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## What Do I See? Analyzing Interesting Videofluoroscopic Swallow Studies

Karen Sheffler, MS, CCC-SLP, BCS-S

Moderated by:  
Amy Natho, MS, CCC-SLP, CEU Administrator, [SpeechPathology.com](http://SpeechPathology.com)



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# What Do I See? Analyzing Interesting Videofluoroscopic Swallow Studies

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Swallowing Disorders

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continued™

## Introduction

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## Videofluoroscopic Swallow Study (VFSS) aka Modified Barium Swallow Study (MBSS)



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## Learner Outcomes

*Participants will be able to:*

Describe how to gather a thorough case history in order to form a hypothesis, conduct a productive videofluoroscopic exam, and guide education, counseling and recommendations after the exam.

Describe structural versus physiological deficits in swallowing that may be seen on the VFSS exam versus those that can be best detected on FEES.

Interpret difficult studies with multifactorial issues to perform a thorough exam and contribute to the medical team's differential diagnosis.

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## Do you remember the “basics?”

The next few slides are review & here for your reference.

Please see my prior [SpeechPathology.com](http://SpeechPathology.com) webinar called:

### **Videofluoroscopic Swallow Study (VFSS):** Safety & Efficiency *and* Underlying Structure & Physiology

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### **Dysphagia = difficulty swallowing (oral, pharyngeal, esophageal stages)**

- Dysphagia is NOT a disease in-and-of-itself.
- Dysphagia is a **symptom** of many different diseases, disorders, and structural/functional abnormalities. Across **many systems**.
- Requires a multidisciplinary or transdisciplinary approach with every patient.
- Instrumental evaluations play a key role in differential diagnosis.

SLPs do not diagnose, but our thoughtful evaluations play a huge role in helping the medical team come to a diagnosis!

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## Recall Wisdom from Bonnie Martin-Harris

Dr. Bonnie Martin-Harris, PhD, CCC-SLP, BCS-S, FASHA



*Is the VFSS the Gold-Standard?*

"One cannot dichotomize."

"It depends on the nature of the question."  
(Martin-Harris, DRS 2015)

The VFSS is "much more than penetration and aspiration, even though that is what people obsess about!"  
(Martin-Harris, 2016b)

"Think Backwards!"  
Find the underlying action or impairment.  
What is the peripheral and central control?  
(Martin-Harris, 2016b)

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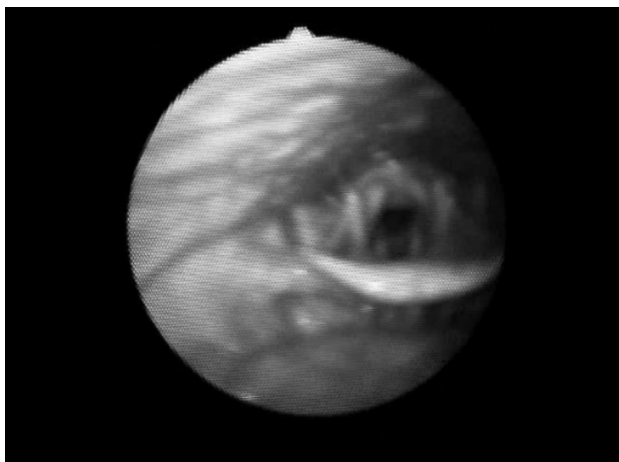
## FEES *and* VFSS (not versus)

<https://www.youtube.com/watch?v=YSaUTbusqE>

Many good FEES anatomy videos on YouTube!

Answer the question:  
**Why** do you want the exam?

What are your questions?



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Slide courtesy of Dr Ianessa Humbert & Critical Thinking in Dysphagia Management/#CTDM

Course

## Videofluoroscopy (basics)

### structures

hyoid bone

larynx

UES

velum

tongue

pharynx

jaw

### swallowing events

lingual bolus forming

velar elevation

lingual propulsion

jaw positioning

laryngeal vestibule closure

UES opening

hyoid excursion

laryngeal excursion

pharyngeal shortening

pharyngeal constriction

### bolus flow events

aspiration

reflux

nasal regurgitation

penetration

anterior bolus loss

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## Instrumental exams ask WHY?

- Answer with “What are the underlying problems?”:
- **Behavioral/Cognitive** (distractibility, impulsivity, attention, awareness)
- **Structural** (i.e., pouches, diverticulum, tumor, missing anatomy, scar tissue, fibrotic/stiff tissue, edema, ACDF with hardware pressing on posterior pharyngeal wall)
- **Coordination** (e.g., coordination of breathing & swallowing)
- **Physiological**

Are the physiological problems related to:

- **Timing** (i.e., oral or pharyngeal swallow delay, slow-spastic movement, slow laryngeal vestibule closure reaction time)
- **Motility** (i.e., suspected weakness in the oral, pharyngeal and/or laryngeal muscles, spastic/restricted movement, decreased pharyngeal constriction, UES opening)
- **Sensory** (poor sensory input can give weak output; poor sensation can cause problems with airway protection)

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## Keep asking Why? Keep digging!

- Problems with structure and/or function? Why?
- Structure: Pain (odynophagia) radiating to ear & food stuck on one side – Why? – refer to ORL for cancer?
- Function/physiology deficits: Is weakness suspected? Why?
  - Generalized weakness from prolonged ICU stay & critical illness
  - Neuromuscular weakness from an acute event/disease/disorder
  - Timing deficits - pharyngeal delay due to suspected acute stroke
- Cognition: what is causing oral delays & decreased bolus containment? Delirium? Lack of awareness & impulsivity?
  - We interpret what is behind the bolus flow & residue findings
  - Remember, it is not all about the bolus. What happened **within the structure or function of the swallow** to make the bolus do that?

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## Thorough Exams

- Why **AP** View?
  - Gross view of **pharyngeal movement and vocal cord mobility** (tell the patient to sniff and then produce high pitched “eee”)
  - See pharyngeal **contraction** bilaterally on a large & viscous bolus.
  - Pharyngeal **residue**: bilateral and equal; more so on left or right; more so in valleculae or pyriforms. See if there is a diverticulum and which side.
- Why **Scan** down? (Not an esophageal “screen”)
  - Have you answered all the questions if you stop at the UES?
  - Globus sensation: problem may be distal, referred sensation to neck.
  - Retention in the esophagus directly impacts the safety & efficiency of swallowing. Does it clear? Retrograde flow?
  - Provide tips to keep eating functionally. Scan is NOT diagnostic.
  - Make appropriate referrals (GI → Barium swallow, EGD, HRM).

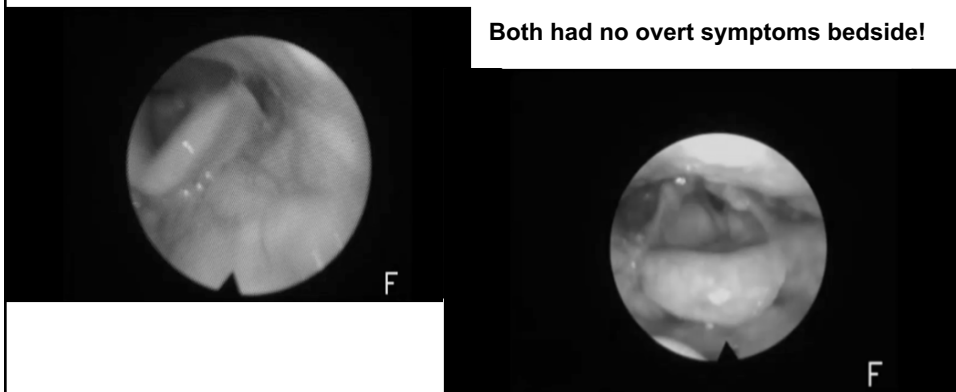
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## The Importance of Instrumental Evaluations

Two patients status-post extubation with "laryngeal injury & NPO" per doctors' orders.  
Which one is ready to eat? Would you have "suspected" that bedside??

**Both had no overt symptoms bedside!**



Videos courtesy of Theresa Richard @ MobileDysphagiaDiagnostics.com

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## The Case History

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continued™

## What Am I Expecting?

### Detective Work!

Form a hypothesis  
based on:

- thorough chart review,
- interview with patient and caregivers, and
- clinical/bedside swallowing evaluation (may not have with outpatients).

The instrumental evaluation  
helps us confirm or negate  
our hypotheses.

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#### Onset details:

Sudden onset  
vs  
Gradual?

#### How often?

Intermittent  
vs  
Constant

#### Course:

Better, Same,  
Worsening?

TODAY'S DATE: \_\_\_\_\_

NAME: \_\_\_\_\_

HEIGHT: \_\_\_\_\_ WEIGHT: \_\_\_\_\_

#### SWALLOWING HISTORY:

1. Please describe your swallowing problem: Great to see their own words...

\_\_\_\_\_

2. How long have you had trouble swallowing? \_\_\_\_\_

3. Describe when / how your trouble swallowing began. \_\_\_\_\_

4. Have your symptoms improved or worsened since they began? \_\_\_\_\_

5. Please list any swallowing tests or therapy you have had, including where, when and the results. \_\_\_\_\_

\_\_\_\_\_

6. To what extent are the following scenarios problematic for you?

| Circle the appropriate response                     | 0 = No Problem 4 = Severe Problem |   |   |   |   |
|---|-----------------------------------|---|---|---|---|
| My swallowing problem has caused me to lose weight. | 0                                 | 1 | 2 | 3 | 4 |
| My swallowing problem interferes with               |                                   |   |   |   |   |

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## Use a Quality of Life measure

### EAT-10

Total is 40.  
Total score of over 3 may indicate dysphagia.

5. Please list any swallowing tests or therapy you have had, including where, when and the results.

6. To what extent are the following scenarios problematic for you?

| Circle the appropriate response                                       | 0 = No Problem 4 = Severe Problem |   |   |   |   |
|---|-----------------------------------|---|---|---|---|
| My swallowing problem has caused me to lose weight.                   | 0                                 | 1 | 2 | 3 | 4 |
| My swallowing problem interferes with my ability to go out for meals. | 0                                 | 1 | 2 | 3 | 4 |
| Swallowing Liquids takes extra effort.                                | 0                                 | 1 | 2 | 3 | 4 |
| Swallowing Solids takes extra effort.                                 | 0                                 | 1 | 2 | 3 | 4 |
| Swallowing Pills takes extra effort.                                  | 0                                 | 1 | 2 | 3 | 4 |
| Swallowing is painful.  | 0                                 | 1 | 2 | 3 | 4 |
| The pleasure of eating is affected by my swallowing                   | 0                                 | 1 | 2 | 3 | 4 |
| When I swallow, food sticks in my throat.                             | 0                                 | 1 | 2 | 3 | 4 |
| I cough when I eat.   | 0                                 | 1 | 2 | 3 | 4 |
| Swallowing is stressful.  | 0                                 | 1 | 2 | 3 | 4 |
| Total Eat-10:   |                                   |   |   |   |   |

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Dysphagia to:  
Solids,  
Liquids,  
Pills

Down the wrong way

Stuck (have the person point)

Chewing

Fear of choking

Fatigue

7. What types of foods do you currently eat? ☐ Regular ☐ Soft ☐ Chopped ☐ Blended

8. Please list any foods you avoid eating because of trouble swallowing. \_\_\_\_\_

9. What type of liquids do you drink? ☐ Regular Liquids ☐ Thickened Liquids

10. How do you swallow pills? ☐ Whole ☐ Crushed  
☐ With Water ☐ Other

| Please rate the frequency with which you experience the following: | Never | Sometimes | Frequently | Always |
|--|-------|-----------|------------|--------|
| Food or liquid goes down the wrong way                             |       |           |            |        |
| Food gets stuck in my throat.                                      |       |           |            |        |
| Food gets stuck in my chest.                                       |       |           |            |        |
| I have trouble chewing solid foods.                                |       |           |            |        |
| I am scared I will choke when eating and drinking.                 |       |           |            |        |
| I have required the Heimlich Maneuver.                             |       |           |            |        |
| I fatigue when eating and drinking.                                |       |           |            |        |
| I have symptoms of heartburn / reflux.                             |       |           |            |        |
| I cough after a meal.  |       |           |            |        |
| I cough when not eating and drinking.                              |       |           |            |        |
| I have the sensation of a lump in my throat.                       |       |           |            |        |
| I have dry mouth.  |       |           |            |        |
| I have excess mucous / saliva.                                     |       |           |            |        |

Ask about reflux,  
dry mouth, saliva.

Additional Information: Ask about mealtimes. Such as,  
How long does it take you to finish a meal?

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Pertinent Past  
Medical/Surgical  
History

PAIN

Allergies

Pneumonia hx

Weight loss

Speech-language,  
voice, cognition

Smoking history

#### MEDICAL / SURGICAL HISTORY:

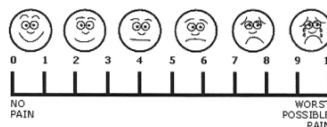
1. Have you had any of the following?

☐ Surgery or radiation of the face, head, neck, thyroid or mouth      ☐ Stroke / TIA  
☐ Diabetes      ☐ Brain injury or surgery  
☐ Cardiac Surgery If yes, please specify \_\_\_\_\_      ☐ Neurological Disorder  
☐ Cancer If yes, where \_\_\_\_\_      ☐ Psychiatric treatment  
☐ Acid Reflux / GERD      ☐ Lung Disease  
☐ Other: Please describe : \_\_\_\_\_

2. PAIN: Are you in any pain? ☐ Yes ☐ No

If so, Where? \_\_\_\_\_

Please rate your pain on the following scale:



3. ALLERGIES: Please list any known medication, food or environmental allergies.

4. Do you have a history of pneumonia or other respiratory problems? ☐ Yes ☐ No  
If yes, dates: \_\_\_\_\_

5. Have you had any unintentional weight loss recently? ☐ Yes; ☐ How much? ☐ No

6. Do you have any difficulty with: ☐ Speech / Articulation ☐ Voice Volume / Quality  
☐ Language ☐ Memory ☐ Thinking

If yes, please describe: \_\_\_\_\_

7. SMOKING HISTORY: Do you have a history of cigarette/cigar/ pipe smoking? ☐ Yes ☐ No  
If yes, please describe including number of years; when you quit; number of packs per day: \_\_\_\_\_

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Special  
Addendum for  
Head & Neck  
Cancer  
Patients

#### ONCOLOGIC HISTORY

Pathology: Squamous cell carcinoma, Adenocarcinoma, Adenoid cystic, \_\_\_\_\_

TNM Staging: \_\_\_\_\_

Disease Site: \_\_\_\_\_  
 (Oral cavity, oropharynx, nasopharynx, supraglottic, glottis, hypopharynx, salivary glands)

Point on Continuum: \_\_\_\_\_  
 (Pre-treatment, during treatment, immediately post-treatment, years post)

Surgical Intervention: \_\_\_\_\_  
 (Definitive, salvage, neck dissection, operative note)

Radiation Therapy: Conventional XRT, IMRT, proton beam therapy, brachy therapy

Dose: \_\_\_\_\_

Schedule: \_\_\_\_\_

Location: \_\_\_\_\_

Chemotherapy: Concurrent, Induction, Adjuvant, Neoadjuvant, Regional

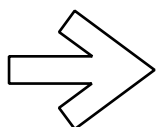
Type: \_\_\_\_\_

Dose and Schedule: \_\_\_\_\_

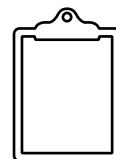
#### PROGNOSTIC CO-MORBIDITIES/PMH:

(Pulmonary, Renal, Cardiac, other cancer, PVD, CVA, severe HTN, Hepatic disease)

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Important:



- Do a thorough chart review.
- Review the case history form with the patient/caregivers in your interview before exam.
- Review medications (including those that affect voice, swallowing, salivation or the disease itself - such as Parkinson's meds).
- Use **holistic thinking**, as sometimes the level of complaints & deficits do not match...

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## EAT-10 Score & Deficits Don't Always Match

### Info gathered in chart review:

- 50+ y/o female seen for outpatient VFSS due to "persistent choking sensation and difficulty starting the swallow," per MD order.
- She had extensive work-up in past for her Type 3 Achalasia, but she is now s/p Heller Myotomy with partial wrap fundoplication. Her recent High Resolution Manometry exam was normal. Her "timed Barium Swallow" showed "stable appearance of partial fundoplication, small recurrent hiatal hernia (HH), and unchanged **epiphrenic and fundal diverticulum.**" This study showed air-fluid level in esophagus at 1 minute, but cleared at 2 minutes. Contrast in epiphrenic diverticulum at 2 min.; cleared at 5 min.
- EGD confirmed epiphrenic diverticulum at 35cm from incisors, small HH, but normal esophageal and stomach mucosa.
- Weight loss: dropped 50 lbs in one year.

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## EAT-10 Score & Deficits Don't Always Match

### Information gathered from patient and EAT-10:

- Onset 6-8 years ago, worsening. With EAT-10 score of **38/40**.
- Solids & Liquids rated as 4 out of 4 in severity. Points to esophageal region for where breads and meats feel stuck, but she says she has thrown herself over sink to eject rye bread. Has liquid regurgitation, which "takes her breath away."
- Pills rated as 3 out of 4, and she notes that the pills stay in her mouth, admitting to fear/hesitancy. She does not take half the pills on her list.
- Pain rated as 3 out of 4 on EAT-10, but 1-2/10 on pain scale.
- Severe impact on quality of life, interfering with going out to meals, pleasure of eating, stress level. She is smoking for "something to do," as she said: "I don't want to smoke, I'd rather eat." Affects relationships.
- Other Factors: Dry mouth due to meds & she avoids drinking fluids; Does not wear dentures due to pain/poor fit; Never eats full meals.

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## EAT-10 38/40 Case



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## EAT-10 38/40 - Summary

- Normal oropharyngeal swallow function
- Esophageal dysphagia that was not detected with other exams.
- **Liquid regurgitation** with retrograde flow and esophageal backflow (supraesophageal reflux) to the hypopharynx. However, she had good airway closure reaction to prevent aspiration after the swallow.
- This is likely why liquids “take her breath away.”
- **Esophageal retention (aka, stasis)** with liquids, foods, pill in the distal esophagus and in the epiphrenic diverticulum. Structural and motility issues, again, not picked up by HRM.
  - She learned by watching the video that she was overly sensitive to small amounts of distal residue, which leads to her hesitancy and fear of swallowing due to referred sensation of it sticking higher in neck.
  - “I can’t swallow it,” re the cracker before even chewing. Then she swallowed without residue once given encouragement & biofeedback.
  - Her risks for choking are low. Counseling throughout & after.

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## EAT-10 38/40 - Recommendations

- Soft & Bite-Sized (per IDDSI standards), Thin liquids
  - Avoid hard/dry foods like tough meats and breads, due to no dentures, dry mouth, and food remaining in esophagus.
  - Taught IDDSI Fork Pressure Test
  - Follow-up with dentist, as chewing foods well helps food clear through the esophagus.
- Safer Swallow Strategies:
  - Sit upright, eat slowly when calm and not stressed.
  - No talking while chewing and eating
  - Slowly alternate liquids and solids
  - Drink liquids slowly, pausing between taking 1-3 sips at a time. Do not chug liquids rapidly to prevent liquids coming back up to your throat.

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## EAT-10 38/40 - Recommendations

3. Patient given a handout on reflux precautions. She had frequent eructations after eating and noted a prior ORL saying that there was signs of LPR. Advised PCP to review prior ORL reports, and to refer as needed.

4. Oral Hygiene: consider adding an artificial saliva substitute to swish and swallow before meals, as lubrication of the lining of the throat and esophagus may help.

5. Follow-up with a dietitian regarding her weight loss and to help her choose high calorie foods and drinks for small/frequent meals.

6. Consider further counseling with a psychologist for her fears around eating/swallowing, as she was visibly upset during the exam, showing a significant impact on quality of life.

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## Esophageal backflow on FEES

**<https://www.youtube.com/watch?v=OI1UfBLGCZY>**

Thank you to Katrina Woodward, MS, CCC-SLP,  
from SDX Dysphagia Experts YouTube channel.  
[SDX-FEES.com](http://SDX-FEES.com)

SDX Dysphagia Experts,  
21 Waterville Rd, Avon, CT 06001

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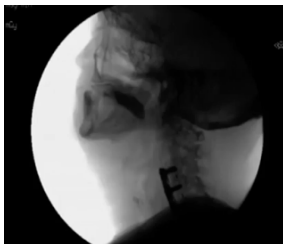
# Structural Findings

Watch for when  
“structural” issues may  
ALSO have problems with  
timing and motility  
(physiological parameters)

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## ACDF (C3-C5)

- Pertinent PMH: 70+ y/o female  
Bipolar, HTN, obesity, DM, hiatal  
hernia, Barrett’s esophagus,  
smoking
- Per bedside swallow: NPO until  
the VFSS, but she refused.  
Offered recs as options. Chose to  
start Puree, Honey thick (tsp), with  
VFSS the next day.



### Demonstrates:

- Prevertebral edema
- Minimal anterior/superior  
movement of the hyolaryngeal  
complex
- Penetration during and after the  
swallow, leading to aspirations.
- Re-penetrations on residue
- Need for review in slow motion  
for frame-by-frame analysis to  
not miss aspiration events.
- Need for keeping camera on to  
not miss aspiration
- Effortful swallow worked better  
with biofeedback (“oh yeah!”)

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## ACDF (C3-C5)

- After the VFSS, pt refused to stay on puree, but she accepted Minced & Moist (aka, moist ground) & Moderately thick liquids (aka, Honey thick liquids). Discharged from inpatient stay to home with VNA SLP.
- Some of the safer swallow strategies provided:
  - Liquids: Small sips by cup. Multiple effortful swallows, cough/dry swallow
  - Solids: swallow with EFFORT multiple times (3-4x)
  - Pills: whole, 1 at a time embedded in puree & multiple effortful swallows
  - \*FREQUENT COUGH/DRY SWALLOW DURING MEALS, AS YOU COULD HAVE LIQUIDS AND SECRETIONS GETTING INTO YOUR AIRWAY.

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## Dysphagia post-op ACDF

- Aspiration in 50% of **those reporting dysphagia** in those who were <2 months post. Increased posterior pharyngeal wall thickness and reduced epiglottic inversion. (Leonard & Belafsky, 2011)
- Risk factors for dysphagia: **60+** years old, **female**, internal fixation with titanium plate/titanium mesh, narrowest esophageal distance before internal fixation of less than 5 mm, and **3 operative segments**. (Li, et al., 2017)
- Greater risk of dysphagia: when patients had the **highest operative levels** at C3 or C4 versus those with C5 to C7. (Kang, et al., 2011; Kang, et al., 2016 - VFSS included in 2016 study)
- Dysphagia related to: Significantly increased soft tissue thickness & decreased maximal UES opening distance. (Kang, et al., 2016)

“Severe sensory dysfunction immediately after surgery which could result in silent aspiration, should be evaluated through objective test tools such as VFSS, rather than relying on the subjective dysphagia symptoms.” (Kang, et al., 2016)

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## Pharyngocele

- 70+ y/o female referred due to globus sensation, hx of mild esophageal dysmotility and moderate to severe reflux (per prior esophagram).
- Per patient: EAT-10 score 13/40
  - Onset: about 10 months ago
  - Pills: "Hard time to swallow large pills," but cutting pills in 1/2 make the sharp edges scratch her throat.
  - "Always feeling of a lump in the throat that cannot be swallowed," "always something stuck," "always trying to get rid of something there."
  - Pain: 7/10, "dull/constant"
  - Solids: difficulty with foods like chicken or salad
  - Liquids: no difficulty
  - Weight loss: gradual of 20 lbs in 10-15 years. 5 lbs in 1 week.
  - Voice: hoarseness after talking for a while & clearing throat often

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## Pharyngocele



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## Pharyngocele

- Bilateral pharyngeal outpouches, especially seen at height of swallow. Pudding residue w/ head turns not effective.
- Some of the safer swallow strategies provided:
  1. Diet: Regular solids as tolerated\*, thin liquids
  2. Pills: whole, one at a time with thin liquid, using your strategy demonstrated of taking a sip of water first and then taking pill with more water.
  3. \*Strategies: Caution with crumbly solids and items like peas, corn, rice, granola. Chew foods thoroughly, especially meats and salad.
  4. Alternate liquids and solids throughout the meal.
  5. Make sure mouth is moist. Good oral hygiene can help keep the mouth clean and moist.
  6. **Otolaryngology consult to r/o pharyngoceles & laryngopharyngeal reflux (LPR)**
  7. Provided reflux and LPR precautions handout, as reflux was previously identified. Ongoing follow-up with your gastroenterologist.
  8. Follow-up with a dietitian regarding weight loss.

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## Osteophytes

- 85+ y/o male admitted w/ aspiration pneumonia who had ongoing undiagnosed neuromuscular issues, including L sided weakness & dysarthria.
- His VFSS showed: moderate-severe oropharyngeal dysphagia w/ many timing & motility issues (oral & pharyngeal delays, decreased bolus control, decreased hyolaryngeal excursion, decreased tongue base retraction and pharyngeal constriction, causing bilateral residue. Silent penetrations, but sensate to aspiration. Cough not effective).
- HOWEVER, he also had **significant C3-C4 osteophytes**.
- MRI was negative. Per Neuro: “an underlying movement/neuromuscular disorder cannot be ruled-out as the symptoms may be *subtle* on exam.”

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## Osteophytes



**Good example of when the chin tuck makes it worse!**

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## Osteophytes

- No method of oral intake would be completely effective to reduce his aspiration risk. Significant fatigue by the end of the exam, so how will he meet his needs orally?
- RECOMMENDATIONS: Pose recs as OPTIONS, rather than only saying "NPO." Provide aggressive option (those that significantly reduce aspiration risk) through palliative care options (those that focus more on quality of life). Do they want to reduce aspiration risk "at all costs?"
- Initially pt/family decided for a more palliative approach: puree, mildly thick/nectar thick w/ strategies of small bites/sips w/ L head turn, cough/dry swallow, alternate liquids/solids.
- Pt then had ongoing suspected aspiration events and distress/discomfort.

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## Osteophytes

- Code status changed back to full-code & chose aggressive intervention.
- Elevated “hope” offered? Realistic?
- Problem: The team was frequently only reporting findings from the radiologist’s version of the VFSS. Team referred him to the Spine service.
- Radiologist’s note emphasized the C3-C4 Osteophytes ONLY & *incorrectly*:
  - “Large anterior osteophyte at C3-C4 anteriorly displaces the *esophagus* at the level of the laryngeal vestibule and may contribute to aspiration and penetration.” *What?*
  - Potentially due to the over-emphasis on the C3-C4 osteophytes in the radiologist’s note (versus structural & physiological deficits noted by the SLP), he went on to have a C3-C5 ACDF surgery 17 days after the videoswallow.
  - Remained NPO after extubation post-op, due to high aspiration risks (bedside) & persistent prevertebral swelling. Received PEG. Finally discharged to rehab 28 days after the videoswallow. Plan will be for a repeat video at rehab after time for healing.

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continued™

## Head & Neck Cancer Nasal Regurgitation

- 60+ y/o w/ hx of L tonsillar pillar/base of tongue/floor of mouth SCC. Hx of L neck dissection, free anterolateral thigh flap (ALT), XRT 2 years prior.
- Recurrent squamous cell carcinoma (SCC) of Tonsil T2N1M0. This video was after his tumor resection with bilateral neck dissections, lip split mandibulotomy with plates. Video on post-op day 45.



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## Head & Neck Cancer Nasal Regurgitation

- Good examples of:
  - A moving target. SLP guides view to make sure lips to UES all times.
  - Reduced base of tongue retraction/propulsion & decreased pharyngeal constriction
  - **Nasal regurgitation.** Clinician was cueing: "Don't tip your head back." His natural tendency was to use a head tilt up, and I wonder if this would have decreased nasal regurgitations?
  - Poor sensation of residue. "I swallowed it," when cued to dry swallow and to use effortful swallow.
- Recs: NPO, continued feeding via PEG, trials w/ SLP due to prolonged NPO status, palatal prosthesis
- Pt continued to decline after the video with respiratory distress.

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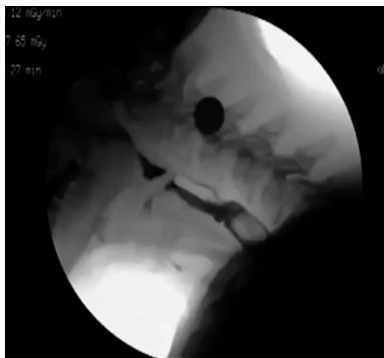
## Head & Neck Cancer of Epiglottis

- 50+ y/o with hx of SCC of epiglottis (T4aN1M0), s/p XRT & chemotherapy with Cisplatin 5 years prior. Hx of pharyngoesophageal segment PES/UES stricture per ORL; s/p repeat dilations. UGI (upper GI/barium swallow) study prior to this video swallow showed NO esophageal stenosis, but the study was terminated due to aspiration of barium.
- Previous ORL evaluations have shown no evidence of recurrence of disease, but recommended repeat esophageal dilations. Why?
- Weight loss: 15 lb, % "vomiting," with food/liquids getting stuck & coming back up. Did unclear pt descriptions lead to the prior UES/esophageal-only focus?
- There was a VFSS 11 months prior that did show deficits w/ base of tongue retraction & pharyngeal constriction w/ significant safety & efficiency issues, but he kept getting dilated.
- EGD after this study also confirmed no resistance to scope passing & no strictures, but again, he was empirically dilated to 54F.

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## Head & Neck Cancer of Epiglottis



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## Head & Neck Cancer of Epiglottis

- **Safety:** Airway compromise due to: decreased hyolaryngeal excursion, decreased laryngeal vestibule closure.
  - Why is epiglottis to the horizontal plane only? **Fibrosis, but also** decreased anterior/superior hyolaryngeal excursion, decreased tongue base propulsion, decreased bolus pressure & pharyngeal pressure to invert this stiff epiglottis.
- **Efficiency:** significant residue. Cues from clinicians constantly to **“try not to spit it out.”** “Swallow hard; push with your tongue, squeeze with your throat.” He was in the habit of returning the bolus to the oral cavity and calling it vomiting. “Make your muscles do the work. You can do it.”
- **Chin Tuck did NOT work.** Too much residue that can fall forward.
- **Super Supraglottic Swallow worked:** “Bear down like you are going to the bathroom. Take a breath through your nose, bear down, swallow, cough, swallow again.” You can hear him exhale loudly. “You did it.”

*Good example of thorough exam in under 5 minutes w/ necessary additions to the protocol with training/biofeedback.*

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# Physiological Findings

We already talked about physiology during the “structural” section, didn’t we? We need to educate the medical team on the **multifactorial issues**. The team has a tendency to simplify it down to one “fixable” issue. This may cause them to push for a surgery to correct the structure, while neglecting the function/physiology. (i.e., fixing the **valve**, without rehabilitating the **pump**).

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## VFSS helps guide the medical team’s differential

- 60+ y/o w/ sudden onset of R forehead numbness after returning from the Caribbean. Progressed to L arm, hip, groin. (“Strange feeling in patches of skin.”)
- 2.5 weeks later, she had sudden onset of difficulty swallowing solids, with food stuck & needing to swallow many times for food to go down. Needing up to 3 swallows to clear saliva. Started to puree foods. Came to hospital a after few days, when she choked on mashed potatoes.
- Progressed: Numbness in chin & lower lip. Coughing with liquids.
- Oral motor exam on day of video significant for: L side palatal weakness. Decreased sensation to cold on L side of mouth, face.
- Voice: progressively worsening hoarseness (overall ?CN V & X at least)
  - Recommended Neuro consult based on bedside findings and suspicions of brainstem (medullary) involvement, but MRI that day was negative for acute stroke.

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## VFSS helps guide the medical team's differential



### Good examples of:

- First swallow is often the worst, with neuro issues
- Pharyngeal & UES findings.
- Poor pharyngeal peristalsis may set-up weak esophageal peristalsis
- Penetration to aspiration happens within 1 second
- Need frame-by-frame analysis & 30fps
- Decreased bolus control w/ spillage & delayed laryngeal vestibule closure reaction time (penetrations just before the height of the swallow). Tried Chin Tuck & volitional LVC (airway closure).
- Need to test 2-3 times. Aspiration on 3rd trial w/ above maneuvers.
- AP & head turn/tuck to BOTH sides really show asymmetries

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## So what caused all this??

- Discussed these abnormal pharyngeal findings with the medical team, stressing the seemingly bulbar causation.
- RECS: Moist Purees, Mildly Thick (aka, Nectar Thick). Single sips by cup. Head turn/tuck to the LEFT (closing off weaker side). Effortful swallows x3 with bites/sips. Alternate foods/liquids. (? larger bites may increase UES distention)
- Malignancy workups were negative. ID & rheumatology involved.
- Chest CT: Confluent mediastinal and symmetric bilateral hilar lymphadenopathy with peribronchial nodules, suspicious for *sarcoidosis*.
- Transbronchial biopsy: proved *sarcoidosis*. Path report revealed non-caseating granulomas. Diagnosed with **Bulbar Neurosarcoidosis**.
  - She had a lung biopsy; not the more risky brain biopsy. Given her clear neuro symptoms and the findings on the lung biopsy, neurosarcoidosis was diagnosed. Patient recalls: final diagnosis was made after she left the hospital.
- Why was the MRI negative? "Patients with NS may **rarely present with cerebrovascular manifestations such as hemorrhage and stroke.**" (See Bathla, et al., 2017)

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## Bulbar Neurosarcoidosis

Over 1 week after the video swallow, she was started on high doses of steroids: Prednisone at 60 mg/daily with gradual taper. She felt 70% better after just the third dose. Symptoms & dysphagia quickly resolved.

Abdallah, T., et al. (2014) reported very similar case of how **dysphagia can “unmask bulbar neurosarcoidosis...”** \*They saw same finding of dysphagia resolution after 3 days of IV methylprednisolone.

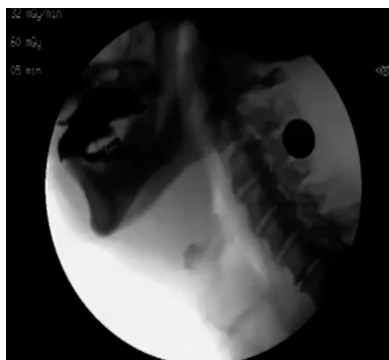
**More on Sarcoidosis:** non-infectious, idiopathic, inflammatory disorder.

- May affect any organ system, but frequently lungs, skin, lymph nodes.
- Common in African Americans & those with Scandinavian ancestry.
- “Increased awareness of this great mimicker could potentially expedite diagnosis & reduce morbidity.” (Bathla, et al., 2016)

Formulation of non-necrotizing (aka, non-caseating) **granulomas**, which are inflammatory reactions forming tight collections of immune cells around foreign substances. Needs biopsy and a pathology report to define sarcoid granulomas & to diagnose sarcoidosis.

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## Parkinson's Disease



Good examples of:

- First swallow is often the worst with neuro issues
- Poor sensation: PD is not only a motility issue.
- Reduced urge to cough
- Address timing of medications
- Pharyngeal delay with **effective** chin tuck
- Chin tuck tends to be useful in patients with neurologically related swallowing pathophysiology (i.e., delay).

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### Recommendations for this person with Parkinson's Disease

1. DIET: Soft & Bite-Sized, Mildly thick liquid, aka, Nectar thick liquids (family had been only slightly thickening liquids before). Family trained in Fork Pressure Test (per [IDDSI.org](http://IDDSI.org))
  - Continue to cut meats into very small pieces. Add moisture w/ sauces/gravy.
  - AVOID MIXED CONSISTENCIES (i.e., soups with liquid and solids)
2. MEDICATIONS: whole in applesauce
3. SAFER SWALLOWING STRATEGIES (and Aspiration/Reflux Precautions):
  - 90 degree angle for oral intake with 1:1 supervision
  - Small sips with nectar thick liquid using a **chin tuck with every sip**.
  - Cue patient to swallow two times for every bite/sip - to clear residue from the mouth, which tends to drip to the throat & airway.
  - To increase caloric intake with a safer liquid consistency, consider giving frappes between meals that are of a moderately thick, aka, honey thick liquid consistency. This thickness caused less aspiration risk.

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### Recommendations for this person with Parkinson's Disease, cont.

4. Dietitian consult to make sure patient is meeting caloric needs
5. Mobilization & Oral Hygiene for aspiration pneumonia prevention
6. Follow-up with neurologist regarding medications for PD due to advancement of dysphagia. Patient was taking Sinemet with meals with all other medications, which may be interfering with effectiveness & bioavailability. **Take 30 minutes prior to meals on an empty stomach.** This may also help reduce symptoms to maximize swallow function for the mealtime.

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## Parkinson's Disease

### Medications affect the swallow

Regarding Sinemet —> Ask patient:

- "When was your last dose?"
- "Do you have a noticeable 'on' and 'off' effect?"
- "Do you still feel like the medication is 'on' or working?"
- "Do you take it on an empty stomach?"

*"At first, levodopa may be taken with a meal or a snack, so that any effects like stomach upset will be lessened. Later, as your body becomes accustomed to the medicine, it **should be taken on an empty stomach so that it works better.** Be sure to talk to your doctor about the best time for you to take this medicine."*

<https://www.mayoclinic.org/drugs-supplements/levodopa-oral-route/proper-use/drg-20064498>

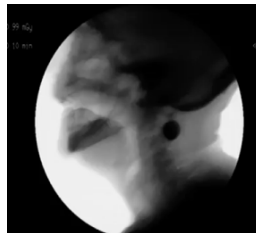
**Advise:** talk with your doctor and pharmacist, as many different items can affect the body's absorption of levodopa (e.g., diets high in fat, iron & protein can interfere).

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## Huntington's Disease choreas

70+ y/o w/ Huntington's Disease diagnosed 3 years prior to this video.

- Onset of dysphagia: 1 year prior with coughing on big pieces of food.
- Eats rapidly; 5 minute meal. Family has been cutting up foods & providing softer foods, which has helped.
- Other factors: Medication regimen, aimed at reducing chorea, may be causing increased lethargy & sleepiness. Additional cognitive-linguistic deficits, decreased attention, distractibility, needing repetitions of commands. Weight loss. Upper dentures only.



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## Huntington's Disease choreas

### Choreas

Jaw, labial and lingual movements, including wide opening of the mouth with labial retraction as well as atypical lingual movements not associated with bolus preparation. Prolonged oral phase. Decreased bolus control/ containment with posterior escape w/ liquids.

### Impaired mastication (don't let people just blame the dentures)

Prolonged and disorganized with pieces of solid bolus left unchewed. The fact that she is missing her bottom dentures may have contributed to (but was NOT the sole cause of) impaired mastication.

### Reduced organization & efficiency

of the oral prep phase and oral transit phases resulted in residue collection on tongue, palate, floor of mouth, needing cues to dry swallow to clear.

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## Huntington's Disease choreas

### Recommendations:

1. Soft & Bite-Sized solids, thin liquids w/ 1:1 supervision for cueing/safety
  - Avoid mixed consistencies
  - Add extra moisture w/ sauces/gravy → cohesive bolus!
2. Medications: whole one at a time with liquids
3. Safer swallow strategies:
  - 90 degree angle for all meals.
  - Decrease distractions (turning TV off)
  - Small bites/sips. 1/2 inch bite sizes. Double Swallow to clear residue.
  - Cue patient to swallow after she finishes chewing to not hold in mouth.
4. Follow-up with Huntington's clinic team re lethargy, choreas & for full meal evaluation on next visit to f/u with these recs.

Don't forget consult to dietitian & to recommend oral hygiene to reduce pneumonia risk

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## The Non-Functional Swallow?

- Do not use this term often
- Exam is not pass/fail.
- You can have a **severe** dysphagia with a low PAS (Penetration/Aspiration Scale score). This video highlights the importance of **Safety & Efficiency**.

RECALL from my VFSS *Back to Basics* course:

**Safety** = penetration & aspiration (Penetration-Aspiration Scale/PAS)

**"Normal"** = less than 3 on the PAS

PAS of 2 is okay!

**Efficiency** = residue and how much residue is too much?

**"Normal"** = valleculae & pyriforms less than 25% full.

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## The Non-Functional Swallow?



Good examples of:

- Severe dysphagia, despite
- Low PAS score (safety rating)
- Severe issue in **Efficiency**
- Very poor tongue base propulsion; no contact with posterior pharyngeal wall.
- Very poor pharyngeal constriction.
- Diffuse bilateral residue
- Suggests weakness
- Check a person's ability to expectorate. Have suctioning handy!

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## Supplemental section: “To Delay or Not to Delay?”

Review from Back to Basics course

ORAL DELAY

PHARYNGEAL  
DELAY

LARYNGEAL VESTIBULE CLOSURE  
reaction time

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## General Timing Measures

### Some specific points in time to watch out for:

#### **Bolus passes ramus of mandible**

- ASK: Was bolus volitionally sent there by anterior to posterior tongue action, completing the oral phase? If the swallow initiation is then delayed, then it is a **pharyngeal delay**. **OR**
- Did bolus *passively* spill posteriorly (posterior escape) due to an **oral delay** with decreased bolus control/containment?

**Onset of Hyoid Burst** (1st true movement/blur of hyoid at the start of the swallow, not a result of tongue pumping)

**Maximum closure/height of approximation of the laryngeal vestibule closure (LVC)**

**Duration of LVC:** 1st frame of LVC to laryngeal vestibule re-opening, or to the last frame of LVC. (Humbert, et al., 2015)

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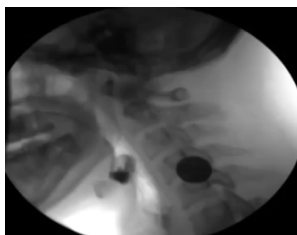
## Example of pharyngeal delay

Look at **Stage Transition Duration**: interval btwn the bolus entering the pharynx (passing the ramus of the mandible) & the onset of hyoid burst.

Mean normal values: -0.22 to 0.54 seconds (Molfenter & Steele, 2012)

Have to test a variety of volumes & densities across trials, as this measure shows the **widest variability**. Watch cued vs uncued swallows. Longer durations & more variable in uncued.

Longer durations in older adults. (Molfenter & Steele, 2012)



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## Let's analyze laryngeal vestibule closure

**Seminal study examined bolus volume effects on laryngeal vestibule closure (LVC):**

- LVC progresses **inferior to superior** for all bolus volumes.
- Early in the swallow, the arytenoid cartilages actively tilt anteriorly towards the epiglottic base. Duration of this closure increased as bolus volume increased.

### **Different mechanisms:**

1. *Airway closure* at the level of the arytenoids to the epiglottic petiole/base, with arytenoid tilt & moving medially, allowing for VC closure (direct neural control),

IS DIFFERENT from

2. The *biomechanical* events that allow for the “mobile” portion of the epiglottis to **invert past the horizontal plane** to fully close the laryngeal vestibule. These biomechanics events are: full superior/anterior hyolaryngeal excursion, downward bolus pressure, pharyngeal constriction, and the tongue base retraction.

Logemann, et al. (1992) Closure mechanisms of laryngeal vestibule during swallow.

<https://www.ncbi.nlm.nih.gov/pubmed/?term=1539666#>

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## Recall from *Back to Basics* course

Using ImageJ, Pearson and colleagues created **CASM** or  
**Computational Analysis of Swallowing Mechanics**

(See free PMC article: Schwertner, Garand, Pearson, 2016)

**Pearson & colleagues confirmed Epiglottic Inversion is  
*dependent* on laryngeal elevation & tongue base  
retraction**

From their 2016 article ***Computational analysis of  
swallowing mechanics underlying impaired epiglottic  
inversion:***

“styloglossus, hyoglossus, and long pharyngeal muscles are  
implicated as targets for rehabilitation in dysphagic patients  
with impaired epiglottic inversion.”

(Pearson, W.G., 2015, March DRS;

and see free PMC article Pearson, Taylor, Blair, Martin-Harris, Laryngoscope, 2016)

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What do we call all that movement?

Laryngeal Vestibule Closure  
Reaction Time



- **Laryngeal Vestibule Closure Reaction Time (LVCrt):** the  
time between the first *onset of the hyoid burst* to *maximum  
approximation or closure of the laryngeal vestibule*
- Nascimento, et al. (2017b, March): studied the LVCrt in young  
& older adults {62-87} who had transient laryngeal penetration  
(PAS of 2, which is still considered safe & normal).

The stage transition durations were similar; **HOWEVER**, they  
found significantly **longer LVCrt** in those who penetrated.  
Therefore, the speed to reach complete closure makes a  
difference. These are the “**just before**” the swallow  
penetrators.

May not be a significant *swallow delay*, but just **slow to fully  
close the laryngeal vestibule**.

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## Laryngeal Vestibule Closure Reaction Time (LVCrt)

Per Dr Catriona Steele:

- We have looked at a number of different timing measures to find predictors of penetration/aspiration. We found that the most explanatory variable is what we call “Laryngeal Vestibule Closure Reaction Time.”
- Incomplete or LATE laryngeal vestibule closure is one of the most common reasons for penetration and aspiration.
- Better predictor of penetration-aspiration than long stage transition durations.

(personal communication with Dr Steele regarding her lab's findings and presentations at ESSD 2015 and DRS 2017, as noted in previous slide)

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## Laryngeal vestibule closure reaction time (LVCrt)

- LVCrt is actually **very short** in normal healthy adults, but it plays a **crucial role in early airway protection** in the swallow. (Guedes, et al., 2017)
- Delayed laryngeal vestibule closure is a main cause for aspiration in stroke patients. (Cabib, et al., 2016)

Normal-Healthy Adults:

**LVCrt** = 0.198 seconds to 0.363 seconds. (Guedes, et al., 2017)

**Typical duration of LVC** = 0.31 to 1.07 seconds (Molfenter & Steele, 2012)

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## Examples of Slow LVCrt



Thank you to Alicia Vose for second video. PhD student of Dr Ianessa Humbert (SwallowingSystemsCore.org).

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## Can't get enough LVC action?

- Check out the "Critical Thinking in Dysphagia Management: Clinical Courses" Facebook page, as Dr Humbert posts terrific mini training videos. See mini tutorials in December 2017 and January 2018 facebook posts.
- See [HopeisintheScience.com](http://HopeisintheScience.com) by Drs Ianessa Humbert & Emily Plowman.

*I have nothing to financially disclose in recommending these resources.*

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**continued** We CAN prolong the laryngeal vestibule closure:

## Volitional LVC maneuver (vLVC)

- Macrae, et al., 2014: The Effects of Feedback on Volitional Manipulation of Airway Protection during Swallowing:
  - “Swallow and hold the thyroid notch up as high and as long as possible, while closing the airway. You will not be able to breathe.”
  - Facilitate laryngeal vestibule closure (not *UES opening* like Mendelsohn)
  - Volitionally **prolong** the closure (not the *peak* elevation as in Mendelsohn)
  - Ensure airway protection just before & during swallowing
  - People CAN volitionally manipulate their LVC through training and feedback

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**continued** And it carries over to faster LVC reaction times!

## Volitional LVC maneuver (vLVC)

Guedes, et al. (2017): training people to **volitionally prolong** their laryngeal vestibule closure by 2 seconds seemed to transfer over to faster airway closure times during natural swallows (20-24% faster LVCrt). Faster times carried over post-training. May aide in airway protection.

Watch volitional laryngeal vestibule closure (vLVC):

<https://www.youtube.com/watch?v=hiPbGsnNj8s>

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# Final word on Instrumentals...

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## FEES example of chronic cough



### WHY INSTRUMENTALS?

This person was put on thickened liquids based on bedside examinations alone!

Many reasons for chronic cough.

Without instrumental exams, choosing the right exam for the right person, we may be **overly restrictive** on some patients AND we may **miss high risk** issues on others.

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Thank you for your  
attention!  
Questions?

[KarenSheffler@SwallowStudy.com](mailto:KarenSheffler@SwallowStudy.com)

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## References

(Citations from the Part 1 Back to Basics Course on VFSS  
and from this Part 2 Advanced lecture.  
See also other links stated in the slides.)

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