Lecture 3

Scoring and Interpretation

Part 1: Anatomic-physiologic Assessment

Prior to Eating & Drinking

Extension of the oral motor exam

Some Anatomic Problems Visualized Better Fluoroscopically

Problems beneath the surface nicely visualized

› Cervical osteophytes

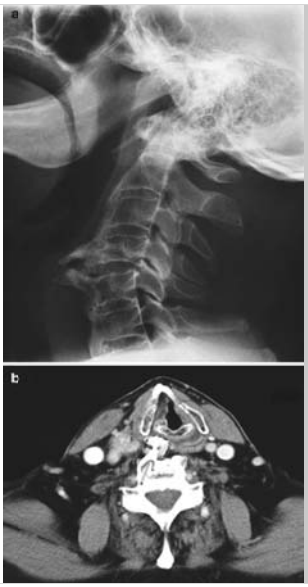
› Fistula

› Outpouching - diverticula

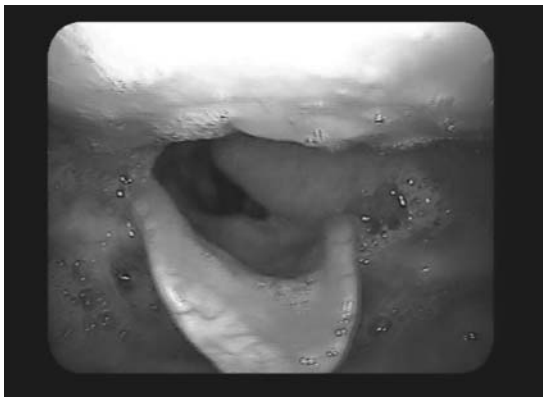
Anatomic Problems

X-ray and CT of osteophyte (Seidler 2009)*

*Seidler TO, Pèrez Àlvarez JC, Wonneberger K, Hacki T. Dysphagia caused by ventral osteophytes of the cervical spine: clinical and radiographic findings. European Archives of Oto-Rhino-Laryngology. 2009;266(2):285-291.



FEES View of Osteophyte



VIDEO

Anatomy.

Osteophyte 1min.FEES

› Osteophytes that were known; goal of FEES was to assess the impact on swallowing

Some Anatomical Problems Better Visualized Endoscopically

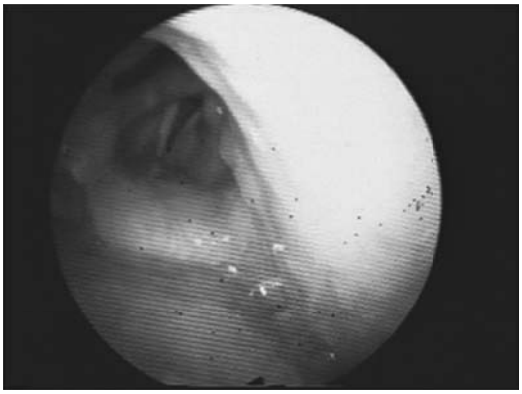
› Edema, erythema, other mucosal irregularity

› Foreign body (NGT, tumor, etc.)

› Asymmetry, resected structures – changes pathway of bolus

› Ask:
- Enough room for the bolus?
- Can airway protect?
- Can epiglottis retroflex?

Lateral Channels Reduced



VIDEO

Anatomy HNC.Francis flap.no lat chan

› History: Surgery for pharyngeal wall cancer; reconstruction included flap tissue to left pharyngeal wall; followed by RT.

Edema

EDEMA: CHF

NORMAL

Secretions

Murray Scale (1996)*: Location, response of patient to secretions

0 Normal, moist mucosa; no excess secretions

1 Secretions pooled outside laryngeal vestibule

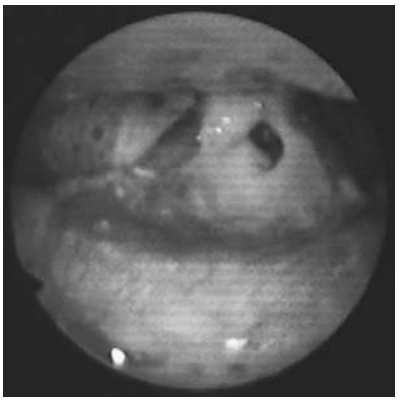
2 Secretions pooled in laryngeal vestibule transiently; patient responds and clears the vestibule

3 Secretions pooled in laryngeal vestibule consistently; patient doesn't respond or cannot clear the vestibule

› Also judge consistency (thick, thin)

*Murray J, Langmore SE, Ginsberg S, Dostie A. The significance of accumulated oropharyngeal secretions and swallowing frequency in predicting aspiration. Dysphagia. 1996;11(2):99-103.

Secretions



Secretions are Important Bolus consistency to evaluate!

› A good predictor of aspiration of liquid or food

*Murray J, Langmore SE, Ginsberg S, Dostie A. The significance of accumulated oropharyngeal secretions and swallowing frequency in predicting aspiration. Dysphagia. 1996;11(2):99-103

› The best predictor of aspiration pneumonia from a FEES

*Takahashi N, Kikutani T, Tamura F, Groher M, Kuboki T. Videoendoscopic assessment of swallowing function to predict the future incidence of pneumonia of the elderly. Journal of oral rehabilitation. 2012;39(6):429-437.

Dziewas, R Towards a basic endoscopic assessment of swallowing in acute stroke – Development and Evaluation of a Simple Dysphagia Score., 2008.

› .

VIDEO

Secretions NGT . Myers 2min18sec

(or 47 sec recording)

› Brain stem stroke patient: 2 days after onset; hospitalized with NGT. He could not initiate a swallow. However, voice, resonance, articulation not affected; only swallowing

› Note sensory response of patient to secretions in the vestibule; falling beneath the VFs

What Can You Deduce From Non-Swallowing Part 1 Tasks?

› Predict swallowing ability

› Understand some reasons for a dysphagia

› For example…

– Incomplete pharyngeal squeeze on Part 1? H: Pharyngeal clearance may be reduced

– Excess secretions in laryngeal vestibule? H: Patient more likely to aspirate liquid/food

Scoring Part II: Swallowing Food & Liquid

Scoring Part 2

› We first look at the Bolus:

– Spillage
– Residue
– Penetration
– Aspiration

› The first thing noticed: our most important marker for judging adequacy of the swallow

Scoring Part 2

When looking at the bolus…

› FEES has the advantage here

› Endoscopy can visualize the bolus with greater sensitivity than fluoroscopy

› Endoscopy identifies cases of laryngeal penetration that are misidentified on fluoroscopy as pharyngeal residue

Studies Comparing FEES & MBS

› Earlier studies compared the two exams for sensitivity and specificity of select findings.

› Results: FEES had excellent agreement with fluoroscopy for identifying aspiration, penetration, spillage, and residue

– Langmore 1991; Willging 1995; Wu, 1997; Kaye, 1997; Leder, 1998; Perie, 1998, Schroeter-Morasch, 1999; Madden, 2000

– ***Limitation of the studies: FEES and MBS exams were done consecutively, not simultaneously; sometimes done days or weeks apart.

Three Studies Using Simultaneous Fluoroscopy and Endoscopy-> Better Evidence

Design: FEES and MBS studies done simultaneously but rated separately, rater is blinded to the other exam

Study 1: Rao, Brady et. al, 2003*

› Simultaneous FEES and MBS exams

› 11 patients with suspected dysphagia

› 5 consistencies tested

› Scored presence/absence of penetration, aspiration, and pharyngeal residue… on the same swallow

› Compared agreement of findings on the 2 exams (same swallow)

*Rao N, Brady SL, Chaudhuri G, Donzelli JJ, Wesling MW. Gold-Standard? Analysis of the videofluoroscopic and fiberoptic endoscopic swallow examinations. Journal of Applied Research. 2003;3(1):89-96.

Study 1: Rao, Brady et. al, 2003*

Results

› High agreement between MBS and FEES (84-97%) but FEES detected aspiration, penetration, and residue more often

› Inter-rater reliability (3 raters) = 90% or higher for all parameters

Study 2: Kelly, Leslie, Beale (2006)*

› Judgment of Severity of Residue in FEES and MBS simultaneous studies

› 15 patients with dysphagia

› 17 SLPs rated severity of residue on each exam

– None, coating, mild, moderate, severe

*Kelly AM, Leslie P, Beale T, Payten C, Drinnan MJ. Fibreoptic endoscopic evaluation of swallowing and videofluoroscopy: does examination type influence perception of pharyngeal residue severity? *Clin Otolaryngol.* 2006;31(5):425-432.

Study 2: Kelly, Leslie, Beale (2006)

Results

› Significant differences in residue scores ($p<0.001$)

› Residue consistently rated as more severe (worse) from FEES compared to MBS.

› Inter- and intra-rater reliability was good with both exams

Study 3: Kelly, Drinnan, Leslie (2007)*

› 17 raters scored swallows from 15 patients

› Scored MBS and FEES views of swallows using the PAS scale (Penetration/aspiration scale)

› Same 15 patients with dysphagia as previous study

› Compared the PAS findings on the 2 exams
  – ANOVA: Were the scores significantly different in the 2 exams?

*Kelly AM, Drinnan MJ, Leslie P. Assessing penetration and aspiration: how do videofluoroscopy and fiberoptic endoscopic evaluation of swallowing compare? *The Laryngoscope.* 2007;117(10):1723-1727.

Study 3: Kelly, Drinnan, Leslie (2007)

Results

› PAS Scores *were* significantly different on MBS and FEES ($p<0.001$)

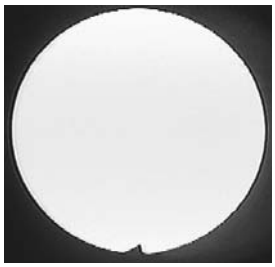
› FEES ratings were overall higher (more abnormal) for both consistencies ($p<0.001$)
  – FEES visualized penetration and aspiration more often than MBS view

› Inter-rater reliability similar for each procedure was good

Why isn't MBS More Sensitive to Aspiration than FEES?

› There is the period of white out in the middle of the swallow where FEES has no view.

› Commonly written: "FEES cannot detect aspiration during the swallow".



Multiple Ways to Detect Aspiration with FEES

› Usually sees it directly as it occurs

› More than 90% of all aspiration events occur before or after the swallow.[1,2]

[1]Smith CH, Logemann JA, Colangelo LA, Rademaker AW, Pauloski BR. Incidence and Patient Characteristics Associated with Silent Aspiration in the Acute Care Setting. *Dysphagia.* 1999;14(1):1-7.

[2]Colodny N. Interjudge and Intrajudge Reliabilities in Fiberoptic Endoscopic Evaluation of Swallowing (Fees(R)) Using the Penetration-Aspiration Scale: A Replication Study. Dysphagia. 2002;17(4):308-315.

If Aspiration Occurs During White-out

Evidence of aspiration

› residue below TVC

› patient expels it

› More sensitive to aspiration if bolus is green – and if thin liquid is barium, milk, or white food color added to water

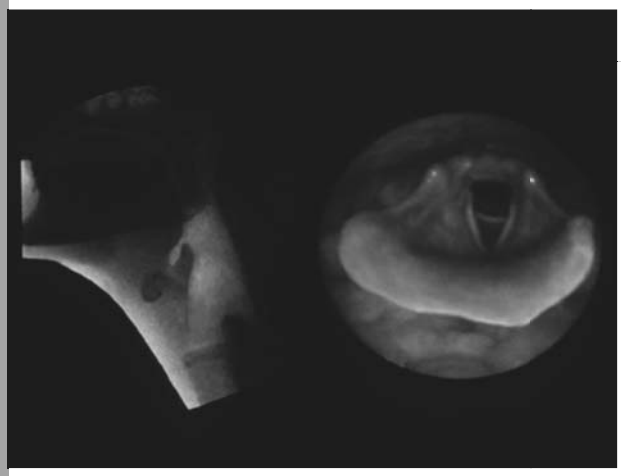
Advantage of Fluoroscopy for Aspiration

› Better detection of aspirated material in trachea than FEES especially if path of aspiration was down the posterior tracheal wall

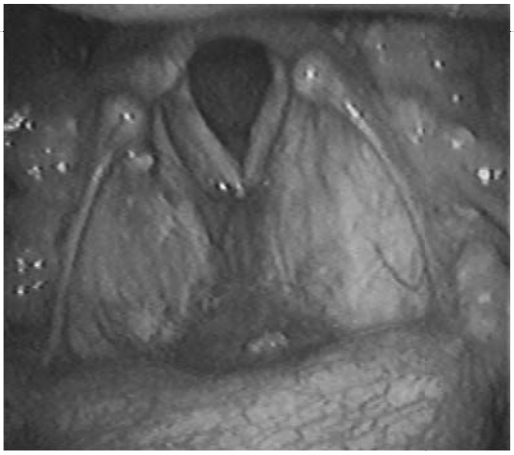
› Better impression of how much is aspirated

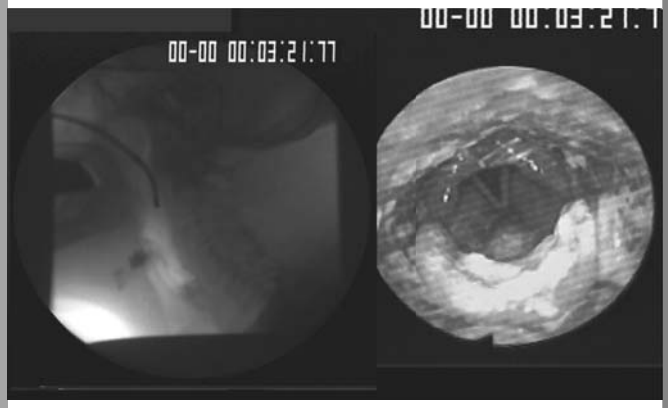
Why does FEES see more residue & localize the bolus better?

Axial view of mucosal surface is advantage



Pharyngeal residue masks the laryngeal residue on fluoroscopy





VIDEO

Simultaneous Study Gwost food 3.24 min

› View a Simultaneous Study: Patient with long standing MS in our NH; on soft diet. Annual FEES to monitor status

Conclusion:

FEES is more sensitive to visualizing the bolus.

Implications of Sensitivity of FEES for visualizing the bolus

› Is this important clinically?

› Do people penetrate? and aspirate? more than we realize?
  – Is it normal to penetrate?

› Is residue more common than generally thought?

Moving Beyond the Bolus: Identifying the Underlying Problem(s) Causing the Dysphagia

Identifying & Analyzing Underlying Pathophysiology / Movements

› Fluoroscopy is very good at identifying many of the movements that occur during the swallow

› Can you understand the problem from a FEES?
  –yes

Most Scoring Systems for FEES

For the most part, they only score bolus parameters…..

Spillage, penetration, aspiration, residue

Can you understand the underlying problem simply by scoring what happens to the bolus?

NO – you need to go beyond – and figure out WHY the bolus event happened!

My Paradigm for Analyzing the Swallow

Oral Preparation → Initiating the swallow

Driving, clearing the bolus through the pharynx

Protecting the airway

Sensing the bolus; awareness

What are the bolus findings that reveal the type of problem ??

› **Spillage?** Problem = Oral prep and Initiating the swallow

› **Residue?** Problem = Driving, clearing the bolus through the pharynx

› **Penetration/ aspiration during the swallow?** Problem = Sealing/ closing off the airway

First problem = "Spillage"

› What is spillage?
- Is it the same as Pharyngeal Delay or Transition time?
- Is it ever normal?
-

"Pharyngeal Delay" / Spillage Time/ Stage Transition

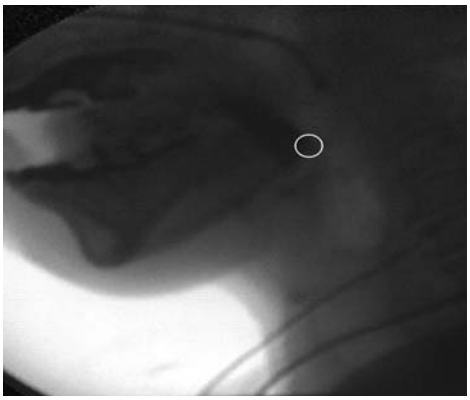
› Generally defined as how long the bolus is in the pharynx before the swallow is triggered (including spillage during oral preparation)

› There are multiple measures of "pharyngeal delay"

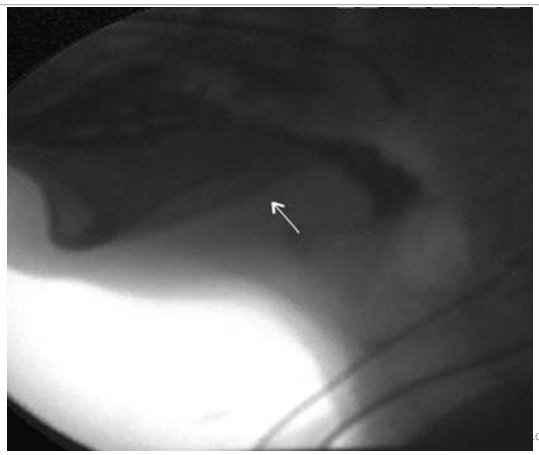
› Fluoroscopic definition

› Endoscopic definition

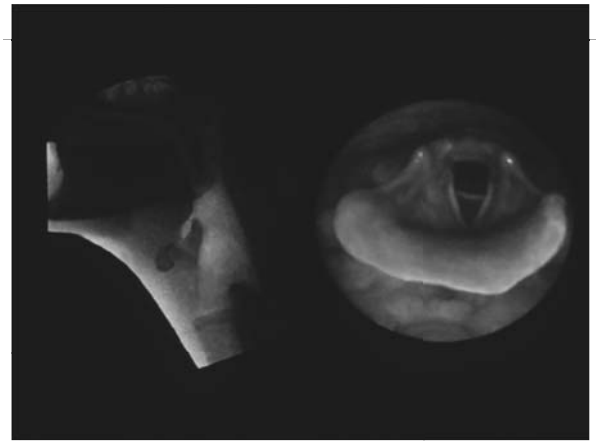
Pharyngeal Delay = Start counting when the bolus reaches this point



Stop counting when the hyoid begins to move superiorly



FEES markers: (1) bolus in view (2) white out



Normal Pharyngeal Delay/Spillage Time

<u>Early Fluoroscopic norms (1)</u>

› Traditional measures & definitions derived from fluoroscopy

› **Liquids < 0.5 second** (0.01-0.42sec) up to 20 ml
- Robbins, Lazarus, Tracy, Langmore (misc. studies from the 80s and 90s)

Normal Pharyngeal Delay/ Spillage - re-defined by Palmer et al

(2) Fluoroscopic norms
- Palmer, Hiemae (1992, 1998, 1999)

› In early studies, patient was given a command to swallow

› ***When no command to swallow was given*** → **longer normal pharyngeal delay times**

- Liquids = 0.8 second
- Food = 1.3 - 1.6 seconds
- Up to 2-3 seconds (great variability)

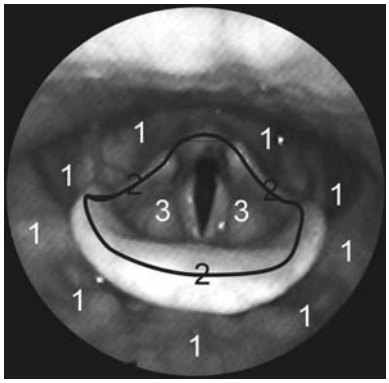
Timing/Spillage in **Natural Eating, Drinking** revealed different norms!

› **(3) Endoscopic norms**: College students ate entire lunch with endoscope in place **(Dua**, 1997)*

How Long Did the Bolus Dwell?

	Valleculae	Pyriforms	Laryngeal Rim
Liquids	3.2 sec	1.5 sec	0.3 sec
Food	2.1 sec	1.5 sec	0.4 sec

The Laryngeal Rim



Furthest Point of Spillage

Dua (1997): How Far Did the Bolus Fall?

	Valleculae	Pyriforms	Laryngeal Rim	Total
Liquids	37%	11%	12%	60%
Food	40%	2%	34%	76%

Spillage results from 4 types of problems 4 patterns:

› Spillage during oral preparation of the bolus

› Spillage at the time of initiation of the swallow
- 1. "Early/ premature appearance of the bolus; mistiming lingual bolus propulsion and pharyngeal response
- 2. Delayed initiation – bolus leaks while patient tries to initiate the swallow
- 3. Small amount leaks prior to initiation

Problem #1. Spillage during Oral Preparation

–Problem containing the bolus? -->
Bolus spills during oral preparation

Is spillage during oral prep always abnormal? Is this Premature Spillage?

Food and Liquid are handled differently
(Hiiemae, Palmer 1992,98,99)

- Oral preparation of food
  - Food that is chewed is moved to the back of the tongue and into the valleculae gradually, as the food in the front of the mouth continues to be processed **Total time for all food to be masticated and moved from the mouth to the valleculae** is directly related to the consistency of the food
- Accumulation time in the valleculae varies
  - 0 seconds for a small bolus
  - 1-2 seconds for cookie banana
  - 2-4 seconds for peanuts
  - **Normal time for a masticated bolus to be seen in the HP may be as long as 5-8 seconds**
- At some point, the person stops preparing the bolus and initiates the swallow - propels all the bolus from the mouth and the pharynx together

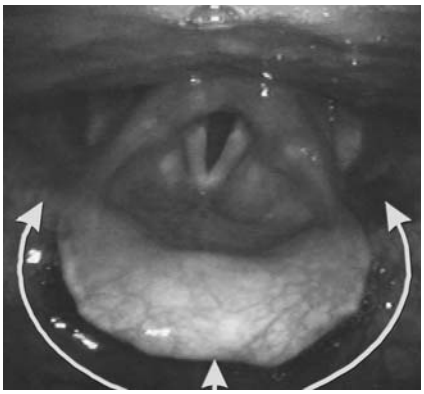
What about Liquids? (according to Palmer)

- No “aliquots” move to the BOT or valleculae
- The *entire liquid bolus* moves from the oral cavity; moves directly into the esophagus
- No spillage during oral prep ----- but
- The head of a liquid bolus may be seen in the HP for a short time as the swallow is initiated – you see the leading edge of the entire liquid bolus as it is swallowed
  - Dua’s study = **up to 3 seconds** (unstructured swallowing) **More common upward time limit = 1.5 - 2 seconds**

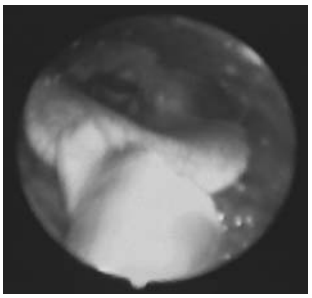
Mixed consistencies = a different pattern

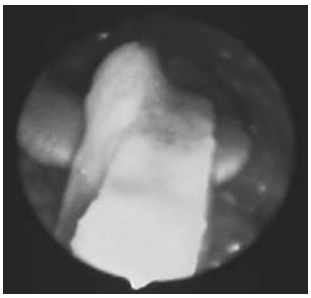
- During oral prep of the solid portion, there may be spillage of the liquid portion
  - (Joe – with apple)
  - ‘normal’ vs ‘abnormal’ **spillage time** with mixed consistencies has **not been studied**

Direction of Liquid Spillage

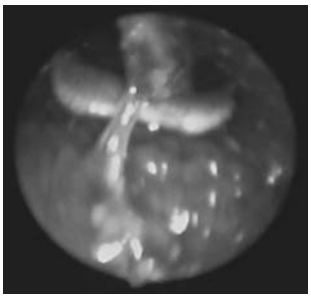


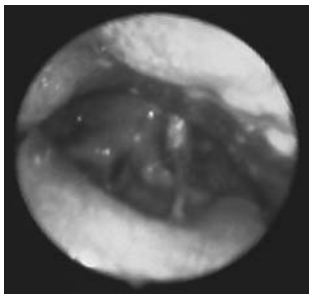
Unmasticated Solid Food Spillage - unpredictable





Direction of Food Spillage





VIDEO

Spillage Bread/cheese

› Example of Spillage of food during Oral Preparation

› Unknown patient

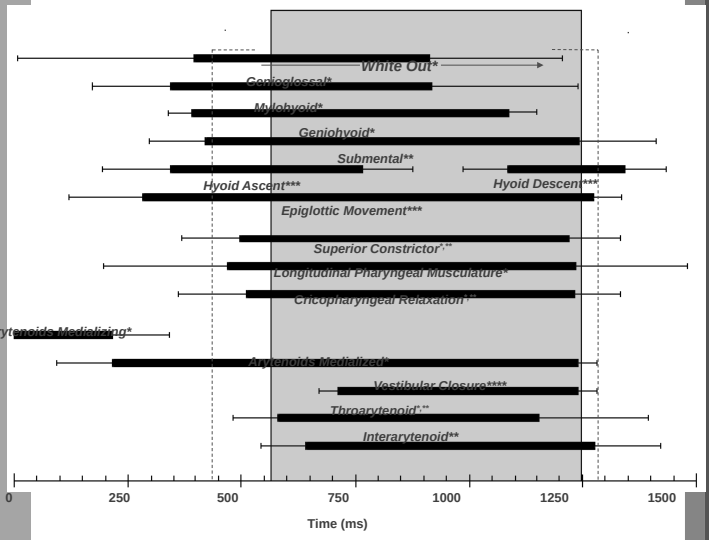
Oral Preparation, Lingual Propulsion and Initiation of the Swallow (the “pharyngeal response”)

› Oral preparation ends, followed by lingual propulsion, and multiple laryngeal/pharyngeal movements that occur nearly simultaneously.

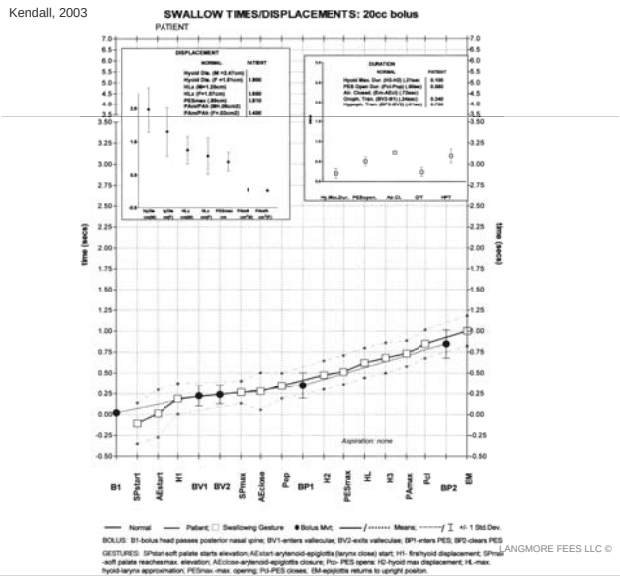
› There a smooth transition from one to the next

› Overlap of movements
– Overlapping reflexes; behavioral influence

› **Timing/ coordination of tongue and laryngeal movements is critical**



Kendall, 2003



Onset of the swallow

Onset of the swallow visualized by:

1 Soft palate rises

2 → Tongue propulsion (bolus moves posteriorly)

↘ Arytenoids move medially and anterior

Three abnormal patterns seen at initiation of the swallow

First pattern:

Mistiming of tongue propulsion with pharyngeal response. ***Bolus is propelled*** into the pharynx ***prematurely***/ before the pharynx is ‘ready’ (swallow is not initiated yet)

Compulsive? involuntary tongue movements?

(Patient does not contain the bolus until ready to swallow)

Second abnormal pattern at Initiation of Swallow

Delayed, slow; 'difficulty' initiating the swallow….***.bolus may or may not spill/ leak*** as the person attempts to initiate the swallow

you may see tongue pumping or 'freezing'

› Either of these 2 patterns → **Bolus Spills or is propelled** into HP prior to laryngeal response/ swallow onset

› Problem = oral control? Incoordination? Delayed swallow initiation/ delayed response?

Third pattern: occasionally seen

Unintentional leakage of a small amount of liquid before the person has initiated the swallow

No lingual propulsion seen

person is distracted?

head turns/ positional change?

incomplete palatal/lingual seal?

VIDEOS

1 Aspir. Before.DanielsExam 1.28sec

2 Spill Delay during oral and at initiation (MS)

3 3062.Drop of penet

Three patterns of spillage illustrated

› 1. "Early/ premature appearance of the bolus; mistiming bolus propulsion and pharyngeal response

› 2. Delayed initiation – bolus leaks while patient tries to initiate the swallow

› 3. Small amount leaks prior to initiation

My Guidelines for Rating Spillage as Abnormal – depends on your instructions!

› Command to swallow → very short (less than ½ sec)

› One bolus at a time – (structured) -> longer

  › Liquids – 1 sec; Food 1-3 sec

› Natural eating/drinking → 1-2 sec for liquids; 5-8 sec for food

  – ***Longer normal spillage time for food*** *than liquids because of the difference in Oral Prep & associated spillage*

› Mixed consistencies: norms not established

› Another criteria: Swallow is not triggered immediately as bolus crosses laryngeal rim

Problem #2: Incomplete Pharyngeal Bolus Clearance

Viewed as…….. **RESIDUE** LEFT IN THE Hypopharynx/ larynx AFTER THE SWALLOW

Inadequate bolus driving, clearing forces are due to…

› Reduced ROM
  – Weak
  – Loss of mobility / stiffness

› Anatomic / Structural Problem
  – Restricts movement
  – Alters structures
  – Interferes with bolus clearance

Viewing Structural Movements

Primary forces:

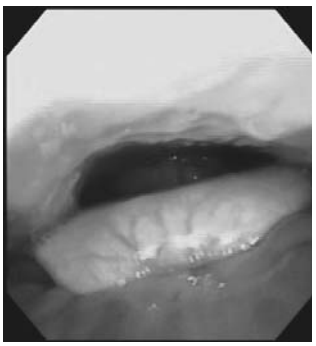
1. Base of tongue pressure against pharyngeal walls
2. Pharyngeal contraction – constrictors and longitudinal muscles

Secondary force:

1. **Hyolaryngeal excursion** Helps close off airspace; Moves the larynx up and forward, out of the way - so that pharyngeal squeeze can be more efficient

Viewing Base of Tongue Retraction on FEES

› Approaching pharyngeal walls
  – Only seen in Part 1 tasks



Judging Pharyngeal Contraction

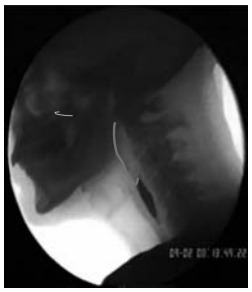
Not seen completely with either tool

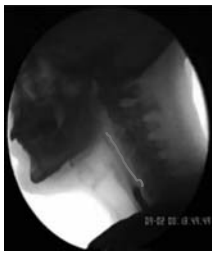
› On MBS:
  – Judge movement of (posterior) pharyngeal wall (MBSImp)
  – Rebecca Leonard's PCR measure

› On FEES
  – View pharyngeal medialization during the swallow
  – Whiteout, from 1st to last frame (from onset of hyoid elevation until airspace opens) = approximately 0.5sec

› Manometry is the direct (and best) measure of pharyngeal pressure

Pharyngeal Contraction and Stripping Wave



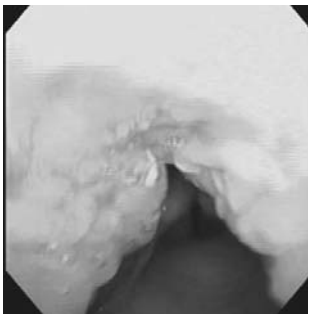


Leonard: PCR Ratio – percent of airway closed

Viewing Pharyngeal Contraction on FEES

PART 1 OF PROTOCOL

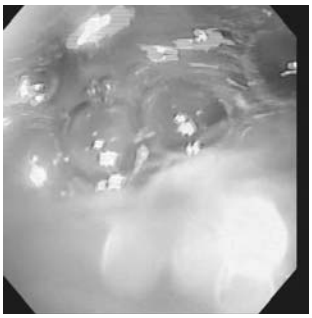
PART 1 OF PROTOCOL



White out corresponds to airspace closure

COMPLETE WHITE OUT

INCOMPLETE WHITE OUT



Residue is our Best Indicator for

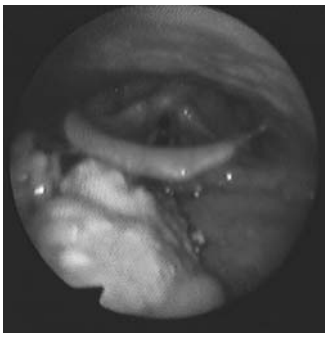
Reduced Bolus Clearance

and for Localizing the region of reduced bolus clearance

(Perlman (1992); Dejaeger (1997); Olsson (1997); Perie (1998); Pauloski, 09)

Question: What does Residue on Base of Tongue mean?

› What has not moved adequately / generated enough force?



Residue in Vallecula

› Why is there residue in the vallecula?

› What has not moved adequately / generated enough force?

Epiglottic Retroflexion is a key finding on FEES

› What causes it to retroflex?

› 20 larynges examined and verified timing of movements on MBS studies

- 1st movement: **tongue** retraction and pressure on the epiglottis
- 2nd movement (down-folding) from hyoid and thyroid movement
- **Both hyoid and laryngeal movement are needed for complete down-folding of the epiglottis**

– Van Daele DJ, Intrinsic fibre architecture and attachments of the human epiglottis and their contributions to the mechanism of deglutition. J Anat, 1995

Residue in Pyriforms

› Why is there residue in the pyriforms?

› What has not moved adequately / generated enough force?

› FEES can also specify residue in the lateral channels (superior portion of the pyriforms)

Residue in Valleculae AND Pyriforms

› Caused by weakness throughout the pharyngeal cavity
  – Perlman (1992); Dejaeger (1997); Olsson (1997); Perie (1998)

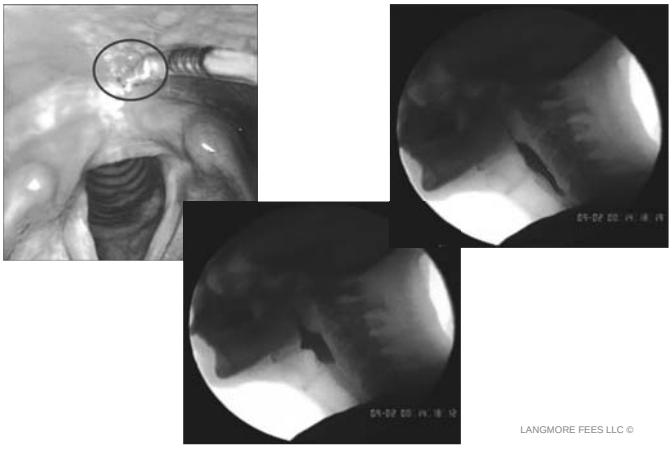
Another Consider re: Residue in Pyriforms

› It could also be due to UES that doesn't open adequately.

› Would need to verify on MBS.

UES Opening Contributes to Bolus Clearance
(it must open for the bolus to pass through)

Cricopharyngeal Relaxation and Opening



Rating Amount of Residue: Good Indicator of Severity

› Jess Pisegna found most SLPs score severity of residue from rating % of cavity filled

› An informal scale –not standardized

0 = none or coating on FEES

1 (Mild) = up to about 25% of the cavity filled

2 (Moderate) = 25-75% of the cavity is filled

3 (Severe) = more than 75% of the cavity

3 published Residue Scales

› Daniele Farnetti's Residue Scale takes location, clearance into account

› (Farneti D. Pooling score: an endoscopic model for evaluating severity of dysphagia. Acta Otorhinolaryngol Ital 2008: 28: 135-40

› Farneti D, Fattori B, Nacci A, mancin V, Simonelli M, Ruoppolo G, Genovese E. The pooling-score (P-score): inter and intra-rater reliabiity in endoscopic assessment of the severity of dysphagia. Acta Otorhinolaryngologica Ital 2014:34:1-00

› BRACS (Boston Residue and Clearance Scale) also takes this into account – (preliminary version only to date)

› Kaneoka AS, Langmore SE, Krisciunas GP, Field K, Scheel R, McNally E, Walsh MJ, O'Dea MB, Cabral H. The Boston rEsidue and Clearance Scale: Preliminary reliability and validity testing. Folia Phon et Logopaedica, 2013: 65:312-317

The Yale Pharyngeal Residue Severity Rating Scale (Neubauer, 2015)

› 5 point ordinal scale – location and amount

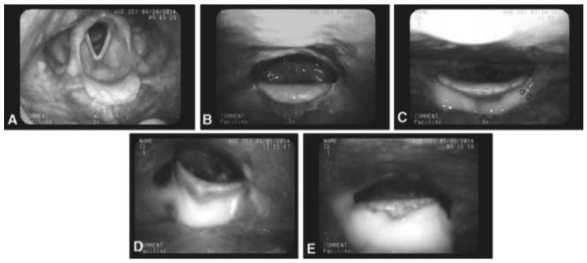
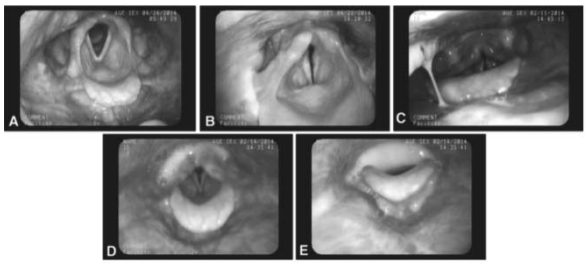


Fig. 1 The vallecula images with the greatest inter-rater agreement for each residue level: a none; b trace; c mild; d moderate; and e severe



Is Residue seen in Normals?

› All large studies find small amount of residue can be normal

› Also, consider - How many swallows are needed to clear the residue?
  – Double swallows are normal!! (Dziadziola 2012)

VIDEOS

Residue.HD.
michael
052511
cracker sev

Residue
OPCRip
FEES
11-13-08
water ApS
1.23sec

› Patient with Huntington's Disease: cracker

› Patient with OP cancer treated solely with RT: 5 years post RT: taking thin liquid, then applesauce

How to judge Residue as 'normal' on FEES?

› Coating is normal

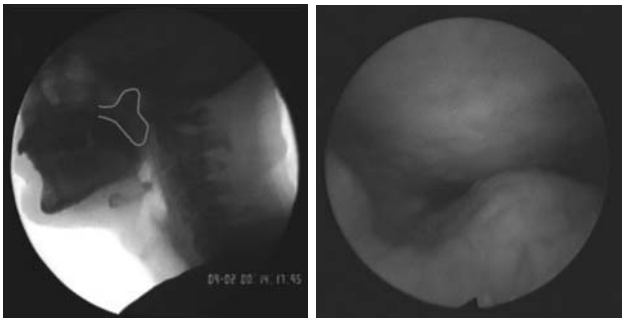
› "Mild" residue (if some depth to it) = abnormal - if it is not cleared immediately with a second swallow

› Recall that FEES will detect more residue than fluoroscopy!

Problem #3: VP Valving, UES valving, Laryngeal Valving

- Valving
  - VP Valving
    - **BOLUS regurgitates up to the nasal cavity**
  - Laryngeal Valving (airway closure)
    - **BOLUS seen in the laryngeal vestibule and/or beneath the glottis**
  - UES Opening
    - **BOLUS seen in the piriforms persistently**

VP Valving



VIDEO

VPI.NPC.XRT

- Patient with NPC – showed Velopharyngeal Incompetence after RT

Laryngeal Valving: Closing off the Airway

Airway Closure for the Swallow

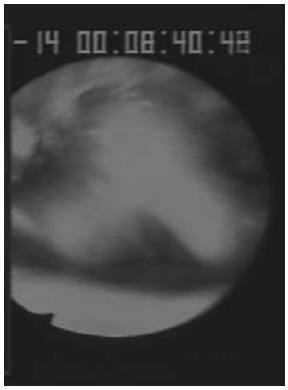
<u>Remember: Airway closure occurs in this order (overlapping)</u>

1. Arytenoids tilt forward to contact petiole of epiglottis and cover glottis
2. The epiglottis retroflexes and covers the arytenoids
3. True vocal folds adduct to seal the glottis

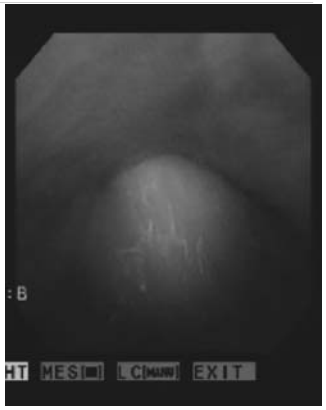
Laryngeal Airway Valve Closure

- Fluoroscopy: look for…
  - Arytenoids tilt forward to touch base of the epiglottis
  - Epiglottis retroflexion
- FEES: look for…
  - Arytenoids tilt forward to touch base of epiglottis
  - Epiglottis retroflexion - after white out
  - Airway/glottic closure from Part I tasks (VC, arytenoid adduction)

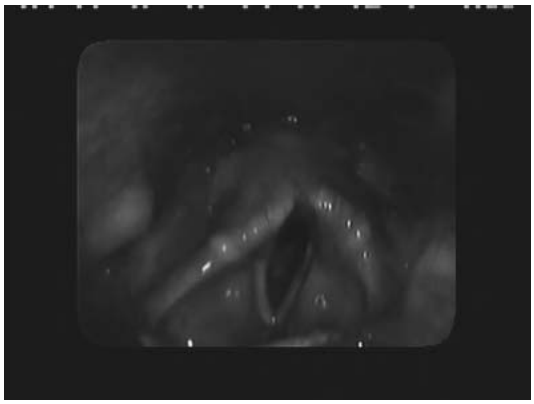
Arytenoid to Base of Epiglottis - not always seen endoscopically



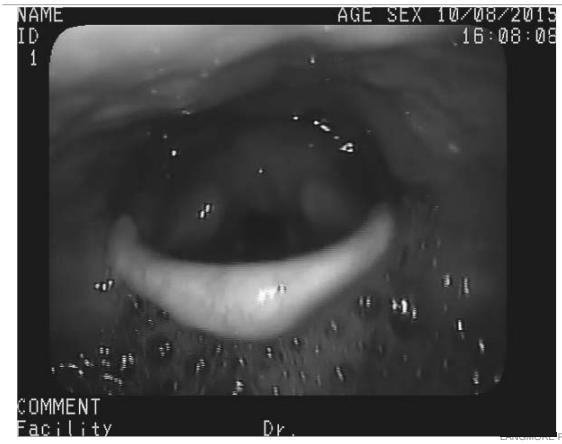
Epiglottic Inversion –seen if manual light setting used Good view here



Incomplete epiglottic retroflexion



Cannot judge epiglottic return here



Glottic Closure

› True vocal cords adduct

› Infer glottic closure from from breath tasks

FEES visualizes

1. Arytenoid to epiglottis contact at onset of swallow – may not be seen
   › *Primarily caused by hyoid and laryngeal excursion*
2. Epiglottis retroflexion - seen as it returns to rest after whiteout
   › *Caused by hyoid and laryngeal excursion – could also be anatomical obstruction or stiff epiglottis*
3. Glottic closure (in Part 1 tasks)
   › *VC adduction*

Interpreting Aspiration

› Don't just ask "Does the airway fail to close"?

But

First, ask:

› *"When does the Airway Fail to close"? Or "When did the aspiration occur?"*

When did aspiration occur?

› **If before the swallow** begins (or just at the initiation of the swallow) then ***due to mistiming***

– The BOLUS spilled into the airway before it closed off

– The bolus spilled into the airway before it was time for it to close; a timing issue!

When did aspiration occur?

› **If after the swallow** over, then ***due to reduced bolus clearance*** and residue that falls into the airway.

The residue overflowed the laryngeal rim - penetrated -- and aspirated after the swallow, as the larynx/ airway opened up.

the BOLUS was aspirated after the swallow – due to incomplete bolus clearance!

When did the aspiration occur?

› If aspiration occurs **during the swallow**, then it IS ***due to reduced laryngeal valving…***

› The airway should completely close off during the swallow

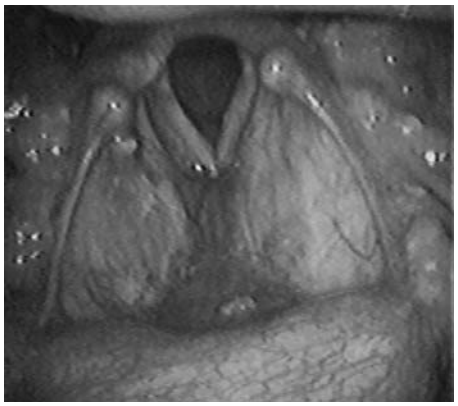
› **Work on laryngeal valving!**
– Hyolaryngeal excursion (arytenoid and epiglottic movement)
– VC adduction

Aspiration during the swallow is not seen with FEES – look for evidence of the penetration or aspiration after the swallow

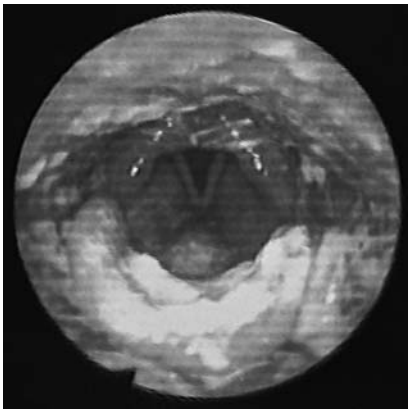
Look at the bolus left behind in the laryngeal vestibule or on the subglottic shelf

Try to determine if arytenoids, epiglottis, or VCs did not close off

What Didn't Close?



What Didn't Close?



Judging Penetration & Aspiration

› Before, during, or after the swallow?

› How deep? What was the patient's response?

– Rosenbek's 8-Point Penetration/Aspiration Scale (1996)[1] applied to endoscopy by Colodny (2002)[2]

[1] Rosenbek JC, Robbins JA, Roecker EB, Coyle JL, Wood JL. A penetration-aspiration scale. Dysphagia. 1996;11(2):93-98.

[2] Colodny N. Interjudge and Intrajudge Reliabilities in Fiberoptic Endoscopic Evaluation of Swallowing (Fees) Using the Penetration-Aspiration Scale: A Replication Study. Dysphagia. 2002;17(4):308-315.

Penetration Aspiration Scale

#1 - no penetration or aspiration

#2 - penetration, above TVC, pt expels

#3 - penetration, above TVC, pt does not attempt to expel

#4 - penetration to TVC, pt expels

#5 - penetration to TVC, pt does not expel

#6 - aspiration, pt expectorates the bolus

#7 - aspiration, pt tries to expectorate it, but unsuccessful

#8 - aspiration, pt makes no attempt to expel

Reports of Penetration & Aspiration in Normals

› Penetration and aspiration occasionally seen in healthy adults

Daggett et al 06; Martin-Harris et al, 05; Hind et al, 01; Dozier et al, 06; Robbins et al, 99); most people penetrate occasionally (83%); many people (28%) aspirate occasionally; both increase in elderly

› Butler: this increases among elderly.*

*Butler SG, Stuart A, Kemp S. Flexible Endoscopic Evaluation of Swallowing in Healthy Young and Older Adults. Annals of Otology, Rhinology & Laryngology. 2009;118(2):99-106.

VIDEOS:

Show some Aspiration videos.

› Aspir Bef Milk.16sec
– No info on patient

› Aspir Bef Dur Delay WeakSw CVA BrStemVirg.

› Brain stem CVA

› Aspir Dur.thin liquid.1010
– ICU patient

› Aspir Dur XRT+ VC sx 27 sec
– Surgery on vocal cords and RT to entire larynx

› Aspir Dur After.BOT.XRT Conrad.18sec
– Patient with base of tongue HNC post RT

› Aspir Bef Dur After food residueHNC Sx.RT 40sec
– patient with OPC post surgery to tongue plus RT

Thank you: Questions?