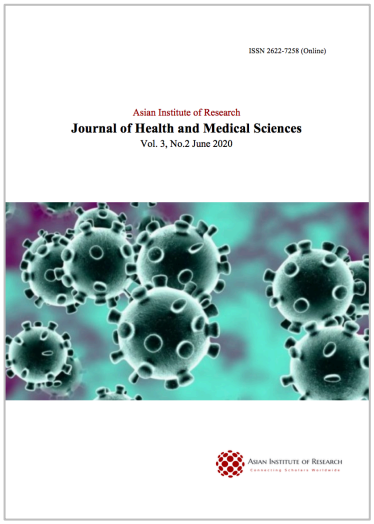

Journal of Health and Medical Sciences

Zamayel, Khotib Amin, and Sudjud, Reza Widianto. (2020), Lung Ultrasound on Critical Ill Patient with Lung Pathology. In: *Journal of Health and Medical Sciences*, Vol.3, No.2, 196-199.

ISSN 2622-7258

DOI: 10.31014/aior.1994.03.02.115

The online version of this article can be found at:
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The Asian Institute of Research
Journal of Health and Medical Sciences
Vol.3, No.2, 2020: 196-199
ISSN 2622-7258

DOI: 10.31014/aior.1994.03.02.115

Lung Ultrasound on Critical Ill Patient with Lung Pathology

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Abstract
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.

Keywords: Consolidations, Critical, Lung, Pleural Effusion, Ultrasound

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 criticall 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.

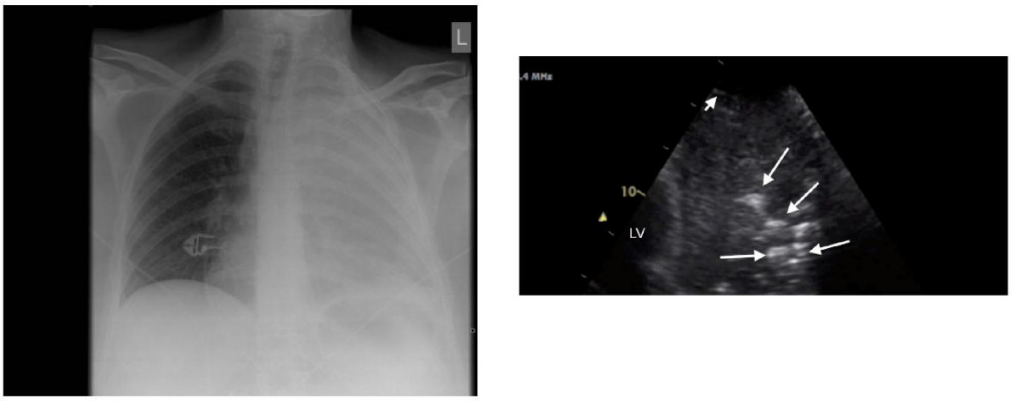
Case Presentation

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 (Figure 1A) 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 (Figure 1B). This examination showed no pleural effusion but an hypoechogenic area with air bronchogram and many hyperogenic spots. CT scan was performed later and resulted in complete lung consolidations compatible with pneumonia.

Figure 1



(A) (B)

Chest x-ray and ultrasound of patient 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.*

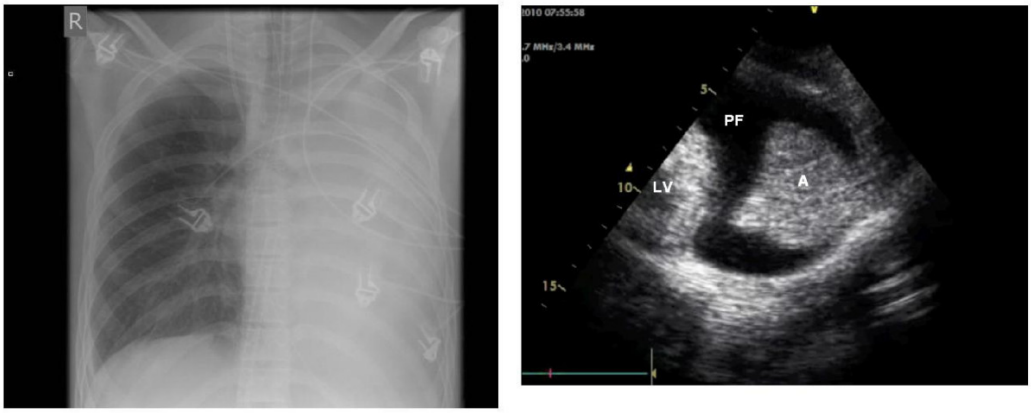
Case 2

A 16-year-old man was admitted to Tangerang General Hospital with cardiogenic shock due to idiopathic dilated cardiomyopathy.

Chest X-ray (Figure 2A) 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 (Figure 2B). 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 appear fairly normal showing that the therapy was effective.

Figure 2



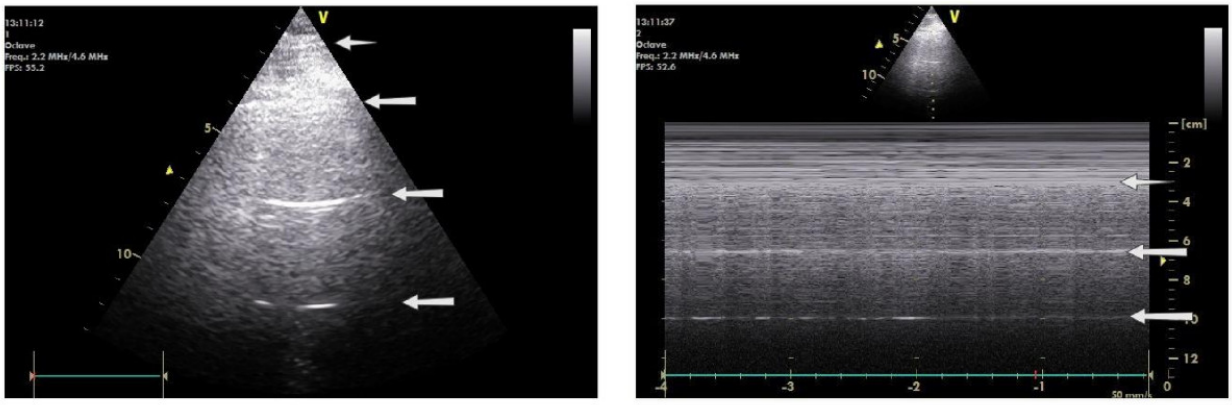
(A) (B)

Chest x-ray and ultrasound of Patient 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).*

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 establishin 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 (Gambar 3). In a comparative study by Lichtensten et al., 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% in respectively in chest x-ray.[2] In children, ultrasonography showed the same critical value compared to CT scan in detecting parapneumonic effusion.[3] In 2008, an algorithm (called BLUE protocol) for lung ultrasonography was established and reached a direct diagnosis in >90% acute respiratory failure.[4] 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 a major potential lung diseases. 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.

Figure 3



Normal lung ultrasound. *(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).*

Conclusion

Lung ultrasound is a safe and reliable tool in distinguishing pulmonary pathology in unstable critical ill patients.

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