

Diagnosing Pulmonary Embolism When the Clinical Picture Is Not Clear – The Role of the Point-of-care Ultrasound

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Abstract

Point-of-care ultrasound (POCUS) has become a reliable and powerful tool working as a complement to the traditional physical examination. It has proven to be a reliable and reproducible method to a quicker and safer diagnosis, sometimes surpassing the diagnostic accuracy of more traditional techniques. We present two cases of pulmonary embolism (PE) with clinical presentations that suggested other diagnoses, prior to the performance of POCUS: a 60-year-old patient with nausea and vomiting and a 66-year-old female with a week-long progressive increase of shortness of breath and increased peripheral edema. In the reported cases, we aim to pinpoint the importance and usefulness of POCUS in the everyday evaluation of our patients, in multiple settings and by multiple specialty physicians, supported by its robust evidence-based background. It has proven to be a useful tool in evaluating in a fast and nonharmful way complementing more traditional techniques, which proves to be especially important regarding cases, like the ones we describe, when the correct diagnosis is not always clear to presentation. The use of multiorgan POCUS allows even in the most atypical presentations, the rise of suspicion of PE, leading to the necessary steps to a final diagnosis and management.

Keywords: Deep vein thrombosis, lung ultrasound, point-of-care ultrasound, pulmonary embolism

INTRODUCTION

In the last few decades, point-of-care ultrasound (POCUS) has become a reliable and powerful tool working as a complement to the traditional physical examination. It has proven to be a reliable and reproducible method to a quicker and safer diagnosis, sometimes surpassing the diagnostic accuracy of more traditional techniques.^[1]

When it comes to pulmonary embolism (PE), the gold standard diagnostic technique is multidetector computed tomographic pulmonary angiography (MCTPA) performed to a high pretest probability patient. Although POCUS – especially multiorgan POCUS – is feasible and despite being less specific and sensitive than MCTPA, it can be important in some clinical settings, reducing radiation exposure and increasing the accuracy of pretests.^[2] Ultrasound can reveal direct signs on deep vein and heart exploration, as well as indirect pulmonary and pleural signs suggesting PE. To illustrate this, we present

two cases of PE with presentations that suggested other diagnoses, prior to the performance of POCUS.

CASE REPORT

Case 1

A 60-year-old man, with previous medical history of surgically removed hypophyseal macroadenoma with postsurgical hypothyroidism, urged to the emergency department (ED) complaining of nausea and vomiting associated with fever (~38°C) for the previous 3 days. He also complained of mild pleuritic pain with referral to the left posterior hemithorax during exertion over the past couple of months, which could

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be resolved by resting. In the ED, he was afebrile (37.2°C) and hemodynamically stable (blood pressure: 110/74 mmHg and heart rate: 74 bpm), and O₂ saturation in room air was 95%. There were no findings regarding heart and lung auscultation. Abdominal inspection revealed no signs of tenderness or liver and spleen enlargement. Blood test and blood gas analysis were unremarkable. With the finding of left posterior chest pain aggravated by palpitation, ultrasonography was performed and showed two areas of subpleural wedge-shaped consolidations with focal B-lines [Figure 1a]. Echocardiogram showed enlargement of the right ventricle [Figure 1b]. Despite the low Wells score, these findings together with a high D-dimer level (11,910 ng/ml; normal value [NV] <250 ng/ml) led to a MCTPA that confirmed the diagnosis of bilateral PE. The patient was initiated on anticoagulation and eventually made a full recovery.

Case 2

A 66-year-old woman, with previous medical history of heart failure with preserved ejection fraction (New York Heart Association stage II), hypertension, obesity, and anemia due to vaginal blood loss of unknown etiology, presented to the ED with a week-long progressive increase of shortness of breath in usual daily life activities and increased peripheral edema, as well as progressively increasing vaginal blood loss. At presentation, she was afebrile and slightly hypertensive (150/87 mmHg) with an increased heart rate of 112 bpm and O₂ saturation at room air of 89%. Heart auscultation was normal, and some wheezing and basal crackles were present during lung auscultation. Lower limbs had significant edema extending to the middle of the leg and slight erythema bilaterally. Initial assumption was that the clinical picture was attributed to decompensated heart failure due to blood loss and aggravated anemia. Blood work revealed hemoglobin of 8.9 g/dL (NV: 11.9–14.8 g/dL), no inflammatory marker elevation, and a slight elevation in troponin 103 ng/L (NV: <14 ng/L for women). Blood gas analysis showed hypoxemia at 69 mmHg (NV: 75–100 mmHg). Despite this, due to leg swelling and erythema, lower extremity vein ultrasound was performed and showed signs of acute femoral vein thrombosis [Figure 2a]. By now, PE rose in suspicion and heart and lung ultrasound

was also performed at the patient's bedside. Echocardiogram showed enlarged right cavities in the apical four-chamber view and a "D-sign" on the parasternal short-axis view [Figure 2b], which is a consequence of the right ventricle compressing the left ventricle. Lung ultrasound revealed pleural irregularities and signs of pulmonary infarction. MCTPA was performed to confirm the suspicion and showed bilateral PE with signs of right heart overload. The patient was started on acenocoumarol, which eventually led to intracranial bleeding and death. An anti-Xa activity level was measured before the bleeding episode, being 1.0 UI/mL (NV: 0.8–1.2).

DISCUSSION

Multiorgan POCUS has a robust evidence-based background. It is adopted by a variety of physicians in a lot of different settings, allowing to a more efficient and quickly evaluation and management of our patients.^[2,3]

This way, it proves to be highly valuable as a complement to traditional examination tools, especially when it comes to cases where the clinical picture is unclear.

Regarding PE, the range of presentations is wide,^[4] frequently leading to misdiagnosis and otherwise preventable morbidity and death.^[5] Atypical presenting symptoms of PE, such as syncope, recurrent fever,^[6] bradycardia,^[2] epigastric pain,^[7] flank pain,^[8] right upper quadrant and back pain,^[9] and seizure,^[10] are described in the literature despite their rarity. This leads to the need of a more cautious approach in patients with risk factors for PE despite their presentation.^[4] The value of POCUS stands out in these cases, especially in a multiorgan approach.^[2]

Multiorgan POCUS including lung, venous compression, and focused cardiac ultrasound as a clinical adjunct can play a significant role in the diagnosis and management of PE.

The presence of subpleural consolidations and focal B-lines is highly specific for focal interstitial syndrome (i.e., pneumonia, fibrosis, atelectasis, pulmonary infarction, neoplasia, etc.). Compression ultrasound is the mainstay of venous thrombosis diagnosis. Focused cardiac ultrasound may reveal evidence

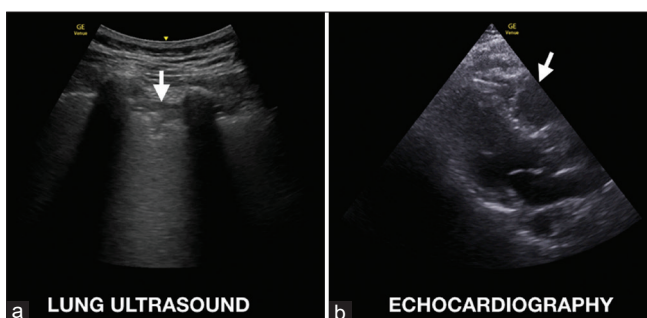


Figure 1: Lung ultrasound performed with a curvilinear probe at the most sensitive area of the chest, revealing a subpleural consolidation (white arrow), suggestive of pulmonary infarction (a). Parasternal long axis of the heart showing a right ventricle diameter above 3 cm (white arrow) (b)

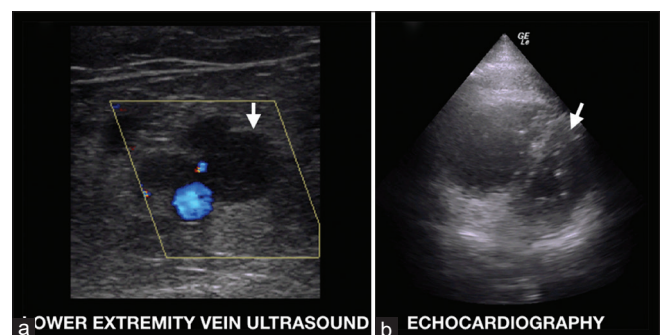


Figure 2: Lower extremity vein ultrasound showing an enlarged, noncompressible femoral vein (white arrow), which corresponds with a deep vein thrombus (a). Parasternal short axis of the heart showing right ventricle strain and a "D-" shaped left ventricle (white arrow) (b)

of right ventricle strain. Combining these examinations in a protocolized approach allows a quick but unrefutably precious look at the most important locations regarding PE.^[2]

POCUS is useful in the diagnosis of acute PE, either as a screening tool in patients with atypical presentation or as an aid before the confirmation by chest computed tomography in patients with high clinical suspicion, leading to the necessary steps to a final diagnosis and management.

We have obtained informed consent from the patients.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

Yale Tung Chen is the guarantor of the content of the present letter. The authors certify that they have no commercial associations that might pose a conflict of interest in connection with this editorial letter.

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