Eating in “SINC”: Oral Feeding on CPAP and Beyond

Winnipeg, April 2015

A Quality Improvement Project
Calgary Zone NICUs

Presenter Disclosure

- Stacey Dalgleish, MN, NNP
- Alberta Health Services
- No conflicts
- No potential conflicts of interest
Presentation Objectives

• Describe eating as a developmental task.

• Review relationship between eating and breathing.

• Define “SINC” as a QI construct to safely guide the initiation and advancement of oral feeding.

• Illustrate examples of neonates fed safely using “SINC” strategies.

• Share outcome data from a “SINC” cohort

Calgary Zone

• 1.1 million
• referral area southern Alberta

5 NICUs
• 123 beds
• 650 nurses
• 28 Neonatologists
  …at least that many opinions
Calgary Status 2012

- Developing skill
  - Oral feeding protocol
  - “Reading the feeder”
  - OT support – 1
- Optimal lung
  - Rapidly reducing burden of BPD for families
- No Auditing
- Safety concerns
  - Oral feeding while on CPAP
- Developmental concerns
  - Missing opportunities for feeding skill acquisition

Long term burden of oral aversion
  - No local data

Optimal Lung Practices

- Prolonged CPAP to ensure FRC
- Historical culture to withhold oral feeding on CPAP
  - Advancing technology, increasing knowledge
- Feedback regarding delayed feeders
- Rapid PDSA Cycles (Spring 2012)
  - ? Remove CPAP for feeding practice
  - ? High Flow NP
  - ? Discontinue CPAP at 36 weeks

All unsuccessful: Loss of FRC, no endurance, delayed feeding success
Baby G. 27 weeks in 2012
Feeding pattern 37-39 weeks CGA (99 feeds)

Quality Improvement Question?

- Can we help babies born at ≤32 weeks to breathe and eat?

  1. Physiologic stability
  2. Demonstrate cues of readiness to feed
  3. Require time and/or support for optimal lung development
     ❖ Thousands of new alveoli and neuronal connections being built every day!!
“And” is better than “Or”

- **Breathing**…… optimal lung development

- **AND**

- **Eating**…… food is pleasant and satisfying

  Optimal lung = endurance and capacity to eat

Evidence

- Oral sensory deprivation/overload

- “Skill” acquisition – building neural pathways
  - Immaturity alone alters the typical path to learning feeding skills

- Oral aversion

- CPAP and risk of aspiration

- Variable flow CPAP (fluidic flip)
Too Much OR Too Little

There can be oral sensory deprivation OR overload with learning to eat
- No opportunity to suck or taste
- Forced opportunity to suck or taste
- Overwhelmed by situation

Fragile Feeders

- Premature infants < 32 weeks
- Immature
- Medically fragile
  - Appreciate individual developmental progression and medical co-morbidities
- Volume is not the only goal of feeding
Eating Organization Develops in an Orderly Fashion

- Infant ventilation stops during swallowing
  - Eating may over-ride respiratory chemical control
- Neuronal mapping
  - Clin Perinat, 2011 (Browne and Ross)
- Preterm infants show progression of oral-motor development between 30 and 45 weeks
  - Robust NNS is not predictive of ability to manage fluid
  - Poor sucking pressures, frequencies, duration and efficiency

Eating = Pleasure

- Developmental vulnerability
  - Eating is predictable and pleasurable, without stress
  - Establishing learned experiences
  - Affecting ability and desire to eat

- Eating skill acquisition is best achieved by:
  - Gently offering feeds with frequency
  - Cues for feeding and stopping
  - Caregiver contributing to safety and success

- Nursing Research, 2012, Thoyre.
Early and Frequent Feeding Practice

  - Offered on basis of cardio-respiratory and behavioral responses
    - Sooner to fully orally fed
    - Diminished LOS
Ironic of Breast Feeding

- Breast milk is MOST desired nutrition
- Breast feeding was non-quantifiable
- Bottle feeding was “easier”
- Worries about supplementation
- “Breastfeeding Paradox”
  - LIFT and EPIPAGE cohorts

Long Term consequences

- Feeding difficulties associated with language delay in preterm infants
  - J Peds, 2013 (Adams Chapman et al.)
  - 18-22 month Bayley
  - 1477 preterm infants, < 26 weeks

- < 1 % of preterm infants required supplemental tube feeds at time of NICU discharge.
  - Advances in Neonatal Care, 2007 (Kirkby, et al.)

- 10-80% of parents report problems feeding NICU graduates in the first 24 months
  - J Paeds and Child Health, 2002 (Cerro et al.)
  - Archives of Dis (fetal), 2003 (Wood et al.)
Burden of Oral Aversion

- Oral aversion may present:
  - In NICU
  - At end of reflexive sucking
  - At introduction of solids
    - Babies are not free from this morbidity until 1 year of life

- Burden of oral aversion
  - Non-standardized definition
    - Rates of 10-70%
    - Neurodevelopmental delay, BPD
  - ? standardized definition, referral process, or approach to NICU graduate feeding difficulties

“Sufficient” Eaters vs “Skilled” Eaters

- Poor feeding outcomes increase as gestational age decreases
  - <600 gram neonates followed to 3 years of age
    - 62% had continued eating problems
      - Food as reward, coaxing, food refusal
      - Poor weight gain, vomiting, chronic diarrhea
    - 29% had gastrostomy tubes
  - Sufficient rather than skilled feeders
    - JOGNN, 2007 (Thoyre et al.)
Literature Support

- Wealth of emerging literature
  - Introduction and advancement of oral feeds
  - LOS
- Paucity of research supporting or refuting practice of oral feeding on CPAP

Variable flow CPAP

*Figure 8-5* A photograph of the infant Flow Driver pressure generator without the nasal prongs being attached. This is a variable-flow CPAP device. Dual injector jets are directed toward the nasal prongs after they are attached. (Courtesy Electro Medical Equipment, Ltd., Brighton, England.)
Variable flow CPAP

Figure 8.9 = Schematic representations of the “fluid flip” of the variable-flow CPAP device, the Infant Flow Driver. A. During the child’s inspiration, the Bernoulli effect directs gas flow toward each nostril to maintain a constant pressure. B. During the child’s exhalation, the Coanda effect causes inspiratory flow to “flip” and leave the generation chamber via the expiratory limb. As such, the child does not have to exhale against high inspiratory flow, and work of breathing is decreased compared to continuous-flow CPAP. The residual gas pressure enables stable levels of CPAP to be delivered to the child. (Courtesy Electro Medical Equipment, Ltd., Brighton, England)

CPAP and Canadian Lambs

- NNS and CPAP
- Nutritive sucking and CPAP
  - Esophageal multichannel intraluminal impedance pH monitoring: CPAP +6
  - Measured with impedance for safe swallowing and GER during bottling
  - Multiple studies supported safety of practice
    - Praud and associates
      - Journal of pediatric gastroenterology and nutrition, 2013
Preterm babies can breast feed

- Nyqvist
  - 1999 – early human development
  - 2008 – Acata Paediatr
  - 2013 – J Human Lact
    - From 29 weeks onward

To Remember…..

- No arbitrary feeding schedules or expectations
  - Bottle 1, gavage 2
- Obligate suck as reflex
- Volitional = choice
- Cue based
  - Cues for Engagement and DIS-engagement
    - No coax, prod, encourage, badger etc etc etc
- More breast feeding focus
“Eating in SINC”

- Therapeutic Tasting on CPAP (July 2012)
  - Pilot at FMC
  - Implemented by NNPs for “Fragile Feeders” (still on CPAP at 32 weeks)

- Following principles of the Oral Feeding Protocol…
  - NNS
  - Then small volume feeding progression on CPAP
  - Maximum feeding times and volumes defined
  - Infant must prove skill and endurance before advancing to larger volume or longer time

  - *Zonal confusion when babies transferred from FMC

Safe Individualized Nipple Feeding Competence

- “Feeding in SINC” algorithm – multi-disciplinary collaboration

- Sub-group of Oral Feeding Committee
  - Zonal educational roll out June 2013

- QI project began July 2013
  - Super-users identified
  - Pod talks
  - Site visits
  - Audit tools developed/revised
  - Collaboration with consultants re: follow-up/long-term outcome evaluations
Urban Myths

- “This will delay babies’ discharge”
- “Feeding on CPAP is not safe”
- “If we don’t push them, we will miss the baby’s feeding window”
- “Parents are unhappy with the slow progression”
- “This will take autonomy away from experienced nurses”
- “Babies should be allowed to nipple feed as long as they want to suck – it’s cruel to stop them”

How?

- Baseline audit
- Multi-disciplinary team
- Literature review
- Expert opinion
  - Sherbrooke, Quebec
  - Scandinavia
- Pilot project on the NP team
- Fragile neonates cue for feeding and have opportunity to “taste” at breast or with drops offered during NNS with a pacifier
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Monday, April 13, 2015
9:15 a.m. – 10:00 a.m.

A Case Over Time

The Tale Continues

To 5pm HF
This could go either way….

“I can get this kid to eat…”
It went badly….at 45 weeks, baby transferred to pediatrics.

**Quality Eating**

**Cue Based**
- Feeding is relationship based
- Positive experience
- The baby is learning to feed and skills are emerging
- Learning to eat is a developmental skill focusing on the baby

**Volume Based**
- Feeding is a competitive sport
- Intake is most important
- The baby is a “good feeder” or a “poor feeder”
- Feeding the baby is about who can “get the volume in”
“Competence”? 

- No decompensation:
  - Increased apnea/bradys
  - Need for increased respiratory support
  - *Deterioration often subtle at first

Infant must prove competence

No disengagement:

- LOW tolerance for stopping the feed –
  - “No” means “NO!”

- Feeding experiences must be positive
  - Building neural connections
    - Goal is to hard-wire food + pleasure vs food + discomfort/fear.
  - Infant does not have to prove disengagement
Stage A - K

- A: NNS
- B: Maximum 5% volume
  - Maximum 5 minutes
- B-C: Drops with a soother
- D: Open nipple with drops
- E-K: Closed bottle
- Breast feeding at every stage
  - Max volume and time
  - Notes re endurance, distress
Breastfeeding

- Included at EVERY stage!
  - Hopefully first oral experience
- If cueing, baby can (should) go to breast every time
- Requires conversation/management of pumping
- “Baby should breastfeed at an APPROPRIATELY pumped breast”
- Careful assessment of infant at breast (swallowing, flooding, etc)
  - *If mom reports milk transfer, assume baby took max oral volume for that feeding

SINC Project

- Control population 2012
  - Born ≤ 32 weeks
  - Calgary Oral Feeding Guideline
  - Inconsistent application
- SINC population 2013/2014
  - Born at ≤ 32 weeks defined as fragile feeders
  - Follow the SINC algorithm
  - Volume and time protected
  - Cues for engagement and disengagement
- No change in respiratory management guidelines
Advance or Not?

- Emphasis on *quality* of feedings, not quantity
  - Increased number of (positive) feeding opportunities correlated to earlier full nipple feeding
  - Slow, conservative approach in early stages creates strong basic skills that may allow more rapid advancement later – *opposite is also true*

- Consider feeding and respiratory pattern over past few days

- Negative trend?
  - Return to previous stage until stability is recovered
    - *Smaller increases allow earlier, less dramatic response*

- Physician/NNP orders feeding stage after *multidisciplinary discussion* during daily rounds

“Caution Events”

- Vaccinations
- Eye exam
- Tub bath
- Procedures
- GERD
- Site transfers (prepare the parents!)
- Consider the baby’s planned/ recent “workload” prior to each feeding opportunity
Auditing

1. Compliance with algorithm
2. Gestational age at introduction of oral feeds
3. Gestational age at full oral feeds
4. Gestational age at discharge home
5. Rates of oral aversion
   • Retrospective comparison with 2012 cohort
   • Plus:
     • Safety
     • Impact on other feeding issues
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Case 2

Oral feeds over 11 days

Volume (mLs)

Case 3

Oral feeds over 12 days

Volume (mLs)
A Better Way…
Making Progress

40 weeks, baby discharged home, fully orally fed, on room air
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Baby S. 24 weeks in 2013

Baby H (25 weeks)

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Making Progress: Baby H

36-37 weeks

38-39 weeks

40 weeks, Fully Orally Fed
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Baby T. 29 1/7 weeks

32 wks: RA

33 wks: 2 lpm, 0.21

34 wks: 2 lpm, 0.21

35 wks: 1 lpm, 0.21

36 wks: RA Demand feeds

Baby B. 24 5/7 weeks

CPAP +7, 0.27

CPAP +7, 0.25

CPAP +4, 0.21* RA

CPAP +7, 0.29

CPAP +6, 0.21

CPAP +4, 0.21

RA
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A closer look…Baby B.

32-33 weeks

34-35 weeks

Baby B. cont

36-37 weeks

38-39 weeks

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Baby B. cont

40-41 weeks

42-43 weeks

Baby B. Home at 45 4/7 weeks, demand feeds

44-45 weeks
### Case Study: Baby S  Born 30/6  1800g

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### Baby S cont.

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### Events: Vacc, ROP, Proc, Other

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- G=60% = 1.6 mL
- G=60% = 3.1 mL
- G=60% = 1.6 mL
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- G=60% = 3.1 mL
Baby S – to discharge

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Discharged 36 2/7, RA, EBM/SimAdv

SINC Project Results

- Discharged on gavage
- Discharged on home oxygen
- LOS
- Time of first feeding
- Time of first breast feeding
- Amount of breast feeding at discharge
Gestation at First Breastfeed

Gestation at First Oral Feed
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73

Infants Discharged Home with Feeds per Gavage

74

Calgary Zone Home O2
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Median Age to Discharge
Open Lung 2012 vs Open Lung + SINC 2013

No Safety Concerns to Date

- Babies stay on CPAP to allow optimal lung development
- Babies SAFELY cue for small volumes until consistently capable and then advance slowly
- Breastfeeding is the preferable mode for all oral feeding experiences
- Parents become more engaged with infant feeding, and have reported self-confidence with feeding
- As with all QI projects, close auditing for safety, efficacy and unintended consequences
Next Steps

- Follow to 1 year for feeding difficulties
- Physiologic studies underway
  - Stability during all modes of careful eating

Conclusions

- Early eating while on CPAP is safe
  - With protocolized co-regulated techniques and strategies
- SINC provided a standardized feed advancement
  - Calgary zone NICUs
  - Fragile feeders
- Long term follow up will provide further information about outcomes
The Team

- Stacey Dalgleish
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- Linda Kostecky
- Noreen Blachly
  - Jammey Kerik, Susan Charron, Marj Bickell (FMC)
  - Jeanne Scotland, Ann Smith (RGH)
  - Dallas Baumler, Kyla Lavery (SHC)
  - Kirenza Holland, Darlene MacDonald (PLC)
  - Deborah Clark (Neo Lead)
- Super User RNs, Nursing Admin (all sites)