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Case Report

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Through The Lens of The Chest X-Ray: Revisiting Classical Signs of Pulmonary Embolism

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Abstract

Pulmonary embolism (PE) may present with subtle but specific radiographic clues on chest X-ray. We describe a series of three patients with acute PE demonstrating classical findings, including the Palla's sign, Hampton's hump, and Westermark's sign, across varied clinical settings. In all cases, these findings prompted early diagnostic consideration and were subsequently confirmed by computed tomography pulmonary angiography. Echocardiographic findings varied between cases and ranged from normal ventricular function to evidence of right-ventricular strain. This case series highlights the continued educational value of recognising classical chest X-ray signs of PE, particularly in supporting early clinical suspicion when definitive imaging is delayed or not immediately available.

Keywords: Pulmonary embolism; Venous thromboembolism; Chest X-ray; Imaging.

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INTRODUCTION

Pulmonary embolism (PE) is a common and potentially fatal cardiovascular emergency, and delayed diagnosis is associated with increased morbidity and mortality.[1] Computed tomography pulmonary angiography (CTPA) is the diagnostic reference standard; however, chest radiography remains the most frequently performed

performed initial imaging investigation in patients presenting with acute dyspnoea or chest pain in the emergency department.[2]

Although chest radiographic findings in PE are often normal or nonspecific, several classical signs have been described and retain diagnostic value due to their relatively high specificity.[2–4] Palla's sign refers to enlargement of the right descending pulmonary artery caused by acute thromboembolic obstruction.[3] Hampton's hump appears as a pleural-based, wedge-shaped opacity and represents pulmonary infarction.[3,4] Westermark's sign describes focal peripheral oligemia distal to an occluded pulmonary artery due to reduced pulmonary arterial flow.[3]

While these findings are individually uncommon and lack sensitivity, their recognition can support early clinical suspicion and prompt timely escalation to definitive imaging. We present a case series of three patients with acute PE demonstrating classical chest radiographic signs with CTPA correlation and variable echocardiographic findings.

CASE REPORTS

Case 1

A man in his 60s, ten days after resection of rectal carcinoma, presented with exertional dyspnoea and tachycardia. His chest X-ray demonstrated enlargement of the right descending pulmonary artery consistent with the Palla's sign (**Figure 1a**) and a pleural-based, wedge-shaped opacity in the right mid-zone consistent with the Hampton's hump (**Figure 1a**).

Transthoracic echocardiography showed normal right- and left-ventricular size and systolic function, with no evidence of right-ventricular dilatation, hypokinesia, or septal flattening.

A CTPA confirmed bilateral pulmonary embolus (**Figure 1b**). The patient clinically deteriorated and required intravenous thrombolysis, followed by therapeutic anticoagulation with good recovery.

Case 2

A home-bound man in his 30s presented with seizures and severe dyspnoea. He was hypoxemic, tachycardic, and required intubation. His chest radiograph revealed three classical signs: Palla's sign, Westermark's sign, and Hampton's hump (**Figure 2a**).

Transthoracic echocardiography demonstrated right-ventricular dilatation without interventricular septal flattening or regional wall motion abnormalities. A CTPA confirmed a large saddle pulmonary embolus (**Figure 2b**). He was treated with anticoagulation and supportive ventilation in the intensive care unit.

Case 3

A man in his 40s with bronchial asthma and a recent right metatarsal fracture immobilised in a back-slab presented with acute shortness of breath. Chest radiography demonstrated the Palla's sign (**Figure 3a**).

A bedside echocardiography showed right-ventricular dilatation, a D-shaped septum, and McConnell's sign—preserved apical motion with mid-free wall akinesia suggestive of acute right-heart strain.

A CTPA confirmed a large saddle PE (**Figure 3b**). He improved with therapeutic anticoagulation.

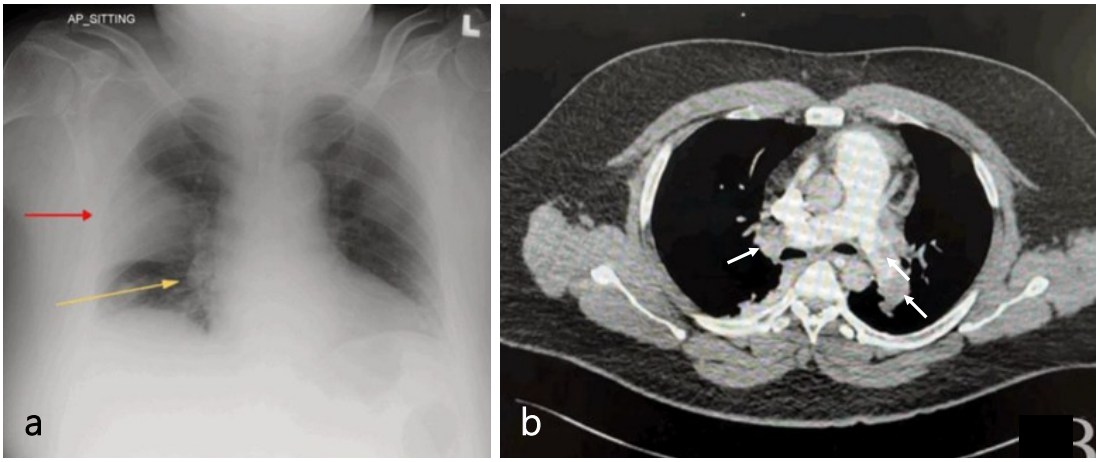

Figure 1: a) Chest X-ray showing Hampton's hump (yellow arrow) and Palla's sign (red arrow), b) Axial CTPA image confirming an intraluminal right pulmonary artery embolus and also embolism affecting the left pulmonary artery (White arrows).

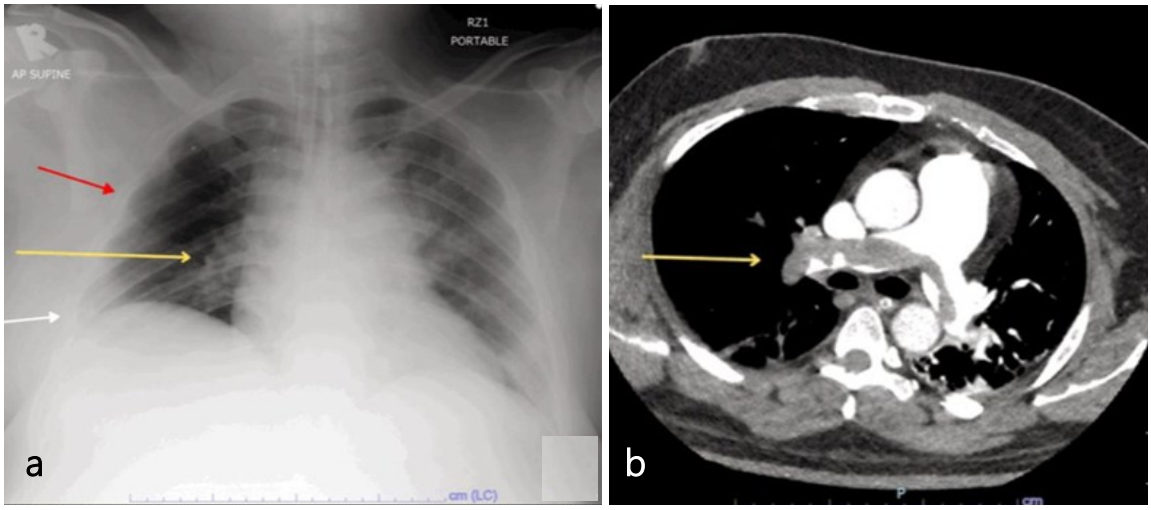

Figure 2: a) Chest radiograph showing: Palla's sign (yellow arrow), peripheral wedge opacity (red arrow) and focal oligemia (white arrow), b) Axial CT pulmonary angiography demonstrating a right pulmonary artery embolus (yellow arrow).

DISCUSSION

Chest radiography has limited sensitivity for the diagnosis of PE but retains clinical and educational value when classical signs are present. In the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED) study, chest radiographs were frequently abnormal in patients with confirmed PE; however, most findings were nonspecific and lacked diagnostic sensitivity when considered in isolation.[3]

Several classical chest radiographic signs have been described and are traditionally associated with acute PE. The Palla's sign reflects enlargement of the right descending pulmonary artery and is attributed to acute thromboembolic obstruction of a central pulmonary vessel.[3] In this case series, Palla's sign on chest radiography corresponded with central pulmonary artery thrombus on CTPA in all three cases, including saddle emboli in Cases 2 and 3.

The Westermark's sign represents focal peripheral oligemia distal to an occluded pulmonary artery, resulting from reduced pulmonary arterial perfusion.[3] This finding was demonstrated in Case 2 and correlated with a large saddle PE on CTPA, consistent with extensive proximal obstruction.

The Hampton's hump appears as a pleural-based, wedge-shaped opacity and represents pulmonary infarction distal to an embolus.[3,4] In Cases 1 and 2, this radiographic finding correlated with acute pulmonary embolism on CTPA and is consistent with previously described imaging-pathological associations.

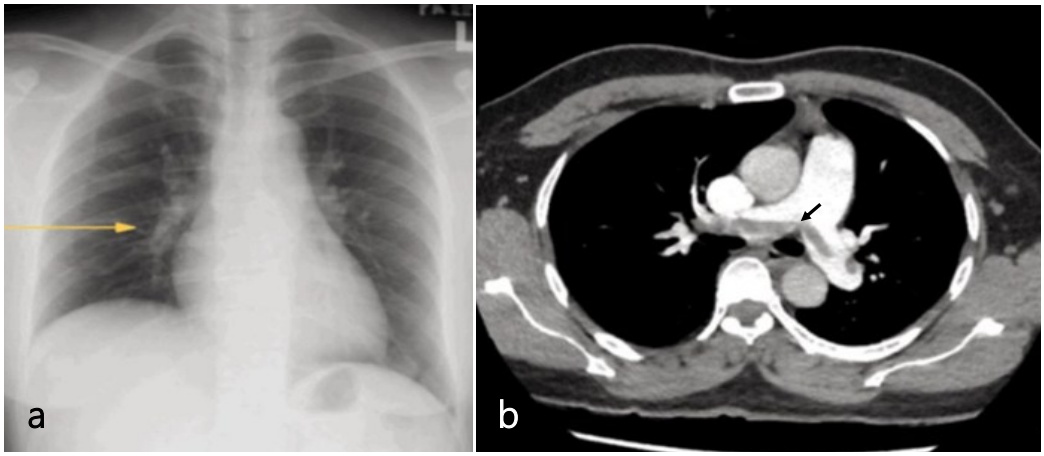

Figure 3: a) Chest radiograph showing Palla's sign (yellow arrow), b) CTPA demonstrating a long saddle pulmonary embolism (arrow).

Although these classical signs are well recognised, they are uncommon and demonstrate low sensitivity. Reported sensitivities for individual signs are generally below 30%, while specificities are higher, reflecting their value as supportive rather than screening findings.[2–4] Consequently, the absence of these signs does not exclude PE, but their presence should prompt urgent consideration of the diagnosis and expedited confirmatory imaging.

Transthoracic echocardiography provided additional physiological context in this series but did not directly correlate with specific chest radiographic signs. Echocardiographic findings ranged from normal ventricular function (Case 1), to isolated right-ventricular dilatation (Case 2), and overt right-ventricular strain with McConnell's sign (Case 3). These findings complement CTPA and clinical assessment in evaluating haemodynamic impact, but PE severity should be determined based on haemodynamic status and right-ventricular dysfunction rather than chest radiographic appearances alone.[2]

Importantly, while the coexistence of multiple classical chest radiographic signs may heighten diagnostic suspicion for PE, there is insufficient evidence to support their use as independent markers of disease severity. Their primary value lies in early pattern recognition, particularly in emergency settings where CT access may be delayed.

CONCLUSION

This case series highlights the continued relevance of classical chest X-ray signs of PE when interpreted in conjunction with CTPA and echocardiography, reinforcing their role as adjunctive tools in contemporary emergency imaging.

Take Home Message

- **Diagnostic Clues:** Classical chest X-ray signs, such as the Palla's sign, Hampton's hump, and Westermark's sign, provide specific radiographic clues that prompt early diagnostic consideration for PE.
- **Clinical Utility:** While these signs lack sensitivity and cannot exclude PE, their high specificity supports urgent escalation to definitive imaging.
- **Assessment of Severity:** Radiographic signs do not independently reflect disease severity; assessment should instead rely on haemodynamic status and echocardiographic evidence of right-ventricular strain.
- **Educational Relevance:** Recognising these classical patterns remains a valuable clinical skill in emergency settings, particularly when access to CTPA is limited or delayed.

Abbreviations

PE	Pulmonary embolism
CT	Computed topography
CTPA	CT Pulmonary angiography
PIOPED	Prospective Investigation of Pulmonary Embolism Diagnosis

Declarations

All the authors declared no competing interests.

Patient Consent

Written consent was obtained from all patients for publications of the clinical details and accompanying images.

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