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CASE REPORT

Allergic bronchopulmonary aspergillosis: a unique presentation in a pediatric patient

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Abstract Infection by the *Aspergillus* species of fungus can result in a variety of clinically and radiographically unique pulmonary diseases. The specific disease manifested is most dependent upon the immunocompetency of the infected individual. Allergic bronchopulmonary aspergillosis (ABPA) is most commonly seen in patients with asthma and cystic fibrosis. Since its original description in 1952, much has been published describing the radiographic manifestations of this disease. In this article, we present the unusual case of a 13-year-old whose initial radiographic presentation was that of a dense lobar consolidation. Additionally, we highlight the contributory role of the radiologist in guiding the appropriate clinical work-up and treatment of this disease.

Keywords ABPA · Aspergillosis · Consolidation · Child

Introduction

Since the original description of allergic bronchopulmonary aspergillosis (ABPA) in 1952, several studies have expanded upon and redefined the radiographic findings common to the disease [1–5]. Although no one radiographic finding is diagnostic of ABPA, the presence of central bronchiectasis with an upper lobe predominance and mucoid impaction are characteristic in patients with the proper clinical symptoms and serology. Ward et al. [4] found the presence of centrilobular nodules to be highly suggestive of ABPA in asthmatics. These classic findings may be absent in the acute phase of the disease; patchy, migratory opacities or atelectasis from mucous plugging may be all that is seen [6]. Nevertheless, the improved understanding of the radiographic manifestations of ABPA has allowed for the earlier diagnosis and treatment of infected individuals.

In this report, we describe the unique initial presentation of ABPA as an isolated lobar alveolar opacification. Although two prior cases of ABPA presenting as masses have been described in the adult literature [7], ABPA that has first manifested as a dense lobar consolidation is a rare occurrence in children. We also reinforce the importance of effective communication between the radiologist and clinician in order to facilitate appropriate work-up and care and to avoid unnecessary interventions.

Case report

A 13-year-old girl presented to the pediatric clinic with a 2-week history of dry cough that occurred almost exclusively at night. Her medical history was remarkable for pneumonia at the age of 3 weeks. She had a remote history of asthma, for which she had been without symptoms or treatment since the age of 2 years. She also complained of seasonal allergies. The patient's half-sibling had cystic fibrosis, but the patient's sweat test was negative. She was prescribed a fluticasone inhaler, an albuterol nebulizer for use at night, and cetirizine. Soon afterward, the patient discontinued use of the fluticasone inhaler after apparently experiencing a worsening of her cough. Subsequently, her chronic night cough improved with regular use of the albuterol nebulizer and cetirizine. She reported only an occasional daytime cough that was not bothersome.

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Four months later, the patient returned to clinic complaining of an increased cough after self-discontinuation of the albuterol. Physical examination was remarkable for wheezing, which was not noted on her prior visit. A chest radiograph revealed a right lower lobe air-space opacity without evidence of diffuse or focal peribronchial thickening or bronchiectasis. She was diagnosed clinically with pneumonia and treated with a 10-day course of amoxicillin. Additionally, the patient was prescribed a fluticasone propionate and salmeterol powder inhaler and an albuterol rescue inhaler. Again, the patient's cough symptoms improved.

Two months later, the patient returned with complaints of a persistent intermittent cough. Physical examination was remarkable for decreased breath sounds at the right base, and laboratory tests were notable for a white blood cell count of $15\times10^3/\mu l$ (reference range $4.5–13.0\times10^3/\mu l$) with 11% eosinophils (reference range 0–4%). A repeat chest radiograph demonstrated interval enlargement of the right lower lobe opacity (Fig. 1). Given the persistence of this opacity, a chest CT scan was performed to exclude a possible underlying neoplastic or congenital lesion. The CT scan showed an isolated dense right lower lobe consolidation (Fig. 2) with associated subcarinal and right hilar lymphadenopathy (Fig. 3). Normal pulmonary vasculature was present traversing the consolidation. The proximal right lower lobe segmental bronchus was patent, but the distal bronchi and bronchioles could not be identified and were thought to be compressed by mass effect. There were no abnormal communicating vessels between the systemic vasculature and the consolidation to suggest a sequestration. The patient was maintained on her regimen of cetirizine and an albuterol rescue inhaler.

Based upon an initial concern that the CT findings represented a mass, the patient was referred to pediatric surgery at our institution, where the decision was made to pursue a thoracotomy for a tissue diagnosis. Two weeks later, a repeat CT scan performed prior to the scheduled surgery demonstrated a significant decrease in the size of the consolidation. Partial resolution of mucous plugging revealed underlying bronchiectasis in the right lower lobe (Fig. 4), which was not appreciated on the initial CT scan. In light of the new findings, the scheduled surgery was cancelled and bronchoscopy performed instead. Bronchoscopy revealed a large amount of purulent material and mucous within the dilated right lower lobe airways. *Aspergillus fumigatus* was cultured from the washings. Follow-up laboratory work was remarkable for an *Aspergillus* antibody titer of 1:32, which was indicative of recent infection and a serum IgE level of 2,896 kU/l (reference range 0–114 kU/l), thus supporting the diagnosis of allergic bronchopulmonary aspergillosis.

Appropriate corticosteroid therapy was initiated. A follow-up chest radiograph 2 months later demonstrated resolution of the right lower lobe opacity with persistent bronchiectasis (Fig. 5). Clinically, the patient responded with complete resolution of all cough symptoms, obviating further need for cetirizine and the albuterol rescue inhaler, and her serum IgE levels appropriately declined. At the time of this report, the patient remained asymptomatic and without recurrence.

Discussion

Aspergillus is a ubiquitous fungus that grows on decaying vegetation. Infection occurs through inhalation into the lungs, and the disease severity depends on the patient's immune status. Infection can result in the development of

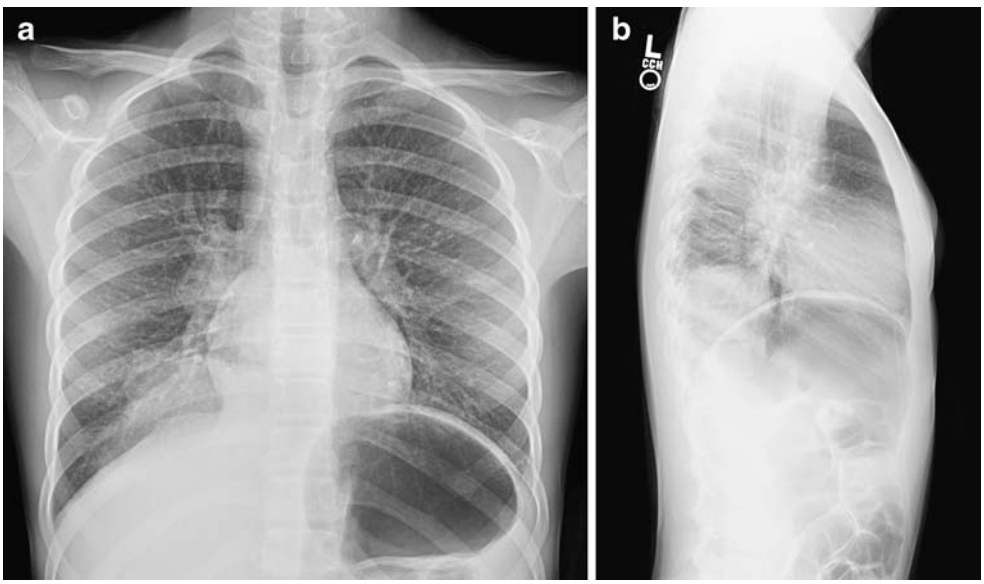

Fig. 1 Chest radiographs. Frontal (**a**) and lateral (**b**) images demonstrate a right lower lobe air space opacity

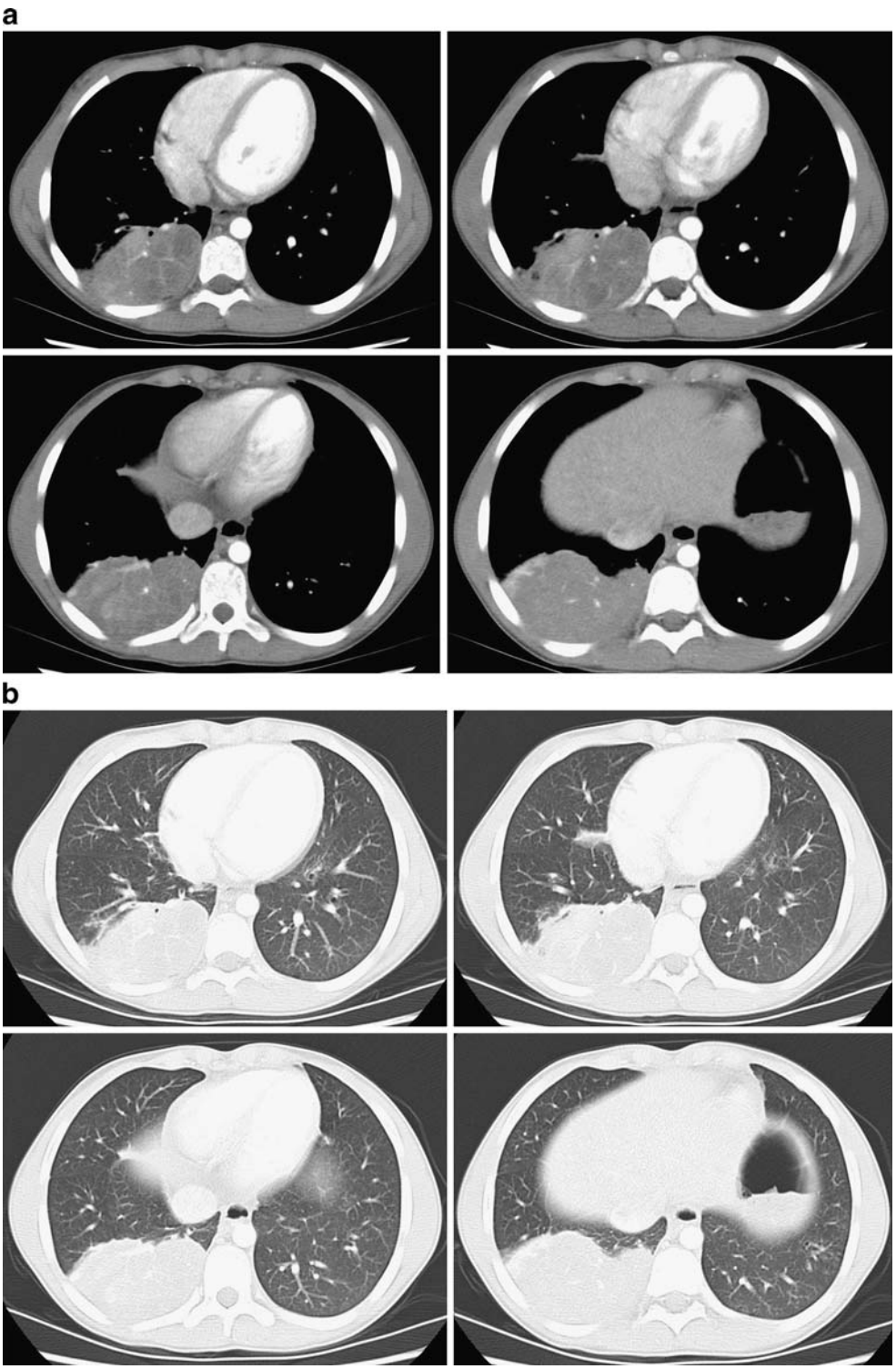

Fig. 2 Chest CT images. Soft tissue (**a**) and lung (**b**) windows through the right lower lobe demonstrate a dense consolidation with normal internal vascularity. The bronchi are inapparent

an aspergilloma, invasive aspergillosis, semiinvasive aspergillosis, obstructing bronchial aspergillosis, or allergic aspergillosis, which includes hypersensitivity pneumonitis and ABPA [8]. ABPA commonly affects individuals with asthma and cystic fibrosis. The pathogenesis involves a type I hypersensitivity immune response with release of IgE in response to endobronchial fungal growth. A delayed type III response occurs as a result of IgG release with deposition of immune complexes and inflammatory cells within the bronchial airways. This manifests as patchy opacities on chest radiography [5, 6]. Over time, continued airway wall injury leads to mucous plugging and bronchiectasis. If left untreated, end-stage lung disease manifested by pulmonary fibrosis can result.

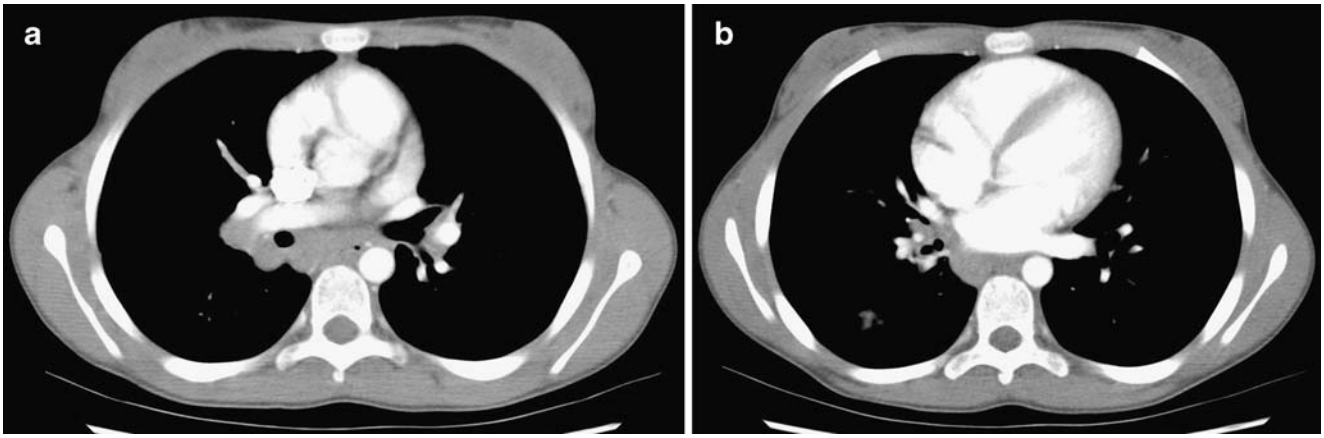

Fig. 3 Chest CT images demonstrate right hilar (**a**) and subcarinal (**b**) lymphadenopathy and patency of the right lower lobe bronchus

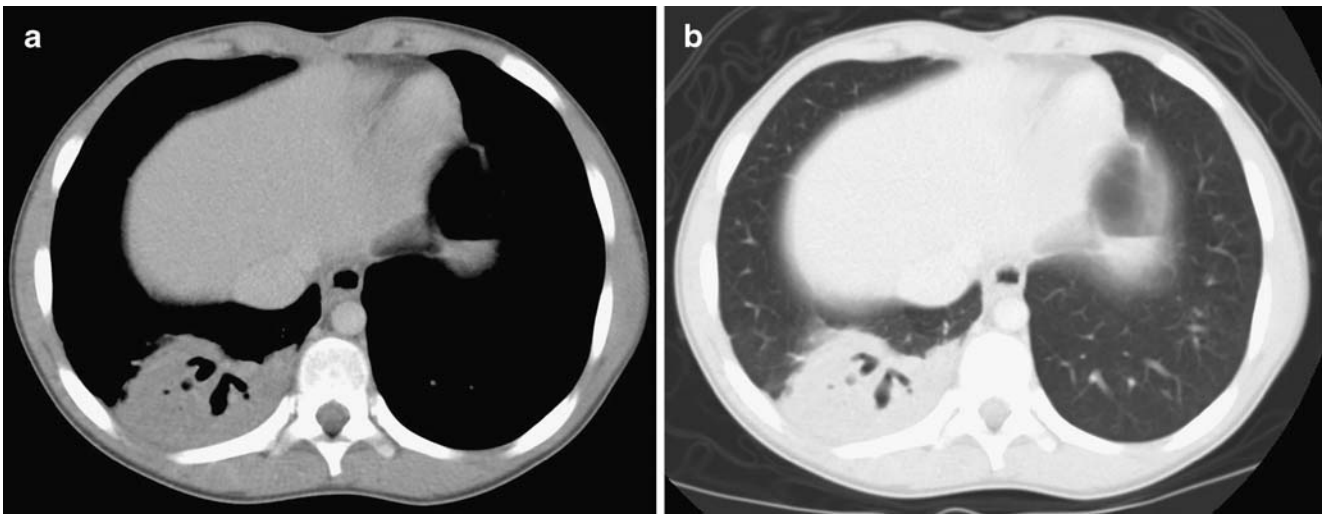

Fig. 4 Repeat presurgical CT scan 2 weeks after Fig. 2. **a**, **b** Images demonstrate an interval decrease in the right lower lobe consolidation with obvious bronchiectasis

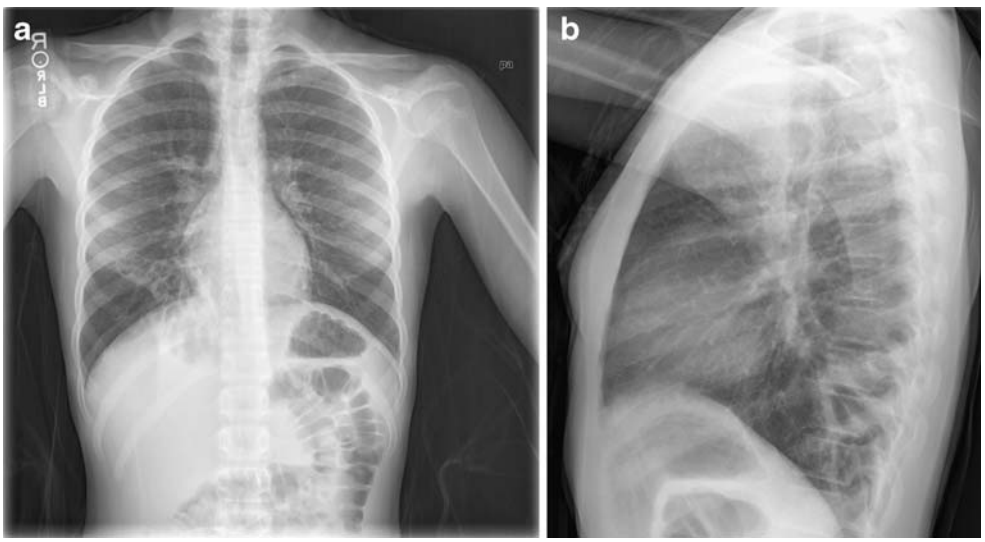

Fig. 5 Chest radiographs after initiation of corticosteroid treatment. Frontal (**a**) and lateral (**b**) images demonstrate marked improvement in the right lower lobe opacity with residual bronchiectasis

Patients with ABPA can present clinically with symptoms of increased cough, fever, dyspnea, wheezing, pleuritic chest pain, and hemoptysis [7]. Occasionally, patients expectorate mucous plugs. Strict diagnostic criteria for ABPA have been established. These include wheezing with episodic bronchial obstruction, peripheral blood eosinophilia, skin reactivity to *Aspergillus*, immunologic reactivity to *Aspergillus* antigen, elevated serum IgE levels, and a history of pulmonary infiltrates and central bronchiectasis on chest radiography [5, 7]. Treatment is with corticosteroids; however, recurrent exacerbations can occur with discontinuation of therapy. Serum IgE levels can be used to monitor response to corticosteroid treatment [8].

With acute ABPA, bronchiectasis may not be present, and patchy pulmonary opacities may be the only findings on chest radiographs. These opacities can regress either spontaneously or in response to steroid treatment [6]. Atelectasis resulting from mucous plugging can also be seen. The degree of atelectasis ranges from involvement of a segment to an entire lung. Other findings of ABPA include tram-line shadows, parallel-line shadows, and ring shadows, which are manifestations of the inflammatory changes in the tissues surrounding damaged, dilated bronchi [5]. Mucoid impaction within dilated bronchi produces what have been described as "toothpaste" or "gloved-finger" shadows [5, 6, 8]. These shadows are predominantly seen in segmental and subsegmental bronchi of the upper lobes, and they sometimes clear with coughing. CT is valuable in evaluating small mucous plugs that are not evident on plain radiographs. Impacted mucous can be hyperattenuating or even calcified, in which case it may be evident on plain radiographs [8]. Although not specific for ABPA, central bronchiectasis is highly suggestive of the diagnosis. However, this finding can also be seen in patients with uncomplicated asthma, prior infections, and cystic fibrosis. In several studies, the incidence of bronchiectasis in ABPA ranged from 75% to 100%, with an upper lobe predominance in all but one study [1–4, 6]. CT is more sensitive than plain radiography in detecting bronchiectasis, and it is thus considered the gold standard.

When given the classic radiographic findings in an asthmatic patient with supporting symptoms and serology, the diagnosis of ABPA seems straightforward. However, the radiologic manifestations and symptoms with acute disease are nonspecific. As demonstrated in our patient, many factors can make the diagnosis of ABPA challenging. Our patient was not a classic asthmatic, nor was her remote history disclosed by the clinician. The patient's chest radiographs demonstrated a persistent airspace consolidation rather than patchy, migratory opacities or areas of atelectasis. The initial CT scan showed a dense consolidation of the right lower lobe that was mistaken for a mass, as well as hilar and mediastinal adenopathy. Underlying bronchiectasis within the consolidation was not appreciated because of the presence of isodense mucous impaction. Additionally, these findings were isolated to the right lower lobe rather than a more classic upper lobe distribution of ABPA. These atypical features resulted in an initial differential diagnosis of neoplastic and congenital etiologies. The follow-up CT scan demonstrating a decreased size of the lobar opacity with associated bronchiectasis allowed for a more appropriate differential diagnosis of infectious and inflammatory etiologies. It still remains unclear as to why the pulmonary opacity regressed between the two CT examinations considering that the patient received no further medical management during this period. Nevertheless, the new radiographic findings allowed a more appropriate clinical evaluation, including bronchoscopy, which ultimately led to the correct diagnosis of ABPA.

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References

1. Angus RM, Davies ML, Cowan MD et al (1994) Computed tomographic scanning of the lung in patients with allergic bronchopulmonary aspergillosis in asthmatic patients with a positive skin test to Aspergillus fumigatus. Thorax 49:586–589
2. Neeld DA, Goodman LR, Gurney JW et al (1990) Computerized tomography in the evaluation of allergic bronchopulmonary aspergillosis. Am Rev Respir Dis 142:1200–1205
3. Panchal N, Pant C, Bhagat R et al (1994) Central bronchiectasis in allergic bronchopulmonary aspergillosis: comparative evaluation of computed tomography of the thorax with bronchography. Eur Respir J 7:1290–1293
4. Ward S, Heyneman L, Lee MJ et al (1999) Accuracy of CT in the diagnosis of allergic bronchopulmonary aspergillosis in asthmatic patients. AJR 173:937–942
5. Mintzer RA, Rogers LF, Kruglik GD et al (1978) The spectrum of radiologic findings in allergic bronchopulmonary aspergillosis. Radiology 127:301–307
6. Lynch DA (1998) Imaging of asthma and allergic bronchopulmonary mycosis. Radiol Clin North Am 36:129–142
7. Cote CG, Cicchelli R, Hassoun PM (1998) Hemoptysis and a lung mass in a 51-year-old patient with asthma. Chest 114:1465–1468
8. Gotway MB, Dawn SK, Caoili EM et al (2002) The radiologic spectrum of pulmonary Aspergillus infections. J Comput Assist Tomogr 26:159–173