Masqueraders of Asthma: Wheezing in Infants & Children

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All that wheezes is not asthma…

(Chevalier Jackson, MD)

…but often it is!
How is This Child Different?

- History
- Physical examination
  - Physiological differences
- Pulmonary function studies
- Imaging
- Endoscopy

Historical Clues

- Perinatal respiratory problems
  - Prematurity? BPD? Airway intubation?
- Timing of symptoms
  - At rest / with exercise or crying
  - During feedings vs after feedings
- Recurrence vs Persistence
  - Dynamic vs fixed process
- Response to prior therapies
Physical Examination

Inspiration

Expiration

WHEEZING
Noise Reflects the Anatomic Site of Obstruction
Human Tracheal Compliance

Factors Affecting Collapse of Large Airways

- Pleural pressure
- Intraluminal pressure
- Intrinsic rigidity (compliance) of airway wall

Effect of Collapsing Pressures on Tracheal Cross-Sectional Area

Effect of Peripheral Obstruction

• Bronchiolitis
• Asthma
• Vocal cord dysfunction

Heterophonous Wheezing

• Asthma
• Cystic Fibrosis
• Gastroesophageal reflux
• Local or systemic immune deficiency
Asthma: Key Diagnostic Elements - The R’s

- Recurrence
  - vs persistent
- Response to bronchodilators
  - Clinical, objective measurements
- Reaction to “triggers”
  - viral infections, allergens, smoke
- absence of unassociated findings (exclude other diagnoses)

Heterophonous Wheezing: Danger Signs

- Poor growth
  - Intestinal malabsorption
  - Recurrent infections
- Recurrent sinopulmonary infections
  - Extrapulmonary infections
- Digital clubbing
- Neonatal distress
GERD and Asthma

- Both diseases occur frequently
  - 5-12% children with asthma
  - 8-13% infants and children with GERD
- Nocturnal or post-prandial symptoms
  - 44% wheezing infants with abnormal pH probes had no sx$s^1$
- Not all studies demonstrate improvement with GERD Rx$^2$

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$^2$Writing Committee for ALA Asthma Clinical Research Centers. JAMA 307:373; 2012

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Asthma       GER

- Vagal reflexes
- Neurogenic inflammation
  - Substance P
  - Neurokinin A
- Microaspiration
- Heightened bronchial reactivity

Scarupa MD et al. Pediatr Drugs 7:177; 2005
Homophonous Wheezing

- Foreign body aspiration
- Non-structural
  - Gastroesophageal reflux
  - Retained foreign body
  - Chronic bacterial bronchitis

Foreign Body Aspiration
Clinical Findings

- Unequal breath sounds
- Localized wheezes
- History of choking episode *absent* in 30%
Foreign Body Aspiration
Radiographic Findings

- Localized hyperinflation
- Localized atelectasis
- Differential density

- Inspiratory / Expiratory films
- Decubitus views

*A normal radiograph cannot RULE OUT a Retained Foreign Body

- 10 month old with 3 month history of wheezing
- Hospitalized at 7 months for wheezing, treated with bronchodilators and steroids
- Improved, but wheezing never resolved
  - Homophonous wheezing
2 yo with wheezing
Foreign Body Aspiration

Management

- If HIGHLY SUSPECTED
  - Open tube (rigid) bronchoscopy

- If POSSIBLE but NOT HIGHLY SUSPECTED
  - May consider flexible bronchoscopy
Chronic Bacterial Bronchitis  
(Protracted Bacterial Bronchitis)

- Longstanding wheeze with “wet” cough
- Protracted infection of conducting airways
  - Non-typable *Haemophilus influenzae*
  - *Moraxella catarrhalis*
  - *Streptococcus pneumoniae*
- Biofilms, impaired mucociliary clearance
- No identifiable immunodeficiencies
- Definitive dx: bronchoscopy and BAL

*Craven V et al. Arch Dis Child 98:72; 2013*

Homophonous Wheezing

- Tracheomalacia / bronchomalacia
- Vascular compression / Rings
- Tracheal stenosis / webs
- External compression
- Intraluminal masses
Tracheomalacia

Clinical Considerations

- Often “happy wheezers”
- May worsen obstruction after bronchodilator therapy
- Can often improve with bronchconstrictor therapy
  - Bethanechol
  - Ipratropium

Tracheomalacia

- Congenital
  - Tracheoesophageal fistula
  - Vascular compression
  - Isolated

- Acquired
  - Mechanical ventilation
  - Severe peripheral obstruction

Hysinger EB and Panitch HB.
Normal Trachea

Intrathoracic Tracheomalacia
Wheezing in Congenital Heart Disease

- Mucosal edema with airway narrowing
- Enlarged (hypertensive) pulmonary arteries
- Vascular rings
Anomalous Innominate Artery
Double Aortic Arch


Complete Tracheal Rings
Choosing a path...

- Exclude “red flags” or specific diagnoses
- Presence of “3R”s
  - Ask: How is this not like asthma?
- Consider trial of anti-asthma therapy
- Need to objectively monitor response

Evaluation of Wheezing

**Main Studies**

- Chest radiograph - 2 views
- Chest CT(A) (insp and exp)
- MR/MRA
- Pulmonary function testing
  - Clinical response to β agonist
  - Bronchoscopy +/- BAL
10 year girl
"Asthma" x 3 yrs
Ex preemie
Biphasic wheeze
? Response to Rx

Dx.: subglottic Stenosis
Rx: surgical

Evaluation of Wheezing
Adjunctive Studies

- Sweat test
- Immunological evaluation
- Airway fluoroscopy
- pH probe / gastric scintigraphy
Summary

• Timing and quality of the sound help distinguish site(s) of obstruction
• Response to prior therapies can direct subsequent evaluation
• Establishing the site of obstruction leads the diagnostic evaluation