



Feeding Guidelines

for NICU Patients

OVERVIEW

Feeding infants in the neonatal intensive care unit (NICU) is a complex and important part of a baby's care, growth, and overall health. There are many factors to consider when feeding infants, particularly those born prematurely. These infants are at a high risk for morbidity and mortality related to feeding problems, but they can also benefit greatly from a successful feeding regimen. Issues to consider include: what to feed, when to feed, and how to advance feeds. Given that we observe institutional differences in resource utilization, in part due to variation of feeding practices, a large

goal of this guideline is to attempt to reduce some of the variation and promote optimal care.

HUMAN MILK FEEDING

Human milk, with its unique and non-reproducible mixture of enzymes, hormones, and immunological and anti-inflammatory properties, is the gold standard for neonatal nutrition, particularly for premature and sick newborns. Reductions in rates of necrotizing enterocolitis (NEC), sepsis, and retinopathy of prematurity (ROP) are associated with consumption of human milk.¹



With increasing volume of human milk feeds, decreased rates of late-onset sepsis, pneumonia and asthma are demonstrated.²

Health care costs decrease proportionally to volume increases in human milk feeds. For example, feeding at least 50 mL/kg/day of maternal breast milk reduced hospital costs amongst VLBW (very low birth weight) infants an average of \$31,514. Feeding human milk also results in a decrease in both short and long-term health care costs.³

PARENTERAL SUPPLEMENTATION

Parenteral nutrition (PN) is needed to provide nutrients until feeds are close to a volume of 100 ml/kg/day. If blood glucose concentration is stable at this volume of enteral feeds, then PN may be discontinued.

DONOR MILK

The American Academy of Pediatrics Guideline⁴ recommends that when the mother's own breast milk is unavailable, donor breast milk should be used for high-risk infants; particularly for infants with birth weights less than 1,500 grams or who have severe intestinal disorders, such as abdominal wall defects.

Pasteurized donor milk is safe when obtained from the Human Milk Banking Association of North America (HMBANA) human milk banks, which do extensive screening, storing and pasteurization. There are negligible risks of infectious contaminants, including HIV or hepatitis.⁴ There is evidence that donor milk improves feeding absorption and tolerance, and reduces rates of NEC.

The cost of donor milk is estimated at \$3-\$5 per ounce, but its use in an appropriate population of infants should not be limited by the family's ability to pay. Some health plans and state Medicaid programs cover the cost of donor breast milk, but their coverage policies should be consulted to determine whether there is a benefit available.

It has been estimated that for every \$1 spent on donor milk, \$11 to \$37 in NICU costs could be saved due to a reduced length of stay.⁴

STANDARDIZED FEEDING PROTOCOLS

Implementing a standardized feeding regimen in the NICU is protective against NEC, while also optimizing growth velocity in a premature infant.

Feeding guidelines should address:

1. Starting trophic feeds
2. Advancing feeds
3. Fortifying feeds
4. Initiating oral feeding

STARTING TROPHIC FEEDS

Early enteral feedings are crucial to delivering optimal nutrition. Should enteral feeds be delayed for more than 24 hours, there is a risk of intestinal

villous atrophy, a delay in the time needed to reach full feeding volume, and an increase of exposure to parenteral nutrition (PN).⁵

Enteral feed volume of 5-20 mL/kg/day is recommended as a starting point; a feeding advance of 20 mL/kg/day can then be initiated, though there is evidence that a quicker feeding advance can also be used safely. Trophic feedings can be safely started with an umbilical artery catheter in place.⁶

Slower feeding advances in infants who are growth restricted, have intestinal injury, or who are extremely premature may be warranted.

Advantages of trophic feedings include: decreased rates of cholestatic jaundice, metabolic bone disease of prematurity, length of time to reach full enteral feedings, feeding intolerance, and extrauterine growth failure.⁷

ADVANCING FEEDS

Neonatologists have reported feeding protocols with several common threads:

- Start feeds at 5-20 mL/kg/day for trophic feeds.
- Feedings advance at around 20 mL/kg/day when the infant is tolerating trophic feeds well.
- Slower feed advance in infants who are IUGR, have hypotension, or who are more premature (such as less than 28 weeks gestation).
- The goal is to advance feeds to 140-160 mL/kg/day.
- Fortification of feeds (see the following section) to 24 kcal/ounce or more, if needed.
- Timing of fortification can vary from starting feeds at 24 kcal/ounce, to first reaching full feed volume and then adding fortification.

FEEDING FORTIFICATION

Fortification of breast milk with human milk fortifier, or increasing the caloric density of preterm formulas, can provide benefits in terms of improved



growth and bone density. Fortification typically results in 22 kcal/oz to 30 kcal/oz. The caloric density is adjusted, depending upon infant's gestational age at birth, birth weight, metabolic needs and growth. An infant's weight should be monitored daily, with weight gain expected to be at least 15 gm/kg/day ideally. The timing of adding fortification can occur at any point during the feed advance.

Protein supplementation is also important; for each gram of additional protein, there is an increase of 6.5 g/day of body weight and 0.4 cm/week of head circumference.

INITIATING ORAL FEEDING

Preterm infants often start receiving enteral nutrition via a feeding tube. As they mature, oral feeds are gradually introduced. Oral feeding is not typically initiated in preterm infants before 32 weeks post menstrual age (PMA), as coordination of sucking, swallowing, and breathing is not typically present in newborns before this age. Early interventions, such as the recognition of feeding cues, paced feeding and postural support to improve oral intake can significantly impact outcomes.⁹ Oral skills and readiness should be assessed throughout the NICU course.¹⁰

CONCLUSION

In working with NICUs nationwide, the following list represents what we have found to be the most widely adopted best practices.

- Develop, or implement from existing sources, a feeding protocol which is agreed upon and followed by the NICU staff.
- Utilize human breast milk whenever possible, from the infant's mother, or from donor sources.



- Advance and fortify feeds appropriately to optimize nutrition and growth.
- Assess for oral feeding readiness and initiate and encourage oromotor development to progress the infant towards discharge.

When the NICU team focuses on a standard approach and practice for feeding initiation and advancement, this leads to less variation in outcomes, earlier discharge and ultimately lower resource utilization and costs.

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