

## Apneas, Bradycardias, & Desaturations During Oral Feedings in Growing Premies: Nature vs Nurture

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### Goals & Objectives:

- 1) To learn the significance of laryngeal chemo-receptors and their elicited response,
- 2) To learn the physiology of As, Bs, Ds, during swallowing,
- 3) To demonstrate fluoroscopic evidence of naso-pharyngeal reflux, penetration, aspiration, etc.
- 4) To understand various strategies to prevent As, Bs, Ds during oral feedings.
- 5) To manage infants in private practices for follow-up care.

The American Academy of Pediatrics recommends that preterm infants demonstrate **competent oral feeding** skills before hospital discharge.

(AAP, 1998)

the attainment:

- of exclusive oral feedings
- coordination of suck, swallow and breathe

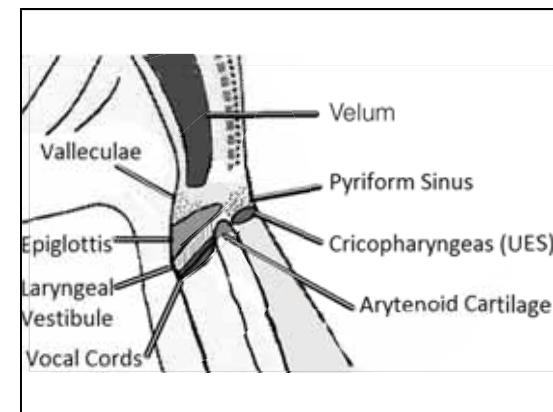
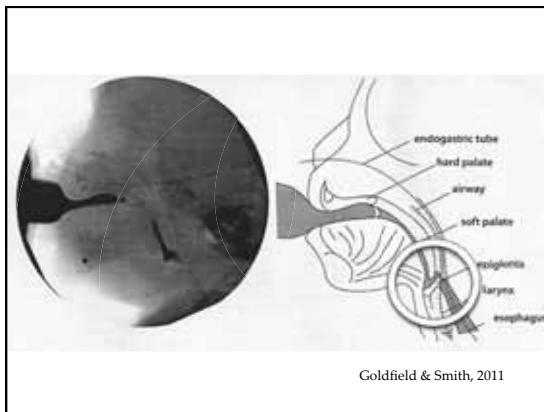
### Nature vs Nurture

#### ◆ Neural Immaturity

- ◆ Primarily reflexive responses
- ◆ Poor physiologic and state regulation
- ◆ Incoordination of suck-swallow-breathe

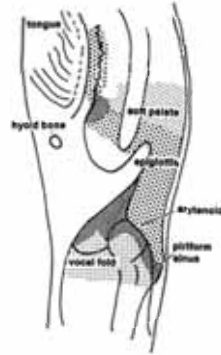
#### ◆ Feeding practices

- ◆ Protocols for feeding readiness
- ◆ Nipple flow rates
- ◆ Feeding position
- ◆ "encouragement" during feedings





**Laryngeal Chemo Receptors**



The most dense area of sensory receptors are within the laryngeal vestibule

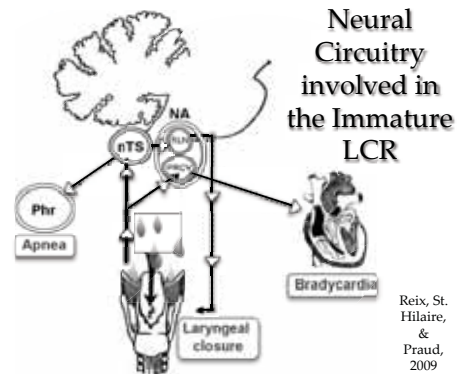
Reix, St. Hilaire, & Praud, 2009

## Laryngeal Chemo-Reflexes

- ◆ In children/adults = cough, swallow and arousal
- ◆ In newborns and preterm infants = exaggerated vagal and sympathetic components
  - ◆ Vagal responses = apnea, bradycardia, laryngospasm } O<sub>2</sub> desaturations
  - ◆ Sympathetic responses = systemic hypertension, blood flow redistribution



**Fetal Protective Reflexes**



Reix, St. Hilaire, & Praud, 2009

## Laryngopharyngeal Reflux (LPR)

(a.k.a. Gastro-eso-pharyngeal reflux, Eso-phago-pharyngeal reflux, Gastro-esophageal-laryngeal reflux, Supra-esophageal reflux, Pharyngo-esophageal reflux, Extra-esophageal reflux)

Both Acidic and Non-Acidic gastric content has identified in the triggering of the LCR.

- ◆ Infrequently = "un-expectedness" of reflux
- ◆ Frequently = possible defective or immature swallowing mechanism.
- ◆ Presence of acute or chronic laryngeal inflammation may heighten laryngeal reactivity

## Naso-Pharyngeal Reflux



## Now What?

### We Intervene:

1) **Bedside Feeding Evaluation:** to assess for “subjective” success with various feeding modifications

- ◆ nipple flow rate = bolus size
- ◆ position – semi upright, upright, side lying, etc.
- ◆ Cue-based feeding

2) **Objective Feeding Evaluation:** to objectively evaluate the extent of swallowing physiology as well as to establish appropriate intervention techniques

- ◆ Modified Barium Swallow Study (MBS)
- ◆ Fiberoptic Endoscopic Evaluation of Swallowing with Sensory Testing (FEEST)

## When to Study

Only after:

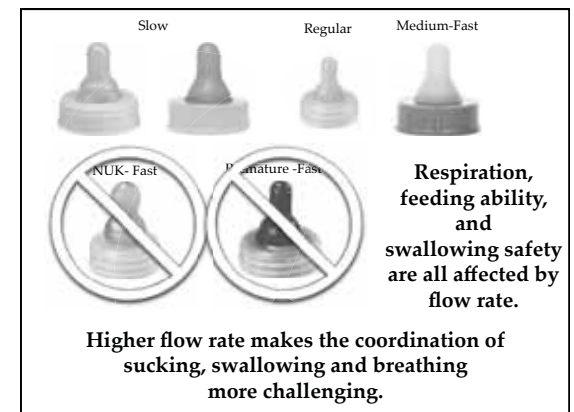
- trying positional changes,
- trying pacing techniques,
- trying different nipple/bottle systems
- allowing for continued maturation of the infant’s feeding development,

VanDahm, et al., 2009, ICAN

with no improvements  
or  
with continued suspicion of aspiration

## Nipple Flow Rate = Bolus Size

- ◆ High-flow nipples increased incidence of feeding related apneas and bradycardia in preterm infants (Matthew, 1991)
- ◆ Deglutition apnea duration increased from 0.5s to 5s with increases in bolus volume (Hiss et al., 2001)
- ◆ Large volume swallows were more inclined to produce an inspiratory post-swallow breath, instead of an expiratory post-swallow breath, which increased the risk of aspiration. (Martin et al., 1994)



## Ultra Preemie Nipple

- 35% slower than their original "premature" nipple
- According to a recent study done by Kelli Jackman (2013)

• Similac Slow Flow	7.1ml/min
• Dr. Brown's Premature	7.3ml/min
• Enfamil Slow Flow	8.8ml/min

Although not tested in this study, the New Ultra-Premie Nipple would flow around 5.2ml/min

Dr. Brown's

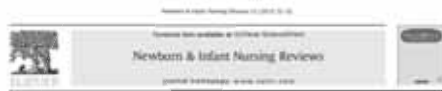
## Side-Lying Position

- ◆ Better oxygen saturations, decreases work of breathing and less HR variability with use of sidelying with premies (Clark, et al., 2007)
- ◆ Better state regulation, better swallowing and better physiologic stability with sidelying (Thoyre, in press)
- ◆ Why? – Less effects of gravity
  - ◆ affords more ease of anterior-posterior rib cage movement
  - ◆ increases lung compliance and decreases airway resistance
  - ◆ Makes it easier to maintain head and trunk alignment
  - ◆ Reduces potential for bolus misdirection
  - ◆ Reduced bolus flow rate due to lower hydro-static pressure
- ☆ Similar to the cross-cradle position for breastfeeding, which is our benchmark for optimal oral feeding experiences



## Cue-Based Feeding

Volume-Driven vs Infant-Driven



Cue-based Co-regulated Feeding in the Neonatal Intensive Care Unit: Supporting Parents in Learning to Feed Their Preterm Infant

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Always keep in mind...

Thickening is NEVER our first intervention.  
Our preferred intervention is identifying feeding modifications to improve swallowing in preemies with dysphagia

Consistency	Rice Cereal : Formula	Dr. Brown's Nipple	Flow Rate
Half-Nectar	1 TBSP : 3oz 1tspn : 30ml	Level 2	regular
		Level 1	slow
Nectar	1TBSP : 2oz 1 tspn : 20ml	Level 3	regular
		Level 2	slow
Honey	1 TBSP : 1oz 1tspn : 10ml	Level 4	regular
		Level 3	slow

Never use the "Y" cut; the bolus is too large.  
Never cut a standard nipple; the bolus is too unpredictable.

## Thickening Liquids

- ◆ National Dysphagia Diet (2002) proposed terms for liquids and correlating viscosity ranges:
  - ◆ Thin 1-50 centiPoise (cP)
  - ◆ Nectar 51-350 cP
  - ◆ Honey 351-1,750 cP
- ◆ The thickening of liquids may :
  - ◆ improve the effectiveness and safety of the swallow, thereby reducing the risk of penetration or aspiration.
  - ◆ improve the child's oral control of the liquid and the coordination of SSB

## After Discharge

- ◆ All thickening recommendations should be continued until a repeat swallow study objectively assesses that child's safety on thin liquids (Weir, 2007, Pediatric Radiology)
- ◆ Talk to the parents and make your own record of their interpretation of the frequency of As,Bs,Ds in the NICU
  - ◆ Ask specific clinical questions to help guide them through any bottle/breast feeding difficulties:
    - ◆ Coughing, choking, nasal congestion, wet vocal quality, throat clear
    - ◆ How long does it take to finish a bottle
    - ◆ Do they fall asleep while bottle feeding
- ◆ If feeding difficulties continue, refer out for a feeding evaluation to establish individualized modifications.

## Take Away Points

- ◆ As, Bs, Ds are linked to Laryngeal Chemo Reflexes
- ◆ They are stimulated by swallowing difficulties and/or GE reflux as well as by improper feeding practices (nature & nurture)
- ◆ Feeding modifications can reduce / eliminate their occurrence
  - ◆ These modifications are easy to teach to nursing staff and to parents
- ◆ When modifications don't work, a swallow study is recommended
- ◆ The Pediatric Dream Team makes the swallow studies most reliable and valid
- ◆ Any recommendations regarding thickening should be continued until a repeat swallow study is performed.



Thank you!

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