Asthma Mimickers: A Case Based Approach

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March 1, 2014
Objectives

• Discuss possible causes of wheezing/cough and their treatment
• Discuss case presentations to better illustrate causes of wheezing/cough other than asthma
• Explain differences between those causes and asthma
• Identify hallmarks of clinical presentation of endobronchial foreign body
Grand Rounds 8-9am
Cook Children’s Medical Center, Hochberger Auditorium

“Asthma Mimickers with A Focus on Foreign Body Aspiration”
March 18, 2014
Disclosure

• No financial relationships to disclose
“If I can put everyone to sleep within the first five minutes, the rest of my presentation should go pretty well.”
Case Presentation

• 5 year old male with dry intermittent cough and occasional wheezing x 7 months
• Cough described as harsh, occurring day and night
• Per mother, occurs more frequently during temporal changes in weather (i.e., cold air), exercise, and “when mountain cedar levels are high”
Case Presentation

• No relation to feeds
• Denies sinus symptoms
• Symptoms NOT relieved by Albuterol
• Treatments tried:
  – Multiple short courses of oral steroids
  – Patient started on inhaled steroids
  – 10 day course of antibiotics
• Referred to pulmonary
What is “wheezing?”

- Defined as a continuous musical expiratory sound caused by intrathoracic airway obstruction
- Produced by oscillation of opposing walls of an airway that are narrowed to the point of closure

Wheezing

• Often confused with:
  – “Rattling” (congestion)
  – A high pitched inspiratory noise (stridor)
  – A low pitched inspiratory noise (snoring)
Wheezeing—exam findings

• Asthma/Lower airway obstruction: classically demonstrate high-pitched musical expiratory sounds, varying in tone and timing ("polyphonic")

• Localized bronchial narrowing: single pitch, begins/ends at same time ("monophonic")
What is “asthma”? 

- Characterized by:
  - Hyperresponsiveness of the airways to various stimuli, leading to reversible airway obstruction
  - Airway obstruction result of bronchospasm and inflammation/mucosal edema
  - Reversibility with treatment a key component
Asthma

- Significant phenotypic variability
- Variability in clinical presentation can lead to overdiagnosis, underdiagnosis, and misdiagnosis of asthma
“All that wheezes is not asthma, and all that is asthma does not wheeze.”

--A very wise person
When symptoms persist despite conventional asthma therapy, or when classic symptoms do not exist, one must consider other diagnoses.
Differential diagnosis of wheezing

- Asthma
- Vocal cord dysfunction
- GER
- Chronic aspiration
- Tracheomalacia/Bronchomalacia
- Foreign body aspiration
- Cystic fibrosis
- Primary ciliary dyskinesia
- Immunodeficiency
- Cardiac disease/Vascular compression
- Bronchiolitis obliterans
Differential diagnosis of wheezing/cough

- Asthma
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Case #1

- 10 year old female presenting for shortness of breath with activity
- Patient reports mid-sternal chest pain, wheezing
- Symptoms relieved by rest
- Diagnosed with asthma, allergic rhinitis
- Tried Albuterol, Singulair in past, but did not improve symptoms
- Fam Hx: brother with asthma
Case #1

- Due to dyspnea on exertion, seen by Cardiology, Echo done (normal); 6 min walk test normal
- Patient continued on Albuterol prn
- Seen in f/u 1 month later: symptoms not better
- Upon further questioning, patient describes dyspnea with stressful situations, also throat tightness and difficulty getting air in
- Albuterol not relieving symptoms
Case #1

• Given constellation of symptoms and PFT findings, vocal cord dysfunction is suspected; patient referred to speech therapy after being taught abdominal breathing exercises in clinic

• After meeting with speech therapist, practicing breathing exercises, patient no longer having symptoms, and no longer using bronchodilator
Vocal cord dysfunction

- Involves paradoxical closure of the vocal cords during inspiration and sometimes expiration, producing obstructive symptoms
- Also known as paradoxical vocal fold movement
Vocal cord dysfunction

- First described in 1842 by Dunglison
- Described disorders of the laryngeal muscles brought on by “hysteria”
- 1974—Patterson et al. “Munchausen’s stridor”
- 1983—Christopher et al described group of patients, mainly female, ages 20-40, many with history of abuse

Vocal cord dysfunction

• Classic presentation:
  – Stridor
  – Throat tightness
  – Refractory asthma
  – Female predominance (2-3 times as likely)

• Triggers:
  – Strong emotions/stress
  – Exercise
  – GER
Vocal cord dysfunction

- Classic patient: adolescent female, type A personality, straight “A” student, extracurricular activities (cheerleading, gymnastics, swimming)
- Concomitance with asthma—30-60%
## Comparing Asthma and VCD Exacerbations

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<thead>
<tr>
<th></th>
<th>Asthma</th>
<th>Vocal cord dysfunction</th>
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<tr>
<td><strong>Time of onset</strong></td>
<td>Within minutes</td>
<td>Within seconds</td>
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<tr>
<td><strong>Dyspnea during</strong></td>
<td>Expiration</td>
<td>Inspiration</td>
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<td><strong>Area of obstruction</strong></td>
<td>Lower airways</td>
<td>Throat</td>
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<td><strong>Effect of inhalers</strong></td>
<td>Highly effective</td>
<td>Often ineffective</td>
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<td><strong>Triggers</strong></td>
<td>Irritants, exercise, allergens</td>
<td>Irritants, exercise, stress</td>
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<tr>
<td><strong>Hypoxemia?</strong></td>
<td>More common—due to V/Q mismatch</td>
<td>Less common—due to hypoventilation</td>
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</table>
Pulmonary function tests
Pulmonary function tests

Fixed Obstruction: Intra or Extra thoracic

Extra thoracic obstruction (variable)

Intra thoracic obstruction (variable)
VCD Treatment

• Involves breathing techniques to help manage the vocal cords, usually taught by a speech pathologist
  – Effective in 80-90% of patients if done correctly

• Anticholinergics (Ipratropium bromide inhaled) also have been shown to be of some use, esp in exercise related VCD

• Prognosis favorable
Case #2

• 7 month old male with recurrent wheezing since birth, worse after recent RSV infection
• Occurs daily, day and night
• Multiple courses of oral steroids
• Started on budesonide 0.25 mg BID inhaled
• Also started on trial of lansoprazole x 1 month
Case #2

- Mom reports frequent spitting up, along with wheezing during/after feeds
- Patient otherwise neurologically normal
- Flexible bronchoscopy done, shows normal anatomy, occasional lipid-laden macrophages
- Swallow function study done—demonstrates aspiration, thickened feeds recommended
Case #2

- Only minimal relief provided, mom electively stops lansoprazole.
- Repeat swallow function study done at 11 then 15 months continues to demonstrate aspiration.
- Referred to ENT for further evaluation.
- Rigid bronchoscopy performed, demonstrates type 1 laryngeal cleft.
Swallow Dysfunction/Chronic Aspiration
Congenital causes of swallow dysfunction

- Developmental
- Anatomic
- Neurologic/Neuromuscular
Laryngeal Cleft

Type I
Type II
Type III
Type IV

Courtesy of: http://speech-language-pathology-audiology.advanceweb.com/Article/Laryngeal-Cleft-1.aspx
Retrospective review of patients referred to Pediatric Pulmonary center for recurrent wheezing/stridor/cough over 3 year span

112 patients otherwise healthy, term infants underwent VSS and 24-h pH probe as part of workup

Aspiration and Wheezing

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of Infants</th>
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<tbody>
<tr>
<td>Both studies normal</td>
<td>55 infants (49%)</td>
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<tr>
<td>Abnormal pH probe</td>
<td>18 infants (16%)</td>
</tr>
<tr>
<td>Abnormal VSS</td>
<td>13 infants (11.6%)</td>
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<tr>
<td>Both pH probe and VSS abnormal</td>
<td>26 infants (23%)</td>
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<td>Severity of Aspiration on VSS</td>
<td>Management</td>
</tr>
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<td>--------------------------------------------------------</td>
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<tr>
<td>Aspiration on thin consistencies alone (n = 7)</td>
<td>Thickened feeds</td>
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<tr>
<td>Aspiration on thin and semi-thick consistencies (n = 2)</td>
<td>Thickened feeds</td>
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<tr>
<td>Aspiration (n = 4)</td>
<td></td>
</tr>
<tr>
<td>Thin/semi-thick</td>
<td>NJ feeds (n = 3)</td>
</tr>
<tr>
<td>Thick</td>
<td>Gastrostomy tube feeds (n = 1)</td>
</tr>
</tbody>
</table>
Case #3

• 18 month old male seen for recurrent bronchitis
• Mom reports daily congestion, with purulent nasal drainage, and daily wet/dry cough
• Has had several episodes of otitis media, with chronic otorrhea, and underwent tympanostomy tube placement; he continues to have drainage
Case #3

- Birth history significant for NICU stay for transient tachypnea of the newborn and O2 requirement; patient in NICU x 11 days
Chest X-ray
Case #3

- Patient underwent bronchoscopy with ciliary brush biopsy
- Diagnosis of primary ciliary dyskinesia (Kartagener syndrome) is confirmed
Primary ciliary dyskinesia
Primary ciliary dyskinesia

- Also known as immotile ciliary syndrome, Kartagener syndrome/triad
- First described in early 1900s
- 1933-Kartagener describes patients with chronic sinusitis, bronchiectasis, and situs inversus totalis
- 1976-discovery that these patients have defective ultraciliary structure

• Estimated incidence 1:10,000-20,000 live births
• Less than 1,000 confirmed cases in United States
• Underdiagnosed; Why?
  – Cardinal signs/symptoms under-recognized by clinicians
  – Diagnostic tools not readily available
Ciliary structure and function

- 9+2 configuration
- Coordinated movement responsible for clearing bacteria and toxic substances from the conducting airways, paranasal sinuses, middle ear and reproductive tract
- Also important during embryogenesis

Clinical symptoms

- Respiratory distress in neonatal period
  - 75-80% of patients with PCD have history of TTN, hypoxemia, and/or neonatal pneumonia
- Daily rhinitis and wet cough
- Chronic sinusitis and recurrent otitis media
- Progression to bronchiectasis
- Microbiome similar to that seen in cystic fibrosis
- Lung function decline not as marked as seen in CF
Non-pulmonary manifestations

- Situs inversus totalis
  - ~40-50% of patients with PCD have “Kartagener syndrome”
  - Heterotaxy, asplenia
- Infertility
- Pectus deformities
Diagnosis

• Can be difficult
• Three methods:
  – (1) Evaluation of ciliary ultrastructure via electron microscopy
    • Can be done with nasal epithelium or via bronchoscopy
    • Nasal epithelium MUST be healthy
    • Changes can be SECONDARY, and thus, false positives can be seen
    • Normal ultrastructure in about 30% of patients with PCD
Diagnosis

• Three methods:
  – (2) Nasal nitric oxide
    • Low in patients with PCD
    • Useful in patients >5 years of age
    • Only available at highly specialized centers
  – (3) Genetics
    • So far, PCD-causing mutations described in 32 genes
    • Accounts for 65-70% of patients with PCD
    • Two commercial labs available
    • Expensive
Management

• Much extrapolated from CF and non-CF bronchiectasis

• **Lung disease:** Airway clearance, antibiotic therapy, anti-inflammatory and mucolytic agents

• **Ear disease:** Placement of PE tubes controversial, as chronic otorrhea is a problem

• **Chronic sinusitis:** sinus rinses, nasal steroids, sinus surgery if needed

• Life expectancy is usually normal (compare with CF)
## Findings to suggest other etiologies

### History
- Onset early in infancy
- Neurologic dysfunction
- Wheezing with/after feeds
- Diarrhea
- Poor weight gain
- Stridor
- O2 requirement >1 week after onset

### Exam and Other findings
- Clubbing
- Murmur
- Stridor
- Focal signs-- exam/CXR
- Crackles on exam
- Recurrent/prolonged cyanosis or hypoxemia
- Anemia
- Irreversible airflow obstruction

Fakhoury KF. *Up to date* 2012.
Approach to chronic wheeze or cough

- First line
  - CXR
  - PFTs

- Second line
  - Trial of GER therapy
  - Sweat test
  - Infectious workup (Pertussis, TB, Mycoplasma)

- Based on H & P
  - GI studies (pH/impedance study, swallow function, Upper GI)
  - Bronchoscopy
  - Ciliary biopsy
  - Echo
  - Sinus CT
  - Chest CT
  - Immune workup

**when asthma therapies aren’t working**
“Maybe we should wait for the radiologist for the official read...”
Case #4

- 7 month old female with h/o GER seen at OSH for “sounding hoarse”
- Also with wheezing/barky cough along with difficulty breathing
- Given IV methylprednisolone, racemic epinephrine, albuterol, ceftriaxone, then transferred to CCMC for suspected croup
- On exam, noted to have significant stridor/wheezing, tachypnea, and sternal retractions
• Due to significant increase in work of breathing, patient transferred to PICU
• Pediatric surgery consulted due to suspicion of foreign body
• Rigid bronchoscopy performed
Foreign Body Aspiration
Foreign body aspiration

- Most common cause of accidental death in children < 1 year of age
- Accounts for approximately 7% of deaths in the US in children younger than 4 years of age
- 80% of aspiration events in children occur under 3 years of age
- Reasons include lack of molar teeth, exploration of objects, and poor swallowing coordination
Three phases of FB aspiration

• (1) Initial stage: choking episode followed by coughing, gagging, and airway obstruction
  – Choking event elicited in 80% of cases

• (2) Asymptomatic period

• (3) Symptoms of complications: cough, wheezing
  – Rate of serious complications, including bronchiectasis, pneumonia, is 2.5x higher when diagnosed more than 24 hours after event
## Objects aspirated

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<thead>
<tr>
<th>Nature</th>
<th>Number</th>
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<tbody>
<tr>
<td>Organic FB</td>
<td>1751</td>
<td>66.7</td>
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<td>Peanuts</td>
<td>1119</td>
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<td>Sunflower seed</td>
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<tr>
<td>Almonds</td>
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<tr>
<td>Ears of wheat</td>
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<td>Acorns</td>
<td>34</td>
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<td>Beans</td>
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<td>Bones</td>
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<td>Pistachio</td>
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<td>Others</td>
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<td>Inorganic FB</td>
<td>676</td>
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<td>Metal</td>
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<td>Scarf pins</td>
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<td>Pins, nails, screws</td>
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<td>Others</td>
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<tr>
<td>Plastic</td>
<td>230</td>
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<tr>
<td>Pen caps</td>
<td>136</td>
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<td>Pearls</td>
<td>31</td>
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<tr>
<td>Others</td>
<td>63</td>
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<tr>
<td>Miscellaneous: stones, small light bulb, etc.</td>
<td>174</td>
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<td>197</td>
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</table>

### Location of Aspirated foreign body

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Period and type of study</th>
<th>Total no. of children</th>
<th>Age (years)</th>
<th>Sex (% male)</th>
<th>Distribution of inhaled foreign bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baharloo et al. 1999 [1]</td>
<td>Belgium</td>
<td>1976–1996 Retrospective</td>
<td>84</td>
<td>Mean 2.6±1.3</td>
<td>60</td>
<td>Right bronchial tree 50%</td>
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<td>≥3: 34%</td>
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<tr>
<td>Tokar et al. 2004 [19]*</td>
<td>Turkey</td>
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<td>Peripheral 2%</td>
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<td>Divisi et al. 2007 [10]</td>
<td>Italy</td>
<td>1986–2004 Retrospective</td>
<td>121</td>
<td>Mean 6 (range 4–8)</td>
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<td>Left bronchial tree 18%</td>
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<td>Tracheal 8%</td>
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Rigid bronchoscopy

• Therapeutic modality of choice

• Advantages:
  – Control of the airway
  – Visualization
  – Manipulation of object with wide variety of forceps

• Negative bronchoscopy rate 10-61%
Rigid Bronchoscopy--Complications

- Major iatrogenic complications <1%
- Include:
  - Laryngeal edema and/or bronchospasm
  - Pneumothorax/pneumomediastinum
  - Cardiac arrest
  - Hypoxic brain injury
  - Airway laceration
Flexible bronchoscopy

- Aids in diagnosis by visualization
- Ability to evaluate for distal FB
- Can be done with moderate sedation
- Less complication rate
- Has been more recently used for FB extraction (success rate 91-95%)
Flexible Bronch vs. Rigid Bronch

• Flexible—Less control of airway, also smaller forceps
• Rigid—higher complication rate
• American Thoracic Society recommendation: “Under most circumstances removal of foreign bodies and abnormal tissue should be carried out with the rigid bronchoscope”
Is it over yet???
Diagnosis of FBA
• Unfortunately, with regards to FBA, history and physical exam associated with low sensitivity/specificity

• Adjunctive diagnostic studies have been shown to help reduce negative rigid bronchoscopy rate (from 18%→2% in one study)
Diagnostic studies

- Plain view CXR
- Special view CXRs
- Chest CT
- Flexible bronchoscopy
Chest X-ray findings

- Only approximately 10% of FB objects are radiopaque
- Indirect signs:
  - Obstructive emphysema/Unilateral hyperinflation (inspiratory/expiratory films)
  - Atelectasis
  - Mediastinal shift
- Airway fluoroscopy
What about adjunctive chest radiographs (i.e., expiratory or decubitus films)?
• Retrospective study from Seattle Children’s Hospital, 1997-2008
• 328 patients underwent standard view CXRs in addition to special view CXRs
<table>
<thead>
<tr>
<th>Radiographs</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decubitus radiographs (n=194)</td>
<td>Standard 2-view</td>
<td>0.56</td>
</tr>
<tr>
<td>Standard 2-view + decubitus</td>
<td>0.56</td>
<td>0.64</td>
</tr>
<tr>
<td>Expiratory radiographs (n=134)</td>
<td>Standard 2-view</td>
<td>0.33</td>
</tr>
<tr>
<td>Standard 2-view + expiratory</td>
<td>0.62</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Conclusions—special view radiographs

- Overall obtaining CXR added to likelihood of a foreign body if CXR suggestive (vs. history/PE alone)
- Findings demonstrated lack of clinical benefit with use of adding decubitus films
- Adding expiratory films showed an increase in true positives without adding false positives, but test accuracy was low
### Table 1  
Sensitivity (Sens.) and specificity (Spec.) of clinical history (penetration syndrome), chest examination, chest radiograph and chest CT for the diagnosis of bronchial foreign body according to various studies.

<table>
<thead>
<tr>
<th></th>
<th>Penetration syndrome</th>
<th>Chest examination</th>
<th>Chest radiograph</th>
<th>Chest CT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sens. (%)</td>
<td>Spec. (%)</td>
<td>Sens. (%)</td>
<td>Spec. (%)</td>
</tr>
<tr>
<td>Heyer CM, 2006</td>
<td>75.4</td>
<td>92.1</td>
<td>56.6</td>
<td>65.8</td>
</tr>
<tr>
<td>Righini CA, 2007</td>
<td>88</td>
<td>10</td>
<td>88</td>
<td>30</td>
</tr>
<tr>
<td>Ciftci AO, 2003</td>
<td>91</td>
<td>46</td>
<td>86</td>
<td>26</td>
</tr>
<tr>
<td>Ayed AK, 2003</td>
<td>82</td>
<td>38</td>
<td>80</td>
<td>72</td>
</tr>
<tr>
<td>Hong SJ, 2008</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cevizci N, 2008</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haliloglu M, 2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Flexible bronchoscopy is commonly used in diagnosing foreign body when diagnosis is in question.
- Close to 100% sensitive and specific.
## Diagnosis—CT vs Flex Bronch

<table>
<thead>
<tr>
<th></th>
<th>Multidetector CT</th>
<th>Flexible Bronchoscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantages</strong></td>
<td>Rapid</td>
<td>High sensitivity</td>
</tr>
<tr>
<td></td>
<td>No sedation needed</td>
<td>High specificity</td>
</tr>
<tr>
<td></td>
<td>Noninvasive</td>
<td>Distal aspiration (small objects)</td>
</tr>
<tr>
<td></td>
<td>High sensitivity</td>
<td></td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>False positives due to mucus plugging</td>
<td>Invasive</td>
</tr>
<tr>
<td></td>
<td>Radiation</td>
<td>Requires sedation</td>
</tr>
</tbody>
</table>

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**Diagnosis—CT vs Flex Bronch**
image gently® when we care for kids! The image gently® Campaign is an initiative of the Alliance for Radiation Safety in Pediatric Imaging. The campaign goal is to change practice by increasing awareness of the opportunities to promote radiation protection in the imaging of children.

Image Gently Impact

The Image gently campaign launched 1/22/08. This is a snapshot of what has happened since:

21,393 medical professionals have taken the pledge

Upcoming Conferences Click here to view upcoming meetings around the world where Image Gently will be represented.
<table>
<thead>
<tr>
<th>Clinical investigation [n (%)]</th>
<th>FBA+</th>
<th>FBA−</th>
<th>P</th>
<th>Odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auscultation</td>
<td>90 (74)</td>
<td>24 (63)</td>
<td>.223</td>
<td>1.6 (0.76-3.55)</td>
</tr>
<tr>
<td>Percussion</td>
<td>2 (2)</td>
<td>0 (0)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Decreased breath sounds</td>
<td>69 (57)</td>
<td>13 (34)</td>
<td>.025</td>
<td>2.5 (1.17-5.35)</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>41 (34)</td>
<td>12 (32)</td>
<td>1.0</td>
<td>1.1 (0.5-2.4)</td>
</tr>
<tr>
<td>Choking crisis</td>
<td>92 (75)</td>
<td>3 (8)</td>
<td>&lt;.001</td>
<td>35.8 (10.3-124.8)</td>
</tr>
<tr>
<td>Cough on admission</td>
<td>50 (41)</td>
<td>17 (45)</td>
<td>.710</td>
<td>0.86 (0.4-1.8)</td>
</tr>
<tr>
<td>Fever on admission</td>
<td>20 (16)</td>
<td>7 (18)</td>
<td>.806</td>
<td>0.87 (0.34-2.25)</td>
</tr>
<tr>
<td>Radiologic signs [n (%)]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infiltrate</td>
<td>23 (19)</td>
<td>6 (16)</td>
<td>.811</td>
<td>1.2 (0.46-3.31)</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>10 (8)</td>
<td>1 (3)</td>
<td>.462</td>
<td>3.3 (0.4-26.7)</td>
</tr>
<tr>
<td>Bronchial wall thickening</td>
<td>8 (7)</td>
<td>2 (5)</td>
<td>1.0</td>
<td>1.3 (0.3-6.2)</td>
</tr>
<tr>
<td>Focal hyperinflation</td>
<td>76 (62)</td>
<td>1 (3)</td>
<td>&lt;.001</td>
<td>61.1 (8.1-460.7)</td>
</tr>
<tr>
<td>Mediastinal shift</td>
<td>25 (21)</td>
<td>1 (3)</td>
<td>.01</td>
<td>9.5 (1.3-73.0)</td>
</tr>
<tr>
<td>Radiopaque foreign body</td>
<td>5 (4)</td>
<td>0 (0)</td>
<td>.34</td>
<td></td>
</tr>
<tr>
<td>Laboratory findingsb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRP (mg/dL; mean ± SD)</td>
<td>2.5 ± 6.6</td>
<td>1.0 ± 1.3</td>
<td>.029</td>
<td></td>
</tr>
<tr>
<td>CRP &gt;0.6 mg/dL [n (%)]</td>
<td>17/101 (17)</td>
<td>4/37 (11)</td>
<td>.438</td>
<td>1.67 (0.56-4.33)</td>
</tr>
<tr>
<td>WBC count (1/μL; mean ± SD)</td>
<td>15,002 ± 6752</td>
<td>11,516 ± 5276</td>
<td>.005</td>
<td></td>
</tr>
<tr>
<td>WBC count &gt;10,000/μL</td>
<td>86/111 (78)</td>
<td>19/37 (51)</td>
<td>.004</td>
<td>3.3 (1.4-7.7)</td>
</tr>
</tbody>
</table>

Fig. 3 Cumulative proportions of pFBA by number of risk factors (focal hyperinflation on chest radiograph, witnessed choking crisis, and/or WBC count >10,000/μL).
Predictors of FBA

• Studies indicate poor correlation among event history, hospital presentation, and imaging to prove the absence of foreign body

• If index of suspicion exists, diagnostic bronchoscopy should be performed

Choking can be prevented. Food accounts for over 50% of choking episodes. Be alert for small objects that can cause choking, such as coins, buttons, and small toys. Check under furniture and between cushions for small items that children could find and put in their mouths. Toys are designed to be used by children within a certain age range. Age guidelines take into account the safety of a toy based on any possible choking hazard. Don’t let young children play with toys designed for older children. Latex balloons are also a choking hazard. If a child bites a balloon and takes a breath, he could suck it into his airway.

**Choking Hazard Items**

Keep items that are choking hazards away from babies and young children. These include:

- Coins
- Buttons
- Toys with small parts
- Toys that can fit entirely in a child’s mouth
- Small balls, marbles
- Balloons
- Small hair bows, barrettes, rubber bands
- Pen or marker caps
- Small button-type batteries
- Refrigerator magnets
- Pieces of dog food
Summary

• Not all that wheezes IS asthma, and with a good history/physical exam, other entities can be differentiated and managed

• Foreign body aspiration is a common life-threatening emergency; diagnosis can be difficult, esp with lack of significant exam/diagnostic findings

• If an index of suspicion exists, careful airway evaluation MUST be considered
Findings to suggest other etiologies

**History**
- Onset early in infancy
- Neurologic dysfunction
- Wheezing with/after feeds
- Diarrhea
- Poor weight gain
- Stridor
- O2 requirement >1 week after onset

**Exam and Other findings**
- Clubbing
- Murmur
- Stridor
- Focal signs-- exam/CXR
- Crackles on exam
- Recurrent/prolonged cyanosis or hypoxemia
- Anemia
- Irreversible airflow obstruction

Fakhoury KF. *Up to date* 2012.
Questions?