®. Students were assessed by a pre- and post-curriculum written test, and a final hands-on skills assessment.

Students with traditional ultrasound education scored 55% and 82% respectively on the pre- and posttest. Students with self-guided learning scored 54% and 74%, respectively. On the skills assessment, students with traditional ultrasound education scored an average of 4/5 on and those with self-guided learning scored an average of 2.5/5. However, the traditional education cohort had a total of 24 hours education, and the self-guided cohort averaged 2.6 hours. In the self-guided group, those who spent more time with the simulator and online education material had better scores, suggesting that integrating an independent learning curriculum with simulation-based modules may contribute to medical student ultrasound education. We do see a role for ultrasound simulators as an adjunct in ultrasound education.

Keywords: Ultrasound, Point-of-Care Ultrasound, Medical Education, Simulation, Asynchronous Learning.

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Introduction

Incorporating bedside ultrasound into undergraduate medical education is a somewhat new approach, only taught at a handful of schools in the United States. Literature regarding ultrasound in medical student education reveals that students overall feel that it is a valuable part of their education as well as a skill that they will utilize in their residency and beyond.[1,3] Ultrasound education can serve to reinforce anatomy and pathophysiology, and enhance problem-solving skills.[13] Students may learn protocols that they can incorporate into future critical moments in medicine. Ultrasound education also accomplishes LCME accreditation goals including active learning and independent study, lab and practical opportunities, problem solving skills and clinical reasoning, and prepares students to enter many fields of graduate medical education.[4,15]

Given the clear benefit of incorporating ultrasound education at early levels of medical learning, there has been a steep rise in the percentage of medical schools utilizing ultrasound as a core curriculum component. A survey completed in 2014 found 62% of medical schools incorporate ultrasound into their curriculum.[2] This same survey also showed a lack of standardization of amongst medical schools in regard to modalities of ultrasound education.[2] Limitations exist to implementing ultrasound education in medical schools. Ultrasound is traditionally taught with a lecture, followed by a hands-on scanning lab with standardized patients, which has been shown to be successful and well received by medical students in prior studies.[5] However, this approach requires ultrasound machines, instructors, and standardized patients. Monetary constraints for universities as well as time constraints from faculty may be potentially limiting with regards to ultrasound education.[8] Furthermore, many institutions lack formally trained ultrasound faculty to proctor and facilitate these courses.

Given these limitations, a wide variety of new methodologies for ultrasound education have been proposed. In the recent decades, there has been a national movement toward simulation based medical education. Studies regarding medical education as a whole have shown not only equal but superior results in achieving specific clinical skills goals when comparing simulation-based methods to traditional methods.[9] Furthermore, simulation-based learning was found to be cost effective as well as well received by learners, in addition to providing a safe learning environment for high risk procedures and patient encounters that normally pose a potential threat to patient safety when involving less experienced learners.[9] The clear effectiveness of simulation-based learning in medical education has led to the creation and assessment of several simulation-based learning modules specific to point-of-care ultrasound education, which could potentially help with some of the aforementioned limitation the many undergraduate medical schools face with regards to ultrasound education.[7,8,10,14] A meta-analysis by Sidhu et al found that literature overall reflects a "general enthusiasm for ultrasound simulation-based medical education, with reported instances of meaningful learning". However, there lacked compelling evidence in this study showing correlation of improvement in in vivo ultrasound practice skills.[14] Lewiss et al looked further into simulation based point of care ultrasound education and found that "the reproducibility of clinical scenarios, the ability to measure performance metrics, the opportunity to encounter and respond to abnormal or critical findings in a safe setting, as well as the potential to identify provider deficiencies before patient encounters are all convincing arguments for using simulation in point-of-care ultrasound education".[8]

There have been limited studies looking specifically into high fidelity simulators for ultrasound education at the post graduate medical level. These high-fidelity simulators allow learners to engage in active, dynamic cases that can be manipulated to allow for a variety of clinical experiences. High fidelity simulators have been found to particularly helpful in high risk ultrasound procedures as well as in more sensitive areas of the body, for instance esophageal and pelvic ultrasound exams.[8] Studies specifically looking into comparing high fidelity, simulation-based education versus traditional education have found similar results in learns ability to interpret and obtain images in a timely fashion with similar written test scores.[6,7]

The SonoSim® ultrasound simulator is one such high fidelity simulator. It utilizes a computer application with a simulated ultrasound probe and provides learners with access to a variety of courses on fundamental aspects of point-of-care ultrasound and point-of-care ultrasound exams. In addition, there are dozens of case-based simulated patient interactions in which learners go through a simulated patient-provider interaction, and must perform, obtain, and interpret ultrasound images to provide the appropriate diagnosis and management. A pilot study by Paddock et al looked specifically at the SonoSim® ultrasound simulator device as a means to ultrasound education training for disaster response teams. When compared to a traditional skills training group, participants showed no statistical significance in image acquisition and interpretation, nor in improvement in pre- and post- course scores.[10]

Advances in information technology as well as multimedia resources has also led to increasing incorporation of internet technologies into medical education. These so-called E-Learning technologies "offer learners control over context, learning sequence, pace of learning, time, and often media, allowing them to tailor their experiences to meet their personal learning objectives".[11] E-Learning modulations have shown to be at least as effective as traditional instructor-led methods.[11] The Council of Emergency Medicine Residency Directors (CORD) recognized the importance of E-Learning based education in its 2008 Recommendations, calling for deliberate mixture of both synchronous and asynchronous learning in emergency medicine residency programs.[12]

The purpose of our study was to look specifically at incorporating an asynchronized, self-guided, simulation-based curriculum into undergraduate medical education using E-Learning methods with online accessible video lectures in combination with high fidelity ultrasound simulator, the SonoSim®. We compared this learning approach to a more traditional, lecture based, hands-on, instructor lead curriculum in a small population of third year medical students enrolled at the Charlotte Campus of the University of North Carolina School of Medicine.

Methods

In 2010, the University of North Carolina School of Medicine (UNC-SOM) formally partnered with Carolinas HealthCare System, currently known as Atrium Health, in Charlotte, North Carolina to create the UNC SOM-Charlotte Campus. Beginning with the 2013-2014 academic year, a program titled the Charlotte Longitudinal Integrated Curriculum (CLIC) was established, creating an environment in which third-year medical students were simultaneously enrolled in clinical experiences within all clerkships, rather than the standard 4 to 8-week individual clerkship blocks. In 2014-2015 education year, medical students in the 3rd year branch of the UNC-SOM were divided into two groups, the standard medical school curriculum and the longitudinal curriculum. The students were selected into one of the two paths through an application and interview process in the fall of their second year of medical school. Students in the Charlotte Longitudinal Integrated Curriculum (CLIC) had a total of seven ultrasound sessions, each four hours in length (Appendix I). The six primary educational sessions consisted of a lecture and a hands-on scanning session. Emergency Medicine ultrasound faculty at Carolinas Medical Center led hands-on scanning sessions. The instructor to student ratio was 1:2-4 for each scanning station. These students had a total of 24 hours of medical ultrasound education, 6 hours total of lecture and 18 hours total of hands-on ultrasound training with simulators as well as standardized patients.

The students in the standard medical school curriculum (SC) did not have any designated ultrasound teaching sessions or formal requirements for ultrasound education. At the end of the 2013-2014 year, many medical students in the standard curriculum expressed concern for the lack of ultrasound education in their curriculum. Thus, the asynchronous independent ultrasound curriculum was developed for the 2015-2016 curriculum.

In the fall of 2014, we hosted an optional information session about the self-guided simulation-based ultrasound curriculum which the 15 medical students enrolled in the standard medical school curriculum were invited to attend. This session was completely optional and voluntary. Of the 15 medical students enrolled in the standard curriculum, 9 attended this information session, and of those, 5 agreed to participate in our curriculum. It was made clear in the initial session that this curriculum was optional, voluntary, and in no way would affect the students' clerkship grades.

The students who enrolled in the asynchronous curriculum were given access to online ultrasound education materials that covered basic ultrasound physics and ultrasound anatomy as well as instructions for performing different point of care ultrasound exams focusing on the FAST, cardiac, thoracic, and aorta ultrasound exams. Appendix II depicts the curriculum that was made available to the students enrolled. The basics of the curriculum include four online lecture videos, ten SonoSim® Simulation Cases, and four SonoSim® Courses.

The four lecture videos were approximately 25- 35 minutes in length and the topics were: (1) ultrasound physics and knobology, (2) the FAST ultrasound exam and free fluid detection, (3) the aorta ultrasound exam and (4) basic cardiac and thoracic ultrasound exam. These videos were comprised of lecture slides with voice-over teaching combined with live videos of the exams being performed on standardized patients. These lectures were made available through a hospital SharePoint site for medical students and were also available online via YouTube®.

These students also had access to the SonoSim® ultrasound simulator. The SonoSim® ultrasound simulator is a high-fidelity ultrasound simulator which uses a computer-based application with a simulated ultrasound probe. The SonoSim® ultrasound simulator has several basic courses on ultrasound physics as well as point of care ultrasound exams. In addition, SonoSim® features several case-based learning modules. The students were allowed access to the SonoSim® machine at all times for the approximate 4-month period. The students completed a sign out sheet each time they used the simulator, which allowed us to record the number of times and duration of each use. The students were asked to complete ten SonoSim® Simulation Cases, and four SonoSim® Courses as part of the curriculum (Appendix II). The topics of these SonoSim® courses correlated with the four video lectures.

The students enrolled in the asynchronous curriculum were allowed to complete the course material at any time between December of 2014 (after taking the written pre-test) and April of 2015 (prior to taking the written post-test and OSCE). The number of hours each student spent on the SonoSim® ultrasound simulator was logged via the sign-out sheet. In addition, following the completion of the course, the students enrolled were asked the number of videos out of four that they viewed.

The medical students in both curriculums were given the same 20-question, multiple-choice written pre-test prior to the start of both courses. At the end of the courses, medical students in both curricula were once again given the same 20-question, multiple-choice written post-test. Both groups also underwent an Objective Structured Clinical Examination (OSCE) at the conclusion of the course. The OSCE consisted of four stations, each with a standardized patient and a faculty evaluator. The students were asked to obtain key images at each of the four stations (Appendix III). The evaluator assigned the students a score of 1 through 5 based on a predetermined defined scoring system (Appendix IV).

All medical students participating in both the Charlotte Longitudinal Integrated Curriculum (CLIC) and the asynchronous curriculum were made aware prior to the start of the curriculum that they would be involved in our research project and that their scores on the pretest, posttest, and OSCE would be used in our research projects. All students agreed and signed an Informed Consent form which provided full disclosure of research, risk, confidentiality, costs, and financial interests.

group (traditional and asynchronous) using paired t-test. Next, the curriculum groups will be compared on demographic and baseline variables (including pre-test scores) using Student's t-test for interval data, the Wilcoxon rank sum test for ordinal data, and the chi-square test or Fisher's exact test for categorical data. The primary analysis will be a Student's t-test comparing the curriculum groups on mean change in score from pretest to post-test. A secondary analysis will be a chi-square test (or Fisher's exact test) comparing the proportion of students in each curriculum group whose score improved by 20 percentage points. This analysis will include only students whose pre-test score was less than or equal to 80 percentage points. The curriculum groups also will be compared on mean post-test score using Student's t-test. Finally, the curriculum groups will be compared on the ultrasound skills assessment using the Wilcoxon rank sum test, which is appropriate for ordinal data. SAS® Enterprise Guide® 6.1 will be employed for all analyses. A two-tailed p-value of less than 0.05 will be considered statistically significant.

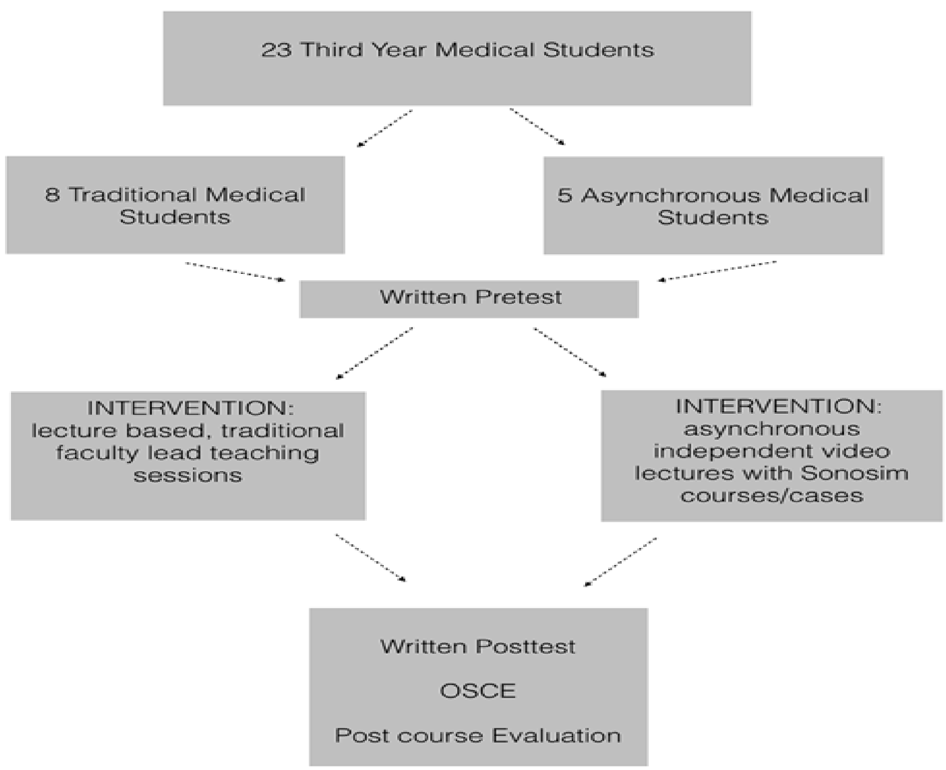

Figure 1. Assignment of Third Year Medical Students to Traditional Ultrasound Education vs. Asynchronous Ultrasound Education.

Statistical Methods

Descriptive statistics, including means and standard deviations, and counts and percentages, will be calculated. Initially, pre-test and post-test scores will be compared within each curriculum

Results

Written Test:

i. Full Groups:

In the Traditional Group, the written post-test scores were signifi cantly higher than the pre-test scores (mean increase = 5.4, s.d. = 0.9) ($p < 0.0001$, paired t-test). In the self-guided group, the written post-test scores were not significantly different from the pre-test scores (mean increase = 4.0, s.d. = 4.1) (p = 0.0959, paired t-test). The mean change in score was not significantly different between the traditional group (5.4) and the self-guided group (4.0) (p = 0.5012, Student's t-test). The proportion of students whose score increased by at least 20% from pretest to post-test was not significantly different between the traditional group (8/8 = 1.0) and the self-guided group (3/5 = 0.6) (p = 0.1282, Fisher's exact test).

Table 1. Written Pre and Post-Test Mean (s.d.) Scores for Traditional and Self-Guided Groups

	Traditional (n=8)	Self-Guided (n=5)
Pretest	11.0 (1.9)	10.8 (1.9)
Posttest	16.4 (1.3)	14.8 (3.0)
Change in Score (post minus pre)	5.4 (0.9)	4.0 (4.1)

ii. Reduced Self-Guided Group (Including only students who completed 50% or more of curriculum)

The pre and post-written test scores were analyzed for the students in the self-guided ultrasound curriculum who completed 50% or more of the curriculum. The mean change in score was significantly greater in the reduced self-guided group (8.0) than in the traditional group (5.4) (p = 0.0101, Student's t-test). The proportion of students whose score increased by at least 20% from pretest to posttest was not significantly different between the traditional group (8/8 = 1.0) and the reduced self-guided group (2.2 = 1.0) (p = 1.000, Fisher's exact test).

Table 2. Written Pre and Post-Test Mean (s.d) Scores for Traditional and Reduced Self-Guided Groups

	Traditional (n=8)	Reduced Self-Guided (n=2)
Pretest	11.0 (1.9)	9.0 (1.4)
Posttest	16.4 (1.3)	17.0 (0.0)
Change in Score (post minus pre)	5.4 (0.9)	8.0 (1.4)

B. Skills Assessment:

i. Full Groups:

Traditional group and Self-Guided group skills assessment scores are significantly different at the 0.05 significance level on performance of thoracic exam and overall median score when combining all four skills assessment examination scores.

Table 3: Skills Assessment Median (interquartile range) scores for Traditional and Self-Guided Groups on Performance of Cardiac, Thoracic, FAST, and Aorta Ultrasound OSCE

	Traditional (n=8)	Self-Guided (n=5)	p-value (Wilcoxon rank sum test)
Cardiac	4.0 (1.0)	2.0 (0.8)	0.1035
Thoracic	4.5 (1.0)	2.0 (1.0)	0.0047
FAST	4.0 (0.9)	2.8 (1.8)	0.2377
Aorta	4.0 (0.9)	1.8 (3.0)	0.1212
Total	4.1 (0.4)	1.7 (1.6)	0.0233

ii. Reduced Self-Guided Group

The OSCE, or skills assessment scores, were also analyzed for the students in the self-guided group who completed 50% or more of the curriculum. No significant difference in skills assessment score between the traditional and Reduced Self-Guided groups in all 4 areas and in total average median score.

Table 4. Skills Assessment Median (interquartile range) scores for Traditional and Reduced Self-Guided Groups on Performance of Cardiac, Thoracic, FAST, and Aorta Ultrasound OSCE

	Traditional (n=8)	Self-Guided (n=5)	p-value (Wilcoxon rank sum test)
Cardiac	4.0 (1.0)	3.6 (1.8)	1
Thoracic	4.5 (1.0)	2.5 (1.0)	0.0601
FAST	4.0 (0.9)	4.4 (0.3)	0.5074
Aorta	4.0 (0.9)	4.1 (0.2)	0.8945

A post-group analysis of the time spent by the self-guided group utilizing the resources provided for the ultrasound curriculum showed all self-guided students an average of 4 hours total on the ultrasound videos and SonoSim®. The average hours spent utilizing the ultrasound resources by the reduced self-guided group was 8.3 hours.

Table 5. Time (hours) Self-Guided Group Spent Utilizing Provided Ultrasound Education Resources.

Mean (s.d.) hours of spent for Ultrasound education (self-guided group only)

	Full Group (n=2)	Reduced Group (n=2)
Videos	1.4 (2.0)	3.5 (0.7)
SonoSim	2.6 (2.5)	4.8 (1.1)
Total	4.0 (4.2)	8.3 (1.8)

Discussion

The above data compares the improvement in knowledge retention and skills acquisition between two different point-of-care ultrasound curricula. With regards to the written test scores, both groups met the pre-set goal of at least a 20% increase in score from the pre-test and the post-test. Furthermore, there was no significant difference between the absolute mean change in score between the two groups. However, while the traditional group did have an overall significant rise in score between the pre- and post-test, the self-guided group did not. This could be due to the small size of the self-guided group, but also could show the inferiority of the self-guided group to the traditional group with regard to knowledge retention and testing.

In comparison, the traditional group consistently outscored the self-guided group on the skills assessment. The traditional group had higher average median scores on all components of the skills assessment, significantly different (p-value < 0.05) on the thoracic exam specifically. In addition, the traditional group had an average median score of 4.1 (0.4) on the skills assessment, compared to the self-guided group's average median score of 1.7 (1.6), which is again statistically significant (p-value<0.05).

This data does show that while the two groups had similar improvement on the written exam, there was a significantly different level of performance on the skills assessment exam. This data supports that asynchronous and simulation-based learning may be equivalent to traditional learning in knowledge acquisition and retention. However, the data also points out a possible limitation of asynchronous and simulation-driven education, which is the lack of true real-time application and teaching of skills and patient-bedside learning, shown by the self-guided group's significantly worse performance on the skills assessment exam. The traditional group were allotted 18 hours of hands-on ultrasound learning utilizing actual ultrasound machines and standardized patients. In addition, there was ultrasound-trained faculty present providing feedback. The traditional group also had the benefit of using actual ultrasound machines, similar to the one used on the final skills assessment. In comparison, the self-guided group were assigned 10 SonoSim® cases and 4 courses (which would take approximately 8 hours to complete). In addition, many of the students in the self-guided group had never before used an ultrasound machine prior to the final assessment.

It is important to point out, however, the significant difference in time spent between the two groups. The traditional group had a total of 24 hours of dedicated ultrasound curriculum. In comparison, the average time spend in hours on ultrasound curricula for the self-guided group was 4.0 hours. The difference in time spent alone between the two groups could perhaps explain the different in performance on the written and skills assessments. Furthermore, 3 out of the 5 students in the self-guided group did not complete a majority of the course work assigned. This in itself shows another limitation of asynchronous learning, which is reliance on learners to complete the material on an honor system and with no scheduled time. However, if the self-guided group perhaps had set aside time in the 3rd year curriculum to complete all course material, perhaps they would have scored higher on the skills assessment exam. For example, a separate data analysis, as shown above, was performed to compare the traditional group with a reduced sub-group of the self-guided students to included only the students who completed more than the majority (greater than 50%) of the online videos and SonoSim® cases. In this reduced sub-group, the self-guided group had a significantly higher increased change in score of 8.0 (1.4) on the written test compared to the traditional group change in score of 5.4 (0.9) (p-value < 0.05). In addition, there was no significant difference in the average median score on the skills assessment between the two groups: median score of 4.1 for the traditional group and a median score of 3.7 for the reduced self-guided group, with a p-value of 0.36.

It is important to note a major limitation of this data is the size of the reduced self-guided group, only 2 students. However, the data does perhaps show the utility of asynchronous and simulation-based learning for ultrasound teaching and improvement in both knowledge retention and real time skills application. In the future, a larger study with access to more medical students, and perhaps a curriculum that allows set aside time in the schedule for the online and simulation-based learning would be beneficial to better compare this style of learning with traditional methods.

Limitations

A major limitation of this study was the number of medical students enrolled. The sample size was limited due to the number of enrolled medical students at UNC-SOM Charlotte Campus, a total of 23 to start. We did not have control over the number of students (eight) enrolled in the Charlotte Longitudinal Integrated Curriculum (CLIC), which was preset and predetermined prior to the initiation of this study. With regards to the number of students enrolled in the self-guided curriculum, there was a maximum of fifteen standard curriculum students eligible to participate in the course. Of the fifteen students, five committed to our curriculum. This number was somewhat limited by the fact that the self-guided curriculum was an optional, non-mandatory part of the students third year clerkship. Thus, in addition to the medical students' full course load and clerkship requirements, the students were asked to complete this additional coursework. These students were not given any additional time allotment in their schedule for course completion, as opposed to the students enrolled in the CLIC, who had a dedicated 24 hours of ultrasound education assigned to them in their clerkships.

Appendix

Appendix I: Longitudinal ultrasound curriculum for the Charlotte Longitudinal Integrated Curriculum (CLIC) Program for academic year 2014-15.

Session 1: Introduction and Pretest.

Pre-test

Didactic Session

- Introduction to basic ultrasound physics
- Image orientation and acquisition
- Anatomic appearances of tissue
- Instrumentation and "Knobology"

Practical Session

- Introduction to ultrasound machines
- Probe selection
- "Knobology"

Session 2: The Cardiopulmonary Patient

- Didactic Session

Using ultrasound for evaluation of the patient with:

- Dyspnea
- Chest Pain
- Hypotension
- Leg swelling
- Practical Session

Cardiac ultrasound

Evaluation of general function and anatomy: parasternal long axis, parasternal short axis, apical four chamber view, subxiphoid view

- Thoracic ultrasound
- Assessment for effusion, consolidation and pneumothorax
- Lower extremity venous ultrasound

Assessment for DVT: Femoral, saphenofemoral junction and popliteal vein locations using compression

Session 3: The Acute Abdomen - Free Fluid

Didactic Session

Diagnostic concerns and utility of ultrasound in evaluating patients with:

- Peritonitis
- Distended abdomen
- Back pain/Abdominal Aortic Aneurysm (AAA)
- Other causes of free fluid

Practical Session

Focused Abdominal Sonography in Trauma (FAST) exam

Evaluation for presence of free fluid: Morison's Pouch (RUQ) view, retrovesicular view (transverse and sagittal), perisplenic view and cardiac view (subxiphoid or parasternal long views)

Aorta

Evaluation for AAA or aortic dissection: Proximal and distal segments of the abdominal aorta, in transverse and longitudinal planes with measurements, identification of aortofemoral bifurcation

Session 4: The Acute Abdomen - Other Causes

Didactic Session

Diagnostic concerns and utility of ultrasound in evaluating patients with:

- Abdominal pain
- Renal insufficiency

- Flank pain
- Pediatric abdominal pain

Practical Session

Right upper quadrant ultrasound

Evaluation of the gallbladder with focus on identification of cholecystitis: Transverse and sagittal views of gallbladder, identification of portal triad, measurement of common bile duct

Renal ultrasound

Evaluation of kidneys and bladder for signs of hydronephrosis, cysts and urinary outlet

obstruction: Transverse and sagittal views of bilateral kidneys, transverse and sagittal views of bladder with bladder volume measurement

Session 5: The Pregnant Patient

Didactic Session

OB/GYN applications of ultrasound

- Review of anatomy
- Normal uterus and ovaries
- Early intrauterine pregnancy
- Fetal presentation
- Placenta

Practical Session

- Trans-abdominal pelvic ultrasound
- Normal ovaries and uterus: Transverse and sagittal views
- Transvaginal pelvic ultrasound

Identification of abnormal anatomy and pathology with Blue Phantom: Transverse and sagittal views of uterus and bilateral adnexa

Session 6: Procedural Guidance

Didactic Session

- Role of ultrasound in medical procedures
- Identification of procedural anatomy
- Patient safety

Practical Session

- Central venous access

Identification of anatomy and placement of central venous catheter using Blue Phantom model: short and long axis views

- Paracentesis
- Identification of landmarks
- Thoracentesis
- Identification of landmarks

Session 7: Course Wrap-up

Didactic Session

Knowledge assessment - Post-test

Practical Session

Skills assessment - OSCE

Individual ultrasound examination stations

- FAST
- Aorta
- Transvaginal
- Procedural guidance
- Image interpretation stations
- Image identification and diagnostic determination

Appendix II: Independent Ultrasound Curriculum Course Guide

Independent Ultrasound Curriculum

Course Guide

2014-2015

Carolinas Medical Center Department of Emergency Medicine

Objective

a. The independent ultrasound curriculum is a newly developed, self-guided independent learning ultrasound program that is being offered to the UNC-Chapel Hill Charlotte-based MS3. The goals of the program are to provide interested MS3s with an introductory level course on clinical ultrasonography, focusing on fundamental ultrasound physics, operator skills, and clinical uses of ultrasound. Education material will include online video lectures as well as assigned modules on the SonoSim® tutorial simulation system (available for sign out in MEB). There will be a written pre-test and post –test, as well as a case base final examination at the end of the year.

I. Requirements: completion of all material will be on the honor system. Goal is for completion of all material prior to final Objective Structured Clinical Examination in April 2015. The SonoSim® computer will be available for independent check out in the MED at all times.

Course Website: http://teams.carolinas.org/sites/MSL/ultrasound/SitePages/Home.aspx

a. **Video lectures**

b. Four video lectures available online on the below links:

1. Introduction: Basic Ultrasound Skills and Physics http://youtu.be/Vqiq6j9XFks

2. Cardiac and Thoracic Ultrasound http://youtu.be/dkjOmc_dN_0

3. FAST and eFAST Ultrasound http://youtu.be/InGWHQo7FGk

4. Aorta Ultrasound http://youtu.be/GyQIw58vVEU

c. **SonoSim® Material**

i. Four SonoSim® Courses:

1. Aorta/IVC

2. FAST

3. Cardiology

4. Fundamentals

ii. **Ten SonoSim® Simulation Course:**

1. **Core Aorta/IVC**

a. Case 3

b. Case 4

c. Case 6

2. Core Cardiology

a. Case 1

b. Case 6

c. Case 7

3. FAST:

a. Case 1

b. Case 7

4. eFAST:

a. Case 1

b. Case 7

d. Written Pre-Test

i. 20 question, multiple choice format, to be taken at own convenience prior to December 1, 2014

1. Please email Celeste Colcord (celeste.colcord@carolinas.org) to schedule

e. Written Post-Test and Case-Based Final examination

i. OSCE will be scheduled sometime in April 2015

II. **Course Staff:**

a. Course Director: Margaret Lewis, MD. Faculty Member, CMC Department of Emergency Medicine. margaret.lewis@carolinas.org

b. Resident Course Assistant: Lindsey Jannach, MD. PGY-2, CMC Department of Emergency Medicine. lindsey.jannach@carolinas.org

c. Ultrasound Department Administration: Heather Gaines. heather.gaines@carolinas.org. office: Floor 3 MED

d. UNC-CH Medical Student Administration: Celeste Colcord. celeste.colcord@carolinas.org

III. Research: We will be using data from both the Independent Ultrasound Course as well as CLIC Ultrasound course for a research project on medical student education in ultrasonography. The research project has met all requirements of IRB as well as the CMC Emergency Medicine Research Review Committee. Students will be required to sign a form authorizing use of data for research.

Appendix III: Skills assessment stations and expectations for each

Station	Primary goal	Secondary goal
Cardiac echo	Obtain images: PSL, PSS, A4, SX	
Thoracic	Obtain images: Right & left 2ICS	
FAST	Obtain images: MP, RV, PS, SX	
Aorta	Obtain images: PA, DA, bifurcation	Obtain mea surements

PSL-Parasternal long axis, PSS-Parasternal short axis, A4-Apical four-chamber view, SX-Subxiphoid view, 2ICS-Second intercostal space, MP-Morison's pouch view, RV-Retrovesicular view (transverse and sagittal), PS-Perisplenic view, PA-Proximal aorta (transverse and sagittal), DA-Distal aorta (transverse and sagittal)

Appendix IV: Skills assessment grading form

1	2	3	4	5
Very poor image acquisition	Limited ability	Moderate ability to obtain image	Good image acquisition	Excellent ability

Modified Likert scale grading matrix for each station. Students were graded on acquisition of each particular image for each station. Cumulative scoring for each particular station was then obtained by averaging the station's scores.

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