

Atypical Presentation of Pulmonary Embolism: Flank Pain as the Sole Symptom in a PERC-Negative Patient – The Role of POCUS in Early Detection

Abdolghader Pakniyat^{1*} and Sabrina Berdouk^{2**}

¹Board-certified Emergency Medicine, Al Zahra Pvt. Hospital
Dubai, Dubai, United Arab Emirates

²Consultant Emergency Medicine, Head of Emergency
Department, Educational Leadership, EM Mastery Academy,
Dubai, UAE

*Corresponding Author

Sabrina Berdouk, Consultant Emergency Medicine, Head of Emergency
Department, Educational Leadership, EM Mastery Academy, Dubai,
UAE.

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Abstract

Pulmonary embolism (PE) is a potentially life-threatening condition with diverse clinical presentations. While dyspnea and pleuritic chest pain are the hallmark symptoms, atypical presentations such as isolated flank pain can obscure timely diagnosis. We report a case of a 39-year-old male smoker who presented with left-sided flank pain exacerbated by deep inspiration. Despite meeting Pulmonary Embolism Rule-Out Criteria (PERC), the crucial role of lung point-of-care ultrasound (POCUS) in identifying localized B-lines and an elevated D-dimer prompted CT pulmonary angiography, confirming segmental PE. This case underscores the diagnostic utility of POCUS and highlights the limitations of PERC in atypical presentations.

Keywords: Pulmonary Embolism, Flank Pain, Point-of-Care Ultrasound, PERC, D-dimer, CT Pulmonary Angiography

1. Introduction

Pulmonary embolism (PE) is a leading cause of cardiovascular morbidity and mortality, with an estimated incidence of 60–70 cases per 100,000 individuals annually [1]. It results from the obstruction of pulmonary arteries by thrombi, most commonly originating from deep vein thrombosis (DVT) in the lower extremities. PE presents with a broad spectrum of clinical manifestations, ranging from asymptomatic cases to sudden cardiac arrest. The classical triad of dyspnea, pleuritic chest pain, and hemoptysis is well recognized; however, a significant proportion of patients exhibit non-specific or atypical symptoms, leading to frequent misdiagnoses and delayed treatment [1-3]. Atypical presentations of PE include syncope, isolated cough, upper abdominal pain, and, as in this case, flank pain. Flank pain as the sole presenting symptom of PE is uncommon and often leads to misattribution to renal, musculoskeletal, or gastrointestinal etiologies. Studies show that up to 30% of PE cases present with atypical symptoms, increasing the likelihood of diagnostic challenges. Given the potential for fatal complications, including right heart failure and hemodynamic collapse, timely diagnosis and intervention are vital [4,5].

Although risk stratification tools such as the Pulmonary Embolism Rule-Out Criteria (PERC) are extensively used in the emergency department (ED) due to their simplicity and reliability, clinicians must be cautious about their limitations. Recent evidence suggests that certain atypical presentations—such as isolated flank pain—may significantly undermine the sensitivity of PERC, potentially delaying the diagnosis and management of PE. Emergency physicians should thus maintain a high index of suspicion even when decision rules appear reassuring, particularly in patients presenting with atypical symptoms or subtle risk factors. The utility of POCUS as a bedside diagnostic tool has become increasingly recognized in emergency medicine, particularly in ambiguous presentations of critical conditions like pulmonary embolism. Lung ultrasound is a rapid, non-invasive technique that can detect pulmonary infarctions or consolidations not visible on initial chest X-rays, significantly shortening the diagnostic process. Previous studies have demonstrated that lung ultrasound findings such as localized B-lines or subpleural consolidations strongly correlate with peripheral pulmonary infarctions associated with segmental or subsegmental PE, highlighting its practical value in ED decision-making.

Risk stratification tools, such as the Wells' criteria and the Pulmonary Embolism Rule-Out Criteria (PERC), are frequently used in emergency settings to determine the need for further investigation. While PERC is highly sensitive in ruling out PE in low-risk patients, its applicability in cases with unusual presentations remains uncertain [4]. We present a case that illustrates these points: an atypical presentation of PE (flank pain as the sole symptom in a PERC-negative patient) in which POCUS played a critical role in early detection and management.

2. Case Presentation

A 39-year-old male with a history of smoking (10 pack-years) presented to the emergency department with a 12-hour history of sharp, left-sided flank pain without radiation rated 6/10 in intensity. The pain was slightly exacerbated by deep inspiration and changing position but was not associated with dyspnea, cough,

fever, hemoptysis, or leg swelling. He had recently undertaken 11-hour flight four weeks prior but had no personal or family history of venous thromboembolism, recent surgery, malignancy, or chronic illness. On initial evaluation, his vital signs were stable: blood pressure 142/89 mmHg, heart rate 60 bpm, respiratory rate 16 breaths/min, oxygen saturation 98% on room air, and temperature 36°C. Physical examination revealed normal heart sounds with no murmurs. The respiratory assessment was unremarkable, with no wheezing or rales. His abdominal exam was normal, with no tenderness, guarding, or distention. His extremities showed no signs of edema or deep vein thrombosis.

Point-of-care ultrasound (POCUS) ruled out hydronephrosis or nephrolithiasis and revealed localized B-lines in the 10th-11th intercostal space of the left posterior chest, suggestive of lung pathology.

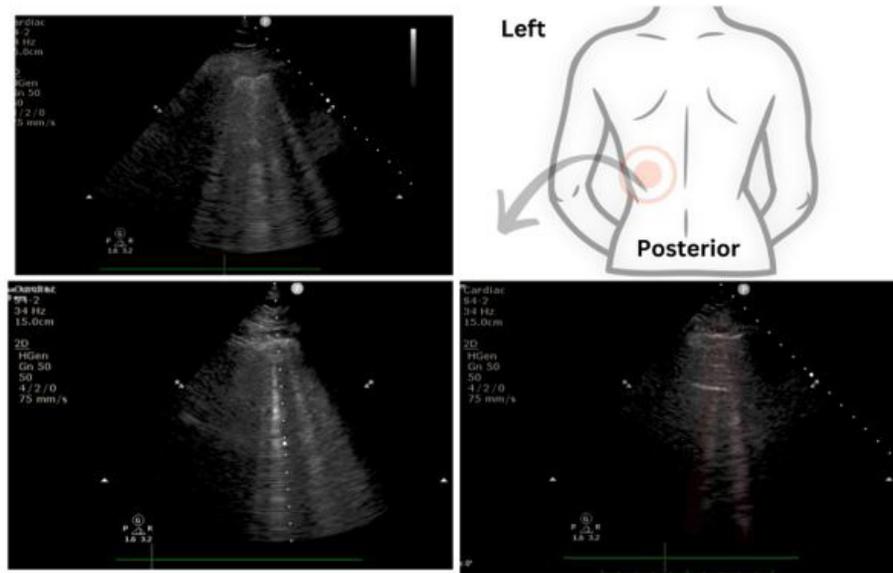


Figure 1: Point-of-care Ultrasound (POCUS) using a Phased-Array probe on the left Posterior Thorax, Demonstrating B-lines Suggestive of Pulmonary Pathology. This Finding Contributed to the Suspicion of Pulmonary Embolism (PE)-related Infarction in a PERC-Negative Patient with Isolated Flank Pain

Given his stable hemodynamic status, an initial workup included an electrocardiogram (ECG), which demonstrated normal sinus rhythm without signs of right heart strain, normal finding on bedside echocardiography, normal bilateral Ultrasound scan of leg veins and Haziness in the left lower zone at the CP angle noted in a chest x-ray.

A routine laboratory panel was within normal limits, but his D-dimer level was elevated at 1.8 mg/L (normal <0.5 mg/L), prompting further investigation.

To further evaluate the possibility of PE, CT pulmonary angiography (CTPA) was performed. This revealed multiple filling defects in the segmental and subsegmental branches of the right lower pulmonary artery, reaching the posterior basal subsegmental branch. Additionally, occlusive filling defects were seen in the left lateral-basal subsegmental pulmonary arteries. The scan also showed heterogeneous ground-glass opacification in the left lower lobe, indicative of pulmonary infarction, with minimal left pleural fluid.

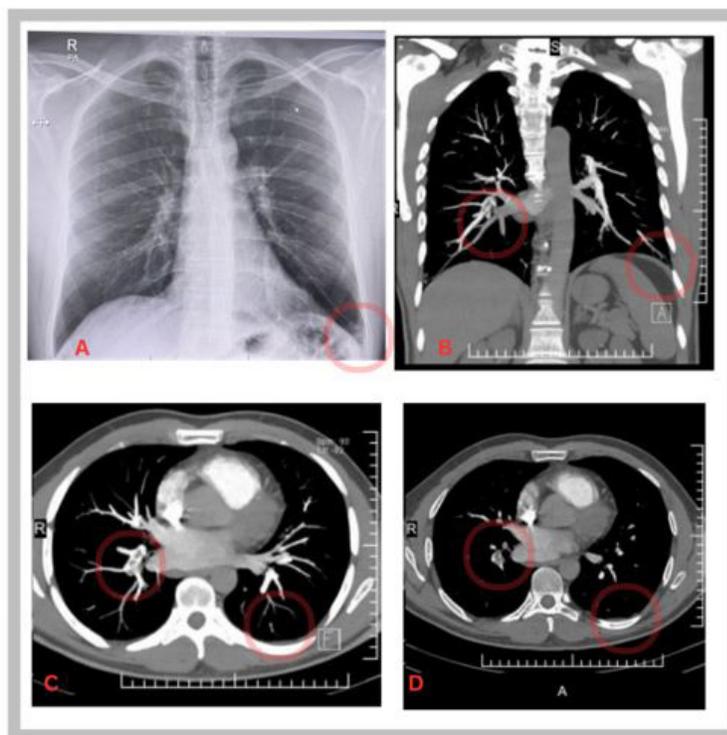


Figure 2: (A) CXR: Subtle Opacity in the Left Lower Lung Field, Raising Suspicion for Pulmonary Pathology, (B, C, D) CTPA: Segmental and Sub-segmental Pulmonary Emboli in the Right Lower Pulmonary Artery and Left Lateral-Basal sub-segmental Arteries, with Associated Pulmonary Infarct, Bibasal Ground-Glass Opacities, and Minimal Left Pleural Fluid

Based on these findings, a diagnosis of segmental PE with pulmonary infarction was established despite the patient being PERC-negative. He was promptly initiated on therapeutic anticoagulation with subcutaneous enoxaparin (Clexane) 80 mg. Pain management included intravenous paracetamol. The patient remained hemodynamically stable throughout his hospital course and was monitored closely for 24 hours. He was subsequently admitted under pulmonology care for further observation and discharged with oral anticoagulation therapy. At his 3-month follow-up, he was asymptomatic, with no recurrence of PE.

3. Discussion

Diagnosing PE can be particularly challenging when symptoms deviate from the typical presentation of dyspnea and pleuritic chest pain. In this case, flank pain was the primary complaint, a presentation reported in less than 5% of PE cases. The absence of common PE symptoms can lead to misdiagnosis, often resulting in an initial workup focused on renal or musculoskeletal causes rather than a thromboembolic process. Studies suggest that such atypical cases frequently result in delayed diagnosis and increased risk of complications [3-6]. Physicians should consider pulmonary embolism when diagnosing patients with isolated flank pain. Unexpected pulmonary findings on abdominal CT scans can suggest PE in the right clinical context [5]. Using integrated point-of-care lung ultrasound (POCUS) and assessing the lungs at the bedside, especially in cases with flank pain without obvious pathologies like hydronephrosis, may detect related lung pathology. This can lead to prompt investigation and diagnosis of

PE in suspected cases.

One possible explanation for the patient's presentation is pleural irritation due to pulmonary infarction, which can manifest as pain referred to the flank due to shared innervation of the diaphragm and lower thoracic structures [5,6]. Additionally, embolic obstruction of subsegmental pulmonary arteries has been associated with localized inflammation and infarction, as seen in the heterogeneous ground-glass opacification noted on CTPA. This correlation highlights the importance of imaging in atypical cases, particularly when clinical signs alone do not strongly indicate PE. POCUS played a crucial role in this case, demonstrating localized B-lines suggestive of pulmonary infarction. Lung ultrasound has been shown to have high diagnostic accuracy in PE, with a sensitivity of 81% and specificity of 83% when combined with clinical assessment. The use of POCUS in this patient guided further evaluation despite his PERC-negative status. Literature supports that multi-organ ultrasound assessment, incorporating lung, cardiac, and venous ultrasound, significantly improves diagnostic accuracy in suspected PE, studies linked B-lines to peripheral PE infarcts, demonstrating a specificity of 78% when evaluated in the appropriate clinical context [7-9].

Additionally, cardiac POCUS findings, such as McConnell's sign (RV free wall hypokinesis), have been reported to have a specificity of 77% for PE, reinforcing its role in risk stratification [10]. Given the diagnostic limitations of PERC, as highlighted in a meta-analysis by Singh B et al. showing a 1.5% PE prevalence

in PERC-negative patients, clinical suspicion should not be dismissed solely based on scoring criteria, particularly in high-risk individuals with risk factors such as malignancy, smoking, and recent travel [11]. Although PERC is validated and widely applied, emergency physicians should be aware of its limitations, particularly in atypical or subtle presentations. A recent meta-analysis found that a notable minority of patients who were PERC-negative still had PE when further investigated, especially among those with atypical presentations or unrecognized thrombophilic conditions. This emphasizes that clinical judgment should not be entirely replaced by clinical decision rules. If there remains reasonable clinical suspicion, additional diagnostic measures—including POCUS, D-dimer testing, or advanced imaging—should be pursued, even when a patient initially meets PERC criteria.

This case highlights the role of prolonged travel and smoking as contributing risk factors for PE. Long-distance travel increases VTE risk, peaking within the first two weeks post-travel and normalizing by eight weeks. Despite being PERC-negative, this patient's history warranted further evaluation, demonstrating the limitations of PERC and Wells' criteria in atypical cases. A comprehensive clinical assessment incorporating history, risk factors, and imaging remains crucial for timely diagnosis and management [12-14].

4. Conclusion

This case emphasizes the importance of clinical vigilance for pulmonary embolism, even in patients presenting atypically with isolated flank pain. It demonstrates the diagnostic value of POCUS, especially in scenarios where standard clinical decision tools like PERC fail to capture underlying risks. Emergency clinicians should consider integrating multi-organ ultrasound into their routine evaluation of unexplained or atypical presentations of PE. Further research is warranted to refine clinical decision rules, incorporating the role of bedside ultrasound, to enhance timely diagnosis, reduce unnecessary radiation exposure, and ultimately improve patient outcomes.

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