Influencing Factor and Research Progress of Neonatal Nutritional Support

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Abstract. Neonatal nutrition has been the subject of debate and research since ancient times. The lack of the nutritional needs of newborns will lead to a series of problems such as growth stagnation, neurodysplasia and reduced cognitive level. This article reviews influencing factors of the neonatal nutrition support and research progress.

Keywords: neonatal; nutritional support; breast milk.

1. Introduction

The focus of neonatal nutritional support research is mainly on improving cognitive and metabolic levels and providing the most effective nutritional help for the newborn to improve growth metabolism and developmental levels. In recent years, experts and scholars at home and abroad have made great progress in the research of nutritional support for newborns, especially premature infants [1][2][3]. However, due to the unsatisfied nutritional needs of premature infants, problems such as growth stagnation and neurodysplasia are still widespread. Based on the existing research results, this paper reviews the neonatal nutrition support components, influencing factors, neonatal nutrition status and research progress, and provides theoretical reference for neonatal clinical nutrition support.

2. Ingredients for nutritional support

2.1 Breast milk

Breast milk is widely recognized as the best source of nutrition for preterm infants. Breast milk of premature mothers contains different components with higher protein concentrations compared with those of term births. Breast milk Breastfeeding in preterm infants has many advantages, including improved immune defense system and gastrointestinal function, reducing the probability of enterocolitis necrosis, and promoting physical and brain growth, and long-term improvement in neural development. These advantages have prompted the establishment of breast milk banks so that infants can obtain donor milk when it is insufficient. However, donor milk is usually derived from late lactating mothers, and pasteurization and storage can cause nutrient loss, particularly the loss of fat. The way to address these problems is by adding fortifier, which include bovine or human milk protein.

2.2 Mineral

Preterm infants are at risk of metabolic bone disease due to inadequate mineral reserves at birth, limited mineral intake, use of harmful bone drugs, and lack of vitamin d. Severe cases can cause clinical rickets or cause fractures of newborn babies without trauma. In the past, the amount of calcium and phosphorus added to the parenteral nutrient solution was limited due to poor mineral solubility. However, the use of organophosphates improves the stability of high concentrations of calcium and organophosphate solutions, thereby increasing the intake of parenteral calcium and phosphate. Although breast milk is considered an ideal nutritional source for preterm infants, it contains insufficient minerals to meet the need for rapid skeletal growth in preterm infants.

2.3 Protein

Early plasma protein amount is beneficial to improve the nutritional level of the newborn, and the protein intake required to maintain normal growth depends on the growth rate of the child. In very low birth weight infants, at least 3 to 3.5 g / kg of amino acids per day, maintaining a nitrogen content and growth rate similar to the fetus in utero. The results of several studies suggest that an early daily intravenous injection of amino acid 3.6g / kg is safe, well tolerated, and drives increased nitrogen balance and the rate of protein synthesis. Studies have shown that growth indicators, including linear growth, have improved in infants fed a high-protein content formula in low birth weight infants.

3. Influencing factors of nutritional support

3.1 Taste and smell

Smell and taste activate the head response and the release of appetite hormones in the saliva, so they are very important for metabolism. Smell and taste also initiate metabolic processes by the secretion of insulin and hunger hormones. In adults, impaired oral nutrition perception is associated with increased energy intake and body mass index. Premature infants receive milk through a gastric tube and have no chance to smell or taste. However, when infants born at 32 weeks of gestation have been detected by changes in brain oxygenation response, they can be judged pleasant or unpleasant for different odor reviews. He Jing [4], Liang Meifang [5] 's research shows that providing smell and taste before gastric tube feeding can reduce the time to reach whole intestinal feeding and full sucking feeding.

3.2 Sex

Although girls and boys differ in growth and experience different metabolic levels and endocrine environments, different feeding methods are rarely adopted for preterm boys and girls. However, Kostlin Gille Natascha[6] noted that the level of myeloid derived suppressor cell in breast milk depends on the sex of the baby, indicating that the composition of breast milk varies by the sex of the offspring, suggesting that the different nutritional needs of girls and boys may be biologically justified.Anna C. Tottman[7] showed a specific association between early nutritional support in very premature infants and outcomes. For girls, higher early fat and enteral nutrient intake was inversely associated with neurological disorder, while boys did not show this correlation. Prospective trials of neonatal nutrition should consider that outcomes may vary by infant sex, and therefore, future studies on nutrition in preterm infants may need to consider sex-specific.

This difference in nutritional effects in boys and girls requires nutritional intervention clinical trials that evaluate the effects of complementary nutrition on boys and girls separately, detect sex-related effects, and detect differences in long-term metabolic, cardiovascular outcomes, physical development, and neural development.

4. Neonatal nutrition problems

4.1 Very premature

Very premature infants are born, if still in the womb, they will grow very quickly. In order to maintain a growth rate similar to that of those born in utero, infants born at 24 weeks of pregnancy need to weigh twice that at 30 weeks and five times that at 40 weeks. This amazing growth rate requires higher energy, protein and other nutrients than normally born babies. Since most placental transfer of nutrients usually begins in the sixth month of pregnancy, very premature infants are born with low storage of key nutrients such as iron, zinc, calcium and vitamins, and little or no subcutaneous fat and glycogen storage. At the same time, the physiological immaturity of very premature infants makes providing adequate nutrition a significant challenge. In the first few days,

the common problems of fluid, glucose and electrolyte imbalance due to the unsound skin barrier function, coupled with respiratory distress and other early diseases, further increase the need for high-energy nutrition. Therefore, adequate nutrition is essential for the growth of very premature infants, and the smaller the infant, the greater the challenge of providing optimal early nutrition. The immature structure and function of the gut means that the tolerance of intestinal feeding is poor, while the imperfect swallowing and respiratory system allow sucking feeding until it approaches the gestational age of term. However, early intake of fluid may increase the risk of patent patent ductus arteriosus, bronchopulmonary dysplasia and necrotizing enterocolitis. In the first few days after birth, infusion of drugs to maintain blood vessel access and blood pressure stability usually lead to a large number of the nutrient solution intake, the limits the nutrient solution intake, means that early slow growth, in addition to slow growth, insufficient nutrition can also cause cell metabolism decomposition, promote cell release ions (such as phosphate and potassium) and electrolyte disorder. In addition, the lack of nutrients and minerals can cause the risk of hypoglycemia and metabolic bone disease.

In practice, the usual approach is to start intravenous fluids immediately after birth and provide nutritional support until enteral feeding is fully functional for [8][9]. Enteral feeding via gastric or nasal tubes, initially at small doses (usually 1 ml per 4-12 hours) and then slowly increasing the dose. The transition from primary intravenous nutrition to complete enteral feeding may be uncertain, with repetition in between, which usually takes 7-14 days or longer when feeding is intolerant. Xu Jingyi [10] pointed out: if it is mainly breastfeeding, usually need to add milk powder to increase energy, protein and trace element, which will contribute to the rapid growth of babies. The use of preterm formula is also based on the same reason.

4.2 Preterm infants in the middle and late stage

Infants born at 32-36 weeks represent more than 80% of preterm infants worldwide, with about 13 million infants per year. Therefore, these infants have a much higher proportion of health problems related to preterm birth than do very premature infants. Most infants born in developed countries survive, but increasing evidence suggests that developmental and metabolic functions are compromised in [11] compared to term-born infants. At 34 weeks of gestation, the total brain weight was 65% of the brain weight at 40 weeks of gestation, so the role of early nutrition to support brain growth in these infants is identical to those who were born very prematurely. In addition, Wang Qingqing [12] pointed out that the balance between metabolism and cognition exists not only in very premature infants, but also in middle and late premature infants. Middle and late premature infants and very premature infants, have malnutrition problems, their sucking, swallowing, breathing coordination and intestinal movement is not mature, the supply of breast milk often can not keep up, the liver glycogen storage multiplied between 36 and 40 weeks, but not enough to make up for the lack of enteral nutrition. However, mid-to-late preterm infants are similar to full-term infants who, compared to very preterm infants, are not given complementary nutrition until full breastfeeding is established. There are no data on whether only 10% glucose is sufficient in the absence of nitrogen before waiting for breast milk or enteral feeding tolerance, or whether infants should receive nutrition to reduce metabolic breakdown. This condition is common in clinical practice, and pediatric clinics urgently need relevant randomized trials to seek the best approach to feeding middle or late preterm infants.

The lack of extensive and effective evidence in practice is one of the challenges in providing nutrition for mid-to late preterm infants. Since late preterm infants otherwise look good and parents have strong opinions about intravenous nutritional feeding, there is great resistance to providing them with medical services. For example, some parents prefer to give infant formula with gastric tubes to avoid intravenous fluids, while others prefer infants to receive intravenous fluids while waiting for breast milk to avoid formula.

4.3 Term infant

Breastfeeding is the most ideal way for infants to obtain nutrition, and breastfeeding has many advantages. Most infants can accept breast feeding, however, in some rare cases, cannot breastfeeding or breastfeeding has the risk of harm, such as maternal HIV is a relative contraindications to breastfeeding, some maternal drugs, such as antitumor drugs, can also be excreted by breast milk, rare metabolic diseases, such as galactosemia, phenylketonuria, need to be fed with specific formula, to avoid potentially fatal complications.

Infant formula is designed to be as similar to breast milk as possible. Results from an experimental study in Baars [13] mice suggest that reformulation, keeping lipids contained in larger droplets more similar to breast milk than smaller droplets in formula, reduces fat accumulation by 30% and prevents the emergence of adult obesity associated with a Western diet. Reformula milk can improve the short-term memory ability. It may be more beneficial to modify the triacylglycerol structure in the formula to be closer to that in breast milk, which leads to softer stool, increased fecal bifidobacteria, and increased total body bone mineral content. All of these studies suggest that, although formula composition can be modified in a way that improves metabolic outcomes, breastfeeding remains the best method for neonatal nutrition.

5. Conclusions and prospects

This paper analyzes the composition, role and influencing factors of neonatal nutritional support, and reviews the nutritional status of very premature, middle and late preterm and term infants, which has theoretical and practical significance for the application of clinical neonatal nutritional support. At present, despite much knowledge about neonatal nutrition, there is still much work to be done. Nutrition for all gestational age infants requires the assessment of not only short-term effects on growth and body composition, but also sustained long-term metabolism and neurodevelopment.

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