Nutritional management of preterm newborn after hospital discharge: energy and nutrients

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Abstract

Preterm infants are at risk for poor growth while in the Neonatal Intensive Care Unit (NICU) and after discharge from the NICU. The main objective is to reach the body composition and rate of growth of a normal fetus/infant of the same post-menstrual age during the first entire year of life. In case of human milk, the limited data do not provide convincing evidence that feeding preterm infants after discharge with multi-nutrient fortified human milk, compared with unfortified, affects important outcomes including growth rates during infancy. Conversely, if formula-fed, post discharge formulas produce short term advantages in growth rate but no long term advantages are demonstrated. It is very important to establish a feeding plan and a follow up for all preterm babies who are discharged from NICU in order to recognize as soon as possible any growth deficit.

Introduction

Preterm infants are at risk for poor growth while in NICU and after discharge from the NICU. They must be closely monitored and may require interventions to promote better growth. Early infancy is a period of substantial cellular hyperplasia and hypertrophy and growth abnormalities can have permanent serious effects. Abnormalities in growth during this period may persist into adulthood, especially in patients who were preterm infants.[1] Numerous studies underline the importance of adequate feeding of preterm infants for their short- and long-term development.[2-5]

Once they regain their birth weight, the growth of preterm infants is targeted to the following goals, based upon the estimated intrauterine growth from historical cohort studies of live births of infants of various gestational age (GA): weight should increase 15 to 18 g/kg per day, length should increase 1 cm/week and head circumference should increase 0,7 cm/week.

However, in many cases low-birth-weight infants' growth is inadequate and their weights are below the 10th percentile at the time of discharge.[6,7]

Before discharge, it is very important to make a nutritional evaluation and to establish a feeding plan and follow up in order to recognize as soon as possible any growth deficit.

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Nutrition after discharge

There are few data regarding the specific nutrient intakes required in preterm infants after discharge. The main objective is to reach the body composition and rate of growth of a normal foetus/infant of the same post-menstrual age during the first entire year of life.[8] So, monitoring growth is crucial in the follow up of these infants. Growth parameters include the infant's weight, length, and head circumference and should be monitored on a weekly to biweekly basis for the first four to six weeks after hospital discharge. After this initial period of close observation, infants who are growing normally can be monitored every month and then every two months. Biweekly or monthly follow-up visits should continue for infants with slow weight gain who remain below the third percentile on a standard growth curve when they have reached 40 post-menstrual weeks, or who have chronic health problems [*e.g.*, bronchopulmonary dysplasia (BPD)]. Close monitoring should continue until a steady adequate growth pattern is established. Infants who have a suboptimal growth should be evaluated and treated as soon as the poor growth is identified. Delays in instituting treatment simply worsen the degree of growth failure and increase the amount of catch-up growth that will subsequently be required to achieve normal growth. Infants who are extremely short may need further evaluation for growth retardation, including consultation by a pediatric endocrinologist. Referral is based on the extent of the shortness, parental concern, and whether catch-up growth has occurred.

Not only weight but even head circumference is an important

growth parameter for preterm infants. Slow head growth is associated with developmental delay. In one report, very low birth weight infants whose head circumferences were below normal by eight months corrected age had poor cognitive function, academic achievement, and behavior at eight years of age, compared with controls with normal head size. A rapid increase in head circumference may indicate post hemorrhagic hydrocephalus. Infants with abnormal head growth should have neuroimaging studies to evaluate the cause.[9,10]

In addiction to prematurity, there are some conditions in which babies have more difficult to reach adequate growth: growth failure is in fact common in infant with BPD, with reported rate of 30 to 67 percent. This is due to increased energy expenditure, to reduced fat absorption, to chronic hypoxia and to poor feeding potency.[11,12]

Current practice on feeding preterm infants after hospital discharge

During hospitalization we can try to promote the growth of premature newborn with enteral and parenteral nutrition and with many nutrient supplementations but, when we discharge these little babies, what can we do to minimise growth restriction? Guidelines that specify how to feed preterm infants after hospital discharge are scarce and conflicting. Post-discharge practices regarding feeding vary widely by country, NICU, and caregiver.[13]

Nutritional recommendations in literature are based on the studies of stable preterm infants with few complications and aimed at providing amounts of nutrients that may approximate intrauterine growth. But sometimes these recommended intakes do not cover added nutrient requirements that may be needed to compensate for nutritional deficits during the first weeks/months of life.

So, preterm infants are usually growth restricted at hospital discharge. Extrauterine growth retardation (EUGR) describes postnatal growth of preterm infants that is less than the expected growth of a foetus at the same post-conceptional age. It is a problem that occurs in 60-100% of preterm births globally.[14-17] EUGR has been defined at discharge as growth values <10th percentile or <- 2SD from the mean of intrauterine growth expectation. It has been also defined as a change in z-score of > -1 SD or > -2 SD from birth to discharge.[18]

Human milk

Although there is a lack of evidence to suggest a prescriptive approach to feed very-low-birth-weight infants after discharge, there is a general consensus that human milk (HM) should be preferred to formula for every infant. Many organizations recommend that mother's own milk be the exclusive source of nutrition for the first six months of life.[19,20] But, despite the many non-nutritional advantages of HM, growth of HM-fed preterm is poorer than formula-fed infants. During hospitalization, HM should be fortified with protein, minerals and vitamins to ensure optimal nutrient intake for infants weighing <1500 g at birth. Some neonatologists suggest the practice of HM fortification also after discharge. This implies the use of breast pump and bottle and may potentially interfere with breast feeding.[19]

Cochrane analyzed the effect of HM fortification after hospital discharge in preterm infants (< 37 weeks of gestational age) and low birth infants (<2,5 kg). Primary outcomes were growth and development and secondary outcomes were feed intolerance, duration of breast milk-feeding, measure of bone mineralization, clinical or radiological evidence of rickets and blood pressure on long term follow up. The limited data do not provide convincing evidence that feeding preterm infants at home with multi-nutrient fortified HM compared with unfortified affects important outcomes including growth rates during infancy. There are no data on long term growth.[21] Since fortifying breast milk for infants fed directly from the breast is logically difficult and has the potential to interfere with breast feeding, it is important to determine if mothers would support further trials of this intervention. As an alternative to fortified HM, babies with poor growth could be fed with HM alternate with a post-discharge formula (PDF). The choice of weather, how and how long to supplement HM-fed infants needs to be individualized based on the infant's own risk factor, prior growth and ability of the parents to carry out the suggested regimens.[7,22]

Infant formulae

In case of formula-feeding, some Authors suggest that nutrient-enriched formulas like PDF may have short advantages compared to standard formulas preterm, such as improved growth and greater accretion of lean mass.[23] PDF have high contents of protein, minerals and trace elements as well as a long-chain polyunsaturated fatty acid supply.

Infants receiving PDF until 6-mo corrected age have increase on lean mass and in bone mineral content compared with infants fed term formula.[24] Furthermore, also the growth of head circumference in the first six months of life is better in infants fed with PDF than standard formula.[25]

Some clinicians suggest that babies should receive PDF at least until a post-conceptional age of 40 weeks, but possibly until about 52 weeks of post-conceptional age.[13,26]

So, short term advantages of PDF are demonstrated but on the contrary, at age 8 years no differences were found in body size, body composition, bone variables and metabolic health variables when comparing infants fed with PDF with those fed with standard formulas.[27] Cochrane, analyzing 16 trials with a total of 1251 preterm infants, does not find differences in growth and development between PDF fed infants and standard formula fed infants and does not support the recommendations to prescribe PDF after hospital discharge. Limited evidence suggests that feeding preterm formula after hospital discharge may increase growth rates up to 18 months post term.[28]

Conclusions

Continued growth monitoring is required to adapt feeding choices to the needs of individual infants and to avoid underfeeding or overfeeding. Individualized programs for each infant are needed to promote their growth and to avoid malnutrition.

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