



## Case Report

### Usefulness of chest ultrasonography in detecting pulmonary embolism in patient with chronic obstructive pulmonary disease and chronic renal failure: a case report

#### Abstract

We describe the case of a 75-year-old man affected by a chronic obstructive pulmonary disease and chronic renal failure admitted to our emergency department for dyspnea and interscapular stabbing pain. Chest radiography showed diffuse parenchymal consolidation in the lower right lung with bronchiectasis, but the treatment for infection disease did not improve the clinical conditions of the patient. According to Wells score indicating an intermediate risk for pulmonary embolism, we performed a chest ultrasonography that showed ultrasonographic patterns of thromboembolism. Because the presence of chronic renal failure limited the execution of a helical computed tomographic pulmonary angiography, a pulmonary scintigraphy was performed confirming the diagnosis of pulmonary embolism. Our case suggested that chest ultrasonography can be a valuable tool for early detection of pulmonary embolism and to establish immediately an appropriate therapy.

Pulmonary embolism is a common and potentially lethal cardiopulmonary disease with nonspecific signs and symptoms [1] so that its diagnosis could be difficult and requires a high index of clinical suspicion by the emergency physician and is, therefore, frequently underdiagnosed and undertreated [2]. Chest radiography is the first imaging diagnostic modality used in the emergency department (ED), although it may often show nonspecific and indirect signs or it may even be normal.

Pulmonary angiography is currently the criterion standard [3], but it is rarely used because of its invasive nature and the relative high risk of complications [4].

Helical computed tomographic pulmonary angiography (HCTPA) has been recently established as the reference modality, with high sensitivity and specificity [3], but it has limitations in detecting injury in subsegmental arteries [5].

On the other hand, ventilation/perfusion lung scan is often not sufficiently conclusive [6–8], although it is sometimes used [9,10].

However, critically ill patients may sometimes not tolerate any of these diagnostic modalities, or adequate equipment might not be available in the ED.

In these cases, chest ultrasonography that exhibited high sensitivity [3] can play a useful role in directing the physician to formulate the correct diagnosis and to optimize the treatment, improving the prognosis.

A 75-year-old man was admitted to our ED for dyspnea and interscapular stabbing pain, exacerbated by deep inspiration and cough, started 3 weeks ago.

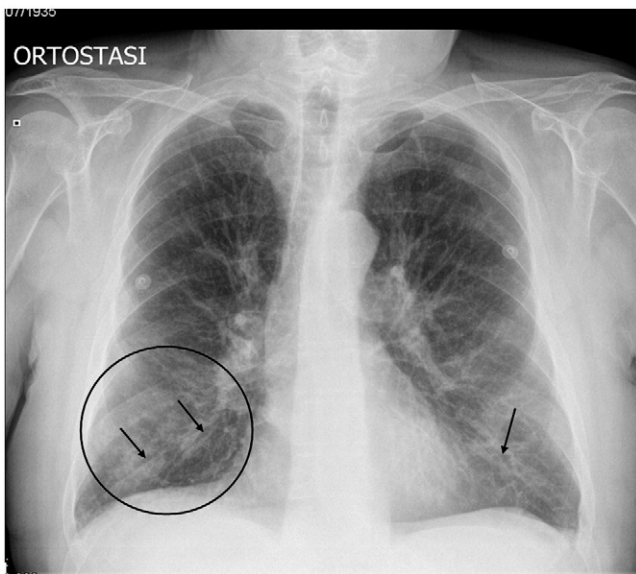
The patient was a former smoker and had a history of right pleurisy and spontaneous pneumothorax and was affected by a chronic obstructive pulmonary disease and a chronic renal failure syndrome. In the last 3 months, the patient was treated twice for a pulmonary infection by *Pseudomonas aeruginosa*.

Vital signs at admission were heart rate of 75 beats per minute, blood pressure of 165/80 mm Hg, respiratory rate of 22 breaths per minute, oxygen saturation of 96% during oxygen administration (2 L/min) by nasal probes, Glasgow Coma Scale of 15, and no fever.

The patient was tachypneic with recruitment of accessory respiratory muscles. Chest examination revealed widely reduced breath sounds bilaterally, with pleural rubs at both lung basis. Cardiovascular and abdominal examinations disclosed no abnormalities.

Blood tests revealed increased creatinine (1.77 mg/dL), serum urea nitrogen (0.88 g/L) and D-dimer (572 ng/dL) levels. The 12-lead electrocardiogram demonstrated normal sinus rhythm at rate of 70 beats per minute.

Chest radiography showed diffuse parenchymal consolidation in the lower right lung with bronchiectasis (Fig. 1). For the persistence of dyspnea associated to pain, the elevated D-dimer value, and the absence of infectious signs, according to Wells score [11], the presence of pulmonary embolism with intermediate risk was suspected; therefore, a chest ultrasonography and an echocardiographic examination were performed.



**Fig. 1** Plain chest radiogram showing diffuse, confluent parenchymal consolidations in the lower lobe of right lung, possibly affecting the lateral field of middle lobe. Band images with a track morphology compatible with bronchiectasis bilaterally (arrows). A few small soft nodules in the upper lobes. Reduced expansion of the costophrenic angles. Normal cardiac silhouette.

Echocardiographic examination was normal. Chest ultrasonography was preferred to HCTPA due to the presence of chronic renal failure and showed a normal pleural gliding with a diffusely irregular pleural line and a diffuse interstitial syndrome, likely due to the chronic obstructive pulmonary disease. We also observed 6 pleural-based, wedge-shaped, parenchymal hypodense areas (4 in the lower middle field of right lung and 2 in the lower field of left lung) associated to a partial disruption of the pleural line (Fig. 2). These sonographic findings were suggestive of thromboembolic lesions according to the criteria reported in the literature [3,4] and allow us to make diagnosis of pulmonary embolism.

To confirm the ultrasonographic diagnosis, the next day a pulmonary perfusion scintigraphy was performed, and it showed a perfusion deficit in the lower middle field of the right lung (Fig. 3), consistent with the diagnosis of pulmonary embolism.

As already described in the literature [3,12], the ultrasonographic patterns of thromboembolism include hypoechoic areas of lung tissue extending to the pleura. Commonly, these lesions are wedge shaped (85%) [3], round, or polygonal, mainly located within the lower lobes with a preference in the right lung [3,4]. The pleural line can appear irregular, and a localized or basal pleural effusion can be found in up to two-third of patients [4]. In our case, chest ultrasound showed lesions similar to the above with prevalence in the right lung, but without pleural effusion.

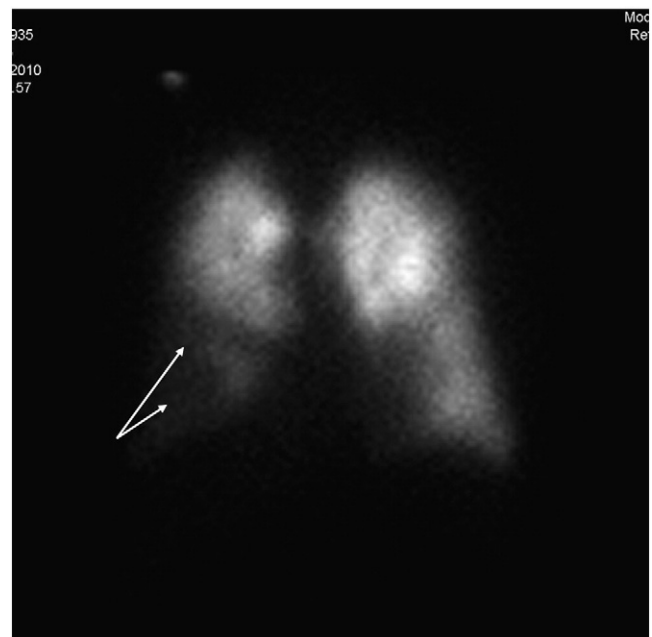
The subsequent pulmonary scintigraphy confirmed the diagnosis, although this modality did not agree with chest ultrasonography regarding the number and localization of the lesions.



**Fig. 2** Two-dimensional chest ultrasound showing pleural-based, wedge-shaped, parenchymal hypodense areas (star), associated to a partial disruption of the pleural line (arrows).

Currently, there is not unanimity among the international guidelines to include chest ultrasonography in the flow chart for pulmonary embolism diagnosis.

However, we believe that chest ultrasonography may represent an attractive and safe alternative to other diagnostic modalities for the diagnosis of pulmonary embolism, especially in the emergency setting for patients



**Fig. 3** Lung scintigraphic image demonstrating the presence of deficit fixing in the middle field of the lower right lung, only partially attributable to consolidations described by chest radiography. Clinical interpretation: picture compatible with pulmonary embolism in the right lung.

unable to undergo a HCTPA scan for the presence of renal failure, contrast agent allergy, pregnancy, or due to the clinical instability. Despite its advantages, chest ultrasonography also has some limits: only thromboembolic lesions extending up to the lung periphery can be detectable, although this condition can be found in almost all cases [3], and this modality is operator dependent; therefore, a structured training program must be delivered to all ED physicians.

In conclusion, chest ultrasonography can be a valuable tool for early detection of pulmonary embolism and to establish immediately an appropriate therapy in the ED.

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