

## 2nd Italian WINFOCUS Congress, Milan, Italy, 10–13 December 2008

### ACCURACY OF CHEST SONOGRAPHY IN THE EMERGENCY DEPARTMENT TO DETECT CONGESTIVE HEART FAILURE IN ACUTE DYSPNEIC PATIENTS (EUCAD 1)

A. Testa, R. Giannuzzi, G. Portale, G. Pignataro, N. Gentiloni Silveri

Department of Emergency Medicine, A. Gemelli University Hospital,  
Rome, Italy

**Background:** Dyspnea is one of the most common cause of admittance in the Emergency Department (ED). The real challenge is understanding which is the cause of this symptom in order to begin a right management. Recent studies report that extravascular lung water can be accurately assessed with ultrasound lung comets (ULCs) by chest sonography (US) [1–3].

**Objective:** The aim of this study is to validate chest US in detecting congestive heart failure in patients admitted to ED complaining acute dyspnea.

**Patients and methods:** From 01/02 to 30/11/2007 we performed chest US in 65 pts admitted to ED complaining acute dyspnea of uncertain origin. We used an Acuson X150TM System (Siemens, Erlangen Germany) with a 3–5 MHz convex probe, and we examined three different lung windows (the upper, the middle and the basal fields following an oblique line from the lung's apex) of each lung. A widespread interstitial-alveolar syndrome was defined when were found more than three B lines for each windows in at least two windows for each side. Pleural effusion was confirmed by the presence of an anechoic area in the costo-phrenic sinus. Echocardiogram was performed in all pts. The diagnosis was independently made by a different physician, according to the clinical presentation, laboratory data, EKG, chest X-ray, Echocardiogram and from the response to therapy.

**Results:** Congestive heart failure was found in 38/65 pts (prevalence 58%). Chest US resulted really confident to detect cardiac dyspnea, with sensibility 97%, specificity 85%, PPV 96%, NPV 90% and accuracy 92%.

**Conclusion:** Chest US performed in pts complaining acute dyspnea is an useful tool for the emergency physician to distinguish cardiac from non-cardiac origin in order to establish a correct treatment.

#### References

1. Frassi F et al (2007) Prognostic value of extravascular lung water assessed with lung comets by chest sonography in patients with dyspnea and/or chest pain. *J Card Fail* 13:830–835
2. Lichtenstein DA, Meziere GA (2008) Relevance of lung ultrasound in diagnosis of acute respiratory failure: the BLUE protocol. *Chest* 134:117–125
3. Volpicelli G, Caramello V et al (2008) Bedside ultrasound of the lung for the monitoring of acute decompensated heart failure. *Am J Emerg Med* 26:585–591

### EMERGENCY DIAGNOSIS OF PULMONARY EDEMA BY LUNG ULTRASOUND LIMITED TO THE ANTERIOR CHEST

G. Volpicelli<sup>1</sup>, V. E. Noble<sup>2</sup>, A. Liteplo<sup>2</sup>, L. Cardinale<sup>3</sup>

<sup>1</sup>Department of Emergency Medicine, San Luigi Gonzaga Hospital,  
Orbassano (Torino), Italy

<sup>2</sup>Department of Emergency Medicine, Massachusetts General Hospital,  
Boston, MA, USA

<sup>3</sup>Institute of Radiology, San Luigi Gonzaga Hospital, Orbassano  
(Torino), Italy,

**Background:** B-lines are vertical echogenic artifacts seen on lung ultrasound that allow bedside diagnosis of pulmonary edema. The “BLUE” protocol, recently published by Lichtenstein and Mezière, suggests that cardiogenic pulmonary edema is sufficiently ruled out in the ICU setting when B-lines are not predominant in the anterior chest (the “B profile”).

**Objective:** Our analysis sought to evaluate the accuracy of the B profile for ruling out pulmonary edema in the ED patient population.

**Patients and methods:** The ultrasound lung scans of patients with confirmed official diagnoses of acute decompensated heart failure (ADHF) from two ED databases were retrospectively analyzed. 170 acutely dyspneic patients had complete studies (130 from one database and 40 from the other). The scans were reviewed using the B profile definition for ruling out pulmonary edema and comparing that to an alternate scanning protocol that includes ultrasound evaluation of the lateral and anterior chest.

**Results:** Of the 170 ED patients with ADHF diagnoses, the B profile missed 16.5% ( $n = 28$ ). These 28 patients did not show anterior bilateral B-lines that fit the criteria for positive under the BLUE protocol. Moreover, 4.1% of those patients (7/170) had only lateral B-lines on their lung scans and would have been completely missed.

**Conclusion:** Limiting the sonographic lung examination to the anterior chest areas could lead to the loss of a significant number of diagnoses of ADHF in the dyspneic ED patient. Despite the high scientific value of the BLUE protocol, examination of the lateral chest areas is necessary for these patients.

#### Suggested readings

1. Lichtenstein DA, Mezière GA (2008) Relevance of lung ultrasound in the diagnosis of acute respiratory failure. *Chest* 134:117–125
2. Volpicelli G, Mussa A, Garofalo G et al (2006) Bedside lung ultrasound in the assessment of alveolar-interstitial syndrome. *Am J Emerg Med* 24:689–696
3. Volpicelli G, Caramello V, Cardinale L et al (2008) Bedside ultrasound of the lung for the monitoring of acute decompensated heart failure. *Am J Emerg Med* 26:585–591
4. Gluecker T, Capasso P, Schnyder P et al (1999) Clinical and radiologic features of pulmonary edema. *Radiographics* 19:1507–1531

## RELIABILITY OF BEDSIDE LUNG ULTRASOUND IN THE DIAGNOSTIC PROCESS OF PLEURITIC PAIN IN THE EMERGENCY DEPARTMENT

G. Volpicelli<sup>1</sup>, A. Mussa<sup>1</sup>, L. Cardinale<sup>2</sup>,  
M. Cravino<sup>1</sup>, M. Frascisco<sup>1</sup>

<sup>1</sup>Department of Emergency Medicine,

<sup>2</sup>Institute of Radiology, San Luigi Gonzaga Hospital, Orbassano (Torino), Italy

**Background:** Pleuritic pain in the ED elicits a long list of possible pleural and lung conditions. In case of negative chest radiography (CXR), other routine bedside diagnostic tools, including history, physical signs and laboratory data, can be useful to differentiate between pleuropulmonary diseases and parietal chest pain. Lung ultrasound (LUS) has the advantage of being easily performed bedside, and it could be useful in the diagnostic process.

**Objective:** Comparing the usefulness of LUS with other bedside diagnostic tools commonly used in the ED in the differential diagnosis of pleuritic pain with silent CXR.

**Material and methods:** We studied 54 patients complaining of pleuritic pain who showed non-diagnostic CXR. All patients were submitted to history recording, clinical examination, blood sample and blinded LUS. Results were compared with final official diagnosis, confirmed by other conclusive image techniques and follow-up.

**Results:** In 34 cases final diagnosis was musculoskeletal parietal chest pain. The other 20 patients (37%) were diagnosed a pleuropulmonary condition (15 pneumonia, 4 pulmonary embolism, 1 lung cancer). Diagnostic accuracy of LUS, routine blood tests and symptoms in predicting any pleural and/or pulmonary radioccut condition is shown in the following table (data are expressed as percentage; WBC = white blood cells count; CRP = C-reactive protein; \* at least one positive blood test, including WBC, CRP and D-dimer; # at least one symptom in the history, including fever, cough and hemoptysis; § positivity of any blood test or any symptom).

	Sensitivity	Specificity	Pos. PV	Neg. PV	Accuracy
LUS	95.0	97.1	95.0	97.1	96.3
WBC	45.0	94.1	81.8	74.4	75.9
CRP	90.0	82.4	75.0	93.3	85.2
D-dimer	75.0	76.5	65.2	83.9	75.9
Fever	50.0	88.2	71.4	75.0	74.1
Cough	45.1	64.7	42.9	66.7	57.4
Hemoptysis	5.0	94.1	33.3	62.7	61.1
Laboratory pos.*	95.0	67.6	63.3	95.8	77.8
Symptom pos.#	65.0	58.8	48.1	74.1	61.1
Lab/Sympt pos.§	100	47.1	52.6	100	66.7

**Conclusion:** commonly reported symptoms, CXR and blood tests may be inadequate in the diagnostic process of pleuritic pain, especially in differentiating a parietal chest pain from a pleuropulmonary condition. In case of silent CXR, bedside lung ultrasound is crucial for the correct diagnosis and subsequent management of the patient.

## DIFFERENT ULTRASONOGRAPHIC FINDINGS IN PERIPHERAL LUNG CONSOLIDATION

A. Testa, R. Giannuzzi, A. M. Meloni, G. Pignataro,  
N. Gentiloni Silveri

Emergency Department, A. Gemelli University Hospital, Roma, Italy

**Background:** Chest ultrasonography (US) is able to detect different kind of peripheral lung pathologies such as infectious and neoplastic, other than traumatic and cardiac ones [1]. An infectious pathogenesis, expanding the subpleural septa, can provoke an interstio-alveolar syndrome [2], which should not be evident in neoplastic. Moreover, air bronchogram is considered typical X-ray and US finding in pneumonia but not in neoplasm.

**Objective:** To distinguish between infectious alveolar consolidation from neoplastic ones by researching the following US findings: (1) the interstitial pattern all around the lesion (comet tail artifacts or B and C lines); (2) the presence of air bronchogram.

**Patients and methods:** We selected 25 patients (pts) with peripheral lung consolidation shown by chest X-ray. 18/25 pts were admitted to the Emergency Department complaining cough, fever and chest pain. In these pts chest X-ray showed an infectious lung consolidation, in agreement with white blood count and the healing after antibiotics. 7/25 pts had peripheral lung consolidation suspected for neoplasm. Chest US was performed by an independent physician to all patient using an Acuson X150™ System (Siemens, Erlangen Germany) equipped with a 3–5 MHz convex probe, looking for lung consolidation to detect inside air bronchogram and surrounding B and C lines [3].

**Results:** Among 18 pts that we observed with suspected pneumonia in 15 we were able to recognise alveolar consolidation by US: surrounding B and C lines and inside air bronchogram were found in all patients. 3/7 pts with suspected neoplastic consolidation were excluded because the lesion was undetectable (2) or resulted benign (1). All the remaining 4 pts showed a hypo-anecoic homogeneous lesion without surrounding comet tail artifacts or air bronchogram.

**Conclusion:** Our study suggests that US can help to distinguish between infectious and neoplastic peripheral lung consolidations according to the detection of inside air bronchogram and surrounding comet tail artifacts (B and C lines).

### References

1. Copetti R, Soldati G (2006) *Ecografia Toracica*. CG Edizioni Medico-Scientifiche, Torino
2. Lichtenstein D et al (1997) The comet tail artefact: an ultrasound sign of alveolar-interstitial syndrome. *Am J Resp Care Med* 156:1640–1646
3. Testa A (2008) *Ecografia Clinica in Urgenza*. Verduci Editore, Roma

## ULTRASOUND GUIDANCE IN CENTRAL VENOUS CATHETERIZATION: WHICH TECHNIQUE SHOULD WE USE?

A. LaGreca<sup>1</sup>, M. Pittiruti<sup>1</sup>, A. Emoli<sup>2</sup>, G. Scoppettuolo<sup>3</sup>

<sup>1</sup>Department of Surgery,

<sup>2</sup>Day Hospital of Oncology,

<sup>3</sup>Department of Infectious Diseases, Catholic University Hospital, Rome, Italy

**Background:** Ultrasound (US) guidance for insertion of central venous catheters (CVC) is recommended by many clinical associations, though it is still unclear which venous approach is to be preferred.

**Patients and methods:** We adopted the following protocol for CVC placement: after US evaluation of the internal jugular vein (IJV), the brachiocephalic vein (BCV), the subclavian vein (SV) and the axillary vein (AV) on both sides, one of the following US guided approaches was chosen: (1) low lateral ‘Jernigan’ approach to the IJV, (2) lateral approach to the BCV, (3) supraclavicular approach to the SV, (4) infraclavicular approach to the SV or AV. Correct position of the tip was controlled either by intraoperative EKG guidance or by chest X-ray.

**Results:** In 12 months, 607 CVC were inserted; the chosen approach was either BCV ( $n = 360$ ), or IJV ( $n = 203$ ), or supraclavicular SV ( $n = 32$ ), or infraclavicular SV/AV ( $n = 12$ ). In eight procedures (two IJV, four supraclavicular SV, two infraclavicular SV/AV), the operator decided to shift to another approach (BCV in most cases, except one shift to contralateral IJV). Complications were: arterial puncture 1%, (six cases: five with IJV, one with supraclavicular SV); malposition 0.6% (four cases, all from the left side, two with IJV and two with infraclavicular SV/AV).

**Conclusions:** (a) The US approach to the central veins is characterized by an overall minimal incidence of complications; (b) preoperative US evaluation allows to choose the venous approach most likely to be successful and uneventful; (c) the US guided cannulation of the BCV appears to be particularly safe.

### PROPOSAL OF A TRAINING MODEL FOR ULTRASOUND GUIDED INSERTION OF CENTRAL VENOUS CATHETERS

A. LaGreca<sup>1</sup>, M. Pittiruti<sup>1</sup>, A. Emoli<sup>2</sup>, G. Scoppetuolo<sup>3</sup>

<sup>1</sup>Department of Surgery,

<sup>2</sup>Day Hospital of Oncology,

<sup>3</sup>Department of Infectious Diseases, Catholic University Hospital, Rome, Italy

**Background:** Ultrasound guidance (USG) is gaining widespread acceptance as an essential tool during insertion of central venous catheters (CVC), but its incorporation into clinical practice has met some resistance. One of the reasons is that some training issues, such as learning curve and teaching modalities, are still a matter of controversy. We present the results of our early teaching experience about USG for CVC insertion.

**Objective:** to compare the performance of EP vs. NEP both in USG and USA procedures.

**Patients and Methods:** In our University, a Master on Central Venous Access has been activated since 2003. Ultrasound devices have been introduced into routine clinical practice of CVC insertion since 2004, and soon incorporated into our teaching protocol since February 2005. The study period runs from February 2005 to September 2006.

Cannulation protocol: (a) US evaluation of the internal jugular vein (IJV) on both sides to assess position, dimension, relationship with carotid artery; classification of IJV as “easy” (depth < 2 cm., diameter > 5 mm, lateral to the artery) or “difficult” (depth > 2 cm., diameter < 5 mm. or collapsible during breathing, medial to the artery); (b) decision to stick the vein by US assistance (USA) for “easy” veins or under direct US guidance (USG) for “difficult” veins. (c) the IJV was always punctured via the low lateral Jernigan approach, both with USA and USG; (d) after two failed USA attempts, USG venipuncture was adopted; during USG procedures, an axial scan of the vein (“short axis” scan) was obtained, while the needle were introduced parallel to the ultrasound beam (“in plane” puncture); (e) when IJV was not available, a “second choice” USG venipuncture of the following veins was performed: innominate,

axillary (infra-clavicular approach); subclavian (supra-clavicular approach); femoral.

Teaching protocol:

- a total amount of 8 h of formal lessons about US for CVC insertion;
- 4 h of laboratory training for USG procedures on a biologic simulator, as described elsewhere;
- a minimum of 25 procedures observed;
- a minimum of 10 procedures performed under direct supervision of an expert operator;
- audit after three months of independent activity.

Insertions were randomly assigned either to experienced physicians of our resident Team (EP) or to physicians in-training (Non Expert Operators—NEP), i.e. students of the Master. “Non expert operators” were defined as operators who had completed a first teaching step of 5 observed and 5 performed procedures.

**Results:** In the study period, 715 CVC were inserted in 695 adult patients (181 short term CVC + 218 tunnelled CVC + 316 ports); 460 procedures were performed by EP, 255 by NEP. The procedure started as USA in 522 and as USG in 299 cases (no significant difference comparing EP vs. EP): a shift from USA to USG was necessary in 8% (7.1% in EP vs. 10% in NEP: n.s.). The IJV was successfully cannulated in most patients, with very few exceptions (innominate vein in 12 cases, axillary vein 2, femoral vein in 1, all by USG). Complications were: failure 0%; pneumothorax 0%; hemothorax 0%; accidental arterial puncture 1.1%, (1.7% USA vs. 0.3% USG,  $p < .01$ ; no difference EP vs. NEP); hematoma 0.4% (only for USA; no difference EP vs. NEP); malposition (0.8%, exclusively with the left IJV; no difference EP vs. NEP).

**Conclusions:** (a) The ultrasound based approach to the IJV was characterized by an overall minimal incidence of complications; (b) direct USG was associated with a reduced risk of accidental arterial puncture and hematoma, if compared to USA; (c) cannulation of the right IJV was associated with a reduced risk of malposition; (d) there was no significant difference in % of complications comparing experienced physicians versus physicians with a very short training; (e) the US technique is easy to learn and associated with a very short learning curve; (f) the better results of USG as compared to USA prompted us to adopt the former technique as the procedure of choice both in clinical as well as in teaching practice.

### CONTRAST-ENHANCED ULTRASONOGRAPHY (CEUS) VERSUS CHEST X-RAY IN CATHETER TIP LOCALIZATION AFTER CENTRAL VENOUS CANNULATION

F. Corradi<sup>1</sup>, C. Brusasco<sup>2</sup>, C. Launo<sup>2</sup>, S. Palermo<sup>2</sup>, M. Mergoni<sup>1</sup>, A. Vezzani<sup>1</sup>

<sup>1</sup>Servizio di Anestesia e Rianimazione. Azienda Ospedaliera di Parma, Parma, Italy,

<sup>2</sup>Anestesia Rianimazione. Università degli Studi di Genova, Genoa, Italy

**Background:** After the insertion of a central venous catheter, chest radiograph is usually obtained to ensure correct positioning of the catheter tip.

**Objective:** To determine the usefulness of conventional B-mode (US) plus real-time contrast-enhanced (CEUS) ultrasonography to evaluate central catheter misplacements and tip positioning (i.e., right atrium, superior vena cava-atrium junction, or superior vena cava) in mechanically ventilated adults, thus obviating the need for a post-procedural radiograph.

**Materials and methods:** A prospective study of 74 consecutive central venous access procedures using landmark technique was conducted in an adult intensive care unit. The preferred catheterization site was the right subclavian one. At the end of the procedure a B-mode US was first performed to assess catheter position and then CEUS was used to exactly detect the catheter tip position, avoiding unknown RA placing. CEUS studies were performed using a commercially available US system and 3.5 MHz transducers on epigastric window. The contrast agent was prepared by mixing ten times 1 mL of air and 9 mL of saline into two syringes connected by a three-way stopcock to an indwelling catheter placed in the central line. The bubble containing saline was then injected as bolus. A post-procedural chest radiograph was obtained in all patients and was considered as reference technique.

**Results:** In seven cases US examination was impossible for physical limitations. In 50/67 patients post-procedural US and CEUS showed catheter and tip position inside in the vena cava. Among 16 patients expected to have a complication, US detected 4 catheter malpositioning and CEUS 12 tip misplacements into the right atrium. US plus CEUS showed a 96% sensitivity and 93% specificity, with a 98% positive predictive value and 88% negative predictive value in the detection of catheter malpositioning and right atrium tip misplacement. In 64/67 (96%) cases there was concordance between US plus CEUS and chest radiography.

**Conclusions:** The close concordance between US plus CEUS and chest radiography in detection of tip malpositioning and catheter misplacement justifies the use of sonography as a reference technique to ensure the correct positioning of catheter tip after central venous cannulation in order to optimize hospital resources utilization and minimize time-consumption and radiation. Chest radiography may be still necessary when sonographic examination is limited by meteorism, deep traumatic or surgical wound, low echogenicity transmission or technical limitations at insertion site, such as presence of neck sterile drainage in oral or maxillar surgery.

#### CONTRAST ENHANCED ULTRASONOGRAPHY IN THE EVALUATION OF RENAL TRAUMA

S. L. Sartoni Galloni, C. De Luca, M. Branchini, M. Valentino, L. Ansaloni, A. Pinna, L. Barozzi

Emergency Department Surgery, Bologna, Italy

**Background:** To prospectively compare the diagnostic value of ultrasound (US) and contrast-enhanced ultrasound (CE-US) with computed tomography (CT) for detection of renal injuries in blunt abdominal trauma patients.

**Patients and methods:** US, CE-US and CT were performed to assess possible abdominal organ injuries in 152 non consecutive hemodynamically stable patients with blunt abdominal trauma and a strong clinical suspicion of abdominal lesions. US and CE-US findings were compared with CT findings, the reference standard technique. 24 out of 152 patients (15.7%) had renal lesions, the severity of which was graded according to the organ injury severity scale of the American Association for the Surgery of Trauma (AAST).

**Results:** Eleven out of 24 traumatic parenchymal lesions had perirenal fluid collection at baseline US. 27 renal parenchymal lesions, with or without perirenal or retroperitoneal haematoma, were identified at contrast-enhanced US. The sensitivity and specificity of US were 45.8 and 91.4% respectively. CE-US had a sensitivity of 96.4%, a specificity of 100% and a positive and negative predictive value of 100 and 92.5% respectively.

**Conclusion:** CE-US was found to be more sensitive than US and almost as sensitive as CT in the detection of traumatic renal traumatic injuries. It can therefore be proposed as a useful tool in the assessment of blunt abdominal trauma. CE-US reduced radiation exposure and can be used also in patients with reduced renal function and/or with previous adverse reaction to iodinated contrast media.

#### ULTRASOUND POINT OF CARE IN SWELLING NECK: EITHER FLUID OR TISSUE BUT AIR DETECTION

P. Pasquero<sup>1</sup>, R. Vergano<sup>2</sup>, U. Marchisio<sup>1</sup>

Medicina ad indirizzo d'Urgenza<sup>1</sup>, Otorinolaringoiatria<sup>2</sup>, Maria Vittoria Hospital, Torino, Italy

**Case report:** We presented a case of swelling neck in a 65 year old Caucasian man observed in Emergency Department. No other masses or lymphadenopathy could be felt in the neck. The medical history of this patient included a tracheostomy followed by decannulation with tracheoplasty, 3 weeks before, because of intracerebral haematoma, T2 diabetes mellitus and mild hypertension. Any modification of vital sign were observed (Oxygen Saturation 97%, BP 120/80). Where the anterior cervical mass was found, a point of care ultrasound scanning identified only presence of air without surrounding subcutaneous emphysema. In fact diffuse horizontal lines (A lines) arising from swelling subcutaneous layers were detected by means of a linear probe (Figs. 2, 3, 4). No other fluid or tissue ultrasound sign, in spite of objective examination findings, were detected so we could rule out cyst, bleeding, abscess or thyroid mass and lymphadenopathy. Complete decompressions of swelling neck were temporally obtained using a fine needle aspiration until the next breaths. After surgical exploration, a tracheal fistula was found, with a valve mechanism, that needed anterior tracheal wall reinforcement with a new tracheoplasty. The tracheal fistula, late complication of tracheotomy closure, healed by secondary intention after 15 days.

#### PERCUTANEOUS ECHO-GUIDED ABLATION TREATMENT OF TENDINOUS CALCIFICATIONS IN THE ACUTE ACHING SHOULDER

F. Angelini, G. De Conti, N. Boscolo Bariga, A. Lauro, M. Trevisan

UOS Radiologia Ortopedica Azienda Ospedaliera di Padova, Padova, Italy

**Background:** The “aching shoulder” has a prevalence in the population ranging from 7 to 25% which often induces patients to go to emergency units because of the marked painful symptomatology during the acute phase. In the 45% of the aching shoulder syndromes rotator cuff calcifications are present. During the acute phase the treatment of choice is NSAIDs based pain control or loco-regional infiltrations of corticosteroids. A valid alternative is the use of the percutaneous echo-guided ablation treatment of tendinous calcifications in order to eliminate the main source of pain: this treatment can only be performed in hospitals with interventional radiology units. Procedural modalities are reported as well as personal experience in a controlled casistic.

**Patients and Methods:** From September 2006 to July 2008 216 treatments were performed at the orthopaedic radiology unit of Padova: 47 patients came from the emergency units of various

hospitals. The procedure consists of echo-guided positioning of two 16 or 18 gauge needles with very close points at the calcification under loco-regional anesthesia. A turbulent flux is created thanks to the injection of high pressure physiological solution through one of the needles, which induces the fragmentation of the calcification. The fragments are removed through the other needle. In the second phase of the procedure a corticosteroid infiltration of the subacromial-deltoid bursa is made as well as the washing of the latter with physiological solution if fibro-adhesive bursitis is present. When calcifications are either no more evident or treatable—i.e. only the bursitis is the source of the acute painful symptomatology—only the washing with physiological solution is performed. The follow-up requires an X-ray and an echographic examination at 2 months and even a MR at 6 months.

**Results:** Every patient showed an improvement both of the echoradiographic features and of the symptomatology. This was confirmed by the significant increase of Constant Score, which is the most used index to quantify the pain and the functional inability of the shoulder. In some cases the procedure was repeated because of the recurrence of the symptomatology but the final outcome was good anyway with the increase of Constant Score. In the MR controls at 6 months only tendon structural alterations in the site of treatment were seen.

**Conclusions:** The percutaneous echo-guided ablation treatment of tendinous calcifications of the shoulder is a valid alternative to traditional therapies: it gives immediate benefit and it also permits to treat electively the bursa. It has neither contraindications nor relevant risks. A good knowledge of musculoskeletal echography and manual skills in the operative part are required anyway. It must be therefore considered as a second level echographic procedure for expert clinicians.

## ULTRASOUND DETECTION OF SPONTANEOUS GAS GANGRENE IN THE EMERGENCY SETTING

A. Testa<sup>1</sup>, R. Giannuzzi<sup>1</sup>, K. De Gaetano Donati<sup>2</sup>, N. Gentiloni Silveri<sup>1</sup>

<sup>1</sup>Emergency Department,

<sup>2</sup>Infectious Diseases Department,

A. Gemelli University Hospital, Rome, Italy

**Background:** Gas gangrene is a rapidly progressive pathology caused by different species of *Clostridium* that can induce a severe myonecrosis with gas production and sepsis [1]. In rare cases *Clostridia* disseminate via blood stream, even in absence of wounds as source of departure, this being more frequent in immunodeficients. About one-third of the cases of “spontaneous” gas gangrene are caused by *Clostridium Septicum* [2].

**Objective:** In emergency setting bedside goal-directed sonography may help in a prompt diagnosis of gas infiltrating soft tissue, avoiding loss of time while organising further investigations.

**Case report:** We report the case of a 51 old women affecting by spontaneous gas gangrene involving the right upper limb due to *Clostridium septicum*. She suffered of ankylosing spondylitis and had been treated for a long time with immunosuppressors. The source of infection remained unknown and the progression was rapidly lethal, although adequate pharmacological therapy was promptly given and the patient was submitted to surgical debridement. In absence of crepitus the diagnosis was made by the sonographic detection of gas artifacts like comet tails, that had overthrown muscles and subcutaneous tissue.

**Conclusion:** Ultrasound study in ED may easily detect gas producing infection interesting soft tissues. The bedside goal-directed sonography, already used in the diagnosis of Fournier’s gangrene [3], may promptly confirm diagnosis detecting gas artifacts in soft tissues and suggesting an urgent surgical treatment, avoiding the further loss of time while organising other investigations.

### References

1. Folstad SG (2004) Soft tissue infections. In: Tintinalli JE et al Emergency Medicine, a comprehensive study guide. McGraw-Hill, NY, pp 979–981
2. Corey E (1991) Nontraumatic gas gangrene: case report and review of emergency therapeutics. *J Emerg Med* 9:431
3. Kane CJ, Nash P (1996) Ultrasonographic appearance of necrotizing gangrene: aid in early diagnosis. *Urology* 48:142–144

## ROLE OF ULTRASOUND IN DETECTING GAS CONTAMINATION OF A PENETRATING WOUND WITH RETAINED FOREIGN BODY

R. Giannuzzi<sup>1</sup>, A. Testa<sup>1</sup>, G. Zirio<sup>2</sup>, A. La Greca<sup>3</sup>, N. Gentiloni Silveri<sup>1</sup>

<sup>1</sup>Departments of Emergency Medicine,

<sup>2</sup>Orthopaedics and Traumatology and

<sup>3</sup>Surgery, A. Gemelli University Hospital, Rome, Italy

**Background:** Detection of a superficial foreign body (FB) may be difficult, especially if non-radiopaque. The accuracy of ultrasonography (US) in detecting radiopaque and non-radiopaque FBs in soft tissues and possible complications is well established both in vitro and in vivo studies.

**Objective:** US assessment of spontaneous disappearance of the air bubbles can distinguish a harmless traumatic nature of the wound from a life-threatening gas-producing bacterial infection.

**Case report:** A young man arrived at the Emergency Department (ED) complaining of a painful wound in his right forearm. He had been hit by slivers while working with a lawn-mower some hours before. X-ray of the forearm showed a radiopaque object near the radius. US examination using Acuson X150™ ultrasound system (Siemens, Erlangen Germany) and a 10.0 MHz small parts probe, detected the FB retained in the muscle and the gas microbubbles forming a line along the wound track. As it was not clear whether the gas was endogenous (infective) or exogenous (air deriving from the FB), the patient was hospitalized for observation. Their monodimensional arrangement in a line<sup>3</sup> and their small size (<1 mm) did not allow the forming of the typical US artifacts (comet tails), but gas was suspected due to spontaneous and pressure provoked movements like “sparkling-wine microbubbles”. US documented the complete disappearance of the gas, thus ruling out complications due to infection.

**Conclusion:** In the ED, US examination is recommended to define the characteristics of the gas bubbles in order to distinguish a normally healing wound from a life-threatening infection.

### References

1. Turkcuer I, Atilla R, Topacoglu H et al (2006) Do we really need plain and soft-tissue radiographies to detect radiolucent foreign bodies in the ED? *Am J Emerg Med* 24:763–768
2. Graham DD (2002) Ultrasound in the emergency department: detection of wooden foreign bodies in the soft tissues. *J Emerg Med* 22:75–79

## POCKET VS. PORTABLE US IN THE EMERGENCY DEPARTMENT: PRELIMINARY RESULTS

M. Zago, D. Mariani, H. Kurihara, A. Casamassima, M. G. Turconi, F. Luzzana

Emergency and Trauma Surgery Section, General and Minimally Invasive Surgery Unit Emergency Department, Istituto Clinico Humanitas IRCCS, Rozzano, Milano, Italy

**Background:** Emergency US is an essential tool in any Emergency Dept. (ED). Portability improved the use of US in ED.

**Objective:** Evaluation of the performance of a pocket US (P-US) (Siemens P10–Germany) for point-of-care US in emergency settings (ED, ICUs), in comparison with a standard portable US machine (SP-US).

**Patients and Methods:** From October 1st to November 1, 2008, 4 US-trained acute care surgeons performed 135 focused US with both P10 and SP-US on 62 pts. P10 is a P-US equipped with a unique micro-convex probe (2–4 MHz). In ED SP-US machine was always available; in ICUs not immediately. The following data were analyzed: time of indication for US, time of accomplishment, influence on patient management. Focused questions were classified in basic (pleural and abdominal effusion, gallstones, abdominal aneurysm, pneumothorax (ptx), hydronephrosis, bladder retention, CUS) and advanced (IVC diameter, cardiac motility and load, lung interstitial syndrome, acute appendicitis, diverticulitis). When SP-US was immediately available, the time required for P10 exam was subtracted in analysis.

**Results:** US scan was performed to search for 25 peritoneal effusions, 21 pleural effusions, 11 hydronephrosis, 18 gallstone diseases, 7 aortic aneurysm, 4 CUS. Some patients had more than a district examined (mean 2.1). Accordance between portable and pocket US results was respectively 96% for peritoneal effusion, 95.2% for pleural effusion, 91% for hydronephrosis, 95% for gallbladder disease, 100% for abdominal aorta and bladder retention. Feasibility and accuracy of P10 was 25% for CUS and 20% for ptx, 16% for acute diverticulitis, 8% for appendicitis. Good accordance was obtained for cardiac scans (93%). The question answer time was 1–4 min for P10, 3–43 min for SP-US. When the clinical question was satisfied by P10 exam, additional informations obtained with SP-US did not affect management.

**Conclusion:** P10 is a useful effective tool for point-of-care US in experienced hands. Time was in favor of P10. Good reliability was obtained for peritoneal and pleural effusions, cardiac motility and load, hydronephrosis, gallbladder diseases, bladder retention. Visceral and vascular (CUS) US are not good fields for P10. More data are required to validate an extensive US-enhanced cycle.

## CARDIAC AND ABDOMINAL ULTRASOUND TO DETECT TYPE A AORTIC DISSECTION IN THE EMERGENCY DEPARTMENT

A. Barchitta, L. Ruzza, V. Cianci, F. Tosato

Department of Emergency Medicine, Padova, Italy

**Background:** The detection of aortic dissection (AD) is one of the most important diagnosis for emergency physicians (EP). Transthoracic e transesophageal echocardiography (TTE/TEE) and computer tomography (TC) with intravenous contrast medium are the first choice of imaging modalities in this setting. The most used Stanford classification divided AD in type A (65%, involving the ascending aorta) and type B (35%, involving the descending aorta). In 80–90% of type A, the intimal laceration begins in the first centimeters from aortic valvular plane due

to its parietal weakness and greater parietal stress from ejection strength. The evidence at TTE of aortic root dilatation (>45 mm), with a flap with or without an eccentric aortic regurgitation or pericardial effusion (type A) and the evidence at abdominal ultrasound of a flap inside the aorta (type A, B) is very suggestive for dissection. Emergency cardiac and abdominal ultrasound (ECUS/EAUS) focused for AD performed by emergency physicians is an important tool in minimizing the time for this lifesaving diagnosis.

**Objective:** To verify the usefulness of ECUS/EAUS in detecting type A dissection.

**Patients and methods:** From January 2005 to October 2008, 7 patients (pts) complaining of chest and back pain were admitted to our Emergency Department (ED) for of which also had abdominal pain. ECG did not show significant alterations and Troponin I assay was normal. ECUS/EAUS were performed by EP after clinical evaluation. The type A (AD diagnosis) was confirmed by CT in 6 pts (in 2 cases the intimal flap ended at the diaphragmatic aorta), and by TEE in 1 pt (intimal flap until the aortic arch).

**Results:** ECUS showed in all cases aortic root dilatation (>45 mm) with valvular regurgitation and a flap inside it. In 3 cases, there was also mild pericardial effusion. EAUS showed in 4 cases also an abdominal aortic flap.

**Conclusions:** Sensibility and specificity of ECUS/EAUS to detect type A (AD) are estimated around 60 and 83% respectively. ECUS/EAUS performed by emergency physicians is no doubt an important diagnostic and promptly available exam in ED reducing the time to detect AD type A. A fast diagnosis in this setting is very important considering this pathology affected by 1% mortality rate/hour from the onset of symptoms.

### Suggested readings

1. Dimwsky AJ, Carey MJ (1999) Aortic dissection. *Am J of Emerg Med* 17(4):372–375
2. Fojtik JP, Costantino TG (2007) The diagnosis of aortic dissection by emergency medicine ultrasound. *J Emerg Med* 32(2):191–196

## EMERGENCY ULTRASOUND IN PATIENT WITH UNDIFFERENTIATED FEVER

S. Berardi<sup>1</sup>, C. Del Borgo<sup>2</sup>, G. Salone<sup>2</sup>, A. Vetica<sup>2</sup>, L. Giovannelli<sup>1</sup>, M. Mellacina<sup>1</sup>

<sup>1</sup>Emergency Department,

<sup>2</sup>Infectious disease Department, S. M. Goretti Hospital, Latina, Italy

**Background:** Bedside emergency ultrasonography leads to a better diagnosis and to a serial, not invasive monitoring of disease evolution.

**Object:** Emergency ultrasound in patient suffering from undifferentiated fever can reveal insidious pathologies that would require a timely diagnosis and treatment since their potential fatal prognosis.

**Case report:** A 47 year old woman, with history of metrorrhagia from uterine fibromatosis, came to observation for fever from a week with no other signs nor symptoms. Considering the undifferentiated nature of the fever, it was performed a multidistrict, multiple transducer ultrasonography according to the protocol for differential diagnosis of the fever [1]; in this way, multiple liver abscess (maximum diameter 3 cm) were pointed out and then submitted to serial monitoring until their complete regression. Liver abscess is one of the most insidious cause of fever of unknown origin, not directly combined to associated pathologies [2], with rapid evolution towards septic shock and elevated mortality. Laboratoristic findings performed in emergency were globally normal: this reaffirms how ecography has modified the running of the case.

**Conclusion:** In patient under 50 years old of age, infectious diseases are the main reason of fever of unknown origin [3]; emergency ultrasound can be considered in the first diagnostic assessment as a mean to point out clinical pictures rapidly evolving towards septic shock.

#### Bibliography

1. Testa A, Manuale di ecografia clinica in urgenza, Verduci ed., p 452 and foll.
2. Rahimian J (2004) Pyogenic liver abscess: recent trends in etiology and mortality. Clin Infect Dis 39:1654–1659
3. Harrison, Principi di Medicina interna XIV ed., Mc Graw Hill, p 900 and foll.

### CEREBRAL ULTRASONOGRAPHY IN DECOMPRESSIVE CRANIECTOMY. DO WE STILL NEED CT SCAN?

T. Chilà, A. Caricato, V. Mignani, F. Visconti, R. Pacifico, D. Ciolino, M. Antonelli

Istituto di Anestesiologia e Rianimazione, Università Cattolica del Sacro Cuore, Roma, Italy

**Background:** Decompressive craniotomy (DC) makes it easier to visualize cerebral structures by transcranial ultrasonography.

**Object:** To compare cerebral ultrasonography made through the decompressive craniectomies osteal operculum with CT scan.

**Patients and methods:** Ten patients with cranial trauma. Nine of these underwent temporal-parietal DC; one patient underwent bifrontal DC. We performed a mean number of three brain CT scan for each patient, on the overall 28 CT scan. Before each CT scan, we performed ultrasonography examination. We used a 4 Hz convex probe on the skin of the DC hole, with adequate sterile gel and no pressure on the brain.

#### Results:

**Midline shift:** In three patients, CT scan showed midline shift. With 1 mm error, ultrasonography sensitivity and specificity, compared to CT scan, was 100%.

**Focal hyperdense lesions:** ultrasonography showed all thirty-seven focal hyperdense lesions visualized by CT. With 5 mm error, the three main axes correspondence was 85%. Once, the ultrasounds visualized a hyperecogenic lesion in the midbrain of 10 × 10 × 5 mm not shown by CT scan.

**Focal hypodense lesions:** focal hypodense lesions in CT scan were visualized just in the 25% of the cases with ultrasonography. They appeared like hypoeogenic lesions in 45% of cases and hyperecogenic in the remaining 55% of cases.

**Cerebral ventricles size:** we could always visualize lateral and third ventricles with the ultrasonography just as the CT scan usually does. **Intracranial pressure catheter (ICP) position:** like CT scan, ultrasonography could always visualize the right ICP catheter position.

**Conclusion:** In patients with DC, there is a good correspondence between CT scan and ultrasounds regarding the focal hypodense and hyperdense lesions, the midline position, the cerebral ventricles size and the ICP position. Ultrasonography was not so useful in detecting hypodense lesions.

Ultrasonography through the DC hole can provide useful information in intensive care. In many cases, it can replace CT scan.

#### Suggested readings

1. Llompart Pou (2004) Monitoring midline shift by transcranial color-coded sonography in traumatic brain injury. A comparison with cranial computerized tomography. Intensive Care Med 30:1672–1675
2. Behnke (2002) Sonographic imaging of the brain parenchyma. Eur J Ultrasound 16:73–80

### TRANSCRANIAL COLOR-CODED SONOGRAPHY (TCCS) VERSUS TRANSCRANIAL DOPPLER ULTRASONOGRAPHY (TCD) IN SEGMENTAL CEREBRAL VASOSPASM

T. Chilà, A. Caricato, V. Mignani, F. Visconti, D. Ciolino, R. Lorusso, M. Antonelli

Istituto di Anestesiologia e Rianimazione, Policlinico Universitario A. Gemelli, Rome, Italy

**Background:** Transcranial Doppler ultrasonography can be performed by conventional method (TCD) or by color-coded sonography (TCCS). TCCS can follow the vessel along its length, and can analyze mean velocity at different depth. Furthermore, angle-corrected flow velocities in basal cerebral arteries can be obtained only by TCCS. After subarachnoid hemorrhage, vasospasm is often focal, localized in the proximal portion of cerebral arteries. In these cases, it may be missed by TCD.

**Results:** we describe three cases of segmental vasospasm in three patients with subarachnoid hemorrhage. In all cases, the increase of mean velocities in middle cerebral artery above 120 cm/sec was observed by TCCS, but not by TCD.

**Conclusions:** TCD can miss segmental vasospasm. Current recommendations do not give us indications about the method to perform transcranial Doppler. TCCS can decrease mistakes giving a more accurate diagnosis.

#### Suggested readings

1. Bartels (1993) Transcranial color-coded duplex ultrasound—possibilities and limits of this method in comparison with conventional transcranial Doppler ultrasound. Ultraschall Med. 14(6):272–278
2. Martin (1995) Measurement of blood flow velocity in the basal cerebral circulation: advantages of transcranial color-coded sonography over conventional transcranial Doppler. J Clin Ultrasound 23:21–26
3. Schoeninig (1993) Comparative study of transcranial color duplex sonography and transcranial Doppler sonography in adults. J Neurosurg 78:776–784
4. Homar (2007) Hemodinámica cerebral en pacientes con traumatismo craneoencefálico evaluada por doppler transcranial y duplex transcranial con codificación en color. Estudio comparativo. Neurocirugía 18:221–226

### DIAGNOSTIC ACCURACY AND REPRODUCIBILITY OF LUNG ULTRASOUND IN ACUTE DYSPNEA EVALUATION IN THE EMERGENCY DEPARTMENT EUCADI (EMERGENCY ULTRASOUND OF THE CHEST IN ACUTE DYSPNEA I)

G. A. Cibinel, G. Casoli, F. Elia, M. Padoan, A. Goffi

SC Medicina e Chirurgia d'Urgenza, ASL TO3, Pinerolo, Turin, Italy

**Background:** In patients admitted to the Emergency Department (ED) with acute dyspnea, the initial diagnostic work-out (history, physical examination, EKG, chest X-ray, BNP) is often not very accurate in defining the etiologic cause (cardiac and/or pulmonary) together with the underlying pathophysiology.

**Objective:** To evaluate the diagnostic accuracy and reproducibility of lung ultrasound in identifying cardiac causes of acute dyspnea in patients presenting to the ED.

**Patients and methods:** Between January and July 2007 we prospectively enrolled 60 patients admitted to the ED of the Pinerolo

General Hospital (Turin, Italy) with acute dyspnea (i.e. dyspnea appeared or worsened in the last 48 h). In all patients, we performed lung ultrasound and evaluated the presence of diffuse interstitial syndrome using three antero-lateral thoracic windows, as well as the presence of pleural effusion using a basal window on both sides of the thorax. The final diagnosis (cardiogenic or not cardiogenic dyspnoea) was confirmed, in a retrospective way, by two expert physicians (an emergency medicine specialist and a cardiologist), not aware of the scope of the study, using all available data (clinical findings, EKG, chest X-ray, echocardiography—carried out in all patients—response to therapy), but not lung ultrasound results.

**Results:** The finding of diffuse interstitial syndrome by lung ultrasound was highly predictive for cardiogenic dyspnea (sensitivity 94%, specificity 96%, negative predictive value 93%, positive predictive value 97%, LR  $-0.06$ , LR  $+24.57$ ). On the contrary, detection of pleural effusion was not helpful in differential diagnosis. The reproducibility of the lung ultrasound performed in an emergency setting was very good ( $k$  between 0.93 and 0.96).

**Conclusion:** In patients presenting to the ED with acute dyspnea, lung ultrasound, performed with the purpose of identifying diffuse interstitial syndrome, is a very accurate technique for discriminating cardiogenic from not-cardiogenic causes.

#### DIAGNOSTIC-THERAPEUTIC IMPACT OF INTEGRATED ULTRASONOGRAPHY IN PATIENTS WITH CARDIAC ARREST OR PERI-ARREST – EUCAP (EMERGENCY ULTRASOUND IN CARDIAC ARREST AND PERI-ARREST)

G. A. Cibinel, I. Scalvenzo, S. Desiderio, A. Martini, G. Casoli, A. Goffi

SC Medicina e Chirurgia d'Urgenza, ASL TO3, Pinerolo, Turin, Italy

**Background:** Making the right diagnosis in patients with cardiac arrest or peri-arrest (shock and severe respiratory failure) is often difficult when based only on the clinical evaluation.

**Objective:** To study the feasibility and the diagnostic-therapeutic impact of integrated ultrasound in patients with cardiac arrest or peri-arrest in the ED.

**Patients and methods:** We enrolled 30 patients admitted to the ED of the Pinerolo General Hospital (Turin, Italy), 14 with cardiac arrest (PEA 12, V-Fib 1, asystolia 1), and 16 in peri-arrest. All patients were managed according to ALS and ATLS guidelines; in addition, they underwent extensive ultrasonographic evaluation, primarily focused on heart or lungs, then extended to other body districts, if needed. We evaluated: feasibility, diagnostic-therapeutic impact and potential support in procedure execution.

**Results:** The integrated ultrasound approach was feasible in all patients, in a short time and without interfering with other procedures. Heart was evaluated in 30 patients (100%), lungs in 11 (37%), inferior vena cava (IVC) in 9 (30%), and other districts in 11 (37%). In 19 out of 30 patients (63%) the diagnosis was defined based on ultrasound results: pulmonary embolism 7, cardiac tamponade 1, acute pulmonary oedema 2, myocardial infarction 1, aortic valve endocarditis 1, aortic dissection 1, pneumothorax 1, ARDS 1, hypovolemia 4. Ultrasonography findings led to therapeutic changes in 13 out of 30 patients (43%): thrombolysis 6, discontinuation of chest compressions during pseudo-PEA 2, fluid resuscitation 1, pericardiocentesis 1, chest tube 1, antibiotics 1, anticoagulation 1. In 9 out of 30 patients (30%) invasive procedures were performed with ultrasound support.

**Conclusion:** In patients with cardiac arrest or peri-arrest, integrated ultrasound is feasible in a short time and has high diagnostic-therapeutic impact, leading to better diagnostic definition and/or therapeutic variations in over a half of the patients.

#### DIAGNOSTIC-THERAPEUTIC IMPACT OF ECHOCARDIOGRAPHY IN ACUTE DYSPNOEA MANAGEMENT IN THE EMERGENCY DEPARTMENT EUHAD (EMERGENCY ULTRASOUND OF THE HEART IN ACUTE DYSPNOEA)

G. A. Cibinel, G. Porrino, G. Griot, M. Civita, G. Casoli, A. Goffi

SC Medicina e Chirurgia d'Urgenza, ASL TO3, Pinerolo, Turin, Italy

**Background:** Lung ultrasound has elevated accuracy in discriminating cardiogenic from not-cardiogenic causes of dyspnea, but it does not allow to define the underlying cardiac pathophysiology, which often can be only presumed.

**Objective:** To study the feasibility and the diagnostic-therapeutic impact of echocardiography in patients with acute dyspnea in the ED.

**Patients and methods:** Between January and June 2006 we prospectively enrolled 50 patients admitted to the ED of the Pinerolo General Hospital (Turin, Italy) with acute dyspnoea (i.e. dyspnea appeared or worsened in the last 48 h). In each patient we performed: physical examination, lung ultrasound, EKG, chest X-ray, and arterial blood gas analysis (ABG). On the basis of the results, the physician examining the patient was invited to define: (a) the main diagnosis (heart failure HF, lung failure LF, or mixed failure MF), (b) the cardiac pathophysiology, and (c) the etiological diagnosis. Immediately after this first evaluation, echocardiography was performed in all patients. We then compared the diagnosis made before and after the performance of echocardiography, and we recorded the therapeutic changes that were introduced based on the ultrasonography findings.

**Results:** Echocardiography was feasible in all patients. Echocardiography results induced a change in the main diagnosis in 2 out of 50 patients (4%), and in cardiac pathophysiology in 19 out of 50 patients (38%). In addition, ultrasonography findings led to therapeutic changes in 8 patients.

**Conclusion:** In patients with acute dyspnea in the setting of ED, the integration/implementation of clinical evaluation with lung ultrasound allows the correct definition of cardiac pathophysiology only in about 60% of patients. In our experience, echocardiography is feasible in all patients and has high diagnostic (40%) and therapeutic (15–20%) impact.

#### THE RELEVANCE OF LUNG ULTRASOUND IN THE MANAGEMENT OF PATIENTS WITH SUSPECTED PNEUMONIA IN EMERGENCY DEPARTMENT

F. Cortellaro, M. Ragazzi, D. Coen

Emergency Department, Niguarda Hospital, Milano, Italy

**Background:** The radiologic diagnosis of pneumonia in ED has a low sensitivity and specificity, often delaying the appropriate therapy and leading to unnecessary examinations.



**Objective:** Evaluate the diagnostic potential of lung ultrasound in patients admitted in ED with suspected pneumonia and a non-diagnostic first chest XR, using as control the diagnosis at discharge.

**Patients and methods:** We examined 17 pt, between August and October 2008, admitted to our ED with suspected pneumonia (fever, chest/abdominal pain, cough, dyspnoea, increased CRP, WBC) and first chest XR non-diagnostic for pneumonia. All lung ultrasound were performed with a convex 3.5–5 MHz probe, scanning perpendicular, oblique and parallel to the ribs in anterior, lateral and posterior thorax. Lateral position was used to scan the posterior thorax in critical patients. All scans were performed by the same operator and lasted less than 5 min. US signs considered diagnostic of pneumonia:

- Lung consolidation containing branching echogenic structures with centrifugal movements during breathing (dynamic bronchograms), anechoic tubular structures with hyperechogenic walls, with no color-Doppler signal (fluid bronchograms)
- Interstitial Syndrome (B lines) near the consolidation or isolated asymmetric (early stages), or bilateral early bilater pneumonia, interstitial pneumonia)
- Hypoechoic pleural line with reduced or absent gliding, irregular border between consolidation and normal lung.

**Results** Lung US was positive in 5 pt with pleuritic pain, 6 pt with sepsis of unknown origin, 2 pt with dyspnoea, 4 pt with respiratory failure in chronic lung disease. Lung US showed retrocardiac pneumonia in 8 pt (47%) and in these entire cases first chest XR was performed only in AP. First chest XR was negative in 11 pt, uncertain in 2 pt, positive for pleural effusion in 4 pt. Chest XR was performed only in AP in 14 cases (82%). A second chest XR was controlled in 10 pt resulting positive for pneumonia in 4 cases. Chest CT scan was performed in 6 pt, always confirming the US findings.: 4 consolidations, 1 ground glass pattern(B lines US finding), 1 consolidation with empyema. In the remaining 7 cases the diagnosis of pneumonia was supported by clinical and laboratory evolution. Lung US changed therapy and medical decisions in 16 cases.

**Conclusions:** Lung US is a simple and rapid examination that can be easily repeated bedside and could be a very useful diagnostic tool in ED. Chest XR seems to have a low accuracy, in particular when the exam is performed only in. Lung US could discover pneumonia before chest XR (interstitial pattern in the early stages). We cannot say anything about sensitivity or specificity of lung US, because we did not consider pt with first positive chest XR, or negative lung US.

#### Suggested readings

1. Lichtenstein DA (2008) Relevance of lung ultrasound in the diagnosis of acute respiratory failure. *Chest* 134:117–125
2. Bouhemad B (2007) Clinical review: bedside lung ultrasound in critical care practice. *Critical Care* 11:05
3. Volpicelli G (2008) Diagnosis of radio-occult pulmonary conditions by real-time chest ultrasonography in patients with pleuritic pain. *Ultrasound Med Biol* 34(11):1717–1720

#### ECHOGUIDED CENTRAL VENOUS CANNULATION: A NEURO INTENSIVE CARE UNIT SURVEY

L. Frattini<sup>1</sup>, F. Lusenti<sup>2</sup>, P. Fumagalli<sup>2</sup>, S. Iacoboni<sup>2</sup>, C. Martini<sup>2</sup>

<sup>1</sup>Scuola di Specializzazione in Anestesia e Rianimazione, Università dell'Insubria, Varese,

<sup>2</sup>Il SAR Neuroranimazione, Ospedale di Lecco

**Background:** Central venous catheters (CVC) are positioned in the neuro intensive care unit (NICU) of A. Manzoni Hospital (Lecco) to patients admitted both to the NICU both to other wards of the hospital; method, access way of cannulation and Xray control are at the

discretion of the physicians. They are allowed to use an echocolor-doppler (ECD) device, if they want to, to guide CVC\_positioning since last February 2008. Every procedure is recorded in a database. **Objective:** To retrospectively evaluate if ECD acquire has modified CVC positioning ways.

**Patients and methods:** 69 CVC have been positioned between February and November 2008, 48 by expert physicians (with more than 5 years of work) and 21 by less expert ones (less than 5 years). Indications to CVC positioning have been especially superficial veins absence (30% of cases) and the prescription of phlebo-toxic drugs (51%); the most frequently used veins have been right internal jugular vein (30 cases = 44%) and right subclavian vein (28 cases = 41%).

**Results:** of the 48 procedures performed by the expert physicians, 27 (56%) have been performed with echography and 21 (44%) without echography; of the 21 procedures performed by the less expert ones, 15 (72%) have been performed with and 6 (28%) without echography. A X-ray control has been performed in 55 cases (80%) and has not in 14: 12 (86%) of the latest echo control had been used.

**Conclusion:** A greater inclination to the ECD use in the less expert group (OR = 1.9) than the expert one (OR = 0.5) results from the mentioned data; it could depend on a lower attitude of the latest toward new technologies. The larger safety that was given to the operator by ECD use brings in the less appeal to X-ray control.

#### DIAGNOSTIC-THERAPEUTIC IMPACT OF LUNG ULTRASOUND IN ACUTE DYSPNEA MANAGEMENT IN THE EMERGENCY DEPARTMENT, *EUCAD2 (EMERGENCY ULTRASOUND OF THE CHEST IN ACUTE DYSPNEA 2)*

A. Goffi, M. Civita, E. Laurita, G. Casoli, G. Porrino, G. A. Cibinel  
SC Medicina e Chirurgia d'Urgenza, ASL TO3, Pinerolo, Turin, Italy

**Background:** Lung ultrasound has elevated accuracy in the diagnostic evaluation of patients with dyspnea. However, no data concerning the diagnostic-therapeutic impact of this technique in patients with acute dyspnoea in the setting of Emergency Department (ED) are currently available.

**Objective:** To study the diagnostic-therapeutic impact of lung ultrasound in patients with acute dyspnoea in the ED.

**Patients and methods:** Between June and October 2008, we prospectively enrolled 33 patients admitted to the ED of the Pinerolo General Hospital (Turin, Italy) with acute dyspnea (i.e. dyspnoea appeared or worsened in the last 48 h). The presence of 5 fundamental syndromes (consolidation, localized and diffused interstitial syndrome, pneumothorax, and pleural effusion) was evaluated by lung ultrasound by the emergency physician who first evaluated the patient in the ED. We then compared the clinical diagnosis made before and after the performance of lung ultrasound, and we recorded the therapeutic changes that were introduced based on the ultrasonography findings.

**Results:** Lung ultrasound performance induced a change of the initial diagnosis in about 50% of the patients. In particular, the diagnostic hypothesis made after the first evaluation in the ED (main, respiratory pathophysiological and etiological) was modified, as a consequence of lung ultrasound results, in 48, 55, and 61% of the patients, respectively. In addition, ultrasonography findings led to therapeutic changes in 17 out of 33 patients (52%); if we considered only those patients in whom the diagnosis was modified after lung ultrasound, we recorded a therapeutic change in 78% of the patients.

**Conclusion:** Lung ultrasound improves the diagnostic definition in patients with acute dyspnea in the setting of ED. This better diagnosis often leads to change the therapy, which can be oriented to the pathophysiology.

**Suggested reading**

1. Cibinel GA, Martini A, Casoli G (2007) Perché questo paziente “ha il fiato corto”? *Decidere in Medicina* 2007;VII(3):5–17

**NURSING USAGE OF ULTRASOUND-ENHANCED VENOUS ACCESS**

R. Oldani<sup>1</sup>, A. S. Mandrini<sup>1</sup>, G. Mammoliti Luprano<sup>1</sup>, V. S. Roveda<sup>1</sup>, D. Mariani<sup>2</sup>, A. A. Casamassima<sup>1</sup>, H. Kurihara<sup>2</sup>, M. Zago<sup>2</sup>

<sup>1</sup>Emergency Department, Istituto Clinico Humanitas, Rozzano, MI, Italy

<sup>2</sup>UO General and Minimally Invasive Surgery, Emergency and Trauma Surgery Section, Istituto Clinico Humanitas, Rozzano, MI, Italy

**Background:** About 70% of patients accessing Emergency Department (ED) require the placement of a venous vascular access. The venous access placement may be difficult due to anatomical/somatic patient's tissue characteristics or to the changes induced by the disease, or because of other variables related to the patient's physiological state. Repeated attempts at inserting the peripheral venous catheter may cause patient's discomfort resulting in dissatisfaction and distrust towards the operators; sometimes ED nurse has to refer to a medical specialist who can provide peripheral or central line. Another solution is finally represented by the nursing staff usage of ultrasound guidance, which allows you to “see” the goal and to increase the percentage of finding the line single-shot (SS).

**Objective:** Introduction of Ultrasound in nursing, improving the management and retrieval of peripheral venous access through ultrasound, improved patient's satisfaction and reducing the waste of time and resources.

**Patients and methods:** The Humanitas Clinical Institute is home to Emergency Department with an average of about 4.000 accesses per month; we included in our study patients with venous access typically defined difficult, or diseases with cancer undergoing chemotherapy (CT), drug addicts or with history of drug abuse, discrepancy patients and/or elderly, obese patients and all patients in whom it is impossible to find inspection/palpable venous structure. Criteria for inclusion in the protocol: two failed attempts of venous access, children < 25 kg, after the first attempt failed in patients intolerant, as the first approach if not visible or palpable peripheral vein. Four ED nurses trained in Ultrasound usage, five successive phases of training: (1) An explanation of the device and knowlogy (2) Familiarization with the specific anatomy ultrasound (3) Live training on non-critical patients (patients in Green codes) five cases per person (4) Using the device on patients in green code posing problems in finding venous access. (5) Use of the device on critical patients. The average time for training was generally around 60 minutes.

**Results:** After a brief training period, October 2008 was taken as sample. In the months before, the four nurses placed venous access on 466 patients; of these patients, 36 (8.6%) were found with Ultrasound-Enhanced technique. The characteristics of the population who has been recruited are following: 7 obese patients (average BMI 32), 8 in cancer patients (previous CT), 2 drug addicted patients, 4 Cachexia/Dyscrasia patients, 5 patients on which was difficult inspection and palpation of the vein, and 2 patients on which had repeatedly failed to find Vein by traditional methods. Priority Codes were so distributed: 20 green, 7 yellow, 1 red. On all patients with US-Enhanced venous access placement, the percentage of SS access was 87%, and the remaining 13% has necessitated a second attempt.

**Conclusion:** The training for finding venous access on difficult patients with ultrasound guidance is a quickly learn technique that ensures obtaining venous access single-shot. The success rate in the

first attempt was extremely high. Although the evidence shows a clear approval of the method by patients, the numbers of our series are still insufficient to determine a statistically significant reduction in time and saving of resources.

**CENTRAL VEIN CATHETERIZATION: THREE APPROACHES COMPARED**

S. Russo, M. Marcianò

UOC Medicina d'Urgenza, Ospedali Riuniti, Trieste, Italy

**Background:** Subclavian vein is usually preferred for central vein catheter (CVC) positioning because of its easy accessibility and few infective complications, also relative to anterior ultrasonographically-guided internal jugular vein placement. Little is known about the complications of the posterior approach of ultrasonographically-guided internal jugular vein catheterization.

**Objective:** Incidence of early and late complications due to infraclavicular subclavian vein catheterization (iS) relative to echo-guided internal jugular vein by anterior (aIJ) or posterior (pIJ) approach.

**Patients and methods:** 87 patients have been cannulated with a CVC with the approach in which the operator was most confident. All the precautions for infection prevention have been strictly observed and the subsequent management has been uniformly done in the three groups. The early and late complications have been evaluated and the differences between the three groups have been examined by the one way variance analysis (ANOVA).

**Results:** The CVCs positioned have been: 22 iS, 31 aIJ and 34 pIJ. The early complications have been: 4.5% in the iS group (one pneumothorax), 0% in the ultrasound-guided aIJL and pIJ. The late complications have been: 4.5% in the iS group (vein thrombosis), 6.4% in the aIJ group (catheter-related infection and vein thrombosis), 2.9% in the pIJ group (skin redness without catheter-related infection). Multiple incannulation attempts have been made with the iS approach. The difference in late complications has reached statistical significance between the pIJ group and either iS and aIJ groups.

**Conclusion:** The posterior ultrasound-guided approach is associated with small percentage of early and late complications and as such is better than the subclavian approach. These results are the consequence of the use of ultrasound (reduced incannulation attempts) and of the ease of dressing of the posteriorly positioned internal jugular catheter.

**Suggested reading**

1. Pratt RJ, Pellowe CM, Wilson JA, Loveday HP et al (2007) epic2 Guidelines. *J Hosp Infection* 65:5:51–564

**CENTRAL VENOUS PRESSURE EVALUATION BY ULTRASONOGRAPHY OF THE INTERNAL JUGULAR VEIN**

S. Russo, M. Marcianò

UOC Medicina d'Urgenza, Ospedali Riuniti, Trieste, Italy

**Background:** Central venous pressure (CVP) is usually measured by invasive technique. CVP evaluation from inferior caval vein diameter [1] (cCVP) is biased by body position and abdominal hypertension while existing methods of evaluation by ultrasonography of the internal jugular vein [2] (jCVP) are qualitative and with no clear correlation with the invasively measured CVP.

**Objective:** The reproducibility of the evaluation of jCVP and correlation with invasive CVP (iCVP) respect to inferior caval CVP was studied.

**Patients and methods:** 91 patients have been studied, first with jugular and then caval ultrasonography, finally with iCVP measurement. cCVP was evaluated with a score system, jCVP was the result of the measurement of the vertical from the 4th intercostal anterior axillary space to the edge of blood column in jugular vein. iCVP was measured in end-diastole. Measurements were repeated after different loading conditions by experienced operators. A linear regression analysis and correlation with *t* test has been done.

**Results:** The following mean *M* (standard deviation SD) values, in cmH<sub>2</sub>O, and tendency lines *R*<sup>2</sup> have been obtained: iCVP *M* = 12 (SD 4.1), *R*<sup>2</sup> = 0.91; jCVP *M* = 12.28 (SD 4.25), *R*<sup>2</sup> = 0.86; cCVP *M* = 13.18 (SD 5.97), *R*<sup>2</sup> = 0.62. The correlation between iCVP and jCVP has been *r* = 0.96, between iCVP and cCVP *r* = 0.82 (*P* < 0.05). The interobserver variability has been: 5% for iCVP, 7% for jCVP, 11% for cCVP.

**Conclusion:** The ultrasonography of the internal jugular vein for CVP is valid and reproducible and constitutes a good alternative to CVP invasively measured.

#### Bibliography

- Jardin F, Vieillard-Baron A (2006) Ultrasonographic examination of the venae cavae. *Intensive Care Med* 32:203–206
- Jang T, Aubin C, Naunheim R, Char D (2004) Ultrasonography of the internal jugular vein in patients with dyspnea without jugular venous distention on physical examination. *Ann Emerg Med* 44:160

#### THE PERITONEAL DIALYSIS. A MODEL FOR THE LEARNING OF THE FAST

S. Sofia<sup>1</sup>, L. Zucchini<sup>1</sup>, C. Descovich<sup>1</sup>, L. Coli<sup>2</sup>

<sup>1</sup>First Aid and Urgent Care Unit, C. A. Pizzardi Hospital, Bologna, Italy

<sup>2</sup>Nephrology, Dialysis and Transplant Unit, S. Orsola Malpigli University Hospital, Bologna, Italy

**Background:** The peritoneal dialysis is a treatment of the chronic renal failure alternative to the haemodialysis, in which some amount of a defined solution come exchanged inside of the peritoneal cavity by means of a transcutaneous catheter. The patient in peritoneal dialysis constitutes an interesting model for the practical training on the FAST.

**Objectives:** To test a didactic model for (a) the acknowledgment and (b) the semiquantitative appraisal of the free fluid in a program of abbreviated training for the FAST.

**Patients and methods:** Eight doctors with none (group 1, *n* = 3 doctors), beginning (group 2, *n* = 3 doctors) and >3 years (group 3, *n* = 2 doctors) experience in abdominal ultrasound have carried out a proctored FAST on patients submitted to peritoneal dialysis, 3 months after a FAST theoretical course of 6 h. The proof consisted of three tests, breaking in peritoneal cavity of 500, 1000 and 1500 cc of fluid respectively. After every filling, an expert examiner previously executed a test standard: (1) four scannings for: pericardic (±), peritoneal (±) and pleuric (±) effusion and (2) a semiquantitative appraisal of fluid amount (light, moderated and abundant), with which they have been compared the results of the students.

**Results:** The overall results of the tests have been the following: (a) acknowledgment of fluid effusion: difference from the standard of 47%, due to the epigastric (pericardial) and pleuric view, while no disagreement has observed for the free peritoneal liquid; (b) semiquantitative appraisal of free fluid: variance of 46%, due to differences in all categories of effusion and in all groups of students, and oriented towards the underestimate.

**Conclusions:** The patient submitted to peritoneal dialysis is a valid model for the appraisal of proficiency in the course of a program of abbreviated training on the FAST.