Scholars Journal of Medical Case Reports
Abbreviated Key Title: Sch J Med Case Rep
ISSN 2347-9507 (Print) | ISSN 2347-6559 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Radiology

Re-Expansion Pulmonary Edema Following Drainage of a Massive Spontaneous Pneumothorax: A Case Report

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DOI: https://doi.org/10.36347/sjmcr.2026.v14i11.069 | **Received:** 22.09.2026 | **Accepted:** 14.11.2026 | **Published:** 18.11.2026

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Abstract **Case Report**

Re-expansion pulmonary edema (REPE) is a rare but potentially life-threatening complication following the rapid re-expansion of a collapsed lung, particularly after drainage of a large pneumothorax. Its radiological presentation may be subtle or extensive, making CT imaging valuable for early recognition and differential diagnosis. We report the case of a 43-year-old chronic tobacco and cannabis smoker who developed REPE following drainage of a right-sided spontaneous pneumothorax. Chest CT scan revealed patchy and nodular ground-glass opacities, areas of parenchymal consolidation, and smooth interlobular septal thickening involving the re-expanded right lung. These findings illustrate the characteristic CT features of REPE and emphasize the importance of radiological assessment in distinguishing this complication from infectious and other inflammatory pulmonary conditions. Early recognition of these imaging patterns is essential for appropriate diagnosis and post-drainage monitoring.

Keywords: Re-expansion pulmonary edema; spontaneous pneumothorax; chest computed tomography.

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1. INTRODUCTION

Re-expansion pulmonary edema (REPE), also known as "edema ex vacuo," is an iatrogenic complication occurring in approximately 1% of patients following the rapid evacuation of pneumothorax or pleural effusion [1]. The pathophysiology is multifactorial, largely attributed to increased alveolar-capillary permeability, surfactant depletion, and reperfusion injury following chronic collapse [1]. We present a case of radiographically evident REPE following the drainage of a total spontaneous pneumothorax in a 43-year-old male.

2. CASE PRESENTATION

2.1. Patient Information

A 43-year-old male presented to the emergency department complaining of acute-onset dyspnea and right-sided chest pain. The patient was an active tobacco smoker and a chronic cannabis consumer. His medical history was significant for chronic bronchitis and chronic dyspnea. He had no history of tuberculosis (TB), no known TB contacts.

2.2. Clinical Findings

The symptoms began one day prior to admission with dyspnea classified as stage IV of the Modified Medical Research Council (mMRC). This was accompanied by a right-sided chest pain and a productive cough; his overall general condition was preserved.

On physical examination, the patient was conscious and hemodynamically stable. The physical exam revealed visible subcostal retractions and the presence of digital clubbing. Assessment of the right hemithorax demonstrated a right-sided air pleural effusion syndrome.

2.3. Diagnostic Assessment

Initial laboratory investigations revealed a leukocytosis of 10,000 cells/mm³, with a neutrophil predominance. The C-reactive protein (CRP) level was 0.83 mg/L. Sputum analysis via GeneXpert for *Mycobacterium tuberculosis* was negative, effectively ruling out active pulmonary TB. An initial chest X-Ray was performed (Fig1), revealing a massive total right spontaneous pneumothorax.

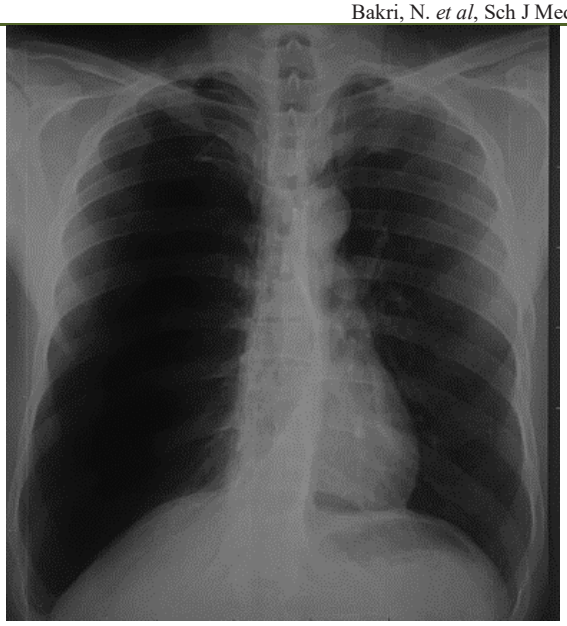


Fig. 1: Chest X-ray at admission showing a right pneumothorax

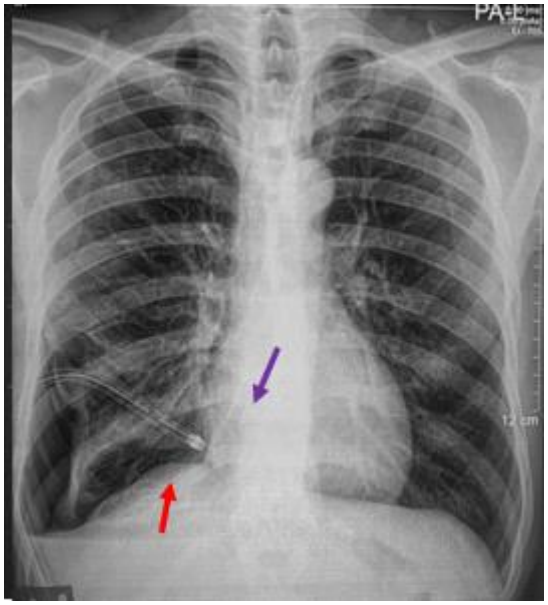


Fig. 2: Chest X-Ray demonstrates the correct placement of the chest tube (purple arrow) and demonstrated re-expansion of the right lung to the chest wall (red arrow)

2.4. Therapeutic Intervention and Evolution

An intercostal tube thoracostomy was placed in the 5th intercostal space, along the mid-axillary line on the right side. A post-drainage chest X-Ray (***Fig. 2***) confirmed the correct placement of the chest tube and demonstrated re-expansion of the right lung to the chest wall.

Following the procedure, the patient experienced a notable improvement in his dyspnea and a complete resolution of his cough; however, he paradoxically developed worsening right-sided chest pain.

Due to the aggravated pain, a non-contrast chest computed tomography (CT) scan was requested. The CT images (Fig. 3) revealed patchy and nodular ground-glass opacities interspersed with areas of parenchymal consolidation in the right middle and lower lobes. Additionally, smooth thickening of the interlobular septal lines was observed. Other findings included a small residual right pneumothorax, right lateral chest wall subcutaneous emphysema, and an absence of mediastinal lymphadenopathy. Given the clinical context of rapid lung re-expansion and the characteristic radiological findings, a diagnosis of re-expansion pulmonary edema (REPE / edema ex vacuo) was established.

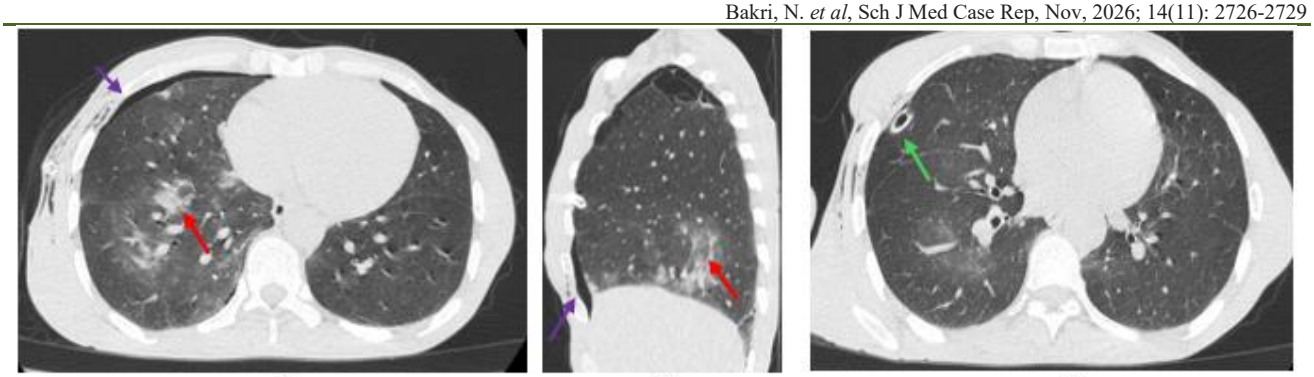


Fig. 3: Chest CT scans (lung window) showing patchy and nodular ground-glass opacities associated with areas of pulmonary consolidation throughout the right lung. (red arrows). A small right-sided hydropneumothorax is also visible (purple arrows), while the tip of the chest drainage tube is indicated by the green arrow. (A, C) Axial sections; (B) sagittal section

3. DISCUSSION

Chronic smoking of both tobacco and cannabis has a synergistic, detrimental effect on the pulmonary parenchyma. Recent literature demonstrates that cannabis smoking significantly increases the risk of developing bullous lung disease and large spontaneous pneumothorax in a dose-dependent manner [2]. The presence of chronic bronchitis, dyspnea, and digital clubbing in our patient strongly pointed toward an underlying chronic pulmonary pathology (likely emphysematous bullae) exacerbated by his substance use.

The standard treatment of a total pneumothorax involves pleural space decompression via tube thoracostomy. However, rapid lung re-expansion can precipitate REPE. The pathogenesis is believed to be related to the hypoxic environment of the collapsed lung, which alters the integrity of the capillary endothelium. Subsequent rapid re-expansion and reperfusion trigger an inflammatory cascade and oxidative stress, resulting in an influx of protein-rich fluid into the alveoli and interstitium [1].

Radiologically, the recognition of REPE is crucial to avoid misdiagnosis, such as infectious pneumonia or pulmonary contusion. According to the radiological literature (including *Radiopaedia* and high-resolution CT studies), the hallmark CT findings of REPE are ipsilateral and often gravity-dependent [3, 4]. They typically consist of patchy ground-glass opacities, which may coalesce into frank consolidation, accompanied by smooth interlobular septal thickening and intralobular interstitial thickening [3, 5]. Our patient's CT scan presented a textbook manifestation of these findings—specifically, the nodular and patchy ground-glass opacities with septal thickening in the re-expanded middle and basal lobes.

REPE may mimic several pulmonary conditions, including pneumonia, pulmonary hemorrhage, aspiration, and organizing pneumonia, making its recognition challenging. In the absence of specific diagnostic criteria, diagnosis relies primarily on the clinical context and characteristic radiological findings [6-8]. Chest radiographs typically demonstrate unilateral airspace opacities that may progress over the first 24–48 hours and resolve spontaneously within 3–7 days [7–9]. High Resolution Computed Tomography (HRCT) provides additional diagnostic information by characterizing the distribution and extent of pulmonary abnormalities, although imaging findings should always be interpreted alongside clinical and laboratory data. REPE may also be incidentally detected during investigations for spontaneous pneumothorax, highlighting the importance of radiological awareness [10, 11].

Clinically, REPE can range from a mild, almost asymptomatic radiological finding to a fulminant, life-threatening condition presenting with severe hypoxemia [1, 5]. In our case, the patient manifested worsening chest pain rather than severe hypoxemic respiratory failure, highlighting a clinically mild but radiographically significant phenotype of REPE. Management in such cases is generally supportive, emphasizing adequate oxygenation, monitoring, and pain control until the edema spontaneously resolves.

4. CONCLUSION

This case emphasizes the necessity of close clinical monitoring following the drainage of a massive spontaneous pneumothorax. Clinicians and radiologists must maintain a high index of suspicion for re-expansion pulmonary edema if a patient develops new or worsening symptoms—such as chest pain or hypoxia—post-thoracostomy. Furthermore, this report reaffirms the classic HRCT features of REPE and underscores the significant lung parenchymal damage associated with chronic cannabis and tobacco use.

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