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Case Report

An Interesting Case of Allergic Bronchopulmonary Aspergillosis Resulting in Type II Respiratory Failure

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Abstract: *Aspergillus fumigatus* can cause an immunological hypersensitivity reaction known as allergic bronchopulmonary aspergillosis (ABPA), which often worsens asthma and cystic fibrosis patients' conditions. In India, where tuberculosis (TB) is endemic, a significant proportion of allergic bronchopulmonary aspergillosis (ABPA) patients are misdiagnosed as pulmonary TB before reaching a diagnosis of ABPA due to long-lasting symptoms. We discuss an uncommon presentation of ABPA with type II respiratory failure in a 48-year-old asthmatic female. Given this, one can speculate on the importance of ABPA presenting with respiratory failure since these cases are rare and diagnosed quite late, which can also prove fatal.

Keywords: *Aspergillus*; respiratory failure; bronchiectasis; asthma

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1. Introduction

Acute bronchopulmonary aspergillosis (ABPA) results from a severe allergic reaction caused by the fungus *Aspergillus* (most commonly *Aspergillus fumigatus*). ABPA affects an estimated 4.8 million people worldwide [1]. Dr. K.F. Hinson first described allergic bronchopulmonary aspergillosis (ABPA) in 1952 [2].

The thick mucus in the airways of asthmatic patients makes it difficult to clear fungal spores when inhaled. These spores are very common in the air but generally cause disease only in immunocompromised patients. ABPA causes bronchospasm and accumulation of mucus, resulting in cough, difficulty breathing, and airway obstruction symptoms. Here we report a case of ABPA associated with type II respiratory failure based on certain signs and symptoms, as per The International Society for Human and Animal Mycology (ISHAM) criteria [3]. The illness known as respiratory failure occurs when either one or both of the respiratory system's two gas exchange processes—oxygenation and carbon dioxide elimination—fail. It can be categorised as either hypoxemic or hypercapnic. A $PaCO_2$ greater than 45 mm Hg indicates hypercapnic respiratory failure (type II). Patients with hypercapnic respiratory failure who are breathing room air frequently experience hypoxemia. The length of hypercapnia has an impact on pH, which in turn depends on bicarbonate concentration. Drug overdose, neuromuscular disease, anomalies of the chest wall, and severe airway issues are some of the common etiologies (e.g., asthma and chronic obstructive pulmonary disease (COPD)).

2. Case Presentation

A 48-year-old female presented to the respiratory medicine outpatients department with complaints of breathlessness on exertion and a cough; expectorants had been used for the last 14 years. These symptoms were accompanied by on-and-off fever not associated with chills and rigors, and generalized swelling of body for the last 14 days. There was no history of COVID-19 infection or tuberculosis. The patient also reported no history of contact with any tuberculosis patients in the past.

On examination, she was found to be ill, wasted, and febrile. Examination of her respiratory system revealed tachypnoea. She was also dyspnoeic with reduced chest expansion. Bilateral rhonchi and coarse crepitations were present on auscultation. A cardiovascular examination revealed tachycardia. General examination showed clubbing of upper limb digits (grade 2).

Haematological investigations revealed haemoglobin at 10.4 gm/dL with a platelet count of 250,000/mm^3. Random blood sugar (RBS) was 85 mg/dL. The patient was found to be negative for HIV, and Hepatitis B and C viruses. The serum IgE level was elevated at 5812 IU/mL. The absolute eosinophil count was 312 cells/Cu.mm. A skin prick test for *Aspergillus fumigatus* was positive. The test revealed immediate cutaneous hypersensitivity to *Aspergillus fumigatus*. Serological tests for aspergillus specific IgE and IgG were elevated.

A chest X-ray (Figure 1) revealed bilateral infiltration with ring shadow, which was suggestive of bronchiectasis. High resolution computed tomography (HRCT) of the thorax (Figure 2) confirmed moderate to gross tubulocystic bronchiectasis with surrounding fibrosis in bilateral lung fields. The signet ring sign was also positive.

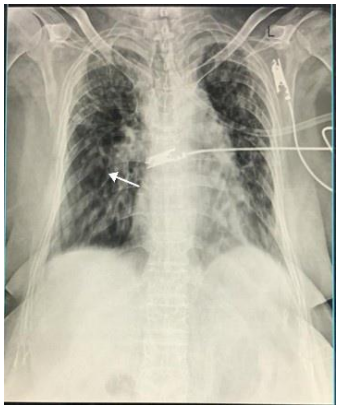

Figure 1. Chest X-ray showing bilateral infiltration with ring shadow suggestive of bronchiectasis.

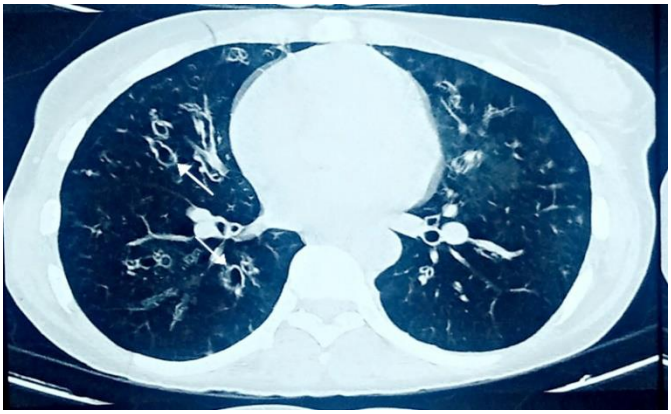

Figure 2. HRCT of the thorax showing moderate to gross tubule-cystic bronchiectasis with surrounding fibrosis in both lung fields. Signet ring sign positive.

Based on the serum IgE, the skin prick test for aspergillus, and specific serological markers a diagnosis of allergic bronchopulmonary aspergillosis cystic bronchiectasis ABPA (CB) was made. Her arterial blood gas analysis showed hypercapnia PCO_2 was 67 and her pH was 7.29. She was in respiratory acidosis; therefore, NIV was given. The patient was managed conservatively using oxygen therapy with moist oxygen to maintain saturation between 88 and 92% on the nasal prong for more than 18 h a day and with non-invasive ventilation (NIV). Treatment also included oral corticosteroids and anti-fungal drugs such as itraconazole (200 mg twice daily for 16 weeks) and prednisolone (0.5 to 1 mg/kg a

day for two weeks, which was subsequently tapered down to 5 to 10 mg every 2 weeks over 3 to 5 months). Nebulizer medications were also given such as levosalbutamol and ipratropium. Treatment helps in the complete resolution of asthma symptoms, but recurrence of symptoms occurred on treatment withdrawal. The patient was further managed conservatively and discharged after 11 days.

3. Discussion

Aspergillus species are moulds that have around one hundred species worldwide, and most illnesses are caused by *Aspergillus fumigatus*, *Aspergillus niger*, *Aspergillus clavatus*, and *Aspergillus flavus* [4]. In our case, *Aspergillus fumigatus* is the causative organism causing ABPA. ABPA patients clinically present with uncontrolled asthma conditions, cough, dyspnea, anorexia, low-grade fever, loss of weight, wheezing, and/or rhonchi or crepitations on auscultation. [5,6] The prevalence of ABPA in patients with asthma and cystic fibrosis is about 13% and 9%, respectively [7].

In 2021, a case of ABPA was reported in a woman without a known history of asthma [8]; however, in our case, the patient had a known history of asthma.

Untreated patients progress to irreversible lung fibrosis and respiratory failure [9]. In 2011, a case of ABPA was reported in a 22-year-old female who presented with acute hypoxaemic respiratory failure secondary to lung collapse [10]. In our case, the patient presented with acute breathlessness and respiratory failure (type II) which is a rare condition in ABPA. Type II respiratory failure occurs when the respiratory system is unable to adequately remove carbon dioxide from the body, leading to hypercapnia. Studies show that almost one-third of ABPA patients in India are wrongly diagnosed with pulmonary TB [11]. A 2006 study in India showed that out of 126 patients presenting to a chest clinic with ABPA, 59 were initially misdiagnosed with pulmonary TB and received ATT [12]. Similarly, a 2009 retrospective study revealed that 91% of patients with ABPA were initially diagnosed with pulmonary TB and were prescribed ATT [13]. In our case, the patient was misdiagnosed with TB and was put on irregular ATT for a year. This misdiagnosis resulted in a more severe presentation as type II respiratory failure.

High resolution computer tomography (HRCT) of the thorax showed moderate to gross tubulo-cystic bronchiectasis with surrounding fibrosis in both lung fields. An X-ray showed bilateral infiltrations with "ring shadow" suggestive of bronchiectasis. Other shadows which may present radiologically include finger in glove shadows, tramline shadows, and toothpaste shadows [14].

The availability of rapid and simple skin prick tests and IgE specific to *Aspergillosis fumigatus* (>0.3 kUA/l) is very useful in the diagnosis of ABPA [14]. It reveals immediate cutaneous hypersensitivity to *A. fumigatus* which was the case with our patient. Serum precipitins or specific IgG against *Aspergillus fumigatus* are detected in 69–90% of cases of ABPA [15,16]. A study was conducted in China from 2014 to 2016 in 1842 asthmatic cases where 126 patients were tested for *A. fumigatus*-IgE (6.84%), and 28 had *A. fumigatus*-sIgE > 0.35 kUA/L (22.22%). Of 1842 patients, 0.6% were diagnosed with ABPA, even though *A. fumigatus*-sIgE was not initially detected [15]. In our case, the patient was positive for *A. fumigatus.*

A diagnosis of ABPA is confirmed when the case presentation meets the criteria established in 2013 by the ABPA working group of The International Society for Human and Animal Mycology [3]. If the total IgE level is over 1000 IU/mL, two among three criteria are sufficient for establishing the diagnosis of ABPA: positive serum precipitins/*Aspergillus fumigatus* IgG, an eosinophil blood count of >500 cell/L, and a chest CT consistent with ABPA (mucus impaction, tree-in-bud pattern, and centrilobular nodules). This is the case in our patients with a total IgE level above 1000 IU/mL. It is known that pulmonary eosinophilia produces far more eosinophils than in peripheral blood; thus, a low eosinophilic blood count does not exclude ABPA [16]. Our patient had a total eosinophil count of <500 cell/L because of the continuous use of glucocorticoids in the treatment [17].

In glucocorticoid-dependent patients, antifungal therapy could be added, which was the case with our patient. Itraconazole requires frequent liver enzyme level monitoring because of its toxicity [18]. Omalizumab, an anti-IgE therapy which has a steroid sparing effect, has the potential to be an efficient substitute or as an additional therapy option for ABPA in asthma patients who do not respond to corticosteroids. In 2019, three cases of ABPA were successfully treated with omalizumab [19]. In our case, and due to the high level of IgE, omalizumab was also used as it has proven its efficacy in ABPA compared to long-term glucocorticoids. The nebulizer medication albuterol was also provided through a nebulizer machine that turns liquid medicine into fine mist to easily reach the lung. The patient should be examined every two months using chest radiography and total serum IgE levels until remission. In our case, she was misdiagnosed earlier and put on irregular ATT for a year. This misdiagnosis resulted in a severe presentation as type II respiratory failure, which is rare in ABPA. However, she now responds well using anti-fungal drugs, steroids, oxygen therapy, and NIV.

4. Conclusions

Early diagnosis is better and more effective in the management of ABPA. Chronic ABPA patients can present with acute respiratory failure with carbon dioxide narcosis. Corticosteroids are the primary stem therapy for ABPA, although antifungals are also effective medication for ABPA patients who are steroid-dependent. Nebulizer therapy is very useful as it changes liquid medication into fine droplets (in aerosol or mist form) so you can inhale it into your lungs.

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