



**Texas Children's
Hospital**

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

Elton Lambert, MD Eric Chiou, MD
Julie P. Katkin MD Catherine L. Turk, PhD, CCC-SLP

Aerodigestive Program at Texas Children's Hospital



81

Objectives

- Development of schema for evaluating patients with chronic cough
- Multidisciplinary evaluation of a child with a chronic cough and feeding difficulties
 - Otolaryngology – Gastroenterology
 - Pulmonology – Speech Pathology
- Role of triple endoscopy and swallowing evaluations in a child with a chronic cough and chronic respiratory complaints

82

Chronic Cough

A cough of more than 3 to 4 weeks duration

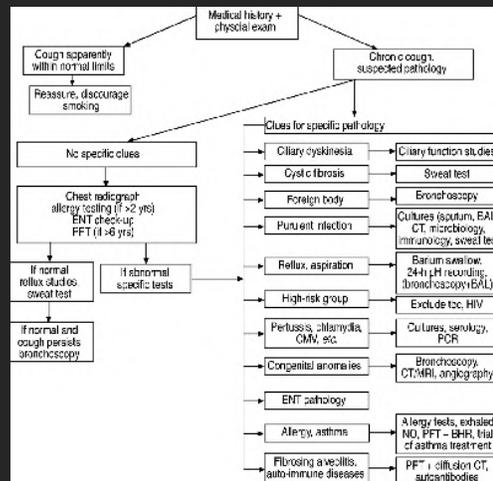


Sadof M, Kasloivsky, R Pediatrics in Review
 November 2013, VOLUME 34 / ISSUE 11
 Chronic Cough in Children: A Primary Care and Subspecialty Collaborative Approach



Chronic Cough

A cough of more than 3 to 4 weeks duration



Case

Why does my child cough so much?

87

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

88

From an Otolaryngologist's Perspective

Noisy Breathing – Squeak, Snore or Gurgle

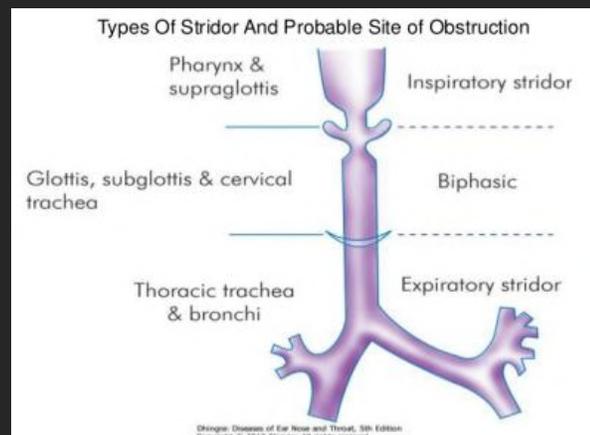
- Stridor
 - Inspiratory
 - Expiratory
 - Biphasic
- Stertor & Snoring
- Gurgling
 - Secretion Handling

89

From an Otolaryngologist's Perspective

Noisy Breathing – Squeak, Snore or Gurgle

- Stridor
 - Inspiratory
 - Expiratory
 - Biphasic
- Stertor & Snoring
- Gurgling
 - Secretion Handling

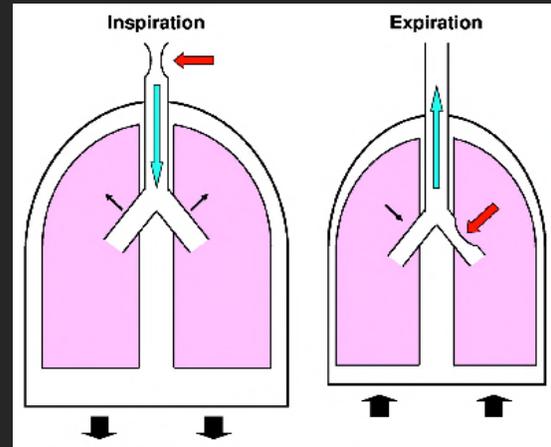


90

From an Otolaryngologist's Perspective

Noisy Breathing – Squeak, Snore or Gurgle

- Stridor
 - Inspiratory
 - Expiratory
 - Biphasic
- Stertor & Snoring
- Gurgling
 - Secretion Handling



91

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



92

From an Otolaryngologist's Perspective

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

Cash et al Chronic Cough in Children JAMA Otolaryngol Head Neck Surg. 2015;141(5):417-423.



93

From a Pulmonologist's Perspective

Cough – Onset

- From birth – abnormal
- Possible foreign body event
- Post-viral
- Family history of asthma



94

From a Pulmonologist's Perspective

Cough – Triggers

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

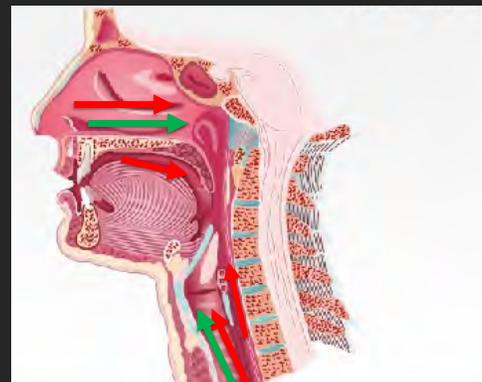


95

From a Pulmonologist's Perspective

Cough – Contents

- Dry – doesn't help me much
- Productive of sputum/mucus/phlegm
– (Asthma can cause mucus secretion)
- Blood



96

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



97

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 clear¹



¹Chang AB, Oppenheimer JJ, Weinberger MM, et al. Etiologies of chronic cough in pediatric cohorts: CHEST Guideline and Expert Panel Report. Chest. 2017;152(3):607-617

98

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



99

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

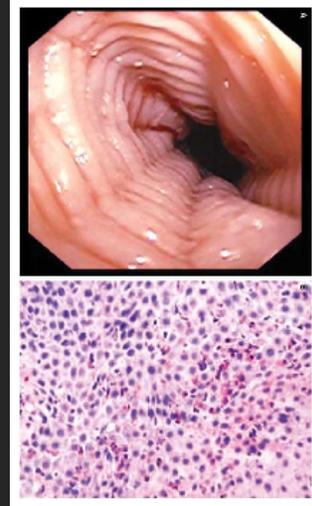


100

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



101

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

102

Brief Overview of 3 Phases of Swallowing

1

ORAL

- Oral preparatory
- Oral transit

2

PHARYNGEAL

3

ESOPHAGEAL



103

Phases of Swallowing:

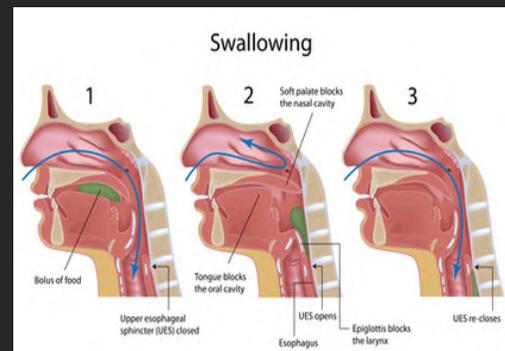
1

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



104

Pharyngeal Phase – In Order of Events

2

- 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



105

Esophageal Phase

3

- 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



106

Normal Swallowing



107

Normal Infant



108

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?



109

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
- Intubated 1 week in NICU
- 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



110

Medication List and Diet

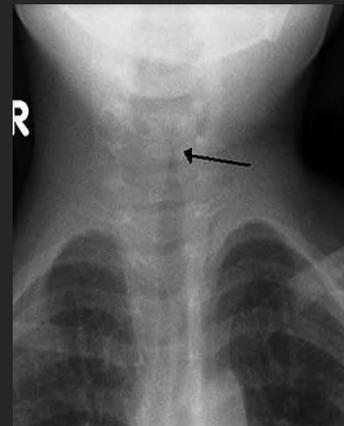
- Dexamethasone last week for croup
- Albuterol Every 4 hours as needed
- Fluticasone Inhaler 44 mcg/puff Twice a Day
- Ranitidine 1 ml twice daily
- Bottled fed with Rice Cereal as thickener



111

Croup and Steroids

- Acute onset stridor, barking 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



112

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



113

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**

114

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

Malfertheiner P, et al. Proton-pump inhibitors: understanding the complications and risks. *Nat Rev Gastroenterol Hepatol*. 2017 Dec;14(12):697-710



115

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)



116

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



Rosen R, et al. Pediatric Gastroesophageal Reflux Clinical Practice Guidelines – Joint Recommendations of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition and the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition. J Pediatr Gastroenterol Nutr. 2018 Mar;66(3):516-554



117

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**



118

Thickening Terms:

- Thin liquid
- Half nectar liquid – **Slightly thick**
- Nectar thick – **Mildly thick**
- Honey thick – **Moderately thick**

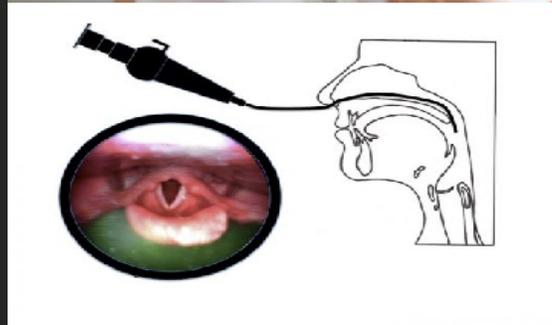
These will be changing to **IDDSI** framework in the next few years



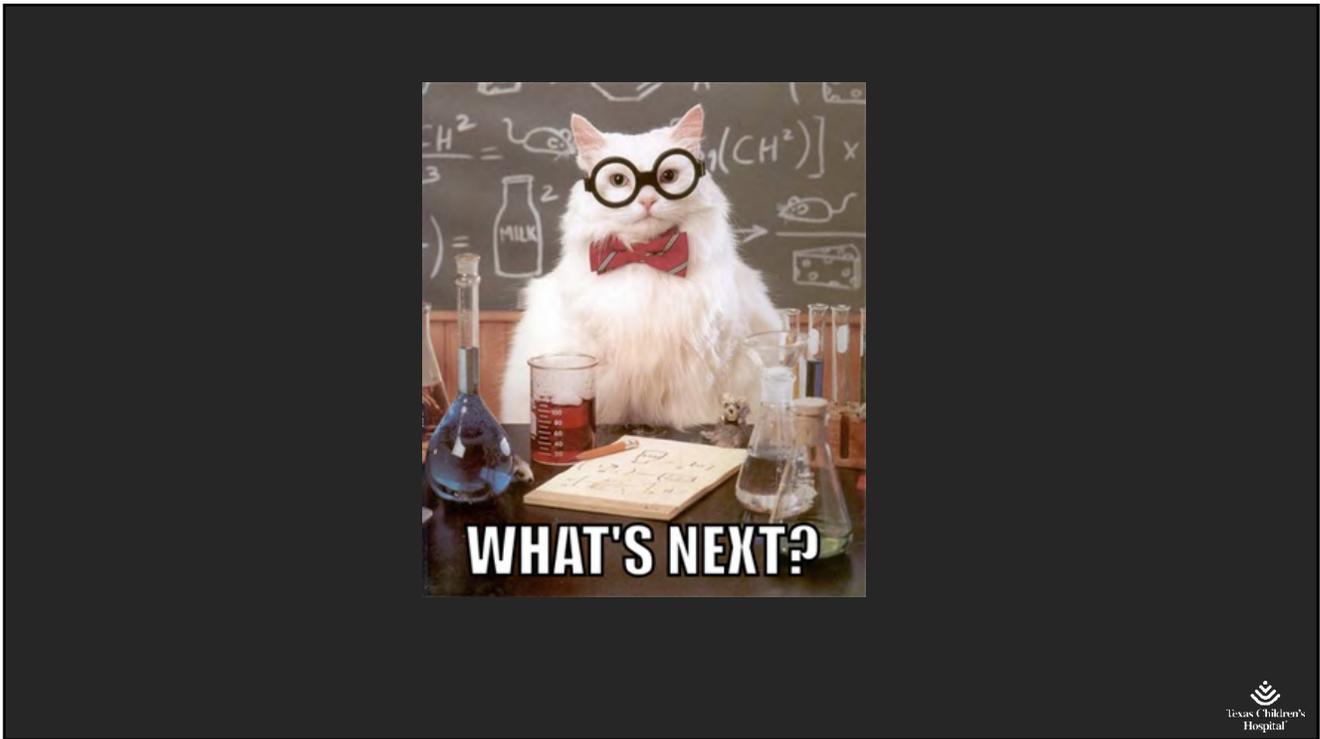
119

Examination

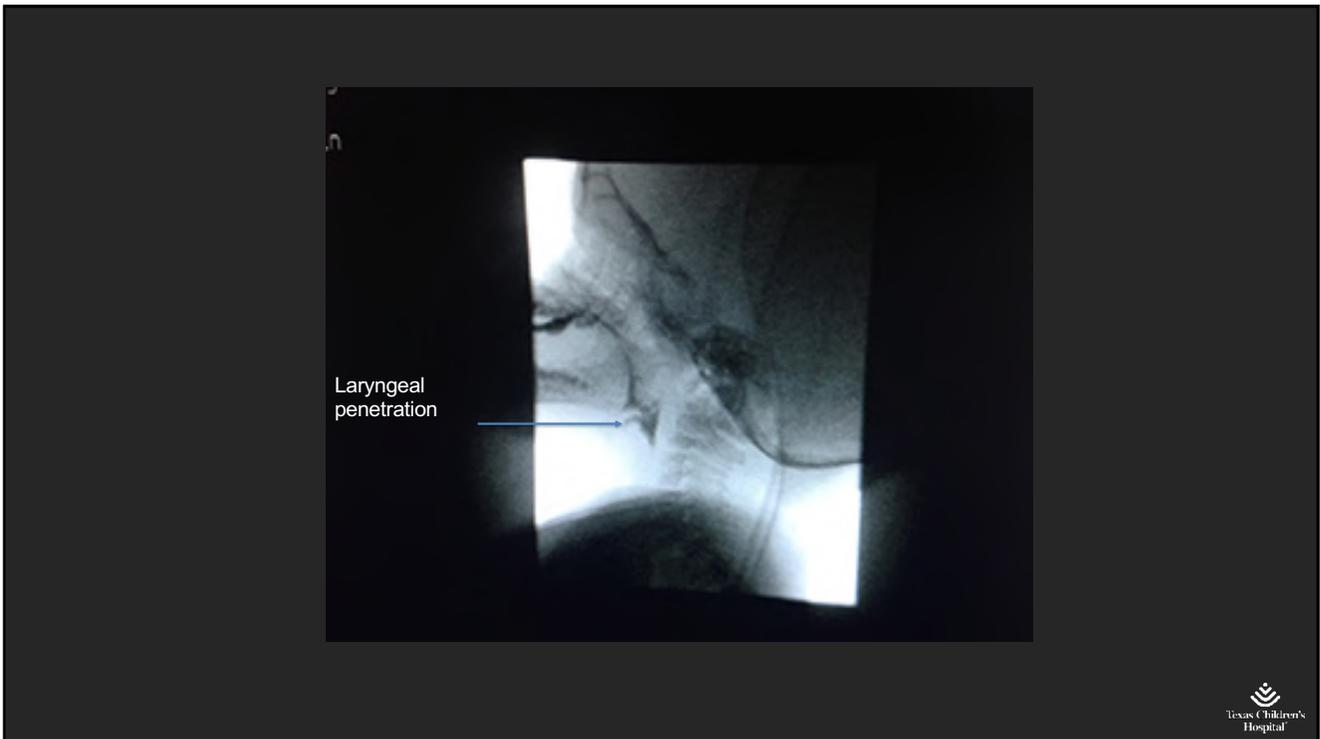
- HEENT – Gurgling and stridor during feeds
- Pulmonary – Rhonchi
Transmitted airway sounds
- GI – Belly soft good,
bowel Sounds
- Speech – good initiation of
suck, cough and choking
during feeds
- Flexible laryngoscopy



120



121



122

Laryngeal Penetration.... Normal or Not?

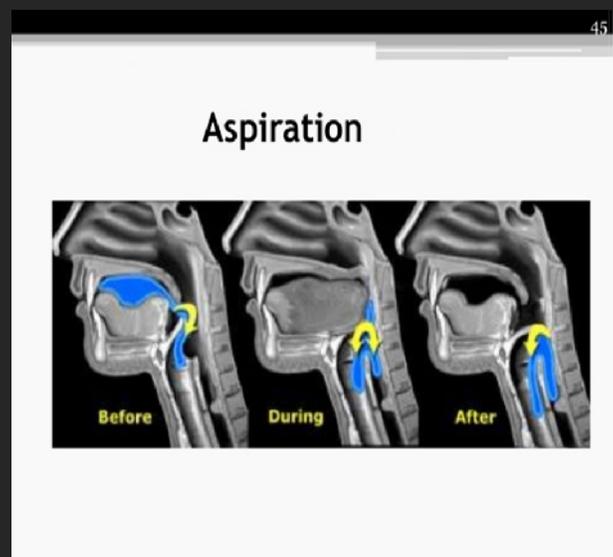
- “Deep” penetration is defined as liquid or food that contacts that superior surface of the true vocal folds but does not go beneath the true folds (Friedman)
- In infants, “deep” penetration as defined by contrast that enters the lower 1/3 of the laryngeal vestibule is associated with subsequent tracheal aspiration on videofluoroscopic swallow studies (Friedman)



123

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?



124

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)



125

Aspiration BEFORE the Swallow



126

Aspiration DURING the swallow

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



127

Aspiration DURING the Swallow



128

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

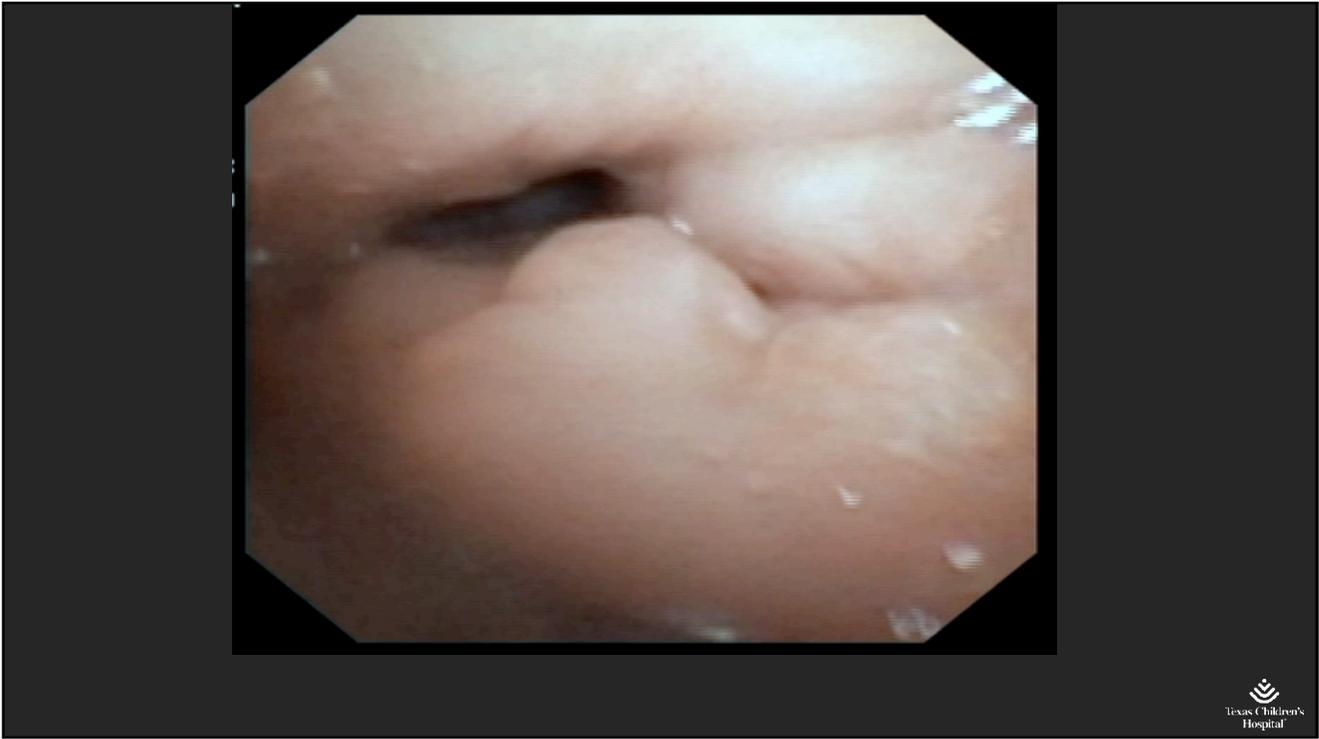


129

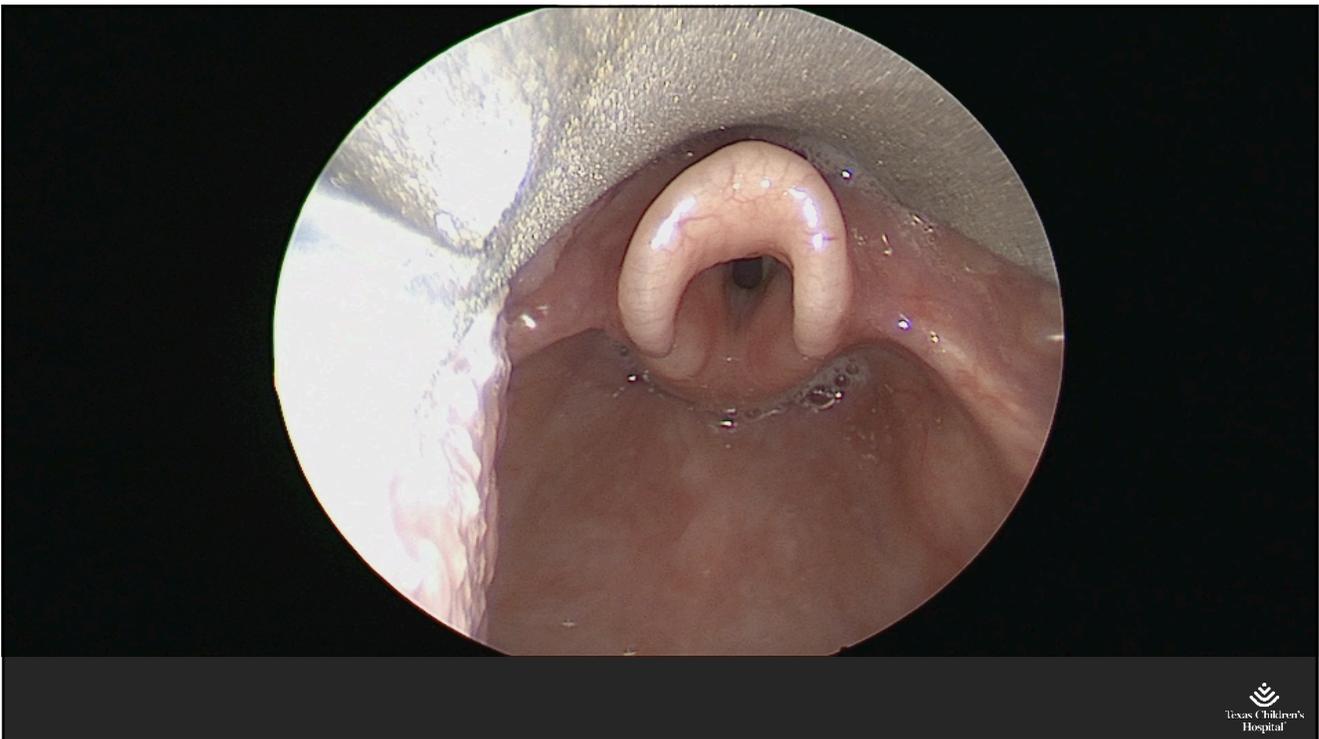
Aspiration AFTER the Swallow on Residuals of Nectar Thick Liquids



130



131



132



133

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



134

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**



135

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



136

Follow up: An Aerodigestive Perspective

Otolaryngology

- Response to interventions, change in aspiration signs/symptoms

Pulmonary

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

Gastroenterology

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

Speech Pathology

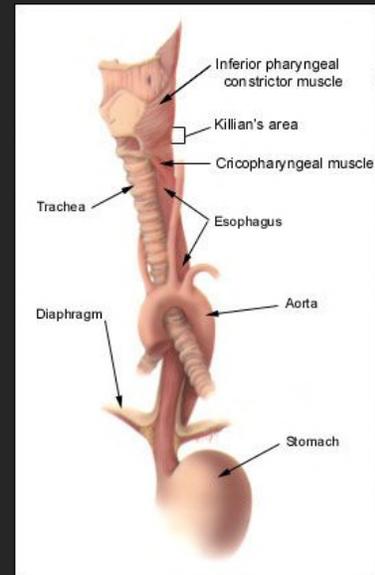
- Assess need for ongoing feeding/swallowing therapy
- Adjustment to diet/feeding strategies



137

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



Size and Prevalence of Pediatric Aerodigestive Programs in 2017.
Gumer L, Rosen R, Gold BD, Chiou EH, Greifer M, Cohen S, Friedlander JA.
J Pediatr Gastroenterol Nutr. 2019 May;68(5):e72-e76

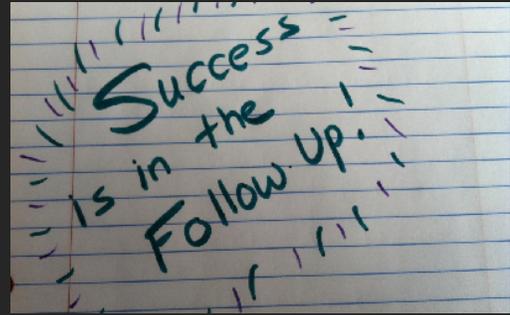
Demonstrating the benefits of a multidisciplinary aerodigestive program.
Ruiz AG, Bhatt JM, DeBoer EM, Friedlander J, Janosy N, Peterson MB, Wine T, Deterding R, Prager JD.
Laryngoscope. 2019 Mar 27.



138

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



139

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

140



141