CASE REPORT

Bedside lung ultrasound versus chest X-ray use in the emergency department

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Abstract: Acute dyspnoea is one of the most common reasons patients present to the emergency departments (ED). In most cases, the physical examination and bedside radiographs are inconclusive, resulting in the need for more sophisticated diagnostics. These diagnostics may delay treatment or expose the patient to unnecessary radiation. Here, we present the case of a dyspnoeic patient with a normal chest X-ray. The patient was diagnosed with pneumonia by bedside lung ultrasound (BLUS). BLUS revealed bilateral pleural effusion, which was more significant on the right side of the thorax. The right lower lung lobe was consolidated and quad, sinusoid and shred signs were present on BLUS. Chest X-rays demonstrated normal findings. Based on this discrepancy, computerised tomography (CT) of the chest was ordered. A consolidated right lower lung lobe was clearly appreciated with bilateral pleural effusion. However, this finding was not observed on the chest X-ray. Because of the dynamic nature of the disease process, we were able to diagnose pathological changes in the lung earlier with the use of BLUS. In conclusion, this modality may replace the chest X-ray in the ED because it can be used bedside, has high accuracy, and minimal cost.

Keywords: bedside lung ultrasound, dyspnoea, emergency department, pneumonia

Introduction

Acute dyspnoea is one of the most common reasons patients present to the emergency departments (EDs). In most cases, the physical examination and bedside radiography are inconclusive, resulting in the need for more sophisticated diagnostics [1]. These diagnostics may delay treatment or expose the patient to unnecessary radiation. Here, we present a case of dyspnoea due to pneumonia in a patient with a normal chest X-ray that was diagnosed using bedside lung ultrasound (BLUS).

Case

A 47-year-old female presented to the emergency department with 4 days of moderate dyspnoea and cough. She did not previously have a history of dyspnoea or pulmonary disorders. She had a complete physical examination and upon auscultation, respiratory sounds were decreased in the basal areas. Additionally, some inspiratory crackles were appreciated in the right basal segments. The rest of physical examination was unremarkable. The chest X-ray was reported as normal (Fig. 1A), and an emergency specialist performed a BLUS. Bilateral pleural effusion was observed in the lateral and posterior segments of the lower lobes. This pleural effusion was greater in the right hemithorax. In addition, consolidation of the right basal segments was appreciated (Fig. 1B and 1C). Because of the discrepancy between the chest X-ray and the BLUS findings, a computerised tomography (CT) of the chest was ordered. Bilateral pleural effusion was greater on the right side and consolidation of the right lower lobe was observed on the chest CT, confirming the BLUS findings (Fig. 1D). An antibiotic regimen was prescribed, and outpatient treatment was planned.

Discussion

Radiographs can diagnose many common ailments, including pneumothorax, pleural effusion (up to 500 ml), alveolar consolidation and interstitial syndrome. According to the study by Lichtenstein et al. [2], BLUS can immediately provide a diagnosis of acute respira-
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Fig. 1. A: PA chest X-ray demonstrating normal findings with no pleural effusion and no consolidation of the right hemithorax; B: Posterolateral examination of the right lung lobe using bedside ultrasonography revealed an anechoic area with a quad sign framed with white lines (static finding of effusion) and an uneven lung surface, indicating consolidation (shred sign) which has shown as a white arrow; C: M-mode ultrasonography showed sinusoid lung border movement towards the probe (dynamic sign of the effusion), indicating that the effusion is likely a transudate; D: Computerised tomography of the chest, clearly diagnosing consolidation of the right lower lobe with bilateral pleural effusion, which was not observed on the chest X-ray

failure in 90.5% of critical care unit cases. Based on the premise that the air-to-fluid ratio differs completely from one disease to another and that the ratio results in different artefact patterns visible during BLUS, a BLUS examination protocol has been proposed. Each hemithorax is divided into three zones (anterior, lateral and posterior) and four points (two in the anterior zone, one lateral and one posterior). A 3.6 MHZ microconvex sector probe was used in our case (Mindray Bio-medical Electronics, Shenzen, China). Anterior points immediately indicate a pneumothorax without a time delay (absence of lung sliding, comet tail artefacts and presence of a lung point). In addition, anterior points can also reveal interstitial fluid collection (predominance of comet tail artefacts). The posterior point, however, can immediately indicate pleural effusion and 90% of acute alveolar consolidation (AAA) locations. Consolidation yields two characteristic patterns, which are called tissue-like signs and shred signs. The consolidated lung has a tissue-like pattern that is echoic, with regular trabeculations reminiscent of a liver. The lung border is observed as shredded with an uneven surface. It has been shown that when the definition of the AAA includes both of these signs, the sensitivity of ultrasound is 90% and the specificity of CT, which is considered the gold standard, is 98% [3]. The presence of air bronchograms and a decrease in lung sliding are the other ultrasonographic findings in AAA. It is important to note that relying on the anechoic appearance of the pathology is not sufficient to clearly diagnose effusion. Pleural effusion can be framed within a quad and limited by four regular borders called a quad sign. A sinusoid sign is the main dynamic sign of
effusion. With the help of M mode ultrasonography, we can differentiate lung line movement towards the pleura with respect to inspiration. The presence of both signs together confirms effusion with a sensitivity and specificity of 93%, with CT being the gold standard [1, 4]. Most studies have been conducted in intensive care units, and ultrasonography results from these studies were comparable with portable chest X-rays. However, as demonstrated in our case, even chest X-ray devices in radiology departments fail to depict parenchymal and pleural lesions, and adjunctive use of BLUS in the ED is helpful in the early detection of pleural and peripheral lung disease. Because of the dynamic nature of the disease process, we can observe pathological changes earlier using BLUS. However, more time is needed for pathological changes to be observed on chest X-rays. In conclusion, BLUS may replace the chest X-ray in such conditions because it can be used bedside and has high accuracy as well as minimal low cost. Furthermore, there is no exposure to radiation, and there is no need to transport the emergent patient to a radiology unit.

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References

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