Providing SLP Services in Pediatric Acute Care and Medical settings

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Learning Objectives

THE PARTICIPANT WILL GAIN KNOWLEDGE AND UNDERSTANDING OF SLP SERVICES IN THE AREAS OF PEDIATRIC ACUTE CARE AND MEDICAL BASED SERVICES.

THE PARTICIPANT WILL APPLY CONCEPTS, SKILLS AND KNOWLEDGE LEARNED IN THE AREA OF SPEECH PATHOLOGY TO BETTER UNDERSTAND THE ROLE OF AN SLP IN PEDIATRIC ACUTE CARE AND MEDICALLY BASED SERVICES.

AGENDA
OVERVIEW OF SERVICES PROVIDED

- Cleft Palate and Craniofacial Clinic
- Multidisciplinary Behavioral Feeding Clinic
- Pediatric Acute Care Services
- Aerodigestive Clinic
- NICU
- Pediatric Texture Swallow Study/VFSS/MBS

Cleft Lip and Palate

- -what is it?
- -incidence
- -cause

Congenital Syndromes or Genetic Sequences associated Cleft lip and palate

- 22q11.2 deletion syndrome/DiGeorge Syndrome or
- Velo-cardio-facial
- Charge Syndrome
- Pierre Robin Sequence
- Van der Woude Syndrome…

CLEFT PALATE AND CRANIOFACIAL CLINICS

CLEFT PALATE AND CRANIOFACIAL CLINICS

Cleft Palate and Craniofacial Teams

- Otolaryngologist
- Plastic Surgeon
- Dentist/Orthodontist
- Oral Maxillary Facial Surgeon
- Speech Pathologist
- Audiologist
- Social work
- Genetics

Craniofacial may also include

- Neurosurgeon

Clinical Manifestations of cleft palate

- -respiratory concerns (OSA, associated cardiac issues)
- -feeding difficulty (bottle/breast, transitioning to solids, nasal regurgitation)
- -hearing deficits
- -speech and language difficulties
- -resonance and airflow disorders
- -vocal distortions
- -dental issues/malocclusions
- -psychosocial impact on the individual and family

CLEFT PALATE AND CRANIOFACIAL CLINICS

CLEFT PALATE AND CRANIOFACIAL CLINICS

Speech Pathologist Role

- ▶Assess PO feeding
- ▶Feeding and swallow difficulty due to
  - difficult latch
  - poor inefficient suck
  - nasal regurgitation
  - small retracted jaw limiting airway
  - poor coordination or respiration and swallowing
  - early fatigue

▶Swallow study if indicated (coughing/choking, wet congested breathing, desaturations, apnea/bradycardia..)

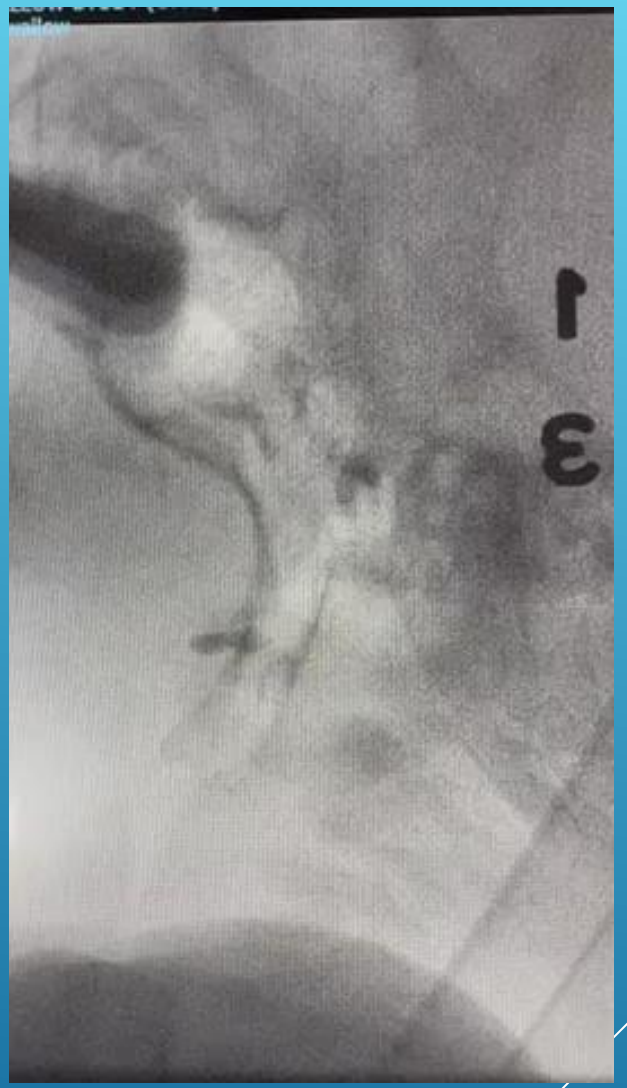
CLEFT PALATE AND CRANIOFACIAL CLINICS

Dr Brown's Specialty Feeding System

Haberman Feeder

Enfamil Cleft Lip and Palate Nurser

Pigeon Cleft Palate Feeder



CLEFT PALATE AND CRANIOFACIAL CLINICS

Speech Pathologist Role

0-6 months: Assess PO feeding (bottle/breast)

1- 3 years: PO feeding/swallowing -transition to solids

-cup drinking

Speech and Language – pre-language skills, speech sound repertoire, babbling, expressive vocabulary

Goldman-Fristoe Test of Articulation

Resonance – in connected speech

Voice

Fluency

4 – 7 years: Speech and Language – GFTA developmental errors, compensatory errors and obligatory errors

Resonance evaluation and assessment of velopharyngeal closure to provide information to the team to determine need for VPI surgical intervention

-auditory perception

-mirror for nasal fogging (American English Sentence Sample)

-nasometry

-videoflouroscopy

-videostroboscopy

Psychosocial impact of speech and resonance impairment (Velo VPI Effects on Life Outcomes)

Communicate with treating therapists in AEA or private local therapists

CLEFT PALATE AND CRANIOFACIAL CLINICS

SPEECH PATHOLOGIST ROLE

6-12 years: Articulation developmental, compensatory and obligatory errors

Resonance -auditory perception, nasal fogging on mirror, nasometry (American English Sentence Sample)

Voice

Fluency

Psychosocial impact (Velo VPI Effects on Life Outcomes)

12 years: Articulation compensatory and obligatory errors

Resonance – auditory perception, nasal fogging on mirror, nasometry (American English Sentence Sample)

Voice

Fluency

Psychosocial impact (Velo VPI Effects on Life Outcomes, Parent and Youth)

CLEFT PALATE AND CRANIOFACIAL CLINICS

Teaming Meeting

-each discipline discusses results of evaluations

-integrate information to determine next steps

surgeries (VPI, dental, fistula repairs, bone grafts..)

therapies or other referrals

interim follow up with specific disciplines

determine follow up with team

QUESTIONS ABOUT CLEFT CLINIC?

Pediatric Feeding Disorders are characterized by chronic feeding difficulties including swallowing problems, disruptive mealtime behaviors and rigid food preferences. PFD can result in nutritional compromise and failure to master age or developmentally appropriate feeding skills. (Gosa et al, 2020, Goday et al 2019)

Incidence: 45 % of typically developing children

80 % of children with developmental disabilities and complex medical conditions

(Dharmara et al 2023)

PEDIATRIC FEEDING DISORDERS

MULTIDISCIPLINARY BEHAVIORAL PEDIATRIC FEEDING CLINIC

Pediatric Feeding Disorder

Impaired oral intake that is not age-appropriate and is associated with at least one dysfunctional domain: medical, nutritional, feeding skills, and/or psychosocial (World Health Organization International Classification of Functioning, Disability and Health (Dharmaraj et al, 2023)

A. A Disturbance in Oral Intake of Nutrients, Inappropriate for Age, Lasting at Least Two Weeks, and Associated with One or More of the Following:	
Medical dysfunction	Cardiorespiratory compromise during oral feeding Aspiration or recurrent aspiration pneumonitis
Nutritional dysfunction	Malnutrition Specific nutrient deficiency or significantly restricted intake of one or more nutrients resulting from decreased dietary diversity Reliance on enteral feeds or oral supplements to sustain nutrition and/or hydration
Feeding skill dysfunction	Need for texture modification of liquid or food Use of modified feeding position or equipment Use of modified feeding strategies
Psychosocial dysfunction	Active or passive avoidance behaviors by child when feeding or being fed Inappropriate caregiver management of child's feeding and/or nutrition needs Disruption of social functioning within a feeding context Disruption of caregiver-child relationship associated with feeding
B. Absence of the cognitive processes consistent with eating disorders and pattern of oral intake is not due to a lack of food or congruent with cultural norms.	

PEDIATRIC FEEDING DISORDER

Child

- Underlying diagnosis
- Comorbidities
- Neurodevelopmental status
- Oral and oral feeding experiences
- Type and severity of swallow dysfunction

Age or Timing of Exposure

- Growth and developmental (motor and cognitive)
- Aspiration and effects on lung development
- Optimal nutrition for development
- neuroplasticity

Environment/Social Influences

- Impact of child/caregiver relationship
- Feeding techniques
- Access to healthcare and appropriate therapies
- Cultural background
- Other psychosocial factors

MULTIDISCIPLINARY BEHAVIORAL PEDIATRIC FEEDING CLINIC

Team Includes:

Gastroenterology and nurse coordinator

Behavioral Psychology

Speech Pathology

Dietician

May also include: Social Work, Occupational Therapist, Physical Therapist

MULTIDISCIPLINARY BEHAVIORAL PEDIATRIC FEEDING CLINIC

ROLES

Gastroenterologist – growth, medical assessment and needs, GI system function, management of NG or G-tube care/change

GI Nurse – assists with prescriptions, accessing WIC

Dietician – growth, BMI and weight gain; caloric needs

Speech – oral motor and feeding and swallowing skills; sensory skills or aversions

Psychologist – behavioral aspects of feeding, relationship between caregiver and child; cultural relationship, feeding experiences

WHO?

- Gastrostomy (g-tube) or naso-gastric (ng-tube) dependent, regardless of a diagnosis of gastroesophageal reflux disease (GERD)
- Malnutrition, or failure to thrive nutritionally
- History of esophageal surgeries
- Food allergies, including eosinophilic esophagitis
- Suspected or diagnosed micronutrient deficiency
- Oral aversion, or a picky eater
- Choking, gagging, or vomiting when eating
- Oral motor and sensory issues
- Feeding difficulties or feeding disorders

MULTIDISCIPLINARY BEHAVIORAL PEDIATRIC FEEDING CLINIC
EVALUATION

Medical Assessment

-past medical history

-assess growth history and head circumference

-developmental history

-assessment of NG or G-tube

-labs

-GI system function and habits

-assess for food allergies or intolerance

Nutrition Assessment

-weight, length/height, BMI and growth history

-assess caloric intake and nutrients

-estimates of energy and protein intake

Psychosocial Assessment

-mealtime environment and routines

-interactions between child and caregiver

-assess for psychiatric conditions

-mealtime behaviors

-cultural meal practices

-Family stressors and perception of the problem

Feeding skills Assessment

-Oral motor

-Handling of secretions

-Swallowing function, need for Modified Barium Swallow Study

-Developmental feeding skills

-Behaviors – compensatory, sensory

-positioning and seating

MULTIDISCIPLINARY BEHAVIORAL PEDIATRIC FEEDING CLINIC

INTERVENTIONS/RECOMMENDATIONS

Team Based Recommendations

- -provides comprehensive plan to treat all areas
- -avoiding duplication of services

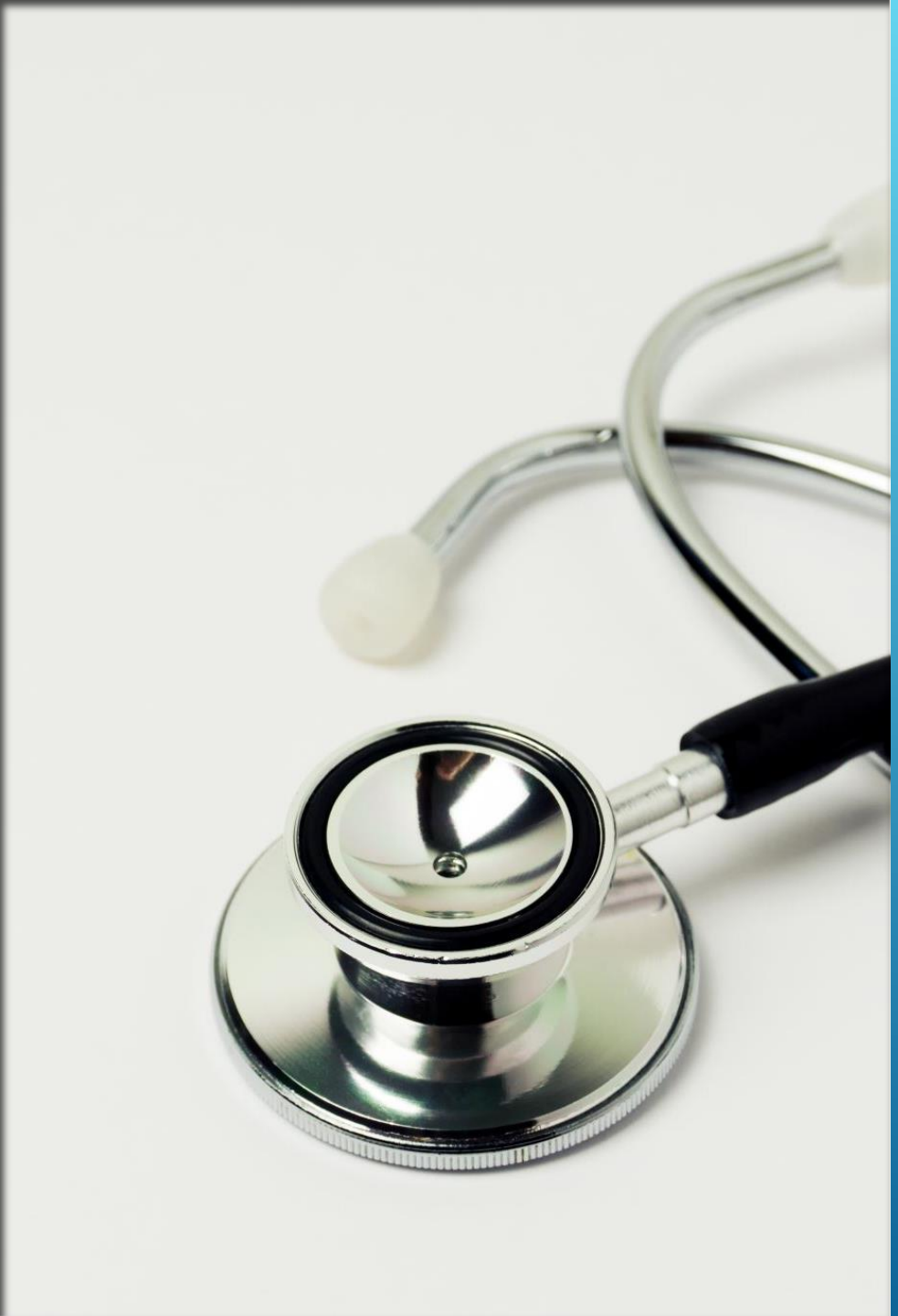
GI doctor – treatment of GI conditions (GERD, constipation, EoE…

Dietician –provides nutritional plan for adequate growth and development and manage enteral feedings

Behavioral Psychologist – provide behavioral strategies and interventions, referral for additional behavioral or developmental assessment, child-caregiver relationship and mealtime conflict interventions

Speech Pathologist – determine safest and most efficient mode or diet for adequate nutrition/hydration, further assessment of swallowing, interventions for swallow dysfunction, interventions for feeding skills development; interventions for sensory aversion, provide appropriate postural support recommendations

QUESTIONS ABOUT PFD OR MULTIDISCIPLINARY FEEDING CLINIC?



PEDIATRIC ACUTE CARE

PEDIATRIC ACUTE CARE

Role of SLP

- Assess swallow function and risk of aspiration
- Make diet recommendations
- Assess communication – need for AAC to communicate acute care needs (ie. prolonged intubation but awake)
- Assess communication, cognitive and language deficits
- Assess voice changes
- Tracheostomy
  - assess swallow function
  - communication
  - readiness for speaking valve

PEDIATRIC ACUTE CARE

Pediatric Intensive Care Unit PICU

-post extubation swallowing

-tracheostomy/ventilator

-acute communication needs

General Pediatric Units

Cancer Unit

Neonatal Intensive Care Unit NICU

Post extubation dysphagia

-29% of pediatric patients exhibit swallow difficulty

-laryngeal edema with weakness and decreased sensation

-dyssynchronous breathing and swallowing

-poor secretion management

-possible laryngeal injury, oropharyngeal trauma, reflux muscular weakness

- Increased risk for infants and young children as the feeding and swallowing is not full developed. Interruption during a critical developmental stages of feeding development causing maladaptive oral motor learning and oral aversion
- Every hour of intubation increases the odds of dysphagia by about 50% each day

(Hoffmeister et al 2019)

PEDIATRIC ACUTE CARE

Tracheostomy and Ventilator Dependence

Tracheostomy Tube – curved tube that is inserted through an incision in the trachea to create an artificial airway

Ventilator – machine that helps deliver oxygen to a patient and may also help to remove caron dioxide on exhale

Research has shown dysphagia in up to 93% of patients with tracheostomy with studies showing 94% with aspiration and 50-82% of aspiration detected was silent

-creates an open system with absence of subglottic pressure

-changes in sensation, decreased strength of swallow, difficult elevating the larynx and decreased relaxation of the UES

-need for instrumental assessment (MBS, FEES) due to high incidence of silent aspiration

Passy-Muir Speaking Valve - one-way valve placed on the hub of the trach tube redirect airflow through the vocal folds, mouth and nose:

- enabling communication
- restores positive airway pressure and sensation for improved swallowing and section management
- PMV In-line with patients with tracheostomy requiring mechanical ventilation

- Traumatic Brain Injury TBI – swallow function, trach/vent, cognitive linguistic assessment
- Cardiac – post extubation swallowing, inefficient feeding due to cardiorespiratory effort; vocal cord paresis or paralysis (RLN) during cardiac surgery
- Failure To Thrive – efficiency of PO feeding, swallowing and need for instrumental
- Viral or respiratory Illness – post extubation, oral aversion, feeding stamina/efficiency, risk of aspiration and need for instrumental
- Cancer – swallowing, oral aversions, communication, cognitive-linguistic changes
- Neurological disease (ie HIE, CVA, tumors..) and disorders
- Airway or respiratory anomalies –assess swallow and risk of aspiration, efficiency of feeding, tracheostomy
- Medically complex patients (Neurological or Genetic disorders..) – feeding/swallowing, trach/vent

PEDIATRIC ACUTE CARE

PICU cardiac patient EB-76 do

-previously healthy full-term infant

-admit with multiple episodes of vomiting, listlessness, and increased work of breathing; supraventricular tachycardia with HR into 230s

-cardiac arrest with 25 min of CPR; placed on ECMO and intubated for 9 days then weaned to NCPAP then NC and speech consulted 6 days after extubation

Results: initial consult no PO readiness cues, difficulty managing secretions, weak hoarse cry; take

2 days later stronger cry and voice although still hoarse, accepting tastes and demonstrating increased interest

3 days later stronger interest in PO and stronger cry; ready for swallow study

Results of MBS: decreased latch and strength of suck, decreased coordination or respiration and swallowing with increased work of breathing and delayed laryngeal closure resulting in intermittent laryngeal penetration with fatigue Started PO feeds 2x/day for 10 min

Over next 2 days he did well and increased PO feeds to 4x/day for 10 min over the next two weeks PO feeds gradually increased and on return visit was taking full feeds and the NG tube had been removed

CASE STUDY #2

18 yo male; motorcycle hit by pickup truck, found unresponsive on the road, no helmet. GCS 3; arrived intubated with numerous maxillofacial injuries, intraparenchymal hemorrhage with greatest insult to the R frontal lobe, bilateral pelvic fractures, left femoral dissection, multiple leg fractures/injuries and pulmonary contusions. Developed acute respiratory failure due to Pneumonia and unable to wean from the vent; trach and PEG tube placed by OTO on

Day 23. Day 2 of tracheostomy started trach collar trials to wean from the vent

Day 35 Speech consult for AAC

Day 38 rec'd consult for swallow eval and PMV; tol trial 10 min weak voice increased WOB; ice chips

Day 41: re-assess with PMV; tolerated 10 min; weak voice although increased voicing with cues REC: start PMV with supervision working up to 1 hour;

Day 52 decannulated

Day 56: completed **initial MBS** with open trach stoma; Rec ice chips and water trials

Day 70 (2 weeks after initial MBS) repeat MBS; **RECS**: started on cup diet with thin liquids; single sips with chin tuck and head turn to the left; throat clear every couple of sips and re-swallow; continued GJ tube feeds

Day 72: left for inpatient rehab

Day 122: follow up with Nutrition; still requiring GJ feeds but drinking most of his formula; eating solids by mouth (PB crackers, burritos, chips, meat, potatoes, rice, MCDonalds; discharged from outpatient PT/OT/Speech

QUESTIONS ABOUT ACUTE CARE?

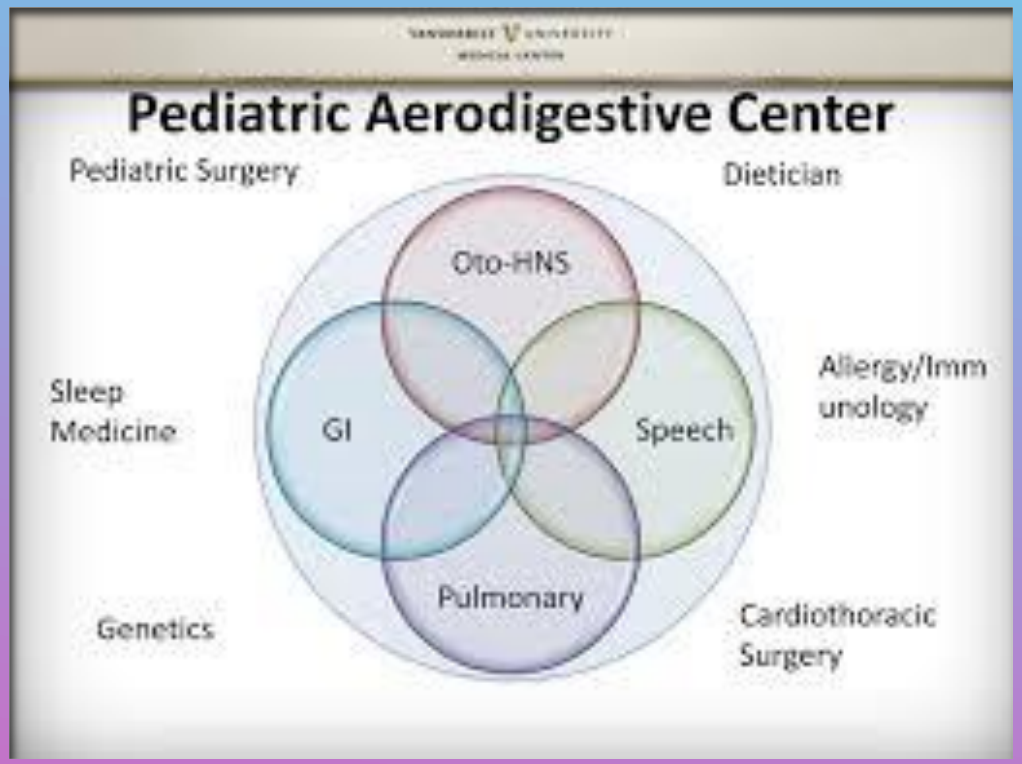
AERODIGESTIVE CLINIC

Addresses the specific needs of children with complex multi-system problems affecting the respiratory and upper gastrointestinal tracts

Provides comprehensive coordinated evaluation and management of complex conditions of upper airway, lungs and upper digestive trac

Focus on children with a combination of multiple and interrelated congenital and/or acquired conditions affecting airway, breathing, feeding and swallowing and concerns about growth and nutrition

(Boesch, et al, 2018)



AERODIGESTIVE CLINIC

Core Aerodigestive Team Members

Pediatric Otolaryngologist (ENT)

Pediatric Pulmonologist

Pediatric Gastroenterologist

Speech Language Pathologist

Other Specialty Team Members

Cardiology or Cardiothoracic Surgery

Allergy/Immunology

Sleep Medicine

Genetics

Pediatric Surgery

Dietician

Respiratory Therapy

Social Work

Otolaryngology

Strider
Noisy Breathing
Recurrent Croup
Epiglottic inflammation
Laryngeal Cleft
Laryngeal stenosis
Laryngomalacia
Vocal cord paralysis
Tracheal Stenosis
Laryngeal webs
Airway obstruction
Obstructive Sleep Apnea
Velopharyngeal dysfunction

Gastroenterology

Esophageal motility disorders
Gastroesophageal reflux disease
Esophageal structural disorder (TEF, EA, strictures, web, hiatal hernia, vascular ring..)
Eosinophilic Esophagitis
Feeding Intolerance
Malnutrition or Failure to Thrive
Feeding Tube Dependence

Pulmonology

Chronic cough
Wheezing
Recurrent Pneumonia or Recurrent Upper Respiratory Infections
Tracheomalacia
Bronchomalacia
Chronic Lung Disease
Cardiopulmonary Disease

Speech Pathology

Feeding difficulties and disorders
Excessive drooling
Dysphagia
Aspiration
Voicing difficulties
Communication

AERODIGESTIVE CLINIC

COMMON AERODIGESTIVE PROBLEMS AMONG SUBSPECIALISTS

AERODIGESTIVE CLINIC

DIAGNOSTICS

- ENT – flexible laryngoscopy, neck x-ray
- Pulmonologist – chest x-ray, chest CT, bronchoalveolar lavage
- Gastroenterologist – UGI, esophagram, impedance pH
- monitoring, mucosal endoscopic assessment, esophageal manometry
- Speech Therapist – clinical evaluation of oral motor, feeding and swallowing, FEES with ENT, MBS, voice assessment, PMV assessment
- Sleep Study – obstructive sleep apnea, central sleep apnea
- Triple scope – direct rigid laryngoscopy and bronchoscopy, flexible bronchoscopy, Esophagogastroduodenoscopy EGD

INTERVENTIONS

- Comprehensive plan is developed based on data collected from all disciplines
- Surgical – laryngeal cleft repair, Supraglottalplasty, airway reconstruction, vocal fold injections, dilation of the airway, esophageal dilations, Nissen procedure, G-tube placement…
- Pharmacological – reflux medication, medication for excessive drooling, pulmonary medications
- Diet modifications- change in formula or food avoidance for food sensitivities and intolerances, modifications of texture or thickening liquids due to feeding or swallowing difficulties and aspiration; calorie boosting or supplemental nutrition
- Alternate mode of nutrition/hydration – aspiration, inefficient or inadequate PO intake, FTT

AERODIGESTIVE CLINIC

CASE STUDY -- LJ

- **28w0d twin B**, IUGR, left heart failure; VSD; prolonged intubation and multiple re-intubations, , severe BPD, Pulmonary HTN, hydronephrosis with urinary obstruction; slow to work up to full enteral feed
- **Day of life 136 (47w3d)** Start PO feeds at Phase 1; on NCPAP RAM cannula 6 cm H2O
- **Day of life 150 (49w3d**) speech consult; rec swallow study due to PO on NCPAP and congestion/cough with PO
- **Dol 163 (51w6d)** swallow study; immediate moderate-severe aspiration with all nipple flows
- **Repeat swallow study DOL 172** moderate silent aspiration thin with deep penetration with mildly thick
- **DOL 175 (53w0d)** discharged from the hospital with full NG tube feeds on NC 1.5 L 100% O2
- **4 weeks later (6 m 4 m CA)** repeat swallow study silent aspiration of thin, consistent deep pen with mildly thick and 1 episode of mild pen with moderately thick; start with spoon tastes 1x/day continue NG tube feeds
- **Repeat swallow study 10m (7 m CA);** NC 1.0 L mod-severe feeding and swallowing impairment; referral to ENT for airway eval due to chronic aspiration; still with NG feeds plan for G-tube
- **ENT saw 1 months later**- FLL WNL good B VF movement; suspected laryngeal cleft plan for DL/B
- **13 mo DLB** identified Type Laryngeal cleft with laryngeal cleft injection; G-tube placed; referred to AERO clinic
- **12 m Feeding clinic and repeat swallow study** All aspiration was silently with no attempts to clear. ; rec continue G-tube feeds; offer thick puree spoon
- **16 m AERO** clinic **ENT** wet junky cough; recent aspiration pneumonia after emesis, drooling; started solids 1x/day family reports improvement since cleft injection plan for triple scope plan for permanent cleft repair **GI** –suspect esophagitis; plan for EGD started Omeprazole **Pulmonology** baseline O2 needs due to chronic lung disease unable to wean started started Flovent and cont albuterol; triple scope planned
- **18 mo triple scope** permanent cleft repair, EGD with biopsies, flexible bronchoscopy and bronchoalveolar lavage
- **20 m repeat swallow study**: improvement noted started drinking moderately thick liquids from trainer cup **Follow up AERO:** O2 weaned to ½ L, PO feeding going well; biopsy results from EGD showed minimal esophagitis cont with reflux med; chronic congestion improved follow up in AERO in 4 months

QUESTIONS ABOUT AERODIGESTIVE CLINIC?

SPEECH PATHOLOGY IN THE NICU

ORAL FEEDING AND THE NICU

The knowledge and skills specific to serving infants within the NICU environment focus on communication, cognition, feeding, and swallowing in the developing infant within the context of the family.
Knowledge required:

- **Normal embryology, perinatal, and postnatal infant development**
- **Atypical infant development** which includes theories and research findings, risk factors in prenatal and perinatal development, etiologies, and medical conditions.
- **Family-centered practices** including the impact of the NICU experience on family dynamics and function, information about family systems, parent-infant interactions, parent empowerment, and meaningful professional alliances.
- **Team-based processes**

Specialized knowledge is also needed in the following areas:

- **Foundations of developmentally supportive care** (e.g., synactive theory, behavioral state organization).
- **Medical complications affecting infants as well as the medical equipment and procedures used in the NICU**.
- **Staffing patterns in the NICU**.
- **Ecology of the NICU.**
- **Parenting in the NICU.**

(ASHA, 2004)

FEEDING AND THE NICU

THE EXPERIENCE OF LEARNING TO FEED IN THE NICU MAY PREDISPOSE PRETERM INFANTS TO FEEDING PROBLEMS THAT PERSIST WELL BEYOND DISCHARGE.

STUDIES HAVE SHOWN THAT MORE THAN 50 % OF PARENTS OF NICU GRADUATES REPORT PROBLEMS FEEDING AT THE AGE OF 18-24 MONTHS

FEEDING –COMPLEX DYNAMIC PROCESS

PHYSIOLOGICAL STABILITY IS CONSIDERED THE FOUNDATION FOR ORGANIZING:

MOVEMENT

BEHAVIORAL STATE

ATTENTION/INTERACTION

SELF-REGULATION

ORGANIZATION OF THESE SUBSYSTEMS IS THE FOUNDATION FOR SAFE AND EFFICIENT FEEDING

(GOLDFIELD ET. AL; SHAKER,2017)

FEEDING AND NEURODEVELOPMENT

- FEEDING REQUIRES INTEGRATION, MATURATION AND COORDINATION OF THESE SYSTEMS WHICH IS OBSERVED THROUGH:

  SUCK/SWALLOW/BREATH COORDINATION

  MAINTAINING PHYSIOLOGICAL STABILITY

  SUSTAINING ATTENTION TO THE TASK

  CONTROLLING AND COORDINATING POSTURAL, ORAL AND UPPER AIRWAY MOTOR SYSTEMS

  PROTECTING AIRWAY FROM FLUID

- BEHAVIORS DURING FEEDING ARE A DIRECT REFLECTION OF THE INTERACTIONS OF THESE SUBSYSTEMS AND NEED TO BE INTERPRETED FROM THAT PERSPECTIVE

  -COMPENSATORY BEHAVIORS OR STRESS CUES ARE A MEANS TO ACHIEVE OR MAINTAIN

  STABILITY

FOSTERING NEUROPROTECTION DURING FEEDING

- EARLY FEEDING EXPERIENCES CAN EFFECT THE BRAIN OF THE DEVELOPING PRETERM

  -DEVELOPING MOTOR AND SENSORY PATHWAYS AND THOSE THAT ARE USED

  EITHER POSITIVE OR NEGATIVE ARE REINFORCED WHILE UNUSED PATHWAYS

  ARE PRUNED

- EXPERIENCE OF LEARNING TO FEED IN THE NICU MAY PRE-DISPOSE PRETERM INFANTS TO FEEDING PROBLEMS THAT PERSIST BEYOND THE NICU LONG AFTER DISCHARGE TO HOME

(SHAKER 2017)

FOSTERING NEUROPROTECTION/NEURODEVELOPMENT

- PROVIDE INTERVENTIONS THAT PROMOTE STABILITY AND AVOID ONSET OF MALADAPTIVE BEHAVIORS DURING FEEDING
- PROVIDE POSITIVE INTERACTIONS DURING FEEDING

  READING BEHAVIORAL CUES

  SUPPORT COPING SKILLS

  DECREASE STRESS

  OFFERING POSITIVE EXPERIENCES
- FOCUS ON THE QUALITY OF THE FEED- MOVING AWAY FROM VOLUME DRIVEN CULTURE

INFANT DEVELOPMENT

- 1-8 weeks (embryo)
  - major structures forming
  - Beginning of facial, oral cavity and pharyngeal development
  - Taste buds evident at 7 weeks and some mature by 12 weeks
- 9-12 weeks (fetus)
  - Completion of facial, oral and pharyngeal structures
  - Pharyngeal swallow can be seen at 10-11th weeks of fetal life
- 13-16 weeks
  - Suckling response may be elicited

INFANT DEVELOPMENT

- 17-20 weeks
  - True suckling response with forward and backward motion of the tongue
- 21-25 weeks gestation
  - By 24 weeks lungs produce surfactant
  - Suckling response continues but mature pattern/rhythm not developed

INFANT DEVELOPMENT

- 26-29 weeks
  - Difficulty breathing air, nervous system is maturing
  - Standard of practice (SOP) >= 29 weeks gestation may begin gustatory stimulation " Milk in Mouth" under certain conditions
    - Non-intubated, non-sedated
    - .5-1 ml by small syringe
    - Monitor tolerance and document responses

NICU ORAL FEEDING

Pre-Feeding Readiness		
Touch	**Smell**	**Taste: Initiate if baby is rooting**
Skin to skin with parents	Held skin to skin by mother	Nuzzling at pumped breast
Held by caregiver	Breast milk on baby's fingers with hands to face	Breast milk on baby's fingers or pacifier with hands to mouth
Hands to face & mouth	Breast milk on upper lip	Milk on pacifier with bolus feeds for patient ≥ 29 weeks, non-intubated, & non-sedated

INFANT DEVELOPMENT

- 30-34 weeks--potential for feeding begins
  - SOP supports babe presented to breast as early as 33 weeks gestation under certain conditions
    - Appropriate expectations need to be communicated to mother/family
  - NICU SOP >= 33 weeks, show signs of feeding readiness (rooting, finger sucking, mouthing) and medically able can attempt oral feeding in a cue based feeding protocol
    - appropriate expectations communicated to family
    - feeding readiness does not mean full PO feeds, gradual process of learning
    - looking at introductory level sills

INFANT DEVELOPMENT

- 34 weeks
  - Some medically stable infants born at 34 weeks can feed well enough to grow
  - May or may not require some nutrition via NG (nasogastric) tube but more likely than not will need some supplemental nutrition
- 35-40 weeks
  - 38-42 weeks gestation is considered is “term” and if otherwise medically stable and stable from a respiratory standpoint should be able to feed well enough to grow

INFANT DEVELOPMENT

Infants who were born prematurely do not necessarily meet the same developmental milestones as if they were a full-term infant

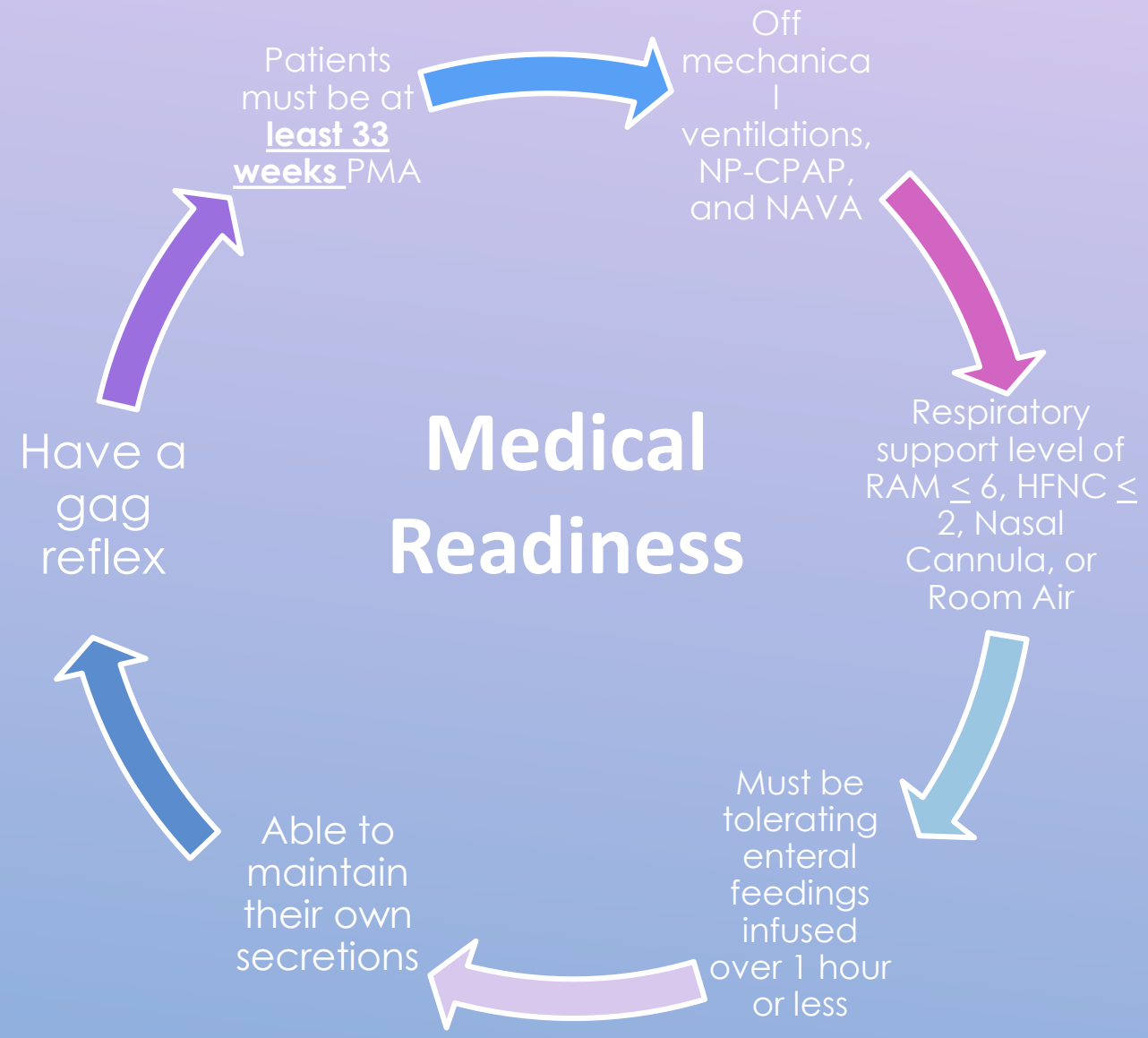
- Sleep/wake cycles
- Feeding abilities
- Breathing
- Responses

- A 37 weeks GA infant although considered full term does not equal a 40 week term infant
- An infant born at 32 weeks that is now 40 weeks does not equal a full term 40 week infant; prematurity counts

INFANT DEVELOPMENT

- Medical conditions may delay introduction of oral feeding including
  - cardiac
  - pulmonary
  - GI
  - other

GUIDELINES TO INITIATE ORAL FEEDING



INFANT GUIDED FEEDING

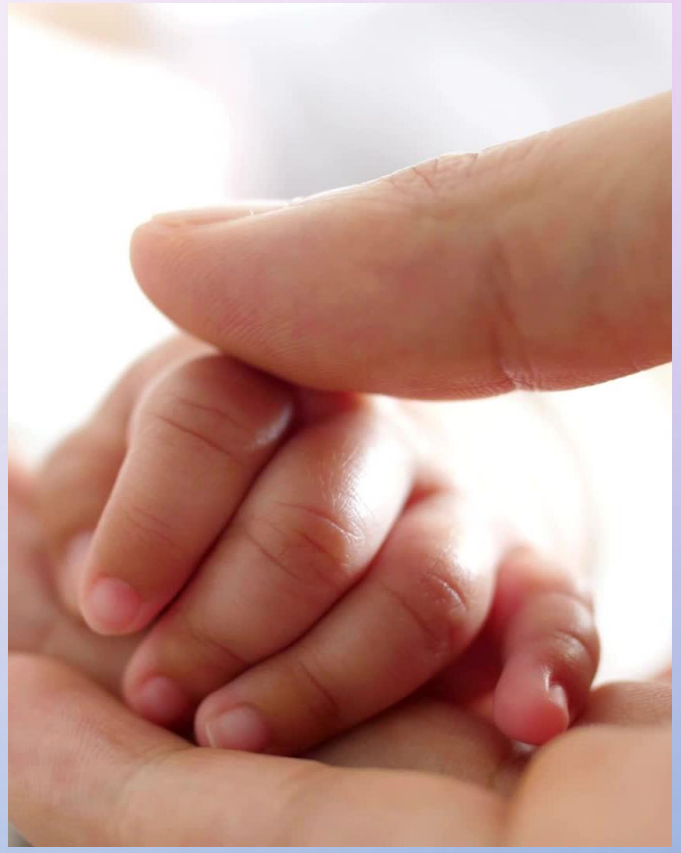
- PROMOTE POSITIVE FEEDING EXPERIENCE
- CO-REGULATION BETWEEN CAREGIVER AND INFANT FORMS THAT FOUNDATION FOR POSITIVE INFANT FEEDING
- CONTINGENT INTERVENTIONS
- OBSERVING MOMENT TO MOMENT DURING FEEDING FOR CUES OF STRESS VERSUS STABILITY SPECIFIC TO SWALLOWING, BREATHING, PHYSIOLOGICAL STABILITY, POSTURAL CONTROL AND STATE REGULATION
- CONTINUOUSLY MODIFYING THE FEEDING APPROACH THROUGH INDIVIDUALIZED INTERVENTIONS CONTINGENT ON THE INFANT'S BEHAVIORAL CUES (SHAKER, 2017; DOWLING, 1999)

INFANT GUIDED FEEDING (CUE BASED FEEDING)

- RESEARCH HAS SHOWN THAT THE ABILITY TO FEED WELL IS CLOSELY RELATED TO THE CAREGIVER'S ABILITY TO UNDERSTAND AND RESPOND TO THE INFANTS PHYSIOLOGICAL AND BEHAVIORAL COMMUNICATION CUES

- "MOM, YOU GOT THIS" FEEDING IS COMMUNICATION. WHEN WE HELP NICU CAREGIVERS INTERPRET WHAT THEIR PREEMIE IS TELLING THEM DURING FEEDING, WE SUPPORT THE PARENT-INFANT RELATIONSHIP.

- VOLUME IS NOT THE GOAL



INFANT GUIDED FEEDING (CUE BASED FEEDING) AND PARENT/CHILD RELATIONSHIP

INFANT FEEDING OFFERS ONE THE EARLIEST OPPORTUNITIES TO SUPPORT THE CONNECTION BETWEEN PARENT AND THE INFANT

- **PROMOTED THROUGH POSITIVE FEEDING INTERACTIONS**

  INTERACTION DURING FEEDING AIDS IN THE DEVELOPMENT OF SOCIAL INTERACTION, COMMUNICATION AND BEING RESPONSIVE TO OTHERS BETWEEN BOTH PARENTS AND THE INFANT

  -RECOGNIZING THE STRESS OF PARENTS WITH AN INFANT IN THE NICU

  -EMPOWERING PARENTS TO HELP DEVELOP THE FEEDING RELATIONSHIP FOR BONDING AND ATTACHMENT

- **POSITIVE FEEDING EXPERIENCE FOR THE INFANT AND FOR THE FEEDER**
  - FOR INFANT—AVOID UNDUE STRESS, ALLOW FOR SUPPORTED FEEDING EXPERIENCE, AVOID NEGATIVE EXPERIENCES
  - FOR FEEDER—CARING AND NURTURING ENVIRONMENT, PROVIDING ADEQUATE SUPPORT, AVOIDING FRUSTRATION
- **PROMOTES POSITIVE NEURODEVELOPMENT**

(SHAKER, 2017; GEORGE ET AL. 2008)

WHAT & WHY CUE BASED FEEDINGS?

- WHAT:
  - Cue based feedings are scheduled feedings where oral attempts are based on infant readiness cues.
  - And responding to cues for infant guided feeding during the feeding and responding to cue for when to stop the feed
- WHY:
  - Supports successful coping of preterm/term infants.
  - Promotes communication and attachment.
  - Connects infant behaviors to consequences; teaches him that he can affect his environment.
  - Supports brain development.
  - Provides pleasurable feeding experiences for infants – prevent long term negative outcomes – oral aversion
  - Decreases to the time to full feeds

INFANT CUES

- Tell us about
  - When to start and when to end feeding
  - When to pause
  - Milk flow
  - Ability to tolerate bolus size
  - Optimal length of sucking burst,
  - Need for postural support
  - Need for assisting with state change
  - When coordination is no longer synchronized

Infant Feeding Readiness Scale A scale used to evaluate the oral feeding readiness at each attempt		
1	Alert and/ or fussing before care; rooting and/or bringing of hands to mouth/taking of pacifier; shows infant stability	**FEED**
2	Initially drowsy then alert once handled; rooting or taking of pacifier; adequate tone and infant stability	**FEED**
3	Briefly alert with care; no hunger behaviors; no change in tone and has infant instability	**DO NOT FEED**
4	Sleeps throughout care; no hunger behaviors; no change in tone and/or has infant instability	**DO NOT FEED**
5	Needs increased oxygen with care; apnea and/or bradycardia with care; tachypnea greater than baseline with care, increased infant instability	**DO NOT FEED**

FEEDING SEQUENCE

FEEDING SEQUENCE

Pre-Feeding

Pre-Feeding Readiness		
Touch	Smell	Taste: Initiate if baby is rooting
Skin to skin with parents	Held skin to skin by mother	Nuzzling at pumped breast
Held by caregiver	Breast milk on baby's fingers with hands to face	Breast milk on baby's fingers or pacifier with hands to mouth
Hands to face & mouth	Breast milk on upper lip	Milk on pacifier with bolus feeds for patient ≥ 29 weeks, non-intubated, & non-sedated

Skill

Suck → Swallow → Breath

3 Breathing Patterns:

1. Suck, Suck, Suck, Forget to breath
2. Suck, Suck, Suck, Breathe, Breathe, Breathe, Suck, Suck, Suck
3. Suck, Breathe, Suck, Breathe, Suck, Breathe

Sucking Rhythm and Sucking Burst

FEEDING SEQUENCE

Efficiency

Can they consume the amount in the time frame?

Goals:

1. Maintain alert state
2. Maintain energy
3. Maintain oral-motor tone

Endurance

Sucking burst of 20-30 sucks seamlessly integrating breathing with sucking and swallowing.

Goals:

1. Full Coordination and ability
2. Demands to be feed
3. Enjoyment of eating

GETTING READY FOR A FEEDING

- **Assess readiness** – physiological stability
- **Facilitate calm/alert state**
  - Calm if agitated by swaddling (providing boundaries and support)—leave hands at midline at face
  - Awake if sleepy/sleeping
    - Gradually increase light and sound in room
    - Loosen swaddling
    - Attempt to elicit rooting reflex
    - Non-nutritive sucking with gloved finger or pacifier
- Offer pacifier to support readiness/organization and stability
- Offer PO only if **respiration is stable** under 60 and maintaining saturations
- Offer PO only if **maintaining awake and alert state**

POSITIONING AND HOLDING

- **Infant should be well supported**
  - Chin, hands, flexed hips, knees midline
- **Elevated sidelying position**
  - Similar to breast feeding positions
  - Supports better respiratory movements
  - Helps with loss of flow

FEEDING STRESS CUES

CHANGE IN ENERGY

- CHANGE IN STATE OF ALERTNESS –FALLING ASLEEP WITH FEEDS
- CHANGE IN POSTURAL CONTROL OR TONE AND MOVEMENT PATTERNS
- DISINTEREST IN FEEDING

CHANGE IN BEHAVIOR

- EYEBROW RAISE
- EYELID FLUTTER
- FURROWED BROW
- WORRIED LOOK
- MOVING AWAY FROM NIPPLE
- EXTENDING FINGERS OR ARMS
- PUSHING NIPPLE AWAY

CHANGE IN CARDIO-RESPIRATORY BEHAVIOR:

- COLOR CHANGE FROM BASELINE (PALLOR, CYANOSIS)
- RESPIRATORY FATIGUE
- TACHYPNEA
- NASAL FLARING AND/OR BLANCHING
- CHIN TUGGING/PULLING HEAD BACK
- SHALLOW SHORT BREATHS INSTEAD OF A SERIES OF DEEP BREATHS
- UNSTABLE SATURATIONS
- BRADYCARDIA, APNEA

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- UNSTABLE SATURATIONS
- BRADYCARDIA, APNEA

FEEDING STRESS CUES (CONT'D)

UNCOUPLING OF SWALLOWING AND BREATHING REFLECTED IN:

- LOSS OF BOLUS CONTROL ORALLY ("DROOLING")
- GULPING
- GURGLING SOUNDS IN THE PHARYNX
- MULTIPLE SWALLOWS TO CLEAR BOLUS
- COUGHING AND/OR CHOKING

ORAL FEEDING ADVANCEMENT GUIDELINES

Infants must have a PMA > 33 weeks, meet medical readiness, and meet Guidelines to Initiate Oral Feeding to begin Oral Feeding Advancement Guidelines		
PHASE	**Feeding Advancement**	**Oral Support** During non-PO feeds
1	• Breastfeed or bottle feed 2 times per calendar day without adverse effects • Feeding must be non-consecutive (i.e. not 2 in a row) • When intake of each offered feeding is greater than 75% without increased infant instability, for 48 hours advance to the next phase	• Skin-to-Skin • Held during bolus • Hands to face • Milk drops on fingers, hands, and/or lips • Nuzzling at pumped breast • Milk on pacifier with bolus feed
2	• Breastfeed or bottle feed 4 times per calendar day without adverse effects • Feedings may have 2 consecutive attempts if cueing • When intake of each offered feeding is greater than 75% without increased infant instability, for 48 hours advance to the next phase	Same as above
3	• Breastfeed or bottle feed 6 times per calendar day without adverse effects • If feed 3 consecutive feedings in a row, then administer the fourth feeding via tube • When intake of each offered feeding is greater than 90% without increased infant instability, for 48 hours advance to the next phase	Same as above
4	• Breastfeed or bottle feed all feedings without adverse effects • Minimum volume per 24 hour shift established for growth • When volume minimum met for 48 hours patient is Ad Lib and NG may be removed	Same as above

WHEN TO CALL SPEECH PATHOLOGY???

EVALUATION OF ORAL SENSORY/MOTOR AND SWALLOWING STATUS WITH THE GOAL OF ASSESSING READINESS TO FEED PRIOR TO INITIATING FEEDINGS SHOULD BE CONSIDERED FOR INFANTS WITH THE FOLLOWING:

- HISTORY OF ECMO
- TRACHEOSTOMY
- ORAL FEEDS INTRODUCED AFTER 36 WEEKS POSTMENSTRUAL AGE (PMA) (INFANTS < 1000 GRAMS/< 26 WEEKS ESTIMATED GESTATIONAL AGE (EGA))
- GRADE III OR IV INTRAVENTRICULAR HEMORRHAGE
- PERIVENTRICULAR LEUKOMALACIA
- PROGRESSIVE HYDROCEPHALUS
- ABSENT OR POOR SWALLOW REQUIRING FREQUENT SUCTIONING OF SECRETIONS
- ABSENT OR WEAK GAG OR CRY
- VOCAL CORD PARALYSIS OR PARESIS
- AIRWAY ABNORMALITIES
- HISTORY OF HYPOXIC-ISCHEMIC ENCEPHALOPATHY (HIE) OR OTHER NEUROLOGICAL DIAGNOSIS
- CLEFT LIP AND PALATE

EVALUATION OF FEEDING/SWALLOWING EVALUATION TREATMENT IS APPROPRIATE FOR INFANTS WITH THE FOLLOWING FEEDING ISSUES:

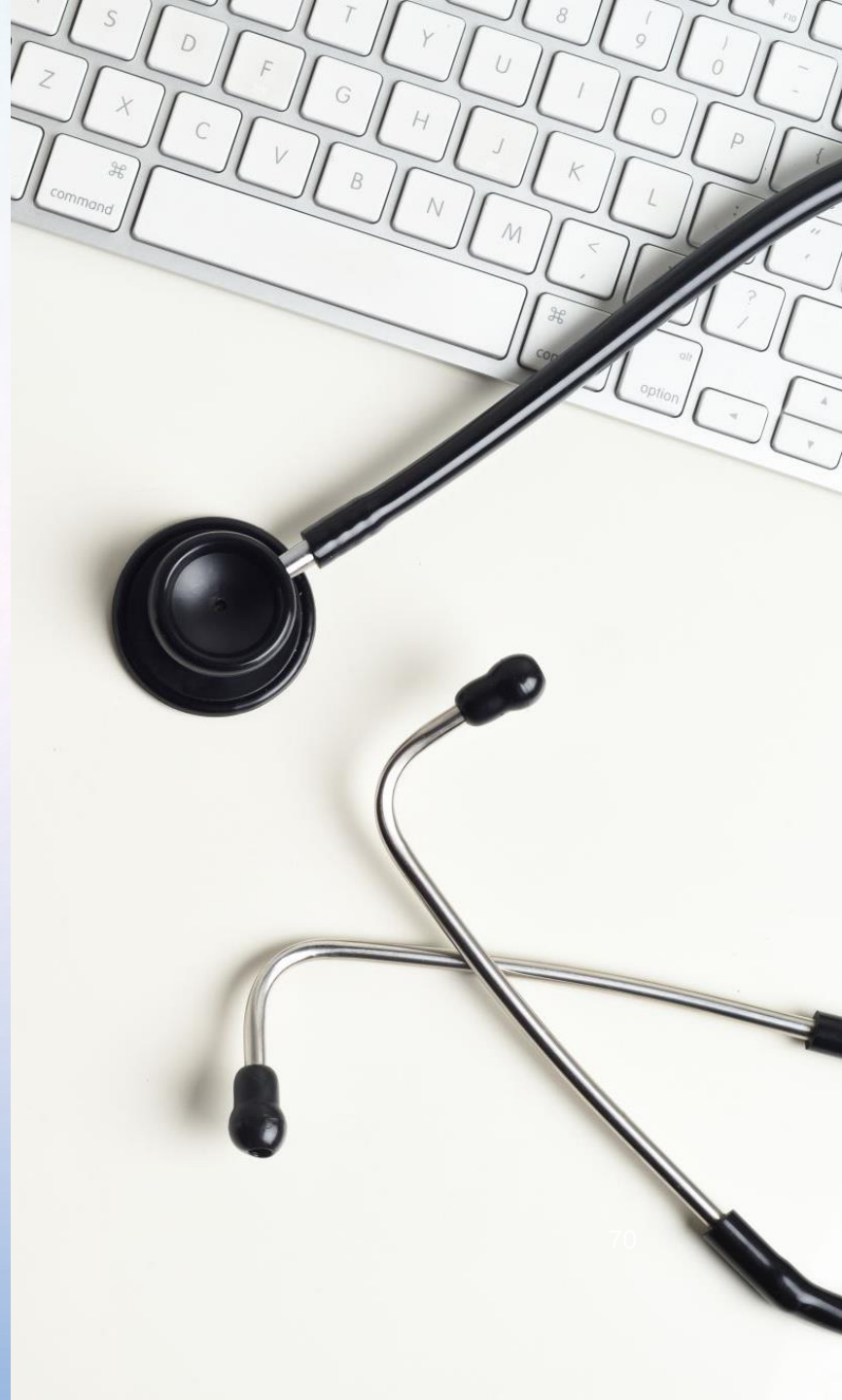
- INABILITY TO LATCH ON AND INITIATE AN APPROPRIATE SUCK AFTER 34 WEEKS PMA.
- FREQUENT DESATURATIONS DURING FEEDING UNRESPONSIVE TO OXYGEN THERAPY.
- APNEA/BRADYCARDIA DURING FEEDING AFTER 34 WEEKS PMA.
- POOR ORAL INTAKE < 50% OF REQUIRED VOLUME AFTER 36 WEEKS PMA.
- SPUTTERING, COUGHING, CHOKING, CONGESTION (FEEDINGS IN THE NARES OR NASAL PHARYNX) DURING/AFTER FEEDINGS.
- INCREASED OR PROLONGED INFANT INSTABILITY WITH FEEDINGS
- FAILURE TO PROGRESS THROUGH ORAL FEEDING ADVANCEMENT GUIDELINES
- ORAL AVERSION: REFUSING PACIFIER, EXCESSIVE GAGGING WITH NORMAL ORAL STIMULATION
- NEED FOR AN EARLY FEEDING SKILLS ASSESSMENT

WHERE DO SLPS FIT IN?

- EVALUATION AND TREATMENT OF INFANTS WITH FEEDING/SWALLOWING IMPAIRMENTS
  - CLINICAL/BEDSIDE ASSESSMENTS/TREATMENT

    EARLY FEEDING SKILLS ASSESSMENT FOR PRETERM INFANTS
  - PEDIATRIC TEXTURE SWALLOW/SUCK-SWALLOW STUDY/OPMS

    HTTP://WWW.YOUTUBE.COM/WATCH?V=BSFA31HKEV0



EARLY FEEDING SKILLS ASSESSMENT

Early Feeding Skills Assessment (EFS) Clinical Version: EFS, Readiness, Recovery, Conditions

Pre-feeding Baseline: Respiratory Rate _____ Oxygen Saturation _____ Heart Rate _____

READINESS (Immediately Prior to Feeding)			
Motor	Flexed body position with arms toward midline (with or without support) through assessment period	Loss of flexed position with handling	Non-flexed body position with arms to sides throughout assessment period
State	Awake	Drowsy	Sleep
Oral-motor behavior when offered finger or pacifier	Actively opens mouth and drops tongue to receive the nipple when lips are stroked	Opens mouth but does not actively seek the nipple	Does not open mouth when lips are stroked

DEVELOPMENT

- Non-nutritive suck not always predictive of nutritive suck and feeding performance
- Mature non-nutritive suck
  - 2 sucks per second in runs of variable length depending on infant, state, and environment
  - Should have no respiratory compromise
- Mature nutritive suck
  - 1 suck per second
  - Quality and rate may influenced by flow, taste, hunger, environment, pulmonary status

EARLY FEEDING SKILLS ASSESSMENT (EFS)			
Respiratory Regulation	**3**	**2**	**1**
1. Each time the nipple is received, transitions to sucking without behavioral or cardio-respiratory instability [a]	Consistently stable	Instability for at least one transition	Instability for most or all transitions
2. Times the length of the sucking burst to remain stable	Consistently	Occasionally sucks too long before stopping to breathe	Frequently sucks too long before stopping to breathe
3. Integrates breathing within the sucking burst	Consistently	Attempts to add breaths but is not yet fully integrated	No or rare breaths during the sucking burst
4. Organizes long sucking bursts (7+ sucks) without signs of behavioral or cardio-respiratory instability	Consistently takes long sucking bursts and remains stable	Occasionally long sucking bursts lead to instability	Frequently long sucking bursts lead to instability OR no long sucking bursts
5. Increased work of breathing [b]	Never or rarely	Occasionally	Frequently

Oral-Motor Functioning	**3**	**2**	**1**
6. Actively opens mouth and drops tongue to receive the nipple when lips are stroked	Consistently	Inconsistent	Never
7. Promptly starts sucking once nipple is received	Consistently	Inconsistent	Never or rarely
8. Sucks with steady and strong suction	Consistently	Occasional compression-only sucking	Frequent compression-only sucking
9. Loss of milk at lips	No or rare loss of milk	Occasional loss of milk	Frequent loss of milk

Swallowing Coordination	3	2	1
10. Gurgling/rattle sounds created by fluid in the nose or pharynx	No or rare gurgling	Occasional gurgling	Frequent gurgling
11. Gulping or effortful hard swallows	No or rare gulping	Occasional gulping	Frequent gulping
12. High-pitched "yelping" sound when transitioning from swallowing to breathing	No or rare "yelping"	Occasional "yelping"	Frequent "yelping"
13. Coughing or choking sounds	Never	One event observed	More than one event
Engagement	**3**	**2**	**1**
14. State	Awake	Becomes drowsy late in the feeding	Becomes drowsy early in the feeding
15. Energy [c]	Sustains motor tone/energy	Late loss of tone/energy	Early loss of tone/energy
Physiologic Stability	**3**	**2**	**1**
16. Stress [d]	No or rare	Occasional	Frequent
17. Color change	No color change	Occasional color change	Frequent or prolonged color change
18. Stable oxygen saturation	Stable, remains close to pre-feeding level	Occasional dips below clinical standards	Frequent or prolonged dips below clinical standards
19. Stable heart rate	Stable, remains close to pre-feeding level	Occasional rise or dips 20% above or below pre-feeding	Frequent rise or dips 20% above or below pre-feeding

[a] Instability is evidenced by behavioral (eyebrow raise, eyelid flutter, furrowed brow, worried look, moving away from nipple, extending fingers or arms, pushing nipple away) or physiologic cues (apnea, desaturations, heart rate drops).

[b] Increased work of breathing is evidenced by nasal flaring and/or blanching, chin tugging/pulling head back/head bobbing, suprasternal retractions, grunting/prolonging the exhale, or use of accessory breathing muscles.

[c] Energy is expressed through motor tone, postural control, midline feeding position, and flexion.

[d] Eyebrow raise, eyelid flutter, furrowed brow, worried look, moving away from nipple, extending fingers or arms, pushing nipple away

RECOVERY (Post-Feeding)			
State	Quiet alert	Sleep or drowsy	Restless
Energy level	Flexed body position with arms toward midline (with or without support)	Period of decreased muscle tone; recovers after short rest	Energy depleted after feeding, loss of tone/energy, flaccid

Feeding conditions:

Feeding skills: ____ maintained across the feeding ____ improved during the feeding ____ declined during the feeding

Amount of supplemental oxygen pre-feeding: _____ Amount of supplemental oxygen during feeding: _____

Fed with NG/OG tube in place: Yes / No Type of bottle/nipple used _____ Length of feeding (minutes) ___

Volume consumed ____ cc Position: cradled __ semi-elevated side-lying __ semi-upright in front __ other _____

Recommendations for next feeding:

EFS Scoring: Each subscale is scored individually. Each item can score 1, 2, or 3 with 1 representing the least skill or high frequency of problem (right hand column) and 3 representing mature skill or absence of problem (left hand column). Scores of 2 indicate skills that are emerging/occasionally observed or problems that are occasionally observed. Provide total scores and an "X" in the appropriate box to the right of the total score for each subscale.

	Total Score	Every item scores "3" Skill is consistently observed	At least one item scores "2" Skill still emerging and/or problem is indicated	At least one item scores "1" Skill not yet evident and/or significant problem is evident
Respiratory Regulation (Range 5 – 15)				
Oral-Motor Organization (Range 4 – 12)				
Swallowing Coordination (Range 4 – 12)				
Engagement (Range 2 – 6)				
Physiologic Stability (Range 4 – 12)				
Total EFS (Range 19 – 57)				

AFTER THE EVALUATION

DETERMINE NEED FOR INSTRUMENTAL ASSESSMENT

- SYNTHESIZE INFORMATION GATHERED AND CLINICAL ASSESSMENT

OR

DEVELOP INDIVIDUALIZED FEEDING PLAN FOCUSING ON:

- FEEDING READINESS
- MAINTAINING PHYSIOLOGICAL STABILITY
- SUPPORTING SUCK/SWALLOW/BREATH
- RECOMMENDATIONS FOR ADVANCING FEEDS

UPON DISCHARGE FROM THE NICU

SPEECH THERAPY FOLLOWS TO FACILITATE ADVANCING TO FULL PO FEEDS

- ADDRESS STAMINA
- SWALLOW
- ORAL AVERSIONS

FOLLOW UP CLINICS

- HIGH RISK INFANT/NICU CLINIC
- MULTIDISCIPLINARY FEEDING CLINIC
- AERODIGESTIVE CLINIC
- GI WITH DIETICIAN VISIT

Questions about NICU?

VIDEOFLOUROSCOPIC SWALLOW STUDY

(PEDIATRIC TEXTURE SWALLOW STUDY, MODIFIED BARIUM SWALLOW STUDY VFSS)

DETERMINING NEED FOR INSTRUMENTAL SWALLOW STUDY

High incidence of silent aspiration in infants and young children

Presenting symptoms in infants and young children vary

Clinical evaluation should not always be reassuring in the context of ongoing aerodigestive symptoms (chronic cough, congestion…) or history of respiratory illness

Detailed medical and feeding history is crucial and must be considered in decision-making process

(Duncan et al, 2018; Arvedson et al, 1993)

DETERMINING NEED FOR INSTRUMENTAL SWALLOW EVALUATION

- COUGHING/CHOKING WITH FEEDS
- APNEA/BRADYCARDIA
- DESATURATIONS
- CONGESTION/WET BREATHING
- SPUTTERING/GURGLING
- STRIDER OR NOISE BREATHING
- POOR SECRETION MANAGEMENT
- FAILURE TO PROGRESS
- INCREASED OXYGEN REQUIREMENTS
- MULTIPLE SWALLOWS TO CLEAR
- FAILURE TO THRIVE
- CYANOSIS
- RECURRING RESPIRATORY INFECTIONS/ILLNESSES
- UNEXPLAINED RECURRENT FEVERS
- SAFETY of PO prior to initiating feeding therapy for severely impaired

High risk conditions

- Tracheostomy
- Vocal fold paresis/paralysis
- Airway abnormalities (TEF, laryngomalacia, laryngeal cleft…)
- Neurological impairments
- Genetic Disorders (PRS, Down Syndrome, DiGeorge Syndrome, Cleft palate..)
- Need for ECMO
- Prolonged Intubation

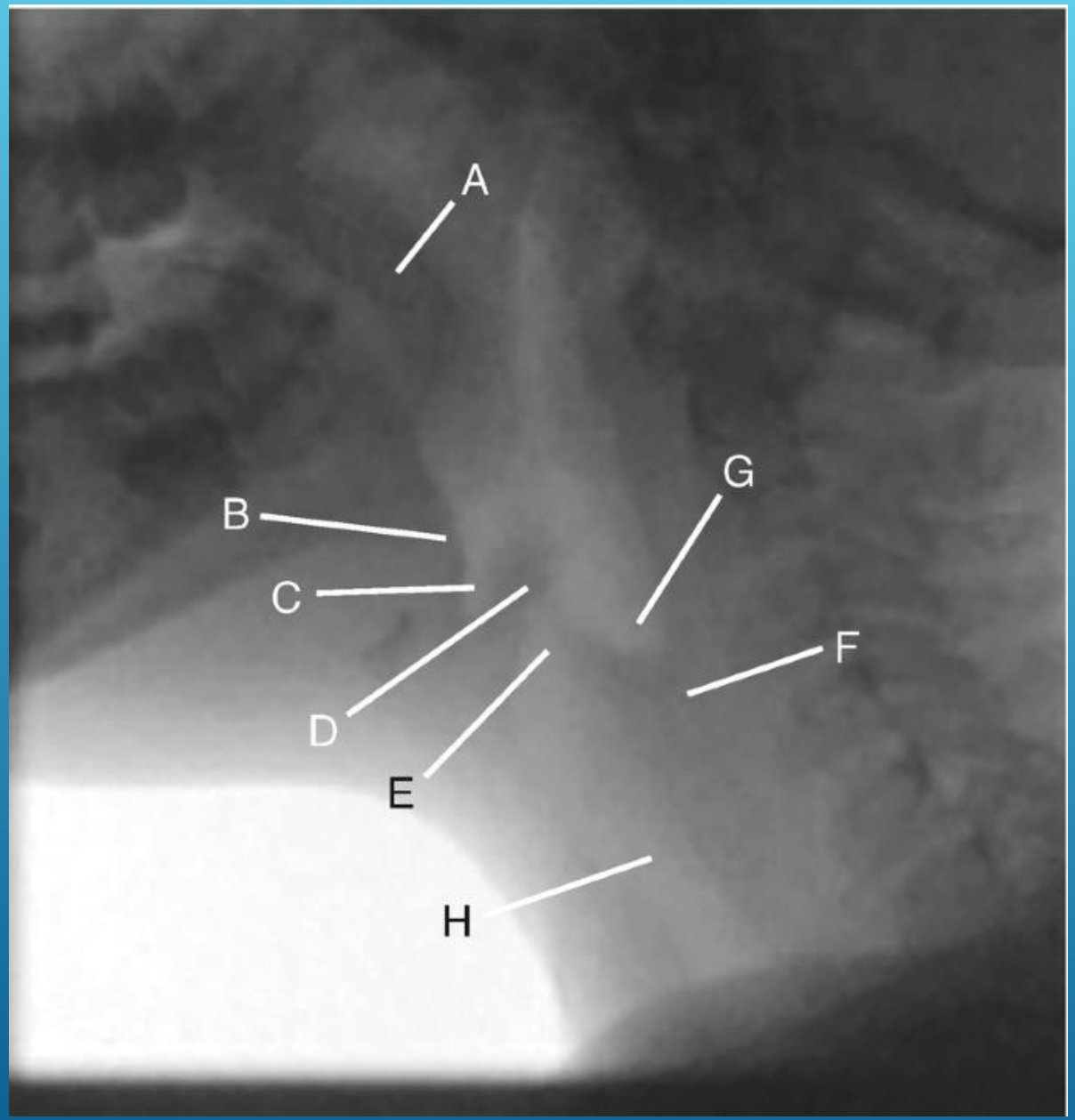
VFSS VS FEES

VFSS

- **Objective assessment of all the phases of swallowing in the correlation of the phases**
- **Able to evaluate for silent aspiration during all phases of the swallow**
- **Objective assessment of aerodigestive function and coordination (suck-swallow-breath); visualization of all 3 phases**
- **Able to objectively test and identify therapeutic options**
- **Can help identify abnormal A&P (Ie.) Malacia, cleft palate, laryngeal cleft, etc**
- **Objective assessment of aerodigestive function and coordination (suck-swallow-breath)**
- **Visual feedback for patient's families**

FEES

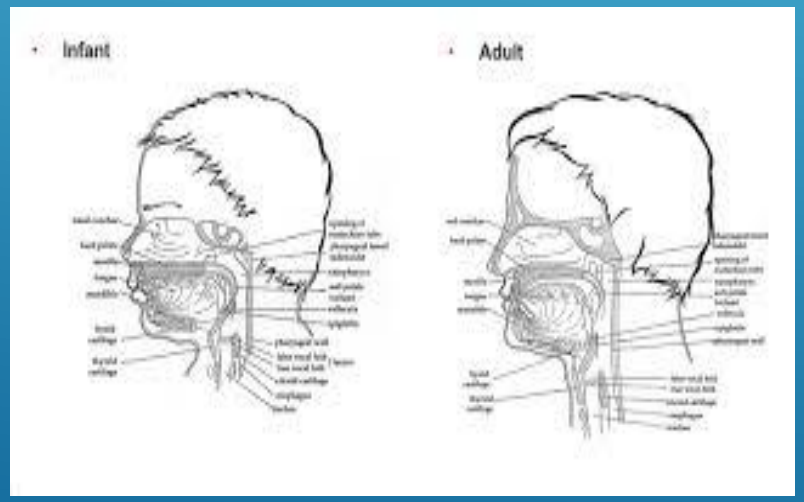
- ABILITY TO VISUALIZE VOCAL FOLDS
- ASESSING BREASTFEEDING
- VISUALIZATION OF SPECIFIC LEVELS OF AIRWAY PROTECTION (laryngomalacia, epiglottis, VF)
- MANAGEMENT OF SECRETIONS
- SPECIALIZED SENSORY TESTING when applicable
- NO EXPOSURE TO RADIATION- can repeat as needed without concern of radiation exposure
- LONGER CONTINUOUS OBSERVATION



VFSS IMAGE WITH STRUCTURES LABELED. **A**: SOFT PALATE; **B**: BASE OF TONGUE; **C**: VALLECULA; **D**: EPIGLOTTIS; **E**: LARYNGEAL VESTIBULE; **F**: UES (UPPER ESOPHAGEAL SPHINCTER) **G**: PYRIFORM SINUSES; **H**: TRACHEA

(OLSON-GREB, BK, 2020)

Infants and growth



ANATOMY AND PHYSIOLOGY OF INFANT SWALLOW CHANGES OVER TIME WITH GROWTH AND DEVELOPMENT

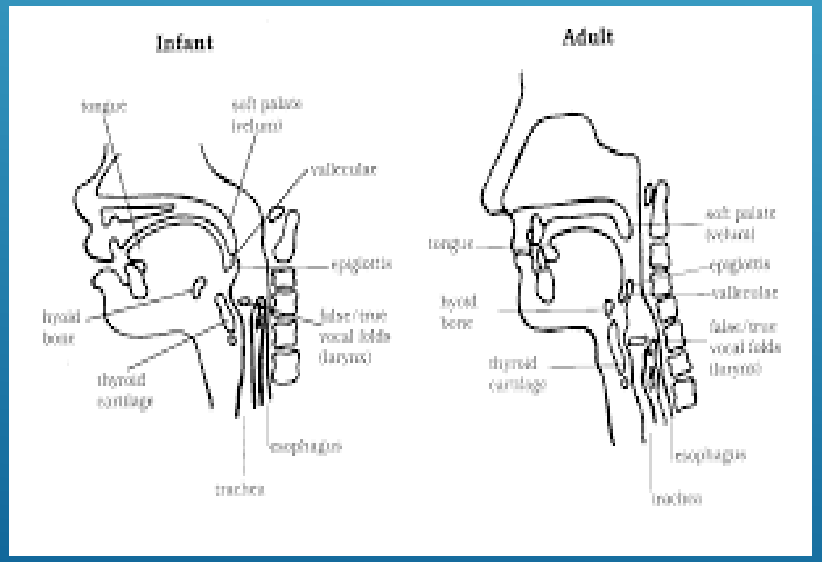
-NEWBORNS FLEXED TUCKED POSITION, LARYNX IS TUCKED UNDER THE CHIN,
-INFANTS SWALLOW IS REFLEXIVE RULED BY THE BRAINSTEM
-FLEXION WITH NO HYOLARYNGEAL ELEVATION

STRUCTURE AND FUNCTION- CHANGE IS STRUCTURE DEMANDS AND CHANGE IN FUNCTION

4-6 MONTHS
-REFLEXES DISAPPEAR AND CORTICAL CONTROL INVOLVEMENT
-LARYNX STARTS MOVING TOWARD ADULT POSITION INCREASING NEED FOR HYOLARYNGEAL ELEVATION
- SOFT PALATE NO LONGER APPROXIMATES THE EPIGLOTTIS AND THERE IS A PROGRESSION OF EPIGLOTTIC DISPLACEMENT FOR AIRWAY PROTECTION

6-12 MONTHS
-CORTICAL CONTROL DEVELOPMENT OF THE MOTOR STRIP AND THE BRAIN BECOMES MORE ORGANIZED FOR FURTHER FEEDING DEVELOPMENT SKILLS (IE CHEWING)
-STORESD SENSORY EXPERIENCES SIGNAL PROPERTIES SIGNAL TO CONTROL THE BOLUS (IF SOMETHING IS HARD THEN WE CHEW…), MOTOR RESPONSE TO PERCEIVE SENSORY PROPERTIES

Infants and growth



AS ANATOMY CHANGES THE PHYSIOLOGY GRADUALLY CHANGES
-ORAL CAVITY ENLARGES
-PHARYNX ELONGATES
*NEED MORE ACTIVE CONTROL TO DIRECT THE BOLUS AND PROTECT THE AIRWAY

12 MONTHS TO 3 YEARS TRANSITIONAL STAGE
-MIX OF INFANT AND MORE ADULT LIKE PATTERNS

3 YEARS TO 5 YEARS
-HYOLARYNGEAL EXCURSION INCREASES ESPECIALLY REACHING ADULT LIKE AROUND YEARS

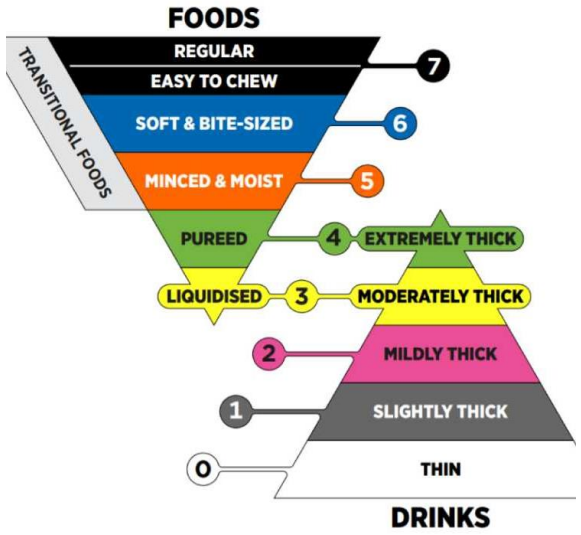
APPROXIMATES ADULT AROUND THE AGE OF 5 YEARS
(KUA ET AL, 2006)

PRIOR TO THE STUDY

- MEDICAL AND SWALLOWING HISTORY
  - * NATURE OF THE PROBLEM AND CONCERNS ABOUT SWALLOWING
  - * GENERAL MEDICAL HISTORY
  - * TIMING AND DURATION OF ONSET OF SYMPTOMS
  - * CHARACTERISTICS OF THE FEEDING/SWALLOWING DIFFICULTY
  - * HISTORY OF WEIGHT GAIN AND GROWTH
  - * HISTORY OF RESPIRATORY ILLNESS
  - *OTHER CONTRIBUTING FACTORS
- TYPICAL FEEDING PATTERNS - utensils, consistencies, feeders
- DETERMINE TYPICAL POSITION FOR FEEDING
- DISCUSS THE PROCEDURE WITH THE FAMILY/CHILD
- ORAL MOTOR EXAM
- ASSESSMENT OF SECRETION MANAGEMENT

- POSITION
  - *SIMULATE NATURAL FEEDING POSITION AS MUCH AS POSSIBLE
  - *HEAD, NECK AND TRUNK SHOULD BE FULL SUPPORTED
- SUPPORTS NEEDED – SUPPLEMENTAL O2, CARDIAC, RESPIRATORY MONITORS
- UTENSILS- BOTTLES WITH SPECIFIC NIPPLE FLOWS AND OPTIONS, SPECIAL CUPS, SIPPIE CUPES, SPECIAL UTENSILS
- VISCOSITES

SET UP AND PROCEDURES



International Dysphagia Diet Standardization Initiative (IDDSI) framework IDDSI

VFSS SHOULD TEST THE FULL RANGE OF DEVELOPMENTALLY APPROPRIATE CONSISTENCIES. ADDITIONALLY, IT IS IMPORTANT THAT THE VISCOSITY OF THE FLUIDS TESTED DURING VFSS MATCHES WHAT IS RECOMMENDED TO THE PATIENT

STANDARDIZED SET OF BARIUM CONTRAST
-LEVELS 0-4 ON THE IDDSIM SULFATE CONSISTENCIES HAVE BEEN DEVELOPED AND ARE SPEDIFICALLY USED FOR VFSS

(MARTIN-HARRIS ET AL ,2017;CICHERO ET AL, 2017)

PRESENTATION OF CONTRAST

MBSIMP – PROTOCOL FOR INTRODUCTION OF CONTRAST AND BOLUS SIZE FOR ADULTS AND OLDER CHILDREN

INFANTS AND YOUNG CHILDREN

- NOT YET A STANDARD PROTOCOL FOR BOTTLE FED INFANTS;
  BABYVFSSIMP, 5 FUNCTIONAL DOMAINS WITH 24 COMPONENTS
  MARTIN-HARRIS ET AL, 2019

-START WITH WHAT THEY ARE CURRENTLY DOING

-SHOULD OFFER ALL DEVELOPMENTALLY APPROPRIATE VISCOSITIES

LIMITATIONS

Information we can obtain from VFSS to determine appropriate interventions:

*LIP CLOSURE

*MASTICATION

*PREPARATION AND ORAL CONTROL OF THE BOLUS

*EFFECTIVENESS OF ORAL TRANSFER

*VELOPHARYNGEAL FUNCTION

*HYOLARYNGEAL ELEVATION

*AIRWAY PROTECTION/CLOSURE
TIMING AND COMPLETENESS OF CLOSURE
COMPRESSION OF SUPRAGLOTTIC STRUCTURES
EPIGLOTTIC INVERSION

*TIMING OF TRIGGERING OF THE PHARYNGEAL SWALLOW

*COMBINATION OF EVENTS OF THE PHARNGEAL SWALLOW

*POOLING OF BOLSU MATERIAL IN THE VALLECULAE AND PYRIFORM SINUSES

*EFFICIENCY OF PHARYNGEAL CLERING AND PRESENCE OF RESIDUALS

*NUMBER OF SWALLOWS TO CLEAR

*PRESENCES AND TIMING OF AIRWAY COMPROMISE (PENETRATION OR ASPIRATION)

*PATIENT'S REPONSE TO AIRWAY COMPROMISE

WITH INFANTS

*COORDINATION OF SUCK/SWALLOW/BREATH

*MORE PRECISE INDICATION OF WOB

*INITIATION OF NUTRITIVE SUCK

*# OF SUCKS TO FORM THE BOLUS

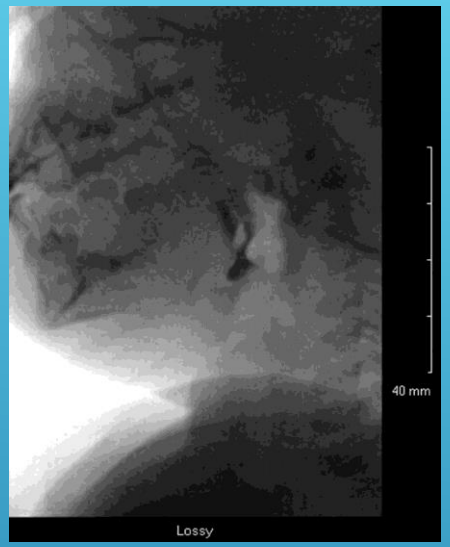
*NUTRITIVE SUCK RHYTHM/ORGANIZATION

*ORAL RESIDUALS AT THE END OF SUCK-SWALLOW SEQUENCE

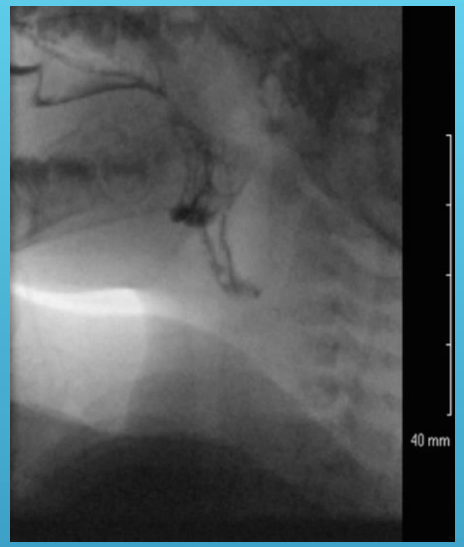
*SUCK/SWALLOW BOLUS CONTROL

NORMAL INFANT VIDEOFLOUROSCOPIC SWALLOW STUDY

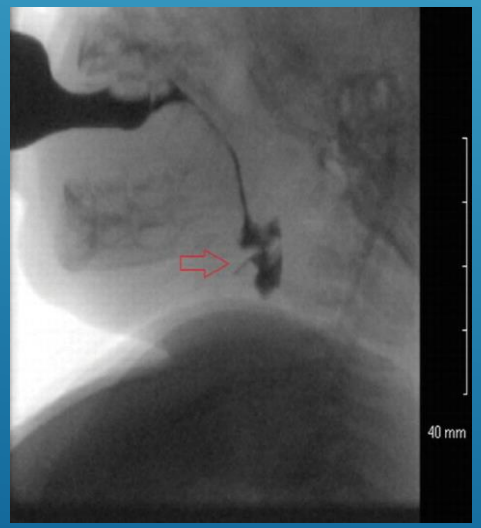
Orophayrngeal swallow disorder



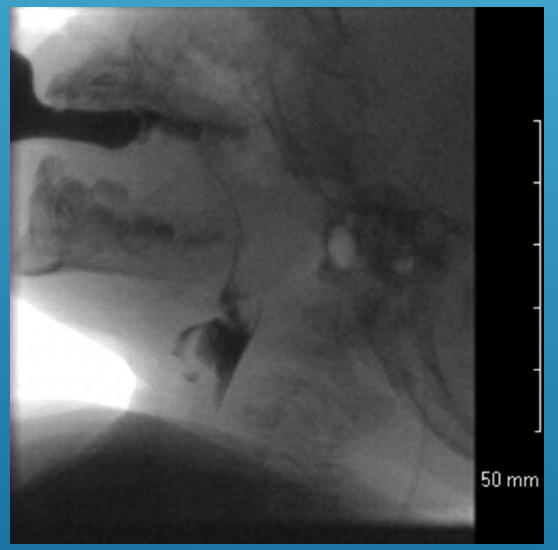
Delay to the valleculae



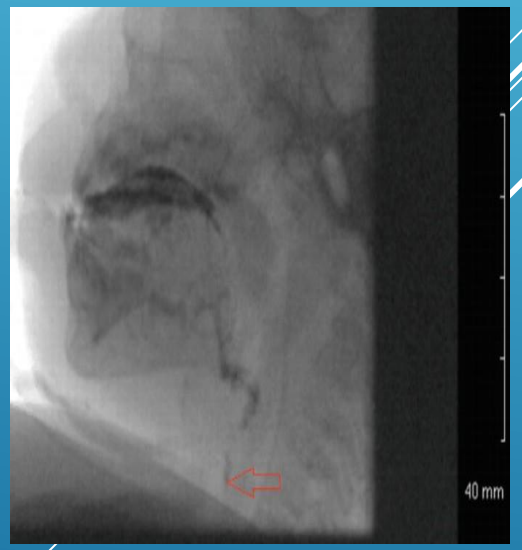
Delay to the pyriform sinuses



Deep penetration



Aspiration during the swallow



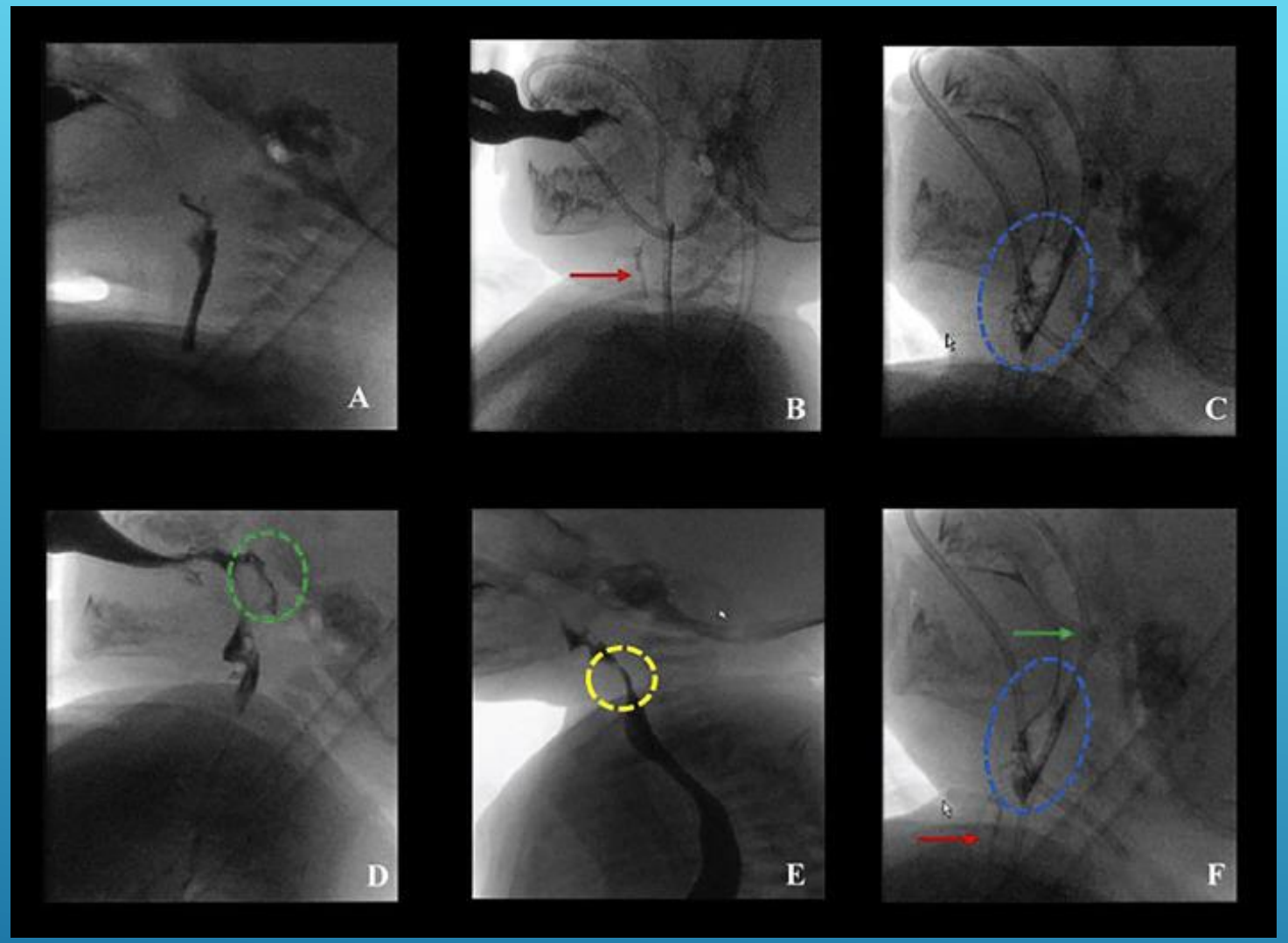
Aspiration posterior tracheal wall

PENETRATION-ASPIRATION SCALE (PAS)

Eight-point penetration-aspiration scale

1. Material does not enter the airway
2. Material enters the airway, remains above the vocal folds, and is ejected from the airway
3. Material enters the airway, remains above the vocal folds, and is not ejected from the airway
4. Material enters the airway, contacts the vocal folds, and is ejected from the airway
5. Material enters the airway, contacts the vocal folds, and is not ejected from the airway
6. Material enters the airway, passes below the vocal folds, and is ejected into the larynx or out of the airway
7. Material enters the airway, passes below the vocal folds, and is not ejected from the trachea despite effort
8. Material enters the airway, passes below the vocal folds, and no effort is made to eject

From Rosenbek et al. [33],



A- No aspiration during swallowing (PAS = 1), B- aspiration (PAS = 8, red arrow shows material below the true vocal folds), C- post swallow residue, D- Nasopharyngeal reflux (green circle), E– Esophagopharyngeal reflux (yellow circle shows bolus material returning to PES and above), F- Nasopharyngeal reflux (green arrow), post swallow residue (blue circle) and aspiration (red arrow) in an infant. Dhaarmarathna, et al, 2020

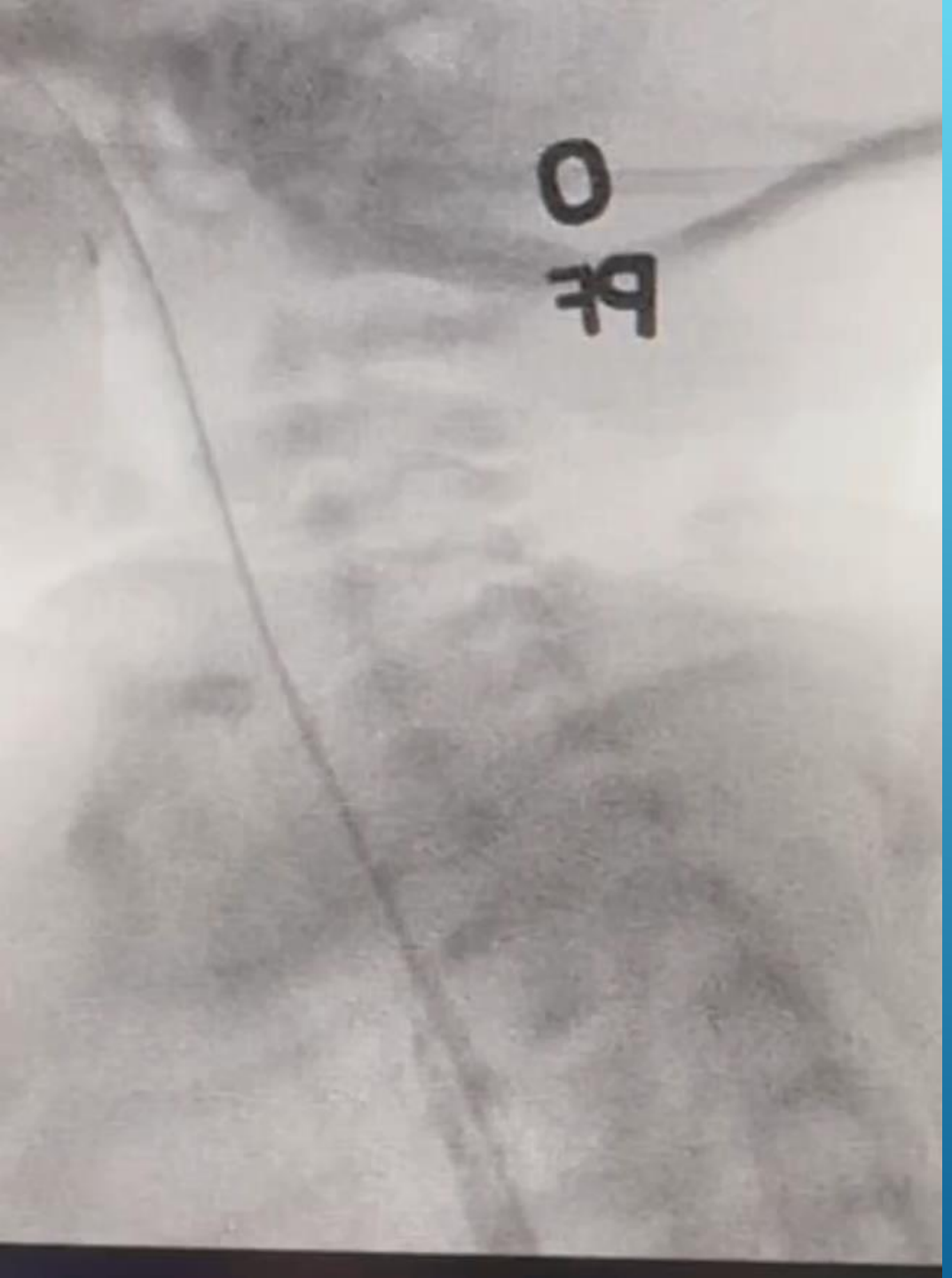
INTERPRETING DATA FROM THE STUDY:

TESTING FEEDING MODIFICATIONS (ALTERED BOLUS FLOW RATE, MODIFIED CUPS OR SPOONS)

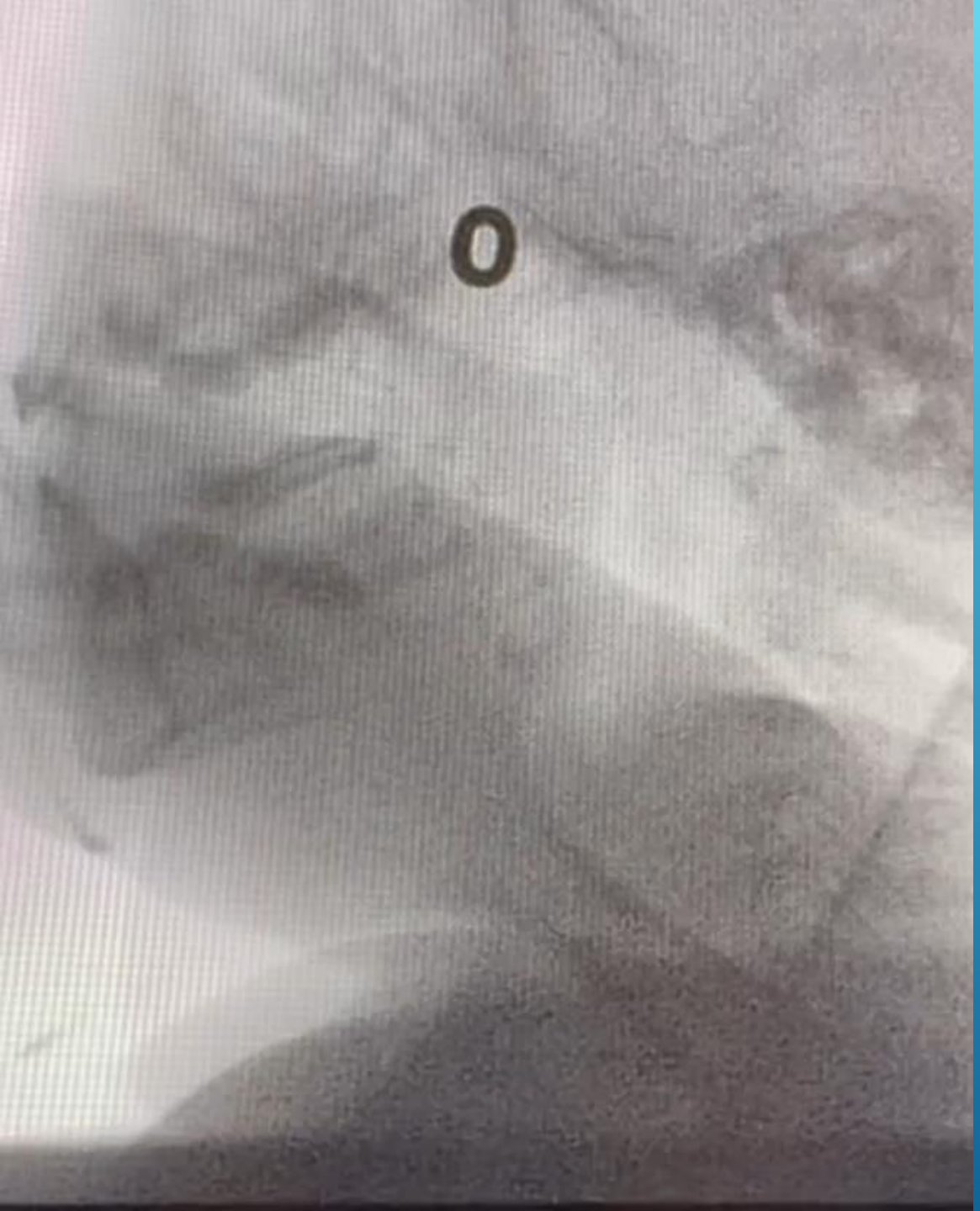
MODIFIED VISCOSITY

CHANGES IN POSTURE/POSITIONING
IMPLEMENTATION OF EXTERNAL PACING, COMPENSATORY STRATEGIES

MAKING RECOMMENDATIONS FOR DIET, FEEDING MODIFICATIONS, OR OTHER THERAPEUTIC INTERVENTIONS INDICATED BASED ON THE RESULTS OF THE STUDY.



TB



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QUESTIONS ?

THANK YOU

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REFERENCES

ARVEDSON J, ROGERS B, BUCK G, SMART P, MSALL M. SILENT ASPIRATION PROMINENT IN CHILDREN WITH DYSPHAGIA. INT J PEDIATR OTORHINOLARYNGOL. 1994 JAN;28(2-3):173-81. DOI: 10.1016/0165-5876(94)90009-4. PMID: 8157416.

BARBOSA LDE R, GOMES E, FISCHER GB. SINAIS CLÍNICOS DE DISFAGIA EM LACTENTES COM BRONQUIOLITE VIRAL AGUDA [CLINICAL SIGNS OF DYSPHAGIA IN INFANTS WITH ACUTE VIRAL BRONCHIOLITIS]. REV PAUL PEDIATR. 2014 SEP;32(3):157-63. DOI: 10.1590/0103-0582201432302. EPUB 2014 OCT 3. PMID: 25479843; PMCID: PMC4227334.

BAS PULLENS, MARLOES STREPPEL, SWALLOWING PROBLEMS IN CHILDREN WITH A TRACHEOSTOMY, SEMINARS IN PEDIATRIC SURGERY, VOLUME 30, ISSUE 3, 2021

BOESCH RP, BALAKRISHNAN K, ACRA S, BENSCOTER DT, COFER SA, COLLACO JM, DAHL JP, DAINES CL, DEALARCON A, DEBOER EM, DETERDING RR, FRIEDLANDER JA, GOLD BD, GROTHE RM, HART CK, KAZACHKOV M, LEFTON-GREIF MA, MILLER CK, MOORE PE, PENTIUK S, PETERSON-CARMICHAEL S, PICCIONE J, PRAGER JD, PUTNAM PE, ROSEN R, RUTTER MJ, RYAN MJ, SKINNER ML, TORRES-SILVA C, WOOTTEN CT, ZUR KB, COTTON RT, WOOD RE. STRUCTURE AND FUNCTIONS OF PEDIATRIC AERODIGESTIVE PROGRAMS: A CONSENSUS STATEMEN PEDIATRICS. 2018 MAR;141(3):E20171701. DOI: 10.1542/PEDS.2017-1701. EPUB 2018 FEB 7. PMID: 29437862.

CHAPMAN, K. L., BAYLIS, A., TROST-CARDAMONE, J., CORDERO, K. N., DIXON, A., DOBBELSTEYN, C., . . . SELL, D. (2016). THE AMERICLEFT SPEECH PROJECT: A TRAINING AND RELIABILITY STUDY. *THE CLEFT PALATE CRANIOFACIAL JOURNAL, 53,* 93–108

Cichero JAY, Lam P, Steele CM, Hanson B, Chen J, Dantas RO, et al. Development of international terminology and definitions for texture-modified foods and thickened fluids used in dysphagia management: the IDDSI framework. (International Dysphagia Diet Standardisation Initiative) (report) (author abstract). Dysphagia. 2017;32(2):293.

Dharmaraj, R.; Elmaoued, R.; Alkhouri, R.; Vohra, P.; Castillo, R.O. Evaluation and Management of Pediatric Feeding Disorder. *Gastrointest. Disord.* **2023**, *5*, 75-86. https://doi.org/10.3390/gidisord501000

DeBoer EM, Prager JD, Ruiz AG, Jensen EL, Deterding RR, Friedlander JA, Soden J. Multidisciplinary care of children with repaired esophageal atresia and tracheoesophageal fistula. Pediatr Pulmonol. 2016 Jun;51(6):576-81. doi: 10.1002/ppul.23330. Epub 2015 Sep 30. PMID: 26422584.

Goday, P.S.; Huh, S.Y.; Silverman, A.; Lukens, C.T.; Dodrill, P.; Cohen, S.S.; Delaney, A.L.; Feuling, M.B.; Noel, R.J.; Gisel, E.; et al. Pediatric feeding disorder: Consensus definition and conceptual framework. *J. Pediatr. Gastroenterol. Nutr.* **2019**, *68*, 124–129. [**Google Scholar**] [**CrossRef**] [**PubMed**]

Gosa MM, Dodrill P, Lefton-Greif MA, Silverman A. A Multidisciplinary Approach to Pediatric Feeding Disorders: Roles of the Speech-Language Pathologist and Behavioral Psychologist. Am J Speech Lang Pathol. 2020 Jul 10;29(2S):956-966. doi: 10.1044/2020_AJSLP-19-00069. Epub 2020 Jul 10. PMID: 32650658.

Hoffmeister, Jesse; Zaborek, Nicholas; Thibeault, Susan L. Postextubation Dysphagia in Pediatric Populations: Incidence, Risk Factors, and Outcomes, The Journal of Pediatrics, Volume 211, 2019, Pages 126-133.e1, ISSN 0022-3476.

Irace A L, Dombrowski N D, Kawai K et al. Evaluation of aspiration in infants with laryngomalacia and recurrent respiratory and feeding difficulties. *JAMA Otolaryngol Head Neck Surg.* 2019;145(02):146–151

Jadcherla, Sudarshan R. Challenges to Eating, Swallowing, and Aerodigestive Functions in Infants: A Burning Platform That Needs Attention!, The Journal of Pediatrics, Volume 211, 2019, Pages 7-9, ISSN 0022-3476.

Kanotra SP, Weiner R, Rahhal R. Making the case for multidisciplinary pediatric aerodigestive programs. World J Gastroenterol. 2022 Jul 28;28(28):3620-3626. doi: 10.3748/wjg.v28.i28.3620. PMID: 36161050; PMCID: PMC9372800.

Leder SB. Incidence and type of aspiration in acute care patients requiring mechanical ventilation via a new tracheotomy. Chest. 2002 Nov;122(5):1721-6. doi: 10.1378/chest.122.5.1721. PMID: 12426277.

Lee JH, Chang YS, Yoo HS, Ahn SY, Seo HJ, Choi SH, Jeon GW, Koo SH, Hwang JH, Park WS. Swallowing dysfunction in very low birth weight infants with oral feeding desaturation. World J Pediatr. 2011 Nov;7(4):337-43. doi: 10.1007/s12519-011-0281-9. Epub 2011 Oct 20. PMID: 22015726.

Lefton-Greif, M. A., McGrattan, K. E., Carson, K. A., Pinto, J. M., Wright, J. M., & Martin-Harris, B. (2018). First Steps Towards Development of an Instrument for the Reproducible Quantification of Oropharyngeal Swallow Physiology in Bottle-Fed Children. *Dysphagia*, *33*(1), 76–82. https://doi.org/10.1007/s00455-017-9834-y

Li, Lilun, Strum, David, Larson, Stephen, Preciado, Diego. Quality of life outcomes following velopharyngeal insufficiency surgery, International Journal of Pediatric Otorhinolaryngology, Volume 127, 2019, 109643, ISSN 0165-587

Martin-Harris B, Carson KA, Pinto JM, Lefton-Greif MA. BaByVFSSImP© A Novel Measurement Tool for Videofluoroscopic Assessment of Swallowing Impairment in Bottle-Fed Babies: Establishing a Standard. Dysphagia. 2020 Feb;35(1):90-98. doi: 10.1007/s00455-019-10008-x. Epub 2019 Apr 6. PMID: 30955137; PMCID: PMC6778717.

McInnes RJ, Shepherd AJ, Cheyne H, Niven C. Infant feeding in the neonatal unit. Matern Child Nutr. 2010 Oct;6(4):306-17. doi: 10.1111/j.1740-8709.2009.00210.x. PMID: 21050385; PMCID: PMC6860858.

Mercado-Deane MG, Burton EM, Harlow SA, Glover AS, Deane DA, Guill MF, Hudson V. Swallowing dysfunction in infants less than 1 year of age. Pediatr Radiol. 2001 Jun;31(6):423-8. doi: 10.1007/s002470100456. PMID: 11436889.

Miglani A, Schraff S, Clarke PY, Basharat U, Woodward P, Kang P, Stevens L, Woodward J, Williams H, Williams DI. An Aerodigestive Approach to Laryngeal Clefts and Dysphagia Using Injection Laryngoplasty in Young Children. Curr Gastroenterol Rep. 2017 Nov 6;19(12):60. doi: 10.1007/s11894-017-0599-0. PMID: 29105033.

Miller CK. Aspiration and Swallowing Dysfunction in Pediatric Patients. ICAN: Infant, Child, & Adolescent Nutrition. 2011;3(6):336-343. doi:10.1177/1941406411423967

Olson-Greb, B.K. (2020). Videofluoroscopic Evaluation of the Swallow in Infants and Children. In: McMurray, J., Hoffman, M., Braden, M. (eds) Multidisciplinary Management of Pediatric Voice and Swallowing Disorders. Springer, Cham. https://doi.org/10.1007/978-3-030-26191-7_17

Re GL, Vernuccio F, Di Vittorio ML, Scopelliti L, Di Piazza A, Terranova MC, Picone D, Tudisca C, Salerno S. Swallowing evaluation with videofluoroscopy in the paediatric population. Acta Otorhinolaryngol Ital. 2019 Oct;39(5):279-288. doi: 10.14639/0392-100X-1942. Epub 2019 Mar 25. PMID: 30933173; PMCID: PMC6843585.

Rosenbek JC, Robbins JA, Roecker EB, Coyle JL, Wood JL. A penetration-aspiration scale. Dysphagia. 1996;11(2):93–8.

Rossoni EP, Miranda VSG, Barbosa LR. The Prevalence of Dysphagia in Children with Laryngomalacia Pre and Postsupraglottoplasty: A Systematic Review with Meta-Analysis. Int Arch Otorhinolaryngol. 2024 Feb 5;28(1):e170-e176. doi: 10.1055/s-0042-1755309. PMID: 38322449; PMCID: PMC10843910.

Ruiz AG, Bhatt JM, DeBoer EM, Friedlander J, Janosy N, Peterson MB, Wine T, Deterding R, Prager JD. Demonstrating the benefits of a multidisciplinary aerodigestive program. Laryngoscope. 2020 Feb;130(2):521-525. doi: 10.1002/lary.27939. Epub 2019 Mar 27. PMID: 30919460.

Shaker, C.S. (2017). Infant-Guided, Co-Regulated Feeding in the Neonatal Intensive Care Unit. Part I: Theoretical Underpinning for Neuroprotection. 38 (2), 96-105.

Thompson B, Lundine JP, Madhoun L, Hu H, Holliman-Wade D, Bates DG. Standardization of Radiologic Procedures for Pediatric Videofluoroscopic Swallow Studies: A Service-based Quality Improvement Initiative. Pediatr Qual Saf. 2018 Dec 6;3(6):e123. doi: 10.1097/pq9.0000000000000123. PMID: 31334455; PMCID: PMC6581479.

Thoyre SM, Shaker CS, Pridham KF. The early feeding skills assessment for preterm infants. Neonatal Netw. 2005 May-Jun;24(3):7-16. doi: 10.1891/0730-0832.24.3.7. PMID: 15960007; PMCID: PMC2828611.