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### Acute dyspnea in Emergency Room (ER): diagnostic open window provided by quick lung ultrasound (LUS) compared with brain natriuretic peptide assessment (BNP)

G. Beretta, D. Grisanti, E. Grossi, G. Pinelli

Department of Emergency and Medical Intensive Care,  
Nuovo Ospedale Civile, Modena, Italy

**Background:** Differentiating cardiogenic and non-cardiogenic acute dyspnea is a challenging diagnostic problem in the ED (Emergency Department), where many patients (pts) are elderly and have chronic pneumo-myocardial pathologies. Appropriate therapy affects immediate outcome reducing the need for mechanical ventilation. While the latest guidelines propose BNP determination, we recently added LUS to standard evaluation.

**Aim:** To compare the predictive role of LUS vs BNP for early diagnosis of non-traumatic acute dyspnea.

**Methods:** We studied 48 severely dyspneic pts over 1 year. EKG, blood gas analysis, BNP and LUS were performed at arrival in ED, before any therapy. Quick 4-scan LUS searched for signs of diffuse alveolar-interstitial syndrome (bilateral lung comets (ULCs) + normal gliding  $\pm$  pleural effusion).

**Results:** 41 hospitalized pts had diagnostic work up (blind to BNP level) defining diagnosis of heart failure or dyspnea with non-cardiac causes. The remaining 7 pts were discharged from the ED with diagnosis of non-cardiogenic dyspnea; all 7 had no ULCs, negative BNP and absence of lung extravascular water on chest X-ray. BNP demonstrated high negative but poor positive predictive values: more than 40% pts had high BNP level with final diagnosis other than heart failure ( $p = 0.048$ ). LUS highly predicted the nature of dyspnea, failing in only 3 pts (2 false positive, 1 false negative;  $p < 0.01$ ).

**Conclusions:** LUS is a bedside useful tool to quickly differentiate dyspnea due to pulmonary congestion from non-cardiac respiratory distress. Levels of BNP resulted in the “gray zone” for most pts, thus appearing poorly specific and unable to guide immediate therapeutic decisions.

### False positive lung point? A case of isolated traumatic mediastinal emphysema

G. Beretta, E. Michellini, M. Pradelli

Department of Emergency and Medical Intensive Care,  
Nuovo Ospedale Civile, Modena, Italy

**Background:** “Lung point” is considered a 100% specific ultrasound sign for diagnosis of pneumothorax (PNX). Pneumomediastinum is also detectable with ultrasound, as described in 1983 (“air gap sign”). On chest X-ray pneumomediastinum may be mistaken for pneumothorax when it extends into the extrapleural tissues behind the sternum. We describe a case of ultrasound detection of mediastinal air mimicking parasternal lung point.

**Discussion:** A 22-year-old male patient (pt) was admitted in our emergency room for chest pain after a blunt thoracic trauma. Chest X-ray was negative but lung ultrasound (linear probe, supine pt) revealed absence of lung sliding and a quick moving “lung point” on the right side of sternum. A CT scan showed mediastinal substernal emphysema, without concomitant pneumothorax. Pt had spontaneous resolution under antibiotic prophylaxis, with disappearance of sonographic and radiologic findings.

**Conclusion:** Isolated mediastinal emphysema may mimic the sonographic appearance (“lung point”) of occult parasternal pneumothorax.

### Lung ultrasound for a correct diagnosis and right treatment of acute pulmonary pathologies in critically ill patients: a case report

C. Acciarri, R. Danieli

Department of Anaesthesiology and Intensive Care,  
“Mazzoni” Hospital, Ascoli Piceno, Italy

**Background:** Bedside chest radiography is routinely performed in critically ill patients for assessing lung status despite limited

diagnostic performance. In some cases it leads to an incorrect assessment with subsequent therapeutic relevance. Lung ultrasound can be routinely performed at bedside and may provide accurate information on lung status with diagnostic and therapeutic relevance.

**Objective:** We present a case in which lung ultrasound performed after chest radiography was invaluable in achieving the correct diagnosis and the appropriate management of a patient with acute hypoxemia.

**Patients and methods:** A 32 years old man was admitted at ICU with acute respiratory failure after a spinal trauma C6–C7. He was treated with mechanical ventilation and after an initial period of clinical stabilization he suffered a rapid deterioration of respiratory function with hypoxemia and desaturation. A bedside chest X-ray showed complete opacification of right lung field that was reported as “massive pleural effusion”. Before inserting a pleural drainage catheter, a lung ultrasound was performed detecting elevation of right hemidiaphragm with liver visualization up to the level of 2nd intercostal space and complete atelectasis of the right lung. A bronchoscopic disobstruction was immediately performed with re-expansion and reoxygenation of the collapsed lung.

**Conclusion:** Lung ultrasound is an accurate method to diagnose acute pulmonary pathologies in ICU, above all when traditional chest radiography pose a challenge in the differential diagnosis of pathologies requiring different management. In this case it was useful to quickly identify the appropriate treatment avoiding unnecessary and potentially risky maneuvers.

### Role of lung ultrasound in the management of respiratory failure due to H1N1 influenza in ICU

L. Tutino, G. Cianchi, R. Spina, S. Batacchi, F. Barbani, S. Biondi, A. Nella, S. di Valvasone, A. Peris

Intensive Care of Emergency, Careggi Teaching Hospital, Florence, Italy

**Background:** Influenza A (H1N1) infection can develop pulmonary symptoms ranging from minor disease to Acute Respiratory Distress Syndrome (ARDS). At the moment there is limited experience in the use of Lung ultrasounds (LU) in patients with H1N1 flu respiratory failure.

**Objective:** To assess the effectiveness of LU performed by trained intensivists, as the sole imaging technique adopted during ICU stay in the management of respiratory failure due to N1H1 flu.

**Patients and methods:** From September 2009, four patients with pharyngeal swab positive for H1N1 virus, who developed ARDS, were admitted to ICU and mechanically ventilated. Two of them required Extra Corporeal Membrane Oxygenation for refractory hypoxemia. LU was performed twice a day. Anterior, lateral, and posterior views from the base to the apex were obtained supine, with convex probe (3.5–5 MHz) perpendicular to the chest wall. Normal anatomical lines were followed, using intercostal spaces as acoustic windows. Images were stored in an electronic database and an electronic reporting form was adopted to permit review and further evaluations.

**Results:** A single lung CT scans per patient was performed before ICU admission; lung management was guided by LU assessment only. In all cases pathological patterns have been identified: consolidations and alveolar interstitial syndrome were the most frequent ones. Recruitment maneuvers, FiO<sub>2</sub>/PEEP de-escalation, timing for extubation, management of pleural effusion were also guided by LU findings. All patients were successfully weaned and, during spontaneous breathing, LU was used to assess improvements after physiotherapy sessions.

**Conclusion:** Patients with H1N1 flu respiratory failure present a variety of pulmonary patterns that can be identified by LU. In our experience LU resulted to be feasible and effective for monitoring and management of these patients during all phases of their ICU stay.

### US-guided central venous catheter placement: efficacy of a training course for inexperienced operators

F. Lo Curto<sup>1</sup>, M. Civita<sup>2</sup>, S. Ferrero<sup>2</sup>, E. Pivetta<sup>2</sup>, G. Casoli<sup>2</sup>, G. Griot<sup>2</sup>, G.A. Cibinel<sup>2</sup>

<sup>1</sup>Scuola di Specializzazione in Medicina Interna, Università di Torino; <sup>2</sup>Dipartimento di Emergenza e Accettazione, Ospedale “E. Agnelli”, Pinerolo, Torino, Italy

**Background:** Adverse effects during central venous catheter (CVC) placements are inversely correlated to the operator’s experience; the use of ultrasound (US) guidance increases the rate of successful catheterization and reduces the risk of complications.

**Objective:** To verify efficacy and complication rate of US-guided CVC placement, performed by inexperienced operators, following a specific theoretic and practical training course.

**Patients and methods:** Eight inexperienced operators were trained in needle tip and guidewire visualization during insertion through the skin and into the vessel with a “tilting probe” technique in transverse approach and “three-handed” method. After this training, they performed proctored internal jugular vein CVC placement in emergency settings (36 patients). Post-procedural assessment of CVC tip position was evaluated not only with chest X-ray but also with contrast-enhanced echocardiography.

**Results:** As adverse effects, only three arterial punctures occurred (8.3%) (without further sequelae); there was 97% efficacy. There were no misplacements. Contrast-enhanced echocardiography always agreed with chest-X ray.

**Conclusion:** Acquisition of the “tilting probe” technique for real-time visualization of the needle tip and guidewire enabled inexperienced operators to insert CVC with high efficacy and no clinical sequelae also in case of arterial puncture. Contrast-enhanced echocardiography is a reliable method in CVC tip position assessment.

### Initially echo-assisted treatment of severe sepsis and septic shock

S. Russo

Medicina d’Urgenza, Ospedale Cattinara, Trieste, Italy

**Background:** Severe sepsis and septic shock (SS) require monitoring central vein pressure (CVP) but central vein catheter (CVC) insertion may be time-consuming and cost-ineffective.

**Objective:** Relevance of ultrasonographic guide to fluid administration in the management of SS.

**Patients and methods:** 40 SS patient were examined subdivided in two groups: the former was evaluated by ultrasonography (internal jugular, lung and cardiac ultrasonography), the latter only by invasive CVP. A catheter was inserted to patients of the echo-group after attainment of normal CVP. SS bundles have been respected. The following have been evaluated: APACHE II at admission, lactate values every 6 h, labs to diagnosing multiorgan failure, fluids administered in the first and sixth hour, amines, organ failure and mortality. Student *t* test and P calculation have been performed.

**Results:** Echo-group had APACHE II median value of 16 while invasive group had 18 ( $p < 0.5$ ). The echo-group received a mean of 930 mL fluid (SD 172.2), the invasive group 722.5 mL (SD 197) ( $p = 0.001$ ). Lactate was similar in the two groups but in the sonographically evaluated patients the values lowered more rapidly ( $p = 0.53$ ). The echo-group received a mean of 0.9 mcg/kg/min (SD 0.51) of norepinephrine, the invasive group 1.2 mcg/kg/min (SD 0.4) with  $p < 0.05$ . Dobutamine has been infused with no relevant differences. 6 cases of acute renal failure were observed in the echo-group and 9 in invasive group, of which one underwent dialysis. No differences were noted regarding other organ failures. Mortality has been similar in the two groups (8 cases in echo- and 9 in invasive group).

**Conclusion:** The initial phases of severe sepsis/septic shock can be managed with ultrasonographic evaluation in order to administer optimal quantity of fluids and attain CVP.

### ***Amanita Phalloides* intoxication and liver emergency ultrasound role: a case report**

C. Caroselli<sup>1</sup>, D. Cigolini<sup>1</sup>, G. Bruno<sup>2</sup>, G. Ricci<sup>1</sup>

<sup>1</sup>Dipartimento di Emergenza e Accettazione, Ospedale Civile Maggiore, Azienda Ospedaliera-Istituti Ospitalieri, Verona, Italy

<sup>2</sup>Unità di Allergologia ed Immunologia Clinica, Dipartimento di Medicina Interna, Università di Roma “La Sapienza”, II Facoltà di Medicina e Chirurgia, Azienda Ospedaliera Sant’Andrea, Rome, Italy

*Amanita Phalloides* is a very dangerous mushroom with a high grade of toxicity and mortality rate due to the action of a toxin named *Amanitine* contained inside this mushroom. It is possible to observe three different dramatic clinical phases if patient is not timely and correctly treated: gastrointestinal phase, hepatic phase, hepato-renal syndrome comprehensive of: haemorrhage, hepatic failure and fits.

Here we report on a 65-year-old woman who referred to our Emergency Department (ED) with a 6 h before history of *Amanita Phalloides* ingestion. On admission she reported abdominal pain, diarrhoea, nausea and numerous alimentary vomiting episodes. Physical examination revealed painful abdomen. She had normal blood pressure (130/80 mmHg) with a pulse of 70 beats/min, normal rate of breathing (15 breath/min) and the non-invasive  $SO_2$  was 96% on room air. Patient underwent immediately gastric lavage in order to remove residuals of food containing mushroom and then treatment with 100 g activated charcoal (AC) and 30 g magnesium sulphate administration. Hepatic enzymes were within the normal range at the beginning (GOT 16 U/I and GPT 16 U/I). She was given saline fluids intravenously 7000 mL/24 h. Then it was administered therapy with an initial dose of *N*-acetylcysteine (NAC) 150 mg/kg intravenously and 50 mg/kg each 4 h. Moreover liver ultrasound monitoring was carried out. After 3 days we assisted to marked elevation of hepatic enzymes (GPT 815 U/I; GOT 554 U/I) and liver ultrasound showed hepatic centrolobular necrosis; then we continued NAC administration 50 mg/kg each 4 h intravenously. After 6 days transaminases decreased until, after 12 days, we assisted to normalization of biochemical data and liver ultrasound monitoring showed partial normalization of hepatic peri-lesional area.

The patient left hospital after 20 days in good health with complete *restitutio ad integrum*.

Liver could be damaged in many ways from amanitine and histological exam show different kind of structural injuries: steatosis, focal necrosis of hepatocytes or apoptosis, portal structures necrosis, liver cirrhosis, carcinogenesis. Nevertheless in our case report hepatic damage was characterized by steatosis and hepatic centrolobular necrosis.

The aim of this description is to suggest a possible safe, non invasive and dynamic viewing method, identified in liver ultrasound, for monitoring patients intoxicated with *Amanitine* and treated with NAC.