

Dysphagia in Pediatric Patients with Brain Injury

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Disclosures

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Comprehensive Inpatient Rehabilitation Unit (CIRU) at Children's Healthcare of Atlanta

- 28 bed unit within acute care hospital
- Treated 40-50 children with brain injuries under 36 months each year
- Patients birth to 21 years of age
- Patients are admitted to pediatric physiatry providers
- Patients receive 3 hours of therapy per day between PT, OT, and SLP
- Other services include music therapy, recreation therapy, neuropsychology, child psychology, school services, and child life

Incidence of Brain Injury

- ~37,200 children sustain a severe TBI every year in the US
- TBI is the leading cause of death in children in the United States
- Children 0-4 have highest incidence of TBI in the non-elderly

Neuroanatomy and terminology

- Acquired brain injury (ABI)
 - Non-traumatic brain injury
 - Traumatic brain injury (TBI)

Etiologies of brain injury

- Anoxia
 - Brain is totally deprived of oxygen
 - Neural cells die via apoptosis
- Hypoxia
 - Partial loss of oxygen
- Hypoxic Ischemic
 - Oxygen deprivation
 - Impaired cerebral blood flow
- Seizure disorders

Etiologies of brain injury

- Cerebrovascular accident
 - Hemorrhagic vs ischemic
 - Common causes:
 - Arteriovenous malformation
 - Aneurysm
 - Emboli
 - 2 to 13 per 100,000 children per year
- Encephalitis
 - Autoimmune
 - Infectious

Etiologies of brain injury

- Traumatic brain injury (TBI)
 - Open vs closed injuries
 - Diffuse axonal injury (DAI)
 - Hemorrhage
 - Subdural hematoma (SDH)
 - Intracerebral hemorrhage (ICH)
 - Subarachnoid hematoma (SAH)
 - Epidural hematoma
 - Falls
 - Motor vehicle collisions (MVC)
 - Abusive head trauma (AHT)

Types of brain bleeds

- Intracranial
- Subdural
- Subarachnoid
- Epidural
- Intraventricular

(Maas et al. 2017)

Abusive head trauma (AHT)

- Most common type of TBI in kids <24 months
- Injury to the cranium, cerebral parenchyma, and/or cervical spinal cord
- Mechanism of injury:
 - Shaking
 - Direct impact
 - Combination
- Secondary injuries are common
- Previously used terminology:
 - Inflicted TBI (ITBI)
 - Non-accidental head trauma or non-accidental trauma (NAHT/NAT)
 - Shaken impact syndrome

Shaken baby syndrome

- Bleeding in the brain
- Cerebral edema
- Retinal hemorrhages
- Other fractures consistent with trauma
- Secondary complications

(Elsevir Patient Education 2021)

(Wang et al. 2019)

Other terminology

- Status epilepticus
- Midline shift
- Craniotomy
- Decompressive craniectomy
- Hydrocephalus
- External ventricular drain (EVD)
- Ventriculoperitoneal shunt
- Skeletal survey



Medication

- Anti-convulsant therapy contributes to dysphagia
 - Sedation
 - Inattention to eating
 - Lack of coordination
 - GI upset
 - Nausea
 - Vomiting
 - Diarrhea
 - Constipation

Pediatric dysphagia

- Huang et al. 2014
 - 12.3% of children had severe dysphagia post surgery following TBI
 - Higher rate of ICU admissions in children with dysphagia
 - Those with severe dysphagia were younger and utilized more medical intervention
 - Higher incidence of dysphagia in children 1-3 years of age
 - Children are more likely to silently aspirate than adults

Pediatric dysphagia terminology

- Oral Phase Dysphagia
- Pharyngeal Phase Dysphagia
- Esophageal Phase
- Aspiration
- Penetration
- Feeding Tubes
 - Nasogastric Tube (NG)
 - Gastrostomy/G-tube (PEG)
 - Nasoduodenal tube (ND)
 - Nasojejunal tube (NJ)
 - Gastro-jejunal tube (GJ)
 - Jejunal tube (J)

Assessment of dysphagia

- Thorough case history
- Clinical feeding evaluation
- Instrumental swallowing evaluation

Case History

- History & Physical
- Review imaging
 - Neuro imaging
 - Previous swallow studies
 - Chest X-Ray
- Respiratory status
 - Oxygen requirements
 - Intubation/extubation history
 - Airway anomalies
- GI considerations
- Feeding history
- Developmental history
- Social history

Clinical feeding evaluation

- State regulation
 - Arousal
 - Agitation
 - Positioning
- Reflexes
 - Rooting
 - Transverse Tongue
 - Phasic bite
 - Sucking
 - Gag
- Non-nutritive skills (NNS)
 - Secretion management
 - Active latch vs munching
 - Suck strength
 - Sucking bursts
 - Vitals with NNS

Clinical feeding evaluation

- Oral Feeding Assessment
 - Feeding Readiness
 - Flow Rate
 - Slow flow vs preemie
 - Positioning
 - Elevated side-lying
 - Upright
 - Semi-reclined/cradled



Clinical feeding evaluation

- Signs of Aspiration
 - Coughing
 - Increased congestion
 - Wet/gurgly vocal quality or breathing
- Breathing difficulties
 - Increased respiratory rate or heart rate
 - Stridor
 - Retractions
 - Poor suck/swallow/breathe pattern
 - Nasal flaring
 - Color changes
- Other signs of dysphagia
 - Anterior loss
 - Poor self-pacing
 - Self-limiting

Instrumental Assessment

- VFSS/MBSS
 - 15 frames per second in pediatric patients
- FEES
- Both have advantages and disadvantages

Instrumental assessment

- MBSS
 - Positioning
 - Tumble form
 - Elevated side-lying on fluoroscopy table
 - Cannot assess breast feeding
 - Unable to see movement of hyoid or epiglottis
- FEES
 - Can see before and after swallow
 - White out during the swallow
 - NG tube
 - Can see vocal fold abnormalities
 - Can use during breast feeding



Clinical evaluations vs. instrumental

- Duncan et al.
 - More than 80% of pediatric aspiration is silent
 - No single symptom was predictive of aspiration on MBSS
 - Clinical feeding evaluation only 44% sensitive for predicting aspiration on MBSS
- Velayuthum et al.
 - 34% of patients demonstrated aspiration on at least one consistency
 - 89.3% of those who aspirated showed silent aspiration
 - 37.5% of patients with neurological disease silently aspirated with only 3 percent showing overt signs

Lung and airway consequences of aspiration

- Chronic bronchiolar inflammation
 - Bronchiectasis
 - 51% of those under 2 years of age with chronic pulmonary aspiration
- Pneumonia
 - Laryngeal penetration is predictor for PNA in children
 - Aspiration
 - Food/liquid
 - Gastric contents
 - Saliva
 - Occurs in 12-40% of children who aspirate

(Gudberg et al. 2016, Piccone et al. 2011, Tanaka et al. 2019)

Neuroplasticity

“Ability of the nervous system to change itself, form new connections, and create new neurons in order to compensate for injury or adapt to changes in the environment.” –The Essential Brain Injury Guide

- Experience dependent learning
 - Elicit behavior
 - Synaptic change
 - Motor map reorganization

Neuroplasticity

- Use it or lose it
- Use it and improve it
- Specificity
- Repetition
- Intensity
- Time
- Salience
- Age
- Transference
- Interference

Treatment of dysphagia

- Tactile cueing
 - Chin support
 - Cheek support
 - Used as a cue to obtain suck, not throughout the feed
 - Never force feed
- Positioning
 - Change positioning to support feeding
 - Upright
 - Elevated side-lying
- Thickening liquids
- Changes in flow rate
- Pacing
- Caregiver training

Takeaways

- Aspiration is often silent
- Clinical swallow evaluation is not sufficient to diagnose dysphagia in infants and young children with a brain injury

Long term considerations for treatment

- Prognosis for acquiring new skills is worse the younger the child is at injury
- Anatomy changes as children grow
- Swallowing function changes as children grow and develop
 - Cup drinking
 - Chewing
- “Adult-like” swallowing at ~36 months
- Will likely require long term feeding and/or speech, language, cognitive therapy
- For ongoing dysphagia, thickening weans can be beneficial

Social considerations

- Department of Child and Family Services (DFCS) and/or law enforcement often involved with AHT
 - Parents may retain custody
 - DFCS may take custody
- Disposition changes throughout the admission
- Must consider long-term needs of the child when providing caregiver education
- Social situation will continue to evolve after discharge

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