

Bronchial foreign body aspiration diagnosed with MDCT

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Foreign body aspiration (FBA) is a common accident in young children. Undiagnosed and retained foreign bodies may result in severe early and late complications such as asphyxia, pneumonia, atelectasis and bronchiectasis. Moreover, because it can mimic bronchiolitis, croup or asthma, an accurate history and a high index of suspicion are of paramount importance for early diagnosis. With our experience on bronchial FBA initially misdiagnosed as acute bronchiolitis, we emphasize that a minute radiological finding should not be neglected and a repeat chest radiograph may be helpful when the initial study shows normal findings. Multidetector computed tomography is a very useful noninvasive diagnostic modality for FBA. (*Korean J Pediatr* 2007;50:781-784)

Key Words : Foreign body aspiration, Bronchus, Children

Introduction

Foreign body aspiration (FBA) is one of the most common accidents in children, especially during the first 3 to 4 years of age¹⁾. It can be a life-threatening event when it causes acute upper airway obstruction. Undiagnosed and retained foreign bodies may also cause serious complications including pneumonia, atelectasis, bronchiectasis and bronchoesophageal fistula²⁾. In addition, because it can mimic bronchiolitis, croup or asthma²⁾, the diagnosis of FBA is sometimes delayed unless a clinician has a high index of suspicion.

We describe here two patients with FBA who were initially diagnosed as acute bronchiolitis. The presence of a foreign body in the airways was confirmed with multidetector computed tomography (MDCT).

Case Reports

Case 1

A 11-month-old girl developed persistent cough and wheezy respiration. She visited a private clinic where she was diagnosed as acute bronchiolitis. Despite treatment with

medications and inhaled bronchodilator, her symptoms got worse. She was then brought to our hospital. On history taking, we noted that her symptoms developed after eating a chestnut four days before. Her vital signs were stable without fever. Localized wheezing was heard at the right lower lung field on chest auscultation. Chest radiography was immediately taken in which a minute hyperaeration was seen in the right lower lung (Fig. 1A). Localized air trapping was obscure and easily negligible. For confirmation of FBA, chest MDCT scan was performed which demonstrated the foreign body obstructing the proximal portion of the right bronchus intermedius with obstructive emphysema of the right middle and lower lobes (Fig. 1B, 1C). Immediately, the foreign body was removed with a rigid bronchoscope under the general anesthesia.

Case 2

A 19-month-old boy was brought to our hospital with persistent cough for 10 days. He developed a severe cough and wheezing 10 days ago. He visited a private clinic where he was diagnosed as acute bronchiolitis and treated with medications and inhalation therapy. However, his symptoms continued and he was referred to our hospital. His vital signs were stable with normal body temperature. Pulse oximetry showed oxygen saturation of 99%. On chest auscultation, the breathing sound was decreased in the entire right lung field. There was no significant abnormal findings in chest radiograph (Fig. 2A). Then, we repeated chest radiography

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Fig. 1. (Case 1) (A) Chest radiograph shows a minute hyperinflation of the right lower lung. (B) Coronal reformed MDCT image shows lodgement of the foreign body in the right bronchus intermedius with obstructive emphysema of the middle and lower lobes. (C) With 3D reconstruction, the foreign body is shown obstructing the right bronchus intermedius. Note the patency of the right upper bronchial orifice.



Fig. 2. (Case 2) (A) There is no abnormal findings in the initial chest radiograph. (B) One hour later, hyperinflation of the right lung becomes apparent in repeat chest radiograph. (C) Coronal reformed MDCT image shows lodgement of the foreign body in the right main bronchus with obstructive emphysema of the entire right lung.

one hour later. On repeat chest radiograph, hyperinflation of the entire right lung became apparent, suggestive of FBA (Fig. 2B). In more precise history, it was revealed that a sudden onset of cough and wheezing developed after vomiting while eating some crab flesh. Chest MDCT scan showed the foreign body was lodged in the right main bronchus with obstructive emphysema of the entire right lung (Fig. 2C). It was promptly eliminated with a rigid bronchoscope under the general anesthesia.

Discussion

FBA is a common accident in infants and young children. The degree of airway compromise and the severity of symptoms depend on the location and nature of the aspirated object. It can cause upper airway obstruction and be a life-threatening event. However, most foreign bodies pass through the larynx and become lodged in the trachea or main bron-

chus¹⁻³. If the foreign body remains in the bronchial tree undiagnosed, it can cause inflammation and necrosis of airway mucosa, resulting in serious complications such as pneumonia, atelectasis, emphysema, bronchiectasis or bronchoesophageal fistula². Moreover, many cases of FBA are initially treated as asthma or respiratory infection such as bronchiolitis or croup². Thus, early diagnosis is important for successful and uncomplicated management of FBA.

FBA affects almost 2.5 million children each year and leads to about 300 deaths annually in the United States⁴. In Korea, this is the fourth cause of childhood accidents for visiting the emergency department, following trauma, fall-down and burns⁵. It is most commonly observed in the second year of life, with 80% of all events occurring in children 18 months to 3 years of age^{3,4}. This increased incidence has been attributed to several factors in this age group: they tend to put small objects into their mouths; and do not yet have the molars needed for proper chewing³.

The most frequently aspirated objects are organic food materials such as peanuts, popcorns or vegetables. Nonfood objects include balloons, coins, pen tops and pins⁴. Although the nature of aspirated foreign bodies reported in various studies differs according to lifestyle and eating habits, generally nuts (particularly peanuts) remain the most commonly aspirated objects in children^{3, 6}.

Aspirated foreign bodies are usually found in the proximal airways (trachea, right and left main bronchi)^{1, 6} and preferentially, they are located in the right bronchial tree because of its larger size and more vertical branching from the trachea than the left³. However, others reported that there is no significant difference in the location of a foreign body between the right and left bronchus^{6, 7}.

The most frequent symptom is so-called "penetration syndrome", which is defined as a sudden onset of choking and intractable cough with or without vomiting⁶. Other presenting symptoms include cough, breathlessness, wheezing, dyspnea and cyanosis.

The most frequent physical findings are localized decreased breath sound and localized wheezing on chest auscultation³. It is reported that only 26.3% of the patients who aspirate inorganic foreign bodies and 91.7% of the patients who aspirate organic objects have an abnormal physical examination¹. Midulla et al.³ analyzed the role of physical findings in the diagnosis of FBA. They suggested that the presence of a clinical triad (cough, localized wheezing and localized decreased breath sound) indicates a high risk of FBA (92%). Our case 1 had cough and localized wheezing while case 2 had cough and decreased breath sound in the entire lung involved.

The most predominant radiological finding observed is localized air trapping followed by atelectasis^{3, 7, 8}. Radiological examination may be helpful if the foreign body is radiopaque or if there is an area of air trapping and/or atelectasis. However, a high percentage of children (up to 30%) with FBA have normal or nonspecific chest X-ray findings⁷. Thus, although the radiological findings can help confirm the presence of a foreign body, negative findings do not exclude the possibility of FBA. In our case 1, we did not neglect an obscure localized hyperinflation on chest X-ray which could be a clue to the diagnosis of FBA. In case 2, the initial radiographic finding was normal, but we repeated a chest radiograph in which air trapping became apparent, suggestive of FBA. If FBA is suspected in adults or well-cooperated older children, chest radiographs at inspiration

and expiration can be taken whereas it is unable to get chest X-rays at each cycle of respiration in children. At this time, repeat chest radiograph can be helpful.

There are a number of factors contributing to a delayed diagnosis of FBA: parental negligence, the absence of a history of FBA and the presence of a normal chest radiograph. As described in our cases, although the patients had a history of choking and sudden onset of cough, the primary physicians did not have a high index of clinical suspicion and simply thought that these symptoms were from bronchiolitis. In our opinion, FBA can be differentiated from acute bronchiolitis in terms of 1) the absence of fever, 2) no preceding upper respiratory infection and 3) abrupt onset.

All children who present with a history of suspected FBA, even those without clinical and radiological evidence, should undergo diagnostic bronchoscopy^{9, 10}. However, it is invasive and serious complications may occur such as vocal cord injury, tracheal laceration and subglottic edema¹¹. In contrast, recently developed virtual bronchoscopy, MDCT, is a non-invasive technique that provides an internal view of the tracheobronchial tree by 3-dimensional (3D) reconstruction^{9, 10, 12}. The sensitivity and specificity of MDCT compared with rigid bronchoscopy are 100% each⁹.

Treatment consists of direct visualization of the airway and removal of the foreign body with a rigid bronchoscope under the general anesthesia.

Although most patients have complete recovery after removal of the foreign body, the risk of long-term complications increases with increasing elapsed time from aspiration to diagnosis¹⁰. Complications are noted in 60% of patients who are diagnosed 30 days after aspiration¹. Thus, early diagnosis of FBA with a high index of suspicion is of utmost importance to decrease the risk of complications.

한글 요약

다중검출 나선형 CT로 진단한 기관지 이물 흡인

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이물 흡인은 영아와 어린 소아에서 흔히 발생하는 사고이다. 진단이 늦거나 기도 내에 이물이 오래 머물게 되면 질식의 위험 뿐만 아니라 폐렴, 무기폐, 또는 기관지 확장증 등의 합병증이 발생한다. 또한 세기관지염이나 크루프, 천식 등으로 잘못 진단하고 치료하는 경우가 많이 있게 된다. 저자들은 초기에 세기관지염으로 진단되었다가 기관지 이물 흡인으로 확진되어 치료한

증례를 통해, 자세한 병력청취와 세밀한 진찰소견에 의해 이물 흡인을 강력히 의심하는 것이 진단에 매우 중요함을 인식하였다. 이 때, 흉부 방사선 이상 소견이 미약하더라도 무시해서는 아니 되며 이상 소견이 뚜렷하지 않다면 시간차를 두고 반복 검사를 하는 것이 진단에 도움이 된다. 이물 흡인의 확진에는 다중검출 나선형 CT 검사가 매우 유용하게 이용될 수 있다.

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