



“Hyperdense Mucus Plug” Sign – CT Findings In Allergic Bronchopulmonary Aspergillosis

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Background: Allergic Bronchopulmonary Aspergillosis (ABPA) is a hypersensitivity response to *Aspergillus fumigatus* with varied radiological manifestations. While the differential diagnosis of central bronchiectasis is broad, identifying pathognomonic radiological features on high-resolution computed tomography (HRCT) is essential for an accurate diagnosis.

Case Presentation: A 52-year-old female with a history of asthma presented with a chronic cough and expectoration. Laboratory workup demonstrated elevated eosinophil counts and total serum IgE. Chest radiography revealed central bronchiectasis with a right upper lobe radio-opaque shadow. Unenhanced HRCT confirmed bilateral central bronchiectasis and identified hyperdense mucus plugging in the right upper lobe bronchi (density = 101 HU) distal to a large bronchocele, establishing a diagnosis of ABPA with high-attenuation mucus (ABPA-HAM). The patient was successfully treated with systemic corticosteroids and oral antifungals.

Discussion: High-attenuation mucus (HAM) is defined as mucoid impaction denser than normal paraspinal skeletal muscle. Present in up to 30% of ABPA patients, HAM correlates with increased disease severity, higher baseline serum IgE, and a greater risk of relapse following therapy.

Conclusion: The “hyperdense mucus plug” sign is a characteristic and virtually diagnostic HRCT finding in ABPA. Early recognition is critical for prompt therapeutic intervention and long-term prognostic monitoring.

Keywords: Allergic Bronchopulmonary Aspergillosis (ABPA), High-resolution Computed tomography (HRCT), High-attenuation mucus (HAM)

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Introduction

Allergic Bronchopulmonary Aspergillosis (ABPA) is a complex hypersensitivity response to the common fungus *Aspergillus fumigatus*, typically occurring in patients suffering from chronic bronchial asthma or cystic fibrosis. The disease presents with a wide variety of radiological manifestations. The characteristic high-resolution computed tomography (HRCT) findings of ABPA include central bronchiectasis, mucoid impaction, high-attenuation mucus, linear or branching centrilobular opacities ("tree-in-bud" pattern), atelectasis, peripheral consolidation, diffuse ground-glass opacities, mosaic perfusion, and air trapping on expiratory imaging(1).

While the differential diagnosis for central bronchiectasis is vast and frequently inconclusive, the specific radiological finding of hyperdense mucus serves as a highly characteristic, virtually pathognomonic feature of ABPA that significantly aids in clinching the clinical diagnosis.

Case Report

A 52-year-old female with a 10-year history of poorly controlled bronchial asthma presented to the outpatient department with a 3-week history of worsening cough, low-grade fever, and thick, yellowish expectoration containing brownish plugs. On clinical examination, bilateral coarse wheezing and rhonchi were audible, predominantly over the upper lung fields.

Initial laboratory evaluations revealed a significantly raised total leukocyte count with profound peripheral blood eosinophilia (absolute eosinophil count: 1,250 cells/ μ L). Total serum immunoglobulin E (IgE) levels were markedly elevated at 8,400 IU/mL (normal < 100 IU/mL).

The baseline posteroanterior chest radiograph demonstrated bilateral central bronchiectasis associated with a dense, branching, radio-opaque mass-like shadow in right upper lobe, mimicking a central pulmonary lesion (Fig. 1). To further characterize this finding, an unenhanced thoracic CT exam was performed. The HRCT revealed bilateral central bronchiectasis (Fig. 3) associated with hyperdense branching mucus plugging within bronchus of right upper lobe (Fig. 2). The impacted mucoid material demonstrated a distinctly high attenuation value of 101 Hounsfield Units (HU), making it denser than adjacent paraspinal skeletal muscle (Fig. 2).

A large, fluid-filled bronchocele was noted immediately distal to this hyperdense mucus plug (Fig. 2).

Based on combined clinical, serological, and highly characteristic radiological findings, definitive diagnosis of ABPA-HAM (High Attenuation Mucus) was established. The patient was initiated on systemic corticosteroid therapy (oral prednisolone at 0.5 mg/kg/day) combined with oral antifungal therapy (itraconazole 200 mg twice daily) to suppress immune response and reduce fungal burden. The patient demonstrated remarkable clinical improvement within two weeks, noting substantial reduction in cough & dyspnea. Follow-up laboratory evaluation at six weeks showed 50% decline in serum IgE levels & repeat chest radiograph confirmed complete resolution of right upper lobe mucoid impaction.



Figure 1: Posteroanterior chest radiograph of a 52-year-old female patient showing bilateral central bronchiectasis and a high-attenuation mass-like mucoid impaction lesion in the right upper lobe.



Figure 2: Unenhanced axial CT image of the same patient showing a high-attenuation mucus plug (white arrow, density = 101 HU) in the right upper lobe bronchus with a large fluid-filled bronchocele situated distal to the mucus plug.



Figure 3: Unenhanced axial lung-window CT image demonstrating widespread, classic central bronchiectasis.

IMAGING FINDINGS & DISCUSSION

Hyperdense or High Attenuation Mucus (HAM) plugs remain a crucial diagnostic cornerstone in evaluating ABPA. Radiologically, HAM is defined as mucoid impaction within dilated bronchi that exhibits an attenuation value greater than normal paraspinal skeletal muscle on non-contrast HRCT(2-4). This distinct hyperdensity occurs in approximately 30% of patients diagnosed with ABPA. The physical mechanism underlying this high density is attributed to the condensation of calcium salts and the accumulation of metallic ions (such as iron & manganese) manufactured by proliferating fungal hyphae within the stagnant mucus.

From a clinical standpoint, the presence of the HAM sign carries important prognostic implications. It has been postulated that the presence of dense mucoid impaction directly correlates with increased severity of ABPA. Patients presenting with the HAM sign have been reported to exhibit higher baseline mean eosinophil counts, higher mean serum IgE levels, and elevated *Aspergillus fumigatus*-specific IgE levels. Furthermore, these patients demonstrate a significantly greater likelihood of experiencing clinical and radiological relapses following the cessation of standard therapy(3,5,6,7).

CLINICO-RADIOLOGICAL OVERVIEW

HRCT plays a pivotal role in establishing a clear diagnosis of ABPA, particularly in identifying proximal airway abnormalities when conventional chest radiographs show non-specific findings or simulate neoplastic masses.

To standardize clinical management, staging and classification phenotypes have been described based on these clinico-radiological presentations:

ABPA-Serological / ABPA(S): Characterized by patients who meet all standard immunological and serological markers (raised absolute eosinophil counts and total serum IgE) but lack classic proximal bronchiectasis on HRCT.

ABPA-Central Bronchiectasis / ABPA(CB): Designated when serologically positive patients demonstrate clear structural evidence of proximal, central bronchiectasis favoring the diagnosis.

ABPA-High Attenuation Mucus/ABPA(HAM): Represents the most severe visual phenotype where dense mucus plugs are visualized, a finding considered nearly diagnostic of the underlying fungal hypersensitivity state.

The standard medical management relies heavily on oral corticosteroids to suppress the intense pulmonary immune reaction, utilizing higher doses during acute exacerbations followed by a gradual taper to a lower maintenance dose. In cases where critical airway obstruction leads to severe segmental atelectasis, mechanical clearing via bronchoscopic aspiration may be required. While completely eradicating the environmental fungus from the respiratory tract is clinically challenging, long-term oral azole antifungals are routinely added to the regimen to minimize fungal colonization and reduce the frequency of relapses. Strict longitudinal monitoring of treatment response should be conducted using serial chest radiographs, pulmonary function testing (PFT), and regular tracking of total serum IgE titers(8).

LIMITATIONS

LIMITATIONS This report is limited by its retrospective, single-case design, which inherently limits the generalizability of our observations across all ABPA phenotypes. Also, since short-term follow-up confirmed clinical remission and radiological resolution, long-term multi-year follow-up data is required for note prospective relapses typical of the high-attenuation mucus subtype.

CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

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