Gulping & Gasping: Infant Dysphagia

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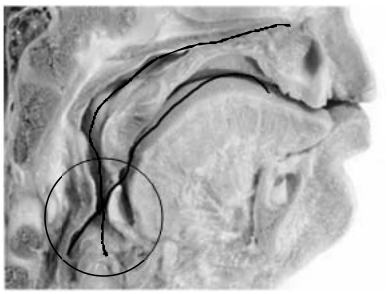
Disclosure

Breastfeeding research collaborative with Columbia University and Tel Aviv University Departments of Biomedical Engineering, studying sucking, swallowing and nipple biomechanics.

I am the author of textbooks on infant sucking and breastfeeding tools and receive royalties on sales.

Human Food and Air Paths Cross

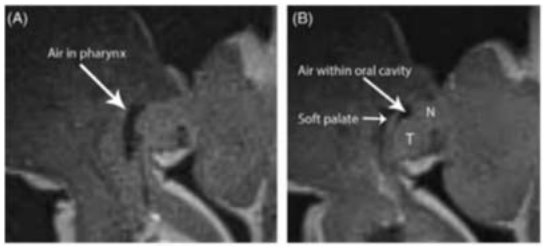


Courtesy of Brian Palmer, DDS.

Risk getting air into gastrointestinal tract (aerophagia) OR food into the airway (aspiration).

Breastfeeding & human milk *reduce* risk & consequences of dysphagia.

Sustained Latch Prevents Air Swallowing

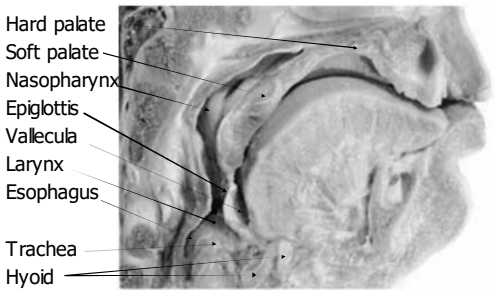


Mills, N., Lydon, A.-M., Davies-Payne, D., Keesing, M., Geddes, D. T., & Mirjalili, S. A. (2020). Imaging the breastfeeding swallow: Pilot study utilizing real-time MRI. Laryngoscope Investigative Otolaryngology, 5(3), 572–579. https://doi.org/10.1002/lio2.397

Protection from Flooding

- Build on higher ground (larynx is high in throat)
- Build under a ledge (larynx tilts under base of tongue)
- Create drainage channels (epiglottis acts like a rock in a stream, not an umbrella, directs milk to pyriform sinuses)
- Close the chimney flue (soft palate seals off nasopharynx)
- Grade your property (pharyngeal muscles contract)
- Sweep out water (tongue wavelike movements push milk down the shortened pharynx for a safe swallow)
- Use a blower to clean up (exhale after swallowing, cough)

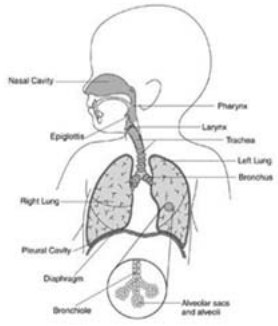
Newborn Airway and Mouth



Courtesy of Brian Palmer, DDS.

Protective Anatomy:

- High larynx
- High, forward tongue position
- Deep vallecula
- Soft palate & epiglottis touch
- Epiglottis near larynx
- Larynx tucks under tongue



Infant/Child Airway (> 3 Months)

- Growth of neck separate soft palate & epiglottis, brings larynx down and tongue down and back
- Increased risk of dysphagia, especially during transition

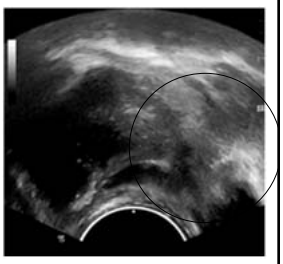
Courtesy Medical University of South Carolina children's hospital, (MUSCkids.com)

Normal Respiratory Pattern Leaves Time for SAFE Swallow!

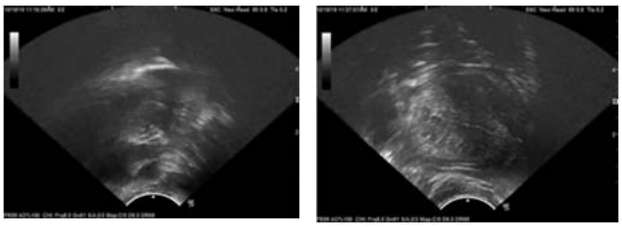
- Neonatal RR = 30-40
- Suck:Swallow:Breathe triad occurs about once per second during initial sucking burst (nutritive, after MER)
- Airway closure ~ ½ respiratory cycle (deglution apnea)
- Easily integrated with smooth, rhythmic swallowing.

Suck & Swallow Review

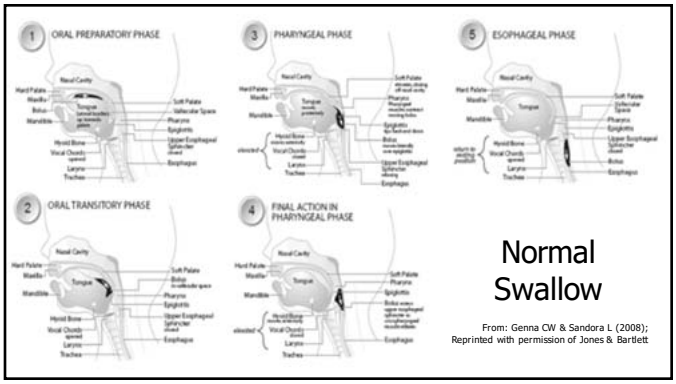
- Soft palate seals to tongue base
- Mandible & anterior tongue move down
- Wave of downward motion along grooved tongue, gathers bolus in cup at valleculae
- Mandible & anterior tongue rise, wave up upward motion continues along tongue
- Larynx pulled up, forward (under tongue base), vocal folds adduct, epiglottis tilts, soft palate elevates, continuing tongue movement propels bolus into pharynx
- Pharyngeal muscles contract
- Bolus passes into esophagus (UES)
- Airway opens & descends, baby breathes



Tongue Movements



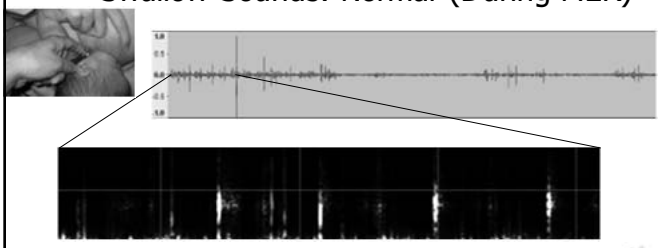
Submental | Transbuccal (Right Cheek)



Normal Swallow

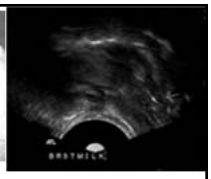
From: Genna CW & Sandora L (2008); Reprinted with permission of Jones & Bartlett

Swallow Sounds: Normal (During MER)



Frakking, T. T., Chang, A. B., O'Grady, K.-A. F., David, M., & Weir, K. A. (2017). Reliability for detecting oropharyngeal aspiration in children using cervical auscultation. *International Journal of Speech-Language Pathology*, *19*(6), 569–577.

Instrumental Studies



- FEES
- VFSS / MBS
- Ultrasound

Armstrong et al (2020).

Courtesy Cincinnati Children's

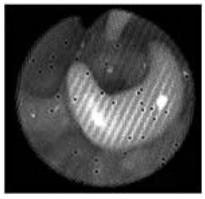
FEES: Fiberoptic Endoscopic Evaluation of Swallowing

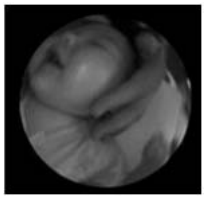
- Thin endoscope passed through nose
- Direct visualization of airway movements
- Can be done during BF

Armstrong, E. S., Reynolds, J., Sturdivant, C., Carroll, S., & Suterwala, M. S. (2020). Assessing Swallowing of the Breastfeeding NICU Infant Using Fiberoptic Endoscopic Evaluation of Swallowing: A Feasibility Study. Advances in Neonatal Care, 20(3), 244–250.

Normal Swallow is Dependent on Position

Semisupine on BF Pillow **Upright** Courtesy of Nikki Mills





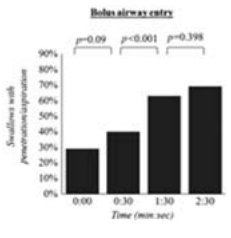
Mills, et al., (2021). Flexible Endoscopic Evaluation of Swallowing in Breastfeeding Infants With Laryngomalacia: Observed Clinical and Endoscopic Changes With Alteration of Infant Positioning at the Breast. Annals of Otology, Rhinology & Laryngology, 130(7), 653–665.

Burst-Pause Pattern

- Initial faster sucking to induce MER
- Slower, deeper nutritive sucking in bursts of 10-30 with 2-5 second respiratory pauses
- As feeding progresses:
  - Shorter sucking bursts
  - Longer respiratory pauses

Changes Through the Feeding

- VFSS Study, n=50 Suspected Dysphagia
- Full term, no external pacing required, could stay latched, use of own bottle and nipple
- Penetration/aspiration more likely after 1.5 minutes of feeding.



Increased with time:

Premature spillage (poor bolus control)

Late swallow initiation

Late swallow initiation location (below valleculae)

McGrattan, K. E., McGhee, H. C., McKelvey, K. L., Clemmens, C. S., Hill, E. G., DeToma, A., Hill, J. G., Simmons, C. E., & Martin-Harris, B. (2020). Capturing infant swallow impairment on videofluoroscopy: Timing matters. *Pediatric Radiology*, *50*(2), 199–206. https://doi.org/10.1007/s00247-019-04527-w

Dysphagia

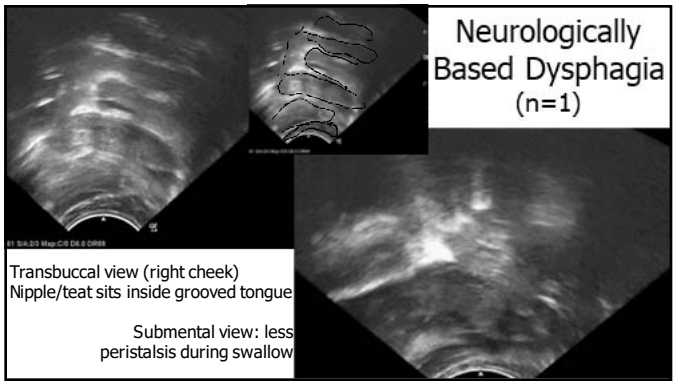
Signs of Dysphagia

- Hard swallows (gulping)
- Wet breathing, especially increasing with feeds
- Color changes
- Brief bursts of stridor (laryngeal penetration)
- Eyes tightly closed, furrowed forehead, stress signs
- Blinking during swallow
- Feeding resistance /fussiness
- Prolonged feeds/low weight gain

Refer: speech therapy

Mahurin-Smith & Genna (2019). Assessing the Breastfeeding Dyad: A Guide for Speech-Language Pathologists. *Perspectives of the ASHA Special Interest Groups*, *4*(3), 502–506.

Neurologically Based Dysphagia (n=1)



Transbuccal view (right cheek)
Nipple/teat sits inside grooved tongue

Submental view: less peristalsis during swallow

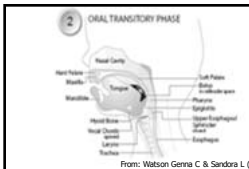
Problems: Oral Phase

- Poor attachment
- Loss of bolus anteriorly (from mouth)
  - Lack of lip/tongue seal
- Difficulty forming bolus
  - Tongue incoordination or weakness
  - Tongue tie
  - Effortful tongue movements
  - Reduced oral sensation

Hall (2000); Arvedson & Leifon-Graf (1998)
Genna (2022, 2023)

From: Genna CW & Sandora L (2008); Reprinted with permission of Jones & Bartlett

Problems: Oral Phase



From: Watson Genna C & Sandora L (2008); Reprinted with permission of Jones & Bartlett

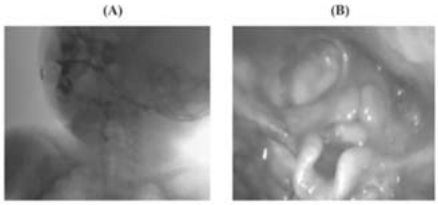
- Inability to move bolus posteriorly
  - Reduced tongue groove
  - Reduced tongue elevation/lack of contact with palate/lack of peristaltic-like movement
- Loss of bolus over base of tongue prior to swallow
  - Resulting in aspiration before swallow is initiated
    - airway protective mechanisms have not engaged
    - Delayed oral transit time (> 3 seconds)

Courtesy of CK Miller Cincinatti Children's Hospital
Laryngeal Penetration before swallow

Miller, C. K., & Willging, J. P. (2020).

Hall (2000); Arvedson & Leifon-Graf (1998)

Laryngeal Penetration: FEES vs VFSS

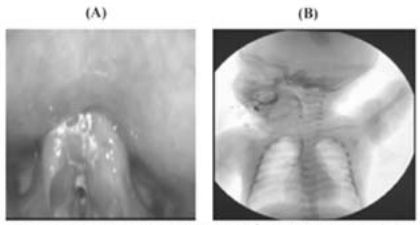


[a] Videofluoroscopic swallow study [b] Fibreoptic endoscopic evaluation of swallowing

Fig. 1. Image showing penetration in VFSS[a] and FEES[b] in young children.

Pavithran, J et al.,(2020). Exploring the utility of fibreoptic endoscopic evaluation of swallowing in young children- A comparison with videofluoroscopy. International Journal of Pediatric Otorhinolaryngology, 138, 110339. https://doi.org/10.1016/j.ijporl.2020.110339

Aspiration FEES vs. VFSS



[a] Fibreoptic endoscopic evaluation of swallowing, [b] Videofluoroscopic swallow study

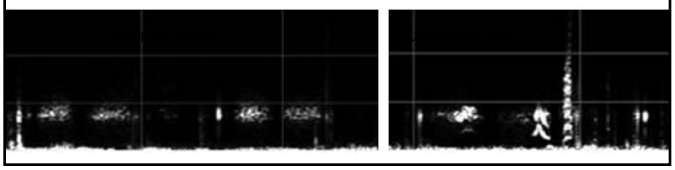
Fig. 2. Image showing aspiration in FEES[a] and VFSS[b] in young children.

Pavithran, J., et al., (2020). Exploring the utility of fibreoptic endoscopic evaluation of swallowing in young children- A comparison with videofluoroscopy. International Journal of Pediatric Otorhinolaryngology, 138, 110339. https://doi.org/10.1016/j.ijporl.2020.110339

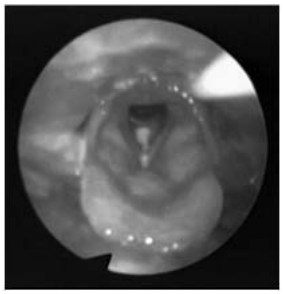
Normal Swallow on Cervical Auscultation

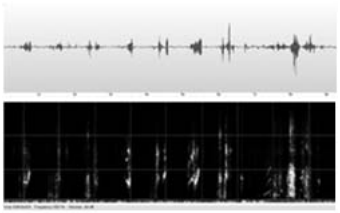
- Swallow duration less than one second
- Fast bolus transit sound
- Normal breathing sounds

Frakking, T. T., Chang, A. B., O'Grady, K.-A. F., Yang, J., David, M., & Weir, K. A. (2017). Acoustic and Perceptual Profiles of Swallowing Sounds in Children: Normative Data for 4–36 Months from a Cross-Sectional Study Cohort. *Dysphagia*, *32*(2), 261–270.



Aspiration FEES & CA



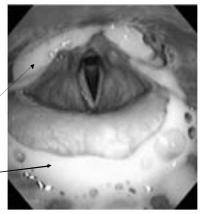


Leder, S. B., & Murray, J. T. (2008). Fiberoptic Endoscopic Evaluation of Swallowing. Physical Medicine and Rehabilitation Clinics of North America, 19(4), 787–801.

Milk in Vallecula and Pyriform Sinuses

Pyriform sinus

vallecula



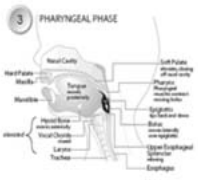
Courtesy of Nikki Mills MD, PhD
Milk in Pyriform Sinuses- Infant with Laryngomalacia

Leder, S. B., & Murray, J. T. (2008). Fiberoptic Endoscopic Evaluation of Swallowing. Physical Medicine and Rehabilitation Clinics of North America, 19(4), 787–801.

Problems: Pharyngeal Phase

- Delayed initiation of swallow
  - Material collecting in pharynx
- Poor posterior tongue approximation to pharyngeal walls
  - Decreased positive pressure
- Weak contraction of pharyngeal muscles
  - Residue remaining in pharynx
- Vocal folds do not close completely
  - Bolus enters airway
  - Aspiration during the swallow

Hall (2000); Arvedson & Leifon-Graf (1998)



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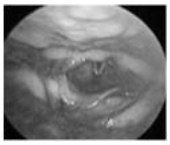
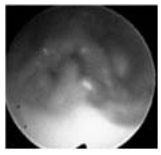


Courtesy of CK Miller Cincinnatti Children's Hospital

Problems: Pharyngeal Phase

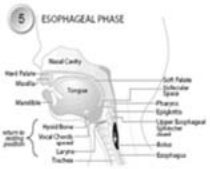
- Nasal reflux from inadequate velopharyngeal closure
- Inadequate clearance of material in the pharynx
  - Aspiration after swallow completed
    - Residue inhaled
    - Residue spills into airway
- Pharyngoesophageal segment (UES) does not open
- Bolus does not enter esophagus
  - Aspiration after the swallow from material sitting in airway

Hall (2000); Arvedson & Leifon-Graf (1998)



Courtesy of CK Miller Cincinnatti Children's Hospital

Problems: Esophageal Phase



From: Genna CW & Sandora L (2008); Reprinted with permission of Jones & Bartlett

- Bolus does not move through to lower esophageal sphincter or moves retrograde
  - Pressure may cause contents to rise upward
    - Reflux
    - Emesis
    - Possible aspiration of material after the swallow completed
- Reduced peristalsis

Hall (2000); Arvedson & Leiffon-Graf (1998)

Post fistula repair at higher risk

Incidence of Pediatric Feeding & Swallowing Problems

- Mild to moderate "feeding problems" occur in up to 25%-35% of normally developing infants and children.
- Incidence increases (40%-70%) with structural, neurological, metabolic, or mixed etiology.
- Estimated 75-80% of children with cerebral palsy have dysphagia.

Rogers and Arvedson

Problems Can Occur in Multiple Phases

Especially neurologically impaired infants

Examples: inability to form bolus and loss of control over base of tongue, weak movement of bolus through pharynx, nasopharyngeal backflow, aspiration before, during, after swallow.

Dysmotility Related Dysphagia

Poor oral transport & pharyngeal dysmotility result in dysphagia (slow feeding, gagging, vomiting). Silent aspiration/penetration common. Unrelated to cardiac issues.

Eicher PS, Donald-Mcginn DM, Fox CA, Driscoll DA, Emanuel BS, Zackai EH (2000). Dysphagia in children with a 22q11.2 deletion: unusual pattern found on modified barium swallow. *J Pediatr 137*: 158-64.

Wong, N. S., Feng, Z., Rappazzo, C., Turk, C., Randall, C., & Ongkasuwan, J. (2019). Patterns of Dysphagia and Airway Protection in Infants with 22q11.2-Deletion Syndrome. *The Laryngoscope*, https://doi.org/10.1002/lary.28317

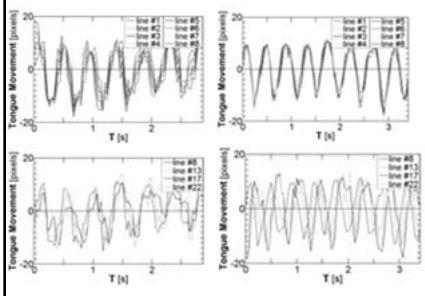
Tongue-tie Alters Tongue Motility

Lack of tongue peristalsis in symptomatic ankyloglossia
Schlatter, 2019

Resolution of dysphagia in 5/11 (43%) with pre-post frenotomy VFSS
Buck, 2020
- most likely if no confounders

Peristalsis – essential for normal swallow; altered or eliminated in ankyloglossia and neurologically based dysphagia (n=1) Genna, 2021

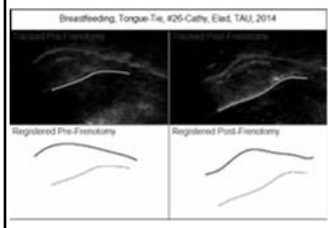
Tongue Tie Impairs Normal Peristalsis



Genna, C. W., Saperstein, Y., Siegel, S. A., Laine, A. F., & Elad, D. (2021). Quantitative imaging of tongue kinematics during infant feeding and adult swallowing reveals highly conserved patterns. Physiological Reports, 9(3), e14685.

Elad, D et al., (2014). Biomechanics of milk extraction during breast-feeding. Proceedings of the National Academy of Sciences, 111(14), 5230–5235.

Tongue Tie & Dysphagia



- 3 of 11 with TT and aspiration on MBS resolved immediately after frenotomy
- 2 resolved later
- Recovery less likely if there were comorbidities

Buck, L. S., Frey, H., Davis, M., Robbins, M., Spankovich, C., Narisetty, V., & Carron, J. D. (2020). Characteristics and considerations for children with ankyloglossia undergoing frenulectomy for dysphagia and aspiration. *American Journal of Otolaryngology*, 41(3),

Silent Aspiration: Role of Cough

Infants < 51 weeks gestational age – greater risk of silent aspiration

Aspiration not associated with LRI

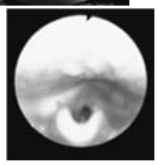
Most resolve with development of laryngeal cough reflex (71%).

Consider age before exposing to radiation.

Balest, et al., (2020). Consideration of Cough Reflex Development When Ordering Modified Barium Swallow Studies in Infants. *Dysphagia*, *35*(3), 533–541.

Instrumental Swallowing Evaluation

- Videofluoroscopic swallowing study (VFSS)
  - Also called modified barium swallow study (MBS)
- Fiberoptic endoscopic evaluation of swallowing (FEES)



VFSS Advantages

- Tests overall swallowing ability--oral, pharyngeal, and esophageal phases
- Visualize hyolaryngeal elevation
- Visualize penetration/aspiration occurring before, during, after swallow
- AP and Lateral views possible
- Timing and clearing of food/liquid from oropharynx
- Treatment strategies can be trialed to determine effectiveness during the procedure
- Researchers attempting to standardize protocol.

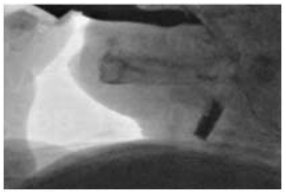
(Gosa, Suiter, & Kahane, 2015; Weckmueller, Easterling, & Arvedson, 2011; MartinHarris, 2015; MartinHarris & Jones, 2008; MartinHarris, et al., 2008)

VFSS Disadvantages

- Exposure to x-rays. Must limit exposure >1-2 minutes
- Infant rarely held by mother or breastfed. Bottle feeding is not true representation of infant's breastfeeding skills
- Must be done in radiology suite with special equipment
- Requires barium—alters taste/texture of liquid/food. Mixture of breast milk with barium may not accurately represent viscosity of typical feedings
- Specialized training required

Courtesy of Cincinnati Children's Hospital

VFSS



Fluids used in VFSS differ from infant foods

Liquid barium is 3.4 x more viscous than pre-thickened formula

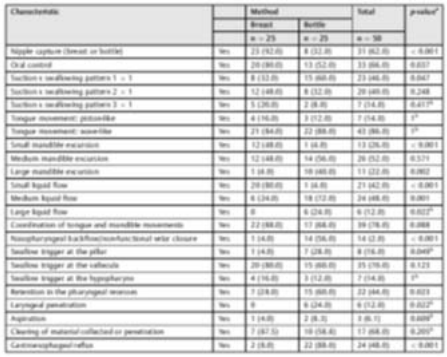
"… the considerable differences in density and yield stress show that it is not truly representative of handthickened infant formula. Consequently, behaviours seen during infant VFSS may not be representative of patterns occurring during typical feeds. Use of liquid barium may yield false-negative or false-positive results due to differences in viscosity. "

Chicero et al., 2011

Barium sulfate increased viscosity of human milk 18x, adaptamil 18.5x

Hernandez et al., 2020

Human milk viscosity increases for 2 hours after mixing with gum thickeners Koo et al, 2019



Characteristic		Method		Total	p-value*
		Breast	Bottle		
		n = 25	n = 25	n = 50	
Nipple capture (breast or bottle)	Yes	23 (92.0)	8 (32.0)	31 (62.0)	< 0.001
Oral control	Yes	20 (80.0)	13 (52.0)	33 (66.0)	0.037
Suction x swallowing pattern 1 > 1	Yes	8 (32.0)	15 (60.0)	23 (46.0)	0.047
Suction x swallowing pattern 2 > 1	Yes	12 (48.0)	8 (32.0)	20 (40.0)	0.248
Suction x swallowing pattern 3 > 1	Yes	5 (20.0)	2 (8.0)	7 (14.0)	0.417†
Tongue movement: pistonlike	Yes	4 (16.0)	3 (12.0)	7 (14.0)	1†
Tongue movement: wavelike	Yes	21 (84.0)	22 (88.0)	43 (86.0)	1†
Small mandible excursion	Yes	12 (48.0)	1 (4.0)	13 (26.0)	< 0.001
Medium mandible excursion	Yes	12 (48.0)	14 (56.0)	26 (52.0)	0.571
Large mandible excursion	Yes	1 (4.0)	10 (40.0)	11 (22.0)	0.002
Small liquid flow	Yes	20 (80.0)	1 (4.0)	21 (42.0)	< 0.001
Medium liquid flow	Yes	6 (24.0)	18 (72.0)	24 (48.0)	0.001
Large liquid flow	Yes	0	6 (24.0)	6 (12.0)	0.022†
Coordination of tongue and mandible movements	Yes	22 (88.0)	17 (68.0)	39 (78.0)	0.088
Nasopharyngeal backflow/nonfunctional velar closure	Yes	1 (4.0)	14 (56.0)	14 (2.0)	< 0.001
Swallow trigger at the pillar	Yes	1 (4.0)	7 (28.0)	8 (16.0)	0.049†
Swallow trigger at the valleculs	Yes	20 (80.0)	15 (60.0)	35 (70.0)	0.123
Swallow trigger at the hypopharynx	Yes	4 (16.0)	3 (12.0)	7 (14.0)	1†
Retention in the pharyngeal recesses	Yes	7 (28.0)	15 (60.0)	22 (44.0)	0.023
Laryngeal penetration	Yes	0	6 (24.0)	6 (12.0)	0.022†
Aspiration	Yes	1 (4.0)	2 (8.0)	3 (6.1)	0.600†
Clearing of material collected or penetration	Yes	7 (87.5)	10 (58.8)	17 (68.0)	0.203†
Gastroesophageal reflux	Yes	2 (8.0)	22 (88.0)	24 (48.0)	< 0.001

VFSS during bf and bottle feeding

Many differences

Larger flow during bottle feeding, greater risk of dysphagia

Hernandez, A. M., & Bianchini, E. M. G. (2019). Swallowing Analyses of Neonates and Infants in Breastfeeding and Bottle-feeding: Impact on Videofluoroscopy Swallow Studies. *International Archives of Otorhinolaryngology, 23*(3), e343–e353.

Advantages of FEES

- Identifying:
  - Anatomic abnormalities contributing to swallowing problem
  - Premature spillage of liquid/food prior to swallow
  - Occurrence and source of penetration/aspiration
  - Sensitivity of structures to presence of liquid/food
  - Ability of infant/child to clear food/liquid from pharynx

Additional Advantages of FEES

- No exposure to radiation so no time limitations.
- No use of barium
- Ease of conducting exam (more portable)
- Observe signs of reflux irritation to pharynx and larynx
- Infants can be held by mother and also breastfed. BF not common with VFSS
- Assist with determining readiness for advancing oral feedings

Disadvantages of FEES

- Passage of scope may:
  - Irritate nasal mucosa
  - Trigger gagging &/or vomiting
- Cannot observe events during swallow (aspiration) due to "white out" (reflection from epiglottis movement)
- Focus limited to pharyngeal phase of swallowing
- Requires special training

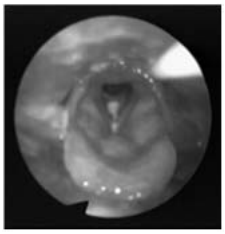
Flexible Endoscope Passed Transnasally

- Flexible endoscope
- Multiple Sizes
- Light source, camera head and processor
- Video recorder and monitor

Courtesy of Cincinnati Children's

FEES Exam

secretion management
pharyngeal secretion pooling,
premature spillage,
delayed swallow initiation,
penetration,
aspiration (and clearing),
silent aspiration,
residue,
laryngeal sensation (air puff or touch)



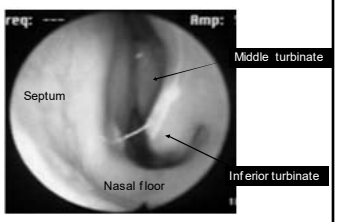
Aspiration of milk

From Leder & Murray (2008).

Zang, J., Kiehn, S., Flügel, T., Koseki, J.-C., Nießen, A., Kim, S. H., Pflug, C., & Nienstedt, J. C. (2022). Implementation of Pediatric Flexible-Endoscopic Evaluation of Swallowing: A Systematic Review and Recommendations for Future Research. *Dysphagia*. https://doi.org/10.1007/s00455-022-10446-0

Nasal Anatomy

Moore, K.L., et al (2010). Clinically Oriented Anatomy, 6th edition.



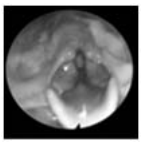
Courtesy of Cincinnati Children's Hospital

View from Above of Normal Pediatric Airway

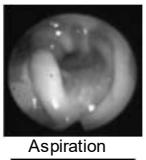
This should link to pedsamle.avi from asha videos folder.

FEES: Identifying Problems Before and After Swallow

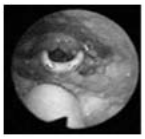
Spillage before swallow



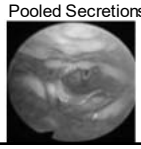
Penetration



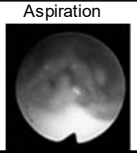
Residue after swallow



Pooled Secretions

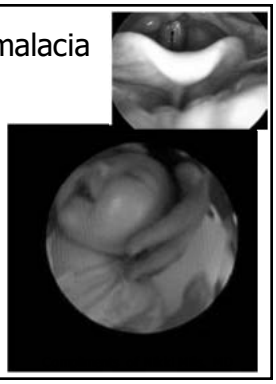


Aspiration



Courtesy of Cincinnati Children's

FEES During BF - Laryngomalacia



Suterwala, M. S., Reynolds, J., Carroll, S., Sturdivant, C., & Armstrong, E. S. (2017). Using fiberoptic endoscopic evaluation of swallowing to detect laryngeal penetration and aspiration in infants in the neonatal intensive care unit. *Journal of Perinatology*, *37*(4), 404–408.

Reynolds, J., Carroll, S., & Sturdivant, C. (2016). Fiberoptic Endoscopic Evaluation of Swallowing: A Multidisciplinary Alternative for Assessment of Infants With Dysphagia in the Neonatal Intensive Care Unit. *Advances in Neonatal Care*, *16*(1), 37–43.

Infants with Cardiac Disease (FEES)

Associations with Severity (DOSS)

- Laryngeal congestion ('wet' vocal quality & noisy exhalation)

Kwa, L., Willette, S., & Schroeder, J. W. (2022). Evaluating dysphagia in infants with congenital heart disease using Fiberoptic Endoscopic Evaluation of Swallowing. *International Journal of Pediatric Otorhinolaryngology*, *152*, 111004.

NOT Associated with Severity

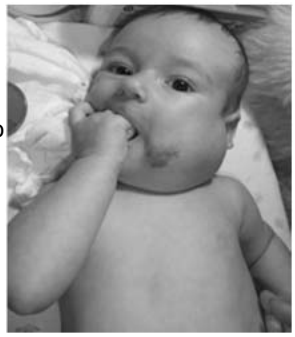
- Lower airway infections (also Balest 2020 on VFSS)
- Vocal fold paralysis
- Cardiac Surgery

DOSS – Dysphagia Outcome & Severity Score 1 (most severe, tube feeds only) to 7 (normal swallow).

Teamwork

"Good communication between the SLP and lactation consultant regarding selection of techniques to explore during instrumental exams can support the infant's possibility of remaining at the breast"

Supporting Sucking Skills in Breastfeeding Infants, 3rd ed. 2017



Breastfeeding Strategies for Safer Swallowing

Breastfeeding Strategies for Dysphagia

- Lower sympathetic tone (skin to skin, carrying, massage, gentle feeding) to lower respiratory rate
- Positioning (prone, semi-prone, straddle/upright, sidelying)
- Pacing (hands off head, no prodding)
- Rhythm (walking while feeding)
- Flow Control (breast massage, pressure on breast, milk expression before feeding)
- Supportive Techniques (oral support, sublingual pressure)

Genna CW (2023) Supporting Sucking Skills in Breastfeeding Infants, 4th edition, Jones & Bartlett

FEES : Aspiration on Bottle, not Breast

- Personal communication with Jenny Reynolds Nov 22, 2019
- Watch for upcoming research

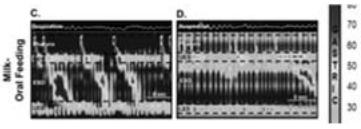
Quitting BF?

- 87 infants with VFSS documented aspiration/penetration
- Continued bf or bof HM
- 90% – no pulmonary illness (3+ mos)
- 10% (n=8) – new pulmonary dx
  - 6 dx laryngeal cleft
  - 2 required NPO and g-tube (continually pulled ng tube)

Hersh, C. J., Sorbo, J., Moreno, J. M., Hartnick, E., Fracchia, M. S., & Hartnick, C. J. (2022). Aspiration does not mean the end of a breast-feeding relationship. *International Journal of Pediatric Otorhinolaryngology, 161*, 111263.

Better Outcomes with Parent Ed & Choice

- VFSS + High Resolution Manometry
- Higher percentage of successful oral feeding when parents are educated on own infant's strengths and issues and allowed to choose intervention (including continuing breastfeeding) than expert-directed treatment.



Jadcherla, S. R., Hasenstab, K. A., Osborn, E. K., Levy, D. S., Ipek, H., Helmick, R., Sultana, Z., Logue, N., Yildiz, V. O., Blosser, H., Shah, S. H., & Wei, L. (2021). Mechanisms and management considerations of parent-chosen feeding approaches to infants with swallowing difficulties: An observational study. *Scientific Reports, 11*(1), Article 1.

State & Autonomic N.S.

Preparatory Handling
-Lower baseline respiratory rate
-Safer feeding with improved neurobehavioral organization

(Bell 2008; Burtchen 2019; Medoff-Cooper 2015; Gakenheimer-Smith 2019).

Breast Massage

before feeding increases fat content of milk; may reduce strength of milk ejection

Deep Attachment

Positioning

Semiprone

Kneeling or Upright Straddle

Sidelying

Allow Baby to release breast as needed – avoid head holding

Breast pressure during MER

Block ducts temporarily

Change area blocked each feeding to avoid plugged ducts

Don't interrupt baby's seal on breast

Carol Chamblin, DNP, IBCLC

Nipple shield may slow flow

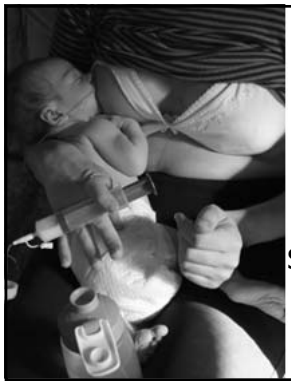
Express Before Breastfeeding

Safe progression to oral feeding in tube fed infants

Not usually necessary in preterm infants

Increases production and milk flow overall

Manual expression vs pumping



Supplement Cautiously

Monitor Stress Signals

Eye Contact, Intent Expression or Play

signal normal swallowing

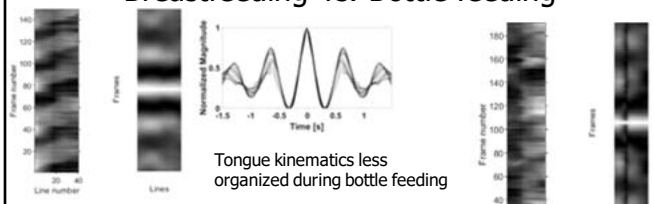
Courtesy: Yolanda Wright

Miller-Loncar, 2004

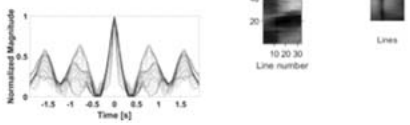
Alternative Feeding

Fingerfeeding safer than syringe feeding (Bulder et al 2020)
Semielevated sidelying bottle feeding safer position (Girgin et al 2018)
Human milk safest fluid for airway (laryngeal chemoresponse) (Mizuno 2002)

Breastfeeding vs. Bottle feeding



Tongue kinematics less organized during bottle feeding



Genna, C. W., Saperstein, Y., Siegel, S. A., Laine, A. F., & Elad, D. (2021). Quantitative imaging of tongue kinematics during infant feeding and adult swallowing reveals highly conserved patterns. *Physiological Reports*, *9*(3), e14685.

Track Efficacy of Interventions with Cervical Auscultation (or FEES)

Accuracy of dysphagia detection was 93.8% (recorded CA vs VFSS)
Inter and intra-rater reliability Kappa ~.80 (good/very good)

Frakking, T. T., Chang, A. B., O'Grady, K. A. F., David, M., & Weir, K. A. (2017). Reliability for detecting oropharyngeal aspiration in children using cervical auscultation. *International journal of speech-language pathology*, *19*(6), 569-577.

Thickening for Dysphagia

- Human milk amylase quickly thins cereals
- Excess starch calories: obesity
- Altered gut microbiome
- Gums: Ca, Zn, Fe malabsorption
- Xanthan Gum thickeners associated with NEC, contraindicated in infants.
- Increased work of feeding (increased suck:swallow ratio), malnutrition
- Osmolality increase (slower gut transit)
- Increased post-swallow residue
- Uncertain effect on respiratory health

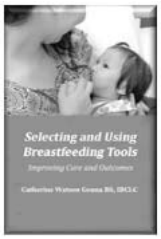
- Gelmix (Carob bean gum) works on human milk – min. 42 wks ga/6 lb

Stewart, A., & Burr, S. (2021). Thickened liquids: Do they still have a place in the paediatric dysphagia toolkit? *Current Opinion in Otolaryngology & Head and Neck Surgery*, *29*(3), 194–199.

Review

- Swallow coordination is usually better during bf
- Improve baby's organization:
  - Increased respiratory reserve
  - Improved coordination
- Position to protect airway
- Pacing at breast – massage, block ducts, avoid head holding
- Supplement with care
- Consider pre-pumping breast
- Assess effect of interventions
- Refer: Feeding specialist SLP & OT

For more information:



http://www.cwgenna.com/clinicalcornerpage.html