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ABSTRACTS

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A CASE OF SURVIVAL TO HOSPITAL ADMISSION AFTER AKINETIC CARDIAC ARREST

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Background: Cardiac akinesia in cardiac arrest predicts absolute mortality [1].
Case report: A 63-year-old gentleman with severe infective exacerbation of bronchial asthma presented to Emergency Department (ED) in asystole. Return of spontaneous circulation (ROSC) was achieved after 19 min of cardiopulmonary resuscitation (CPR). Subsequently his ventilatory support was complicated by episodes of severe bronchospasm. He experienced three episodes of pulseless electrical activity (PEA) cardiac arrest due to hypoxia over the period of 7 h in ED. During each episode of PEA arrest, we incorporated bedside echocardiography during CPR. Cardiac akinesia was noted during the second PEA arrest while hypokinetic cardiac motion was demonstrated in the other two PEAs. ROSC was achieved in all the PEAs. The patient survived to leave ED and was admitted to the critical care unit. He unfortunately succumbed due to severe ventilatory failure.
Discussion: This case adds to the two published cases (2, 3) of survival to hospital admission after akinetic PEA arrest. However, as the other two cases, our patient did not survive to hospital discharge.
Conclusion: The prediction of absolute mortality with cardiac akinesia during cardiac arrest is still questionable. A multicentre study with large number of cases will give more insight into the survival rate of akinetic cardiac arrest.

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WORKFLOW AND QUALITY IMPROVEMENTS USING WALL-MOUNTED ULTRASOUND MACHINES IN PELVIC EXAM ROOMS OF A BUSY EMERGENCY DEPARTMENT

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Objectives: To assess possible improvement in patient flow and delivery of care by utilizing dedicated wall-mounted ultrasound machines in pelvic exam rooms at a busy county emergency department.
Methods: The design of this study was to collect data on patient flow through pelvic exam rooms in the emergency department where ultrasound machines had been mounted on the walls for ready access and examinations. Data was collected from three sources. Survey data was collected for both patients and physicians from the same encounter gathering each person's opinion on privacy, quality of image, quality of care, and perceived improvement in flow over portable ultrasound machines requiring transport into the dedicated rooms. Then time data was collected from each corresponding electronic medical record to compare to patient in department times from 1-year prior who received transvaginal emergency ultrasound exams in the department.
After collection of the patient flow data was analyzed for confidence intervals and any significance of difference from 1-year prior. Survey data was tabulated and charted for interpretation.
Results: Survey data demonstrated that 50/57 patient respondents felt the machines expedited their care while 55/57 felt their privacy was maintained as well. Additionally, 30/57 patients had previous ultrasounds in an emergency department and 15/30 felt this process of having the machines in the room provided a better experience. Of 56 physician respondents, 54 preferred the wall-mounted machines with 41/56 finding the image quality "very good", 12/56 stating "adequate" images, and 3/56 stating "inadequate" image quality. Lastly, 46/56 physicians found the machines expedited patient care.
Time data showed the following median total time in the department was 3 h, 22 min (95% CI 0.023) with median medical decision making time of 3 h (95% CI 0.023). These were compared to 1-year prior where median total time in the department was 3 h, 57 min (95% CI 0.023) and median medical decision making time was 3 h, 40 min (95% CI 0.023).
Conclusions: Wall-mounted ultrasound machines showed improved physician and patient perceived quality of care and patient flow as compared their experiences without. More so times for patients in the department and expedition of decision-making were reduced significantly by the use of wall-mounted ultrasound machines.

A COMPARISON OF TRANSDUCERS FREQUENTLY USED IN THE FOCUSED ASSESSMENT WITH SONOGRAPHY IN TRAUMA EXAM

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Objectives: The focused assessment with sonography exam (FAST) is the most common ultrasound study performed in the emergency department. We aim to compare physician preferences and self-assessed image quality during the FAST exam using two frequently used transducers. To our knowledge this is the first study comparing transducers used in the FAST exam.
Methods: This was a single blinded, prospective randomized investigation of the FAST exam using two human models. Stations had identical SonoSite M-Turbo machines with curved array (C60, 5–2 MHz) and phased array transducers (P21, 5–1 MHz). Machines were set on "abdominal-general" preset with spacial compounding (MB) and tissue harmonics (THI) settings enabled. Emergency Physicians (EPs) of various levels of training ranging from first year residents to attending, all had prior experience performing a FAST exam. EPs were randomized to perform a FAST exam using either the phased array or curved array transducer. Prior to the study EPs were asked their transducer preference. After performing the FAST exam, subjects were asked to rate image quality on a scale of 1–10, with 10 being the best quality and 1 being no image. Subjects then repeated the exam with the alternate transducer and image quality scores were recorded. Data was analyzed using descriptive statistics, chi square tests, and Wilcoxon rank-sum tests.
Results: 30 subjects participated in the study. Prior to the study 28/30 (93%) surveyed stated that they preferred the curved array transducer to the phased array ($P < 0.001$). After completion 13/30 (43%) preferred the phased array transducer and 12/30 (40%) preferred the curved array ($P = 0.79$). 5/30 (17%) had no preference. The median image quality score was 8 (range 3–10) for the phased array, and 8 (range 5–9) for the curved array. There was no significant difference between the image quality scores of the two probes as assessed by the participants ($P = 0.6773$).
Conclusions: The curved array and phased array transducers appear to have similar image quality during the FAST exam. Before the study a majority of physicians stated that they preferred the curved array transducer. However, after completion of the study there was no significant difference in the number who preferred the curved array to the phased array transducer.

THE DIFFERENCE IN ULTRASONOGRAPHIC FINDINGS ACCORDING TO CAUSATIVE VIRAL AGENT TYPE OF ACUTE HEPATITIS

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Objective: To evaluate different ultrasonographic findings in acute hepatitis, according to the causative viral agent types.
Patients and methods: Ultrasound (US) images of the liver were obtained from three hundred and two consecutive patients with acute hepatitis. Among the 302 patients 249 were confirmed as viral hepatitis (hepatitis A in 249, hepatitis B in 47 and hepatitis C in 2), and residual 4 patients were diagnosed as non-viral hepatitis. Three radiologists of abdominal US experience performed the liver US and evaluated imaging findings with respected to liver echotexture, presence of gallbladder (GB) collapse, GB wall thickening, intrahepatic duct (IHD) dilatation, common bile duct (CBD) dilatation lymph node enlargement, splenomegaly and ascites. These US imaging findings of each patient with acute hepatitis were categorized into four groups according to the causative viral agent types (A, B, C) and non-viral hepatitis. The results were evaluated by using the Fisher's exact test and Chi-square test.
Results: The presence of GB collapse was a statistically significant imaging finding to suggest acute hepatitis in hepatitis A and B, whereas there was no GB collapse in any patient of non-viral hepatitis group ($p < 0.05$). And the presence of GB wall thickening was shown statistical significance in only hepatitis A group ($p < 0.05$). Splenomegaly was important finding for help the diagnosis of acute hepatitis B, however, this was not statistically significant ($p > 0.05$). The other US findings (IHD dilatation, CBD dilatation, lymph node enlargement and ascites) were not supportive findings of the specific hepatitis.
Conclusion: On US examination, GB collapse and GB wall thickening were more frequently detected in acute hepatitis A.

CRITICAL ULTRASOUND IN THE SHOCK EVALUATION

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Background: Shock is the final pre-terminal event in many diseases. Patients (pts) in shock have high mortality rates. Diagnosis and initial care must be accurate and prompt to optimize patient outcome.
Objective: To identify the cause of shock within minutes after the patient's arrival in Emergency Department (ED) by Critical Ultrasound (CrUS).
Patients and methods: Double-blind perspective observational study. From July 2009 to July 2010, 22 pts (11 M; 11 F) presented themselves at the ED of Padua Hospital with hypotension or shock of unknown etiology, are initially evaluated with a clinical history, examination and biochemical and standard instrumental techniques by an emergency physician (EP) who makes the diagnosis more likely. A second EP performs the focused emergency cardiac and lung ultrasound, the inferior vena cava ultrasound and possibly emergency abdominal ultrasound and compression ultrasound of legs, expressing a diagnostic hypothesis. The two diagnostic hypotheses are compared with final discharge diagnosis. The pts are assigned to one of five hemodynamic categories from each of EP: cardiogenic shock (CS), hypovolemic shock (HS), septic shock (SS), obstructive shock (OS) and mixed shocks (MS).
Results: CrUS identifies four SS, nine CS, two HS, two OS and five MS. Standard evaluation identifies seven SS, nine CS, three HP and three OS.
Conclusion: Sensibility of CrUS to detect the cause of shock is very high. CrUS is a useful diagnostic and promptly available exam to decrease the time for diagnosis and optimize the therapeutic approach to patient. Indeed CrUS can identify the different hemodynamic determinants of shock that cannot be identified rather easily through standard investigations.

DIAGNOSIS OF TRAUMATIC ILIOPSOAS HEMATOMA USING POINT-OF-CARE ULTRASOUND

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Background: Iliopsoas hematoma is an uncommon entity in trauma patients. History taking and physical examination are very useful for the diagnosis, but imaging is necessary for the confirmation of its existence.
Methods: We reviewed two cases of traumatic iliopsoas hematoma diagnosed by history taking, physical examination and point-of-care ultrasound.
Results/patients: Case one occurred in a 24-year-old man who complained of severe right groin pain and difficulty of walking after falling to the ground during snowboarding. The patient manifested flexion hip contracture on the right side, that is, difficulty of extending the right hip owing to the severe pain. Abdominal examination detected tenderness in the right lower quadrant. A point-of-care ultrasound scan identified the swelling of the right psoas major which compressed the right kidney. Case two occurred in a 74-year-old woman who complained of severe left lower quadrant and left groin pain after falling down. The patient also manifested flexion hip contracture on the left side. Abdominal examination detected tenderness mainly in the left lower quadrant and a palpable mass accompanied by tenderness on the lateral side of the left femoral artery. A point-of-care ultrasound scan identified the swelling of the left psoas major.
Conclusions: Point-of-care ultrasound after obtaining precise history and physical examination is very useful modality for the quick diagnosis of iliopsoas hematoma in emergency rooms.

ECHOCARDIOGRAPHY IN PEDIATRIC CARDIOLOGIC EMERGENCIES

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Background: The nonmalformative cardiac pathology of children has a clinical onset either oligosymptomatic, or polimorf and nonspecific. The echocardiography performed in emergency can offer important diagnostic tools.
Objective: To assess the importance of echocardiography in the early diagnosis of nonmalformative cardiac pathology in children.
Patients and methods: We present the cases of five pediatric patients admitted for various symptoms: respiratory (tachypneea, dyspnea, cough), cardiac (tachycardia, arrhythmias, hepatomegaly, oedema), digestive (anorexia, enlargment of the abdomen), infectious (fever, rash, lymphadenopathy, irritability). The echocardiography allowed the exclusion of congenital heart defects.
Results: The echocardiography revealed data concerning the pathology of coronary arteries (ectasia and aneurysms), presence of large pericardial effusion, heart dilatation with severe systolic dysfunction, enlarged left atrium occupied by a large tumor and left ventricle tumor.
The ultrasound informations, corelated with clinical, biological, ECG and imagistic data offered the following diagnosis: atypical Kawasaki disease, pericarditis, dilative cardiomiopathy during myocarditis, left atrial mixoma, right ventricle tumor.
Conclusion: Echocardiography, a noninvasive imagistic method is extremely useful in pediatric heart pathology, allowing a rapid diagnostic in the nonmalformative heart pathology, with therapeutic impact. More than this, serial ecocardiography allow the follow-up of the evolution of these patients.

TRANS-ABDOMINAL CONTRAST-ENHANCED ULTRASOUND (CEUS) EXAMINATION IN EMERGENCY: A NEW METHOD TO TRIAGE THE PATIENT WITH SEVERE ACUTE PANCREATITIS

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Background: Acute pancreatitis is still a pathological entity with high mortality, ranging up to 30% in specialized centers due to severe forms in disease evolution. CEUS provides information on the vascularization of the pancreatic parenchyma, detecting areas of inflammation, necrosis, as well as the residual parenchyma in acute pancreatitis.
Objective: the aim of our study was to assess the role of CEUS in appreciating the severity of acute pancreatitis by quantitative analysis of the degree of vascularization and to triage the patients with parenchymal necrosis.
Patients and methods: the prospective study (December 2008–May 2010) included 25 patients with presented in ED with acute pancreatitis. CEUS examination was performed with a Logiq 7 ultrasound machine, using "SonoVue" and the afferent software for the quantitative analysis of the acoustic signal.
Results: the analysis of the average value of the maximum acoustic signal intensity (max I) after contrast injection, and of the mean time to signal enhancement appearance (mT): (a) superior mesenteric artery (SMA) used as control: max I 19.37 $\pm$ 8.53 dB, mT 15.85 $\pm$ 4.6 s; (b) inflammation area: max I 14.76 $\pm$ 6.7 dB, mT 15.15 $\pm$ 3.6 s; (c) necrosis area: max I 8.89 $\pm$ 9.91 dB, mT 22.17 $\pm$ 7.9 s; (d) structural ill-defined hypoechoic area: max I 12.03 $\pm$ 5.4 dB, mT 21.67 $\pm$ 4.47 s. The comparison of pancreatic necrosis area measured with contrast enhanced ultrasound and CT revealed a 62.5% concordance.
Conclusion: (1) An important advantage of CEUS is the possible real-time assessment of the vascular pattern. (2) Our study attests the usefulness of CEUS in quantifying the area of necrosis in acute pancreatitis, with similar results to those of CT. (3) CEUS is a useful tool in the emergency to triage the patients with severe acute pancreatitis who need special intensive care units.

CORRELATION OF LUNG ULTRASOUND FINDINGS IN INFANTS WITH BRONCHIOLITIS AND THE RESPIRATORY DISTRESS ASSESSMENT INSTRUMENT (RDAI) SCORE

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Background: Viral bronchiolitis (Br) is the leading cause of hospitalization for infants in the United States; however the diagnosis is based clinically. Validated measures such as the RDAI score are used to stratify disease severity in infants with Br. Lung ultrasound (LUS) findings such as sub-pleural lesions (SPL) and B-lines (BL) have been observed in infants with viral Br, however the significance of these findings is unknown.

Objective: To describe LUS findings in Br and to correlate the frequency of these findings to disease severity based on RDAI score in infants presenting to a pediatric emergency department.
Methods: Prospective cohort of patients 0–2 years of age, receiving chest X-ray (CXR) for suspected bacterial pneumonia. All infants with Br received a RDAI score (0–17) and then had LUS performed. Patients were stratified into subclinical/mild (0–5), moderate (6–11), and severe (12–17) groups based on their RDAI score. Spearman's rho was calculated to determine correlation between frequency of ultrasound findings in six anatomic lung zones and RDAI score.
Results: 85 patients were analyzed, 72% had evidence of Br on CXR. Median age was 9.48 months (IQR 1) 56% were male. SPLs were present in 83% of patients diagnosed with Br giving a sensitivity of 85% (95% CI 71–93%) and specificity of 39% (24–56%). BL were more specific in the diagnosis of Br with 78% (60–89%) but not as sensitive 36% (23–51%). As the RDAI scores increased the number LUS findings also increased ($rho_s = 0.308$, $p = 0.004$).
Conclusion: BL are more specific and SPLs more sensitive for the diagnosis of Br. Frequency of LUS findings correlates with Br severity as measured by RDAI score.

FEASIBILITY OF A BEDSIDE EMERGENCY ULTRASOUND TRAINING CURRICULUM AND ITS DIAGNOSTIC IMPACT AT AN URBAN PUBLIC HOSPITAL IN DAR ES SALAAM, TANZANIA

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Background: Bedside ultrasound has rapidly evolved to become a crucial part of Emergency Department practice and a growing part of critical care practice in resource-rich settings. Because of its portability and diagnostic utility, ultrasound has also long been suggested as a beneficial imaging modality for limited-resource settings. However, little research has been done to evaluate the feasibility and utility of training in bedside ultrasound or the clinical impact of its sustained use in limited-resource settings.
Objective: To evaluate the feasibility and diagnostic impact of a bedside ultrasound training curriculum at Muhimbili National Hospital in Dar es Salaam, Tanzania
Patients and methods: Our project was conducted in the Emergency Department at Muhimbili Hospital and consisted of (1) a pre-project needs analysis survey; (2) a 4-week training course at Muhimbili in April 2010; and (3) a post-course impact evaluation. Post-training assessment included evaluation of participant learning as well as documentation of the utilization and diagnostic impact of bedside ultrasound at the site. Providers filled out a data sheet on each ultrasound performed during a 3-week follow up period, reporting suspected diagnosis and planned disposition both before and after the performance of bedside ultrasound.
Results: 15 registrar physicians were trained in a 4-week bedside emergency ultrasound course covering the evaluation of pregnancy, cardiac and pleural effusion, pneumothorax, biliary disease, and FAST. The level of satisfaction with the course was extremely high with 14/15 participants "Very Satisfied". Eighty-eight bedside ultrasounds were performed during the follow-up period. The most common indication for the use of bedside ultrasound was trauma, and the use of bedside ultrasound changed diagnosis or disposition in 43% of cases.
Conclusion: Training in bedside ultrasound was both feasible and well-received in an urban African hospital. The use of bedside ultrasound changed diagnosis or disposition in a substantial number of cases.

THE DISCRIMINATORY ZONE FOR EMERGENCY PHYSICIAN-PERFORMED ULTRASOUND IN THE IDENTIFICATION OF INTRAUTERINE PREGNANCY

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Background: The "discriminatory zone" refers to the concentration of serum b-hCG at which ultrasound approaches 100% sensitivity for the identification of intrauterine pregnancy (IUP). Typical discriminatory zone values in the literature range from 1,500 to 3,000 mIU/ml for transvaginal sonography. These values have largely been derived from studies of gynecology or radiology-performed ultrasound, and their relevance to patients undergoing emergency physician-performed ultrasound (EPPU) is unknown.
Objective: To determine the effective discriminatory zone for pelvic EPPU in a symptomatic cohort of first trimester pregnant ED patients.
Patients and methods: This was a prospective study of consecutive female ED patients presenting with abdominal pain or vaginal bleeding who had a positive urine pregnancy test. Patients with known IUP by previous ultrasound were excluded. Patients received a pelvic EPPU, serum bhCG testing, and subsequent Radiologist-Performed Ultrasound (RPU). Radiologists were blinded to the result of the EPPU. Patients were ultimately classified as having an IUP if they had at least a gestational sac and yolk sac by RPU on initial or subsequent visit, ongoing pregnancy at 8 week telephone follow-up, or histopathological evidence of IUP.
Results: Thirty-one emergency physicians performed EPPU on 229 patients. Of these, 167 (73%) were ultimately classified as having a definitive IUP. The sensitivity of EPPU for IUP was 68% (95% CI 61–75) and the specificity, 98% (95% CI 91–100). Positive predictive value was 99% (95% CI 92–100) and negative predictive value was 53.5% (95% CI 44–63). One patient diagnosed with IUP was later found to have molar pregnancy by formal ultrasound. No clear discriminatory zone could be identified for EPPU, although above 50,000 mIU/ml, 57 of 63 IUPs were seen (90%).
Conclusion: The discriminatory zone for EPPU is substantially higher than that reported for radiology or gynecology ultrasound.

ADEQUACY OF EMERGENCY DEPARTMENT BEDSIDE ECHOCARDIOGRAPHY PERFORMED BY NON-MEDICAL-PROFESSIONAL WITH MINIMAL TRAINING

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Background: Emergency department (ED) bedside echocardiography (echo) has developed in the last 20 years into a critical diagnostic tool for multiple ED patient presentations, including chest pain, dyspnea, undifferentiated shock, cardiac arrest, and many others. Multiple studies have proven that non-cardiologists can effectively perform bedside echo and improve outcomes.
Objective: To date, no study has evaluated if non-medical-professionals can be rapidly taught to effectively perform bedside echo for

ED physician interpretation. If this were possible, it would relieve the limitation of time pressure from the ED physician. This study evaluates the adequacy of non-medical-professional performed bedside echo.

Patients and methods: This pilot study was performed at the University of Utah. A research assistant (RA) was trained by an ED ultrasound fellow to perform bedside echo in nine total hours, including three didactic and six hands-on hours. He was taught to obtain four main views: subcostal, parasternal long, parasternal short, and apical. Adequacy was defined as at least one view which grossly assesses cardiac function and presence of pericardial effusion. The RA, an undergraduate student, enrolled a convenience sample of ED chest pain patients. The ED ultrasound director evaluated the studies for adequacy.

Results: 36 echos were performed over the initial 1-month study period. In 33 of the 36 (92%) he was able to adequately obtain at least one view, enabling the reviewer to grossly assess overall function and for the presence of pericardial effusion. He was able to obtain multiple adequate views in the majority or patients, 25/36 (69%).

Conclusion: Bedside echo is a valuable tool that has been shown to be easy to learn by non-cardiologists. We believe this is the first study that suggests a novice non-medical-professional can be rapidly and effectively taught to perform bedside echocardiography for physician interpretation.

This is a small pilot study that needs future follow up studies to confirm the results with other learners and larger numbers

THE POTENTIAL BENEFIT OF ULTRASOUND TO AID IN DIAGNOSIS AND MANAGEMENT OF EMERGENCY DEPARTMENT PATIENTS IN A DEVELOPING COUNTRY

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Objectives: Ultrasound has been shown to have multiple uses which may be practical for developing countries. Despite the benefit added to patient care, no studies have quantified the number of patients presenting to an emergency department (ED) in a developing country who would potentially benefit from the use of ultrasound. We quantify the number of potential patients who would benefit from ultrasound in the ED and determine which types of ultrasound exams would be most utilized.

Methods: We reviewed 100 charts of patients presenting to an ED in Cusco, Peru where there is an ultrasound machine but no CT scanner from January and February 2008. We used patient chief complaint and discharge or admission diagnoses to determine whether the use of ultrasound would have assisted in the evaluation of these patients.

Results: Of the 100 patients whose charts we were able to obtain, 15 (15%) would have benefited from bedside ultrasound in the emergency department. Of these 15 patients, 4 (27%) had an ultrasound during their time in the ED. In six patients, ultrasound would likely have been the most definitive imaging modality. The US scans indicated were right upper quadrant ultrasound to evaluate the gallbladder in 9 (60%) patients, the focused assessment with sonography in trauma (FAST) scan in 4 (27%) patients, and renal ultrasound in 2 (13%) patients.

Conclusions: Bedside ultrasound in the emergency department of a developing country could potentially benefit a significant portion of patients. Training in abdominal ultrasound of the right upper quadrant, kidneys, and the FAST scan may be high yield in future educational efforts.

ACQUIRED PULMONARY STENOSIS CAUSED BY PULMONARY ARTERY THROMBOEMBOLI: THE ROLE OF TRANSESOPHAGEAL ECHOCARDIOGRAPHY

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Background: Computed tomography angiography used to be an effective alternative to catheter angiography in diagnosis of suspected cases of pulmonary embolism. We report a case which demonstrates pulmonary embolism detected by transesophageal echocardiography. Pulmonary embolism carries a high mortality. Among the techniques for the diagnosis of acute or chronic pulmonary embolism, transesophageal echocardiography is the tool of choice in many emergency situations due to visualizing the central pulmonary artery thromboemboli.

Methods: A 58-year-old man, whose chief complain was mild shortness of breath for 1 month, presented with enlarged heart shadow on chest X-ray and idiopathic severe pulmonary hypertension on transthoracic echocardiography.

Results: Transesophageal echocardiography was performed. There was no abnormal shunt. Acquired mild pulmonary stenosis caused by big thrombus which filled in pulmonary artery trunk was detected incidentally. Pulmonary embolism was confirmed by computed tomography. The uncomplicated thrombus removal was performed in University of Medicine and Pharmacy Hospital.

Conclusions: Transesophageal echocardiography can be used in the diagnosis of suspected large acute pulmonary embolism and in chronic pulmonary hypertension associated with recurrent pulmonary thrombi.

TRANSTHORACIC ECHOCARDIOGRAPHIC ASSESSMENT OF PRELOAD AND CARDIAC FUNCTION IN THE EARLY RESUSCITATION OF SEVERE SEPSIS AND SEPTIC SHOCK

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Background: Early goal directed therapy has outlined the importance of preload and cardiac function in early treatment of septic shock. Unfortunately, assessing preload and cardiac function requires the use of a central venous catheter, which can be associated with adverse side effects. Transthoracic echocardiography (TTE) offers a non-invasive and low-risk modality to measure volume status and cardiac function in patients with septic shock. Previous studies have mostly focused on transesophageal echocardiography to make these assessments, which is of little utility in the emergency department.

Objective: The objective of this study was to analyze the utility of TTE in the early presentation of septic shock as a non-invasive means of assessing volume status and cardiac function as compared to invasive means such as central venous pressure (CVP) and central venous oxygen saturation (ScvO2).

Patients and methods: This study was conducted as a prospective observational study at Intermountain Medical Center from September 2008 to February 2010. A TTE was performed within the first 6 h of admission on patients who presented with severe sepsis or septic shock. This echo was performed by an echo tech, critical care physician, or emergency physician. Analysis and interpretation of the echo was performed by critical care and emergency physicians.

Cardiac output (CO) by echocardiography was evaluated in normal fashion using the velocity time integral of the LV outflow tract. Right ventricular size, left ventricular size and left ventricular function were evaluated by standard measures using 2D echo and the Simpsons Method. IVC size and compressibility was obtained through the subcostal view using M-mode. CVP and ScvO2 were obtained at the time of the echocardiogram when available.
Results: 80 patients were enrolled in the study. The average age was 55 years and 51% were male. The average apache II score was 24.2 and overall in-hospital mortality was 17.5%. Right ventricular area to left ventricular area ratio (RVAD:LVAD) was correlated with increased CVP. RVAD:LVAD ≥ 1 had a 100% sensitivity for CVP ≥ 11. Patients with a RVAD:LVAD ≥ 1 had an average CVP of 16.6 ± 4.2 (95% CI 0.69–1). CVP was also correlated with the IVC compressibility index. For a CVP < 12 the IVC collapsibility index was 19% higher than in patients with a CVP ≥ 12 (95% CI 5.6–32.4). ScvO2 was correlated with echocardiographic estimated CO. CO < 6 L/min was 87.5% specific (95% CI 6.6–9.8) and 66.7% sensitive (95% CI 0.36–0.83) for a ScvO2 < 70.
Conclusion: Transthoracic echocardiography in patients with severe sepsis and septic shock may be used as a non-invasive means to evaluate volume status and cardiac function. RVAD and IVC compressibility correlate highly with CVP. CO measured by TTE may also be used in place of ScvO2 monitoring. Further research should include a prospective head-to-head trial comparing invasive monitoring to noninvasive TTE.

ULTRASOUND DIAGNOSIS OF OBSTRUCTIVE JAUNDICE ETIOLOGY IN PRIMARY HEALTH CARE SYSTEM

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Background: The investigation of a patients with jaundice begin with thorough review of the history of presentation, medication use, post medical history, physical examination, and evaluation of liver function tests. Other noninvasive diagnostic tests include ultrasound, computed tomography, and scintigraphy. Ultrasonography is the first step method used to detect biliary obstruction and etiology with accuracy ranges from 77 to 94%.
Objective: The objective of the present study was to assess the validity of ultrasound investigation to detect causes of obstructive jaundice.
Patients and methods: During 5 years period we analyzed in retrospective study all referred patients with obstructive jaundice in our clinic. Ultrasound examination was performed with "Aloka" 4000 color Doppler equipment, with convex transducer 3.8–6 MHz. Patients were examined in different position and plane according standard ultrasound protocol. The final ultrasound diagnosis were compared with other methods—CT, NMR and intraoperationem. Patient's data were archived electronically, and retrospectively analyzed.
Results: 208 patients were with obstruction–dilatation of the biliary tree. 77 of them had stone in common bile duct, pancreatic tumor 19, pseudo cyst 6, Klatskin tumor 2, tumor of the gallbladder 11, acute cholecystitis 19, edematous pancreatitis 1, enlarged lymph nodes 6, and in 54 of them were not evidence of any pathology. Sensitivity of ultrasound diagnosed etiology of obstructive jaundice were 75%.
Conclusions: Ultrasound is first line procedure, safe, inexpensive and very sensitive method for diagnostic evaluation of the dilatation of biliary ducts, determination of the level and causes of the biliary obstruction with high accuracy.

ROLE OF ULTRASOUND IN FRACTURE DIAGNOSIS: A PROSPECTIVE STUDY

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Background: A relatively not well explored land in ultrasonography is the bone. In the last years thanks to the medical evidence of usefulness of ultrasonography in the diagnostic evaluation of the musculoskeletal system this diagnostic approach is noteworthy increasing.
Ultrasound of the bone is a technically easy method and permits a tridimentional study of the musculoskeletal system, it is possible to repeat it for monitoring and above all is not invasive.
Materials and methods: This prospective open-label study involved 83 patients (45 women; 38 men) presented consecutively to our Emergency Department (ED) after musculoskeletal traumatic events. All patients presented to ED with suspected closed bone fractures resulting from a trauma and giving consent to participate to the study underwent ultrasonography before undergo traditional X-rays. Patients with open injuries were studied covering the probe with sterile protection to prevent contamination and infections. Patients enrolled were studied using a 7.5 MHz linear array probe and all the exams were carried out by the same physician. The radiologists were blinded to the result of ultrasound exam. The outcome measure in both techniques was: *yes fracture* or *no fracture*. Ultrasound fracture diagnosis was given when an interruption of the cortical echo or a dorsal band of echoes limited to the fractured zone was present.
Results: We examined consecutively 83 patients. In 23 patients both diagnostic procedures confirmed the presence of fracture. In two patients (in 1 patient sternum and in 1 patient ribs) ultrasound showed fracture not confirmed from X-rays. In three patients ultrasound gave normal result but X-rays showed fracture (in all these 3 patient the fractured bone was ankle)
Discussion: The results of this study are preliminary and need of further confirmations. In particular we think that is necessary to increase the number of patients enrolled and it may be of interest to compare the results between different ED to attempt to demonstrate if ultrasound is more sensitive and/or specific than X-rays in screening for bone fractures. The use of ultrasound is not intended to replace conventional X-rays to identify fractures but the objective is to reduce the use of X-rays to those patients in which the diagnosis is not sure or inconclusive. The aim of this study is to create a protocol involving use of ultrasound in screening of bone in Emergency. Interestingly ultrasound is a possible safe, non invasive and dynamic viewing method to rapidly identify which patients most likely have fractures.

PROSPECTIVE EVALUATION OF POINT-OF-CARE ULTRASOUND FOR THE DETECTION OF PLEURAL EFFUSION AND ASSISTED THORACENTESIS IN CHILDREN PRESENTING TO THE EMERGENCY DEPARTMENT

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Background: The prevalence of pleural effusion in children with suspected bacterial pneumonia (PNA) presenting to a pediatric emergency department (PED) is unknown. Most estimated prevalence rates of parapneumonic effusions are reported from retrospective studies of hospitalized children.
Objective: We report on the prevalence of pleural effusion detected by clinician-performed point-of-care ultrasound compared to chest X-ray (CXR) and our experience with ultrasound-assisted thoracentesis in a sample of children with suspected PNA presenting to a PED.
Methods: We conducted a prospective observational study on children 0–21 years of age presenting to the PED requiring CXR for suspected PNA from November 2008 to June 2010. Point-of-care ultrasound to detect pleural effusion was performed by pediatric emergency medicine physicians.
Results: Of 200 patients enrolled, 37 were diagnosed with PNA by CXR. Point-of-care ultrasound detected 7 patients with pleural effusion (3.5% of all patients/19% of all patients with PNA), and CXR detected 3 patients with pleural effusion (1.5% of all patients/8% of all patients with PNA). Simple inter-observer agreement between two sonologists on the presence of pleural effusion by ultrasound was 100%. One patient out of seven had subsequent ultrasound-assisted thoracentesis which was successfully performed without complication.
Conclusion: Parapneumonic effusions are uncommon in children with suspected bacterial PNA presenting to the emergency department. Point-of-care ultrasound detected pleural effusion more often than CXR in children, and was useful assisting in thoracentesis.

CURRENT STATE AND ACTIVITIES OF EMERGENCY PHYSICIAN-PERFORMED ULTRASONOGRAPHY IN SOUTH KOREA

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Background: There have been reports on usefulness of ultrasonography (US), however, no reports on current state and activities. This study was to evaluate the current state and activities of US in metropolitan area of Kyonggi Province of South Korea.
Method: This study was conducted using questionnaire which consisted of eight questions developed by three emergency physicians experienced in workshops for emergency US: the number of patients, trainees, emergency physicians, US examination among 13 applicable clinical situations (ACEP guideline), and the presence of supervisor for training of US, claim for US examination, independent code for claim, and accessibility and quality of US machine. The activities of US were the average number of US examination among five clinical situations recommended by ACEP. We assessed the association between activities and the variables using multivariate regression analysis.
Results: Total enrolled hospitals were 54 and the overall response rate was 85.2% (46 hospitals). The average percentage of US examination for 13 clinical situation (ACEP guidelines) are as follows: multiple trauma (75.1 ± 29.5%), pain of right upper abdomen (57.6 ± 29.6%), cardiac arrest (54.4 ± 30.6%), flank pain (42.4 ± 31.6%), severe abdominal pain (41.6 ± 29.2%), chest pain or dyspnea (35.8 ± 27.3%), pain of right lower abdominal pain (33.6 ± 28.9%), hypotension (33.3 ± 27.8%), procedure (21.3 ± 22.6%), intussusceptions (17.1 ± 26.5%), central line access (16.2 ± 21.4%), testicular torsion (14.7 ± 23.7%), pregnancy or fetus (9.1 ± 10.8%) The average percentage of current activities was 52.6. The factor associated with current activities are as follows: quality of US machine ($p = 0.004$), the presence of supervisor for training of US ($p = 0.002$), the number of patients ($p = 0.000$), and claim for US examination ($p = 0.048$).
Conclusion: The current state and activities among the enrolled hospitals are varied. The factors associated with current activities are the number of patients, quality of US machine, the presence of supervisor for training of US, and claim for US examination. It is important to improve these factors for effective use of US.

EARLY FAILURE OF ULTRASOUND-GUIDED PERIPHERAL INTRAVENOUS CATHETERS IN THE EMERGENCY DEPARTMENT. IT'S NOT JUST ABOUT GETTING THE IV: IT'S ABOUT KEEPING IT

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Background: Ultrasound allows for placement of peripheral intravenous catheters in patients with difficult access by providing visualization of deeper, smaller, and more proximal veins. Despite this improvement it has been observed that many ultrasound-guided peripheral IVs (USGPIVs) become dislodged, infiltrate, or stop working within hours of placement.
Objective: This study set out to determine the affect of vessel depth, diameter, and location on early failure of USGPIVs in the ED setting.
Patients and methods: This was a single center prospective observational study. Patients were included if there were two failed IV attempts or a history of difficult IV access plus the inability to identify any veins on physical exam. Patients were excluded if three attempts at an USGPIV were unsuccessful. All USGPIVs were placed using 20 gauge 48 mm long catheters. Patient characteristics (demographic information, vital signs, and medical history) were collected on enrolled patients. USGPIVs were followed for 12 h after placement by review of IV tracking chart documentation. Failures were USGPIVs that infiltrated, became dislodged or unusable within 12 h. IVs that failed within 4 h were considered 'early failures.' Multivariable logistic regression was performed to determine the affect of patient and vessel characteristics on early and overall USGPIV failure.
Results: Of 151 successfully placed USGPIVs, 11% (16/151) failed within 4 h (early failures) and 24% (36/151) failed within 12 h (overall failures). Vessel depth was an independent predictor of early failure; odds-ratio 1.7 (95% CI 1.33–2.28) for each 0.2 cm increase in depth. Analysis of data revealed there were 0% (0/58) early failures for vessels below 0.6 cm, 10% (5 of 52) early failures for vessels between 0.6 and 0.99 cm, and 27% (11 of 30) early failures for vessels 1 cm or greater ($p < 0.0001$).
For overall USGPIV failure, both vessel depth and vessel location were found to be independent predictors. Odds ratios (95% CI) of failure were 1.6 (1.3–2.0) for each 0.2 cm increase in depth and 6.6 (2.2–19.9) for proximal IV placement ($p = 0.001$). Analysis of location data revealed a 34% (32/95) failure rate when placed in the arm compared to 7% (4/56) failure rate when placed in or distal to the antecubital fossa ($p < 0.0001$). Patient characteristics and vessel diameter were unrelated to USGPIV failure at both 4 and 12 h.

Conclusion: Avoidance of deep vessels and vessels proximal to the antecubital fossa will likely improve longevity of USGPIVs.

MITRAL ANNULAR MOTION AT POINT OF CARE PREDICTS ACUTE CORONARY SYNDROME

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Background: The current approach to chest pain presenting to the Emergency Department (ED) is to perform an electrocardiogram and serum analysis for cardiac biomarkers (troponin-T or troponin-I) at time of presentation and at 6–10 h post resolution of pain. Most of these patients will not have coronary artery disease. This results in significant patient numbers with a low prevalence of acute coronary syndrome (1–2%) (ACS) occupying acute hospital beds.
Objective: To determine if point-of-care echocardiography in ED has the potential to identify patients who do not have ACS and so can be safely discharged home.
Patients and methods: All patients presenting with chest pain to ED who do not have ST-elevation myocardial infarction had a transthoracic echocardiogram performed, with M-mode analysis of septal and lateral mitral annular motion (MAM) from the apical four chamber view.
Results: A systematic literature review was performed to determine the utility of mitral annular motion analysis as a marker of myocardial ischaemia. Results to follow.
Conclusion: MAM is a valid marker of myocardial ischaemia, but can also be affected by other pathological processes, which are discussed by the authors. The feasibility of point-of-care echo analysis of MAM will be further assessed.

PREHOSPITAL ULTRASOUND IN THE FRANCO-GERMAN MODEL OF EMERGENCY MEDICAL SERVICES

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Background: Prehospital emergency services are a relatively recent development of healthcare worldwide. Also in the most affluent countries, EMS are unevenly developed and inhomogenously organized. All EMS can be classified as structured according to either the franco-german or the anglo American model of EMS. The former is based on the principle of bringing high-quality medical care to the patient at home or on the street, and is usually physician-run, whereas the latter aims at bringing the patient to hospital care in the shortest time interval, and thus is mainly paramedic-operated.
Objective: To assess, based on the review of existing literature and personal conjecture, which role can ultrasound play in the further improvement of prehospital emergency practice, especially in the franco-german model.
Patients and methods: n.a.
Results: Prehospital ultrasound can provide early diagnosis in critical patients or critical scenarios. However, this is only one of the multiple advantages yielded in the course of managing a critical patient. Amongst the others are improved patient staging, especially as filling status is concerned, targeted referral of the patient, particularly relevant with a time-dependent specialistic problem, e.g. a ruptured AAA, improved communication and teamwork with admitting hospital, mass casualties triage and support in invasive manoeuvres. To gather all benefits of ultrasound in the prehospital arena it is necessary i the presence of a fully trained physician whose management of the patient can be adjusted accordingly to US findings.
Conclusion: Ultrasound is an invaluable tool for prehospital emergency medical practice with the availability of affordable, lightweight ultrasound machines, the issue of equipping physician-staffed ambulances becomes crucial.

COMBINING TISSUE DOPPLER ECHOCARDIOGRAPHY AND LUNG ROCKETS SIGN IN THE DIFFERENTIAL DIAGNOSIS OF ACUTE DYSPNEA

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Background: It is important to discriminate the origin of acute dyspnea in emergency department. Both positive lung rockets sign and elevated E/Ea (the ratio of peak early diastolic mitral inflow velocity to peak early mitral annular velocity measured by tissue Doppler echocardiography) are reported to be an excellent indicator for the pulmonary congestion.
Objective: We tried to determine the discriminating abilities of lung rockets sign in lung ultrasound and E/Ea in acute dyspnea and to develop the new algorithm using two variables.
Patients and methods: This prospective observational study was performed in an urban emergency department. For the patient with dyspnea at rest visiting emergency department, we preformed bedside emergency ultrasound assessing the presence of lung rockets sign and measuring the E/Ea. Patients were divided into two groups depending on the cause of dyspnea, pulmonary edema or other origin. We compared the two variables and develop the algorithm using the decision tree analysis.
Results: 66 patients (39 pulmonary edema, 27 other cause) were enrolled. There were significant differences between two groups in presence of lung rockets sign ($p < 0.001$) and E/Ea ($p < 0.001$) by univariate analyses. The area under the receiver operating characteristic curve of the new scoring system with two variables for detecting pulmonary congestion was 0.90 (95% CI 0.801–0.960). The presence of lung rockets sign and E/Ea > 13.27 had 100% specificity and positive predictive value for pulmonary congestion.
Conclusion: Lung rockets sign in lung ultrasound and measurement of E/Ea could be helpful in the differential diagnosis of shortness of breath quickly and easily in ED.

THE USE OF LUNG ULTRASONOGRAPHY IN PREHOSPITAL EMERGENCY MEDICINE: A CASE SERIES

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Background: Since the introduction of portable handheld ultrasound devices in the late 1990s, their use for abdominal, lung and cardiac sonography as rapid diagnostic tools in intensive care units has been validated in numerous studies. Here, we report a preliminary series of three cases of lung sonography in prehospital emergency medicine, which has not been studied before.
Patients and methods: In the setting of a physician-staffed prehospital emergency medical service, the ambulance vehicle was equipped with a portable ultrasound device with a 2–4 MHz microcurved probe.
Results: The first patient, a 67-year-old male with COPD stage IV and coronary artery disease presented to the prehospital emergency physician with shortness of breath, but no characteristic crackles. Ultrasound scan of the lung revealed B-Lines indicative of pulmonary edema and allowed targeted treatment of the pulmonary congestion with anti-hypertensives. The second dyspnoeic patient with a history of COPD and congestive heart failure presented with ankle edema and rales over both lungs, but sonography of the lungs showed A-lines and a positive lung sliding phenomenon. Thus, pulmonary edema was considered unlikely and the patient was treated for exacerbated COPD with prednisolone and nebulized terbutaline, which lead to immediate clinical improvement. In the third case, the prehospital emergency physician was called to a young man in panic with shortness of breath, retrosternal pain and dyspnea. Sonography displayed the absence of lung sliding and comet-tail artifacts on the left, indicating a pneumothorax, which was confirmed and treated in the receiving hospital.
Conclusion: This case series demonstrates that lung sonography may be a useful diagnostic tool in the prehospital setting. Further studies are needed to assess necessary training intervals for emergency physicians and possible clinical benefits.

TAKO-TSUBO SYNDROME AND QUETIAPINE'S OVERDOSE: A TERRIBLE "COCKTAIL"

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Background: Several reports in the literature have noted the favorable risk–benefit profile of quetiapine, used as atypical antipsychotic in the treatment of schizophrenia. Potentially life-threatening consequences from overdose include QT prolongation and respiratory depression. We report here a first case of ST-elevated with prolongation of the QT interval at 12-lead ECG in mild overdoses with 1300 mg of quetiapine in a patient with unknown tako-tsubo syndrome.
Case report: A 65-year-old female with a history of schizophrenia and depression presented to the emergency department (ED) after an ingestion of 13 tablets of quetiapine 100 mg, in a suicide attempt. The woman arrived awake and alert at the ED approximately 1 h post-ingestion. Patient presented with hemodynamic shock with a blood pressure of 70/35 mmHg and acute respiratory distress syndrome (ARDS): she was breathing rapidly at 40 breath/min and the non-invasive oxygen saturation (SpO_2) showed 79% while she was breathing room air. She had a weak pulse but peripheral pulses were normal and symmetrical. The mental status examination showed good orientation to place and time. The patient had a Glasgow Coma Scale (GCS) score of 14 (range 3–15). The initial 12-lead ECG showed a sinus rhythmus (97 min^{-1}) with convex ST-segment elevation (max 3 mm at 80 ms from J point) in the inferior leads II, III, aVF. The EKG revealed also an important prolonged QT and QTc interval measuring (respectively, 460 and 560 ms) in the inferior leads. The PR interval (140 ms) and QRS complex (90 ms) remained relatively constant. An echocardiogram performed in ED on admission revealed a left ventricular apex "paralyzed". The image was consistent with Tako-tsubo syndrome. She was treated with dopamine intravenously, O_2 therapy and non-invasive mechanical ventilation (NIMV) and her respiratory and hemodynamic conditions stabilized. Gastric lavage was performed and activated charcoal administered approximately 1 1/2 h after drug ingestion. ECG seriated showed that the ST abnormality had resolved by 4 h later. Continuous cardiac monitoring for 24 h revealed any tachy- or bradyarrhytmias appeared or any cardiac conduction abnormalities. Blood pressure remained stable. After 20-h observation in emergency room she remained stable and was sent home. After 4 months the *Tako-tsubo* disappeared: there was full recovery. The tip of the left ventricle contract normally again.
Discussion: We present a case of ST-segment elevation and prolongation of the QT interval at 12-lead ECG with quetiapine overdose (1,300 mg), which was complicated by ARDS in a patient with Tako-tsubo syndrome. A probable fatal case of overdose of quetiapine was reported in a patient's autopsy, that revealed cardiomegaly, with left ventricular hypertrophy and bilateral pulmonary congestion[1].
In our patient Tako-tsubo syndrome complicated the prognosis of the patients. However a correct treatment of the patient permitted a good outcome. There is no specific antidote, and quetiapine overdose is managed by appropriate supportive measures. These included gastric lavage and administration of activated charcoal and a laxative, maintaining airway and ensuring adequate ventilation and oxygenation, and continuous cardiovascular monitoring[2].

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E-LEARNING FOR THORAXSONOGRAPHY

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Background: Thorax sonography allows the diagnosis of pleural effusion and pneumothorax particularly in supine position with similar specificity but higher sensitivity than thorax X-ray (1, 2). So far it requires combined theoretical and hands on training to teach these diagnostics which partially depend on the recognition of moving patterns. Computer technology now allows to display, explain and animate such information.
Objective: Developing an e-learning of thorax sonography.
Methods: An animated, interactive online tutorial was created using Adobe-Flash and Web-Kit-Freiburg/Germany [3]. The e-learning has been used as a preparation for a certified training programme followed by an evaluation of trained doctors using visual analogue scales VAS (Trial A). A prospective learning success study has been conducted with medical students using a 20 question multiple choice test (Trial B). The study also included a sustainability test after 2 weeks.

Results: An online tutorial is now available on the internet in English and German languages. The VAS self evaluation of the knowledge increase of 19 participating doctors using the e-learning has been 79% (median, min. of 50%, max. 97%). Trial B: During the prospective learning success study in 29 medical students the increase of correct answers was 11.7–17/20 (relative increase of 45.1%, $p < 0.0001$ Wilcoxon's matched pairs test). Two weeks after the post test still 83% of the questions were answered correctly ($p > 0.0001$ vs. pretest).
Conclusion: The basics of thorax sonography can be taught with high effectiveness with an e-learning.

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TEST CHARACTERISTICS OF SONOGRAPHIC EVALUATION OF IVC MAXIMUM DIAMETER AND IVC COLLAPSIBILITY INDEX IN PREDICTING CHF AMONG DYSPNEIC PATIENTS IN THE EMERGENCY DEPARTMENT

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Objectives: Emergency bedside ultrasound (EMBU) assessment of the inferior vena cava (IVC) for signs of increased right atrial pressure (RAP) may contribute to the evaluation of dyspneic patients by helping to distinguish CHF and non-cardiac causes of dyspnea. Both maximal IVC diameter and IVC respirophasic collapsibility index (IVC-CI) are related to RAP. In this study we compare the two variables in dyspneic ED patients to determine their test characteristics in diagnosing CHF. We tested the null-hypothesis that both variables would perform equally in diagnosing CHF.
Methods: This prospective study was performed in the ED of an urban academic medical center, annual census 55,000, using a convenience sample of dyspneic patients, age $\geq$18, with differential Dx including CHF. EMBU was performed by emergency physicians with experience in bedside echocardiography. Maximum and minimum IVC diameters were recorded using M-mode images. The IVC-CI was calculated as (IVC maximum − IVC minimum)/(IVC maximum). Receiver operator characteristic (ROC) curves with confidence intervals (CI) were generated to determine optimal cutoffs of IVC parameters in predicting CHF using standard methods. The criterion standard for presence or absence of CHF was determined by two blinded physicians' review of all clinical data relating to the ED visit (including admission, if applicable).
Results: 89 of 94 subjects had adequate IVC views, 57% male, median age 63. 36 (40%) had a final diagnosis of CHF. Area under the ROC curve for maximal IVC diameter predicting CHF was 74% (95% CI 64–82%). Area under the ROC curve for IVC-CI predicting CHF was 71% (95% CI 61–80%). The difference between the two areas was 3.0% (95% CI −11 to 16%). An IVC maximum dimension of 2.0 cm and IVC collapsibility of $\leq$15% were the optimal cutoffs to predict CHF.
Conclusion: IVC ultrasound evaluation of maximum diameter and of IVC-CI provide useful information in distinguishing dyspneic patients with and without CHF in the ED. There is no difference in the accuracy of IVC maximal diameter and IVC-CI in the diagnosis of CHF.

ACCURACY OF VARIOUS METHODS OF B-LINE ASSESSMENT IN THE DIAGNOSIS OF CHF COMPARED BY ROC CURVES

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Objectives: Rapid diagnosis (Dx) of interstitial pulmonary edema (PE) in the ED permits timely management of congestive heart failure (CHF). Identification of pleural-based B-line artifacts by emergency bedside ultrasound (EMBU) has been advocated for identifying PE and thus distinguishing CHF from non-cardiac etiologies of dyspnea such as COPD. However, a variety of B-line assessment techniques have been advocated, and the accuracy of the different techniques in Dx of CHF is unknown. There has been no comparison between the different methods in predicting CHF. We investigated the null hypothesis that the various B-line assessment techniques will perform equally in discriminating between CHF and other causes of dyspnea.
Methods: A prospective study was performed in the ED of an urban academic medical center, annual census 55,000, using a convenience sample of dyspneic patients, age $\geq$18, with differential Dx including CHF. EMBU was performed by emergency physicians who counted the number of B-lines in 1 rib-space in each of 8 previously described thoracic regions (upper anterior, lower anterior, upper lateral and lower lateral on both sides). The total number of B-lines present for a patient comprised the total B-line score (BLS). A rib space is considered B+ if $\geq$3 b-lines are present. The total number of B+ zones for a patient was the B+ zone score (BZS). Another score based on the number of bilateral B+ zones for a patient comprised the bilateral B+ zone score (BZ2). The criterion standard for presence or absence of CHF was determined by two blinded physicians' review of all clinical data relating to the ED visit (including admission, if applicable). B-line scores were compared in predicting CHF using receiver operator characteristic (ROC) curves and standard statistical methods.
Results: 94 subjects were enrolled, 56% male, median age 63. 39 (41%) had a final Dx of CHF. In assessing the accuracy of B-lines in diagnosing CHF, area under the ROC curve (A′) [95% CI] for BLS, BZS, and BZ2 were 77% [67–86%], 75% [65–84%] and 75% [65–84%], respectively. There was no statistically significant difference between the areas under the curves for any technique.
Conclusions: In ED patients with dyspnea, all B-line scoring techniques performed similarly for the diagnosis of CHF. While, none of the techniques outperform previously established test characteristics of BNP (ROC A′ of >90) the use of EMBU can aid the examiner in rapidly establishing the diagnosis of CHF before BNP testing is complete with good accuracy.

TEST CHARACTERISTICS OF VARIOUS TECHNIQUES OF ULTRASOUND ASSESSMENT FOR PULMONARY EDEMA USING B-LINES

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Objectives: Sonographic B-line artifacts are a sign of increased interstitial lung water and are advocated as a method to distinguish cardiac and non-cardiac causes of dyspnea. Two methods for quantifying B-lines are commonly used. One counts the number of B-lines in rib-spaces up to a maximum of 10, the other classifies a rib space with $\geq$3 B-lines as a B+ zone. However both methods depend on counting techniques that vary; and inter-rater test-characteristics of B-line counting are unknown. This study examines three methods of B-line counting for inter-rater reliability. The null hypothesis was that different methods of counting B-lines would have equal inter-rater reliability.
Methods: This was a review of videotaped B-line assessments obtained from patients as part of a prospective study of a convenience sample of dyspneic ED patients, age $\geq$18, with differential Dx including CHF, in an urban academic medical center, annual census 55,000. Video clips of ultrasound exams were recorded by emergency physicians evaluating the pleura for B-lines in 1 rib-space in each of eight thoracic regions. Video clips were reviewed by three blinded pairs of EPs with experience in B-line assessment. Each pair used one of the following definitions for B-line counting:

Definition 1: Total # of B-lines entering into the intercostal space over an entire respiratory cycle. Fused B-lines were counted as one.

Definition 2: Total # of B-lines entering into the intercostal space over an entire respiratory cycle. White lung pattern counted as 10 B-lines. Fused B-lines counted as a percentage of the space filled divided by 10, then added to the number of separate B-lines over entire cycle.

Definition 3: Greatest # of B-lines in the intercostal space at any one instant. White lung pattern at any instant counted as 10 B-lines. Fused B-lines counted as a percentage of the space filled divided by 10, then added to the number of separate B-lines at that instant.

Each reviewer's B-line count for the video clips of each rib-space was recorded. Single-measures intraclass correlation coefficient (ICC) was used to assess inter-rater reliability for the three definitions of BL counting. Nonweighted Cohen's Kappa (κ) was used to assess inter-rater reliability with the B+ zone method.
Results: 456 intercostal video clips were reviewed. ICC (95% CI) for definitions 1, 2, and 3 were 84% (81–87%), 87% (85–90%) and 89% (87–91%), respectively. For the B+ zone method κ were 70% (61–79%), 80% (73–87%) and 71% (63–79%) using definitions 1, 2, and 3, respectively.
Conclusion: All methods of B-line counting showed high inter-rater agreement. Definition 3 is more reliable than definition 1 for B-line counts. There were no significant differences between the other methods when using a BLS or B+ zones.

PROSPECTIVE APPLICATION OF THE BEDSIDE LUNG ULTRASOUND IN EMERGENCY (BLUE) PROTOCOL FOR RAPID EMERGENCY DEPARTMENT TRIAGE AND MANAGEMENT DURING THE 2009 H1N1 INFLUENZA PANDEMIC

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Background: Emergency department visits quadrupled with the initial onset and surge during the 2009 H1N1 Influenza Pandemic in New York City (NYC) from April to June 2009. 567 patients requiring hospitalization with confirmed 2009 H1N1 Influenza in NYC. There were 16 deaths, 46% of admitted patients were <18 years old and 20% were <5 years. 80% of confirmed cases had a known underlying risk condition, most commonly asthma (40% of confirmed cases).
Objective: To describe our experience in utilizing a modified BLUE protocol in patients with respiratory symptoms requiring CXR during the initial onset of 2009 H1N1 Influenza Pandemic (April to June 2009) in an urban emergency department.
Methods: We conducted a prospective convenience observational cohort study enrolling patients requiring Chest X-ray for suspected pneumonia during the onset and surge of the 2009 H1N1 Influenza Pandemic. We describe the application of a modified BLUE protocol with posterior thorax scanning in a cohort of patients with lung ultrasound findings.
Results: 20 pandemic 2009 H1N1 influenza patients requiring CXR were enrolled during this time period. Average age was 6.7 years (range 6 months-20 years old). Average examination time was 7 $\pm$ 2 min. A description of lung ultrasound findings and clinical outcomes will be presented. Modified BLUE protocol assisted in the identification of symptomatic patients with evidence of viral pneumonia (n = 15; 75%), viral pneumonia with superimposed bacterial pneumonia (n = 7; 35%), isolated bacterial pneumonia only (n = 1; 5%), and no ultrasound findings of viral or bacterial pneumonia (n = 5; 25%) in this cohort of patients.
Conclusion: A modified BLUE protocol maybe useful during epidemics or pandemics of respiratory illnesses for rapid point-of-care triage and management of patients requiring immediate respiratory isolation or cohorting and subsequent treatment with anti-viral medication, as well as patients requiring antibiotics for concurrent superimposed bacterial pneumonia.

OCULAR SONOGRAPHIC ASSESSMENT OF INTRACRANIAL PRESSURES IN STEEP TRENDELENBURG POSITION UNDERGOING ROBOT-ASSISTED LAPAROSCOPIC PROSTATECTOMY

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Background: The steep Trendelenburg position during robot-assisted laparoscopic prostatectomy provides best surgical view but it is known to increase the intracranial pressure especially in patients with CO_2 pneumoperitoneum. The non invasive ultrasonographic measurement of optic nerve sheath diameter (ONSD) has been proposed as a method to detect raised intracranial pressure (ICP).
Objective: We investigated the diameter of optic nerve (OND) and ONSD using optic nerve ultrasound (ONUS).
Patients and methods: ONUS was performed in 20 patients undergoing robot-assisted laparoscopic prostatectomy. ONSD was measured 3 mm behind the globe through a 7.5-MHz ultrasound probe on the both side of closed eyelids. Serial binocular scans were recorded at eight time points during surgery. 5 min before the start of operation (I5), 5 min after insufflations of CO_2 (C5), 10 min after trendelenburg position (H10), 30 min after trendelenburg position (H30), 60 min after trendelenburg position (H60), 90 min after trendelenburg position (H90), 120 min after trendelenburg position (H120), 5 min after supine position (S5) and 5 min after the end of surgery (E5)
Results: The diameter of optic nerve were not significantly different at every time point. The range for ONSD were 3.14–3.26 mm (mean $\pm$ SD; 3.2 $\pm$ 0.03). The diameter of optic nerve sheath were increased from I5 to H60(5.6–6.6 mm. There were no differences at

H90, H120 and S5 (6.6–6.7 mm). ONSD were decreased at E5 (6.4 mm).
Conclusion: The ONSD increased during steep Trendelenburg position with CO_2 pneumoperitoneum until H60, It seems that the ONSD remain stable after that, and returns to be normal after supine position. But the OND were not affected by steep Trendelenburg position and CO_2 pneumoperitoneum. Our study confirms the utility of sequential ONUS in diagnostic evaluation of increased ICP. ONSD can provide a useful information for risky patients.

LUNG ULTRASOUND "COMET-TAIL" SIGN IS A RELIABLE METHOD FOR DIAGNOSING HEART FAILURE AS A CAUSE OF ACUTE DYSPNEA

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Background: Research on use of lung ultrasound (LUS) has indicated that pulmonary oedema as well as other pulmonary pathology present specific, clearly recognizable patterns and enable differential diagnosis of acute dyspnea.
Objective: To determine the diagnostic accuracy of bilateral "comet-tail" sign on LUS (multiple vertical B-lines "lung rockets"), N-terminal pro-brain natriuretic peptide (NT-proBNP), and clinical assessment in differentiating heart failure (HF)-related from pulmonary-related acute dyspnea in a pre-hospital setting.
Patients and methods: Two groups of patients with acute dyspnea were prospectively compared: HF-related acute dyspnea group ($n = 129$) versus pulmonary-related acute dyspnea (asthma/COPD) group ($n = 89$). All patients with chief or major complaint of acute dyspnea had focused LUS performed, along with basic laboratory, NTproBNP and chest X-ray (CXR) for diagnosis of pulmonary oedema.
Results: Ultrasound signs (anterior comet-tail sign bilaterally): Sensitivity 100% (95% CI 98–100%); Negative predictive value (NPV) 100% (95% CI 98–100%); Specificity 95% (95% CI 91–100%), Positive predictive value (PPV) 96% (95% CI 93–100%).
NTproBNP: sensitivity 92%(95% CI 88–95%); NPV 86% (95% CI 82–90%); specificity 89% (95% CI 84–92%); PPV 90% (95% CI 85–94).
Prehospital Boston modified scoring: sensitivity 85% (95% CI 79–89); NPV 80% (95% CI 77–85); Specificity 86% (95% CI 82–90); PPV 90% (95% CI 86–93).
Comparing the three methods, significant differences were found between ultrasound sign versus NTproBNP ($p < 0.05$) and ultrasound sign versus prehospital Boston modified scoring ($p < 0.05$). In all eleven false-positive patients by NTproBNP method, we confirmed absence of comet-tail sign and excluded HF in pulmonary related dyspnea patients. In all five false-positive patients by ultrasound method, we excluded HF with NT-pro-BNP in pulmonary-related dyspnea.
Conclusion: Ultrasound comet-tail sign is the best method for confirmation of acute HF and in combination with NT-proBNP a reliable method for rule-out of acute HF in pre-hospital emergency setting.

USE OF PORTABLE ULTRASONOGRAPHY BY THE AMATEUR IN EARLY DIAGNOSIS OF PATIENTS WITH SEVERE SEPSIS AND ABDOMINAL PAIN

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Background: The mortality and morbidity of patients with severe sepsis is high. One of the early management goal is to identify surgical correctable causes of sepsis. Clinical examination or laboratory tests are not able to diagnose these. Conventionally emergency physicians are not trained to perform ultrasound and ultrasonographers are not available in the emergency department.
Objective: To describe patients who presented to the emergency department with septic shock where portable abdominal ultrasounds made the correct diagnosis within minutes after consultation.
Patients and methods: Emergency physicians in our department were trained in ultrasonography in an 8 h course which includes both didactic lectures and practical application by general surgeons, emergency physicians, urologists and radiologists. We were taught to identify free peritoneal fluid, *cholelithitis*, hydronephrosis and abdominal aortic aneurysm. We performed ultrasound on patients who were clinically indicated as part of the physical examination. We consulted among each other. We attended a course by Winfocus 1 year later. I collected three cases that demonstrate the value of ultrasound in the assessment of septic shock patients.
Results: (1) A 72 year old gentleman complained of fever for 48 h associated with abdominal pain and right hip pain. On examination, the abdomen was soft but tender diffusely. There were no pulsatile masses. The right hip was tender but range of movement was full. Ultrasound showed dilated abdominal aorta measuring 8 cm. Diagnosis: mycotic aneurysm. (2) 74 year old diabetic lady complained of 2 days of left loin pain with fever. Left lumbar and loin tenderness was noted. Ultrasound showed moderate left hydronephrosis. Diagnosis: left pyonephrosis. (3) A 43-year-old lady presented with severe epigastric pain for and fever for 1 day. Examination showed tender epigastrium and right hypochondrium. Ultrasound showed distended gall bladder with thickened gall bladder wall and a fluid level. Diagnosis: empyema gall bladder. The image of the above patients' will be shown.
Conclusion: Emergency physicians can be trained to perform emergency ultrasound to identify potentially life threatening conditions that otherwise are unable to be diagnosed.
Suggested readings
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NONTRAUMATIC BLADDER RUPTURE IN A 69 YEARS-OLD FEMALE PRESENT WITH FEVER AND ABDOMINAL PAIN

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A 69-year-old female patient came to our emergency department due to fever and lower abdominal pain noted for 2 days. Physical examination showed tenderness over the lower abdomen but no rebound pain. WBC 15800 Seg 67 Band 17 BUN/Cr 38/2.3 CRP 36.06 Urine analysis showed pyuria. Emergency ultrasound showed some bowel loops dilatation in mid-abdomen with fluid retention, urinary bladder wall thickening with moderate amount of ascites noted in pelvic cavity. Abdominal CT scan had done subsequently and showed there was fluid collection within pelvic cavity anterior to the urinary bladder, accompanied with contrast leakage in delayed films, suggesting urinary bladder rupture. Finally the patient was taken to operation room and operation showed a perforative hole at right anterior wall with turbid ascites in peritoneal cavity. Simple cystorrhaphy was done and patient was discharged uneventfully.

OPERATOR-DEPENDENCY IN THE ULTRASOUND DIAGNOSIS OF ACUTE APPENDICITIS

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Background: Ultrasound is evaluated as a useful imaging modality for the diagnosis of acute appendicitis. However, it is not easy for inexperienced sonographers to detect the evidence of appendicitis.
Objective: To clarify the relation between the accuracy of the ultrasound diagnosis for acute appendicitis and the competency of sonographers.
Patients and methods: In 206 cases of acute appendicitis confirmed by laparotomy for the latest 5 years, we retrospectively evaluated the accuracy of the ultrasound diagnoses made by well-trained ultrasound technicians, attending surgeons/physicians and junior residents, respectively. The ultrasound diagnoses were based on the recognition of the appendix, fecaliths or an ileocecal abscess as well as physical findings.
Results: The ultrasound diagnosis was accurate in 92 (93.9%) of 98 cases examined by well-trained ultrasound technicians, 38 (82.6%) of 46 cases examined by attending surgeons/physicians, and 20 (32.8%) of 61 cases examined by junior residents.
Conclusion: The accuracy of ultrasound diagnosis of acute appendicitis was dependent on the competency of sonographers.

A NEW NON-BIOLOGICAL MODEL FOR TRAINING IN ULTRASOUND-GUIDED REGIONAL ANESTHESIA

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Background: Ultrasound guided regional anaesthesia (UGRA) is an efficient and secure technique to save patients from needless pain. Recent studies have shown that the use of ultrasound can improve the quality of nerve blocks and avoid anaesthetic mistakes by enabling the anaesthesiologist to visualize the target nerve during the injection of local anaesthetics. Beside a profound knowledge of anatomy and basic ultrasound theory, it is necessary to acquire precise coordination with ultrasonic probe and local anaesthetic needles in order to safely apply this innovative technique. Biological models (turkey breast) allow to train skills before working on patients. However, biological models are not anatomically correct and their conservation is delicate.
Objective: To build a new non-biologic model for training and education purposes in UGRA.
Methods and results: We introduce a new non-biological home-made model for sonographic control in regional anaesthesia (SOCRATES) (4, patent pending). The advantage of this model is its durability, a high anatomic similarity to the human groin region to simulate the femoral nerve block and the possibility of showing the spread of local anaesthetic under ultrasonic control. We fabricated a tissue mimicking material for ultrasound use from three non-toxic components that can be bought in common stores. In this material structures are embedded which occur as artery, vein, femoral nerve and fascia. It can serve for near-realistic injection training with good assessment of trainees (satisfaction score 82.04%).
Conclusion: This new non-biological model will be of interest for training and education in UGRA.

A NEW METHOD OF ULTRASOUND SIMULATION IN PERI-RESUSCITATION CARE

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Background: ALS-compliant echocardiography can be a useful tool to identify potentially reversible conditions in real time at the bedside [1]. In this context we recently developed the focused echocardiographic evaluation in life support (FEEL) method [2]. Ultrasound simulation is an emerging method in critical care medicine [3,4]. To establish an educational tool for echocardiography in peri-resuscitation care we developed a system of a modified ultrasound simulator which is integrated in commercial ALS-trainers.
Objective: We aimed to determine the hands-off times (HOT) of echocardiography in comparison to the defibrillation in ALS scenarios.
Patients and methods: During a 1-day training courses novice echocardiographers ($n = 86$) had to complete a pre-defined peri-resuscitation scenario twice and to use defibrillation or echocardiography when indicated. Before the first scenario trainees did not get any information about the workflow of FEEL. After the first attempt trainees received a debriefing by the instructor and underwent the standardised training on the FEEL procedure. We used a modified mannequin combining standard features with a real time 3D-transthoracic echocardiography simulator for our study. All scenarios were filmed and hands-off times of defibrillation and echocardiography were analysed.
Results: During simulated resuscitation scenarios hands-off times to perform echocardiography according to the FEEL protocol was comparable to those to perform defibrillation (Pre-Training, mean $\pm$ standard deviation, 32.8 ± 18.0 s for defibrillation and 30.0 ± 15.8 s for FEEL). However, after brief training the times were reduced significantly for the FEEL exam (13.0 ± 3.4 s, $p < 0.01$) but not for defibrillation (22.9 ± 17.8 s).
Conclusion: The combination of a ALS and ultrasound simulator enables to determine hands-off time in simulated ALS. FEEL can be applied in an ALS-compliant way and without prolonging HOT and can be applied faster than ECG rhythm analysis or defibrillation after a brief training in simulation.

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OPTIC NERVE SHEATH SONO-ANATOMY IN RAISED INTRACRANIAL PRESSURE REVISITED: AN EXPERIMENTAL STUDY

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Background: Optic nerve ultrasound is widely being used to detect raised intracranial pressure (RICP). The current guidelines for measurement of optic nerve sheath diameter (ONSD) are based on the sono-anatomy described in studies using a 7.5 MHz linear probe. This measurement can sometimes include the edge artefact around the true dura, contributing to the wide variation in threshold measurement of ONSD for RICP. A relook at the sono-anatomy of the optic nerve sheath in RICP using currently ubiquitous higher frequency probes (>10 MHz) is long overdue.
Objective: To determine means of identifying the true dura mater and subarachnoid space and differentiating them from artefacts in cadaver orbital preparations with simulated raised subarachnoid pressure.
Methods: The bony roofs of orbits were removed in two cadavers to expose the orbital structures. The subarachnoid space of each optic nerve was cannulated and axial and lateral ultrasound measurements were performed with a 13 MHz linear probe before and after insufflating the space with fluid under increasing pressure.
Results: The true dura could be identified by tracing its curvature away from the optic nerve head and noting its merger with the scleral layers. A thin anechoic edge artefact could be seen separating the dura from the echogenic fat, particularly at normal CSF pressures. At normal pressures, the true anechoic subarachnoid CSF space was either not visible or was seen as a thin sliver between the pia and the dura. At elevated CSF pressures this space was clearly seen as an anechoic triangular or semi lunar space with scattered trabecular echoes on either side of the anterior optic nerve. This space tapered posteriorly 6–7 mm behind the papilla. This is in contrast to edge artefacts which maintain their thickness or widen, posteriorly.
Conclusion: The described sono-anatomy can guide identification of the true dura and margins of the subarachnoid space, and differentiate them from artefacts using high frequency ultrasound. This could result in more accurate and reproducible cursor placement for ONSD measurement.

EARLY MODIFICATIONS IN KIDNEY CORTICAL BLOOD FLOW AND ITS USEFULNESS FOR THE DETECTION OF INCIPIENT HAEMORRHAGIC SHOCK IN TRAUMA PATIENTS

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Objective: To study if early changes in renal cortical blood flow predict the development of hypovolemic shock after trauma.
Materials and methods: A prospective observational study conducted in 51 adult hemodynamically stable patients admitted to the emergency department because of suspected or definite severe trauma and retrospectively divided into two groups depending on whether or not they developed haemorragic shock requiring blood transfusion. Doppler ultrasound measurements of right and left interlobar arteries were obtained and Renal Doppler Resistance Index (RDRI) was recorded at admittance (within 1 h from trauma) and related to arterial blood gas analysis (haemoglobin, base deficit, lactate, CO_2, pH), heart rate, and outcome in the first 24 h (mortality, intensive care unit admittance, blood transfusion).
Results: Statistically significant differences between patients who developed shock within 24 h and those who did not were the following: higher RDRI (0.79 ± 0.12 vs. 0.62 ± 0.05, $p < 0.001$), lower base deficit (-4.0 ± 4 vs. 0.1 ± 3 mEq./L, $p = 0.001$) and higher lactate (2.7 ± 1.2 mMol/L vs. 2 ± 1 mMol/L, $p = 0.015$). AUC's of ROC analysis were significant for RDRI (AUC = 0.89, CI 0.73–1.05, $p < 0.001$) and lactate (AUC = 0.76, CI 0.55–0.96, $p = 0.04$), and borderline for BD, Hr, Hb, and pH. By multivariate analysis, RDRI at admittance resulted to be the only good independent predictor of hypovolemic shock and bleeding ($p < 0.001$), whereas haemoglobin, base deficit, heart rate, lactate and pH were not significant.
Conclusion: In trauma patients with stable haemodynamic conditions at admittance renal cortical blood flow redistribution occurs very early in response to occult bleeding and can be non-invasively detected by RDRI. The present study proposes RDRI as a non-invasive measurement of changes in renal circulation to detect blood loss, which may help activate early surgical or radiological intervention of patients with major trauma.

THE USEFULNESS OF MODIFIED BLUE (BEDSIDE LUNG ULTRASOUND IN EMERGENCY) PROTOCOL FOR DYSPNEA IN EMERGENCY DEPARTMENT (ED): THE BLUE-ED PROTOCOL

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Background: The BLUE protocol has been known as an excellent diagnostic tool for acute respiratory failures requiring admission to in intensive care unit. We incorporated cardiac ultrasound in BLUE algorithm because in emergent setting, we need to look for the cardiac origin as well. Cardiac evaluation was focused on detecting 3Es; effusion (cardiac tamponade), equality (right ventricular enlargement), and ejection fraction.
Objective: We examined if this BLUE-ED could help emergency physicians make an accurate diagnosis for all the patients complaining of dyspnea.
Patients and methods: This prospective observational study was performed for the patients (over 18 years old) with resting dyspnea during 12 months. At first, we assessed lung sliding, artifacts (A lines and B lines), alveolar consolidation and pleural effusion on stage I and II evaluation with 2–6 MHz curved probe. Then we checked heart to detect 3Es on parasternal long axis and apical or subcostal four chamber view using 2–4 MHz probe. We divided all the possible conditions into ten categories and developed the BLUE-ED algorithm to reach each category. We compared it with final diagnosis which was categorized with the same method and examined the agreements using kappa statistics. We compare the physician's level of confidence (LOC) for the first impression. 10 categories were as below: (1) Normal or inconclusive, (2) pulmonary embolism, (3) airway disease

(COPD or asthma), (4) pneumothorax, (5) large pleural effusion with any etiology, (6) Alveolar consolidation, (7) Acute pulmonary edema, (8) ARDS, (9) chronic interstitial lung disease with exacerbation, (10) pericardial effusion with/without tamponade.
Results: 120 patients were finally enrolled. The mean of physician's LOC for the first impression before and after BLUE-ED was 3.41 ± 0.69 and 4.58 ± 0.60, respectively (maximum of LOC is 5, paired *t* test $p < 0.001$). Cohen's kappa between the diagnosis after BLUE-ED and final diagnosis was 0.913 ($p < 0.001$).
Conclusion: BLUE-ED could help the emergency physician make an accurate diagnosis in patients with dyspnea in emergent setting.

ULTRASOUND MEASUREMENT OF OPTIC NERVE SHEATH DIAMETER IN NON-TRAUMATIC CRITICAL PATIENTS: A NEW DISEASE SEVERITY AND PROGNOSTIC TOOL?

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Background: Non-traumatic critical patients are usually assessed with various disease severity scores. They may be suffering from elevated intracranial pressure (EICP) not clinically obvious[1]. An ultrasound (US) measurement of the optic nerve sheath diameter (ONSD), by detecting ICP[2], could contribute to severity scoring.
Objective: Evaluation of US ONSD for disease severity assessment of non-traumatic critical patients.
Patients and methods: In a prospective observational study, non-traumatic critical patients were assessed by US ONSD, acute physiology and chronic health evaluation II (APACHE II), Glasgow Coma Scale (GCS). ONSD was bilaterally measured 3 mm behind the globe using a 10-MHz linear probe on the closed eyelids of supine patients; the average of the two ONSD was calculated. Cerebral computed tomography (CCT) was obtained when clinically necessary. Every patient was followed-up to discharge. Correlation analysis and Student's *t* test were performed.
Results: Thirty-three patients were enrolled; CT scan was performed in 19 cases. APACHE II and ONSD US correlated with $r = 0.72$ ($p = 0.0001$); GCS and ONSD US with $r = -0.73$: the less the GCS the larger the ONSD ($p = 0.013$). The CT detected only a cerebral hemorrhage but no mass effect (mean ONSD of 4 mm) and a chronic hydrocephalus (mean ONSD of 4.1 mm). A worse prognosis was found with ONSD >5.6 mm. By ROC analysis a value >5.7 mm was 100% specific and 80% sensitive for length of hospitalization or death.
Conclusion: US ONSD may be useful in severity-scoring critical non-traumatic patients, independent of CT scans and clinically EICP.
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INFERIOR VENA CAVA DIAMETER: DOES THE INTRA-ABDOMINAL PRESSURE MATTER?

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Background: Critical patients are often assessed by ultrasonography (US) of the heart lung and the inferior vena cava (IVC) when evaluated for volume status. Intra-abdominal pressure (IAP) is never accounted for variations in IVC diameter.
Objective: To ascertain the influence of IAP on the IVC diameter to estimate atrial pressure.
Patients and methods: Consecutive critical patients evaluated for volume status were assessed for invasive central venous pressure (iCVP) using a central vein catheter joined to standard transducer and monitor, US of the IVC and IAP. For IVC a sectorial 3 MHz probe was used and percent respiratory variation measured during normal spontaneous ventilation to calculate atrial pressure (uAP). IAP was measured at end-expiration in supine position after instillation of 25 ml saline in bladder, with the transducer zeroed at the level of the mid-axillary line and avoiding abdominal muscle strain[1]. For each patient lung and heart ultrasonography was also performed.
Results: Twenty-four patients were enrolled and evaluated by an experienced physician. The difference between the iCVP and the uAP was assumed significant when it was at least 5 cm H_2O. iCVP and uAP had correlation index $r = 0.54$ [95% confidence interval (CI) 0.18–0.78], $p = 0.0017$. Receiver Operator Characteristic curve gave IAP value of 15 mmHg above which sensitivity is 85.7% and specificity 94.1% for uAP corresponding to iCVP. When analyzed only patients with IAP inferior to 15 mmHg, the correlation between uAP and iCVP was $r = 0.95$ (95% CI 0.86–0.98).
Conclusion: IVC diameter for estimating CVP should be regarded with caution when intra-abdominal hypertension is present. In critical patients it may be useful to measure IAP when evaluating IVC for CVP and volume status.
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PRENATAL SCREENING IN THE DEVELOPING WORLD USING ULTRASOUND AND THE SANA TELEMEDICINE PLATFORM

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Background: The UN Millenium Development Goals identify perinatal and maternal mortality as major causes of death in the developing world [1]. In many parts of the world, women living in remote or rural areas do not have access to obstetricians and therefore do not benefit from proper prenatal care. Most women deliver at home, and if complications such as breech presentation or placenta previa arise, few medical options exist. Identifying these high-risk pregnancies and referring them to obstetricians in larger cities may therefore reduce maternal and perinatal mortality. However reaching women in rural and remote areas is challenging, and most local health workers (LHWs) do not have the training or equipment to identify high risk pregnancies.
Objective: To develop a mobile telemedicine platform that integrates a patient's clinical history and prenatal screening ultrasound images into an electronic medical record reviewable remotely in near real-time by physician specialists.

Patients and methods: Sana is an Android-based telemedicine platform that allows LHWs to collect patient clinical history and prenatal ultrasound images on a smartphone and transmit it to a central server using a cellular signal. Images captured on a portable ultrasound machine can be downloaded to a laptop, which is then paired to a smartphone running the Sana application. Obstetricians can then review this information remotely on the internet, identify high-risk pregnancies, and notify the LHW that the woman needs further evaluation and treatment.
Previous work has shown that mid-level health providers are able to make accurate diagnoses using point-of-care ultrasound after only minimal training [2]. The proposed work flow augments this capability by allowing remote physician supervision and feedback, a critical component to improving the LHWs diagnostic abilities.
Conclusion: Sana-enabled smart phones can be used by LHWs to identify high-risk pregnancies by allowing near realtime supervision by remote obstetricians. Identification of high-risk pregnancies and appropriate referral may reduce perinatal and maternal mortality in the developing world.

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THE PRESENCE OR ABSENCE OF CARDIAC MOVEMENT IDENTIFIED ON PRE-HOSPITAL ECHOCARDIOGRAPHY PREDICTS OUTCOME IN CARDIAC ARREST PATIENTS

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Background: The pre-hospital treatment of cardiac arrest is managed according to standardized protocols, however strong recommendations under which circumstances resuscitation efforts should be stopped or continued do not exist. Some case reports and case series of echocardiography in pre-hospital management of resuscitation have been published, but on-scene echocardiography as a predictor for outcome has not been evaluated in any prospective study.
Objective: Determine the ability of pre-hospital emergency echocardiography to predict survival in cardiac arrest patients at the scene.
Patients and methods: All participating emergency physicians ($n = 24$) received a 4-h course in focused echocardiography including 1 h of theoretical basics and video demonstrations and 1 h of hands-on training. After obtaining standard procedures such as defibrillation, intubation and vascular access, a focused ultrasound was performed during the pulse-check according to the FEEL algorithm described by Breitkreutz et al. Patients were divided into movement and no-movement groups. Sonographic evidence of movement was defined as any motion of the myocardium, ranging from visible ventricular fibrillation to coordinated ventricular contractions. CPR had to be continued for at least 15 min after the initial echocardiography according to recent AHA guidelines and no decisions were made based on the results of ultrasound.
Results: We enrolled 40 patients in the study. Thirty patients had no movement on echocardiography. One patient of the no movement group (3%) versus four patients of the movement group (40%) survived to hospital admission ($p < 0.05$). Cardiac standstill on echocardiogram resulted in a positive predictive value of 96.7% for death at the scene with a negative predictive value of 40%.
Conclusion: The absence of cardiac movement on pre-hospital ultrasound may help predict adverse outcome in cardiac arrest patients. Larger studies are needed before any conclusions about ending resuscitative efforts prematurely can be made.

DEVELOPMENT OF EMERGENCY ABDOMINAL ULTRASOUND COURSE IN KOREA: 1-YEAR EXPERIENCE

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Background: Ultrasound has been used in the emergency department for 15 years in Korea. Although the use and necessity of emergency ultrasound (EUS) has grown, we have yet to accomplish a structured and standardized training curriculum for EUS.
Objective: This report describes a 1-year experience of emergency abdominal ultrasound course that we developed for emergency medicine residents and physicians.
Patients and methods: Six-hour course consists of didactic lectures and hands-on practice. A 1-h didactic lecture was provided. The lecture consisted of basic ultrasound physics and principles, and anatomy for abdominal ultrasound. In the hands-on session, the instructors demonstrated the abdominal ultrasound techniques forehand and then the students practiced on the standard patients. Participants evaluated the programs using a five or ten point Likert scale. After 2 months to 1 year, the participants evaluated the usefulness of the course, the knowledge, and self confidence.
Results: Total of 61 trainees participated in eight courses. The evaluation score for overall quality of content, clinical utility, quality of educational method, quality of instructor, and time allocation were 4.4 ± 0.7, 4.5 ± 0.6, 4.3 ± 0.6, 4.4 ± 0.6, 4.1 ± 0.7, respectively. The evaluation score of the self-confidence of each scan before and after the course were as follows: liver scan, 3.2 ± 2.1 to 6.9 ± 1.2; gallbladder and bile duct scan 3.0 ± 2.5 to 6.9 ± 1.2; pancreas scan, 2.4 ± 2.1 to 6.3 ± 1.3; renal scan, 3.6 ± 2.6 to 7.6 ± 1.3. Evaluation score followed up after 2 months to 1 year for self confidence of each scan were as follows: liver scan, 6.1 ± 1.5; gallbladder and bile duct scan, 6.5 ± 1.6; pancreas scan, 5.5 ± 1.8; renal scan, 7.2 ± 1.5.
Conclusion: The Emergency Abdominal Ultrasound Course was a fairly successful course. But continuous improvement for educational content including objective evaluation tool needs to be developed.

FEEDBACK FOLLOWING THE INAUGURAL YEARS' DELIVERY OF THE FIRST UNIVERSITY MASTERS-LEVEL PROGRAMME IN EMERGENCY MEDICINE AND CRITICAL CARE IN THE UNITED KINGDOM

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At the 5th WINFOCUS World Congress, we delivered an oral presentation on the development of the first university masters-level programme in Emergency Medicine & Critical Care in the United Kingdom [1]. This programme provided an opportunity for emergency medicine and critical care physicians, from all over the UK to engage with formal ultrasound education, delivered in a way specific to their needs and commitments [2].

Recruitment to the programme was better than expected and it has proven a success with excellent retention and progression rates. Eighteen participants were recruited to the programme, with five awarded a certificate in medical ultrasound and 11 progressing to their second year of study. One participant deferred their assessments and one withdrew from the programme.

Feedback was obtained from the participants throughout the academic year and this has been acted upon to further improve the experience. In this presentation we provided a detailed overview of the first years' delivery, including the learning, teaching and assessment strategy, retention and progression data, participant feedback, problems encountered and planned enhancements, such as video conferencing, increased peer support, dedicated distance learning packages, focused learning packs, new clinical pathways and dedicated practical teaching and assessment days.

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A PILOT STUDY TO DETERMINE THE FEASIBILITY OF PERFORMING AN OBSERVED ASSESSMENT REMOTELY, BY TRANSMITTING SIMULTANEOUS ULTRASOUND AND A/V SIGNALS, OVER A STANDARD INTERNET CONNECTION

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Introduction: The need to deliver ultrasound education and perform competency assessment has grown as point of care ultrasound use has spread throughout the developed and developing world. Responsible practice requires an observed assessment to evaluate a candidate's skill competency but this is increasingly difficult with the increasing number and the ever widening geographic distribution of ultrasound candidates [1]. A pilot study was performed to determine the feasibility of performing an observed assessment remotely, by transmitting simultaneous ultrasound and A/V signals, over a standard internet connection to an assessor on a different continent.

Method: Three practitioners performed four different examinations (FAST, AAA, echocardiography and chest ultrasound) on a normal volunteer [2]. The practitioners made several predetermined errors in technique and/or equipment manipulation. Two assessors, one present with the practitioners and one on a different continent watching a live video feed, observed the practitioners to identify these errors. The assessors' observations were compared. The video feed used a picture in picture method as the main feed to our streaming device. We achieved this by running 2 High Definition Sony EX3 cameras into our vision mixer (NewTek TCXD300) along with a composite video feed from the ultrasound device. Audio was also combined with the video signal through the same mixer utilising 2 Sony lavalier radio microphones. The vision mixer output was a flash video stream which we embedded into a free web streaming provider http://www.ustream.tv. We had a laptop computer setup to display the stream at the studio end in order to monitor the "on air" feed. Real-time communication was via a hand held mobile device (iPhone).

Results: In all cases both assessors were able to identify the deliberate mistakes, but some differences were noted between the assessors when grading the quality of the obtained images.

Discussion: The real time video streaming technique allowed the remote assessor to perform an adequate competency assessment. Some benefit was also noted from having a combined video image as it gave a clear picture of the ultrasound display and the participant's hand at all times. Communication was adequate via the mobile device, although there was some delay (about 8 s) which could be improved.

Conclusion: This pilot suggests it is possible to perform an assessment remotely, using real time video streaming techniques and commonly available digital imaging software. Further studies should be performed to explore this area, as it has the potential to open up education and assessment to a large number of practitioners in the developed and developing world.

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THE USEFULNESS OF "SEARCH 9ES" (SONOGRAPHIC EVALUATION OF AETIOLOGY FOR RESPIRATORY DIFFICULTY, CHEST PAIN, OR HYPOTENSION USING 9ES) IN EMERGENCY DEPARTMENT (ED)

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Background: It is important to identify the causes of dyspnea, chest pain, or hypotension rapidly in ED. We had developed 9Es system for the focused thoracic ultrasound to detect the origins in those critical situations. 9Es are the nine initial Es consisting of empty thorax (pneumothorax), edematous lung, extended-FAST, effusion (pericardial/pleural effusion, cardiac tamponade), equality (pulmonary embolism), ejection fraction, endocardial inward motion (acute coronary syndrome),

exits and entrances (valves, aorta, and IVC), E/E′ (early mitral inflow velocity divided by early mitral annular velocity) and hemodynamics.
Objective: We evaluated the effectiveness of so-called SEARCH 9Es system.
Patients and methods: Using SEARCH 9Es, we performed focused thoracic ultrasound for the patients (over 18 years old) with chest pain, dyspnea, or low blood pressure in ED. We made the checklist to search for bimodal answers to each question about every single E except the last E (E/E′) which is numerical data and needs pulsed and continuous waved Doppler techniques. We divided all the possible conditions into 15 categories using the 9Es answers and clinical information and developed the SEARCH 9Es algorithm to reach each category. We compared it with final diagnosis which was categorized with the same method and examined the agreements using kappa statistics. We compare the physician's level of confidence (LOC) for the first impression and number of suggested diagnostic list before and after SEARCH 9Es.
Results: 225 were finally enrolled. The mean of physician's level of confidence (LOC) for the first impression before and after SEARCH 9Es was 2.96 ± 0.92 and 4.32 ± 0.93, respectively (maximum of LOC is 5, paired *t* test $p < 0.001$). The mean number of diagnoses before and after SEARCH 9Es was 2.73 ± 1.62 and 1.52 ± 0.79, respectively (paired *t* test $p < 0.001$). Cohen's kappa between the diagnosis after SEARCH 9Es and final diagnosis was 0.917 ($p < 0.001$).
Conclusion: Using SEARCH 9Es, emergency physicians could make rapid and accurate decisions in patients with dyspnea, chest pain, or hypotension in ED.

EMERGENCY ULTRASOUND CAN BE USED TO VERIFY SHOULDER REDUCTION

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Background: The diagnosis of shoulder dislocation and verification of shoulder reduction depend mainly on physical examination and radiography. Emergency ultrasound has been reported in several cases to successfully verify shoulder reduction. If we can use emergency ultrasound to provide real-time verification for shoulder reduction, we can prevent unnecessary repetitive reduction and more medications.
Objective: The aim of this study was to determine the efficacy of emergency ultrasound in the diagnosis of shoulder dislocation and real-time verification of shoulder reduction.
Patients and methods: This was a prospective, convenient sample study conducted in one teaching hospital that provides urban tertiary care. Patients, older than 18-year-old, were eligible if they presented to the emergency department with acute shoulder dislocation defined as within 14 days of injury. We excluded patients having open wounds that interfered with ultrasound scanning. We enrolled convenient patients encountered within main author's shifts (CKC), who is a senior emergency physician and familiar with musculoskeletal ultrasound.
Results: The study included 20 patients. The mean age of the patients was 48 years old, from 18 to 87, and half of them were men. The injury mechanisms were minor falling downs for seven patients, sport-related injuries for five, habitual dislocations for five, and traffic accidents for three. All patients had anterior shoulder dislocations and five of them had fractures. Seventeen (85%) patients received procedural sedation and analgesia with oxygen and monitoring during the reduction. One patient who refused procedural sedation and analgesia and post-reduction radiography had habitual dislocations; the reduction was confirmed by clinical examination and ultrasound only. We verified all successful reduction with ultrasound immediately after the reduction.
Conclusion: Emergency ultrasound can be a useful tool to provide real-time verification for shoulder reduction.

RAPID DIAGNOSIS OF HEPATOCELLULAR CARCINOMA WITH SPONTANEOUS RUPTURE IN EMERGENCY DEPARTMENT: ROLE OF BEDSIDE ULTRASOUND

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Background: Spontaneous rupture of hepatocellular carcinoma is rare but life-threatening [1]. Rapid diagnosis may fasten resuscitation and treatment.
Objective: The aim of this study was to investigate the role of bedside ultrasound in the diagnosis of spontaneous ruptured hepatocellular carcinoma and impact on patient outcome.
Patients and methods: We retrospectively reviewed 43 medical records with the diagnosis of spontaneous rupture of hepatocellular carcinoma from 1 January 2004 to 31 December 2009. The gold standard of diagnosis was computed tomography. 34 patients underwent bedside sonography before computed tomography.
Results: 25 out of 34 patients (73.5%) were accurately diagnosed to have spontaneous rupture of hepatocellular carcinoma before computed tomography. The time needed for diagnosis by bedside ultrasound was 80 min. The time needed for diagnosis by computed tomography was 142.4 min (p value 0.005). Mortality rate was 9/18 (50%) for computed tomography group if compared to 10/25 (40%) of bedside ultrasound group (no statistical significance). Besides, for those who survived the event, the admission duration was shorter significantly in bedside ultrasound group (9.7 days) compared to computed tomography group (24.3 days) (p value 0.019).
Conclusion: Bedside ultrasound is useful in the rapid diagnosis of spontaneous rupture of hepatocellular carcinoma. Rapid diagnosis may lead to prompt resuscitation and treatment. This may result in lower mortality rate and shorter admission duration.
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LEFT VENTRICULAR COMPLIANCE: CORRELATION BETWEEN ECHOCARDIOGRAPHIC AND HEMODYNAMIC PARAMETERS

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Objective: The aim of this study was to assess the correlation between non invasive echo-Doppler parameters of diastolic function end-diastolic left ventricular (LV) filling pressures.
Methods: The patient population was composed of 44 subjects (34 men and 10 women) 52% with normal ventricular function.
Results: LV end-diastolic pressure was statistically different ($P = 0.022$) in the four subgroups divided on the basis of the mitral flow pattern in the overall population and in the patients with

depressed LV function. In the overall population LV end-diastolic pressure was significantly correlated with: (1) E/A ratio of mitral flow ($r = 0.45$, $P = 0.002$); (2) mitral E wave peak velocity ($r = 0.39$, $P = 0.017$); (3) isovolumic relaxation time ($r = 0.34$, $P = 0.01$); (4) left atrial diameter ($r = 0.33$, $P = 0.037$); (5) duration of retrograde A wave of pulmonary venous flow ($r = 0.33$, $P = 0.03$); (6) pulmonary vein D wave peak velocity ($r = 0.29$, $P = 0.05$).
Conclusion: Among the echo-Doppler variables examined, those derived from transmitral flow and pulmonary vein flow show the best correlation with left ventricular end-diastolic pressure. Thus, the echo-Doppler evaluation of LV diastolic function should take into account this limitation.

LUNG ULTRASONOGRAPHY IN THE DIAGNOSTIC WORK UP OF PNEUMONIA IN STROKE PATIENTS

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Background: Pneumonia is a frequent complication in patients with stroke and its early diagnosis is commonly a challenge**.** Chest X-ray (CXR) has several limitations especially in bedridden patients. Lung ultrasonography (LUS) is a promising technique in the detection of peripheral pneumonic infiltrates and pleural effusions.
Objective: We performed this study to assess the usefulness of bedside LUS in the diagnostic work up of pneumonia in stroke patients in comparison to CXR.
Patients and methods: We collected data on consecutive ischemic or hemorrhagic stroke patients admitted to Perugia's Stroke Unit from April 2009 to May 2010, in whom pneumonia was suspected according to clinical and laboratory findings. LUS and CXR were performed within 24 h from the onset of pulmonary symptoms and within 24 h from each other. LUS operator and radiologist were blinded to respective results. According to a revised version of the research protocol, after October 2009 CT scan was foreseen in all CXR/LUS discordant cases. Statistical analysis was done to assess concordance (Pearson Chi-square test) and symmetry (McNemar test) between LUS and CXR results.
Results: Out of the 40 patients studied, 9 were CXR positive. In this group LUS was positive in eight cases (7 homolateral and 1 contralateral to CXR finding) and negative in one. In the one CXR positive and LUS negative patient, CT scan confirmed LUS result. There were 29 negative CXR patients. In this group LUS was positive in 17 cases, negative in 13 cases and non conclusive in 1 case. Among the 17 CXR negative and LUS positive cases, 6 patients underwent CT scan which confirmed pneumonia.
Conclusion: LUS has the potential role to detect pneumonic infiltrates and pleural effusion in severe stroke patients with negative CXR and clinical suspicion of pneumonia.

ULTRASOUND ASSESSMENT OF SEVERE DEHYDRATION IN CHILDREN WITH DIARRHOEA

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Background: Acute gastroenteritis remains a major cause of morbidity and mortality in children around the world, accounting for nearly two million deaths annually in children under 5 years of age. While oral rehydration solution (ORS) has been shown to be an effective, safe, and inexpensive method of treating children with mild to moderate dehydration, IV fluids are required to treat children with severe dehydration.
Objective: We attempt to determine whether ultrasound assessment of the inferior vena cava (IVC) can be used to determine the severity of dehydration in children presenting with diarrhoea, and whether it performs better than the World Health Organization (WHO) clinical scale.
Patients and methods: We enrolled a prospective cohort of children presenting with diarrhoea to three rural hospitals in Rwanda. Upon arrival, a local physician trained in basic ultrasound performed an ultrasound of the IVC and aorta. Children were also assessed clinically by a second clinician using the standard criteria recommended by WHO. All children were weighed on admission to the hospital, rehydrated according to standard protocols, then weighed again just prior to discharge; a percent weight change of >10% was considered the gold standard for severe dehydration. We used ROC curves to determine the maximum sensitivity and specificity for IVC to aorta ratio, percent IVC collapse, and the WHO scale compared to our gold standard.
Results: Complete data was available on 52 children for analysis, ranging in age from 1 month to 10 years. 29% of the children had severe dehydration according to our gold standard. Using the best ROC curve cutoff of 1.22, aorta/IVC ratio had a sensitivity (SN) of 93% (95% CI 81–100%), specificity (SP) of 59% (95% CI 44–75%), likelihood ratio positive (LR+) of 2.3 (95% CI 1.5–3.5), and likelihood ratio negative (LR−) of 0.11 (95% CI 0.02–0.76) for detecting severe dehydration. Using the best cutoff of 27% collapse, IVC inspiratory collapse had a SN of 93% (95% CI 81–100%), SP of 35% (95% CI 20–51%), LR+ of 1.4 (95% CI 1.1–1.9), and LR− of 0.19 (95% CI 0.03–1.3). Using the best ROC curve cutoff of 2 or more signs, the WHO score had a SN of 73% (95% CI 51–96%), SP of 43% (95% CI 27–59%), LR+ of 1.3 (95% CI 0.9–2.0), and LR− of 0.62 (95% CI 0.25–1.5).
Conclusion: We found ultrasound assessment of aorta/IVC ratio to be an accurate predictor of severe dehydration in children with diarrhoea and/or vomiting. While the numbers of patients enrolled in our study were too small to definitively say that ultrasound performed better than clinical exam for evaluating dehydration status in children, it is clear that ultrasound may be a useful adjunct to clinical exam in guiding management of these patients.

FOCUSED ASSESSMENT WITH SONOGRAPHY IN TRAUMA (FAST): A 1 YEAR RETROSPECTIVE STUDY

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Background: To evaluate the accuracy of ultrasound in predicting the need for emergency laparotomy in patients who sustained trauma presenting to the Emergency Department.
Objective: This study aims to (1) compare the sensitivity and specificity of FAST as used by our local emergency physicians and surgeons compared with those from other studies performed abroad; (2) compare the use of ultrasound versus CT abdomen/pelvis in the detection of intraabdominal bleeding; (3) determine if any false

negative ultrasound studies were associated with significant morbidity e.g. unexpected laparotomy.

Patients and methods: A 1 year retrospective study of all patients enrolled in the trauma registry presenting to the Emergency Department, Singapore General Hospital from 1st January 2009 to 31st December 2009.

Results: There were 285 patients of which 243 (85.3%) were men. The mean age was 38.2 years. 183 patients (64.2%) sustained trauma from road traffic accidents. Mechanisms of trauma include MVAs (183 patients, 64.2%), falls (66 patients, 23.1%), penetrating wounds (15 patients, 5.3%), assaults (4 patients, 1.4%) and others (17 patients, 6%). There were 276 patients with FAST done, of which 133 also had CT abdomen and pelvis (CTAP) done. Nine patients did not have FAST. 143 patients had only FAST done.

Comparing FAST with CTAP, the sensitivity (Sn) was 0.355, specificity (Sp) was 0.921, positive predictive value (PPV) was 0.55 and negative predictive value (NPV) was 0.823. Comparing FAST with need for abdominal surgery, the Sn was 0.857, SP was 0.922, PPV was 0.222 and NPV was 0.996.

There was only one patient with a negative FAST result and who had abdominal surgery. He had a perforated appendicitis and hence the trauma was thought to be incidental.

Conclusion: FAST has a high NPV for abnormal CTAP results and need for surgery. We recommend that in patients with negative FAST, there is no need for further CTAP and that clinical follow up would suffice.

EMERGENCY PHYSICIAN ULTRASONOGRAPHY FOR EVALUATING PATIENTS AT RISK FOR ECTOPIC PREGNANCY: A META-ANALYSIS

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Background: Ectopic pregnancy (EP) is a common concern in emergency departments (EDs), and remains the leading cause of first trimester mortality. Pelvic ultrasound by emergency physicians has been investigated as a diagnostic test for EP.

Objective: We sought to perform a systematic review and present a meta-analysis of the use of emergency physician pelvic ultrasound in the evaluation of patients at risk of EP.

Patients and methods: A structured search was performed of both MEDLINE and EMBASE. Inclusion criteria were: (1) study reported original research on ED patients at risk for EP; (2) emergency physician performed and interpreted the initial pelvic ultrasound; and (3) follow-up was conducted on all patients. Sensitivity was defined as the proportion of patients with ectopic pregnancy for which ED ultrasound demonstrated no intrauterine pregnancy. A random effects model was used to obtain summary test characteristics.

Results: The initial search showed 576 publications, abstract review yielded 60 with potential relevance, and 10 studies were included. There was a total of 2,057 patients of whom 152 (7.5%) had EP. 58% of the patients were studied at training hospitals, and 42% of the patients were studied in community ED settings. The pooled sensitivity estimate was 99.3% (95% CI 96.6–100), negative predictive value was 99.96% (95% CI 99.6–100), and negative likelihood ratio was 0.08 (95% CI 0.025–0.25); all without significant heterogeneity.

Conclusions: The results of this meta-analysis suggest that in a wide variety of clinical settings, the use of bedside ultrasound performed by emergency physicians as a diagnostic test for EP provides excellent sensitivity and negative predictive value. Visualization of an intrauterine pregnancy by an emergency physician is generally sufficient to rule out ectopic pregnancy. These findings support the appropriate use of pelvic ultrasound by emergency physicians in clinical practice.