LANGMORE FEES 2.0

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FEES PROTOCOLS: UPDATE

- Part 1 tasks : are they predictive of swallowing?
- Part 2: Complete protocols: have any been validated?
- Customized Part 2 protocols

PART 1 TASKS: WHY DO WE DO THEM?

QUESTION: DO PART 1 TASKS PREDICT SWALLOWING FUNCTION?

YES, STRONG PREDICTORS	FAIR TO GOOD PREDICTABILITY	NOT KNOWN
Anatomy	Pharyngeal squeeze	Laryngeal lift
Secretions	Vocal fold mobility	BOT retraction
Airway/glottic closure	Swallow frequency	
Epiglottic retroflexion		

HIGH PREDICTABILITY FOR SWALLOWING

- Anatomy –
- Secretions -
- Glottic closure –
- Epiglottic retroflexion (must observe during swallowing)

HIGHLIGHTING THE IMPORTANCE OF ANATOMY

- *In Scoring Abnormal Findings folder -*
  - *Anat LaryngCa.XRT 1 yr post Laura 30 sec;*
    - *2 yrs post. (1.5 min)*
  - *Anat Asymm BOSkull*
  - *Anat* Granuloma (NGT midline) 19sec

SECRETIONS – GOOD EVIDENCE IN LITERATURE FOR HIGH RISK FOR ASPIRATION AND PNEUMONIA

- High predictor of aspiration of liquid, food
  - Murray J, et al. The significance of accumulated oropharyngeal secretions and swallowing frequency in predicting aspiration. Dysphagia. 1996;11(2):99–103. (p =0.0001)
- Best predictor of aspiration pneumonia from all findings in the FEES exams (p = 0.026)
  - Takahashi N, et al. Videoendoscopic assessment of swallowing function to predict the future incidence of pneumonia of the elderly. J Oral Rehab. 2012;39(6):429–37.

ASSESSING GLOTTIC CLOSURE: GOOD PREDICTABILITY; HIGH VALUE

- Glottic closure/ airway closure tested in Part 1 (volitional or reflexive cough, grunt, clear throat, hold breath ---- (NOT PHONATION) shows ability to close airway at the level of the vocal folds during AUTOMATIC/ REFLEXIVE task ,
  - This should predict closure during swallowing
- Ability to maintain closure for 5 seconds shows potential for maintaining apnea during the swallow BUT this is a volitional task

VIDEOS: SECRETIONS; GLOTTIC CLOSURE

ABNORMAL FINDINGS MOVIE →

SECRETIONS THICK HOLD BREATH

ABNL PART 1 LARYNGEAL ASYMM PHON BREATH HOLD

EPIGLOTTIC RETROFLEXION: ONLY ASSESSED DURING SWALLOWING:

- Question: Does epiglottal retroflexion reflect hyolaryngeal excursion?
- VanDaele, (1995) = our best study to date. Epiglottis needs full hyoid and laryngeal excursion to retroflex/downfold completely – study on larynges in cadavers and MBS studies
- Current study underway with simult. Fluoro and FEES; epiglottic retroflexion scored on FEES; HL excursion scored on MBS: results looks positive (Pisegna)

FAIR PREDICTABILITY FOR SWALLOWING

1. PHARYNGEAL SQUEEZE
2. SWALLOW FREQUENCY
3. VOCAL FOLD MOBILITY

1. PHARYNGEAL SQUEEZE

Does Pharyngeal squeeze predict good/poor pharyngeal contraction during the swallow?

FULLER (2008) : VALIDATION OF THE PHARYNGEAL SQUEEZE MANEUVER (PSM)

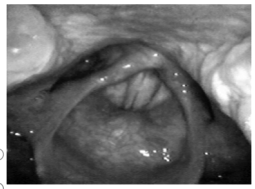
- Simultaneous FEES/MBS
  - 28 patients with dysphagia
  - **Scored PSM from FEES:**
    - Normal = contraction seen
    - Abnormal = minimal or no contraction seen
  - **Scored PCR (Pharyngeal Constrictor Ratio) from fluoro** *during swallows* – quantitative measure
  - Compared the 2 ratings

FULLER RESULTS

- PSM (FEES) normal in 86%; PCR (MBS) normal in 79%;
  - IRR agreement = 93%
- Intact PSM was highly predictive of good pharyngeal strength (from PCR)
- BUT diminished PSM→ only fair sensitivity for predicting poor PCR
  - some normals with poor PSM had good PCR during swallowing)
- Needs more study!! In patients with dysphagia

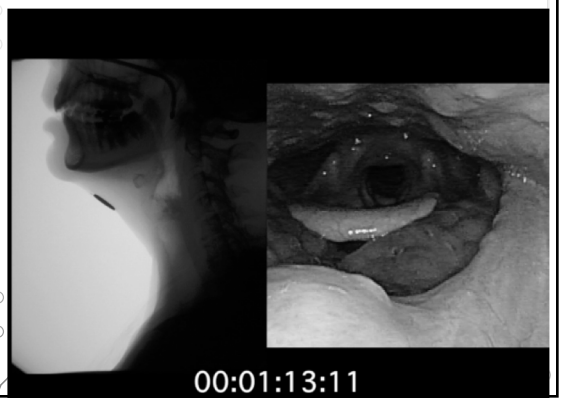
VIEWING PHARYNGEAL CONTRACTION ON FEES

PHARYNGEAL SQUEEZE -;
PART 1 OF PROTOCOL

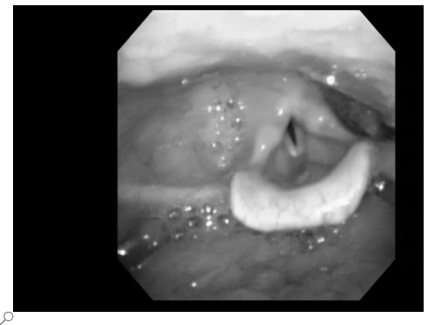


Langmore fee

GOOD VIEW OF PHARYNGEAL SQUEEZE DURING THE SWALLOW



POOR PHARYNGEAL SQUEEZE



THE LIMITATION OF PHARYNGEAL SQUEEZE MANEUVER

- Cognitive, alertness, ability to model a novel phonatory task, etc.

2. SWALLOW FREQUENCY – SOMETIMES OF VALUE

- Note frequency of spontaneous swallow
  - Normal = 2-3 per minute with scope in place
  - Crary 2014 – good screening task to ID dysphagia
- If no spontaneous swallows, consider why not
  - Dry mouth?
  - Reduced sensitivity to scope in throat?
  - Weak/no swallow?
- Ask patient to swallow; judge its effectiveness

3. VOCAL FOLD MOBILITY SEEN IN PHONATION, RESPIRATION, COUGH

- Consider volitional → reflexive tasks:
  - Phonation of 'eee'; repeated 'he, he, he'
  - Alternate inhale deeply & phonate
  - Cough – esp reflexive cough with good inhale before the cough
- Reflexive task (cough) is more similar to swallowing and thus, a better predictor

UNKNOWN PREDICTABILITY: BOT RETRACTION ARYNGEAL LIFT

- **BOT retraction:** low back vowel (eg., post vocalic 'l')
  - Easy to do, but judgement of good/fair/poor???
  - Variable among people with different dialects, etc.
  - Most reliable score = symmetry

DOES LARYNGEAL LIFT FOR PITCH GLIDE PREDICT LARYNGEAL EXCURSION DURING SWALLOWING?

- Miloro, 2014: effortful pitch glide **uses same muscles** as in swallowing – although less amplitude for voice
- Pisegna (unpublished) found low correlation of reduced laryngeal lift for pitch glide and laryngeal excursion – both measured only on MBS

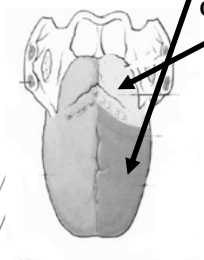
ANOTHER POSSIBLE MEANING OF REDUCED PITCH GLIDE

- Rajappa 2017 – CVA pts w/ reduced pitch elevation (singing) had no signif assoc w/laryngeal lift during swallowing
- BUT they did have significantly more **silent aspiration**
- **Why?**
  - *If SLN affected -> reduced sensation in larynx **and** reduced pitch glide (CT muscle)*
- Rajappa et al, 2017. Reduced maximum pitch elevation predicts silent aspiration of small liquid volumes in stroke patients. *Frontiers in Neuro, 2017*

HOW IMPORTANT IS SENSORY TESTING? WHAT DOES IT REVEAL?

CN VII (Facial):
Taste: anterior 2/3 tongue

CN IX (Glossopharyngeal):
General sensation: post 1/3 tongue and oropharynx
Taste: post 1/3 tongue
Stimulation of CN IX in the oropharynx triggers a swallow



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- CN X (Vagus) – Superior laryngeal nerve (internal branch, iSLN
  General sensation: the larynx and pharynx, to the level of the vocal folds
- CN X – Recurrent laryngeal nerve
- General sensation:
- below the vocal folds

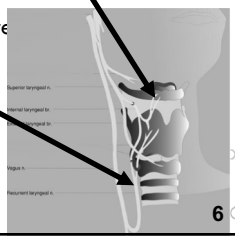

Image from www.drmkotb.com

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Is Laryngeal Sensation important for safe Swallowing?

- Laryngeal sensation is important to trigger airway protective reflexes **(Bradley, 2000).** (Dua, 2014)
- When the larynx is anesthetized, the incidence of aspiration significantly increases **(Sulica, 2002).**
- Reduction of laryngeal sensation is commonly found in patients with dysphagia **(Aviv, 1997)**

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Laryngeal Sensory Testing and the LAR

- If you stimulate the mucosa overlying the superior laryngeal nerve (SLN), at threshold or higher, it will trigger an LAR – laryngeal adductor reflex.
  - SLN –> brainstem → RLN
- This is the most reliable, consistent response

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Two Methods of Sensory Testing

	Air Pulse Method	Touch Method
Main use	research	clinical
Equipment	air pulse stimulator (Pentax AP- 4000) channel scope (FNL10-/13RAP)	regular endoscope
Stimulation	air pulse, 2-10 mmHg, 50 ms	light touch
Test sites	arytenoids	arytenoids, the tip of epiglottis
Responses	The Laryngeal Airway Reflex (the **LAR)**	**LAR,** subject report, cough, gag, swallows, etc.
Measurements	4 mmHg < normal (Aviv, 1997)	present / absent (Langmore, 2001)

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- Air pulse method and touch method
- *Video:*
  - *Protocols ---Sensory TestingAirPulsetouch.Mike*

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DOES RESPONSE TO TOUCH TEST PREDICT PENETRATION/ASPIRATION?

(Onofri, 2014)

- 91 post stroke patients
- Compared FEES – penetration or aspiration compared to Touch test - (patient response = cough or LAR)
- Results: significant correlation for all consistencies for occurrence of **penetration or aspiration** and reduced **laryngeal sensitivity**

Onofri SM, et al, Correlation between laryngeal sensitivity and penetration/aspiration after stroke. Dysphagia, 2014.

Three studies by Asako Kaneoka

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5 healthy adults	5 Parkinson's disease (PD)	6 post-radiation for head and neck cancer (HNC)
50 ≥ age	EAT-10 ≥ 3	EAT-10 ≥ 3
EAT10 < 3		

Given FEES, air pulse test, and touch test

Compared the worst PAS score on FEES to LAR on each sensory test

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Results

- Laryngeal sensory loss detected by the air pulse method was NOT significantly associated with penetration during FEES
  - Some normal volunteers had 'sensory loss' per the air pulse method - but normal swallow; it was too sensitive!
- Laryngeal sensory loss revealed by the touch method *was significantly* associated with increased PAS score.
  - Supported Onofri's finding
- Conclusion: the touch method may be more clinically relevant.

Kaneoka, A. et al. *(2014)* A Comparison of Two Methods of Endoscopic Laryngeal Sensory Testing: A Preliminary Study *Annals of Oto rhino laryn*

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FOLLOW UP STUDY: KANEOKA

- 61 patients in hospital: received FEES and touch test
- Followed for pneumonia

Results: no significant association between LAR response to touch and penetration or aspiration

- contrary to her previous results

BUT there *was* a significant association between LAR and development of pneumonia

- so it may be meaningful. More studies needed

Kaneoka, et al, *2017*, Relationship between laryngeal sensory deficits, aspiration, and pneumonia in patient with dysphagia. *Dysphagia*

THIRD STUDY: A LIMITATION OF THE TOUCH TEST

- Measured the pressures used by 2 examiners when touching arytenoid for the Touch Test
- Results: pressure values ranged from 11 mmHg to 350.00+ mmHg.
- LAR and voice report were most reliable, frequent methods of response

Kaneoka, et al, Variability of the pressure measurements exerted by the tip of laryngoscope during laryngeal sensory testing. *AJSLP, 2017*

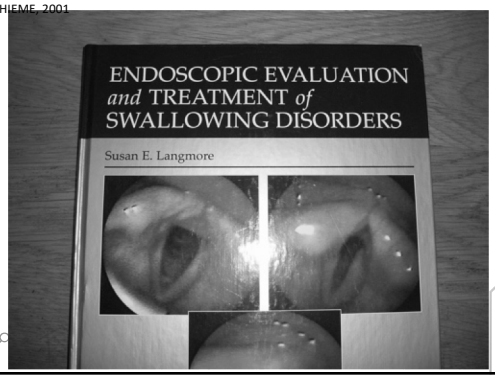
FEES PART 2: SWALLOWING FOOD AND LIQUID

FEES PART 2: SWALLOWING FOOD AND LIQUID:

- Is there a Langmore Complete Standard Protocol (and Scoring System)?
- None that is validated for IRR, for concurrent validity, etc.
- Some groups working on it; starting with IRR
  - Nothing yet published

Protocol published in Langmore text – but not validated

THIEME, 2001



WHAT TYPE OF PROTOCOL TO USE?

STANDARD (= SAME PROTOCOL FOR EVERYONE) ALLOWS YOU TO COMPARE TO NORMS, PRIOR EXAMS

FUNCTIONAL GIVES YOU WINDOW TO REAL LIFE

CUSTOMIZED HELPS WITH DIFFERENTIAL DIAGNOSIS; ANSWERS SPECIFIC QUESTIONS

FEES GIVES YOU THE OPTION

THE RESULTS MIGHT BE DIFFERENT!

A STANDARD PROTOCOL HAS DISTINCT ADVANTAGES

- Hey, 2011: showed that electronic med record with protocol and scoring items embedded – led to more complete scoring and less time than free text
- A Documentation System to Save Time and Ensure Proper Application of the Fiberoptic Endoscopic Evaluation of Swallowing (FEES) Christiane Hey, et al, Folia Phoniatrica et Logopaedica, 2011

WHAT IS THE LANGMORE PROTOCOL? SEE HANDOUT

- Part 1 Tasks: see protocol handout
- Part 2 : Food and Liquid – see next slides
- Part 3: Interventions To be done per clinician decision

LANGMORE STANDARD FEES EXAM: PART 2

- The standard exam involves a standard progression of bolus consistencies & volumes

My guidelines:

Start with **FEES Ice Chip protocol** if patient NPO or severe dysphagia

ICE CHIP PROTOCOL

- Reference = Pisegna, Langmore – 2018. The Ice Chip Protocol: A description of the protocol and case reports

  Perspectives of ASHA SIG 13, Vol 3 (Part 1)

Outcome of Ice Chip Protocol:

stop the exam

or continue with the standard protocol (next slide)

STANDARD PROTOCOL

Consistencies to give

Start with small amount of **thin liquid, nectar thick liquid** or **puree,** depending on medical problem; examiner discretion

- Continue with this easiest consistency; followed by more difficult consistencies
  - Minimum of three consistencies if possible
    - THIN or NECTAR THICK LIQUID
    - PUREE (APPLESAUCE; YOGURT, PUDDING)
    - DRY FOOD (CRACKER)

VOLUMES/ BOLUS SIZES

- Increase the volume after each successful trial (no aspiration; residue moderate or less)
- But if not successful (aspiration or severe residue), repeat the trial once; if unsuccessful a second time, switch to the next consistency
- Usual Order and volumes:
  - LIQUID = 5ml, 10ml (optional), 15 ml, single sip, consecutive sips.
  - PUREE FOOD – 5ml, 10ml (optional), 15ml, consecutive boluses
  - DRY, SOLID FOOD (cracker or bread) – small bite; large bite

END OF STANDARD PROTOCOL, PART 2

- Then **customize** the rest of the exam for the patient

Examples:

- Challenge the patient – larger, consecutive boluses; mixed consistencies
- Ask the patient to eat the rest of the food and liquid! Observe eating behavior; look for changes in swallowing ability

IDEAS FOR FUNCTIONAL/ CUSTOMIZED EXAMS

- Perform FEES with patient in bed – if that is how he will eat!
- Perform exam to determine if patient self-monitors (Is he careful? Does he respond to residue?)

See if fatigue is affecting swallowing ability

- Perform the FEES exam after patient has eaten for awhile, or do a longer exam to induce fatigue

OTHER PROTOCOLS AND SCORING SYSTEMS

IF THE EXAM IS A SCREENING EXAM, DO NOT CALL IT 'FEES'

- Brief exam; one consistency given, no part 1 tasks; no interventions.
  - This is not a FEES exam; this is a screening procedure

A published "screen". = Curtis et al, 2016 – SEES

- Rigid endoscope – insert orally after the swallow to visualize residue, post-swallow penetration or aspiration
- If severe residue, follow with full FEES

BAIJENS, SPEYER, (2014) ASKED ….WHAT PROTOCOL IS BEST TO DETECT ASPIRATION?

- Determined the best FEES protocol to detect aspiration *by # of swallows given*
- 84 patients: HNC; Neurologic
- Standardized FEES exam - 10 swallows of thin liquid, 10 thick liquid – all 10 ml
- After 10 trials, they arbitrarily designated the patient as an aspirator or non-aspirator.

BAIJENS - RESULTS

- Increasing probability of aspirating over time;
- **Median # of swallow trials needed to reveal aspiration for thin liquid = 2 (HNC) vs 7 (neuro)
  - After 3 trials (thin), 46% of patients aspirated
  - At the 10th trial, 68% had aspirated
- *Conclusions: With limited # of trials, you will underestimate the risk for aspirating*
- *If 70% detection is acceptable, then 3-4 trials is enough; if 100% detection is desired, then you must give many more trials –(unknown #)*
- *The # of new patients who aspirated declined over time: most of the aspirators were detected by trial # 7 for thin liquids and trial #5 for thick liquids*
- *Discussion: how many trials should you give?*

CUSTOMIZED PROTOCOLS FOR DIFFERENT PATIENT POPULATIONS

DZIEWAS, WARNECKE – GERMAN GROUP AT MUNSTER UNIVERSITY/HOSPITAL

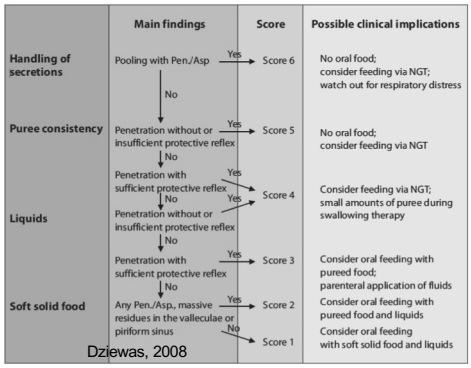
STROKE PROTOCOL (REALLY A SCREEN)

- Dziewas and Warnecke's protocol for stroke patients
  - –Towards a Basic Endoscopic Assessment of Swallowing in Acute Stroke – 2008
  - –Fiberoptic Endoscopic Dysphagia Severity Scale Predicts outcome after acute stroke – 2009
- Standard protocol -> 6 point range of scores for dysphagia severity and -> diet Rx

FEDSS: FIBEROPTIC ENDOSCOPY DYSPHAGIA SEVERITY SCALE (DZIEWAS R, ET AL 2008 CEREBROVASC DIS)

100 stroke pts -FEES done on any patient with NIHSS score ≥ 3 points

- Puree, then liquid, then bread – 3ml each x3
- Scored saliva, food, liquid as:
  - Pen/aspir with/without a protective reflex (cough) Exam stopped when pen/asp seen; prescribed diet recommendations
  - If patient failed, FEES given within 2 days



Dziewas, 2008

VALIDITY OF THE STROKE FEDSS SCALE

- Dziewas –
  - 70% of pts who had penet/asp of secretions -> intubated during hospitalization
- Warnecke –
  - Score was signif predictor of functional outcome (modified Rankin Scale (mRS) –- at 3 months, *even when adjusted for stroke severity*

WHAT ABOUT SAFETY OF FEES WITH ACUTE STROKE?

Warnecke – 2009

- 300 patients given FEES within 1-3 days post stroke
  - Included 35 hemorrhagic strokes
  - No signif diff in epistaxis between patients with/ without anticoagulant drugs or antiplatelet drugs, anti-thrombolytic treatment, or in those with/without hemorrhage
  - Avg about 4-5%
- There were sig increases in HR & BP (in 4.7% cf 1.7%)and drop in O2 saturation (in 9%) but none needed treatment
  - O2 dropped from 96.7% to 96.2%
  - No tachycardia or bradycardia

PROTOCOL FOR MG PATIENTS – (WARNECKE T, ET AL, J NEUROL, 2008)

- Start w/ puree, then bread, then thin liquids
- When pen-asp seen, stop.
- Administer Tensilon test
  - – Use same consistency that -> pen/aspir before
  - -- Does the swallow improve? If so, MG supported

MG TEST CONT'D

- If no pen-asp, continue with Fatiguable Swallow Test
  - up to 30 bread swallows. When residue occurs……
- Administer Tensilon
- Does the swallow improve?

MOVIE OF PATIENT BEING WORKED UP FOR MYASTHENIA GRAVIS

PROTOCOL MOVIES: MG CRACKER_1

MG CRACKER_4

- Warnecke and Dziewas have also customized protocols for
  - Parkinsons
  - Progressive Supranuclear Palsy
  - Other populations