Pediatric Cough

Pramod Kelkar, MD
Past Chair, Cough Committee, American Academy of Allergy, Asthma & Immunology
Founder, National Cough Clinic

Private Practice:
www.allergy-care.net
www.nationalcoughclinic.com
Minneapolis, MN, USA
Disclosures

• Speakers’ Bureau/Consultant/Ad Board
  Greer Labs, TEVA, Respiratory Research, CoCo Pharma, Merck, AZ
Why do we cough?

- Cough is an important defense mechanism of the body that serves to clear the airway of excessive secretions and foreign matter.
- It can be activated by:
  1. Mechanical stimuli: foreign body, dust, talking
  2. Chemical stimuli: smoke, perfumes
  3. Thermal stimuli: cold air, hot air, cold water ingestion
What is the success rate with specific therapy in chronic cough?

(A) 40-50%
(B) 60-80%
(C) 80-100%
What’s the success rate?

• Cause of cough can be determined in 88 to 100% of cases
• Success rates with specific therapies range from 84 to 98%

*Chest 1998;114(2):133s-181s
Thorax 1998;53:738-743*
History

- Triggers: Talking, laughter, walking, running, strong smells, perfumes
- Timing: Daytime Vs nighttime
- Relationship with meals
- Preceding Events:
  Viral URI, Recent Immigration from a developing country, foreign travel
- Analysis of cough sound: Peds Vs Adult
- Review of systems is very important
Analysis of cough sound

- **Barking or brassy cough**: Croup, tracheomalacia, habit cough
- **Honking**: Psychogenic
- **Paroxysmal with or without whoop**: pertussis and parapertussis
- **Staccato**: Chlamydia in infants
Physical Examination

- Thick, yellow postnasal drip visible in oropharynx: think chronic sinusitis
- Look into ears to rule out wax impaction and other causes (Arnold’s Nerve)
- Look at nails for clubbing (CF, etc.)
- Check for thyroid masses
- Look for signs of atopy
Cough Reflex Sensitivity

- Can be modulated by disease or drugs
- Heightened CRS can occur in post-viral cough, asthma, GERD, ACE-inhibitor therapy
- CRS more common in women
Increased Cough Receptor Sensitivity

**Cough Stimuli**
- Foreign Body
- Dust/ cigarette smoke
- Airway deformation
- Mucous
- Capsaicin
- Nicotine
- Histamine
- Bradykinin
- Prostaglandins (E$_2$, F$_{2\alpha}$)

**Neural mediators**
- Tachykinins, Neurokinin, Substance P?, CGRP?

**Types of nerve fibers**
- Rapidly adapting receptors
- Pulmonary C fibers
- Bronchial C fibers

**COUGH**
Cough vs. Airway Hyperreactivity

• Cough and Bronchial hyperreactivity (BHR) often coexist
• Cough and BHR are independent physiologic responses
• Inhibition studies
  – Lidocaine, oral codeine inhibit cough, not BHR
  – Cromolyn, atropine inhibit BHR, not cough

Choudry, Eur Resp J 1990;3:579-83,
Sheppard, Am Rev Resp Dis 1983; 127:691-4
Normal Cough

- Normal Children Cough
- Healthy school-age children can have up to 34 cough episodes per day
- Can at times appear prolonged or nocturnal
- Recurrent viral URI may seem like persistent cough
- Post-infectious cough can last 10 days or longer after a viral infection
Abnormal Cough

- Chronic cough - lasts > 4 to 8 weeks
- Character/Quality of cough - spasmodic (pertussis), barking/brassy (croup)
- Wet or dry
- Nocturnal - asthma, sinusitis
- Age of the child - infants and young children have anatomic abnormalities of respiratory and GI tract
Specific Cough

• Associated with underlying respiratory or systemic disease
• Obvious symptoms or signs/physical examination, abnormal CXR, abnormal laboratory results
• Example- Bronchiectasis, Pertussis
Nonspecific cough

- Isolated cough as the sole symptom
- Usually dry
- In adults- UACS, Asthma, Eosinophilic bronchitis, GERD
- In children- UACS, Asthma and GERD account for <10% of causes
- Most common cause in children- Protracted Bacterial Bronchitis
Protracted Bacterial Bronchitis

- Most common (up to 40%) cause of nonspecific chronic wet cough in children
- Resolves with antibiotic therapy
- Misdiagnosed or underdiagnosed
- Bronchoscopy shows neutrophilic inflammation
- S. pneumoniae, H. influenzae, M. catarrhalis
- Amoxicillin and clavulanate for two weeks

GERD

• Far less common in children than adults
• Aspiration with swallowing in the absence of GERD may cause cough
• Silent reflux often associated with asthma
• A positive response to empiric therapy with thickened feedings in infants and an acid-suppressive regimen suggests GERD
• Nonacid reflux detected by impedance measurement
Habit Cough Syndrome

- Dry, barking or honking
- Absent at night, improves with distraction
- Sounds very annoying but the child is unperturbed (la belle indifference)
- Very disturbing to parents, teachers, caregivers
- May start after a viral infection
- Can be difficult to differentiate from a tic disorder/Tourette’s syndrome
Treatment of Habit Cough

• Accurate diagnosis is important to avoid unnecessary exhaustive work-up
• Self hypnosis
• Biofeedback
• Breathing exercises/Speech therapy
• Suggestion therapy
• Lidocaine via nebulization
Upper Airway Cough Syndrome

- Old terminology was postnasal drip syndrome
- Includes allergic and nonallergic rhinitis, sinusitis, tonsillar hypertrophy causing tissue impingement on the epiglottis
- Limited CT sinus is helpful for sinusitis
- Treat the cause
- Older/first-generation antihistamines like brompheniramine can be helpful
Asthma

- Accurate diagnosis is critical
- Cough-variant asthma- over-diagnosed or under-diagnosed?
- A time-limited (4-6 weeks) empiric trial of ICS +/- leukotriene modifiers
- By itself, a response to ICS does not confirm a diagnosis of asthma
- Presence of multiple causes may delay the response
Interesting Facts

• While children with asthma can present with chronic cough, most children with isolated cough do not have asthma.
• Environmental Tobacco Smoke (ETS) exposure is associated with increased coughing illnesses and an important contributing factor, ETS alone is not the sole etiology.
Methacholine Challenge test

In a setting of adult chronic cough patients:

- Positive predictive value: 60-88%
- Negative predictive value: 100%

*Chest 1999;116(2):279-84*
General Principles in Management

- Clinical history and physical exam are used to guide testing
- Recommendations are based primarily on expert opinion, due to lack of controlled pediatric studies
- No evidence supporting the use of medications for symptomatic relief of acute or chronic cough in children; some data suggests potentially harmful effects
Are we missing pertussis?

- 75 adults, cough for more than 14 days
- Pertussis diagnosis based on culture and PT or FHA titer
- 21% of adults had evidence of B. pertussis infection
- Clinical features and routine lab tests were of limited value in making the diagnosis

_JAMA_ 1995;273:1044-1046
Pertussis: Laboratory Diagnosis

- Leukocytosis with absolute lymphocytosis
- (Posterior) Nasopharyngeal swab and aspirate
- DFA testing: quick results but unreliable
- PCR: results in 48 h, false positives possible
- Culture of swab: takes 7 days for results
- Negative culture does not rule it out!
- Serology: IgG and IgA to fimbria, pertussis toxin and filamentous hemagglutinin (not standardized)
- Blood cultures: not useful
Pertussis

When to suspect & Whom to treat?

• Suspect and treat if a clear cut history of exposure
• Suspect and treat if cough and vomiting (?)
• Erythromycin is the drug of choice; however, unless administered early, it does not alter the course of the disease

*NEJM* 2000;343(23):1715-1721
*JAMA* 1995;273:1044-1046
Can asthma be a possibility if a pre- and post-bronchodilator spirometry is completely normal?

(A) Yes
(B) No
Methacholine Challenge test and allergy skin test correlative study in the diagnosis of asthma

• $N=175$
• Allergy skin tests are simple, safe, inexpensive and reliable and there was an excellent correlation between these two tests
• More studies needed to clarify this further

Chronic cough completely Relieved by a course of Prednisone.

Is this diagnostic of asthma?
Chronic cough relieved by prednisone

Possibilities:
(1) Allergic rhinitis
(2) Asthma
(3) Eosinophilic bronchitis
(4) Others
Eosinophilic bronchitis
<table>
<thead>
<tr>
<th><strong>Asthma</strong></th>
<th><strong>Eosinophilic bronchitis</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sputum eosinophilia</td>
<td>• Sputum eosinophilia</td>
</tr>
<tr>
<td>• Airway hyperresponsiveness</td>
<td>• <strong>No airway hyperresponsiveness</strong></td>
</tr>
<tr>
<td>• Treatment is inhaled or oral steroids</td>
<td>• Treatment is inhaled or oral steroids</td>
</tr>
<tr>
<td></td>
<td>• Natural history unclear</td>
</tr>
</tbody>
</table>

*Am J Respir Crit Care Med 1999;160:406-410*
Causes of cough: single or multiple?

- Multiple causes were found in more than 60% when a large number of diagnostic tests are performed (US experience)
- Multiple causes were found in <26% when investigations were tailored to presenting features (European experience)
Reasons for misdiagnosis of chronic cough

- Failure to consider common extrapulmonary causes
- Insufficient dose of medication or duration of therapy
GERD/Laryngopharyngeal Reflux

Pseudosulcus vocalis
Posterior commissure hypertrophy

Vocal fold edema
Ventricular obliteration

Ear, Nose, Throat J 2002;82 (9 Suppl 2): 10-13
Risks of proton-pump inhibitor therapy

- Community-acquired pneumonia
- Calcium malabsorption and hip fractures
- Vitamin B-12 malabsorption
  (assess vitamin B-12 levels in patients on long-term PPI)
- Community-acquired *C diff.* infection
- Atrophic gastritis (PPI+ *H. pylori*)

*Dose and duration- dependent!*

What is the clinical utility of flexible bronchoscopy

- Adds little to the diagnosis of chronic cough in the context of normal CXR or CT
- Useful to detect and assess endobronchial lesions (tumors, foreign bodies): very rare
- Always get a Chest CT before bronchoscopy
- If you are checking a Chest CT: include neck (speaker’s experience)

Psychogenic (Habit) cough

• True incidence unknown
• Overdiagnosed by physicians
• Diagnosis of exclusion
• Patient education is the key

Refractory Idiopathic Cough

Rule out all the possible causes first

Very challenging to treat

Experimental therapies:

Lidocaine nebulization, Water and salt irrigations of nose and sinus, Neurontin, Pamelor, Xanax, Baclofen, speech therapy evaluation and breathing exercises

Patient and family education and counselling

Am J Respir Crit Care Med 1995;152:2068-75
Zebras to watch for

- “Clinically silent” suppurative airway disease
- Congestive heart failure
- Cancer: bronchogenic, esophageal, metastasis
- Cystic fibrosis
- Interstitial lung disease
- Foreign bodies
- Pneumonia, Recurrent aspiration, pharyngeal dysf.
- Sarcoidosis

*Chest* 1995;108(4):991-7
Zebras to watch for cont...

- Pressure from an intrathoracic mass
- Primary ciliary dyskinesia (infertility)
- Lingual thyroid (hypothyroidism)
- Sleep apnea
- Vocal cord dysfunction
- Pulmonary tuberculosis
- Bronchiectasis

*Otolaryngol Head Neck Surg* 2001;125:433-4
*J Allergy Clin Immunol* 2001;108(1):143
Take Home Points

• Individualize the treatment
• Flow diagrams/ Suggested reading


(2) Rank MA, Kelkar PS, Oppenheimer JJ. Ann Allergy Asthma Immunol. 2007;98:305-313

(3) Morice AH. ERJ 2004;24:481-492 (European)


(4) Morice AH, McGarvey L, Pavord I. Thorax 2006; 61:suppl 1 (British)
Bibliography continued…

• Ramanuja V, Kelkar P. Pediatric Cough. Annals of Allergy Asthma and Immunology 2010;105(1):3-8


Thank you!

Pramod Kelkar, MD
Past-Chair, Cough Committee, American Academy of Allergy, Asthma & Immunology
Founder, National Cough Clinic

Private Practice:
www.allergy-care.net
www.nationalcoughclinic.com
Minneapolis, MN, USA