

Foreign body aspiration: An important etiology of respiratory symptoms in children

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Allergists and pulmonologists are commonly confronted with patients who have symptoms of chronic cough, wheeze, and dyspnea. Most of these children are diagnosed with asthma and successfully treated with asthma medications. A subset of these patients, however, does not respond as expected to standard asthma therapy and presents a diagnostic challenge. The possibility of foreign body aspiration should be considered in any child who presents with these symptoms.

CASE REPORT

A 12-year-old white girl was referred to the pediatric pulmonary clinic for evaluation of dyspnea. She complained of episodic dyspnea for 1 year but reported that it had been much worse over the period of the past 3 months. There was no shortness of breath at rest, but dyspnea and wheezing limited activity. Wheezing was described as both inspiratory and expiratory and could be heard 5 feet away. She had a persistent dry cough during the day and night that was occasionally productive. She denied high-pitched stridor. She denied heartburn, gassiness, dysgeusia, or halitosis. She denied choking with eating or any other choking episodes. She had had no weight loss, night sweats, or foreign travel. She had begun to have low-grade fevers over the period of the past 72 hours. She had no nasal congestion. Her past medical history was unremarkable and negative specifically for asthma, allergies, or recurrent infections. She had been taking fluticasone/salmeterol, montelukast, prednisone, and albuterol without significant benefit. The family history was positive for asthma in her father and sister. There were no environmental exposures.

On examination, she was well nourished and in no distress, with a respiratory rate of 16 and oxygen saturation of 97% on room air. She exhibited a loud monophonic inspiratory and

expiratory wheeze. There were no crackles. There were no retractions. The remainder of the examination was normal. Spirometry demonstrated mild obstruction with a normal forced vital capacity, an FEV₁ of 80% predicted, and an FEV₁/forced vital capacity of 75. The flow-volume loop appeared normal, and there was no bronchodilator response. Chest x-ray revealed a normal cardiophrenic silhouette with left-sided aortic arch. There was complete resolution of a right lower lobe opacity seen on chest film 2 weeks previously. High kilovolt anterior-posterior and lateral upper airway films were normal.

Because of her dyspnea and loud monophonic wheezing, flexible bronchoscopy was performed to evaluate for large airway compression. The upper airway and trachea were normal. A smooth, cylindrical foreign body with a hole in the middle was tightly lodged in the bronchus intermedius. There was significant mucus accumulation because of the chronic airway inflammation as well as significant granulation tissue around its edges, suggesting that it had been there for some time. The foreign body was removed with difficulty with rigid bronchoscopy by otolaryngology and found to be a plastic pen cap (see the [video clip](#) in this article's Online Repository at www.jacionline.org). After removal of the foreign body, the child's wheezing and dyspnea on exertion resolved. She underwent repeat flexible bronchoscopy 1 month after the foreign body was removed, revealing resolution of the endobronchial granulation tissue.

DISCUSSION

Airway foreign body aspiration is an important cause of respiratory distress, morbidity, and mortality in children, especially those younger than 3 years. In 2000, 160 children under the age of 14 years died from foreign body aspiration or ingestion.¹ In 2005, there were more than 4600 deaths from foreign body aspiration in the United States.² The peak incidence of foreign body aspiration in children occurs between the ages of 1 and 2 years, when children are generally mobile and have a tendency to put objects in their mouths.³ Food is the most common foreign body found in the airways of infants and toddlers, whereas non-food items such as the pen cap in our case are more commonly found as airway foreign bodies in older children and adolescents.^{4,5} One large study of aspirated foreign bodies in children revealed that most were found lodged in the bronchi with 60% in the right lung, as in our case.⁶ When foreign bodies are in the laryngeal or tracheal airways, they tend to present more acutely and be associated with higher morbidity and mortality.⁷

Presenting symptoms for aspiration of a foreign body may be nonspecific and can include coughing, wheezing, shortness of breath, and fever. Eliciting a careful history of any episode of choking, especially one associated with sudden onset of cough

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or shortness of breath, may prove important in not missing the diagnosis. Often the initial event lasts only for seconds to minutes and is followed by a period of no symptoms, misinterpreted as resolution by the child or family.⁸ The re-emergence of symptoms of cough or wheeze or dyspnea can often then be interpreted as acute pneumonia, asthma exacerbation, bronchiolitis, or croup.

When examined, children with foreign body aspiration may have focal wheezing or decreased air entry, but they might also have generalized wheezing or even a clear chest. If a secondary pneumonia has developed, there may also be crackles on auscultation or dullness to percussion. It is important to perform a thorough chest evaluation with the child quiet in a quiet room to determine the nuances of the examination effectively.

Radiographs are commonly performed in children with suspected foreign body aspiration and may show evidence of unilateral hyperinflation, mediastinal shift, atelectasis, or pneumonia. The hyperinflation and mediastinal shift occur when a foreign body has partially obstructed an airway, allowing air entry on inspiration but little air escape on expiration. Atelectasis or secondary pneumonia may develop in the obstructed lung distal to the aspirated object.⁹ If the aspirated object happens to be radiopaque, it may be seen on a plain radiograph, but most aspirated objects, especially food, are radiolucent.¹⁰ Unfortunately, chest radiographs are often completely normal in cases of foreign body aspiration, so a normal film does not rule out the diagnosis.¹¹ Attempting expiratory films or bilateral lateral decubitus films in young children may help demonstrate air trapping caused by a foreign body, but in some studies, these films did not add much to the diagnostic ability of radiographs.¹²

Ultimately, the airways need to be examined directly in all cases of suspected foreign body aspiration. Because complications such as pneumonia, granulation tissue formation, and bronchiectasis increase if the diagnosis is delayed, moving toward bronchoscopy early in the evaluation is preferred.

Flexible bronchoscopy may be used, as in our case, in cases of potential foreign body aspiration when the diagnosis is sufficiently unclear. Flexible bronchoscopy allows a complete airway evaluation to find potential foreign bodies. If there is no foreign body, then the complete examination and bronchoalveolar lavage will help determine the cause of the respiratory symptoms. In only very limited cases with experienced bronchoscopists should foreign body removal be attempted with flexible bronchoscopy. The flexible instrument was not designed for object removal, and grasping foreign bodies with forceps out the end of a bronchoscope could easily lead to dislodgement of the object and acute airway obstruction. If a foreign body is detected on flexible bronchoscopy, as in our case, the patient should be referred for rigid bronchoscopy for removal.

When foreign body aspiration is highly suspected, as in a witnessed choking event followed by classic symptoms, rigid bronchoscopy is the procedure of choice.¹³ Rigid bronchoscopy allows ventilatory control of the airway, excellent visualization,

and the ability to use a wide variety of forceps and other instruments to remove the foreign object. If the object becomes dislodged during rigid bronchoscopy, it is more easily retrieved while continuing to ventilate the child adequately.

One approach to the child with suspected foreign body aspiration is a combined procedure of both flexible and rigid bronchoscopy.¹⁴ In this case, the foreign body can be removed with rigid bronchoscopy, but the airway can fully be examined with the flexible instrument, and bronchoalveolar lavage for cultures to determine the need for antibiotics may also be performed. The combined approach may save the child extra anesthesia and may lead to more thorough care of the airway.

If there has been the development of infection or airway obstruction with granulation tissue because of a foreign body, the child should be treated with appropriate antibiotics and steroids to decrease airway inflammation. Repeat evaluation of the airway may be necessary to ensure the removal of all foreign objects, to re-evaluate the development of granulation tissue, or to assess ongoing infection. Most children do well and recover fully, but having a high index of suspicion for foreign body aspiration will help resolve symptoms quickly and prevent complications.

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