Swallow Screening: What is it, and should we be doing it?

- ASHA's Preferred Practice Pattern on Swallowing Screening:
  
  "Swallowing screening is a pass/fail procedure to identify individuals who require a comprehensive assessment of swallowing function or a referral for other professional and/or medical services" (ASHA, 2004, p. 3-10).
Diagnostic Tests vs. Screening

- Diagnostic tests are used when a person is suspected of having a condition.
  - Purpose is to confirm this or rule it out.
- Screening tests are given more broadly, usually to groups of asymptomatic people to determine if any of them have the condition in question.
  - Groups can range from everyone in the population to a more individualized, case-finding approach of people at high risk for a condition.

Screening Tests

- Screening tests in general have high sensitivities and low specificities, which allows detection of most patients with a condition, while having the acceptable disadvantage of a high rate of false positivity.

Why screen?

- Videofluoroscopy is considered the criterion standard for dysphagia assessment.
- FEES also has its merits
- Why not do an instrumental assessment on everyone?
Why screen?

- Risk of pneumonia is 11 times higher for patients with severe dysphagia and aspiration.
- Hospitals using a mandatory and formal dysphagia screening have lower pneumonia rates than those without. (Hinchey et al., 2005; Odderson et al., 1995)

Why screen?

- ASHA, AHA, VHA all recommend screening patients who are suspected of having dysphagia.
- Dysphagia screening for individuals admitted to the hospital with stroke or suspicion of stroke is recommended or required in the U.S., Canada, Australia, and the United Kingdom. (Martino et al., 2008)

The Joint Commission

- The Joint Commission Primary Stroke Center certification:
  - One performance measure included a dysphagia screen for all individuals with ischemic and hemorrhagic stroke prior to ingestion of food, fluids, or medications.
  - This requirement was retired as a performance measure in 2010.
  - WHY?
What is a screen?
- Hands-off observation?
- Questionnaire?
- Bolus administration?

Who Should Screen?
- SLPs
- Nurses
- Physicians
- Someone else?

Bolus administration
- How much?
- What type?
Goals of our research

- To develop a valid and reliable screening tool for determination of aspiration risk
- To develop a screening tool that can be used across a number of health care delivery settings
- To develop a screening tool that can be used reliably by a number of health care professionals

3-Ounce Water Swallow Test

- 3-ounce water swallow test (DePippo et al., 1992)
  - Widely used clinical screening to determine risk of aspiration
  - Patients are given 3 ounces of water and asked to drink the entire amount.
  - Failure:
    - Inability to consume entire 3 ounces
    - Coughing/throat clear within 1 minute of test administration

3-Ounce Water Swallow Test

- Value has been evaluated by others:
  - McCullough et al., 2001, 2005
    - Sensitivity = 48-80%, Specificity = 50%-95%
  - Mari et al., 1997
    - Sensitivity = 52%, Specificity = 86%
  - Zhou et al., 2011
    - Sensitivity = 87.3%, Specificity = 42.3%
  - Patterson et al., 2011
    - Sensitivity = 67%, Specificity = 40%
We sought to expand the clinical utility of the 3 ounce water swallow test:
- Does the 3 ounce water test identify patients who aspirate?
- Does failure on the 3 ounce water test indicate that individuals are unsafe for an oral diet?
- Does passing the 3 ounce water test indicate an ability to tolerate an oral diet without the need for further instrumental assessment?

Subjects:
- All FEES performed from Dec. 1999-Sept. 2006
- N=3,000
  - Males: 1,669 (55.6%); X=66.8y, Range=2.2-105y
  - Females: 1,324 (44.3%); X=70.1y, Range=3.0-105y

(Missing Data: Gender=7 [0.2%] patients; Age=18 [0.6%] patients)

12 Diagnostic Categories:
- Cardiothoracic surgery  N = 180
- Esophageal surgery  N = 63
- Head/Neck surgery  N = 111
- Neurosurgery  N = 232
- Medical  N = 492
- Pulmonary  N = 451
- Cancer  N = 125
- Left stroke  N = 227
- Right stroke  N = 203
- Brainstem stroke  N = 38
- Parkinson's disease  N = 18
- Dementia  N = 86
Suiter & Leder, 2008

- All subjects completed FEES, then 3 ounce water swallow test.
- Tester was not blinded.
- FEES served as the criterion standard to which results of the 3 ounce water test were compared.

Can the 3-ounce water test accurately identify individuals who aspirate thin liquids?

<table>
<thead>
<tr>
<th></th>
<th>Aspiration</th>
<th>No Aspiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEES Aspiration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>664</td>
<td>1185</td>
</tr>
<tr>
<td>a/ True Positive</td>
<td>664</td>
<td>1185</td>
</tr>
<tr>
<td>b/ False Positive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Ounce Water Test</td>
<td>24</td>
<td>1127</td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c/ False Negative</td>
<td>24</td>
<td>1127</td>
</tr>
<tr>
<td>d/ True Negative</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Suiter, 2015

- Can the 3-ounce water test accurately identify individuals who aspirate thin liquids?
  - Sensitivity = 96.5%
  - Specificity = 48.7%
  - PPV = 35.9%
  - NPV = 97.9%
Can the 3-ounce water test accurately identify individuals who aspirate thin liquids?

Conclusions:
- High sensitivity + High negative predictive value
- Good predictor of a patient’s ability to tolerate thin liquids
- High false positive rate (49.7%) + low specificity
- Nearly half of the individuals who failed the 3-ounce challenge did not aspirate during FEES.
- Thus, the 3-ounce water test over-refers individuals for instrumental assessment.

Does failure on the 3-ounce water test indicate inability to tolerate an oral diet?

<table>
<thead>
<tr>
<th></th>
<th>Unsafe for P.O. Diet</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>a/ True Positive</td>
<td>543</td>
</tr>
<tr>
<td>3 Ounce Water Test</td>
<td>b/False Positive</td>
<td>1304</td>
</tr>
<tr>
<td>Negative</td>
<td>c/False Negative</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>d/True Negative</td>
<td>1131</td>
</tr>
</tbody>
</table>

Does failure on the 3-ounce water test indicate inability to tolerate an oral diet?

- Sensitivity = 96.4%
- Specificity = 46.4%
- PPV = 29.4%
- NPV = 98.3%
Does failure on the 3-ounce water test indicate inability to tolerate an oral diet?

- High sensitivity + High negative predictive value
  - Passing the 3-ounce test is a good predictor of ability to tolerate an oral diet.
- Low specificity + high false negative rate
  - Many patients were recommended for nil by mouth status unnecessarily.

Conclusions: Caveats

- Tester was not blinded.
- Results based only on FEES results (not VFSS).
- Results are based on an SLP administering the screening test.
- Studies were based on a referred sample rather than a consecutive sample.

Additional Studies

- Command following and orientation (Leder, Sitter, & Listano-Warner, 2009)
- Oral mechanism exam (Leder, Sitter, Murray, & Rademaker 2013)
- Double-blind study (Sitter, Sloggy, & Leder, 2013)
- Nurse-administered screening (Warner, Sitter, Nystrom, Poku, & Leder, 2013)
- Use of the 3-ounce screening test in various patient populations (Sitter et al., 2009; Leder et al., 2011; Leder et al., 2012)
Orientation and Command Following
(Leder, Suiter & Lisitano Warner, 2009)

- Do ability to follow commands and orientation status affect odds of aspiration?
- Referred sample of 4,070 patients
  - Ages: 10y - 105 y
  - 2296 males, 1766 females (data missing for 8)
  - 14 diagnostic categories

Orientation:
- What is your name?
- Where are you right now?
- What year is it?

Command following:
- Done in conjunction with oral-mechanism exam
  - Open your mouth
  - Stick out your tongue
  - Smile
- Swallowing then assessed with FEES

Orientation:
- 2217/4070 participants were oriented x 3
  - 526 (23.7%) aspirated thin liquids
  - 1691 (76.3%) did not aspirate
- 1853/4070 participants were not oriented x 3
  - 535 (29.0%) aspirated thin liquids
  - 1318 (71.0%) did not aspirate
- Pearson’s chi-square
  - Significant relationship between orientation status and aspiration ($p \leq 0.001$)
  - Odds of liquid aspiration were 31% greater for those not oriented x 3
Orientation and Command Following
(Leder, Suiter & Lisitano Warner, 2009)

- Command following:
  - 3418/4066 participants were able to follow commands
    - 842 (24.6%) aspirated thin liquids
    - 2576 (75.4%) did not aspirate
  - 648/4066 participants were unable to follow commands
    - 219 (33.8%) aspirated thin liquids
    - 429 (66.2%) did not aspirate
- Pearson’s chi-square:
  - Significant relationship between command following ability and aspiration ($p \leq 0.001$)
  - Odds of liquid aspiration were 57% greater for those not able to follow commands

Oral Mechanism Examination
(Leder, Suiter, Murray & Rademaker, 2013)

- Do results of an oral mechanism examination reflect odds of aspiration risk?
  - Lip closure
  - Lingual range of movement
  - Facial symmetry
- 3,919 participants
  - 1,780 females, 2,314 males
  - Ages 2y-105y
  - 14 diagnostic categories
- Oral mechanism exam followed by FEES

A stepwise multiple logistic regression analysis revealed that reduced lingual range of motion was associated with increased odds of aspiration.
- Participants with decreased lingual ROM had 2.72 times the odds of aspiration as those with adequate lingual ROM.
- Decreased lingual ROM was an independent risk factor for aspiration.
Yale Swallow Protocol

- Orientation and command following
- Oral mechanism examination
- 3-ounce water swallow test

Validation of the Yale Swallow Protocol
(Suiter, Sloggy, & Leder, 2013)

- Prospective, double blind study using videofluoroscopic swallow study as the reference standard.
  - 25 males, ages 63-82
  - Referred sample

All completed Yale Swallow Protocol

- Administered and scored independently by 2 speech-language pathologists

All completed a videofluoroscopic swallow study

- Different SLP and Radiologist, blinded to results of the Yale Swallow Protocol, reviewed study independently and determined if aspiration of thin liquids occurred
Validation of the Yale Swallow Protocol  
(Suiter, Sloggy, & Leder, 2013)

- **Sensitivity** = 100.0%
- **Specificity** = 63.6%
- **PPV** = 77.8%
- **NPV** = 100.0%

---

Nurse-administered Protocol  
(Warner, Suiter, Nystrom, Poskus, & Leder, 2013)

- Nurses completed on-line training in administration of the Yale Swallow Protocol
  - Compared results of nurse-administered Yale Swallow Protocol to SLP-administered Yale Swallow Protocol for 101 patients
  - Inter-rater protocol agreement was 98.01%.
  - With training, nurses can reliably use the Yale Swallow Protocol to determine aspiration risk.
Future Directions for Research

- Use of the Yale Swallow Protocol in different settings:
  - Rehabilitation
  - Skilled nursing
  - Outpatient facilities
- Validation of the protocol using videofluoroscopy in a larger patient population

Future Research (cont.)

- Systematic review of non-instrumental swallow screening/assessments
  - Goal is to identify a set of clinical predictors of dysphagia

Clinical Assessment
What we’ll cover…

- Purpose of a clinical swallow evaluation
- Components of a clinical swallow evaluation
- Information that can be obtained from a clinical swallow evaluation
- Research regarding accuracy of the clinical swallow evaluation

Introduction

- Clinical swallow evaluations are sometimes all a clinician has.
- At a minimum, what should they include?
- What can we reliably detect based on bedside evaluations?

Purpose of the Clinical Examination

(ASHA, 2000, Clinical Indicators for Instrumental Assessment of Dysphagia)

- Allows the SLP to:
  - Integrate information from interview/case history, review medical records, observations from physical exam
  - Observe and assess integrity and function of structures of the upper airway and digestive tract
  - Identify presence and observe the characteristics of a dysphagia based on clinical signs and symptoms
Purpose of the Clinical Examination
(ASHA, 2000, Clinical Indicators for Instrumental Assessment of Dysphagia)
- Identify clinical signs/symptoms of esophageal dysphagia or GER
- Determine need for instrumental exam
- Determine if patient is appropriate candidate for treatment and/or management
- Recommend route of nutritional management
- Recommend clinical interventions

Clinical Swallow Evaluation: Components
- Chart Review
- Case history
- Cognitive assessment
- Cranial Nerve Examination
- Bolus administration

Chart Review
- Medical history
- Surgical history
- Current imaging (chest x-rays, MRIs, CT scans, etc.)
- Nursing notes
Chart Review

- McCullough et al., 2005:
  - Presence of pneumonia (current) and poor oral hygiene were the most predictive of aspiration.
  - However, absence of these signs did not provide much information regarding aspiration risk.
  - Other factors such as report (by family or nurse) of dysphagia, drooling, presence of non-oral feeding, need for suctioning, and dehydration had high positive likelihood ratios as well (2.4-3.6).

Case History

- Chief complaint
- Current diet
- When does the problem occur?
- Are there particular foods/liquids that trigger the problem?
- How long does it take you to eat a meal?
- Is this affecting your quality of life?

Cognitive-Linguistic Assessment

- What information does it provide?
  - Aspiration risk
  - Ability to participate in further assessment/therapy
  - Impulsivity
  - Is the patient easily distracted?
Oral Mechanism Examination

- How do we do it?
- What information does it provide?

Cranial Nerve Exam

- Cranial nerves V, VII, IX, X, and XII are involved in swallowing.

Cranial Nerve Exam: Trigeminal Nerve

- Examine jaw at rest
- Bite
- Mouth opening
  - With and without resistance
Cranial Nerve Exam: Facial Nerve

- Facial symmetry
- Pucker lips
- Smile

Cranial Nerve Exam: Glossopharyngeal and Vagus Nerves

- Often damaged together
- To assess:
  - Velum at rest and during elevation
  - Gag response
  - Vocal quality
  - Voluntary cough

Cranial Nerve Exam: Hypoglossal Nerve

- Examine tongue:
  - At rest
  - Protrusion
  - Lateralization
Bolus Presentation

- How do we decide whether to give any boluses?
- If we do start with boluses, which ones?
- Do we really need to give all sizes and viscosities of boluses?
  - How much is enough?
- What are we looking for?

Deciding to present trial swallows

- Logemann says:
  - If patient is:
    - Acutely ill
    - Has significant pulmonary complications
    - Has a weak voluntary cough
    - Is over 80 years old
    - Cannot follow directions
    - Is suspected of having a pharyngeal dysphagia
  - Risk is high, benefit is low
- If pt. can follow directions, cough on command and has good pulmonary function, risk is low.

If pt. is being orally fed, note...

- Reaction to food
- Oral movements in food manipulation and chewing
- Any coughing, throat clearing, or struggling behaviors or changes in breathing and their frequency relative to swallowing and their occurrence during the meal (before, during, end)
- Changes in secretion levels throughout the meal
- Duration of the meal and total oral intake
- Coordination of breathing and swallowing
Deciding to present trial swallows

- Logemann (1998) says:
  - If patient is:
    - Acutely ill
    - Has significant pulmonary complications
    - Has a weak voluntary cough
    - Is over 80 years old
    - Cannot follow directions
    - Is suspected of having a pharyngeal dysphagia
  - Risk is high, benefit is low
- If pt. can follow directions, cough on command and has good pulmonary function, risk is low.

Predictors of Aspiration: Cough

- Smith Hammond et al., 2009:
  - Compared subjective clinical assessments of signs of aspiration (e.g., absent swallow, reflexive cough after swallow, difficulty handling secretions) to objective measures of cough
  - Clinical signs were 74% accurate for detecting aspiration
    - Sens = 58%, Spec = 83%
  - Objective measures of voluntary cough were more accurate
    - Sens = 82-91%, Spec = 81-92%

Predictors of Aspiration: Dysphonia

- Dysphonia: Breathiness, hoarseness, harshness
  - Some studies have indicated that presence of dysphonia is predictive of aspiration (Daniels et al., 1998; Horner et al., 1988; Linden et al., 1993)
- Wet vocal quality
  - Clinicians do not reliably perceive “wet” vocal quality when material is present in the larynx during phonation (Groves-Wright et al., 2010)
- Reduced pitch elevation
  - Predictive of higher (worse) Penetration-Aspiration Scale scores (Malandraki et al., 2011)
Predictors of Aspiration: Dysarthria

- Daniels et al. and McCullough et al. (2005) have both found that presence of dysarthria is significantly associated with increased aspiration risk in individuals with stroke.

Predictors of Aspiration: Watering Eyes, Runny Nose, Sneezing

- Autonomic reflexive responses to irritants to eyes or nose
- Not predictors of aspiration

Predictors of Aspiration: Absent Gag Response

- Leder (1996)
  - Performed FEES on 14 individuals with absent gag response
    - 86% (12/14) were able to eat an oral diet.
    - The gag reflex was absent in 13% (9/69) of nondysphagic subjects
- CONCLUSION:
  - The absence of a gag reflex does not appear to be a predictor of dysphagia.
How important is aspiration risk vs. dysphagia risk?
- Best predictors for who will develop aspiration pneumonia are:
  - Dependency on others for feeding
  - Dependency of oral care
  - Number of decayed teeth
  - Time feeding
- Dysphagia and aspiration, although risk factors, were not the most predictive factors for development of aspiration pneumonia.

Published assessments
- Mann Assessment of Swallowing Ability
- Swallowing Ability and Function Exam (SAFE)

Cervical Auscultation (CA)

Definition
- Listening to the sounds of swallowing with a stethoscope (stethoscope or other measurement device) at or around the level of the larynx to gain information about the pharyngeal phase of swallowing and adjacent respirations.
- Described as consisting of two distinct components (‘bursts’ or ‘clanks’), with or without a smaller third component or ‘puff’.
Cervical Auscultation

Strengths
- Easy
- Available and portable
- Non-invasive
- Cost efficient
- No radiation exposure
- Can sample swallow repeatedly and for prolonged periods of time
- No contrast required - uses 'real' food/liquid
- More appropriate referrals to VFS

Cervical Auscultation

- Leslie et al., 2007
  - Found no evidence of a causal link between swallow-related events and sounds recorded during the swallow
  - Concluded there are no data to support incorporating cervical auscultation into swallow evaluations

- Borr et al., 2007
  - Evaluated swallow apnea duration and "number of gulps"
  - Found only fair inter-rater reliability for these measures

Oxygen Saturation

Definition:
- Non-invasive continuous measure of arterial blood oxygenation
- Provides information about:
  - Oxygenation of peripheral blood flow
  - Aspiration event vs. overall pulmonary status

Technique
- Sensor placed on finger, toe, earlobe
- As oxygen content of the blood increases, blood color changes
- Sensors monitor the wavelengths of light emitted by small light sources as it passes through tissue
- Measures the amount of light absorbed by the blood in the tissue
- 95-100% normal range; <90 suggests significant problems
Pulse Oximetry

- Resting oxygen saturation levels may differ between groups of people with and without dysphagia (Colodny, 2000)
  - But, levels did not change as a function of penetration/aspiration
- Leder (2000)
  - Recorded oxygen saturation levels simultaneously with FEES
  - Found no significant differences in saturation levels based on aspiration status

Conclusions

- Clinical swallow evaluations can give us valuable information about our patients who are at risk for aspiration and/or dysphagia.
- They cannot, at this time, provide us with information regarding bolus flow or swallow physiology.

Instrumental Assessment of Swallowing: Videofluoroscopy & Endoscopy
The purpose of the Videofluoroscopic Swallow Study (VFSS) is to:

1. Define the abnormalities in anatomy and physiology causing the patient’s symptoms.
2. Identify and evaluate treatment strategies that may immediately enable the patient to eat safely and/or efficiently.

What a VFSS is NOT

- Pass/fail test
- Examination to determine if someone is aspirating
Advantages of VFSS:

1. Allows visualization of all three phases of the swallow (oral, pharyngeal, esophageal).
2. Can see what is taking place at the height of the pharyngeal swallow.
3. Little patient discomfort.
4. Allows assessment of various aspects of the swallow, such as hyolaryngeal excursion and tongue base retraction, which must be inferred during FEES.

Advantages of VFSS (cont.):

5. Can directly view aspiration during the swallow. This must be inferred during FEES.
6. Can be done on patients who might not tolerate FEES, such as those with brain injury or dementia.

Disadvantages

- Radiation exposure
- Positioning
- Cost
- Use of unnatural liquids/foods
How much radiation exposure do our patients receive during VFSS?

- Wright, Boyd, & Workman (1998):
  - Mean effective dose to patients is 0.4 mSv, which compares favorably with effective doses associated with other common radiological procedures (e.g., CXR = .04 mSv, barium swallow study = 4.6 mSv).

Radiation exposure

- Dependent upon:
  - Swallowing impairment severity
    - The more severely impaired, the longer the exposure time
  - Clinician experience
    - Less experienced clinicians take longer
  - Standardized protocol
    - Did not significantly improve exposure time

Pulse rate

- Reducing pulse rate is one means of reducing radiation exposure.
  - Dose reduction of 22% when rate is reduced from 30 frames per second to 15 frames per second
**Pulse rate**

- Affects accuracy of evaluation
  - Oropharyngeal swallow lasts 1 second
  - Reducing from 30 fps to 15 fps means we get half the images from each swallow
  - Differences were noted in MBSImP scores, PA scale scores, and treatment recommendations (Randhawa et al., 2017)

---

**To standardize, or not to standardize…**

- Advantages of a standard protocol
  - Allows for pre- to post-treatment comparisons
  - Allows for consistency across settings
  - If using standard barium consistencies, allows for cross-examination comparisons

- Disadvantages
  - Takes individualization out of the equation

---

**Do we swallow barium differently?**

- Barium reduces taste intensity
- Does not alter behavioral parameters of swallowing
- Use of barium solutions to evaluate swallow function can be assumed to elicit behaviors similar to those used with non-barium liquids

- Nagy, Steele, & Pelletier (2014)
Fiberoptic Endoscopic Evaluation of Swallowing (FEES)

FEES

- Involves the passage of a flexible endoscope transnasally to obtain a superior view of the pharynx, larynx, and trachea
- Allows the clinician to objectively evaluate the pharyngeal phase of the swallow

Why FEES?

- VFSS has disadvantages
- FEES has advantages, including:
  - Portability
  - Unlimited time for introduction of therapeutic strategies
  - No radiation exposure
  - Direct view of the anatomy
What can we see with FEES?

- Actual structures moving
- Movement of the bolus before the swallow
- Speed/duration of some movements
- Adequacy/completeness of velopharyngeal closure
- Epiglottal descent and return
- Airway status/closure—before and at the onset of the swallow

Suiter, 2015

What can we see with FEES?

- Secretion management
  - Murray et al., 1996
    - Endoscopically visible secretions located within the laryngeal vestibule were highly predictive of subsequent aspiration of food and liquid.
    - Hospitalized patients swallowed less frequently than nonhospitalized patients.
  - Donzelli et al., 2003
    - Patients with tracheotomy have more secretions
    - Presence and amount of accumulated oropharyngeal secretions were predictive of aspiration of food and/or liquid.

Suiter, 2015

Secretion Management
Whiteout

- Occurs at the height of the swallow
- Caused by deflection of the tip of the endoscope by the tongue base as it retracts and movement of the pharyngeal walls
- Lasts approx. 0.650 seconds
- So, we can't see what is happening during the swallow
  - We can make inferences about what happened based on what we see before and after the swallow.

Indications for FEES

- Need exam immediately
- Positioning in x-ray difficult
- Transportation to hospital problematic
- Concern about radiation exposure
- Severe dysphagia with very weak or possibly absent swallow reflex
- Very limited ability to tolerate any aspiration

Indications for FEES (cont.)

- Post-intubation or post-surgery
- Need to assess fatigue or swallow status after a meal
- With any of the following clinical symptoms:
  - Hypermastality
  - Hoarse, breathy voice
  - Wet voice quality
  - Rapid respiratory rate; effortful breathing
  - Inability to handle saliva/secretions
Findings revealed better endoscopically

- Anatomical relations, alterations in anatomy
- Effect of feeding tube on anatomy and swallowing
- Velopharyngeal closure, nasal reflux
- Frequency of spontaneous or dry swallows
- Status of secretions, ability to sense, swallow, or clear secretions

FEESST

- Fiberoptic endoscopic evaluation of swallowing with sensory testing.
- Scope has 2 channels, one that allows for delivery of an air puff to the aryepiglottic folds.
  - Assess for vocal fold closure in response to air puff.

Risks associated with endoscopy

- Difficult patients
  - Agitated, tactilely defensive patients
  - Hyperactive gag reflex
  - Small nasal passage
  - Bleeding disorder or taking blood thinner (e.g., Coumadin)
  - History of fainting
  - Acute cardiac problems that predispose patient to bradycardia
Risks associated with endoscopy

- Adverse reactions
  - Discomfort
  - Gagging/vomiting
  - Nose bleed
  - Allergic reaction/hypersensitivity to topical anesthesia or nasal spray
  - Laryngospasm
  - Vasovagal response

Is Blue Dye Safe?

- The FDA has approved the use of Blue No. 1 for use in foods, drugs, and cosmetics.
- Blue dye is commonly found in candies, confections, and beverages.

Is Blue Dye Safe?

- Maloney et al., 2000
  - Letter to the Editor in New England Journal of Medicine
  - Reported 2 cases in which blue dye was added to enteral feedings.
    - Both developed pneumonia with sepsis
    - Both died of refractory hypotension and acidosis
      - Their skin, serum, and urine turned green or blue.
      - Autopsies revealed green or blue discoloration of the skin and internal organs.
Is Blue Dye Safe?

- Maloney et al. (cont)
  - Blue dye no. 1 is an inhibitor of mitochondrial respiration in vitro and reduces oxygen consumption by a factor of 8 in mitochondrial preparations in vitro.
  - Maloney and colleagues hypothesize that the refractory hypotension and metabolic acidosis seen in the 2 patients was due to the known biochemical effects of the blue dye.

- Others have reported blue dye No. 1 associated deaths:
  - Gaur, Sorg, Shukla, 2003
  - Maloney, Bhargava, Ryan, Batchelder, & Hallback, 2001
  - Lucarelli, Shirk, Julian, & Crouser, 2004

- FDA Report
  - As of September 2003, 20 cases associating the use of blue dye in tube feedings with blue discoloration of body fluids and skin, as well as more serious complications.
    - 12 reported deaths
    - In 75% of reported cases, patients had a history of sepsis (and therefore likely altered gut permeability) before or during systemic absorption of Blue 1.
Is Blue Dye Safe?

Other issues

File, Tan, & Thomson (1995) described an outbreak of *Pseudomonas aeruginosa*, a ventilator-associated infection.

- 19/20 patients with this infection had received tube feedings that had been tinted from the same common-use bottle of blue dye.
- When the hospital replaced the bottle with single-use vials, the outbreak stopped.

Suiter, 2015

Is Blue Dye Safe?

Knoll (1993) reported a study in which gram-negative and gram-positive rods (types of bacteria) were found, not only in an open bottle of dye, but also in two unopened bottles.

Suiter, 2015

Is Blue Dye Safe?

- Amount of dye SLPs use in FEES is typically quite small—5-10 cc
- Sterile vials of blue food dye are available, which might alleviate the concern over contamination (Novartis Nutrition, Freemont, MI).

Suiter, 2015
Is Blue Dye Necessary?

- Leder et al., 2005
  - Compared swallows of blue-dyed materials to those of non-dyed opaque materials
  - 4 variables were rated:
    - Initiation of the pharyngeal stage
    - Valleculae and pyriform sinus residue
    - Penetration
    - Aspiration
  - High reliability between blue-dyed and non-dyed conditions for all features

Clinical Privileging

- General recommendations
  - Class training: 10-16 hours
  - Observe/participate in 5 FEES
  - 25 successful FEES procedures
    - Perform and interpret

Equipment Needs

- Endoscope
- Light source
- Chip camera
- VCR and Monitor
- Cart
Protocol for FEES

• Anatomic-Physiologic Assessment
  - Velopharyngeal closure
  - Appearance of hypopharynx and larynx at rest
  - Handling of secretions and swallow frequency
  - Base of tongue movement
  - Respiration
  - Airway protection
  - Phonation
  - Pharyngeal musculature

Protocol for FEES

- Swallowing Food and Liquid
  - Mix desired food or liquid with food coloring (preferably blue)
  - May start with ice chips or may apply drops of food coloring to tongue to mix with saliva
  - Don’t necessarily have to present anything

To anesthetize, or not to anesthetize…

- Lester et al., 2013
  - Examined healthy participants swallowing under anesthetized and non-anesthetized conditions
  - Anesthetized swallows yielded higher (worse) Penetration-Aspiration scale scores
  - Reported discomfort level was higher for non-anesthetized condition
  - Others have reported no difference in pain or discomfort when the two conditions are compared (Leder et al., 1997; Burton et al., 2012)
Is FEES within an SLP’s scope of practice?

- Approved by ASHA since 1992
- A joint statement between ASHA and the American Academy of Otolaryngology-Head & Neck Surgery indicated support for SLPs using FEES
  - The AAO rescinded its support of this statement.
- Tennessee has a state law that indicates endoscopy is within an SLP’s scope of practice.
  - Other states are dealing with this issue, e.g., Illinois.

How do VFSS and FEES compare?

- Ratings for penetration/aspiration tend to be higher on FEES than on VFSS (Kelly, Drinnan, & Leslie, 2007)
- Residue is perceived as greater on FEES (Kelly et al., 2010)

<table>
<thead>
<tr>
<th>Characteristic: Suspected Dysfunction</th>
<th>MBS</th>
<th>FEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspiration</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Laryngeal penetration</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pharyngeal residue</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Reduced Hyolaryngeal Excursion</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Inadequate response delay</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>UES Dysfunction</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Oral Phase Dysfunction</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Aspirated or coughed patient</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Dysphonia and dysphagia</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Wet vocal quality and dysphagia</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Poor secretion management</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Post-oral coordination</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Poor anatomy</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

Suiter, 2015
Conclusions

- VESS and FEEs each have advantages and disadvantages
- Choose the exam that is best tailored for your particular patient depending upon medical status, facility, and medical history.