Dysphagia In the Aerodigestive Patient

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Overview

- Changes in Normal Anatomy Over Time
- Normal and Abnormal Physiology of Swallowing in Children
- The Evolution of Etiologies of Dysphagia After the NICU
- The Evaluation and Treatment of Dysphagia in the Aerodigestive Patient
- Dysphagia Through the Airway Reconstruction Process
Changes in Normal Anatomy Over Time

Adult

2 y/o

2 d/o
<table>
<thead>
<tr>
<th>Anatomic location</th>
<th>Infant</th>
<th>Adolescent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral cavity</td>
<td>Smaller, due to size and position of mandible</td>
<td>Larger, due to downward forward growth of mandible</td>
</tr>
<tr>
<td></td>
<td>Filled with tongue and fat pads</td>
<td>Presence of teeth and absence of suckling pads creates more space</td>
</tr>
<tr>
<td>Tongue</td>
<td>Housed entirely in the oral cavity</td>
<td>Base of tongue is located in the oropharynx</td>
</tr>
<tr>
<td>Larynx</td>
<td>Approximately 1/3 the size of the adult larynx, minimal gender differences</td>
<td>Vocal fold length is 17–21 mm</td>
</tr>
<tr>
<td></td>
<td>Vocal fold length is 2.5–3.0 mm</td>
<td>Size of the adult larynx is 36 mm for females and 44 mm for males</td>
</tr>
<tr>
<td>Epiglottis</td>
<td>Tip is located at C2</td>
<td>Tip is located at C5–7</td>
</tr>
<tr>
<td></td>
<td>Tip makes contact with soft palate</td>
<td>Tip no longer makes contact with soft palate</td>
</tr>
</tbody>
</table>
Changes in Normal Anatomy Over Time
Normal and Abnormal Physiology of Swallowing in Children
Dysphagia in the Aerodigestive Patient

Definition of Dysphagia: difficulty with any step of the feeding process—from accepting foods and liquids into the mouth to the entry of food into the stomach and intestines.

Dysphagia Encompasses both feeding and Swallowing-
- Oral Stage
- Oropharyngeal Phase
- Pharyngeal Phase
- Esophageal Phase
Efficient Feeding and Swallowing Requires:

- Oral Preparation Stage—preparing the food or liquid in the oral cavity to form a bolus-including sucking liquids, manipulating soft boluses, and chewing solid food.
- Oropharyngeal Phase—moving or propelling the bolus posteriorly through the oral cavity.
- Pharyngeal Phase—initiating the swallow; moving the bolus through the pharynx.
- Esophageal Phase—moving the bolus through the cervical and thoracic esophagus and into the stomach via esophageal peristalsis (Logemann, 1998).
Phases of the Swallowing process:

1. Bolus of food
2. Soft palate blocks the nasal cavity
3. Epiglottis blocks the larynx

- Upper esophageal sphincter (UES) closed
- Tongue blocks the oral cavity
- UES opens
- Esophagus
- UES re-closes
Coordination of Respiration/Swallowing

- Pharynx is a channel for both airflow and the passage of ingested material, breathing and swallowing cannot occur simultaneously without risk to the airway.
- Respiratory Patterns and Swallowing are highly coordinated, (sucking/breathing may occur simultaneously, but at moment of swallowing, airway is closed.
The Evolution of Etiologies of Dysphagia After the NICU

• Oral Aversion/Textural Concerns
• Neurocognitive Delay
• Structural Problems
• Laryngeal Inflammation

Source: IP THA Data via Strategic Marketing Office
Dysphagia: Structural Problems

- Choanal stenosis
- Cleft lip/palate
- Laryngotracheal cleft
- TEF/EA
- Vascular ring
- Tumors
- Craniofacial anomalies
- Glottic insufficiency
Laryngeal Inflammation: the Backbone of Aerodigestive Clinic Dysphagia

- Prolonged intubation
- Multiple intubations
- Allergic disease
- GERD
- EoE
Double-Staged, Anterior-Posterior Costal Cartilage Graft Laryngotracheoplasty
Three Weeks Later
The Evaluation and Treatment of Dysphagia in the Aerodigestive Patient
Evaluation

• Starting point: baseline assessment of feeding status, oral stage problems, related medical problems, identify clinical signs & symptoms of dysphagia
• Limitations: cannot assess beyond the oral phase
• Outcome: provides basis for clinical pathway to determine further assessments, instrumental & other
Common feeding Presentations in the Aerodigestive Patient

• Compromised nutritional status
• Poor growth/Failure to thrive due to poor volume/mechanics
• Food refusal/Limited food repertoire/Food Sensitivities
• Decreased volume
• Delayed oral motor/feeding skills
• Choking/coughing/gagging/vomiting while eating/drinking
• Difficulty transitioning from enteral to oral feeds
• Maladaptive/Behavioral feeding problems
Common Swallowing Presentations in the Aerodigestive Patient

- Wet/gurgly vocal quality with eating/drinking
- History of chronic Pulmonary issues, ie: wheezing, recurrent respiratory infections, hx of recurrent pneumonia, poorly controlled asthma
- Fevers of unclear etiology
- Apnea/bradycardia/color changes with feeding
- Stridor
- Vocal cord dysfunction
- Coughing/choking with eating/drinking
Videofluoroscopic Swallow Study

• Indications: patient demonstrates signs or symptoms of swallowing dysfunction

• Collaborative examination via radiologist & speech pathologist
• SLP: positioning, use of feeding equipment & food/liquid to which patient is accustomed
  – Implementation of compensatory strategies
  – Involvement of family
  – Dual interpretation with radiologist, decision-making following study in collaboration with others on team
VFSS : Advantages

• Advantages:
  – View of all phases of swallow, no discomfort, ability to try compensatory strategies
  – Provides ongoing view of airway protection during rapid chain swallowing sequences i.e. bottle-feeds
  – Provides opportunity to exclude structural problem in esophagus as source of dysphagia
VFSS: Disadvantages

• Radiation exposure
• Child may resist barium – may not get sufficient sample for meaningful interpretation
• Not feasible if child has negligible oral intake
• Operator dependent
• Poor interrator reliability – implications for accuracy of interpretation and appropriateness of subsequent recommendations re: feeds
FEES Assessment

• Pediatric FEES – A definition
  – Transnasal passage of endoscope to view pharyngeal and laryngeal structures
  – Assessment of ability to protect airway during swallowing
  – Collaborative exam – Speech Pathology & Otolaryngology
Non-Surgical Treatment of Dysphagia: Infant Treatment
Goals of Treatment

Safely support adequate nutrition/hydration
Determine feeding techniques to maximize feeding safety and efficiency
Attain age/developmentally appropriate feeding skills
Treatment

- Positioning
- Diet Modifications
- Equipment/Utensils
- Feeding Techniques
- Oral Motor Skills
- Pacing/Feeding Strategies
- Sensory
- Behavioral Interventions
- Parent Education
The Treatment of Dysphagia: Surgical

Anatomical Problem = Anatomical Solution*

*Not universally true
*Not universally true
Anatomical Problem = Anatomical Solution

• Specific Anatomies
• Dysphagia in Airway Reconstruction
Breathe  Suck  Swallow
Suck
Swallow
Breathe

Frenulectomy
Palatoplasty
Part. glossectomy

Suck

Swallow

Breathe
Breathe → Suck → Swallow

Cricopharyngeal myotomy
Tx. Vallecular cyst
Palatoplasty
Repair laryngeal cleft
Repair CNPAS
Tx. Choanal atresia
Tx. Valleeclar cyst
Supraglottoplasty
Airway Recon.

Breathe  Suck  Swallow
More About Breathing: Dysphagia and Airway Reconstruction

I. Preoperative Causes of Dysphagia

II. Assessing Dysphagia in the Preoperative Patient

III. Postoperative Dysphagia: Early Phase

IV. Postoperative Dysphagia: Late Phase
Dysphagia and Airway Reconstruction

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Preoperative Causes of Dysphagia

Anatomical Considerations

- Laryngomalacia
- Subglottic stenosis
- Tracheal stenosis
- Vocal fold paralysis
- Cricothyroidal fixation
- Laryngeal cleft
- Tracheoesophageal fistula
- Laryngeal scarring
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- GERD
- Eosinophilic Esophagitis
- Other Chronic Laryngitis
- Oral Aversion/Texture Refusal
- Oral-Motor Problems
- Age <2 years
- Multiple Medical Comorbidities
- Neurological Dysfunction
- Tracheostomy-Dependent
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Assessing Dysphagia in the Preoperative Patient

- Specifically, the sphincteric functions of the larynx may be temporarily or permanently altered by airway reconstruction.
Assessing Dysphagia in the Preoperative Patient

- History
- Physical
- Flexible Nasopharyngoscopy
- FEES/FEEEST
- Video Fluoroscopic Swallow Study
Fiberoptic Endoscopic Evaluation of Swallowing (FEES)

Assess For:

- Pooling of secretions
- Poor oral motor skills with premature spillage
- Laryngeal penetration
- Aspiration
- Hypopharyngeal residue
Fiberoptic Endoscopic Evaluation of Swallowing (FEES)
Videofluoroscopic Swallow Study (VFSS)
WHAT IS AIRWAY RECONSTRUCTION?
Interlude: What is “Airway Reconstruction?”

- Single Stage = Leave the OR without a tracheostomy
- Double Stage = Leave the OR with a tracheostomy
Interlude: What is “Airway Reconstruction?”

Augmentation (Grafting)
Interlude: What is “Airway Reconstruction?”

Slide Tracheoplasty
Dysphagia and Airway Reconstruction

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Postoperative Dysphagia: Early Phase

Tracheostomies and the Etiologies of Dysphagia

- Oral
- Pharyngeal
- Esophageal
- No Dysphagia
Postoperative Dysphagia: Early Phase

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Postoperative Dysphagia: Early Phase

Tracheostomies lead to [pharyngeal-phase] dysphagia by several mechanisms:

1. Restricted laryngeal elevation
2. Subglottic air cushion is lost (improved with capping/PMSV)
3. Laryngeal adductor reflex is blunted
Postoperative Dysphagia: Early Phase

In airway reconstruction, the patient is getting more than simply a tracheostomy (or its removal). What is the nature and timeline of dysphagia in this unique population?
Postoperative Dysphagia: Early Phase

Types of Stents Used in Airway Reconstruction:
1. Endotracheal tube
2. Suprastomal stent
3. Montgomery laryngeal stent
4. T-tube
5. Tracheal [bronchial] stent
6. None
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What Is a “Tracheal Stent?”
POD 4 ssCTR with a tracheal stent
What is a Sutured (vs Non-Sutured) Suprastomal Stent?
VFSS Example of Dysphagia To Thins With a Suprastomal Stent
Management of Oral Feeding in Children Undergoing Airway Reconstruction

Lee P. Smith, MD; Staci E. Otto, MS; Kathrine A. Wagner, MA; Linda Chewaproug, MS; Ian N. Jacobs, MD; Karen B. Zur, MD

- 18 ss cases, 22 ds cases – oral feeders preop
- 7/16 patients had successful feeding (stent in)
  - 4 had stent sutured, 12 had non-sutured stents
  - 4/4 with sutured stent tolerated feeds
- 34/40 (85%) resumed preop diet within 0-8 days of stent removal/extubation, average 1.9 days
  - 6/40 (15%) had significant postop dysphagia
    - No difference in graft sizes, age, previous LTR, ss, ds...
Early Postoperative Dysphagia

• Improving Voice and Swallow
  – Passy Muir Valve usage

• Dysphagia of a greater duration is associated with:
  – DS anterior+posterior grafts with a T-tube stent
  – DS CTR with a T-tube stent and
  – DS VF lateralization
  – DS petiole repositioning
  – DS open arytenoidectomy
Early Postoperative Dysphagia: Feeding Tips—PART 1

With a Suprastomal Stent
• Thin liquids and purees initially
• Alternate sips of thins with solids to clear residue from the stent
• PO intake may require a “supraglottic swallow sequence” (clear throat → hold bolus → hold breath and swallow → clear throat)

Immediately After Extubation (ss) or Stent Removal (ds)
• Lightly thickened liquids, purees, soft, dissolving solids are commonly recommended
• Advance as tolerated by bedside SLP visits
• Repeat VFSS a few days later as indicated (if postop VFSS was abnormal and dysphagia persists)
Early Postoperative Dysphagia

- A success story: VFSS examples from a 67 y/o child with end-stage rheumatoid arthritis affecting the larynx requiring urgent tracheotomy and ultimately repaired with an endoscopic posterior graft LTP

Her capped suprastomal stent
POD 3 ds Posterior LTP (endoscopic) with a capped suprastomal stent
Same patient, POD 1 after stent removal
Postoperative Dysphagia: Late Phase

- 97% achieved or improved upon their preoperative feeding status
- Postop dysphagia did not lead to weight loss
- No decrease in standardized growth chart during the 12 months postop
- Patients with G tubes preoperatively continued to use them postoperatively
Distilling the Data From Three Studies: Postoperative Oral Feeding Prognosis For Patients Who Were Oral Feeders Preoperatively

**Time to PO after dsLTP/CTR in pts who took SOME PO (stent in)**

4-28 days (16/18 Pts@ CCHMC); “by POD 2” (7/16 Pts@ CHOP)

**Time to PO after ssLTP/CTR in oral feeders (extubated)**

1-5 days (13/13 Pts@ CCHMC); 0-8 days (16/18 Pts@ CHOP)

**# Back to Preop Oral Diet after dsLTP/CTR (stent out)**

28/29 Pts@ CCHMC; 39/40 Pts@ CHOP; 28/29 Pts@ MUSC
Postoperative Dysphagia: Late Phase

- Decannulation Rate: 93.1-94%
- Diet Same As Preop Rate: 97-100%
- Satisfactory Voice Rate: TBD
Conclusions

• Instrumental measures to assess dysphagia preoperatively (FEES and/or VFSS) are useful in predicting long-term postoperative feeding status after airway reconstruction

• Respect the young (2 y/o and younger), tracheostomy-dependent, medically complex
Conclusions

- Transient dysphagia is common following airway reconstruction.

- Nearly universally, airway patients, in time, return to or improve upon their preoperative swallowing abilities.
Dysphagia in the Aerodigestive Patient

THANK YOU