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Case Report

Necrotizing pulmonary infection from retained foreign body: Case report and review of the literature

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ABSTRACT

Airway foreign body is one of the more common and potentially life-threatening consultations received by pediatric otolaryngologists. Despite a low-threshold for operative evaluation, airway foreign bodies are frequently missed and can result in serious complications. Necrotizing pulmonary infection is one such possible complication that has been historically treated with lung resection. We report the case of a 2-year-old boy presenting with a necrotizing pulmonary infection from a foreign body in the distal left lower lobe that had gone unrecognized for one year and subsequently review the literature regarding a changing trend in management of pediatric necrotizing pulmonary infections.

1. Introduction

Foreign body aspiration in the pediatric population is an unfortunately common occurrence with the potential for devastating complications. As reported by the Centers for Disease Control and Prevention, 17,500 patients with airway foreign bodies were seen in the emergency department in 2001, and recent reports have estimated the rate of death or anoxic brain injury in these patients to be approximately 4% [1,2]. Furthermore, airway foreign bodies are also frequently missed or incorrectly diagnosed which can lead to recurrent pneumonia, asthma, pulmonary abscesses, or necrotizing pneumonia, as was seen in the patient reported in the present case report [3–6].

Necrotizing pneumonia (previously termed massive pulmonary gangrene) is a potential complication of chronic pneumonia in which the lung parenchyma becomes necrotic. It is associated with a poor prognosis and a high risk of bronchopleural fistula [7]. Radiographically, it appears as a non-enhancing area of lung within an area of consolidation on computed tomography (CT) [7]. Recommended treatment varies from antibiotics alone to pneumonectomy, but there is growing evidence for conservative management in children. We present the case of a 2-year-old boy with a necrotizing pulmonary infection from foreign body aspiration one year prior to presentation and review the literature regarding management of necrotizing pneumonia.

2. Case report

A 2-year-old male was brought to the emergency room by his mother with a complaint of worsening cough and fever. His history was notable for asthma diagnosed at one year of age after the development of wheezing. He did not have a history of a witnessed aspiration event, though the mother did note that he often put small toys in his mouth and nose. Over the next year, he was diagnosed and treated for 4 separate events of pneumonia, each found to be in the left lower lobe on chest x-ray (CXR). There was no evidence of radiopaque foreign body in any of these x-rays. He had been treated with a number of antibiotics including amoxicillin, amoxicillin/clavulanic acid, and azithromycin. He was started on albuterol and budesonide nebulized treatments as management for presumed asthma. After each course of antibiotics, the patient would improve for a short period of time, only to have a recurrence of cough and fever after one or two weeks. In the month prior to admission at our institution, he had been treated with a 4-week course of azithromycin, but failed to improve.

Upon arrival, his exam was notable for decreased breath sounds in the left lobe. His oxygen saturation was normal on room air and he was febrile to 38.4° Celsius. His white blood cell count (WBC) was elevated to 20.4 × $10^3/\mu L$. He was started on intravenous (IV) vancomycin and ceftriaxone. A CXR was performed which demonstrated left lung base opacification consistent with a left

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lower lobe pneumonia (Fig. 1). No foreign body was visualized. The chest x-ray was repeated in left lateral decubitus with no evidence of air trapping. Given the history of recurrent pneumonia in the same site, a CT of the chest was performed, which demonstrated a radiopaque foreign body at the junction of the left main and lower lobe bronchus. There was also noted to be extensive left lower lobe consolidation with increased cystic change throughout the left lower lobe suggesting underlying necrotizing component (Fig. 2).

Given these findings, thoracic surgery and otolaryngology were consulted. Thoracic surgery initially recommended consideration of a left lower lobectomy with possible need for completion pneumonectomy. It was the opinion of thoracic surgery that given the necrotic appearance of the lung on CT, the tissue was unlikely to recover any functionality, and removal of the foreign body could result in creation of a bronchial tear necessitating emergent lower lobectomy. A collaborative approach to treatment was discussed between the thoracic and head and neck surgery services. It was discussed that while adults with similar CT findings suggestive of pulmonary necrosis are unlikely to recover any meaningful lung function, children have been found to have to capacity for regeneration. Therefore, attempt at foreign body removal was offered by otolaryngology, with the understanding that there was a risk of bronchial injury, potentially necessitating emergent lobectomy as described by the thoracic surgery service. The family elected to proceed with foreign body removal.

The patient was taken to the operating room where rigid bronchoscopy was performed with a size 4.0 rigid pediatric bronchoscope. Upon entering the airway, the left mainstem bronchus was found to be circumferentially obstructed by granulation tissue. The granulation tissue was carefully debrided with cupped forceps. The bronchoscope was advanced to the area of the left lower lobe takeoff where purulent material was noted and suctioned. The foreign body was identified distally in the left lower lateral segmental bronchus. It was removed using optical alligator forceps (Fig. 3). The airway was inspected and further purulent material was suctioned with no evidence of additional foreign body. There was no evidence of any bronchial injury from removal of the foreign body. The purulent fluid was sent to the laboratory for bacterial and fungal cultures without any growth after 5 days. The chest x-ray was repeated 6 days after surgery with interval improvement (Fig. 4). The patient was admitted for a total of 11 days on the pediatric service. Infectious disease was consulted who recommended long-term treatment with IV linezolid and piperacillin/tazobactam. The patient had a PICC line placed and remained on these antibiotics for a total of 4 weeks, after which the PICC line was removed. He was evaluated in clinic 5 months after discharge, at which time he had no respiratory complaints. His chest x-ray had returned to normal, and he no longer required breathing treatments.

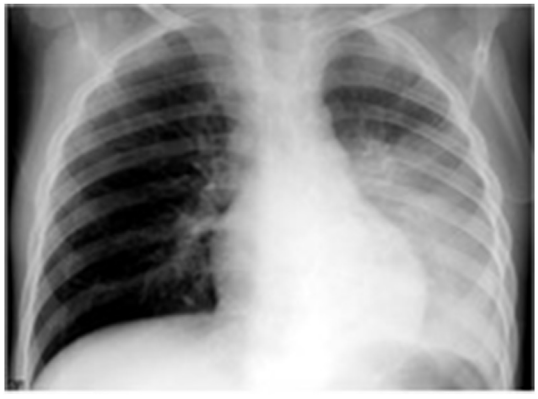

Fig. 1. PA chest x-ray taken on the day of admission demonstrating left lower lobe opacification consistent with pneumonia.

3. Discussion

Foreign body aspiration is a frequent occurrence in the pediatric population, with an estimated rate of 29.9/100,000 children and is associated with high patient morbidity [1]. It represents the sixth most common cause of accidental death in children under 1 year of age [8]. Even when immediately recognized, the rate of death or anoxic brain injury is reported to be as high as 4% in pediatric patients who suffer an aspirated foreign body [2].

Failure to recognize airway foreign body is regrettably common as children frequently present without the classic history and exam findings: observed choking event, coughing/wheezing, and air trapping on lateral decubitus chest x-ray. Indeed, it has been reported that the presence of all three findings is present in only 35–39% of patients who later go on to have an identified foreign body at bronchoscopy [9,10]. A 10-year review of pediatric airway foreign body out of Children's Hospital Boston, noted that only 52% of patients presenting with what was later diagnosed as an airway foreign body underwent bronchoscopy and removal within 24 hours of presentation. In their study, the average time to treatment was a surprising 17 days. Physician decision-making was found to be the most common cause of delay (17.7% of cases), followed by parental cause (15.5%), and negative history (12.5%) [3]. In another report of 174 children ultimately diagnosed with airway foreign bodies, 29% were not diagnosed/treated until 4–30 days following presentation, and 20% were delayed by 30 or more days [4].

Failure to accurately and quickly diagnose a foreign body can lead to a variety of complications including bronchiectasis, recurrent pneumonia, asthma, and pulmonary abscess [5,6,11]. As was seen in the present case, necrotizing pneumonia is another potential complication of a retained airway foreign body that is seldom discussed in the literature.

Previously termed massive pulmonary gangrene, necrotizing pneumonia is a severe complication of pneumonia that is rarely encountered by pediatric otolaryngologists. It is characterized by liquefaction and cavitation of lung tissue resulting from severe pneumonia [12–14]. Radiographically, it can be difficult to distinguish from pneumonia with or without pleural effusion on CXR, and it is therefore typically diagnosed using computed tomography. On CT, it appears as a non-enhancing area of lung with loss of normal pulmonary architecture within an area of consolidation [7]. The areas of decreased enhancement reflect liquefactive necrosis, and over time, such areas are seen to be replaced by small air or fluid filled cavities [7,14,15].

Pathogenic organisms that have been found to be associated with necrotizing pneumonia include *Streptococcus pneumonia, Staphylococcus aureus*, and *Mycoplasma pneumonia*, with *Streptococcus pneumonia* reported as the most common pathogen in children [16,17]. It is not associated with immunodeficiency [17]. Children who are most susceptible to necrotizing pneumonia are between 2 and 4 years of age. In its usual presentation, patients are brought to medical care after approximately one week of cough and fever. Affected patient's laboratory findings are notable for elevated white blood cell count, and commonly low hemoglobin and serum albumin, thought to be the result of protein loss into the diseased lung tissue. It has been reported that bronchopleural fistula (BPF) formation is as common as 33–63% of children with necrotizing pneumonia [15,18]. The mortality rate in children is reported to be between 0 and 5.5% [14,18].

Recommended treatment varies from antibiotics alone to pneumonectomy. In adults, literature regarding the treatment of