# Creating Feeding Guidelines

PQCNC Initiative: Increasing Use of Mother's Milk for the Very Low Birthweight Babies in the Critical Care Centers of North Carolina

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# Suggestions to provide optimal nutritional support for the VLBW infants

- Work with a multidisciplinary team
- Adapt feeding guidelines that address parenteral and enteral needs
- Create a system to monitor nutritional systems and outcomes
- Reevaluate and upgrade systems and guidelines on a regular basis

# Goals of nutritional support for the preterm infant

- Optimize short-term outcomes
- Optimize short-term growth
- Prevent feeding-related morbidities
  - NEC
  - Central line complications, including sepsis
  - Osteopenia of prematurity
- Optimize long-term outcomes

# Goals of nutritional support for the preterm infant: most are met with use of MBM

- ✓ Optimize short-term outcomes
- Optimize short-term growth (*can be done if milk is fortified)*
- ✓ Prevent feeding-related morbidities
  - ✓ NEC
  - ✓ Central line complications, including sepsis
  - Osteopenia of prematurity (*can be prevented with fortification)*
- ✓ Optimize long-term outcomes

# MBM for the preterm infant

- Optimizes short term outcomes
  - Decreased infections (sepsis/meningitis, UTI's)
  - Less NEC
- Can help prevent feeding-related morbidities
  - Improved feeding tolerance, leading to less time with central lines, and less need for hyperalimentation
  - Less NEC

# Breastmilk also improves long-term outcomes

- Decreased mortality (less infection, SIDS)
- Less need for rehospitalization (mostly due to decreased respiratory-related illnesses)
- Improved long-term outcomes (higher IQ, less obesity/hypertension); decreased impact of NEC on neurological outcomes

# PQCNC Initiative: Recognition of the vital importance of MBM

- We've addressed communication with families, how to obtain milk, and how to achieve ongoing supply
- We've begun to address the central role kangaroo (skin-to-skin care) should play in optimizing milk production, in mother-infant bonding *(and this will receive further attention in the April webinar);* however, of note, there is also a growing understanding of the importance STS care plays in improving brain development for these babies
- But today we are discussing feeding guidelines. Human milk is ideally used within specifically-developed feeding guidelines because most of these VLBW babies receive a combination of parenteral and enteral nutrition, and most are gavage-fed, so caregivers are tightly regulating their nutrition.

# Feeding protocols improve feeding practices, safety and consistency

from VO "Got Milk" group: Kuzma-O'Reilly, Potentially Better Practices in Neo Int Care Nutrition, *Peds 2003*

| **Feeding practice** | **Baseline** | **Implementation** |
|---|---|---|
| Use of HM as first feed | 47% | 62% |
| Day feeds started | 9 | 5 |
| Day to reach 120 kcal/kg/d from enteral feeds | 39 +/-26 | 28 +/- 15 |
| Rates of NEC (3 institutions) | 16%/6%/5% | 6%/4%/6% |

*And* significantly less growth failure at discharge; also decreased avg length of stay for the larger babies

# Feeding guidelines reduce NEC : results of a meta-analysis

- 6 studies summarized in 2005 article noted the impact of standardized feeding protocols on NEC rates in LBW or VLBW infants in 6 different units; total of ~4000 babies pre-protocols and nearly 5000 post-protocols
- meta-analysis showed reduction of NEC from 4.6% to 2.2%, or a relative risk reduction of 87%

*From* Patole. Impact of standardised feeding regimens on incidence of NEC: a systematic review and meta-analysis of observational studies. *Arch Dis Child Fetal Neo Ed 2005;90:F147-F151*

# Specifics of feeding guidelines included in Patole's article

- All infants were fed by intermittent bolus feeds, and most were started in first week of life (though specific day of life differed)
- The units also made different decisions re:
  - use of trophic feeds (2/6 used, for 3-6 days)
  - advancement (4/6 units used 10-20 ml/kg/d, one "no more than 24 ml/kg/d", one "max <30ml/kg/d," although most feeding volumes in that study were advanced <24)
  - reasons to withhold feeds

* *But overall, the "nonaggressive" approach to feeds seems the key*

(From Patole. Impact of standardised feeding regimens on incidence of NEC: a systematic review and meta-analysis of observational studies. *Arch Dis Child Fetal Neo Ed* 2005;90:F147-F151)

# There are multiple questions to address in creating feeding protocols: issues for today's talk

- What to feed?
- When to start?
- How much to start?
- How to feed (og vs ng vs transpyloric), bolus vs continuous vs something in between?
- Whether or not to use trophic feeds?
- How to advance?

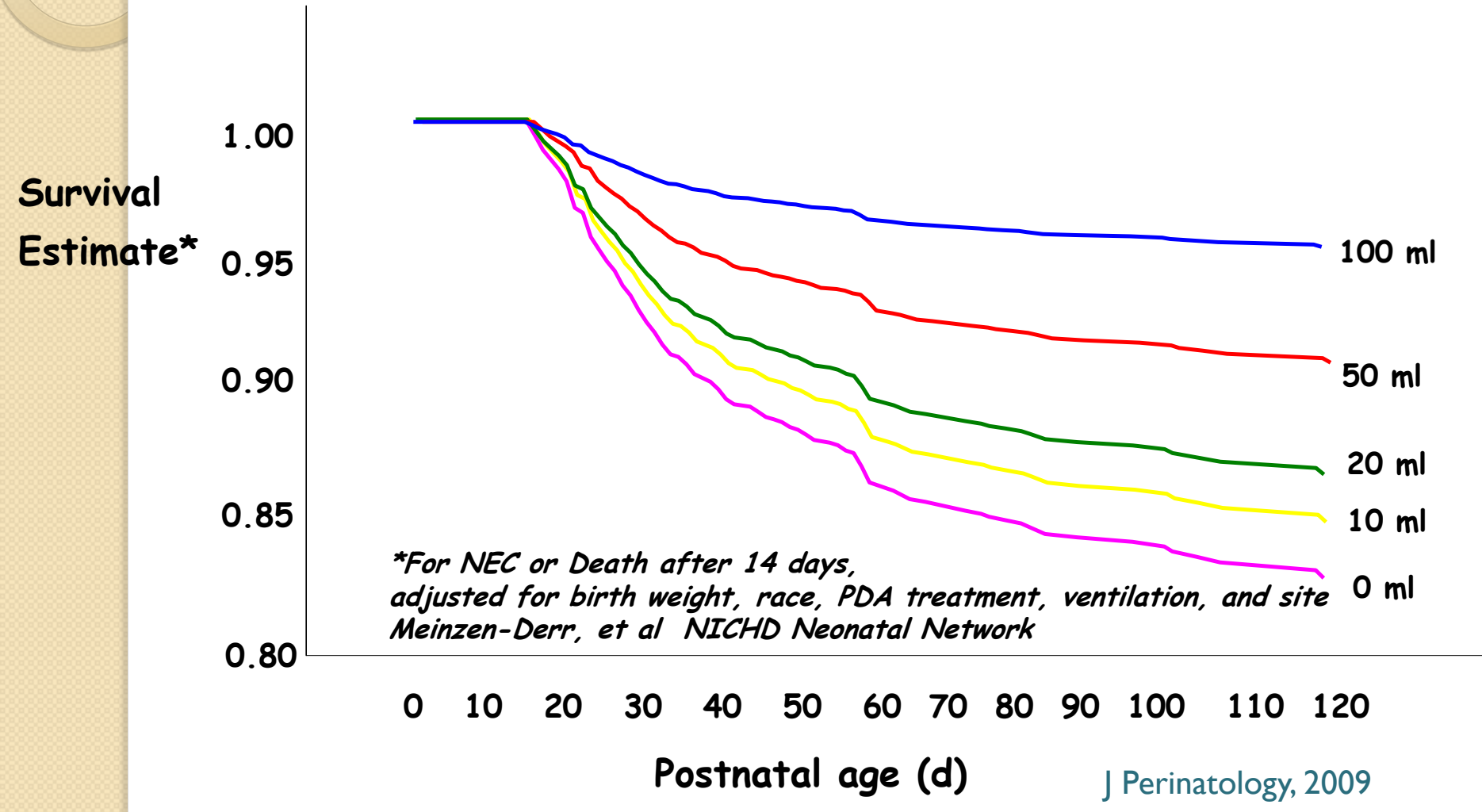
# What to feed?

- MBM, especially colostrum, is first choice
  - Few contraindications:  include certain infectious diseases (HIV, TB, mono if infant is preterm), certain drugs (illicit, cytotoxic drugs)
- DBM is reasonable second choice
  - If screened pasteurized milk is available
  - Only after parental consent obtained

# Mother's milk is especially suited for her baby

- In addition to nutrition, provides enzymes, hormones, growth factors, anti-oxidants, anti-inflammatory factors and other bioactive factors, with new components and interactions being discovered regularly
- Species-specific components
- Dose-specific impact: the more MBM rec'd the better the outcome, both short-term (less NEC and death) and long-term (better development and less rehospitalizations)

# "Survival curves" for NEC or death in ELBW's by cumulative amount of MBM (ml/kg) in first 14 days of life




J Perinatology, 2009

# Special properties of colostrum from mothers with preterm infants

- Increased levels of IgA, IgG and IgM, as well as a variety of cells (the more preterm the infant is, the higher the levels)
- Also contains large amounts of lactoferrin and other immunomodulators
- Increased levels of protein compared to later milk, and to mothers with term infants
- Oropharyngeal administration of small amounts of colostrum allows contact with mucosa/lymphoid tissue, and appears to be safe

Data from Rodriguez, *Jnl of Perinatology*, 2009 and Rodriguez , *Adv in Neonatal Care*, 2010

# If using colostrum…

- Use of colostrum is highly recommended
- O.2 ml every 2 hrs in cheek of even the sickest babies is safe
- Use of colostrum sends early powerful signal to mother of the importance of her milk
- May consider a flexible order [eg "may feed colostrum up to *x* (*if x= 10 ml/kg/d, divided into 8 feeds)* ml q 3hrs in cheek or via og/ng if available", and feed above total fluids] to insure that the first feeds will be MBM

# May consider using pasteurized donor milk until mom's milk is available

- Species specificity maintained
- Composition:  pasteurizing does not decrease nutritional value
- Benefits for preterm infants;  less NEC, improved feeding tolerance, improved long-term cardiovascular health
- Safe source of human milk with respect to potential infectious diseases
- Of note:  adopting strategies to decrease potential of suboptimal growth is important consideration, just as it is with mother's milk

# Donor Milk Decreases Risk of Necrotizing Enterocolitis

| | DM | Formula |
|---|---|---|
| Gross 1983 | 1/42 | 3/29 |
| Cooper 1984 | 1/24 | 3/15 |
| Lucas 1990 | 1/87 | 4/80 |
| Schanler 2005 | 5/78 (6%) | 10/88 (11%) |
| Overall * | 8/231 (4%) | 20/212 (9%) |

*Risk of NEC is reduced significantly with donor milk, 0.35 (0.15-0.81)

Morales and Schanler,
*Seminars in Perinatology 2007*

# When to start feeds?

- First week of life, preferably day 1-2, is promoted by multiple experts
- May feed on ventilator, on CPAP and with umbilical lines in place
- Several studies have shown that delaying feeds does not decrease the incidence of NEC
- Davey (*J Peds 1994*) showed the safety of feeding with umbilical lines in place, and if infants were fed earlier (2d vs 5), they had less sepsis and fewer central lines, without an increase in NEC
- A retrospective Israeli review by Flidel-Rimon (*Arch Dis Child FNE 2004*) looked at sepsis in <1500 gm babies found that those who developed sepsis were fed later than those who did not (4.8d vs 2.8) again, without a difference in NEC

# Reasons to hold or delay feeds

- Contraindications to feeding include:
  - specific GI anomalies (eg, gastroschisis, omphalocele, tracheoesophageal fistula or significant abdominal distention)
  - in first few days following significant hypoxic ischemic injury
- Relative contraindications include:
  - significant cardiovascular instability (eg significant cyanotic episodes, or low blood pressure requiring pressors)
  - transfusions of blood or blood products (platelets, immunoglobulin)
  - Presence of a patent ductus arteriosus, or medical prophylaxis or treatment of the PDA with non-steroidal anti-inflammatory medications (indomethacin, ibuprofen)
  - (?delay feeds or slow feeds for IUGR/SGA infants)

# How much to start?

- Most advocate small volume feeds, on order of 10-20 ml/kg/d for the VLBW infant
- If using MBM only, would be limited by amount of colostrum produced

# How to feed?

- Og/ng bolus feeds is usual recommendation (very few of these babies will be ready to po feed)
- Feeding frequency may vary, from twice a day to 12 times a day (q 12 hrs to q 2 hrs)
- If feeds are not going well, may increase interval between feeds, prolong the infusion time, or decrease volume; rarely are transpyloric feeds necessary or desirable

# Possible role for continuous feeds?

- In babies with respiratory compromise, may find less impact on pulmonary mechanics with continuous feeds
- But weight gain not as robust with continuous feeds (less physiologic, decreased fat delivery)
- However, of interest, Pietz (*Peds 2007*) described their 20 yr experience with late-onset "slow drip" feeds in over 1000 babies in Cleveland, and had an incredibly low rate of NEC of 0.4% (but if fed off protocol, or were given steroids or indomethacin, rate was 6%); about half of these babies were formula-fed. But feeds were not started until 8-11 days in the smallest babies, and achieving full feeds took up to 6 wks in those infants.

# Trophic feeds or not? A bit of background

- Also known as minimal enteral feeding, or "gut priming" or "non-nutritive feeding"; generally defined in premature infants as <25 ml/kg/d, and not advancing beyond that volume for several days
- Began as a practice in the 1980's to feed babies on vents and with lines in; trophic feeds were found to be a safe way to enterally feed babies who ordinarily would not have been fed for weeks or months
- Benefits include decreasing mucosal atrophy, and in stimulating certain gut hormones
- Compared to no feedings, early studies showed that trophic feeds allowed decreased time to full feeds, less osteopenia and less cholestasis, without an increase in NEC

Tyson, Trophic feedings for parenterally fed infants. *Cochrane Database 2005*

# Trophic feeds or not in 2011? It's complicated

- Berseth ( *Peds, 2003*) did only true RCT to date of trophic feeds vs advancing feeds: she found marked reduction in incidence of NEC in babies whose feeds remained at the trophic level for 10 days before advancing feeds, compared to the babies in whom feeds were advanced at 20 ml/kg/d as a routine, without trophic feeds; however, feeds were not started on most babies until after the first week of life, and most babies were fed formula, and it was a relatively small study
- A more recent article from Australia (Henderson, *Arch Dis Child FN Ed 2009*) provided a case control comparison for 53 NEC cases found among 10 neonatal units; they found that babies with NEC were more likely to have received formula, and had a shorter time on trophic feeds (3 days vs 6) and a faster time to full feeds (9 d vs 14)
- A 2009 Cochrane Database review of early trophic feeds (Bombell and McGuire) states that that their current metaanalysis provided no positive evidence of effect of trophic feeds on feeding tolerance or growth rates, and correctly points out that long-term outcome data is badly needed. However there was not an increase in NEC rates. They conclude that the "data were felt to be insufficient to inform clinical practice".

# Trophic feeds create tension

- May prolong time on TPN
- May reduce dose of MBM received, and if MBM supply exceeds amount prescribed, is this a good practice?

- How to resolve? Very difficult
- Tyson and Kennedy (*Seminars in Perinatology, 2007*) suggest that >3000 babies would be needed to have a large enough power to resolve issues of impact of certain nutritional practices on outcomes such as "death or impairment", and >8000 to resolve issues of "death or NEC"
- Could a "graduated" trophic feeding regimen be a reasonable alternative? (eg the more mature babies would have shorter times on trophic feeds, compared to the younger ones); again perhaps reasonable, but with no data
- using trophic feeds in situations in which babies would ordinarily not be fed, (eg low-level pressors, use of indomethacin, or in which aspirates are persistent) may be reasonable

# How to advance?

- Older studies showed larger volume advancements (>50 ml/kg/d) could be associated with NEC, while the babies who did not get NEC were fed at no more than ~25 ml/kg/d
- Many studies show that conservative feeding advancements (10-20 ml/kg/d) are generally safe and associated with less NEC than faster advancements
- Newer smaller studies show advances up to 35 ml/kg/d may be okay (though very few ELBW infants were included in these studies); but, again, to have study of significant strength, would need hundreds or thousands of babies studied
- A safe recommendation would be 10-20 ml/kg/d; and to try to avoid practices such as faster advancements because "IV came out, so advanced faster"

## Ronnestad. Late-onset septicemia in a Norwegian cohort of extremely premature infants receiving very early full human milk feeding. *Peds 2005, 115, e269-276.*

- A look at infants born in 1999-2000, in 21 Norwegian units, with GA<28 wks or BW <1000gms; each unit has own milk bank
- All received MBM or DBM (at full feeds of 170-180 ml/kg/d, 92% rec'd MBM, 6% DBM and 2% formula); 60% began feeds on d#1, 96% by d#3; 70% achieved full feeds within wk#2, 89% within wk#3
- Different units used different advancement protocols (0.5-1 ml q 6-8 hrs was mentioned), and they may have fed with bolus feeds or continuous; overall NEC rate was 4%
- 22% of cohort developed sepsis: infants who became septic were sicker and smaller babies in general, and had UVC's in for longer period (7d vs 1)
- *But direct relationship was found between time of establishment of full feeds and incidence of late-onset sepsis: within wks 1-2, 9-11%, wk 3-4, 37-40%*

# In sum

- Recommendations often from "expert opinion", strong data still needed for many feeding-related issues
- MBM first choice for feeding; using colostrum if possible seems ideal
- Consider donor milk if there are insufficient quantities of MBM
- Start feeds in first day or two, with small volume (10-20 ml/kg/d)
- Consider using trophic feeds, perhaps for shorter period than 10 days
- Aim for feeding advancement of 10-20 ml/kg/d, aim to get to full feeds by ~2-3 wks of life

# PQCNC Shares Guidelines

- Some groups have graciously shared their feeding guidelines, posted on the PQCNC website

# Summary of Shared Feeding Guidelines for VLBW Infants in NC

| | Unit A | B | C | D |
|---|---|---|---|---|
| What to start | MBM or DBM or 24 cal PT formula | Human milk preferred (colostrum for early feeds) | MBM or DBM or 20 cal PT formula | MBM or DBM (fresh colostrum encouraged) |
| When to start | Within 24-48 hrs in stable infants | Within 24-48 hrs in stable infants | n/a | 1-4 d |
| Start volume | 10-20 ml/kg/d | 5-20 ml/kg/d | 5-10 ml/kg/d | 10-20 ml/kg/d |
| Trophic feeds | In specific circumstances | 1-5 d | 2-5 d | 2-8 d |
| Advancement | 10-20 ml/kg/d (more slowly in SGA infants) | 10-20 ml/kg/d | 10-15 ml/kg/d | 20 ml/kg/d |

# Other feeding issues that will be addressed in upcoming session

- Role of early protein/TPN?
- When to fortify?
- How to fortify?
- How to address poor weight gain?

- *However, we do not currently plan to discuss other issues such as how to deal with aspirates, potential for CMV infection, potential roles of prebiotics &/or postbiotics, decreasing overall use of antibiotics early in life, how to transition to breastfeeding/po feeding….but would like to know which of these, or other topics, would be of interest if we have time in the future*

# Thanks

# References


- CPQCC nutritional toolkit
- Cochrane Database of systematic reviews
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