Foreign Body in the Pediatric Airway

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BACKGROUND

Foreign body aspiration (FBA) is a common cause of morbidity and mortality in children. More than 17,000 children are seen in emergency departments each year for choking-related episodes, with >150 deaths per year. The age group most at risk is 1 to 3 years of age. These children may choke on food substances given their incomplete dentition, immature swallowing coordination, and tendency toward distraction during meals. In addition, infants and toddlers are newly adapted to walking and have a tendency to put everything in their mouths. This increases their risk of unwitnessed choking events. Older children more commonly aspirate things such as pins and pen caps, which they are holding in their mouths.

PRESENTATION

Children who have aspirated foreign material may present acutely following a witnessed or reported event. Families commonly report a choking or gagging episode. Such an event, followed by sudden onset of coughing with unilateral wheezing or decreased aeration represents the classic diagnostic triad for FBA in the mainstem or lower bronchi. When the foreign body becomes lodged more proximally, partial upper airway obstruction can lead to hoarseness or stridor. Complete obstruction of the trachea or larynx can occur either from mechanical blockage or from induced laryngospasm. The mortality with complete laryngeal obstruction approaches 50%.

Many children have unwitnessed aspiration events. Infants are preverbal and young children may not recognize the need to tell their parents. As a result, respiratory symptoms may be incorrectly attributed to illnesses such as asthma or croup. Subsequent recurrent pulmonary infections may lead to the delayed diagnosis of chronic FBA. This can occur weeks to months after the aspiration event.

For the purpose of this chapter, we will focus only on acute airway management in the context of known or suspected FBA.

TECHNIQUE

The approach to the management of FBA will differ depending on whether the obstruction is partial or complete, and the level of consciousness of the child.

Partial Airway Obstruction

Children with FBA who have the ability to cough, cry, or speak are demonstrating adequate air exchange, and therefore have incomplete airway obstruction. Beyond infancy, children will naturally hold themselves in a position that maximizes airway patency. In addition, they possess a reflexive cough, which is the most effective means of clearing the airway. These patients, therefore, should be managed "expectantly." That is, no attempts at relief maneuvers should be attempted to avoid dislodgement of the foreign body to a location that aggravates the degree of obstruction.

Resources should be summoned to provide removal in the operating room setting whenever possible. If an operating room or pediatric expert resources are unavailable, an alternative plan must be initiated. Appropriately sized equipment should be gathered for foreign body removal, as well as for more definitive airway management in the event that the child progresses to complete airway obstruction (discussed below).

Attempts at removal of the foreign body for children with partial airway obstruction are rarely performed in the emergency department. Children are unlikely to cooperate with efforts to remove an airway foreign body even with effective topical anesthesia. Furthermore, unintentionally placing
a laryngoscope blade too deeply in small children will risk placing direct pressure on the foreign body which can further obstruct the airway. Therefore, in most cases, the child should be allowed to continue to attempt to clear the foreign body reflexively as long as possible, or until an operating room is available. Only when the patient is showing signs of tiring or progression toward complete obstruction, should attempts at removal be made. In such circumstances, sedation with ketamine titrated intravenously to effect if possible (or 4 mg per kg IM if not) reliably produces dissociative sedation while maintaining respiratory drive and airway reflexes. Once sedated, the laryngoscope is methodically inserted a small distance at a time, while attempting to identify any supraglottic foreign body.

If the patient progresses to complete obstruction, either because of unavoidable progression or as a result of attempts at removal, immediate intervention is required.

Complete Airway Obstruction

The loss of the ability to phonate in an awake child with a suspected FBA indicates complete airway obstruction. Chest wall movement will persist with attempted respiratory efforts; however, no sounds will be heard on inspiration or expiration. Conscious children will appear scared, although infants will not reliably place their hands to their neck to signify choking as older children or adults will. Instead, they will often raise clenched fists above their heads with eyes wide open as an expression of distress.

Pediatric Basic Life Support (BLS) techniques should be used immediately in the conscious patient with complete airway obstruction from FBA. The goal is to generate intrathoracic pressure to expel the foreign body from the airway. In infants, this is most safely attempted with the child in a head down position, using repeated cycles of back blows and chest compressions, five per cycle. Subdiaphragmatic abdominal thrusts (the Heimlich maneuver) are not recommended in infants because of the risk of accidental injury to the relatively large liver protruding beneath the costal margin. In children older than 1 year, the Heimlich maneuver is recommended, just as with adults. These initial maneuvers should be repeated until either the foreign body is expelled or the patient becomes unresponsive.

There is no role for attempting instrumentation to remove the foreign body in a conscious child. With complete obstruction of the airway, rapid oxygen desaturation will render the patient unconscious within 1 or 2 minutes, at which point attempts at removal can be made. For the child who remains unconscious, the oropharynx should first be examined for a visible foreign body. If something is seen, it should be removed directly. If no foreign material is seen, a blind oropharyngeal finger sweep should not be performed. In the emergency department, the immediate maneuver is direct laryngoscopy for possible foreign body visualization and removal. This is exactly analogous to the adult patient (see Chapter 40). The administration of a neuromuscular blocking agent is not indicated for the initial attempt. Only if children have clenched teeth or other signs of muscle activity will it be necessary to use a rapid onset neuromuscular blocking agent. If the foreign body can be identified under direct laryngoscopy, it should be removed using Magill or alligator forceps, or other available instruments. Care must be taken to avoid advancing the foreign body to a position where it becomes more tightly lodged or to a location where it is no longer retrievable. Similarly, organic material may be friable and should be grasped gently to avoid creating smaller fragments that can fall deeper into the tracheobronchial tree.

If the foreign body cannot be retrieved during laryngoscopy or expelled by blind maneuvers, attempts should be made to advance the foreign material distally into either mainstem bronchus using an endotracheal tube. The child should be intubated and the endotracheal tube inserted as deeply as possible, advancing the obstructing material with it. The tube should then be withdrawn to the standard "lip-to-tip" distance provided by the Broselow—Luten tape or other formulas. At this point, ventilation of the unobstructed lung is attempted (see Fig. 27-1). High resistance following this maneuver may result from soft material such as food substances becoming lodged within the endotracheal tube, preventing easy passage of air. If this occurs, replacement of the endotracheal tube using the appropriate insertion depth provides the most effective means to ventilate the patient through the patent mainstem bronchi.
A percutaneous approach (e.g., needle cricothyrotomy) is rarely indicated in FBA. Details of this approach are provided in Chapter 25. Needle cricothyrotomy will only be successful if the needle entry site is distal to the obstruction (e.g., a foreign body just below the vocal cords at the cricoid ring). If the foreign body cannot be visualized during attempts at direct laryngoscopy, it is unlikely that a percutaneous approach will be distal to the object, rendering the procedure ineffective. Ventilation strategies following percutaneous airway techniques are reviewed in Chapter 25. In patients with complete airway obstruction, it is important to remember that no air can exit through the glottis into the pharynx. The only means for exhalation is through the narrow lumen of the catheter, therefore the risk of barotrauma increases following each delivered breath.
Figure 27-2 Stepwise Approach for the Management of an Aspirated Foreign Body.

Both forced intubation and needle cricothyrotomy are temporizing measures designed to re-establish some degree of oxygenation and ventilation. When successful, the patient can then be taken to the operating room for removal of the foreign body with a bronchoscope or by thoracotomy as needed.

An overview of the stepwise approach to managing FBA in children is presented in Figure 27-2. The same for adults is seen in Figure 40-1 in Chapter 40.

TIPS AND PEARLS

1. Many aspiration events in children are unwitnessed, and young children are incapable of verbalizing what has happened. Consider aspiration in any infant/toddler with acute onset of respiratory distress.

2. The safest removal of a foreign body from a pediatric airway occurs in the operating room. Recruit necessary personnel and resources as early as possible.

3. Reflexive cough is likely to be the most successful mechanism for clearing a foreign body from a partially obstructed airway. Avoid interfering with an alert child who is sitting in a position of comfort and coughing.

4. In the emergency department, if there is high suspicion for obstruction from FBA, direct laryngoscopy for possible direct removal should be attempted before positive-pressure breaths to avoid advancing the foreign body to an unreachable position.

5. Avoid the Heimlich maneuver in children <1 year of age to prevent inadvertent injury to the liver.

6. Needle cricothyrotomy is unlikely to be successful in any child in whom the foreign body cannot be visualized above or immediately below the glottis, and therefore should not be attempted in these patients.
EVIDENCE

- How common is FBA in children and what do they aspirate? More than 17,000 children are seen in emergency departments each year for choking-related episodes, with >150 deaths per year.1,2 Younger children typically choke on food items; older children more commonly aspirate things such as pins and pen caps, which they are holding in their mouths.3

REFERENCES

