Clinical Nutrition Guidelines

CSPEN guidelines for nutrition support in neonates

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In the last few decades, there has been a significant increase in survival rate of preterm infants, especially very low birth weight infants. The nutrition problems have become particularly relevant in neonates, and nutrition support is usually required for preterm infants and most sick term infants. The actual amount of nutrition must be calculated (not estimated) in neonates. The goals of nutrition support are to maintain development and growth while avoiding nutrition related complications. Nutrition requirements (enteral nutrition and parenteral nutrition) should be adjusted according to different weights and gestational age. Parenteral nutrition (PN), which allows the infant's requirements for growth and development to be met, is indicated in infants for whom feeding via the enteral route is impossible, inadequate, or hazardous. Enteral nutrition (EN) should be gradually introduced and should replace PN as quickly as possible in order to minimize any side-effects from exposure to PN. Inadequate substrate intake in early infancy can cause long-term detrimental effects in terms of metabolic programming of the risk of illness in later life. Optimal nutrition care of the preterm infant offers the opportunity to improve outcomes for children. This guideline aims to provide proposed advisable ranges for nutrient intakes in neonates. These recommendations are based on a considered review of available scientific reports on the subject, and on expert consensus for which the available scientific data are considered inadequate.

Key Words: parenteral nutrition, enteral nutrition, premature infant, neonate, nutrition support

GRADING SYSTEM

The quality and strength of the supporting literature was graded according to American Society for Parenteral and Enteral Nutrition (ASPEN). The grade of recommendation depends on the scientific quality of the studies reported (Table 1).

ENTERAL NUTRITION

Recommended intakes

1. **Energy:** Most of neonates will have an optimal growth when enteral feedings provide 105~130 kcal/kg/d. Increased energy intake in premature infants (110~135 kcal/kg/d) and extremely low birth weight infants (150 kcal/kg/d) will meet the needs of these neonates (C).
2. **Protein:** Protein intake of term infants is 2~3 g/kg/d with a protein/energy ratio of 1.8~2.7 g/100 kcal. Protein intake of premature infants is 3.5~4.5 g/kg/d (4.0~4.5 g/kg/d in infants weighting less than 1 kg at birth, 3.5~4.0 g/kg/d in infants weighting 1.0~1.8 kg at birth) with a protein/energy ratio of 3.2~4.1 g/100 kcal (C).
3. **Lipid:** 5~7 g/kg/d (40~50% of total energy) (C).
4. **Carbohydrate:** 10~14 g/kg/d (40~50% of total energy) (C).

Feeding mode

1. **Breastfeeding:** Infants should start breastfeeding as soon as possible after birth, especially for preterm infants (A). However, there are some situations as follows which should be considered appropriately. (1) Breastfeeding is not recommended for the infants with their mothers infected with human immunodeficiency virus (HIV) and human T-cell tropic virus (HTLV) (C); (2) Infants with their mothers infected with active tuberculosis can be bottle-fed pasteurized breast-milk. Breastfeeding can be continued 7-14 days after the completion of therapy (E); (3) Infants with their mothers infected or carried with hepatitis B virus (HBV) can be breastfed after receiving high-titre hepatitis B immune globulin followed by hepatitis B vaccine within 24h after birth (C); (4) Infants with their mothers infected or carried with (cytomegalovirus) CMV can be breastfed. Preterm infants may have a higher risk of CMV infection, and pasteurized breast-milk is a better choice for them due to safety concern (E); (5) Infants with their mothers infected with herpes simplex virus can be breastfed unless skin lesions are not healed (E); (6) Infants with their mothers infected with Treponema pallidum cannot be breastfed until 24 hours after discontinuing the medication, if skin lesions do not involve the breast (E); (7) Infants with their mothers receiving medical isotopes or having been exposed to ra-

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Table 1. Grading system

Grade of recommendation	
A	Supported by at least two level I investigations
B	Supported by one level I investigation
C	Supported by level II investigations only
D	Supported by at least two level III investigations
E	Supported by level IV or level V evidence
Level of evidence	
I	Large, randomized trials with clear-cut results; low risk of false-positive (alpha) error or false-negative (beta) error
II	Small, randomized trials with uncertain results; moderate to high risk of false-positive (alpha) and/or false-negative (beta) error
III	Nonrandomized, contemporaneous controls
IV	Nonrandomized, historical controls
V	Case series, uncontrolled studies, and expert opinion

Note: Large studies warranting level I evidence were defined as those with ≥100 patients or those which fulfilled end point criteria predetermined by power analysis. Meta-analyses were used to organize information and to draw conclusions about overall treatment effect from multiple studies on a particular subject. The grade of recommendation, however, was based on the level of evidence of the individual studies.

dioactive substances cannot be breastfed until radioisotopes are cleared from breast-milk (E); (8) or chemotherapy cannot be breastfed until drugs are cleared from breast-milk (E); (9) Phenylketonuria and galactosemia are not absolute contraindication of breastfeeding. Breastfeeding combined with formula free of phenylalanine and galactose can be used based on the monitoring of serum phenylalanine and galactose-1-phosphate levels (E).

2. Artificial feeding

(1) Oral feeding: Suitable for newborns who have normal suckling, swallowing and breathing functions and gestational age ≥ 32~34 weeks (A).

(2) Tube feeding:

1) Indications: i) Preterm infants with gestational age <32~34 weeks; ii) Those who have dysfunction of sucking and swallowing, or cannot be fed orally; iii) Those who cannot be fed orally due to illness or medical condition; iv) As a supplement of inadequate oral nutrition intake. (E)

2) Feeding routes: i) Orogastric or nasogastric feeding: Preferred choice of patients who receiving tube feeding (A). Small-sized catheter made of soft silicone or polyurethane is preferred during tube feeding (E). ii) Gastrostomy: Suitable for tube feeding longer than 4 weeks, esophagotracheal fistula, esophageal atresia, esophageal injury, failure to thrive, neurological disorders et al (C). Percutaneous endoscopic gastrostomy (PEG) is recommended if applicable. iii) Transpyloric or postpyloric feeding: Including nasoduodenal, nasojejunal, gastrojejunal tubes and jejunostomy/percutaneous endoscopic jejunostomy (PEJ). Suitable for upper gastrointestinal abnormalities, lack of gastric motility, high risk of inhalation and severe gastroesophageal reflux (E).

3) Feeding methods: i) Bolus: Suitable for mature, gastrointestinal tolerant, orogastric/nasogastric fed neonates, but not suitable for those with gastroesophageal reflux and delayed gastric emptying. Bolus rate should be limited. (C) ii) Intermittent: Suitable for the infants with gastroesophageal reflux, delayed gastric emptying and high risk of inhalation. Each infusion should be lasted from 30 minutes to 2 hours (infusion pump is recommended). Intermittent infusion should be administrated at 1~4 hours interval according to gastrointestinal tolerance. (C) iii) Continuous: Suitable for infants intolerant to bolus or intermittent infusion. The infusion should be administrated continuously during 20~24 hours and controlled by syringes. The formula in the syringes should be changed every 3 hours. (C)

4) Feeding plan for the preterm infants (see Table 2). (E) The milk volume should be advanced according to the feeding tolerance. The interval duration should be adjusted according to the gestational age and birth weight.

3. Enteral nutrition indications: Feeding should be initiated as early as possible for those with normal gastrointestinal tract and stable hemodynamics. Feeding should be initiated within 12 hours after birth for those with a birth weight of more than 1000 g; Feeding could be delayed until 24~48 hours after birth for those with severe perinatal asphyxia (5 minutes Apgar score <4), umbilical arterial cannula and those with a birth weight of less than 1,000 g. (E)

4. Enteral nutrition contraindications: Gastrointestinal obstructions due to congenital malformation; suspicion or diagnosis of necrotizing enterocolitis; the enteral nutrition should be suspended for those with hemodynamic instability including: the situations that require fluid resuscitation or vasoactive dopamine > 5ug/kg/min; multiple organ dysfunction due to various reasons. (E)

Table 2. Feeding plan for the preterm infant

Birth weight (g)	Schedule	Initial rate (ml/kg/d)	Volume increase (ml/kg/d)	Full feeding volume (ml/kg/d)
<750	q2h[†,‡]	≤10×1 week	15	150
750 - 1000	q2h[†,‡]	10	15-20	150
1001-1250	q2h[†,‡]	10	20	150
1251-1500	q3h	20	20	150
1501-1800	q3h	30	30	150
1800-2500	q3h	40	40	165
>2500	q4h	50	50	180

[†] Continuous feeding is not recommended for human milk due to potential for milk separation.
[‡] Some units begin with 1 mL every 12 hours and progress gradually to every 2-3 hours

5. Minimal enteral nutrition (MEN)

(1) MEN is indicated for the newborns with gastrointestinal dysfunction, but without contraindications of enteral feeding. The purpose of MEN is to promote the maturation of gastrointestinal function and to improve the feeding tolerance. MEN is a non-nutritional feeding. (A)

(2) MEN should be initiated as soon as possible after birth if applicable. The formula or breast-milk is administrated though nasogastric tube continuously or intermittently using infusion pumps. The recommended dosage is 10~20 ml/kg/d, and it could be lasted for 3~5 days. (E)

Selection of breastfeeding and enteral formula

Breast milk and infants formula are suitable for different protocols and routes of enteral feeding.

1. **Breast milk:** Breastfeeding is the optimal way of feeding infants, and should be continued until at least 6 months after birth (A).
2. **Human milk fortifier (HMF):** HMF is recommended for preterm infants with birth weight less than 2000 g (C) when feeding volume reaches 50~100 ml/kg/d (E). The infants are recommended to use half-fortified breast-milk initially, and then switch to full-fortified milk based on the enhancement of feeding tolerance. The preterm infants who still have growth retardation at discharge should continue to use fortified breast-milk until at least 40 weeks corrected gestational age, or continue to use fortified breast-milk until 52 weeks corrected gestational age based on the growth status (E).
3. **Preterm formula:** Suitable for preterm infants gestational age <34 w or birth weight <2 kg (E).
4. **Preterm post-discharge formula:** Suitable for preterm infants after discharge. For the preterm infants who still have growth retardation at discharge, periodic growth monitoring and personalized feeding protocol are recommended. Infants whose growth index reaches 25-50 percentile on growth charts (with corrected age), can switch to standard formula (E).
5. **Standard infant formula:** Suitable for full-term infants with normal gastrointestinal function, and for preterm infants with gestational age greater than 34 weeks and birth weight more than 2 kg (B).
6. **Hydrolyzed protein formula and amino acid-based formula:** Partially hydrolyzed protein formula is suitable for newborns with high risk of allergy (C). Extensively hydrolyzed protein formula and amino acid-based formula are recommended for those who have undergone milk protein allergy after birth (C). Amino acid-based formula is not suitable for preterm infants due to its high osmotic pressure (E). Hydrolyzed protein formula can be chosen by those with gut dysfunction (short bowel syndrome, intestinal fistula et al.). who are intolerant to whole protein formula (E). Although hydrolyzed protein formula is not suitable for preterm infants due to its nutritional ingredients, it can still be considered temporally for those undergoing feeding intolerance or medical complications (E).
7. **Lactose-free (low-lactose) formula:** Suitable for infants with primary or secondary lactose intolerance or intestinal dysfunctions (eg, persistent diarrhea, short bowel syndrome, intestinal fistula et al.) (B).
8. **Special formula:** Suitable for infants with metabolic diseases (eg, phenylketonuria, maple syrup urine disease) (A).

Formula milk preparation and storage

Formula milk preparation and preservation: All the containers should be sterilized before preparation, and the preparation should be performed in a specialized room or a separated area. The principles of asepsis should be

Table 3. Enteral Nutrition Monitoring

	Parameters	Beginning	Stable
Intake	Energy (kcal/kg)	qd	qd
	Protein (g/kg)	qd	qd
Feeding tube	Tube position	q8h	q8h
	Nasal and oral nursing	q8h	q8h
	Stoma nursing of gastrostomy /jejunostomy	qd	qd
Clinical signs and symptoms	Gastric residue	Before feeding	Before feeding
	Frequency and characters of stool	qd	qd
	Vomiting	qd	qd
	Abdominal distension	qd	qd
Body fluid balance	Intake and output	qd	qd
Growth parameters	Weight (kg)	qd~qod	biw~tiw
	Length (cm)	qw	qw
	Head circumference (cm)	qw	qw
Laboratory	Blood routine	qw	qw
	Liver function	qw	qow
	Renal function	qw	qw
	Blood glucose	qd~tid	prn
	Electrolyte	prn	prn
	Stool routine and fecal occult blood test	prn	prn
	Stool pH	prn	prn
	Urine specific gravity	prn	prn

strictly abided by. The formula should be used immediately after preparation in the wards. The formula should be stored in the refrigerator and heated before using in a centralized preparation room. The formula should not be kept at room temperature for longer than 2 hours. (E)

Enteral nutrition monitoring (Table 3) (E)

Parenteral Nutrition (PN)

PN is used to provide energy, liquid, amino acid, carbohydrate, fat, vitamins and minerals to neonates who cannot be fully fed by oral or enteral route.

Indications

Congenital digestive malformation, such as esophageal atresia, intestinal atresia; acquired gastrointestinal diseases: necrotizing enterocolitis; and preterm infants. (E)

Methods of venous access

The proper selection of venous access for PN support mainly depends on the nutrition requirement of the patient and predicted duration of PN, and individual situations such as coagulation status and vascular conditions should also be taken into consideration (E).

1. **Peripheral venous access:** Peripheral venous access is suitable for short-term (<2 w) application, and the osmolarity of PN mixture should not exceed 900 mOsm/L (E).

   The prevention of peripheral vein thrombophlebitis is based on several interventions: aseptic technique during catheter placement and catheter care; and the choice of the smallest gauge possible (E).
2. **Central venous access:** Central venous access is required in high osmolarity PN formulation or long term PN support, which includes peripherally inserted central venous catheter (PICC), central venous catheter (CVC) and the umbilical vein catheter (only applicable to the newborn infants).

   Complications of central venous placement include pneumothorax, catheter misplacement, hemothorax, thrombosis, air embolism. Umbilical vein catheterization may also cause severe complications such as portal hypertension, liver abscess and etc.

   The insertion and nursing care of central venous placement should be implemented by fully trained professionals, strictly following the standard procedures (A).

   The use of central venous catheter decreases the number of catheters/venipuncture attempts needed to deliver the nutrition (B). PICC is recommended in neonatal patients with expected long-term PN administration (E).

Infusion systems for parenteral nutrition

1. **All-in-one (AIO) system:** All substrates (carbohydrates, lipids, amino acids, vitamins, electrolytes and trace elements) are admixed in a single container and simultaneously administered through one intravenous line. All-in-one admixtures provide safe, effective and low-risk PN for practically all indications and applications for neonates. (C)

   Advantages: Increased ease of administration; reduced manipulation-related complications; better nutrient balance, utilization and assimilation; cost saving.

   Disadvantages: Impossibility of removing a substance from an already prepared bag.

Preparation of AIO admixtures

AIO admixtures are compounded aseptically under clean room condition by using a suitable laminar airflow cabinet in the hospital pharmacy. The right mixing sequence is: (1) Add the electrolytes and trace elements to amino acid solutions or glucose solutions. (2) Mix the fat-soluble vitamins with water-soluble vitamins and then add to the lipid emulsion. (3) Mix amino acid solutions with glucose solutions thoroughly. Continue with the lipid emulsion and mix thoroughly. (4) AIO admixtures prepared for individual patients should be correctly labeled for reasons of drug safety. Label should contain both the patient information and a detailed composition.

Storage: AIO admixtures are usually manufactured daily and they should be stored at 2-8°C less than 24 hours (D). If the admixture is lipid-free, it should be protected from light.

Notes: (1) The retention samples from each prepared AIO admixture should be retained under refrigeration (4°C) for 24 hours. (2) Potentially incompatible substances (eg calcium and phosphate) must be added separately to AIO admixtures. The final concentrations of monovalent (mainly Na^+ and K^+) and divalent (mainly Mg^{++} and Ca^{++}) cation should not exceed 150 mmol/L and 5 mmol/L, respectively. (3) AIO admixtures are usually not used as vehicles for drugs. (4) The evaluation of microbiological (aseptic preparation) and physico-chemical stability (emulsion dispersion, solubility, decomposition, and sorption phenomena etc.) require specialized pharmaceutical knowledge. (D)

2. **Multiple bottle system:** Individual substrates (carbohydrates, lipids and amino acids) are stored in separate bottles and infused through separate iv lines either in parallel or in sequence (C).

   Advantages: Flexibility and ease of adjustment to rapidly changing patient needs (eg in ICU patients).

   Disadvantages: Increased handling of bottle changes; hyperglycemia and electrolyte disorders.

   Notes: The infusion duration of lipid emulsion usually exceeds 20 hours.

Table 4. Daily parenteral fluid intake for neonates (ml/kg/d)

Birth weight (g)	1^{st}	2^{nd}	3^{rd} - 6^{th}	$>7^{th}$
<750	100 - 140	120 - 160	140 - 200	140 - 160
750~1000	100 - 120	100 - 140	130 - 180	140 - 160
1000~1500	80 - 100	100 - 120	120 - 160	150
>1500	60 - 80	80 - 120	120 - 160	150

Table 5. Daily recommended intakes of parenteral electrolytes in neonates

Electrolytes (mmol/kg/d)	Premature infants	Term infants
Na	2.0 - 3.0	2.0 - 3.0
K	1.0 - 2.0	1.0 - 2.0
Ca	0.6 - 0.8	0.5 - 0.6
P	1.0 - 1.2	1.2 - 1.3
Mg	0.3 - 0.4	0.4 - 0.5

†Potassium is not administered in principle within the first 3 days of life except in patients with hypopotassaemia

Parenteral nutrition composition and daily requirements

Parenteral nutrition is used to treat neonates that cannot be fully fed by oral or enteral route. It consists of amino acids, lipids, carbohydrate, vitamins, electrolytes, trace elements and water.

Fluids

The fluid volume for infants can be determined by clinical status (phototherapy, incubator, ventilator, heart and lung function, and the results of monitoring) (see Table 4). Total fluid should be infused uniformly every 20~24 hours, preferably through an infusion-pump (C)

Calorie

Calorie intake of term infants and premature infants are 70~90 kcal/kg/d and 80~100 kcal/kg/d, respectively (E).

Amino acids

Pediatric amino acid solutions are recommended for neonates, which is started within the first 24 hours of life as 1.5~2.0 g/kg/d (without abnormal renal function) and is increased up to 3.0 g/kg/d in term infants and 3.5~4.0 g/kg/d in premature infants, respectively. The nitrogen/non-protein calorie is 1 g/100~200 kcal (B).

Lipid emulsions

The recommended starting dose of lipid emulsions is 1.0 g/kg/d within the first 24 hours of life and is increased by 0.5~1.0 g/kg/d, up to 3 g/kg/d (C). The 20% lipid emulsion is recommended for premature infants. MCT/LCT lipid emulsions have an advantage over LCT lipid emulsions (B). Oliver oil-based lipid emulsions have the potential to reduce the lipid peroxidation (C).

Glucose

The recommended starting dose of glucose is 4~8 mg/kg/min and is increased by 1~2 mg/kg/min up to 11~14 mg/kg/min (C), with diligent glucose monitoring. The recommended blood glucose level should be no more than 150 mg/dL (E). The use of early insulin therapy to prevent hyperglycemia is not recommended (A). The glucose infusion rate should be reduced by 1~2 mg/kg/min and insulin should be administered (0.05 IU/kg/h) when hyperglycemia is uncontrollable with glucose infusion rate being 4 mg/kg/min (E).

Electrolytes

Dosage recommendation for electrolytes is shown in Table 5 (D).

Vitamins

Thirteen vitamins are administered during PN, which include 4 lipid-soluble vitamins and 9 water-soluble vitamins. Recommended intake of parenteral vitamins in neonates is shown in Table 6. Vitamin-mixture-products for adults can be substituted for pediatrics products when pediatric vitamin products are unavailable (E).

Trace elements

Recommended intake of parenteral trace elements in neonates is shown in Table 7. Trace elements products for adults can be substituted for pediatrics products when pediatric trace elements products are unavailable (E).

Parenteral nutrition monitoring (Table 8) (E)

Parenteral nutrition-associated complications

1. Central venous catheter-associated bloodstream infection: infants with long-term parenteral nutrition are higher risk than those with short-term parenteral nutrition (D).
2. Metabolic Disorder: such as hyperglycemia, hypoglycemia, hypertriglyceridemia, and metabolic bone disease. Special attention should be paid to osteopenia in preterm infants and patients with long-term parenteral nutrition (D).

Table 6. Daily recommended intakes of parenteral vitamins in neonates

Vitamin	Neonate (Dosage/kg/d)
Water soluble	
Vitamin C (mg)	15-25
Vitamin B-1 (mg)	0.35-0.5
Vitamin B-2 (mg)	0.15-0.2
Niacin (mg)	4.0-6.8
Vitamin B-6 (mg)	0.15-0.2
Vitamin B-12 (μg)	0.3
Pantothenic acid (mg)	1.0-2.0
Biotin (μg)	5.0-8.0
Lipid soluble	
Vitamin A (μg) †	150-300
Vitamin D (μg) †	0.8
Vitamin K (μg)	10.0
Vitamin E (mg) †	2.8-3.5

†1μg RE = 1μg all-trans retinol = 3.3IU vitamin A; 10μg vitamin D = 400IU；2.8mg α-tocopherol = 2.8IU vitamin E

Table 7. Daily recommended intakes of parenteral trace elements in neonates

Trace elements	Premature infants (μg/kg/d)	Term infants (μg/kg/d)
Zinc	400-450	250<3m 100>3m
Copper	20	20
Selenium	2.0-3.0	2.0-3.0
Chromium	0	0
Manganese	1.0	1.0
Molybdenum	1.0	0.25
Iodine	1.0	1.0
Iron	200	50-100

Table 8. Parenteral Nutrition Monitoring

Parameters		First week	Stable
Intake	Energy (kcal/kg/d)	qd	qd
	Protein (g/kg/d)	qd	qd
Clinical signs observation	Skin elasticity, Fontanel,	qd	qd
	Jaundice, Edema	qd	qd
Growth parameter	Weight	qd~qod	biw~tiw
	Head circumference	qw	qw
	Length	qw	qw
Body fluid balance	Intake and output	qd	qd
Laboratory	CBC	biw~tiw	qw~biw
	Blood Na^+, K^+, Cl^-	biw (or the first day after adjustment of electrolyte dosage)	qw (or the first day after adjustment of electrolyte dosage)
	Blood Ca	biw	qw
	Blood P, Mg	qw	prn
	Trace element	prn	Prn (patients with hepatic or renal dysfunction and those on long-term PN)
	Liver function	qw	qw~qow
	Renal function	qw	qw~qow
	Plasma triglyceride and total cholesterol†	qw	prn
	Blood glucose	qd~qid	Prn (after adjustment of formula or when the symptom of hyer- or hypoglycemia present)
	Urine glucose (when blood glucose is unavailable)	The same as above	The same as above
CVC monitor	Effusion	bid~tid	bid~tid
	Limb swelling	bid~tid	bid~tid
	Color of skin	bid~tid	bid~tid

†Lipid emulsion injection should be stopped for 6 hours before serum lipid determination

3. Hepatic complications: such as cholestasis and liver injury. The onset is associated with duration of parenteral nutrition, episode of necrotizing enterocolitis and septicemia (C), rather than high dose of intravenous protein (B). Earlier establishment of enteral nutrition could reduce the incidence and severity of cholestasis (C).

Cautions or contraindications of parenteral nutrition

1. Fluid infusion should not be used for the purpose of nutrition support in a state of shock, or severe water-electrolyte disturbance or acid-base imbalance until the condition has been remedy. (E)
2. Dose of lipid emulsion should be reduced on patients with sever infection, or bleeding tendency, or coagulation abnormalities. (E)
3. Lipid emulsion should be reduced when plasma triglyceride is over 2.26 mmol/L (200 mg/dL), and suspended when it is over 3.4 mmol/L (300 mg/dL) until clearance. (E)
4. Dose of lipid emulsion should be reduced when plasma indirect bilirubin concentration is over 170 umol/L (10 mg/dL). (E)
5. Severe liver dysfunction cautions lipid emulsions and non-liver-specific amino acid preparations. (E)
6. Severe renal dysfunction cautions lipid emulsions and non-kidney-specific amino acid preparations. (E)

PN and EN

I. Start EN (except EN contraindications) on the first day after birth, if EN cannot reach caloric and protein adequacy, PN should be considered. (A)
II. Formula: PN = (1-EN/110) × 80, (unit of PN and EN: kcal/kg/d) (110: caloric of full enteral nutrition, 80: caloric of full parenteral nutrition). (E)

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Clinical Nutrition Guidelines

CSPEN guideline for nutrition support in neonates

Working group of Pediatrics, Chinese Society of Parenteral and Enteral Nutrition
Working group of Neonatology, Chinese Society of Pediatrics
Working group of Neonatal Surgery, Chinese Society of Pediatric Surgery

中国新生儿营养支持指南

在过去的几十年里，早产儿的存活率明显升高，尤其是极低出生体重儿。新生儿的营养问题也变得越来越重要。早产儿和大多数疾病状态的足月儿通常需要营养支持。新生儿的营养需要量必要经过實際计算(而不是估计)。营养支持的目标是维持正常的营养状况和生长需要的同时，避免营养相关并发症的发生。不同体重和胎龄的新生儿营养需要(肠内营养和肠外营养)是不同的。在患儿无法进行肠内营养、肠内营养摄入不足或肠内营养会造成危害的情况下，肠外营养(PN)可以满足患儿生长及發育的需求。肠内营养(EN)应逐步添加并尽快取代 PN，以减少 PN 的并发症 。早期摄入量不足，可造成远期代谢疾病的不利影响。合適的营养支持可以改善早产儿的預後狀況。本指南旨在为新生儿合理营养支持提供推荐摄入量。这些建议是基于对相关文献进行分析，以及在资料不足情况下达成的专家共识。

关键词：肠外营养、肠内营养、早产儿、新生儿 、营养支持