

Abstract:

Foreign body aspiration (FBA) is an important cause of morbidity and mortality in pediatrics. Most cases occur in children younger than 3 years, and the classic triad of choking, cough, and unilateral wheezing or decreased air entry is seen in only a minority of patients. Oftentimes, the diagnosis can be challenging when an aspiration event is not directly witnessed. Management depends on the acuity of the presentation. Patients with evidence of complete upper airway obstruction should have age-appropriate basic life support maneuvers performed. Patients with partial obstruction who are able to maintain their airway but with potential for deterioration should be taken immediately to the operating room for removal whenever possible. Stable patients may have radiographic studies performed to assist in risk stratification. Patients in whom suspicion for FBA is high should undergo bronchoscopy, whereas a subset of low-risk patients may be observed. Delays in diagnosis increase the risk of complications.

Keywords:

foreign body; aspiration; management; bronchoscopy; pediatric

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Foreign Body Aspiration in Children

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Foreign body aspiration occurs when a foreign object, often food, becomes accidentally lodged at a point within the hypopharynx or tracheobronchial tree. Aspiration varies in presentation ranging from complete upper airway obstruction and arrest to more indolent presentations related to the development of sequelae such as chronic pulmonary infections and bronchiectasis. Most commonly FBA cases are suspected or witnessed, the patients are symptomatic, and they present acutely for evaluation. A high level of suspicion will aid in establishing a timely diagnosis and helps to prevent complications from missed cases.

EPIDEMIOLOGY

Foreign body aspiration (FBA) occurs at an estimated rate of 29.9/100 000 population and was responsible for 160 deaths in the United States in 2000.¹ Over the past 40 years, there have been 3 times as many international studies reporting FBA and 5 times the number of patients in those series compared with reports from the United States.² Despite the larger number of reports internationally, incidence rates among different countries are difficult to compare.

Seventy percent of FBA occurs in children younger than 3 years.³⁻⁹ The peak incidence occurs between 1 and 2 years of age.^{10,11} There are normal developmental factors specific to this age group that increase their risk for aspiration including: immature dentition, poor coordination of swallowing, and higher position of the epiglottis. Behavioral tendencies such as easy distraction, talking or crying during eating, or oral exploration (ie, placing objects in the mouth) also contribute to the increased risk of FBA in toddlers and infants. Foreign

body aspiration occurs 1.7 times more frequently in males presumably due to their more active and inquisitive nature.^{3-9,12-16}

Aspirated foreign bodies can be broadly categorized as food and nonfood items. Food and food-related items are by far the most commonly aspirated across all age groups, particularly peanuts, tree nuts, and seeds (Table 1).^{2,4-8,12,13,15} The type of aspirated food depends on dietary practices which vary geographically. In the United States, for example, aspiration of beans is rare as they constitute a smaller part of the diet compared with international countries, where beans are consumed more frequently and therefore more commonly aspirated.² Older children tend to aspirate nonfood materials such as pen caps and pins more frequently than do younger children.¹⁷ The incidence of nonfood FBA is higher in the United States compared with reported international rates.²

The overall mortality rate from FBA is 0.7 to 1.8% but varies by anatomic location.^{17,18} Complete obstruction of the larynx carries up to a 45% mortality rate.¹⁹ Foreign body aspiration is the sixth most common cause of accidental death in children and is the most common cause of unintentional death in children younger than 1 year.⁵ Balloons are the objects most commonly associated with mortality.²⁰ Public education and regulation of nonfood choking hazards have been associated with decreased mortality rates observed over the past 3 decades.²¹

A recent study estimated the inpatient costs associated with pediatric bronchial FBA in the United States to be \$12.8 million annually. The actual socioeconomic burden of FBA is higher considering that 2.2% of FBA patients have anoxic brain injury and require long-term care, often at skilled care facilities.¹⁸

PATHOPHYSIOLOGY

Aspirated objects lodge most frequently in the right mainstem bronchus followed by the left mainstem and then the trachea and larynx, respectively (Table 2).^{5,6,8,12,13} When an object is aspirated, it may cause mechanical airway obstruction with asphyxiation, especially if it becomes lodged in the larynx. Irritation of the larynx may also result in partial or complete laryngospasm, with associated stridor, respiratory distress, or asphyxiation even without direct obstruction by the foreign body. Alternatively, stridor may result from the foreign body itself causing partial obstruction of the upper airway.

Foreign bodies lodged more distally may cause initial irritation and edema resulting in wheezing or cough. Prolonged presence of a foreign body may result in erosion into the respiratory mucosa and associated hemoptysis. Chronic obstruction of bronchi can result in bronchiectasis and recurrent pneumonias.

PRESENTATION TO THE EMERGENCY DEPARTMENT

Patients with FBA have a wide range of presentations to the emergency department, depending on the anatomic location of the foreign body, the degree of airway obstruction, the time to presentation, and the presence of complications. It is important to maintain a high level of suspicion in patients with a history of choking or the sudden onset of a cough. Careful questioning regarding the possibility of aspiration and the presence of associated symptoms can help prevent missed cases. A negative physical examination result alone cannot be used to rule out FBA because as many as 30% of patients with FBA have no appreciable findings on presentation to the emergency department.¹⁴

Patients with complete or near-complete upper airway obstruction may present in extremis with severe respiratory distress and cyanosis, or they may be unconscious with respiratory failure or in arrest from asphyxiation. Obstruction may be mechanical due to the foreign body itself or it may be due to associated edema or laryngospasm. Older patients with complete or near-complete obstruction generally appear scared, unable to speak, and holding their hands over their necks. Younger children and infants may have their eyes wide open with clenched fists raised above their heads signifying distress.²² With progressive hypoxia and/or hypercarbia, patients become lethargic and eventually unresponsive.

Patients with partial upper airway obstruction may present with stridor, hoarseness, or drooling with varying degrees of respiratory distress depending on the severity of the obstruction. They may sit leaning forward or in the tripod position in an attempt to maximize airway patency. Lower airway obstruction is signified by wheezing or unilateral decreased breath sounds on the affected side. Persistent cough can be a prominent symptom in upper or lower airway obstruction, although the cough reflex can fatigue over time. The most common signs and symptoms of FBA are shown in Table 3.^{3-7,13-16,23}

There are 3 classic phases with FBA.¹¹ Phase 1 involves an episode of choking, cough, or gag followed by ongoing symptoms of cough, noisy breathing, voice change, or drooling. Most patients will present with these symptoms within 24 hours of the aspiration

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