



# Streptococcus pneumoniae Pneumonia Presenting with Diffuse Bilateral Centrilobular Nodules and Tree-in-Bud Pattern: A Case Report

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## Abstract

*Streptococcus pneumoniae* is a common cause of community-acquired pneumonia, typically presenting with lobar consolidation on imaging. We report a rare case of *S. pneumoniae* pneumonia in a 30-year-old woman with multiple sclerosis on rituximab therapy, who presented with diffuse bilateral centrilobular nodules and tree-in-bud pattern on high-resolution computed tomography (HRCT). Bronchoalveolar lavage culture confirmed penicillin-sensitive *Streptococcus pneumoniae*. The patient responded well to targeted antibiotic therapy with complete clinical and radiological resolution. This case highlights an uncommon radiologic presentation of pneumococcal pneumonia and underscores the importance of considering *S. pneumoniae* in the differential diagnosis of diffuse centrilobular nodules with tree-in-bud pattern.

**Keywords:** *Streptococcus pneumoniae*, pneumonia, centrilobular nodules, tree-in-bud pattern, high-resolution computed tomography, bronchoalveolar lavage, immunocompromised, rituximab, diffuse lung nodules, atypical pneumonia

## 1. Introduction

*Streptococcus pneumoniae* is the leading bacterial pathogen in community-acquired pneumonia, classically manifesting as lobar consolidation on chest imaging. Diffuse centrilobular nodules and tree-in-bud patterns are more commonly associated with small airway infections such as tuberculosis, atypical mycobacteria, and fungal infections. Rare presentations of pneumococcal pneumonia with these radiologic features pose diagnostic challenges and may delay appropriate treatment. We present a case illustrating this atypical imaging pattern in an immunocompromised patient.

## 2. Case Presentation

A 30-year-old female with multiple sclerosis managed with rituximab every six months for three years presented to the pulmonary clinic with a 3-week history of productive cough and intermittent fever. She reported yellow sputum but denied weight loss, night sweats, or known sick contacts. She had a mild COVID-19 infection six months prior, managed outpatient with no pneumonia on chest X-ray.

On examination, she was afebrile and stable. Bilateral coarse crackles were noted in the middle and lower lung zones. Initial chest X-ray demonstrated bilateral ground-glass opacities, more prominent on the left. Sputum cultures were negative.

Persistent symptoms prompted HRCT on day 82 post-onset, revealing diffuse bilateral centrilobular nodules, ground-glass opacities, a tree-in-bud pattern predominantly in lower lobes, and bronchial wall thickening.

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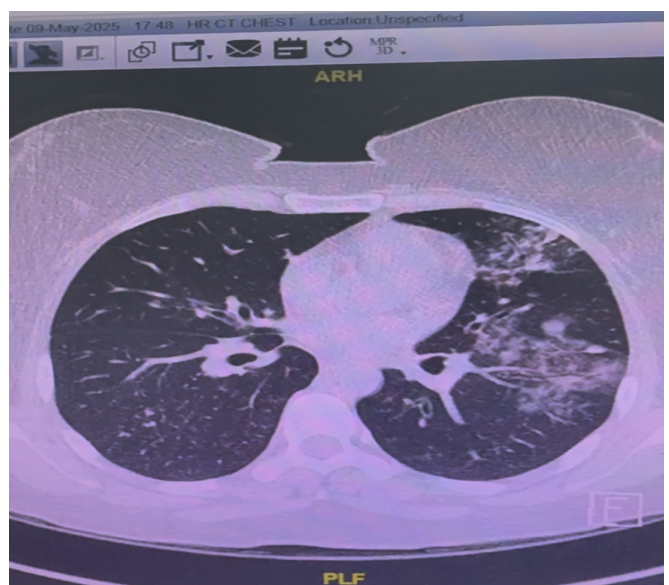
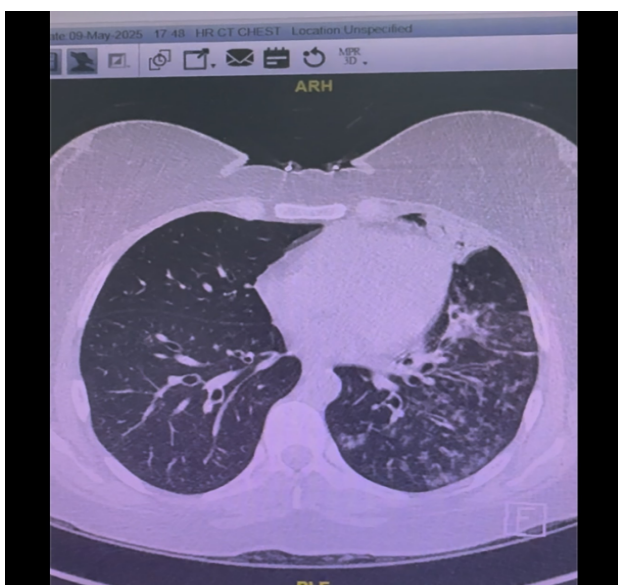
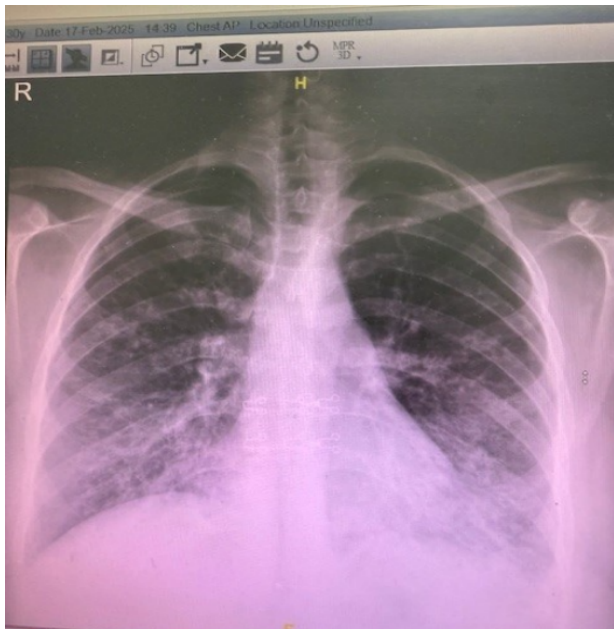
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The patient was admitted under isolation; on admission, she was febrile (38.6°C) with bilateral crackles. Laboratory evaluation showed leukocytosis (WBC  $21 \times 10^9/L$ , neutrophils  $17.7 \times 10^9/L$ ), elevated CRP (17.9 mg/dL), and ESR (62 mm/hr). HIV, autoimmune markers, and respiratory viral panels were negative.

Bronchoscopy with bronchoalveolar lavage (BAL) on day 85 revealed turbid, creamy secretions with neutrophil predominance (70%). PCR and cultures ruled out tuberculosis. BAL cultures grew penicillin-sensitive *Streptococcus pneumoniae*.

Antibiotic therapy was switched to oral amoxicillin/clavulanic acid 625 mg thrice daily for 14 days. Follow-up at two weeks post-treatment showed complete symptom resolution.

Repeat HRCT two months later demonstrated significant radiological improvement with near-complete resolution of nodules, tree-in-bud pattern, and consolidations. Inflammatory markers normalized.



### 3. Discussion

Diffuse centrilobular nodules and tree-in-bud patterns on HRCT typically indicate small airway inflammation or infection. While commonly linked to mycobacterial and fungal infections, bacterial pathogens like *Streptococcus pneumoniae* are less frequently associated with this pattern. The classic radiologic presentation of pneumococcal pneumonia involves lobar consolidation due to alveolar exudates. However, centrilobular nodules have been reported in up to half of cases, usually localized near areas of consolidation [11,12].

This case is notable for diffuse bilateral involvement and a pronounced tree-in-bud appearance, an uncommon presentation for *S. pneumoniae* pneumonia, particularly in an immunocompromised host. Awareness of such atypical imaging findings can help avoid misdiagnosis and guide appropriate antibiotic therapy [1,2].

### 4. Conclusion

This case demonstrates an unusual radiologic manifestation of *Streptococcus pneumoniae* pneumonia characterized by diffuse centrilobular nodules and tree-in-bud pattern. Clinicians should consider pneumococcal infection in the differential diagnosis of this imaging pattern, especially in immunocompromised patients, to ensure timely and effective management.

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