

SWALLOWING DISORDERS IN INFANTS AND TODDLERS: TESTING AND TREATMENT

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Disclosure

In the past 12 months, I have had no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity.

Objectives

- Recognize swallowing problems in normal and medically-complex infants and toddlers
- Understand the instrumental diagnosis of dysphagia
- Comprehend the role non-physician colleagues provide to the diagnosis and treatment of dysphagia
- Be empowered to synthesize and execute plans for infants and children with swallowing disorders

SWALLOWING AND DYSPHAGIA



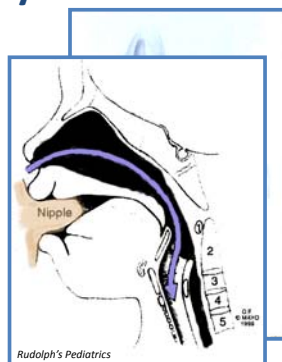
Normal progression of feeding skill acquisition:

Breast / Bottle only	0-4 mos
Smooth puree by spoon	4-6 mos
Soft chewables and cup	6-8 mos
Mashed table food	8-12 mos
Chopped table food	12-18 mos

*Development of Swallowing and Feeding: Prenatal through First Year of Life
Delaney & Arvedson, Dev Dis Res Rev, 2008*

Infant Anatomy

- Tongue fills mouth
- Edentulous
- Small mandible relative to maxilla
- No definite oropharynx
- 1/3 of adult size
- Narrow vertical epiglottis



Transitional Anatomy

- Oral cavity enlarging
- Dentulous
- Lengthening mandible
- Elongating pharynx
- Descending larynx
- Widening epiglottis



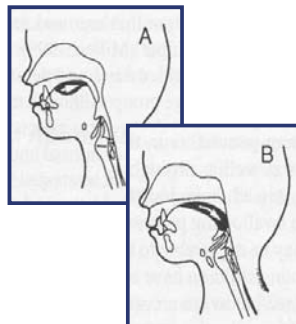
Adult Anatomy

- Tongue rests on floor
- Dentulous
- Larger mandible relative to maxilla
- Present oropharynx
- Flat, wide epiglottis



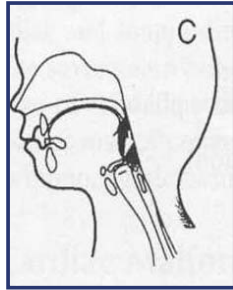
Oral Stage

- Oral manipulation of food
- Timing depends on consistency
- First posterior movement of bolus by tongue
- Voluntary
- Airway open



Onset of Pharyngeal Swallow

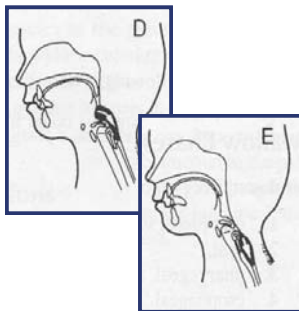
- Bolus passes anterior faucial arch to valleculae
- Elevation and retraction of velum (soft palate)
- Elevation and anterior movement of hyoid and larynx
- Closure of larynx
- Opening of CP juncture



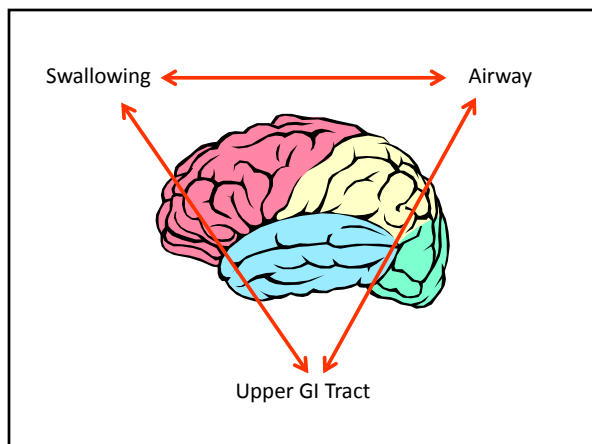
Arvedson & Brodsky

Pharyngeal Stage

- Pharyngeal transit time: 1 sec or less
- No hesitation of bolus
- Clearance of pharynx post-swallow
- Return of larynx to rest position in individual swallows
- Resume respiration



Arvedson & Brodsky



Oral Phase:



Afferent		Touch	Taste
	Trigeminal (V)	Oral cavity, anterior 2/3 of tongue	None
	Facial (VII)	None	Anterior 2/3 of tongue
Efferent	Glossopharyngeal (IX)	Posterior 1/3 of tongue	Posterior 1/3 of tongue
	Trigeminal (V)	Muscles of mastication	
	Facial (VII)	Lips and face	
	Vagus (X) Hypoglossal (XII) C1 & C2	Tongue	

Pharyngeal Phase:



Afferent	Glossopharyngeal (IX)	Pharynx
	Vagus (X)	Larynx and Esophagus
Efferent	Trigeminal (V)	Tensor veli palatini
	Glossopharyngeal (IX) Vagus (X)	Palate, pharynx, larynx
	Trigeminal (V) Facial (VII) C1 & C2	Hyoid and laryngeal movement

DIAGNOSIS



Dysphagia

- Def: **difficulty in swallowing**
- A symptom, not a disease
- Indicates an underlying problem
 - Neurologic
 - Muscular
 - Anatomic
- Generally, physicians not trained in assessment



Assessment of dysphagia:

- Clinical assessment
- Instrumental assessment
 - Videofluoroscopic swallow study (VSS)
 - Fiber-optic endoscopic evaluation of swallow (FEES)
 - Scintigraphy (milk scan / spit scan)
 - High-resolution manometry
- Assessment for sequelae of aspiration
 - CT Scan
 - Bronchoscopy
- Assessment for CNS anatomic pathology
 - Brain MRI

Clinical Evaluation of Swallow

- Prospective evaluation of 75 children*
 - Age range 0-14 years, mean 2 years
 - Clinical evaluation (compared to VSS) :
 - 92% sensitivity for detection of fluid aspiration
 - 33% sensitivity for detection of solid aspiration
- No radiation or instrumentation
- Cannot detect silent aspiration

*DeMatteo et al., Dev Med Child Neurology, 47, 2005

Videofluoroscopic Swallow Study

- Thought to be “gold standard”
- *Unlike other gold standards :*
 - Variability in procedure
 - Variability in interpretation of procedure
 - Aspiration may be only measure with high inter-rater reliability
- Effective in predicting development of pneumonia relative to degree of swallowing dysfunction

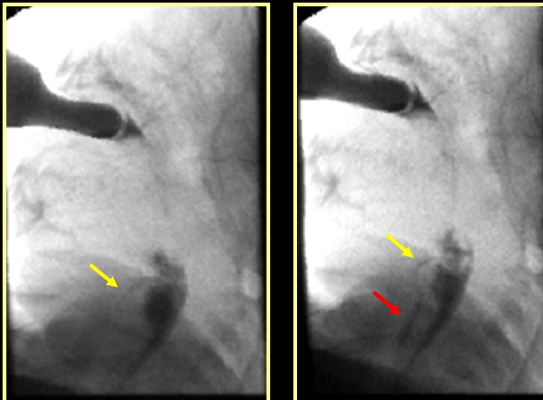


O'Donoghue and Bagnall, Folia Phoniatr Logop, 51, 1999

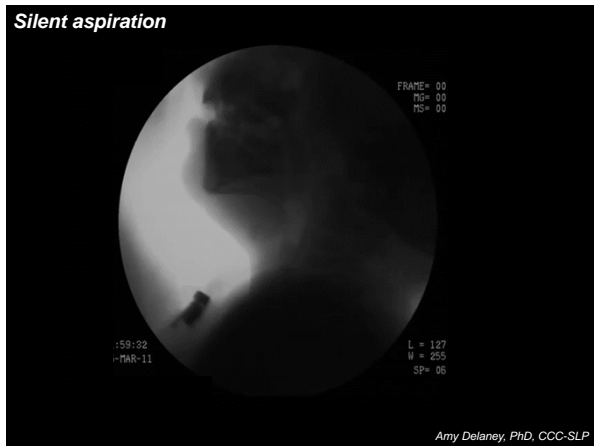
VSS – systematic assessment

- **Oral phase components**
 - Lip closure
 - Tongue control during bolus hold
 - Bolus preparation / mastication
 - Bolus transport / lingual motion
 - Oral residue: amount
 - Oral residue: location
- **Pharyngeal phase components**
 - Initiation of pharyngeal swallow
 - Soft palate elevation
 - Laryngeal elevation
 - Anterior hyoid excursion
 - Epiglottic movement
 - Laryngeal vestibular closure: height of swallow
 - Pharyngeal stripping wave
 - Pharyngeal contraction
 - Pharyngoesophageal segment
- **Esophageal phase components**
 - Esophageal clearance in upright position
- **Penetration / Aspiration**
 - Thin liquid (sipper cup)
 - Thin liquid (medicine cup, bottle, syringe)
 - Puree (spoon)
 - Dissolvable finger foods
- **Therapeutic interventions**
 - opening
 - Tongue base retraction
 - Pharyngeal residue: amount
 - Pharyngeal residue: location

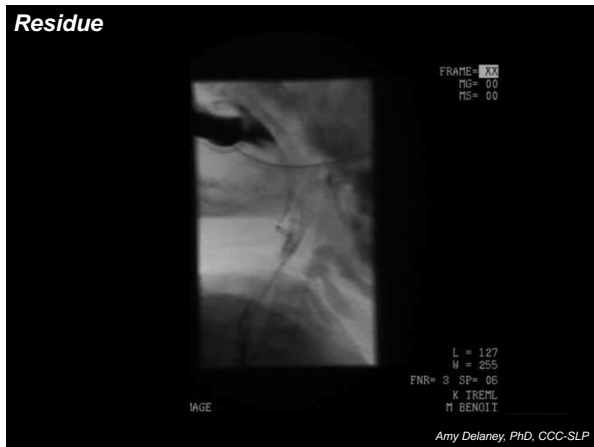
Assessment criteria at Duke



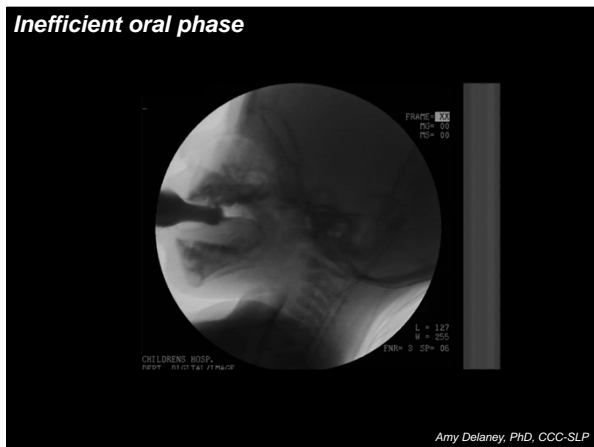
Silent aspiration



Residue



Inefficient oral phase



No chewing



Absent oral phase (1)



Absent oral phase (2)



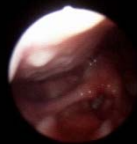
Fiberoptic endoscopic evaluation of swallow (FEES)

- Similar to VSS in detecting aspiration
- May be best when :
 - Pharyngeal or laryngeal abnormality is suspected
 - Tracheotomy or ETT in place
 - Difficulty managing secretions
 - Assessment of sensation is important
- Cannot evaluate oral phase of swallow
- May add sensory testing

Residue



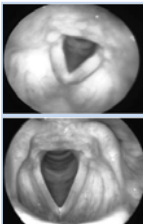
Paralyzed vocal fold



Videos courtesy of David Brown, MD

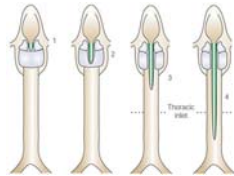
How reliable are flexible laryngoscopic findings?

- 52 adults with no history of ENT abnormalities or problems with GERD
- Flexible and rigid laryngoscopy
- Blind review by three reviewers
 - Abnormalities in 93% by flexible laryngoscope
 - Abnormalities in 83% by rigid laryngoscopy
- Limited concordance in findings among evaluators
- Findings on laryngoscopy may be non-specific
- Appearance differs according to instrument
- Inter-observer variability



Milstein et al, Laryngoscope, 115, 2005

Posterior Laryngeal Cleft



Subglottic Stenosis

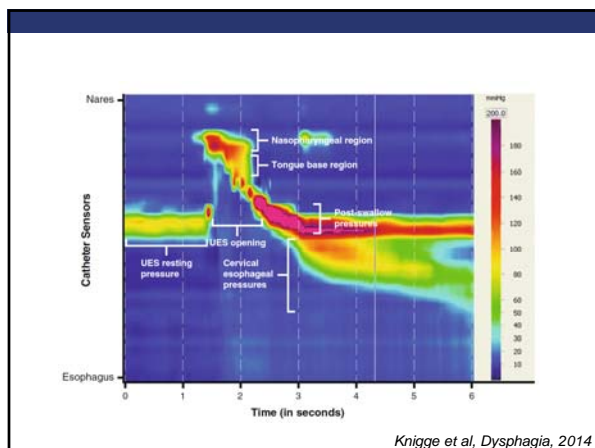


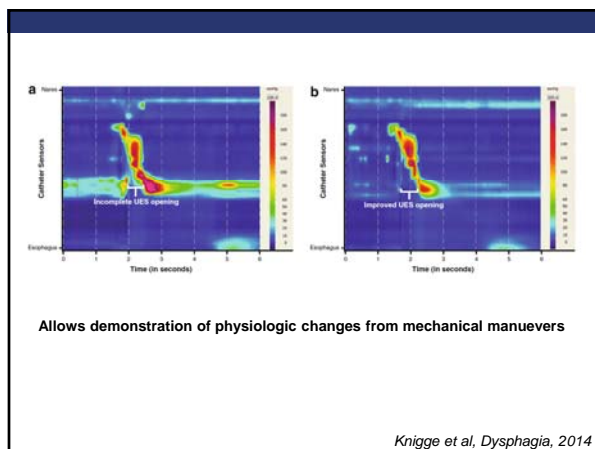
What about the future?

- High-resolution manometry (HRM) for speech-language pathologists
- Technological extension of manofluorography
- Ongoing pediatric research
 - Natalie Rommel
 - Tahir Omari
 - Review in JPGN, 2011
- Detailed physiologic analysis
- No assessment of the oral phase



Knigge et al, Dysphagia, 2014







THERAPISTS AND THERAPY

Therapists

- **Skill-based therapists**
 - Speech-language pathologists
 - Occupational therapists
 - Speech therapists
- **Behavior-based therapists**
 - Pediatric psychologists
 - Social workers
 - Technicians



Caveat emptor...

- Unlike North American medical education, there are no broadly accepted standards that delineate educational experience for skill therapists
- Competency with infant/toddler dysphagia gathered individually by interested individuals
- Look for:
 - Techniques (work within scope of practice)
 - Training
 - Reputation with complex and non-complex patients
 - **Experience in working with physicians**



Dysphagia

- 611 publications since 2005
- 29 relevant to infant populations (4.7%)

Table 3. Behavioral Intervention Strategies		
Intervention to Modify Behavior	Indication	Examples of Interventions
Stimulus control	Manipulation of stimulus environment before behavior to increase desirability of behavior and reduce problem behavior within the child. These techniques are used before, during, or after the behavior to increase the child's motivation to perform the behavior.	Use of visual aids to indicate appropriate behavior (e.g., "No" sign). Use of visual aids to indicate inappropriate behavior (e.g., "No" sign). Use of visual aids to indicate appropriate behavior (e.g., "No" sign).
Positive reinforcement	Reinforcement that increases the frequency of a desirable feeding behavior due to the addition of a reward immediately following the desired feeding response.	Giving a reward (e.g., a sticker) for reaching a goal. Giving a reward (e.g., a sticker) for reaching a goal. Giving a reward (e.g., a sticker) for reaching a goal.
Negative reinforcement	Reinforcement that increases the frequency of a desirable feeding behavior due to the removal of an aversive stimulus immediately following the desired feeding response.	Removing a stimulus (e.g., a sticker) for reaching a goal. Removing a stimulus (e.g., a sticker) for reaching a goal. Removing a stimulus (e.g., a sticker) for reaching a goal.
Extinction training	Behavior that involves the individual that feeding behavior will be reinforced by the presence of a desired stimulus. The reinforcement schedule is the targeted behavior and the child's response to the stimulus.	Using the method called shaping, which involves changing behavior by reinforcing successive approximations of the desired behavior. Using the method called shaping, which involves changing behavior by reinforcing successive approximations of the desired behavior. Using the method called shaping, which involves changing behavior by reinforcing successive approximations of the desired behavior.
Extinction	Behavior that reduces the frequency of an undesired feeding behavior due to the removal of a reward immediately following the undesired feeding response.	Removing a stimulus (e.g., a sticker) for reaching a goal. Removing a stimulus (e.g., a sticker) for reaching a goal. Removing a stimulus (e.g., a sticker) for reaching a goal.
Punishment	Behavior that reduces the frequency of an undesired feeding behavior by presenting an aversive stimulus or removing a desirable stimulus as a consequence of the behavior.	Using the method called shaping, which involves changing behavior by reinforcing successive approximations of the desired behavior. Using the method called shaping, which involves changing behavior by reinforcing successive approximations of the desired behavior. Using the method called shaping, which involves changing behavior by reinforcing successive approximations of the desired behavior.
Discrimination	Behavior that reduces negative behavior by giving a reward response to the desired behavior and a punishment response to the undesired behavior.	Using the method called shaping, which involves changing behavior by reinforcing successive approximations of the desired behavior. Using the method called shaping, which involves changing behavior by reinforcing successive approximations of the desired behavior. Using the method called shaping, which involves changing behavior by reinforcing successive approximations of the desired behavior.

Integration Therapies for Children With Mental and Behavioral Disorders

Pediatrics, 2012

Silverman AH, NCP, 2010

PUTTING IT ALL TOGETHER

- Failure to gain weight ?
- Vomiting / GERD ?
- Dysphagia / aspiration ?

- Consider causes other than insufficient calories (maldigestion, malabsorption, ↑ demands)
- Caloric supplementation
- Structure meals
- Augmentation of appetite
- Acid suppression
- Formula / diet changes
- UGI series
- Consider non-GI causes
- EGD with biopsies
- pH/Impedance testing
- ENT / SLP evaluation
- Instrumental assessment
- Appropriate feeding interventions
- Pulmonary evaluation

No progress ?

Inability to control ?

Concerns with pulmonary health ?

Tube Feeding (NG / GT)

Ongoing vomiting or reflux with / without aspiration and / or lung disease ?

- Intestinal feeding
- Fundoplication

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No adequate trials exist upon which to form evidence-based conclusions:

No evidence to document pulmonary effects of allowing OR restricting drinking water in children who aspirate thin liquids.

Weir et al, Cochrane Database Sys Rev, 2012.

Aspiration, alone, is not a reason to stop oral feeding; progression of lung disease is.

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32. Taco *Mary Beth Feuling, MS, RD*

Ingredients

- 1 cup Taco Meat, prepared
- 2 Tbsp Sour Cream
- 2 Tbsp Guacamole
- 4 Tbsp Cheese Sauce

Instructions

- Heat taco meat and cheese sauce.
- Blend all ingredients for 1 minute, scrape down sides, and blend for an additional minute.

Makes 1 1/2 cup

Nutrients per Serving:

Kcal (kcal)	315
Protein (g)	18.8
Carb (g)	10.5
Fat (g)	23.3
Sodium (mg)	869
Calcium (mg)	215
Dietary Fiber (g)	0

No progress ?

Ongoing vomiting and aspiration and

oral feeding application

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No progress ?

Therapy
skills, behaviors

Tube feeding

Ongoing vomiting or reflux with / without aspiration and / or lung disease ?

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- Fundoplication

Concerns with pulmonary health ?

Conclusions

- Swallowing function in young children reflects anatomic and neurodevelopmental maturation
- Medically-complex children are at increased risk of dysphagia
- Among the multiple modalities for the assessment of dysphagia, VSS is the current standard
- Therapists **expert** at the management of infant dysphagia are rare – be nice to them
- Management of infant dysphagia requires multidisciplinary care with good communication among care providers
