What’s the reason for the wheezing?

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Pediatric Grand Rounds
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All that wheezes is not asthma!
Chevalier Jackson

Objectives

• Distinguish stridor from wheeze
• Distinguish the classic history for vocal cord dysfunction compared to that for asthma
• Develop a relevant differential diagnosis and management plan for an infant or child with wheeze

Case 1 History

• 15 year old female presents to the ED with difficulty breathing and “wheezing”
• “Difficulty getting the air in”
• Dyspnea
• Tightness in the throat for the past 15 minutes

Physical Examination

• Similar symptoms starting 3 months ago with gym class and soccer
• Symptoms are becoming more frequent
• In between episodes she is asymptomatic
• Albuterol does not prevent her symptoms
**Stridor** | **Wheeze**
---|---
Usually inspiratory, can be biphasic | Expiratory, can be biphasic
Upper (extrathoracic) airway | Lower (intrathoracic) airway
Continuous noise | Discontinuous noise; Monophonic or polyphonic
Not responsive to bronchodilator | May or may not be responsive to bronchodilator

**Vocal Cord Dysfunction (VCD)**

**Variable Upper Airway Obstruction**

**Persistent Adduction of the Vocal Cords**

**VCD**
- History
  - Dyspnea (76-95%)
  - More trouble getting air “in”
  - Cough
  - Noise breathing in (stridor)
  - Tightness in the throat and chest
  - Neck pain
  - Hoarseness
  - Dysphonia
  - Numbness or tingling in hands, feet or lips
  - Lightheaded or dizzy
- Physical Examination
  - Stridor during an attack
  - If present, wheezing is biphasic and loudest over the larynx and large airways
  - Pulse oximetry is normal
VCD

- Extrathoracic obstruction
- Rapid onset and rapid resolution
- Refractory to asthma Rx
- Anxiety preceding
- Can hold breath
- Resolution in sleep
- Normal ABG/pulse oximetry
- Normal CXR

Asthma

- Intrathoracic obstruction
- Insidious onset and slower to resolve
- Bronchodilators help
- Anxiety following
- Can't hold breath
- Symptomatic in sleep
- Abnormal ABG/pulse oximetry
- Hyperinflated, peribronchial thickening or atelectasis on CXR

Etiology

- Athletes
- Laryngeal hyperresponsiveness
  - Irritant induced
  - GERD
- Post-nasal drip
- Psychologic (functional) causes
  - Depression, Anxiety, Obsessive compulsive disorder, conversion disorder
- Comorbidity with Asthma or GERD

Acute Management

- Common:
  - Reassurance
  - Relaxed breathing techniques: panting, pursed lips, sniffing
  - Anxiolytics (Benzodiazepines)
  - Heliox (20-40%)
  - Inhaled saline as placebo
  - Inhaled lidocaine
  - Inhaled atrovent (if exercise induced)

- Less common:
  - CPAP
  - Anesthesia (Propofol)
  - Injection of Botulinum toxin
  - Intubation or tracheostomy (historical, not indicated!)

Lessons Learned from Case 1

- VCD can be easily confused with asthma and is often a comorbid condition
- Differentiating VCD from asthma relies on good clinical history and PE
- Recognizing the difference can prevent needless hospitalizations, testing and medication side effects!

Long-term Management

- Speech therapy
  - Resistive breathing
  - “Relaxed throat” breathing or diaphragmatic breathing
- Psychologic counseling
  - Relaxation techniques
  - Biofeedback
  - Self-hypnosis

Case 2

- 8 month old male with wheeze
- Noisy breathing and cough x 3 months
- Worse when awake
- Possible response to albuterol
- Trial of inhaled budesonide x 6 weeks: no improvement
- No history of foreign body aspiration or choking
• Pediatrician heard inspiratory stridor
• Clinically diagnosed with laryngomalacia near full term birth

Normal Larynx
- arytenoid tissue and epiglottis
- short AE folds

Differential Diagnosis of Wheezing in Infants

Large airways (Monophonic)
- Tracheal
  - Subglottic stenosis
  - Tracheomalacia
  -Repaird TEF
  - Complete tracheal rings
  - Vascular rings
  - Hemangioa
  - Tumor
- Bronchial
  - Bronchomalacia or bronchial stenosis
  - Foreign body
  - Blue lymphadenopathy (ng Ts)
  - Vascular rings
  - Bronchiomalacia
  - Cardiomyo
  - Pulmonary artery dilatation
  - Tumor (rare)

Small airways (Polyphonic)
- Asthma
- Bronchiolitis
- Cystic fibrosis
- GERD
- BPD
- PCD
- Bronchiolitis obliterans

Tracheomalacia
- Normal Trachea
- Tracheomalacia

Congenital Anomalies: Tracheomalacia

Extrinsic Airway Compression
- Suspected External Compression
  - enlarged lymph nodes
  - vascular structures
  - lung abscess
  - cysts
Foreign Bodies

- Food Products are frequent culprits
- Nuts cause many problems
  - Small, easy to aspirate
  - Nut oil, irritant
  - Break apart causing airway obstruction

Vascular Rings

- Aberrant Right Subclavian – esophageal compression
- Right aortic arch
- Double aortic arch

Anomalous Innominate Artery

Pulmonary Artery Sling (Aberrant L pulmonary artery)

Vascular Compression of the Airways

<table>
<thead>
<tr>
<th>Tracheal</th>
<th>Esophageal</th>
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<tbody>
<tr>
<td>• Obstruction of airflow</td>
<td></td>
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<tr>
<td>• Impaired mucus clearance</td>
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<td>• Reflex apnea</td>
<td>• Dysphagia</td>
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<td>• Regurgitation</td>
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<td>• Aspiration</td>
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Plan

- Referred to ENT for laryngoscopy, procedure to be coordinated with flexible bronchoscopy to assess lower airway dynamics
- Seen 4 weeks later by ENT
- Rigid bronchoscopy performed 7 weeks after Pulmonology appointment (at 8 months of age)
Physical Exam on admission POD #1 after rigid bronchoscopy

- Gen: Playful, Afebrile, RR 28, Pulse oximetry 97% on RA.
- Neck: Posterior cervical lymphadenopathy 2 cm bilaterally.
**Lymph node pathology**
- multiple focally caseating granulomas
**DDX** Mycobacterium TB, NTM, Fungal infection

**Tuberculosis Evaluation**
- Quantiferon gold test positive
- NG aspirates x 3 smear negative
- Sent home on 4 drug therapy:
  - Isoniazid
  - Rifampin
  - Pyrazinamide
  - Ethambutol
- BAL cultures, NG aspirates, and brush cultures ultimately grew Mycobacterium tuberculosis sensitive to isoniazid

**Lessons Learned from Case 2**
- Don’t forget mediastinal lymphadenopathy as a cause of wheeze in infants
- Anyone can get TB
  - And in this case the index case was never found
- Directly observed therapy is a good thing
  - Patients rarely take the medications prescribed to them exactly as prescribed 😊

**Case 3**
- 2 year old male previously healthy
- Placed in his toddler bed at 9pm
- One of the bottom dresser drawers was open
- Mother observed him to have choking and difficulty breathing
- ED physicians heard inspiratory stridor and expiratory wheezing

**Foreign Body Aspiration**

**WHAT IS YOUR TOP DIAGNOSIS UNLESS PROVED OTHERWISE?**
FOREIGN BODY ASPIRATION

**Appropriate history**
- Vulnerable age
  - (95% ages 1-4 years)
- Witnessed aspiration event (choking in 80-90%)
- Respiratory distress (acute)
- Recurrent pneumonia
- Sx: drooling, stridor, dysphonia, cough, wheeze

**Exam**
- Relentless stridor/cough
- Wheeze (unilateral or bilateral)
- Decreased/absent breath sounds
Lessons Learned from Case 3

• Pediatricians can help prevent accidental foreign body aspiration, which is quite common!
• Foreign body removal is not always an easy thing
• I am supported by the evidence in chopping up foods into tiny pieces for my kids 😊

Take Home Points

• Differentiate stridor from wheeze
• Think of other causes of wheezing
  – Tracheobronchomalacia
  – Mediastinal lymphadenopathy
  – Foreign body aspiration
• VCD can often be differentiated from asthma
  – History, PE and flow volume loops
• We are happy to consult for help!

References

• Weinberger M and Abu-Hasan M. Pseudo-asthma when cough, wheezing and dyspnea are not asthma. Pediatrics 2007; 120:855-64.
• For additional information:
  • National Jewish Medical and Research Center
  • http://www.njc.org/disease-info/diseases/vcd/index.aspx
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