“Why Does My Child Cough So Much?”: An Aerodigestive Perspective

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Objectives

• Development of schema for evaluating patients with chronic cough

• Multidisciplinary evaluation of a child with a chronic cough and feeding difficulties
  – Otolaryngology
  – Pulmonology
  – Gastroenterology
  – Speech Pathology

• Role of triple endoscopy and swallowing evaluations in a child with a chronic cough and chronic respiratory complaints
Chronic Cough

A cough of more than 3 to 4 weeks duration
Chronic Cough

A cough of more than 3 to 4 weeks duration
Case

Why does my child cough so much?

- 11 month old, former 36 weeker
- Noisy breathing and one episode of croup
- Wet cough, frequent respiratory infections and “asthma”
- Spitting up and “reflux”
- Choking and gagging on feeds
From an Otolaryngologist’s Perspective

Noisy Breathing – Squeak, Snore or Gurgle

• Stridor
  – Inspiratory
  – Expiratory
  – Biphasic

• Stertor & Snoring
• Gurgling
  – Secretion Handling
From an Otolaryngologist’s Perspective

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- Stridor
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From an Otolaryngologist’s Perspective

- Quality of noisy breathing
- Sleep disordered breathing
- History of intubation or prolonged NICU Course
- Number of croup episodes
- General HEENT history
- Prior evaluations/interventions
From an Otolaryngologist’s Perspective

<table>
<thead>
<tr>
<th>Cause</th>
<th>Patients, No. (%)</th>
</tr>
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<tbody>
<tr>
<td>Infectious (URTI, sinusitis, UACS, and/or LRTI)</td>
<td>23 (34)</td>
</tr>
<tr>
<td>Airway hyperreactivity (Asthma and/or RAD)</td>
<td>14 (24)</td>
</tr>
<tr>
<td>GERD</td>
<td>14 (24)</td>
</tr>
<tr>
<td>Unresolved</td>
<td>8 (14)</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
<td>6 (10)</td>
</tr>
<tr>
<td>Laryngomalacia</td>
<td>5 (9)</td>
</tr>
<tr>
<td>Habit</td>
<td>4 (7)</td>
</tr>
</tbody>
</table>


From a Pulmonologist’s Perspective

**Cough – Onset**

- From birth – abnormal
- Possible foreign body event
- Post-viral
- Family history of asthma
From a Pulmonologist’s Perspective

Cough – Triggers

• Running / activity
• Cold air / smells / pollen etc etc etc
• Feeding (especially drinking)
• Stress

Cough – Contents

• Dry – doesn’t help me much
• Productive of sputum/mucus/phlegm
  – (Asthma can cause mucus secretion)
• Blood
From a Pulmonologist’s Perspective

Cough – Prior Treatments

• Antibiotics
• Bronchodilators
  – Technique (spacer!)
  – Dosage (1-2 puffs may be low)
  – What effect and for how long?
• Steroids

From a Gastroenterologist's Perspective

• Gastroesophageal reflux disease (GERD) is commonly associated with chronic cough in adults
• The connection between GERD and pediatric cough is less clear

From a Gastroenterologist's Perspective

• Presence and timing of other typical GERD symptoms (e.g. heartburn, recurrent regurgitation) can be helpful

• In infants and younger patients:
  – Symptoms often vague and non-specific
  – Non-acidic reflux may be more prevalent

• Important to consider other potential conditions:
  – Cow’s milk protein intolerance
  – Colic
  – Swallowing dysfunction

From a Gastroenterologist's Perspective

Besides cough, also pay attention to other feeding symptoms:

• Choking
• Vomiting
• Feeding difficulty or feeding refusal
• Difficulty with solids versus liquids
• Poor weight gain/failure to thrive
From a Gastroenterologist's Perspective

Eosinophilic Esophagitis (EoE) – new kid on the block:
- Chronic inflammatory condition
- Strongly associated with other atopic disorders
- Symptoms secondary to esophageal dysfunction and inflammation

From a Speech Pathologist’s Perspective

Coughing/choking are common signs/symptoms of dysphagia and are frequently used when requesting a Videofluoroscopic Swallow Study

Questions regarding “coughing” associated with feeding include:
- Timing of cough (during/after meals, beginning/end of meals)
- Consistency dependent (liquids, purees, solids)
- Frequency
- Severity
Brief Overview of 3 Phases of Swallowing

1. **ORAL**
   - Oral preparatory
   - Oral transit

2. **PHARYNGEAL**

3. **ESOPHAGEAL**

Phases of Swallowing:

**Oral Preparatory Phase**
- Expression of liquid from the bottle;
- Procuring food/liquid from utensils;
- Chewing; forming a bolus/controlling bolus

**Oral Transit**
- The duration is one second or less
- The bolus is propelled to the pharynx. The soft palate begins to elevate to close off the nasopharynx
Pharyngeal Phase – In Order of Events

- Velopharyngeal closure
- Hyoid movement
- Tongue base retracts
- Laryngeal elevation
- Epiglottis is tipped downward
- True and false vocal fold closure
- Initiation of pharyngeal constriction
- Opening of cricopharyngus

Esophageal Phase

- As SLPs, we only evaluate the upper 1/3 of the esophagus. The radiologist may evaluate the esophagus during the UGI series or esophagram
- Peristaltic movement through the esophagus and into the stomach
Normal Swallowing

Normal Infant
An Aerodigestive Perspective

• 11 month old former 36 weeker
• Noisy breathing and one episode of croup
• Wet cough, frequent respiratory infections and “asthma”
• Spitting up and “reflux”
• Choking and gagging on feeds

Why does my child cough so much?

An Aerodigestive Perspective

• 11 month old former 36 weeker
• Intubated 1 week in NICU
• Noisy breathing and one episode of croup
• Stridor early, constant gurgling
• Wet cough occasional wheezing
• 2 episodes of bronchiolitis, 1 pneumonia
• Spitting up since birth, but improving
• Good weight gain
• Chokes with liquids, slow in transition to solids
Medication List and Diet

- Dexamethasone last week for croup
- Albuterol Every 4 hours as needed
- Fluticasone Inhaler 44 mcg/puff Twice a Day
- Ranitidine 1 ml twice daily
- Bottled fed with Rice Cereal as thickener

Croup and Steroids

- Acute onset stridor, barky cough
- Corticosteroids
  - Dexamethasone up to 0.6 mg/kg IM/PO/IV
  - Prednisolone (1 mg/kg)
  - Trials for inhaled budesonide
- ER care – Hydration >>>> Racemic epi
- Consults for Recurrence (n?), chronic cough, h/o intubation, severity, atypical presentation

Role of direct laryngoscopy and bronchoscopy in recurrent croup.
Delany DR, Johnston DR.
Otolaryngol Head Neck Surg. 2015 Jan;152(1):159-64
Inhalers

**MDI + SPACER**

- Bronchodilator nebs work well / steroid nebs tend not to
- I tend to avoid dry powder or breath-actuated inhalers
- Spacer for **everyone** regardless of age

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**Inhalers – 3 Common Pitfalls**

1. “Albuterol didn’t work” – did it not work at all, or it only lasts a few hours?

2. Failure of steroid neb or breath-actuated inhaler does *not* necessarily mean failure of steroids

3. Black box warning on ICS-LABA is **gone**
Acid Suppressants and GERD

Proton Pump Inhibitors

- Many studies have raised concern about adverse effects associated with long-term PPI use
  - Primarily adult and observational studies
- What is real?
  - Low to modest risk of enteric bacterial infection (*C diff, Salmonella*, etc)
  - Idiosyncratic acute kidney injury is rare
  - Prevalence of bone fractures attributable to PPIs in older patients is low
- Ultimately consider risk (relative & absolute) versus benefits


Acid Suppressants and GERD

Ranitidine (Zantac)

- FDA alerted about possible high levels of known carcinogen (NDMA) in ranitidine products
- Preliminary FDA testing with much lower levels of NDMA
- Investigation ongoing but no FDA recall has been issued
- If long-term treatment needed, consider alternative medications such as cimetidine (Tagamet) or famotidine (Pepcid)
Acid Suppressants and GERD

- Use acid suppressants wisely
- Avoid using for chronic cough in the absence of other more typical reflux symptoms
- Due to concern for side effects, try to use the lowest dose possible for the shortest length of time


To Thicken or NOT To Thicken....

BEFORE thickening, we try to change...

- Flow rate
- Positioning
- Type of drinking vessel
- Bolus size

If the above modifications do not help, then THICKEN
Thickening Terms:

• Thin liquid
• Half nectar liquid – Slightly thick
• Nectar thick – Mildly thick
• Honey thick – Moderately thick

These will be changing to IDDSI framework in the next few years

Examination

• HEENT – Gurgling and stridor during feeds
• Pulmonary – Rhonchi Transmitted airway sounds
• GI – Belly soft good, bowel Sounds
• Speech – good initiation of suck, cough and choking during feeds
• Flexible laryngoscopy
Laryngeal Penetration…. Normal or Not?

• “Deep” penetration is defined as liquid or food that contacts that superior surface of the true vocal folds but does not go beneath the true folds (Friedman)

• In infants, “deep” penetration as defined by contrast that enters the lower 1/3 of the laryngeal vestibule is associated with subsequent tracheal aspiration on videofluoroscopic swallow studies (Friedman)

Timing of the Aspiration?
Before During After

• Gives us insight into the cause of the aspiration
• Goal: What is the cause of the aspiration; Why are they aspirating?
Aspiration BEFORE the Swallow

• Limited bolus control/containment

• Reduced tongue and soft palate approximation for posterior oral containment which leads to premature spillage to the pharynx (reduced posterior oral containment)

• Delayed initiation of the swallow (liquids dwelling in the valleculae and/or pyriform sinuses prior to the swallow)
Aspiration DURING the swallow

- Decreased laryngeal closure (vocal fold paresis/paralysis/glottic gap, etc).
- Poor timing of laryngeal closure
Aspiration AFTER the Swallow

• Weak pharyngeal musculature results in pharyngeal residue
• Residue then falls into the airway post-swallow
• Typically residue in the pyriform sinuses more concerning
Bronchoalveolar Lavage Results

**Lung, Lingula, Bronchoalveolar Lavage**

1. Cellular specimen with 85% macrophages, 10% neutrophils, 5% lymphocytes, and rare eosinophils
2. Squamous cells with fungal organisms morphologically compatible with candida, suggestive of upper airway contamination (see comment)
3. Negative for pneumocystis organisms on silver stain
4. Few (5%) lipid-laden macrophages on oil-red-o stain
EGD Biopsies

A. Esophagus, “proximal,” endoscopic biopsies: no significant pathologic abnormality

B. Esophagus, “distal,” endoscopic biopsies: no significant pathologic abnormality

C. Stomach, antral mucosa, endoscopic biopsies: no significant pathologic abnormality

D. Small intestine, “duodenum,” endoscopic biopsies: no significant pathologic abnormality

EGD Biopsy – Final Diagnosis

A. Esophagus, proximal, endoscopic biopsies: esophagitis, up to 9 eosinophils in a high power field

B. Esophagus, distal, endoscopic biopsies:
   • Esophagitis, peak of approximately 40 eosinophils in a high power field
Follow up: An Aerodigestive Perspective

Otolaryngology
- Response to interventions, change in aspiration signs/symptoms

Gastroenterology
- Adjustment to reflux medication
- Weight gain/Diet modifications
- Response to interventions – e.g., balloon dilation for strictures

Pulmonary
- Adjustment to inhalers/medications for airway inflammation
- Monitor respiratory infections
- Consider other diagnoses that could contribute to chronic cough

Speech Pathology
- Assess need for ongoing feeding/swallowing therapy
- Adjustment to diet/feeding strategies

Aerodigestive Programs
- Proliferating around the nation – 34 programs
- Patient satisfaction high with decrease anesthesia time, costs and charges compared to separate procedures
- Can lead to decreased hospitalizations especially in children who aspirate chronically


Demonstrating the benefits of a multidisciplinary aerodigestive program.
Case Follow up

- **Otolaryngology**
  - Good response to laryngeal cleft injection

- **Pulmonary**
  - Continue Fluticasone Inhaler
  - No recent hospitalizations

- **Gastroenterology**
  - Off Zantac

- **Speech Pathology**
  - No aspiration or penetration on follow up swallow study

Key Points

- Chronic cough is complicated! Etiologies from upper airway, lower respiratory tract and digestive system are possible

- Cough associated with feeding difficulties and/or frequent/prolonged sicknesses need special attention

- Feeding history and feeding/swallowing interventions including diet modification and positioning is critical in the child with feeding/swallowing difficulties

- Patients with feeding/swallowing issues and respiratory complaints can benefit from combined evaluation by Otolaryngology, Pulmonology, Gastroenterology and Speech Pathology

- Concerns for anatomic etiologies for recurrent respiratory infections, noisy breathing and gastrointestinal complaints may benefit from endoscopic evaluations