Chronic Cough In Children

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Disclosure

• Speakers Bureau, Alcon
Cough

• A sudden, violent expiratory expulsion of air after deep inspiration and closure of the laryngeal sphincter
• 6.7% of all pediatric visits; 35% of preschool children report cough in any given month
• Important defense mechanism
  – Removal of abnormal secretions, exudates, or inflammatory products
  – Removal of foreign bodies
  – Removal of irritating sensations in respiratory tract
“The cough is the watchdog of the lungs. Protects from a ‘dangerous intruder’ or an ‘internal enemy’.”

- Chevalier Jackson (1920)
“...but that all too often, physicians drug this watchdog to sleep at a time when its efforts are most needed.”

- Lauren Holinger (1986)
Cough

- 16 million physician visits / year
- Most are acute and cause is evident
- Chronic cough is arbitrarily defined as greater than three to four weeks duration, though some feel chronic cough is greater than eight weeks; other categories then are acute (< 3 wks) and subacute (3-8 wks)
Diagnosis → Therapy → Resolution

(Symptomatic Care)
Pediatric Cough

• Duration
  – Acute (< 2 weeks)
  – Protracted acute (2-4 weeks)
  – Chronic (> 4 weeks)

• Likelihood of underlying disease or process
  – Expected
  – Specific
  – Nonspecific

• Cough quality
  – Wet or productive versus dry cough
Cough Receptors

- Sensory nerve fibers located between the ciliated pseudostratified columnar epithelial cells of the airway
- Sensitive to many stimuli, including chemical and mechanical
- Adapt readily
Higher centers
Ear
Paranasal Sinuses
Nose
Pharynx
Larynx
Pleura
Tracheobronchial tree
Pericardium
Diaphragm
Peritoneum
Esophagus, Stomach

Receptors

Afferents

Efferents-Effectors
Vagus Nerve
Phrenic and other nerves

- Larynx
- Tracheobronchial Tree
- Expiratory muscles
- Abdominal muscles
- Diaphragm
- Intercostal muscles
- Peritoneal muscles

Cough center of Medulla
Defense Mechanisms For Airway Protection

- Cough reflex (25% of newborns, over 90% by one month)
- Gag reflex
- Mucociliary clearance
- Macrophage phagocytosis
- Lymphatic drainage
Chronic Cough

• Etiology can be found about 80% of cases
• In these cases, therapy is effective 84-97% of the time
• In about 25% of cases, two or more etiologies of the cough may be found
Chronic Cough

Unified Airway

Rhinologic
- Allergic Rhinitis
- Sinusitis
- Non-Allergic Rhinitis

Pulmonary
- Pulmonary Infection
- Asthma
- Other Inflammation

Esophageal
- GERD / LPR

Brain
- Tumor
- Systemic Disease

Aspiration, Reflex

(silent)
Cough

• Can aid in spread of infection
• May be indicative of underlying disease
• May affect quality of life for patient and family
Persistent Cough

Irritation of Larynx and Trachea

Vomiting

Failure to Thrive

Serious Complications
- Rib fractures
- Pneumothorax
- Pneumomediastinum
- Rupture of rectus abdominis muscles

Exhaustion
Chronic Cough

• Holinger (1991)
• 72 infants and children (under 16 years)
• Cough greater than four weeks and normal CXR
• 19.4 month delay in diagnosis
### Clinical Hints About Cough

<table>
<thead>
<tr>
<th>Cough Characteristics</th>
<th>Think of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staccato, paroxysmal</td>
<td>Pertussis, CF, foreign body, chlamydia, mycoplasma</td>
</tr>
<tr>
<td>Followed by “whoop”</td>
<td>Pertussis</td>
</tr>
<tr>
<td>All day, never during sleep</td>
<td>Psychogenic, habit</td>
</tr>
<tr>
<td>Barking, brassy</td>
<td>Croup, psychogenic, tracheomalacia</td>
</tr>
<tr>
<td>Abrupt onset</td>
<td>Foreign body</td>
</tr>
<tr>
<td>Follows exercise</td>
<td>Reactive airways disease</td>
</tr>
<tr>
<td>Accompanies eating, drinking</td>
<td>Aspiration</td>
</tr>
<tr>
<td>Productive</td>
<td>Infection, inflammation</td>
</tr>
</tbody>
</table>
## Clinical Hints About Cough

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<th>Cough Characteristics</th>
<th>Think of</th>
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<tbody>
<tr>
<td>Excessive regurgitation; dried vomitus found next to head of infant in morning</td>
<td>Gastroesophageal reflux</td>
</tr>
<tr>
<td>Arching, crying in pain (esp. at night)</td>
<td>Gastroesophageal reflux</td>
</tr>
<tr>
<td>Recurrent pneumonia, sinusitis, and otitis media</td>
<td>IgA or IgG subclass deficiency; PCD</td>
</tr>
<tr>
<td>Steatorrhea; failure to thrive</td>
<td>CF</td>
</tr>
<tr>
<td>Rectal prolapse</td>
<td>CF</td>
</tr>
<tr>
<td>Digital clubbing</td>
<td>CF; hepatopulmonary syndrome; others</td>
</tr>
</tbody>
</table>
Without a presumptive or inferential diagnosis, chronic cough can not be well managed since it is a sign of underlying disease, not a diagnosis in and of itself.
Therapy → Diagnosis Dependent
<table>
<thead>
<tr>
<th>Age Group</th>
<th>Birth - 18 months</th>
<th>18 months - 6 years</th>
<th>6 - 16 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLB/E</td>
<td></td>
<td>CT of sinuses</td>
<td>PFTs (with metacholine challenge testing)</td>
</tr>
<tr>
<td>Barium esophagram</td>
<td></td>
<td>Bronchodilator trial</td>
<td></td>
</tr>
<tr>
<td>pH probe</td>
<td></td>
<td>MLB/E</td>
<td>CT of sinuses</td>
</tr>
<tr>
<td>Bronchodilator trial</td>
<td></td>
<td></td>
<td>MLB/E</td>
</tr>
</tbody>
</table>
# Diagnostic Protocol

<table>
<thead>
<tr>
<th>Initial Evaluation</th>
<th>History</th>
<th>Remove irritant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physical Exam</td>
<td>Treat postnasal drip, sinusitis, etc</td>
</tr>
<tr>
<td></td>
<td>Chest X-ray</td>
<td>Treat / further evaluation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bronchoscopy</th>
<th>Evaluate anatomy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Remove foreign body</td>
</tr>
<tr>
<td></td>
<td>Collect specimen for cultures, pathology</td>
</tr>
</tbody>
</table>
History

• Age
• Pollution exposure, including tobacco smoke
• PMH
• Medications
• Cough character
• Non-central heating
• History of recurrent pneumonia, GERD, CF, sinusitis
Historical Factors

Infants

• Passive smoke may exacerbate cough
• Aspiration worsening cough suggestive of anatomic problem such as cleft larynx or TEF
• Many infectious etiologies (chlamydia, RSV, CMV)
Historical Factors

School age

- Consider CF, FB, PND, smoke exposure, infectious causes
- Active or passive smoking
- CVA, psychogenic causes
- Medicines (angiotensin - converting enzyme inhibitor like captopril)
Daily Pattern

• Nocturnal after retiring → GERD, PND
• Nocturnal (early AM) → asthma
• Morning → suppurative lung disease (CF)
• Daytime (absent at night) → psychogenic
• Feeding → aspiration
Sputum Production

• Clear → asthma
• Purulent → CF, primary ciliary dyskinesia, immune deficiency, localized bronchiectasis
• Bloody → CF, FB, bronchiectasis, hemosiderosis, pulmonary embolism
Physical Examination

• General health and nutrition
• With asthma or allergic disease, one may see allergic rhinitis, conjunctivitis, hypertrophy of pharyngeal lymphoid follicles
• When associated with OM, sinusitis, and asthma, consider PCD (primary ciliary dyskinesia)
• Nasal polyps → CF, asthma
Physical Examination

• ↑ AP diameter of thorax → CF, asthma
• Diffuse wheezing → asthma
• Localized wheezing → bronchial obstruction (FB, bronchomalacia, tumor)
• “Crackles” → pneumonia, pulmonary fibrosis
Miscellaneous

• Inspiratory stridor → narrowing in larynx, upper trachea
• Expiratory wheezing → asthma, bronchial narrowing from FB
• Seasonal variation → asthma (worse in cold or allergy exposure) → infections (winter, day care)
Indications for Bronchoscopy

• Severity or duration of symptoms greater than eight weeks (arbitrary)
• Suspicion of a foreign body or other obstructive lesion
• Failure to make a diagnosis by other means
Specimens

• AFB
• Fungus
• Chlamydia
• Routine C&S
• Cytology (eosinophils, macrophages, neoplasm)
## Diagnostic Protocol

<table>
<thead>
<tr>
<th>Pulmonary Function Testing</th>
<th>Treat asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treat fixed obstruction</td>
</tr>
</tbody>
</table>
Cough Variant Asthma

• Controversial
• Cough associated with exercise, cold exposure, sleep, or laughing
• Persistent, non-productive
• Airways obstructed with edema, bronchoconstriction, and mucous
• PFT may be diagnostic but, in children under six years, a trial of albuterol may be more appropriate since they cannot do the test
# Diagnostic Protocol

<table>
<thead>
<tr>
<th>GERD Testing</th>
<th>pH probe</th>
<th>Treat GERD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper GI series</td>
<td></td>
<td>Treat any anatomic abnormalities</td>
</tr>
<tr>
<td>Esophagoscopy</td>
<td></td>
<td>Consider biopsy</td>
</tr>
</tbody>
</table>
pH Probe is the Gold Standard
For GERD Evaluation
(probably)
## Diagnostic Protocol

<table>
<thead>
<tr>
<th>Other Testing</th>
<th>Laboratory testing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sinus computed tomography (CT) scan</td>
</tr>
<tr>
<td></td>
<td>Consultation: Allergy/Immunology, Otolaryngology, Pulmonary, Infectious Diseases, Cardiology</td>
</tr>
</tbody>
</table>
Laboratory Testing

- CBC with differential
- Sputum for cytology, TB, bacteria and fungal stains and cultures
- Nasal smear for eosinophils
- Viral, fungal titers
- Pertussis
- Quantitative immunoglobulins
- Alpha-1-antitrypsin
Evaluation of Paranasal Sinuses

- Clinical
- Radiographic
## Common Diagnoses

<table>
<thead>
<tr>
<th>Birth - 18 months</th>
<th>18 months - 6 years</th>
<th>6 - 16 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cough-variant asthma (CVA)</td>
<td>• Sinusitis</td>
<td>• CVA</td>
</tr>
<tr>
<td>• Innominate artery compression of trachea</td>
<td>• CVA</td>
<td>• Psychogenic cough</td>
</tr>
<tr>
<td>• GERD</td>
<td>• GERD</td>
<td>• Sinusitis</td>
</tr>
<tr>
<td>• Tracheomalacia</td>
<td>• SGS</td>
<td></td>
</tr>
<tr>
<td>• SGS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Sinusitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• CF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Bronchogenic cyst</td>
<td></td>
<td></td>
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</tbody>
</table>
Unusual Anatomic Cause:
Elongated Uvula
Cough Illness/Bronchitis-Principles Of Judicial Use Of Antimicrobial Agents


2. Antimicrobial treatment for prolonged cough (>10 days) may be indicated occasionally. Pertussis should be treated according to established recommendations. *Mycoplasma pneumoniae* infection may cause pneumonia and prolonged cough (usually in children ≥ 8 years of age); a macrolide may be used for treatment. Children with underlying chronic pulmonary disease (not including asthma) may benefit occasionally from antimicrobial therapy for acute exacerbations, usually amoxicillin-clavulanate or a second or third generation cephalosporin.
Unified Airway: Pathophysiology Of Cough

- Inhalant antigen or irritant exposure, Sinusitis
  - Nasal Congestion
  - Runny Nose
  - Postnasal Drainage
    - Pharyngeal / Laryngitis
      - Throat clearing
      - Coughing
      - Vocal fold edema
      - Dysphonia
    - Upstream mucous migration
  - Pulmonary congestion
    - Bronchospasm, coughing
Terminology collected from recent literature describing symptoms associated with paradoxical vocal fold motion, chronic cough, or laryngospasm

<table>
<thead>
<tr>
<th></th>
<th>Paradoxical Vocal Fold Motion</th>
<th>Chronic Cough</th>
<th>Laryngospasm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocal cord dysfunction</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Munchausen’s stridor</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional airway obstruction</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Paradoxical vocal fold dysfunction</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Episodic paroxysmal laryngospasm</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Adult onset asthma</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Factitious asthma</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paradoxical vocal fold movement</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Breathing abnormalities</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Psychogenic stridor</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Irritable larynx syndrome</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Laryngeal dyskinesia</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Trigeminal neuralgia</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Response To Therapy

- Antibiotics → suppurative lung disease or sinusitis
- Bronchodilators → asthma
- Steroids → nonspecific (asthma, allergy, any inflammation)
  → Absence of response → anatomic, psychogenic
- Antihistamines → PND, allergy
- Anti-reflux → GERD
- Speech-language pathologist → behavioral manifestations
• Cause of cough varies with age. Some diagnoses are more common in certain age groups.
• Obtaining posterior and lateral chest radiographs is the first step in evaluating the patient.
• Patient evaluation is individualized on the basis of the following:
  – The results of studies previously completed
  – What is most cost-effective
  – What is least invasive
  – What is most likely to establish the correct diagnosis
Pearls and Perils

• Two or more diagnoses need to be considered when the diagnosis is not readily apparent.

• When there is no response to therapy:
  – The condition is being undertreated,
  – The family or patient is noncompliant,
  – The diagnosis is incorrect, or
  – The therapy is incorrect.

• Oral antibiotic therapy for sinusitis may take as long as 6 weeks for the patient to respond.

• Initial aggressive therapy may be necessary to control cough-variant asthma. Often a brief course of steroids is necessary.
MEDICAL OFFICE

YOUR COUGH SOUNDS MUCH BETTER.

THANKS. I'VE BEEN PRACTICING.