BC Children's Hospital Emergency Room Clinical Practice Guidelines

Bronchial Foreign Bodies

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Bronchial Foreign Bodies in Children

BACKGROUND:

Aspiration of foreign bodies results in significant morbidity and mortality in children. The majority of foreign body aspirations occur in children less than 4 years of age. Immature dentition, poor food control, activity during feeding, and propensity to explore the environment orally are some of the reasons why children are susceptible to foreign body aspiration.

LARYNGEAL FOREIGN BODIES:

Completely obstructive laryngeal foreign bodies cause acute respiratory distress and aphonia. Uncut hot dogs, uncut grapes, and gel candies (a.k.a 'fruit poppers') are the foods most commonly responsible for lethal choking. Popped balloons and marbles may also cause complete laryngeal obstruction. Retrieval of these objects requires institution of prompt basic life support measures, such as the Heimlich maneuver or rigid laryngoscopy and retrieval with McGill forceps. In older children, heroic maneuvers, such as cricothyroidotomy and/or rapid tracheotomy might be technically possible and allow bypass of the obstructed larynx.

Partially obstructive laryngeal foreign bodies include thin, sharp objects, such as holographic stickers, pencil shavings and ketchup wrappers. Although rare, these objects can become lodged between the vocal cords in the sagittal plane and cause dysphonia, a "croupy" cough and progressive biphasic stridor despite medications for presumed croup. Flexible laryngoscopy is often diagnositic of these radiolucent objects. Occasionally a large metal object, such as a fishhook or the hardware from a Christmas tree ornament may become a partially obstructive supraglottic foreign body, but these are usually readily diagnosed by history and radiology.

BRONCHIAL FOREIGN BODIES:

Aspirated foreign bodies most commonly lodge in the bronchi. Organic matter, especially nut fragments, account for the majority of aspirated objects. Raw carrots, unpopped popcorn kernels, raw apples and pears, and dried peas and beans are the other most common organic bronchial foreign bodies. Inorganic objects such as plastic toy parts and metal pins and thumbtacks make up a minority of cases.

Diagnosis of bronchial foreign body aspiration is challenging in children. There are several reasons for the delayed diagnosis. The aspiration event is often unwitnessed or denied by parents. Most aspirated objects are radiolucent. After the initial coughing paroxysm, there usually is a quiescent (relatively asymptomatic) phase for about a week before pneumonia or other complications may occur. The wheezing that is present during the quiescent phase is often attributed to viral infections or asthma and may initially respond to bronchodilators, steroids and/or antibiotics. Every year in our hospital, we encounter several cases in which the diagnosis of a bronchial foreign body has been delayed, sometimes for several weeks or longer. A high index of suspicion is required for prompt diagnosis. Any patient who has a severe coughing fit after oral exposure to a high risk object must be considered to have a bronchial foreign body until proven otherwise.

PATHOPHYSIOLOGY:

There are three pathophysiologic considerations for aspirated foreign bodies: the anatomy of the lodgment site, the physical properties of the foreign body (size, shape, and composition), and the local tissue reaction to the foreign body. For example, eggshells have a propensity to lodge in the larynx. This is due to the sharp, thin, and firm nature of eggshells making them suitable for lodgment between the vocal cords in the sagittal plane. For purposes of this guideline, we focus on bronchi as the primary anatomical site. The specific physical property of the object and the local reaction determine the risk category of the aspirated foreign body. 'High-risk' objects such as nuts create more morbidity in contrast to the 'low-risk' objects such as cereals.

EVALUATION:

There are three important diagnostic factors that determine the need for bronchoscopy: history, physical examination, and imaging modalities. History of choking is present in 75 to 90% of cases. Obtaining a history of choking therefore is an essential clue to diagnosis of bronchial foreign bodies. Physical examination is nonspecific and often similar to the examination of a child with reactive airway disease. The classic triad of wheeze, cough, and decreased breath sounds occurs in only one-third of all cases affected cases. This triad is more common when diagnosis is delayed. About 20% of patients with bronchial foreign bodies are totally asymptomatic. Inspiratory and expiratory chest radiographs are difficult to obtain in an uncooperative child. Despite this, in some series, up to 80% of retrieved bronchial foreign bodies demonstrated abnormal inspiratory and expiratory chest radiographs (FIGURE 1). Lateral decubitus chest radiographs and fluoroscopy are rarely used in our institution, but may be helpful for diagnosis in less cooperative children.

TREATMENT:

The most important element of treatment is prevention. Parents should be warned of the risk of death to young children from uncut hot dogs, uncut grapes, gel candies (a.k.a. fruit poppers), popped balloons and disc batteries. Hot dogs and grapes should be cut into small pieces until a child is at least five years old and has no developmental delay in terms of swallowing. Children should be taught to sit quietly while chewing and swallowing. A child's diet should be advanced slowly in terms of food textures.

Once identified, rigid bronchoscopy is almost always successful in retrieving the aspirated bronchial foreign body. For affected children, care at a tertiary center with a full array of pediatric bronchoscopic and anaesthetic equipment and expertise is highly recommended.

COMPLICATIONS:

Atelectasis, pneumonitis, bronchial granulomas, recurrent pneumonias, pneumomediastinum, bronchiectasis, plastic bronchitis, bronchocutaneous or bronchovascular fistulization are among the potential complications of untreated bronchial foreign bodies.

AIM:

The purpose of this guideline is to establish consistency in evaluation of children with bronchial foreign bodies. The aim is to reduce the morbidity associated with delayed diagnosis of these patients.

INCLUSION CRITERIA:

1) Stable children suspected of unilateral foreign body aspiration

EXCLUSION CRITERIA:

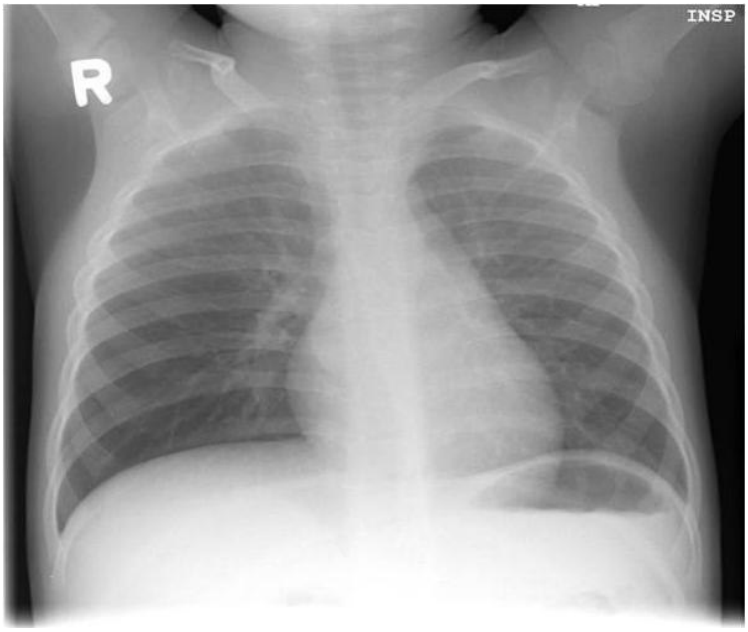
1) upper airway aspirations including laryngeal or pharyngeal aspirations presenting with upper airway obstruction signs and symptoms including stridor, croupy cough, hoarseness, aphonia
2) bilateral bronchial foreign body aspiration
3) clinically unstable children with decreased level of consciousness, airway compromise, respiratory failure (abnormalities of oxygenation and ventilation), and/or shock

KEY POINTS:

1) A history of witnessed episode of choking or acute respiratory distress should elicit suspicion of foreign body aspiration in the clinician.
2) Physical examination of a child with suspected foreign body aspiration focuses on identifying presence of focal wheeze or poor aeration.
3) The primary imaging modality utilized is inspiratory and expiratory chest radiographs looking for air trapping on expiration or unilateral atelectasis (FIGURE 1).
4) Suggestive findings in two out of the three evaluation tools (history, physical examination, and imaging) would implicate involvement of a pediatric otolaryngology for rigid bronchoscopy. (In other hospitals, the surgeon(s) with the most experience with rigid pediatric bronchoscopy and foreign body removal should be consulted).
5) Suggestive findings in one out of these three evaluation tools would implicate telephone consultation with pediatric otolaryngology and close follow-up.
6) Equivocal findings in any of these three evaluation tools would implicate close follow-up.

FIGURE 1:

INSPIRAOTRY VIEW

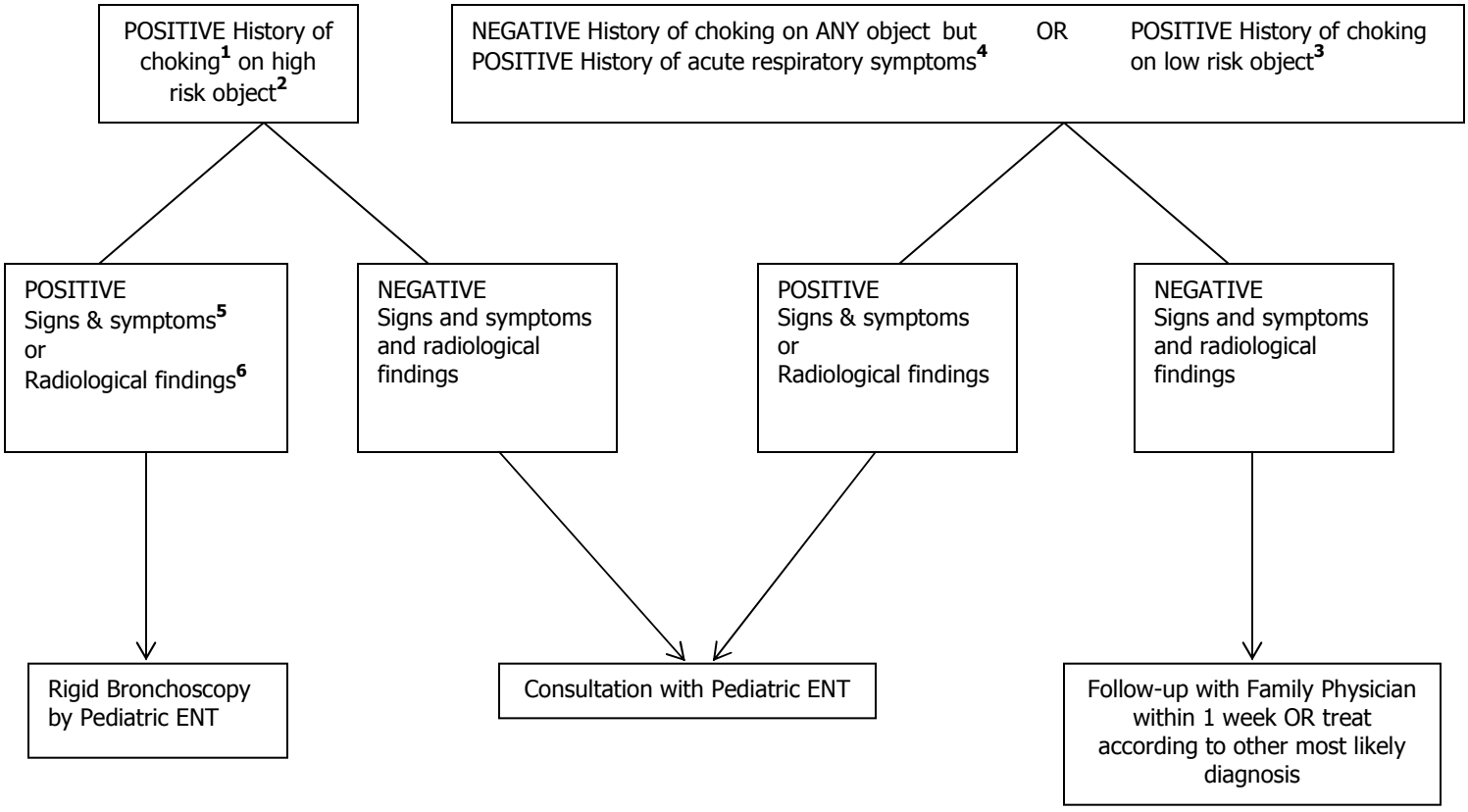


EXPIRATORY VIEW

NOTE: Left side deflates during expiration. Right side cannot deflate. There is right-sided air trapping (i.e. obstructive emphysema) due to partial obstruction (check valve) of the right main bronchus. Mediastinum shifts toward the unobstructed side. When obstruction becomes complete, then complications such as pneumonia or atelectasis ensue.

FLOWCHART:

Suspected Unilateral Bronchial Foreign Body Aspiration in a Clinically Stable Child



DEFINITIONS:

1. Choking: (in terms of a suspected airway foreign body) a witnessed episode of the child putting an object into his/her mouth which results in paroxysmal coughing lasting at least 1 minute (ie, a severe coughing fit suggests and airway foreign body, but gagging and retching without a coughing suggests a pharyngeal or esophageal foreign body)

2. High risk object: any small hard pieces of food, especially nuts or nut fragments, seeds, raw carrots, raw apples, raw pears, unpopped popcorn kernels, dried peas or beans*, or any small pieces of toys, plastic, metal, pebbles, stones or beads

   * note that dried peas and beans rapidly expand as they absorb moisture and therefore require urgent bronchoscopic removal.

3. Low risk object: processed dried cereal, wet noodles, chips, pretzels without nuts, soft or pureed foods, cheese

4. Acute respiratory symptoms: sudden onset of coughing and/or dyspnea in an otherwise healthy child

5. Positive signs and symptoms: persistent cough or focal wheezing or localized decreased air entry

6. Positive Radiological findings: air trapping with expiration (with or without mediastinal shift) or marked consolidation or marked atelectasis or radiopaque object.

7. Pediatric ENT: Pediatric Otolaryngology (the consult should go to the surgical service with the most experience with rigid pediatric bronchoscopy and foreign body removal).

REFERENCES:

Ayed A, Mohsen J, Owayed A. Foreign Body Aspiration in Children: Diagnosis and Treatment. Pediatr Surg Int. 2003;19(6):485-8.

Chiu CY, Wong KS, Lai SH, et al. Factors Predicting Early Diagnosis of Foreign Body Aspiration in Children. Pediatr Emerg Care. 2005; 21(3):161-164.

Lea E, Nawaf H, Yoav T, et al. Diagnostic Evaluation of Foreign Body Aspiration in Children: A Prospective Study. J Pediatr Surg. 2005;40(7):1122-7.

Ludemann JP, Hughes CA, Holinger LD. Management of Foreign Bodies of the Airway. In: Shields TW, LoCicero J, Ponn RB, editors. General thoracic surgery. Vol. 1. 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2000. p. 853-862.

Metrangelo S, Monetti C, Meneghini L, et al. Eight years' Experience with Foreign Body Aspiration in Children: What is Really Important for a Timely Diagnosis? J Pediatr Surg. 1999;34(8):1229-31.

Midulla F, Guidi R, Barbato A, et al. Foreign Body Aspiration in Children. Pediatr Int. 2005;47(6):663-8.

Morley RE, Ludemann JP, Moxham JP, et al. Foreign Body Aspiration in Infants and Toddlers: Recent Trends in British Columbia. J Otolaryngol. 2004; 33(1):37-41.

Oguz F., Citak A, Unuvar E, Sidal M. Airway Foreign Bodies in Childhood. Int J Pediatr Otorhinolaryngol. 2000;52(1):11-6.

Rovin J, Rodgers B. Pediatric Foreign Body Aspiration. Pediatr Rev. 2000; 21(3):86-90.

Schmidt H, Manegold BC. Foreign body aspiration in children. Surg Endosc. 2000; 14(7):644-8.

Schunk JE. Foreign Body – Ingestion/Aspiration. In: Fleisher GR, Ludwig S, Henretig FM, editors. Textbook of Pediatric Emergency Medicine. 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2006. p. 307-314.

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