Breastfeeding the Hypotonic Infant

Academy of Breastfeeding Medicine Protocol #16

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Objectives

• Understand hypotonia
• Background information
• Understand a normal suck and swallow
• Understand how hypotonia may impact suck and swallow
• Game plan for helping dyads
ABM Protocols

• A central goal of The Academy of Breastfeeding Medicine is the development of clinical protocols for managing common medical problems that may impact breastfeeding success.

• Primary authors
• Annotated bibliography
• Protocol Committee
Hypotonia Definitions

• Tone is the resistance of muscle to stretch
• Phasic tone: rapid contraction in response to a high intensity stretch
• Postural tone: prolonged contraction in response to a low intensity stretch
  – When depressed, the infant is less able to maintain body and limbs against gravity
Normal Tone

- Requires an intact central and peripheral nervous system
- Hypotonia is a common symptom of neurologic problems
- May occur without muscle weakness
Hypotonia

- Causes: metabolic, endocrine, nutritional disorders
- Connective tissue disease
- Chromosomal abnormalities
- Preterm age-appropriate hypotonia
- Perinatal hypoxia
- Cerebral palsy
- Medications
Hypotonia (decreased muscle tone)

Traction Response and Horizontal Suspension
Normal Swallowing

- Appears in fetus at around 11 weeks gestation
- Sucking and swallowing develop skills during fetal and neonatal maturation
• normal swallowing
Swallowing in the infant

- Consists of three components:
  - the suck reflex, which is the delivery system and includes the orobuccal phase of deglutition
  - the collecting system, that is, the oropharynx
  - the transport system, that is, the esophagus
Normal Suck and Swallow

- Successful oral feeding requires that children have functional oral sensorimotor and swallowing skills, overall adequate health (including pulmonary and gastrointestinal function), central nervous system integration, and musculoskeletal tone.
Normal Suck and Swallow

- Sucking reflexively initiates swallowing in the infant by stimulation of the lips and deeper parts of the oral cavity.
- The mandible and maxilla (upper gums, lips, palate, and cheeks) are all necessary for compression of the nipple and expression of its contents.
- Infants born at term suckle in bursts of only 3 or 4 sucks for the first day or two before developing more effective sucking, in bursts of 10 to 30
Normal Suck and Swallow

• The normal infant has an arousal response when stimulated for feeding. When the lower lip is depressed, the tongue comes forward.
• This response is an important characteristic of infants, unless they have been fed recently or are extremely fatigued.
Normal Suck and Swallow

• Any defect of the lips, tongue, palate, mandible, maxilla, or cheeks creates problems for the first phase of deglutition, the delivery system of swallowing.

• When reflex suckling initiates swallowing in the infant, the composite suckling and swallowing processes are subcortically controlled.

• As new oral skills, such as biting and chewing, enlist cortical levels for control, the initial phases of swallowing become voluntary.
Normal Suck and Swallow

• In the newborn suckling infant, respirations and swallowing are intimately related to function and rhythmicity when the tongue, lips, and mandible move synergistically as a composite motor organ.

• Swallowing inhibits respiration.
Normal Suck and Swallow

- Sucking, as a purely reflexive process, acquires complexity and conscious control as other functions emerge and mature.
- The mouth is solely concerned with suckling, approximating, and orienting the nipple it encloses.
Normal Suck and Swallow

- The unique suckle reflex of the infant is regulated in the brain stem. It allows the infant a constant flow of milk from a natural or synthetic nipple while maintaining regular respirations.
- The dynamics of the process involve alternating compression of the nipple with development of negative pressure in the oral cavity, which acts as a reservoir while normal respirations are occurring.
- The tongue empties the reservoir into the pharynx at regular intervals and the pharyngeal phase of swallowing occurs with no interruption of the respiratory cycle.
Normal Suck and Swallow

- Oral Prep phase
- Oral phase
- Pharyngeal phase
- Esophagaeal phase
Oral Prep Phase

- The oral preparatory phase occurs when the food is tasted mixed with saliva, and formed into a bolus of proper size and consistency for movement into the pharynx and esophagus.
- During this phase, the tongue keeps the bolus against the hard palate.
- The tongue is elevated toward the palate by the combined actions of the digastric, genioglossus, geniohyoid, and mylohyoid muscles.
Oral Prep Phase

• Intrinsic tongue muscles produce both the initial depression in the dorsum that receives the food and the spreading action that distributes the food throughout the oral cavity.

• The buccinator muscles generate suction in neonates. In this phase, the soft palate is against the tongue base secondary to contraction of the palatoglossus muscles, which allows nasal breathing to continue.
Oral Phase

• The oral phase is characterized by elevation of the tongue and a posterior sweeping or stripping action produced mainly by the action of the styloglossus muscles.

• This propels the bolus past the anterior tonsillar pillars into the pharynx and triggers the "reflex swallow."
Oral Phase

- The receptors for this reflex are thought to be at the base of the anterior pillars, but there is evidence that others exist in the tongue base, epiglottis, and pyriform fossae.
- Sensory impulses for the reflex are conducted through the afferent limbs of cranial nerves V, IX, and X to the swallowing center.
Oral Phase

- The space inside the newborn’s mouth that can be filled with air or fluid is very small.
- Full term infants usually are born with sucking pads in the cheeks.
- The tongue and the sucking pads fill the mouth to create a safe oral stage of the swallow.
- Results in adequate intraoral pressure, allows the infant to suck.
Pharyngeal phase

- During the buccopharyngeal phase of feeding reflex input to the brainstem from the oropharynx and larynx, as well as suprabulbar and chemoreceptor areas controls the sequential activity of the muscles of deglutition.

- Coordinated development of buccopharyngeal functions generally occurs by 35 weeks post-conceptional age in infants, but can be disrupted by respiratory disease or neuropathology.
Pharyngeal Phase

• In infants, the pharyngeal phase is of longer duration and the forward movement of the posterior pharyngeal wall is exaggerated, compared with that of adults.

• Despite the prolonged transit time of the bolus through the pharynx, there is normally no aspiration seen in newborns and infants.

• This is probably a result of the soft cartilaginous laryngeal framework, which allows more efficient sphincter closure.
Pharyngeal Phase

- The major component of the pharyngeal phase is the reflex swallow. This results from motor activity stimulated by cranial nerves IX and X.
- The reflex swallow may be triggered by a voluntary oral phase component or any stimulation of the afferent receptor in and around the anterior pillar.
- Once it begins, the pharyngeal transit time is very quick, 1 second or less.
Pharyngeal Phase

- Muscle actions and coordination are the most complex during the pharyngeal phase.
- As the tongue propels the bolus posteriorly, the hyoid is pulled anteriorly by the geniohyoid muscles and superiorly by the mylohyoid, stylohyoid, and digastric muscles.
- This results in movement of the larynx superiorly and anteriorly into the tongue base, while the tongue is sweeping posteriorly and pushing the epiglottis into a posterior and horizontal position over the laryngeal introitus.
Pharyngeal Phase

- A negative pressure in the pharynx is generated by these muscle actions.
- At this time, the aryepiglottic folds, false vocal cords, and true vocal cords, collectively known as the laryngeal sphincters, are brought together, subglottic pressure increases, and then respirations cease.
- The net effect is that the lower airway is protected.
Pharyngeal Phase

- As the bolus enters the pharynx and is stripped inferiorly by the combined effects of gravity, the negative pressure mentioned above, and the sequential contractions of the pharyngeal constrictors, the soft palate moves against the posterior pharyngeal wall to close off the nasopharyngeal port.
Pharyngeal Phase

- The bolus divides around the epiglottis, combines, and passes through the cricopharyngeal muscle, or upper esophageal sphincter.
- The cricopharyngeal muscle, which is normally in a constant state of contractions, relaxes to allow the bolus to pass into the esophagus after receiving a signal originating in the oro- and hypopharynx through vagal sensory fibers.
Esophageal phase

• During the esophageal phase of feeding, the bolus of food traverses the esophagus and lower esophageal sphincter, whose tone is also regulated by nuclei in the brainstem and modulated by respiratory drive.

• Control of the lower esophageal sphincter gradually develops postnatally in premature infants.
Airway and Eating

• Simultaneous breathing and nursing from a bottle or breast requires intricate coordination of the muscles that serve both respiration and feeding.
Coughing

- In utero coughing occurs rarely if at all
- Studies in which cough and other airway protective responses have been stimulated by introducing a small bolus of water or saline into the pharynx of sleeping infants have found that the predominant responses are swallowing, apnea and laryngeal closure. Coughing is rare.
- Studies in animal models indicate that with maturation, apnea and swallowing components of the LCR decrease while cough becomes increasingly prominent.
Protective Reflexes

• Pharyngeal reflex swallowing
• Pharygo-UES contractile reflex
• The PRS can be elicited by air or fluid, more though with fluid
• More swallowing reflexes triggered by larger volumes of liquid
• The succeeding swallow inhibits the esophageal propagation of the previous swallow
Airway protection

- Neonates lack volitional swallowing
- Pharyngeal reflexes: principal defense
- UES reflex: poor contractile tone
- Glottal reflex
  - Volume dependent closure
  - Happens at both phases of respiration

- Swallowing skills may depend on volume
- Modification of the feeding strategy by slowing the flow
Airway and GI tract

• There is a close functional relationship between the upper gastrointestinal tract and the airway, which ensures the safety of the airway against aspiration of material in transit through the pharyngoesophageal axis.

• This functional relationship is controlled through two major mechanisms:
  – a brainstem-programmed mechanism such as those governing the integration of the laryngeal closure into swallowing, belching, and vomiting mechanisms
  – brainstem reflexes emanating from the pharynx, larynx, and esophagus.
Upper Airway and GI tract

- Esophageal reflexes
  - secondary peristalsis
  - esophago–upper esophageal sphincter contractile and relaxation reflexes
  - esophago-glottal closure reflexes, and esophageal belch.
- Pharyngeal reflexes
  - pharyngoglottal closure reflex and
  - pharyngo-UES contractile reflex.
- Laryngeal reflexes
  - laryngo-UES contractile and laryngeal adductor reflexes.
UES interactions

- Pharyngo-UES-esophageal manometry was recorded in 10 neonates at 39 +/- 4 weeks postmenstrual age.
- Pharyngeal infusions (n = 155) of air (0.1 to 2.0 mL) and sterile water (0.1 to 0.5 mL) were given.
- Two types of reflexes were recognized: pharyngeal reflexive swallowing and pharyngo-UES-contractile reflex.
- PRS is more frequent than PUCR and the 2 reflexes have distinctive characteristics in air and water stimuli.
Glottal response

- The occurrence of EGCR is independent of the peristaltic reflexes or the respiratory phase of infusion.
- The independent existence of EGCR suggests a hypervigilant state of the glottis to prevent retrograde aspiration during GER events.
Figure 7 Example of esophagoglottal closure reflex evoked by 20 mL room air injected into mid-esophagus.
Figure 8 Esophagoglottal closure reflex.
Upper Airway- Lower GI

• There are inhibitory reflexes emanating from the aerodigestive tract and esophagus,
  – laryngeo–lower esophageal sphincter relaxation
  – pharyngo-LES relaxation
  – esophago-LES relaxation reflexes,
  – pharyngoesophageal inhibitory reflex of primary and secondary peristalsis.
Airway and the GI tract

- The upper esophageal sphincter provides the most proximal physical barrier of the gastrointestinal tract against pharyngeal and laryngeal reflux of gastric content.
- In addition, by maintaining a basal pressure, it prevents entry of air into the esophagus during inspiration.
Feeding Problems

• Result from abnormal or underdeveloped control of the oropharyngeal structures, contributing to an uncoordinated and/or weak suck
Missing Milestones

- When infants with major physical and physiologic problems are prevented from initiating oral feeding in the same time frames as their more typically developing peers, many demonstrate prolonged delays and significant difficulty with oral feeding.

- Significant variations are found in the form and function of the ingestive systems of age-matched healthy infants and at-risk infants.
Missing Milestones

• Ultrasounds revealed that fetal swallowing occurred most commonly in the presence of oral-facial stimulation. Hands were touching face and mouth. In some instances, fingers or thumbs were seen in the mouth. Perhaps some infants miss critical periods while still in the womb.
Bad starts

• Children's prior and current oral experiences strongly influence how they approach oral stimulation and feeding.
• Abnormal or aversive responses to oral stimulation occur frequently when the infant has been deprived of positive sensory input to the mouth.
Bad starts

- Because many of these children require invasive procedures such as prolonged ventilation, suctioning and tube-insertion, they may develop a belief that the mouth is an unpleasant place.
- They avoid using the mouth to explore and learn because it is uncomfortable. They become wary and watchful of anyone who would approach the mouth. Their attempts to protect or guard the area become deeply ingrained.
Critical Periods

• During the critical period, a child's experience--sensory, motor, emotional, and intellectual--determines which of these synapses will be preserved, through pruning of the least useful connections. In this way, each child's brain becomes better tuned to meet the challenges of his or her particular environment.
Critical Periods

• A related theory holds that *learning* itself creates critical periods in a child's brain. That is, the longer a child has been exposed to one type of experience or environment, the less likely he or she will be able to reverse the synaptic learning that has already taken place.
Critical Periods

• Breastfeeding offers a distinct advantage over bottle-feeding when it comes to effective swallowing.
• Although the initial feedings may be brief in duration, success should not be measured by the volume consumed, but by the enjoyment of the baby and mother and the opportunity to practice oral motor skills.
Why Hypotonic Children Need Breastmilk

• I am preaching to the choir
• Decrease morbidity from artificial feedings
• Decreased infections
• Dental malocclusion
• IQ
• Cardiac disease; better growth, higher oxygen sats
Why Hypotonic Children Need Breastmilk

• Many have no problems breastfeeding
• No evidence to suggest they feed better with a bottle
• No evidence to suggest that they need a bottle first
Down Syndrome
Feeding problems in Down Syndrome

• May be associated with low muscle tone, which also affects the strength, mobility and range of motion of the oral muscles and can result in weak sucking, swallowing, lip closure, and tongue protrusion and gastroesophageal reflux.

• Due to a small oral cavity and midfacial hypoplasia, the infant's lips appear thin, the palate is usually flatter with a high arch in the midline and the nasal passages are narrowed.

• The combination of reduced oral space and low muscle tone can result in tongue protrusion.
What the Parents Said

• The participants identified support, advice and guidance as the most important contributions of professionals. They felt strongly about handling infants with Down syndrome as normal babies and providing mothers with choices in order to make decisions regarding feeding options. Specific feeding intervention was required for low muscle tone and positioning of the infant and encouragement of breast feeding. The participants therefore provided a rich source of practical suggestions that should be considered in feeding therapy in infants with Down syndrome.
What the Doctors Said

• As a result of the early feeding problems in infants with Down syndrome, and the emotional responses of parents to the often unexpected diagnosis of Down syndrome early mother-infant attachment may be disrupted and breast feeding is often not possible.
Procedures: Educate

• All mothers should be educated about the benefits of breastmilk for themselves and their infants

• Close follow up for the child
Facilitation and Assessment of Feeding

• Feed as soon as the child is stable
• Skin-to-skin
• Watch a feeding
• Support of the body
Dancer Hand
Facilitate Milk Transfer

- Hand expression
- Empower mother to find what works for her and the baby
- Counsel patience
- Assess, assess, assess
Ooze Enthusiasm

- Use the right growth curves
- Try alternate modes of feeding
- Feed the baby
Preserve Milk Supply

- Pump
- Pump after feedings
- Bountiful supply makes up for less vigorous feeding efforts
Discharge

- Keep track of mom’s supply
- Sucking efficiency improves over time
- Support groups
- Galactologues
Research

- Do some
- Optimizing suck and milk transfer
- Use of “practice” pacifiers
- Autonomic stability
- Weight gain, growth curves
- Evaluations of alternate feeding methods
- Modifiable factors: epidurals, skin-to-skin