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Lung Ultrasound on Critical Ill Patient with Lung Pathology

Khotib Amin Zamayel*, Reza Widianto Sudjud

Department of Anaesthesiology and Intensive Therapy, Padjajaran University, Bandung, Indonesia

Case Report

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***For Correspondence:** Dr. Khotib Amin Zamayel, Department of Anaesthesiology and Intensive Therapy, Padjajaran University, Bandung, Indonesia

E-mail: indrawijayaMD@gmail.com

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ABSTRACT

Lung Disease (ILD) or Diffuse Parenchymal Lung Disease (DPLD) impacts the interstitium or the tissue and space surrounding the lung's alveoli (air sacs). It affects the perivascular and perilymphatic tissues, basement membrane, pulmonary capillary endothelium, and alveolar epithelium. It might happen if lung damage sets up an unusual healing response. Normally, the body produces just the proper amount of new tissue to repair injury, but with interstitial lung disease, the repair process is slowed down, causing the alveolar tissue to thicken and scar. As a result, it is more challenging for oxygen to enter the bloodstream. Differential diagnosis and treatment of critical ill patients with chest X-ray opacifications may be challenging. This particularly includes patients with respiratory failure due to hemodynamic instability. Opacifications in chest X-ray may be due to hemothorax, pleural effusion, atelectasis or consolidations. Physical examination may not always represent the cause of its opacity and thus not always contribute the right therapeutic approach. In that case, bedside ultrasound may be very helpful. We present two cases with similar x-rays but different diagnosis with the aid of bedside ultrasound. There is documented ultrasound accuracy in distinguishing pleural effusion and consolidations.

INTRODUCTION

Chest X-ray with partial or complete lung field opacifications frequently experienced by critical ill patients. This may introduce some challenges in differential diagnosis and delay management of acute lung pathology in acute

respiratory failure patients. Generally, further evaluation must be carried out, such as Computed Tomography (CT) scan, which is used to guide therapeutic interventions.

A large number of critical ill patients are unstable in such a way so that transportation to CT scanners evokes additional risks. Thoracocentesis when no fluid is present will induce a risk of pneumothorax or losing positive end expiratory pressure during and after the tap which causes alveolar injury and hypoxemia.

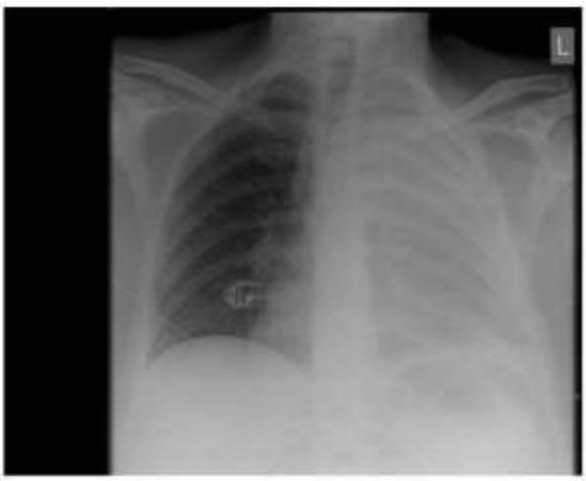
CASE PRESENTATION

Case 1

A-45-year-old woman presented in Tangerang General Hospital due to shortness of breath. She had history of allergy, asthma with recurrent bronchitis. A day before hospital admission, she went to a general practitioner who prescribed Augmentin for her respiratory tract infections. Thoracic X-ray showed opaque shadow on left lung with differential diagnosis of pleural effusion, pneumonia or complete left lung atelectasis. Due to its progressive respiratory failure, an intubation was done.

Lung ultrasound with 5-MHz probe (ultrasound examination) that is parallel to the upper and lower anterior ribs was performed. This examination showed no pleural effusion but a hypoechogenic area with air bronchogram and many hyperogenic spots. CT scan was performed later and resulted in complete lung consolidations compatible with pneumonia. (Figures 1A and 1B).

Figure 1. A. Chest x-ray showed full opacification of left lung. **B.** Chest ultrasound showed pneumonia characterized by irregular hypoechogenic areas with air bronchograms and many hypechogenic regions (long white arrows). The pleural line was hypoechogenic (short white arrow) as often observed.



(A)

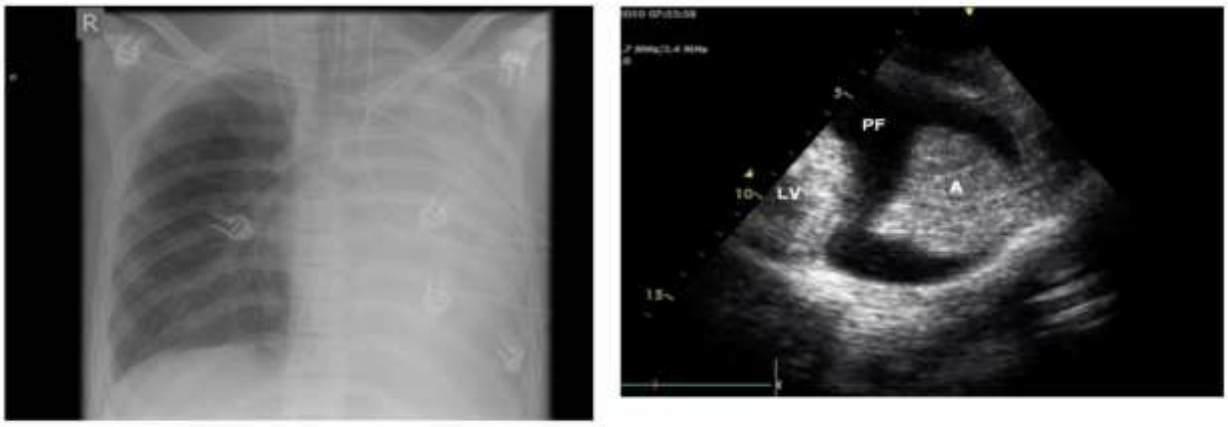
(B)

Case 2

A 16-year-old man was admitted to Tangerang General Hospital with cardiogenic shock due to idiopathic dilated cardiomyopathy. Chest X-ray showed complete left lung consolidations with differential diagnosis of pleural effusion and total left lung atelectasis.

Bedside ultrasound with 5-MHz probe that is parallel to the ribs of lower thorax and upper anterior showed left lung collapse surrounded by hypoechogenic area that indicates pleural effusion (Figures 2A and 2B).

Figure 2. A. Chest x-ray showed total opacification on left lung. **B**. Lung ultrasound with left lung Atelectasis (A) and hypoechogenic area of Pleural Effusion (PF).



(A) (B)

Pleural lines were not visible in the collapsed lung. This patient was managed with bronchial suction through bronchoscopy and treated in right sided position. Sputum plaque was removed from left main bronchus. Afterwards, chest x-ray appears fairly normal showing that the therapy was effective.

RESULTS AND DISCUSSION

The gold standard in establishing differential diagnosis in lung pathologies with chest x-ray is CT scan. To reduce undue risks to patients such as unpleasant extubation and central venous catheter dislocation during transportation, it is better to use a non-invasive bedside instrument. The accuracy of ultrasound in establishing lung pathologies like pleural effusion, consolidations or pneumothorax was shown in several studies [1,2]. In normal lung, ultrasound usually identifies pleural line.

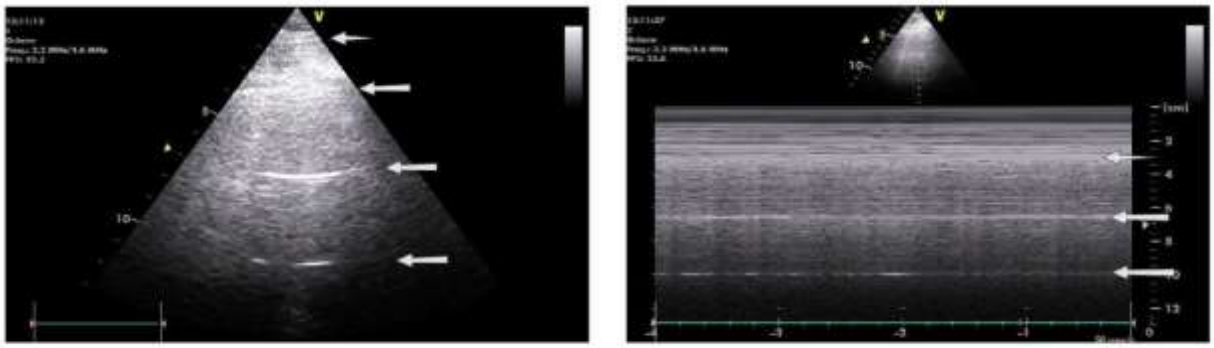
The horizontal line beneath pleural line was separated with regular intervals which are equal to the distance between the skin and pleural line. This line is an artefact line and reflects the presence of high acoustic impedance gradient elements (air and pleural tissue in this case), and they are called line A [3].

It was shown that the accuracy of ultrasound in ARDS patients was 93% for pleural effusion, 97% for consolidations and 95% for alveolar interstitial syndrome compared with 47%, 75% and 72% is respectively in chest x-ray. In children, ultrasonography showed the same critical value compared to CT scan in detecting Para pneumonic effusion.

In 2008, an algorithm (called BLUE protocol) for lung ultrasonography was established and reached a direct diagnosis in >90% acute respiratory failure [4-8].

We would like to promote the use of bedside ultrasound in emergency departments as well as critical units as a reliable, Low-cost and radiation-free tool for determining the differential diagnosis of major potential lung diseases (Figures 3A and 3B).

Figure 3. A. Pleural lines (arrows): Horizontal lines or lines arising from the pleural line are separated at regular intervals which are equal to the distance between the skin and the pleural line. **B.** Mode M showed the pleural line. Below the pleural line is a seashore sign (sandy pattern) due to lung dynamics and sliding pleural. The horizontal lines are A lines, separated by regular intervals (arrows).



(A) (B)

CONCLUSION

The physical properties of ultrasonography grant a proper access to pleural space pathologies, such as air, fluids, or adhesive lung consolidations. This tool has seen significant developments in critical care for the past ten years, notably in the case of central venous line installation, echocardiography, and lung ultrasonography. Lung ultrasound is a safe and reliable tool in distinguishing pulmonary pathology in unstable critical ill patients.

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