

Endobronchial ultrasound: beyond nodes and masses

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Abstract

Pulmonary embolism (PE) is a life-threatening condition with varied presentation and, therefore, poses clinical challenge for early diagnosis and proper management without which it carries high mortality. Previous studies on the role of endobronchial ultrasound (EBUS) in diagnosis of PE were carried out after PE was already diagnosed by computed tomography pulmonary angiography. We report a case of massive PE with shock, promptly diagnosed with bed side EBUS – Doppler study, as patient's clinical condition did not allow conventionally proposed diagnostic algorithm.

Introduction

Pulmonary embolism (PE) is a medical emergency with high morbidity and mortality. Regularly revised guidelines have proposed a systematic diagnostic and management protocol. Despite best recommendations, there are clinical situations where PE poses a clinical challenge in diagnosis and management.

Clinical prediction scores, D-Dimer, computed tomography pulmonary angiography (CTPA), lung scintigraphy, magnetic resonance (MR) angiography, compression venous ultrasound and echocardiography are various diagnostic procedures proposed. But it still remains difficult to diagnose PE in conditions such as renal failure, pregnancy and in hemodynamically unstable patients.

Convex probe endobronchial ultrasound (EBUS) has been used for mediastinal lymphadenopathy and adjacent masses. Doppler assessment of mediastinal vasculature by EBUS has recently been mentioned for diagnosis of central PE [1,2]. Previous studies evaluated EBUS as a diagnostic tool for PE and compared it with CTPA. In our case due to various comorbid conditions and medical limitations, EBUS was considered as the test to ascertain PE.

Case Report

A 65-year-old man, chronic smoker (40 pack years cigarette smoking) with chronic obstructive pulmonary disease (COPD) (GOLD class C), was brought to emergency department in altered sensorium with a history of fever and intermittent hemoptysis for the past 2 months. He had associated breathlessness and swelling of the left leg. His risk for deep vein thrombosis (DVT)/PE was calculated as per the revised Geneva score, and he was found to be at high risk with a score of 15. The patient had been receiving empirical anti-tuberculosis treatment for the past month for left upper lobe pneumonia identified on chest X-ray (CXR).

On examination, our patient had altered sensorium, tachycardia (heart rate: 130 bpm), tachypnea (respiratory rate: 38/min), with hypotension (82/50 mmHg) and severe hypoxia (peripheral capillary oxygen saturation of 78% on room air). Admission blood gases showed pH: 7.26, bicarbonate (HCO_3): 24.7 mmol/L, partial pressure of carbon dioxide (PCO_2): 55 mmHg, partial pressure of oxygen (PO_2): 53 mmHg, and base excess (-3.7 mmol/L).

His blood investigations showed raised aspartate aminotransferase (AST) and alanine transaminase (ALT) (AST/ALT $-111/69.0$), renal dysfunction (serum creatinine:

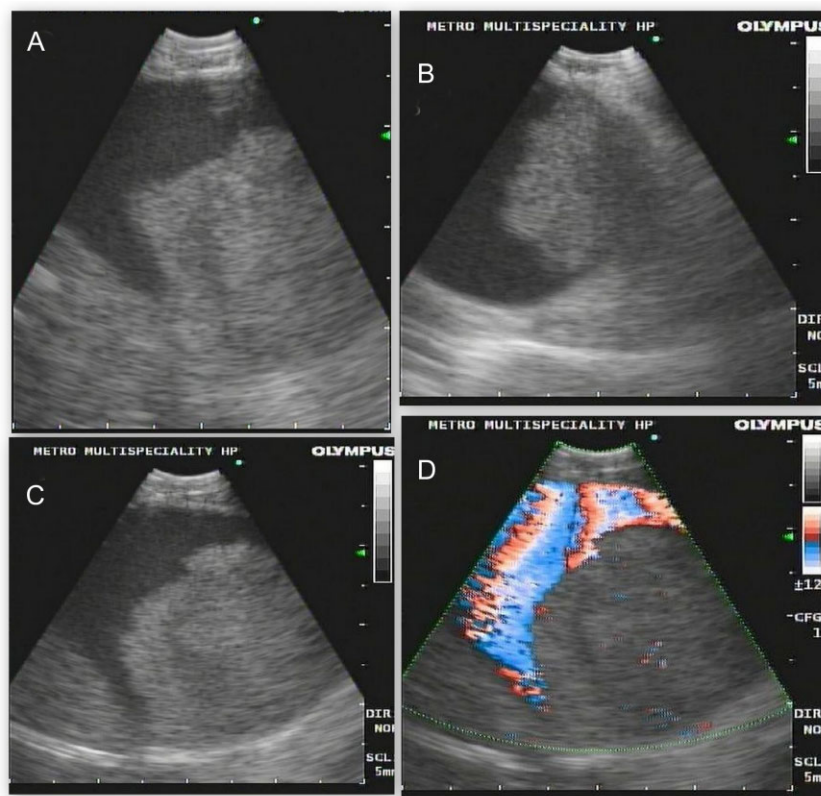


Figure 1. An echogenic mass visualized in both central pulmonary arteries (A–C) and flow interruption (D).

2.5 mg/dL [glomerular filtration rate: 27.7 mL/min] and urea: 111 mg/dL). CXR showed non-homogeneous opacity in left upper lobe. In view of unilateral lower limb swelling and non-resolving opacity on CXR, the possibility of malignancy in the left upper lobe associated with DVT was the provisional diagnosis.

Our patient was put on mechanical ventilation. His venous Doppler of lower limb showed DVT involving left common femoral, superficial femoral vein and popliteal vein. His echocardiography showed normal left ventricle functions with dilated right ventricle (RV) and moderate pulmonary hypertension. Because of renal dysfunction, CT pulmonary angiography was not carried out and both ventilation perfusion scans and MR angiography were not feasible as the patient was hemodynamically unstable on inotropes and on ventilator.

Routine bronchoscopy performed on ventilator showed no intra-bronchial growth. Bronchoalveolar lavage was sent for cultures. In view of non-contributory bronchoscopy and findings of corpulmonale on ECHO, EBUS bronchoscopy (Olympus BF type UC 180 F ultrasonic video-bronchoscope and EU-ME1 endoscopic ultrasound console; Olympus Medical systems Corp., Hachioji-shi, Tokyo, Japan) was carried out. It showed an echogenic mass visualized in both

central pulmonary arteries (Fig. 1A–C). On color Doppler, flow was interrupted in left pulmonary artery confirming massive PE (Fig. 1D). High-risk pretest score (15) and left leg proximal DVT along with suggestive ECHO supported the diagnosis of pulmonary thromboembolism, and hence, he was given anticoagulation as per his renal functions.

Renal functions normalized over the next 72 h. On the fourth day, CTPA was performed that showed a large thrombus in main pulmonary artery extending into the right and left PA and left lower lobe branches (Fig. 2A–C). Lung window showed left upper lobe consolidation (Fig. 2D). On the same day, thrombolysis with alteplase (100 mg) was carried out. Patient improved over the next 48 h with decrease in right ventricular and PA pressures, which was assessed on repeat ECHO. Our patient became conscious and was planned for extubation. However, he developed generalized seizures. His CT brain did not reveal any metastasis or intra-cerebral bleed; however, there was subarachnoid hemorrhage. Our patient could not survive this event.

Discussion

PE continues to be a life-threatening emergency, and is difficult to diagnose and manage, despite advancements in

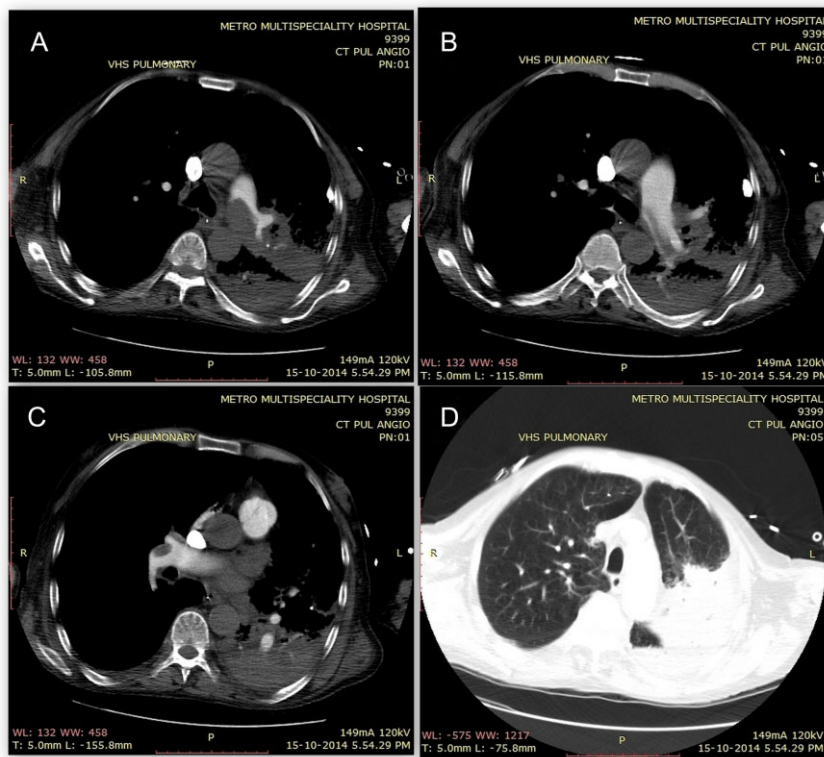


Figure 2. Computed tomography pulmonary angiography showed a large thrombus in main pulmonary artery (PA) extending into right and left PA and left lower lobe branches (A–C) and left upper lobe consolidation (D).

early diagnosis and best guidelines. Multi-detector CT pulmonary angiography is presently the diagnostic modality of choice. In cases of renal failure, hypersensitivity to contrast media or pregnancy CTPA cannot be performed.

MR imaging also has its limitations as it is impractical in critically ill patients on inotropes, contrast hypersensitivity and due to motion artifacts. Ventilation–perfusion scintigraphy is not appropriate in patients with pre-existing lung disease besides being unsuitable in hemodynamically unstable cases.

RV pressure overload/dysfunction, RV dilatation/RV contractility and measurement of tricuspid annulus plane systolic excursion may be useful in hemodynamically compromised suspected PE patients. If CTPA is contraindicated, these parameters assessed on echocardiography may justify emergency reperfusion treatment, but ECHO parameters are non-specific and need to be interpreted with caution. Demonstration of DVT on compression ultrasonography is another diagnostic strategy used in suspected PE cases, although its overall sensitivity for the presence of PE is low (39.7%). In a case scenario like ours, neither CTPA nor ventilation/perfusion scan were possible. The patient was on ventilator and hence bedside portable echo was carried out which demonstrated dilated RV and

moderate pulmonary artery hypertension, but these findings are non-specific and of questionable use especially with an abnormal CXR and history of COPD.

Previous studies have suggested that EBUS may be useful in diagnosis of PE. However, in all published literature convex probe (CP) EBUS was used to demonstrate PE after abnormal CTPA findings [3–5]. In our case, CTPA could not be carried out initially, being contraindicated, and PE was first demonstrated on EBUS Doppler. Findings were later confirmed on CTPA after improvement in renal functions.

In previous studies, the location of PE was known prior to EBUS, but in our case, thrombus was identified de novo by CP-EBUS. EBUS carried out on the first day had suggested PE in bilateral main pulmonary arteries but our patient was thrombolysed only after confirmation with CT pulmonary angiography as per the established guidelines. Thrombolysis on the basis of EBUS findings was a possibility, which is not mentioned in any current guidelines. Therefore, we propose the use of EBUS for detecting central PE and a guide for thrombolytic therapy in exceptional cases, as in the present case. Early decision for definitive therapy based on EBUS can be life saving, although the need for proper training and expertise in EBUS Doppler is required.

Disclosure Statements

No conflict of interest declared.

Appropriate written informed consent was obtained for publication of this case report and accompanying images.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Video S1. Video demonstrates a non-transmural thrombus in left pulmonary artery on endobronchial ultrasound, also seen on color Doppler study.