

ES-01

Image Forum: Point-of-care Ultrasound (POCUS) and Abdominal Perforation*Jen-Tang Sun**Emergency Department**Far Eastern Memorial Hospital*

This case report highlights the effective use of point-of-care ultrasound (POCUS) in diagnosing a hollow organ perforation. An 81-year-old male presented with sudden abdominal pain, and POCUS revealed critical signs such as the curtain sign and an enhanced peritoneal stripe sign (EPSS), indicating free intraperitoneal air. These findings were later confirmed by computed tomography. The early identification of hollow organ perforation using POCUS facilitated prompt surgical intervention, leading to a successful patient outcome. This case underscores the value of POCUS in emergency settings for rapid and accurate diagnosis of life-threatening conditions.

ES-02

Speckle Tracking and 3D Echocardiography Application in Patient with Cardiac Arrest*Chia-Ching Chne**Chang-Bin Show Chwan Memorial Hospital*

Cardiopulmonary resuscitation (CPR) is a critical intervention employed to restore circulation and oxygenation in individuals experiencing cardiac arrest. Survival and neurological outcomes in post-CPR patients are heavily influenced by the effectiveness of CPR and the underlying cardiac function. To enhance our understanding of the hemodynamic consequences of CPR and its impact on cardiac function, speckle tracking echocardiography (STE) has emerged as a valuable imaging modality.

STE is an advanced echocardiographic technique that provides quantitative assessments of myocardial strain and strain rate. By tracking the movement of speckles within cardiac tissue, STE

offers a comprehensive analysis of myocardial mechanics, allowing for the evaluation of both global and regional cardiac function [1]. In the context of CPR, STE has the potential to provide valuable insights into the immediate changes in cardiac function during resuscitation efforts.

Assessing cardiac function during and after CPR is challenging due to the dynamic nature of the process. Traditional echocardiographic methods may not capture the subtle alterations in myocardial mechanics that occur during CPR. STE in transesophageal echocardiography, with its ability to detect changes in strain and strain rate, can offer a more detailed assessment of cardiac performance during resuscitation and its immediate aftermath, allows quantitative evaluation of chest compressions in real time during CPR, offering valuable insights into the effectiveness of cardiac massage and chest compression quality.

ES-03

A Feasibility Study of a Handmade Ultrasound-guided Phantom for Paracentesis*Chih Hsien Lin**Emergency department of National Taiwan**University Hospital Hsin Chu branch*

Paracentesis is a commonly encountered procedure in clinical practice. The use of ultrasound guidance diminishes the risk of a dry tap (failure to obtain fluid) during paracentesis and reduces the likelihood of complications. Simulation-based training is effective for ultrasound (US)-guided procedures. However, commercially developed simulators are costly. This study aims to evaluate the feasibility of a hand-made phantom for US-guided paracentesis.

We described the recipe to prepare an agar phantom. We collected the US performance data of 50 novices, including 22 postgraduate-year (PGY) residents and 28 undergraduate-year (UGY) students, who used the phantom for training, as well as 12 emergency residents with prior US-guided

experience. We obtained the feedback after using the phantom with the Likert 5-point scale. The data were presented with medians and interquartile ranges (IQRs) and analyzed by the Wilcoxon rank sum test.

While emergency residents demonstrated superior performance compared to trainees, all trainees exhibited acceptable proficiency (global rating of ≥ 3 , 50/50 vs. 12/12, $p = 1.000$) and comparable needle steadiness [5 (5) vs. 5 (5), $p = 0.223$]. No significant difference in performance was observed between PGYs [5 (4–5)] and UGYs [5 (4–5), $p = 0.825$]. No significant differences were observed in terms of image stimulation, puncture texture, needle visualization, drainage simulation, and endurance of the phantom between emergency residents and trainees. However, experienced residents rated puncture texture and draining fluid as “neutral” (3/5 on the Likert scale). The cost of the paracentesis phantom is US\$16.00 for at least 30 simulations, reducing it to US\$6.00 without a container.

The paracentesis phantom proves to be a practical and cost-effective training tool.

It enables novices to acquire paracentesis skills, enhances their US proficiency, and boosts their confidence. Nevertheless, further investigation is needed to assess its long-term impact on clinical performance in real patients.

ES-04

A Woman with Painful Neck after COVID-19 Vaccination

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Introduction: A 31-year-old woman presented with progressive left-side neck pain 2 days after receiving the Oxford-AstraZeneca COVID-19 vaccine in her left arm. Examination revealed multiple tender neck masses. Point-of-care ultrasound was performed.

Diagnosis: The findings were consistent with

neck lymphadenitis following COVID-19 vaccination. The condition resolved spontaneously within 2 weeks, and the patient was asymptomatic at the 1-month follow-up. Point-of-care ultrasound effectively identified lymphadenitis by showing increased vascularity and enlarged, hypoechoic lymph nodes.

Conclusion: Neck lymphadenitis can occur after COVID-19 vaccination, typically resolving within weeks. Point-of-care ultrasound is a valuable tool for diagnosing vaccine-related lymphadenitis and differentiating it from other conditions.

ES-05

Rapid Detecting Brachial Plexus Injury by Point-of-Care Ultrasonography

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Brachial plexus injury (BPI) is regarded as one of the most devastating injuries of the upper extremity. Brachial plexus neuropathy can result in high morbidity by seriously affecting the motor function and sensation of the upper limbs, leading to a loss of activities of daily living. The use of computed tomography myelogram and/or magnetic resonance imaging (MRI) to assess the brachial plexus provides valuable details, including the location, morphology, and severity of preganglionic and postganglionic injuries during the preoperative period. However, high-field-strength MRI with specific coils and specialized sequences may not be available in every emergency setting and can be time-consuming. In contrast, point-of-care ultrasonography (POCUS) offers a practical alternative, providing good image resolution of muscles and nerves, which facilitates the early detection of neuromuscular injuries. Here, we present a case report of BPI where POCUS provided indirect evidence of cervical root injury and expedited the time to MRI.

ES-06

Successful Outcome of Manual Testicular Detorsion Using Point-of-Care Ultrasound Guidance- A Clinical Experience

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Testicular torsion is a surgical emergency. It obstructs the blood supply to the testes, leading to testicular ischemia and necrosis. It presents with a sudden onset of severe unilateral testicular pain associated with nausea, vomiting, swollen scrotum, and high-riding testicles with an absent cremasteric reflex and negative Prehn sign. Prompt diagnosis of ischemic testicles using ultrasonography is challenging for emergency physicians.

Color Doppler ultrasound may reveal a relative decrease or absence of blood flow in the affected testicle. The most specific ultrasonographic feature was the whirlpool sign of the spermatic cord. Manual detorsion should be performed as soon as possible before surgical intervention. However, manual detorsion may fail because of patient discomfort, incomplete torsion, and rotation of the testicle in a less common direction. We will share a case demonstrating ultrasound-guided detorsion in a 14-year-old boy with right testicular torsion. The present case highlights the importance of incorporating ultrasound guidance into manual detorsion, which can improve the success rate of the procedure.

ES-07

Use of a Deep-Learning Algorithm to Guide Novices in Performing Focused Assessment With Sonography in Trauma

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Focused Assessment with Sonography in Trauma (FAST) is crucial for rapid diagnosis in trauma care but is highly operator-dependent, especially among novice users. This quality improvement study aimed to evaluate the impact of artificial intelligence (AI) guidance on the quality of FAST examinations performed by novice operators. From March 20 to April 20, 2022, 30 operators, including registered nurses, nurse practitioners, and emergency medical technicians, were randomized into two groups: with AI guidance and without AI guidance. A deep learning algorithm provided real-time feedback to the AI-guided group, assessing the diagnostic quality of images captured during the examination of 10 healthy subjects. The primary outcome was the quality of diagnostic images, rated by expert echocardiographers on a scale of 1 to 5. Results indicated that AI guidance significantly improved image quality, with a higher median quality score (5 vs. 4; $P = .02$) and a greater rate of acceptable quality images (84% vs. 68%; $P = .002$). AI guidance was associated with longer examination times initially but is expected to reduce the learning curve. This study suggests that AI guidance enhances the diagnostic performance of novices in FAST but requires further validation in clinical trauma settings.

ES-08

The Effect of Point-of-care Ultrasound on Length of Stay and Mortality in Patients with Chest Pain/Dyspnea

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Purpose: This study aims to investigate the effects of point-of-care ultrasound (PoCUS) on length of stay (LOS) and mortality in hemodynamically stable patients with chest pain/dyspnea.

Materials and methods: The prospective study was conducted from June 2020 to May 2021. A convenience sample of adult non-traumatic patients with chest pain/dyspnea was included and evaluated by PoCUS. The primary outcome was the relationship between the door-to-PoCUS time and LOS/mortality categorized by the ST-segment elevation (STE) and non-STE on the initial electrocardiogram. The diagnostic accuracy of PoCUS was computed, compared to the final diagnosis.

Results: A total of 465 patients were included. 3 of 18 patients with STE had unexpected cardiac tamponade and 1 had myocarditis with pulmonary edema. PoCUS had a minimal effect on LOS and mortality in patients with STE. In the non-STE group, the shorter door-to-PoCUS time was associated with a shorter LOS (coefficient, 1.26 ± 0.47 , $p=0.008$). After categorizing the timing of PoCUS as 30, 60, 90, and 120 minutes, PoCUS had a positive effect, especially when performed within 90 minutes of arrival, on LOS of less than 360 minutes (OR, 2.42, 95% CI, 1.61-3.64) and patient survival (OR, 3.32, 95% CI, 1.14-9.71). The overall diagnostic performance of PoCUS was 96.6% (95% CI, 94.9-98.2%), but lower efficacy occurred in pulmonary embolism and myocardial infarction.

Conclusion: The use of PoCUS was associated with a shorter LOS and less mortality in patients with non-STE, especially when performed within 90 minutes of arrival. Although the effect on patients with STE was minimal, PoCUS played a role in discovering unexpected diagnoses.

a rare clinical entity and is often misdiagnosed due to highly vague symptoms. We report that point-of-care ultrasound (POCUS) serves as a useful and noninvasive tool for early detection of PMA.

Case Report: Our patient was a 35-year-old man without any past medical illness who visited the emergency department due to right lower back pain and hematuria for 8 months. He denied fever, trauma, or recreational drug use. On arrival, the patient's vital signs were stable and had no fever. Laboratory tests showed white blood cell count $12,800/\mu\text{L}$ with neutrophil segment 83.2%, C-reactive protein 0.2 mg/dL, and normal renal function. Urine routine showed red blood cells $> 100/\text{high-power field}$. Kidney-ureter-bladder radiograph revealed positive psoas sign on the right. POCUS showed a mixed echogenic mass adjacent to the right kidney. Subsequently, contrast abdominal computed tomography revealed T10–T11 collapsed vertebral bodies with disc erosion and right psoas muscle abscess at the right kidney level. The patient received open drainage of psoas muscle abscess and T11–T12 laminectomy. He was discharged 13th day post admission.

Why Should an Emergency Physician Be Aware of This? Early and accurate diagnosis of PMA is important because if left untreated, mortality rate can reach 100%. A potential pitfall in our case is the presence of hematuria with flank pain that could lead to incorrect diagnosis of renal calculi, a much more common condition. This case illustrates the importance of using POCUS in any patient with back or flank pain, with or without hematuria.

ES-09

A Case of Psoas Muscle Abscess With Hematuria, Detected Initially by Point-of-Care Ultrasound in the Emergency Department

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Background: Psoas muscle abscess (PMA) is a collection of pus in the psoas muscle. It is considered

ES-10

Image Forum: A Woman with Right Calf Pain

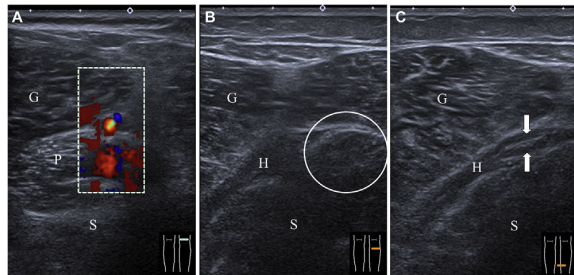
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History: An 47-year-old woman presented to the emergency department with a sudden-onset sharp pain in her right calf, noted while going down the stairs. A point-of-care ultrasound revealed fluid

accumulation between the muscle plane of the medial gastrocnemius and soleus muscles (Figure) and a grossly normal muscle belly. Plantaris tendon rupture was diagnosed.

Figure:



Sonoanatomy: Ultrasound image of the popliteal fossa (panel A) toward the inferior-medial aspect of the calf muscle (panel C); A, showing patent popliteal artery and vein (rectangle); B, showing retracted stump of the plantaris muscle (circle) with blurred margin and peripheral hematoma at the myotendinous junction; C, showing a hematoma tracking along the muscle plane of medial gastrocnemius and soleus muscles, and a linear hypoechoic structure (plantaris tendon; arrow) in it. G, medial gastrocnemius muscle; H, hematoma; P, plantaris muscle; S, soleus muscle.

ES-P01

Assessing the Efficacy of Serial Comprehensive Prehospital Point-of-Care Ultrasound Training Curricula for Paramedics

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Background: Pre-hospital ultrasound enables early diagnosis of life-threatening conditions,

facilitating prompt patient transport to appropriate hospitals. To train paramedics in Hsinchu, we designed a comprehensive pre-hospital ultrasound training program and evaluate its efficacy using pretest and posttests.

Methods: This prospective study involved paramedics in Hsinchu who participated in at least one ultrasound course and completed both pre- and post-tests. From September 2022 to June 2023, four courses were conducted covering “Course 1 – Introduction”, “Course 2 – Trauma”, “Course 3 – Cardiopulmonary Emergencies”, and “Course 4 – Resuscitation”. Each course included a 1-hour lecture and a 2-hour hands-on workshop. Participants completed a pre-test of ten multiple-choice questions before the course and the same test after the course. Scores from pre- and post-tests were compared to assess learning outcomes. A second post-test was conducted two weeks later to evaluate knowledge retention.

Results: A total of 44 paramedics participated: 25 in Course 1, 25 in Course 2, 22 in Course 3, and 16 in Course 4. Participants showed significant improvement in mean post-test scores compared to pre-test scores (Course 1: 82.4 vs. 47.6, $p < 0.001$; Course 2: 71.2 vs. 55.2, $p = 0.001$; Course 3: 64.6 vs. 37.7, $p < 0.001$; Course 4: 91.9 vs 77.5, $p < 0.001$). However, there was a noticeable trend of score decline in the second post-test compared to the immediate post-test. (Course 1: 75.2 vs. 82.4, $p = 0.139$; Course 2: 63.6 vs. 71.2, $p = 0.107$; Course 3: 62.27 vs. 64.6, $p = 0.633$; Course 4: 86.3 vs. 91.9, $p = 0.023$). Subgroup analysis showed no significant differences in post-test scores based on age, education level, years of experience, or previous ultrasound training.

Conclusion: The designed pre-hospital ultrasound course significantly enhanced paramedics' ultrasound knowledge and skills. However, post-course reinforcement training is essential to maintain knowledge retention.

Keywords: Prehospital ultrasound; Paramedics; Course efficacy; Pre-test; Post-test

ES-P02

Portable Ultrasound in Home Healthcare: Penghu's Experience

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Background: The innovation of portable ultrasound technology revolutionized home healthcare and supports global trend towards more accessible patient-centered medical services.

Materials and Methods: This study involves a retrospective review of cases where portable ultrasound and Point-of-Care Ultrasound (POCUS) were utilized in home healthcare, analyzing patient outcomes, the range of conditions diagnosed and treated, and the procedures performed.

Results: Initially, my portable ultrasound was used to evaluate abdominal solid organs, such as the liver, gallbladder, pancreas, spleen, kidneys, and bladder. With POCUS, the scope of applications expanded significantly. Physicians can now differentiate chief complaints such as dyspnea, fever, flank pain, limb edema, and oliguria, among others. Diagnoses of ovarian cancer and hepatocellular carcinoma (HCC) have been made for disabled elderly patients who are unable or unwilling to visit the hospital.

Invasive procedures such as paracentesis for advanced pancreatic cancer, HCC, or liver cirrhosis; thoracentesis for advanced lung cancer and pleural effusion in malnourished veterans with heart failure; and arthrocentesis for knee osteoarthritis and Baker's cyst can now be performed at home, leading to earlier diagnosis, timely interventions, and improved patient satisfaction. This approach reduces hospital visits and alleviates the burden on healthcare facilities.

Conclusion: The integration of POCUS into home healthcare represents a significant advancement in medical practices and supports integrated and multidisciplinary care, enhancing the ability of primary care physicians to deliver comprehensive healthcare services. The "Hospital at Home" (HaH) pilot project for acute illness home care underscores the vital role of POCUS in direct patient evaluation. With ongoing education, training, and the utilization of these technologies, healthcare

providers improve the quality of life and comfort for housebound patients.

Keywords: Portable Ultrasound, Point-of-Care Ultrasound (POCUS), Home Healthcare

ES-P03

Reducing Carbon Dioxide Emissions by Replacing the Use of Diagnostic Computer Tomography with Ultrasound in the Emergency Department

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Background: Medical imaging plays a crucial role in diagnosing and managing various medical conditions, but it also contributes significantly to carbon dioxide (CO₂) emissions, thus exacerbating climate change. Efforts to mitigate the environmental impact of medical imaging have gained traction, emphasizing the importance of adopting low-impact imaging alternatives. Ultrasound imaging is a promising alternative to CT, offering diagnostic capabilities with substantially lower carbon emissions. This study focuses on reducing carbon dioxide emissions by replacing diagnostic computer tomography with ultrasound in the emergency department and the possible impact of patient care quality measured by annual emergency visits.

Materials and Methods: After implementing the POCUS program at Chang-Bin Show Chwan Memorial Hospital for 3 years, we estimated the annual savings in CO₂ emissions from the emergency department and changes in annual ED visits.

Results: Mean CO₂ emissions were 17.5 kg/scan for MRI; 9.2 kg/scan for CT; 0.8 kg/scan for CXR; 0.5 kg/scan for MCXR; and 0.5 kg/scan for US. The annual visits of the emergency department were 23980 in 2021, 29574 in 2022, and 29763 in 2023. The usage rate of CT was 13.8% in 2021, 12.8% in 2022, and 12.6 in 2023. The usage rate of POCUS was 26.2% in 2021, 37.7% in 2022, and 54.1 in 2023.

Conclusion: This study shows the feasibility of replacing CT with ultrasound in emergency settings without compromised diagnostic accuracy and patient satisfaction. The annual ED visits show a positive increase with the usage of POCUS. (Keywords: POCUS, CO2 emissions)

ES-P04

Traumatic Pneumothorax Diagnosed by Prehospital Ultrasound

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Background: Traumatic pneumothorax, a potentially life-threatening condition, occurs in up to 20% of major trauma patients and can be challenging to diagnose at the scene of an incident. Prehospital ultrasound, particularly point-of-care ultrasound (PoCUS), has emerged as a valuable tool in the early detection and management of this condition. The use of ultrasound in prehospital settings has been shown to alter patient management decisions, especially in trauma cases involving chest injuries. This diagnostic modality's portability and rapid deployment make it particularly useful for assessing pneumothorax before hospital arrival. Here we present a case report of traumatic pneumothorax while prehospital ultrasound performed by EMTP provides direct evidence of

stratosphere sign without lung sliding nor lung pulse.

Materials and Methods: A 20-year-old male was involved in a high-speed motor vehicle collision, presenting with signs of respiratory distress, low blood pressure, and confusion. The emergency medical service (EMS) team, equipped with a portable ultrasound device, performed an Extended Focused Assessment with Sonography in Trauma (eFAST) examination on-site. The ultrasound revealed the absence of lung sliding, lung pulse, and stratosphere sign, indicative of a pneumothorax

The EMS team promptly identified a right-sided traumatic pneumothorax, a critical finding that altered the patient's management strategy. This immediate diagnosis enabled the team to provide timely intervention, including supplemental oxygen and preparation for potential needle decompression if necessary

Results: The patient was transported to the nearest trauma center, where further imaging confirmed the prehospital ultrasound findings. The early detection and management of the pneumothorax likely prevented further complications such as tension pneumothorax and hemodynamic instability.

Conclusion: This case underscores the importance of prehospital ultrasound in the rapid diagnosis of traumatic injuries, particularly in settings where traditional imaging modalities are not readily available

(Keywords: prehospital ultrasound, pneumothorax)