Pediatric Fiberoptic Endoscopic Evaluation of Swallowing (FEES)  
When, Where, How, & Who?

Claire Kane Miller, PhD CCC/SLP, BRS-S  
J. Paul Willging, MD  
Professor, Pediatric Otolaryngology, Head and Neck Surgery

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Disclosure Statement

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Objectives

• Describe the use of the pediatric FEES protocol in a collaborative clinic setting
• Define appropriate candidates – considerations for FEES, VSS, or both exams
• Identify swallowing parameters endoscopically
• Discuss application of FEES in the diagnostic workup of pediatric patients with dysphagia
Background

- Application of FEES in the pediatric population: Cincinnati Children's - 1993
- Transnasal passage of a flexible endoscope to assess swallowing function
- Focus on ability to achieve and maintain airway protection during swallowing
- To date, ~ 5000 pediatric FEES procedures have been performed at CCHMC
Pediatric FEES Pilot Study

• Permission obtained from IRB to evaluate swallowing in patients already undergoing nasopharyngoscopy (nodules, VPI)
  - Goal to determine feasibility of doing FEES with pediatric patients

• Normative data collected

• Expansion – dual VSS/FEES exams
Split Screen Studies

- Split screen studies: simultaneous fluoroscopy and FEES exams
- Comparison of VSS & FEES Results
- Inclusion of pediatric patients with known or suspected airway protection problems
Eventual Development of the Pediatric FEES Clinic

• Collaborative team effort
  – Pediatric Otolaryngologist, Director
  – Pediatric Speech Pathologist
  – Otolaryngology Nurse

• Value of collaboration - multidisciplinary

• Appreciation of specific and overlapping knowledge areas
Focus of FEES in the Pediatric Population

• Assessment of :
  - Anatomy as it affects swallowing function
  - Movement and sensation of critical structures in the hypopharynx and laryngopharynx
  - Secretion management
  - Airway protection during swallowing – food/liquid
  - Response to therapeutic interventions to improve safety of swallow
Potential FEES Candidates?

- Known or suspected laryngeal abnormality
- NPO patients or those who have negligible oral intake
- Questionable secretion management/suspected secretion management issues
- Readiness for introduction of po
Potential FEES Candidates

• Abnormal videofluoroscopy results – more info needed re swallowing function, anatomy, sensory awareness
• Surgical patients – pre-operative assessment of swallowing ability, risk for aspiration post-op
• Patients who are unable to be positioned for videofluoroscopic swallowing study
• Need for interval exams – avoid radiation
Pediatric FEES Patients

- Age range – 2 days to adult
- Outpatient clinic & bedside assessments
- Used as initial and interval exam
Range of Patient Diagnoses

- **Structural issues**
  - Laryngeal clefts, LTE clefts
  - Glottic webs, pharyngeal stenosis, buccopharyngeal membrane
  - Congenital & acquired vocal fold paralysis, subglottic stenosis
  - Cystic hygroma, cervical lymphatic malformation

- ** Syndromes**
  - CHARGE, VATER, Down Syndrome, DiGeorge, Williams Syndrome, Pierre Robin Sequence, Cri du Chat, Robinow

- **Chromosomal abnormalities**

- **Neurologic Conditions**
  - Chiari malformation, traumatic brain injury, neurodegenerative disease, anoxic brain injury, shaken baby syndrome
    - *Most patients with multiple diagnoses*
How and Where
Necessary Equipment and Supplies

• Flexible endoscope
  – Assorted sizes beneficial
  – 2.2mm, 3.5mm, 3.7mm, 4.0mm
• Light source
• Camera head and processor
• Video recorder
• Monitor

Reimbursement requires that the examination is recorded
FEES Clinic Room Set-up

- Appropriate size scope
- O2 Set-up
- Suction
- Topical Anesthetic
- Alcohol Pad/ Clear Dip
- Towels
- Gown
- Gloves
- Emesis basin
- Liquids, solids, feeding equipment
Patient Preparation - Anesthetic

- Spray nose with Pontocaine and Afrin spray according to age
- 1:1 mixture of Afrin & Pontocaine
- Dosing
- Patient upright, head in neutral - apply toward middle meatus
- Additional 2% Lidocaine on the scope
Contraindications to Spray

☑ Infants < 1 year old
☑ Neurological Deficit
☑ Inability to manage secretions
☑ Known allergy to Pontocaine or Afrin
☑ Gut feeling
During the Study. . .

- Prepare child on parent’s lap, position upright
- Flex scope inserted
- Supplies on hand
- Anticipate special needs of patient
  - Tracheal suctioning, NP suctioning, vomiting
During the FEES Exam

• Expectation of Parent
  - Hold child on lap and cradle arms
• Nurse will support and steady head
• Watch arms
• Speech Pathologist – feeding & compensatory strategies
SLP Prior to FEES Procedure

- Review hx, oral motor exam/feeding assessment
- Assemble and prepare feeding equipment and food items prior to exam in the FEES room
- Be prepared with options for liquid viscosity, texture options, nipple alternatives, plan for compensatory strategies
SLP During the FEES Assessment

- Assist with patient positioning during exam
- Communicate with ENT re anatomical findings and airway protection ability
- SLP presents the solids & liquids to the patient and assesses swallowing parameters in conjunction with ENT
- Introduction of compensatory strategies: pacing, changes in flow, viscosity, alternating fluids, solids
Focus of FEES – Interpretation

• Assessment of:
  – Anatomy as it affects swallowing function
  – Movement and sensation of structures in the hypopharynx and laryngopharynx
  – Secretion management
  – Airway protection during swallowing – food/liquid
  – Response to therapeutic interventions to improve safety of swallow
Introduction of Compensatory Strategies

• Will differ in infants & children whether test used is VSS, FEES, or both exams

• With Infants:
  – Positioning
  – Pacing
  – Flow Rate
  – Viscosity
Compensatory Strategies in Older Children/Adolescents

• Verbal cueing – i.e. supraglottic swallow sequence to assist with airway closure
• Alternation of sips of liquid with bites of solids to assist with clearance
• Chin tuck – head tilt – head turn to modify bolus path – dependent on ability to follow directions
• Thickened liquid +/-
• Other
Physician Role: Anatomic & Functional Assessment

- Contractile function of the hypopharyngeal musculature
  - Symmetry of contraction
- Secretion management
  - Protection of the airway
  - Sensory awareness of materials in hypopharynx
- Evaluation of swallowing parameters in conjunction with SLP
Anatomic & Functional Assessment
Physician input

- Assessment of hypopharynx & larynx
  - Pyriform sinuses for masses or asymmetry
  - Laryngeal anatomy
    - Epiglottis
    - Valleculae
    - Aryepiglottic folds
    - Arytenoids
    - False vocal folds
    - True vocal folds
Anatomic & Functional Assessment
Physician Input

- Laryngeal function
  - True vocal fold mobility
  - Laryngomalacia
- Laryngeal anatomy
  - Laryngeal cleft
  - Ventricular or saccular cyst
Small granuloma LVF - posterior
Laryngomalacia
Abductor VF Paralysis
Laryngeal Web
Laryngeal Clefts

Normal Type I Type II Type III Type IV Type IV (long)

Thoracic Inlet
Additional Anatomic Observations

- Tongue base obstruction
- Supraglottic collapse
- Vocal fold immobility
- Anatomic variations
- Supraglottic collapse
Interesting Findings

Coiled NG

Tri-fid epiglottis

Laryngeal cleft

Full per oral feeder
Sensory Assessment During FEES

- Determining laryngopharyngeal sensation
  - Laryngeal adductor reflex (LAR)
  - Tapping region of the aryepiglottic fold
  - More precise – calibrated duration and intensity-controlled air pulse
  - Response – cough with or without swallow; brief non-rhythmic break in respiration
Diminished Sensory Responsiveness - Implications

- Laryngeal sensation is essential for airway protection
- LPST > 4.5 mm Hg correlated with:
  - Laryngeal penetration and aspiration
  - Pooled hypopharyngeal secretions
  - Pneumonia
  - Neurologic disorder
  - Gastroesophageal reflux
    - Link et al., 2000 (median age of subjects = 2.7)
FEES: Adverse Effects

• No significant adverse events in > 5,000 pediatric FEES examinations and tens of thousands of pediatric flexible laryngoscopy examinations in the office setting
• Epistaxis (nosebleeds)
• Vasovagal response (fainting)
  – Patient
  – Caregiver
FEES: Adverse Effects

- Laryngospasm – some notes
  - Generally seen in anesthetized patients
  - Stimulation of the larynx by secretions
  - Reflexive closure of the glottis
  - Inability to move air
  - Life-threatening emergency

- Low risk of occurrence in awake state (i.e. during FEES)

- Medical intervention/treatment
Possible Contraindications to FEES

• All are relative – there are few absolute contraindications to FEES and those pertain to the ability to mechanically perform the test, not the medical condition of the patient

• Anatomic conditions that would limit visualization
  – Nasal obstruction
  – Choanal atresia
  – Retrognathia
  – Pharyngeal stenosis

• Medically fragile patients
Special Considerations to FEES

• Subacute Bacterial Endocarditis (SBE)
  **Prophylactic antibiotics**
  - Risk of developing bacterial vegetations on the heart valves in patients with cardiac abnormalities
  - Generally NOT indicated in flexible endoscopy unless biopsy is taken

• Pulse oximetry, supplemental oxygen, suction equipment, resuscitation equipment
Special Considerations During FEES

- Isolation
  - MRSA
- Parental Needs
  - Pregnancy
  - Fear of holding child
  - Fear of procedure
When
Decision-Making VSS, FEES, or Both

- Video swallow study provides overall view of oral, pharyngeal, and cervical esophageal phases of swallowing – logical starting point in most cases
- FEES can provide a closer look at swallowing abnormalities, rule out certain structural issues, confirm findings of VSS
- Decision may be based on availability
- Adjunct, not replacement exams
Comparing VSS & FEES
Secretion Management

- VSS – no apparent secretions
- FEES – can detect and judge:
  - Appearance of secretions: normal, foamy, thick
  - Amount of standing secretions: normal, excessive
  - Pooling within the laryngeal vestibule
  - Evidence of leakage into the subglottis
  - Patient response to secretions: normal spontaneous swallows to clear, no attempt to clear, ineffective attempts to clear
Velopharyngeal Closure During Swallowing

• FEES
  - Nasopharyngoscopy routinely used to assess adequacy of the velopharyngeal sphincter
  - VP closure is simultaneous with medial motion of the arytenoids

• VSS
  - Clear visualization of backward motion of velum against posterior pharyngeal wall
Hyoid/Laryngeal Elevation

- **FEES**
  - Note laryngeal elevation toward the scope

- **VSS**
  - Able to visualize directly
Pharyngeal Contraction

- **VSS**
  - Contraction of the pharynx during swallowing can be directly visualized
  - Adequacy of hypopharyngeal clearance

- **FEES**
  - As the pharynx contracts during swallowing, structures close around and the tip and deflect light
  - As structures resume resting position, view opens
  - Can view structures before and after - not during swallow
Function of the UES

• **FEES**
  - May see incidental episodes of reflux during exam, opening of the UES, patient response to reflux events
  - Opening during swallowing occurs during white-out during
  - Visualize closed segment following swallows

• **VSS**
  - Clear view of upper esophageal sphincter function
  - Restriction in opening apparent
Vocal Fold Mobility

• Shadow image on VSS
• On FEES: clear view of respiration – abduction
• Airway protection – adduction
  – Cough – complete adduction, incomplete
  – Hold breath – TVC adduct – complete/incomplete, FVC adduct, yes/no
  – Arytenoid contact medially – normal, reduced
• Phonation – Adduction, Abduction
  – TVC adduction, normal, abnormal
  – FVC – adducted/hyperadduction
  – Excessive closing down of arytenoids
  – Asymmetry of arytenoids
  – Use of supraglottic compensatory compression
Swallowing Parameters

- Secretion management
- Swallowing Response Time
- Pharyngeal clearance
- Laryngeal Penetration
- Aspiration
- Protective Reactions
- Responses to compensatory strategies
Secretion Management
Identification of Swallowing Abnormalities During FEES - Stills

- Premature Entry/ Swallow Response Time
  - Escape of material over the tongue base in the absence of purposeful oral motor movements to transfer into the hypopharynx
Laryngeal Penetration

- Passage of food or liquid within the confines of the endolarynx
- Contact onto the laryngeal surface of the epiglottis, aryepiglottic folds, or the arytenoids
- Location can be described in terms of proximity to the airway
Penetration
Aspiration

- Passage of secretions, food, or liquid below the level of the true vocal folds
- Identify before, during, after swallow
- Note reaction, protective response, ability to clear
Residue

- Retention of food or liquid in the hypopharynx following swallowing
- Related to strength of pharyngeal contraction, depressed sensory threshold, or cricopharyngeal dysfunction
Regurgitated material heading to the larynx
Case Study – J.L.

• Born @ 36 weeks with hypoplastic left heart syndrome
• Candidate for the Norwood procedure – performed at DOL 3
• Clinically, demonstrating coordinated non-nutritive sucking, accepting ~ 5mls during oral feeding trials with coordinated suck/swallow pattern, displaying weak cry
• FEES study performed at 2 weeks of age to assess vocal fold function, airway protection skills, and readiness to advance with oral feeds
Case
Pediatric FEES Ratings & Report

• Collaborative rating when appropriate
• Dual (ENT/SLP) FEES report in electronic medical record
  • Description/ratings of:
    • Appearance of structures
    • Function of structures for provision of airway protection
    • Sensation: quantification of response
    • Response to compensatory strategies
    • Impressions/Recommendations
Findings

• Problem with bolus propulsion:
  – Possible Reasons:
    • Poor tongue base retraction
    • Weak pharyngeal contraction
    • Problems with CP opening

• Issues with airway protection
  – Inadequate TVC adduction, poor closure/movement of supraglottic structures, inadequate retroversion of the epiglottis
  – Problems with maintaining coordination of bolus flow/airway protection
  – Depressed sensory response
Recommendations

- Recommendations ideally come from objective observations in VSS/FEES in the context of overall knowledge of infant/child (medical issues, age, development, energy, state (maintenance), caloric needs/volume
Recommendations

- Compensatory strategies identified as effective in improving airway protection/swallowing function in 60% of the patients with swallowing abnormalities
  - Single sips
    - Timing of swallowing with airway closure
      Preiksaitis & Mills, 1996
  - Alternating liquids/solids – to improve clearance through the hypopharynx
  - Decreased rate of intake, pacing of intake
    - To maintain airway protection
- Readiness to transition to po
- Dietary changes – transitioning from thickened liquid
Management Decisions

- In discussion with the family:
- Address the safety of feeding
- What types of liquids, foods are appropriate?
- What compensatory strategies improve swallowing function?
- Focus upon collaborative decision-making with the family
Advantages of FEES

- Can detect signs of reflux irritation
- Portability
- Feasible for patients difficult to position for videofluoroscopy
- No radiation or time limits
- Initial or interval exam
- Can help to determine readiness for oral feeds
- Provides information re surgical candidacy – airway reconstruction patients
- Biofeedback useful for some patients
Disadvantages of FEES

• Some discomfort with scope passage – usually subsides once stimulation of nasal mucosa ends
• Presence of scope may trigger gagging &/or vomiting
• View disappears briefly during moment of swallow “white out” – therefore unable to detect events during the swallow
• Consistent loss of view during sequential swallowing i.e. bottle intake – implications for interpretation
• Focus limited to pharyngeal phase of swallowing
• Requires special training
Most Frequent Follow-up or Referral Type Following FEES

- ENT - recommendations regarding readiness for airway reconstruction
- Gastroenterology
- Speech Pathology and/or Occupational Therapy
- Psychology
- Radiology – Video Swallow Study
Conclusions

• Relatively low percentage of "normal studies" combined with measurable outcome variables indicate the specific clinical value of FEES

• FEES is another tool that helps to identify the underlying abnormality in swallowing physiology, not simply a test to indicate "aspiration" "no aspiration"
Billing Considerations

• ENT code – 31575.6 Flexible laryngoscopy

• Speech Pathology considerations
  – CPT 92612: Flexible endoscopic evaluation of swallowing
  – FEES with sensory testing = 92614
    • Caution: sensory testing not covered by some insurance companies

  – If done in collaboration with ENT (with ENT passing the scope), cannot both bill for FEES. SLP - consider ICD dysphagia code + procedural code for either limited or comprehensive dysphagia evaluation (92610)

• New Dysphagia ICD 9 Codes: (effective October, 2007)
  – 787.20 Dysphagia, unspecified
  – 787.21 Dysphagia, oral phase
  – 787.22 Dysphagia, oropharyngeal phase
  – 787.24 Dysphagia, pharyngoesophageal phase
  – 787.29 Other Dysphagia
References


• Willging, Miller, Link, & Rudolph. Use of FEES to assess and manage pediatric patients. In: Evaluation and Treatment of Swallowing Disorders, Langmore S. 2001