

Parenteral nutrition

Why is parenteral nutrition important for preterm infants?

Some preterm and sick newborns have

- an immature gut,
- unstable health conditions or
- higher nutritional needs than can be covered by enteral nutrition or breastfeeding,
- do not tolerate enteral nutrition due to clinical conditions (e.g. infections, surgery).

These vulnerable newborns, predominantly those with a birthweight < 1500 g, rely on parenteral nutrition.

Parenteral nutrition aims at maintaining optimal growth and development according to intrauterine conditions, preventing catabolic state, decreasing complications of prematurity and improving neurodevelopmental outcomes in order to optimise lifelong health and well-being.

The **goals** of parenteral nutrition are

1. to enable an adequate supply of macronutrients and
2. to provide sufficient amounts of fluid, electrolytes, trace elements and vitamins

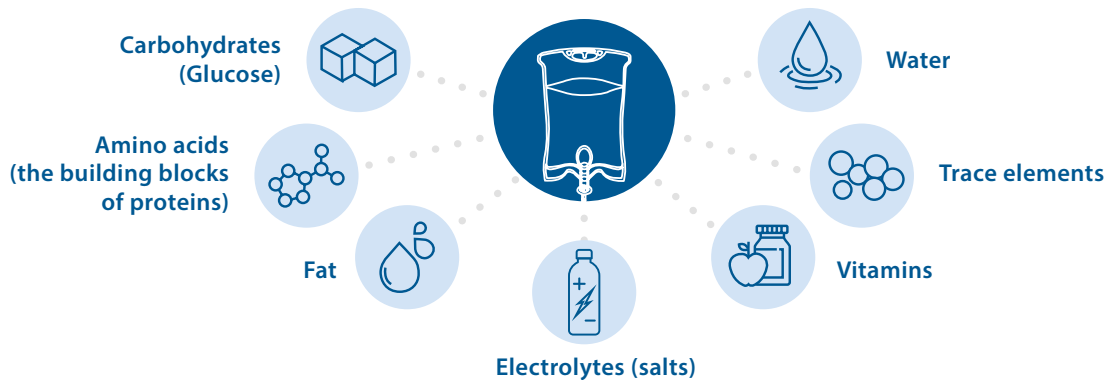


Important:

parenteral nutrition is an **interim solution**. It should only be administered as long as necessary. In parallel, small amounts of enteral nutrition (human milk or fortified human milk) should be administered to support the gastrointestinal maturation. While the amount of enteral nutrition is continuously increased, parenteral nutrition should gradually be reduced.

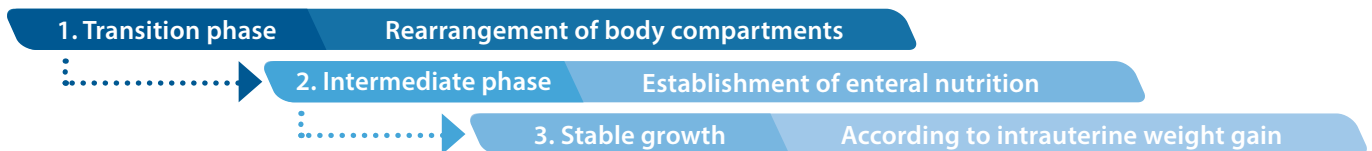
Components of parenteral nutrition


Parenteral nutrition is an emulsion that is given as an infusion. It includes various components whose concentrations are adapted to the infant's needs and depend on age and clinical condition:¹





Parenteral nutrition during phases of postnatal adaptation

After birth, several physiological adaptation processes occur, which can be grouped into three phases.²⁻⁴



 Starting parenteral nutrition on day one, as early as possible, is a crucial success factor

 Glucose, amino acids AND lipids should be introduced on day one

 Nutrient concentrations depend on whether infants are born preterm or term and their weight, and should be retrieved from guidelines and adapted daily

What are standardised and individualised parenteral nutrition and their benefits?⁵

| | Individualised parenteral nutrition | Standardised parenteral nutrition |
|------------------------|---|--|
| Description | <ul style="list-style-type: none"> Nutrient composition adapted to the individual needs of a specific patient (individual ratio) | <ul style="list-style-type: none"> Standardised composition of nutrients covering the need of a majority of patients with the same age and clinical conditions (set ratio) |
| Appropriate for | <ul style="list-style-type: none"> Recommended for very sick and metabolically unstable newborns with specific nutritional needs All preterm and sick newborns with indication for parenteral nutrition | <ul style="list-style-type: none"> Majority of preterm and sick newborns with indication for parenteral nutrition |
| Production site | <ul style="list-style-type: none"> Hospital pharmacy Hospital ward | <ul style="list-style-type: none"> Hospital pharmacy External compounding centres Validated licensed manufacturer |
| Advantages | <ul style="list-style-type: none"> Optimally adapted to individual needs Composition of nutrients adaptable on a daily basis | <ul style="list-style-type: none"> Lower risk for prescription, ordering and administration errors Possibility to store a stock of infusions readily available Stability and sterility testing and rigorous testing of industrially produced solutions Long shelf-life and uncomplicated storage conditions of industrially produced solutions |

The **2018 European Guideline on pediatric parenteral nutrition** recommend

1. to prefer the use of standardised solutions over the use of individualised solutions for a majority of newborns including preterm infants with a very low birthweight⁵
2. that individualised solutions should be used when the nutritional requirements cannot be met by the available range of standard solutions (i.e. in very sick and metabolically unstable infants)⁵

Practical advice

- A range of standardised solutions suiting different clinical conditions should always be available at the ward.^{5,6}
- Computerised programs to calculate nutritional requirements should be used to identify the most adequate standardised solution and to optimise the use of individualised solutions.⁵
- Industrially manufactured ready-to-use multi-chamber bags are available, easy to use, safe, have a long shelf-life and can be made available at the ward for immediate use.^{5,7}



In my hospital we have successfully been using standardised parenteral nutrition for > 80% of the infants for over 20 years. Consequently, we can focus our attention and make individualised parenteral nutrition for the patients that really need it.

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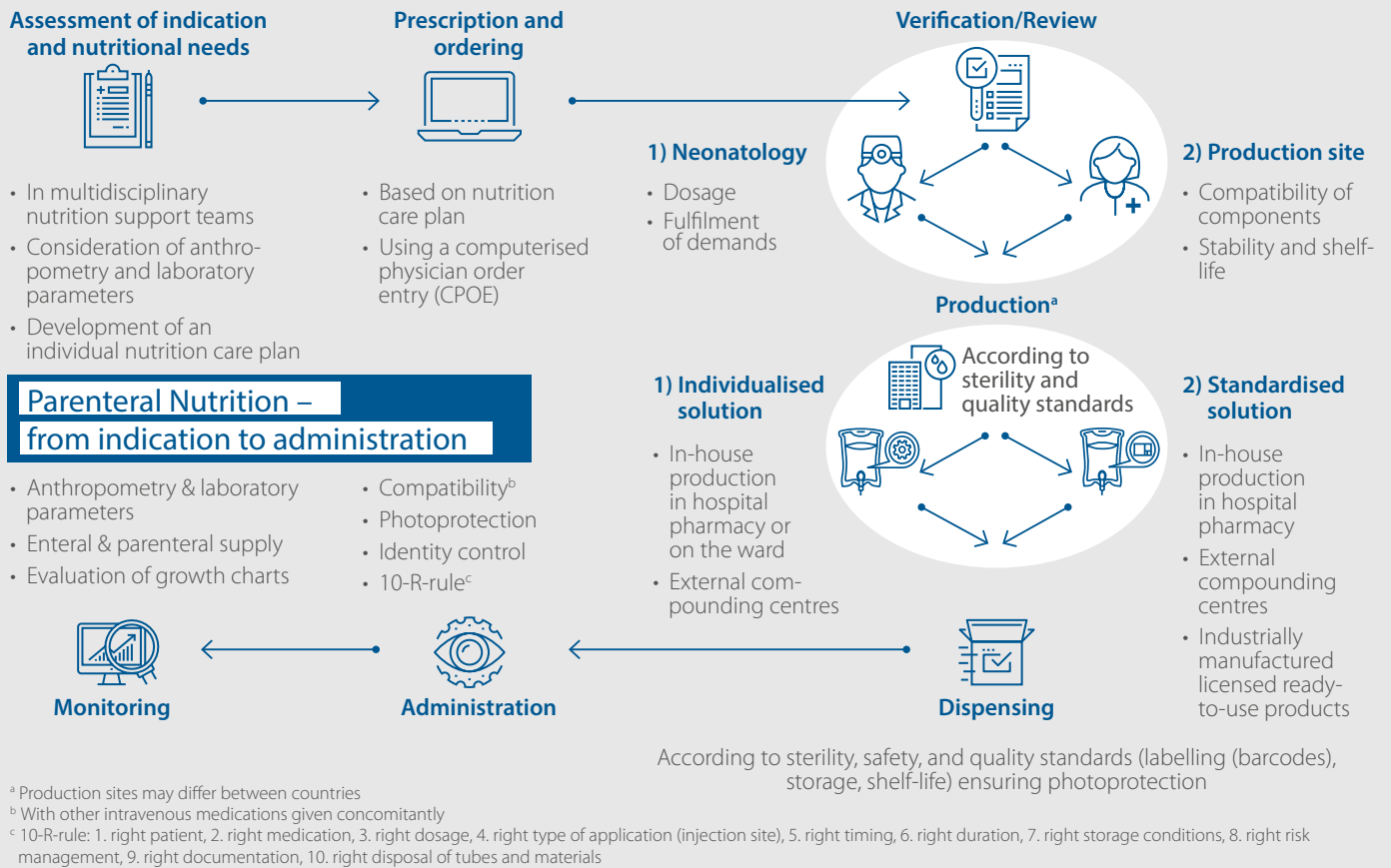
From indication to administration

Several steps are required before parenteral solution can be provided. A multidisciplinary nutrition support team should be involved.^{6,8-11}

- | | | |
|---|--|--|
|  Neonatologists/paediatricians ^a |  Dietitians/nutritionists |  Hygiene experts |
|  Neonatal nurses |  Pharmacists |  Parents and families |
|  Midwives |  Lactation consultants | |



^aIncluding paediatric surgeons and paediatric gastroenterologists



How can risks be minimised?

Due to potential risks (medical side effects or errors introduced by imprecise handling), parenteral nutrition is classified as ‘high-alert’ medication.¹² **‘Administering parenteral nutrition as long as necessary but as short as possible’** should be THE guiding principle.

Adhering to the latest recommendations of evidence-based guidelines can minimise the risks of parenteral nutrition!

Guideline on parenteral nutrition for preterm and sick neonates from **European and Chinese associations**

ESPGHAN/ESPEN/ESPR/CSPEN^b guidelines on pediatric parenteral nutrition (<https://espghan.info/published-guidelines>)

Local/country-specific guidelines on parenteral nutrition for preterm and sick neonates

are available in some countries (**Germany**, the **UK**, etc.)

Unit-specific care bundles on patient safety and hygiene practice should be established and adhered to

see standards on **patient safety and hygiene practice** (<https://bit.ly/ESCNH-patient-safety-hygiene>)

Guidelines on enteral nutrition for preterm and sick neonates

Adhering to the latest guidelines for **preterm enteral nutrition** also helps to optimise parenteral nutrition

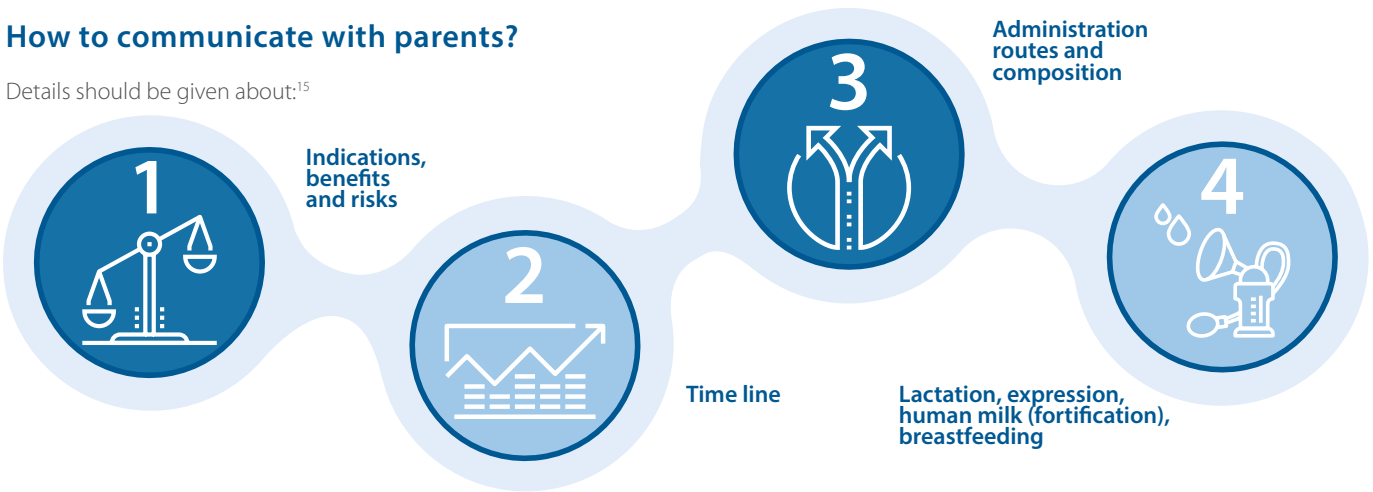
Barriers and (risk) management of parenteral nutrition

| Barriers in the implementation of European guidelines: ^{13,14} | Risk management measures can help to overcome barriers: |
|---|---|
| <ul style="list-style-type: none"> Poor knowledge of guidelines Lack of support and training Prescription software not available No availability or cooperation with pharmacy Concerns to cause infections Errors in prescription and application | <ul style="list-style-type: none"> Development and regular exchange in a multidisciplinary nutrition support team Verification of provision processes and error management^{4,8} Utilisation of patient-individual nutrition care plans Continuous training of professionals Regular monitoring of growth, signs of infections, nutritional status and assessment of laboratory parameters¹⁵ Make prescription software available, along with training and regular utilisation^{4,16} Use standardised solutions whenever possible^{4,17} Choose catheter type wisely and ensure sterile working conditions (“scrub the hub”)⁴ |

^b ESPGHAN: European Society for Paediatric Gastroenterology, Hepatology and Nutrition, ESPEN: European Society for Clinical Nutrition and Metabolism, ESPR: European Society for Paediatric Research, CSPEN: Chinese Society for Parenteral and Enteral Nutrition

How to communicate with parents?

Details should be given about:¹⁵



| | | | |
|--|--|---|---|
| Written  <p>to provide professional but easily understandable and clear information</p> | <p>How should information be given?</p> | <p>to discuss concerns and be responsive to questions</p> | Orally  |
| <p>See the factsheet '<i>Parenteral nutrition for very preterm and ill babies</i>' for parents</p> | | <p>Show parents a bag containing parenteral nutrition and explain the need, components, injection site, safety measures and potential risks</p> | |



Parents are the most important care-givers for their infants and therefore it is essential to include them in all steps of the nutritional management – not only in issues on breastfeeding and enteral nutrition but also parenteral nutrition.



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References

- Mihatsch, W. A. et al. Clinical Nutrition. 2018; 37: 2303–2305.
- Jochum, F. et al. Clinical Nutrition. 2018; 37: 2344–2353.
- Ernährungskommission der Österreichischen Gesellschaft für Kinder- und Jugendheilkunde (ÖGJK) et al. Monatsschr Kinderheilkd. 2020; 168: 634–643.
- Nadja Haiden Neo Scan. in revision.
- Riskin, A. et al. Clinical Nutrition. 2018; 37: 2409–2417.
- EFCNI, GNPI, ADKA. www.efcni.org/wp-content/uploads/2021/06/2021_06_17_EFCNI_GNPI_ADKA_Toolkit_PE_final_Druckbogen.pdf (accessed November 30, 2021).
- Rigo, J. et al. J Pediatr Gastroenterol Nutr. 2012; 54: 210–217.
- Puntis, Jwl. et al. Clinical Nutrition. 2018; 37: 2392–2400.
- Agostoni, C. et al. J Pediatr Gastroenterol Nutr. 2005; 41: 8–11.
- Jeong, E. et al. BMC Pediatrics. 2016; 16.
- Boullata, J. I. Journal of Parenteral and Enteral Nutrition. 2012; 36: 105-135.
- Institute for Safe Medication Practices. www.ismp.org/sites/default/files/attachments/2018-08/highAlert2018-Acute-Final.pdf (accessed October 14, 2020).
- Lapillonne, A. et al. British Medical Journal Publishing Group BMJ Open. 2013; 3: e003478.
- Hoffmann, J. et al. Monatsschr Kinderheilkd. 2021.
- EFCNI. www.efcni.org/wp-content/uploads/2019/09/2019_09_16_EFCNI_Parenteral-Nutrition_Positionspapier_web.pdf (accessed April 19, 2022).
- Hilmas, E., Peoples, J. D. JPEN J Parenter Enteral Nutr. 2012; 36: 325-355.
- Hoffmann, J. et al. Z Geburtsh Neonatol. 2022; 6.

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About EFCNI

The European Foundation for the Care of Newborn Infants (EFCNI) is the first pan-European organisation and network to represent the interests of preterm and newborn infants and their families. It brings together parents, healthcare experts from different disciplines, and scientists with the common goal of improving long-term health of preterm and newborn children. EFCNI’s vision is to ensure the best start in life for every baby.

The **EFCNI Academy** is an international education programme for healthcare professionals under the umbrella of EFCNI.

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