CHEST-I01

Lung Ultrasound in the Critically Ill - The BLUE-protocol

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The BLUE-protocol1 is a fast protocol, providing immediate diagnosis of acute respiratory failure. It is part of critical ultrasound, that we defined in 1991 as “ultrasound for the critically ill, by the critical care physician, and whole body ultrasound”. This approach, which considers the lung, provides a different definition of ultrasound.

Simple machines are suitable. We use a 1992, gray-scale unit, and a microconvex probe (universal for the whole body). The BLUE-protocol analyzes ten signs: bat sign (pleural line), lung sliding (yielding seashore sign), A-lines (horizontal artifacts), quad sign and sinusoid sign (indicating pleural effusion), fractal sign and lung sign (indicating lung consolidation), B-line and lung rockets (specific comet-tail artifacts indicating interstitial syndrome), abolished lung sliding with stratosphere sign (suggesting pneumothorax), lung point (indicating pneumothorax). These disorders were assessed using CT with sensitivity and specificity ranging from 90 to 100%. The venous step (not yet published) is associated to lung ultrasound for diagnosing pulmpnary embolism.

The BLUE-protocol combines signs with locations, generating profiles. Hemodynamic pulmonary edema, pulmonary embolism, pneumonia, COPD, asthma, and pneumothorax. Hemodynamic pulmonary edema generate symmetrical anterior lung rockets plus lung sliding, the B-profile (one of the 8 profiles).

The BLUE-protocol is completely qualitative. It can therefore be done in <3min. It is fully opposed to LUS (lung ultrasound scores) and other complex applications.

Very shortly, derived from the BLUE-protocol, the FALLS-protocol2 helps making immediate diagnosis of acute circulatory failure. It uses B-lines as direct parameters of clinical volemia and the endpoint for fluid therapy. It allows simplification of echocardiography, reduced to simple real-time analysis (left ventricle hypocontractility, right ventricle dilatation, pericardial effusion).

These applications are applicable in trauma, ICU, remote areas, neonates..., making lung ultrasound a holistic discipline through a visual medicine. CEURF trains since 1990 intensivists to the BLUE-protocol at the bedside of the critically ill.

References:
1. Chest 134:117-125
2. Chest 136:1014-1020

CHEST-S01

How to Integrate POCUS into Daily Practice

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Point-of-care ultrasonography (POCUS) is defined as brining ultrasound machine to the patients, wherever they are, with acquisition and interpretation of the ultrasound image in real time. POCUS requires several basic intrinsic and extrinsic foundations to accomplish this goal, to really make it purposeful and helpful in clinical practice. In daily practice, a physician with matured skills of POCUS will always try to incorporate some of these skills in a traditional usual care. It will eventually redesign the algorithms in the care of a specific clinical scenario, such as respiratory distress, shock, abdominal pain and oliguria. Physicians who try to use POCUS to improve their clinical care should first ask an answerable question, which is decisive for the subsequent exams or treatments. POCUS, as a dynamic examination, is quite often complimentary to other nondynamic imaging modality like CT scan. Today I would like to share the ideation of integration of POCUS into daily practice, with several POCUS cases of mine to the audience.

CHEST-S02

The Role of EBUS in Interventional Pulmonologists

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Lung cancer is the most common cause of cancer related death in the worldwide. The outcome of the disease depends on staging, therefore proper staging must be performed to determine the treatment plan. Endobronchial ultrasound (EBUS) is a revolutionary tool for lung cancer diagnosis and lymph node (LN) staging.

There are two kinds of EBUS. EBUS with a miniature probe is mainly used for the diagnosis of peripheral pulmonary lesions (PPLs). There are 3 essential steps during the bronchoscopic technique for the diagnosis of PPLs. The first step is demonstrating the capability of reaching a target (navigation). The next step is demonstrating the arrival of the sampling device at the target (confirmation). The final step should be obtaining adequate diagnostic samples (acquisition). Radial-EBUS plays the role in “confirmation” step, by verifying contact with the target through its real-time imaging. We can not only affirm the location, but also detect the internal structure of PPLs during the EBUS study. These help the interventional pulmonologists to guide the transbronchial biopsy, thereby improving the diagnostic accuracy.

The convex probe-endobronchial ultrasound (CP-EBUS) combined with transbronchial needle aspiration (TBNA) is a minimally invasive procedure. It has been shown to have a high sensitivity and diagnostic yield for LN staging of lung cancer. New biopsy tools, such as large size biopsy needle, ultrathin cryoprobe might help to obtain larger tissue specimens. CP-EBUS might aid in the pricing of therapeutic devices for the treatment of mediastinal lesions in the future.

CHEST-S03

Combined Cone-Beam Computed Tomography-Derived Augmented Fluoroscopy with Endobronchial Ultrasound for Peripheral Pulmonary Lesions

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The peripheral pulmonary lesions (PPLs) are frequently encountered in clinical practice with the popularity of low-dose chest computed tomography for lung cancer screening. PPLs often need tissue proof, such as transthoracic biopsy or transbronchial biopsy. With the use of radial endobronchial ultrasound (rEBUS), the diagnostic yield of transbronchial biopsy for PPL got significant improvement. However, the overall diagnostic yield of rEBUS-guided transbronchial biopsy reported was around 70%. The diagnostic yield was even lower for benign lesions and lesions less than 2cm, which was obviously lower than transthoracic needle biopsy, such as CT-guided biopsy. However, the CT-guided biopsy had a higher complication rate, such as pneumothorax, hemorrhage, and air embolism. Cone-beam CT (CBCT) is a recently developed technique using a cone-shaped scan beam of C-arm to generate imaging like traditional CT and had a lower radiation dose in comparison with traditional CT. The CBCT-derived augmented fluoroscopy (CBCT-AF) is a recently developed technique, using 3-dimension imaging obtained from CBCT for lesion detection and annotation. The detected and annotated lesion on CBCT imaging would project to a 2-dimension fluoroscopic image screen. In this section, we will talk about the rationale for using CBCT-AF during the rEBUS-guided transbronchial biopsy, the general concept of CBCT and AF, the technical aspect of performing CBCT-AF during bronchoscopic procedures, and the limitations of CBCT-AF.