Pulmonary Aspergilloma

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Abstract

Chest CT is the gold standard for diagnosing pulmonary aspergilloma, with key features including a mobile, rounded mass within a pre-existing cavity, typically in the upper lung fields. The Monod sign, characterized by an air crescent surrounding the aspergilloma, is a key diagnostic radiological finding, in addition to cavity wall thickening, that helps distinguish aspergilloma from other cavitary lung pathologies. Chest CT is integral in diagnosis and guiding treatment, determining the need for minimally invasive intervention with direct cavitary antifungal therapy, surgical intervention with lobectomy, or antifungal therapy alone, and monitoring asymptomatic cases or detecting symptom progression over time.

Keywords: chest, lung, infection

Case Summary

A teenaged female with a history of renal transplant developed a cavitary lesion in the right lung positive for *Aspergillus*.

Imaging Findings

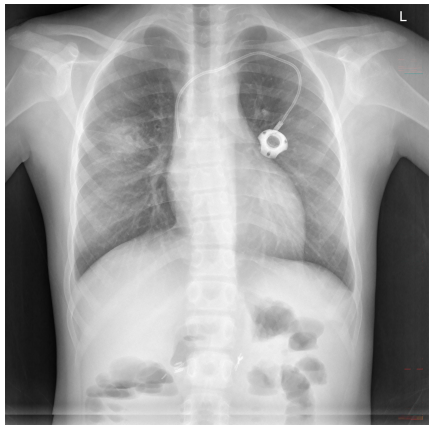
Figure 1 shows a frontal chest radiograph indicating consolidation in the right upper lung lobe with several small cavitary areas (arrows) in the upper portion of the consolidation. 5 months prior to obtainining Figures 1, 2, Figure 3 was obtained. In the interval, the cavity was consolidated and enlarged and there was a fungus ball within (arrowheads).

Diagnosis

Pulmonary aspergilloma.

Differential diagnoses for cavitary lung lesions in children encompass various phenotypes of pulmonary aspergillosis, notably invasive pulmonary aspergillosis (IPA) and allergic bronchopulmonary aspergillosis (ABPA). Other pediatric fungal lung diseases with similar presentation include pneumocystis pneumonia, cryptococcal pneumonia, pulmonary histoplasmosis, pulmonary blastomycosis, coccidioidomycosis pneumonia, candida pneumonia, and pulmonary mucormycosis. While there is overlap in radiological and clinical features of these diseases, the presence of a mobile mass within a pre-existing cavity on prone and supine imaging in a relatively asymptomatic, immunocompetent patient is a strong diagnostic indicator of pulmonary aspergilloma.

Figure 1. A frontal chest radiograph demonstrating a rounded area of airspace opacification with ill-defined margins and lucencies in the upper aspect of the consolidation (arrows).



Discussion

Pulmonary aspergilloma is a noninvasive form of colonization by *Aspergillus* fungi in a pre-existing lung cavity. *Aspergillus* species are ubiquitous environmental fungi that play a role in organic matter decomposition. The most common human pathogens of the species are *A. fumigatus, A. flavus, A. terreus*, and *A. niger*. The pathogenesis involves the inhalation of *Aspergillus* spores, which colonize and multiply within these pre-existing lung cavities, forming a characteristic fungus ball. While daily inhalation of these fungal spores is common, they have the potential to trigger a spectrum of illnesses contingent upon the immune status of the host as well as prior lung pathology.[1]

Aspergillus infection in children spans from benign colonization to

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Figure 2. (A) Axial and (B) coronal images from a chest CT with interval coalescence of the small cavities into a large cavity with an associated fungus ball (arrowheads) within.

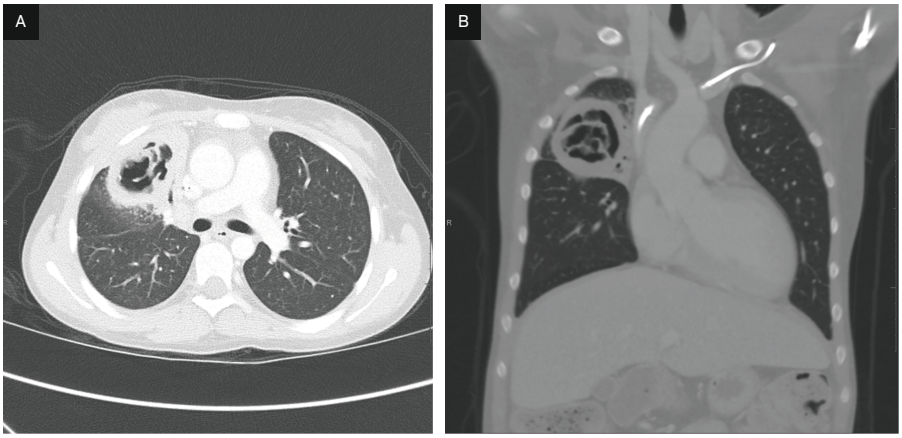
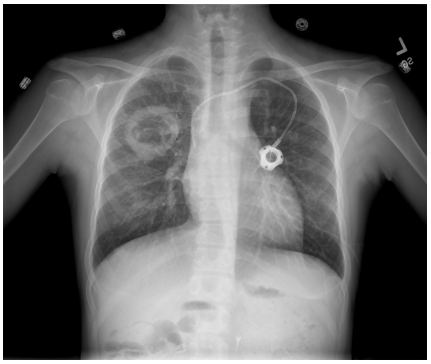


Figure 3. Follow-up frontal chest radiograph showing the sharply defined, round lesion with a large, central cavity.



life-threatening invasive diseases. There are 3 broad categories of *Aspergillus*-related pulmonary diseases: ABPA, IPA, and chronic pulmonary aspergillosis (CPA).[2] Pulmonary aspergilloma is under the umbrella of CPA, which encompasses a spectrum of diseases affecting immunocompetent patients with underlying structural pulmonary alteration. Aspergilloma is a less severe form of CPA.[1,3] In immunocompetent children, exposure to *Aspergillus* spores is often inconsequential.[4] However, aspergilloma may develop in cases where cavitary lung lesions or pre-existing lung damage are present, most commonly in cases of tuberculosis or sarcoidosis.[2] Children with immune deficiencies are at a higher risk of developing other forms of aspergillosis, including ABPA, chronic necrotizing aspergillosis, and more severe forms like IPA. ABPA is characterized by hypersensitivity reactions to fungal antigens and typically manifests as an eosinophilic lung disease. This condition primarily occurs in individuals with conditions like long-standing asthma or cystic fibrosis. Invasive aspergillosis, the most severe form of *Aspergillus* infection, is often life-threatening. This condition predominantly affects individuals with compromised immune systems, such as those undergoing immunosuppressive therapies, chemotherapy for malignancies, or organ transplantation.[4]

The clinical presentation of pulmonary aspergilloma primarily revolves around symptoms related to the underlying cavitary lesion and the mechanical effects of the fungus ball. Although patients can be asymptomatic, commonly reported symptoms include hemoptysis, chest pain, cough, and, occasionally, constitutional symptoms such as fever and weight loss. Hemoptysis is a hallmark symptom and can be severe enough to potentially lead to life-threatening bleeding.[5] Hemoptysis in pulmonary aspergilloma is caused by damage to the capillaries within the cavity.[5,6]

Imaging findings are pivotal for the diagnosis of pulmonary aspergilloma. The diagnosis is based on characteristic findings from chest radiographs and CT imaging supported by sputum cultures or the presence of serum antibodies against *Aspergillus*.[7] While chest radiographs may initially appear nonspecific, chest CT is the diagnostic modality of choice. CT scans of the chest unveil distinctive features characteristic of aspergilloma that are instrumental in distinguishing it from other cavitary lung lesions. Typically, chest CT reveals a well-defined, dense, rounded mass within a pre-existing cavity. These masses are frequently located in the upper lobes. Moreover, these masses may display mobility within the cavity in response to changes in the patient's position. One of the characteristic radiological findings is the presence of an air crescent sign surrounding the mass. This sign signifies necrotic lung separating from the wall in an immune-suppressed patient often recovering from IPA. In contrast, the Monod sign represents a mobile fungus ball shifting in a preexisting pulmonary cavity.[1,6,8,9] In addition to these features, the cavity wall may exhibit thickening and irregularities, indicative of chronic inflammation in response to the presence of the fungus ball.[2,6] Importantly, there is usually no evidence of invasion beyond the cavity walls, with the surrounding lung tissue appearing normal.[8]

The treatment of aspergilloma in pediatric patients involves careful consideration of the clinical scenario and underlying conditions. Patients who remain asymptomatic and exhibit stable radiographic findings over extended periods generally do not require any treatment.[5] Repeat CT scans can be used for monitoring if new symptoms arise.[1] Surgical resection, such as lobectomy or segmentectomy, is the most definitive treatment for symptomatic aspergilloma and is often indicated in cases of significant hemoptysis.[2,7] However, surgery carries notable risks and should be

carefully considered based on the child's overall health and pulmonary reserve.[8] In patients unfit for surgery or who refuse an open approach, percutaneous catheter placement into the pulmonary cavity with delivery of amphotericin B is an alternative. Antifungal therapy, typically with agents like itraconazole or voriconazole, may be used as adjunctive treatment when surgery is contraindicated or as a bridge to surgery.[10] In patients with pulmonary hemorrhage, bronchial artery embolization can successfully manage hemoptysis.[3]

Surgical resection is the primary therapy for a pulmonary aspergilloma. The lesion is cured in approximately 80% of cases. Using oral antifungal drugs leads to partial or complete resolution in about 60%. Surgery is often a necessary adjunct. There are insufficient data on the success rate of intracavitary injection of amphotericin B or other antifungal medications. In contrast, patients with invasive aspergillus have a high mortality rate of 30-80%.

Conclusion

Chest CT is the gold standard for diagnosing pulmonary aspergilloma, with key features including a mobile, rounded mass within a pre-existing cavity, typically in the upper lung fields. The Monod sign, characterized by an air crescent surrounding the aspergilloma, is a key diagnostic radiological finding, in addition to cavity wall thickening, that helps distinguish aspergilloma from other cavitary lung pathologies. Chest CT is integral in diagnosis and guiding treatment, determining the need for minimally invasive intervention with direct cavitary antifungal therapy, surgical intervention with lobectomy, or antifungal therapy alone, and monitoring asymptomatic cases or detecting symptom progression over time.

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