

Enteral nutrition (Pediatrics)

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Enteral nutrition is the most effective and acceptable way to achieve and maintain adequate nutritional status in children who have functional GIT. The profile of enteral nutrition substrates is similar to the parenteral profile.

In addition to balanced products, supplementary products for the treatment of renal and liver disorders and nutrition of patients with stress, immunodeficiency and lung disorders are also produced. There are products with a trace amount of lactose, preparations without residue and with a higher fiber content. There are also different types of defined products for children.

Enteral nutrition has fewer complications compared to parenteral nutrition, is easier to prepare and administer, and is cheaper. If not sufficiently tolerated, supplemental parenteral nutrition is indicated. The so-called early enteral nutrition in the post-exercise period represents enteral nutrition started within 24 hours after the stroke or within 8 hours after the operation. The advantage of this approach is the reduction of the hypermetabolic response and the improvement of the integrity of the GIT. It prevents the formation of mucosal atrophy, improves wound healing, reduces the incidence of infectious complications and bacterial translocation. In some studies, a shortening of hospitalization was also confirmed.

Benefits of early enteral nutrition

- satisfaction of nutritional requirements
- reduction of complications related to total parenteral nutrition
- lower price
- GIT integrity support
- improving tolerance to enteral nutrition
- improving wound healing
- shortening of hospitalization
- reducing the incidence of infections, sepsis and bacterial translocation
- reduction of the hypermetabolic response to stress

In critically ill patients, we leave the so-called *hospital diet system*. Therapeutic nutrition for this group of patients must have pharmaceutical parameters with a precise definition of the mineral content, the proportions of individual substrates, vitamins and trace elements determined by the recipe.

When switching from parenteral nutritional support to critically ill patients to enteral care, we assume the use of products whose absorption is ensured even when altering GIT function. We consider it advantageous to administer oligopeptic preparations with fat- containing triglycerides with a medium chain fatty acids (MCT, *medium chain triacylglycerol*) which do not require pancreatic lipase for absorption. The transport capacity for oligopeptides and amino acids is separate and the load on one transport system does not affect the function of the other. Only after the critical phase of the disorder has disappeared do we move to a balanced high-molecular diet and dietary system.

Indication

- disorders of digestion and absorption of nutrients
- upper GIT passage disorders
- CNS diseases and neuromuscular diseases
- metabolic and other chronic diseases
- prevention and treatment of hypercatabolism

Contraindication

Enteral nutrition is absolutely contraindicated in

- NPB
- ileal states
- toxic megacolon
- acute pancreatitis
- liver failure
- severe diarrhea
- bleeding into the GIT

Method of administration of enteral nutrition products

thumb | PEG scheme. If you need short-term nutritional support (3 to 4 weeks), we choose a nasogastric or nasojejunal tube. Nasojejunal administration is indicated for gastric administration intolerance. A modern option in nasojejunal nutrition is the introduction of a trluminal enteral tube by the endoscopic method. The most proximal port is reserved for the derivation of the gastric bubble, the middle port is used to aspirate the stomach contents and the distal jejunal port is intended for self-nutrition. Sometimes the administration of prokinetics is advantageous, metoclopramide and erythromycin are used.

For long-term nutritional support, we then choose gastrostomy (PEG), jejunostomy (PEJ).

Enteral nutrition can be given continuously or in the form of boluses. In general, children are better tolerant of tube feeding when given continuously, but bolus administration is "more physiological". Continuous administration of enteral nutrition preparations requires an enteral pump, especially in children who do not tolerate fluctuations in the volume administered and in children in need of nocturnal feeding.

Classification of enteral nutrition products

350px | right | Enteral nutrition system

From the point of view of the formulation of enteral preparations, it is necessary to monitor their energy density, osmolality, protein content and their main source, fat content and its main source, as well as carbohydrate content. Some products are specifically enriched with arginine, nucleotides, taurine, glutamine and fiber.

Therapeutic enteral nutrition can be divided into nutrition:

- balanced or balanced,
- organ - specific and
- tissue or system specific.

Balanced nutrition contains all standard nutritional components and its composition usually meets the needs of the organism without serious organ damage.

Organ-specific nutrition is indicated for patients with organ involvement, especially the liver and kidneys. It usually serves as a supplement to a balanced diet (eg in patients with chronic renal failure).

Tissue- or system-specific nutrition, eg immunomodulatory, is based on a balanced preparation with an increase in substances with an immunomodulatory effect (nucleotides, glutamine, arginine, taurine, omega-3 polyunsaturated fatty acids). It is usually used to feed severe stressful conditions and patients with secondary immunodeficiency.

From the point of view of the chemical structure of the used substrates, we distinguish the preparations as follows:

- **elemental nutrition**
- **oligomeric nutrition**
- **polymer nutrition**
- **modular nutrition**

Elemental nutrition (low molecular weight I. generation; molecular)

It contains most of the components in molecular form (glucose, amino acids, fatty acids). It has a high osmolality. It does not need enzymatic equipment of the intestine for absorption. It is administered by nasogastric or nasojejunal gavage, or by PEG / PEJ.

Oligomeric nutrition (low molecular weight 2nd generation; oligopeptide)

It contains oligopeptides and amino acids, sugars are provided mainly by maltodextrin and fats with soybean oil. It has an osmolality of about 350 mosmol / l. It is mainly administered by gavage or PEG / PEJ. If it is well-corrected, its oral administration can be tolerated for a shorter period. It is the standard nutrition profile of critically ill patients.

High molecular weight (polymer) nutrition

right | 250px | high molecular weight nutrition It contains valuable protein, maltodextrin and fats with a high content of essential fatty acids and MCT. It is also administered orally by gavage. The osmolality is usually 300 mosmol / l. The possibility of good taste correction of preparations ensures their long-term application by the oral route.

Modular nutrition

Modular nutrition offers individual nutritional substances in substrate modules. It is then possible to create the composition of nutrition for the patient according to the current situation (nutrition prepared according to the patient's needs, so-called tailored nutrition).

The profile of electrolytes, vitamins and trace elements in all preparations corresponds to the daily needs of the organism while maintaining the recommended daily dose.

Pediatric products are intended for children from 1 to 6 years. They are complete balanced polymer diets with lower content of protein, sodium and higher concentration of calcium and vitamin D3. For newborns and infants, infant formula, including dietetics (low-lactose formulas, extensive hydrolysates) can be used for enteral nutrition. The choice of product and the method of administration of enteral nutrition depends on the age, underlying disease and clinical condition of the child. From the point of view of nutritional tolerance, the actual method of introducing enteral nutrition is very important. Initiation of the application is most suitable continuously, with undiluted nutritional preparation.

Fiber

Fiber is part of enteral nutrition products. In the past, it was not given nutritional significance. However, the current state of knowledge ranks fiber among substances with specific nutritional significance. Fiber has a major effect on maintaining the function of the gastrointestinal tract. These are residues of plant skeletons that are resistant to the action of digestive enzymes.

The main components of fiber are cellulose, hemicellulose, gums, lignin, pectins and mucilages. Fiber increases the growth of bacteria in the large intestine, increases the weight of stools, lowers cholesterol, regulates blood glucose levels and speeds up the passage of food through the intestine.

The fiber is digested by the effect of bacterial anaerobic fermentation in the large intestine. This process releases short chain fatty acids, acetic acid, butyric acid and propionic acid (SCFA). These are the main source of energy for the cells of the colon, stimulating the proliferation of mucosal cells and increasing blood flow in the wall of the colon. They are needed to maintain its integrity. The use of fiber-containing products reduces the incidence of some complications, such as diarrhea, in critically ill patients.

Fats

The source of fats in enteral nutrition is usually an oil with a high content of polyunsaturated fatty acids, ie soybean oil, sunflower oil or rapeseed oil, fish oil in combination with vegetable, triglycerides with a medium chain fatty acids. Omega-3 and omega-6 polyunsaturated fatty acids are part of Omegaven® for enteral nutrition. Enteral administration shows that EPA and DHA located in the 2nd position of the triglyceride have a positive effect on their absorption, as well as faster absorption of medium chain triglycerides in the 1st and 3rd position and long chain fatty acid in the 2nd position. .

Practical recommendations for the application of enteral nutrition

At the beginning of enteral nutrition, we start continuously with 1 to 2 ml / kg / hour or frequent bolus feeding, when the bolus must be given slowly for about 15 to 30 minutes. Initially, we prefer maximum isotonic concentrations with an energy content of 0.5 kcal / ml. We increase the volume and concentration separately. First we increase the volume and only after reaching half the required volume we start to increase the concentration.

As a standard we use formulas where 1 ml = 1 kcal and in 500 ml the content of nutrients: protein 20 g, carbohydrates 65 g, fats (MCT) 20 g. Especially then we use formulas with increased energy content, 1 ml = 1.5 kcal, they contain predominantly branched-chain amino acids. In balanced preparations suitable for patients without organ involvement, almost 50% of energy is supplied in sugars, 30% in fats and about 20% is represented in proteins. In enteral nutrition, sugars are most often supplied in the form of maltodextrin or hydrolyzed cereal starch. In the event of intolerance (vomiting, diarrhea, excessive residual volume), we return to the still tolerated volume and concentration.

If the child does not receive full enteral nutrition, supplemental parenteral nutrition is inevitable. The addition of parenteral nutrition is indicated if at least 80% of the energy target cannot be administered to the patient within 72 hours. In terms of evaluating the quality of proteins, it is necessary to mention some parameters and terms that are used in this regard. High nutritional quality protein should be used in all enteral nutrition products. This is evaluated by the so-called biological value given by the ratio between retained nitrogen and absorbed nitrogen. The chemical score compares the composition of amino acids in food with the composition of egg white protein. High quality proteins include egg protein, milk protein, meat protein and fish protein. For infants, the diet of choice is breast milk or preparations containing egg white protein and casein.

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