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Review on feeding of pre mature baby

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Abstract

This systematic review summarizes available literature regarding complementary feeding (CF) in preterm infants, with or without comorbidities that may interfere with oral functions. Methods: A literature search was conducted in PubMed and the Cochrane Library. Studies relating to preterm infants (gestational age <37 weeks) were included in the analysis. Retrieved papers were categorized according to their main topic: CF timing and quality; clinical outcome; recommendations; strategies in infants with oral dysfunction. Results: The literature search in PubMed retrieved 6295 papers. Forty met inclusion criteria. The Cochrane search identified four additional study protocols, two related to studies included among PubMed search results, and two ongoing trials. Moreover, among 112 papers dealing with oral feeding, four aiming at managing CF in preterm infants with oral dysfunctions were identified. Conclusions: The available literature does not provide specific guidelines on the management of CF in preterm infants, who are generally weaned earlier than term infants. There is a paucity of data regarding the relationship between CF and growth/quality of growth and health outcomes in preterm infants. It could be suggested to start CF between five and eight months of chronological age if infants have reached three months corrected age and if they have acquired the necessary developmental skills. An individualized multidisciplinary intervention is advisable for preterm infants with oral dysfunctions.

Keywords: Review, feeding, pre mature, baby

Introduction

Contractions and dilation (opening) of the cervix before 37 weeks of pregnancy are considered preterm, or premature, labor. A normal pregnancy lasts about 40 weeks after the first day of the last period (38 weeks after fertilization). The danger of preterm labor is that it will lead to the birth of a baby that has not fully developed, and therefore has a high risk of complications. About 10% of all pregnancies result in premature birth. About 60% of serious complications or infant deaths are due to consequences of premature birth.

Proper nutrition in infancy is essential for normal growth, resistance to infection, long term health and optimal neurologic and cognitive development. Providing adequate nutrition to preterm infants is challenging because of several problems, some of them unique to these small infants. These problems include immaturity of bowel function, inability to suck and swallow, high risk of necrotizing enterocolitis (NEC), illnesses that may interfere with adequate enteral feeding (e.g., RDS, patent ductus arteriosus) and medical interventions that preclude feeding (e.g., umbilical vessel catheters, exchange transfusion, indomethacin therapy)

Physiology and Pathophysiology

The gut has formed and has completed its rotation back into the abdominal cavity by 10 weeks of gestation. By 16 weeks, the fetus can swallow amniotic fluid. GI motor activity is present before 24 weeks, but organized peristalsis is not established until 29-30 weeks and is facilitated by antenatal corticosteroid treatment. Coordinated sucking and swallowing develops at 32-34 weeks. By term, the fetus swallows about 150 cc/kg/day of amniotic fluid, which has 275 mOsm/L, contains carbohydrates, protein, fat, electrolytes, immunoglobulins and growth factors, and plays an important role in development of GI function. Preterm birth interrupts this development. Even if nutrients are provided parenterally, lack of enteric intake leads to decreased circulating gut peptides, slower enterocyte turnover and nutrient transport, decreased bile acid secretion, and increased susceptibility to infection due to impaired barrier function by intestinal epithelium, lack of colonization by normal commensal flora and colonization by pathogenic organisms.

For fat digestion, the newborn depends on lingual lipase, which is stimulated by sucking and swallowing and by nutrients in the stomach but not the small bowel. The figure is a chronological representation of GI development during fetal life.

Preterm labor can be extremely frightening, because mothers-to-be quite naturally fear that their baby will be born too early and suffer the problems of prematurity. If your baby is born too soon, there is a great chance that her lungs will be underdeveloped. If so, she'll need to be put onto a ventilator that can breathe for her. Receiving oxygen through a ventilator can lead to complications.

Your baby may also have trouble maintaining a normal body temperature, and may become hypothermic (too cold). She'll need to be kept warm. Your baby might be so early that she can't coordinate her muscles to suck and swallow. If this is the case, she'll have to be fed through a needle in the vein (intravenously), or through a tube passed into her nose, down her throat and into her stomach. A premature baby may also develop complications such as bleeding into the brain; an increased risk of infections, especially meningitis and sepsis; problems with kidney function; and jaundice. Premature babies are at higher risk for long-term complications, which may include vision impairment or blindness, hearing impairment, cerebral palsy and chronic lung problems. The earlier the baby is born, the more likely that she will have these complications.

You are more likely to experience preterm labor if

- You have had preterm labor or delivered a premature infant in the past.
- You are carrying more than one baby (such as twins or triplets).
- Your mother used the medication diethylstilbestrol (DES) while she was pregnant with you.
- You have an abnormally shaped uterus or an abnormal cervix.
- You have had a cone biopsy of your cervix in the past.
- You are younger than 18 or older than 40 years.
- You belong to a non-Caucasian race.
- You are living in poverty.
- You got pregnant while using an IUD, and it is left in place during the pregnancy.
- You were seriously underweight when you became pregnant.
- You smoke or use cocaine or other street drugs.
- You have had second-trimester miscarriages during previous pregnancies, or you have had three or more elective abortions.
- You are not receiving prenatal care from a qualified health-care provider.
- You have a cervical infection, such as group B streptococci, gonorrhea, chlamydia, syphilis, trichomonas or gardnerella.
- You are employed, doing extremely physical and strenuous work.

Symptoms

- Contractions (tightening and hardening of the uterus), occurring more than four per hour (may be painless).
- Low cramps, similar to menstrual cramps.
- Low backache.
- A feeling of pelvic pressure.
- Abdominal cramps, gas or diarrhea.

A change in quality or quantity of vaginal discharge, especially any gush or leak of fluid.

Nutritional Requirement of Preterm Babies

Calorie: The calorie need of non-growing preterm babies during the first week of life are 60kcal/kg/day. After first one or two weeks of life most preterm babies require 120-150 kcal/kg/day to maintain satisfactory growth. High calorie may be necessary in babies who are not gaining weight, post-operative patients and extreme preterms.

Fluid: Fluids needs of preterm babies are relatively high during the first week of life. The intake of fluids varies from 90-100 ml/kg/day for 7-10days. Additional fluids may be required when the baby is under the phototherapy or a radiant warmer.

Carbohydrate: Preterm babies can tolerate 50percent of the calories in the form of carbohydrates. Very low birth weight babies may have difficulty in tolerating the lactose, the first few days. Glucose polymers are well tolerated.

Protien: preterm babies require 34gm of protein/ kg of body weight for rapied growth. Excess of protein may lead to metabolic problems of acidosis. Human milk mainly contain whey protein which are better utilized. Certain amino acids essential for the preterm such as cystine, taurine, alanine and arginine. These are present in breast milk.

Fat: Fat malabsorption and steatorrhea can occur in preterm due to reduced amounts of pancreatic lipase, carboxylic ester hydrolase, bile acid and lingual lipase.

About 40-50 per calories in diet of the preterm should be available from the fats. Very low birth weight babies poorly digest and absorb saturated triglycerides. Vegetable oils containing unsaturated long chain fatty acid are better absorbed. Better still are medium chain triglyceride because their digestion and absorption are not dependent on bile salts level. Premature babies are given polyunsaturated fats and high levels of iron. Iron promotes the peroxidation of the polyunsaturated fatty acids and this might imply that vitamin A requirements are higher in such infants.

Minerals and vitamins: Calcium and phosphorus supplements may be needed to prevent rickets or osteopenia in preterms. Iron deficiency can occur by 6-12 weeks and hence 2.5mg/kg/day of iron starting from 6-8 weeks of age may be given. Zinc supplements has been shown to increase weight gain. Zinc is found to be low in banked milk. All pre term babies should receive vitamins supplements in addition tom the amount present in human milk.

Feeding Protocol

The following are guidelines for the initiation and advance of enteral feedings in preterm infants:

1. Method of feeding: Because these infants usually have not yet developed coordinated sucking and swallowing, they must be fed by gavage:
 - Orogastric tubes are usually used. Because infants are obligate nose breathers, it is best not to occlude the nares with a tube. In addition, repeated insertion of a nasal gastric tube can cause inflammation of the nose with subsequent obstruction.
 - Estimate length of tube that must be inserted to reach the stomach.

- Insert the tube and aspirate to see if gastric contents are returned. While listening over stomach with stethoscope, inject ~5cc of air. If tube is in stomach, you should hear bubbling as you inject air. If you cannot hear any bubbling, tube may be in the trachea. Therefore, do not feed infant until you are certain that tube is in stomach.
- Do not use duodenal or jejunal tubes for gavage feedings as feedings are less well tolerated and do not stimulate secretion of lingual lipase. In addition, residuals are no longer useful in assessing tolerance of feedings.
- Nipple feedings can be considered as the infant matures. The best judge of when to start nipple feedings is an experienced Nurse.

2. Content of feeding: Begin with either: -Breast milk (preterm breast milk is 290 mOsm/L) or

- Formula for preterm infants (e.g., Premature Enfamil™ or Similac Special Care™, 260 mOsm/L).
- Some physicians use half-strength feedings, but there is no evidence that this is beneficial. In fact, hypo-osmolar solutions may slow gastric emptying, leading to increased incidence of residuals and feeding intolerance. Remember that fetuses swallow amniotic fluid, which is 275 mOsm/L, and this swallowing begins at 16 weeks

gestation.

3. Guidelines for Feeding: Initiation of feedings, their volume and the rate of advance of feedings are related to birth weight, gestational age and how the infant has tolerated feeds to date. General guidelines include:

- Initial volume is 2 cc/kg per feeding with a minimal absolute volume of 2 cc
- Do not advance feedings faster than 20 cc/kg/d.
- Do not advance feedings if there are any signs that the baby is not tolerating feeds. Aggressive advances of feedings increase the risk of NEC.
- A small volume, even if not advanced, is much better than nothing at all. Even very small volumes stimulate maturation of gut motility and production of enteric peptides.
- Bolus feedings are preferable to continuous feedings. The goals for “full feedings” are:
- Volume: 150-160 cc/kg/d -Calories: 110-120 kcal/kg/d - Some SGA infants will require a higher caloric intake to achieve consistent weight gain.

Detailed recommendations for feeding are shown in the following table.

Table 1: Recommendations for feeding of preterm infants

Gestational Ave (weeks)	Volume of first feed lcc/kv)	Rate of feeding	
		Frequency	advance
24 to 26	2 or	q6-8h	None for 5-7d, then
	2 cc total		10-15 cc/kg/d
26-28	2	q4-6h	None for 3-5d, then
			10-20 cc/kg/d
28-32	2	q4h	As tolerated, but aim to reach full feeds only after 7d

Fortifying Feedings not only provides mores calories but also improved intake of calcium, phosphorus and protein. Fortify feedings (breast milk and formula) as follows: -When infant is tolerating ≥ 100 cc/kg/d, feedings may be fortified to 22 cal/oz. -When infant has been tolerating ≥ 150 cc/kg/d for at least 2d, feedings may be fortified to 24 cal/oz.

There are three ways to feed premature babies: intravenously, through a feeding tube, and directly by mouth. They may receive three different kinds of nutrition: total parenteral nutrition (TPN), breast milk, and infant formula designed for premature babies. How and what a premature baby is fed depends on their gestational age and whether there are complications with any part of the gastrointestinal tract.

Intravenous feeding and parenteral nutrition

Although even the most premature gut is capable of accepting and digesting milk, sometimes the baby may be too unwell to be fed this way. In such cases, premature babies are fed in a way that bypasses the digestive system altogether and delivers nutrition directly to the baby's bloodstream through an intravenous line (IV) or a catheter. Through this line, a premature baby is initially fed sugar water with essential electrolytes for a few days, followed by a solution called total parenteral nutrition (TPN). Made up of proteins, vitamins, minerals, sugar, fat and water, TPN feeding may go on for days or weeks depending on the maturity of the baby and their ability to feed in an alternative way.

Gavage Feeding

Once the premature baby is stable enough to receive feeding through the gut, they can be given gavage or nasogastric (NG)

feedings. A small tube is inserted through the nose or mouth and run directly into the baby's stomach. Small amounts of expressed breast milk or formula are then gently allowed to flow into the stomach. If the baby handles these feedings, they are fed progressively larger quantities.

Breastfeeding and bottle feeding

Once the baby has developed the co-ordination to begin sucking and swallowing, the team will make an effort to help the parents with breast feeding. Most mothers are encouraged to pump their milk right away so that the flow of milk begins and continues. Pumped breast milk can be given to the baby when they are ready for either gavage, breastfeeding or bottle feeding. Many parents have a great desire to feed their child themselves, which enhances their parenting role and helps with the bonding process.

Contra-indications to feeding

Do not start feeds if the infant:

- Is receiving indomethacin, or received it within the previous 48h
- Has a hemodynamically significant patent ductus arteriosus
- Has either an umbilical arterial or venous catheter. Do not start feedings until the catheters have been removed for ≥ 8 h.
- Is polycythemic.
- Has significant metabolic acidosis.
- Has severe respiratory instability or there is impending endotracheal intubation
- Has hemodynamic instability as evidenced by clinical

signs of sepsis, hypotension, is receiving dopamine (at a dose >3 mcg/kg/min) or other vasopressor drugs

- Received an exchange transfusion within the past 48h.
- Has abdominal distension or other signs of GI dysfunction.
- Has had an episode of severe asphyxia (perinatal or post-natal) in the previous 72h.

Intolerance to Feedings

Intolerance to feeding is common among very small preterm infants, and most such infants will have episodes that require either temporary discontinuation of feedings or a delay in advancing feedings. Although most episodes resolve spontaneously and without sequelae, any signs of feeding intolerance should be regarded as potentially serious because of the increased risk of NEC among these infants. Signs that indicate possible intolerance of feeding include:

- Gastric residuals or emesis
- Abdominal distension
- Blood in the stool (gross or occult)
- Loose stools or diarrhea
- Metabolic acidosis
- Temperature instability
- Onset of apneic episodes
- Hyperglycemia

Management of Feeding Intolerance

Should be related to the type and severity of the presenting signs, as described below:

1. Gastric residuals

- **Non-bilious residuals:** If these are smaller than the volume of a feeding and are not increasing in volume, and if the infant otherwise appears well, feeding can continue but the infant should be observed carefully for other signs of feeding intolerance. If the infant has any other worrisome findings, hold the feedings, consider obtaining an abdominal radiograph and observe the infant. -If the residuals are greater than the volume of a feeding or are progressively increasing in volume, hold the feedings and observe closely.
- Bilious residuals are a serious sign. Hold feedings, evaluate infant closely, and consider further workup including abdominal radiograph, CBC and platelets.

2. Abdominal distension is a serious sign

Discontinue feedings, obtain abdominal radiograph, and consider further evaluation and treatment (see section on NEC, P. 133).

3. Blood in stools

Discontinue feedings, consider obtaining clotting studies and abdominal radiograph. 4. If metabolic acidosis occurs, hold feedings, evaluate closely for NEC, sepsis, hypotension and a patent ductus arteriosus. Metabolic acidosis in the presence of NEC is a grave prognostic sign.

4. Loose stools, temperature instability, apnea, Hyperglycemia

Hold feedings and evaluate infant carefully. If feedings have to be stopped for any of these reasons, notify the Neonatology Fellow and/or the Attending Physician, so that they can follow the infant's condition with you. If there is any doubt about how well an infant is tolerating feedings, it is best to hold feedings, evaluate the infant and discuss the case with

the other members of the team.

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