American Journal of Emergency Medicine 37 (2019) 377.e1–377.e3

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Case Report

Scan the lung: Point-of-care ultrasound of a pulmonary consolidation with loculated pleural effusion

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ARTICLE INFO

Article history:
Received 13 July 2018
Received in revised form 23 October 2018
Accepted 25 October 2018

Keywords:
Complex pleural effusion
Point-of-care ultrasound
POCUS
Parapneumonic effusion
Thoracic ultrasound
Pulmonary ultrasound

ABSTRACT

Thoracic ultrasound has become an increasingly valuable tool in the evaluation of critically ill patients in the emergency department (ED). The utility of point-of-care ultrasound (POCUS) to identify suspected pneumothorax, pulmonary edema, pleural effusion and pneumonia has been well established (Pagano et al.; Brogi et al.; Cortellaro et al.; Irwin and Cook [1–4]). The 2014 American College of Emergency Physicians (ACEP) Ultrasound Imaging Compendium included lung and pleural ultrasound with the primary indication of identifying pneumothorax and pleural effusion as part of the core POCUS indications for all emergency physicians [5]. We present a unique case in which a patient presented to the ED in respiratory distress. Portable chest X-ray demonstrated near complete opacification of his right hemithorax. POCUS demonstrated a large right sided loculated pleural effusion with associated septations and surrounding consolidation suggestive of a parapneumonic effusion.

1. Case presentation

A 69-year-old male with a history of prior cerebrovascular accident (CVA) status post tracheostomy presented to the ED in respiratory distress. He was diaphoretic and ill-appearing on arrival. His initial vital signs were significant for a heart rate of 111 bpm, blood pressure of 141/95 mm Hg, respiratory rate of 24 breaths per minute, and a rectal temperature of 99.2 °F. Physical examination revealed an awake, cachectic male with a midline trachea and 6.0 cuffed tracheostomy tube in place. His heart was noted to be regular with a tachycardic rate. He had diffuse rhonchi auscultated in bilateral lung fields. His abdomen was soft, nonreader, and nondistended with a PEG tube in place without surrounding inflammatory skin changes.

The emergency physician ordered a complete blood count, basic metabolic panel, cardiac biomarkers, electrocardiograph, chest X-ray, blood cultures and a lactate. The patient was administered a bolus of normal saline and switched from pressure support to volume control mode on the ventilator. A portable chest X-ray demonstrated near complete opacification of the right hemithorax. A pulmonary POCUS examination was preformed utilizing a phased array transducer which demonstrated a dense consolidation of the right anterior lung with dynamic air bronchograms and an associated loculated pleural effusion [Figs. 1 & 2]. A computed tomography (CT) scan of the chest, abdomen and pelvis without contrast was preformed to better delineate this sonographic finding and to investigate for associated pathology. CT findings [Figs. 3 & 4] confirmed the appearance of a complex pleural effusion with associated consolidation of the right hemithorax. The patient was diagnosed with pneumonia with a loculated parapneumonic effusion. He was initiated on broad spectrum antibiotics and admitted to the intensive care unit for further management.

2. Discussion

Thoracic point-of-care ultrasound is an established diagnostic tool for the evaluation of suspected pneumonia, pulmonary edema, pneumothorax and pleural effusion [1-4]. The rapid identification of pneumonia in the ED is of high clinical concern as it is a condition associated with high hospitalization rate and high mortality with over 900,000 deaths in individuals 65 years of age or older in the U.S. each year [1,6]. The diagnosis is confirmed when imaging modalities elucidate a pulmonary infiltrate in an individual with suggestive clinical features [6]. The most commonly used and recommended initial imaging modality of chest radiograph has poor sensitivity for the diagnosis of pneumonia [1,3]. In an ED based study, Cortellaro and colleagues identified a sensitivity and specificity of 99% and 95% respectively for the diagnosis of infiltrate on pulmonary ultrasound. These values far exceed the sensitivity and specificity of chest X-ray found in their study at 67% and 85% respectively and is similar to the gold standard of chest computed tomography (CT) [3,4]. The sonographic appearance of a consolidation on pulmonary ultrasound can be varied from an echotexture appearing similar to that of tissue, such as the liver, to that of a subpleural echo-poor region. Lung ultrasound is also an ideal modality for the evaluation of the mechanically ventilated patient. The International Consensus Conference on Lung Ultrasound (ICC-LUS) offered a

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https://doi.org/10.1016/j.ajem.2018.10.054
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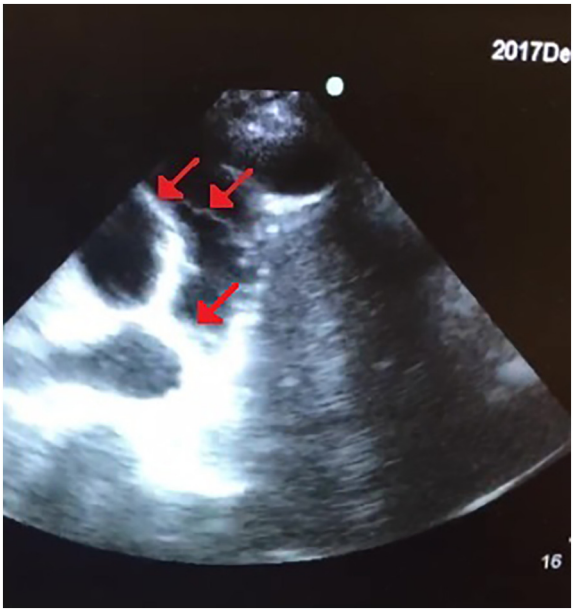

Fig. 1. Thoracic POCUS image of right anterior hemithorax at the 4th intercostal space, arrows demonstrating loculations of parapneumonic effusion.

level A recommendation to the use of lung ultrasound over portable chest X-ray due to its improved accuracy in the detection of a consolidation [7].

Pleural effusion is another important pulmonary pathology that can be rapidly and accurately identified with ultrasound [4]. Multiple disease processes can produce pleural effusions ranging from volume overload and congestive heart failure to pleuroparenchymal infections [2]. Effusions are best identified in the gravity dependent portion of the lung based on patient positioning. They are best visualized directly above the diaphragm posteriorly and laterally in the supine or seated patient [4]. Chest X-ray is once more the most commonly used initial imaging study, yet it's sensitivity remains limited and again pulmonary ultrasound is a superior study. The ICC-LUS has recognized the accuracy of thoracic ultrasound for the diagnosis of pleural effusions and consider

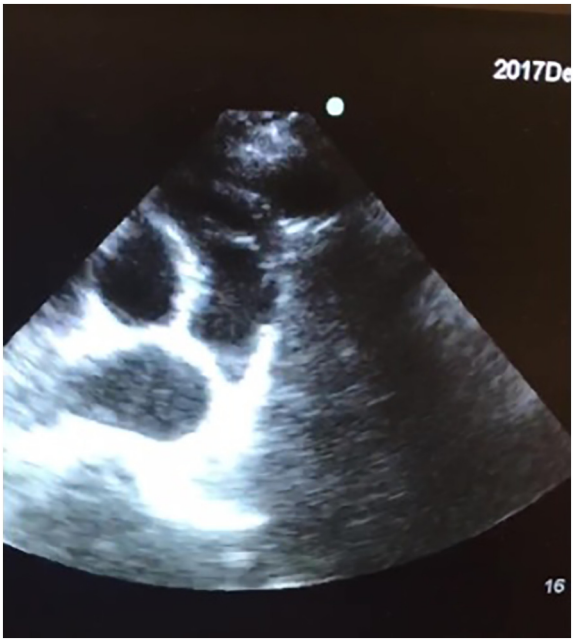

Fig. 2. Thoracic POCUS image of right anterior hemithorax at the 4th intercostal space.

Fig. 3. Axial CT image, arrow demonstrating anterior margin of loculation.

it as accurate as the gold standard of chest CT in the diagnosis of pleural effusion [2,7]. Pulmonary ultrasound has the added benefit over chest X-ray in that it can assist in the differentiation of transudates, exudates, or hemothorax. Transudates are anechoic in appearance and can be commonly found in bilateral lungs. Exudates typically have internal echogenicity, can contain fibrin strands forming septations, are associated with thickened pleura and parenchymal lung changes. A hemothorax on pulmonary ultrasound typically appears an effusion with a homogenous echogenic appearance [2].

Fig. 4. Coronal CT image of parapneumonic effusion in right hemithorax.

Our case is unique in that it is a rare presentation of a loculated pleural effusion with an associated pneumonia with echogenic features which mimic the appearance of the heart on echocardiography. The septations noted within the parapneumonic effusion have an appearance similar to the atria or ventricles on ultrasound. Although it is easy to discern these structures from the true appearance of the heart, it is important to recognize that pleural effusions while easily visualized with ultrasound can have a varied presentation dependent on the etiology of the effusion. This finding represents a novel presentation of a common condition visualized on a fast emerging first line imaging modality in patients with suspected pneumonia.

3. Conclusions

Point-of-care ultrasound is a core diagnostic study in the armamentarium of the emergency physician evaluating a patient with a cardiopulmonary complaint. The increased use of POCUS to identify pulmonary consolidations and pleural effusions will have the additional benefit of identifying many interesting and novel pathologic states. A hypoechoic area noted in either hemithorax with associated adjacent atelectasis is highly suspicious for a pleural effusion. The addition of internal stranding suggests it is a complex pleural effusion and justifies the use of additional diagnostic tools.

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