

Tracheobronchial Foreign Body

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An 18-month-old boy has sudden onset of tachypnea and coughing at home while playing with beads. Upon presentation to the emergency department, the child has right-sided wheezing and decreased air entry. The child is scheduled for bronchoscopy and removal of a presumed bronchially located bead.

What Is the Typical Presentation of Foreign Body (FB) Aspiration?

The majority of FB aspirations in small children are witnessed. Early symptoms include drooling, tachypnea, retractions, stridor, wheezing, and/or use of accessory muscles. Children with greater than 24 hours of symptoms may present with tachypnea, fever, and signs of respiratory distress.

What Is the Most Common Type of Aspirated FB?

Foods such as nuts and seeds, as well as other organic material in the bronchial tree, are the most commonly aspirated objects, but any small object, such as a bead, can be accidentally inhaled when a toddler places it in his or her mouth. Because of their inability to coordinate swallowing and breathing movements, children under the age of four should not be fed any kind of small nut.

It is interesting to note the types of foreign bodies anesthesiologists *don't* see presenting for urgent bronchoscopic removal. Larger items such as hot dogs, balloons, and plastic wrappers can seal off the airway. They are not easily dislodged by either the Heimlich maneuver or coughing. Aspiration of these objects is associated with a high fatality rate.

How Does the Physical Exam Help to Locate the FB in the Airway?

The presence of stridor or wheezing may help you to determine the location of the FB. Stridor is produced by turbulent airflow through an obstructed airway. Inspiratory stridor usually indicates obstruction at or above the larynx. Expiratory or biphasic stridor generally points to obstruction below the larynx.

Decreased breath sounds are a very common finding and may help to determine the laterality of a bronchially placed FB. The incidence of right-sided foreign bodies is higher than foreign bodies in the left-sided bronchial tree. The absence of breath sounds over a portion of lung provides a clue to where you are likely to find the FB obstructing the airway: high in the hypopharynx obstructing the glottis opening, at the carina obstructing the mainstem bronchi or in the esophagus compressing the trachea.

Are Diagnostic Radiographs Necessary?

Not necessarily if the aspiration or sudden choking episode was witnessed. The vast majority of objects aspirated into the tracheobronchial tree are radiolucent, and chest radiographs are often not suggestive of pathologic changes in the first 24 hours after aspiration. A large review of airway FB cases found that only 11% of aspirated objects were radiopaque. Unilateral emphysema may be seen on chest X-ray due to the ball-valve effect of a distal obstruction. Radiographs are usually indicated when there is no history of a witnessed aspiration, and the child has an undiagnosed persistent cough or unilateral wheeze.

Radiographic signs of a lower bronchial obstruction may include:

- Air trapping on the side of occlusion by the FB exerting a ball-valve effect

- Flattened diaphragm
- Mediastinal shift to the unaffected side
- Bronchogram w/ cut-off
- Right middle lobe collapse
- Left upper lobe collapse

When Is Removal of a Bronchial FB a Surgical Emergency?

Conditions that warrant immediate bronchoscopy and removal of the FB include cyanosis/hypoxemia, or increased work of breathing. The suspicion of lipid pneumonitis due to an inhaled peanut, or tissue corrosion due to inhalation of a disc battery are also important reasons to attempt removal as soon as possible. When a peanut is aspirated, the patient's symptoms may worsen as the peanut oils initiate an inflammatory reaction. The peanut may swell and become more brittle, complicating removal.

What Is the Preferred Anesthetic Management Technique for FB Removal?

Most children presenting for removal of a bronchial FB will have an intravenous catheter *in situ* on arrival to the operating room. Midazolam can be titrated to achieve anxiolysis in the preoperative holding area under direct supervision of the anesthesiologist. An anticholinergic agent such as atropine or glycopyrrolate can also be administered to decrease secretions and block a vagal response. If a full stomach is suspected, rapid sequence induction and tracheal intubation may be performed prior to gastric evacuation; however, if there is suspicion that the FB could move distally with positive pressure ventilation, then spontaneous ventilation with an inhaled agent may be indicated.

There are advantages and disadvantages of both spontaneous and controlled ventilation methods during bronchoscopy. During spontaneous ventilation, interruptions in the anesthesia breathing circuit will not interfere with continuous oxygenation, and for some obstructive lesions with a ball-valve effect, negative pressure breathing may provide better oxygenation and ventilation. Disadvantages of spontaneous ventilation include the requirement to maintain

a sufficient depth of anesthesia to obliterate airway reflexes and prevent patient movement during instrumentation yet maintain sufficient ventilatory function and hemodynamic stability. Thus, topical anesthesia to the airway is an important component of this technique.

A controlled ventilation technique, which may or may not consist of the administration of a neuromuscular blocker, relies on intermittent positive pressure breaths between apneic periods when the surgeon instruments the airway. Its advantages include the ability to provide optimal oxygenation and ventilation during the breathing phase, and assurance of lack of patient movement. Its obvious disadvantage is that during periods of apnea, even with preoxygenation, there is a limited time before oxyhemoglobin desaturation will occur, and the child will require additional positive pressure breaths. Another significant disadvantage is the lack of assurance that positive pressure ventilation will be successful with an obstructive lesion within the airway. In the case of a FB lodged within the bronchial tree, a theoretical disadvantage of positive pressure is the unintentional movement of the object distally. This can worsen airway exchange or create a ball-valve effect with hemodynamic consequences secondary to lung compression of vascular structures. This complication is rare.

What Complications Can Occur during Removal of the FB?

- Inadequate air exchange after the bronchoscope is inserted (spontaneous ventilation via the rigid bronchoscope increases dead space, work of breathing, and leakage of ventilating volumes resulting in reduced ventilation and oxygenation);
- Large objects may not fit through the rigid scope channel and may require excessive manipulation to remove
- Organic objects may crumble into pieces that need to be removed with multiple reinsertions of the bronchoscope and forceps
- Bronchospasm
- Pneumothorax or pneumomediastinum
- Tracheal or bronchial laceration
- Aspiration of gastric contents
- Hypoxemia and hypercarbia
- Arrhythmias or cardiac arrest

What Complications Can Occur after Removal of the Bronchial FB?

- Airway edema requiring continuous treatment with IV dexamethasone, inhaled racemic epinephrine, or humidified oxygen
- Pneumonitis from peanut oils if the diagnosis was delayed
- Post-obstructive pulmonary edema

Suggested Reading

- Fidkowski CW, Zheng H, Firth PG. The anesthetic considerations of tracheobronchial foreign bodies in children: a literature review. *Anesth Anal.* 2010;111(4):1016–25. PMID: 20802055.
- Zur KB, Litman RS. Pediatric airway foreign body retrieval: surgical and anesthetic perspectives. *Paediatr Anaesth.* 2009;19 Suppl 1:109–17. PMID: 19572850.