Ultrasound: Should it be a compulsory part of rheumatology training

Developments in technology, changing management paradigms and the availability of powerful new anti-rheumatic drugs have led to a rapid expansion in the use of ultrasound in the management of patients with inflammatory arthritis. Ultrasound is an ideal tool for point of care imaging- widely available, safe, relatively inexpensive and can be used to image many joint areas in a relatively short period of time. US enables early diagnosis, more accurate monitoing and as a potential treatement end-point -thus avoiding under or over-treatment. Additionally, ultrasound plays an important role in patient education, allowing them to 'see' their own joints and identify either the prescence or abscence of pathology.

Whilst the uptake of US in rheumatlogy is increasing across European countries and guidelines are now in place as to what should be taught from EULAR and EFSUMB, the challenge now is to develop training programmes within individual countries and to persuade national societies that ultrasound should be an integral part of trainees post graduate training.

This presentation will discuss our European experiences thus far with a focus on the UK and the challenges that need to be overcome.

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Meta Information

Submission ID: 7 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Head and Neck Ultrasound: A Multimodal Education Approach in the Predoctoral Setting

Introduction

The traditional method of ultrasound instruction in medical education is to have ultrasound taught on a live, healthy model in conjunction with standard physical exam maneuvers. However, this method cannot demonstrate pathology and does not allow students to practice more advanced ultrasound procedures. In this study, we demonstrate that by augmenting the traditional instructional program with additional modalities, students can gain a more comprehensive understanding of ultrasound technique and gain a greater confidence in their own ultrasound skills.

Methods

A new, multimodal curriculum was developed and applied to the Head and Neck module of the 2014 Loma Linda University Ultrasound Symposium. The teaching sessions were divided into five components: 1) an instructor given didactic session that focused on anatomy and pathology, 2) an instructor given live model demonstration of normal anatomy and ultrasound technique, 3) student practice session on a live model, 4) computer simulated pathologic cases, and 5) fine needle aspiration (FNA) biopsy on ultrasound phantom models.

Students were asked to fill out a brief survey rating each teaching method as well as rating their confidence with head and neck ultrasound before and after the teaching session. Data from these surveys was analyzed as a whole as well in groups of MS1+MS2 students who had received previous ultrasound training and MS3+MS4 student who had not.

Results

The survey showed that students previously trained in ultrasound had an average pre-instruction confidence with head and neck ultrasound of 4.14/10 compared to 1.44/10 in the ultrasound naïve group ($p=0.003$). Following the instructional sessions, the students' confidence increased respectively to 8.14/10 and 7.78/10 ($p=0.53$), showing a 4.14 (96%) increase in the MS1+MS2 and a 6.34 (440%) increase in the MS3+MS4 group.

The highest rated instructional method for MS1+ MS2 group was instructor demonstration on live model (9.5), while the lowest rated was the computer simulation cases (7.79). For the MS3+MS4 group, the highest rated category was participant practice on live model (9.78) and the lowest rated was the didactic presentation (8.22). The combined results among all students rated instructor demonstration on a live model highest (9.47) and computer simulation cases lowest (8.25)

Conculsion

Overall, our study shows that a multimodal ultrasound instruction was beneficial in increasing medical students' confidence in head and neck ultrasound. All five modalities were rated highly by students, and the results of pre- and post-instructional surveys showed a significant increase in confidence in both ultrasound "naïve" and ultrasound trained groups. It is our hope that more

medical schools will expand their curriculums so that students are given well-rounded ultrasound education including normal anatomy, pathological findings, and procedural techniques.

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Meta Information

Submission ID: 9 Student Submission: 1
Format: Oral

Topic: Use of ultrasound in Undergraduate Medical Education

A Curriculum and Assessment Tool for Point of Care Ultrasound Training in a Limited Resource Setting

Introduction

Clinician-performed point of care ultrasound (POCUS) can have a significant impact on patient management, especially in settings where other imaging is not readily available. Currently, widespread lack of training in low and middle income countries (LMICs) prevents ultrasound (US) from reaching its full potential as an effective diagnostic tool. We describe a pilot study of a novel, POCUS training curriculum, implementation program, and an assessment tool for POCUS knowledge.

Methods

This is a retrospective review of an educational intervention and curriculum description.

2 cohorts of physicians were trained using this curriculum, 10 in 2013 and 21 in 2014. Rwandan and Burundian Medical Directors selected physicians for the training based on a reported self-interest in ultrasound. Fellowship trained emergency physicians from the USA taught course participants the POCUS curriculum (Table 2) over a 70-hour period (Table 1). Course evaluation included pre and post training confidence surveys as well as pre and post training knowledge exams (multiple choice, image recognition and interpretation).

Results

The unique curriculum increased participants' scores on a POCUS knowledge test (Figure 1). Confidence in performing several common POCUS applications also increased (Figure 2). Specifically, confidence increased greatly when performing POCUS 2nd and 3rd trimester OB/GYN exams, procedural evaluation for thoracentesis, DVT exams and skin/soft tissue ultrasound (Figure 2). Gains were also seen in understanding mechanics, physics and artifacts of ultrasound. Participants' confidence in teaching the exams they learned in this curriculum also increased, with the greatest gains in applications relating to thoracentesis and DVT (figure 3). Overall, on a 1-5 Likert Scale of agreement, participants reported an increase in feeling prepared to use US from 3 (SD=0.7) to 3.9 (SD=0.3) and an increase in preparedness to teach US from 2.4 (SD= 1) to 3.6 (SD =0.6).

Conclusion

This paper describes a novel curriculum and its efficacy in POCUS education for health care providers in a remote international setting. Our data suggest it is possible to improve provider confidence and POCUS knowledge though a focused educational intervention. Future iterations of this course and subsequent research should consider improving knowledge transmission through use of language translations and assessment of sustainability and long-term impact on patient care.

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Meta Information

Submission ID:	10	Student Submission:	0
Format:	Poster		

Topic: Point of Care ultrasound in health care delivery to underserved populations

Point of care Ultrasonography as an adjunct tool for musculoskeletal examination.

Introduction : The evolution of musculoskeletal ultrasound has reached a point where it has become possible for clinicians to have high quality real-time imaging in the office setting. Here we share our experience of Ultrasound as an adjunct tool for musculoskeletal examination in a sports medicine clinic.

Ultrasound was used as adjunct tool to 200 clinical musculoskeletal examinations done at an outpatient setting, and here are three examples where point of care Ultrasonography was used as an important tool in diagnosing and managing clinical cases where otherwise the diagnosis might have been missed.

Case 1: A 57 year old gentleman had a fall on the outstretched hand after slipping off a staircase. Initially he was seen and examined in the ER and was sent home with a diagnosis with wrist sprain. However, he continued to have pain for more than a week when he was seen in a sports medicine clinic. On examination, most of his pain and tenderness was over the mid dorsum of the wrist without obvious swelling, and there was increased pain on stressing of scapho-lunate joint but Watson test (for assessing scapho-lunate instability) was negative.

The point-of-care Ultrasound was done as part of clinical examination which showed increased scapho-lunate space, absence of scapho-lunate ligament, fluid collection around the joint, and it also showed scapho-lunate instability on dynamic testing. MRI of wrist confirmed the tear of scapholunate ligament and scapho-lunate instability. He was then referred to a hand surgeon for further management.

Case2 : A healthy 68 yr old gentleman developed pain over the medial aspect of the elbow after an injury. Clinically, there was tenderness over the medial epicondyle of the elbow and so it was diagnosed as sprain of the common flexor origin. But there was some edema over anterior cubital fossa of the elbow as well. On close examination, it looked like dilated brachial vein. The point of care ultrasound examination showed that it was actually the dilated brachial artery, though the exact cause of it was not known. He was referred urgently to vascular surgeon for further assessment.

Case 3: A 40 year old healthy lady presented to clinic with heel pain after stamping the left heel hard on the ground. There was severe swelling and tenderness over the heel of the foot. She also had numbness over the lateral aspect of the sole and lateral surface of the foot. Clinically, she was thought to have possible planter fascia rupture, although the numbness was not well explained. Ultrasound examination of the heel did not show any finding suggesting planter fascia rupture, but fluid and swelling around the heel pad proved severe contusion of the heel pad. Also, there was an evidence of compression of the lateral planter nerve by the swelling which was found to be the cause for the numbness over the lateral aspect of the foot.

Discussion

These cases illustrates the potential benefit of utilizing point-of-care ultrasound as an assessment tool for musculoskeletal examination. Ultrasound will not only gives quick evaluation for any

musculoskeletal conditions but also reduce the time and cost for patient care and eventually increase the patient satisfaction.

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Meta Information

Submission ID:	12	Student Submission:	0
Format:	Poster		

Topic: Point of Care ultrasound in general clinical practice

The Passive Diaphragm

Background

Ultrasound (US) is a non-invasive way to assess diaphragm structure and function. Diaphragm Thickness (Tdi) as measured by US has proven accurate when compared to direct measurement in human cadavers via excision of the area in question (Cohn, 1997). Also described is a decrease in diaphragm thickness in diaphragmatic paralysis (Gottesman, 1997), and a positive correlation between Thickening Fraction (TF) and improved respiratory function (Summerhill, 2008). Such studies were in spontaneously breathing, non-intubated patients. Studies involving spontaneously breathing patients under positive pressure ventilation (PPV) have shown that mechanically ventilated patients' diaphragms thin on average 6% caliber loss daily (Grosu, 2012), though it is unclear whether thinning is associated with a loss of function or strength.

Unaddressed in the literature is the physiology of the diaphragm in patients who are truly passive under PPV. With our case study, we aim to contribute to the fund of knowledge regarding whether the passive diaphragm's structural changes, including Tdi with respect to tidal volume (TV), is comparable to conditions in which the diaphragm is engaged by neuronally-mediated contraction, as in spontaneously breathing patients.

Objective

To determine structural changes in the diaphragm of a subject who is passively breathing under PPV.

Study Design / Methods

We performed diaphragm US on a ventilated patient who had been declared brain dead. Using the high-frequency linear array transducer probe of a Sonosite M-Turbo portable US unit, the patient was examined while supine. The diaphragm was initially visualized at the zone of apposition at a right mid-axillary scan plane, with the liver identifiable at the far field. Videos were captured during the entire respiratory cycle at three delivered volumes (400, 600, and 800mL). Images were taken at end-expiration (Tdi at residual volume, or Tmin) and maximal inspiration (Tdi at lung volume, or Tmax). Thickness measurements were taken using still frames, using zoom functionality for optimal visualization in accordance with methods described by Cohn: measuring from the inner edge of the peritoneal and parietal layers flanking the muscular diaphragm, after distinct identification of these layers. The thickening fraction (TF) was calculated as (Tmax-Tmin)/Tmin for each delivered TV.

Results

At 400cc TV, Tmin=0.13cm, and Tmax=0.19cm. At 800cc TV, Tmin=0.12cm and Tmax=0.22cm. TF (400cc)=0.46 and TF (800cc)=0.83. Given these data, it appears that the TF of the passively excursing diaphragm can be predicted by the equation $TF = 0.92 \times TV + 0.09$.

Conclusions

To our knowledge we are the first to demonstrate that a neuronally disengaged diaphragm thickens with comparable physiology when passively excursed, as when the diaphragm is active in respiratory effort.

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Meta Information

Submission ID:	14	Student Submission:	0
Format:	Poster		
Topic:	Point of Care ultrasound in general clinical practice		

Using Ultrasound to Enhance Student Understanding of Cardiac Function and Electrophysiology

INTRODUCTION. The exposure to ultrasound technology during undergraduate medical education is highly variable across institutions as medical schools seek to incorporate clinical correlations into the basic science training. Ultrasound has been implemented to enhance teaching cardiac physiology to first-year medical students at A.T. Still University's Kirksville College of Osteopathic Medicine (KCOM). Our goal is to integrate ultrasound and cardiac physiology to provide better correlation of the electrical and mechanical events during the cardiac cycle. A workshop combining electrocardiogram (ECG) and echocardiography (ECHO) was integrated into the cardiology block of the second semester of osteopathic medical education. The objectives of this study were to assess medical student perception of ECG using live ultrasound imaging, and to determine their ability to identify electrical and subsequent mechanical events during the cardiac cycle after a focused didactic session.

METHODS. The ECG/ECHO workshop was preceded by a brief presentation to explain the objectives and clinical relevance of the exercise and provide a live demonstration of the ultrasound scanning technique. Student competency in the ECG component of the workshop was evaluated through pre- and post- tests. Student competency in the ultrasound component of the workshop was evaluated through the ultrasound assignment focused on identifying cardiac structures on the ultrasound image. To complete the assignment, each student was required to obtain 3 ultrasound images of the heart in the parasternal long-axis view and use M-mode modality for the imaging of the left ventricle and mitral and aortic valves. Each ultrasound image was then annotated to correlate ECG components with the related valvular events, wall motion, and heart sounds (S1, S2).

RESULTS. Results of the pre- and post- tests were analyzed and revealed improvement ($p<0.05$) between the mean pre-test (56%) and the post-test scores (76%). Students successfully submitted the labelled ultrasound images through the learning management system. This study revealed a marked improvement in student understanding of how cardiac electrical events correlate with cardiac valvular events and ventricular wall motion identified using ultrasound.

CONCLUSIONS. Using real-time ECG and cardiac ultrasound, students were able to correlate the electrical activity of the heart with cardiac mechanical events. The students were successful in identifying the ECG waveforms and intervals on a live image with the cardiac mechanical events on the M-mode ultrasound images. This exercise helped students better understand cardiac physiology and to develop skills that will indirectly enhance the quality of future patient care.

Authors

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Meta Information

Submission ID: 15 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Effects of Ultrasound Implementation on Physical Exam Learning and Teaching During the First Year of Medical Education

Objectives: Increasing emphasis has been placed on point-of-care ultrasonography in medical school. The overall effects of ultrasound curriculum implementation on the traditional physical examination skills of medical students are still unknown. We studied the effects on the Objective Standardized Clinical Examination (OSCE) scores of Year 1 medical students before and after ultrasound curriculum implementation.

Methods: An ultrasound curriculum was incorporated into the physical diagnosis (PDX) course for Year 1 medical students in the 2012-2013 academic year. We performed a prospective observational study comparing traditional OSCE scores of Year 1 medical students exposed to the ultrasound curriculum (POST-US) versus historic Year 1 medical student controls (PRE-US) with no ultrasound exposure. Questionnaire data was also obtained from Year 1 medical students and PDX faculty to assess attitudes towards ultrasound implementation.

Results: The final overall OSCE scores were graded with a 5-point Likert-type scale from unsatisfactory to outstanding. There was a significant increase in “outstanding” scores in the POST-US compared to the PRE-US group, 27.0% vs 10.9% ($p<0.001$). The POST-US group had statistically ($p<0.05$) increased first-time pass rates on blood pressure measurements, abdominal examination, and professionalism. Student and PDX faculty questionnaire data showed an overall positive response with most agreeing or strongly agreeing that ultrasound should be included in the future Year 1 medical student curriculum.

Conclusions: Ultrasound implementation into a physical diagnosis curriculum for Year 1 medical students is feasible and may improve their overall traditional physical exam skills.

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Meta Information

Submission ID: 16 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Reported Cognitive Load Associated with Using Ultrasound may Inform Curriculum Development for Teaching Anatomy and Physical Examination Skills

Background

Ultrasonography is increasingly used for teaching anatomy and physical examination skills for undergraduate medical education. Aside from learner satisfaction, to date, there is little guidance on how to structure its use for teaching. Under the premise of the cognitive load theory, learning is enhanced when cognitive load is optimized. Thus, the measurement of cognitive load provides an opportunity to inform curriculum design.

Objective

This published study aimed to determine ultrasound's perceived utility for learning and to investigate the effect of cognitive load on its perceived utility.(1)

Methods

All first-year medical students completed ultrasound training that includes a 13-minute didactic component, four 20-minute ultrasound-guided anatomy sessions, and and two 25-minute ultrasound-guided physical examination sessions. Learners were asked to complete a survey on comfort with physical examination techniques (3 items; alpha = 0.77), perceived utility of ultrasound in learning (2 items; alpha = 0.89), and cognitive load on ultrasound use [measured with a validated nine-point scale (10 items; alpha = 0.88)]. Dimensions represented by the cognitive load instrument were identified using principal components analysis. Correlation of dimensions with perceived utility of ultrasound use was evaluated using linear regression analysis.

Results

Of the 159 medical students, 137 (86%) completed the study. Learners found ultrasound useful for learning anatomy and physical examination (mean 4.2 ± 0.9 and 4.4 ± 0.8 respectively; where 1 = very useless and 5 = very useful). Principal components analysis on the cognitive load survey revealed two primary factors, "image interpretation" and "basic knobology," accounting for 60.3% of the total variance. Weighted factor scores were not associated with perceived utility in learning anatomy (Beta = 0.01, p = 0.62 for "image interpretation" and Beta = -0.04, p=0.33 for "basic knobology"). Factor score on "knobology" however was inversely associated with perceived utility for learning physical examination (Beta = -0.06; p = 0.03).

Conclusion

Our results suggest that the higher the cognitive load reported on knobology, the less likely the learners were to find ultrasound useful for learning physical examination skills. This adverse relationship was not present for learning anatomy. Thus, we conclude that a basic introduction to ultrasound may suffice for teaching anatomy. However, more training may be required for teaching physical examination. Prior to teaching physical examination skills with ultrasonography, we recommend ensuring that learners have sufficient knobology skills.

References

1. Jamniczky HA, McLaughlin K, Kaminska ME, et al. Cognitive load imposed by knobology may adversely affect learners' perception of utility in using ultrasonography to learn physical examination skills, but not anatomy. Anat Sci Educ 2014.

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Meta Information

Submission ID: 17 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

First "Glass" Education: Telementored Cardiac Ultrasonography Using Google Glass. A Pilot Study

Objectives:

The objective of this study was to determine the feasibility of telementored instruction in bedside ultrasonography using Google Glass. We sought to examine whether first-time ultrasound users could obtain adequate parasternal long axis (PSLA) views to approximate ejection fraction utilizing Google Glass telementoring.

Methods:

This was a prospective, randomized, single-blinded study. Eighteen second-year medical students were randomized into three groups and tasked with obtaining parasternal long axis (PSLA) cardiac imaging. Group A received real-time telementored education through Google Glass via Google Hangout from a remotely located expert. Group B received bedside education from the same expert. Group C represented the control, and received no instruction. Each subject was given three minutes to obtain a best PSLA cardiac imaging using a portable GE Vscan. Image clips obtained by each subject were stored. A second expert, blinded to instructional mode, evaluated images for adequacy and assigned an image-quality rating on a 0-10 scale.

Results:

Group A was able to obtain an adequate image 6/6 (100%) of the time with median image quality rating of 7.5 (IQR 6-10) out of 10. Group B was also able to obtain an adequate view 6/6 (100%), with median image quality rating of 8 (IQR 7-9). Group C was able to obtain an adequate view in 1/6 (17%) of the time, with median image quality of 0 (IQR 0-2). There were no statistically significant differences between Group A and Group B in the achievement of adequate images for EPSS measurement, or in image quality.

Conclusions:

In this pilot/feasibility study we demonstrated that novice ultrasound users were able to obtain adequate imaging to determine a healthy patient's ejection fraction through telementored education utilizing Google Glass. This preliminary data suggest telementoring as an adequate means of medical education in bedside ultrasonography. This conclusion will need to be validated with larger, more powerful studies including evaluation of pathological findings and varying body habitus amongst models.

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Meta Information

Submission ID:	18	Student Submission:	1
Format:	Oral		

Topic: Use of ultrasound in Undergraduate Medical Education

Implementation of an Ultrasound Training of Trainers Program for Limited Resource Settings: A pilot project from Rwanda

Introduction

Clinician-performed point of care ultrasound (POCUS) is emerging as an important diagnostic tool for use in low and middle income countries (LMICs) and other resource limited settings. The most prominent barrier to adoption of this operator dependent modality in LMICs is lack of training. To create sustainable ultrasound services and continued supply of ultrasound-trained clinicians, local trainers must be cultivated. We describe a pilot training program and curriculum for the development of Rwandan physicians into point of care ultrasound trainers.

Methods

We selected 7 physicians representing 4 hospitals in Rwanda who had previously had at least 6 months of ultrasound experience and coursework. Subjects participated in a 2 day training including education on adult learning theory, commonly made ultrasound mistakes and corrections, focused training in areas of self-identified weakness, and ultrasound specific education methods (Table 1).

Course evaluation included pre and post confidence surveys and pre and post observed ultrasound training skills exams. Wilcoxon Signed-Rank Test was used to compare pre and post-course results.

Results

We created a unique curriculum focusing on improvement of trainers personal ultrasound skills, education on methods of teaching and adult learning theory, and ultrasound-specific teaching considerations (table 1). We administered the curriculum using lectures, hands-on practice on live volunteers, hands-on practice on patients with pathology, flip chart discussions and brainstorming sessions, and observed displays of ultrasound training techniques. 7 physicians participated in training provided by 2 ultrasound expert clinicians. We also piloted a novel assessment tool including a pre and post survey assessing confidence in performing and training various POCUS exams; On a Likert scale of 1-5 (least to most confident) there was an increase in confidence to deliver a lecture (2.6 to 4.3), recognize ((2.9 to 4.6) and correct mechanical learner mistakes in hands-on scanning sessions (3 to 4.4) after the course. Pre and post course observations of course participants teaching ultrasound for trauma (eFAST exam) (Table 2) were conducted. This observed exam included patient and ultrasound learner actors who systematically made a series of common mistakes that the trainer had to recognize and correct to score points. There was a trend toward improvement in confidence in performing and teaching all ultrasound exams, and in the observed ability to teach ultrasound skills.

Conclusion

We describe a novel curriculum and assessment tools for the development of a cadre of ultrasound trainers in a low resource setting. Future research should focus on the sustainability and productivity of ultrasound trainers in LMICs and the impact on physician performance.

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Meta Information

Submission ID: 19 Student Submission: 0
Format: Oral

Topic: Point of Care ultrasound in health care delivery to underserved populations

Discussion on Pediatric Emergency Medicine Ultrasound Education: Moving Towards a Consensus

Point-of-Care Ultrasound (POC US) is a widely used clinical modality in the emergency department (ED), with over 90% of emergency medicine (EM) residency programs have an integrated curriculum for POC US. The Emergency Ultrasound Guidelines by the American College of Emergency Physicians (ACEP) and The Emergency Medicine Milestone Project (2013) delineate core competencies in POC US for residents, and reinforces its importance in emergency medicine training.

Not surprisingly, the use of POC US by pediatric emergency medicine (PEM) physicians is increasing with subsequent demands for training. A recent survey noted that 95% of PEM programs endorse the use of PEM in their emergency departments, and over 79% of these program offer a structured emergency US rotation. Despite the dramatic increase in US education within PEM fellowships, there is no standardized educational curriculum for Pediatric Emergency Medicine fellows. Veira et al. recommended in a recent article that EUS education could occur primarily during a PEM fellowship; and provided a program and curricular framework that could be integrated into the PEM fellowship curriculum. This is in contrast to a free-standing pediatric EUS fellowship that offers a more focused learning environment and opportunities for research and administrative experience that PEM fellows may or may not be offered in PEM fellowship. Although several publications have made recommendations regarding the core applications for PEM POC US training, there is currently no formal policy statement that includes comprehensive guidelines or a curriculum for POC US in PEM. Consensus on a succinct curriculum would help ensure that PEM clinicians and learn to use the US consistently and safely. Equally as important, this has significant ramifications on the type and quality of teaching PEM clinicians will then offer residents and students rotating within the department.

To further elucidate on the current state of pediatric emergency ultrasound in the U.S. we propose a panel discussion with several leaders in pediatric emergency ultrasound to discuss these issues.

By the end of this panel based didactic, the participant will be able to:

- Understand the similarities and differences of existing PEM POC US

  educational curriculums in PEM fellowships and pediatric EUS

  fellowships
- Understand differences between PEM and adult POC US applications
- Determine how one defined curriculum could provide educational

  benefit to EM attendings, fellows, residents, and students
- Understand how pediatric ultrasound applications can be integrated

into medical school and residency training (pre-fellowship level)

- Discuss the future directions of POC US education in PEM

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Submission ID:	21	Student Submission:	0
Format:	Panel		
Topic:	Use of ultrasound in Graduate Medical and Continuing Education		

Use of low-cost ultrasound phantoms for training at a free ultrasound symposium for medical students

Introduction:

The third annual Ultrafest at UC Irvine was a free one-day ultrasound symposium that drew medical students from across California to learn about point-of-care ultrasound. Fifteen workshops were offered, including 3 where students practiced ultrasound-guided procedures. Simulation is an important component of developing these skills and multiple commercial ultrasound phantoms are available. However, as Ultrafest is a free, single-day symposium, we sought to utilize low cost phantoms made from commonly available home products. These phantoms were used for training in ultrasound-guided needle biopsy, nerve blocks, blood draws, and thoracentesis.

Methods:

Recipes for homemade ultrasound phantoms have been previously published. Lo et al. (2012) described a ratio of 1 liter water, 12 tablespoons gelatin, and 4 tablespoons psyllium fiber to create phantoms both sonographically similar to human tissue and durable enough for multiple needle injections. Household buckets were used to form the body of phantoms, and common objects were selected to simulate additional desired structures. Palmetto olives simulated masses for needle biopsy phantoms. “Twisting balloons” filled with ultrasound gel represented vessels, and paracord simulated nerves for nerve block and blood draw phantoms. For a phantom simulating pleural effusion, segments of PVC pipe represented ribs, and a molded cavity filled with ultrasound gel represented a fluid-filled thoracic cavity. Formation of each phantom went through the following process: 1) mix psyllium, gelatin, and water over stove on medium heat; 2) pour layer of warm psyllium/gelatin mixture into desired mold, allow to cool and harden; 3) pour small second layer and place desired objects, then allow to harden; 4) pour final layer on top without disrupting objects in layer below.

Results:

The following phantoms were made: 2 for pleural effusion, 2 for nerve blocks with multiple veins/nerves, 4 vascular models with multiple vessels, and 2 with several masses for needle biopsy. The total cost in materials for these phantoms was $64.41, and approximately 10 hours were required to make them. Estimates of students that practiced on each of these phantoms ranged from 20 on each nerve block phantom to 40 on each of the others.

Discussion:

A variety of low-cost homemade ultrasound phantoms were successfully made and utilized in hands-on procedural workshops at a free ultrasound symposium for medical students. Limitations of these phantoms included time to make them, difficulty placing objects, and damage after several needle sticks. However, with experience the time to make phantoms decreased, each endured at least 20 needle sticks, and the average cost per phantom was only $6.44. In conclusion, these ultrasound phantoms are useful low-cost educational tools that can be utilized in mass instruction or low-resource settings.

1. Lo MD et al. “Homemade ultrasound phantom for teaching identification of superficial soft tissue abscess.” Emerg Med J 2012;29:738-741.

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Meta Information

Submission ID: 22 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Fresh Cadaver Ultrasound: A Procedures Model for Undergraduate Medical Education

ABSTRACT

Study Objectives:

Point-of-care (POC) ultrasound (US) has invaded nearly every specialty in medicine. As a result, a demand has risen for earlier exposure to US during the clinical years of undergraduate medical education. Although one of the main uses of POC US is invasive medical procedures, there is no standardized educational model for procedural skills which can provide the operator a real-life simulation. The objective of our study was to describe a unique fresh cadaver preparation technique and to determine the impact of a procedure-focused ultrasound training session.

Methods:

This study was a cross-sectional study at an urban academic medical center. A sixteen-item questionnaire was administered at the beginning and end of the session. Fifty-five third year medical students participated in this one day event during their surgical clerkship. During this session, students were trained to perform the following ultrasound-guided procedures: internal jugular vein cannulation, femoral artery cannulation and pericardiocentesis.

Preparation of the fresh cadaver involved the following: surgically ligating the proximal and distal vessels of a given region, and then using a cadaver embalming pump to administer infusate in a pulsatile and realistic fashion. To increase the viscosity of the fluid and allow for multiple cannulation attempts, a commercially available additive was mixed into the fluid. The embalming pump was inserted into the basilic vein, saphenous vein and the superficial femoral artery. For the pericardiocentesis model, high viscosity fluid was directed into the pericardial sac using ultrasound guidance.

Results:

Fifty-five third year medical students participated in this study. One hundred percent (95% CI, 100%-100%) of medical students agreed that US can help increase confidence to perform procedures in the future. Eighty percent (95% CI 70%-91%) of students felt that there was a benefit of learning ultrasound based anatomy in addition to traditional methods. Student confidence was self-rated on a five-point Likert scale. The student median score of their confidence in ultrasound-guided central line placement was 2 (interquartile range 1-2) and after the education session it was 4 (interquartile range 4-5) (p=.0001). Student median score of their confidence in performing femoral artery cannulation was 2 (interquartile range 1-2) and after the session it was 3 (interquartile range 2-3) (p=.001). Student median score of their confidence in performing pericardiocentesis was 1 (interquartile range 1-1) and after the session it was 2 (interquartile range 2-3) (p=.001).

Conclusion:

The use of fresh cadavers for procedure-focused US education is a realistic method that improved the confidence of third year medical students in performing complex but critical procedures.

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Meta Information

Submission ID: 23 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

A Cost-Effective, Gelatin-Based Phantom for Learning Head and Neck FNA

Background

The rise in popularity of ultrasound imaging has seen a corresponding increase in demand for effective training tools. Ultrasound models, or phantoms, are especially useful in instruction and practice of ultrasound-guided invasive procedures such as FNA. Unfortunately, many of these models are expensive and impractical for routine use. With this in mind, we developed two low-cost, gelatin-based phantom models that can be used for assessment and instruction of FNA technique of the head and neck.

Methods

Both models were created using commonly available materials including disposable plastic containers, Knox gelatin (Nabisco), psyllium husk fiber powder, green olives, blueberries and food coloring. The first model was made using a two-liter rectangular container with two separate layers of gelatin. The first layer utilized a ratio of two cups boiling water to four tablespoons psyllium to 42 grams of gelatin to 20 drops food coloring while the second layer had four cups boiling water to four tablespoons psyllium to 84 grams of gelatin to 40 drops food coloring. Olives and blueberries were embedded in the lower, more echogenic layer to simulate cystic and nodular lesions. The second model was created using a cylindrical, two-liter container to more closely simulate the shape of a human neck. A pig laryngotracheal complex with olives and blueberries sutured to it was secured in the center of it and a surrounded with a gelatin solution using a similar ratio to the second layer of the first model. Other materials included an ultrasound machine with a linear probe, 22 gauge, 1.5 inch needles, and 10 cc syringes.

Results

Both gelatin phantom models were successfully used to obtain images and practice FNA technique.

Discussion

These phantoms were created with everyday items available at a local grocery store and online retailer. The total cost for both models was under $40, and they can be refrigerated and re-used for up to two weeks. The first model utilizes layers of varying ecogenicities, which are comparable with thyroid and soft tissues of the neck. The second model containing the pig laryngotracheal complex simulates realistic anatomy. Olives and blueberries embedded in both phantoms resemble masses commonly seen in head and neck pathology and allow practice of FNA technique. Additionally, our models provide a stepwise approach to learning technique that may not be achieved from one model alone. Fundamental skills such as probe positioning, image adjustment, and needle placement can be learned first on the flat, rectangular model while the second model can be used to develop more advanced skills.

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Meta Information

Submission ID:	24	Student Submission:	1
Format:	Poster		
Topic:	Use of ultrasound in Graduate Medical and Continuing Education		

Absent Sinusoid Sign Predicts Trapped Lung

Background

Pleural effusion is a common condition for which pulmonary consultation is requested. Evaluation typically includes assessment of utility of thoracentesis or tube thoracostomy. However, chronic pleural effusions present a diagnostic and therapeutic quandary. These long-standing fluid collections can result in organization and a “trapped lung”, which fails to re-expand on removal of pleural fluid. Also, chronic atelectasis from mass effect or endobronchial obstruction would generate a non-expandable lung within a chronic pleural effusion. Pursuit of pleural intervention, without the ability to predict an immobile lung, exposes the patient to undue harm by an unwarranted procedure. Bedside chest ultrasound (US) done at the time of patient visit by the pulmonary fellow has become standard of care at our institution in the management of pleural disease. Sinusoid sign, a dynamic finding on chest US by M-Mode, demonstrates free movement of lung parenchyma with respiratory effort (fig. 1).

Objective

This case series describes our recent experience that absence of sinusoid sign is a means of predicting the physiology of trapped lung.

Methods

Case #1

A 63 year-old (y/o) male presenting with increasing shortness of breath (SOB). A large pleural effusion was seen on computed tomography (CT). The effusion was confirmed by US, with an absence of sinusoid sign (fig. 2) noted on M-mode. The effusion was drained, and repeat CT showed trapped lung (fig. 3).

Case #2

A 65 y/o male presenting with SOB and right pleuritic chest pain. CT showed a complex pleural effusion. As he was not a surgical candidate due to severe COPD, fibrinolytic therapy by chest tube was pursued, limited by discomfort. US showed a small effusion and absence of sinusoid sign. Repeat CT confirmed a partially re-expanded lung with persistent effusion. Chest tube was safely removed as trapped lung was present.

Case #3

A 64 y/o male with history of chronic right pleural effusion status-post surgical decortication and pleurodesis presenting with acute SOB. New left effusion was seen on CT. US confirmed the effusion and absence of sinusoid sign. Post-thoracentesis CT revealed trapped lung.

Results

Three cases of trapped lung were evaluated, all of which were found retrospectively to have absence of sinusoid sign by chest US. In our experience using US for pleural interventions, the presence of sinusoid sign has always correlated with an expandable lung.

Conclusion

This case series demonstrates that Absence of Sinusoid Sign can be a pertinent finding to predict trapped lung during pleural effusion evaluation, indicating an immobile lung which wouldn't expand after pleural drainage. Prospective clinical investigation is warranted, including correlation of US with pleural pressures and patient outcomes, however we've demonstrated the role of chest US as an indispensable tool in the immediate bedside evaluation and management of pleural disease.

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Meta Information

Submission ID:	25	Student Submission:	0
Format:	Poster		
Topic:	New Uses		

Technical Physicians – a new medical professional using Ultrasound

Since 2003 University of Twente trains students as Technical Physicians (TP): a new academic professional who improves diagnosis and therapy in the direct patient care by safe and innovative use of medical technology. Technical Medicine as an education fills the gap between classical medical education and complex technology. After graduation each TP has the knowledge, skills and problem solving attitude to design and safely apply improved diagnostics and therapeutics in direct patient care.

This interdisciplinary study has a three years Bachelor's and a three years Master's Program. The last specializes in two tracks: Medical Imaging & Intervention and Medical Sensing & Stimulation. Students are trained in our state-of-the-art simulated learning environment (Experimental Center for Technical Medicine; ECTM) and on the job in two years rotating clinical internships at academic and teaching hospitals. After graduation they work in the direct and individual patient care as legally certified Technical Physicians. Currently we have approximately 160 graduated Technical Physicians and over 100 internship locations both national and international (e.g.: University Hospital Leiden, Amsterdam University Hospital, Utrecht University Hospital, Yale University School of Medicine, Guy's Hospital (London) and the University of Florida).

The TP is an expert in all imaging modalities. The essential concepts of light (spectroscopy), sound (ultrasound), radiation (CT and x-ray) and magnetism (MRI) are taught in the context of the human anatomy and (patho) physiology. Since ultrasound is a popular imaging technology it is incorporated as a theme running through the whole educational program. The students are taught in deeper understanding and insight of the principals of ultrasound both by lectures and practical work.

Practical work includes phantom measurements (e.g. measuring US transitions by placement of pipes of different composition in a phantom or flow measurements (Figures 1 and 2)) and hands-on supervised clinical use of the ultrasound machine. This combination of a thorough technical and medical background and basic understanding of hands-on-use enables the TP to use ultrasound innovative in medical research and practice and analyze the results from a different perspective than Technicians or Physicians. The TP is able to predict in what case US is the optimal imaging modality to use in order to get the best picture of the underlying tissue and acts accordingly.

In order to obtain and extent the level of knowledge and skills post-graduate courses are offered by the specialists at the ECTM. During this course lectures on technology are combined with training on simulators to understand plain perception and 'knobology'. The training is completed with structured clinical hands-on training to translate knowledge to clinical work, ensures adequate ultrasound training for Technical Physicians. This combination of three learning methods is a unique training design, especially developed to train the TP.

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Meta Information

Submission ID:	26	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

Lung ultrasound performed by nurses to check for correct lung exclusion in thoracic surgery.

Fiber optic bronchoscopy is the standard technique to assess correct double lumen endotracheal tubes positioning before one-lung ventilation. However it requires a trained anesthesiologist and is resources and time consuming. Aim of this study is to compare it with thoracic ultrasound in terms of sensibility, specificity and cost-effectiveness. We designed a case-control, cross-over study, in which lung exclusion was assessed both via standard bronchoscopy and thoracic ultrasound, performed by a trained anesthesiologist nurse.

A continuous cohort of adult patients undergoing thoracic surgery on one-lung ventilation with a left double lumen tube, underwent first fiberoptic control, followed by thoracic ultrasound. The anesthesiologist and the nurse were both blinded to each other's verdict.

A total of 51 patients were included over a period of 5 months. The two techniques resulted to be equally sensitive and specific, but thoracic ultrasound was associated to a significantly quicker execution, which, together with personnel costs, material costs and costs of sterilization, had a significant economic impact. Net saving per case was 37.2±5.4 Euros, which translated into a total reduction in hospital costs of 7'810.72±52.7 Euros.

Even though bronchoscopy still remains the gold standard, thoracic ultrasound could be a specific, sensitive and cost-effective alternative method to quickly confirm correct lung exclusion when a left double lumen tube is used.

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Meta Information

Submission ID: 27 Student Submission: 0
Format: Poster

Topic: New Uses

Pre-course case-based E-learning can potentially reduce attendance time in point-of-care ultrasound courses

Background

Theoretical knowledge (TK), visual perception (VP) and sensorimotor skills (MS) are key elements in ultrasound education. Frontal, class -room based presentations are routinely used to teach TK. VP and MS are trained during hands-on sessions (HOT).

We wanted to study the effect of frontal presentations and case-based e-Learning on the performance in HOT.

Methods

60 medical students were randomized into 2x2 groups (G1-4).

G1 and G3 (n= 29) were subject to a pre-course E-learning, based on short screencasts (5min), a discussion of 60 min and a HOT session on the day of the course. G 2 and G4 (n=31) were presented frontal presentations on the day of the course before the HOT. All G completed a multiple choice (MC) pre-test (test A), HOT sessions, a practical post-course test (test PT) and MC tests after the HOT (test B) and one day after the course (test C). Data of groups 1 and 3 as well as 2 and 4 were pooled, the Mann-Whithney U-test was used for statistical analysis.

Results

G 1 and 3 performed significantly better in test A (mean 79.6; median 84.2; 95% CI 73.2-85.9) compared to G 2 and 4 (65.9; 65.8; 60.3-71.6) who had not participated in case-based E-learning ($p < 0.05$) (Fig.1). No significant difference between G 1/3 and G2/4 were found in tests PT, B and C.

Conclusion

In preparation to HOT sessions case-based E-learning is an effective method of education and can reduce attendance time in ultrasound courses.

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Meta Information

Submission ID: 28 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Point-of-Care ultrasound-guided diagnosis and manual detorsion in cases of acute testicular torsion

Study objective:

Manual detorsion is a safe, non-invasive, and quick method of restoring blood flow to an ischemic testicle that increases the probability of testicular salvage in cases of acute testicular torsion. A systematic review of all published series of manual detorsion over the past 40 years that included at least 4 or more patients demonstrates an approximately 80% success rate (143/177) of pre-operative manual detorsion. Most literature to date has used clinical end-points such as pain relief and restoration of clinical exam findings to determine success. No studies to date have reported on the bedside ultrasound performed by Emergency Physicians to diagnose torsion or to determine the end-point for pre-operative manual detorsion. We analyzed data from a retrospective cohort of seven cases of acute torsion from our Emergency Department in which ultrasound-guided diagnosis and detorsion was performed at the bedside by Emergency Physicians to determine: 1) findings used by the EP to diagnose torsion 2) findings used to determine end-point for detorsion and 3) the success rate of US-guided bedside detorsion.

Methods:

This was a retrospective review of 7 patients from our institution who underwent Ultrasound-guided bedside detorsion in cases of known or suspected testicular torsion during a 5 year period. Screening for patients to include in the study was done by systematically reviewing our in-house Ultrasound archive for testicular exams. Patients were included if the initial US showed decreased or complete absence of flow by color Doppler or color power Doppler and onset of symptoms was less than 24 hours prior to ED presentation. Seven patients met criteria. Patient's charts were then reviewed for demographic information, time to presentation, time from triage to ED detorsion, medications administered, bedside and formal US findings, surgical course, and follow-up imaging and clinic notes.

Results: 7 patients aged 13-39 underwent ultrasound-guided bedside detorsion for acute testicular pain of less than 24 hours duration over the study period. Time from onset to ED detorsion ranged from 1.5 hrs to 12 hrs. Median time was 3 hours. Diagnosis was made by absence of flow on CPD or color Doppler in 4/7 patients and decreased flow relative to unaffected side in 3/7 patients. All 7 patients had return of color flow or increased flow after bedside detorsion. 4/7 patients were taken to OR for exploration and orchiopexy. All 4 of these patients were noted to be anatomically detorsed with a viable testicle at time at surgery. 3/7 patients refused operative intervention. Two of these patients were seen in follow-up and had no further complaints of testicular pain and one of them had an elective orchiopexy 4 months later and had a normal testicle at time of operation. One patient was lost to follow up.

Time from onset of pain to ED detorsion ranged from 1.5 hrs to 14 hours, median time 3 hours. Time from ED triage to detorsion ranged from 0.5 – 2 hours, median 0.5 hours. 6/7 patients received analgesia. 2/7 patients received sedation. There were no known complications from the ED intervention.

Conclusions:

The results of our retrospective study suggest that Ultrasound-guided diagnosis and detorsion performed at the bedside by the EPs is safe and effective at restoring blood flow to an acutely torsed testicle. Our experience also demonstrates that the objective end-point of restoration of flow by CPD or color Doppler is associated with anatomic detorsion at time of surgical exploration. Furthermore, our results suggest that use of analgesics and sedation do not compromise the operators ability to determine the end-point of the procedure.

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Meta Information

Submission ID:	30	Student Submission:	0
Format:	Poster		

Topic: Point of Care ultrasound in general clinical practice

A prospective evaluation of real-time, transverse tracheal ultrasound in the evaluation of emergent intubation by minimally trained practitioners

Securing a definitive airway via endotracheal intubation is often necessary in the management of critically ill patients in an emergency department (ED) setting. Despite the large number of ED intubations, there continue to be challenges in confirming correct placement of endotracheal tube with studies reporting the rate of esophageal intubation between 1-24%. Inability to detect an improperly placed endotracheal tube can lead to disastrous outcomes such as death or hypoxic brain injury if not discovered and corrected quickly. In our study, the primary objective is to determine if minimally trained Emergency Medicine resident physicians can confirm correct placement of endotracheal intubation using bedside ultrasound in real time. This study will compare immediate bedside ultrasound interpretation with CO2 color change, direct visualization by intubator and post procedural chest x-ray for placement. A secondary objective will be to determine if level of training plays a role in the ability of a sonographer to determine endotracheal versus esophageal intubation. This was a multi-center, prospective, cohort study designed to assess the diagnostic accuracy of real-time Emergency Department (ED) bedside ultrasound in confirming position of endotracheal intubation. To date, 41 patients have been enrolled with a sensitivity of 96% and a specificity of 100%. Although our results are promising, further larger clinical studies must be performed to thoroughly evaluate the usefulness of bedside ultrasound to confirm tube placement during emergent intubation.

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Meta Information

Submission ID: 31 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Incorporation of Didactic and Hands-on Ultrasound Skills into a Gross Anatomy Course

Introduction

The introduction of ultrasound in undergraduate medical education is gaining momentum across the country. There are many challenges in incorporating both didactic and hands-on learning of ultrasound, which is critical for developing ultrasound skills. Here we outline the challenges, successes and lessons learned after implementation of ultrasound into the medical gross anatomy course at West Virginia University.

Methods

Over the past 2 years, 6 hours of didactic lectures were added into the gross anatomy course as part of a longitudinal ultrasound thread within the WVU SOM. In addition, 6 dedicated hands-on skills labs were added to the gross anatomy curriculum. Ultrasound skills labs were held in conjunction with gross anatomy labs, where select students rotated out of limited portions of gross anatomy lab to attend ultrasound lab. Ultrasound content was organized to coincide with or immediately follow the content of the anatomy curriculum. Finally, brief ultrasound technical skill quizzes, a final hands-on ultrasound practical, and incorporation of ultrasound material into gross anatomy written examinations were included for assessment.

Results

All ultrasound material was required for students. Post semester student surveys conveyed that the curriculum was well received by students and seen as valuable. The students performed very well on assessments of ultrasound knowledge and skills. Student feedback was used to modify the scheduling and delivery of the lab sessions.

Challenges: Time in curriculum, time and space for labs, evaluation of student knowledge and skill, coordination and timing of a large number of students moving between labs, equipment, instructor time.

Successes: Small student: machine: instructor ratios, perceived improvements in student interaction with patients, satisfactory student performance on assessments, minimal disruption of and effective coordination with anatomy curricular content

Lessons learned: Planning for such a large scale project requires significant time prior to implementation, scheduling multiple labs allows for smaller groups, assessment helps keep students engaged, laboratory guides improve lab efficiency and workflow, collaboration with gross anatomy faculty improves content

Discussion

With many medical schools attempting to integrate ultrasound into preclinical undergraduate medical education, each institution will face unique challenges and have variable resources, particularly in implementing hands-on material. We

present one model incorporated within our school's existing structure that we hope can serve to assist other schools in similar situations.

Conclusion

There are many challenges in incorporating hands-on ultrasound material into a gross anatomy curriculum. The authors present one possible model for incorporation that has been successful and well received.

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Meta Information

Submission ID: 32 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Ultrasound-guided, percutaneous liver biopsy as a day-case procedure: Five-year experience at a single institution.

Background: Percutaneous liver biopsy is a commonly performed procedure and is an important tool in the diagnosis and management of parenchymal liver disease.

Purpose: The purpose of this study was to determine the technical success and complication rates of ultrasound-guided, percutaneous liver biopsy performed as a day-case procedure at our institution over a 5-year period.

Methods: A retrospective review was undertaken of all day-case liver biopsies performed for parenchymal liver disease at our institution between January 2009 and March 2014. Data collected included: patient demographics; needle type and size; the indication for the procedure; pathology results; and procedure-related complications.

Results: A total of 78 biopsies were performed. The mean age was 46.6 years and 47/78 (60.3%) patients were female. An 18G automatic needle was used in all cases. In 77/78 (98.7%) cases the right lobe of the liver was biopsied. The indications for the procedure were hepatitis C (43/78, 55.1%), autoimmune hepatitis (11/78, 14.1%), primary biliary cirrhosis (4/78, 5.1%), hepatitis B (2/78, 2.6%), cryptogenic fibrosis (1/78, 1.3%), schistosomiasis (1/78, 1.3%), and abnormal liver function tests of unknown cause (16/78, 20.5%). In 77/78 (98.7%) cases the tissue sample obtained was considered adequate for histological analysis. The degree of fibrosis was none/mild in 39/77 (50.6%), moderate in 16/77 (20.8%) and severe/cirrhotic in 22/77 (28.6%) cases. Three patients (3.9%) required admission, one for severe post-procedural pain and two for symptomatic haemorrhage, one of whom required transfusion. There were no fatalities seen in this patient series.

Conclusions: Ultrasound-guided, percutaneous liver biopsy can be safely and effectively carried out as a day-case procedure when performed by an experienced operator.

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Meta Information

Submission ID: 34 Student Submission: 0
Format: Poster

Topic: Patient Safety

Medical student Ultra Sound Training - A MUST for Medical Students ; First Ever Procedural Ultrasound Training for Medical Students in the UK

Introduction:

The use of ultrasound to guide invasive procedures is steadily growing. The increased accuracy, decreased complications and overall patient and clinician satisfaction of ultrasound-guided procedures makes it a useful skill to acquire. In this study we have sought to explore whether basic procedural ultrasound training in the form of ultrasound guided peripheral venous cannulation and arterial blood gas sampling can be taught to medical students by focusing on generic skills that could be individually assessed.

Method:

All 5th year medical students who attended clinical placements at Dewsbury and District Hospital were enrolled in this training course. A pre course questionnaire was given to ascertain previous training in medical ultrasound. This was followed by 70 minutes of didactic teaching and 120 minutes of supervised scanning. The didactic teaching covered basic physics of ultrasound, knobology, governance and a lecture demonstrating the procedure. The scan practice was on ultrasound compatible training blocks, phantoms and live models using a linear transducer. Finally the students were assessed formatively using a seven-component competency assessment tool created using Kirk-Patrick learning and training model. All the students were assessed on ultrasound compatible training blocks. Experienced clinical staff competent in the procedure delivered the teaching and assessments.

Results:

Total of 59 students were enrolled on to this training course. 94.9%

(n=56) did not have any training in medical ultrasound. Only 5.1%

(n=3) had training, which was informal. 89.8% (n=53) of the students were able to independently optimise the images on the ultrasound training block. 84.7% (n=50) students were able to independently stabilise the transducer on the ultrasound training block. 91.5% (n=54) of students were able to achieve both longitudinal and transverse images of the vessels on the ultrasound training block independently. 74.6% (n = 44) students were able to insert the needle into the vessels on the ultrasound training block on both longitudinal and transverse planes independently demonstrating the ability to track the needle. Students who were unable to achieve the above independently succeeded after a minimal prompt. Prompting was needed mainly in the area of probe stabilisation.

Conclusion:

To the best of our knowledge this is the first ever procedural ultrasound training course conducted in the UK for medical students. The majority of students were able to demonstrate the generic procedural ultrasound skill independently with limited training.

This study suggests that skills requiring hand-eye co-ordination such as transducer stabilisation is more challenging for students. This needs to be more intensively targeted in procedural ultrasound training programmes designed for medical students.

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Meta Information

Submission ID:	35	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

JUST for FY2s - Junior doctor Ultra Sound Training for FY2s; Creating a new generation of Ultrasound savvy Foundation Doctors in the UK

Introduction

Ultrasound guidance for peripheral intravenous access (IV Access) and arterial blood gas sampling (ABG Sampling) in patients with difficult vascular access is currently utilised by trained senior clinicians especially in Emergency Medicine and Anaesthesiology. However junior doctors are called upon more often to perform difficult peripheral IV access and ABG sampling as the first point of contact and are therefore the ones who are most in need of this skill. Therefore a training programme was devised to ascertain whether foundation year two doctors, FY2s (first year post intern) could successfully acquire this skill with a short training course.

Method

All FY2s in Yorkshire and Humber region, UK were invited to apply for the course. A pre course questionnaire was given to the enrolled FY2s to ascertain previous training in medical ultrasound. This was followed by 70 minutes of didactic teaching and 120 minutes of supervised scanning. The didactic teaching covered basic physics of ultrasound, knobology, governance and a lecture demonstrating the procedure. The scan practice was on ultrasound compatible training blocks, phantoms and live models using a linear transducer. Finally the FY2s were assessed formatively using a seven-component competency assessment tool created using the Kirk-Patrick learning and training model. All FY2s were assessed on ultrasound compatible training blocks. The teaching and assessments were delivered by experienced clinical staff competent in the procedure.

Results

As there was a very high demand for the course, additional dates were opened to accommodate all 94 FY2 who applied for it. 87 completed the pre-course questionnaire. 85.0% (n =74) did not have any training in medical ultrasound. Only 15% (n = 13) had training, which was mostly informal. After the short training course 95.7% (n=90) of the FY2s were able to independently optimize the images and 96.8% (n= 91) FY2s were able to independently stabilize the transducer on the ultrasound training block.

91.5% (n =86) of FY2s were able to achieve both longitudinal and transverse images of the vessels independently and 86.2% (n = 81) were able to insert the needle into the vessels on both longitudinal and transverse planes independently demonstrating the ability to track the needle. FY2s who were unable to achieve the above independently succeeded after a minimal prompt.

Conclusion

To the best of our knowledge this is the first ever procedural ultrasound training course conducted in the UK aimed at Foundation Year 2 doctors.

This study shows encouraging signs that ultrasound guided IV access and ABG sampling could be successfully taught to first year post intern doctors with a short training course.

The overwhelming demand for the course also highlights that this course is addressing an unmet need amongst junior doctors.

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Meta Information

Submission ID: 36 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Point of care ultrasound course for undergraduate medical students: preliminary results.

Background

Point of care ultrasound has been recognized as an outstanding semiotic tool and has been innovating the way of all the medical community learns, teaches and practices medicine. As ultrasound could be “the new stethoscope” in next future, medical schools should update their curriculum by introducing the teaching of this competency for undergraduate students empowering its incorporation into medical care, especially in emergency and critical medicine.

Summary of Work

Since October 2013, a blended-learning point of care ultrasound course has been introduced to last year students of a medical school in Brazil, during their Emergency Medicine rotation. The course consists of twenty-hour theoretical and practical classes, and an on line education platform that proposes scenarios in which point of care ultrasound may have improved clinical management. Students answered a test on four occasions: course’s first day (Pre-Test = PRE) course’s last day (Post-Test = PoT), 60 days after course’s end (PoT60) and 180 days after course’s end (PoT180). At the end of the course, students were asked to evaluate it through a satisfaction questionnaire.

Summary of Results

Preliminary data shows statistical difference ($p<0,01$) between the pre and the post-tests, revealing improvement in medium score from 38% correct answers in PRE (medium score=15,32/SD+/-3,4) to 83,7% in PoT (medium score=33,5/SD+/-2,6), 80,9% in PoT60 (medium score=32,3/SD+/-4,14) and 78,8% in PoT180 (medium score=31,5/SD+/-3,12) There was no statistical difference among post-tests (PoT, PoT60 and PoT180).

In their satisfaction questionnaire, students positively evaluated the course/method, classifying point of care ultrasound as a “great semiotic tool” that helps “anatomical comprehension”, “clinical reasoning”, and “improvement in diagnosis quickness and accuracy”.

Conclusions

Point of care ultrasound is easily learned by undergraduate medical students and theoretical knowledge is rapidly achievable presenting a steep learning curve.

Take Home Message

Point of care ultrasound may become “the new stethoscope” for physicians and teaching it to undergraduate students could empower this evolution in medical practice.

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Meta Information

Submission ID:	37	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

A proposed curriculum for educating paramedics and other out-of-hospital providers on the use of ultrasound in the field setting

Introduction: Use of ultrasound technology is still novel in the out-of-hospital setting, but it is an area of tremendous interest. Emergency medical care is a continuum that begins when emergency medical services (EMS) providers make first contact with a patient. It has been suggested that expanding the use of ultrasound into the prehospital environment could lead to more rapid diagnosis of potentially life-threatening conditions and improve patient outcomes. New Mexico is a prime location to begin evaluating the feasibility and efficacy of prehospital ultrasound training, being that it is a largely rural/frontier state with long EMS transport times, and sparse advanced care facilities. Methods: The University of New Mexico Department EMS Academy is the largest training institution for paramedics and emergency medical technicians (EMTs) in New Mexico. For two semesters, a prehospital ultrasonography course has been taught to paramedics at the University of New Mexico EMS Academy. Each semester, the course met for 14 class sessions, occurring once weekly for 3 hours. Ultrasound topics covered in the course included: basic physics and knobology, the E-FAST exam, pulmonary ultrasound findings, assessment of the aorta and inferior vena cava, deep venous thrombosis exam, ultrasound guidance for the placement of peripheral intravenous catheters, basic echocardiography, fetal assessment, soft tissue abnormalities, retinal assessment and measurement of optic nerve sheath diameter. These exams have the potential to provide the out-of-hospital provider with the most pertinent clinical information, to identify of a life-threatening problem, or to change resource utilization and hospital destination decision-making. Students were evaluated with midterm and final written and practical examinations, as well as in-class quizzes and journal club written assignments. A timed E-FAST exam and the ability to perform a 4-view cardiac ultrasound assessment were part of the students' final examination for the course. Fourteen students' performance on these tasks was retrospectively reviewed. Results: The average time for completion of an E-FAST exam was 148.6 seconds. Ten of the 14 students were able to obtain all 4 cardiac ultrasound views on their examination. Conclusion: After 42 hours of classroom education, paramedics are able to quickly perform E-FAST exams, and the majority of the students evaluated were able to perform basic echocardiography. A prehospital ultrasound curriculum should focus on identifying life-threatening conditions which require immediate treatment, alter the patient's destination for definitive care, or provide justification for resource utilization such as air medical transport.

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Meta Information

Submission ID: 38 Student Submission: 0
Format: Oral

Topic: New Uses

The Rural Obstetrical Ultrasound Triage Exam (ROUTE): Teaching Obstetrical Ultrasound To Healthcare Workers In A Rural Low-Resource International Setting

INTRODUCTION: The purpose of this pilot study was to determine the feasibility of training rural healthcare workers, with little to no prior ultrasound experience, in the Rural Obstetrical Ultrasound Triage Exam (ROUTE). The ROUTE was developed to establish a diagnostic algorithm for the use of portable ultrasound in rural areas as a means of triaging obstetrical patients for future maternal or fetal complication risk. Healthcare workers were associates of Floating Doctors, a nonprofit medical relief organization providing services to indigenous communities in Panama. Participants included Panamanian physicians, nurses, Red Cross volunteers and Ministry of Health employees.

METHODS: Healthcare workers received a two-hour presentation on basic ultrasound techniques and the ROUTE, followed by six hours of hands-on sessions with standardized subjects and an ultrasound simulation program. The course was taught by medical students who completed a year-long ultrasound program at the University of California, Irvine School of Medicine and an average of twelve hours of additional training in obstetrical ultrasound with certified ultrasound technicians and obstetricians. Attitudes about obstetrical ultrasound, as well as prior experience and knowledge with the technology, were assessed with a twenty-item survey. Upon completion of the course, the same survey was given to assess knowledge gained and changes in attitudes. Healthcare workers then performed ROUTE scans on obstetrical patients to whom they were blinded. All scans were read in real time by trained medical students. Practical skills were assessed by comparison to the trained medical students who served as controls.

RESULTS: Following the didactic sessions, knowledge in obstetrical ultrasound improved from 31.31% correct on pre-course surveys to 70.71% on post-course surveys (n=12). In both pre- and post-course surveys, healthcare workers reported that they felt obstetrical ultrasound was safe for both mother and fetus and that the technology was either useful or very useful in the healthcare setting in which they practice. They were able to accurately assess fetal number (n=26), fetal presentation (n=10) and presence of gross abnormalities (n=26) on 100% of scans. Placenta location was correctly assessed 76% of the time (n=25). On average, healthcare workers dated pregnancies based on crown-rump length (CRL) within 7 days (n=7) and biparietal diameter (BPD) within 12 days (n=10) of the trained medical student controls. Average healthcare worker amniotic fluid index (AFI) measurements were within 2.2cm (n=8) of the medical student controls.

CONCLUSION: This feasibility study found that rural healthcare workers are able to successfully learn the ROUTE exam following 8 hours of didactic and hands-on training. With this evidence, Floating Doctors plans to create a sustainable obstetrical ultrasound program so they can positively impact pregnancy management. Limitations included lack of familiarity with the multiple-choice testing method among some healthcare workers, which may have impacted pre- and post-course survey scores.

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Meta Information

Submission ID: 39 Student Submission: 1
Format: Oral

Topic: Point of Care ultrasound in health care delivery to underserved populations

Recombinant Technology: The Future of POCUS!

The use of point-of-care ultrasound (POCUS) continues to grow within the practice of medicine worldwide. Predictably, the ultrasound technology driving this growth has become cheaper, smaller and more powerful according to Moore's Law. However, little recombination with other emerging technologies has taken place until recently.

The emergence of exponential, information-based technologies is radically transforming all aspects of life. Technologies such as robotics, artificial intelligence, biotechnology and bioinformatics, networks and computing, energy systems and nanotechnology are disrupting industries, companies, careers and lives.

The potential for these technologies to be spliced or recombined with POCUS in new and exciting ways is unlimited. This poster offers a glimpse at the impact on POCUS practice and education.

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Meta Information

Submission ID:	40	Student Submission:	0
Format:	Poster		
Topic:	Technology		

P2Lead: Bringing the PEM POCUS Leadership Community Together!

The role of point-of-care ultrasound (POCUS) continues to mature in the practice of pediatric emergency medicine (PEM) worldwide. Many academic PEM programs across North America have begun to incorporate the technology both in clinical practice and in PEM Fellowship training. However, implementation and capacity building has been slow. Barriers such as bureaucratic inertia, resource constraint, lack of expertise and impractical expectations have proven challenging at many sites.

On May 28, 2014, PEM POCUS leaders representing the major pediatric institutions in Canada and the United States gathered in Toronto, Ontario for an event called P2Lead or PEM POCUS Lead. Over the course of two days, these 46 PEM POCUS leaders participated in a series of orchestrated small and large group discussions. Crowd-sourced topics were formulated using pre-event surveys and focused on four key areas: administration, research, education and innovation. Specific topics included: quality assurance, clinical workflow, intra-hospital collaboration, faculty engagement, competency in training, collaborative research logistics, group communication and near term priorities. Social events to promote networking completed the agenda.

Participants were offered a venue to share their personal barriers and challenges, and to elicit the collective experience of the group. Solutions were suggested and explored with equal voice given to all leaders regardless of program maturity or size. The enthusiasm and optimism created by the event was evident in the feedback. Comments reflected the high value of this shared experience at both the individual and group level.

As P2Lead concluded, the group decided to develop an organizational structure to support ongoing collaboration. Formal efforts are now underway to delineate priorities and strategy.

More importantly, informal collaboration has been growing exponentially as a result of expanded networking and mentorship.

P2Lead demonstrates the desire of the PEM POCUS leadership community to collaborate on an international scale and provides a simple model of how POCUS leaders within a subspecialty or area of interest can come together to begin the process of building a collaborative network.

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Meta Information

Submission ID: 41 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Utilization of 3D printing to create low-cost, high fidelity ultrasound phantoms

BACKGROUND: Currently available commercial ultrasound (US) phantoms have flaws. They are expensive, they often have poor anatomic fidelity, and for some procedures, such as shoulder joint injections, do not exist. There are low-cost, do-it-yourself (DIY) phantoms that typically are either gelatin castings containing embedded objects or animal tissue. Flaws of these models are low anatomic fidelity, lack of durability, and the use of animal tissue. With three-dimensional (3D) printing technology it is possible to address some of these flaws and fabricate better DIY phantoms.

OBJECTIVE: To create an inexpensive US phantom for shoulder joint injection training that has a high degree of anatomic fidelity by integrating 3D printing technology with previously described DIY techniques.

METHODS: To design the phantom, open-source STL files of pertinent anatomy were downloaded from BodyParts3D (http://lifesciencedb.jp/bp3d/). The STL files were imported into Freeform Plus (3D Systems) and refined in a digital clay environment. Verification of bone/muscle attachment and minor adaption of muscle bodies were performed. Additionally, ligaments were manually created. The STL files were exported, registration bocks were added, and the files were prepared for fabrication (Magics, Materialise) on a Connex 500 (Stratasys) additive manufacturing machine/3D printer. The insert was fabricated using Vero White to represent bone and Tango Black Plus to represent muscle/tendon/ligament. Approximate material costs were $150. A mold was created using the downloaded skin surface file. Again, minor adaptions were made using Freeform Plus. The surface was then used to create a 3mm thick shell mold of the soft tissue. The neck region was removed for filling and registration holes were added. The mold was manufactured on a SLA 7000 (3D Systems) from Accura 7570. Approximate material costs were $100. The insert and mold were then assembled and filled with a 10% by weight gelatin mixture (Knox® unflavored gelatin) containing 14g suspended psyllium husk (Metamucil® fiber powder) per liter of gelatin. Approximate material costs were $30. Imaging of the phantom was performed using a M-Turbo® (Sonosite) portable US machine.

RESULTS: A shoulder joint injection US phantom that exhibits high anatomic fidelity with a material cost of approximately $280 was successfully created.

CONCLUSIONS: With 3D printing resources we created a low-cost, anatomically correct shoulder phantom that will enhance US training for joint injections. Possible refinements include replacing gelatin with a more durable material such as silicone or other readily available casting compound. Additionally, developments in 3D printing will increase the number of available printing materials. Characterization of the sonographic properties of these materials is needed. Increasing affordability of 3D printing technology, along with research in materials will make inexpensive, anatomically accurate, and durable DIY training phantoms a feasible reality.

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Meta Information

Submission ID:	42	Student Submission:	0
Format:	Poster		
Topic:	Technology		

Teaching Procedural Ultrasound to Medical Students, Is it too early?

Introduction:

Ultrasound guided medical procedures are mostly performed by senior clinicians. Increasingly medical schools are introducing ultrasound to medical students for educational and diagnostic purposes. In this study we have sought to ascertain whether there is a significant difference between skill acquisition in basic procedural ultrasound between medical students and postgraduate doctors.

Method:

The two groups compared were 5th year medical students of the Leeds Medical School who attended clinical placements at Dewsbury and District Hospital and Foundation Year 2 (FY2s) doctors working in the Yorkshire and Humber region, UK. The procedure utilised for the assessment was ultrasound guided peripheral intravenous access and arterial blood gas sampling.

A pre course questionnaire was given to both groups to ascertain previous training in medical ultrasound. Then both groups underwent a short training course of 70 minutes of didactic teaching and 120 minutes of supervised scanning. Finally both groups were assessed formatively using a seven-component competency assessment tool created using Kirk-Patrick learning and training model. Both groups were assessed on ultrasound compatible training blocks. Experienced clinical staff competent in the procedure delivered the teaching and assessments. Fisher's exact test was applied to calculate the statistical significance of the prior medical ultrasound training and outcomes in competency assessment between the two groups.

Results:

59 medical students and 94 FY2s were enrolled on to this training course.

5% (n=3) medical students had received training in various diagnostic and procedural ultrasound skills where as 15% (n= 13) of FY2s had the same (p= 0.10). These training were informal for both groups.

The outcomes of the competency assessment of both groups are given in table 1.

There was no significant difference between the prior ultrasound training that both groups received. There was no significant difference in image acquisition and optimisation and performing the overall procedure.

The only significant difference was in maintaining transducer stabilisation while performing the procedure where medical students who found transducer stabilisation challenging but still were able to achieve the procedure following minimal prompting on stabilisation.

Conclusion:

To the best of our knowledge this is the first ever procedural ultrasound training course in the UK which compared medical students and FY2s in the competency of performing ultrasound guided peripheral IV access and ABG sampling in a controlled setting.

The only component that the medical students found challenging was the transducer stabilisation and yet with minimal prompt, they were able to achieve this.

This encourages the medical educators to concentrate on transducer stabilisation when teaching medical students procedural ultrasound training in the future.

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Meta Information

Submission ID:	44	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

Estimation of spleen size by medical residents with hand carried ultrasound

Objective: Physical examination can identify easily palpable splenomegaly, but evaluating lesser degrees of splenomegaly is problematic. Hand carried ultrasound (HCU) allows rapid bedside assessment of patients. We conducted this study to determine if a brief educational intervention would allow medical residents to reliably assess spleen size using HCU.

Methods: PGY 1 Internal medicine residents were shown a brief (45 min) powerpoint presentation on the basics of ultrasound, the use of an HCU device (Vscan, GE) and principles of splenic sonography. They were allowed to practice on each other using the HCU to assess spleen size for one hour, in the presence of an instructor.

Patients with varying degrees of splenomegaly were recruited from the hematology clinics and staff at UBC. A sonographer measured spleen size in each patient using conventional ultrasound (CU; Ultrasonix, SonixTouch, Richmond, BC). Subsequently, the trained medical residents scanned the same patients using the HCU, blinded to the sonographer's measurements. The instructor was not present during scanning.

Results: Thirteen first year residents (all with minimal prior ultrasound training) and 19 patients (BMI 24.3 ± 1.6 kg/m2; 10 M/9 F) were recruited. The greatest longitudinal measurement was 14.0 ± 0.4cm with CU and 12.6 ± 0.4 cm with HCU ($p<0.05$). The correlation between CU performed by a sonographer and HCU performed by a resident was $r=0.85$ ($p<0.0001$).

Conclusions: We have shown that minimal training of residents will allow them to reliably assess spleen size at point of care using HCU, although they appear to underestimate the actual size by about one cm. We believe that our findings, if replicated in other centres and in different clinical scenarios, may change the process by which clinicians examine the spleen.

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Meta Information

Submission ID: 45 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Assessing the Accuracy of Bedside Compression Ultrasonography for the Diagnosis of Proximal Lower Extremity Deep Vein Thrombosis (DVT) Performed by Internal Medicine Residents

Introduction: Limitation in the availability of ultrasonography at our institution prompted us to launch bedside compression ultrasonography (BCU) training in our internal medicine residency program. To evaluate the accuracy of BCU performed by internal medicine residents for the diagnosis of DVT, we designed a study to compare the results of resident performed BCU with technician performed studies interpreted by a radiologist (TPS).

Method: Over a four month period, we conducted a consecutive sampling of all patients admitted by internal medicine residents who performed a BCU at the time of admission if DVT was clinically suspected. The results were compared to a TPS. Prior to enrollment, all 21 categorical internal medicine residents attended a (1hour) didactic and participated in supervised hands-on compression ultrasonography training for the detection of proximal DVT.

Results: A total of 23 patients were included in the study. All patients received bilateral compression ultrasonography in accordance to published guidelines. 5 senior residents performed 23 studies. The patients ranged in ages from 33 to 79 years and the Body Mass Index (BMI) ranged from 22 to 51. Three patients had a BMI greater than 40. Eight (8) studies (patients) performed by the residents and interpreted as positive were confirmed by a radiologist's interpretation. 14 studies (patients) performed by the residents and interpreted as negative were confirmed by the formal interpretation. In one patient with a BMI of 46, the resident could not visualize the veins adequately and reported the results as un-interpretable; the formal result was positive. (This case was included in the sensitivity data, but excluded from the predictive values. It was treated as a positive study until receipt of the formal interpretation). Diagnostic characteristics of resident BCU (with 95% confidence intervals) are: specificity 100% (81%-100%); sensitivity 89% (56%-99%); positive predictive value 100% (69%-100%); negative predictive value (NPV) 100% (81%-100%). Due to the small sample size we could not show that NPV and specificity significantly exceed 95% (p=0.49 for both).

Conclusion: Following a didactic session and supervised hands-on–training, Internal medicine residents can with great accuracy perform compression ultrasonography for the diagnosis of proximal lower extremity DVT. Inability to visualize the veins in patients with a clinical suspicion of DVT, would always require a formal study (example, the patient with a BMI of 46). With a NPV and specificity of 100%, the major advantage of resident performed BCU would be avoiding unnecessary anticoagulation of patients requiring hospitalization.

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Meta Information

Submission ID:	46	Student Submission:	0
Format:	Poster		
Topic:	Use of ultrasound in Graduate Medical and Continuing Education		

Obtaining vascular access with a linear finger transducer on phantom models

Ultrasound plays an integral role in obtaining vascular access. Using ultrasound for internal jugular (IJ) central venous catheterization (CVC) has been established as the standard of care. Since ultrasound's introduction into medical practice, novel technologies have expanded the way ultrasound is used. This study examines the usability and physician preference for a novel finger-worn ultrasound transducer (FWT) to the standard linear array transducer (SLT).

In our ongoing prospective randomized equivalence study, a FWT is compared to the SLT in performing IJ venous cannulation on a Blue Phantom IJ model. Each participant completes a preliminary questionnaire, documenting demographic information and previous ultrasound and central line experience, and completes informed consent to be a subject in the study. After a brief training module, subjects are randomized to start with either the SLT or the FWT. User preference is then determined on a Likert-scale post-study questionnaire.

We hypothesize that a FWT will have an equivalent time to cannulation as the SLT, which is the primary outcome used to determine sample size; we also hypothesize that physicians will prefer a FWT to a SLT. Secondary outcomes include: number of cannulation attempts, image quality, and transducer preference measured by user questionnaire. Sample size was calculated using a margin of 30 seconds for the mean difference in time to cannulation to be considered clinical meaningful, requiring a total of 36 subjects for 80% power at a 5% significance level.

Preliminary data from ten study subjects suggest the FWT outperforms the SLT in time to cannulation beyond our equivalence margin. Mean time to cannulation for the SLT vs. FWT was 132.9 seconds and 88.2 seconds, respectively, a difference of 50.98 seconds. Mean time to vessel puncture measurements showed the FWT took 31.28 seconds less than the SLT. Number of attempts and image quality were not significantly different between the groups.

Preliminary data also suggests that the SLT is the preferred transducer by 6/10 participants, with one participant undecided. The most substantial difference was seen in preference for "ease of manipulation of probe." In this case, users ranked the SLT 4.1 compared to 3.3 for the FWT, a 0.8 difference. SLT was preferred to the FWT in every other preference metric, with a delta ranging from 0.2 to 0.7.

In conclusion, time to cannulation was significantly lower for a FWT when compared with the SLT. However, users preferred the SLT. Ease of manipulation of the FWT appears to be the major subjective concern, as several subjects expressed difficulty with transitioning from a short axis to a long axis view with the FWT. Future studies should evaluate a FWT that contains both axes within the probe.

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Meta Information

Submission ID:	47	Student Submission:	0
Format:	Poster		
Topic:	Technology		

Current EM Ultrasound Training in Residency: Implications for Future Practice

INTRODUCTION

Bedside Ultrasound (BU) is an essential skill in EM. Previous studies show that resident ultrasound (US) education varies widely among residency programs. The 2008 ACEP US Guidelines recommend that all EM residency programs have an US Director, 24-hour access to an US, perform a minimum of 150 scans and identified 11 core applications (trauma, IUP, AAA, cardiac, biliary, urinary tract, DVT, soft-tissue, thoracic, ocular and procedural guidance). The ACGME recently introduced new residency accreditation standards and out-come bases evaluations, Milestones. One of which, addresses residents' US skills based on 5 levels. There are no recent studies, which look at the current status of resident BU training.

OBJECTIVE

The goal is to assess the current status of BU training and identify successful aspects of BU education. This study can help predict performance on the US Milestone assessment and provide implications to the evolving role of BU.

METHODS

This study is an observational, cross-sectional study that examined several aspects of senior EM residents' training and confidence with US. Data was collected between April and June 2012 via an online survey sent to the CORD listserv along with snowball sampling. Descriptive statistics were used to describe all study variables.

RESULTS

The survey received 270 responses of which 258 met inclusion criteria. Most were located in the Northeast (35%) or Midwest (33%). Almost all had an US Director (93%), a Fellowship (61%) and all had 24-hour access to an US. Approximately 37% found that designated US shifts were most effective for learning. Obtaining high quality images was rated as the most challenging aspect (72%). More than 2/3 indicated that BU was frequently or almost always useful in clinical decision making. Resident confidence was rated highest with FAST, renal US and procedural guidance as opposed to lowest with musculoskeletal, ocular and DVT. Almost 70% plan to use ultrasound during every shift after residency.

CONCLUSION

EM BU training has improved with most residents meeting ACEP guideline and at least a Milestone Level 3 by gaining experience with all of the core applications. As suspected, the number of US performed correlated with the resident's confidence in that type of US. This indicates that hands-on experience is very valuable and should have emphasis in the training arena. Sample bias is a significant limitation to this study.

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Meta Information

Submission ID: 48 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

The Role of Video Games in Ultrasound Medical Education

Ultrasound is a ubiquitous imaging modality that is evolving into a point-of-care diagnostic tool used by physicians across many different specialties.1 The rise in its popularity is attributed to its ability to provide real-time and non-invasive imaging that provides more efficient diagnosis and decreases medical errors.2 As its utility continues to increase, it is beginning to be incorporated into pre-clinical medical education in hopes of giving students the confidence to begin implementing ultrasound in the clinical setting well before residency. These programs have shown that medical students greatly benefit from having an enhanced level of understanding of ultrasound.3-11 However, universal implementation of these programs across all medical schools has been limited by the high costs of additional equipment and the need for a large number of well-trained faculty.5

One way in which this limitation can be addressed is through the use of gaming. Research has shown that medical students are overwhelmingly in favor of enhancing their medical knowledge through video games.12 Gaming can increase retention by testing recently learned material through engaging and interactive scenarios that provide real-time feedback.13,14 Additionally, games have a unique advantage in creating a "flow state" in which the difficulty adjusts appropriately to match a player's skill.15 This has been shown to reduce anxiety and boredom and elicit an intense focus of attention.16 Finally, social gaming applications can stimulate a sense of competition that has been proven to reward repeat play and provide substantial motivation for learning new material.17 It is no surprise that games have already started to be routinely incorporated into medical education with much success.18

We are proposing to develop a free, online educational application that will capitalize on the research-proven benefits of gamification. Our web-based app will allow students to progress through a three-stage approach to ultrasound education: a learning phase, a testing phase and a competition phase. During each phase they will develop their knowledge by viewing a large number of high-resolution scans that will continually be revised using a complex algorithm of crowd-sourced self-maintenance. They will receive real-time feedback and achieve a "flow state" with challenges that are appropriate for their skill level. When all of these attributes are combined, you have a product that would allow students from anywhere around the world to have access to an enriching and dynamic learning environment that is not only efficient, but fun. Ultimately, this game will be a valuable resource to the influx of new, young minds that are scrambling to find new applications for this cheap, ubiquitous modality.

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Meta Information

Submission ID:	49	Student Submission:	1
Format:	Poster		
Topic:	Use of ultrasound in Undergraduate Medical Education		

Student Designed International Ultrasound Projects

At UC Irvine, ultrasound has been incorporated as a means of deepening students' understanding of medicine, providing avenues for new and exciting research opportunities, and increasing the fund of knowledge that these students are able to share in their both their local communities and abroad. In an effort to provide opportunities to both use and improve their newly developed ultrasound skills, students at UCI have organized trips abroad to underserved areas; areas where fast and efficient imaging modalities are desperately needed.

These students have participated in a wide range of research projects, some of which include: imaging cerebral malaria in Tanzania, teaching Panamanian midwives to use ultrasound to assist childbirth in remote villages, and scanning for renal disease in migrate farm workers in Nicaragua. Additionally, other projects have focused on disseminating their ultrasound knowledge, arranging ultrasound electives at international, rural-based, medical schools in Australia, as well as Romania.

The impact of these projects is multi-fold. Of course, there is the obvious benefit to those underserved areas in which students travel to; providing an imaging modality to detect pathology that would normally be missed. There is the additional benefit to teaching international medical students- so they can use this skill in their future practices in rural communities and strengthen their abilities in ultrasound as well. These programs provide an outlet for medical students to apply their newly acquired ultrasound skills, making a perfect example of the medical adage, "see one, do one, teach one." By encouraging students to continue to pursue their interests within ultrasound as both researchers and teachers, we are creating more competent and experienced physicians with a better understanding of a broad variety of cultures, pathology, and practice methods.

While the concept of medical students going abroad is not necessarily innovative, the means by which UCI students are accomplishing it is. These projects, whether it is teaching ultrasound in Tanzania, or scanning for kidney disease in Nicaragua, have all been student organized and designed- with our student ultrasound interest group and faculty acting only in an oversight role. Furthermore, one of the largest barriers to traveling abroad is funding; however, thanks to a student run endeavor campaign, UCI has received a generous donation of $100,000 to fund these projects for the next 5 years.

Students at UCI have a unique skill that most medical students are not fortunate enough to learn. In the spirit of our school motto, "Discover, teach, heal" we have decided to use our knowledge to discover new uses for ultrasound abroad, to teach ultrasound to practitioners so as to provide better care for their patients, all in the hopes of that this can lead to the healing of those who might usually go untreated.

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Meta Information

Submission ID:	50	Student Submission:	0
Format:	Poster		
Topic:	Point of Care ultrasound in health care delivery to underserved populations		

Integrating an Ultrasound Curriculum into Internal Medicine Residency: Looking Back and Looking Forward

Background:

Although limited ultrasound exams can augment bedside diagnosis, significant challenges currently exist to the widespread teaching of this modality. Few data and no consensus exist on the integration of an ultrasound exam curriculum into an internal medicine residency to augment cardiac physical examination. Therefore, since 1997, we have sought to develop a single, evidence-based "quick look" cardiac limited ultrasound exam (CLUE) and incorporate its training into the mandatory curriculum of all internal medicine residents.

Methods:

Initial CLUE derivation studies occurred within the hospital's echo lab and initial resident imaging began during cardiology rotations. After 10 years, the CLUE imaging protocol was included in all institutional echo studies, which provided ongoing validation and outcome data. In 2007, Graduate Medical Education deemed resident participation in the CLUE curriculum mandatory, with weekly ICU bedside teaching rounds, monthly noon lectures and competitions, grand rounds, proctored imaging on cardiology rotations, and recently, website/app training and assessment. Participation in CLUE research was an extracurricular activity. Laptop and pocket-sized devices for residents were available in outpatient clinic, ICU, inpatient wards and ED settings. Primary teaching responsibilities were delegated to the CLUE Program Director, sonographers in the echo lab, and resident-to-resident teaching. Resident knowledge, performance and competency were assessed using a CLUE-CEX assessment tool (2007-present) at the end of training. In the program's formal resident assessment, CLUE competency was considered necessary in order to be considered "superior" in procedural skills.

Results:

The basic CLUE that developed and was validated included signs of LV dysfunction, left atrial enlargement, interstitial lung edema, pleural and pericardial effusion and elevated central venous pressures. Over time, emphasis on imaging skills and web-based interpretation replaced didactic lecturing as primary teaching methods. Resident's preferred method of learning CLUE was during rounds at the patient's bedside, and independent use appeared heavily-based on device availability. Residents now perform the basic CLUE in <1 minute and are taught additional signs of AAA and carotid atherosclerosis. Although variable by resident, the overall hours dedicated to the CLUE curriculum accounted for <2% of the total residency curriculum. No significant decrement was noted in overall mean in-training program scores during the phase-in of the ultrasound curriculum. Of 78 senior residents (100% participation), n=64 (82%) have passed the CLUE-CEX. In 2014, four interns passed the CLUE-CEX. CLUE competency was without relationship to resident in-training exam scores or gender. In CLUE research, since 1998, 16 residents published in CLUE of whom 8(50%) entered cardiology or critical care.

Conclusions:

Development and incorporation of an ultrasound curriculum based on a single exam can be accomplished within an internal medicine residency. Despite agreement on the imaging protocol, future challenges need to address faculty development and clinical outcome studies in residents deemed competent in CLUE.

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Meta Information

Submission ID: 51 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Examining Medical Student Opinions of Ultrasound in Undergraduate Medical Education and Medical Student-Organized Ultrasound Education Initiatives

Objectives:

Medical students have substantial access to bedside ultrasound education outside of their medical curriculums thanks to resources such as the Ultrasound Podcast or SonoMojo's USIG Toolbox. Because of this some students are creating their own ultrasound education opportunities in the absence of formal ultrasound curriculums. In our study we examined student opinions of ultrasound in medical education in medical students with limited ultrasound education in their curriculum during several student-organized ultrasound workshops.

Methods:

Study subjects were medical students participating in student-sponsored ultrasound education workshops organized by an Ultrasound Interest Group (USIG). Surveys assessed student opinions on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). 190 total surveys were collected over four Ultrasound Interest Group hands-on ultrasound workshops, which covered gallbladder, cardiac, vascular access, and nerve block ultrasound. Agreement scores (AS) represent the average value of subjects' agreement with a statement.

Results:

Medical students seeking bedside ultrasound came from a variety of specialty interests (20% emergency medicine, 13% internal medicine, 12% surgery, 4% family medicine, 3% pediatrics, 19% other, 25% multiple specialties). Prior to workshop participation, subjects agreed that ultrasound should be included in basic anatomy courses (87% agreement, AS 4.4) and physical exam courses (91% agreement, AS 4.5). They also agreed that learning ultrasound would enhance their medical education (100% agreement, AS 4.7) and they would like more ultrasound in their medical curriculum (93% agreement, AS 4.4). Following workshop participation, subjects retained their high baseline opinions about ultrasound in medical education. 100% of subjects agreed that ultrasound would enhance their medical education, should be included in physical exam courses, and that they wanted more ultrasound in their medical curriculum (AS 4.8, 4.7, and 4.7, respectively). When asked about the student-sponsored ultrasound workshops, subjects agreed that they were worthwhile (100% agreement, AS 4.8), taught them something they could not have learn elsewhere in their medical education (99% agreement, AS 4.8), and added something valuable to their medical education (99% agreement, AS 4.6). Subjects agreed that they learned something relevant to their pre-clinical coursework (91% agreement, AS 4.5), which they could use in their future clinical practice (100% agreement, AS 4.8). Nearly all subjects planned to attend future USIG workshops (96% agreement, AS 4.7) and wanted to learn more ultrasound after their experience (99% agreement, AS 4.6).

Conclusions:

Medical students with limited ultrasound education in their medical curriculums want to learn ultrasound. They feel ultrasound should be incorporated into their undergraduate medical education

and will seek it out if not provided by their current medical curriculum. USIGs are a great method to provide students with immediate access to ultrasound education that they feel is worthwhile and provides them with education not found elsewhere in their medical curriculum.

Authors

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Meta Information

Submission ID:	52	Student Submission:	1
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

Tailoring anatomy education to the 21st century using ultrasound

Purpose: Five years ago we have introduced CT based learning to the anatomy course. Two years ago, following the radiological approach's success we have adopted ultrasound (US) as an integral part of the anatomy course. Herein is the methodology used as well as our lessons in embracing this technology as an important pillar in anatomy education.

Materials and methods: At our disposal was an IU22 xMatrix ultrasound system (Philips Healthcare) equipped with 3 transducers (linear, cardiac and abdominal). The first year US was thought, US was incorporated into the curriculum solely via frontal lectures given by US specialists. In the second year of teaching, US trained anatomy instructors gave small practical classes and US specialists' lectures accompanied the course. Students were given free access to the US machine throughout the semester. In addition, a medical simulator (Simbionix) was at the students disposal throughout the semester. Assessment questioners were filled out by students following final exams.

Results: broadening anatomical education to include radiological modalities is a natural assimilation of modern technology to study anatomy and pathology. The US modality was encountered with mixed responses of perplexity followed by growing enthusiasm as self-practice took place. Marked differences were noted between the first and second year.

Conclusions: US introduces the concept of living anatomy, promotes self-learning by utilizing students natural growing tendency towards virtual reality. Equally important is the early introduction of students to an essential modality of medical practice, which will be used by future physicians as a primary means of viewing anatomical structures and inspecting the body in actual practice. This preliminary study produced important lessons for future anatomy education via ultrasound.

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Meta Information

Submission ID: 53 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Case-based E-learning shows equivalent effects on the retention of knowledge when compared to frontal class-room based lectures

Background

Theoretical knowledge (TK), visual perception (VP) and sensorimotor skills (MS) are key elements in ultrasound education. TK can be taught via class -room based lectures or via E-learning curricula. VP and MS are acquired in hands-on training (HOT). We wanted to assess the influence of a case-based E-learning, including post-course learning via Facebook on the retention of knowledge in medical students.

Methods

60 medical students were randomized into 2x2 groups (G1-4).

G1 (n= 13) and G3 (n= 15) were subject to a pre-course E-learning, based on short screencasts (5min), a discussion of 60 min and a HOT session on the day of the course. G 2 (n=16) and G4 (n=13) were presented frontal presentations on the day of the course before the HOT. Groups 2 and 3 participated in a post-course E-learning curriculum using Facebook. A tweet, sometimes including US images, was posted to a secured group every weekday. All G completed a multiple-choice test (test C) and a free-text test showing videos and asking for a diagnosis (test D) six weeks after the day of the course. The Mann-Whithney U-test was used for statistical analysis.

Results

A total of 62 medical students were recruited for the study, 57 completed the study protocol and were available for analysis. G 1 (only pre-course E-learning) achieved comparable scores as G 4 (only class-room presentations) (mean 82.0 ± 7.7 vs. 82.1 ± 8.7, p=0.81) (Fig.1). When comparing G2 and G3 no significant difference could be found (84.6 ± 7.8 vs. 82.2± 8.2, p= 0.3). When pooling data of G1/4 and G2/3 no difference was found (62.8 ± 16.1 vs. 70.4 ± 14.0, p=0.35).

Conclusion

Case-based pre-course E-learning is as effective for retention of knowledge as class- room based lectures even six weeks afterwards. Post-course E-learning using Facebook was not able to enhance retention any further.

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Meta Information

Submission ID:	54	Student Submission:	0
Format:	Poster		
Topic:	Use of ultrasound in Undergraduate Medical Education		

Medical Student Opinions of Cardiac Ultrasound in Medical Education

Purpose:

Medical student exposure to point of care ultrasonography (PoCUS) training is on the rise, especially during their preclinical years. As faculty and students alike realize the great educational potential of PoCUS, ultrasound lectures and hands-on training is being introduced to medical school curriculums. In our study we examined medical student opinions of ultrasound in medical education among the first medical students to participate in a newly instituted ultrasound curriculum.

Methods:

62 subjects participated in this study. Subjects were second year medical students participating in a hands-on cardiac ultrasound lab as a part of their physical exam course curriculum, during the cardiac systems block. The ultrasound lab included a didactic lecture component and hands-on training. Subjects completed surveys about their opinions of cardiac ultrasound in relation to their medical education before and after participation in the ultrasound lab. Whenever possible before and after surveys were matched, which occurred for 23 subjects. Surveys measures subject agreement with positive statements about PoCUS in learning cardiac knowledge and in medical education on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Results:

In the pre-lab survey subjects expressed a high baseline interest in integrating ultrasound into preclinical courses. 92% of subjects expressed that they wanted ultrasound integrated into the anatomy course. 82% of subjects expressed that they wanted ultrasound included in their physical exam course's lectures. They also expressed a high baseline agreement that ultrasound enhanced learning cardiac anatomy (72%) and physiology (74%). Following their ultrasound lab experience, students' high base line opinions about ultrasound enhancing learning cardiac anatomy and physiology remained high (70%, 66%). The p values do not show this slight decrease to be statistically significant. In addition, after their experience with cardiac ultrasound education subjects showed a statistically significant increase in their self-reported knowledge and comfort with cardiac PoCUS (5% to 27%). Matched before and after survey data revealed that students with prior cardiac ultrasound experience, through participation in Ultrasound Interest Group workshops, had greater self-reported knowledge with both normal cardiac anatomy and cardiac pathology before the lab (4.29/3.42 v. 3.67/2.87, .04/.03 p values). However, this difference between experienced and inexperienced subjects disappeared after a single cardiac ultrasound training session (4.14/3.29 v. 3.73/2.29, .08/.16 p values).

Conclusion:

Medical students clearly want more exposure to cardiac ultrasound education. They feel that it enhances how they learn cardiac anatomy and physiology. Even second year students with minimal clinical exposure are able to learn and feel comfortable using basic cardiac ultrasound. While further research is certainly warranted to discern exactly in ways PoCUS benefits medical student education,

it is clear that medical students are eager to learn ultrasound and want PoCUS further incorporated into their medical school curriculum.

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Meta Information

Submission ID: 55 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Canadian National Survey on Undergraduate Bedside Ultrasound Education

Objectives: Bedside ultrasound (point of care ultrasound) is being increasingly integrated into clinical practice as an adjunct to the physical exam and patient history. Accordingly, more emphasis is being directed to the teaching of bedside ultrasound at the undergraduate level. In the United States, a growing number of faculties have included ultrasound teaching in their undergraduate medical curricula. The educational landscape for undergraduate bedside ultrasound teaching in Canada is unknown. The aim of this study is to determine the extent of bedside ultrasound teaching in medical schools across Canada.

Methods: An online survey comprised of 19 multiple-choice questions was distributed to Associate Deans of undergraduate medical education in accredited Canadian medical schools. Bedside ultrasound teaching was evaluated according to: 1) timeline, 2) course format, 3) course logistics, and 4) opinion on bedside ultrasound.

Results: There are 17 accredited medical schools in Canada. Responses were received from nine schools, constituting a 53% response rate at the time of abstract submission. More than 50% of schools had integrated ultrasound teaching into their undergraduate curriculum (6/9 schools, 67%). Of those schools teaching bedside ultrasound, integration occurred within the last two academic years (4/6 schools, 67%). Bedside ultrasound was taught predominantly to first-year (5/6 schools, 83%) and second-year students (6/6 schools, 100%) with some schools teaching ultrasound in every year (2/6 schools, 33%). Students received on average 1-5 hours of ultrasound teaching per year and instructors were primarily non-radiologist physicians with experience in bedside ultrasound (4/5 schools, 80%). The instructional approach was clinical problem-based and the format included both lecture and practical hands-on sessions. The majority of Associate Deans agreed that bedside ultrasound is a useful adjunct to the physical exam (9/9 schools, 100%) and does not negatively impact patient safety (8/9 schools, 89%). They agreed that teaching should be part of their curriculum (8/9 schools, 89%) and list time constraints of the curriculum as the greatest obstacle for integrating bedside ultrasound education (7/9 schools, 78%).

Conclusion: Bedside ultrasound teaching is becoming increasingly integrated into accredited medical schools across Canada. Overall, Canadian undergraduate bedside ultrasound teaching 1) is consistent with a general trend to early (preclinical) integration in medical curricula, 2) uses a clinical problem-based approach 3) is taught by experienced non-radiologists, and 4) should be, in the opinion of Associate Deans, included in the undergraduate medical school curriculum.

Authors

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Meta Information

Submission ID:	56	Student Submission:	1
Format:	Poster		
Topic:	Use of ultrasound in Undergraduate Medical Education		

Should Ultrasound be an Essential Skill for Anatomists Who Teach in Undergraduate Medical Education? A General Needs Assessment Study on the Role of Ultrasound in Anatomy Graduate Education

Ultrasound is increasingly integrated into the basic science curriculum in undergraduate medical education (UME). Commonly, ultrasound training coincides with gross anatomy, yet most anatomists have little experience with this imaging modality. This paper reports on a general needs assessment study on the role of ultrasound in anatomy graduate education. A short online survey was distributed to faculty in anatomy Master's and Doctoral programs. The survey included 10 multiple choice questions to gauge the current state of ultrasound training in anatomy programs, and 7 questions using a symmetric five-point Likert scale to evaluate anatomists' perceptions on the role of ultrasound in anatomy. Over 50 individuals participated in the survey, representing more than 35 anatomy graduate programs in the USA; nearly half of the programs surveyed offer both Master's and PhD degrees. Most anatomists surveyed self-reported as novice users or have no experience with ultrasound. While more than half of anatomy programs surveyed provide focused training in medical imaging, only a minority of programs provide focused training in ultrasound specifically. Focused training is defined as active learning where students perform ultrasound rather than watching a lecture/demo. Very few programs require anatomy grad students to teach ultrasound, although nearly half of the programs surveyed require students to teach in the gross lab. The majority of anatomy educators surveyed agree/strongly agree with the following statements: US can be used to reinforce key anatomy concepts such as tissue characteristics, landmarks, relationships, orientation; US can be used to reinforce anatomy clinical correlates; US is a useful skill for graduates who plan to teach in a medical school; US should be a required skill for graduates who plan to teach in a medical school; experience with ultrasound will make graduates more competitive on the job market. Furthermore, a majority of anatomists surveyed wish they had received more ultrasound training themselves. While ultrasound training is increasingly offered concurrently with gross anatomy during UME, few anatomists have experience with ultrasound. Despite having little experience with ultrasound, trends in the perception of ultrasound's role in anatomy suggest that anatomists highly value this imaging modality, and consider it a useful and marketable skill for future anatomists. Survey results suggest that only a minority of anatomy graduate programs currently provide focused training in ultrasound, and very few provide opportunities to gain teaching experience in ultrasound. These findings suggest that the next generation of medical school anatomy faculty will continue to lack experience with this imaging modality, unless anatomy graduate programs expand their curriculum to include training in ultrasound. It is time to integrate ultrasound training into anatomy graduate education, to ensure that future anatomists have the skill set to meet the changing needs of medical students and contribute fully to UME.

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Meta Information

Submission ID:	57	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

The development of a medical school ultrasound elective: an innovative approach through interdepartmental and multiple teaching modalities

Background: Point of Care Ultrasound (POCUS) is a skill that requires active, hands-on learning in addition to traditional passive education. However, it is a still a skill without widespread faculty competency and limited resources at most medical training centers creating barriers to learning. Additionally, it is a complex skill incorporating the cognitive, psychomotor and affective domains of learning. Therefore, it was critical to develop a curriculum that taught students how to successfully acquire images, interpret them and use this information to appropriately guide clinical decisions.

Methods: We developed a four week elective course that used a flipped-classroom design. Prior to the start of the course, students were required to take a pre-course cognitive assessment and self-reported confidence survey in the use of POCUS. Students would independently view the on-line content covering the core POCUS examinations through structured on-line modules created by our faculty before attending scheduled workshops. At these workshop sessions, the instructors primarily focused on hands-on practice scanning of a standardized patient (SP) in order to provide direct observation and formative feedback. In the second half of each workshop session, the students were presented simulated cases where they scanned the SP, but were shown stock clips of normal or pathologic findings according to the views acquired on the SP, integrating their ability to interpret images and use that information to make clinical decisions. Amongst these workshop sessions, students performed practice scans to improve their skills in the clinical settings of the Emergency Department, Intensive Care Units, and other acute care venues under the supervision of faculty trained in POCUS. The course faculty was composed of physicians from the departments of Emergency Medicine, Critical Care Medicine, Pulmonary Critical Care, Pediatrics, and Anesthesiology. At the completion of the course, students took a written final exam, a practicum skills exam and a post-course self-reported survey to assess pre- and post- curriculum changes.

Results: To date, this course had 2 pilot offerings in the spring 2014 academic year. Students had an average increase of 27% (95% CI= 10.5-43.5%, p=0.009) between pre-and post-curriculum exam scores as well as unanimous scoring of 100% accuracy on a practicum component on the final exam. There was a statistically significant increase in student responses to perceived self confidence in performing POCUS exams as well as uniformly positive qualitative feedback.

Conclusions: Our use of a flipped classroom design and multi-media delivery of content has been a successful approach to teaching POCUS. Our curriculum demonstrated achievement in each domain of learning as well as overall POCUS skill acquisition. Similar curriculum development would be advantageous for other medical centers with limited faculty and resources to overcome these barriers for introduction of POCUS into medical education.

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Meta Information

Submission ID:	59	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

Transabdominal ultrasound-guided urethral catheterization with transrectal pressure

Background and Objectives: Occasionally, difficulty with standard urethral catheterization is encountered in male patients. Some causes of difficulty are considered to be related to the course of the posterior and bulbar urethra (PBU), which is located in or near the prostate. We assumed that the possible course of the PBU can be evaluated with transabdominal ultrasound (TAUS) and manipulated with transrectal pressure using a digital rectal examination. As a pilot study, we evaluated whether TAUS revealed the tip of a urethral catheter and whether TAUS-guided catheterization with transrectal pressure is successful in male patients in whom performing standard catheterization is difficult, the cause of which might be related to the course of the PBU.

Methods: The eligible study participants included adult male patients in whom standard catheterization failed in our emergency department or who were transferred from other facilities following failure of catheterization and subsequent urethral bleeding. An exclusion criterion was having a history of urological surgery. Patients in whom the tip of the catheter could not be advanced through the PBU judging from the inserted length were enrolled in the study when a study physician was available. The study physician was an emergency physician experienced with TAUS. First, an emergency nurse advanced a catheter until the progress was obstructed. Next, the physician performed TAUS to detect the tip of the catheter. To detect the tip more easily, the physician asked the nurse to oscillate the catheter gently and move the tip. If the tip was detected, TAUS-guided catheterization with transrectal pressure was subsequently performed as follows. The nurse withdrew 2-3 cm from the point of the obstruction. The physician then inserted the index finger of the free hand into the rectum and kept pushing the point of the obstruction ventrally under TAUS guidance. Following these procedures, the nurse again advanced the catheter.

Results: Six patients (age range: 56-93 years) were enrolled between March 2011 and April 2012. The tip of a catheter was detected in the urethra or the false passage using TAUS in four of the six patients. In these four patients, the curve of the urethra became gentle or the false passage was compressed by transrectal pressure and the tip was advanced smoothly to the bladder.

Conclusions: In some male patients in whom performing standard urethral catheterization is difficult, TAUS reveals the tip of the catheter and TAUS-guided catheterization with transrectal pressure may be safe and useful.

(The results of this study has been published in J Emerg Med 2014; 46: 215-9.)

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Meta Information

Submission ID:	60	Student Submission:	0
Format:	Poster		
Topic:	New Uses		

Clinical Outcomes of Suspected Pediatric Appendicitis Following Ultrasound Evaluation

Purpose:

To examine the clinical pathways and outcomes for pediatric patients presenting to the emergency department for suspected appendicitis initially evaluated with right lower quadrant ultrasound (US).

Methods:

After IRB approval, 829 emergency department right lower quadrant appendix US examinations for suspected appendicitis in patients < 18 years-old were examined. Clinical management was categorized as follows: (1) No further workup, discharged home; (2) Additional diagnostic imaging performed (e.g. CT abdomen and pelvis); (3) Admission to hospital for observation or surgery; (4) Transfer to local children's hospital for observation or surgery. Patient outcome categories include (1) Pathology proven appendicitis or operative findings consistent with appendicitis; (2) Pathology negative for appendicitis or operative findings not consistent with appendicitis; (3) Resolution of symptoms after non-operative treatment; (4) Non-resolution of symptoms after non-operative treatment.

Results:

Of initial US exams, 3.9% (n=33) were reported as positive for appendicitis, 36.4% (n=308) were negative and the appendix was identified. The appendix was not visualized in 59.6% (n=504) of cases. CT of the abdomen and pelvis was recommended by the radiologist in 30.1% of cases (n=260).

CT was ordered in 39.2% (n=102) of recommended cases and in an additional 112 patients (19% of CTs) when no recommendation was made. CT was positive in 15 cases of the 102 performed after US recommendation, and in 13 cases of the 112 performed without recommendation.

Of the 88 patients admitted for observation, 22.9% had a positive US and 21.3% had a positive CT. Of the 136 that were transferred to the local children's hospital, 15.4% had a positive US and 11.0% had a positive CT. Of the 44 admitted directly for surgery, 36.3% had a positive US and 25% had a positive CT.

Conclusion:

The sensitivity, specificity and positive predictive value of transabdominal US are high in appropriately selected pediatric patient populations. The unnecessary use of CT in management of suspected pediatric appendicitis is on the rise nationally, and accounted for a significant portion of exams performed at our institution. Improved decision support tools can aid clinicians in avoiding unnecessary imaging and radiation.

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Meta Information

Submission ID:	61	Student Submission:	0
Format:	Poster		
Topic:	Patient Safety		

Assessment of Undergraduate Bedside Ultrasound Education at McGill University

Objectives: Undergraduate teaching of bedside ultrasound improves a medical student's knowledge of basic anatomy and physiology (Hoppmann et al., 2011; Rao et al., 2008), and diagnostic accuracy (Kobal et al., 2004; Mouratev et al., 2013). These benefits hinge on the acquisition of bedside ultrasound skills by medical students. The aim of this study was to evaluate skill acquisition in the new undergraduate bedside ultrasound course at McGill University.

Methods: Course objectives and pre-course reading material were distributed to Year 1 medical students (n=195) prior to six clinically based one-hour practical teaching modules evenly spaced during the academic year (approach to dyspnea, hypotension, rule-out AAA, rule-out free abdominal fluid, kidney injury, swollen leg). The bedside ultrasound course was evaluated using a quantitative assessment of student skills and student perspectives. Skill acquisition was based on the student's ability to meet course objectives (n=6-8 objectives per module centered on image generation/interpretation) and rated using anonymous evaluation forms containing a Likert-type rating scale with four categories (strongly disagree, disagree, agree, strongly agree). Evaluation forms were completed by instructors (n=8) and students (n=126-195) immediately following each teaching module.

Results: According to instructor evaluations, the mean percentage of students assigned a scale of 'strongly agree' or 'agree' for their ability to successfully meet all objectives in all modules was 98 ± 0.4% (strongly agree = 52 ± 3%, agree = 46 ± 3%), evaluations. The mean percentages were similar for the six different modules during the year. According to student self-evaluations, the mean percentage of students assigned a scale of 'strongly agree' was significantly greater than the percentage assigned by instructors (86 ± 2% versus 52 ± 3%; $p<0.0001$). A high percentage of students agreed that bedside ultrasound improved their understanding of anatomy for all modules (mean=95 ± 0.01%).

Conclusion: Acquisition of bedside ultrasound skills in first-year medical students was excellent throughout the year, suggesting that course objectives were set at an achievable level for the teaching time allotted. Student self-evaluations indicated an over-estimate of skill acquisition, concurrent with previous reports of over-confidence in self-assessments (Dunning et al., 2004). Students consistently reported an improved understanding of basic anatomy following completion of this new undergraduate course in bedside ultrasound.

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Meta Information

Submission ID:	62	Student Submission:	0
Format:	Poster		
Topic:	Use of ultrasound in Undergraduate Medical Education		

Non-surgical Treatment of Compressive Neuropathy by the Ligament of Struthers

The supracondylar process is a well-known anatomic variant, which is often clinically silent, however, instances of upper extremity neurovascular compression have been reported in the literature. We report a case of a 52-year-old female who presented with median nerve neuropathy secondary to compression of the median nerve and brachial artery by an ipsilateral supracondylar process and associated ligament of Struthers. Conservative treatment of this condition included steroid injection by means of ultrasound-guided hydrodissection.

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Meta Information

Submission ID:	63	Student Submission:	0
Format:	Poster		
Topic:	New Uses		

Development, Implementation, and Evaluation of a mobile point-of-care ultrasound tracking system and mobile research tool within an Internal Medicine residency.

Background: Ultrasound competency and certification declarations both require timely, complete, and accurate collection of user exam data. The ability to record ultrasound exam data at the point of care with a mobile device may assist in these requirements.

Methods: A mobile, smartphone-based application was developed to track point-of-care ultrasound (POCUS) exams performed across the Internal Medicine Bedside UltraSound (IMBUS) program at a quaternary care center's IM residency program. The application was built to gather immediate, complete, and robust data about the exam performed, physician/student interpretation of the exam, and any research data applicable to the performed exam. The administrative back-end of the application was built to function as 1) the QA interface for over-reading, 2) tracking interface for identifying struggling users, 3) an informative interface for individuals to track progress towards competency and certification within the residency's IMBUS program, and 4) data gathering repository for research studies. The back-end of this application was developed to allow for interrogation and analysis of data across an entire system of POCUS. Analysis pre and post application implementation was completed to address completeness of data gathering and user experience.

Results: Following implementation of the tracking application, 22,000 exams were performed over 30 months. 99% of exams performed by residents and staff were recorded using the application at the point-of-care. The capture rate prior to the smartphone application while utlilizing a paper-based system was 68%. Residents felt that the ability of the application to show them their progress towards certification in each area of IMBUS was helpful and motivational in guiding their practice exams. Users felt the application was a more efficient way to enter data with the primary reasons being the user-friendly interface and accessibility (as all physicians carry smartphones as their pager amongst this group). The application successfully recorded data for several point-of-care ultrasound research studies during the 30 months. The administrative back-end of the application allowed tracking and modification of our competency/credentialing exam quantity targets.

Conclusion: A robust point-of-care mobile tool resulted in more timely, complete, and accurate data for students, residents, and faculty performing point-of-care ultrasound. The ability for the administration and individual to track their progress and certification with the application was essential to the POCUS training environment. The administrative back-end added significant efficiency to a mastery learning approach to assess competency in point-of-care ultrasound. Integration of routine clinical POCUS exam data collection with research study data gathering could also make point-of-care ultrasound research more efficient.

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Meta Information

Submission ID:	64	Student Submission:	0
Format:	Poster		
Topic:	Use of ultrasound in Graduate Medical and Continuing Education		

Surgical Critical Care and Ultrasound Training: Changing the Paradigm

The ideal method to train physicians in point of care ultrasound (POCUS) remains unclear. Guideline inconsistencies exist between governing organizations and specialties, further complicating the matter. In the field of surgical critical care, there is no standard. The training for critical care fellows at the Shock Trauma center (STC) has consisted of a one month dedicated rotation in the Critical Care Ultrasound Program (CCUP), with an emphasis on US for trauma and hemodynamic echocardiography. Noting gaps in our training, we have recently modernized our training pathway and aim to validate it against historical means.

Methods:

Outgoing fellows from the 2013-2014 year group were tested in the areas of knowledge, image interpretation, image acquisition and technical ultrasound skills. Testing was created and proctored through the CCUP. Knowledge categories included FAST, lung, cardiac, vascular, and ultrasound physics. Also included was a self-evaluation instrument measuring confidence and self-perceived competence. Incoming fellows for the 2014-2015 year group completed an identical testing algorithm prior to initiation of the academic year and again after taking 'The Leading Edge,' a one day intensive ultrasound introduction course. Fellows have continued assessments quarterly as the new training algorithm is validated.

Results:

Eleven outgoing fellows (OF) and 13 incoming fellows (InF) were included in the study group (n=24). 83% were surgeons. Internal review of the CCUP, in combination with OF assessment results, revealed gaps in training. These included image interpretation, advanced cardiac imaging, and lung ultrasound. As expected, initial knowledge and skills scores were significantly less in the InF than the OF group. However, image interpretation was not different between groups. After an intensive one day course, InF skill significantly increased from initial testing ($p=0.007$), and approached skills of the OF group.

Both groups reported similar initial self-confidence and competence. OF group reported significantly improved scores in the areas of basic and advanced cardiac imaging, lung for pneumothorax, and imaging of the IVC. No differences were noted in the areas of FAST or procedural US skills.

Conclusions:

The CCUP is unique in surgical critical care training. After a one month of dedicated training in ultrasound, trainees showed improved scores in ultrasound knowledge, image interpretation, and skills. Knowledge gaps prompted a change in training, which remains to be validated. Preliminary results reveal that the one day and one month courses led to equivalent skills and knowledge. High levels of initial confidence existed in both group with regards to FAST and procedural skills, not surprising in a group of surgeons. However, a significant difference existed amongst those from a medical background regarding the FAST exams. The prior training algorithm led to improved confidence and self-reported competence in all other categories amongst OF group. Long term retention of knowledge and skills remains to be seen, and we have ongoing data collection directed

at answering this question. Additional testing can further elicit retention of both skills and knowledge amongst those of different training backgrounds, thus allowing for a more tailored teaching approached if needed.

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Meta Information

Submission ID: 65 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

A Novel Look into Musculoskeletal Ultrasound Use in Internal Medicine Residency

Introduction:

Ultrasonography (US) is gaining popularity across a wide range of medical specialties. It allows for informed management decision-making (1), enhanced diagnostic confidence, and direct visualization of pathology (2). Musculoskeletal Ultrasound (MSK US), in particular, is utilized clinically in many Internal Medicine (IM) subspecialties, and has a role in Primary Care, Rheumatology, and Sports Medicine. However, MSK US has not been formally taught during IM training. Therefore, our study is the first of its kind to look at the perceived importance, as well as residents' confidence using MSK US within an IM residency program.

Methods:

During their residency training at the University of Connecticut in Farmington, CT, IM residents received formal MSK US training. The course involved hands-on use of the US before and after a 4-hour musculoskeletal simulation lab with incorporation of didactics in theory, technique, and identification of anatomic structures. An electronic questionnaire was sent out to the residents asking their confidence levels in basic ultrasonography theory and identification of musculoskeletal structures before and after this training.

Results:

One hundred of 128 residents responded to the survey, and 49 of these residents had received the US training at the time of the survey. Prior to the course, 75.5% (37/49) of the residents surveyed were not confident in understanding the basic principles of MSK US, whereas 24.5% (12/49) were somewhat confident and 0% were very confident. After completion of the course, 4% (2/49) were not confident, 87.8% (43/49) were somewhat confident and 8.2% (4/49) were very confident. Assessment of participants' confidence in identification of 18 musculoskeletal structures prior to taking the course revealed 79.5% were not confident in identifying the structures, 18.5% were somewhat confident, and 2% were very confident. After the US course, participants' confidence levels increased. Only 20.75% were not confident, 68.64% were somewhat confident, and 10.6% were very confident. Using a 3-point Likert scale (1=not confident, 2=somewhat confident, 3=very confident), participants' confidence in identifying 18 musculoskeletal structures increased from a mean of 1.22 prior to the course to 1.9 after the US course ($p<0.05$). Despite the residents' desire to pursue a wide array of specialities, 97% of them believed an MSK US training course would be a beneficial addition to their residency training.

Discussion:

Our study is the first of its kind investigating the implementation of musculoskeletal US teaching in IM residency training. The results show that IM residents believe there is a need for MSK US training within their residency training, and that even a 4 hour session improved their confidence in utilizing MSK US. Our study should serve as a pilot for future investigation incorporating the use of US training into an IM residency curriculum.

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Authors

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Meta Information

Submission ID:	66	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Medical Student Opinions of Two Models for Bedside Ultrasound Peripheral IV Placement

Purpose:

As medical student exposure to bedside ultrasound increases, the need to teach an expanding number of skills also increases. To adequately communicate these new skills teaching models are often necessary. Models must be functional, cost effective, and help students improve their skills. There are often multiple model options, each with their own inherent pros and cons. This is certainly the case with teaching ultrasound guided peripheral IV access and two available teaching models, the Blue Phantom™ (BP) and a self-made tofu model.

Objective:

Our study compares student opinions of two peripheral IV teaching models, the more costly Blue Phantom™ and a less expensive self-made tofu model.

Methods:

50 medical students participated in a hands-on ultrasound workshop. 34 subjects enrolled in the study. Subjects used both vascular access models and completed surveys after participation in the workshop. Surveys assessed student opinions about each model and impact they had on their learning on a Likert Scale from 1 (strongly disagree) to 5 (strongly agree). Responses were analyzed to determine student preferences. Agreement with a survey statement was confirmed by a mean agreement score >3.5.

Results: While subjects felt both the tofu model and the BP were easy to use (tofu 4.42 ± 0.71, BP 4.71 ± 0.53, p-value 0.048), that they liked using each (tofu 3.85 ± 0.80, BP 4.50 ± 0.69, p-value 0.002), and felt confident performing ultrasound guided vascular access with both models (tofu 3.97 ± 0.94, BP 4.56 ± 0.70, p-value 0.003); the BP model had statistically significant higher agreement scores. Students felt confident in their ability to perform vascular access after utilizing the tofu model (73.5%) and the BP model (88.9%). 87.9% of students agreed the tofu model was easy to use, while 96.4% of students agreed the BP was easy to use. On average, students estimated the cost of the tofu model to be $6 (actual cost $2.50) and BP to be $58 (actual cost $500). When asked if the BP was worth the extra expense as a teaching tool if it cost 100 times more than the tofu model, 58.6% responded no.

Conclusion:

When learning ultrasound guided peripheral vascular access, medical students like both the tofu and BP models. They feel both models are easy to use and allowed them to feel more confident about performing ultrasound guided peripheral access. While students more strongly preferred the BP model, a large number also feel the BP model is not worth the extra cost. The added fact that tofu models are easy to make and cost effective makes the tofu model a good substitute for the more expensive BP model in teaching ultrasound guided vascular access.

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Meta Information

Submission ID: 67 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Hypertrophic Cardiomyopathy Screening in Under 5 Minutes

Objective: To track medical student acquisition time of ultrasound images obtained as a screening for hypertrophic cardiomyopathy and to determine the number of scans students need to perform to achieve minimum scan time while maintaining scan quality.

Methods: University of California, Irvine medical students were recruited and trained to obtain cardiac ultrasound images to detect hypertrophic cardiomyopathy (HCM) in local high school athletes. HCM ultrasound training involved watching an instructional video and up to two hours of supervised, hands-on ultrasound use. Students had unlimited access to an ultrasound machine for non-supervised practice.

Ten Orange County, California high schools or junior colleges hosted the ultrasound cardiac screening team of 5-12 medical students and 1-2 supervising physicians as part of student athlete physical events. An average of 120 student athletes were scanned during each 4-hour screening. Medical students were instructed to acquire the best image possible in a reasonable time; they were never told to hurry, but the queue of athletes waiting for scans created a natural sense of urgency.

For each athlete, a medical student obtained 2-second video-clips of parasternal long (PSL) and parasternal short (PSS) cardiac views. From the parasternal short view, apical to the mitral valve, the muscular ventricular septum and the left ventricular wall were monitored in motion mode (m-mode) and were measured in systole and diastole on a still m-mode image. A pediatric cardiologist reviewed the recorded ultrasound videos and images after the screening and rated them as acceptable or unacceptable.

Analysis of acquisition time was limited to ten first-year medical students who performed the most scans during the screening season. The number of acceptable scans per person in this group ranged from 22 to 86. The first twenty scans of these students were analyzed for acquisition time. Acquisition time was calculated by subtracting the time stamps between the initial patient entry and the final m-mode image. Any scan rated unacceptable was excluded from the analysis.

Results:

Average acquisition time for the hypertrophic cardiomyopathy exam decreased from 8 minutes and 25 seconds (8:25) to 4 minutes and 40 seconds (4:40) after completing 20 scans. A plot of the acquisition time was fitted with an exponential decay function, with a calculated plateau value of 4 minutes at 40 seconds with a 95% confidence interval between 3:17 seconds and 6:03.

Conclusion: Medical student ultrasound acquisition time decreases in a non-linear fashion until the student has performed approximately 20 acceptable scans, at which time the student appears to have achieved minimal scanning time to acquire acceptable images for hypertrophic cardiomyopathy screening.

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Meta Information

Submission ID:	68	Student Submission:	1
Format:	Poster		

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Training the Trainer: Instructional Videos to Standardize Ultrasound Teaching Sessions and Maximize Hands-on Time for First Year Medical Students

Background: Ultrasonography is increasingly used in undergraduate medical education as a teaching tool to improve students' understanding of anatomy, physiology, and physical examination skills. The implementation of a robust curriculum for medical students requires many ultrasound instructors, often with different medical expertise, teaching experiences, and with busy schedules. Limited access to ultrasound instructors presents two challenges: 1) difficulty in coordinating sessions for ultrasound instructors to ensure standardized teaching of medical students; 2) insufficient hands-on time for medical students. The most effective method to standardize the curriculum delivered by ultrasound instructors remains to be established.

Aims: We hypothesize that the creation of instructional training videos for faculty will: 1) standardize the instruction of the ultrasound training; 2) maximize medical students' ultrasound hands-on time.

Intervention: We developed a collection of brief, 5-minute instructional videos that will serve as demonstrations of the training sessions on sonographic assessment of living anatomy and how sonoanatomy relates to physical examination skills. The initial collection consists of videos on neck, brachial plexus, cardiac, and lungs sonoanatomy, as well as, thyroid, jugular venous pressure and abdominal physical examinations. The instructional videos will be accessible online, allowing faculty to prepare for the sessions according to their schedule. A consistent format for these videos and teaching approach will allow standardization of the ultrasound training. The instructors are encouraged to spend no longer than 5 minutes as part of their demonstration in order to maximize hands-on experience for the trainees. The videos will be made available to the students following the ultrasound training sessions to facilitate individually-paced learning and review of the material anywhere, at anytime. A combination of hands-on training and access to the videos will support three types of learning: visual, auditory, and kinesthetic.

Evaluation: The value of the instructional videos will be assessed by administering post-participation questionnaires to both faculty and students, consisting of five-point Likert-scale and open response questions. Faculty will be asked to provide feedback on the instructional videos regarding the following: learning objectives, organization and duration, usefulness to their preparation, impact on their confidence in teaching medical students, impact on the live demonstrations, strengths and weaknesses, areas for improvement, and overall satisfaction. Students will be asked to provide feedback on the following: learning objectives, organization and duration of the live demonstrations, opportunity to ask questions, hands-on ultrasound experience under supervision, confidence in ultrasound skills, evaluation of the instructors, interest in ultrasonography before and after the training sessions, knowledge about the use of ultrasonography in clinical practice, impact on their understanding of anatomy and physical examination skills, usefulness of access to the instructional videos following the sessions, strengths and weaknesses of the videos and in-person sessions, areas for improvement, and overall satisfaction.

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Meta Information

Submission ID:	69	Student Submission:	1
Format:	Poster		
Topic:	Use of ultrasound in Undergraduate Medical Education		

Open Source Ultrasound Simulator Enhances Resident Ultrasound Education

Background: Simulation is an effective method of education for high acuity, low frequency events. Bedside ultrasound is an increasingly important tool in Emergency Medicine and is ripe for integration into current simulation curricula. Commercial ultrasound simulators are prohibitively expensive, creating a large barrier to point of care ultrasound simulation. The EDUS2 open source simulator, which costs as little as $50 to assemble, can be easily added onto existing simulated cases to improve image interpretation skills and integration of ultrasound into the approach to patient care.

Objective: This study seeks to demonstrate that the EDUS2 simulator is an effective tool for Emergency Medicine resident ultrasound education.

Methods: The PGY1 UPMC Emergency Medicine residency class participated in the study. All 16 residents attended a lecture teaching the RUSH exam for use in patients with undifferentiated hypotension. Later in the year residents participated in a series of 4 short simulated cases of undifferentiated hypotension using SimMan and our customary sim lab setup. Residents were randomized into a group with access to the EDUS2 simulator and a group without the simulator, but access to projected US clips if requested. During the cases data was collected on components of the RUSH exam performed/requested by the residents. Surveys were administered before and after the lecture as well as after the cases using Likert scales to assess comfort with ultrasound and the RUSH exam. A third group of residents was unable to participate in the cases due to clinical commitments but still completed the lecture and surveys.

Results: Residents with access to the simulator performed more components of the RUSH exam than those without. 4.65 components/case vs. 2.94 ($p < 0.05$). Residents who used the simulator were significantly more comfortable with the RUSH exam than those who did not perform the cases. 6 vs 4.14 on a 7 point Likert scale ($p<0.01$). Residents with the simulator were non-significantly more comfortable with the RUSH exam than those without ($p=0.11$).

Discussion: The EDUS2 simulator successfully encourages residents to incorporate more point of care ultrasound into their simulated cases. Simulated cases utilizing ultrasound also improve resident comfort with point of care ultrasound. The study is hampered by small sample size, but results are very promising and further study with larger populations is warranted.

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Meta Information

Submission ID: 70 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Evaluation of shoulder injury in the emergency department: Utility of bedside ultrasound in the diagnosis of acute shoulder dislocation

Bedside ultrasound is emerging as a rapid, point-of-care imaging modality that may facilitate the diagnosis of acute shoulder dislocations and expedite definitive treatment in the Emergency Department. To date, no previous studies have attempted to standardize an approach for the evaluation of shoulder dislocation by ultrasound. Our study aims to determine the efficacy of ultrasound in diagnosing shoulder dislocations in patients presenting with acute shoulder pain. Bedside ultrasound was used to measure the distance between the humeral head and glenoid rim which is then compared to plain-film x-rays. Eighty-one patients presenting to the ED with complaints of shoulder pain that were scheduled for conventional plain film x-ray were enrolled in the prospective observational study. Bedside ultrasound measurements exceeding an acceptable distance were compared to plain-film x-ray interpretations with a 93.3% sensitivity and 98.5% specificity for acute dislocation. This data suggests that ultrasound is an effective tool used to help clinicians diagnose anterior shoulder dislocations.

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Meta Information

Submission ID: 71 Student Submission: 0
Format: Oral

Topic: Point of Care ultrasound in general clinical practice

Towards a standardized Ultrasound curriculum for Pulmonary and Critical Care Fellowships

Currently no standardized curriculum exists for ultrasound (US) training at the Pulmonary and Critical Care Medicine (PCCM) fellowship level. Such training is required by the Accreditation Council for Graduate Medical Education (ACGME) and is invaluable to the care of patients encountered in PCCM practice. Many barriers to PCCM US training exist, including content redundancy, time constraints, and a need for practice on abnormal subjects. Furthermore, adult professional learners are internally motivated and have improved learning in the event that the learning objectives are well aligned with their personal and professional motivations. Therefore a successful PCCM US curriculum must engage these motivations.

Our curriculum is a comprehensive and multi-faceted year long program with simulation training, targeted and interactive didactics, escalating portfolio development, deliberate practice and real-time patient scanning as the key elements. All teaching events are targeted and time efficient, barriers to education at a busy academic program are eliminated. We use a case based approach and the incorporation of supervised practice sessions with MICU patients as scanning models in order to engage the adult trainees' internal motivations, namely the motivations to perform well in fellowship training, to advance the care of their patients and to feel more confident in handling of critical medical situations with their newly acquired skills.

We have begun the first stage of our proposed curriculum, which is comprised of self- directed learning, and a comprehensive and interactive formal course. Our coursework incorporates not only clear didactics but also real-time (normal model) scanning, simulation training, and supervised scanning in the Medical Intensive Care Unit (MICU) of abnormal findings.

An anonymous survey described 100% approval ratings for course design, teaching effectivity and the benefits of real-time scanning, MICU scanning and simulation based supervised practice techniques. Fifty percent of responders tagged time as a constraint, indicating that increasing the allotted of time for the course overall, practice time and for machine control would be considered beneficial.

Testing to evaluate key elements of ultrasound learning (image acquisition, scan plane control, and image recognition and interpretation of findings within clinical context) was used to evaluate skill and knowledge level at this early stage of curriculum implementation. Analyses of pre-course and post-course testing showed an improvement in performance (cohort average of 25%, range 12.5-43.75% vs 71.25%, range 56.25- 87.5%). This improvement in scores was statistically significant ($p<0.0007$).

Our educational program is a novel approach to PCCM US training. We anticipate it to be an effective method of training using our multifaceted teaching approach. We believe our method circumvents barriers to effective training in PCCM fellowships and is designed to engage the motivations of our trainees. Our study protocol is designed to validate this educational program and initial testing suggests that our methods have been successful in their initial stages.

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Meta Information

Submission ID: 72 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Utility of Point-of-Care Ultrasound in Underserved and Rural Settings in the Lake Victoria Region of Tanzania

A group of six University of California at Irvine (UCI) medical students shadowed Tanzanian physicians for five weeks at three hospitals in the Lake Victoria region - a private hospital in downtown Mwanza, a government hospital in Mwanza, and the principal hospital on a rural island in Lake Victoria. Only two of these hospitals had an ultrasound machine, and neither was available for use directly by physicians. Students were accompanied by a licensed US physician and certified ultrasonographer. During rounds, UCI students used Sonosite portable ultrasounds to provide bedside ultrasound that Tanzanian physicians could use to aid in diagnosis and treatment of their patients. The students provided non-invasive, point-of-care imaging to Tanzanian physicians working in underserved and rural hospital settings by performing scans learned through the ultrasound curriculum and training at UCI School of Medicine. In several instances, UCI-led ultrasonography impacted physicians' case interpretation and proposed treatment plans, as evidenced by three cases. Case 1: 76-year old man with shortness of breath had been diagnosed with asthma but was suspected to have congestive heart failure (CHF). Using ultrasound in the physician's office, UCI students demonstrated presence of ascites (in hepatorenal recess, splenorenal recess, and rectovesical pouch), bilateral pleural effusion, pericardial effusion, and left and right ventricular dysfunction in this patient. With this information, the patient's physician confirmed a diagnosis of CHF and altered his treatment plan. Case 2: A third-trimester pregnant woman could not afford prenatal ultrasonography and sought at-home ultrasound screening from UCI students in the presence of the US physician. A normal fetal heart rate (FHR) was detected; however, ultrasound imaging indicated a breech presentation. Based on this information, her physician was contacted and the woman was advised to seek hospital delivery instead of the intended home birth, which may have resulted in severe complications. Case 3: A second-trimester pregnant woman presents for routine prenatal checkup. Hospital physicians and nurses could not detect FHR using a Pinard horn and requested bedside ultrasound. Imaging revealed an immobile fetus with absent FHR and no atrial or ventricular contraction. Her physician confirmed intrauterine death and provided appropriate treatment and counseling.

These were three of several cases in which UCI medical students demonstrated utility of bedside ultrasound in improving patient care in resource-poor and rural Tanzanian communities. This underscores the importance of investing in bedside ultrasound machines and training for practicing healthcare workers in underserved settings.

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Meta Information

Submission ID:	74	Student Submission:	1
Format:	Poster		
Topic:	Point of Care ultrasound in health care delivery to underserved populations		

Chronic Effects of Longterm Schistosomiasis Exposure in Mwanza and Ukerewe Island, Tanzania

Schistosoma mansoni and Schistosoma haematobium are endemic in Tanzania and have become a major public health concern, particularly in the Lake Victoria region. Although acute schistosomiasis is easily and successfully treated with praziquantel, there has been little research on chronic effects of longterm exposure to Schistosoma parasites[1]. In the present study, consent was obtained from 59 patients (28 males, 31 females) at two Tanzanian hospital locations in Ukerewe Island and Mwanza. Of note, Ukerewe Island has significantly higher prevalence of S. mansoni than in Mwanza city and represents a region of chronic exposure to schistosomiasis.[2] Health interviews were conducted prior to scanning to determine comorbidities and past schistosomiasis infection and treatment. The World Health Organization (WHO)'s "Ultrasound in Schistosomiasis"[3] protocol was adapted to scan kidneys, ureters, renal pelvis, bladder, liver, portal veins, and spleen with a Sonosite portable ultrasound. In addition, patients provided urine and feces samples, which were tested in hospital clinical laboratories as standard of care for detecting the presence or absence of S. haematobium and S. mansoni, respectively. Bladder wall abnormalities were not detected in the majority of patients; however, distortion of bladder shape occurred in 45.7% (27/59) patients. With the exception of reversal of flow in portal veins of select patients with comorbidities, significant liver pathology was not observed in the majority of patients despite chronic exposure to schistosomiasis and/or current S. mansoni infection. A surprising finding was that dilated bowels were detected in 36.8% (14/38) patients from Ukerewe Island and in only 28.5% (6/21) of patients from Mwanza, one of whom had laboratory-confirmed schistosomiasis. Detection of dilated bowels is not addressed in the WHO protocol. Based on our findings, ultrasound may augment current evaluation of pathology associated with chronic schistosomiasis exposure and WHO protocols should be amended to include investigation of bowel dilation in patients with S. mansoni exposure and infection. Ultrasound may be useful in diagnosing clinically significant schistosomiasis in populations with high prevalence of infection thus allowing more focused use of anti-parasitic therapy.

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Meta Information

Submission ID:	75	Student Submission:	1
Format:	Poster		
Topic:	New Uses		

Continued Success of "Introduction to Ultrasound" Course in Mwanza, Tanzania

In July 2014, UC Irvine (UCI) School of Medicine students returned to Mwanza, Tanzania to continue an introductory ultrasound curriculum initiated in 2013. Six Sonosite Nanomaxx ultrasound machines were used for the course, which included instruction in knobology, cardiac, pulmonary, abdominal, emergency FAST exam, pelvic, and basic obstetric ultrasound. The curriculum was based on the UCI ultrasound curriculum, written by John Fox, M.D., with lecture powerpoints, study guides, and quizzes for each lesson.

Thirty-three people participated in the course including two school administrators, four medical professionals, and 27 healthcare students. The length of the course was two weeks with classes and training sessions every day. Pre-tests on basic ultrasound concepts were administered for each topic at the beginning of the course and identical post-tests were administered upon course completion. The mean of written pre-tests was 25% (SD=1%). After the course, the mean of post-tests was 75% (SD=15%). The 2014 final exam, consisting of 20 written questions, had a mean of 84% (SD=11%). The five-question practical portion of the final exam, which assessed students' ability to correctly locate and identify structures with ultrasound, was successful with an average of 94% (SD=1%). All 33 students successfully passed the course.

Test scores from 2014 were also compared to those of the previous year's course. In 2013, 134 people participated in the three-week course. Scores of the 2013 pre-test (mean=23%, SD=13%) and post-test (mean=74%, SD=14%) were not significantly different from those of the 2014 course. The mean overall score of the course was 79%. Scores for the 2013 practical component (mean=84%, SD=17%) were lower than in 2014. A total of 113 (93% of students who completed the course) passed the final exam.

Compared to 2013, the 2014 course was shorter in total duration but classes were held more frequently, there was more practice time with the ultrasound machines, and the pelvic lecture was extended to include one lecture on pelvic/gynecology ultrasound and one lecture on obstetric ultrasound. There were fewer students in the 2014 course due to constraints of the Tanzanian academic calendar. However, fewer enrolled students allowed for a lower ratio of student to ultrasound machines during class and more hours of practice. This likely explains why test scores for practical components were higher in 2014 than in 2013.

UCI medical students have successfully implemented an "Introduction to Ultrasound" course in Mwanza, Tanzania, as evidenced by the high pass rates of both the 2013 and 2014 classes and the enthusiasm of the Tanzanian school administration to establish a longterm partnership with UCI and integrate the ultrasound course into their curriculum.

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Meta Information

Submission ID:	76	Student Submission:	1
Format:	Poster		

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Screening for Pediatric Cardiac Abnormalities in Rural Panama

INTRO: A group of medical students traveled to Bocas Del Toro, Panama for the purpose of scanning pediatric populations for Congenital Heart Defects (CHD) and Rheumatic Heart Disease (RHD) with portable ultrasound. We partnered directly with Floating Doctors, a volunteer based non-profit medical relief team that has served this area of Panama for the past three years. Floating Doctors has identified a need for pediatric cardiac ultrasound screening in these communities. Floating Doctors founder Dr. Benjamin LaBrot, and the Floating Doctors team have met numerous indigenous Ngobe children with congenital heart defects (CHD) and rheumatic heart disease (RHD) in areas where poverty and lack of transportation severely restrict access to healthcare. Echocardiography is well established as the first-line imaging technique in the diagnosis of all forms of congenital heart disease [1]. Dr. John Fox assisted our group in the development of the Pediatric Echocardiography Screening (PECS) exam specifically for use with this group of medical students in Bocas Del Toro. The PECS exam establishes a protocol for CHD and RHD screening with portable ultrasound that involves the 5 basic cardiac ultrasound views of the heart and employs doppler techniques to screen for structural abnormalities.

OBJECTIVE: To identify the prevalence of CHD and RHD in the pediatric population of Bocas del Toro and surrounding island communities.

METHODS: Screening of patients using the PECS exam was completed on all clinic patients under the age of 18 if consent/assent was obtained. 36 children were scanned using the PECS exam.

RESULTS: We are still analyzing data, however trends so far have established the prevalence of a congenital heart defects in the Ngobe population is <1%.

DISCUSSION: The findings of this study will be important in evaluating the prevalence of CHDs and RHD in the Ngobe population. If indeed the prevalence is higher than the norm, it indicates the need for ultrasound screenings in these communities, and that proper cardiac ultrasound training of the Floating Doctors workers has the ability to positively impact health outcomes, especially in those with cardiovascular complications. This study aims to bring attention to the health of the Ngobe population, particularly congenital heart defects in children.

Authors

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Meta Information

Submission ID: 77 Student Submission: 1
Format: Poster

Topic: Point of Care ultrasound in health care delivery to underserved populations

Evaluating effectiveness of didactic methods in medical student ultrasound education

Combs, JW; Harounian, J; Kasimoglu, IH; Patel, MK; Pina-Paz S; Said, S; Smith, T; Fox, JC

UC Irvine medical students traveled to Istanbul University, Cerrahpasa School of Medicine to teach bedside ultrasound (BUS) medical students. The research project aimed to compare and evaluate different methods of teaching BUS in a one-week training course. The efficacy of three different teaching methods were compared: lecture with hands-on training modules, podcast with hands-on training modules, and hands-on training modules alone. Our prediction was that a combination of lecture with hands-on training modules would be the most effective method to teach BUS.

BUS was taught in two separate one-week sessions. Students were only allowed to attend one of the two sessions. 91 students participated in the BUS training course. Hands-on training modules accommodated 3-4 students per hour per group throughout both sessions. Topics covered during each session included: 1) Knobology and Cardiac Ultrasound, 2) Abdominal Ultrasound, 3) Pulmonary Ultrasound, 4) Focused Assessment with Sonography for Trauma (FAST) exam. Medical students were randomly assigned to three groups. Each group attended hands-on training modules from Monday through Thursday. Before the hands-on training session, Group A attended a lecture, Group B watched a podcast, and Group C served as the control group and had neither. All students took a written exam prior to and at the end of the BUS course. At the end of the course, students were also given a practical evaluation during which they had three minutes to complete a FAST exam.

The scores of students' pre- to post-training tests increased from 39% to 86% in Group A, from 36% to 80% in Group B, and from 35% to 75% in Group C. Data analysis of written exam scores (both pre-test and post-test) showed no significant difference among the three groups using ANOVA ($F=0.986$ $p=0.377$ for pre-test; $F=3.080$ $p=.051$ for post-test). The average for the practical exam was 80% for Group A, 81% for Group B, and 70% for Group C. ANOVA was performed to compare the difference in the groups' performance on the practical exam ($F=3.081$ $p=0.051$). These data suggest that there is not a significant difference in teaching methods on students' performance on the practical exam.

These preliminary results suggest all three methods are equally effective in teaching medical students basic ultrasound concepts as well as practical ultrasound skills. Although preliminary analysis indicates that no particular method of teaching significantly influences the development of practical ultrasound knowledge ($p=0.051$), studying a larger sample size may better clarify the association, if any, between different teaching methods and the acquisition of practical ultrasound knowledge.

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Meta Information

Submission ID:	78	Student Submission:	1
Format:	Poster		

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Curriculum for Teaching Pediatric Cardiac Ultrasound in Rural Panama

INTRO: A group of medical students traveled to Bocas Del Toro, Panama to initiate a cardiac ultrasound project in this area. We partnered directly with Floating Doctors, a volunteer based non-profit medical relief team that has served this area of Panama for the past three years. Float- ing Doctors has identified a need for pediatric cardiac ultrasound screening in these communities. In order to create a sustainable cardiac ultrasound program, one of our project's goals was to teach healthcare workers in the area to perform a cardiac ultrasound assessment of a pediatric patient. Our group created a curriculum to teach basic echocardiography to rural international healthcare workers and volunteers with little to no previous experience with ultrasound. The curriculum, which integrates both didactic and hands-on material, was taught to healthcare workers and volunteers in the area around Bocas Del Toro, Panama. Effectiveness of learning was rated with both subjective and objective assessments of ultrasound skills before and after the ultrasound course.

OBJECTIVE: To assess the effectiveness of a pediatric-focused cardiac ultrasound curriculum for teaching rural international healthcare workers and volunteers.

METHODS: We taught a cardiac ultrasound curriculum to healthcare workers and volunteers in the area of Bocas del Toro. Effectiveness of learning was rated with both subjective and objective assessments of ultrasound skills before and after the ultrasound course.

RESULTS: We are still acquiring data, however trends so far have established that participants scored higher on the ultrasound assessment after they received the curriculum then they did pre-curriculum.

DISCUSSION: The findings of this study will be important in evaluating the efficacy of a short course in teaching cardiac ultrasound skills. If indeed the post-curriculum test scores are significantly higher than the pre-curriculum test scores, then this indicates that this short course in cardiac ultrasound is an effective tool. Proper cardiac ultrasound training of the Floating Doctors workers has the ability to positively impact health outcomes, especially for patients with cardiovascular complications.

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Meta Information

Submission ID: 79 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

One-year Retention of "Introduction to Ultrasound" Course and Future Improvements in Mwanza, Tanzania

In 2013, UC Irvine (UCI) School of Medicine students administered an "Introduction to Ultrasound" course to 113 clinical officer students at Tandabui Institute of Health, Education, Science and Technology (TIHEST) and practicing healthcare professionals in Mwanza, Tanzania. The original course was modeled on UCI's ultrasound curriculum written by John Fox, M.D. with lectures and hands-on ultrasound training for each topic. In 2014, UCI students returned to assess the success of the "Introduction to Ultrasound" course and analyzed retention by re-administering the 2013 final exam. In 2013, the average written final examination score for 122 students was 74% with a standard deviation of 14%. In 2014, the same final examination was given to 56 returning students before the advanced course began with an average of 41% and a standard deviation of 10%.

Availability of ultrasound machines to students was considered in evaluating the effectiveness and necessity of the course. In a survey given to returning students, 60% did not use an ultrasound during the year, 20% used ultrasound several times during the year, and 18% used ultrasound monthly or more frequently. Although 92% reported having ultrasound at their workplace, 31% of students reported not having ultrasound access to practice when desired. Given four options, 63% of students selected "practicing on ultrasound machine myself" was the most effective learning technique in the previous year's course.

To improve retention results and ultrasound education in this community, we worked with school administrators to incorporate ultrasound education as a mandatory aspect of the curriculum and give students more hands-on practice with ultrasound machines throughout the year. Recorded podcasts, study guides, and powerpoint presentations for seven introductory topics were given to the school and students. All material was created by UCI medical students modeled after Dr. Fox's curriculum and was available online for TIHEST and its students. In addition, six iPads with course material and two electronic ultrasound textbooks were donated to the school. The iPad curriculum is available without internet, a necessity since 31% of students reported having no internet access. TIHEST will purchase two ultrasound machines to remain on school campus in the clinical skills center along with the iPads. Our aim is for students to watch podcasts or read course material on the iPads while concurrently practicing with ultrasound machines. UCI students have the capability to update materials from California, and administrators were trained on updating the iPads and communicating with UCI students to request additional materials. UCI students will return in 2015 to compare retention levels and understanding after implementation of the new iPad-based curriculum. It is our hope to increase retention and ultrasound use in this medical community in the coming years.

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Meta Information

Submission ID:	80	Student Submission:	1
Format:	Poster		

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Critical care and emergency ultrasound knowledge and expectations in an internal medicine training program in Guatemala City

Background: Guatemala is a low/middle income country struggling with a fragmented and under-funded healthcare system. Roosevelt Hospital, one of two public hospitals in Guatemala City, hosts an internal medicine residency program. The program has forty-two residents and includes an emergency department (ED), inpatient floors, and intensive care unit (ICU). Given the lack of an emergency medicine residency program, internal medicine residents staff the emergency department. With limited access to technology, diagnostics, and therapies, mortality rates in 2013 were 23.3% and 26.8% in the ICU and ED respectively. In high income countries, bedside ultrasonography is a standard cost-effective technology used in EDs and ICUs. At Roosevelt hospital, even though ultrasonography is available, internists do not use it at the bedside as a routine diagnostic tool. Therefore, we sought to assess internal medicine trainees' knowledge and needs to establish a bedside ultrasound training program adapted to Guatemala in order to improve patient care and outcomes.

Methods: To assess knowledge and expectations for an ultrasound training program, a questionnaire regarding experiences, interests and perceived barriers to using bedside ultrasound was given to the medical residents at Roosevelt Hospital. The survey was voluntary and anonymous.

Results: Most residents completed the survey (37/42, 88% response rate). The majority (81%) had received no formal ultrasound training. Of those who had received prior training, none had more than five hours. Only two residents had received hands-on training. Regarding ultrasound bedside use, none had used it for central venous access, arterial line placement or shock evaluation. All residents were interested in learning how to use ultrasound in the evaluation of shock and respiratory failure. The most frequently cited barrier to learning ultrasound for these indications was the lack of local expertise (76% and 84%, respectively). Nearly all (92%) thought the greatest barrier to implementing an ultrasound training program was access to a reliable portable machine (only 8% thought it would be too difficult). However, they all recognized the need and expressed interest in receiving training.

Conclusions: Medical residents at Roosevelt hospital are interested and recognize the need for training and implementing diagnostic bedside ultrasound. Their perceived barriers (availability of portable ultrasound and local expertise) can be easily resolved through donations (ultrasound machine) and utilization of local radiologists and cardiologists as trainers. Therefore, creating a resident-based, sustainable, bedside ultrasound training program at Roosevelt Hospital has potential to improve medical education and provide additional cost-effective diagnosis, leading to improved patient care and outcomes.

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Meta Information

Submission ID:	81	Student Submission:	0
Format:	Poster		
Topic:	Point of Care ultrasound in health care delivery to underserved populations		

B-pattern in lung ultrasound can quantity extravascular lung water measured by gravimetry in rats

“B-pattern” (in description of multiple B-lines with interstitial syndrome) obtained with lung ultrasound can detect EVLW both in human and experimental acute lung injury (ALI). However, in human and large animals, lung ultrasound evaluates only the subpleural costal area, extending for 3–4 cm, so when we do correlation relationship between B-lines and other technique, only the subpleural area can be measured by lung ultrasound, which may inconsistent with the facts. however, the rats’ lung are very thin, the ultrasound can penetrate the whole lung, so the lung ultrasound can assess the whole lung but not only one part, so do post-mortem gravimetry which also estimates the water content of the whole lung. this is the reason why we choose rats to assess EVLW with lung ultrasound.

For more precise quantification of interstitial syndrome, the 28-scanning-site technique can be useful, there is some difference when we use this technique between human and rats ,in human we do it according to the anatomical location in the longitudinal plane, however, in rats Lung scanning was performed in the vertical plane on the rat’s back . From each ultrasound image, five to six intercostal space were present, when we turn the probe up and down ,we can get the whole lung image in the lung's vertical axis, which always consisted by seven intercostals spaces.

Therefore, we planned the present study in rats’ lung to test the hypothesis that the B pattern score in lung ultrasound was correlated to the EVLW measured by the experimental gravimetric technique in ALI induced by OA.

Twenty-Four anesthetized, cannulated (central vein and carotid artery) rats were studied: six sham-operated animals served as controls and, in remaining 18 animals, ALI was induced by injection of oleic acid via the central venous catheter. B-lines were measured by lung ultrasound in four scanning sites in each animal. At the end of each experiment, both lungs were dissected, weighed and dried to determine wet/dry weight ratio by gravimetry. 3 of them also do the computed tomography to observe the morphological change.

After the injection of oleic acid, B-pattern score increased over time. A significant correlation was found between the wet/dry ratio and B-pattern score. These data suggest that in an experimental rat model of ALI/ARDS, B-pattern assessed by lung ultrasound provide a simple, semiquantitative, noninvasive index of lung water accumulation, strongly correlated to invasive gravimetric assessment.

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Meta Information

Submission ID:	82	Student Submission:	0
Format:	Poster		
Topic:	New Uses		

Effectiveness of teaching vascular anatomy with ultrasound for undergraduate nursing students

Background:

Ultrasound has been used gradually and widely in medical education for the past several years. With interest in and need for education in ultrasound, a number of medical schools have recently developed ultrasound curricula for undergraduate medical education. We began expansion of ultrasound not only to medical school but school of nursing. As a pilot for undergraduate nursing education, we conducted a hands-on session for on vascular anatomy with ultrasound for the second degree students of Bachelor of Science of Nursing.

Purpose:

To see whether incorporating ultrasound into vascular anatomy class can improve students' learning experiences

Methods:

The students were required to watch online lectures on history and physics of ultrasound and lectures on knobology and user's guide on the ultrasound devices prior to the class. Student knowledge was assessed with pictoral and non-pictoral multiple-choice questions. All students (n = 31) were required to take pre- and post-test for the class session which included didactic lecture and hands-on teaching. Descriptive statistics and Student's t-test were used for statistical analysis.

Results:

Student average score on the pre-test was 33% and that of the post-test was 70% (student's t-test, $p < 0.05$). Observation of students during activities indicated that visualization of structures with ultrasound helped students localize the venipuncture site. Future plans for improved integration of ultrasound skills for vascular access include providing more integrated anatomical instruction, ultrasound images with clearly identified structures and assessment of ultrasound skills during OSCE.

Conclusions:

In conclusion, incorporating ultrasound into teaching vascular anatomy was effective and should be expanded to all undergraduate or graduate nursing education.

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Meta Information

Submission ID:	84	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

Perception on ultrasound in nursing education by undergraduate nursing students

Background: Ultrasound has been used gradually and widely in medical education for the past several years. With interest in and need for education in ultrasound, a number of medical schools have recently developed ultrasound curricula. However, there is little information on using ultrasound in undergraduate nursing education and undergraduate nursing students' perception of ultrasound in medical education in nursing school.

We sought to determine the general perception of nursing students regarding ultrasound and its need in nursing education.

Purposes: We used a questionnaire to study how much undergraduate nursing students knew about ultrasound. We sought to determine the general perception of nursing students regarding ultrasound and its need in nursing education.

Methods: To assess perception, we created an eight-item survey and administered this prior to a pilot didactic class with ultrasound on vascular anatomy. Qualtrics (online survey software) was used. Results were analyzed with descriptive statistics and Chi-square test.

Results:

All 31 students participated in the survey. Prior to nursing school, most students (90.3 %) had not utilized ultrasound. One student had previous experience through volunteering and shadowing and the other one saw veterinary ultrasound. In regard to student perception of ultrasound in nursing education, 61.3% surveyed answered "it is an educational tool to be used in all areas of nursing education", 32.3% felt "it is an educational tool to be utilized in a clinical setting" while 6.5% felt "it is an educational tool to be utilized for anatomy and physiology". Fifteen students surveyed (48.4%) felt more than 50% of nursing schools have an integrated ultrasound program. Of twenty five listed clinical specialties, students felt the top 5 specialties that utilized ultrasound were: Cardiology (96.8%), Obstetrics and Gynecology (90.3%), Gastroenterology (87.1%), Nephrology (83.9%), and Hematology/Oncology (83.9%). Twenty five students surveyed (80.1%) answered Radiology utilized ultrasound. Three students (9.7%) believed ultrasound increases radiation exposure to examinees. Nineteen (61%) students answered that ultrasound is infrequently used for guided peripheral intravenous access.

There was no significant relationship between previous exposure of ultrasound and general perception of ultrasound in nursing education (Chi-square test, $p = 0.94$). Regarding misconception of radiation with ultrasound, there was no significant difference between groups with previous experience and non-experience group (Chi-square test, $p = 0.55$).

Conclusions:

In conclusion, the majority of students were not aware that ultrasound in undergraduate nursing education was not widely implemented and some of student did not realize that ultrasound does not use radiation.

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Meta Information

Submission ID: 85 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

BROADENING THE REACH OF ULTRASOUND MEDICAL EDUCATION WITH INTERNAL MEDICINE ULTRASOUND ROUNDS

Introduction: The Internal Medicine (IM) Ultrasound (US) Community of Practice (COP) is a group of medical professionals from attending physicians to medical students that work to integrate US into the Internal Medicine practice through education, research, and advanced clinical training. The scope of anatomy and pathophysiology seen by medical students studying the clinical uses of US can be limited because their subjects tend to be healthy fellow classmates. The goal of the IM US rounds is to broaden the scope of this education by teaching on actual patients, in real time, on the wards.

Methods: The IM US COP student leaders have started a program within our institution for US leaders in the various sub-specialties of IM to be able to expand the scope of US education by teaching medical students, with an interest in IM and who are trained in US, the clinical applicability of bedside ultrasound. Physician instructors take a group of 4-5 medical students to 3-5 patients on their service and demonstrate critical ultrasound findings. The physician instructor uses this medium to teach US technique, applicable anatomy, physiology, and disease. When patients allow, students also practice hands-on US skills in this real-life yet supervised setting.

Results: The Internal Medicine Ultrasound Community of Practice has assembled in administrative meetings and US sessions. The US Rounds began the year with a session by a faculty leader on the general medicine service as an introduction to US Rounds. The first session focuses on common and important US based findings in patients. The monthly sessions, following the original session, are held within one of the IM sub-specialties.

Conclusion: The IM US Rounds is a means of expanding the medical education of students looking to develop their US clinical skills as it applies to the full range of IM. The US Rounds serve to prepare students early in the use of US and how medical interpretation skills are used to make clinical decisions. Working with patients allows the student to supplement their current knowledge base of “normal” with true pathophysiology and disease that can often only be provided by patients.

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Meta Information

Submission ID: 86 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Undergraduate Ultrasound Education: views of first-year residents and residency directors.

OBJECTIVES:

Medical schools across the country are increasingly introducing ultrasound training into their curricula, but little is known about how these programs influence match decisions or whether they are beneficial to residency training. We sought to examine the views of residents and residency directors on undergraduate participation in an integrated medical school ultrasound curriculum.

METHODS:

The University of South Carolina School of Medicine introduced an integrated ultrasound curriculum in 2006. As part of a larger survey of the medical school's curriculum, recent graduates at the conclusion of the PGY-1 year and their residency directors were queried regarding their attitudes towards the residents' previous experience with an integrated undergraduate ultrasound curriculum.

RESULTS:

Forty out of 79 graduates (51%) completed the overall survey, of which 38 (48%) completed the ultrasound portion. On a 5-point scale ranging from "poor" to "excellent," respondents rated the ultrasound curriculum 4.43, with 91% choosing either "good"(4) or "excellent"(5). 95% of respondents felt the undergraduate ultrasound curriculum was beneficial during their first year of residency. 18% felt their exposure to ultrasound influenced their choice of residency specialty. While only 34% of respondents felt having ultrasound training gave them an advantage in the match, 70% felt it would be an advantage for future graduates. 89% of graduates felt ultrasound should be standard in medical education. Eighteen of the 27 residency director respondents (67%) felt having undergraduate ultrasound experience was a positive attribute for current applicants and would be an advantage for future residents. 70% of residency director respondents felt it would be an important skill for future residents.

DISCUSSION:

The use of point-of-care ultrasound has been shown to reduce procedural complications, increase diagnostic accuracy, and improve patient care in multiple clinical settings. Prior publications have shown students overwhelmingly report ultrasound training improves their medical education; however no data have yet been published regarding the experience of graduates of this program. After one year of post-graduate medical training the majority of respondents rated their previous experience highly. Further, graduates and the majority of residency directors view this experience as positive and both feel ultrasound training will be advantageous for students in future residency matches.

CONCLUSIONS:

Undergraduate ultrasound education is viewed positively by both current residents with prior ultrasound training and their residency directors. Further study on trends of these opinions and how they influence the residency match process is warranted.

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Meta Information

Submission ID: 87 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Efficacy of Teaching Non-Physician Subjects Ultrasound Through Video Modules

This study aims to evaluate the ability for non-physician, ultrasound-naive subjects to become competent with ultrasound through video modules. Three one minute modules were prepared to demonstrate knobology and the identification of a rib fracture and a pneumothorax. Participants are then divided into two groups; the control group is asked to identify and save images of rib and normal lung sliding without exposure to the video modules. The second group has access to the modules throughout ultrasounding. Each group is given 10 minutes to save images without additional assistance or guidance. The participants are then evaluated by a third-party ultrasound trained physician in ability to save adequate images. The participants subsequently were tested in their ability to identify normal versus abnormal images in quiz format. This study hopes to elucidate whether or not ultrasound-naive participants are able to adequately teach themselves basic ultrasound methods from stand alone video modules. The implications range from educational modules prepared for students as primary or adjunct learning in ultrasound to remote or tele-medicine.

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Meta Information

Submission ID: 88 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

A Pilot Study of Ultrasound Education at Harvard Medical School: First Year Experience

Background: Point-of-care ultrasound (POCUS) use is expanding across all medical specialties and there has been increasing interest and effort to introduce ultrasound into the medical school curriculum. Ultrasonography has been shown to be feasible, well received, and to enhance learning across all four years of medical education.

Objectives: To determine the feasibility of integrating clinician-performed ultrasound into the Harvard Medical School curriculum. Led by a multidisciplinary team of instructors, ultrasound was introduced into the first year anatomy course as well as the second year physical exam course.

Methods: During the gross anatomy course, 176 first-year medical students attended a 40-minute introductory lecture and participated in four small-group sessions during dissection lab sessions. Focused ultrasound sessions reviewed anatomy of the neck, chest, cardiac system, and abdomen.

For the physical exam course, 4 brief lectures followed by hands-on sessions were introduced to 38 second year students. Four sessions were developed, including: 1) introduction to ultrasound; 2) the evaluation of the neck and thyroid; 3) the musculoskeletal exam; and 4) the abdominal exam. Pre- and post- course questionnaires were administered to evaluate student-perceived experience, attitudes, understanding, and knowledge of ultrasound, and its applications to learning the physical exam.

Results: The four sessions integrated into the gross anatomy lab proved feasible. Among the first year students, 91% agreed or strongly agreed that the ultrasound sessions were a positive addition to the course.

Within the physical exam course, 33 out of 38 students (87% response rate) completed a post-assessment survey of the ultrasound sessions. Using a 5-point Likert scale, 94% of students strongly agreed that they would like to see ultrasound incorporated into the medical school curriculum, and 95% felt that US teaching should continue to be part of the physical diagnosis course. Eighty-eight percent of students agreed that the ultrasound sessions allowed them to more effectively learn the physical exam and improved confidence in their exam skills. In addition, 91% of students agreed or strongly agreed that ultrasound should be given additional time throughout the 4 year medical school curriculum.

Conclusions: Clinician-performed ultrasound can effectively be integrated into the Harvard Medical School curriculum by utilizing didactic and small group hands-on sessions. Medical students perceived that ultrasound training in the curriculum is valuable in understanding human anatomy as well as learning physical exam skills. Following this pilot program, students surveyed overwhelmingly desired continued and greater incorporation of ultrasonography into the medical school curriculum. We hope to expand on the past year's work and continue towards incorporation of ultrasound education into all four years of the Harvard Medical School curriculum. This innovative program demonstrates the feasibility of incorporating clinician- performed ultrasound as an additional learning modality during medical school education.

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Meta Information

Submission ID:	89	Student Submission:	0
Format:	Oral		

Topic: Use of ultrasound in Undergraduate Medical Education

Point-of-Care Ultrasound and the Patients' Perspective: A Collaborative Quality Initiative

Background:

Point-of-care (POC) ultrasound is an innovative, safe, cost-effective, and rapidly evolving technique, now utilized in both the inpatient and outpatient settings. This tool has documented benefits and efficacy when utilized in the emergency department, critical care units, as well as peri-procedurally. It has been touted as the "visual stethoscope" of the 21st century, and as a result, is now more widely available and is currently being integrated into our medical education/training.

Over the past several years, there has been emerging interest in the utilization of bedside cardiac POC ultrasound, both in the patient and outpatient settings. Numerous recent studies have clearly demonstrated the utility of this technology, highlighting its utility in terms of real-time assessment of hemodynamics, cardiac anatomy and function, as well as its utility in augmenting the traditional bedside examination with resultant impact on clinical decision-making. POC ultrasound usage has even been shown to reduce overall length of hospitalization.

Despite the available literature, there has been limited meaningful documentation as to the perceived benefits of POC ultrasound, as deemed directly by patients. To our knowledge, no other study has directly examined the educational and motivational benefits of POC ultrasound, nor the perception for overall utility and patient satisfaction with this technique.

Summary of Work:

Given the paucity of patient-centered literature, we are currently seeking to assess for POC focused cardiac ultrasound-related perception of satisfaction, overall value, disease understanding, self-directed health engagement, and future healthcare preferences, as perceived directly by patients. We have designed a quality-based and methodologically validated patient survey questionnaire. This questionnaire will be administered to one hundred patients (inpatient cardiology service and outpatient general medicine clinic) within our institution, immediately after completing an augmented physical examination with use of POC focused cardiac ultrasound. The responses to the questionnaire will be analyzed, assessing for our primary outcomes: patient satisfaction, overall added value, changes in disease understanding, changes in self-directed health engagement, and future preferences for providers/care-systems that utilize this technology.

Conclusion:

Point-of-care ultrasound is an innovative technology that is here to stay. With an ever expanding and evidence-based supportive literature, point-of-care ultrasound has the potential of revolutionizing real-time care provided to patients. In this age of quality metrics, efficiency, and patient satisfaction, our study, a true patient-focused quality initiative, will seek to directly assess the patients' perspective for this pioneering and impactful technology. We are currently acquiring our data and look forward to sharing our preliminary results.

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Meta Information

Submission ID: 90 Student Submission: 0
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Asynchronous Compared with Conventional Learning for Medical Student FAST Exam Training Using a Novel Grading System

Introduction: Ultrasound (US) is an indispensable skill for the modern physician. Appropriate use of bedside ultrasound requires the ability to acquire images as well as the ability to interpret images correctly. There is little research on the comparative effectiveness of different instructional approaches in teaching these disparate skills.

We compared an asynchronous online module (AM) with a conventional classroom lecture (CL) followed by hands-on ultrasound session for the instruction of medical students (MS) in the Focused Assessment with Sonography for Trauma (FAST) exam. The students were assessed using a novel package of metrics to separately test their ability to acquire ultrasound images, ability to interpret these images, and confidence performing this exam again in the future.

Methods: Volunteer MS were prospectively enrolled and randomized to either a classroom lecture or an asynchronous module. A pretest to assess understanding of the FAST exam and interpretation of images was obtained. All MS received small group hands-on instruction and were tested using a FAST exam training model (Blue Phantom), which was positive for free fluid in the left and right upper quadrants. MS interpreted the images they acquired. The MS completed a post-test similar to the pretest. The quality of these images was assessed using the technical components of the B-QUIET instrument (a quality assurance tool used to assess image quality). MS judged their comfort with the exam on a visual analog scale before and after the training. At 4 months post-training a follow up test was sent out to all participants.

Results: Forty-three MS were enrolled, 18 in the AM group and 25 in the conventional group. Twenty-five students (11 in the online group, 14 in the in-class group) took the follow up test. Test scores, confidence, and B-QUIET scores were compared using student's T test. Interpretations of images were compared using Mann-Whitney-U testing. The pretest, post-test, follow up test scores, MS' confidence, and percentage of MS correctly interpreting their own images were not significantly different between groups. The mean B-QUIET scores were slightly lower in the online group (18 and 19 in the in class group with $p=0.025$).

Conclusion: Asynchronous learning was as effective as conventional lecture in evaluation metrics that assessed both cognitive skills and image interpretation. Quality of image acquisition as measured using B-quiet scores showed a small, but statistically significant, decrease in the AM group. It is unclear if this has any clinical relevance, especially given the similarity in interpretation accuracy. The primary limitation of this study is small sample size. Future research should extend this model to residents and trained physicians.

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Meta Information

Submission ID:	91	Student Submission:	0
Format:	Poster		
Topic:	Use of ultrasound in Undergraduate Medical Education		

Ultrasound Milestones for Physical Medicine & Rehabilitation Graduate Medical Education

Objective: To articulate clinical competency Milestones for nerve and musculoskeletal (MSK) ultrasound (US) procedures relevant to physical medicine and rehabilitation (PM&R) residency programs.

Background: In the United States this year, PM&R joins many other medical specialties by implementing Milestones for clinical competencies established by the Accreditation Council of Graduate Medical Education (ACGME). Milestones are used to evaluate residents' progress through the development of knowledge, skills and attitudes essential to the scope of practice of physiatry. The American Academy of Physical Medicine & Rehabilitation (AAPM&R) released a position statement in March, 2014 indicating that "diagnostic and interventional MSK ultrasound is a fundamental component of physiatric practice" and "criteria must be established to demonstrate competence". Although the ACGME tracks ultrasound guidance and extremity ultrasound procedures by PM&R residents (national averages for 2013 graduates are 15 and 6, respectively), current procedural Milestones for PM&R include injections (which may include US-guidance), but not diagnostic nerve or MSK ultrasound. There is a need for PM&R Milestones specific to interventional and diagnostic US procedures.

Methods: PM&R has a wide scope of practice, including "orthopedic, neurologic, rheumatologic, oncologic, vascular, industrial/occupational, cardiovascular, pulmonary or sports-related conditions" (AAPMR Position Statement 2014). Given this wide field of possible training and expertise, we have divided US procedures into core and advanced topics, where mastery of core procedures could be reasonably expected of all residents and advanced topics might require additional subspecialty training. Core nerve procedures overlap with some core US procedures in neurology and anesthesiology (e.g., visualizing and performing injections at the median and ulnar nerves). Similarly, core musculoskeletal procedures overlap with core US procedures in rheumatology, sports medicine, and family medicine (e.g., ultrasonography and injections of the shoulder, knee, and wrist). Milestones were developed to demarcate degrees of expertise expected for learners as they advance in skills and knowledge from interns to residency graduates.

Results

Milestones for diagnostic and interventional nerve and MSK US studies are described in Tables A and B (below).

Conclusions

These US Milestones have face validity and may be a viable model for tracking clinical competency for residents learning nerve and MSK ultrasonography. Feasibility and content validity of these Milestones need to be evaluated through testing in a PM&R residency program.

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Meta Information

Submission ID: 92 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Longitudinal Curriculum for Teaching Point-of-Care Ultrasound to Internal Medicine Residents

Background:

As more medical schools introduce ultrasound training into their curriculum, our institution has seen a surge in interest for ultrasound training. This includes education in the use of ultrasound during procedures as well as utilization in bedside diagnosis and decision making. Many residency programs have begun to offer discrete workshops or training sessions to teach residents basic ultrasound skills. However, the extent of ultrasound training prior to residency and the comfort with ultrasound technique is heterogenous among trainees and lack of ongoing training may negatively impact retention of knowledge and this skill based competency. Concurrently, there has been a shift in medical education to evaluate trainees on the basis of competency-based milestones. In this spirit, we have implemented an internal medicine residency ultrasound (IMRUS) curriculum that reinforces and assesses competency in the use of point-of-care ultrasound overall years of training.

Summary of work:

The IMRUS curriculum is spread across all three of internal medicine training. During orientation, all trainees are taught basic ultrasound technique, image acquisition and interpretation via an introductory course which includes hands-on knobology sessions and training in ultrasound use for paracentesis and thoracentesis on cadavers. Education is reinforced during first year with image interpretation sessions during inpatient morning report and bimonthly point-of-care bedside ultrasound rounds for the hospital-based general medicine teaching services. During these rounds, trainees receive one-on-one training by our ultrasound faculty in image acquisition and interpretation on hospitalized patients with common pathology. During second and third year of training, a monthly workshops are held during the ambulatory clinic block where abdominal aortic, inferior vena cava, and renal ultrasound assessment is taught on standardized patients within our multidisciplinary simulation center. Learners are assessed with surveys and direct observation at onset of training and reassessed during third year to measure retention of skills in image acquisition and interpretation and reinforce core principles. Additionally, an internal medicine residency dedicated ultrasound machine is readily available for second and third year trainees to encourage use in point-of-care diagnosis and to facilitate competency in ultrasound-guided procedures.

Conclusion:

Ultrasound is an important point-of-care tool for bedside decision-making and guided procedures. A structured, longitudinal curriculum is important to facilitate both acquisition as well as retention of trainee skill and competency with image acquisition, image interpretation, and procedural ability with this skill. Future work includes developing and validating ultrasound-specific milestones akin to the ACGME milestones to track trainee competency with point-of-care ultrasound throughout our curriculum.

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Meta Information

Submission ID: 93 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Ultrasound Interest Group 2.0: An Update for Advancing Programs

Purpose: With the advance in ultrasound technology and clinical utility with relative lack of training for physicians across nearly all specialties, there is a growing need for ultrasound's integration into undergraduate medical education. While there is various penetrance into the required curriculum, there remains opportunity for ultrasound education in the form of an ultrasound interest group (USIG). The original USIG, described in 2011, was structured simply with an executive board consisting of a President, Vice President, Treasurer, and Secretary. As participation and number of research and educational projects grew, there was a need for an advanced structure to the USIG to allow for its overwhelming scope. Central to this restructuring has been the development of committees to appropriately delegate tasks and share responsibility.

Methods: To accommodate for increased membership and number of research and education projects, a committee structure was designed to improve delegation and maximize productivity. These committees consisted of Research, Education, Outreach, Technology, and Grants. Each committee is chaired by an upperclassman medical student with significant ultrasound experience. The committee chairs are responsible for overseeing projects that are classified under their heading. The committees are staffed by members, who actively lead individual projects and report to both the executive board and committee chairs with semi-annual status updates.

Results: While components of the updated USIG are regularly being re-evaluated and updated, the committee structure has allowed for the initiation, advancement, or completion of over 30 projects. The hierarchy has allowed shared responsibility and has expanded leadership opportunities for novice ultrasound students. These leadership opportunities help to incentivize ultrasound participation in a curriculum that does not currently mandate this.

Conclusion: The advanced structure to USIG including committees has allowed for shared leadership making it possible for the program to oversee more projects. Expanding the ultrasound opportunities is a vital step to improving participation by students of all skill levels. The addition of status reports by committee members will serve to encourage the advancement of the projects, allow for the program to help committee members navigate obstacles to completion, and track the status for seamless transitions between leadership. This advanced structure is currently helping to allow students of all educational levels learn basic ultrasound skills to help prepare them for the expanding clinical applications they will encounter throughout their career.

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Meta Information

Submission ID:	94	Student Submission:	1
Format:	Poster		
Topic:	Use of ultrasound in Undergraduate Medical Education		

Using Telemedicine to Teach Bedside Ultrasound Skills

Objectives: The remote diagnosis and treatment of patients by means of telecommunication technology (telemedicine) has both financial and health care benefits for remote health care centers. Telemedicine is currently used for real-time supervision of experienced bedside ultrasound clinicians. It is unknown whether this technology can be used to teach bedside ultrasound to ultrasound-naive clinicians. The aim of this study was to determine if telemedicine could be used to teach a bedside ultrasound skill important in the diagnosis of intra-abdominal bleeding.

Methods: Nurses (n=10) were recruited from St. Mary's Hospital Center (a McGill University affiliated teaching hospital) and randomly divided in two groups (Control and Telemedicine). Both groups had similar levels of clinical experience and no ultrasound experience. Both groups were given identical educational material to study one week prior to the teaching workshop. Each group received an identical teaching workshop on how to image Morison's pouch.

The Control group was taught to image Morison's pouch in-person (control teaching). The Telemedicine group was taught to image Morison's pouch via telemedicine (telemedicine teaching). The instructor and Telemedicine group were located in two different rooms within the same hospital. The Telemedicine group was able to view the instructor's scanning techniques and generated ultrasound images and vice-versa.

To assess the effectiveness of the control and telemedicine teaching workshops, both groups completed a theoretical and practical test before the workshop (pre-test) and an identical test after the workshop (post-test). The theoretical test (n=9 questions) was designed to test for knowledge of basic ultrasound physics, probe choice, image generation technique, and the importance of imaging Morison's pouch. The practical test (n=four criteria) was designed to test for ultrasound skills regarding: 1) choice of probe with correct placement of the orientation marker, 2) optimal patient and sonographer positioning, and 3-4) identification and image quality of Morison's pouch. The ability to meet the four criteria was scored 'able' or 'unable' by an emergency physician with bedside ultrasound credentials and blinded to the teaching method.

Results: Prior to teaching, the Control group and the Telemedicine group showed similar mean scores for the theoretical pre-test (Control: 69 ± 9%; Telemedicine: 73 ± 15%). Both groups also performed similarly on the practical pre-test (Control: scored 'unable' on 20/20 criteria; Telemedicine: scored 'unable' on 20/20 criteria). After teaching, the Control group significantly improved its mean score on the practical post-test (scored 'able' on 20/20 criteria). The Telemedicine group also significantly improved its mean score on the practical post-test (scored 'able' on 19/20 criteria). This resulted in similar scores between the Control group and the Telemedicine group for their performance on the practical post-test. After teaching, the Telemedicine group significantly improved its mean score on the theoretical post-test (89 ± 8%; $p < 0.05$; paired t-test) while the Control group showed no change on the theoretical post-test (67 ± 8%). The average time required to produce an ultrasound image of Morison's pouch was statistically similar in both groups (Control: 1.24 min; Telemedicine: 1.24 min).

Conclusion: The results demonstrate that telemedicine can successfully teach ultrasound-naïve clinicians the bedside ultrasound skills necessary to identify Morison's pouch. Telemedicine teaching

1) was equivalent to in-person teaching for the acquisition of practical skills and 2) was more successful than in-person teaching for the acquisition of theoretical knowledge. Remote teaching of this bedside ultrasound skill may help in the diagnosis of intra-abdominal bleeding and trauma care in remote health care centers.

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Meta Information

Submission ID: 95 Student Submission: 1
Format: Oral

Topic: Point of Care ultrasound in health care delivery to underserved populations

“Blended-learning” point of care ultrasound course for undergraduate medical students: preliminary results from e-learning Moodle© platform.

Background

Medical schools has been updating their curricula by introducing point of care ultrasound courses for undergraduate students because this method could become not only a new semiotic device, but also a great teaching tool that helps students in their process of clinical learning. Teaching methods that incorporate technology into learning process has proved equally or more efficient than traditional classes. In medical education, blended-learning methodology (“b-learning”) has the benefit of associating the advantages of “e-learning” and those of traditional classes. “E-learning” could stimulate students in achieving theoretical knowledge, could facilitate its retention and could be a great alternative to continuous education even when students are no longer inserted in a formal context of learning.

Summary of Work

Since October 2013, a blended-learning course of point of care ultrasound has been introduced to the curriculum of a medical school in Brazil, for last year students during their Emergency Medicine rotation. The course consists of twenty-hours theoretical and practical classes, and an “e-learning” Moodle©-platform, based on real scenarios in which point of care ultrasound may have improved clinical management. The “e-learning” platform proposes 3 categories of activities: 1-Virtual Lectures (VL) – video lessons about the same topics lectured during the course. 2-Ultrasound Challenge (UC) – students are invited to interpret point of care ultrasound examinations from real cases and to formulate diagnostic hypothesis; new scenarios and feedback are provided weekly. 3-Ultrasound Quiz (UQ) – multiple choice questions with automatic feedback are provided weekly. Each 30 days, a group of 8 to 9 students started the rotation and are registered on the platform’s ultrasound section. Students have permission to access it indefinitely, even when they are no longer in the Emergency Medicine rotation. New activities were publicized through a post on a dedicated social media website.

Summary of Results

Preliminary data (from November 26th 2013 to July 10th 2014) shows 4.025 total page views (UQ 62,7%; UC 32,7%; UL 2,9%), with medium 30,9 page views/day and medium 59,1 page views/student. During the rotation 3.234 page views was registered (80,3% platform’s page views; medium 29,9 page views/day and medium 47,5 page views/student), and after the end of the rotation page views totalized 791 (19,6% platform page views, medium 12,5 page views/day and medium 11,6 page views/student).

Conclusions

The “e-learning” platform is well accepted by students as a way to practice and review the knowledge acquired during traditional classes and ward round practice and could support a theoretical point of care ultrasound course for undergraduate medical students.

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Meta Information

Submission ID: 96 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Impact of a Daylong Medical Student Course on Procedural Ultrasound

Background: Although procedural ultrasound courses for senior medical students are becoming more common, the impact of such stand-alone courses is largely unknown.

Objective: To examine fourth year medical student knowledge, attitudes, and comfort level with procedural ultrasound, and to determine the impact of a one-day procedural ultrasound course.

Methods: We distributed an internet-based survey to all graduating medical students. Demographic questions addressed prior ultrasound experience and future residency specialty. Respondents were categorized as participants (enrolled in the ultrasound course) or non-participants (not enrolled). All students were sent a pre- and post-test survey, regardless of course participation. Knowledge of procedural ultrasound was assessed by 31 multiple-choice content-based questions accompanied by relevant images and videos when appropriate; scores were calculated as the percentage of correct responses. Mean scores were calculated for each group (participants and non-participants) on the pre- and post-test. Attitudes and comfort level were each assessed with three different questions using a five-point Likert scale of agreement; group scores were calculated as the percentage of respondents who agreed or strongly agreed with each statement. Agreement implied a more supportive attitude or greater comfort with procedural ultrasound. All comparisons were analyzed using the chi-square test, with a two-tailed p-value <0.05 considered to be statistically significant.

Results: All (100%) of the 94 course participants completed both the pre- and post-test. Of the 23 non-participants, 16 (70%) completed both the pre- and post-test. Among the 110 survey respondents, the most common future specialties were Internal Medicine (26%), Surgery (20%), Pediatrics (10%), and Emergency Medicine (10%). Almost all (99%) respondents reported some ultrasound experience during medical school, most commonly during Obstetrics and Gynecology (76%), Emergency Medicine (73%), and Intensive Care Unit (56%) clerkships. There was no statistical difference between the mean pre-test knowledge scores among participants (72%) and non-participants (70%). Among course participants, we found a 13% average increase in knowledge score ($p<0.05$) between the pre and post-tests; there was no significant change in knowledge score among non-participants. We also found an increase in positive attitudes towards procedural ultrasound among participants ($p<0.05$ for two of three questions), with no significant change noted among non-participants. Participants also had an increased comfort level with procedural ultrasound after the course ($p<0.05$ for all three questions).

Conclusions: A one-day course can impact fourth year medical student knowledge, attitudes, and comfort level with the use of ultrasound for procedural guidance.

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Meta Information

Submission ID:	97	Student Submission:	0
Format:	Poster		
Topic:	Use of ultrasound in Undergraduate Medical Education		

The Effectiveness of Ultrasound Simulators in an Introductory Ultrasound Course in Brazil

BACKGROUND: The benefits of point-of-care ultrasound are well-known; it is inexpensive, noninvasive, portable, and increasingly present in rural and less-developed areas (Sippel, 2011). Early exposure to ultrasound in medical education increases users' aptitude in diagnostic and procedural sonography (Fernández-Frackelton, 2007). The use of simulated clinical experiences (e.g. standardized patients and high-tech mannequins) to augment conventional teaching methods is well-established in medical schools (Akaike, 2012), but the utility of simulation in ultrasound education has not yet been investigated. This article discusses the effect of the use of SonoSim ultrasound simulators on learning outcomes for medical residents taking an introductory ultrasound course in Porto Alegre, RS, Brazil.

METHODS: Fifty-three internal medicine residents at Santa Casa de Misericordia Hospital in Porto Alegre, RS, Brazil with no prior ultrasound experience voluntarily enrolled in an introductory point-of-care ultrasound course covering 8 topics. Each teaching session consisted of a presentation-based lecture and 2 hours of hands-on training. For the hands-on training portion, participants were randomly assigned to the "Live Model Only" (LM) group (2 hours scanning live models) or to the "Live Model plus Simulator" (LM+S) group (1 hour with live models and 1 hour of self-instruction using the SonoSim training modules). We anticipate poorer outcomes in the LM+S group, as we believe the most efficient way to learn novel concepts is through direct exposure in a practical setting.

RESULTS: On the 30-item written portion of the exam administered at the conclusion of the course, the LM+S group's mean score was 23.1 (n=21, SD=3.4). The LM group's mean score was 21.8 (n=19, SD=4.8). On the 16-item practical portion of the exam, the LM+S group's mean score was 8.7 (n=22, SD=4.8). The LM group's mean score was 8.7 (n=19, SD=3.9). There was no difference in written or practical exam scores between the two groups ($p>.05$).

DISCUSSION: The results of the final exam suggest that the use of the ultrasound simulators did not affect learning outcomes, positively or negatively. We noted that, deviating from the initial study design, the LM+S group ultimately spent more time overall practicing ultrasound because they did not fatigue as quickly as the LM group. The simulators brought variety to the LM+S group's learning experience, helping them stay engaged longer. Despite their extra practice, the LM+S group gained no learning advantage. Confounding factors include varied English language proficiency and irregular attendance. Limitations include small sample size and suboptimal control.

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Meta Information

Submission ID: 98 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Multidisciplinary Ultrasound Leadership Training Initiative: Using Near-Peer Teaching to Eliminate the Grey Area in Third-Year Medical Student Ultrasound Education

Introduction. Ultrasound training in medical school has traditionally provided its students with some level of generalized technical or academic education during years one (M1) and two (M2), followed by more advanced and specialty-specific opportunities during year four (M4) and beyond. However, little progress has been made in developing students to be leaders in these M4 advanced topics during their third year (M3). The Multidisciplinary Ultrasound Leadership Training Initiative (MULTI) is a novel longitudinal curriculum that provides scaffolding to develop third-year students into leaders in their chosen fields as they differentiate their interests during year three. Embodying Aristotle's idea that teaching is the highest form of understanding, MULTI aims to evaluate the leadership development of M3 students as they design and execute specialty-specific ultrasound training sessions for M1 students while using M2 students as their proctors. We believe that this is an effective way through which to prepare M3 students for increased responsibility while simultaneously filling a gap in ultrasound medical education.

Methods. Methods closely follow those of an internal pilot study conducted last year evaluating the efficacy of ultrasound education in this manner. We will use internal quality data taken both from performance and knowledge assessments and opinion surveys to determine the academic and professional development experienced by the different groups involved in this experience.

Results. Results are forthcoming as the program is implemented, though we expect results to mimic those seen in an internal pilot study conducted over the past year. Results from this study demonstrated the efficacy of this training in educating learners and increasing their confidence with ultrasound. The effect of this program on M3 students as leaders is yet to be determined, though anecdotal responses suggest favorable results.

Conclusions. Results from our one-year internal pilot program show that this is a feasible program to evaluate ultrasound training of junior students by upperclassmen. We hope to duplicate these results and capture the leadership development of those involved in its administration.

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Meta Information

Submission ID:	99	Student Submission:	1
Format:	Poster		
Topic:	Use of ultrasound in Graduate Medical and Continuing Education		

Competency cut-point identification derived from a mastery learning cohort approach: A hybrid model for efficient competency certification in point-of-care ultrasound

Background: Competency and institutional certification amongst point-of-care ultrasound (POCUS) has traditionally been based on somewhat arbitrary quantity-based cut-points similar to those used for invasive procedures amongst medical trainees. Significant variation in POCUS clinical applications, training methods, individual skillsets, and learning curves make a quantity-based system inadequate in assuring competency across a variety of training environments. However, the more rigorous mastery-learning model may not always be feasible due to its intensive resource requirement. A hybrid system may be a more efficient model and result in less variation in competency amongst those certified in POCUS at an institution.

Methods: Following a 40-hour Internal Medicine Bedside UltraSound (IMBUS) bootcamp, POCUS learners performed a pre-determined number of mentored ultrasound exams in each specified area (i.e. cardiac) and finding (i.e. severely reduced LV systolic function) at which time they were eligible for certification in that area and underwent a one-on-one mastery learning assessment of technical, interpretive, and integrative ability in the eligible area of POCUS. Then users were either granted certification if they demonstrated mastery performance or they were required to perform an additional quantity of mentored exams followed by a repeat one-on-one assessment. Quantity of exams at time of certification was tracked using a mobile, smartphone-based tracking tool. The 2nd quartile value for quantity of exams at time of certification amongst the cohort was used to set the minimum quantity of mentored exams in an area for future learners to perform prior to being eligible for the credentialing assessment. This "minimum quantity" fluctuated over the 3-year study period and was adjusted every 4-6 months with analysis of the data. Learners necessitating additional exams above each quantity cut-point were quantified during the study.

Results: 58 residents and faculty learners performed 22,258 exams and 55 learners were certified in POCUS areas over the 30-month study. Credentialing quantity cut-points for each area of POCUS were adjusted over time based on the moving 2nd quartile of the cohort's exam volume at time of certification within the mastery learning system. The number of learners not demonstrating mastery performance when reaching the quantity cut-point decreased as the cut-points were adjusted over time. All initial cut-points were refined over the course of the 30 months based on the cohort's 2nd quartile value for each area. Cardiovascular cut-points were refined by the greatest percentage, all in the positive direction. Abdominal cut-points were refined the least.

Conclusion: Mastery learning certification in POCUS may not be feasible amongst all residency programs. Pure quantity-based competency cut-points are less resource intensive but differ amongst learners, clinical applications, teaching methods, mentoring, and physician skill set. The hybrid system studied set an institution-specific quantity cut-point based on mastery certification within the cohort of learners. Assuming that the previously mentioned factors influencing quantity cut-points remain stable, this hybrid methodology guides a more effective quantity-based system going forward in a given training program. This may be a useful compromise between efficiency of certification and assurance of competency amongst POCUS learners.

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Meta Information

Submission ID:	100	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Caesarean Section Scar Pregnancy Developing into Placenta Accreta: A Case Report

Caesarean section scar pregnancy is a rare form of ectopic pregnancy, reportedly occurring in 1 in 2000 pregnancies. However, the incidence is increasing due to the rising number of caesarean sections. It occurs when the gestational sac implants and grows into a previous caesarean scar. A gestational sac implanted in the anterior portion of the lower uterine segment, near the level of the internal os, can be seen on ultrasound.

Management of a caesarean scar pregnancy includes conservative, medical, and surgical approaches. Most cases are terminated due to the high risk of maternal morbidity and mortality. Although rare, cases managed conservatively may progress to term and have been previously reported to develop into placenta accreta. It has been hypothesized that the pathologic mechanisms between scar pregnancies and placenta accreta are similar, with scar thickness and depth of invasion influencing the direction of progression.

We report a case of a conservatively managed caesarean scar pregnancy diagnosed by ultrasound at 8 weeks 3 days, which later developed into placenta previa and accreta. Additionally, we review the differential diagnosis and ultrasound findings for a lower uterine segment mass in pregnancy.

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Meta Information

Submission ID:	101	Student Submission:	0
Format:	Poster		
Topic:	Point of Care ultrasound in general clinical practice		

Ultrasound Pathology Course in Mwanza, Tanzania

Our team of third year medical students from UC Irvine School of Medicine traveled to Mwanza, Tanzania to continue their established ultrasound curriculum at Tandabui Institute of Health Sciences (TIHEST). We brought two Sonosite Nanomaxx machines and two Sonosim machines to conduct a three-week ultrasound pathology course. Organ systems covered included cardiac, abdominal, pulmonary, OB-GYN, and basic procedures. For each organ system, the lesson covered three to four major pathologies that are frequently observed in Mwanza. Examples of the pathologies taught include cardiac tamponade, ascites, ectopic pregnancy, and pneumothorax. This course was offered to second year clinical officer students who had previously completed the 'Introduction to Ultrasound' course that was offered in 2013. In addition, other second year clinical officer students and health professionals

were also invited to the course. The curriculum was based on the second year ultrasound curriculum developed by Dr. John Christian Fox at UC Irvine School of Medicine, in addition to incorporating new techniques. To accommodate the clinical officer students, our course was conducted at the three hospitals affiliated with TIHEST: Magu, Nyamagana and Ukerewe Island.

61 students participated in the final examination and 55 students passed (90%). Passing was set as achieving an average of 65% and above, and was assessed by averaging their pulmonary, abdominal, OB-GYN, and cardiac pathology quiz scores with their final exam score. Quizzes and the final exam consisted of clinical vignettes, ultrasound pathology pictures, hands-on ultrasound practical and ultrasound videos. Of the 55 students who passed the course, 44 of them participated in the introductory ultrasound course last year (80%). Of the 6 students who did not pass the course, 1 participated in the course last year. On the first day of the course, all students were given a pretest, which consisted of the same questions as the final exam. The average score on the pretest was 50%, while the average score on the written portion of the final exam was 80.6%. Pretests were not returned to the students.

Our longitudinal work at TIHEST will continue throughout the upcoming years. Bedside ultrasound has potential in communities such as Mwanza, and UC Irvine is excited to be a part of its implementation. Next year we wish to teach our established, 'Introduction to Ultrasound' and 'Introduction to Ultrasound Pathology' courses, in addition to a new course for third year clinical officer students. This new course will incorporate bedside ultrasound into student rounds at the three locations Magu, Nyamagana, and Ukerewe Island. Through hands on bedside ultrasound we hope to build upon the foundation of our students' ultrasound knowledge.

In conclusion, we found that through our 'Introduction to Ultrasound Pathology' course students can adequately learn to recognize numerous pathologies seen on ultrasound machines.

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Meta Information

Submission ID: 102 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Surgeon-Performed Ultrasound: Resident Self-Assessment of Frequency of Use and Competency at a Single Center

Background: General surgery as a specialty has accepted and adopted the use of point-of-care ultrasound use into their practice. Surgeon-performed ultrasound (SPUS), or point-of-care ultrasound performed at the bedside by the surgeon, has been demonstrated as effective and accurate over decades. Some surgical organizations require its incorporation into surgical training. At one academic institution, the formal training for residents consisted of an annual hands-on training session that included SPUS applications including FAST, biliary, thyroid, vascular and vascular access training.

Methods: General surgery residents from one urban academic residency program were asked to complete an anonymous survey regarding SPUS. They were surveyed regarding how often they utilized SPUS in their own practice, how proficient they felt at certain applications, and their general opinions regarding the utility or potential barriers to the use of point of care ultrasound.

Results: 20 General surgery residents anonymously completed the survey. 9/20 (45%) stated that they use SPUS in their clinical practice. In regards to their assessment of the adequacy of their training, 0% reported their training as intensive or that they were well-prepared to scan independently. 7/20 (35%) stated their training was sufficient. 13/20 (65%) considered their training insufficient. In stating barriers to use of SPUS, 60% cited lack of personal proficiency, 25% cited preference for the radiology department to perform the studies and 40% found lack of availability of machines to be a barrier. 20% of respondents used SPUS >2 times a week, 25% once a week, 20% once a month, and 10% once a year. When asked which applications they used SPUS for, the most common were FAST (70%) and central venous cannulation (60%).

Conclusion: In this study at a single institution, general surgery residents found their training in SPUS to be less than sufficient. The most common barrier to use of POC ultrasound was lack of personal proficiency, followed by unavailability of machines. FAST and central venous access were the most commonly used applications by general surgery residents.

Authors

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Meta Information

Submission ID: 103 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Sustainable Medical Student Run International Ultrasound Projects

Introduction:

Education for medical students at UC Irvine has been significantly enhanced through the integration of ultrasound into the curriculum. Ultrasound instruction has given students a unique skill that they can utilize during the summer between the first and second years of undergraduate training. It deepens students' understanding of medicine, provided avenues for new and exciting research opportunities, and increases the fund of knowledge that these students are able to share in both their local communities and abroad. In an effort to provide opportunities to both use and improve their newly developed ultrasound skills, students have organized trips abroad to areas where fast and efficient imaging modalities are desperately needed.

Methods/Results:

The numbers have been on the rise for the past three years, with more and more medical students choosing to take their new skill abroad. For the summer of 2014, nearly fifty percent of a class of approximately one hundred chose to go abroad to enrich their medical school experience through teaching ultrasound. This year students traveled to Panama, Tanzania, Australia, Turkey, India and Brazil. Many of these projects have become longitudinal in that students are returning to build upon the advances of the previous class and create sustainable projects for the communities they are serving. We now have three generations of students who have traveled to Australia and Panama and two generations of students who have traveled to Tanzania and India to work on ultrasound projects. These students have participated in a wide range of research projects that are centered on teaching ultrasound.

Discussion:

With the positive feedback students have been continuously giving over the years upon returning from their international ultrasound trips, it is evident that this experience is both productive and stimulating for students. By taking on leadership roles and helping underserved communities, their involvement helps shape the doctor they will be upon graduation from medical school. Our hope is that through publicity of our projects, international ultrasound programs like ours can be implemented at other medical schools. The organization of these projects has been completely student run through our ultrasound student interest group (USIG). Furthermore, one of the largest barriers to traveling abroad is funding. However, thanks to a student run endeavor campaign, UCI has received a generous donation of $100,000 to fund these projects for the next five years.

Students at UCI have a unique skill that most medical students are not fortunate enough to learn. In the spirit of our school motto, "Discover, Teach, Heal" we have decided to use our knowledge to discover new uses for ultrasound abroad all with hope that this can lead to the healing of those who might usually go untreated.

Authors

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Meta Information

Submission ID:	104	Student Submission:	1
Format:	Poster		
Topic:	Use of ultrasound in Undergraduate Medical Education		

Bedside and Consultative Doppler Ultrasound Evaluation of Flow Pattern in Testicular Torsion

Background

Acute scrotal pain is a common presenting complaint in the Emergency Department (ED). Testicular torsion is of primary concern. Point of care ultrasound (POCUS) of the acute scrotum is typically considered an advanced point of care exam but has high utility for ED physicians. The current teaching is that in testicular torsion, the venous flow is interrupted initially due to easy collapsibility of the vessel walls and the low intravascular pressure.

Objectives

To review the doppler ultrasound flow characteristics in the diagnosis of testicular torsion in patients presenting to an academic emergency department.

Methods

We conducted a retrospective review of all male patients who presented to our facility over a 22 month period from 01/2012 to 10/2013 with the diagnosis of testicular torsion. We conducted an exhaustive review of the electronic medical records including operative reports as well as POCUS and radiology images, and descriptive statistics were reported.

Results

There were a total of 12 patients diagnosed with testicular torsion during the study period. 100% of the patients were noted to have absence of arterial flow. 10 (83%) of the patients were noted to have presence of venous flow. The other 2 patients (17%) were noted to have absence of both venous and arterial flow, with one being prenatal bilateral testicular torsion while the other was a 14 year old with intermittent right testicular pain for 2 weeks with history of trauma 1.5 months prior. Of the 12 patients, 3 were diagnosed by US credentialed ED physicians, with documented venous flow and absence of arterial flow, while the others were done by the radiology department when a credentialed ED physician was not available to perform the study.

Conclusion

Of all patients diagnosed with testicular torsion in a teaching hospital over a 22 month period, 83% of the patients still had demonstrated venous flow. All were noted to have absence of arterial flow. The two outliers were of special circumstances, one being prenatal testicular torsion, and the other being prolonged intermittent scrotal pain after trauma, with absence of both venous and arterial flow. This study is of significance as the findings suggest that arterial flow is compromised initially in testicular torsion, which is different from the prior postulation that venous flow is the one interrupted initially.

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Meta Information

Submission ID: 105 Student Submission: 0
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Student workshop preferences for UC Irvine Ultrafest: what ultrasound applications do students want to learn?

Introduction:

Point-of-care ultrasound is a useful diagnostic tool that has been increasingly incorporated into medical school education. Many medical schools have described integrated ultrasound curricula, and specialists from the Society of Radiologists in Ultrasound and the Alliance of Medical School Educators in Radiology recently designed a model for ultrasound education in medical school (Baltarowich et al., 2014). In addition, with many medical school students involved in student-led interest groups, student-directed education is a prominent contribution to learning experiences during medical school, including ultrasound. UC Irvine recently hosted the third annual Ultrafest, a free ultrasound symposium for medical students. This event, similar to other medical student-organized educational events, seeks to cater to the educational interests of student participants. This study aimed to characterize what applications of bedside ultrasound medical students most desire to learn.

Methods:

In registering for Ultrafest in 2014, students submitted preferences for the five stations they would attend. They picked their top 6 from 14 possible choices (see Table 1 for workshops). To emphasize students' highest ranked stations, this study focused on the top 3 stations for each student. Along with these preferences, registrants answered survey questions about their future specialty interests and ultrasound experience. Cohorts of students were stratified by their responses to 1) previous ultrasound experience, and 2) specialties of interest. Percentages of students listing a workshop in their top three choices were calculated for each cohort. Registrants that listed more than 6 preferences or multiple top preferences were excluded from this study.

Results:

Out of the 338 registrants for 2014 UC Irvine Ultrafest, 312 (92%) ranked their top 6 preferences. Table 1 shows percentages of each cohort that listed each workshop within their top 3 preferences. Overall, three most requested stations were Cardiac Ultrasound (44%), Vascular Procedures (41%), and eFAST (39%). Variations were noted for different ultrasound experience levels and different specialty interests.

Discussion:

The workshop preferences of registrants for UC Irvine Ultrafest are characterized in this study. These preferences reflect the applications of point-of-care ultrasound that students are most interested in learning, and how those preferences varied between students with different specialty interests or levels of experience. Students with more hours of previous ultrasound experience were more inclined to attend advanced, clinically-oriented workshops to sharpen their skills. Variations were also seen in preferences of students with certain specialties of interest. These data provide insight into what students are interested in learning about ultrasound and can be used when planning student-organized ultrasound symposiums. Furthermore, these data may aid in catering ultrasound

learning to particular subsets of medical students, such as at events hosted by student specialty interest groups.

Baltarowich et al. “National Ultrasound Curriculum for Medical Students.” Ultrasound Quarterly 2014; 30:13-19.

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Meta Information

Submission ID:	107	Student Submission:	1
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

Evaluation of Medical Student Ultrasound Competencies after Formal Incorporation of Ultrasound Education into the Gross Anatomy Course at the Wayne State University School of Medicine (WSUSOM)

Background: The Wayne State University School of Medicine (WSUSOM) first introduced ultrasound education into the undergraduate Gross Anatomy course in 2006. The curriculum has since evolved over the years, and now formally incorporated into the Gross Anatomy course, and taught concurrently during the corresponding units. A detailed ultrasound curriculum document has been developed for gross anatomy, with measurable goals and objectives, a scanning protocol, pre-test, pos-test. Sessions begin with an introductory lecture, followed by a hands-on portion with emphasis on image acquisition, recognition, and interpretation skills. Anatomic concepts are reviewed during the hands-on portion which concludes with a short image review session. Ultrasound images with clinically based questions are included on the final exam at the conclusion of each unit.

Objectives: 1. To determine the effectiveness of the gross anatomy ultrasound curriculum. 2. To evaluate student ultrasound competencies in image recognition and interpretation. 3. To evaluate student performance among peers

Methods: This was a prospective observational study of first year medical students at the WSUSOM during the gross anatomy course. Students participated in scheduled ultrasound training sessions during each corresponding gross anatomy unit. Educational tools included power point lectures, small group hands-on sessions, detailed curriculum documents, pre and post tests, on-line resources, and final examination. The 4 anatomy units are (1) Upper Limb; (2) Head & Neck; (3) Thorax and Abdomen; and (4) Lower Limb and Pelvis.

Results: Ultrasound test scores during the 2012 and 2013 year 1 gross anatomy final exams involving a total of 600 medical students (300/class) were analyzed to determine the difficulty factor (DF), and the discrimination index (DI).

2012

Unit 1 **********

2	DF – 0.94;	DI – 0.12
3	DF – 0.65;	DI – 0.59
4	DF – 0.45;	DI – 0.45

2013

Unit 1	DF – 0-93;	DI – 0.06
2	DF – 0.62;	DI – 0.35
3	DF – 0.81;	DI – 0.20
4	DF – 0.65;	DI – 0.23

The newly developed curriculum for 2013 resulted in a DI significantly < 0.50 for all units, indicating that students performed fairly evenly in their ultrasound image recognition and interpretation skills.

Conclusion: Ultrasound incorporation into the freshman gross anatomy course is feasible, and when implemented effectively can result in the desired knowledge acquisition of basic ultrasound image recognition and interpretation skills even among a diverse and large group of medical students.

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Meta Information

Submission ID: 108 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Retention Assessment of an Intensive Ultrasound Course in 1st and 5th Year Medical Students.

INTRO: The University of New England School of Rural Medicine (UNE) in Armidale, Australia is part of the Joint Medical Program with the University of Newcastle. In coordination with the University of California Irvine School of Medicine (UCI), UNE established an "Introduction to Ultrasound" course for UNE medical students that has been conducted for the past three years. This course was an intensive two-day workshop held separately for both 1st and 5th year students who had little or no formal ultrasound training. The goal of this course was to increase the students' knowledge and skills in the realm of point-of-care ultrasound. This study examines whether 1st year students can achieve similar learning objectives in basic POC US as 5th year students, and to quantify the educational benefit in administering an ultrasound course earlier or later in a student's medical career.

OBJECTIVE: To determine the efficacy of an intensive point-of-care ultrasound workshop to medical students in training.

METHODS: The ultrasound course was held over a two-day period and included 5 hours of didactic teaching and 8 hours of hands-on skills training. The teaching faculty consisted of GP and ED physicians from UNE as well as Dr. Christian Fox, MD of UCI's Emergency Department. In addition, several UCI medical student tutors participated in the teaching and assessment. The practical skills stations included the following: evaluation for pericardial effusion/Tamponade, pneumothorax, AAA, cardiac views, and FAST and RUSH protocols. For this study, each student was given an identical pre-course and post-course survey. Their performance was evaluated based on a numerical score. The statistics presented consists of data from last year as well as the course given this year.

RESULTS: The 2014 course 5th years had a pre-survey average of 70.22% and a post-survey average of 89.58%. In the 2013 course the 1st years had a pre-survey average of 59.55% and a post-survey average of 93.70%.

DISCUSSION: This study demonstrated the benefits of an intensive ultrasound course for UNE medical students using a combination of UNE resources, Joint Medical Program clinicians, and medical student tutors trained in POC US. The assessment results show that students from both years were able to efficiently absorb and apply the information presented to them in the areas of correct probe placement and orientation, organ and tissue identification, and the presence or absence of common pathology in seven exams views (RUQ, LUQ, suprapubic, Subxiphoid, IVC, PSL, and lung views). These findings suggest that medial student of any level of experience can benefit from an intensive US course.

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Meta Information

Submission ID:	109	Student Submission:	1
Format:	Poster		

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Developing an Effective Curriculum for Incorporating Ultrasound Education into the Gross Anatomy Course in Medical School

Background: Ultrasound was first introduced during the Gross Anatomy course at the Wayne State University School of Medicine (WSUSOM) in 2006. The curriculum has evolved over the years, and now taught concurrently during each corresponding Gross Anatomy unit. During ultrasound sessions, principles of gross anatomy are emphasized including structure and function, clinical application, while introducing students to basic ultrasound techniques of image acquisition, recognition and interpretation.

Objectives: 1. Discuss key components for developing a comprehensive ultrasound curriculum for Gross Anatomy. 2. Develop a systematic approach for incorporating basic and advanced ultrasound imaging applications into the Gross Anatomy course. 3. Describe some of the effective methods of evaluating learner competencies. 4. Discuss challenges associated with program implementation. 5. Recognize the importance of collaboration with the Gross Anatomy instructor to accomplish the educational objectives.

Methods: A detailed ultrasound curriculum has been developed for each Gross Anatomy unit (1. Upper Limb, 2. Head & Neck, 3. Thorax & Abdomen, and 4. Lower Extremity & Pelvis), including a pre-test, core content analysis, measurable objectives, scanning protocol, post-test, power point lecture, illustrative videos for self study, and a final exam focusing on clinical cases evaluating their image recognition and interpretation skills.

Results: Will highlight aspects of the WSUSOM ultrasound curriculum and provide key facts for developing more effective teaching methods using ultrasound to enhance the medical student's understanding of Gross Anatomy.

Conclusion: The current curriculum document has resulted in an effective instructional method to emphasize important aspects of Gross Anatomy while teaching basic ultrasound skills to first year medical students.

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Meta Information

Submission ID: 110 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Combination of NT-proBNP concentration and diaphragm function for prediction of weaning failure from mechanical ventilation

Object: To assess the combination of NT-proBNP concentration and diaphragm function measured by Sonographic to predict weaning failure from mechanical ventilation (MV) due to poor cardiorespiratory capacity before a spontaneous breathing trial (SBT). And then to prove that poor cardiorespiratory capacity was the main cause of weaning failure.

Methods: Prospective, observational study in general intensive care unit (GICU) of Guangdong General Hospital. The clinical trial included 40 patients on MV for over 48 h who underwent an SBT. NT-proBNP and diaphragm function measured by M-mode ultrasonography were performed immediately before and at the end of SBT. The criteria of diaphragmatic dysfunction is vertical excursion<10 mm or paradoxic movements.

Results: 9 (9/40)patients failed the SBT, 2 (2/9)due to elevated NT-proBNP level and 3 (3/9)due to diaphragm dysfunction, 4 (4/9)due to the combination of both. 31 (31/40)patients pass the SBT, 28(28/31) patients of them were extubated successfully, the remaining 3 (3/31)patients failed in 48 hours and reintubated, of whom, 2(2/3) due to the elevated NT-proBNP level, and 1 (1/3)due to diaphragmatic dysfunction. Before SBT, NT-proBNP were higher in patients with weaning failure than the patients extubated successfully, Cutoff values using ROC curve analyses to predict failure of SBT were 1536 ng/L for NT-proBNP (p = 0.041) and 11.0mm for vertical excursion of diaphragmatic movement (p = 0.038).The rate of diaphragm dysfunction were higher than the patients extubated successfully. The combination of high-rised NT-proBNP and diaphragm dysfunction can predict nearly 91% of the patients failed in the SBT.

Conclusion: The combination of NT-proBNP and diaphragm function measured by Sonographic can predict weaning failure due to poor cardiorespiratory capacity before a spontaneous breathing trial (SBT).

Keywords NT-proBNP ; diaphragmatic dysfunction; ultrasonography; M-mode; Weaning

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Meta Information

Submission ID: 111 Student Submission: 0
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

A Description of the 4-Year Longitudinal Ultrasound Curriculum Developed at the Wayne State University School of Medicine (WSUSOM)

Objectives: At the completion of this session, participants should be able to: 1. Discuss key components for developing a 4-year longitudinal ultrasound curriculum for undergraduate medical education. 2. Identify core areas in the medical school curricula where ultrasound education can be incorporated 3. Discuss ways of recruiting faculty to assure program success 4. Discuss challenges associated with program implementation. 5. Recognize the importance of collaboration with course directors / deans to accomplish the educational objectives

Description: This session will provide participants with a description of effective ways of incorporating ultrasound education into the medical school curricula. Participants will learn about the Wayne State University School of Medicine experience since 2006, when the program was implemented. We will include examples of curriculum documents, and also discuss how an ultrasound program at a large medical school like WSUSOM can be implemented effectively. We will also make mention of the Liaison Committee on Medical Education (LCME) standards, and how ultrasound curriculum objectives can be developed to fulfill some of the requirements for medical student education. We will also discuss unique ways of recruiting enough faculty for training sessions, and the effective use of students as instructors (super users). Course participants will also learn about some of the challenges with program implementation, and how to overcome potential roadblocks to help establish a firm foundation for a longitudinal four-year curriculum for ultrasound education in medical school.

Anticipated Outcomes: Developing effective ways to integrate ultrasound education into the undergraduate medical school curricula. Developing effective evaluation methods. How to develop student interest in ultrasound from Yr 1-4.

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Meta Information

Submission ID: 112 Student Submission: 0
Format: Panel

Topic: Use of ultrasound in Undergraduate Medical Education

Characterizing resident physician utilization of IVC ultrasonography versus invasive CVP monitoring in guiding fluid resuscitation of patients with severe sepsis and septic shock

Background: In patients with severe sepsis or septic shock, goal-directed fluid resuscitation during the first 6 hours of care is recommended. Techniques for guiding fluid resuscitation include, among others, invasive central venous pressure (CVP) monitoring and ultrasound (US) measurement of inferior vena cava (IVC) respiratory variation. CVP monitoring is often not performed for these patients in emergency departments (EDs) for a variety of reasons. IVC US is also under-utilized, primarily because resident training in this technique has been variable across institutions nationally.

Objective: To quantify resident physician utilization of IVC US versus CVP monitoring to guide fluid therapy in severe sepsis and septic shock prior to implementation of a formal curriculum in bedside IVC US.

Hypothesis: In guiding fluid resuscitation in ED patients with severe sepsis or septic shock, CVP monitoring will not be commonly used and, in the absence of a formal US curriculum, IVC US will be used even less. Failure to routinely use one of these techniques will be reflected in inadequate fluid therapy and high mortality.

Methods: This is a retrospective chart review of all patients presenting with severe sepsis or septic shock to a single ED from July to December 2012. Severe sepsis was defined as sepsis plus sepsis-induced organ dysfunction, elevated lactate, or markedly abnormal vital signs. Septic shock was defined as sepsis plus systolic BP <90 despite a 30 cc/kg saline challenge. All diagnoses of severe sepsis and septic shock were confirmed by the admitting service.

Results: Fifty-seven (57) patients presented with severe sepsis or septic shock during the 6-month period. The mean age was 62.4 years (range 25-91 years). Thirty-one (31) patients met the criteria for severe sepsis and 26 for septic shock. During the first 6 hours of ED care, the median volume of saline infused was 2.0 L (range 0-7 L). CVP was monitored in none of the patients with severe sepsis and in 7 of 26 patients (26.9%) with septic shock. IVC US was performed in 1 of 31 patients (3.2%) with severe sepsis and in none of the patients in septic shock. Overall mortality was 37% (severe sepsis 29%, septic shock 46%).

Conclusions: In this urban ED, CVP monitoring was uncommonly used in patients presenting with severe sepsis or septic shock. Monitoring IVC respiratory variation by US is a useful alternative technique to guide fluid resuscitation in these patients, but was used even less (in only 1 of 57 patients). The under-utilization of these techniques was associated with inadequate fluid therapy and a high mortality rate. Implementation of IVC US training for resident physicians and formal integration within ED sepsis management protocols can improve outcomes for these critically ill patients.

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Meta Information

Submission ID:	113	Student Submission:	0
Format:	Oral		

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Teaching topographical anatomy using ultrasound vs. anatomical atlas by student tutors

Introduction:

The advantages of using ultrasound in teaching the topographical anatomy are topic of several research papers. However, studies about student tutors teaching other students the anatomy with ultrasound are scarce. The aim of this study is to determine if medical students can score higher on a topographical anatomy test when given a short tutoring session by other students using the ultrasound as a teaching tool.

Methods:

Seventeen third-year medical students from the University of Maribor in Slovenia participated in this research project. Before the teaching began, a pretest that contained 21 questions was given to all the students to determine their level of knowledge. Then, the students were divided in five groups of three and one group of two. Three of those groups were randomly assigned to a teaching class of abdominal anatomy with ultrasound and the three other groups to a teaching class of abdominal anatomy with books. For both types of teaching, each group had a 3-hour course during which emphasis was put on the topographical aspect of the abdominal anatomy. The lessons were given by two other medical students from foreign countries (Canada and Malta) who previously both received 9 hours of training about ultrasound and who rotated between the groups. The content of the lessons was kept constant (adhering to checklist) in both types of teaching. After finishing all the classes, a post-test that contained 21 questions of comparable difficulty to the pre-test was given to the seventeen students in a time frame of 24 – 48 hours after the last teaching session.

Data analysis:

MedCalc statistical package program was used in the analysis of the data. With the small sample size, the gain of each group was calculated (post-test score – pre-test score). Both of the groups were compared by Mann – Whitney test. Median gain value in the ultrasound group was 3.5 and in the book group was 2.0. The distributions in the two groups did not differed significantly (Mann-Whitney U = 31.50, n1= 8, n2= 9, P = 0.66 two tailed). When comparing post-test results with pre-test results within each group, the scores were significantly higher on postest ($P<0.05$).

Conclusion:

Within the constrains and the obvious limitations of the small pilot study, it is possible to infer that a student tutoring program, based on a logical story-line in a small group of students, with any kind of graphical material can augment short term appreciation of topographical anatomy, with no apparent superiority of using real time ultrasound pictures. No inferences can be made upon long time knowledge retention.

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Meta Information

Submission ID:	114	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

Combination of NT-proBNP concentration and diaphragm function for prediction of weaning failure from mechanical ventilation

Object: To assess the combination of NT-proBNP concentration and diaphragm function measured by Sonographic to predict weaning failure from mechanical ventilation (MV) due to poor cardiorespiratory capacity before a spontaneous breathing trial (SBT). And then to prove that poor cardiorespiratory capacity was the main cause of weaning failure.

Methods: Prospective, observational study in general intensive care unit (GICU) of Guangdong general hospital. The clinical trial included 40 patients on MV for over 48 h who underwent an SBT. NT-proBNP and diaphragm function measured by M-mode ultrasonography were performed immediately before and at the end of SBT. The criteria of diaphragmatic dysfunction is vertical excursion<10 mm or paradoxic movements.

Results: 9 (9/40)patients failed the SBT, 1 (1/9)due to elevated NT-proBNP level and 3 (3/9)due to diaphragm dysfunction, 4 (4/9)due to the combination of both. 31 (31/40)patients pass the SBT, 28(28/31) patients of them were extubated successfully, the remaining 3 (28/31)patients failed in 48 hours and reintubated, of them, 2(2/3) due to the elevated NT-proBNP level, and 1 (1/3)due to diaphragmatic dysfunction. Before SBT, NT-proBNP were higher in patients with weaning failure than the patients extubated successfully, Cutoff values using ROC curve analyses to predict failure of SBT were 1536 ng/L for NTproBNP (p = 0.04) and 11mm for vertical excursion of diaphragmatic movement (p = 0.038).The rate of diaphragm dysfunction were higher than the patients extubated successfully. The combination of high-rised NT-proBNP and diaphragm dysfunction can predict nearly 91% of the patients failed in the SBT.

Conclusion: The combination of NT-proBNP and diaphragm function measured by Sonographic can predict weaning failure due to poor cardiorespiratory capacity before a spontaneous breathing trial (SBT).

Keywords: NT-proBNP , diaphragmatic dysfunction, ultrasonography, M-mode, Weaning

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Meta Information

Submission ID: 115 Student Submission: 0
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

CRA Scale: Competency Ranking Assessment Scale

Introduction

Focused ultrasound is a growing field and involves many operators across discipline and level of training. Twelve specialties mention acquisition or interpretation of ultrasound as part of their ACGME milestones. In a recent national survey about a third of the medical schools in the US are using ultrasound in the preclinical years and approximately half during the clinical years. There are several ultrasound fellowships offered in various subspecialties throughout the country and across the world.

With the swift expansion of this field comes a need to assess and rank trainees and faculty in the use of ultrasound. Currently there is no standard curriculum for ultrasound in undergraduate medical education and henceforth no standard assessment tool. Many schools are using written and practical knowledge tests as a method for assessment Much variability between institutions and specialties exists in these assessment methods, and as the students transition into graduate medical education a consistent continuum is currently lacking. Very few residency programs have standard means for assessing resident competency in ultrasound.

The authors address this need by developing the Competency Ranking Assessment Scale (CRA Scale). This scale is designed to track ultrasound competency of trainees across the entirety of the spectrum from undergraduate medical education through graduate medical education to continuing medical education. This scale is multi-faceted addressing knowledge, acquisition, interpretation and experience. The authors believe this scale is flexible to bridge the gap for multiple specialties

Methods: Most studies have established basic numbers that seem to be important transition points in assessing experience The authors used some of these numbers combined with components of the milestones created by CORD and Miller's pyramid of competence to construct our competency ranking assessment scale.

The scale is a 10 level categorization calibrated with a novice at level 0 with no experience. Levels 1 , 2 and 3 are basic skills and are geared with a medical student cohort or beginner learner. The next levels at 4, 5, 6 are at an intermediate level and are geared with a resident cohort in mind. The next levels at 7, 8, 9 are at the advanced level and are geared with a fellow cohort or expert learner. Level 10 is considered an expert not only in clinical skill and number of exams but in regards to research, mentorship, a quality program and contributions to the field. This CRA scale is an attempt to codify this journey toward competency from novice to expert.

Conclusions: The authors created a progressive scale that is able to span all levels of medical education from medical students to residents/fellows and faculty. The authors believe this scale can be applied regardless of specialty or exam being assessed to allow for a common language among ultrasound educators to communicate a learner's level of competence. Future research may tease out whether this scale could be a bridge between medical school and residency and between training and practice. Credentialing boards and hospital privileging committees may find scales such as the Crascale help track a learner's ultrasound proficiency over time.

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Meta Information

Submission ID: 116 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Efficacy of an Inpatient Ultrasound Curriculum in Retention of Ultrasound Knowledge Amongst First Year Internal Medicine Residents

Background: Point-of-care ultrasound is a rapidly evolving component of internal medicine (IM) residency training; however the optimal curriculum for acquiring this skill remains unclear.

Summary of Work: At our institution, incoming IM residents attend a simulation-based ultrasound workshop which includes didactic and hands-on training. Pre- and post- image identification tests for the following structures are were conducted: ascitic fluid, kidney, thyroid, pleural fluid, inferior vena cava (IVC) and internal jugular vein. To facilitate knowledge and skill retention, an ultrasound curriculum (UC) was developed and implemented during inpatient medicine rotations which included a monthly morning report and twice a month afternoon bedside ultrasound rounds on hospitalized patients. Six months after implementation, a follow-up test was sent out to all residents. Only half the incoming class participated in the UC during the first six months.

Summary of Results: Forty-eight residents completed the orientation post-test and the six-month follow-up survey, 24 (50%) of which participated in the inpatient UC. Those without the UC had a decline in the identification of ascitic fluid (88% vs 38%, p=0.005), pleural effusion (67% vs 17%, p=0.003), and IVC (63% vs 33%, p=0.008) at six months, whereas those who participated in the UC showed a non-significant change.

Conclusion: While it has been demonstrated previously that discrete ultrasound workshops can increase ultrasound knowledge and skill, the addition of a longitudinal component to an UC for PGY-1 residents aids in knowledge retention at six months compared to a single workshop alone. These results are promising for IM residency programs working to teach their trainees bedside ultrasound and suggests a need for longitudinal curricula in internal medicine residency training programs to aid in retention of ultrasound skill throughout training.

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Meta Information

Submission ID: 117 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Ultrasound in Ground School: Educational Outcomes and Skill Development

Introduction

Recently The Ohio State University College of Medicine converted to a new curriculum, Lead Serve Inspire (LSI). An established ultrasound program has adapted its previous undergraduate medical education programs and teaching sessions to the 3 parts of this new curriculum. The purpose of the LSI curriculum is to fully integrate clinical and basic science with early clinical exposure and several longitudinal experiences and exposure to a variety of patient populations and care environments. The traditional clinical time is now referred to as Part 2. A component of Part 2 is called Ground School. Ground School is a week-long clinical skills boot camp occurring before each of 3 rings representing groups of specialties with common patient populations. During this Ground School time, all students are exposed to various techniques, exam skills and procedures. Each of the rings has an ultrasound (US) component lasting close to 2 hours for each student. For each ring there are 4 or 5 ultrasound exposures where students are taught about indications for individual scans relevant to their rotation and how to acquire and interpret ultrasound images and video. This education is composed of asynchronous online didactics, a brief tutorial by a trained proctor and hands on scanning. In addition to the exposure stations there is a mandatory station within each ring that students are formally assessed on ultrasound guided vascular access. Utilizing this educational method, all 185 students in Part 2 were exposed to ultrasound training as well as a formal assessment of competency in vascular access. All synchronous time totaled 11 hours. This boot camp will occur twice more in the next academic year as students rotate between rings.

Conclusions

Ultrasound education utilizing the format of brief lectures and hands-on teaching and practice sessions is shown to be effective. The more exposure, a student has with ultrasound, the more proficient they become with the technology. Even in a setting of limited time, the high yield of hands on US scanning and visual learning is immense. It is the hope of this intervention that this will prepare the future crop of physicians to utilize point of care bedside ultrasound to aid in diagnosis and delivery of care. The authors feel this immersion approach to ultrasound education is feasible before entering clinical rotations during the third year of medical school.

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Meta Information

Submission ID: 118 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

US-CAB: ultrasound screening for circulation, airway and breathing during resuscitation

Cardiopulmonary resuscitation emphasizes high-quality and easy-to-learn procedures. Therefore, American Heart Association changed resuscitation procedures from ABC to CAB in 2010 guidelines.

Emergency ultrasound has been used to identify treatable causes during resuscitation, such as cardiac tamponade, hypovolemia , pulmonary embolism and tension pneumothorax. Focused heart ultrasound may influence 78% of clinical management in resuscitation situations. However, it is still challenging for optimal use of point-of-care ultrasound (POCUS) during the initial phase of resuscitation.

Correct endotracheal intubation can be confirmed by using end-tidal CO2 monitoring. However, EtCO2 monitoring cannot provide convincing evidence to confirm correct endotracheal intubation during early phase of cardiac arrest. It is mandatory to develop a feasible and useful way to rapidly confirm correct endotracheal intubation during cardiac arrest resuscitation. Recent studies suggest ultrasound can be used to rapidly confirm correct endotracheal intubation and even bilateral ventilation in emergent situations.

We introduce a novel concept of POCUS during the initial phase of resuscitation: US-CAB. US-CAB means ultrasound screening for circulation, airway and breathing during resuscitation. We integrate US-CAB with standard CAB suggested by AHA during cardiac arrest resuscitation. We suggest US-CAB to be used during the first 10 minutes of resuscitation to screen for cardiac status (C), confirm endotracheal intubation (A) and identify bilateral ventilation (A) rapidly without interruption of resuscitation.

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Meta Information

Submission ID: 120 Student Submission: 0
Format: Oral

Topic: Point of Care ultrasound in general clinical practice

Bedside Sonographic Diagnosis of Pneumothorax in Pediatric Patients

Background:

Pneumothorax used to be diagnosed with chest radiography. Significant advances in sonography have made it a useful tool for the diagnosis of pulmonary pathology. Therefore we employed portable ultrasonography as a non-invasive method and an alternative tool for the bedside diagnosis of pneumothorax.

Method:

We enrolled 21 inpatients that were found to have penumothorax. Their age ranged between newborn to 18 years old. All of them had chest radiography for the confirmation of diagnosis. Also we employed bedside sonography to monitor the patients before and after treatment during October 2010 to December 2012. Sonographic signs of patients with pneumothorax were compared with controls (n=30).

Results:

A total of 51 children, 21 with pneumothorax and 30 without pneumothorax as control group were examined. From the sonographic images, we specifically noted 3 sonographic signs: abolished lung sliding sign, curtain sign and lost of B line sign whereas abolished lung sliding sign had specificity and sensitivity of 100%, Curtain sign had specificity and sensitivity of 100%. Lost of B line sign had a sensitivity of 86% and specificity of 47%.

Conclusion:

Our results demonstrated that there are several sonographic signs useful for the diagnosis of pneumothorax, namely abolished sliding sign and curtain sign. In experienced hands, sonography may be considered a tool of choice for the diagnosis of patients with pneumothorax and may be a convenient monitoring and management guide for patients with pneumothorax.

Authors

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Meta Information

Submission ID: 121 Student Submission: 0
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

The role of Point-of-Care ultrasound in the diagnosis and treatment of critically ill patients

Introduction:

Point-of-Care ultrasound (POC-US) refers to the use of portable ultrasonography at a patient's bedside for diagnostic and therapeutic purposes. Critically ill patients have life threatening physiologic derangements that warrant prompt and accurate workup. POC-US facilitates faster, yet accurate diagnosis, which improves patient's management in a timely fashion.

Case report:

A 53-year-old Caucasian female presented to the emergency department (ED) complaining of weakness, nausea and mild fever for five days. Her past medical history was remarkable for hypertension, insulin-dependent diabetes mellitus, coronary artery disease and a recent coronary artery bypass graft. Her vital signs at ED were normal. The physical exam was only remarkable for a 2/6 systolic murmur, which was not new. Labs were consistent with mild diabetic ketoacidosis (DKA). She was managed with insulin drip, crystalloids and admitted to medical floor.

Early the next morning, she was found to be hypotensive, obtunded, febrile, tachycardic, and tachypneic. Labs showed resolved DKA and leukocytosis. She was diagnosed for SIRS, given broad-spectrum antibiotics and transferred to ICU. We performed a POC-US that showed no evidence of LVRWMA, normal LVEDV, and large mitral valve vegetation (Movies 1-5). A Trans-esophageal echocardiogram (TEE) confirmed a 2.5x1cm vegetation attached to the anterior leaflet of the mitral valve (movies 5-7). The clinical diagnosis was therefore changed to sepsis secondary to Infective endocarditis (IE). The treatment plan also changed and the patient was transferred to the OR for emergent valve replacement/repair.

Discussion:

This case highlights the efficacy of POS-US in critically ill patients. Indeed, the diagnosis, treatment and outcome are diametrically changed after POC-US. In our hands, POS-US has improved the diagnosis, treatment and outcomes of a large cohort of critically ill patients (manuscript in preparation). In addition, POC-US improves patient and family's adherence with the medical treatment as well as satisfaction since the data can be shared in real time. Therefore, a comprehensive curriculum to teach POS-US is warranted to optimize physician's critical decision making ability not only in critical care, but also in other subspecialties.

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Meta Information

Submission ID:	122	Student Submission:	1
Format:	Poster		
Topic:	Point of Care ultrasound in general clinical practice		

Technology Committee Best Practices for Ultrasound Interest Groups

Background: With the progress of point-of-care ultrasound, the importance of meaningful exposure to ultrasound in undergraduate medical education has become evident. As previously described, Ultrasound Interest Groups that include all four years of medical students with faculty advisors, provide an organized home for ultrasound incorporation into medical education, while developing leadership among its members, and supporting technical and educational research projects in ultrasound. Here, we describe the objectives and responsibilities of the Technology Committee and the resources used to foster continued ultrasound education and mentorship.

Objectives:

- Engaging with ultrasound learners through social networks
- Producing original learning material (e.g. Case of the Month)
- Maintenance of online ultrasound learning materials
- Maintaining online calendars of ultrasound-related events and educational programs
- Maintenance of the Sonographic Digital Portfolio
- Supporting other USIG projects and committees

Methods: The Ultrasound Interest Group (USIG) at The Ohio State University College of Medicine is a student interest group comprised of student leaders and members from all years. The Technology Committee is led by an upper classman with 3-4 other medical students, and meets on a monthly basis. USIG uses Google Sites® to manage the educational and organizational materials at www.osuultrasound.com. Organizational pages are maintained on Facebook and Twitter, and are updated regularly with an automated service to allow consistent updates as previously described. This also allows for monitoring and response to others interested in ultrasound education (e.g. #FOAMed or #FOAMus hashtags). Emergency medicine residents and medical students provide interesting ultrasound cases to be presented for the Case of the Month features, which are edited and compiled by a member of the Technology Committee. Ultrasound tutorials feature multiple methods of learning (including videos, slide presentations, and quizzes) to allow learners to use the method most useful to them. This also allows for a central database of educational materials for ultrasound experts to use in a unified manner for didactic sessions. Ultrasound events are maintained on online calendars for reference by students and faculty to improve utilization of simulation space, equipment, and trained simulated ultrasound patients. The sonographic digital portfolio is a cloud-based storage system that allows students to collate their personal ultrasound scans for future review, and in the future will allow for expert feedback of images. The Technology Committee also helps with technology need of other USIG committees, such as appointment management for our ultrasound model pool.

Conclusions: With the progress of point-of-care ultrasound and ultrasound in medical education, Ultrasound Interest Groups are an organized team dedicated to ultrasound incorporation into medical education. Its members develop leadership in roles as committee chairs and members. The objectives and responsibilities of the Technology Committee described here demonstrate the importance of technology for the growth of ultrasound in medical education.

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Meta Information

Submission ID: 123 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Junior Mentors: National Ultrasound Student Interest Group

Junior Mentors

In late 2011 a committee was developed at the American Institute of Ultrasound in Medicine, AIUM, known as the Mentors program. The purpose of this program was to assess needs within ultrasound education within medical school curriculula and create a centralized database of ultrasound experts , educational resources, as well as an interface for those seeking mentorship in ultrasound education. In building on this idea we are developing the Junior Mentors Program. This is a similar program but at the Undergraduate Medical Education Level. Essentially this will function as a national ultrasound student interest group as well as a centralized resource for students to exchange resources and experiences. Our objective is to support student leaders who have blazed a path for ultrasound in their medical curriculum so they can share with other interested student leaders. Additionally, it is our hope to connect those in the Mentors program with those interested students within their region.

Questions?

Why develop a national USIG?

What is the purpose of a national group such as this?

What resources are out there for interested parties?

How have others developed their local programs?

How can a national interest group enhance existing ultrasound infrastructure?

Outcomes

Encourage students who may have fewer resources or mentorship to pursue an organized group for ultrasound education.

Provide regional student contacts to those in the mentors program and mentors contacts for students trying to implement ultrasound at their institutions.

Provide a place for those developing programs to go for help.

Encourage collaboration between institutions at regional and national level in hopes of advancing ultrasound in medical education.

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Meta Information

Submission ID: 124 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Bedside Ultrasound in Internal Medicine: Needs assessment and training program design at UCSF

PURPOSE:

Over the past two decades emergency medicine (EM) has aggressively adopted bedside ultrasound (BUS) as an efficient tool that can improve quality of care. BUS has recently enjoyed increased applications in other specialties including anesthesia and critical care (CC), and many support its use in internal medicine (IM). Our goal was to conduct a needs assessment for BUS within UCSF's IM residency program, and to design a curriculum to address the identified needs.

METHODS:

We invited IM residents to complete a survey regarding their interest and experience in BUS, and conducted a pretest to assess knowledge in pulmonary, cardiac, abdominal and vascular BUS. We brought these results to an expert physician panel from IM, EM, CC, and cardiology to develop a BUS curriculum.

RESULTS:

One hundred of 180 UCSF IM residents responded to the survey. Ninety-nine percent felt that BUS training should be part of the IM curriculum. Greater than 90% believed that BUS was important for obtaining peripheral venous access, assessing volume status, and identifying peritoneal fluid, pleural effusions, and pericardial effusions, while more than 65% believed it was important for assessing LV function and identifying pneumothorax, pulmonary edema, and hydronephrosis. Although few residents expressed confidence in even basic BUS applications such as obtaining peripheral venous access (18.2%), assessing volume status (19%), and identifying pericardial effusions (10%), a large number still utilized BUS for such applications - peripheral venous access (43%), volume status (54%), and pericardial effusion (26%). Few residents reported adequate BUS supervision on IM wards (28%).

Ninety-seven residents took a difficult pretest. Scores were generally low. Forty-seven percent of residents recognized a moderate pericardial effusion, but just 25% recognized a small pleural effusion. Forty percent identified criteria for "fluid responsiveness". Seven percent recognized the popliteal vein and artery. Only 4% recognized the greater saphenous and common femoral veins.

After review of the survey data, pretest scores, and discussion of the evidence base for BUS in IM, the expert panel identified the following needs: broad safety education, increased didactic and hands-on training BUS, and increased supervision. A curriculum was designed in which all interns receive training in BUS safety and high-yield/low-risk applications such as volume status assessment and peripheral venous access guidance. A BUS training track was also developed for senior residents interested in more advanced cardiac, vascular, pulmonary, abdominal, and soft tissue exams. A cadre of UCSF hospitalists is undergoing BUS training to increase resident supervision.

CONCLUSIONS:

We found strong interest in BUS among UCSF IM residents. Many residents are already using BUS despite low confidence, poor knowledge and minimal supervision. We used an expert panel to

develop a curriculum that addresses these deficiencies. This curriculum is currently being piloted within the UCSF IM residency program.

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Meta Information

Submission ID: 125 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Asynchronous Learning for Successful Training of Emergency Department Technicians in Ultrasound Guided Peripheral Intravenous Access

Study Objectives: Peripheral Intravenous (PIV) catheters are routinely placed in the Emergency Department (ED) and are essential for management of acute diseases. However, PIV placement can be difficult for various reasons (morbid obesity, IV drug use, hypovolemia or chronic illness) and may require ultrasound guidance for IV placement. Traditional methods for teaching this skill require classroom lecture and direct supervision of the skill by an educator to achieve competency. On the other hand, asynchronous learning techniques use a web-based approach that removes the limitations of structured classroom time and encourages peer-to-peer interaction. We sought to train ED Technicians (EDTs) to place Ultrasound guided peripheral IVs (USGPIVs) in patients with presumed difficult IV access by using asynchronous education techniques. We hypothesized that the EDTs would learn to successfully place USGPIVs with limited classroom time and more peer assisted learning.

Methods: Training EDTs in USGPIV placement was voluntary and performed in conjunction with the yearly EDT training and skills assessment. Participants were required to complete an online pre-test and a didactic module outlining USGPIV performance, prior to the skills assessment and training day. Comprehension of the material was assessed by satisfactory completion of a posttest given prior to gaining entrance to a skills lab. The skills lab allowed participants to practice USGPIV placement and successful completion was required prior to performing USGPIVs in the ED. The EDTs then demonstrated procedural competency by performing 5 successful proctored USGPIVs in the ED. Proctors could be peers who had already completed the training or the Emergency Medicine Physician trainer. Once the competency was completed, EDTs were certified to perform USGPIVs independently. A data collection form was completed by the EDT on all USGPIV attempts.

Results: 14 EDTs completed all portions of the training and were supervised by another peer during competency 46% of the time. Once deemed competent, these EDTs attempted USGPIVs in 347 patients. The overall success rate for USGPIV placement by EDTs was 97.1% (SD=0.17, N=337/347), with a 1.7% (SD=0.13, N=6/347) rate of inadvertent arterial punctures. All arterial punctures were managed with direct pressure requiring no further intervention.

Conclusion: Asynchronous education of Emergency Department technicians is a safe and effective way to teach ultrasound guided peripheral IV access, decreasing classroom time and increasing peer interactions.

Authors

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Meta Information

Submission ID:	126	Student Submission:	0
Format:	Poster		
Topic:	Point of Care ultrasound in general clinical practice		

Advanced Ultrasound Competency in Anesthesia

Objectives:

1. To promote medical student awareness of ultrasound skills relevant to anesthesia

2. To develop a student taught initiative, developing medical student leaders with advanced competencies in ultrasound

Methods:

The Advanced Ultrasound Competency in Anesthesia (AUCIA) program is a novel longitudinal curriculum, integrating structured mentorship in advanced ultrasound competencies in anesthesia, with the goal of developing students into ultrasound proctors and leaders. Third year medical students enrolled in the anesthesia elective rotation attend an ultrasound focused lecture and didactic session, learning the basic techniques of ultrasound and understanding its application in anesthesia. Fourth year medical students enrolled in the advanced anesthesia elective lead and manage the ultrasound didactic session, only after demonstrating their abilities through an objective OSCE examination administered by an anesthesia resident. Longitudinal participation as both a third year learner, and fourth year proctor give the students eligibility for an advanced competency in anesthesia accolade. Specific skills that will be taught include ultrasound guided central lines, identification of the anatomy in common nerve blocks, and familiarity with following a needle trajectory with the assistance of ultrasound. The project will facilitate the structural formula for student-taught ultrasound integration within medical school curriculum.

The current anesthesia clerkship curriculum limits the procedural exposure students experience prior to their entrance into residency programs. It is expected AUCIA will result in a study population that is facile using ultrasound skills in a clinical setting, while simultaneously promoting its use in anesthesia. AUCIA will track its ability to achieve these goals through likert score surveys completed by all students who attend didactic sessions, and fourth year students prior to development and management of didactic sessions. These cohorts will complete a second survey after the completion of their respective training to track progress in ultrasound competency, relevance of ultrasound in anesthesia, and participants' comfort level in using their acquired skills in an actual clinical setting.

Conclusions:

The AUCIA program is a novel training approach designed to further coordinate structured student mentorship at an institution with a sophisticated UME US program. The AUCI program will ultimately culminate in a longitudinal curriculum leading to advanced competency and promotion of ultrasound preparedness in anesthesia. With the AUCIA curriculum, students acquire the foundations; proctors mold and solidify acquisition techniques; and leaders become more expert in teaching these skills in ultrasound acquisition and interpretation.

Authors

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Meta Information

Submission ID: 127 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Developing Training Tools for Ultrasound Skills Acquisition

Description of the Panel:

Access to training tools, simulators (phantoms, part-task trainers, and VR trainers) and devices are substantial rate limiting factors to providing appropriate opportunities for learners to appreciate and develop new skills and abilities related to the use of ultrasonography in healthcare. The cost of commercially available devices can be substantial while not specifically addressing curricular objectives, skills acquisition, and ranges of difficulty.

This panel will discuss practical and feasible methods to create reliable training tools and devices within your own institution. This will include the development of progressive training tools focusing on a range of learner levels and case complexity, and measuring the effectiveness of developed training aids to assure learning objectives and performance indicators are met.

General questions to be addressed by the panel:

1. How to develop tools for training ultrasound skills.

2. How to create a continuum of progressive skill devices to address longitudinal development of ultrasound skills.

3. How to test the reliability of developed devices.

Anticipated outcomes (educational or other) for the session.

1. Review techniques for developing practical and feasible training tools for ultrasonography education.

2. Review cost effective methods to develop progressive training devices for ultrasonography skills.

3. Discuss how to measure the effectiveness of a new training tool.

Authors

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Meta Information

Submission ID: 128 Student Submission: 0
Format: Panel

Topic: Technology

Combining 3D printing and CT scanning in the production of obstetrical ultrasound phantoms for undergraduate medical education

Introduction

Ultrasound organizations are promoting the incorporation of ultrasound education in undergraduate medical school curricula. While live model training seems to be the best practice, it is not always feasible or practical. Although commercially available phantoms are often considered the next best option, they have constraints such as cost and limited offerings. The current study proposed to combine CT scanning, 3D printing, and traditional molding methods to facilitate the production of a progressively staged set of clinically relevant obstetrical phantoms that are both pedagogically sound and cost effective for undergraduate medical curricula.

Methods

A fetal skeleton model was CT scanned using a GE ® 64 slice scanner. The DICOM data was processed in 3 steps. First, they were imported into Slicer4 software, where serial images were segmented. The segmented images were converted to 3D model and saved as a STereoLithography (STL) file. Secondly, this file was imported into Autodesk Maya 2015 ® for smoothing, scaling, rigging, and positioning. In the third step the final fetal skeleton model was exported as an OBJect (OBJ) file and loaded into Makerbot ® Makerware and was printed with a Makerbot ®Replicator 2X. In Parallel, sixteen-week fetus molds were created using traditional silicone methods. The mold was made using various silicone products from Smooth-On Inc.. The printed fetal skeleton was then embedded in ballistic gel and placed into ultrasound trainers of 3 progressive skill levels. Level one was clear and mapped, level two was clear but unmapped, and level three was opaque and unmapped.

Results

It was possible to successfully print and embed the scanned fetal skeleton as well as to rig the object to fit a pre-made mold within acceptable margins. Digitization also make it possible for the skeleton to be scaled to represent different fetal ages. The printed 16-week skeleton retained fine details but portions were brittle and broke during embedding. The visibility of the fetal skeleton is suitable for level one and two trainers. In all levels tibial length, bi-parietal diameters, and crown rump length could all be measured using ultrasound. Traditional molding methods made it possible to insert organs such as heart, kidney, brain, and liver within the models for increased clinical fidelity.

Conclusions

Combining CT scanning, 3D printing, and traditional molding methods proved to be an effective way to produce highly detailed and representative obstetrical ultrasound phantoms. This method allowed enough variability to produce appropriate step-wised phantoms to progress learners from novice to skilled with multiple and repetitive measures being possible. As such, the current study also paved way to more advanced trans-abdominal and trans-vaginal ultrasound phantoms on which spatial orientations and physical maneuvers can be better appreciated and practiced compared to the current commercially available phantoms.

Authors

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Meta Information

Submission ID: 129 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Academic Residency Track in Focused Ultrasound

Introduction: The use of focused ultrasound has been increasing as more operators are seeing the benefits of point of care bedside ultrasound within their practice. Residents in emergency medicine have had exposure to ultrasound training as focused ultrasound is part of their scope of practice in emergency medicine (Akhtar). There is still variability of ultrasound training among residencies (Ahern). Fellowships in Emergency ultrasound have increased over the last 10 years as criterion for emergency ultrasound becomes codified.

Recently an interest in creating academic tracks within emergency medicine to focus residents on areas of concentration has developed to prepare residents for possible academic careers and leadership within the community.

Methods: A robust ultrasound infrastructure with training, clinical services, research and administration of novel programs existed at a tertiary care medical center. Coordinating residency requirements for graduation and dovetailing those into an ultrasound helped creation of an academic track in focused ultrasound. Two current residents in the second and third year were selected because of previous 4 year medical student experience with ultrasound at the local institution.

Results: Two residents were able to participate in the program during the inaugural year and coordinate their residency requirements using their ultrasound expertise. The components of this focused track covered residency specific requirements and were modeled after the ACEP Emergency Ultrasound Fellowship Guidelines. Activities included the completion of clinical scans, delivering, facilitating hands on proctor sessions, participating and presenting research projects and working on the administration of an institutional ultrasound program.

Discussion: Academic tracks foster mentorship for residents and permit development of an academic or clinical niche within Emergency Medicine (Regan). By focusing their ultrasound scholarly activities into an area of concentration, residents can move through these levels and become innovators and teachers within their niche prior to graduation.

An academic ultrasound track allows residents to refine their knowledge and skills while completing residency requirements and improving the overall Emergency Department ultrasound program. This can serve to advance ultrasound education at all levels.

Academic tracks can increase overall resident satisfaction with training and prepare residents for faculty positions (Regan) and the ability to be an institutional leader in ultrasound education.

Conclusions: Ultrasound is increasingly becoming a modality used by multidisciplinary physicians as well as undergraduate and graduate medical personnel. As this trend continues, the need for those trained in the academic skill sets needed to direct programs will increase. This paper describes a focused method to coordinate the required and elective activities of an academic residency program into an ultrasound area of concentration. The feasibility of this technique could be applicable to other disciplines and provide an avenue for longitudinal training of academic ultrasound skill sets.

Authors

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Meta Information

Submission ID: 130 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

TRAINING CRITICAL CARE FELLOWS IN ICU ECHOCARDIOGRAPHY

Bedside acquisition of Echocardiograms by Critical Care physicians is developing as a standard part of safe, high-quality, patient centered ICU care.

The main indications for Echocardiography in the ICU are assessment of ventricular function, identification of hemodynamically significant valvular defects or tamponade, and assessment of hemodynamic response to resuscitation in real time at the bedside. Echocardiograms frequently reveal clinically relevant information not available by other means that impacts management decisions in real time patient care in the ICU. We believe these indications should be kept in mind when developing a curriculum for CCM Fellows in Echocardiography training, as well as developing the standards for curriculum and credentialing requirements for Critical Care clinicians.

Geisinger has both a Critical Care and Pulmonary/Critical Care fellowship program with a total of four to five fellows per year in each program. We present our Echocardiography curriculum, as well as some preliminary data regarding the effectiveness of this curriculum.

Prior to July, 2013, our Fellowship programs had no formal Echocardiography curriculum. As of July 1, 2013, we have implemented an Echocardiography curriculum that is identical in both Fellowships. We have developed a curriculum that is more robust than that suggested by foCUS, as we believe that Intensivists should be capable of high level Echocardiography in the ICU.

We established a two day course on echocardiography at the beginning of the academic year with a total of 16 hours of combined didactic and hands on training on live models.

We established a monthly Echocardiography conference, led by Dr. Ali.

We have established a syllabus of assigned readings in Echocardiography.

A total of three months for echocardiography rotation were added to our rotation schedule: month one in the echocardiography lab shadowing an echocardiographer to learn image acquisition and beginning interpretation; months 2 and 3 obtaining echocardiograms in the ICU with over read of the images they obtain by an Intensivist with advanced training in echocardiography. A standardized image acquisition tool and written analysis report were developed and implemented. One week of each of months 2 and 3 will be spent with the Echo lab Cardiologist assigned to reading beginning July, 2014.

A pre-test and post-test was administered to Fellows taking the Two Day Echo Course.

The pre-test and post-test were the same test within each year; however, the test changed from 2013 to year 2014 due to learner feedback from 2013 course.

2013 = 15 questions

2014 = 22 questions

Statistical analysis to assess the difference in number of test questions answered correctly pre-test compared to post-test was performed for each year using the t-test. Our null hypothesis was that

no significant improvement in test scores would occur as the result of participation in the two day course.

In 2013, 4 out of 5 Fellows improved their post-test score compared to their pre-test score.

In 2014, 6 out of 6 Fellows improved their post test score compared to their pre-test score.

The degree of improvement was statistically significant in both years.

We recognize several methodological issues with our data. We have small numbers of Fellows each year enrolled in the two day course. There may be improvement in test scores due to bias created by using the same test as the pre- and post-test due to short term memorization of answers as opposed to true, sustained learning as a result of participation in the course.

However, we do believe that true learning occurs in a two day Echocardiography course and the improved post test scores are not due to simple memorization. This impression is supported by Dr. Ali's subsequent observed performance of the Fellows' skill in obtaining and interpreting echocardiograms during the three Echo months of the Critical Care curriculum.

We plan on further objective data collection on the performance of the Fellows in the three Echocardiography months as our Echocardiography curriculum continues to progress and develop, and hope to present this data in the future.

A two day course in Echocardiography for Critical Care Fellows is feasible and results in improved cognitive knowledge and clinical skills in the performance and interpretation of ICU Echocardiograms.

An advanced level of Echocardiography competency is an important skill for Critical Care physicians, and Critical Care Fellowship programs should provide this training.

Authors

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Meta Information

Submission ID: 131 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Echocardiography Training for Physicians and Midlevels in Practice

Rationale:

Echocardiography is indispensable for the diagnosis, management and monitoring of the critically ill. In 2012 Geisinger established an Ultrasound working group and defined pathways for training, competency and credentialing for physicians in practice and in training 1,2,3,4,5.

The Geisinger Health System serves approximately three million people over a 43 county area in predominantly rural northeastern Pennsylvania (Figure 1).

Methods:

A two days hands on course, 8 hours per day and a total of 16 hours. We enrolled physicians (attending's and fellows) and midlevels. The course consisted of didactic lectures and hands on skill stations of live models. The candidates were trained in obtaining the conventional windows. Parasternal long axis (PLAX), parasternal short axis (PASX), apical four chamber views (4c) and subcostal views and identification of inferior vena cava (IVC) and its variability with breathing. Candidates were trained on how to measure stroke volume (SV) and cardiac output (co). Included in training was the handling of the ultrasound (US) machine and knobology.

Results:

Twenty six candidates participated in the two days course. A pretest and post-test examination was done to evaluate the basic US physics and knowledge application, adjustment of the US machine and knobology. A "t" test was used to evaluate the candidate's progress.

The change in pre to post scores was significant ($p<0.0001$). The average change was an increase of 4.23 points (95% CI: 2.92, 5.54 Figure 2).

Conclusion:

A two days echocardiography course showed statistically significant improvement in cognitive skills of the participants. Echocardiography training for Critical Care practitioners is feasible and it is a pre requisite for echocardiography curriculum for critical care fellowship.

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Meta Information

Submission ID:	132	Student Submission:	0
Format:	Poster		
Topic:	Technology		

Assessing Medical Student Background Characteristics, Psychomotor and Visual-spatial Abilities and How They Correlate with Aptitude in Learning Medical Ultrasound

Introduction:

Ultrasound skills are integral to the practice of emergency medicine. Its application requires bimanual dexterity and training in 3D image interpretation. However, given its technological complexity, many training programs lag in assessing the skill of its trainees in this task. This begs the question as to whether individual background characteristics or intelligence types are predictive of aptitude in this area.

Study Objectives:

To determine whether trainee background characteristics or intelligence types: Psychomotor (PM) or Visual-spatial (VS), are more predictive of increased aptitude for learning ultrasound.

Methods:

This prospective study was conducted with a cohort of 3rd year medical students rotating through their emergency medicine clerkship at NY Methodist Hospital, Brooklyn, NY. IRB approval and written consent for participation was obtained. Students with previous exposure to the administered intelligence assessments or medical ultrasound training were excluded.

A survey was created based on previous procedural aptitude studies assessing medical student background characteristics; information on hand dominance, self-report of anatomy knowledge, skill at geographical map interpretation, video game and computer usage, and interest in learning ultrasound. Subsequently, the Purdue Pegboard (PM task) and the Revised Purdue Spatial Visualization Tests (VS task) were given and scored for each student.

Each student was tested separately with a simple ultrasound task; identifying the subxiphoid (SX) cardiac view. First, a brief video tutorial on basic ultrasound instrumentation was given to each subject. In addition, the correct SX view was shown to them. Immediately after, the students had to identify an optimal SX view on a model. A rubric assessed each student's ability in this area, with a single rater giving an ultrasound task score (UTS). This was validated by also testing on ultrasound-trained physicians. A score of 75% or higher was considered to show proficiency.

Results:

Forty-eight medical students were tested. One medical student was excluded from the study due to previous exposure to the PM task. For the pre-test survey, an analysis of variance was used to determine whether any background characteristics had positive correlation with the UTS. The student's interest in learning ultrasound showed the most correlation with a p-value of 0.01. Comparing the PM and VS tasks, linear regressions against the UTS were used. Respectively, the p-values were 0.08 and 0.02.

Conclusions:

The study results were statistically significant when looking at a student's interest in learning ultrasound and their visual-spatial ability based on the Revised Purdue Spatial Visualization Test. These are noteworthy findings that suggest that a beginner's enthusiasm in learning may help them grasp this skill easier than others. Furthermore, ultrasound is a skill that is based in spatial relationships and a higher aptitude in this ability may predict who will succeed at learning medical ultrasound. Enrollment is still ongoing.

Authors

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Meta Information

Submission ID: 133 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

An Assessment of the Ultrasound Curricula of Osteopathic Emergency Medicine Residencies

Background: There is currently no standardized osteopathic (DO) curriculum for emergency ultrasound (EUS) amongst the 48 accredited DO residency programs. The requirement as a joint statement of the American College of Osteopathic Emergency Physicians and the American Osteopathic Association asks residents to perform 40 EUS examinations during training.

The 2008 American College of Emergency Physicians guidelines suggest more detailed EUS graduation requirements. Also, the Accreditation Council for Graduate Medical Education has designated EUS as one of the 23 milestones.

It is now imperative that DO programs be at the same level as the allopathic programs since the major accrediting bodies have recently agreed to a single accreditation system for graduate medical education programs.

This survey study sought to assess all DO emergency medicine residencies. An analysis was performed to summarize the state of EUS training. This may contribute to a future standardized curriculum.

Methods: An anonymous email survey was sent to the DO EUS director or residency program director. Associations between categorical variables were assessed using Fisher's Exact test. Comparisons between medians of continuous variables were made using Wilcoxon's Rank Sum test. The association between two continuous variables was assessed using Pearson's Correlation, and the correlation was tested for significance using the z-test. Two-sided p-values were calculated with $p<0.05$ considered as significant.

Results: 39 of 48 programs responded (81% response rate). Responding programs had an average of 24 residents (range 4-70).

59% (23/39) of programs had an EUS director. Programs with an EUS director were more likely to require a specified number of scans as a graduation requirement. (Programs with EUS director: 90.9% required a specified number of scans; programs without EUS director: only 60.0% required a specified number of scans.) The difference was statistically significant ($p=0.042$).

Programs required an average of 2.9 weeks (range 0-8) of EUS education. 65% of the programs had quality assurance during the rotation. 35% of the programs had faculty evaluate the resident use of ultrasound on shift. No program had an EUS fellowship.

Reported barriers to EUS education included: no protected time for EUS faculty (65%), faculty disinterest (57%), difficulty recruiting EUS focused faculty (49%), and difficulty purchasing hardware (46%).

Conclusions: There is a considerable amount of variability in the resources and scan requirements for graduation amongst DO EM programs.

Limitations of this study include an 81% response rate.

Our data suggests that improving DO EUS education may begin with the recruitment of an EUS director. If DO EM residencies adopt a single and similar set of graduation requirements as allopathic EM residencies, DO uniformity may increase amongst trainees.

Authors

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Meta Information

Submission ID: 134 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Evaluation of ultrasonography near-peer education; a proposed template for use in undergraduate medical education (UME)

Introduction. The use of ultrasound in medical education is rapidly expanding and the need for effective near peer education is apparent. It is also apparent that a need exists for a template to assess the educational gain provided by this modality. The purpose of this study is to evaluate the efficacy of using a near-peer, ultrasound-education program to supplement the learning of second year medical students about gastrointestinal anatomy and pathophysiology. Medical students will complete an on-line learning module in advance of a hands-on didactic session to reinforce the learning material. Knowledge of the content will be assessed before (pre) and after (post) the lessons. Secondary goals are to assess the student's perception about the clinical utility of using ultrasound to learn about organ systems; to assess student interest in ultrasound; and to assess their opinion about the quality of the learning materials.

Methods. Second year medical students will receive verbal and written (email) recruitment messages to invite them to participate in the Hepatobiliary Ultrasound Teaching Session. Prior to attendance, students will complete a pre-test and brief e-learning (Articulate) module as necessary preparation for the teaching session. Session activities will include hands-on acquisition of ultrasound images and small group discussion covering curricula objectives. Participants will complete a posttest to assess learning and an evaluation survey which will be collected through electronic surveys following the session. Post-test results will be paired to pre-test scores for analysis.

To develop the knowledge tests for this project, pre and posttest items will be piloted through a survey of near-peers. A random sample of current third and fourth year medical students will be invited to take and evaluate the test items. Feedback and results from the near-peers will be used to create two parallel tests for use as the pre and posttests with the population of interest.

Results. The final results of this study will be collected in the near future. An internal pilot study conducted showed promising preliminary findings. By validating these results, we will show that ultrasonography near-peer education is effective in undergraduate medical education. In addition we will demonstrate an effective template for the assessment of the near-peer education model.

Authors

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Meta Information

Submission ID: 135 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Integration of Shoulder Ultrasound Imaging with Physical Exam Skills

Ultrasound imaging is rapidly becoming an important and widely used tool for physicians at the point of care. To prepare our students for this skill, Texas Tech University Health Sciences Center/School of Medicine (TTUHSC/SOM) is incorporating ultrasound techniques in all four years of the undergraduate medical curriculum. Ultrasound imaging naturally integrates with physical exam skills by providing a method to visualize the underlying anatomy in a clinical manner. An ultrasound session was designed for second year students and integrated with a clinical case, incorporating the musculoskeletal examination of the shoulder. Prior to the session, students were provided online modules with instructions for performing an ultrasound exam of the shoulder. During the live session, students were presented with a patient scenario including shoulder pain and a history indicating possible injury to the rotator cuff structures. Students received instruction on physical testing of the rotator cuff muscles - medial rotation for subscapularis (Lift-off test), lateral rotation for infraspinatus and teres minor, and abduction (Jobe's test) for supraspinatus. Students were organized in pairs with one US machine and each student scanning the other. Using their knowledge of the shoulder musculoskeletal anatomy, students completed physical testing and ultrasound examination of the rotator cuff muscles and tendons - subscapularis, supraspinatus, infraspinatus and teres minor. This exercise was assessed with a five-point pre- and post-test. Average student performance on these assessments increased from 3.2 on the pre-test to 4.5 on the post-test ($p<0.0001$). Instructors rotated among the students assisting, as needed, with testing and imaging of the shoulder. Supplementing musculoskeletal examination skills with ultrasound imaging can augment the students understanding of the underlying anatomy and introduce students to clinical applications of ultrasound skills. This project was funded by TTUHSC/SOM.

Authors

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Meta Information

Submission ID:	136	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

General surgery ultrasound training program

Introduction: Ultrasound training in general surgery is variable across the country depending on the program visited, resources and personnel. Little has been done to ensure ultrasound skills are formally assessed among general surgeons and it has largely been left up to the institution in order to ensure that the interns are trained to the standards of the institution. In order to develop a program to increase the skills of the general surgery interns, Ohio State has developed a teaching program aimed at the ultrasound skills pertinent to general surgery.

Methods: In order to improve ultrasound knowledge and skills among general surgeons at Ohio State, a seminar teaching program about ultrasound was instituted. The seminar course includes both lectures about ultrasound techniques and physics along with hands-on training sessions. Entry and exit surveys were distributed during the program to gauge attitudes and comfort with ultrasound.

Results: Preliminary results from the course's entry survey have been obtained with 27 respondents. The survey ranged from 1 to 5 and indicated how much the respondents agreed with the question. The entry survey demonstrated relatively low levels of comfort with interpreting ultrasound images (3.00) and performing procedures using ultrasound (2.89) and moderate amounts of comfort with the physics (3.33) and use of ultrasound (3.44). Additionally, the survey demonstrated that the respondents thought that ultrasound would be an important (4.93) and clinically valuable (4.93) part of their future practice and that the respondents were excited to improve their ultrasound skills (4.85). The entry survey also had a component on the lecture presented on the first session. The responses to this component showed that respondents believed that the lecture was moderately effective in increasing their knowledge of ultrasound physics (3.70), equipment (3.44), diagnostics (3.70) and procedures (3.72). Respondents also felt that the course benefited their professional development (3.85).

Conclusions: General surgery interns seem to value and desire acquisition of ultrasound skills for use in their clinical careers. This new seminar based program aims to address this need by improving general surgery intern ultrasound training at The Ohio State Wexner Medical Center. Preliminary data from the entry session indicates that the first lecture of the program was moderately effective at increasing ultrasound knowledge and that the rest of the course could adequately address the need for ultrasound training among residents in general surgery training.

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Meta Information

Submission ID:	137	Student Submission:	1
Format:	Poster		
Topic:	Use of ultrasound in Graduate Medical and Continuing Education		

The Sonographic Digital Portfolio 2.0: Utilizing Cloud Storage and Remote Expert Access to Provide Comprehensive Ultrasound Education

Background: Ultrasonography interest and education continues to expand at the medical student and resident levels. Ultrasound education often begins in the simulation labs with hands-on time with ultrasound experts. And while many students have learned the basics in performing the classic scans (e.g. FAST, Cardiac), competency is often measured with scan quantity. Competency for the more advanced learner often develops in the clinical arena, where pathology is encountered and where hands-on time with experts is more limited. We believe that an update to a previously described system for students to collect their personal ultrasound scans will allow for (1) increased ease of use and (2) provide a mechanism of ultrasound image feedback for the advanced ultrasound learner.

Methods: We have updated a previously described ultrasound digital portfolio that allowed students to save their ultrasound images and videos for later review. This system now uses cloud-based storage of ultrasound images and videos to provide easier access. Scans done in the clinical skills lab are uploaded to a central computer, organized by an automated script, and then synchronized with a cloud-based storage network (Box.com). Students have personal accounts at Box.com and access to a personal shared folder, which contains their personal images and videos. Additionally, we are in the process of adding software that will allow for local US experts to asynchronously review the ultrasound student's saved scans and provide visual, verbal, or written feedback to the student.

Results: Files saved during the 2014 academic year, up until March 2014, were transferred into cloud storage for distribution. During this time, 1,365 individual scans were recorded by over 200 different individuals, amounting to over 11 gigabytes of data, comprised of 6,308 images and 2,825 video clips.

Conclusions: The development of ultrasound continues to outpace the training of most physicians, residents and medical students. The introduction of ultrasound education at the medical student level often occurs in the simulation lab with extensive time from local experts and is often best suited for beginners. The more advanced ultrasound learner often practices in the clinic and wards with limited access to ultrasound experts. They would also benefit from collating a number of scans for personal review and evidence of proficiency. With the introduction of a cloud-based ultrasound image storage solution we hope to see increased use of image collation secondary to ease of access and hope to expand the utilization of ultrasound experts with remote feedback that can go beyond the simulation lab. The addition of asynchronous feedback capabilities will allow for continued US education for students at all levels of competency while maintaining efficient use of local experts' time.

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Meta Information

Submission ID:	138	Student Submission:	1
Format:	Poster		
Topic:	Technology		

A Point-of-Care Echocardiography Curriculum Proposal to Improve the Cardiovascular Physical Diagnosis in Medical Residency Training

Introduction

The cardiovascular physical examination, which relies on inspection, palpation, and auscultation, remains a key element in the evaluation of patients with suspected cardiovascular disease. However, its low sensitivity and specificity, coupled with reduced emphasis and declining cardiac examination skills across all levels of medical training1, have led to a greater reliance on complementary diagnostic modalities.

Internists, hospitalists, and medical residents find the point-of-care echocardiography model attractive, as requests for comprehensive echocardiography studies are often met with significant delays.2 With appropriate training, internists, hospitalists, and residents can successfully utilize point-of-care echocardiography (POCE) to improve the diagnostic accuracy of the cardiac physical examination, screen for cardiovascular disease, prognosticate patient outcomes, and reduce unnecessary referrals for comprehensive echocardiography.3-6

POCE can be cost-effectively used by internists to screen for cardiac pathology in underserved community clinics and resource-poor settings globally.6

Study Hypothesis:

With adequate training, POCE can:

1. Improve the diagnostic accuracy the cardiac physical examination.

2. POCE is superior to the physical examination in evaluating a broad range of cardiovascular pathologies, including LV systolic dysfunction, valvular regurgitation, valvular stenosis, pericardial effusion, and right ventricular dysfunction.2-6

Population to be studied:

Department of Medicine faculty (N=15), and residents PGY1 to PGY3 (N=15) in the Department of Internal Medicine, Brigham and Women's Hospital to participate in a three (3)-phased transthoracic point-of-care (POCE) training program to complement the cardiovascular physical examination:

1. Phase I:Theory (3 mths) - Self-directed online eLearning modules in POCE as a complement to cardiovascular physical diagnosis

2. Phase II: Skills Practicum (6 mths) - Proficiency in the performance and interpretation skills in POCE) for DOM training faculty and residents. "Training the Trainers" (faculty) p—3mths, followed by Resident

3. Phase III: Clinical Pilot (Yr. 2 Option) - Comparison of POCE with Standard Echocardiography (To Assess Specific Pathologies)

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Meta Information

Submission ID: 139 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Assessing the Need for Dedicated Inferior Vena Cava (IVC) Ultrasound Education in Emergency Medicine Residents

Background

Ultrasound of the Inferior Vena Cava (IVC) is used as a surrogate to estimate intravascular volume status as an alternative to invasive central venous pressure monitoring. Visualizing the IVC is routinely taught as a standard view on the focused echocardiographic exam in the Emergency Department. Given the adoption of its routine use with sepsis protocols, we predict that emergency medicine (EM) residents will need training and specific education in order to locate and evaluate the IVC with bedside ultrasound.

Objectives

The objective is to assess the need for dedicated IVC ultrasound education in Emergency Medicine Residents.

Methods

25 EM residents (9 EM-1, 7 EM-2, 9 Em-3) participated in this study. Residents were surveyed about their experience and self-assessment of competency in finding the IVC with ultrasound. These same residents were asked to image and record the IVC as they would a clinical setting using a healthy medical student volunteer under direct observation by an ultrasound credentialed attending. Residents were then given an educational lecture. An instructional video link was sent out via electronic mail that residents could view at their leisure. At a later date, the residents repeated the IVC ultrasound exam under direct observation. The Emergency Medicine Ultrasound Director reviewed these images for quality and clinical applicability and compared them with pre-education scans. A post-education self-assessment survey was sent out to all residents.

Results

All results were found to be statistically significant with a p-value < 0.05. Using the z-test for comparison of adequacy of IVC image acquisition improved with a p-value = 0.0046 and the comparison of ability to make clinical decision based on images improved p-value = 0.014. The quality of the images improved in 76% of residents; the chi-test for differences in outcomes gave p-value = 0.013. Using the paired t-test, the self-assessment of comfort in performing an IVC ultrasound showed improvement with a p-value of 0.00001. All residents felt that dedicated IVC ultrasound teaching was needed.

Conclusion

As IVC ultrasound use becomes routine in the determination of intravascular volume status in septic patients, dedicated IVC ultrasound education is needed and desired amongst EM residents.

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Meta Information

Submission ID: 140 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Best Ultrasound Probe for Subclavian Vein Visualization via the Supraclavicular Approach

BACKGROUND: Central venous catheters (CVC) are placed frequently in patients who require vasopressors, aggressive volume resuscitation, or invasive continuous hemodynamic monitoring. The use of ultrasound in CVC placement reduces the number of placement attempts, procedure time, and complications. Catheters placed specifically in the subclavian vein (SCV) decrease complications, such as catheter-associated infection and thrombosis. The predominant method of SCV CVC placement is the infraclavicular approach, in which the CVC is inserted inferior to the clavicle. The supraclavicular approach, in which the CVC is inserted superior to the clavicle, offers several advantages to the infraclavicular approach including ease of access during cardiopulmonary resuscitation or when the patient is sitting upright. It is also noted to reduce procedural complications such as pneumothoraxes.

OBJECTIVE: This study aims to determine which ultrasound probe provides the best visualization of the subclavian vein via the supraclavicular approach by comparing ultrasound images obtained by three different ultrasound probes.

METHODS: This is a single-site, prospective, observational study performed by UC Irvine Emergency Medicine physicians with a target sample size of 170 adult patients. Physicians will view the SCV by the supraclavicular approach using the Sonosite M-turbo machine, two linear probes (L25 and L38), and the curved endocavitary probe. After visualization using all three probes, the images are independently rated by the physician performing the scan and by the emergency medicine ultrasound department. Ratings are made based on image quality and visualization of the SCV. Additional data, such as age, BMI, diameter of vessel, and total scan time, will be collected to account for any confounding variables and to allow for secondary analysis.

RESULTS: Forty-four patients are enrolled in this study, which does not yet yield statistically significant results. Data trends suggest the L25 probe is the most preferred probe by physicians and provides the best visualization of the SCV.

DISCUSSION: Ultrasound-guided supraclavicular SCV catheter placement can greatly increase the success of CVC placement and reduce catheter-associated complications. This study provides valuable information regarding the quality of images obtained by various ultrasound probes. The L25 probe provides clear images of the SCV, which may contribute to quicker and more accurate catheter placement. Ultimately, optimal probe choice will allow for more efficient and successful CVC placement and will reduce catheter complications. This study will also inform future studies aimed at evaluating success of ultrasound-guided supraclavicular SCV catheter placement.

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Meta Information

Submission ID:	141	Student Submission:	1
Format:	Poster		
Topic:	New Uses		

Can Medical Students Achieve Minimal Competency in MSK Ultrasound

Background: The Accreditation Council for Graduate Medical Education (ACGME) provides the program requirements for Physical Medicine & Rehabilitation (PM&R) residency training. Included in these requirements is the expectation that residents will obtain training in musculoskeletal (MSK) ultrasound. The PM&R milestones project, created by faculty at The Ohio State University, provides a systems-based approach to teach and evaluate ultrasound skills. Competency parameters in ultrasound topics were developed to define degrees of expertise expected as learners progress from interns to residency graduates.

The milestones project is a graduate medical education (GME) effort. However, we feel this teaching model is applicable to the medical student population. The transition from medical school to residency is a challenge. Medical students often express frustration at the disconnect between their training and the application of knowledge and skills required in residency. Incorporating ultrasound competency training will allow students the opportunity to explore and develop this skill.

We propose to develop and test a training module for medical students that will better define the specific desired performance competencies in the use of MSK ultrasound. Demonstrating that students can achieve a minimal competency in MSK ultrasound will ultimately provide a better method of transition from the undergraduate to the GME level by allowing interns to start residency equipped with these basic skills.

Methods: Curriculum for MSK ultrasound has been developed by faculty in the department of PM&R at The Ohio State University College of Medicine (OSUCOM). This includes lectures, hands-on scanning, and a post-training competency assessment. Residents will be assessed and placed in the requisite milestone upon completing necessary skill sets.

We will recruit a pilot group consisting of ten OSUCOM medical students. These students will take a pretest then work through an iBook curriculum that covers ultrasound of three targeted areas; the shoulder, the knee, and the median nerve. This group will also attend scheduled ultrasound training sessions in the clinical skills simulation laboratory. Students will be assessed at the end of these sessions for their skills in musculoskeletal ultrasound with the goal to achieve the first two levels of the PM&R ultrasound milestones project designed for the GME level.

Results: We will review the medical student's and resident's performance on the pre-and post-test assessment of cognitive and technical skills. We will also review feedback from the students and residents on the training and assessment module.

Conclusions: MSK ultrasound is an important component of PM&R practice. The PM&R milestone competencies provides a model for assessing progression of skill in ultrasound. We believe that medical students are capable of achieving minimal competencies in this model. Establishing these skills at the undergraduate level will benefit students in the transition from medical school to residency.

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Meta Information

Submission ID: 142 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Ultrasound Visualization of the Guidewire in the IVC Ensures Catheter Placement into the Central Venous Circulation

A previously described ultrasonographic “bubble test” has been used to confirm central venous catheter (CVC) position. While the bubble test can rapidly confirm intravenous CVC location, it does not ensure that the catheter tip terminates in the vena cava. Indeed, traditional confirmatory tests such as manometry, pressure waveform analysis, blood gas measurement, and ultrasound visualization of the guidewire in the cervical portion of the internal jugular vein do not preclude the CVC tip from terminating in a non-central vein, such as the subclavian (Figure 1) or in the jugular heading intracranially.

We describe a novel, two-person ultrasound technique to confirm in real time that a CVC will be placed intravenously and terminate in the vena cava. This technique, which we call the “IVC wire test,” uses point-of-care ultrasound to visualize the guidewire within the inferior vena cava (IVC) during wire insertion. Following dilation and catheter-over-wire cannulation of the vessel, the CVC can be used immediately to safely deliver vasoactive medications or to accurately measure central venous oxygen saturation without waiting for a post-procedure chest radiograph to confirm position.

In the first step, a linear ultrasound transducer is used to visualize the needle and guidewire as they enter the internal jugular vein. Prior to dilation of the soft tissues and target vessel, a second operator uses the cardiac transducer on the same ultrasound machine, or on a second machine if available. Under the sterile drape, this operator places the transducer on the patient’s abdomen in the subxyphoid position to visualize the intrahepatic IVC in long axis as it enters the right atrium (Figure 2). The first operator advances the guidewire to approximately 25-40 cm, at which point it should be visualized as an echogenic line within the IVC lumen. The depth of insertion will vary according to the size of the patient and location of the insertion site. Care should be taken to reserve adequate length to maintain control of the free end of the guidewire. Once this wire position is confirmed by visualization of the guidewire in the IVC, the CVC may be placed and is safe to use without delay.

In conclusion, the IVC wire test allows real time confirmation that a CVC will be located in the vena cava. The CVC may be used immediately following a reassuring IVC wire test. The role of the post-procedure chest radiograph would be to rule out procedural complication and can be done non-emergently. The IVC wire test may be particularly attractive for an academic emergency physician who supervises less experienced proceduralists. We have changed our practice to adopt this technique and now routinely use the IVC wire test during CVC placements in our emergency department.

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Meta Information

Submission ID: 143 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Grassroots Ultrasound Education: Learning Ultrasound and Changing Ultrasound Culture in Ultrasound Naive Environments

Many medical students and physicians in training have the desire to learn bedside ultrasound, but find themselves in ultrasound naïve clinical or learning environments. In such ultrasound barren landscapes, self-initiated ultrasound education is possible, providing learners look beyond traditional means of medical education and take advantage of Free and Open Access to Medical Education (FOAMed) resources. Such FOAMed materials, including the Ultrasound Podcast presented by Matt Dawson and Mike Mallin, Sonospot presented by Laleh Gharahbaghian, and SonoGuide by Beatrice Hoffman, are produced by the leading ultrasound educators in the nation and provide self-driven learners the opportunity to receive high quality ultrasound education despite their surroundings. As a consequence of practicing their newly acquired skills, independent learners can institute change in their local ultrasound culture simply by exposing their peers to point of care ultrasound. Medical student and resident physician learners can even 'teach the teacher' by demonstrating the many clinical applications of ultrasound in their clinical experiences. In a specific example of 'teaching the teacher' medical students at one university were able to bring ultrasound into their curriculum by exposing their teachers to ultrasound's many uses. In addition, they successfully campaigned for ultrasound curriculum integration into several courses and created a student-driven ultrasound education program to provide interested medical students access the ultrasound education they sought. In this way ultrasound education and curriculum integration can be accomplished using a bottom-up strategy starting with students. Grassroots ultrasound education is a bottom-up, proven strategy for transformation of the learning environment, requiring the learner to be self-motivated, disciplined, persistent, and perhaps most of all, loud.

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Meta Information

Submission ID: 144 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Burden of Lower Extremity Amputations in Managua: A Retrospective Cross-Sectional Pilot Study of Ultrasound Findings to Predict the Level of Amputation at Hospital Escuela Antonio Lenin Fonseca

Introduction:

Major lower extremity amputations are a growing consequence of diabetes. Ultrasound has gained in popularity as a means to guide the level of amputation in high and middle income countries. Stenosis of any vessel above the knee can guide the surgeon to amputate above the knee. For the vessels of the leg sensitivity and specificity of this method ranges from 67-82% and 53-90%. No study to date exists regarding lower extremity amputation amongst diabetics or the use of ultrasound to guide the level of amputation in low & middle income countries.

Methods:

This retrospective cross-sectional study took at place at the national referral center Hospital Escuela Antonio Lenin Fonseca in Managua, Nicaragua (population 959,000). The objective of this study was to determine the strength of association of the level of lower extremity amputation amongst the diabetic foot cohort with ultrasound findings and pre-operative risk factors

Results:

A total of 887 amputations were identified with the primary diagnosis of lower extremity amputation from 2009-2013. The distribution of etiologies included 58 diabetics, 6 traumas, 3 arterial thrombi, 3 cases of osteomyelitis, and 8 unknown diagnoses. Of the 58 diabetics, ultrasound studies were available for 39 of the diabetic patients. There were 7 BKAs and 32 AKAs amongst the diabetics representing 17.95 % and 82.05 % and was found to be statistically significant. A multivariate logistic regression model adjusted for weight and gender found that patients with a peak systolic velocity ratio of 2 or greater were found to have significantly greater odds for an above the knee amputation(OR: 30.48 [95% C.I. (1.40 - 661.5)] p<.05) .

Conclusion:

In our logistic regression model we found that the Doppler ultrasound (peak systolic velocity ratio of 2 or >) was the strongest associated factor at 30x likely to have an AKA. This study provides direction for further investigation. For low & middle income countries a long term prospective study that determines whether ultrasound studies are the appropriate tool to determining the level of amputation is needed.

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Meta Information

Submission ID:	145	Student Submission:	1
Format:	Poster		

Topic: Point of Care ultrasound in health care delivery to underserved populations

Bedside Ultrasound Milestones for Undergraduate Medical Education

The practice of physician-performed bedside ultrasound is increasing in scope and importance. However, ultrasound image acquisition and interpretation remains a technically challenging skill. A number of medical schools are experimenting with formal longitudinal education, extra-curricular activities, and/or elective courses in ultrasound at the medical student level. A method for tracking ultrasound experience, fostering student growth, and incorporating leadership within ultrasound has yet to be optimally defined.

At the resident level, the Accreditation Council for Graduate Medical Education (ACGME) uses milestones to track resident competency in areas of clinical practice. As part of the Emergency Medicine Milestone Project, ACGME and the American Board of Emergency Medicine (ABEM) identified focused ultrasound as one of twenty-three milestone competencies for EM residents. We used the five-tiered ACGME-ABEM milestone system as a model to develop ultrasound milestones for medical students. This framework comprises a series of graded accomplishments, separating learners into basic and advanced competency based on academic commitment and leadership. The medical student milestones may be a valuable scaffold for educators and students designing and pursuing educational experience in ultrasound. The milestones provide a flexible model integrating multiple programs yet allowing the student to tailor their experience.

As bedside ultrasound is a rapidly-evolving field, students must learn both current knowledge and also skills to innovate and adapt for the future. Truly in-depth ultrasound education involves more than just scanning techniques and image interpretation. We looked to fellowship ultrasound education as a model for producing leaders in ultrasound. At the fellowship level, broader ultrasound education includes a series of didactics, scanning shifts, research activities, quality assurance, image review/critique, project presentations, and ultimately manuscript preparation. We have likewise chosen to emphasize competence in leadership and scientific discovery in our milestone framework. In this way we provide a structure for producing future leaders in the evolving field of ultrasound.

Our flexible milestone framework consists of four categories of competence: clinical skills, administrative leadership, research, and educational experience. For each of these competency categories, we have designated five levels of competency milestones. These achievements may be amenable to a one week, one month, or longitudinal programs depending on the level of commitment involved. The milestone framework not only gives students and educators a flexible model for tracking ultrasound knowledge and clinical skills, but also a toolkit to integrate leadership, innovation, and research into medical student ultrasound curriculum. As the field of ultrasound expands and more specialties use this tool in their practice, codifying the leadership paths students can take using ultrasound is imperative. This milestone framework attempts to organize many ultrasound opportunities to lead, serve and inspire within the medical student curriculum at our institution.

The medical student progressing through a topic area demonstrates knowledge on what indications lead to performing a focused ultrasound exam. This is milestone number 1. As the learner acclimates to the machine and the process of acquiring images, they can be assessed in an objective

structured exam in a simulated setting for milestone 2. providing and saving multiple exams leads to 3 and 4 while level 5 is reserved for expertise.

The milestones between undergraduate medical education and graduate medical education may be a bridge where learners can demonstrate competency rather than layer education temporally between various educational strata. The undergraduate medical education experience is a rich one with inquiry, content and opportunity, especially with ultrasound. Milestones help define the competency curve of the learner as they attempt to master this skill to image patient anatomy, use ultrasound images/videos and provide care.

The aggregate of ultrasound experiences can be appropriated into body areas or organ system and academic programs built around these content areas. Advanced competencies build on those basic skills in areas of acquisition, interpretation and medical decision making in a variety of clinical scenarios. Interpretation skills can be measured in a knowledge exam while medical decision making and compliance are assessed in a quality assurance program. The learner's digital portfolio is an evolving record of milestones in simulation and clinical cases each learner logs during their training period. Since this field is just beginning, this framework serves as an introduction to this important topic area and may provide a comparative to future advances in this area.

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Meta Information

Submission ID: 146 Student Submission: 1
Format: Oral

Topic: Use of ultrasound in Undergraduate Medical Education

Advanced Competency in Ultrasound in Undergraduate Medical Education

The integration of ultrasound into undergraduate medical education has accelerated in the last decade. Current literature describes the integration of ultrasound into anatomy, physical exam courses, electives, and advanced longitudinal programs. Some institutions have integrated ultrasound into all 4 years of medical school. In spite of these examples, most medical schools don't yet train students systematically, nor has there been consensus on core or advanced competencies in ultrasound.

At our institution, an ultrasound program for medical students has been in place for over 15 years. During that time, individual programs have been developed to complement existing curriculum and advance student learning. Our undergraduate medical curriculum underwent an overhaul in 2012, creating a new curriculum known as LSI (Lead Serve Inspire). This curriculum consists of three parts. Part 1 consists of the traditional preclinical years using a systems-based approach to anatomy and pathophysiology. Part 2 is dedicated to the traditional third year structured clinical time, where students participate in ground school before entering into specific rotations. Part 3 allows senior student flexibility to develop an advanced competency by providing an individualized clinical experience geared toward their eventual career choice.

Our ultrasound program adapted to this new structure by developing an advanced competency in focused bedside ultrasound. This advanced competency is a compilation of previous programs that existed outside the new curriculum, along with several elective components. A senior honors ultrasound program along with a third year advanced competency alternate experience—both requiring 150 hours of academic commitment—served as Major programs to develop a strategy for obtaining a minimum advanced competency. In addition, minor programs—offered to junior medical students as a way of introduction to ultrasound—complement these major programs, allowing students to achieve a gradation of ultrasound competency from Bronze level up to Platinum level. These levels are benchmarks for students and educators to understand competency and progress. In the initial levels, participation hours and scans are the primary metrics. Later in this multi-tiered system, research and leadership are emphasized, teaching advanced students to be innovators while learning advanced clinical skills. At each level, more leadership, service and time was required to demonstrate an advanced competency with ultrasound.

This framework allowed our institution to develop flexible scaffolding for ultrasound education. Students can develop an advanced competency in ultrasound with participation in clinical scans, educational learning modules, research activities, and administrative leadership. This allows students to tailor their involvement based on interest. Other institutions could use this flexible model for developing their own curricula with varying scopes and objectives. Overall, the program is designed to help students become involved and proficient in the field of ultrasound and specialize their skills into their eventual specialty.

Ultimately the consensus of medical educators could determine those minimal skills and those advanced competency skills required for all or select medical students. Current governing bodies are at the inception of this new discussion on those elements of ultrasound best integrated into

medical education and the impact in clinical care. Future studies will best determine those skills necessary for an advanced competency with ultrasound in undergraduate medical education.

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Meta Information

Submission ID: 147 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

A Novel Universal Subcondylar Classification System Based on Anatomical Features for Ultrasound Triage

INTRODUCTION. Mandibular fractures date back to at least the 17th century BC. Regardless of country or culture, mandibular fractures are and have been a relatively common phenomenon. As treatments for mandibular fractures have evolved numerous classification systems have been proposed. One area of particular interest in the debate over best practices has been the definition of the "subcondylar" region of the mandible. Most classification systems use subcondylar terminology which the authors feel is too nebulous. Definitions range from thinnest point of the mandibular condyle to the ascending ramus (termed "Condylar Base"). The objective of this study was to investigate subcondylar classification and develop a universal classification by integrating anatomy and clinical applicability with both novel and classic ultrasound transducers. METHODS. Literature search was conducted regarding fractures of the mandible and/or subcondylar region. Observations were carried out with bone specimens as well as donor cadavers (DCs) (n=50; 100 sides) with attention to mandibular morphology. Ultrasound (US) was used to identify fractures of the subcondylar region. RESULTS. Literature search revealed multiple subcondylar classifications which were inconsistent. All induced fractures were identified with US. 99 out of 100 sides revealed obvious morphology, 1 side was unclear due to previous pathology. DISCUSSION. Morphological studies revealed a line drawn parallel to the posterior-most aspect of the 3rd molar through the mandible would accurately delineate an anterior border for distal mandibular fractures. In edentulous patients this line may be drawn using the base of the retromandibular triangle. Morphological studies and cadaveric dissection supported this conclusion. US revealed subcondylar fractures in DCs. Subcondylar fractures are common and warrant a standard classification system based on integration of anatomy and clinical practice. Current systems do not appear to be based on anatomy and lack universal acceptance. US could be used as a triage tool for subcondylar fractures. With further research and development, US could become part of the standard diagnostic and rehabilitation protocols. CONCLUSION. This study revealed a novel universal subcondylar fracture classification system which is logical, clinically relevant and based on anatomical features with US application.

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Meta Information

Submission ID: 149 Student Submission: 1
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Ultrasonology: The birth of a new field of study?

Ultrasonography is the writing of images with ultrasound (US) and focuses on the acquisition of ultrasound images as a unique skill. Sonographers graduate with registered diagnostic medical sonography as a certification and degree. Physicians have been known to end US fellowship with completion of this same examination despite its nonspecificity with their clinical practice.

Many operators including physicians have taken the registered diagnostic medical sonography exam as a method to demonstrate some amount of proficiency in the ultrasound community. The time is now for a new field of study, ultrasonology, and the study of not only acquiring but interpreting ultrasound images and using them in medical decision-making.

Much attention has been focused on ultrasound as a skill set in modern medical clinical practice and the requisite training necessary. The rise in clinician performed point of care, focused ultrasound has been due to a combination of miniaturization and portability, improvement in resolution, and the adoption of a limited examination with a specific purpose. As this concept has grown from the trauma bay with the FAST scan to the Emergency Department to the Intensive Care Unit to the OR and beyond, a similar set of issues arises in these areas. Who is credentialed to perform these US procedures, what are the standards, where can we find equipment, how do we document and bill, who are the thought leaders and mentors on the subject?

These components constitute a body of knowledge which is unique and worthy of its own field of study with the breadth and depth from ultrasound physics, technology, physiology, anatomy, and spatial analysis along with decision making and clinical acumen. Ultrasonology crosses all fields of medicine to focus on the patient and sonographic signatures helpful for medical decision-making. Each specialty field incorporates the use of ultrasound into their practice as these clinicians will acquire images and make interpretations to help them manage the patient. This contrasts to ultrasonography which is the study of acquiring ultrasound images and produces individually skilled sonographers.

Ultrasonology is the field of ultrasound from a perspective that explores clinical insights, educational curricula and innovations, research of new knowledge and techniques, with administration and direction of quality within a clinician performed focused US program.

This evolution of clinician performed ultrasound based skills is transcending various training paradigms and crosses many disciplines. As the educational framework and learning curves provide cause for sound clinical service, more ultrasound can be studied for best practice and operational efficiency. The wealth of information available in print, media and social media provide a wide array of content and inquiry. This new field can be demarcated to better codify those areas where ultrasound can better clarify the clinical scenario. From the detection of fluid, the aid to a procedure, the analysis of a wave form or motion mode tracing, the ability to perform key ultrasound skills can benefit many in medicine.

The end product are individuals skilled in ultrasonology and can function as sonologists. This term has been bandied about in the ultrasound community as a physician who acquires and interprets ultrasound and can make clinical decisions with this information. Ultrasonology is better suited for

the movement of teaching medical students how to use ultrasound during their training than is ultrasonography.

Ultrasonology versus Ultrasonography. Which is the better term to describe ultrasound in undergraduate medical education?

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Meta Information

Submission ID: 150 Student Submission: 0
Format: Poster

Topic: New Uses

Seeing Is Believing: Evaluation of a Point-of-Care Ultrasound Curriculum for First-Year Medical Students

Introduction

The introduction of point of care ultrasound has been a novel addition to undergraduate medical education at some medical schools. This study assessed the impact of a point of care ultrasound curriculum on first-year medical students and their faculty. Student competency in image acquisition and interpretation was evaluated after completion of the curriculum and student and faculty impressions of the curriculum were assessed.

Methods

All 142 first-year medical students underwent a curriculum on ultrasound physics and instrumentation, cardiac, thoracic, and abdominal imaging in 2013. Asynchronous learning through web-based tutorials and interactive tests augmented hands-on scanning sessions incorporated into the physical examination course. Students and course faculty completed surveys on their impressions of the curriculum, and all students underwent competency assessments with standardized patients and faculty observers.

Results

Eighty-seven percent of faculty and eighty percent of students felt the physical examination course was the right time to begin incorporating ultrasound into the curriculum. The standardized patient encounter was scored out of 100 points; a score of 70 was defined a priori as a minimum expected competency level. Students demonstrated proper use of the ultrasound machine functions well (mean score 91.6), followed by cardiac and thoracic system assessments (mean score 80.4 and 79.6). The lowest scores were recorded in the abdominal system (mean score 71.6). Two independent observers evaluated 55 of the 142 students. Mean scores for the two independent observers were 0.74 and 0.75 (Pearson correlation coefficient 0.76).

Conclusions

Students and faculty found value in the curriculum, and students were able to demonstrate basic competency in using ultrasound to assess several organ systems. Further study is needed to determine how this emerging technology can best be incorporated into a robust and longitudinal learning experience for medical students.

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Meta Information

Submission ID:	151	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

USIG Research Committee: A Centralized Cloud-Based Database for Coordination of Ultrasound-Related Student Research

Introduction: An initiative to create a cloud-based organization system allowing for coordination and monitoring of multidisciplinary student-led or student-involved ultrasound research projects at the Ohio State University Wexner Medical Center. The goal of this initiative is to facilitate project creation and monitoring, further advancing the level of ultrasound research within the medical center.

Methods: Members of the Ultrasound Interest Group (USIG) research committee created individual project pages using the web-based program, Evernote, with links to a cloud-based storage platform called Buckeyebox. The USIG research committee members, group president, and faculty contacts have “superuser” access to all projects, allowing for coordination and distribution of projects to students interested in ultrasound. Individual students or groups working on ultrasound projects have access to their project page and Buckeyebox storage through the cloud. This allows for a single, updated, project overview site to be created and managed. Further, this allows for coordination and continuation of projects across medical school classes through simple transfer of all materials from one project “owner” to another.

Conclusions: Ohio State University College of Medicine student-led ultrasound research has been large in breadth, with multiple projects across various specialties completed over the past several years. This administrative project aims to centralize and coordinate all student-involved or student-led ultrasound research at a major institution through the use of cloud-based database technology with the goal of promoting and facilitating ultrasound related research projects, leading to increased publication and wider understanding of the core concepts of ultrasound in practice.

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Meta Information

Submission ID:	152	Student Submission:	1
Format:	Poster		
Topic:	Technology		

Point of care ultrasound improves the diagnosis of splenomegaly in hospitalized patients: a randomized trial.

Introduction: Hepatomegaly and splenomegaly are important, clinically relevant conditions and the examination for these conditions is part of the traditional physical examination. However, previous studies have shown that the traditional physical examination has marked limitation in the ability to detect the presence or absence of hepatic or splenic enlargement. Thus, we examined if the addition of point-of-care ultrasonography (POCUS) to the traditional physical examination improves the diagnosis of hepatomegaly and splenomegaly.

Methods: This was a prospective, randomized trial conducted in 2013 and 2014 at the University of Minnesota Medical Center. Adult patients who were able to given consent, without moderate or greater abdominal pain, with no recent abdominal surgeries, and in whom a CT, MR, or abdomen had been performed in the last 48 hours were enrolled. For each subject enrolled, one traditional physical examination and one ultrasound-assisted physical examination were performed by the physicians who were randomly assigned. Examiners consisted of 1 hospitalist, 12 senior residents, and 5 interns, all of whom had less than one hour experience in spleen and liver ultrasound. The findings were recorded by the examiner and compared by the investigators to abdominal CT, MRI, or radiologist-interpreted ultrasound, which served as the reference standards for the study. Excel (Microsoft Corporation, USA) was used for statistical calculations.

Results: A total of 17 subjects were enrolled in the study; one patient did not have radiology results available for spleen size and thus 16 patients were included in the analysis for splenomegaly. The prevalence of hepatomegaly was 17.6% and splenomegaly 18.8%. For hepatomegaly, physical examination had a sensitivity of 0 (95% CI 0-56%) and specificity 71% (45-88%) while physical examination with POCUS had a sensitivity of 33% (6%-79%) and specificity 71% (45-88%). For physical examination alone for hepatomegaly, the LR+ was 0 and LR- 1.4 (1.01-1.95); for physical exam with POCUS the LR+ was 1.17 (0.19-7.07) and LR- was 0.93 (0.39-2.2). For splenomegaly, physical examination had a sensitivity of 33% (6-79%) and specificity 77% (50-92%) while physical examination with POCUS had a sensitivity of 100% (44-100%) and specificity 77% (50-92%). For physical examination alone for splenomegaly, the LR+ was 1.44 (0.22-3.5) and LR- 0.87 (0.37-2.04); for physical exam with POCUS the LR+ was 4.33 (1.61-11.69) and LR- was 0. The addition of POCUS to the traditional physical examination had a statistically significant effect on the examiners' confidence in their ability to detect splenomegaly (mean ± SD) (3.6 ± 0.8 vs 2.8 ± 1.1 on a 5 point scale, $p<0.05$) and hepatomegaly (3.9 ± 0.7 vs 2.9 ± 1.1 on a 5 point scale, $p<0.05$).

Conclusions: Physical examination alone has marked limitation for the detection of hepatosplenomegaly in hospitalized adult patients. The addition of POCUS to the traditional physical examination, especially as a screening test, improves the examinations and examiners' confidence in their examinations for both hepatomegaly and splenomegaly; the effect is more pronounced with splenomegaly. Further studies should be done to improve the ability of physicians to use POCUS to detect abdominal organomegaly. Further, addition of POCUS to the traditional physical examination appears warranted when organomegaly is being considered.

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Meta Information

Submission ID: 153 Student Submission: 0
Format: Oral

Topic: Point of Care ultrasound in general clinical practice

The Role of Point-of-care Ultrasound in the Patient Community of the Rural Emergency Department in Armidale, Australia.

INTRO: Point-of-care ultrasound (POC US) has now become a relatively efficient and inexpensive tool for the physician in a multitude of clinical environments. Clinicians practicing rurally and patients seeking care in remote communities often do not have access to CT, MRI, or other radiographic imaging for diagnostic purposes. The purpose of this study is to determine the ability of POC US to increase diagnostic certainty, shorten time to a definitive intervention, and serve as a procedural adjunct at the Armidale Rural Referral Emergency Department in New South Whales, Australia.

OBJECTIVE: To determine the potential benefit of POC US as a clinical resource in the Emergency Department at the Armidale Rural Referral Hospital (ARRH).

METHODS: This study is a retrospective chart review sampling 300 consecutive ED patients at the ARRH based on a pre-determined list of diagnoses that indicate the use POC US. For each case, the chief complaint, pertinent comorbidities, the use of imaging, and the date and time of the modality ordered were recorded as the preliminary data set. Using expert opinion, this data set was then assessed to determine whether the treatment of these patients would benefit from the use of POC US. Time to obtain imaging, time to discharge, and the use of ultrasound will be compared.

RESULTS: Of 300 consecutive ED visits, 261 patients were discharged, and 39 were admitted to the hospital for further treatment or evaluation. 120 patients had a discharge diagnosis that indicated POC US. The ARRH ordered a formal ultrasound on 17 of these 120 patients, and the average time to obtain an official reading was 9 hours and 29 minutes. It was determined that access to and proper training in the use of POC US could expedite the time to diagnosis and decrease overall ED stay for many patients at ARRH.

DISCUSSION: This study shows the value and efficiency of POC US in a rural ED setting. Considering many rural medical centers, in addition to the ARRH, do not have radiologic services available 24 hours a day, the potential benefit for POC US is tremendous. These results illustrate that POC US can be extremely helpful as an additional diagnostic tool for the emergency physician, especially when traditional radiologic services are unavailable or the necessary equipment is inaccessible. We believe these results propose that the benefits of POC US outweigh the time and resources expended, and suggest the institution of training and acquisition of the necessary US equipment in ARRH and in similar rural community settings.

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Meta Information

Submission ID:	155	Student Submission:	1
Format:	Poster		
Topic:	Point of Care ultrasound in health care delivery to underserved populations		

Developing an undergraduate point of care ultrasound system: a needs assessment

Introduction:

Although undergraduate ultrasound curriculum is not a novel concept, most existing programs in Canada follow the traditional course framework designed to instruct practicing clinicians and are not based on emergent training needs, educational theory or supported by evidence. We have developed a three-phased research program to address these missing concepts by completing a needs assessment, developing and validating a competency-based assessment tool, and testing various educational theories and interventions. The goal of our research program is to develop and implement an effective undergraduate ultrasound curriculum. Currently, we present phase one of our research program: a needs assessment.

We conducted an in-depth assessment of stakeholder groups, including medical students, residents, staff physicians and medical educators to assess the perceived training needs at our institution with the goal of building a relevant and evidence based undergraduate point of care ultrasound curriculum to meet these needs.

Methods:

Using a descriptive, cross-sectional survey of stakeholder groups, we assessed the perceived relevance of various ultrasound principles, skills, teaching environments and teaching interventions as well as the attitudes towards the implementation of an undergraduate point of care ultrasound curriculum.

Results:

There were a total of 150 survey respondents representing all major stakeholder groups. A general consensus was demonstrated among medical learners at all levels of training throughout the survey, where 100% of pre-clerkship and clerkship students, 97% of residents and 81% of educators agreed that the introduction of ultrasound would augment medical student's understanding of anatomy and physiology. In addition, 100% of all medical learners and 81% of educators believed that any undergraduate ultrasound curriculum should also include clinical applications of point of care ultrasound. Further data supported the delivery of both clinical and basic medical science curriculum for various head and neck, thoracic, abdominal, extremity and procedural ultrasound skills to undergraduate medical students. Among medical educators, 71% were in favour of implementing an undergraduate ultrasound curriculum while 24% were neutral and 5% were not in favour of such a curriculum. No medical learners disagreed with the implementation of ultrasound curriculum.

Conclusion:

There is an interest and perceived need for implementation of undergraduate ultrasound curriculum. Inclusion of ultrasound as an adjunct to various anatomy and physiology topics as well as the instruction of clinical applications of point of care ultrasound was desired. Valuable information regarding the inclusion and exclusion of specific ultrasound topics was also collected to assist with future curriculum development. Although medical learners and educators were in favour of

implementing an undergraduate ultrasound curriculum, there was more interest demonstrated among medical learners.

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Meta Information

Submission ID:	156	Student Submission:	0
Format:	Poster		

Topic: Use of ultrasound in Undergraduate Medical Education

An innovative approach to junior resident introductory E-FAST education and outcome assessment

Background:

In many academic institutions junior residents perform the extended focused assessment with sonography in trauma (E-FAST) exam during the trauma resuscitation. The inexperience of these residents and the urgency surrounding the care of trauma patients creates a high probability of error in the performance and interpretation of this crucial aspect of the trauma evaluation.

Objective:

This innovative approach to E-FAST education for novice sonographers aims to improve the accuracy and quality of E-FAST exams performed by junior residents.

Methods:

18 junior residents were enrolled in 2 hours of intensive E-FAST training. Residents completed a pretest assessing baseline understanding of the E-FAST exam and indicated confidence level in their ability to accurately perform and interpret the E-FAST exam on a visual analogue scale (VAS). Throughout a 45-minute lecture, twelve anatomic sites of ultrasound visualization crucial to a quality E-FAST exam were repeatedly emphasized. These included: Morison's pouch, inferior pole of the right kidney, liver tip, right pleural space, the spleen-diaphragm interface, spleen tip, left pleural space, longitudinal pelvic cul-de-sac, transverse pelvis, pericardium, cardiac apex, and pleural line. Over 60 images or video clips of E-FAST exams were displayed to reinforce this information. A one-hour scan lab followed, during which residents performed 2 supervised E-FAST exams and were assessed on recognition of the twelve anatomic structures emphasized in the lecture. Residents completed a post-test and post-course VAS ranking confidence level in their ability to accurately perform and interpret an E-FAST exam.

Results:

Upon course completion, all residents performed E-FAST scans better than expected for their level of training when assessed by 2 expert sonographers on a Likert scale. Participant exam score improved from a pretest mean of 58 percent to 80 percent on a post-test; demonstrating significant improvement in E-FAST understanding. Learner confidence in E-FAST scanning and interpretation ability increased 47% when pretest VAS rankings were compared to post course values.

Conclusion:

A focused educational intervention emphasizing anatomic sites of importance in the E-FAST exam, repeated E-FAST image exposure, and supervised scanning improves the scanning ability, knowledge base, and confidence of junior residents. The effectiveness of this teaching protocol will be further assessed through evaluation of long-term knowledge retention and quality assurance review of junior resident E-FAST exams prior and subsequent to the course.

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Meta Information

Submission ID: 157 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Ultrasound In Urology: A Survey of Residents Regarding Ultrasound Training, Competency, and Utilization in Urologic Surgery Training

Background

Urologists are experts of the genitourinary system and imaging of this anatomy and pathology is inherent to their daily patient care. While all urologists are familiar with prostate ultrasound particularly as it is used for guided prostate biopsy, performing focused renal, bladder and testicular ultrasound is not as widespread. Urology programs have sought out ways to integrate these procedures into their core curriculum. To provide a stronger foundation for discussion of this topic, we report a resident survey within our institution.

Methods

A 19 question survey was developed and distributed using the online website SurveyMonkey.com. Data collected from the survey included demographic information regarding the survey participant, including year of residency. Participants were then asked about their experience and previous training with US, their comfort level with the technology, their skill level with various US procedures, their opinion of the current state of US in graduate medical education, their prediction of future utilization in their own practice, and to identify barriers to training.

Results

There were 12 responses. Half of respondents indicated they are confident performing scans without supervision and two-thirds of the respondents are confident interpreting ultrasound images independently. Approximately 83% of the respondent residents are confident using the ultrasound images obtained in radiology for medical decision making whereas only 33% and 25% are either confident or may be confident in using the ultrasound images they obtained in medical decision making, respectively. 75% of the respondent residents reported they were either skilled or very skilled in imaging the kidney for size and evaluation for hydronephrosis, but only 33% indicated this to determine the presence of a renal mass. 92% of the respondent residents have either intermediate skills or skilled in imaging the testicle. Half of the respondents are skilled or very skilled in determining the presence of intratesticular masses. 75% of the respondents have at least intermediate skill in interpreting waveforms. Most (92%) think that teaching US to identify hydronephrosis, renal masses, testicular masses and testicular torsion probably or definitely should be taught to urology residents. 92% indicated that time constraints were a moderate to significant barrier for provider performed ultrasound and 58% thought the lack of their technical skill and the medicolegal concerns as a moderate or a significant barrier, respectively. Approximately two-thirds of the respondents indicated their concern for missing an important finding as a significant or insurmountable barrier.

Conclusions

Most residents feel comfortable performing and interpreting urologic ultrasounds but are not as comfortable using images they obtain in medical decision-making. Significant barriers continue to

exist with provider-performed ultrasound including time constraints and confidence in technical skill. In order to overcome these issues, it seems a comprehensive US training program curriculum for urology residents is needed.

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Meta Information

Submission ID: 159 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Medical Student Driven Ultrasound Education: Ultrasound Interest Groups

Ultrasound Interest Groups (USIGs) serve to promote ultrasound education among medical students, provide immediate access to ultrasound education, and facilitate ultrasound integration into medical education. These interest groups are both run and organized by medical students and guided by faculty mentors. A USIG can introduce students to the existence of bedside ultrasound and raise awareness about the uses of ultrasound in medicine. They can also provide medical students with immediate access to ultrasound education by organizing hands-on ultrasound skill workshops. This "bottom-up" approach removes the administrative lag time and loss of ultrasound education opportunities, so that students can receive hands-on ultrasound training immediately. The activities of USIGs also promote the development of student ultrasound leaders, who can advocate for their follow students and stimulate curriculum change. The student interest generated by exposure to ultrasound and hands-on ultrasound training by USIGs creates additional pressure to help drive ultrasound integration into medical curriculums. In addition, students involved with USIGs can demonstrate their ultrasound abilities across many departments during their clinical rotations, exposing less ultrasound aware faculty to ultrasound applications. USIGs are a great way to provide immediate access to ultrasound education to medical students and promote ultrasound in medicine and medical education.

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Meta Information

Submission ID: 160 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Multidisciplinary point of care ultrasound education: A mixed-methods evaluation

Background Point of care ultrasound (PoCUS) is well-established within the discipline of emergency medicine. In recent years the value of PoCUS has emerged among other disciplines such as Internal Medicine, Rural Family and General Surgery however formal training opportunities are often limited. Memorial University has addressed this issue through a multidisciplinary approach to postgraduate ultrasound education. This program, now in its third year, incorporates a singular curriculum to train residents from a broad range of disciplines in a cost-efficient fashion. The curriculum consists of online education, skills training, competency development and subsequent knowledge transfer via resident instructors. Purpose: The purpose of this study was to evaluate the attitudes, beliefs and experiences of residents having participated in Memorial's multidisciplinary PoCUS program. Methods: A mixed-methods sequential, exploratory approach was employed to evaluating the PoCUS program. The researchers conducted a focus group to identify key themes and to explore resident experiences. Data was analyzed using a constant comparison method with the results used to generate a survey subsequently administered annually over a two-year period. Discussion: Residents generally felt that a multidisciplinary approach to PoCUS skills training was enjoyable, met the educational needs of a variety of disciplines, and enhanced collaboration. Many felt that, while some skills were less relevant to their chosen discipline, the skills were transferrable and complementary. The study also highlighted certain challenges to the program such as residents performing PoCUS in an ultrasound naive environment and ensuring that established training standards were met. Ultimately, the results supports a multidisciplinary approach to point of care ultrasound education and provides a mechanism to bridge gaps left by increasingly compartmentalized practice of medicine.

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Meta Information

Submission ID: 161 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Ultrasound Guided Vascular Access, A Basic Competency for Ultrasound in Undergraduate Medical Education

Our program reports the experience of a multi year assessment of medical students completing pre clinical introductions to clinical medicine with ultrasound guided vascular access as the basic competency.

Ultrasound has become a teaching aid in many medical programs and has been described across specialties and across the medical hierarchy from students to residents to practicing physicians. As ultrasound becomes more prevalent within each institution and incorporates into medical student educational programs, the question will become what, where, how, and how much?

The skill of ultrasound guided vascular access (USGVA) becomes a viable option for a basic skill when considering its practical applicability in the clinical setting. Many fields require vascular access as a teachable skill. Using ultrasound to complete that skill can be taught with a flipped classroom, hands on demonstration and instruction, deliberate practice and final assessment of key procedural checkpoints that can be mimicked in a skills lab and cadaver setting.

Students typically spend some amount of time familiarizing with anatomy and normal during the 1st years and then transition to clinical duties in the third and fourth year. As students progress in responsibility, they may be called to help provide best practice techniques to problems with vascular access.

Basic plus Advanced competency could be a simple dichotomy for educators to differentiate educational priorities with ultrasound. The content for vascular access as a basic competency and deliverable can help the operator explore other advanced procedures such as paracentesis, thoracentesis, pericardiocentesis, abscess drainage, or other access or biopsy using ultrasound.

The applicability of teaching ultrasound to all medical students is daunting and more clarification of what should be core (basic) and enriched (advanced) competencies, and how much to expose and what to teach still puzzle educators. Teaching medical students how to use ultrasound to visualize planes of vessels and differentiating between artery and vein and distinguishing the needle tip from the shaft are deliverables in medical education.

Thus the direct skill of examining a needle in a phantom in multiple planes was implemented over a multi year period between 2010-2014 to investigate the successful completion of this skill as a documented procedure. Results will be discussed along with insights from implementing checklists and assessed skills for all users.

- Preparing students with an ultrasound skill that may be utilized in a positive way in the clinical setting is prudent education for a modern medical student.

- More research must explore those skill sets utilizing ultrasound as essential and core and which applications are more enriched, elective or part of an advanced competency.

- This presentation will highlight lessons learned from implementing USGVA as a basic competency along a change from one curriculum to another curriculum.

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Meta Information

Submission ID: 162 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Development of a Novel Focused Ultrasound Training Program for Surgical Residents in the Critical Care and Trauma Setting

Focused ultrasound has become an increasingly important component of practice for many general subspecialty surgeons. New surgical graduates are now expected to have developed a proficiency in focused ultrasound for the bedside evaluation of patients, particularly within the trauma and critical care setting. To date however, there are no clear training methods which provide inexperienced surgical residents with focused ultrasound training in the controlled clinical setting needed for competency development. In July 2013 the Orlando Health Department of Surgery developed a novel focused ultrasound training program for surgical residents with the purpose of developing basic ultrasound competency utilizing multimodal training methods. The program was developed in conjunction with Department of Emergency Medicine faculty who hold additional ultrasound certifications and experience. The one month course consisted of both cognitive and behavioral learning models. The cognitive component was developed through two one-hour didactic session, which introduce basic ultrasound physics, knobology and probe selection, ultrasound terminology, exam indications and contraindications, image acquisition techniques, and image interpretation methods. The behavioral component was developed through two one-hour hands-on sessions under faculty supervision with selected critical care patients with the goal of developing psychomotor skills necessary for scanning in addition to interpretation of normal and abnormal exam findings while performing a focused assessment for trauma (FAST) exam. Additionally, participants performed FAST exams independently on all trauma patients admitted to our Level 1 trauma center. A log of all ultrasound exams performed by participants has been maintained in addition to pre and post-course proficiency and satisfaction tests.

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Meta Information

Submission ID: 163 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Integrating Ultrasound Orbital Anatomy and Foreign Body Exploration with Donor Cadaver Patients as a training method for Emergency Medicine Personnel.

INTRODUCTION. The orbit has structures of critical importance regarding the special sense of vision. Foreign body (FB) identification within the orbit is important to emergency department personnel (EDP). Orbital ultrasound (US) is used minimally but visual health is vitally important. Objective of this study was to investigate the use and training of US to identify foreign bodies and anatomical structures within the orbit of donor cadaver patients (DCP).

METHODS. Literature search was conducted using contemporary US and anatomy journals and texts regarding US use within the orbit of DCP's. First and second year (N=51) medical students (MS) were shown how to identify orbital structures using US and asked to identify a list (lens, choroid, ciliary body, iris, sclera, vitreous body, optic nerve, anterior cham¬ber, including foreign bodies) using a 13-6MHz (hockey stick) probe and a 10-5MHz (linear) probe. Assessment was conducted by identifying orbital structures and randomly placed FB's. A Likert scale (1-5) questionnaire was conducted regarding orbital US to identify FB's and orbital anatomy.

RESULTS. Literature search revealed no known research regarding training of EDP using orbital US to identify anatomy and FB's from DCP. All MS successfully conducted US and identified orbital anatomy and FB's from DCP's. Likert scale scores were 4.25, 4.27, and 4.43 respectively. Subjective student feedback was also extremely positive.

DISCUSSION. US is the visual stethoscope of the future which requires 3-D orientation of the anatomical architecture to be assessed. US identification of orbital structures is significant because it is a safe image medium and can be used to identify structures associated with pathologies previously, currently, or routinely investigated with X-ray, CT, or MRI. Orientation and the familiarity of orbital structures in 3-D is an important skill when removing orbital FB's. Integrating orbital US and anatomy from DCP's to identify FB's allows viewing and comparison of 3-D architecture with orientation.

CONCLUSION. This novel pilot study revealed that orbital anatomy and FB's can be successfully identified using ultrasound on DCP's which suggests this could be a successful training method for Emergency Department Personnel.

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Meta Information

Submission ID:	164	Student Submission:	1
Format:	Poster		
Topic:	Use of ultrasound in Undergraduate Medical Education		

Multidisciplinary Ultrasound ICU Rounds: A pathology rich environment.

Introduction

Point of care ultrasound is a vital diagnostic tool in medicine. Ultrasound training has become important at the undergraduate medical education level to prepare students for graduate medical training. At our institution, we have developed a curriculum to integrate teaching medical students point of care, focused ultrasound in the pathology rich environment in the intensive care unit (ICU). The ICU rounds used the I-AIM approach to bedside ultrasound, focusing on indications, acquisition, interpretation and medical decision-making.

Methods

We organized regular ICU rounds in the medical and surgical ICU, which medical students organized and participated. We invited medical students who were dedicated to learning focused ultrasound, emergency medicine residents, emergency medicine ultrasound and critical care fellows, and faculty. The fellows would identify high-yield cases, and the group would approach these cases using the I-AIM technique. Each round lasted 1-3 hours with every member of the group getting hands on scanning time and each member contributing to the discussion after.

Results

In this pathology rich environment, numerous applications of bedside ultrasound were explored. Most common findings included pleural effusions, cardiac pathology such as right heart strain, valvular disease, or decreased cardiac contractility. Many students attended these sessions and were able to see pathology that they otherwise would not be able to in a non-clinical setting.

Conclusions

We have developed a program to teach bedside ultrasonography to learners at all levels, from medical students to faculty. The ICU is an ideal setting as it is pathology rich compared to other clinical settings such as the emergency department where cases may be more sporadic. These sessions had secondary benefits of moving ultrasound training into the clinical setting and links basic science concepts with clinical cases. Furthermore, it allows for medical students to connect with and ask for mentorship from residents, fellows, and faculty.

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Meta Information

Submission ID: 165 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Comparing ultrasound images and probes between variable cadaver preparations for health care training

INTRODUCTION: The ultrasound is the visual stethoscope for today's student health care professional (SHCP). Ultrasound (US) displays the body's architecture in a monochromatic fashion. Seemingly integrating ultrasound with anatomy dissection would enable the learner to better understand the monochromatic image associated with US. Traditional embalmed tissue has the least amount of muscle tissue compliance when compared to lightly embalmed solutions and live tissue. The objective of this study was to investigate if various ultrasound transducers including a novel finger probe by SonicEye can successfully reveal the anatomy from prepared donor cadaver patients using variable embalming solutions. METHODS: A literature search was conducted regarding the use of ultrasound with cadavers for medical students during a medical anatomy lab. Healthy volunteers (n=20), had their supraspinatus, flexor pollicis, and vastus medialis muscle tendon complexes imaged with Fukuda-Denshi® UF-760AG ultrasound system using a Fukuda-Denshi® LA38 5-12 MHz linear probe and a Sonivate SonicEye® 8MHz linear finger probe and the SonoSite® M-Turbo with an HFL 50 15-6MHz linear transducer as controls. Recently deceased unembalmed (n=2), traditionally embalmed (n=20), and live healthy subjects (n=20) had ultrasound imaging performed. Each muscle had each linear transducer placed parallel and perpendicular with muscle fibers. RESULTS: A literature search revealed no known studies regarding a multivariate comparison study using three separate US transducers in the three aforementioned sites to assess if US can significantly reveal muscle architecture on cadaveric tissue to develop US skills. Supraspinatus, flexor pollicis, and vastus medialis of 20 fully embalmed cadavers (n=40 sides) were all successfully identified in all three mediums with all three separate transducers. Images generated in this study were equivocal to that of US textbooks. There were no clinically significant differences between the live and cadaveric tissue, however there was minor variability between the two cohorts.DISCUSSION: In order for the current health care student to acquire ultrasound skills it is important to correlate the monochromatic scaling with the structure being imaged. The novice SHCP could begin this exercise with donor cadavers during an anatomy dissection course. This would be of great significance by enabling the SHCP to achieve the skill set necessary and to improve the learning curve as they matriculate through their training. CONCLUSION: This study revealed that ultrasound can be successfully conducted on recently deceased unembalmed and traditionally embalmed cadaveric tissue allowing anatomy courses to combine ultrasound with dissection.

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Meta Information

Submission ID: 166 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Ultrasound In Urology: A Novel Ultrasound Training Curriculum for Urologic Surgery Residency Programs

Background

Ultrasound in the practice of urology is expanding, as advances in miniaturization are making clinician-performed ultrasound even more common for genitourinary complaints. Owing to it's convenience and availability, low cost, real-time results, and ease of use, ultrasound plays an important role as an initial imaging modality for many genitourinary complaints. Scanning the kidney for renal cysts or hydronephrosis, the bladder for size, volume and presence of blood, as well as the testicle for acute torsion are common tasks for modern urologists. Despite this, training in urologic ultrasound for residents has been limited as many programs struggle to incorporate ultrasound into an already busy resident curriculum.

Methods

At our institution, a novel residency based initiative was developed to provide residents in urology an experience in acquiring and interpreting focused point-of-care ultrasound. Online education materials, interactive modules, and videos were utilized initially to provide background. A comprehensive training booklet with protocols, ultrasound flowsheets, quality checklists, and curriculum requirements was developed and distributed. Resident learners then participated in seminar series covering ultrasound physics and basic scanning technique, as well as renal, bladder, and testicle ultrasound pathology. These sessions included hands-on instruction and the opportunity to individually practice scans on live volunteers. Sessions were held on a quarterly basis with a final exam that included normal and abnormal recognition testing, along with a practical ultrasound standardized assessment test. All residents were asked to keep track of their clinical scans during the year and log them electronically. A clinical skills lab with multiple ultrasound machines was made available at all hours with keycard access for further practice and development of their skills as needed.

Results

Fourteen residents completed the training and logged an average of 31 scans for renal, 37 scans for bladder and 18 for testicle. Scores on recognition and pathology exams were very positive, ranging from 70 to 95%. All residents successfully completed an ultrasound standardized assessment test that critiqued each learner on their acquisition, interpretation and medical decision making in regards to focused urologic ultrasound scanning. Based on their participation in this curriculum, residents were provided a training certificate affirming their sonographic competency in urologic ultrasound.

Conclusions

Focused training for urologic ultrasound is feasible for resident training and can improve physician exposure and competence in bedside ultrasound. Residents demonstrated increased comfort in obtaining and interpreting urologic ultrasound images and a better understanding of the appropriate ultrasound-guided techniques used in urology. Future studies may investigate optimal training times and number of exams to maintain a minimum proficiency in genitourinary ultrasound.

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Submission ID: 167 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Emergency Ultrasound Training Practices and the Emergency Medicine Milestones Project

Objective: With the introduction of the Emergency Medicine (EM) Milestone Project in 2013, EM residencies are required to assess resident Emergency Ultrasound (EUS) skill at regular intervals throughout training. The goals of our study were to determine: 1) which of the Council of EM Residency Directors (CORD) recommended EUS applications are being taught to residents, 2) methods used by programs to instruct EUS and assess EUS competency, and 3) post-graduate year of training in which residents are expected achieve each milestone. We also sought to establish expert opinion on the adequacy of the EUS Milestones as a tool to measure resident competency.

Methods: Participants completed an online survey consisting of 24 multiple choice and free-response questions. The survey was emailed to Ultrasound Program Directors or Residency Program Directors at 168 EM residency programs in the United States. Topics queried included: EUS rotation structure, curriculum and requirements; when, how and by whom EUS competency is evaluated; how the Milestones are integrated into EUS education and competency evaluation; and utility of the EUS Milestones as currently drafted. Survey findings were reported using descriptive statistics.

Results: Responses were received from 89 of the 168 programs surveyed (53%). Programs measure competency in the following modalities: FAST (99%), AAA (96%), cardiac (97%), pregnancy (82%), biliary (86%), central line (75%), renal (60%), DVT (58%), soft tissue (56%), pneumothorax (56%), and ocular (39%). For teaching methods, programs used didactic lectures (93%), procedural workshops (79%), US phantoms (69%), textbook or journal readings (67%), and computer-based learning modules (57%). To assess EUS competency, programs used direct observation on shift (99%), video review (89%), quality assurance (QA) database review (84%), still image review (76%), Standard Direct Observation Tools (SDOT) (55%) and/or Objective Structured Clinical Examination (OSCE) (35%). Sixty-one percent of programs expect post-graduate year 1 (PGY-1) residents to have obtained the Level 1 Milestone prior to beginning residency; 65% expect Level 2 mastery during PGY-1; 55% expect Level 3 mastery during PGY-2; and 45% expect Level 4 mastery during PGY-3. Sixty-two percent responded that the EUS Milestones do not reflect their expectations of residents. They cite insufficient minimum number of scans, paucity of specific criteria, and a Level 5 Milestone which is unattainable for most attending-level physicians as the sources of their concern.

Conclusion: These data demonstrate substantial variability across programs in EUS applications taught, methods of EUS instruction, and approaches to measurement of EUS competency. The majority of respondents expect Milestone Levels 2, 3 and 4 to be achieved during PGY-1, 2 and 3 respectively, a view consistent with the intentions of the Milestones Project. However, most feel that the EUS Milestones are insufficient for assessment of EUS competency.

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Meta Information

Submission ID: 168 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Integrating augmented reality (Google Glass/Glass) with novel SonicEye finger probe and classic linear transducers to identify the bifurcate ligament in live and cadaveric tissue during medical anatomy dissection course

INTRODUCTION. The bifurcate ligament (BFL) is formed by the calcaneonavicular and calcaneocuboid ligaments. It is recognized by musculoskeletal specialists to be under appreciated regarding plantar flexion and inversion mechanism of injury in lateral ankle insults. Ankle sprains which involve the anterior talofibular ligament (ATFL) is the most commonly sprained ligament in the body, however, the mechanism of injury may also injure the BFL, which is not routinely examined or imaged. The objective of this study was to investigate if the BFL could be imaged using variable ultrasound (US) transducers with and with out Glass on live and cadaveric tissue. METHODS. Literature search was conducted regarding integration of Glass and US with multiple transducers to identify the BFL on live and cadaveric tissue. In 2014 a pilot study conducted by the authors developed a surface anatomy target position for US transducer placement to identify the BFL using donor cadaver patients (DCPs). Google Glass/Glass was synced with Fukuda-Denshi UF760AG system using a novel finger probe by SonicEye and classic linear probes by Fukuda-Denshi and SonoSite. First and second year medical students (n=50) were given tutorial instruction on surface and deep anatomy of the BFL and integration of Glass with US to identify the BFL on live and DCs. Each Student performed 3 trials using 3 separate US transducers. RESULTS. Literature search revealed no studies regarding integration of the Glass and US with multiple transducers to identify the BFL on Live and DCs, except an abstract by the authors regarding US identification of the BFL on cadaveric tissue. Initial practice trials with novice 1st and 2nd year medical students (n=57) successfully identified BFL with a 76.92% success rate on cadaveric tissue in less than 2 minutes while using Glass. Success rate of in vivo BFL identification using Glass (n=70) was 87.5% averaging less than 1 minute. DISCUSSION. Musculoskeletal specialists recognize the importance of the BFL, its incidence of injury, and the lack of common understanding amongst clinicians. The high incidence of recurring lateral ankle sprains and the variability of recovery time necessitates greater understanding of the structures associated with lateral ankle sprains. This study revealed that novice US users can identify the BFL. Combining surface palpation, deep dissection, and Glass with US provided a rich technology environment to acquire skill sets for invasive procedures. CONCLUSION. This study reveals that the BFL can be consistently identified by medical students in both live and donor cadaver tissue using Glass with US to provide deeper understanding of the BFL in a clinical setting.

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Meta Information

Submission ID: 169 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Variable modalities of endotracheal tubes to visualize vocal cords using ultrasound with donor cadaver patients

INTRODUCTION. One of the most important skillsets a trainee clinician can acquire is to intubate a compromised airway patient. All healthcare professionals who do not practice this often would benefit from a training environment which mimics real life. Although not ideal, current training methods are through use of artificial mannequins. The objective of this study was to investigate endotracheal (ET) airway intubation of recently deceased unembalmed donor cadavers (RDUDC) and embalmed donor cadavers (EDC) using anterior midline neck ultrasound (US) confirming ET tube placement as a training tool. METHODS. Literature search was conducted regarding airway intubation with cadavers using US of the anterior midline neck. RDUDCs and EDCs(12) received ET intubation with US guidance from 3 separate users. Subjects were intubated using 3 variable conditions associated with the ET tube: standard ET tube, ET tube filled with water and an ET tube with a "B-Braun Echogenic" needle placed within the tube. A Sonosite M-Turbo US probe and a Fukuda Denshi finger probe were placed horizontally with a cranial attitude at the cricothyroid membrane. RESULTS. Literature search revealed no studies using US guided ET tube placement with cadavers that fit the criteria of monitoring the anterior midline neck. ET tube placement was successfully completed on 11 RDUDCs and 1 EDCs by all 3 users' multiple attempts. The same consistent sign was identified on each attempt from all users regardless of variables as the cuff passed the cords. DISCUSSION. This novel pilot study demonstrated that an US probe was successful at identifying the cuff as it crosses the vocal cords in both RDUDCs and EDCs revealing the "cuff cord sign." By isolating US probe placement to the anterior midline neck, it was shown that the maneuver is compatible with a patient with cervical spine immobilization. It was also demonstrated that, in utilizing the the Fukuda Denshi finger probe, one may apply cricoid pressure (Sellick maneuver) while monitoring with US for proper ET tube placement. ET tube placement is both life saving and used routinely in surgical procedures. Overwhelming anxiety is associated with ET tube placement. Therefore training conditions using actual human anatomy is ideal. CONCLUSION. This study identified a novel US "cuff-cord sign" while successfully intubating cadavers. This could potentially be used in vivo in patients who have undergone cervical spine immobilization.

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Submission ID: 170 Student Submission: 1
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

A Novel Integration of the Fast FATE Exam to Rapidly Assess the Thorax in Acute and Subacute Clinical Situations

INTRODUCTION. The emergency FAST (Focused Assessment using Sonography in Trauma) exam utilizes ultrasound to rapidly observe positions in the abdomen and thorax to determine if fluid has accumulated in spaces surrounding organs contained within cavities. A FATE (Focused Assessed Trans-Thoracic Exam) has also been described, using echocardiography to determine if fluid accumulation or structural insults occurred to the heart or lungs exist. This study describes a simpler and more efficient ultrasound exam of the thoracic cavity utilizing a novel biplanar finger transducer with augmented reality (glass). These tools enable the trainee and physician to palpate and manipulate the patient with simultaneous ultrasonography assessment of the thoracic cavity.

METHOD. A literature search was conducted on the Fast FATE exam using a novel finger probe. The Fukuda Denshi UF-760AG ultrasound machine and Sonivate Soniceye biplanar array was used to observe four views of the thoracic cavity. The US images were viewed using glass while palpating with the finger transducer. The three locations which evaluated 1) parasternal long and short axis (4th or 5th left intercostal space between the sternal border and midclavicular line), 2) apical 4 chamber view (6th to 7th intercostal space between midclavicular and anterior axillary line), and subcostal (examining superiorly using the liver as an acoustic window). All views are obtained with the patient in the supine position, however, the parasternal and apical 4 chamber views were also viewed in the left lateral decubitus position.

RESULTS. Literature search revealed no studies using rapid FATE exam with finger transducer and glass. Imaging of subjects (n=20) showed the three transducer placements that revealed the four orientation views that comprise this exam.

DISCUSSION. The Fast FATE exam using biplanar finger array and glass allows the student or physician to integrate a manual exam while observing and palpating the patient in a single uninterrupted exam. The glass eliminates the need to divert the visual field away from the patient to assess a monitor. Concurrently, the finger array transducer allows the physician to palpate the surface anatomy of the body while visualizing the deep architecture with ultrasound. Furthermore it allows for ease of dexterity in moving from one position to another while assessing the thorax. The biplanar finger transduces allows ease of obtaining such views. Rather than orient the probe differently between the two parasternal views, the biplanar probe allows for rapid switching between views without repositioning of the probe. Subcostal views of the heart is an additional way to evaluate pericardial effusion.

CONCLUSION. This study successfully revealed a novel approach to focused thoracic assessment using the Fast FATE exam by integrating glass with a novel finger biplanar transducer.

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Meta Information

Submission ID: 171 Student Submission: 1
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Lateral ankle sprain anatomy - can the bifurcate ligament be consistently identified with ultrasound on cadavers

INTRODUCTION. The bifurcate ligament (BFL) is recognized by musculoskeletal specialists to be under appreciated regarding plantar flexion and inversion mechanisms of injury in lateral ankle insults. The anterior to posterior orientation plane of the BFL is similar but lies inferior, and just anterior to the anterior talofibular ligament (ATFL) and may be injured in severe lateral ankle injuries (LAI). Undiagnosed BFL injury may explain delayed healing and reoccurring injury. The objective of this study was to investigate whether the bifurcate ligament could be identified using ultrasound (US) on donor cadavers (DCs) as a training exercise for anatomy education and clinical assessment. METHODS. Literature search was conducted regarding ultrasound identification of the BFL on DCs. Dissection of 53 embalmed DCs (53R:53L= n106) was conducted to identify the BFL. Digital caliper measurements were taken from the apex of the distal fibula (ADF) to the proximal point of the fifth metatarsal tuberosity (5MT) and ADF to the posterior point of the BFL (PBFL) in the neutral position (n=30 sides). Utilized SonoSite M-Turbo with an HFL 50 15-6MHz linear transducer, Fukuda-Denshi UF-760AG US system using a SonicEye 8MHz linear finger probe to visualize the BFL. Palpation of bony landmarks, following the surface template was performed with US on donor cadavers (n=61 sides; 30R:30L). RESULTS. Literature search revealed no studies regarding US of BFL on DCs. Measurements of ADF-5MT revealed (60.22mm +/- 0.43) and ADF-PBFL (42.18mm +/- 0.51) respectively. US placement on DCs (n=61 sides) following surface template resulted in 76.27% positive identification with 1st probe placement. Of the 23.73% BFLs that were unidentifiable at 1st attempt, 92.86% were positively identified with a modified 2nd attempt (1.44 +/- 0.75cm disto-medial movement of transducer toward 1st MP). DISCUSSION. One study of 19 patients reported 95% identification accuracy with US of damaged ATFL, which was confirmed by arthroscopy. Ankle sprains are the most common lower limb injury that present to the health care system. The variable recovery times and relatively high incidence of recurrence in moderate to severe ATFL injuries suggest that one may benefit from identifying and examining BFL damage using a dependable, inexpensive image medium such as US. Measurements from this study suggest a probe placed two-thirds distance between ADF-5MT in the plane of the great toe from the ADF provides positive visualization of the BFL. CONCLUSION. This study reveals that the BFL can be consistently identified in DCs using US, thus enabling anatomist and clinician access for analysis.

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Meta Information

Submission ID: 172 Student Submission: 1
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Ultrasound In Urology: Diagnostic Ultrasound Milestones for Urologic Surgery Graduate Medical Education

Objective

To articulate clinical competency Milestones for diagnostic ultrasound relevant to urologic surgery residency programs.

Background

In 2012, urology joined many other medical specialties by implementing Milestones for clinical competencies established by the Accreditation Council of Graduate Medical Education (ACGME). Milestones are used to evaluate residents' progress through the development of knowledge, skills and attitudes essential to the scope of practice of urology. In November of 2011, the American Institute of Ultrasound in Medicine (AIUM) in conjunction with the AUA developed practice guidelines for urologic ultrasound, which provided clear standards for kidney, bladder, prostate, scrotal, and penile ultrasound. The AIUM also released an official statement on training guidelines for urologists evaluating and interpreting ultrasound examinations, identifying the required number of ultrasound scans to meet criteria. With these standards, there are clear goals for achieving competency in urologic ultrasound. However Milestones for evaluating progress towards these goals have not been delineated.

Methods

Ultrasound plays an important role as an initial imaging modality for many genitourinary complaints. Scanning the kidney for renal cysts or hydronephrosis, the bladder for size, volume and presence of blood, as well as the testicle for acute torsion are just a few examples of common tasks for modern urologists. Each scan has a different level of difficulty, with transrectal ultrasound biopsy of the prostate likely being the most advanced topic within the scope of urologic ultrasound. Milestones for these core and advanced topics were developed to demarcate degrees of expertise expected as learners advance in skills and knowledge from interns to residency graduates. These Milestones are being implemented in a 14-member, university based urology residency program.

Results

Milestones for genitourinary topics are described below:

Level 1: Knows indications, rationale for, and risks associated with ultrasound procedure.

Level 2a: Can acquire and optimize the ultrasound image in a simulation setting.

Level 2b: Can interpret the diagnostic ultrasound image or perform the interventional ultrasound procedure in a simulation setting.

Level 3a: Can acquire and optimize the ultrasound image in a clinical setting.

Level 3b: Can interpret the diagnostic ultrasound image in a clinical setting and use in medical decision-making or perform the interventional US procedure on a patient.

Level 4: Portfolio of scans which have passed quality evaluation; include at least 25 diagnostic studies, with a minimum of 5 from each of 5 anatomic sites or structures; and at least 15 interventional studies.

Level 5: Able to teach procedures, generates appropriate documentation and billing for studies.

Conclusions

These urology ultrasound Milestones have face validity and may be a viable model for tracking clinical competency for residents learning renal, bladder, and testicular ultrasonography. Feasibility and content validity of these Milestones need to be evaluated through testing in a urology residency program.

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Meta Information

Submission ID: 173 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Applying ultrasound sliding lung sign to cadaveric tissue of varied preparations: method of identifying endotracheal intubation and diagnosing pneumothorax

INTRODUCTION. Sliding lung sign (SLS) is used to confirm correct endotracheal tube (ETT) placement after intubation, and to exclude a pneumothorax (PTX) in a critically injured patient. SLS is visualized as an ultrasound (US) transducer is placed on the 2nd intercostal space of the mid-clavicular line of the anterior thoracic wall to observe the "sliding" of parietal and visceral pleura during respiration. SLS has been commonly used to assess lung function since Rantanen NW first described it in 1986. The objective of this study was to investigate if SLS could be revealed on embalmed cadaveric tissue for use of ETT placement training and PTX assessment. METHODS. Literature search was conducted on US and anatomy journals and texts, regarding SLS using donor cadavers of varied preparations (DCVP). Intubation was conducted and confirmed with US prior and two weeks post embalming (n=10, 5M:5F) of DCVP. To maintain an open mouth, a block was placed between first molars to facilitate ETT placement once the DCVP were embalmed. Sonosite M-Turbo system using HFL50X probe and PaoLus system using biplanar finger array probe was placed at the 2nd mid-clavicular, 4th axillary, and 6th lateral intercostal spaces of the thoracic wall to visualize SLS as the lungs were inflated manually using an Ambu bag. RESULTS. Literature research revealed no known articles. Post intubation, SLS was visualized and recorded using both 2D and video mediums. All preparations revealed the SLS, which indicated correct ETT placement and PTX exclusion. DISCUSSION. ETT intubation and PTX assessment are important critical skills. Providing a training on human tissue outside critical care settings may improve procedure success and diminish user anxiety. In viable tissue, visualization of the SLS confirms correct ETT placement after intubation and PTX exclusion. CONCLUSION. This novel pilot study demonstrates SLS can be successfully conducted on recently deceased and DCVPs suggesting a valuable training method to assess life-saving procedures.

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Meta Information

Submission ID: 174 Student Submission: 1
Format: Poster

Topic: Patient Safety

Syncing Glass with novel SonicEye ultrasound linear and biplanar finger transducers during anatomy dissection lab exams of 1st year medical students

INTRODUCTION. Google Glass provides a freedom to allow the user to become more directly engaged with the task that involves a combination of technology and human interaction. An ideal physical examination would involve acute observation of subtle signs, palpatory information, and viewing of the architecture of the anatomy beneath the surface. The objective of this study was to investigate whether Glass and a novel ultrasound finger transducer can be integrated during a medical anatomy lab to teach and examine ultrasound skills. METHODS. Literature search was conducted regarding the use of Glass synced with ultrasound to teach and examine ultrasound skills during anatomy lab. Glass was synced with the Sonivate SonicEye ultrasound finger probe using the Fukuda-Denshi UF-760AG system to identify common important clinical structures. Thirty minute blocks were allocated for each student (n=15), during dissection of each region of the body: upper limb, thorax, abdomen, pelvis, and lower limb. Students were encouraged and given access to practice with combined Glass and ultrasound finger transducer. During each anatomy lab exam Glass synced with ultrasound finger transducer was used by each student to identify a structure after reading a short vignette. A Likert Scale was applied to a questionnaire following the anatomy lab course. RESULTS. No studies were identified regarding Glass synced with ultrasound to train and examine first year medical students. The results of correctly identified structures from clinical vignettes during each anatomy lab examination was 87% for the first exam, 100% for the second exam, and 80% for the third exam respectively. The questionnaire regarding Glass synced with ultrasound use and assessment revealed an average Likert score of 4.0. DISCUSSION. Glass technology can provide the opportunity to strive for the ideal physical examination of acute observation, palpatory information, and imaging of the body's architecture during movement. In order to achieve the benefit of Glass synced with ultrasound, it may be essential to acquire a basic foundation of Glass with ultrasound skills during an anatomy dissection course. This study revealed that fifteen students during an accelerated summer anatomy course with cadaver dissection were able to acquire the basic technical skills to use Glass synced with ultrasound to identify clinically relevant structures demonstrated by examination results and Likert scale scores. CONCLUSION. This study revealed that Glass synced with a SonicEye ultrasound finger probe can successfully combine modern technology and physical examination with dissection as an effective teaching tool during a medical anatomy lab course for first year students.

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Meta Information

Submission ID: 175 Student Submission: 1
Format: Oral

Topic: Use of ultrasound in Undergraduate Medical Education

Central column knee classification: A novel approach to augment specific knee structures of clinical relevance

INTRODUCTION. Musculoskeletal specialties refer to the anatomical importance of the posteromedial and posterolateral corners of the knee. However, the central region of the knee has not been afforded the equivalent classification and description. This region can be described as a column and includes some of the most commonly injured structures of the knee. The objective of this study was to investigate borders and contents of the central column (CC) of the knee providing a novel learning approach, which integrates regional anatomy with common clinical conditions. METHODS. Literature search was conducted regarding studies of the CC. Dissections of 103 embalmed cadaveric knees were performed to identify bony landmarks and structures of the CC. Ultrasound (US) was used to identify CC structures on cadaveric and viable tissue. RESULTS. Literature search did not reveal studies referring to structures organized as a central column of the knee. Dissection revealed bony landmarks and contents: intercondylar notch, patella, tibial tuberosity, intercondylar eminence, infrapatellar fat pad, retinacula, capsule, quadriceps femoris, patellar, biceps femoris & four other muscle-tendon complexes, oblique popliteal, anterior & posterior cruciate & three other ligaments, popliteal vein & artery, middle genicular & three other arteries, tibial nerve, supra/infrapatellar & two other bursae, anterior/posterior horns of medial/lateral menisci. DISCUSSION. Injuries to the central knee are common and debilitating. US revealed commonly injured structures. Understanding structural relationships is essential for examination, diagnosis, treatment and rehabilitation. This study identified central knee structures and created a column-based model to nurture detailed understanding of anatomical relationships in this fertile pathological area for education, training and research. CONCLUSION. This study investigated a novel approach to understand the anatomy of the knee by highlighting structures that occupy a central column.

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Meta Information

Submission ID: 176 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Regional adductor canal blocks- a thoroughfare or separate spaces

INTRODUCTION. Regional nerve blocks of the lower limb have become part of routine surgical care. Regional nerve blocks are evolving and require detailed knowledge of anatomy to place anesthetic for optimal nerve affects. Knee surgery, especially replacements, is one of the most common joint surgeries performed. Adductor canal (AC) blocks are gaining popularity, attempting to block saphenous nerve within the canal. The proximal AC morphology is not described in detail. There is controversy of the AC and outcome of patients. The objective of this study was to investigate the morphology of the AC and its contents to reveal detailed anatomy aiding clinicians. METHODS. Literature search was conducted regarding the morphology, contents, and blocks of the AC. Dissection of 35 cadavers was performed to analyze the AC and contents. Ultrasound was conducted on cadaveric tissue and used to inject 30 ml of fluid into the lateral femoral triangle. RESULTS. Literature search revealed inconsistency regarding terminology and detailed anatomy of the proximal AC. Dissections revealed continuous space between the femoral triangle and AC. AC dissections revealed 3 compartments; femoral channel (FC), femoral nerve canal (FNC), and femoral vascular canal (FVC). Ultrasound was successful in identifying the femoral nerve and fluid tracking freely from the femoral triangle in the AC. DISCUSSION. Detailed knowledge of distal femoral triangle and proximal AC is critical. Continuation between distal femoral triangle and proximal AC was revealed, causing the authors to suggest the term FC. Motor nerve to the vastus medialus was within its own canal which we suggest is termed the FNC. The femoral vein and artery were encased in a sheath and therefore we suggest FVC. The Saphenous nerve consistently traveled on the anterior surface of the FVC within the space termed the FC. CONCLUSION. This study revealed 3 detailed spaces (FC, FNC, FVC) within the current term of the AC which suggests a more accurate terminology. This also suggests why some adductor blocks are less successful and requires further ultrasound research.

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Meta Information

Submission ID: 177 Student Submission: 1
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Use of ultrasound to identify foreign bodies in variable cadaver preparations

INTRODUCTION. Ultrasound (US) is the visual stethoscope of the future which is being utilized in many specialties with increasing momentum. US is portable, associated with a fast learning curve, non-invasive, cost-effective and can be invaluble clinically. Ultrasound has a wide spectrum of use in diagnostic imaging. One use is identifying foreign bodies (FB) in soft tissue. FB's most commonly penetrate soft tissue during traumatic events, and their identification can prevent further damage. Medical students have been trained to use US successfully to identify structures of donor cadavers (DC). The objective of this study was to use ultrasound to identify different FB's in two separate preparations of DC. METHODS. Literature research was conducted regarding use of multiple US probes identifying FB's in DC preparations. Metal, wood, and rock fragments equivocal to those found as common debris in trauma were placed in the calf muscle of traditionally embalmed cadaveric tissue and in the calf muscle of Freedom art embalmed cadaver tissue prior to US. Multiple US probes types were used. RESUTLS. Literature research revealed no known studies regarding identifying FB's in DC using multiple US probes with variable preparations. Both preparations of cadaveric tissue allowed for visualization of the Foreign Bodies. The traditionally embalmed cadaveric tissue contained more air and was less compliant. Freedom art tissue was more compliant and contained less air. METHODS. The use of Freedom art embalming yields more lifelike tissue leading to less air trapped in tissue and is better for ultrasound imaging. Training healthcare personal to identify Foreign Bodies in Freedom art tissue allows for better imaging and a more effective educational process. CONCLUSION. This study revealed that Freedom art embalming of cadavers allows for superior US imaging of soft tissue and Foreign Bodies when compared with traditionally embalmed cadavers.

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Meta Information

Submission ID: 178 Student Submission: 0
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Conducting FAST exam to identify spaces and cavities of the abdomen and thorax using a novel ultrasound SonicEye finger array probe with variable cadaver preparations.

INTRODUCTION. Ultrasound (US) is the visual stethoscope of the human body. It has a wide spectrum of uses and its utility is increasing in healthcare screening, diagnosis and monitoring. The Focused Assessment for Sonography for Trauma (FAST) exam is becoming commonplace in level I trauma units. FAST exam identifies free fluid in the perihepatic, perisplenic, pericardium, and pelvic spaces. A comprehensive FAST exam of the thorax is novel. The objective of this study was to investigate if FAST exam spaces from the abdomen and thorax of variable prepared cadavers be identified using a novel finger biplanar array probe. METHODS. Literature research was conducted regarding US FAST exam with cadavers. Novel US finger biplanar array probe was performed on conventional and Freedom Art embalmed cadavers (n=14) to identify spaces of the FAST exam in the abdomen and thorax. US images from the US finger biplanar array probe on healthy subjects was the control. RESULTS. Literature search revealed no known studies regarding US FAST exam of the abdomen and extended thorax with cadavers or in situ. All spaces were identified on conventional and Freedom Art embalmed cadavers. Freedom Art prepared cadavers revealed images, which were easier to identify spaces and structures then conventional embalmed cadavers. DISCUSSION. The US FAST exam of the abdomen has proved to be a beneficial skillset. Training healthcare providers the US FAST exam with cadavers could be a valuable tool to develop or maintain skills, which most closely resembles the doctor patient examination interface. Cadaver preparation appears to affect the US image quality. This study confirmed a new finger biplanar array probe performed on the abdomen and thorax can enable anatomy teaching of cavity spaces where pathology is often detected. CONCLUSION. This study revealed a novel US finger biplanar array probe can successfully identify FAST exam spaces in the abdomen and thorax of variable embalmed cadavers.

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Submission ID: 179 Student Submission: 1
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Variable anterior jugular vein morphology and urgent airway procedures

INTRODUCTION. Tracheostomies and cricothyrotomies are life saving procedures. The most variable anatomy during these procedures is the presence of a superficial vein, generally an anterior jugular vein (AJV). Current literature is inconsistent regarding its presence and variation. With the use of ultrasound (US), one could identify a midline superficial vein prior to procedures. The objective of this study was to investigate the morphology of the AJV and whether US can identify them in cadaveric tissue for training procedures. METHODS. Literature search was conducted regarding AJV morphology and in conjunction with airway procedures. Dissection of 90 anterior necks from embalmed donor cadavers (DC) was conducted to analyze the prevalence of AJV. US of recently deceased and embalmed undissected DCs (n=32) was performed. SUMMARY. Literature search of journals revealed fewer than 5 human studies reporting the morphology of the AJV, of which the largest study reported 83% bilateral, 13.5% unilateral, 6.2% midline, and 3% absent. Contemporary anatomy texts and atlas' demonstrate bilateral AJV in 83%, 88%; single 11%,11%; not mentioned or illustrated 22%, 0% respectively. DC dissection revealed bilateral 70%, single 21%, 9% midline, total absence 4%. US of 20 undissected cadavers revealed 44% bilateral, 40% unilateral, 28% midline and 16% absent. Tracheostomies are relatively common procedures, being received by approximately 10% of ICU patients on long-term ventilation. The inconsistency between the atlas and texts overwhelmingly showed a bilateral dominance, however this study and previous cadaveric studies reveal significantly varied morphology of the AJV system that could be damaged in an airway procedure, which can be identified with US. CONCLUSION. This study suggests inconsistencies of AJV morphology in the literature, which is supported by cadaveric dissection and US identification which could decrease morbidity during an invasive airway procedure.

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Meta Information

Submission ID: 180 Student Submission: 1
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Posteromedial corner of the knee – clinical ultrasonography and applications to cadaveric specimens, a comparative study.

INTRODUCTION. Debilitating outcomes are a common occurrence in posteromedial corner (PMC) knee injuries. Musculoskeletal ultrasound (US) provides a modality which can be used to directly correlate the image to underlying anatomy/pathology. Previous study by the authors revealed the bony landmarks of the PMC to be the anterolateral corner of the medial condyle of the femur anteriorly and posterolateral corner of the medial condyle posteriorly. The development of US techniques to look at the PMC structures contained within have been developing over the last couple of decades. The application of visual and palpable anatomy for methodical imaging of the PMC has not been fully exploited and optimized. The objective of this study was to identify visual and palpable landmarks to aid in the correct identification of PMC structures and compare multiple US technologies in identifying PMC structures. METHODS. Literature search was conducted regarding studies of the PMC. Dissection and palpation of embalmed cadaveric knees was performed to identify bony landmarks to be used in identification of PMC structures. US was used to identify PMC structures on 12 cadaveric knees and 18 healthy knees. RESULTS. Literature search revealed no known studies using palpation and identification of bony landmarks for use in imaging the PMC structures. Dissection revealed bony landmarks to be used in identification of PMC structures. PMC structures were consistently identifiable using US in cadaveric and viable tissue using multiple US technologies. DISCUSSION. Injuries to the medial knee are common and debilitating. Rapid and accurate diagnosis of PMC injuries is essential for effective treatment. PMC structures do not exist in isolation; they are interwoven with layers superficial to deep and anterior to posterior. An ultrasound exam was developed using knowledge of anatomy and palpation technique to identify PMC structures in a methodical way proven to work with various US probes and technologies. CONCLUSION. This study suggests a standard way for ultrasonographers to examine the PMC which can be viewed on cadaveric and viable tissue.

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Submission ID: 181 Student Submission: 1
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Posterolateral corner of the knee – erasing the myth of the dark side

: INTRODUCTION. The posterolateral corner (PLC) of the knee has long been thought of as the “dark side” of the knee, with relatively few injuries associated with it compared to the medial side. Injuries of the PLC are often grouped together in musculoskeletal literature. Previous study by the authors revealed the borders of PLC to be the anteromedial corner of the lateral condyle of the femur anteriorly and the posteromedial corner of the lateral condyle of femur posteriorly. Dynamic ultrasound (US) provides a modality in which underlying anatomy/pathology can be directly correlated to on screen imaging. Accurate diagnosis of PLC pathology may lead to quicker recovery and better outcomes. Objective of this study was to investigate the use of visual and palpable bony landmarks to correctly identify PLC structures using multiple ultrasound technologies. METHODS. Literature search was conducted regarding studies of the PLC and ultrasound. Dissection and palpation of embalmed cadaveric knees was performed to identify bony landmarks and structures of the PLC. US was used to identify PLC structures on 12 cadaveric knees and 18 healthy knees. RESULTS. Literature search revealed no known studies using palpation and identification of bony landmarks for US imaging of PLC structures. Dissection revealed bony landmarks to be used in identification of PLC structures. PLC structures were consistently identifiable using US in cadaveric and viable tissue using multiple US technologies. DISCUSSION. Injuries of the lateral knee are relatively common and incapacitating. Detailed understanding of the anatomy and correct diagnosis of associated pathology would advance patient care. PLC structures create a lattice scaffolding revealing points of strength and weakness during varied knee positions and are often compromised in combined injuries. The development of a standardized US exam using bony landmarks for identification of PLC structures provides utility in the advancement of patient care. CONCLUSION. This study suggests a standard way for ultrasonographers to examine the PLC which can be viewed on cadaveric and viable tissue.

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Meta Information

Submission ID: 182 Student Submission: 1
Format: Poster

Topic: Point of Care ultrasound in general clinical practice

Point-of-care ultrasound for primary care management of patients with Chagas disease in rural endemic areas of Brazil.

Background: Chagas disease is a major cause of heart failure in Latin America. There are 3 million people chronically infected in Brazil alone, and about 30% will eventually develop cardiomyopathy. Many of those affected by Chagas disease live in rural areas under poor conditions with limited access to cardiologists and echocardiography. Primary care physicians in rural Brazil manage Chagas disease patients using finite resources and referral options, and portable ultrasound is uncommon. Often, patients do not present to physicians with symptoms or physical exam signs until they already have significant cardiac dysfunction. However, once identified, Chagas disease patients with cardiomyopathy can move up referral channels in the Brazilian public health care system to receive formal cardiology evaluation, echocardiography, pacemakers/implantable cardioverter-defibrillators (ICD), and heart transplants.

Purpose: Our aim is to develop a model for rural primary care physicians in Brazil to use focused cardiac ultrasound to screen Chagas disease patients for the early stages of cardiomyopathy. If these patients can be identified early, there is potential to alter the course of their disease with closer follow-up, heart failure medications, and arrhythmia treatment. A screening protocol should be able to detect subclinical structural abnormalities and systolic dysfunction, while still being relatively simple for a physician with limited ultrasound experience to learn, and efficiently perform during an office visit.

Methods: A medical student with limited training in ultrasound traveled to six rural Brazilian communities in high-endemic regions in the state of Minas Gerais. Using a portable ultrasound machine, 141 patients with serology-positive Chagas disease were examined. Patients with a pacemaker/ICD or New York Heart Association functional class III or IV were excluded. Measurements included left ventricular (LV) diameter, left ventricular ejection fraction, visual estimation of right and left ventricular systolic function, and presence of apical aneurysm or wall motion abnormality. These measurements had previously been validated by the student using the same ultrasound machine and techniques compared with formal echocardiography. Lung ultrasound for pulmonary edema and pleural effusions, and focused physical examination for signs of heart failure were also performed.

Results: Of the 141 patients examined, 59 (41.8%) showed evidence of cardiomyopathy on ultrasound. 13 (9.2%) patients had isolated LV dilation, and the remaining 46 (32.6%) patients had one or more of the following - LV systolic dysfunction, right ventricular systolic dysfunction, apical aneurysm, wall motion abnormality or intraventricular thrombus - with or without LV dilation.

Conclusion: Chagas disease patients with minimal or no symptoms can have cardiac structural or functional abnormalities identifiable with point-of-care ultrasound. There is potential for medical professionals with limited ultrasound training to screen chronic Chagas disease patients for the early signs of cardiomyopathy using focused cardiac ultrasound in a primary care setting for early detection, monitoring, and treatment.

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Meta Information

Submission ID: 183 Student Submission: 1
Format: Oral

Topic: Point of Care ultrasound in health care delivery to underserved populations

PROtocolized Care to Reduce HYpotension after Spinal Anesthesia (ProCRHYSA randomized trial): statistical plan.

Background:

Spinal anesthesia is widely employed in everyday clinical practice. Its main side effect, consisting in an abrupt decrease of systemic vascular resistances, often translates into significant systemic hypotension. To prevent this, blind fluids administration is commonly used. However, this is accomplished on an empirical basis, carrying the risk of volume overload. The PROtocolized Care to Reduce HYpotension after Spinal Anesthesia (ProCRHYSA) is a randomized, monocentric, prospective, three-arm, parallel-group trial, aimed at evaluating non invasive techniques for guidance of volume repletion. These techniques have been validated in critically ill patients, but they have never been studied in a population undergoing elective surgery under spinal anesthesia.

Objective:

To compare significant hypotension rate after spinal anesthesia in three groups: the first without preliminary fluid repletion, the second undergoing vena cava echography-guided volume repletion and the third undergoing "passive legs raising test" (PLRT)-guided volume repletion. We provide here a preliminary data analysis.

Methods:

We randomized consecutive ASA 1 to 3 patients undergoing elective surgery under spinal anesthesia into three groups: the control group, the vena cava ultrasound group and the PLRT group. Patients found to be responsive to fluids within these last two groups were given sequencial boluses of 500 ml crystalloids and reassessed afterward until found euvolemic. Control group did not receive fluids preoperatively. Non-invasive arterial pressure was periodically measured in every patient after spinal anesthesia until discharge to recovery room and significant hypotension (defined according to international guidelines) incidence was calculated in the three groups. Exclusion criteria were: patients found hypotensive before spinal anesthesia, any contraindication to spinal anesthesia, patients' refusal, lack of protocol adherence. Data are given as percentage of significant hypotension, p value (p) and confidence intervals (CI).

Results:

Preliminary results (N=96, 20% of total calculated numerosity) showed a global significant hypotension rate of 45%, differently stratified in specific group: 66% of patients in the control group (N=32), 45% of patients in the vena cava echography group (N=32) and 66% of patient in the passive leg raising test group (N=32). A statistically significant difference with regard to significant hypotension rate was found between the group undergoing vena cava echography-guided volume repletion and the control group (p=0.043, CI=95%). No difference was found between patients undergoing PLRT-guided volume repletion and control group (p=1.0).

Conclusions:

Preliminary data analysis showed a statistically significant difference in the incidence of significant spinal-related arterial hypotension among vena cava ultrasound-guided volume repletion and the control group. However the study is currently still underpowered to allow for definitive conclusions.

Trial registration:

The trial is registered on www.clinicaltrials.gov (number NCT02070276).

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Meta Information

Submission ID:	184	Student Submission:	0
Format:	Oral		
Topic:	New Uses		

Introductory Portable Echocardiography Curriculum for CHD and RHD in a Rural International Setting

INTRO: This paper describes a curriculum used to teach introductory portable echocardiography with an emphasis on congenital heart disease (CHD) and rheumatic heart disease (RHD) to rural international healthcare workers and volunteers. This curriculum provides a review of basic heart anatomy and physiology while students practice the ultrasound views and techniques necessary to evaluate its function. The curriculum's hands-on and didactic components are fully integrated throughout, along with explanations for normal and pathological findings. Effectiveness of student learning is rated with both written and practical assessment. This curriculum was developed by UC Irvine first year medical students at the request of Floating Doctors, a nonprofit medical relief organization in Bocas Del Toro, Panama.

OBJECTIVE: To effectively and efficiently teach introductory echocardiography focused on assessment for CHD and RHD.

METHODS: Beginning in the apical four chamber view, name the four chambers in turn and explain their orientation relative to depth and the probe indicator. Locate and name the mitral and tricuspid heart valves. Name and explain the aortic and pulmonic valves, demonstrating the aortic valve with the apical 5 chamber view. Measure the velocity of blood flow through the mitral, tricuspid, and aortic valves and evaluate both septa with color for defects.

Move into parasternal long view. Explain the relative orientation of the parts using a handheld model heart opened through a lengthwise section. Measure the velocity of blood flow through the mitral valve and measure the interventricular septum during diastole.

Move into parasternal short view starting at the mitral valve level. Ascend to the great vessel level and measure the velocity of blood flow through the pulmonic valve. Then descend to papillary muscle level and use doppler to calculate left ventricle diameter, interventricular septum diameter, and posterior wall diameter.

RESULTS: It takes about one hour to complete this curriculum with two students per ultrasound heart model. This curriculum was used to teach 20 participants including Red Cross workers, nurses, medical students, public health students, and a doctor. Following several sessions, experience and feedback revealed which aspects of teaching were more or less helpful. Students were most engaged by hands on learning. PowerPoint presentations extended the lecture portions of the curriculum and required additional technology not always available in rural international settings. Hand outs were easy to implement and could be utilized for personalized note-taking.

DISCUSSION: Portable ultrasound is especially useful in rural international settings with limited healthcare access. This curriculum helps identify heart disease, both congenital and rheumatic, as early as possible so that pediatric patients may seek treatment. A primary step toward increased ultrasound access in rural international areas is the development of a curriculum for teaching healthcare workers in the field.

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Meta Information

Submission ID: 185 Student Submission: 1
Format: Poster

Topic: Use of ultrasound in Graduate Medical and Continuing Education

Insertion of ultrasound in undergraduate teaching: Pedagogically appropriate and approved by the students.

Introduction: The use of ultrasound (US) is emerging as a powerful tool in diagnostic medical education. The US has become the subject of interest to clinicians and some medical schools, notably in the USA, have already introduced the US teaching in their undergraduate curricula. In Brazil, the first initiative of a structured and horizontal integration of US teaching in the undergraduate curriculum is happening in the Faculty of Medicine of the Federal University of Juiz de Fora. AIM: To present our program of teaching US to medical students. Experience report: To develop this new US program we purchase three portable US units, three full HD TVs, Phantoms, the simulation software SONOSITE® and created a hands-on program distributed in five optional disciplines called “Clinical Echography (CE)”. The program was piloted with forth period medical student class (EC-I) of 29 students. Each student had 16 hours exposure to theoretical and practical activities in each discipline. The topics covered in the CEs were organized in order to match what the students were learning in the their obligatory disciplines. Performance evaluations were based on cognitive multiple-choice tests (MC) and image association (IA), and the Objective Structured Clinical Examination (OSCE). Results: The results presented refer to the discipline EC-I, which was initiated in the second semester of 2013. Among the 27 students selected, 26 completed the EC-I course (one student interrupted the course for medical problems). 92% of students achieved scores >70 points in the MC test, 96% in IA test (>80 points) and 92% in the OSCE (>80 points). The assessment of satisfaction with the discipline EC I (Likert scale-based) showed that the responses "strongly agree" or "agree" to the questions "The US increases my knowledge of physical examination", "US increases my medical knowledge” and "I would like to have more content of US in my medical course" were, respectively, 93%, 100% and 95%. Conclusion: The insertion of teaching US skills to medical students proved to be educationally valuable and approved by students.

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Submission ID: 186 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Medical Student Perceived Value of Ultrasound Education during the First Year of Medical School

Background: Eastern Virginia Medical School (EVMS) implemented a blended-learning, simulation-enhanced ultrasonography curriculum for medical students during the 2012-13 academic year. Our goal was to assess student perception of the value of ultrasound education during the first year of medical school.

Methods: An electronic survey was administered to learners upon the completion of their first year undergraduate medical ultrasound curriculum. M1 students in two academic years were surveyed.

Results: Two hundred thirty six students (95%) felt the overall educational experience in ultrasound enhanced their undergraduate medical education (n=247). Two hundred forty eight (93%) reported would like to see more ultrasound included in the undergraduate medical curriculum (n=266).

Conclusions: A large majority of first year medical students believed the integration of ultrasound into their curricula enhanced their undergraduate medical education. Most students desire more ultrasound within the curricula.

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Meta Information

Submission ID: 187 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Does an integrated undergraduate medical ultrasound program enhance medical student recruitment?

Background: Eastern Virginia Medical School (EVMS) implemented a blended-learning, simulation-enhanced ultrasonography curriculum for medical students during the 2012-13 academic year. Our goal was to assess whether the presence of an integrated ultrasound curricula contributed to a student's decision to attend our medical school.

Methods: A questionnaire was administered to new EVMS medical students during the introductory week of their first year of medical school. Students were asked if the inclusion of an integrated ultrasound curriculum was a reason they chose to attend Eastern Virginia Medical School.

Results: A total of 144 incoming M1 students were surveyed. Twenty-five percent of students (n=36) identified the undergraduate ultrasound curriculum as a reason they chose to attend Eastern Virginia Medical School.

Conclusion: The presence of an integrated undergraduate ultrasound curricula has the capacity to enhance medical student recruitment.

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Submission ID: 188 Student Submission: 0
Format: Poster

Topic: Use of ultrasound in Undergraduate Medical Education

Does the addition of an integrated cardiac ultrasound curriculum to the first- and second years of undergraduate medical education enhance comprehension of cardiac physiology and pharmacology?

F. Lattanzio and the EVMS Ultrasound Group. Eastern Virginia Medical School, Norfolk, VA..

Background: Understanding cardiac physiology is a formidable educational challenge encountered by entering medical students. The complex series of electro-mechanical events that occur during the cardiac cycle can be difficult to comprehend. Deficiencies in learning cardiac physiology are manifested in lower cardiac physiology test grades, coupled with lower student course evaluation scores. In addition, learning deficits may carry over into the second year, impairing performance in cardiovascular pharmacology. Our hypothesis is that by using ultrasound to visualize the cardiac cycle and other dynamic events, medical students can better comprehend and retain the fundamental elements of cardiac mechanics and function throughout their medical school tenure and beyond. The purpose of this abstract is to present preliminary data examining this hypothesis.

Methods: The average GPA and MCAT scores of entering classes in years 2003 -2013 at Eastern Virginia Medical School (EVMS) were used to estimate performance of first year medical school students who were taught cardiac physiology presented in a consistent format by EVMS instructors over a ten year period. Standardized test questions were used to create two examinations encompassing cardiac physiology, with approximately 40 five-choice questions per exam. Student responses were graded and discrimination ratios determined for the questions utilized. Results of student course evaluations were collected using a 0 (poor) to 5 (excellent) scale. In addition to the standard curriculum, the most recent student groups (2012 and 2013) received ultrasound training. The ultrasound educational program included six didactic and five “hands on” laboratory sessions scanning standardized patients. Ultrasounds were performed using GE Logic e and V-scan ultrasound systems.

Results: The average GPAs and MCAT scores of years 2003-2011 entering medical students were not significantly different from years 2012 and 2013. In 2003- 2011, medical students’ averaged scores for both cardiac physiology exams were 81.5+2.8. In 2012 and 2013, students’ averaged scores were 88.35 and 86.5 respectively , trending nearly two standard deviations higher than the 2003-2011 average. Cumulative test scores for all other physiology sections were 83.5+4.46 in 2003-2011 compared to 84.3+2.37 in 2012 and 87.2+5.8 in 2013 (not significantly different). Student physiology course evaluations averaged 3.92 in 2012 and 3.8 in 2013, trending higher than 3.21 in the previous years. Of the 2012 and 2013 students responding to course surveys, ~99% affirmed that learning ultrasound improved their overall medical school experience. The 2012 and 2013 class data demonstrated positive trends linking cardiovascular pharmacology and physiology test scores with ultrasound test scores.

Conclusions: Our data demonstrate upward trends in cardiovascular physiology and pharmacology test scores and student course evaluations when an ultrasound curriculum is integrated into the first-year of undergraduate medical education. In addition, students felt that ultrasound improved their overall medical school experience. We will continue to follow the performance of these medical student classes to determine if there will also be a trend for improvement in clinical tasks involving elements of cardiac physiology in the third and fourth years of medical school.

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Meta Information

Submission ID: 191 Student Submission: 0
Format: Oral

Topic: Use of ultrasound in Undergraduate Medical Education

The use of ultrasound in the teaching of shoulder pathologies

Context: Musculoskeletal teaching to residents is based on demonstrations and questions. Sometimes, residents use their knowledge without understanding the anatomy, which can lower the accuracy of diagnosis. Professors have noted a lack of organization and integration of knowledge in the results of residents' exams pertaining to shoulders. A higher level of anatomical understanding would improve this situation. Objectives: To determine if the use of ultrasound by the professor leads to a better knowledge of shoulder anatomy among residents and to a more accurate diagnosis of pathologies by those residents. Design: Exploration research. Target population: 13 full-time residents in family medicine. Intervention: One group was exposed to musculoskeletal examination of the shoulder through the use of ultrasound. The second group was instructed through traditional teaching methods which exclude the use of ultrasound. The level of understanding was then evaluated with anatomical boards. Diagnostic capabilities were evaluated through objective structured clinical examinations (OSCE) for capsulitis and supraspinatus tendinopathy in pre and post-teaching period. The teaching was conducted throughout an 8 months period. Results: All the residents have significantly improved their knowledge of the anatomy, without any difference between the 2 groups. There was a significant improvement in the identification of the infraspinatus tendon and subacromial bursa in the ultrasound group. All the residents showed an improvement in the shoulder exam maneuvers, resisted movements and palpation but there was no difference between the 2 groups.

Conclusion: The use of ultrasound as a teaching tool for the shoulder exam and anatomy has proven to significantly improve the residents' ability to identify the infraspinatus tendon and subacromial bursa. Cognitive ultrasound relates to reasoning, memory, decision-making and executives functions.

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Meta Information

Submission ID: 193 Student Submission: 0
Format: Poster

Topic: Technology