THE PEDIATRIC INTENSIVE CARE UNIT: DYSPHAGIA MANAGEMENT IN THE TRENCHES

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OBJECTIVES

1. Describe three factors that a clinician should consider when determining timing of evaluation of swallowing in the pediatric intensive care unit.
2. List two special considerations when evaluating the feeding or swallowing of the tracheostomy-dependent infant.
3. Describe one way to facilitate the continuum of care for infants who continue to exhibit feeding or swallowing difficulties post-discharge from the intensive care unit.

THE PEDIATRIC ICU

PATIENT POPULATIONS

- Cardiac Failure
- Respiratory Failure
- Neurological Injury
- Kidney Failure
- Liver Failure

“An ICU is an organized system for the provision of care to critically ill patients that provides intensive and specialized medical and nursing care, an enhanced capacity for monitoring, and multiple modalities of physiologic organ support to sustain life during a period of life-threatening organ system insufficiency.”
ICU PATIENT CONSIDERATIONS

Equipment
- Monitors
- NIRS
- Lines/drains/tubes
- Trach/Ventilator
- VAD

MEDICAL STATUS

Continuum of Respiratory Support
- Intubated/Ventilated
- CPAP
- HFNC
- NC
- Room Air

ICU DELIRIUM

Changes in the patient’s level of awareness and ability to sustain attention

Causes:
- Physiologic disturbance
- Prolonged or excessive use of sedatives

Infants at higher risk due to CNS immaturity (Malas 2017)

Risk Factors:
- Delays in cognition, motor function or language
- Mechanical ventilation

Treatment:
- Medical Management
- Environmental Modification

CAREGIVERS IN THE ICU

Post-traumatic stress disorder
- As high as 42% of parents (Culhane & Pierce, 2012)
- Parents felt “powerless” (Al Zawad, 2019)
EVALUATION CONSIDERATIONS

Post-Extubation Dysphagia

- 6 mechanisms: Trauma, neuromuscular weakness, altered sensation, impaired cognition, gastroesophageal reflux, dysynchronous breathing and swallowing
- Observed in 29% of pediatric patients (Hoffmeister 2019)
- Odds increased for every hour of intubation
- Age of <25 months increased the odds more than 2-fold

Timing of Evaluation

How to define “ready?”
- Alertness
- Respiratory support
- Overall medical plan
- Timing after extubation?

Pre-Feeding Evaluation

- Cognition
- Non-nutritive
- Environmental

Clinical Evaluation of Swallowing

- History
- Previous dysphagia
- Equipment
  - 0-4 months: bottles/nipples (breast milk, formula, direct breastfeeding)
  - 4-6+ months: bottles/nipples, cup, straw, spoon (breast milk, formula, direct breastfeeding, purees, soft solids)

Limitations of Clinical Evaluation

- Sensitivity for predicting aspiration is poor (Duncan 2018)
- 1/3 of patients normal CSE = aspiration on VFSS
- Use clinical to prepare for VFSS
Instrumental Evaluation of Swallowing
 Allows us to more objectively evaluate anatomy and physiology of the swallow and assess the efficacy of interventions to improve swallowing function

<table>
<thead>
<tr>
<th>FEES</th>
<th>VFSS</th>
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<tbody>
<tr>
<td>No set time limit</td>
<td>Limit to 2-3 minutes</td>
</tr>
<tr>
<td>Portability/less at bedside</td>
<td>Transfer to radiology</td>
</tr>
<tr>
<td>View secretion management</td>
<td>Difficult to assess secretion management</td>
</tr>
<tr>
<td>Clear view of structures</td>
<td>Not all tolerate</td>
</tr>
<tr>
<td>White out</td>
<td>Can detect aspiration before, during, and after the swallow</td>
</tr>
<tr>
<td>Limited to pharyngeal phase</td>
<td>Views oral, pharyngeal, esophageal</td>
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CASE STUDY 1
TRACHEOSTOMY/VENTILATOR DEPENDENT

TRACHEOSTOMY
Why tracheostomy?
• Airway disorder
• Airway clearance
• Prolonged ventilation

TRACHEOSTOMY AND SWALLOW
70% of children with a tracheostomy tube presented with problems in the oral and/or pharyngeal phase of swallowing.
43% of the children studied aspirated (Streppel 2019)

WHY?
• Tethered larynx
• Reduced sensation
• Altered air pressures

TRACHEOSTOMY AND SWALLOW
Infants discharged from NICU with trach:
43% full oral feeds
38% combined oral/gavage
19% full gavage feeds (Joseph 2017)

MECHANICAL VENTILATION
Why mechanical ventilation?
• Improved oxygenation
• Improved ventilation
**TRACH/VENT CONTINUUM**

<table>
<thead>
<tr>
<th>Hospital vent</th>
<th>Home vent</th>
<th>HTC</th>
<th>HME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher settings</td>
<td>Lower settings</td>
<td>Off vent</td>
<td></td>
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</table>

**EVALUATION CONSIDERATIONS**

- Off fresh trach precautions
- Cuff deflation
- Tolerating speaking valve?
  - 48% patients < 2 years successful with valve (Brooks 2019)
- Vent settings breaks

**CASE STUDY 1**

**Medical History**
- "Emily" is a 3-week-old baby girl
- She was born prematurely at 35 weeks of gestation
- Diagnosed with spondylocostal dysplasia and congenital scoliosis
- CPAP for 4 days and weaned to room air
- Discharged home with no respiratory support and feeding fully by mouth (hospital slow flow or Dr. Brown’s Preemie)

**CASE STUDY 1: Clinical Swallow Evaluation**

- Emily returned to the ER 2 days after discharge
- Admitted to the ICU for evaluation of acute hypoxic respiratory failure
- CPAP - HFNC 7L - 2L
- Thin liquid via hospital slow flow, side-lying
  - Reduced coordination
  - Intermittent tachypnea
  - Reduced endurance

**CASE STUDY 1: Instrumental Evaluation**

Emily demonstrated functional bottle-feeding skills although mildly reduced bolus containment/control.

Occasional laryngeal penetration, at times “deep” (contacting vocal folds)

No evidence of aspiration

**Recommendation:**
Dr. Brown’s Preemie, side-lying, flow control as needed.

**CASE STUDY 1: Interim History**

- Emily was unable to fully wean respiratory support
- Medical team also concerned for inadequate weight gain
- Tracheostomy/gastrostomy placed at 6 weeks
- Oral feeding re-assessed 1 week following trach/GT
  - Reduced coordination, stress cues and tachypnea
  - Cough, bradycardia, increased tracheal secretions
CASE STUDY 1: Instrumental Evaluation

Repeat VFSS at 2 months
- Variable suck pattern, quickly fatigued
- One instance of trace aspiration
- Limited sample

Recommendation:
Short trials, 1-2x/day at most in therapy

Repeat VFSS at 3 months
- Reduced acceptance, individual swallows
- No penetration aspiration
- Various strategies trialed

Recommendation:
Continue GT primary with therapeutic trials, 1-2x/day as tolerated
Outpatient ENT, dysphagia therapy

CASE STUDY 1: Outcomes

Emily discharged on her home vent and continued to practice therapeutic bottle feeding
- At 6 months, she was able to tolerate a speaking valve
- At 12 months, she is taking most of her formula by mouth
- She is eating solid foods and using single words
- Continues to follow up with ENT and therapies, candidate for decannulation

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CASE STUDY 2

BRAIN INJURY

A disruption in the normal function of the brain that can be caused by a bump, blow, or jolt to the head, or penetrating head injury.

Common mechanisms include:
- Falls
- Struck by an object
- Motor vehicle crash
- Sports-related injury
- Non-accidental

Possible deficits include:
- Cognitive impairment
- Vision/balance deficits
- Irritability
- Impulsivity and agitation
- Sleep disturbance
BRAIN INJURY

- Limited pediatric research on swallowing characteristics
- Combination of oral and pharyngeal deficits
- High risk for silent aspiration \( \text{(Arvedson 1994)} \)

Swallowing Characteristics

Oral Preparatory and Oral Phases:
- Disorganized root and suck
- Decreased tongue to palate seal
- Reduced bolus control and impaired bolus formation
- Tongue pumping
- Prolonged oral transit
- Premature spillage into the pharynx

Pharyngeal Phase:
- Delayed swallow initiation
- Residue (valleculae and pyriform sinuses)
- Laryngeal penetration and aspiration

Predictive Factors for Dysphagia

- Glasgow Coma Scale score <8.5 (severe brain injury)
- Ventilation duration >1.5 days
- Compromised cognitive functioning \( \text{(Morgan 2003)} \)

CASE STUDY 2

Medical History
- "Daniel" is a previously healthy 4-month-old baby boy
- Sustained non-accidental trauma: Right parietal skull fracture and subdural hematoma
- 30 minutes CPR and intubated in ER
- Transferred to PICU for severe TBI management

CASE STUDY 2: Clinical Swallow Evaluation

Readiness
- Room air, tolerating NG, quiet alert, good state regulation
- Oral mech exam
  - Good secretion management, non-nutritive suck, diminished volume of voice
- Thin via Dr. Brown’s level 1
  - Fair coordination, occasional gulping, increased congestion

Recommendation:
- Continue NG primary, proceed with VFSS

CASE STUDY 2: Instrumental Evaluation

Daniel demonstrated variable suck/swallow pattern across various Dr. Brown’s nipples and viscosities presented.
- Best rhythmicity/efficiency with NTL
- Delayed swallow onset with deep penetration or aspiration of thin liquid and half nectar

Recommendation:
- NG primary and pacifier dips
- NTL up to 30cc, therapy only
- Repeat exam in 2 weeks
CASE STUDY 2: Outcomes

Repeat VFSS prior to discharge
- Improved oral phase but continued with delayed swallow
- Recommend half nectar via Dr. Brown’s level 2

FEES in Swallow Disorders Clinic
- Improved timeliness of swallow onset
- Recommend thin liquid via Dr. Brown’s level 1 + purées

CONTINUUM OF CARE
- Hospital course
- Appropriate referrals
- Therapy following discharge

QUESTIONS?

REFERENCES