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# Delayed Diagnosis of Common Variable Immunodeficiency in an Adolescent with Recurrent Severe Respiratory Infections: A Case Report

**Dr Danish H Memon**

Head of Department, Department of Medicine, Noble Hospitals and Research Centre, Hadapsar, Pune

**Dr Sailee MORE**

Senior Resident, Department of Medicine, Noble Hospitals and Research Centre, Hadapsar, Pune

## Abstract

**Background:** Common Variable Immunodeficiency (CVID) is a primary immunodeficiency disorder characterized by hypogammaglobulinemia and recurrent infections, particularly involving the respiratory tract.[1]

**Case Presentation:** We report the case of a 15-year-old male with a four-year history of recurrent respiratory infections, including pneumonia, pleural effusion, and empyema requiring thoracotomy. He also had a prior episode of pneumococcal meningoencephalitis. Immunological evaluation revealed low serum IgG, IgA, and IgM levels, with normal CD4/CD8 counts. A diagnosis of CVID was established.[2]

**Conclusion:** This case highlights the importance of considering primary immunodeficiency in adolescents presenting with recurrent infections. Early diagnosis and timely initiation of intravenous immunoglobulin (IVIG) therapy are essential to prevent complications and improve outcomes.[1]

## Keywords

Common Variable Immunodeficiency; Primary Immunodeficiency; Hypogammaglobulinemia; Recurrent Pneumonia; Adolescents; IVIG Therapy

## Introduction

Common Variable Immunodeficiency (CVID) is among the most common primary immunodeficiency disorders, with an estimated prevalence of 1 in 25,000 to 50,000 individuals.[1] It is characterized by impaired B-cell differentiation and defective antibody production, leading to recurrent infections, autoimmune manifestations, and an increased risk of malignancy.[4–6]

Due to its heterogeneous clinical presentation, diagnosis is frequently delayed.[2],[9] Recent data, including Indian cohort studies, highlight significant diagnostic delays and variability in clinical manifestations.[11] This case highlights the diagnostic challenges and clinical course of CVID in an adolescent with recurrent severe respiratory infections.

**Case Presentation**

A 15-year-old male presented with high-grade fever, productive cough, headache, and vomiting. On examination, he was febrile (102°F), tachycardic (118/min), and tachypneic (24–28/min), with an oxygen saturation ($SpO_2$) of 95% on room air. Chest auscultation revealed crepitations in the right lower lung zone.

Laboratory investigations showed leukocytosis (WBC: 23,000/$mm^3$), elevated C-reactive protein (CRP: 455 mg/L), and raised procalcitonin (2.3 ng/mL), suggestive of severe bacterial infection. Imaging demonstrated consolidation with collapse of the right lung and associated pleural effusion, consistent with complicated pneumonia.[7]

**Timeline of Recurrent Infections**

2017 (Age 11): Pneumococcal meningoencephalitis[4]

2019 (Age 13): Pneumonia with tonsillitis and otorrhea

2019–2020: Recurrent pneumonia with pleural effusion and splenomegaly

2021 (Age 15): Empyema requiring thoracotomy[7]

2022: Diagnosis of CVID confirmed[2]

Further immunological evaluation revealed reduced serum levels of IgG, IgA, and IgM, fulfilling diagnostic criteria for CVID.[2] CD4/CD8 T-cell counts and complement levels were within normal limits. Secondary causes, including HIV, hepatitis infections, and tuberculosis, were excluded.[1]

**Management and Outcome**

The patient received intravenous antibiotics during acute infectious episodes. Following confirmation of CVID, he was initiated on IVIG replacement therapy at a dose of 20 g every three weeks, in accordance with established guidelines.[1]

He also received appropriate immunizations, including pneumococcal, meningococcal, and influenza vaccines.[1] On follow-up, the patient demonstrated significant clinical improvement, with a marked reduction in the frequency and severity of infections, consistent with expected outcomes of IVIG therapy.[5]

**Discussion**

CVID is characterized by impaired humoral immunity, predisposing patients to recurrent infections, particularly of the respiratory tract. Encapsulated organisms such as Streptococcus pneumoniae are commonly implicated.[4],[7]

**Diagnostic Challenges:**

Diagnosis is often delayed due to heterogeneity in clinical presentation.[2],[9] Such delays may result in irreversible complications, including bronchiectasis, autoimmune disorders, and malignancies.[6],[7]

**Phenotypic Variation:**

CVID encompasses a spectrum of clinical phenotypes, ranging from infection-only presentations to those with significant immune dysregulation, including autoimmunity and enteropathy.[3],[4]

**Genetic and Molecular Insights:**

Recent advances have identified genetic contributors, such as SOCS1 variants, which help explain the heterogeneity of CVID phenotypes.[10]

**Treatment Standards:**

IVIG replacement therapy remains the cornerstone of management, significantly reducing infection frequency and improving quality of life.[1],[5] Regular monitoring of IgG trough levels and clinical response is essential to optimize therapy.[1]

**Regional Observations:**

Data from Indian and global cohorts highlight significant diagnostic delays and variable clinical presentations, emphasizing the need for increased awareness and early immunological evaluation in patients with recurrent infections.[8],[11]

**Conclusion**

Primary immunodeficiency disorders should be considered in adolescents presenting with recurrent or unusually severe infections. Early diagnosis and timely initiation of IVIG therapy can significantly reduce morbidity and improve long-term outcomes.[1]

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