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CASE REPORT

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Radiological challenges in differentiating Occult Traumatic Pulmonary Hematoma from mediastinal tumor: a case report and literature review

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Abstract

Traumatic Pulmonary Hematoma (TPH) is a rare consequence of blunt chest trauma, characterised by lung parenchyma laceration and subsequent hemorrhage. While less common than pulmonary contusions, TPH presents significant diagnostic challenges, particularly when it manifests as Occult Traumatic Pulmonary Hematoma (OTPH) exhibiting subtle or atypical imaging features. We report a case where OTPH was initially misdiagnosed as a posterior mediastinal tumor. A 36-year-old male with a history of minor left chest trauma presented with two oval masses in the right paravertebral region on chest computed tomography (CT). These masses were initially suspected to be mediastinal tumors.Thoracoscopic surgery revealed these lesions to be subpleural tumors in the right lower lobe, which were ultimately diagnosed as pulmonary hematomas (PH). This case highlights the necessity of including PH in the differential diagnosis of intrathoracic masses, especially when imaging findings are ambiguous. Accurate diagnosis often necessitates the integration of clinical history with advanced imaging modalities.

Keywords Pulmonary hematoma, Mediastinal tumor, Differential diagnosis, Radiologic imaging, Case report

Introduction

Traumatic Pulmonary Hematoma (TPH) results from blunt chest trauma that causes lung parenchyma laceration, leading to vascular rupture and hemorrhage. A TPH forms when the torn lung tissue fills with blood [1]. TPH is less common than pulmonary contusions, with an incidence rate of 1.2–3.5% in blunt chest traumas. Diagnosis relies on evaluating patient history, trauma specifics, associated pulmonary contusions, and imaging findings.

However, Occult Traumatic Pulmonary Hematoma (OTPH) presents a significant diagnostic challenge due to its subtle or atypical presentation. Detection often necessitates advanced imaging studies such as computed tomography (CT) and magnetic resonance imaging (MRI). Notably, OTPH in certain locations can mimic imaging features of mediastinal tumors, complicating diagnosis. Misdiagnosis on imaging can lead to unnecessary surgeries or delayed treatment, adversely affecting patient outcomes. Therefore, we report a case of OTPH for two key reasons: (1) a history of chest trauma accompanied by non-specific clinical symptoms, and (2) its unique location, rendering it radiologically indistinguishable from a posterior mediastinal tumor.

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Case presentation

A 36-year-old male patient presented two months after experiencing minor left chest trauma (a minor fall) that caused localized left anterior chest pain, which resolved with topical analgesics and without further symptoms. During an annual health check, chest CT revealed two oval masses, measuring 21 mm and 14 mm in diameter, in the right paravertebral region, corresponding to the T7/8 and T8/9 vertebral levels. The masses had a broad base, well-defined boundaries, and an apparent extension into the spinal canal (Fig. 1). The average CT attenuation values on unenhanced imaging for the two masses were 52.7 Hounsfield Units (HU) (located at T7/8) and 69.8 HU (located at T8/9), respectively. Fractures with associated callus formation were observed in the left third and fourth anterior ribs (Fig. 2). The patient was referred to our hospital for further evaluation. Hematological tests were unremarkable. The patient had no history of anticoagulant use or relevant family medical history. Based on the preoperative diagnosis of a posterior mediastinal tumor, likely of neurogenic origin, thoracoscopic surgery was performed.

Intraoperative thoracoscopic exploration unexpectedly revealed two subpleural lesions in the right lower lobe; the local pleura appeared white, without pleural indentation, and was clearly demarcated from the posterior mediastinum. A right lower lobe wedge resection was performed, revealing cystic nodules filled with a brown, viscous fluid. Postoperative pathology confirmed the diagnosis of pulmonary hematoma (PH) (Fig. 3). The operation lasted 60 min, with a blood loss of 10 ml. The patient's postoperative recovery was uneventful. At a two-week follow-up after discharge, no complications were noted, and further follow-up was deemed unnecessary due to the benign nature of the hematoma.

Discussion

It is widely accepted that the primary cause of PH is blunt chest trauma. Diagnosing TPH primarily depends on radiographic findings from X-ray or CT imaging, along with a detailed analysis of the patient's medical history.

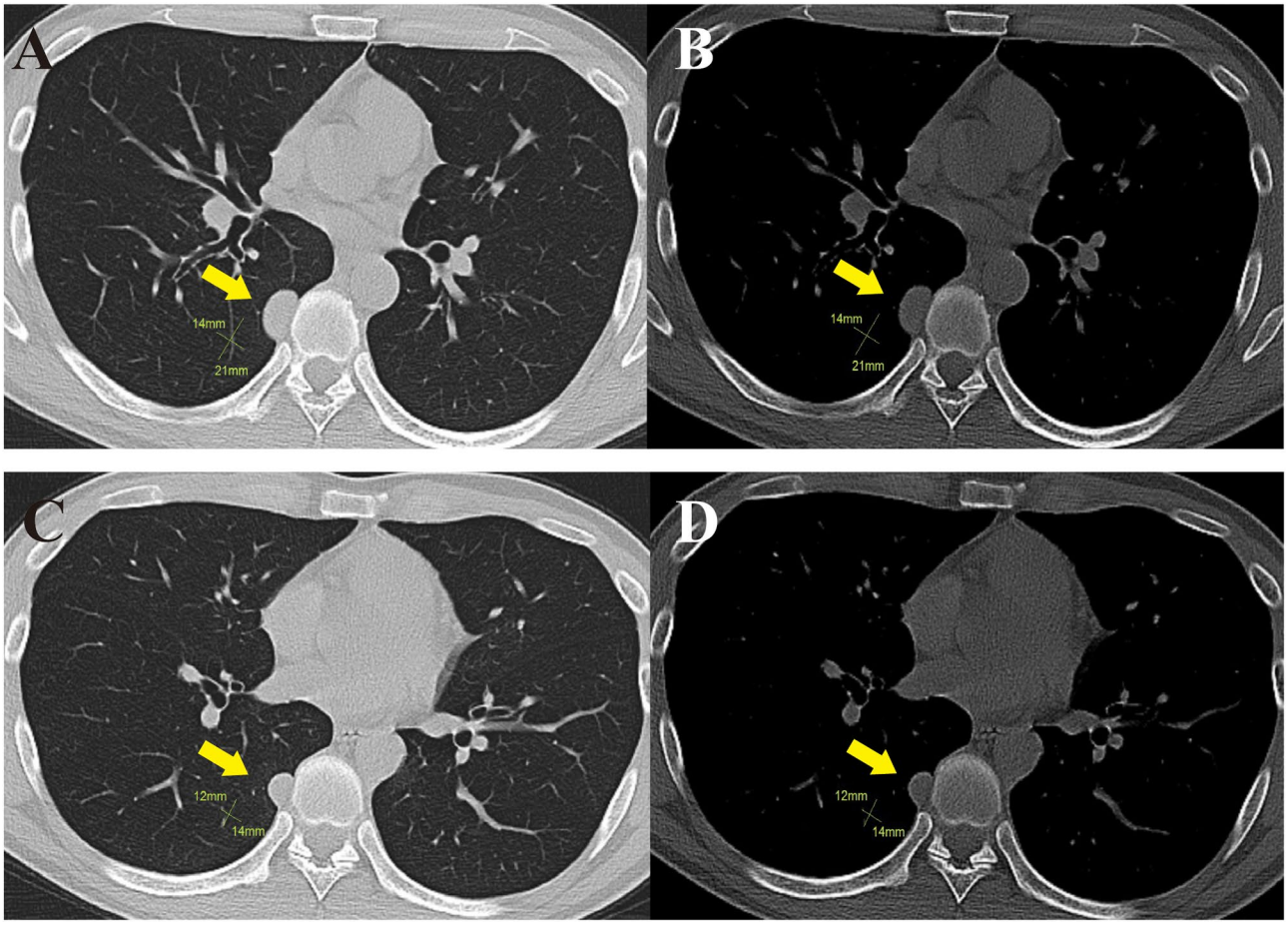

Fig. 1 Chest computed tomography (CT)findings: **(A)** Chest CT scan reveals a 21 × 14 mm nodule located at the side of the right lower lobe or posterior mediastinum. **(B)** Nodule 1 has a broad base, with clear boundaries, and appears to extend into the spinal canal. **(C)** Nodule 2 is observed adjacent to the right T8/9 segment, measuring approximately 14 × 12 mm. **(D)** Nodule 2 has a broad base and appears to extend into the spinal canal

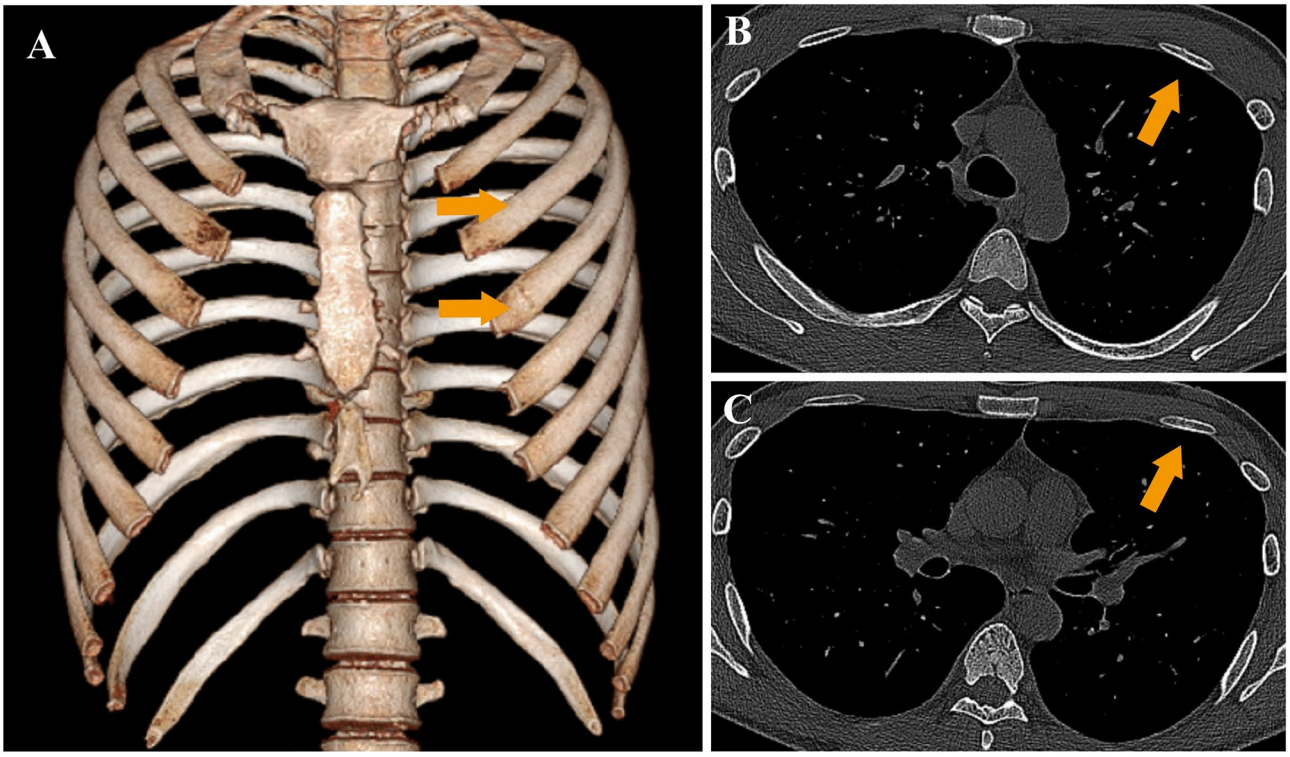

Fig. 2 Three-dimensional reconstruction using the CT of the chest. **(A)** Fractures of the left third and fourth anterior ribs are visible, with well-aligned fracture ends and minimal callus formation. **(B, C)** Fractures of the left third and fourth anterior ribs are evident, with visible fracture lines

CT imaging is particularly useful for determining the hematoma's location, size, shape, and surrounding features. Achieving a definitive diagnosis of TPH becomes straightforward when typical CT findings are paired with a clear history of trauma [2]. However, in the absence of a trauma history or with ambiguous clinical records, particularly regarding chest trauma, or when other etiologies for the hematoma are present, accurate diagnosis using X-ray or CT is challenging. In this case, the patient presented with a mediastinal mass, unaware of prior chest trauma, possibly from a minor fall, and with an occult fracture identified in the left anterior chest wall. The imaging lacked typical PH features, complicating the differential diagnosis. Furthermore, rare etiologies of PH include mediastinal hemorrhage, where blood enters the lung through the bronchial sheath; various thoracic surgeries, such as post-thoracoscopy, post-lobectomy, or post-thoracoplasty; anticoagulant therapy, thrombocytopenia, congenital disorders like Ehlers-Danlos syndrome [3, 4] ; and spontaneous intrapulmonary hematoma without an apparent cause [1].

To differentiate between posterior mediastinal masses and OTPH, key differentiating factors are lesion diversity, fractures of surrounding bone structures, changes in mass size during follow-up, acute angles between the mass and the chest wall, and characteristic hematoma intensities [5, 6]. Posterior mediastinal tumors are predominantly neurogenic, typically located near the spine and sometimes presenting as "dumbbell-shaped" masses with extension into the spinal canal. Neurogenic tumors in the anterior mediastinum are exceedingly rare [7]. In contrast, PHs are usually situated within the lung parenchyma. Posterior mediastinal masses are generally well-defined, round or oval soft-tissue masses with CT attenuation values ranging from 30 to 60 HU. On contrast-enhanced CT or MRI, they often exhibit heterogeneous enhancement. On T2-weighted MRI, these masses usually appear as high-signal lesions, often revealing internal cystic changes and areas of hemorrhage. The principal radiological features of PH include single or multiple irregular or quasi-circular air-filled, air-fluid, or hyperdense shadows, without enhancement on contrast-enhanced scans [8]. In the acute phase, PH typically exhibit high CT attenuation values, around 50–90 HU. In the subacute and chronic phases, the CT values gradually decrease over time, approaching the density of the surrounding lung parenchyma and eventually appearing as heterogeneous in density. MRI can aid in differential diagnosis, as hematomas typically appear as high-signal masses on both T1- and T2-weighted images [9]. However, signal characteristics may vary, influenced by the stage of hematoma evolution, leading to variations in T1 and T2 signal intensity. These time-dependent imaging

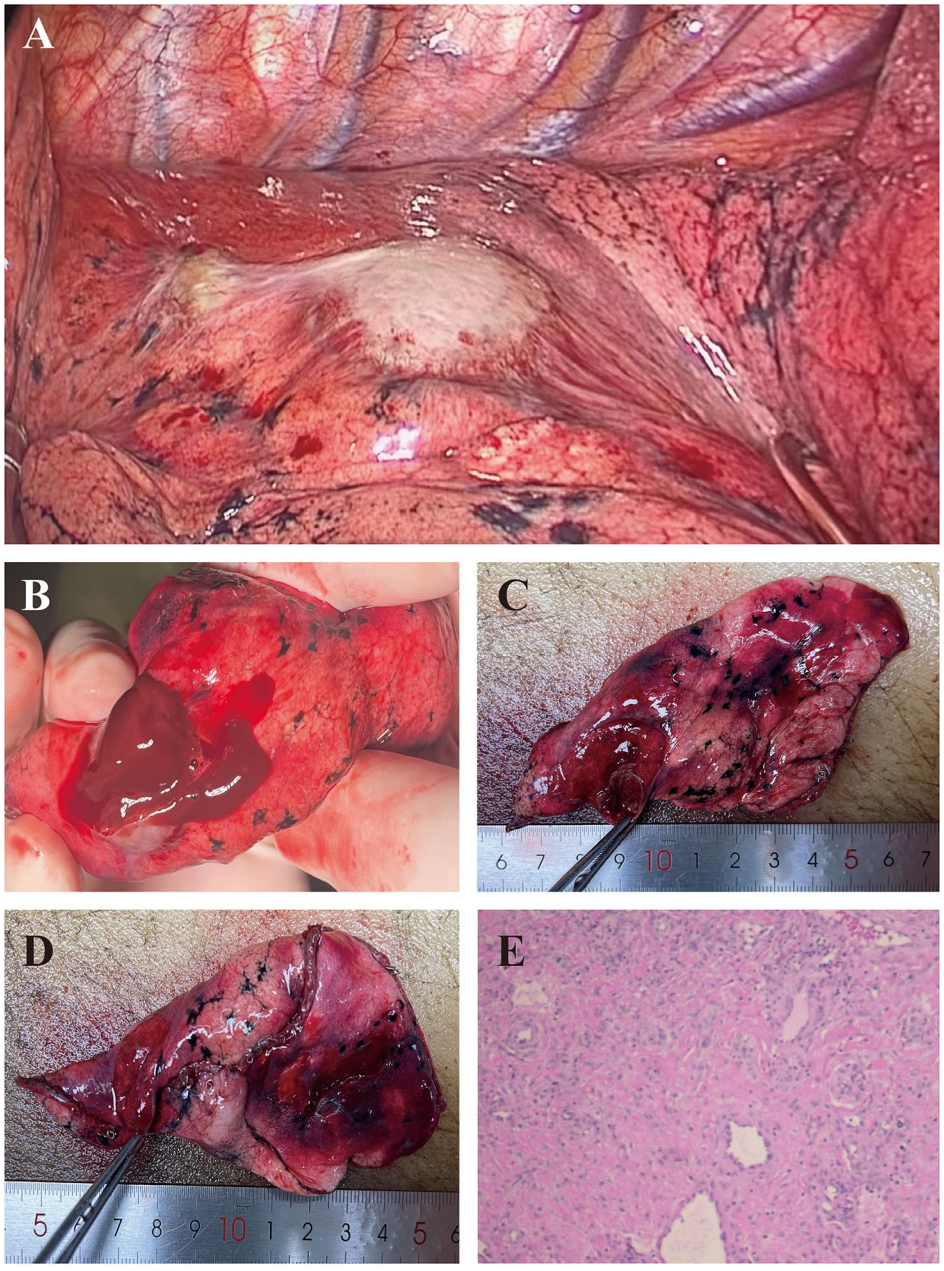

Fig. 3 Intraoperative images of the lesions and pathological findings. **(A)** The white pleural changes observed in the right lower lobe. **(B)** Upon incision, the nodule revealed the discharge of brown fluid. **(C, D)** A segment of the white pleural change exhibited marked pleural thickening and cystic features beneath it. **(E)** The cyst contents comprised red blood cells, fibrin, and hemosiderin-laden macrophages (magnification × 100)

characteristics provide essential diagnostic clues in differentiating hematomas.

If a definitive diagnosis of a pulmonary nodule cannot be established, further investigations such as enhanced chest CT and positron emission tomography (PET-CT) should be conducted during follow-up. Neurogenic tumors may exhibit increased metabolic activity on PET-CT, whereas hematomas generally lack significant metabolic activity [10]. Occasionally, during the acute phase of PH, elevated Fluorodeoxyglucose (FDG) accumulation may be observed, which is likely due to inflammatory cell infiltration associated with acute lung injury [11].

Despite their low incidence, distinguishing between tumors and hematomas based solely on imaging can be challenging. A literature review of clinical data was conducted from cases where preoperative differentiation between PH and other conditions was inconclusive, often necessitating surgical intervention (Table 1). Clinicians should include hematomas in the differential diagnosis when a mass is observed, even in the absence of

Table 1 Cases with inconclusive preoperative differentiation between pulmonary hematoma and other conditions

Author/Year	Gender	Age (years)	Location	Size (mm)	Radiological Features	Duration	Medical History	Preoperative Diagnosis	Definitive Diagnosis
Sushan/2023 [15]	Male	82	RLL abut the diaphragm	40	Noncalcified WC mass	Nodule detected during a physical examination for 5 years	diabetes, OSA, CKD, SCC of scalp, hypothyroidism, hypertension, hypercholesterolemia, post-orthotopic heart transplant	PH	Pulmonary artery pseudoaneurysm
Shunsuke/2022 [16]	Male	23	RML(S4), RLL(S10)	18, 12	WC nodules	Nodule detected during a physical examination	Two months ago, a snowboarding accident resulted in a fracture of the left fifth rib	Benign tumor	PH
Shozo/2021 [17]	Male	74	RLL	8	WC, high-density nodule	Increased to 11 mm after three months	3 years post-operation for primary bladder melanoma	PH	Metastatic malignant melanoma
Sachi/2021 [10]	Male	70	LLL or PM	27	Elliptical, WC nodule, PET-CT SUVmax 1.66	Nodule appeared 17 months after chest trauma	No history of malignancy	Benign lung tumor or neurogenic tumor	PH
Teruya/2020 [6]	Male	63	LLL or PM	20	Extrapleural sign, WC without intraspinal extension	Nodule detected during a annual physical examination	A minor fall and subsequent traumatic subdural hematoma 3 months prior	mediastinal tumor	PH
Zrinka/2016 [18]	Male	38	RL	106	Sharply marked, round shadow	Being hit in the chest by a bull	Had no respiratory symptoms or condition	PH	Pleomorphic adenomas
Eiki/2015 [19]	Male	51	RLL	16	WC nodule	Nodule appeared 3 months after RUL cancer resection	NA	Metastatic carcinoma for lung cancer	PH
Lee/2015 [1]	Male	57	Between RUL and RLL	90	WC cystic mass	Nodule discovered during routine physical examination	Current smoker, COPD	Not confirmed	PH

Abbreviations: RLL, Right Lower Lobe; LLL, Left Lower Lobe; PM, Posterior Mediastinum; RML, Right Middle Lobe; RL, Right Lung; PET-CT, Positron Emission Tomography-Computed Tomography; SUV, Standard Uuptake Value; WC, Well-Circumscribed; PH, Pulmonary Hematoma; CKD, Chronic Kidney Disease; OSA, Obstructive Sleep Apnea; SCC, Squamous Cell Carcinoma; COPD, Chronic Obstructive Pulmonary Disease

symptoms or a clear trauma history.Surgical resection of hematomas is rarely performed due to their tendency for spontaneous resolution [12]. TPH typically resolve within 77.1 to 145.8 days [13, 14]. If a TPH is suspected based on the patient's history and imaging findings, follow-up observation is recommended. When necessary, alternative diagnostic methods such as percutaneous biopsy or bronchoscopy can be employed to confirm the diagnosis. Due to the potential for rare but serious complications, such as progressive hemopneumothorax or cyst infection, close follow-up is advised.

Conclusions

This case illustrates an OTPH that was unexpectedly identified through routine imaging. Radiographically, distinguishing the hematoma from a posterior mediastinal tumor is challenging. Therefore, we recommend considering this condition in the differential diagnosis for patients with abnormal chest CT findings. Clinicians should remain vigilant for the potential presence of a hematoma when assessing intrathoracic masses, even if symptoms are absent or the medical history is unclear.

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Author contributions
ZZ: Data curation, Investigation, Project administration, Visualization, Writing - original draft. YH: Investigation, Project administration. LZ: Investigation, Project administration. BZ: Conceptualization, Investigation, Project administration, Resources, Supervision, Writing -review & editing.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics statement
Written informed consent was obtained from the individual for the publication of any potentially identifiable images or data included in this article.

Competing interests
The authors declare no competing interests.

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