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Poster Session Abstracts

EARLY DETECTION OF MOLAR PREGNANCY WITH SONOGRAPHY: A RETROSPECTIVE ANALYSIS AND REVIEW OF THE LITERATURE

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OBJECTIVE: To evaluate the sonographic features that allow earlier detection of gestational trophoblastic diseases (GTD).

METHODS: A retrospective chart review from our institution, of all the patients that were diagnosed with gestational trophoblastic disease on histopathology, between 2002-2009 was performed. Ultrasonographic findings based on the presence of a gestational sac, yolk sac, fetal pole and appearance of the uterine cavity were compared among all the patients. Additionally, the presence of theca-luteal cysts, size of the right and left ovaries, uterine size, and endometrial thickness were also examined. A review of the literature was conducted using MEDLINE- assisted search, with keywords "sonographic features of gestational trophoblastic disease, "early detection" and "first trimester detection".

RESULTS: A total of 69 patients were diagnosed with GTD from years 2002-2009, based on the histopathology examination of products of conception after termination of pregnancy, of which 48 patients received ultrasound evaluation in first trimester prior to the pregnancy loss. 27 patients showed sonographic evidence suggestive of gestational trophoblastic disease, of which 89% had cystic changes of the endometrium and increased placental heterogeneity. Our study reported 56% sensitivity of ultrasound in diagnosing first trimester GTD with these sonographic features. Mean gestational age for detection of gestational trophoblastic disease was 10 weeks and mean maternal age was 31 years. Detection rate for complete moles was 80% as compared to 20% for partial moles.

CONCLUSIONS: The presence of cystic changes of the endometrium and increased placental heterogeneity allows us to successfully diagnose and treat GTD during the first trimester. This method allows for earlier diagnosis than the current existing sonographic features like snowstorm appearance; which is best visualized during the second trimester. However, histopathology still remains the gold standard for the confirmation of molar pregnancy. An early suspicion of GTD on ultrasound should encourage physicians to consider surgical evacuation of uterus, in face of a pregnancy loss, over the medical methods. This will ensure histopathological confirmation of GTD and close surveillance with post evacuation serum human chorionic gonadotropin levels, thus allowing earlier detection of persistent trophoblastic disease and neoplasias.

PRENATAL DIAGNOSIS BY ULTRASOUND IN TWO DIFFERENT CASES OF INTRATORACIC ABNORMALITIES

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CASE REPORT

A 30-year-old Argentinian primigravida was referred to our prenatal ultrasound department at 27.4 weeks of a single live gestation for a routine anatomic survey. She had no significant medical history. Neither parent reported any family history of congenital malformations. Biometry was consistent with the stated gestational age, and the amniotic fluid was in the percentile 95 (with a ILA of 24). The fetus´s weight was 1760 grs placing him in the percentile 95. The thoracic views appeared abnormal. There was evidence of mediastinal shift with the heart pushed over toward the right-hand side of the chest. The right lung appeared normal and the right pulmonary artery was identified using Doppler velocimetry. However, on the left lung tissue it was found a hyperechogenic mass measuring 51 × 52 mm with vascularization originated from an infra diaphragmatic aortic artery. A diagnosis was made of suspected bronchiopulmonary sequestration. Additional sonographic findings included moderate amount of ascites and slightly heterogeneous liver parenchyma. The fetus born in the 38 week of gestation, and was operated in the city of Buenos Aires, the second day after birth. The tissue remove was examined and confirm a bronchopulmonary sequestration. AMR assistant was not need, but because of a bad ventilatory mechanic of the patient a radioscopy was required and demonstrated a diaphragmatic paresis. The patient survived and did not develop any complications later and currently has two years of age.

The other case report is about a 40-year-old Argentinian primigravida, that was referred to our prenatal ultrasound department at 23.4 weeks of a single live gestation for a routine anatomic survey. She had no significant medical history either. Biometry was consistent with the stated gestational age, and the amniotic fluid was normal. The fetus´s weight was 600 grs. The thoracic views report a bad visualization of the stomach and a near control for it evolution. At the 28.4 week of pregnancy the patient came for another ultrasonographic exam, and it was found that the stomach was intratoracic and was pushing over the heart toward the right-hand side of the chest. The rest of the exam appeared normal. A diagnosis was made of suspected congenital diaphragmatic hernia. The fetus born in the week of gestation 38, and was operated in the city of Rosario, immediately due to a clinical descompensation and x-rays showed not only stomach but also spleen and intestine intrathoracic. The patient survived and currently has 2 months of age.

The clinical, ultrasonographic, x-rays and RMI of this case are reviewed.

DISCUSSION

The prenatal diagnosis of a congenital diaphragmatic hernia and bronchiopulmonary sequestratation can be challenging, and other thoracic abnormalities-including congenital cystic adenomatoid malformation and pulmonary hypoplasia-may have similar sonographic features. A systematic and meticulous approach, is critical to achieve an accurate prenatal diagnosis.

In the investigation of a suspected case of congenital pulmonary sequestration or diaphragmatic hernia, imaging studies have two principal objectives: to rule out other pathologies; and to confirm the presence of an anomalous arterial supply, in the pulmonary sequestration and to determinated the amounts of organs involved in the diaphragmatic hernia. Moreover, postnatal treatment of the diseases is different.

Bronchopulmonary sequestration was first described in 1946 by Pryce as “an abnormal artery arising from the aorta and supplying a bronchopulmonary mass or cyst that is dissociated from the normal bronchial tree”.(1) Since then, a number of cases have been reported in the literature,(2) and, today, pulmonary sequestration, as described by Pryce, is known to be an anomalous lung formation that usually does not have bronchial communication and is typically associated with an aberrant blood supply.(3) It represents between 0.15 and 6.45% of all pulmonary malformations (4). Its etiology remains a controversial issue. The two most often mentioned hypotheses are the following: formation and caudal migration of a supernumerary lung bud that accompanies the esophagus, which would explain the preferential localization of pulmonary sequestration in the lower third of the left hemithorax; and primary pulmonary vascular disorder, which would explain the persistence of the anomalous blood supply.

“Congenital diaphragmatic hernia (CDH), with a birth prevalence of about 1 in 4000, is associated with high perinatal mortality. Extensive animal and human studies have attempted to improve outcome by intrauterine surgical intervention. One of the major challenges in the antenatal assessment of CDH is the prediction of the postnatal outcome. In about 30% of cases of CDH there are associated chromosomal and major defects and in this group the prognosis is poor. In the group with apparently isolated CDH, the survival rate is about 60%, with the remaining babies usually dying in the neonatal period due to pulmonary hypoplasia and/or pulmonary hypertension” (6)

“Early estimation of patient-specific risks for these pregnancy complications would improve pregnancy outcome by shifting antenatal care from a series of routine visits to a more individualized patient and disease-specific approach both in terms of the schedule and content of such visits”. (7)

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5- Congenital diaphragmatic hernia: evaluation of prenatal diagnosis in 20 European regions. E. GARNE*, M. HAEUSLER†, I. BARISIC‡, R. GJERGJA‡, C. STOLL§, M. CLEMENTI¶ and THE EUROSCAN STUDY GROUP*Eurocat Registry of Funen County, University of Southern Denmark, Odense, Denmark, †University Hospital, Graz, Austria, ‡Childrens's University Hospital, Zagreb, Croatia, §Centre Hospitalo-Universitaire, Strasbourg, France and ¶University of Padova, Italy

6- Prenatal prediction of survival in isolated left-sided diaphragmatic hernia - J. JANI, R. L. KELLER† A. BENACHI, K. H. NICOLAIDES, R. FAVRE, E. GRATACOS, J. LAUDY, V. EISENBERG, A. EGGINK, P. VAAST and J. DEPREST on behalf of the Antenatal-CDH-Registry Group. Ultrasound Obstet Gynecol 2006; 27: 18–22 Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/uog.2688

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FEASIBILITY OF SONOGRAPHIC LOCALIZATION OF THE INFERIOR EPIGASTRIC ARTERY PRIOR TO ULTRASOUND-GUIDED PARACENTESIS: A CASE SERIES

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BACKGROUND: Ultrasound-guided paracentesis is commonly performed in the Emergency Department (ED) setting. Injury to the inferior epigastric artery (IEA) is an uncommon, but potentially life-threatening complication of paracentesis. Standard texts recommend avoiding this structure by relying upon anatomical landmarks. If feasible, sonographic localization of the IEA prior to ultrasound-guided paracentesis may provide a more reliable means of avoiding iatrogenic injury to this vessel.

CASE SERIES: We present five ED cases demonstrating the feasibility of IEA visualization prior to paracentesis.

Case 1: A 65-year-old male with hepatitis C and alcoholic liver disease presented with abdominal pain and distension. Bedside ultrasound revealed ascites. The IEA was identified prior to paracentesis (Figure 1). Five liters of fluid was removed without complication. The patient was admitted for further care.
Case 2: A 62-year-old male with alcoholic liver disease and gastric varices presented with abdominal pain and shortness of breath. Physical exam revealed a tense, grossly distended abdomen. Using ultrasonography the location of the right IEA was marked (Figure 2). Large volume paracentesis was performed without complication. The patient was subsequently admitted.
Case 3: A 36-year-old male with Hepatitis B presented complaining of abdominal, scrotal, and lower extremity edema. Ascites and the left IEA were visualized sonographically. Paracentesis was performed lateral to the IEA, removing two liters of peritoneal fluid. The patient was admitted, and had an unremarkable 2-day hospital stay.
Case 4: A 58-year-old male with hepatitis C and cirrhosis was transferred from an outlying hospital for further evaluation of liver failure and altered mental status. A diagnostic paracentesis was performed after sonographic localization of the IEA. Fluid analysis did not suggest spontaneous bacterial peritonitis. He was admitted for hepatic encephalopathy.
Case 5: A 40-year-old female with hepatitis C and cirrhosis was transferred from another facility for worsening ascites and emesis. The IEA was visualized sonographically. The patient underwent paracentesis with removal of two liters of ascitic fluid. She was admitted for further care.

CONCLUSION: This case series demonstrates the feasibility of localizing the IEA prior to paracentesis. Larger studies are needed to determine whether this technique is feasible in all patients with ascites, and whether it yields lower complication rates from paracentesis.

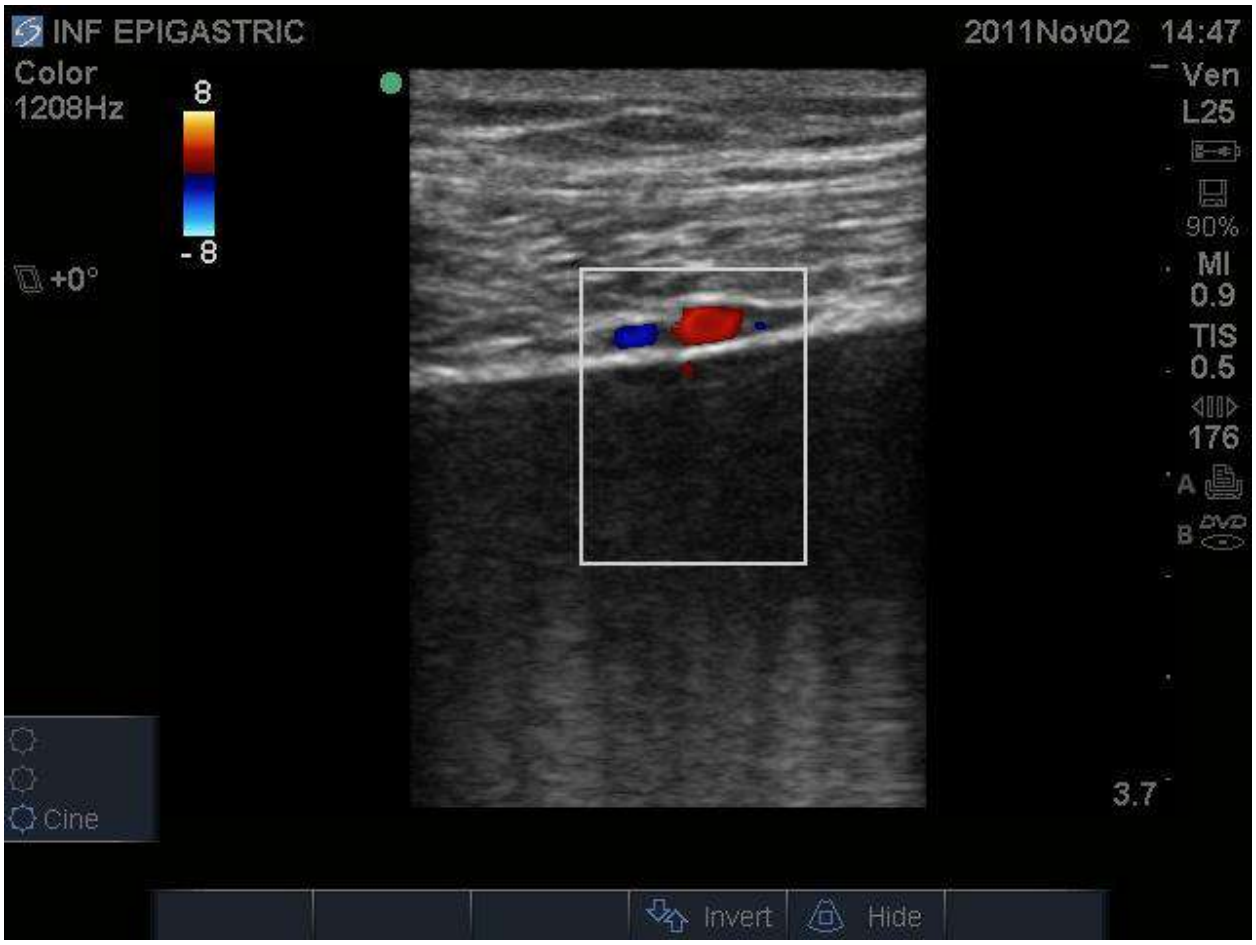

Figure 1: Inferior epigastric artery (red) superficial to the fluid-filled peritoneal cavity.

Figure 2: Location of the inferior epigastric artery as determined by sonography.

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SONOGRAPHY OF THE GLENOID LABRUM: PRECLINICAL METHODOLOGY FOR TEACHING AND DIAGNOSTICS

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OBJECTIVE: Describe how the use of cadavers can generate pre-clinical research data and concomitantly provide an excellent learning environment for sonographic evaluation of the shoulder.

METHODS: *The goal was to confirm that portions of the glenoid labrum were not only sonographically imaged but confirmed with dissection.* Fresh specimens were stored at temperatures between 34° and 36°F and tested within 48 hours of receiving the donor body. When the laboratory was not immediately available for testing, specimens were frozen to -20°F and thawed 12 hours prior to the experiment. The glenohumeral joint (GHJ) of each specimen was pre-conditioned by taking the arm through its full range of motion. While scanning the posterior superior and posterior inferior GHJ, the specimens were positioned as sitting with arms at the side, shoulder in neutral rotation, and elbow flexed to 90 degrees. The equipment utilized was a GE Logiq 9. A 9.0 MHz linear broadband transducer was used for imaging. The 8 cadaveric shoulders were scanned by two researchers. Three scanning approaches were used to visualize 3 regions of labrum:

1) Posterior superior: Region between the 10 o'clock and 8 o'clock.
2) Posterior inferior: Region between 8 o'clock and 6 o'clock.
3) Anterior inferior: Region between 4 o'clock and 6 o'clock.

The posterior scanning approach allowed for visualization of the traditional portions of the labrum. In addition, an axillary view of the anterior inferior glenoid labrum was completed with the arm abducted to 90o and in maximum external rotation. In parallel, undergraduate honors and graduate education in anatomy was facilitated.

RESULTS: Descriptive statistics were generated and provided assurances that structures imaged were at the same site as the specimen recovered. The axillary view provided visualization of a portion of the labrum that is difficult to evaluate and was consistently imaged in all 8 cadaveric shoulders. Validity for imaging and teaching was accomplished through the use of ultrasound directed dye injections and then dissection for confirmation. Descriptive results will be provided for matching the sonographic dimensions of the imaged labrum, with the actual removed specimen.

CONCLUSIONS: The use of sonography to image the glenoid labrum is very reliable based on our preclinical work and provides an excellent teaching tool for graduate education. Students are able to correlate the sonographic anatomy directly with the structures that are displayed in the body. The use of anatomic gold standard validation, with sonography, is an important conjoint research and teaching exercise. Translation of this preclinical work is planned with a cohort of athletes who have chronic overhead throwing pain and injuries (i.e. baseball players). A dynamic diagnostic evaluation of the GHJ is only possible with the use of sonography.

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Sonographic physiology « 101 »: on shock states and fluid responsiveness

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Despite all the modern armamentarium available to physicians caring for unstable patients, predicting fluid responsiveness often remains an elusive task. Along with a thorough understanding of shock physiology, point-of-care ultrasound can prove to be invaluable in predicting fluid responsiveness.

With this in mind, the presentation will focus mainly on two goals.

First, demonstrate how a simple qualitative assessment of the circulation combining heart, lung and IVC sonographic information can help better understand the physiology of cardiac output and venous return in shock states. Finally, demonstrate how these notions can be applied to optimize the initial management of shock and better predict the potential for fluid responsiveness. Physiology… applied clinically.

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ULTRASOUND GUIDED CENTRAL VASCULAR ACCESS WITH A NOVEL ULTRASOUND DEVICE: RESULTS FROM THE FIRST 100 LINES

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INTRODUCTION: Real-time ultrasound guidance is considered to be the standard of care for central venous access for non-emergent central lines. Universal adoption by physicians has been slow despite the data showing that ultrasound guidance results in fewer sticks and less complications. The AxoTrack system (Soma Access Systems, Greenville, SC) is a novel ultrasound guidance system designed to simplify ultrasound guided central venous access by eliminating the hand-eye coordination challenges of conventional ultrasound needle guidance. The device has been cleared for human use by the United States Food and Drug Administration (FDA).

METHODS: After acquiring the AxoTrack device, we gathered data on all central venous lines placed with the AxoTrack device in three hospitals for quality assurance purposes. Physicians and Nurse Practitioners who work in the Intensive Care Unit or Emergency Department at these hospitals and who place central venous catheters were trained to use the AxoTrack system. After IRB approval, we consolidated the data for the first eleven months of use for retrospective review.

RESULTS: The AxoTrack system was used by 37 different health care providers in 100 consecutive patients undergoing central venous cannulation (CVC) from September, 2012 to July, 2013. 99 of 100 patients (99%) had successful central venous cannulation with the guidance of the AxoTrack system. 97 of 100 (97%) of patients had successful cannulation with the first attempt. There were no complications, including pneumothorax, hemothorax, arterial puncture or arterial cannulation.

CONCLUSION: The AxoTrack system is a safe and effective means of CVC that can be used by a variety of health care practitioners.

ULTRAFEST: A ONE-DAY SYMPOSIUM FOR BEDSIDE ULTRASOUND TRAINING FOR MEDICAL STUDENTS IMPROVES PSYCHOMOTOR PERFORMANCE

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OBJECTIVE: To evaluate the effectiveness of hands-on training at a bedside ultrasound symposium ("Ultrafest") to improve both clinical knowledge and image acquisition of medical students. Our primary outcome measure was improvement in multiple choice questions focused on pulmonary or FAST ultrasound knowledge. Our secondary outcome measure was improvement in the ability to acquire images in four windows on standardized models in either pulmonary or FAST ultrasound examinations.

METHODS: This is a prospective cohort study of 48 volunteers (23% of 208 attendees) at "Ultrafest," a free symposium where students attended 5 of 12 hands-on ultrasound workshops for a total of 5 contact training hours. Students were evaluated before and after training for proficiency in either pulmonary ultrasound examination or FAST (Focused Assessment with Sonography for Trauma). Proficiency was assessed by both clinical knowledge through written multiple choice exam and clinical skills through accuracy of image acquisition of four ultrasound windows in each exam. Data analysis was conducted using paired sample t-tests with students as their own controls.

RESULTS: Of 48 students, clinical knowledge was analyzed on 46 students (two exclusions due to incomplete examinations). The pulmonary knowledge scores increased by a mean of 10.1 points (95%CI 8.9-11.3, p<.00005) from a pretest average of 9 to a posttest average of 19 out of 21 possible points. Twenty-two students completed the FAST pre-Ultrafest and post-Ultrafest written exams. The FAST knowledge scores increased by a mean of 7.5 points (95%CI 6.3-8.7 p<.00005) from a pretest average of 8 to a posttest average of 16 out of 21 possible points. Clinical skills data was analyzed on 32 students (16 excluded due to inadequate image clips for evaluation.) The mean score was 1.7 on the pretest and 4.7 on the post test out of a total of 12 possible points. The mean overall improvement was 3.0 (p<.00005) overall, 3.3 (p=.0001) for the FAST exam, and 2.6 (p=.003) for the pulmonary exam.

CONCLUSIONS: This study demonstrates that teaching medical students bedside ultrasound in a small group hands-on setting leads to significant score improvement in both written examinations and image acquisition skills. This model suggests meaningful gains can be achieved with a day-long symposium reaching hundreds of students from multiple medical schools. Further studies are needed to determine if training results in long-term retention or improved patient outcomes.

EMERGENCY DEPARTMENT VS. RADIOLOGY DEPARTMENT PELVIC ULTRASOUND AND EFFECT ON PATIENT LENGTH OF STAY: A RANDOMIZED CONTROL TRIAL

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OBJECTIVE: Although imaging studies are integral in diagnosing many patients presenting to the emergency department (ED), they often substantially extend patient length of stay (LOS). Bedside ultrasound performed by emergency physicians may yield many benefits including improved patient wait times and decreased overall LOS in the ED. We hypothesize there will be a significant decrease in the time to obtain an ultrasound image and an overall decreased LOS for patients who receive emergency department pelvic ultrasound (EDUS) compared to those that receive a radiology department pelvic ultrasound (RDUS).

METHODS: This is a prospective randomized clinical trial for 330 patients presenting to the ED requiring pelvic ultrasound imaging. Consented patients are randomized to EDUS on even days and RDUS on odd days. Time taken to obtain the ultrasound and total time spent in the ED are measured for each patient.

RESULTS: Eighty-four patients have been enrolled in the study from which 35 have been randomized to EDUS and 49 have been randomized to RDUS. The average time to perform pelvic ultrasound in the ED was 5.7 minutes while the average time to obtain pelvic ultrasound through radiology was significantly longer at 71.1 minutes ($p < 0.0001$) (figure 1). The average total time patients spent in the ED for EDUS was 243.4 minutes while the average total time patients spent in the ED for RDUS was significantly longer at 348.4 minutes ($p = 0.002$) (figure 2).

CONCLUSIONS: Preliminary results show a statistically significant reduction in both time to obtain pelvic ultrasounds and total time spent in the emergency department for EDUS compared to RDUS. These initial results suggest that pelvic ultrasound performed at bedside by Emergency Physicians could positively impact patient care by reducing time to diagnosis, patient wait time and length of stay in the ED.

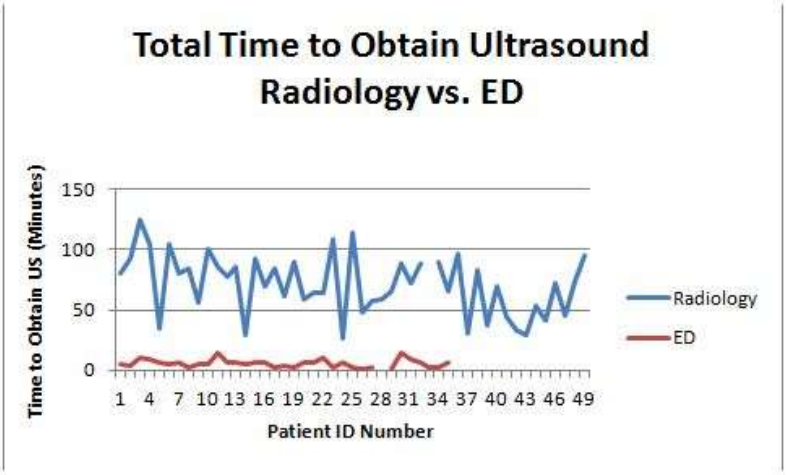

FIGURE 1

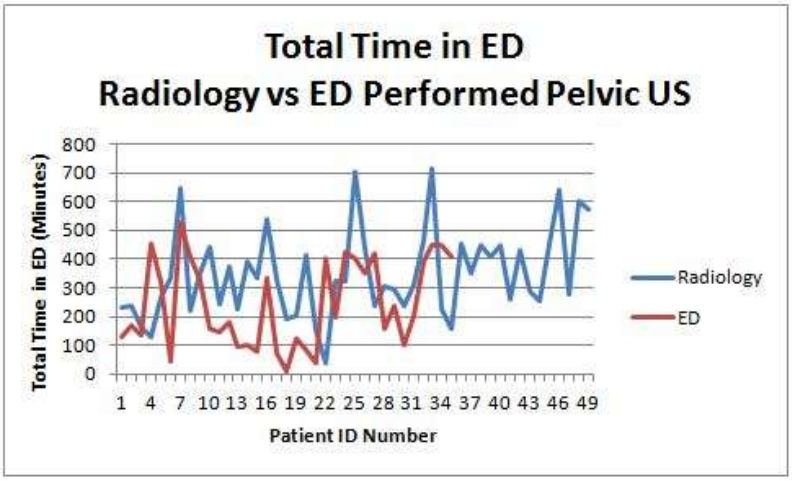

FIGURE 2

USE OF SIMULATION TRAINING PHANTOMS AND REAL-TIME ULTRASONOGRAPHY DURING THE FIRST AND SECOND YEARS OF MEDICAL SCHOOL

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INTRODUCTION: Ultrasound education has been integrated into the curriculum at A.T. Still University-Kirksville College of Osteopathic Medicine since 2011.

METHODS: Students received intense ultrasound training using 18 machines during the first and second years of medical school, which allowed each student to be involved in the hands-on training process. First-year students of the class of 2015 scanned both each other and standardized patients during the ultrasound labs, which created some logistical issues. Our first research question was whether students preferred scanning each other or the standardized patients during ultrasound labs. During the second year, ultrasound elective course students were exposed to ultrasound needle-guided techniques using vascular ultrasound phantoms and breast phantoms. Our second research question was whether students thought that training pads for needle-guided procedures were valuable tools for their upcoming clinical years and future practice. To answer our research questions, we administered a student survey at the end of the second year.

RESULTS: Eighty-three students participated in the survey. Wilcoxon signed ranks test showed that 57% of students preferred to practice ultrasound on other students rather than the standardized patients ($P<.0001$). Ten percent of the students preferred to practice on the standardized patients and 31% of students had no preference for one over the other. Eighty-three percent of the students agreed that simulation training pads for needle-guided procedures were valuable tools for their future practice. Ninety-four percent of students agreed that the elective course helped them develop their diagnostic skills and 95% of students indicated that they are more likely to use ultrasound in their future practice after taking the ultrasound elective course.

CONCLUSION: We initially involved standardized patients in the ultrasound labs because we thought that they would result in more realism and clinical thinking, but they created technical difficulties during scanning and were costly. Students also indicated that they preferred to scan each other during labs. Based on these data, we will only be using standardized patients for practical examinations and students will only be scanning each other during the ultrasound labs. Students were highly satisfied with the simulation training using needle-guided procedure phantoms because it provided them with hands-on clinical skills and prepared them for clinical rotations and future practice. Use of simulation training phantoms and real-time ultrasound in teaching medical students at Kirksville College of Osteopathic Medicine proved to be a very successful experience for students, which they indicated in their responses on the survey.

IMPACT OF THE CLINICAL ULTRASOUND ELECTIVE COURSE ON RETENTION OF ANATOMICAL KNOWLEDGE BY SECOND-YEAR OSTEOPATHIC MEDICAL STUDENTS IN PREPARATION FOR BOARD EXAMS

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PURPOSE. Ultrasound has been integrated into Gross Anatomy and Osteopathic Manipulative Medicine (OMM) courses during the first year of osteopathic medical education (OME) at the A.T. Still University-Kirksville College of Osteopathic Medicine (KCOM) since 2011. Ultrasound labs and web-based learning modules allowed students to acquire images and interpret findings to visualize "living anatomy" through correlations with cadaveric dissection. During OMM labs, students used ultrasound to validate and ultimately enhance their palpatory diagnostic skills. A Clinical Ultrasound Elective course was developed to continue ultrasound training during the second year of OME. The goal of this study was to identify the impact of the ultrasound elective on the understanding of normal anatomy by second-year students as they prepared for board exams.

METHODS. Throughout the elective course, students participated in ultrasound labs, which involved different regions of the body. A multiple-choice 50-question anatomy exam was compiled by two second-year students who were not participating in course design and were not aware of the exercises planned for the elective. Before the start of the elective and after its conclusion, the exam was administered to students who enrolled in the elective and students who didn't. Wilcoxon signed ranks tests were used to determine whether exam scores changed from pre- to post-test. Nonparametric analysis of covariance was used to compare students who took the elective to those that didn't on the post-test exam score, covarying on the pre-test exam score.

RESULTS. The majority of students in this study (93/100) took the elective. Students who took the elective showed statistically significant improvement in the overall anatomy exam score between the pre- and post-tests (8.9 [2.4] vs 12.3 [5.3], $p<0.001$). For those students who did not take the elective, there was no statistically significant improvement (6.1 [2.4] vs 9.9 [4.9], $p=0.19$). There was no significant difference between the groups on the post-test score after accounting for differences in pre-test scores ($p=0.47$). Scores for exam questions pertaining to the upper extremity, lower extremity, chest, and abdomen regions were significantly improved for students who took the elective ($p\leq0.001$) but not the head and neck ($p=0.12$) region.

CONCLUSIONS. Ultrasound elective course offered during the second year of OME at KCOM provided students with an important review of key anatomical concepts preparing them better for board exams. Musculoskeletal, abdominal, and heart ultrasound proved to be most important for retaining relevant anatomical information. More emphasis should be placed on head and neck ultrasound to improve student performance in this area.

PROACTIVE MEDICINE: AN ULTRASOUND-BASED CLINICAL INITIATIVE: "THE UC IRVINE 30"

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BACKGROUND

Correct diagnosis is often dependent upon use of expensive and potentially harmful imaging technologies. With recent innovations in ultrasound technology, hand-held ultrasound provides a safe, portable, non-invasive and cost-effective tool for delivering rapid detailed diagnostic information at the point of service, be it the hospital bedside or the physician's office. The UC Irvine teaching faculty values the recently described significance of the physical examination as expressed by the "Stanford 25" method. This approach specifies the amount of information that can be gleaned from a skillful basic physical examination as performed using the basic tools well known to physicians for centuries.

OBJECTIVE

It is our philosophy that it is time to bring other modalities to the bedside in order to enhance the diagnosis and treatment of disease. UC Irvine has used the Stanford 25 to facilitate the introduction of ultrasonography to the routine physical examination, a union that enhances the diagnosis and treatment of disease in a highly personalized and proactive manner. With the integration of point of care diagnostic ultrasonography into the four-year medical school curriculum since 2010, UC Irvine proceeded to expand the Stanford 25 into an Ultrasound-based Clinical Initiative that we term the UC Irvine 30.

METHODS

The UC Irvine 30 includes the use of a handheld ultrasound device to improve the diagnostic accuracy of each element of the Stanford 25 physical exam, along with 5 additional exams, including fundoscopic exam, pupillary responses, thyroid exam, neck veins, pulmonary exam, point of maximal impulse (PMI) and parasternal heave, examination of the liver, examination of the spleen, common gait abnormalities, deep tendon (ankle jerk) reflex, stigmata of liver disease, internal capsule stroke, knee exam, cardiac second sounds/splitting, involuntary movements, hand exam, mouth exam, shoulder exam, blood pressure and pulsus paradoxus, cervical lymph node assessment, ascites, rectal exam, scrotal mass evaluation, cerebellar testing, bedside ultrasound, pelvic ultrasound, renal ultrasound, bladder ultrasound, vascular ultrasound, and procedural guidance.

DISCUSSION

The integration of ultrasound into the traditional physical exam provides physicians with a safe, portable and non-invasive tool that enhances their ability to detect medical problems and immediately confirm suspected findings at a reasonable cost. The capability to obtain and utilize this additional information is invaluable in almost any medical setting. However, in order to maximally harness the many potential applications and benefits of this simple technology at the bedside, students must be trained early in its use. Incorporation of use of handheld ultrasound into all four years of medical school curricula maximizes students' comfort and ability to obtain accurate images, use these images for diagnostic and procedural purposes, avoid the diagnostic pitfalls of ultrasound, and neutralize operator-dependency of the technology.

ECHOCARDIOGRAPHY PREVALENCE STUDY USING A NEW CRITERIA FOR RHEUMATIC HEART DISEASE IN SCHOOL CHILDREN IN RWANDA

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BACKGROUND: Prevalence rates of rheumatic heart disease (RHD) in sub-Saharan Africa have been shown to be among the world's highest, with only a few echocardiography-based screening studies conducted in the region. Recent screening programs using the combined clinical and echocardiography 2006 WHO/NIH guidelines have been conducted in the region, with some limitations. New evidence-based echocardiography criteria for RHD have been published by the World Heart Federation (WHF, 2012), that are yet been to be tested globally, including in sub-Saharan Africa. We have applied these criteria for the first RHD prevalence study in schoolchildren in Rwanda.

METHODS: Randomly selected students (6 to 16 years of age) from each class of 10 schools from rural and urban areas of Kigali City, in Rwanda, were screened over 10 days by 14 qualified sonographers supervised by a cardiologist and using portable echocardiography machines. Echo images were reviewed by two board-certified echocardiologists, and RHD likelihood was defined as definite or borderline according to the 2012 WHF guidelines.

RESULTS: Out of the 3000 selected, 2693 students (90%) received screening. P1 to P6 classes were equally represented (14.33 to 16.38%) but only 10% of the students were from S1 to S3 classes. Among the students, 49.29% were male and 50.72% females; mean age was 11.6 years (SD±2.88) with mean weight of 35.68 kg (SD±11.62) and height of 139.88cm (SD±15.86).

Seventeen children (0.63%) were confirmed to have definite (0.11%) or borderline (0.52%) RHD; The total prevalence rate is 6.31 per 1000 school children.

CONCLUSIONS: This is one of the first reported studies to use the WHF 2012 echocardiography guidelines. The prevalence rate for RHD was comparable or lower compared to similar studies. However, there were significant limitations including logistical challenges in this resource-poor setting. Echocardiography screening protocols for RHD screening are evolving, and comparative studies are needed to assess the impact of the new guidelines measured against the previous criteria. Future studies should assess cost-effectiveness and simplified screening protocols to facilitate future prevalence studies in resource-poor settings.

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THE COMPARISONS OF CLINICAL AND SONOGRAPHIC CHARACTERISTICS BETWEEN THE EARLY AND LATE APPENDICITIS

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Purpose: To our knowledge, there are no study on the relationship between the degree of appendiceal inflammation and the clinical features. The purpose of this study was to know statistically significant parameter that can earlier diagnose appendicitis comparing clinical features and ultrasonographic findings between early and late appendicitis.

Methods: Right lower quadrant (RLQ) pain ultrasound registry for the period December 2011 to December 2012 was reviewed. Among these cohorts, we selected patients who had pathologic proven appendicitis, and divided these patients into two groups; the early appendicitis group was defined as patients who complained of a diffuse abdominal pain and the late appendicitis group as patients who complained of a localized right lower quadrant pain. We gathered and compared included two groups' gender, age, inflammatory markers (WBC, CRP), clinical features, bedside ultrasonographic and postoperative pathologic findings.

Results: A total of 102 patients were enrolled in this study. WBC and CRP were significantly different between two groups ($p<0.01$). Sonographic tenderness and periappendiceal fat infiltration were more presented in the late group ($p<0.05$). And also more fat infiltration and complicated appendicitis were presented in the late group ($p<.0.05$, $p<0.01$ respectively).

Conclusion: There were statistically significant differences between the early and late appendicitis groups in aspect of clinical, sonographic and pathologic features. Emergency physician can detect an early appendicitis as well as prevent complications even before the migration of abdominal pain to RLQ by using a bedside ultrasography.

Key Words: Appendicitis, Ultrasonography, Right lower quadrant pain

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UTILITY OF POINT-OF-CARE THYROID DOPPLER ULTRASONOGRAPHY IN THE EVALUATION OF THYROTOXICOSIS AND GRAVES' DISEASE

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OBJECTIVE – To describe two interesting cases that support the value of point- of-care thyroid ultrasonography (USG) in the diagnostic evaluation of clinical thyrotoxicosis and Graves'disease (GD).

CASE 1 – 34 year old woman presented with her thyroid "acting up." Previously diagnosed with GD and being treated with methimazole and metoprolol in preparation for ablative radioactive iodine I^{131} therapy. Exophthalmos, goiter**,** and a continuous thyroid bruit were present. Labs revealed TSH <0.005 mcIU/ml, total T_4 21.4 ug/dL (4.8-13.9) and total T_3 641ng/dL (60-181). USG revealed heterogenous echogenicity and markedly increased vascularity on color flow Doppler**,** thus lending confirmation to the underlying etiology and exacerbation of GD.

CASE 2 – 25 year old woman presented to ED with anterior neck pain, fever, and weight loss. Patient with a diffusely enlarged and tender thyroid, tremor, hyperreflexia, and tachycardia. TSH <0.005 mcUI/ml, free T_4 5.69 ng/dL (0.76-1.46) and free T_3 (27.9 pg/ml (2.18-3.98). Thyroiditis was suspected. Computed tomography (CT) revealed diffuse thyroid enlargement that was "consistent with thyroiditis**."** Questioning revealed a family history of thyroid disease and presence of symptoms for 2 months. Radioactive iodine uptake (RAIU) was precluded by recent CT contrast. Doppler USG showed an enlarged heterogenous gland with diffuse intense hypervascularity**.** Thyroid-stimulating immunoglobulin (TSI) activity was 183 units (<122). These findings were consistent with GD. Diagnosis and treatment were appropriately revised.

DISCUSSION – In its usual presentation (exophthalmos, abnormal TFTs and TSI activity), making the diagnosis of GD is straightforward. However, the underlying etiology can be unclear in patients who present with thyrotoxicosis but not the characteristic findings of GD of thyroiditis. Thyroid gland vascularity is increased in GD, frequently accompanied by bruits, while reduced in thyroiditis. Doppler USG in GD reveals high-velocity flow, while flow is reduced or absent in thyroiditis**.** Differentiation impacts therapy. RAIU has been the preferred initial imaging modality; however, is more expensive than USG, associated with radiation exposure, cannot be performed in recent iodine contrast study or amiodarone use, contraindicated in pregnancy, and inferior for identification of thyroid structure**.** Our report and others in the literature support growing use of USG as a convenient, less expensive, and easily repeated first line test.

CONCLUSION – Because of its various advantages, bedside thyroid USG with Color Doppler may be the imaging method of choice to determine the etiology of a thyrotoxic state and accurately confirm the diagnosis of GD.

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DESCRIPTIVE ANALYSIS ABOUT THE PRACTICE USE OF ULTRASOUND IN FOURTH-YEAR MEDICAL STUDENTS AT UNIVERSITY OF LLEIDA (UDL)

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OBJECTIVE: To observe if a sample of students studying Emergency Medicine 4th year at the University of Medicine of Udl, are capable to acquire theoric and specially practice knowledge on the ultrasound and see if increase for them the importance of this diagnostic test for their medical practice, since there is not any evidence of previous publications about the matter in our country.

METHODS: A descriptive analysis about de results which were made to students before and after the practice lesson about ultrasound which lasted for two hours. The surveys are divided in three parts: a) questions about the value of quality ordinal variables about theoric-practice knowledge about ultrasound; b) list of structures and pathologies that the students would be able to detect by using the ultrasound; c) questions of open answers and comments.

RESULTS: Significative statistic results about the knowledge which they acquire about ultrasound are observed, comparing the review previous and post practice (since it increases the number of structures and pathologies which were visualized), it also increases the importance that they give to this diagnostic tool.

CONCLUSION: Our aims are achieved, we mean, the students have increased their level of knowledge about ultrasound as well as the level of the importance of its use in medical practice. Besides we should highlight that it would be interesting to make more practice seminaries on this diagnostic tool, including the introduction of it on different matters inside the studies of Medicine in our country as it happens in other countries.

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EVOLUTIONARY DEVELOPMENT OF AN INTRODUCTION TO ULTRASOUND COURSE IN A RURAL MEDICAL SCHOOL

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The University of New England School of Rural Medicine (UNE SRM) is a five year undergraduate entry medical program that began in 2008 as part of the Joint Medical Program with the University of Newcastle. UNE SRM is also affiliated with the University Of California Irvine School Of Medicine and through this affiliation, UNE SRM has introduced several innovative programs to the medical curriculum including iPads, IMedEd and ultrasound courses in an attempt to make up for the deficits intrinsic in being a rural and remote medical school. The Introduction to Ultrasound course for UNE students was first delivered in 2012 to 91 first and second year students. UCI has provided faculty support and student tutors. The Sonosite Corporation has kindly provided equipment and technical support for these courses. In 2013 the course has now evolved to include ten hours of didactic components with on line modules, lectures, live patient demonstrations and an additional eight hours of hands on skills training. Assessment in the course includes a pre and post knowledge test and an eOSCE (electronic Objective Structured Clinical Examination) for skills assessment. The four online self-directed modules are on You Tube and include one from the University of South Carolina and three from the University of California Irvine (Links through UNE web site http://www.une.edu.au/rural-medicine/students/.) The bulk of the course is administered over a intense 2 day period in the middle of the first year. Ultrasound knowledge is assessed pre and post course using a synchronous, mobile internet based tool (Responseware). Skills assessment is done using an eOSCE format and simulated patients and includes assessment of professional interaction, familiarity with the equipment and ability to identify specific organs. In July 2013, sixty three first year students participated in the course (54% M, 46% F, 77% of students were in 18-20 year age bracket). In a self rated knowledge question, 13.8% considered themselves pre course to have some knowledge or be fairly knowledgeable. Post test this figure was 90.5%. There were 29 knowledge questions given in an MCQ format. The average percent getting the questions correct went from 57.5% on the pre test to 95.6% on the post test (average increase 38%) . On the skills assessment the average score was 33.7 out of a possible 41 items. Three of the 63 students were considered to be unsatisfactory on this component and were given the opportunity to meet the standard.

SUMMARY: Using international connections, online courses, didactic lectures and demonstrations and skills training with the assistant of student tutors form the University of California Irvine, the University of New England School of Rural Medicine has developed a robust Introduction to Ultrasound course for first year medical students. A review of the course after each administration has facilitated steady improvement in the way the course has been delivered and developed. Student tutors remain an integral part of the program.

DUPLEX ULTRASOUND OBJECTIVE STRUCTURED ASSESSMENT OF TECHNICAL SKILLS FOR ARTERIAL STENOSIS DETECTION

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DETAIL: There has been considerable interest in adoption of skills in Duplex assessment of arterial stenosis among specialties that have not previously been trained. This adoption should ideally be through formalized and structured training. Simulator training is increasingly being used for acquisition of psychomotor skills. There is a need for a validated assessment tool for Duplex arterial stenosis measurement for both simulator and real life training.

A novel assessment tool: Duplex Ultrasound Assessment of Technical Skills (DUOSATS) was developed. A modified DUOSATS was used for simulator training. Novice, intermediate experience and expert users of Duplex ultrasound were invited to participate. Participants viewed a standard instructional video and were allowed ample time to familiarize with the equipment. Participant's attempts were recorded and independently assessed by four experts using the modified DUOSATS. Overall assessment was also made.

Content and construct validity as well as reliability have been established. The simulator had good satisfaction rating from participants: median 4; range 3-5) Receiver Operator Characteristic analysis has established a cutoff point of 22/ 34 and 25/ 40 were most appropriate for simulator and real life assessment respectively.

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ECHOCARDIOGRAPHY PREVALENCE STUDY USING A NEW CRITERIA FOR RHEUMATIC HEART DISEASE IN SCHOOL CHILDREN IN RWANDA

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BACKGROUND: Prevalence rates of rheumatic heart disease (RHD) in sub-Saharan Africa have been shown to be among the world's highest, with only a few echocardiography-based screening studies conducted in the region. Recent screening programs using the combined clinical and echocardiography 2006 WHO/NIH guidelines have been conducted in the region, with some limitations. New evidence-based echocardiography criteria for RHD have been published by the World Heart Federation (WHF, 2012), that are yet been to be tested globally, including in sub-Saharan Africa. We have applied these criteria for the first RHD prevalence study in schoolchildren in Rwanda.

METHODS: Randomly selected students (6 to 16 years of age) from each class of 10 schools from rural and urban areas of Kigali City, in Rwanda, were screened over 10 days by 14 qualified sonographers supervised by a cardiologist and using portable echocardiography machines. Echo images were reviewed by two board-certified echocardiologists, and RHD likelihood was defined as definite or borderline according to the 2012 WHF guidelines.

RESULTS: Out of the 3000 selected, 2693 students (90%) received screening. P1 to P6 classes were equally represented (14.33 to 16.38%) but only 10% of the students were from S1 to S3 classes. Among the students, 49.29% were male and 50.72% females; mean age was11.6 years (SD±2.88) with mean weight of 35.68 kg (SD±11.62) and height of 139.88cm (SD±15.86).

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CONCLUSIONS: This is one of the first reported studies to use the WHF 2012 echocardiography guidelines. The prevalence rate for RHD was comparable or lower compared to similar studies. However, there were significant limitations including logistical challenges in this resource-poor setting. Echocardiography screening protocols for RHD screening are evolving, and comparative studies are needed to assess the impact of the new guidelines measured against the previous criteria. Future studies should assess cost-effectiveness and simplified screening protocols to facilitate future prevalence studies in resource-poor settings.

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TEACHING ULTRASOUND BY EXPLORING ANATOMY

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OBJECTIVES: To introduce a longitudinal series of structured, self-guided ultrasound activities into an integrated preclinical medical student anatomy curriculum.

BACKGROUND: A barrier to ultrasound education in medical school has been the availability of trained faculty. The Ohio State University has the infrastructure in place for medical students to gain exposure to ultrasound and practice in a dedicated educational space. The Ohio State University College of Medicine's new curriculum, Lead. Serve. Inspire. (LSI), is divided into three parts. Part I, currently halfway through its first iteration, spreads gross anatomy coursework over the two preclinical years and integrates physiology and pathology, one organ system at a time. Part II represents clinical rotations, while Part III focuses on developing advanced competencies. This ultrasound project was designed as a flexible, self-guided overlay to embed independent ultrasound education into LSI Part I while obviating the need for direct faculty supervision.

METHODS: Preclinical medical students attend seven optional hands-on ultrasound sessions as part of LSI Part I. Additionally, students receive access to eight system-based self-study ultrasound modules designed to teach image acquisition and sonographic signatures of normal tissue by exploring anatomy. Tasks are tiered according to difficulty. Students save images as part of their digital portfolios, while successful completion will be credited toward possible completion of an Advanced Competency in Ultrasound in LSI Part III.

RESULTS: This project has built on the existing ultrasound infrastructure to develop eight self-guided, flexible modules covering the following systems: musculoskeletal, head and neck, cardiac, aortic, hepatobiliary, renal, endocrine, and reproductive anatomy. Furthermore, the flexible modular design of this project makes it possible to use in various combinations throughout LSI Part I, II, and III.

CONCLUSION: Ultrasound education and competency requires a combination of mentorship and opportunity. The challenge of finding faculty to supervise UME ultrasound activities has been an obstacle in the past. This project provides a possible educational model to increase medical student opportunity without increasing the demand on trained faculty.

INTEGRATED SYSTEM OF COMMUNITY PRACTICE FOR FOCUSED ULTRASONOGRAPHY SPANNING UME, GME AND FACULTY LEVELS STANDARDIZING TRAINING, COMPETENCY AND QUALITY

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BACKGROUND: Focused ultrasonography is a proven safe form of imaging that has been used by physicians to aid in diagnosis and procedures. With the increased portability, higher quality and decreased expense, the prevalence of ultrasound in clinical practice has grown. Along with this, the number of point of care ultrasound applications has also grown making this tool more available for bedside clinical practice. However, no clear system of care and training has been developed to 1) standardize the practice for focused ultrasound; 2) define the training needed for a specific competency, and 3) implement measures to maintain the standard of care of a system of practice.

METHODS: A community of practice system for focused ultrasonography was developed integrating undergraduate (UME) and graduate medical education (GME) training with faculty patient care practice at an academic university setting centralized through an Ultrasound Academy. The curriculum begins with longitudinal skills training at the UME level integrated through the four years of preclinical/clinical training through the *Lead. Serve. Inspire.* (LSI) UME curriculum at the Ohio State University College of Medicine. This occurs through 4 years of integrated focused ultrasonography training through didactic teaching, on-line training programs, simulation lab experience with live models, and direct clinical experiences. A course in Advanced Competencies in ultrasonography during the 4th year of UME serves as a transition to GME education by directed specialty specific training in focused ultrasonography. Training continues at the GME level through specialty specific training in focused ultrasonography headed by Learning Communities delineated by key focused ultrasound interests (i.e. Communities in Family Medicine, OBGYN, Critical Care, Emergency Medicine, etc.). These are headed by clinical faculty with specific interest in focused ultrasonography who direct both GME education and departmental training and certification.

RESULTS: Evaluation of this system of practice demonstrates that this integrated approach to focused ultrasound training and certification provides access to educational resources and a clear concept of a standard for the practice of focused ultrasonography. Leadership from developing Learning communities allows for individualized achievement of skills by individuals in the systems at any level of experience. The systems also allows for the evaluation of training needs to achieve specific competencies and methods by which standards of care can be maintained.

CONCLUSIONS: This integrated system of community practice allows practitioners to acquire expertise in focused ultrasonography at any level of training (UME, GME, faculty levels). Furthermore, it sets a clear standard for focused ultrasound practice and builds a framework to evaluate teaching methodology and maintenance of skills for high quality patient care.

THE ULTRASOUND INTEREST GROUP (USIG): INCORPORATING ULTRASOUND EDUCATION AND MENTORSHIP INTO THE MEDICAL STUDENT EXPERIENCE

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INTRODUCTION: With the advent of point-of-care ultrasound as a modality available to physicians for routine patient care, the importance of meaningful exposure to ultrasound in medical education has become paramount. The interest group format in medical schools is commonly used to bring together students passionate about a similar topic; however, these groups typically focus on the first two years and are largely forgotten in the latter two years. Here, we describe a structure for incorporating all medical student years into a framework to foster continued ultrasound education and mentorship.

METHODS: A group of students with faculty advisors formed an Ultrasound Interest Group (USIG). USIG sought interested MS4 students as President and Vice President, chosen at our institution from students in a fourth-year honors ultrasound elective. Additionally, two exceptional MS2's were chosen as secretary and treasurer. Four committees were formed to promote different aspects of ultrasound use in the medical field as well as further the goals of the group: education, research, outreach, and technology. Interested medical students from all four years were invited to apply for leadership positions in these groups, with a fourth-year honors student serving as leader. Finally, all medical students were invited to attend meetings throughout the year offering opportunities to get involved with the committees and ongoing ultrasound projects within the College. In addition to the meetings and committees, the group also served as the central force behind the Ultrasound Challenge skills competition for students.

RESULTS: Over the 2012-13 school year, USIG held four meetings, with an average of 50 members in attendance. The executive board was formed of the President, Vice-president, Secretary and Treasurer, as well as the primary faculty advisor. Each committee had three members and was lead by an Honors Ultrasound elective student. These committees met at least three times throughout the year to address progression towards established goals, and afterwards, the committee leader reported activity to the executive board. Two open scanning sessions were held monthly for ultrasound practice. An ultrasound case of the month was posted to the USIG website 8 times throughout the year. Additionally, USIG aided in the coordination of 17 separate Honors Ultrasound student projects and provided linkages between older and younger interested students.

DISCUSSION: An Ultrasound Interest Group including all four years of medical students with faculty advisors provides an organized home for ultrasound incorporation into medical education, while fostering mentorship throughout the years. This kind of group achieves the goals of providing students with opportunities to achieve technical proficiency in ultrasound, giving and receiving mentorship with other medical students of all years, residents, and faculty, and supporting ongoing research projects in ultrasound for furthering education and technical applications.

CHALLENGES ENCOUNTERED WHILE CREATING A "HOW WE TEACH INFERIOR VENA CAVA (IVC) ULTRASOUND" TEACHING VIDEO

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INTRODUCTION: The use of Computer-Based Video Instruction (CBVI) and other videos of performances (e.g. web-based sources) may provide opportunities for observational learning.[1] Recent studies show that CBVI can be effective for teaching knot tying or suturing. [2,3] We sought to create a teaching video to aid future tutors deliver our "Imaging the Inferior Vena Cava (IVC) to assess for fluid responsiveness" ultrasound station for University of Toronto third year medical students during their Anesthesia simulation day. As our tutors (Anesthesia Clinical Fellows) rotate on an annual basis, we sought to create a learning resource to facilitate our new tutors during the changeover period. We developed this station in September 2012 as a pilot project in preparation for the introduction of an integrated ultrasound curriculum (iUSC) at the University of Toronto in September 2013.

METHODS:

After obtaining tutor and student consent, one of our simulation centre coordinators recorded three complete teaching sessions with a Canon Vixia HFR300® camcorder on a tripod stand. As the sessions were 15 – 20 minutes in length and concerned learning hands on ultrasound probe skills we did not have a script, however, we did write up an outline of the proposed "station flow" in advance. Our tutor had already taught during 3 previous Anesthesia simulation days.

RESULTS:

A 1.4GB 17 minute long teaching video was created after the final editing process. We encountered 2 main challenges:

1. **Verification and editing of content:** We had a content expert (experienced clinician) check our content. This led to 2 more edits by recently qualified film school graduate. Each small edit involved a rendering process and took 2 days to complete. We used PowerPoint© slides to cover any additional teaching points not mentioned during the video.
2. **File sharing:** Due to the size of the initial file (12 GB) we compressed it in order to share it among our group. The length proved problematic, however, as my YouTube accounts only allow 15 minute uploads and if there is any copyrighted material on the video (e.g. background music) it will prevent upload. Sharefile® offers a free trial of video sharing for 30 days. It allowed us to successfully upload our video over a period of 7 hours and provided phone and e-mail customer support during this process at no extra charge. It allows download of the video via an e-mail link that takes an average time of 10 minutes.

CONCLUSIONS:

This process took 3 weeks due to the editing and file sharing challenges we encountered and our only cost was the cost of the professional video editing services. If we are to facilitate learning through enhanced CBVI activities and collaborative learning environments, we believe this information about challenges overcome while creating our teaching video will prove useful to other medical educators in the field.

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PELVIC ULTRASOUND IN MEDICAL EDUCATION: A COMMUNITY OF PRACTICE

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INTRODUCTION: The creation of the new Lead. Serve. Inspire. curriculum at The Ohio State University College of Medicine (OSUCOM) was an opportunity to address ultrasound training in undergraduate medical education (UME). UME training in pelvic ultrasound has yet to be maximized, despite evidence that sensitivity is improved by trainees' repeated exposure to the modality[1]. Fourth year students in an advanced ultrasound training elective had the unique opportunity to shape the education of their successors and lay the foundation for a Community of Practice (CoP) concept during the 2012-2013 academic year.

METHODS: A CoP was created to unite practitioners across levels of training interested in pelvic ultrasound education. First the needs for such education were catalogued. Faculty was surveyed to determine ultrasound procedures all interns should be familiar with. Fourth year medical students reported what they were interested in learning. Learning objectives were developed for the preclinical curriculum.

Resources available to address these needs included a dedicated ultrasound lab, transvaginal ultrasound phantom models, live pregnant models, and senior residents and faculty interested in furthering ultrasound training.

Educational materials were developed to address these needs with available resources. The resulting projects were coordinated to expand the program in the upcoming 2013-2014 academic year.

RESULTS: The initial CoP was formed with five fourth-year medical students interested in obstetrics and gynecology and one faculty advisor and continues to develop this year with four senior students.

Skills critical for interns to develop, including obtaining quality sonographic images, Amniotic Fluid Index, and fetal presentation, were identified by faculty. Fourth year students expressed interest in increased hands-on practice on live patients and simulators. A one-day internship crash course was created for graduating students.

An interactive online module was developed to bring ultrasound into the pre-clinical Reproduction block. A second module was created for integration into the clinical obstetrics and gynecology rotation.

An iPad application was designed with labeled ultrasound images and submitted to the Apple iTunes store.

CONCLUSIONS: With the restructured curriculum at OSUCOM, an opportunity was present to incorporate pelvic ultrasound training at all levels of medical education. The CoP concept is a viable way of coordinating these efforts across students, residents, and faculty. Ultrasound learning opportunities for medical students were dramatically expanded, and it is the goal of the CoP's current senior students to fully utilize the skills of faculty and residents. The value of the CoP approach also includes the augmentation of leadership abilities and an active role shaping the curriculum of the future.

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INTEGRATION OF ULTRASOUND WITHIN THE DEPARTMENT OF INTERNAL MEDICINE THROUGH A LOCAL COMMUNITY OF PRACTICE INITIATIVE

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INTRODUCTION: Ultrasound (US) has been traditionally integrated among the various subspecialties of Internal Medicine (IM), but is still not consistently taught during residency training. With the advent of point of care US (POCUS) the paradigm has shifted and placed this US tool in the hands of the clinician. Using the concept of a community of practice (COP) to administratively match needs with resources, an IM US COP was created at The Ohio State University. The goal was to advance academic ultrasound initiatives within the IM community focusing on clinical patient experiences, education, research, and administrative program development.

METHODS: The construct of a community of practice was created which included student members, residents, and faculty members which included an ultrasound expert within the institution. Goals and objectives were developed after querying all members and prioritizing the challenges in implementing such a program. Regular meetings were arranged after gaining support from the chair, division leaders and key program directors. Roles and responsibilities were created for the faculty leader and faculty champions/mentors that work with interested residents and medical students on various clinical, educational and research topics. In order to increase the use, accessibility, and knowledge of clinician performed focused US within the spectrum of the IM department throughout the Medical Center, the first year was dedicated to developing the bylaws, governance and mission of this administrative group.

RESULTS: The inaugural IM COP at OSU consisted of a faculty leader, several faculty champions, 3 chief residents, 2 IM residents, and 4 medical students entering into the IM field. Concurrent development of basic and advanced US competencies across UME (Undergraduate Medical Education) and GME (Graduate Medical Education) was the framework for the educational mission of the IM US COP. The group convened several times as a whole and established IM COP bylaws and agenda items for the year. These included refinement of vascular access training, the creation of a paracentesis training protocol, coordination of an intern procedural course, ultrasound experiences in the ICU and a series of proposed core and enriched ultrasound experiences. The paracentesis protocol was operationalized administratively to decrease the inefficiency and patient risk of technologist sonographic marking. A framework was established for medical student involvement in US at various levels to promote early exposure to IM US in the medical school curriculum. This list of core and enriched competencies to increase direct ultrasound use in clinical situations by IM residents, fellows and attendings was felt to be the foundation from which to build the entire COP agenda.

CONCLUSIONS: This administrative concept of a community of practice is a novel and feasible method for harnessing local academic interest in ultrasound across the educational spectrum. The goal to pave and improve the path for ultrasound integration within the field of IM was facilitated with central communication between members of this group. To date, the cultural impact of this local COP has helped to realize concrete educational and administrative goals and will continue this momentum during the upcoming academic year. Challenges going forward include changing roles and responsibilities within the IM US COP as academic progression and attrition occurs at the beginning of each year. The IM US COP is a feasible construct to match needs with resources in promoting an ultrasound agenda within Internal Medicine. As ultrasound still remains nascent amidst the residency infrastructure of IM, future goals could include those efforts that could be scaled to other medical centers/IM departments and improve the safety and care for our patients.

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INTEGRATION OF ULTRASOUND IN THE GROSS ANATOMY CURRICULUM: STUDENTS' REFLECTION ON EXPERIENTIAL LEARNING IN A PHILIPPINE MEDICAL SCHOOL

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INTRODUCTION: The use of the ultrasound as a point of care non-invasive imaging modality in various clinical specialties is emerging. Its use as an educational tool to enhance learning in the basic sciences however, is a relatively new undertaking in some medical schools. In the Philippines, the University of Santo Tomas Faculty of Medicine and Surgery pioneered the integration of the ultrasound in the Gross Anatomy curriculum in 2011.

OBJECTIVE: Anchored on Kolb's Experiential Learning, this phenomenographical study was undertaken to explore the medical students' thoughts, experiences, beliefs and feelings about the integration of ultrasound in the Gross Anatomy curriculum.

METHODS: A Critical Incident Questionnaire was deployed through the Blackboard LMS to encourage student reflections of their learning experience.

FINDINGS AND DISCUSSION: Two hundred ninety three students accomplished the survey and their reflections were clustered on the following themes: novelty and modality typifies the awe and engagement that they experienced at using a new technology in expanding their knowledge of Gross Anatomy; visibility and dimensionality typifies how their experience with the ultrasound enabled them to explore deep anatomical structures and how the different structures are related to each other in-situ; facility and interactivity typifies the ease with which they were able to acquire the technical skills through hands-on scanning among themselves; practicality and connectivity typifies how the ultrasound allowed them to extend the knowledge they gained in the cadaver dissections and their realization at how they can use this knowledge in understanding future subjects.

CONCLUSION: Integration of the ultrasound in the Gross Anatomy curriculum provided the students with an introduction to the utility of the ultrasound in visualizing deep anatomical structures in-situ, as well as, allowed them the hands-on experience in technical imaging skills. Reflections enabled the students to relate the new material of learning to prior knowledge and hence a better understanding of Gross Anatomy and enhanced the students' meta-cognitive awareness.

HAND-HELD ULTRASONOGRAPHY TO ASSESS EXTERNAL CHEST COMPRESSIONS ON A FRESH CADAVER

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DETAIL: Between 370,000 and 750,000 in-hospital resuscitation attempts are made in the United States each year.[i] The 2010 International Consensus Conference on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations placed greater importance on chest compressions when changing the sequence of actions to CAB (compressions, airway, breathing).[ii] Current parameters for evaluating compressions give at best an estimate of effectiveness but none can demonstrate in real time blood being compressed out of the left ventricle. Transesophageal echocardiography has been used to assess chamber compression during CPR.[iii] However, it is an invasive procedure which is time consuming and impractical to routinely use during CPR. We sought to addresses the potential use of a hand-held ultrasound device during CPR to assess the effectiveness of chest compressions.

We felt it best to first determine the ability of hand-held ultrasound to assess the effectiveness of chest compression on a cadaver. Using a GE Vscan hand-held ultrasound device we observed the cardiac chambers during external chest compressions on fresh unembalmed cadavers. The accompanying video demonstrates an apical 4 chamber view of the cadaver heart obtained during external chest compressions (Video). The subject was an 89-year-old female with a medium body habitus and time of death being 14.5 h prior to investigation. **C**hest compressions were performed at the standard location from the right side of the cadaver. An apical four chamber echocardiographic images were obtained simultaneously from the left side of the cadaver. There is change in position and configuration of the walls of the right ventricle and left ventricle with marked reduction in chamber size during the compressive phase of CPR. This indicates compression of these cardiac chambers and was observed without interfering with the individual performing chest compressions.

Several factors influenced the ability to obtain a good image demonstrating effective chest compression including: prolonged arrest of the heart leading to coagulation of blood within the heart, decreased compliance of the heart, and less identifiable landmarks due to complete loss of cardiac motion. It is likely that the effects of chest compression would be even more pronounced in acute cardiac arrest victims since the chest and cardiac walls would presumably be more compliant than those of a cadaver. Direct observation of compression of the heart chambers with ultrasound during CPR would allow accurate real-time assessment of the efficacy of the external compressions. Although further study needs to be conducted to determine the best imaging protocol and document the correlation between what is observed on sonography and true perfusion, handheld ultrasound use should be considered during CPR to provide real-time visual assessment of the adequacy of chest compressions. This feedback would permit adjustments to be made during CPR to improve chest compression quality.

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QUALITY IMPROVEMENT NOMENCLATURE FOR FOCUSED ULTRASOUND IN THE EMERGENCY DEPARTMENT FOR IMPROVED DOCUMENTATION PRACTICES

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OBJECTIVES: Focused ultrasonography is a developing field that has significant financial requirements. Medicare and the American College of Physicians have developed specific requirements of image retention and physician interpretation of findings for reimbursement. Lost revenue in emergency ultrasound programs was evaluated and a novel nomenclature to discriminate causes for lost revenue was created. The objective of the study was to develop a nomenclature to codify and discriminate causes for lost potential revenue.

METHODS: A nomenclature was developed and applied to a single institution's entire focused ultrasound records for a 3 month period. All focused ultrasound examinations were categorized as either true, blind, illiterate, or phantom scans. Using current Medicare reimbursement models, a brief fiscal analysis was performed to determine the potential revenue for all ultrasound examinations and the lost potential revenue for the program over the study period.

RESULTS: True ultrasound examinations represented approximately 80.4% of all focused exams performed over the study period. The total actual revenue over the study period was estimated to be $10,825.20 with an estimated $2,817.85 in lost potential revenue due to illiterate and blind examinations. Illiterate and blind ultrasound examinations had a high variability when stratified by CPT code with abdominal examinations representing the highest lost potential revenue.

CONCLUSIONS: Application of the novel nomenclature was able to discriminate the etiology of lost potential revenue in an emergency ultrasound program. Future applications and evaluations of the nomenclature may aid in quality improvement programs designed to improve financial viability of focused ultrasound in the Emergency Department.

EMERGENCY ULTRASOUND PRECEPTORSHIP AS A MODEL FOR CONTINUING MEDICAL EDUCATION

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DETAIL:

The American College of Emergency Physicians (ACEP) developed its first position statement regarding the use of ultrasound by emergency physicians in 1990. Emergency ultrasound (EUS) has developed significantly since that time and is now one of the twenty-three competencies for graduating emergency medicine residents. However, many emergency physicians trained before the ACEP position statement did not have the level of ultrasound training of today's graduates.

Introductory ultrasound education for community emergency physicians without US training in residency is mainly accomplished today by means of 1-2 day courses with hands-on skills stations. Although a generally convenient option, this method of instruction does not provide for future supervised ultrasound training. In addition, for hospital ultrasound credentialing, many departments require multiple proctored exams, which can be challenging in the non-academic setting.

We have developed an ultrasound preceptorship as an option for continuing medical education in emergency ultrasound. This preceptorship can be designated as category II CME. Community physicians in the Carolinas Healthcare System have the option of participating in the ultrasound preceptorship. Requirements include participation in a prior ACEP-based emergency ultrasound course. The student will then rotate in two eight-hour shifts in an 110,000 patient per year emergency department in a level I trauma center. During this time, the student will have one-on-one instruction in a variety of ultrasound applications on real patients.

This ultrasound preceptorship will allow current emergency physicians who graduated prior to the introduction of ultrasound as a core competency in residency the opportunity to learn and perform multiple exams in a real environment on a variety of patients. The ultrasound exams performed during this preceptorship will also count towards credentialing purposes.

Ultrasound education should be seen as a multilevel process from undergraduate through post-graduate training, with programs focused on the needs of the providers. This preceptorship adds to the multidimensional efforts of ultrasound education at the community, post-graduate level.

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USING TWITTER TO DELIVER A QUESTION AND ANSWER CURRICULUM IN MEDICAL EDUCATION

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INTRODUCTION: Today's learners have progressively embraced more technology as learning tools have advanced past traditional forms from the twentieth century to include podcasts, e-books, and web-based applications. Social software is emerging as an important way students can obtain educational material. While there is ample recent literature about the uses of blogs, podcasts, and wikis in medical education, there is less on the use of "push technology" via modalities such as Twitter as a medical education modality. This technology can allow educators to send facts and updates to their students and can potentially aid educational missions. Our objective was to demonstrate a novel curriculum using "push technology" via Twitter to deliver educational questions to mobile devices and then answers as a method to provide daily "flash cards" of ultrasound education.

METHODS: A curriculum consisting of high-yield ultrasound concepts was developed and posted to a Twitter page every morning at 9am EST beginning on July 1st, 2012. Answers were posted at 5pm EST. This was continued through April 13, 2013. Per Twitter guidelines, each post or "tweet" was limited to 140-characters. Followers who signed up to the service received instant notifications "pushed" directly to their mobile devices following the posting of a new tweet. The ultrasound curriculum was divided into monthly categories covering essential ultrasound topics such as trauma, cardiac, critical care, and first-trimester OBGYN scanning designed to mirror an honors ultrasound curriculum at The Ohio State University College of Medicine. The questions were supplemented by normal and pathological images as well as hyperlinks to helpful online resources. To facilitate timely posting of the tweets, a web service called Twuffer was used to schedule automated posting of tweets to the page. In addition, the web service bit.ly was used to shorten hyperlinks to fit within the tweet character limit. Finally, an image hosting service TwitPic was used to store the images to supplement the curriculum.

RESULTS: Daily "tweets" were posted each morning beginning on July 1, 2012. By the April 13, 2013 date, there were 438 followers on Twitter with a total of 493 question and answer tweets.

CONCLUSIONS: Due to its ease of use and widespread applicability, Twitter is an excellent application of "push" technology as a means to deliver educational content. This pilot project utilizing an ultrasound curriculum has demonstrated the potential of Twitter to posit questions and enhance traditional educational methods by providing answers to daily questions.

THE RURAL OBSTETRICAL ULTRASOUND TRIAGE EXAM (ROUTE): TEACHING OBSTETRICAL ULTRASOUND TO MEDICAL STUDENTS INTERESTED IN INTERNATIONAL APPLICATIONS

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INTRODUCTION: The Rural Obstetrical Ultrasound Triage Exam (ROUTE) was developed in an attempt 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. While the routine use of obstetrical ultrasound without a specific clinical indication is not currently the recommended standard of care for all obstetrical patients by our governing bodies (ACR, ACOG, AIUM, and SRU), its application can potentially have a profound effect on maternal and neonatal morbidity and mortality in settings where antenatal care is scarce. It is the purpose of our pilot study to determine if students are first capable of performing all of the various scans required of our ROUTE while defining such an exam for use in future studies. The students included in this study plan to travel to rural Panama to teach the ROUTE algorithm to mid-wives as a means of screening for high-risk obstetrical patients.

METHODS: Medical students with ranging levels of ultrasound training received a 60-minute presentation on the ROUTE, followed by two-to-five 30-minute hands-on sessions with a standardized subject, and an average of 10 hours practicing the ROUTE algorithm on patients in an obstetrics clinic with an obstetrician. The students then completed 2-10 ROUTE exams on obstetrical patients whom they were blinded to. All images were read in real-time by certified obstetrical ultrasound technicians or obstetricians to check for accuracy.

RESULTS: Following the didactic sessions, the students were able to properly assess all elements of the ROUTE exam on 85.7% of the standardized patients (n=42). They were additionally able to measure crown-rump length (CRL), biparietal diameter (BPD), amniotic fluid index (AFI), placental location, and fetal presentation accurately in comparison to certified ultrasound technicians who served as controls. Seven out of eight crown-rump lengths and thirty of thirty-two biparietal diameters had less than 6% error of that measured by controls, and six out of six amniotic fluid indexes obtained were within 16% error of that obtained by the sonographers. Additionally, the students correctly assessed placental location and fetal presentation correctly 95.2% (n=21) and 100% (n=11) of the time, respectively.

CONCLUSION: This feasibility study found that medical students were able to successfully learn the ROUTE exam following approximately 12 hours of didactic and hands-on training. With this evidence to support its feasibility, the students plan to travel to Panama where they will attempt to partner with physicians to teach obstetrical ultrasound to medical workers with the American Red Cross and Parteras (midwives). Future studies hope to learn how effective obstetrical ultrasound can be taught to non-obstetrician, non-radiologist medical workers in Panama, and how ultrasound might affect maternal and neonatal morbidity and mortality in rural low-resource areas.

CHALLENGES IN FACILITATING AN ULTRASOUND TRAINING PROGRAM IN A CROSS-CULTURAL, RESOURCE-LIMITED SETTING: ANECDOTAL REFLECTIONS FROM NAKURU, KENYA

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DETAIL: Obstetric ultrasound is the standard of care in developed economies, yet remains underutilized in many low- and middle-income countries (LMIC). This technology is an important tool for combating high levels of maternal mortality, the leading cause of death in women of childbearing age in LMIC. Even with donated ultrasound machinery, training and implementation in resource-limited settings is fraught with barriers. An ultrasound education program intended to launch the first obstetric ultrasound service in a mid-size Maternity Center Nakuru, Kenya experienced logistical, financial, and cultural challenges.

The training of nine students from various health facilities in this city of almost two million people consisted of interactive, didactic classroom teaching as well as practical, hands-on learning. Intermittent loss of the power supply running the ultrasound and lecture slides created unexpected delays in the education effort. No ultrasound textbooks were available and the potential for continued education was also limited by inconsistent Internet access. Moreover, the majority of trainees returned to facilities without an ultrasound machine but in hopes of acquiring one, which could take months or years. The lack of continual scanning practice immediately post-training raises concerns regarding the retention of knowledge and skills obtained during the course.

Cost is an ever-present barrier in LMIC. This weeklong education workshop cost $800 to facilitate, including accommodating trainers from out of town, yet this expense was beyond the host facility's ability and had to be fundraised. It was even difficult for the clinic to pay locum for two replacement nurses while their staff participated in the program (~$10 per nurse per day). Post workshop, there was no money in the Maternity Center's budget to advertise for this new service, forcing reliance on information dissemination via word of mouth.

Cultural nuances will also likely be long term barriers to implementation of technologic advances. In the fourth largest city in Kenya, there is no expectation of scheduled appointments for medical visits. During the training workshop, there was daily uncertainty as to whether there would be sufficient patients at the right times for students' hands-on scanning practice. As in many countries, patients desired to know fetal sex, but gender identification was not included in the curriculum in deference to possible effects in a society with preference towards males. More difficult to traverse was patients' tendency to overestimate the diagnostic power of ultrasound and its prenatal therapeutic possibilities, creating dissatisfaction with the clinical visit. Additionally, certain ethnic groups in Kenya consider it inappropriate to "see" inside a pregnant mother or visualize an unborn fetus; though this was not a significant concern in this urban setting, it is an important belief to be aware of. Sharing success and challenges of cross-cultural education is necessary for refining efforts in similar future endeavors.

INTEGRATING ULTRASOUND EDUCATION AND RESOURCES IN ORDER TO BRING ULTRASOUND INTERNATIONALLY FOR LONG-TERM DEVELOPMENT (BUILD)

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OBJECTIVE: Bringing Ultrasound Internationally for Long-term Development (BUILD) is aimed at providing an integrated curriculum on ultrasound imaging modalities to medical students interested in pursuing international medical electives during their fourth year of medical school. The BUILD project creates a sustainable educational infrastructure that equips students to both utilize ultrasound imaging on global health electives, and ultimately train local physicians in ultrasound imaging and application.

METHODS: The BUILD program has been implemented by medical students at The Ohio State University College of Medicine. Training will continue during the year prior to international trips and will be coordinated via the International Medicine Ultrasound Liaison (IMUL) associated with the OSUCOM Ultrasound Academy. Initial training will consist of electronic lecture modules and will focus on high-yield scans in the areas of basic physics and image acquisition, obstetrics, cardiac, hepatobiliary, renal, vascular, MSK, and procedural ultrasound. Upon completion of prerequisite modules and associated quizzes for each topic, the IMUL will coordinate multiple hands-on sessions using trained proctors including a final comprehensive hands-on practicum for students. Successful completion of essential material results in allocation of portable ultrasound machine (Sonosite Sonoheart with curvilinear probe, or Sonocite I Look handheld device with microconvex probe) for international use. Prior to leaving for global health electives, students receive instruction on machine care, completion of pre-scan/post-scan diagnoses and dispositions, and are given a local needs assessment survey to be completed by local physicians to facilitate long-term development and education of local physicians. Needs assessment surveys will be compiled and the information provided will be used to develop appropriate learning resources for local physicians, with the long-term goal of providing sustainable ultrasound education to local healthcare practitioners with significant teaching contributions from internationally rotating fourth year medical students.

RESULTS: Successful pilot missions have allowed development of this full curriculum. The BUILD program is currently in process of being implemented more fully at OSUCOM. Several global health trips with targeted departures in early 2014 will receive abbreviated ultrasound training and will be used to confirm critical aspects of the curriculum and provide feedback on ultrasound application in international settings.

CONCLUSION: Ultrasound is increasingly used during international mission trips by medical students without a standardized method of training. Utilizing resources currently set in place for students at OSUCOM, this project will implement guidelines and curriculum to standardize ultrasound training for use internationally. Maximizing student training in focused ultrasound and international service will equip students to help provide ultrasound education to local healthcare providers at international sites.

INVESTIGATION OF THE SLIDING LUNG SIGN ON EMBALMED CADAVERIC TISSUE: A TEACHING METHOD FOR HEALTHCARE STUDENTS

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INTRODUCTION: The sliding lung sign (SLS) is used to confirm proper endotracheal tube (ETT) placement after intubation, and to rule out a pneumothorax (PTX) in a critically injured patient. This sign is visualized as an ultrasound (US) transducer is placed classically on the second intercostal space of the mid-clavicular line of the anterior thoracic wall to observe the “sliding” of parietal and visceral pleura during respiration. Rantanen presented this method in 1986 while assessing equine pneumothoraces, then Werneck in 1987 described the US appearance of the pleura on humans, and Lichtenstein coined the term “sliding lung” in his 1995 study. The objective of this study was to investigate if the SLS could be revealed on embalmed cadaveric tissue for use of ETT placement training.

METHODS: A literature search was conducted on contemporary anatomical and ultrasound texts and journals, regarding the SLS on embalmed cadaveric tissue. Intubation was found by experimentation to be most successful using a size 4 miller blade. An ambu bag was used to inflate the lungs, and a Sonosite M-Turbo US machine using an HFL50X transducer was placed at the second, fourth, and sixth intercostal spaces of the anterior wall to visualize the SLS.

RESULTS: Literature research revealed no known articles regarding SLS using embalmed human cadaveric tissue. However, a large number of articles existed on the SLS in human and animal models that were not embalmed. Following intubation, the SLS was visualized using both 2D and M-Mode views. This indicates proper ETT placement and ruled out a PTX in the area.

DISCUSSION: Airway management by properly intubating with an ETT, and correctly assessing for a PTX are both critical skills. Providing students outside of an emergency setting without risking the life of a patient will be incredibly beneficial to their future career. Occasionally, the SLS was not seen at the second intercostal space, but the sixth intercostal space at the anterior axillary line was an ideal location.

CONCLUSION: This pilot study demonstrates that it is possible to visualize the SLS on embalmed cadaveric tissue. Visualization of the SLS confirms proper ETT placement after intubation and the absence of a PTX in that area. Practicing these procedures on an embalmed cadaver enables the healthcare student to learn life saving skills early on in their education.

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INCOMING FIRST YEAR MEDICAL STUDENTS' PERCEPTION OF ULTRASOUND IN MEDICAL EDUCATION

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BACKGROUND: Ultrasound has been used gradually and widely in medical education for the past several years. The use of ultrasound is a required competency of many residency training programs, and has been shown to improve patient care. Given the interest in and need for education in ultrasound, a number of medical schools have recently developed ultrasound curricula[1]. However, there is little information on medical student perception of ultrasound in medical education in medical school. We sought to determine the general perception of incoming medical students on the need for ultrasound in medical education.

METHODS: We conducted a cross sectional study comparing medical students' perception of ultrasound education. To assess perception, we created a six item survey and administered this prior to an ultrasound demonstration, and used descriptive statistics to analyze the results. All matriculating medical students attending orientation at Texas Tech University Health Sciences Center School of Medicine were invited to participate and received informed consent.

RESULTS: Of the 154 students, 105 students (68.1%) participated in the survey. Prior to medical school, most students (76.2%) had not utilized ultrasound. In regard to student perception of ultrasound in medical education, 73.3% surveyed answered 'it is an educational tool to be used in all areas of medical education', 22.9% felt 'it is an educational tool to be utilized in a clinical setting' while 3.8% felt 'it is an educational tool to be utilized for anatomy and physiology'. Twenty nine students surveyed (27.6%) felt >50% of medical schools have an integrated ultrasound program. Of 25 listed clinical specialties, students felt the top 5 specialties that utilized ultrasound were: Cardiology (88.6%), Gastroenterology (85.7%), Obstetrics and Gynecology (81.9%), Surgery (78.1%), and Urology (74.3%). Only 66.7% of students surveyed believed Radiology utilized ultrasound, and 14.3% believed ultrasound increases radiation exposure to examinees.

CONCLUSION: The majority of medical students surveyed believe ultrasound is an educational tool to be utilized in all areas of medical education, but the majority of students were not aware that ultrasound in undergraduate medical education was not widely implemented. Some students did not realize that ultrasound does not use radiation.

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CURRICULUM MODULE SELECTION FOR ULTRASOUND TRAINING IN GROSS ANATOMY

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DETAIL: The portability and cost-effectiveness of ultrasound makes it an ideal learning tool to supplement traditional methods employed in Gross Anatomy curricula. The introduction of ultrasound anatomy modules into the first year of medical school facilitates the transition between the didactic anatomy course and clinical applications. Studies have shown that the basic operation and interpretation of ultrasound can be effectively taught to medical students, using short instructive sessions and hands-on training.

Currently, there is not a consensus on the content of Ultrasound-Applied Anatomy Training (USAAT) for medical students. We sought to identify the high-yield anatomical topics that are the most clincally relevant and feasible for ultrasound guided teaching in Gross Anatomy courses taught to first year medical students.

This study uses a modified Delphi Survey Method and a quantitative scoring system to prioritize the high yield training modules incorporated in Gross Anatomy curriculum. The Focus Group compiled a list of structures that had the capacity to be detected by ultrasound, given the physical properties of the ultrasound waves and the composition of the anatomical structures. These structures were selected from the Clinical Anatomy curriculum adapted from the Medical Sciences Division at the University of Oxford, in conjunction with the Clinical Anatomy Curriculum generated by the Educational Affairs Committee of the American Association of Clinical Anatomists. This qualitative data was used to inform the First Round of the Delphi survey, which was administered to GW ED physicians that incorporate ultrasound in their clinical practice. These participants were asked to “include” or “exclude” each structure from consideration for the curriculum based on whether or not it can be detected by ultrasound. The results informed the Second Round Survey, a national survey generated to develop a subcohort analysis, evaluating each structure on an ordinal scale (1-10) in 3 constructs: educational yield, technical feasibility, and clinical relevance. Second Round participants included faculty of the 2nd World Congress on Ultrasound in Medical Education, and academic educators identified on PubMed.

The Focus Group generated a list of 1460 structures, which was narrowed down to 312 structures by the First Round Survey (Head and Neck-34, Eye-13, Thorax-39, Abdomen and Back-80, Pelvis and Perineum-24, Upper Extremites-81, Lower Extremities-41). Second Round Survey is pending in the data collection phase.

The results of this study can be used to identify and implement the high-yield educational topics as ultrasound curriculum modules in Gross Anatomy training.

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SONOGRAPHICALLY-ENHANCED ANATOMY TEACHING IN MARIBOR FACULTY OF MEDICINE, SLOVENIA

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Introduction: High-quality anatomy-teaching is one of core requirements in the preclinical period of physician's education. Our department of anatomy will phase-out anatomy classes on corpses and move towards using multimodality electronic anatomy desk-screens. In line with these developments, we have decided to augment anatomy classes with hands-on ultrasound examinations of the regions discussed.

Programme: Out of 22 hands-on anatomy sessions, we identified 14 sessions, where we will directly supplement existing teaching pattern with sonographic presentation. All hands-on sessions follow generic pattern, where students must attend sessions prepared from previous lectures and concepts there discussed. Session begins with short repetition by assistant, based on 2D anatomical atlas. This is then augmented with 3D atlas virtual-corpse dissection. At these stage of enhanced 3D understanding, key concepts are drawn by students by hand. Novel sonographic integration then begins, first with identifying relevant anatomy superficially on volunteer model/student. Students are expected to mark position and orientation of the relevant organ as concisely as possible, as well as its relation to other structures. Finally, ultrasound probe is applied and then students themselves are expected to correctly locate the organ and identify its structure.

Sonographically augmented sessions and their respective content are:

Thorax: we discus layers of thoracic wall, clinically in context of thoracostomy. We visualize heart from four standard projections and its respective structures/chambers. Special emphasis is given on orientation.

Abdomen: during several sessions, we visualize solid organs, their topography, relations and specific internal structure: liver, gallbladder and it's respective ducts. Inferior Vena Cava, spleen, kidneys and potential spaces are discussed. We visualize pancreas, abdominal aorta and superior mesenteric artery. In separate session, anatomy and topography of female genital organs is shown. We discuss importance of visualizing aortic aneurysm, free peritoneal fluid, hydronephrosis and gallbladder pathology.

In lower limb, topography of femoral triangle and popliteal fossa is sonographically explored and clinical relevance sought in DVT identification, establishing IV and IA access and nerve blockade.

Sonographic exploration of neck includes identification of major vessels, muscles, trachea, esophagus and thyroid. Its clinical relevance is highlighted by need for surgical airway establishment, jugular IV access and thyroid anatomy.

We expect, that sonographically enhanced anatomy hands-on sessions will enable students to better solidify anatomic concepts of topography and structure, and to emphasize direct clinical applications of anatomy knowledge.

INTRODUCTION OF WINFOCUS ULTRASOUND LIFE SUPPORT PILOT MENTORING PROGRAMME IN SLOVENIA

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Detail: With advent of small, portable US machines, but especially with refinement of appropriate concepts, era of *Point-of-care-ultrasound* (POCUS) has begun.

With substantial help from WINFOCUS organization, there were nine WINFOCUS Ultrasound Life Support Basic Level 1 (USLS BL1) courses conducted in Slovenia since 2009.

Such two-day courses are aimed at clinicians, sonographic novices, and present basics of US technology, review of regional sonographic findings and culminate in sonographic approach to key critical presentations; sonographically-enhanced approach to patient in cardiac arrest, shock, respiratory failure, trauma, etc.

After the course, candidates return to their clinical environments, where they are expected to refine, upgrade and most importantly, learn to correctly incorporate their newly-acquired knowledge - which is actually very hard. As in every skill, continuity of (correct) practice is the key to success!

We have decided to include 7 core regions/applications: AAA, DVT, lung, heart (with IVC), hydronephrosis, gallbladder and FAST exam.

Probably most important aim of mentoring programme is teaching candidates how to correctly incorporate POCUS exam into overall clinical evaluation of a given patient.

To this end, we have written a LogBook, that apart from sonographic findings, entails anonimized patient data, ***reason*** and ***focused clinical question*** for POCUS exam. Second part of logbook demands results from other diagnostic tests and finally how all collected data were synthesized into clinical decision. Before concluding the case, student is asked to reflect on how POCUS exam has (not) changed clinical decision-making.

With help from WINFOCUS, we have also incorporated into the logbook a unique way of reasoning that candidate has to exhibit, while interpreting sonographic findings. Instead of putting down final sonographic diagnosis, candidate needs to progressively analyze and incorporate gathered data in stages; In first stage describing *raw* sonographic pattern visible on the screen (eg. in right upper quadrant: "*ill-defined hypoechogenic area between isoechogenic structures*"), then interpreting its patho-anatomic substrate ("free fluid in Morrison's pouch") and in final stage incorporating these sonographic interpretation in wider clinical context, based on previous assessment of pre-test probability and appropriate clinical question - in context of blunt abdominal trauma, free fluid in Morrison's space is most probably blood.

After successful completion of all 250 exams, candidate will take a final test consisting of MCQs and live demonstration, thus attaining title of WINFOCUS USLS BL1 provider (1).

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SONOGRAPHICALLY-ENHANCED ABDOMINAL PROPEDEUTIC CLASSES IN MEDICAL SCHOOL MARIBOR - AND WHY *LAENNEC*, FOUNDER OF FONENDO-SCOPE, WAS A TRUE VISIONARY!

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Detail: Ultrasound (US) has become essential tool in clinician's arnamentarium (1). Clasical clinical propedeutic exam is time-honoured traditional skill that every student must master early on. Yet it is clear, that utility of unaided clinical exam, especially conducted by a novice, is often unsatisfactory.

To enhance conceptual understanding of basic preclinical knowledge and to improve propedeutic skills, we have decided to incorporate basic propedeutic US of abdominal cavity, as part of propedeutics curriculum in 3rd year of Medical School in Maribor.

Students first learn propedeutic US examination on a commercial phantom (Ultrasound Examination Training Model "*ABDFAN*"), gaining basic skills and knowledge, moving to examining each other and by the end of the year, examining real patient.

For first OSCE, we use commercial sonographic-phantom and portable US machine. Emphasis is given on topography and spatial relationship of organs. Normal findings are emphasized first, but then abnormal findings are presented as well, to entice them into clinical reasoning. After understanding basic concepts of US use, image generation, orientation, probe positioning and "gaining feeling", students examine each other. After gaining enough confidence in propedeutic sonography, later in sessions, students conduct propedeutic sonographic abdominal exams on real patient. For this, students are given very thorough protocol, starting with appropriate courtesy and introduction disinfection, proper explanation of sonographic exam to the patient, seeking consent, positioning and only then actually performing a sonographic exam.

Students are evaluated in terms of exam performance and overall understanding and integration of gathered informations.

Reasons we start with teaching on artificial phantom are many: scanning conditions for a novice shall be as optimal as possible, with as little artefacts as possible, and controlled content of the model allows this. Secondly, performance on the realistic phantom allows student to gain feeling for the probe, its positioning, grip, movement and sono-orientation on the body and thus better prepares for actual clinical use of US.

Leannec is credited as inventor of stetho-phonendo-scope. Greek root of "*phonendo*" means to "*see with sound*". Although not literally possible in His time, future widespread use of portable US machines will truly make this possible. And prove Laennec and his vision correct.

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INCORPORATION OF FOCUSED CARDIAC ULTRASOUND SKILLS TRAINING AS PART OF THE BASIC CARDIAC ANATOMY AND PHYSIOLOGY CURRICULUM FOR MEDICAL STUDENTS

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Introduction: Focused ultrasonography and its applications are quickly becoming prevalent in all clinical settings. Due to this, it is critical for medical professionals to gain early exposure to better incorporate these skills into medical practice. Ultrasound instruction at the undergraduate medical education (UME) level is in its infancy with little data describing its integration into UME curricula. Training during the preclinical years of medical school may provide students with basic technical skills and assist with integration of complicated concepts of anatomy and physiology.

Methods: A focused cardiac ultrasound curriculum was developed at an academic medical center for preclinical medical students. Curriculum was designed for first-year medical students and occurred as part of their core cardiology lecture series. The focused ultrasound curriculum included a one hour didactic lecture followed by a skills lab with directly supervised ultrasound scanning time. Instruction detailing the subxiphoid, parasternal long and short axis, and apical four-chamber views of the heart as well as visualization of the aorta, celiac trunk, superior mesentaric artery, and aortic bifurcation. The skills session was then proctored by senior medical students experienced with ultrasound to allow students to obtain the views described in the didactic. Following the session, students were given a voluntary feedback survey concerning the new curriculum which included questions on curriculum effectiveness (ranging from strongly disagree to strongly agree) and free form comments.

Results: Thirty-nine students completed feedback surveys with 99% of responses with positive perspectives. Students strongly agreed that the material presented was relevant to the coursework (72%) and the ultrasound experience was an effective learning adjunct (69%). Furthermore, students reported a better understanding of the anatomy (74% strongly agreed) and clinical utility of focused cardiac ultrasound (65% strongly agreed) from this intervention. Written comments emphasized the positive clinical relevance and ability to aid in anatomy re-enforcement. When asked what went well about the sessions, students noted the small group format, the hands-on experience, and the ability to interact with senior medical student proctors. Following this exposure, students expressed increased willingness to pursue and participate in additional ultrasound activities in the future (strongly agree: 64% and 65%, respectively).

Conclusions: Support for focused ultrasound education at the UME level is gaining momentum. This curriculum demonstrates the positive impact of focused ultrasound instruction as an adjunct to formal cardiac anatomy and physiology teaching. In addition, following this exposure, students were more likely to pursue additional ultrasound activities in the future possibly assisting in the incorporation of ultrasound in their medical care.

A BLENDED-LEARNING, INTEGRATED ULTRASONOGRAPHY CURRICULUM FOR FIRST-YEAR MEDICAL STUDENTS: DEVELOPMENT, IMPLEMENTATION AND LESSONS LEARNED

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Background: The increasing use and acceptance of ultrasonography in clinical practice signals the need for medical schools to fully integrate ultrasound education into their undergraduate curricula. Current literature provides little guidance regarding the most effective development, teaching and assessment methods for ultrasonography education. This report presents lessons learned from the development and implementation of a blended-learning, simulation-enhanced curriculum for first-year medical students.

Methods: An Ultrasonography Curriculum Development Advisory Committee (US-CDAC) was formed at Eastern Virginia Medical School (EVMS), comprised of both clinical and non-clinical faculty, met weekly to develop a fully integrated first-year medical student (M-1) ultrasound curriculum and guide its implementation. Institutional Review Board (IRB) approval was obtained and "Body-System" based teaching objectives for the curricula were developed.

Educational modules included didactic, web-based and proctored "hands-on" sessions. The modules were integrated into existing Anatomy and Physiology courses. The modules included Physics and Device Functionality, Thorax (Cardiac and Lung), Neck (Thyroid and Vasculature), Abdomen (Liver, Gallbladder and Spleen) and Pelvis (Kidney, Bladder and Uterus). Ultrasound enhanced Physiology lectures and laboratory sessions included cardiac and vascular physiology, and a session on ultrasound-based approach to patient resuscitation. A series of learner evaluations were developed including demographics, pre- and post-course written evaluation, a post-course Objective Structured Clinical Examination (OSCE) with standardized patients, spatial abilities assessment, mental workload assessment, and program satisfaction survey.

Concurrent with the development of M-1 learning materials, a comprehensive faculty development program was created and implemented to ensure standardization of program content delivery. This program included analogous content and faculty assessments.

Results: The US-CDAC at EVMS was able to successfully develop, implement and evaluate M-1 students on their knowledge of basic ultrasonography, fundamental ability to acquire images, and further improve their appreciation for this important clinical skill in the practice of medicine.

Conclusions: A collaborative approach including Basic Sciences and Clinical faculty has demonstrated an effective model for integrating ultrasonography into the M-1 curriculum. The blended-learning model with an emphasis on hands-on simulation-based training was shown to be an effective approach for content delivery and skill acquisition. Several key lessons were noted during this process. Faculty development and support substantially improved the effectiveness and standardization of content delivery, as well as creating a large instructor pool. Engagement of both Basic Science and Clinical faculty is essential for a successful program development. Lack of engagement by faculty (Basic Sciences and Clinical), may present a barrier to fully integrating ultrasound education across the medical education curriculum. Finally, frequent assessment of the identified learning domains, coupled with specific performance feedback is key to improving learner performance, and evaluating program effectiveness. Further reports will detail specific learner results related to the M-1 Ultrasound curriculum.

CREATING THE BEST BALLISTIC GELATIN FORMULA AS AN INITIAL COMPONENT IN THE ULTRASOUND TRAINING MODULE FOR M1 ANATOMY STUDENTS

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Introduction: Ultrasound organizations promote incorporation of ultrasound education in medical school curricula, with the AAMC calling 2013 "The Year of Ultrasound," as reported in Making Waves: Ultrasound in Medical Education. Though the best training paradigm uses humans, it proves expensive and logistically difficult. During the pilot year (2012) of ultrasound training at Eastern Virginia Medical School (EVMS), gelatin forms with embedded toys were developed as training modules. The purpose of this study was to improve the 'recipe' for the gelatin to enhance longevity.

Methods: At EVMS Department of Pathology & Anatomy, from February-August, 2013, research was designed around 16 training forms, each beginning with a standard 10% ballistic gelatin solution, and with varying combinations of phenol (0.0%, 0.5%, 1.0%, 2.0%), container type (with lid/without lid), and storage type (no refrigeration/refrigeration). Empirical data included any damage to the gelatin forms such as desiccation, and/or mold growth, as well as factors including the development of bubbles, and/or condensation.

Results: Of the containers stored without a lid, all suffered significant desiccation from within one month (not refrigerated) to three months (refrigerated). Desiccation occurred more slowly the higher the percentage of phenol. All containers with lids showed presence of condensation within one day, more prevalent in refrigerated containers. It was noted that once bubbles appeared on the surface of a gelatin form, fungal mold would soon follow. Regardless of storage method, the ones containing 0% phenol became moldy within twelve days (no lid), to six weeks (with a lid). The longest lasting ballistic gelatin form resulted from a refrigerated product, stored with a lid, and with a minimum of 0.5% concentration of phenol added.

Conclusions: Ultrasound imaging provides an inexpensive, non-invasive, real-time method to image a patient's anatomy, and provides the physician with an expedient tool to use in such diverse medical settings as the ER or a rural geographical region. A study done at Wayne State University (2008) pointed out that, as residency programs adopt ultrasound training programs, it becomes imperative for undergraduate medical programs to create or incorporate an ultrasound module or component into the M1 curriculum. The ballistic gelatin forms provide the anatomy instructor with an inexpensive laboratory device for students to acquire rudimentary ultrasound skill prior to the use of fellow students or standardized patients.

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MULTISPECIALTY ULTRASOUND LEADERSHIP TRAINING INITIATIVE (MULTI)

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OBJECTIVES: (1) To promote medical student awareness of ultrasound relevancy in multiple specialties; (2) To develop medical student leaders with advanced competencies in ultrasound through a tiered mentorship initiative

METHODS: The MULTI program is a novel longitudinal curriculum, integrating structured mentorship in advanced ultrasound competencies throughout the first three years of medical student education, with the goal of developing students into ultrasound proctors and leaders. First years participate as students, learning the basics and understanding how ultrasound can be applied to a variety of medical specialties including ambulatory, anesthesiology, orthopedics, and several other medicine subspecialties. Second years who have acquired the foundational knowledge base in ultrasound proctor the hands-on training sessions in the various multispecialty didactics, developing and solidifying their expertise in ultrasound acquisition. Third years with advanced teaching competencies lead and manage an ultrasound didactic session being responsible for clinical content and standardizing the competencies of the 2nd year proctors. The project will broaden to work with multi-specialty ultrasound communities, develop proctors and student leaders for ultrasound in undergraduate medical education, and facilitate a structural foundation for ultrasound integration in the medical center.

Current medical education curriculums limit the procedural exposure students experience prior to their clerkships. It is expected MULTI will result in a study population that is facile using ultrasound skills in a clinical setting, while simultaneously promoting its use throughout various fields of medicine. MULTI will track its ability to achieve these goals through likert score surveys completed by all students who attend a specialty specific didactic, second year students prior to serving as proctors, and third 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 their desired field of medicine, and participants' comfort level in using their acquired skills in an actual clinical setting.

CONCLUSIONS: The MULTI program is a novel training approach designed to further coordinate structured student mentorship at an institution with a sophisticated UME US program. The MULTI program will ultimately culminate in a longitudinal curriculum leading to advanced competency and promote ultrasound's widespread utility within multiple disciplines. With the MULTI 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.

CHANGING ATTITUDES: THE CASE FOR CENTRALIZED ULTRASOUND INFRASTRUCTURE

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DETAIL: In the face of escalating costs and safety issues regarding radiation with advanced imaging, ultrasound (US) is fast becoming a mainstay of medicine across a variety of specialties. However, training in US is lacking for a majority of students and residents[1]. Training in US has been shown to have additional benefits in pre-clinical education in anatomy[2], physiology, and pathophysiology[3], in addition to providing a valuable skill for clinical experience. The focus on ultrasound integration in the curriculum at The Ohio State University College of Medicine has led to the inclusion of several interventions across all 4 years of school. The Clinical Skills Educational and Assessment Center (CSEAC) expansion opened in 2012 and is the central location for US education at OSU. Many of the ultrasound programs would not be possible without this space. This paper assesses the benefits of a dedicated US facility within the simulation center, as evidenced by student usage.

Using a computer based login system we tracked data about center usage, including rank, course, and role.

Fourth year medical students comprise more than half of the 678 entries. Cross-class interaction indicates a developing culture and shifting attitude towards US. Growing interest is noted by the projected increase in activity from 2012 to 2013. Having a centralized education facility greatly enhances the quality of these interactions. Limitations primarily revolved around data collection and compliance with sign-ins resulting in an underestimation of the true impact of the CSEAC. Current efforts focus on obtaining better quality data and increased compliance. Ultrasound literacy is becoming increasingly important in this era of medicine, and while many schools are in the process of forming new curricula and programs, having a central location for education should be a serious consideration. The centralized location (with dedicated space, adequate equipment and expanded access) promotes multidisciplinary use by a variety of learners. The CSEAC usage is an indicator of the US footprint at Ohio State as well as a tool for establishing and measuring culture change.

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THE ULTRASOUND CHALLENGE 2.0: INTRODUCING INTER-INSTITUTION COMPETITION IN MEDICAL STUDENT ULTRASOUND EDUCATION

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BACKGROUND: The Ultrasound Challenge was developed at The Ohio State University College of Medicine (OSU COM) to introduce focused ultrasound to medical students. It also integrated competition, sportsmanship and personal responsibility into the medical student curriculum. The Ultrasound Challenge 2.0 was held at OSU COM in 2013 and included additional medical students from Wayne State University College of Medicine (WSU COM). The goal of this article is to describe our experiences with the successful expansion of our competitive, inter-institutional ultrasound event.

METHODS: The 2013 Ultrasound Challenge 2.0 consisted of six events: focused assessment of sonography for trauma (FAST), aortic, cardiac, pelvic, musculoskeletal and vascular access ultrasound. The participants were given a handbook ahead of time outlining the expectations for each station. The vascular access station was graded in real-time using a synthesized quality scoring tool, BQUIET. The remaining five events were graded retrospectively using BQUIET. In collaboration by consensus author opinion, the top three images were chosen for first, second and third place based on overall image quality and adherence to BQUIET principles.

RESULTS: A total of 40 medical students participated. There were 31 medical students from OSU COM and nine from WSU COM. First, second and third place winners for each event were reported by medical student year (MS). The overall first, second and third place winners were also reported by medical student year. The following winners are listed in first, second and third place order. The FAST event winners were MS2, MS2, and MS3. The cardiac event winners were MS2, MS2, and MS4. The aortic event winners were MS4, MS3, and MS2. The pelvic event winners were MS4, MS4, and MS3. The vascular access event winners were MS4, MS4, and MS4. The musculoskeletal event winners were MS1, MS4 and MS4. The overall event winners were MS4, MS2, and MS2.

CONCLUSIONS: The Ultrasound Challenge 2.0 was a success for those that participated and an opportunity to promote ultrasound excellence at the undergraduate medical education level. The event represents the first inter-institution, medical student ultrasound competition involving medical schools from different states. Students from both institutions were able to practice their image acquisition skills, demonstrate abilities in a competitive environment, and develop collegiality and teamwork.

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ULTRASOUND MANAGEMENT AND ANATOMY OF DISTAL RADIUS FRACTURES

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INTRODUCTION: Distal radius fractures are one of the most common injuries seen in Emergency Departments. Limited research has been conducted regarding ultrasound (US) utilization in closed reduction of fractures. This pilot study investigated the feasibility of utilizing US in manipulation, reduction, and splinting of distal radius fracture in donor-cadaver-patients (DCP).

METHODS: Literature search was conducted on journals and specialty journals regarding the use of US in fracture reduction. US was first used to visualize bony alignment through plaster splinting material on live patients. Bilateral distal radius fractures were induced in DCPs by simulated traumatic accident and fractures were assessed, manipulated, reduced, and splinted under US guidance.

RESULTS: Literature search revealed few studies utilizing US for distal radius fractures, but found US to be a viable alternative to traditional X-Ray. However, none incorporated US during splinting. Fracture assessment, manipulation, and reduction were successful and continued visualization was possible through splinting (cast) material using US.

CONCLUSIONS: Achieving proper reduction of distal radius fractures is paramount. Employing US guided reduction and splinting techniques can save cost and radiation exposure versus traditional X-Ray. US can reduce the amount of time spent during fracture management due to its bedside availability and effectiveness in diminishing the need for repeat reductions. This pilot study suggests that US can be used in complete management of distal radius fractures.

AN INVESTMENT IN THE FUTURE: AN ULTRASOUND PROGRAM FOR ACADEMICALLY TALENTED RISING STUDENTS IN 9TH-12TH GRADES

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OBJECTIVES: The purpose of this program was to design a week-long curriculum in ultrasonography that could be used to instruct students in rising grades 9th-12th to perform and interpret basic ultrasound scans.

METHODS: The Adventures in Medicine: Ultrasound program, sponsored by the University of South Carolina's Carolina Master Scholars series, was developed to include digital presentations, scanning demonstration, instruction, and practice on standardized patients and simulators, as well as question-and-answer sessions. The schedule was taught by medical students and medical faculty. Additionally, competitions on a real-life simulator were used to engage and further learn the principles of ultrasonography.

RESULTS: Through the Adventures in Medicine: Ultrasound program, rising 9th-12th grade students were successfully able to obtain and report findings accurately on ultrasound scans of the thyroid, carotid artery, PLAX, liver, kidney, bladder, and prostate on standardized patients as well as on a simulator.

CONCLUSIONS: The curriculum received overwhelming positive reviews by the students, volunteer medical students, and faculty. This program effectively instructed inexperienced, rising 9th-12th grade students to scan and identify multiple structures with a focused week-long training course.

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MEDICAL STUDENT IMPRESSION OF ULTRASOUND FOCUSED INTERNATIONAL VOLUNTEER EXPERIENCES

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DETAIL: Ultrasound education has traditionally been a skill that is learned after medical school, however a few medical schools have begun integrating an ultrasound component into their core curriculum. While studies have shown that ultrasound can be effectively learned in medical school, students have a limited capacity to use these newly acquired skills. However, students at UC Irvine have found ways to practice their ultrasound skills abroad, in areas where imaging modalities are needed most.

UC Irvine School of Medicine has recently secured dedicated funding from private donors to send students abroad for ultrasound research and teaching projects in underserved areas internationally. With funding secured, students are able to develop ultrasound research projects and teaching curriculums during the academic year, and execute them during their summer. This study investigates the impact that these international experiences had on the ultrasound skill level and opinion of ultrasound utility of those students involved. Students who traveled were given a short survey about how their proficiency with ultrasound had changed as a result of their experience. Responses to answers were recorded on a 5-point scale.

27 medical students, comprising 26 percent of the first year class elected to do international ultrasound projects between their first and second year. Projects included working with NGOs in South and Central America, clinics in rural Africa, and medical schools in Eastern Europe and Australia. Students were asked to subjectively rate their ultrasound skills and ultrasound teaching skills on a scale with 1 being beginner and 5 being advanced. The average pre trip ultrasound skill rating was 2.11 (SD .071) and the post trip rating was 3.65 (SD 0.75) for a p-value < 0.01. Student's average pre-trip rating of ultrasound teaching skills was 1.73 (SD 0.83) and post trip was 3.92 (SD 1.13) p-value <0.01. Additionally, students were asked for their opinion on several ultrasound statements and ranked their opinion on a scale from Strongly Disagree (1) to Strongly Agree (5). Students averaged a response of 4.6 when asked if they felt they made a positive impact on the program they worked with. When asked about inclination to do further international medical trips, students averaged a response of 5. When asked if they are more likely to recommend ultrasound to a peer, they averaged a response of 4.85 and responded 4.8 when asked if their experience made them realize the usefulness of ultrasound in a clinical environment.

Overall, international ultrasound-focused opportunities provide an outlet for medical students to practice and apply newly acquired ultrasound skills under physician supervision. Our study has shown that UC Irvine medical students felt that their international experiences were a positive influence on developing their ultrasound skills and training.

FAMILY MEDICINE ACCELERATED TRACK: IMPLEMENTING ULTRASOUND THROUGHOUT A SUMMER EXPERIENCE WITHIN AN INNOVATIVE CURRICULAR PROGRAM

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Program Background: The Family Medicine Accelerated Track (FMAT) is a 3-year curriculum that culminates in the MD degree and links medical students to affiliated family medicine (FM) residency programs at Texas Tech University Health Sciences Center (TTUHSC) campuses in Lubbock, Amarillo or the Permian Basin. The purpose of the FMAT is to prepare primary care physicians more efficiently and with less cost. The FMAT program was approved by the LCME in February 2010; the first class of 8 students graduated in June 2013 and began residency training in July. The FMAT program offers students a seamless transition between predoctoral and residency training settings and curricula, as they spend 2 years in Lubbock, followed by at least 4 years on the campus where they complete both the final year of medical school and 3 years of FM residency training.

Integration of Ultrasound: The curriculum begins with the FMAT1 course, an 8-week summer concentrated course between the MS1 and MS2 years that prepares students for a longitudinal FM clerkship. FMAT1 includes case-based didactic and small-group content across 7 weekly themes: Cardiovascular, Respiratory, Endocrine/GI, Musculoskeletal (MSK), OB-Gyn/Urology, Neuropsychiatry and Dermatology, each team-taught by FM and basic science faculty. The course uses clinical and pathophysiology correlations focusing on patient assessment skills for the most common primary care diagnoses. Training with ultrasound (US) imaging is incorporated during FMAT1 weeks, including chest and heart US during the Respiratory and Cardiovascular weeks, carotid US during the Neuropsychiatry week, breast and pelvic US during the OB-Gyn week, abdominal US during the GI week, and joint US during the MSK week. Within TTUHSC's state-of-the-art simulation center, students have opportunities to observe and then practice US on manikins, standardized patients or each other, as appropriate.

Using Ultrasound for Assessment: During the 2013 FMAT1 course, which included 8 students, medical knowledge was assessed with 15 MSK questions on the course midterm, 3 of which included ultrasound images. On basic MSK questions, students scored 76% compared with 71% on US-based questions. Analysis showed that the lower score was due to one question (25%), which required the differential identification of the coracoacromial ligament versus the supraspinatous tendon. In addition, the end-of-course OSCE included one case that required students to perform a knee US exam on a standardized patient. Students received debriefing feedback from faculty who observed them by live video. Observation of students during activities indicated that visualization of structures with ultrasound helped students fine-tune their location of surface landmarks for these structures. Student opinions about incorporating US into FMAT1 are highly positive. Future plans include providing more ultrasound images with clearly identified structures during lectures and hands-on examination and further assessment of ultrasound skills during the OSCE.

THE SILENT TOMBS: A GAME FOR MEDICAL STUDENTS TO PRACTICE BASIC ULTRASOUND DIAGNOSTIC SKILLS

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DETAIL: It is well established that ultrasound training during medical school improves overall medical education outcomes, including an improved ability to perform the acquisition and interpretation of images at point of care, improved physical examination skills, and positive impressions about ultrasound by the students [1,2,3]. However, giving students extra instruction and practice poses logistical challenges, typically requiring medical equipment, physical space, proctors, and models, and it is not always practical or possible for students to visit a lab during off hours. Meanwhile, students on wards get scant exposure to ultrasound in practice, as patient charts may simply contain a written report of the image interpretation, devoid of the images themselves or the process used to acquire or interpret those images.

Computer-based training is an alternative that allows students to practice image interpretation, anywhere and anytime, and studies have shown its efficacy [4]. Likewise, computer games are already being used in a variety of fields to improve learning outcomes, as games allow exploration and deep understanding of complex systems through experimentation [5]. While some games already exist for medical training [6], no training games have yet been developed to deal specifically with ultrasound education, so this is an area ripe for exploration.

To address this opportunity, we designed a video game that lets students practice their ultrasound diagnostic skills, by presenting them with a series of images and asking them to interpret these images to form correct diagnoses. To increase player interest, the game is wrapped in a theme of tomb exploration, where the mummified remains of the inhabitants contain clues to allow explorers to find their way through the tomb while avoiding traps in order to find and claim a great treasure within, and the player must scan the bodies to detect the clues (Figure 1). We plan to test the game with first-year medical students to measure improvements in learning outcomes.

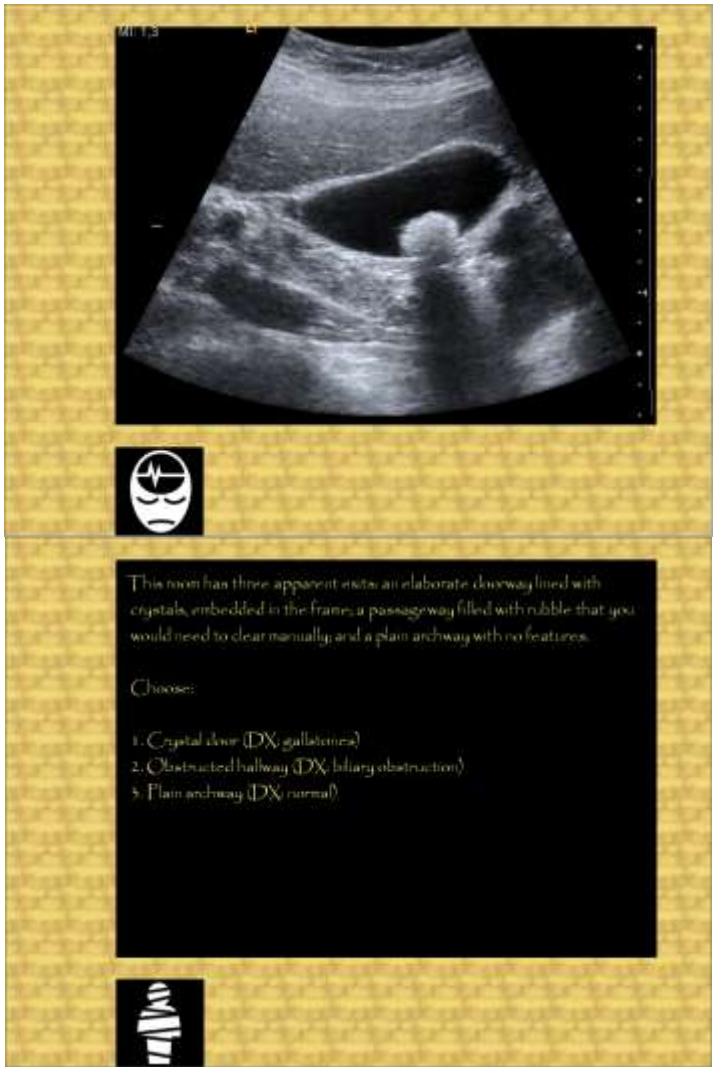

Figure 1: Level 1 (gallbladder scan)

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FOSTERING ANDRAGOGY ULTRASOUND EDUCATION UTILIZING STUDENT PEER-TO-PEER MENTORING

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INTRODUCTION: The philosophy of “see one, do one, teach one” is one of the most efficient ways to learn a skill; by training a group of medical students throughout an academic year in basic and advanced ultrasound (US) techniques – and then allowing them to train first year medical students. This philosophy was put into practice between second and first year medical students. Skill in US is becoming more paramount in the contemporary medical landscape and cannot be underserved.

METHODS: Literature search was conducted on “student run” US education and current US techniques. A student “club” was formed under the heading of “Ultrasound Education”. Club members (students) were mentored on various US techniques. Students were given 24/7 accesses to portable US machines and subsequently practiced skills at their time and pace. US was performed on live volunteers as well as donor-cadavers. Second year students were trained to teach fundamental US skills to first year medical anatomy students.

RESULTS: Literature search revealed recent techniques and accepted standards for US education. US club was successfully created. Students were mentored on a variety of techniques, as well as US guided injections. Students successfully educated fellow classmates on relevant body systems. Questionnaire and examination results demonstrated that second year students mentored first year students.

DISCUSSION: Student knowledge and comfort with US is vital in contemporary medicine. Despite the growing scope of US procedures and skills, qualified US instructors fall short of demand. Utilizing students to help teach their peers common and new US techniques can be disseminated and practiced quickly and can tailor to the individual medical students busy scheduled. This allows students to practice in a “low-pressure” environment before confirming their technique with qualified physicians and allows those physicians to refine student technique, rather than teaching basic skill. By cross-fostering US education, student TA’s also gain experience and reinforcement in teaching practices.

CONCLUSION: This pilot study suggests that US education can be disseminated through student run organizations that can self-organize and tailor to the needs of individual students to educate fellow classmates on important techniques.