When the Cough Won’t Go Away:
A Step-by-Step Approach to Managing Chronic Cough

Traci Gonzales MSN, CPNP, AE-C
Texas Children’s Hospital, Complex Care Clinic
Tomika Harris DNP, CPNP
UTHealth McGovern Medical School, High Risk Children’s Clinic

Speaker Introductions

• Traci Gonzales is a PNP from Houston. She received her BSN from McNeese State University and her MSN from Texas Tech University. Mrs. Gonzales has a particular love for pulmonary medicine and complex care patients. She currently works in the Complex Care Clinic at Texas Children’s Hospital where she serves as PCP for children with mechanical dependence and multiple medical needs. She is also a volunteer national spokesperson for American Lung Association, which allows her to advocate for the lung health of all children.

• Dr. Tomika Harris is a certified pediatric nurse practitioner from Houston. She received her BSN and MSN from the University of Rochester and her DNP from the University of South Florida. Dr. Harris has worked in a variety of clinical and academic positions over the course of her nursing career. Currently, she practices as a PNP with a dynamic team that manages the care of children with complex medical conditions.

Disclosures

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Learning Objectives

• Recognize different etiologies of chronic cough.
• Identify current diagnostic approaches to chronic cough.
• Describe new and recommended pharmacological therapies

Burden of cough

• One of the most common reasons to see a healthcare provider (1)
• 75% of children will have 5 or more visits for chronic cough (14% have more than 15 visits)
• Significant negative affect on quality of life
• Cost to families
• Cost to healthcare system

Definition of a Cough
Receptor Types
- Rapidly Acting
- Slowly Adapting
- C-fibers

Inhalation Phase
- Glottis opens, thoracic cavity expands
- Volume needed for effective cough is generated

Compression Phase
- Glottis closes and chest wall muscles contract, resulting in rapid rise of intrathoracic pressure

Expiratory Phase
- Glottis opens, large airways compress, results in forced exhalation and helps dislodge mucous or other debris from airway

Chronic Cough
- <15 years, defined as cough last 4 or more weeks
- Multifactorial- 26% of children will have 3 or more contributing factors (rank)

Specific Cough Pointers

Finding | Considerations
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Productive Cough | PBB, aspiration, infection
Hemoptysis | TB, Bronchiectasis, autoimmune lung disease
Wheezing | Asthma, bronchiectasis, foreign body
Dyspnea | Asthma, severe lung disease, ILD
Recurrent pneumonia | Immunosuppressed, congenital anomaly, respiratory failure
Neonatal symptoms | Immunosuppressed, congenital anomaly, PCE
Choking episode | Foreign body
Anxiety surrounding symptoms | Tic cough, psychogenic cough
Exposure | Cardiac Disease: PCD, airway malacia, vocal cord paralysis, neurological anomaly
Neurological Disease: Aspiration, ineffective airway clearance
Feeding intolerance: Tracheoesophageal anomaly, aspiration
Failure to thrive | CF, immunodeficiency, severe lung disease, infection
Autoimmune Disease | Interstitial lung disease
Chronic cough: Infection

Pay attention to the Details
- When did it start?
- What makes it worse?
- What makes it better?
- Every day or a period of wellness?
- Associated with an event?
- Worsen when talking about symptoms?
- Present during sleep?
- Improve with distraction?

Personal and family history
- Thorough neonatal history
- Previous hospitalizations for pulmonary diseases, severe infection may cause bronchiectasis
- Any known medical conditions
- Environmental Exposures
- Family History
Physical Exam

- Elicit
  - Hear the characteristics of cough
  - Work of breathing
  - Chest wall deformities
  - Breath sounds:
    - Stridor, deep inspiration, expiration
  - Wheezing: tachypnea, inspiratory, expiratory, polyphonic vs monophonic

Further Workup

- CBC – may be helpful
- Aerosallergen panel
- Total IgE
- Immune workup
- TB skin test or Quantiferon
- Sweat Test
- Genetics (if indicated)
- Imaging (CXR, CT, MRI, ECHO)

Asthma

Chronic airway inflammation with hyperresponsiveness

- Hx:
  - Chronic dry cough
  - Asthma
  - Recurrent bronchitis/chronic pneumonia
  - Family history of asthma or allergy
- Physical exam:
  - Wheezing
  - Expiratory
  - Signs of allergic disease
- Diagnostics:
  - Laboratory with bronchial atopic responsiveness
  - CBC, hyperreactivity, changes in Ht/Hct
**Asthma**

- **Inhaled:**
  - Tiotropium (long-acting muscarinic antagonist)
  - MDI: 1.25 mcg per actuation
    - 6 yr and up: 2 puffs daily

- **Injectables:**
  - Omalizumab – inhibits binding of IgE
    - 6 yr and up: 75-375 mg (max 150 mg per injection site) SC Q2-4 wk
    - dose is based on IgG levels and body weight

**Black Box Warning**

- **Mepolizumab**: reduces eosinophil production by binding and interfering with IL-5
  - 6-11 yr: 40 mg SC Q4 wk
  - 12 and up: 100 mg SC Q4 wk

- **Benralizumab**: binds to IL-5 receptor
  - 12 yr and up: 30 mg SC Q4 wk x3, then Q8 wk

- **Dupilumab**: inhibits IL-4 and IL-13
  - 12 yr and up:
    - >60 kg: 600 mg SC x1, then 300 mg SC Q2 wk
    - ≤60 kg: 400 mg SC x1, then 200 mg Q2 wk

**Protracted Bacterial Bronchitis (PBB)**

**HPI**

- Wet cough >4 wks
- No specific cough pointers
- No evidence of other symptoms after basic workup (spirometry, CXR, etc.)
- Cough typically worse when changing posture

**Physical Exam**

- No list upper airway infection
- No finding of other significant lung disease
- Wet cough
- Wheezing

**Diagnostic:**

- CXR: normal/peribronchial wall thickening

**Treatment**

- **Typical infectious agents:**
  - H. influenzae, S. pneumonia, m catarrhalis
  - HINT (RANk/UTD)

- **Preferred:**
  - Amoxicillin Clavunate 40 mg/kg/d x 14 days (UTD)

- **Alternative:**
  - Second or third generation cephalosporins, trimethoprim-sulfamethoxazole, or macrolides

  - If not resolved at 2 weeks, give another 2 weeks (4 total)

**Recurrent PBB:**

- >3 episodes in one year, needs further workup, refer to specialist (UTD)

**Cystic Fibrosis**

**HPI:**

- Cough
- Recurrent upper respiratory infections
- Failure to thrive
- Nasal polyps
- Poor weight gain
- Steatorrhea

**Physical Exam**

- Pneumonia
- Clubbing
- Failure to Thrive

**Diagnostics**

- Newborn Screen: positive
- Sweat chloride test ≤60 mmol/L or greater
- Genetic Testing: positive for 2 mutations known to cause CF
- Chest X-ray

**Management**

- Referral to CF center or Pediatric Pulmonary
- Airway Clearance
  - Chest Physiotherapy (Manual or Vest)
  - Albuterol and 7% Sodium Chloride
    - Twice daily, increase to 1-4 times per day during exacerbations
  - Pulmozyme 2.5 mg once daily

**Medications**

- Inhaled antibiotics
- Aggressive Antibiotic Management
- Gene specific therapy

**Primary Ciliary Dyskinesia (PCD)**

- Unexplained respiratory distress in term infant
- Year-round daily cough beginning before 6 months of age
- Year-round daily nasal congestion beginning before 6 months of age
- Organ bility defects (organ flipped)

**HPI:**

- Crackles
- Otitis Media

**Physical Exam**

- Chest X-ray: pneumonia, complete lobar collapse

**Diagnostics**

- Nasal Nitric Oxide (nNO): low
- Genetic testing: mutations in PCD-associated gene
- Electron microscopy of ciliary ultrastructure: decreased or no motility
Primary Ciliary Dyskinesia (PCD)

Management
- Referral to PCD center or Pediatric Pulmonology

Airway Clearance
- Chest Physiotherapy (Manual or Vest therapy)
- Albuterol and 7% Sodium Chloride
- 1-2 times per day, increase to 3-4 times daily when acutely ill
- Aggressive Antibiotic Management

Foreign Body

HPI
- Witnessed or reported choking event in young child
- Onset of cough after playing or eating

Physical Exam
- Unilateral monophonic wheeze
- Decreased breath sounds
- Hemoptysis

Diagnostics
- Chest X-ray may be normal
- Chest CT
- Bronchoscopy

Foreign Body continued

May take months or years to diagnose

Tuberculosis (TB)

Global health issue
- 10 million cases worldwide in 2018
- 11% were children <15 years of age
- 250,000 deaths in children due to TB (World Health Organization, 2019)

United States
- Rare in children <18
- Risk factors
  - Being foreign born
  - Parent who is foreign born
  - Lived outside of US <2 months

HPI
- Cough
- Fever
- Weight Loss
- Sick contact

Physical Findings
- Crackles
- Lymphadenitis

Diagnostics
- Chest X-ray
- Skin test
- Sputum culture
- Labs

Management
- Pediatric Infectious Disease
- Pediatric TB Clinic
- Pediatric Pulmonary

Antituberculosis Medications
- Isoniazid
- Rifampin
- Rifabutin
- Pyrazinamide
Interstitial Lung Disease (chILD)
Lung disease that involves the parenchyma and interferes with gas exchange

- HPI:
  - Tachypnea
  - Cough
  - Crackles
  - Crackles, digital clubbing
  - Failure to thrive
  - Activity intolerance
  - Family History

- Physical exam:
  - Crackles, rales, wheezing
  - Cardiac exam generally normal (although may have s/s pulmonary hypertension or cor pulmonale)
  - Abnormal chest wall

Diagnostics
- Spirometry – typically restrictive
- CXR – abnormal but non-specific
- High Resolution CT
- Genetics
- Lung Biopsy

Treatment
- Supportive therapies
- Disease specific
- Lung transplant

Noninfectious Bronchitis/Irritant cough

- HPI:
  - Chronic cough
  - Exposure to irritant (indoor or outdoor pollutants)

- Diagnostics:
  - CXR - normal/peribronchial inflammation

- Treatment:
  - Reduce or avoid exposure to irritant

Space Occupying Lesion

- HPI:
  - Cough
  - Activity intolerance
  - Shortness of breath
  - Increase work of breathing
  - Previous medical history

- Diagnostics:
  - CXR

Space Occupying Lesion

- Management Plan
  - Refer to surgery
  - Refer to pulmonary

Post Infectious
**Post-Viral Cough**

- Thought to be due to hypersensitivity of airway after a respiratory illness
  - Rhinoviruses
  - Influenza
  - Respiratory Syncytial Virus

- HPI
  - Recent respiratory infection

- Physical Exam
  - Normal except for cough

**Diagnostics**
- Thorough history and physical
- Chest x-ray
- Spirometry if able

**Management**
- Watchful waiting
- Reassurance

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**Pertussis (Whooping cough)**

- HPI
  - Classic paroxysmal cough
  - Apnea
  - Post-tussive emesis
  - Rhinorrhea
  - Watery Eyes
  - Fever

- Catarrhal Phase
- Paroxysmal Phase
- Convalescent Phase

**Diagnostics**
- Bacterial Culture
- PCR
- Chest X-ray

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**Mycoplasma pneumoniae**

- HPI
  - Fever
  - Chronic Cough
  - Fatigue
  - Dyspnea
  - Sore throat

- Physical Exam
  - Abnormal breath sounds
Mycoplasma pneumoniae

- Typically variable and nonspecific
- Nasal swab mycoplasma PCR
- Blood: Mycoplasma IgM and IgG

Diagnosis:
- Preferred: Azithromycin 10mg/kg in one dose on day one then 5mg/kg in one dose for 4 days (max dose 500mg)
- Alternatives:
  - Clarithromycin 15mg/kg/day divided BID x 10 days (max daily dose 1g)
  - Doxycycline 2-4mg/kg/day daily or BID for 10 days (max daily dose 200mg)
  - Erythromycin 30-40mg/kg/day QID for 10 days (max daily dose 2g)
  - For children >7yr – tetracycline 20-50mg/kg/day QID for 10 days (max daily dose 2g)

- Immunocompromised:
  - Levofloxacin

Chlamydia pneumoniae

- CXR variable and nonspecific
- Nasal swab mycoplasma PCR
- Blood: Mycoplasma IgM and IgG

Diagnosis:
- Preferred: Azithromycin 10mg/kg on day 1 (max dose 500mg) followed by 5mg/kg/day (max 250mg) on days 2-5.
- Alternative: Doxycycline 2-4mg/kg/day divided into two doses (max daily dose 200mg) for 10-14 days

C. pneumoniae

- Management/Treatment
  - If clinically suspected, labs not needed. Obtain only if it will change plan of care.
  - Preferred: Azithromycin 20mg/kg on day 1 (max dose 500mg) followed by 5mg/kg/day (max 250mg) on days 2-5.
  - Alternative: Doxycycline 2-4mg/kg/day divided into two doses (max daily dose 200mg) for 10-14 days

Upper airway cough syndrome

- Any disease that can cause irritation in the upper airways resulting in cough

- HPI:
  - Postnasal drip
  - Allergic / non allergic rhinitis
  - Sinusitis
  - Tonsillar hypertrophy

- Treatment:
  - Dependent on underlying cause

Extra-Pulmonary

Gastroesophageal Reflux

- Chronic cough related to GERD is most often seen in children with underlying neurological disorders

- HPI:
  - Irritability, poor feeding, respiratory symptoms, and failure to thrive in infants
  - Regurgitation, food aversion, poor weight gain in young children
  - Dysphagia, heartburn, regurgitation, nausea in older children and adolescents

- Diagnostics:
  - Barium swallow study
  - Endoscopy
  - pH probe study
Gastroesophageal Reflux

Management

GI Referral for:
- Unexplained weight loss
- Persistent forceful vomiting
- Dysphagia
- Hematemesis
- No response to treatment

Medications
- PPIs
- H2 blockers

Cardiac

HPI
- Congenital heart disease
- Pulmonary hypertension
- Cardiogenic pulmonary edema
- On ACE inhibitors

Diagnostics
- Chest X-ray
- Echocardiogram
- ECG

Management
- Referral to Pediatric Cardiology
- Discontinue medication

Habit cough & Somatic Cough Disorder

Diagnostics
- Thorough history and physical
- Chest x-ray
- Spirometry if able

Management
- Suggestion therapy
- Referral to psychology or psychiatry

Habit cough

HPI
- Habit cough- repetitive and habitual features

Somatic cough disorder

HPI
- Somatic cough- diagnosis of exclusion and child meets DSM-5 criteria for somatic disorder.

Management
- ENT referral
- Pediatric Surgery referral
- Pediatric Pulmonary referral
- Speech and/or feeding therapy
- Prompt treatment of lower respiratory infections

Tracheoesophageal Fistula (TE Fistula)
Laryngeal Cleft

HPI
- Cough
- Choking with feeding
- Vomiting
- Difficulty breathing
- Noisy breathing
- Recurrent respiratory infections

Diagnostics
- Chest X-ray
- Bronchoscopy
Refactory Chronic Cough

- **HPI:**
  - Refractory to other treatments

- **Treatment:**
  - Neuromodulations (off label use)
  - Gabapentin believed to act on heightened neural sensitization
  - Morphine resulted in too many side effects
  - Gabapentin believed to act on heightened neural sensitization

- **Management:**
  - Refer to Pulmonologist

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**References**

- Irwin RS. Introduction to the diagnosis and management of cough. JACC: Clinical Practice Guidelines. 2018;1(1S):e103–131
- Timely and accurate diagnosis of cough is imperative to prevent complications
- When in doubt, refer to pulmonology

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**Reference**

- Chronic cough is one of the most common reasons to visit a healthcare provider
- Thorough evaluation of history, environment, symptoms and complete physical exam can help accurately diagnose cough
- Timely and accurate diagnosis of cough is imperative to prevent complications
- When in doubt, refer to pulmonology