Progeny HEALTH®

Feeding Best Practices

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 asuccessful feeding regimen. Issues to consider include what to feed, when to feed, and how to advance feeds.

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 (Parker 2021, Strobel 2022).

Decreased rates of late-onset sepsis, pneumonia and asthma are demonstrated with increasing volume of human milk feeds. (Patel 2013). Feeding human milk also results in a decrease in both short and long-term health care costs (Johnson 2014). Colostrum should be used by swabbing the oropharyngeal mucosa every few hours prior to initiating oral feeds due to the immune benefits and early initiation of maternal pumping (Kalanetra 2015, Lee 2015). The American Academy of Pediatrics recommends exclusive breast milk for an infant's first six months of life (Meek 2022).

Racial and ethnic disparities in breastfeeding rates remain a concern. Asian mothers have almost a 17% higher rate of breast feeding compared to Black mothers. Public health measures should be aimed at targeting these groups to improve infant nutrition and outcomes (Chiang 2021).

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Donor Milk

The American Academy of Pediatrics Guideline 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 (AAP 2016).

There is evidence that donor milk improves feeding absorption and tolerance and reduces rates of NEC. The use of donor milk can be cost prohibitive for hospitals and families, but its use in an appropriate population of infants should not be limited by the family's ability to pay. The benefits can lead to a reduced length of stay which ultimately is a cost savings (AAP 2016).

Parenteral Supplementation

Parenteral nutrition (PN) is needed to provide nutrients until a newborn can tolerate enteral feeds. Studies have shown that early initiation of amino acids and lipids improve growth and outcomes. (Adamkin 2013, Vlaardingerbroek 2013)

As enteral feeds are increased, parenteral nutrition is simultaneously weaned. When feeds approach a volume of approximately 100 ml/kg/day, parenteral nutrition can be discontinued if blood glucose levels remain stable. (Fernandes 2019-2020).

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Standardized Feeding Protocols

Implementing a standardized feeding regimen in the NICU is protective against NEC, while also optimizing growth velocity in a premature infant (Fathi 2021). Feeding guidelines should address:

1. Starting trophic feeds
2. Advancing feeds
3. Fortifying feeds
4. Initiating oral feeding
5. Determine and transition to home feeding plan
6. Include kangaroo care

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 (Sallakh-Niknezhad 2012). Initiation of feeding within 72 hours after birth likely reduces the risk of mortality and length of hospital stay (Chitale 2022). 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 (Johnson 2015). 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 (Iowa 2011).

Advancing Feeds

Appropriate advancement of feeds is approximately 20 mL/kg/day when the infant is tolerating trophic feeds well. Slower feeding advances in infants who are IUGR, have hypotension, have intestinal injury, or who are more premature (such as less than 28 weeks gestation) can be considered. 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, is done to ensure adequate calories, vitamins, and minerals in premature infants. Achieving enteral feeds faster results in earlier discontinuation of central venous lines and parenteral nutrition which can reduce catheter related infections (Zingg 2012).

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 the range of 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 trajectory. An infant's weight should be monitored daily, with weight gain expected to be at least 15 grams per day ideally beyond the first week of life. The timing of adding fortification can occur at any point during the feed advance (AAP 2004). Consider liquid over powder fortification due to the concerns for potential contamination leading to infection (Haston 2023).

Feeding Tolerance

Preterm infants can have issues tolerating enteral feeds which can present with abdominal distension, bilious output, emesis, change in stool pattern including bloody stools, and gastric residuals. These clinical symptoms can be early indicators of necrotizing enterocolitis (NEC). Gastric residuals have historically been used to indirectly measure gastric emptying.

Routine measurement of gastric residuals is no longer recommended as it is not useful in guiding advancement of feeds and has not been shown to indicate a risk of NEC. When these symptoms are present in a feeding premature infant, an evaluation including physical examination, laboratory tests, and abdominal radiograph may be warranted. If the clinical picture is concerning, feeds may be held or slowed with serial reassessment on when feeds can be restarted (Parker 2019).

Probiotics

Probiotics and their precursor, prebiotics, are live microorganisms that are beneficial to a healthy intestinal tract. Studies have shown a benefit in preventing NEC, however due to lack of clear evidence on a standard regimen and effectiveness in premature babies, their routine use is not recommended, which is consistent with the 2021 clinical report by the American Academy of Pediatrics. In addition, if they are ordered, an informed consent form should be considered to discuss possible risks and benefits with parents (Morgan 2020, Sharif 2020, Chi 2021, Poindexter 2021).

Initiating Oral Feeding

Preterm infants born before 34 weeks often start receiving enteral nutrition via a feeding tube. As they mature, oral feeds are gradually introduced when infants show signs of oral readiness, which typically occurs at 32 – 34 weeks post menstrual age (PMA). Coordination of sucking, swallowing, and breathing is not typically present in newborns before this age. Approaches that are infant-driven and cue-based are becoming the standard way to initiate oral feeds.

Early interventions, such as the recognition of feeding cues, paced feeding and postural support to improve oral intake can significantly impact outcomes (Shaker 2013). Oral skills and readiness should be assessed throughout the NICU course (Jadcheria 2015). Tubbs-Cooley, 2015 looked at feeding schedules and estimated that missed oral feeding opportunities could have contributed up to $57,120 in excess costs per infant due to extended length of stay.

Feeding difficulties

Some infants are not able to take full volumes by mouth. The etiologies are broad and include anatomic anomalies (cleft lip and palate), functional abnormalities (dysmotility, gastroesophageal reflux), neurologic causes (cerebral palsy, hypoxic brain injury), and prematurity. A videofluoroscopic swallow study (VFSS), also known as a modified barium swallow study (MBS) may be necessary to evaluate the cause of feeding difficulty. In addition, a speech or occupational therapist can be helpful in the evaluation (Hoogewerf 2017).

Premature infants have a natural passage of gastric contents into the esophagus due to the immaturity of the lower esophageal sphincter. This passage of contents is called gastroesophageal reflux (GER) and improves with maturity. Gastroesophageal reflux disease (GERD) is reflux that causes morbidity. Anti-reflux medications (i.e., antacids, prokinetic agents, proton-pump inhibitors) are not recommended in the neonate due to ineffectiveness and potential treatment complications of affecting the gastrointestinal tract adversely (Smith 2016, Omari 2002, Eichenwald 2018).

Discharge planning

Planning for discharge of a premature infant ideally starts on the day of birth. Many premature infants will require fortification of feeds at the time of discharge both to provide sufficient calories and to provide necessary vitamins and minerals. Discharge feeds are typically fortified to 22 kcal/oz. In certain situations, feeds can be fortified up to 30 kcal/oz depending on metabolic needs (for example, congenital cardiac disease). Some infants are not able to feed their entire volumes by mouth and need to be discharged with either gavage feeds or need a surgically placed gastrostomy tube (G-tube).

These possibilities should be discussed with parents well before the need for surgery occurs, so that they are able to process and make an informed decision. In addition, a DME company should be chosen and arranged early enough so that discharge is not delayed (Ronald 2004). Typically, infants who meet all physiologically necessary discharge criteria, can be discharged home 1-2 days after last gavage feed. When planning for discharge home, it is important to ensure that the feeding plan is established several days prior to discharge so that discharge is not delayed due to transition to the home feeding regimen.

Conclusion

Key take away points to a feeding plan include:

- 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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