Cough in Children

Cough in children

- Common symptom
- Most caused by self-limited RTI
- Not an illness by itself, but a cardinal indicator

Defensive mechanisms of Lung

- Specialized epithelial barriers
- Immune responses
- Neural reflex responses: cough reflex
What makes a child cough

**Stimuli**
- Mechanical
  - Touch, pressure, deformation
- Chemical
  - Smoke, mediators

**Cough receptors**
- Pharynx, larynx, trachea, main bronchus
- Nose, paranasal sinus
- External ear, pericardium
- Pleura, diaphragm

**Afferent fibers**
- Vagal, trigeminal, glossopharyngeal

**Cough center**
- Upper brainstem, pons

**Efferent fibers**
- Vagal, phrenic, spinal motors nerves

**Muscles**
- Laryngeal, diaphragmatic, thoracic, abdominal
Stimuli that trigger cough can be broadly divided into mechanical, inflammation and infection, and chemical categories. Examples of each of these are listed in the box. These triggers stimulate the various airway receptors, all of which are vagal airway afferents. The triggers can also sensitize and alter the receptor phenotype. All signals end at the nucleus tractus solitaries, from which second order neurons project into the brainstem respiratory network, which is also responsible for regulating respiration. The cerebral cortex and subcortex can modulate these networks that have plasticity. Neurons from the brainstem network project onto the larynx and spinal motor neurons (respiratory muscles and sphincter) that are activated during cough.\cite{1-4}

References:
Nose and sinuses
Posterior pharynx
Pericardium
Diaphragm
Trachea
Bronchi
Esophagus
Pleura
Ear canals
Ear drums
Stomach

Receptor

Expiratory muscles

Diaphragm

Vagus

Trigeminal
Phrenic
Spinal motor

Medullary cough center

Glosso Pharyngeal

Nerve

Effector

Vagus

Phrenic

Trigeminal

Larynx
Trachea
Bronchi
Cough in Children

Phases

1. Inspiratory
   - Deep breath
   - 1/5-2 TV

2. Compressive
   - Glottic closure
   - Contraction muscles

3. Expressive
   - Glottic opening
   - Explosive exhalation

4. Relaxation
   - Relaxation muscles
Cough - History

Cough

Acute
Less than 3 weeks

Subacute
3 to 8 weeks

Chronic
More than 3 weeks
Chronic Cough in Children

DEFINITION

Cough lasting for > 4 ws

Cough related to acute URTI
resolves within 1 to 3 w
10% > 25 days

Cough in Children

- Normal or expected cough
- Non-specific cough
- Specific cough
Cough in Children

Normal or expected cough

Non-specific cough

Specific cough

Normal but unlucky child

- 6-10 URT infections/ yrs : common
- Growth, development : N
- CxR, ph exam between episodes : N
- No family history of severe infections
- No serious extrapulmonary infections
- Reassurance parents

Chronic Cough in Children

Normal or expected cough

Non-specific cough

Specific cough

Presence of specific pointers

Symptoms and signs of an underlying respiratory or systemic disease
Cough in Children

Non-Specific cough

Normal or expected cough

Specific cough

Absence of identifiable respiratory disease or known aetiology

Most: No serious aetiology
Schematic diagram of the overlap between nonspecific and specific cough in children

Nonspecific cough
(chronic cough without any specific cough "pointers")

Specific cough
(chronic cough with specific cough "pointers")

The presence of signs and symptoms of specific causes of cough (specific cough "pointers") are used to distinguish specific cough from nonspecific cough during the initial evaluation; refer to UpToDate table on specific cough for details. The size of the circles reflect that nonspecific cough is likely more common than specific cough in the community. In referral populations (pulmonary clinics), specific cough is more common than nonspecific cough. The overlap between these circles indicates that some children who are initially categorized as having specific cough (due to the presence of specific cough pointers) ultimately prove to have nonspecific cause, and vice versa.
CAUSES

A. Aspiration syndromes
B. Birth defects
C. Compressive / Cardiac
D. Defects of mucous clearance
E. Environmental lung disease
F. Foreign bodies / Functional
G. Granulomatous diseases
H. Hyper reactive airways
I. Infections / Infiltrations
EVALUATION

RED FLAGS

Respiratory distress
Known foreign body
Cardiac failure
Infant
Complications of severe cough

Cough syncope

Air-leak syndrome

pneumothorax

pneumomediastinum

subcutaneous emphysema

superior vena - caval syndrome
Cough in Children

EVALUATION OF PATIENTS

- **Personal history**: Neonatal problem, feeding H, allergy H, previous infection or illness, vaccination, *Growth, development, appetite, activity*
- **Family history**: *atopy, CF, ID*
- **Quality**: *nonproductive (dry), productive (wet)*
- **Timing**: *supine position, nocturnal, upon awakening*
- **Trigger factors**: *Exercise, temperature changes seasonal variation*
- **Previous therapy**
- **Environmental factors**: Smoke, pets
- **Physical examination**
Chronic Cough

clinical investigations

A Pathogenic Triad in Chronic Cough*

Asthma, Postnasal Drip Syndrome, and Gastroesophageal Reflux Disease

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Background: Coughing may be produced by a number of different disorders in distinct anatomic sites. Chronic cough causes major functional limitation in a considerable patient population and requires careful evaluation.

Methods: Seventy-eight nonsmoking patients of both genders who complained of cough for ≥ 3 weeks and had normal findings on plain chest radiographs were studied prospectively. Their histories were obtained, and physical examinations were performed. The diagnostic workup included pulmonary function tests, CT of the paranasal sinuses and chest, carbachol provocation test, fiberoptic rhinoscopy, fiberoptic bronchoscopy, and 24-h esophageal pH monitoring. The final diagnosis depended on clinical, radiologic, and laboratory findings; a successful response to therapy was required for confirmation.

Results: The causes of chronic cough were determined in all patients. Coughing was due to a single cause in 30 patients (38.5%) and multiple causes in 48 patients (61.5%). The five most important causative factors were asthma (46 patients; 58.9%), postnasal drip syndrome (PNDS; 45 patients; 57.6%), gastroesophageal reflux disease (GERD; 32 patients; 41.1%), bronchiectasis (14
## Cough in Children

### EVALUATION OF PATIENTS

**Age of onset**: specific causes may uniquely affect certain age ranges

<table>
<thead>
<tr>
<th>Infancy</th>
<th>Early childhood</th>
<th>Late childhood</th>
</tr>
</thead>
<tbody>
<tr>
<td>GER, Infection, Congenital malformation, Passive smoking, Environmental pollution, Asthma</td>
<td>Post viral AHR, Asthma, Passive smoking, GER, Foreign body, Bronchiectasis</td>
<td>Asthma, PND, Smoking, TB, Bronchiectasis, Psychogenic cough</td>
</tr>
</tbody>
</table>
Cough in Children

Cough specific pointers
Signs, symptoms of underlying Dz

✓ Auscultatory findings: wheeze, crepitation
✓ Cardiac abnormalities: AW abnormalities, cardiac failure
✓ Dyspnea or tachypnea: AW or parenchymal Dz
✓ Chest wall deformity: AW or parenchymal Dz
✓ Digital clubbing: suppurative lung Dz
✓ Neurodevelopmental abnormalities: aspiration lung Dz
✓ FTT: cystic fibrosis
✓ Hypoxia/cyanosis: AW or parenchymal Dz, cardiac Dz
✓ Recurrent pneumonia: immunodeficiency, suppurative lung Dz, congenital lung abnormalities
Cough in Children

Cough specific pointers

Signs, symptoms of underlying Dz

Cough characteristics

Barking or brassy cough: croup, tracheomalacia

Cough productive casts: plastic bronchitis

Paroxysmal (with or without whoop): pertussis, parapertussis

Staccato: chlamydia in infants

Honking: psychogenic
## Classically recognizable cough sounds in children

<table>
<thead>
<tr>
<th>Cough characteristic</th>
<th>Suggested underlying pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barking or brassy cough</td>
<td>Tracheomalacia, tic cough/somatic cough disorder*, croup (if acute)</td>
</tr>
<tr>
<td>Honking or &quot;goose-like&quot; cough</td>
<td>Tracheomalacia, tic cough/somatic cough disorder*</td>
</tr>
<tr>
<td>Paroxysmal cough (with or without inspiratory whoop)</td>
<td>Pertussis and parapertussis</td>
</tr>
<tr>
<td>Staccato cough</td>
<td>Chlamydia in infants</td>
</tr>
<tr>
<td>Cough productive of casts</td>
<td>Plastic bronchihtis and conditions associated with mucous plugs such as ABPA</td>
</tr>
<tr>
<td>Chronic wet or productive cough only in the mornings</td>
<td>Suppurative lung diseases (eg, bronchiectasis, cystic fibrosis)</td>
</tr>
<tr>
<td>Wet or productive cough</td>
<td>Presence of endobronchial secretions</td>
</tr>
</tbody>
</table>

ABPA: allergic bronchopulmonary aspergillosis.

* Tic cough is sometimes termed "habit cough." Somatic cough disorder was previously known as "psychogenic cough." Although these types of cough have distinct definitions, they cannot always be distinguished clinically and the initial approach to management is similar, unless clear markers of somatic cough disorder are present[3].

Adapted from:
1. QUALITY

- **Whoop**: Pertussis, adenovirus
- **Honking**: laryngeal pathology
- **Dry barking / Brassy**: pharyngeal pathology, habit
- **Feeble**: neuro - muscular disease
- **Moist rattly / Productive**: suppurative lung disease
2. RESPIRATORY DISTRESS

- Stridor/grunt/wheeze localizes anatomical level
- Stridor suggests upper airway obstruction
- If the voice is hoarse it signifies a glottic or supra-glottic problem
- A grunt indicates alveolar disease and wheeze is typical of airway disease
3. **Failure to thrive** - Severe asthma, suppurative disease

4. **Malabsorption / malnutrition** - chronic disorders, cystic fibrosis

5. **Clubbing** - suppurative disorders
6. Murmurs - cardiac lesions

7. Neuro – muscular / anatomical defects - aspiration

8. Pressure effects-hernia, prolapse - consequence of violent or chronic cough
PERFORM

X-ray chest
RADIOLOGICAL EVALUATION OF CHRONIC COUGH
PRACTICAL APPROACH TO CHRONIC COUGH

1. Snoring/ Mouth Breathing
2. Persistent Spasmodic
3. Recurrent, nocturnal, Seasonal, related to feeding
4. Infants
5. Murmurs
6. Multiple multifocal Infections
Snoring / Mouth Breathing

X-ray Paranasal Sinuses and lateral Neck

- Sinusitis
- Adenoids

Antibiotics
Consider Surgery
Persistent Spasmodic

CBC / Chest X-ray

Endo-bronchial TB
Pertussis
Foreign body

No response
Bronchoscopy
Recurrent, nocturnal, Seasonal, related to feeding

Spirometry / Barium studies

Asthma
Aspiration syndromes
Eosinophilia

Bronchodilator/ appropriate Management
No response / surgical causes
Infants

X-ray chest
Ba. Swallow / HRCT
Angiography

Aspiration syndromes
Congenital Anomalies
Sequestrations

Appropriate medical / surgical management
Murmurs

X-ray Chest / 2D-ECHO

Congenital Heart Disease

Anti failure Therapy/ Surgical Management
Multiple multifocal Infections/F.T.T./Malabsorption /Clubbing

X-ray chest / HRCT

CF / immuno - deficiency work Up

Suppurative lung disease

Medical / surgical Management

Genetic counseling
An expiratory chest radiograph showing unilateral lung hyperinflation, suggestive of the presence of foreign body aspiration. This child's bronchoscopy revealed a nut in the right main bronchus.
Radiographic features of bronchiectasis in a child with chronic cough

Chest radiograph of a child showing ring shadows (dashed arrows) and tram-tracking (double arrow) evident within both lower zones; these are radiographic features of bronchiectasis. There is opacification in the right lower zone, obscuring the right cardiac margin and medial aspect of the right hemidiaphragm, consistent with consolidation (thick arrow) in the medial right lower lobe and medial aspect of the right middle lobe. The radiograph also shows hyperinflation and ill-defined consolidation present within the retrocardiac left lower zone. Note that chest radiographs have very poor sensitivity for diagnosing bronchiectasis.
Chest radiograph at the first presentation of a child known to have left atrial isomerism. He was first referred at four years of age with a history of chronic wet cough for more than two years. He never had a prior chest radiograph. The chest radiograph shows collapse of the right lower lobe, which re-expanded after bronchoscopy and intravenous antibiotics. The bronchoscopy showed left pulmonary isomerism and endobronchial secretions. The ciliary biopsy showed immotile cilia, confirming the diagnosis of primary ciliary dyskinesia (PCD). The child also had heterotaxy syndrome, which is commonly associated with PCD.
Radiographic appearance of a normal thymus gland in an infant

Posteroanterior (PA) view of the chest in a healthy infant. The radiopaque paraspinal density just above the heart (arrows) represents the normal infant thymus gland. The right margin is slightly undulating, characteristic of the thymus, which is indented by adjacent costochondral cartilages (thymic wave sign).

Right-sided aortic arch

Chest radiograph showing right-sided arch suggested by the absence of the left aortic contour. The arrow points to the area where the left aortic contour would be seen in a normal radiograph.

A right-sided arch is associated with vascular sling or ring and tracheomalacia. While tracheomalacia does not cause cough, it results in reduced cough efficiency, and hence predisposes the child to prolonged coughing episodes and endobronchial infections such as protracted bacterial bronchitis.
Cough in Children

History - Examination

Presence of specific pointers

Cough > 4 ws

Non-specific cough

Specific cough

CxR

PFTs

NR

R

Asthma TTT ??

Asthma!

No resolved

No

Yes

No

AN

AN

N

N
Non specific cough

Watch, Wait and review

Review in 1-2 ws ®

- Usually postinfectious cough ®
- GER ®
- Missed Foreign body inhalation
- Nonasthmatic eosinophilic bronchitis
- Medication : ACE, IS, ICS
- Environmental irritant : smoke, Air pollution(O3, SO2, NO2, V exhaust)
Cough in Children

Non specific cough

Watch, Wait and review

Review in 1-2 ws

Resolved

Specific pointers?

Discharge

No resolved

Specific cough

Trial of therapy
Cough in Children

Trial of therapy

Dry cough
- ICS 400 mic g/d budesonide
  - Review in 2-3 ws Resolving ?
    - yes
      - Asthma 
        - Period effect
    - No

Wet cough
- ATB 10 days
  - Review in 2-3 ws Resolving ?
    - yes
      - Protracted Bronchitis 
        - Period effect
    - No
Cough in Children

- CBC, ESR, Sweat test, Immune work up
- Sinus radiography
- CxR (inspi, expi)
- CT chest with mediastinal window
- Ba swallow, PH monitor
Step 1 - Evaluation and treatment

- Step 2 - Treat PND, antihistamine/decongestant

- Step 3 - Treatment for asthma, bronchodilators for 2 weeks

- Step 4 - Treatment of GER for 2 weeks

- Step 5 - Chest X-Ray, Mantoux, sinus CT, pulmonary function test, Ba. swallow

- Step 6 - Refer to pulmonologist

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Cough in Children

**Treatment**

- Should be based on aetiology
- AAP recommends against the use of medication containing codeine or dextromethorphan
- Antihistamines, Antihistamines+decongestant: no benefit over placebo
In conclusion

- **Suspect** congenital lung conditions in infants with chronic cough
- Asthma / Cough-variant asthma are the most common cause of chronic cough in children followed by postnasal drip and GERD
- The best way to approach cough is, find the cause and treat it!
CONCLUSION

- Very common in children
- Careful history + physical examination + appropriate investigation enable the correct diagnoses
- In majority: reflective of expected childhood respiratory infection
- In minority: representative of serious disorder
- Should be treated based on aetiology
THANK YOU