Interaction of pancreatic secretion and nutritional status

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Analysis of patients trophological (nutritional) status, which is a necessary component of the assessment of health as well as the severity of the disease consists of the analysis of a wide range of data, including clinical and somatometric data. Psychomotor development, psycho-emotional status (mood), appetite, a condition of the skin and subcutaneous tissue, mucous membranes, muscle tone, and others belong to the first, including peculiarities of sexual maturation.

Somatometric factors include weight, height, head circumference and shoulder width skinfold triceps, the value of the circumference of the shoulder muscles and a few others. Their normal values lie within the standard deviation (1?) or 2575 percentile at centile tables usage.

Expected somatometric indications are widely used in clinical practice. The most famous of these is the deviation of body mass index (BMI), evident in % and equal to

BMI = AMB (kg) / EB (kg) * 100%,

AMB ? Actual mass of the body, EMB - Expected Mass of the body. Normal limits of BMI are 90 -110%.

Body mass index (BMI) (index Quetelet) is expected as interaction of AMB in kg to limits of height (metre) and multiplated. Normal limits of EMB are shown below:

<18,5 - undernutition;

18,524,9 - adequate nutrition;

25,029,9 - supernutrition;

30,0 - obesity.

The nutritional status is assessed by special studying techniques, which are divided into static and functional tests. Determination of abnormal metabolites, enzyme activity, in vitro tests, provocative pathophysiological reactions are referred to the last.

Fecal analysis can be used to assess current supply (determination of the content of mineral substances, lipids), urine (vitamins, except 12 and folacin, vitamins, macro micro elements, including Na, , , Mg, Se, amino acids and others), bile (cholesterol), blood (lipids, vitamins, macro micro elements).

Evaluation of medium-and long-term supply may be made in the examination of red blood cells (vitamins B1, B2, B6, niacin, folacin, Se, Cu), leukocytes (vitamin C, Zn), hair and nails (trace Zn, Cu, etc.), fatty tissue (fatty acids).

Markers of protein deficiency are indicators of biochemical blood. Determining the level of total protein and albumin in the blood are the most available of them, but not the most accurate, due to the relatively long half-life (within 15-20 days). Determining of transferring is more accurate (naturally: 24 g/l, 1/28 days) and transthyretin (naturally: 170350 mg/l, 1/223 days).

Reduction of protein markers are three degrees of protein deficiency: easy - declines ranging from 10% to 20%, average 20% to 30%, severe - more than 30%. Other markers of protein deficiency are the alpha-1-acid glycoprotein (orozomukoid), alpha 1-antitrypsin, C-reactive protein (CRP). In this case, signs of protein deficiency are increasing these indicators by 5% or more.

Prognostic index of inflammation and nutritional status (PIINS) proposed by Carpeintier and Ingenbleek, which is based on the concentration of serum albumin and transthyretin, and the activity of the inflammatory process can be calculated:

PIINS = alpha-1 CGP * CRP * Alb * TTR,

alpha-1 CGP ? alpha concentration-1 of sour glucoprotein (/), RP ? C-reactive protein (mg/l), lb ? level of Albumen(g/l), ? level of transthyretin (mg/l).

Trophological status indicators are also the absolute number of lymphocytes, the actual energy consumption and many others.

Correction of nutritional status is a multifaceted process that includes, in addition to correct underlying pathological process, as power processing, process of digestion and absorption and metabolism.

Table1

Basic enzymes of the pancreas

Enzyme	Target
amylase	Alpha-1,4- glycosidic bonds of starch, glycogen
lipase	Triglycerides (formation of 2-monoglycerides of fatty acids)
Phospholipase A	Phosphatidylcholine (the formation of lysophosphatidylcholine and fatty acids)
carboxylase	Cholesterol esters, and esters of fat soluble vitamins, tri-, di-and monoglycerides
trypsin	Internal protein relation (essential amino acids)
chymotrypsin	Internal protein relation (fragrant amino acids)
elastase	Internal protein relation (neutral amino acids)
carboxypeptidases A and B	External protein relation, including aromatic and aliphatic neutral amino acids, basic amino acids with the carboxyl terminus

Table 2

The dynamics of the relative body weight in children with celiac disease during enzymotherapy treatment with the Creon drug ®

Indications	In 2 month in the context of treatment	
	Without high level enzyme preparations (n – 18)	With high level enzyme preparations (n – 18)
BMI (%), mediana	82	91
A rate of motion, mediana	4	2
% children with motion 4 and less according to Bristol Stool Form	76%	82%

Table 3

Dynamics of protein metabolism indications at children with celiac disease during enzymotherapy treatment with the Creon drug (the proportion of patients with normal values in% of total number of examined children)

Indications	Before treatment	In 2 month in the context of treatment	
		Without high level enzyme preparations	With high level enzyme preparations C
Common protein	50%	72%	89%
Albumen	47%	82%	91%
Transferrin	30%	61%	83%

Adequate function of the digestive glands is obviously necessary for normal metabolic processes in the body, including growth and development. The secretion of pancreatic enzymes that provides the basic processes of digestion of proteins, fats and carbohydrates, is shown in Table 1.

Trypsin, chymotrypsin, elastase, and many others are referred to proteolytic enzymes of the pancreas. All proteolytic enzymes produced by the pancreas in a passive form, and activated by trypsin in the future. Trypsin itself is also secreted as a passive trypsinogen and its activation occurs in the duodenum intestinal enterokinase. Inactive enterokinase is activated by duodenase which is produced by cells of the duodenum.

The proteolytic action of pancreatic secretion is caused by three endopeptidase — trypsin, chymotrypsin and elastase, which degrade proteins and polypeptides from the stomach. Trypsin acts on peptide bonds formed by a basic amino acid, chymotrypsin acts on relation between neutral amino acid residues, while elastase cleaves relations residues adjacent to the small amino acids such as glycine, alanine and serine. The activation of trypsinogen is performed by enterokinase, which hydrolyze its lysine peptide bond. The resulting trypsin acts as at a new molecule trypsinogen and chymotrypsinogen, as well as at procarboxypeptidase proelastaz releasing chymotrypsin, elastase and carboxypeptidase.

Clearing factors (pancreatic lipase, cleaving triglyceride), phospholipase and some others referred to lipolytic enzymes. Moreover, bile acids activate lipase as well as pre emulsify fats, facilitating their exposure to enzyme. Amylolytic activity (cleavage of

starch) of pancreatic amylase secretion is determined by pancreatic enzyme that is secreted directly into the active form.

Thus, the exocrine pancreatic secretion provides the basic processes of digestion of nutrients, therefore the functional state of the pancreas largely determines the nature of the patient's nutritional status. Thus, experimental studies have shown that weight gain in young animals is significantly correlated with the exocrine function of the pancreas. Common factors are found in clinical practice, and therefore therapy with pancreatic enzymes as an important component of nutritional status.

High-energy pancreatic enzyme preparations (like Creon), characterized by the high quality of the substrate, protection from premature activation of the mouth and esophagus (capsule), minimicrospheres certain size (1.0-1.2 mm), ensuring uniform mixing of the gastric and intestinal content, as well as protection against inactivation in the stomach (pH-sensitive shell minimicrospheres).

Highly-energy preparations of digestive enzymes are widely used for the treatment of diseases associated with exocrine pancreatic insufficiency, both absolute and relative. High efficiency of its trophological factor has been shown for the first time in the treatment of patients with cystic fibrosis. The use of these drugs are not only effectively corrected severe pancreatic insufficiency, which is specific for the disease, but allowed to change the nature of power, enhance the uptake of nutrients, significantly improve nutritional status and, as a result, not only to increase the life expectancy of patients, but also to improve its quality.

Pancreatic insufficiency according to the Scientific and Clinical Department of cystic fibrosis State MGNTS RAMS (Moscow) observed in 95.3% of patients with manifestation in the first days of life. The consequence of it is the malabsorption of fats and proteins. 50% of incoming protein may be lost with a motion. Patients with cystic fibrosis are usually observed by good absorption of carbohydrates, but their metabolism can be broken down to development of diabetes later in life. Thus, according to N.I. Kapranov and co-authors after the introduction of treatment of children with cystic fibrosis drug Creon ® hospitalizations decreased by approximately 30%, as well as the number of courses of antibiotic therapy, the quality and expectancy of life have improved significantly. Moreover, the average cost of treatment by highly-energy preparations was approximately 2-3 times lower in comparison with the use of moderate activity drugs, without mention a high pharmacological efficiency.

Work of N. Y. Kashirskaya and co-authors was shown that the transition to the diet without limitation fat in CF patients is possible having adequate replacement therapy. At the same time serum lipid profile of blood serum has significantly changed. High fat, high-calorie diet combined with microsphere enzymes with a pH-sensitive membrane is able to maintain normal nutritional status and lipid composition of the blood plasma of patients with cystic fibrosis at a normal level in accordance with foreign investigators' facts. Furthermore, an increase of fat food ingredients and application of new forms of pancreatic enzymes leads to an increase in polyunsaturated fatty acid composition of phospholipids and their metabolites. This conception is confirmed and developed by the last examination in the sphere of CF patients' efficiency treatment.

Celiac disease is a hereditary disease caused by intolerance to gluten, a protein of some cereals, characterized by malabsorption syndrome, where the intestinal

absorption of almost all nutrients is disturbed. An indication for celiac disease treatment is a gluten-free diet, which is supplemented by syndromic treatment, aimed to improve the digestive processes in the gut. Indispensable component of this therapy in recent years has been the use of high-drugs pancreatic enzymes (Creon ® 10000 or Creon 25000).

According to our data, the increase in triglyceride excretion in the feces, indicating exocrine pancreatic insufficiency occurs in 18% of patients in the active phase of celiac disease, and 52% - in remission. Mechanism for the involvement of the pancreas in the pathological process of celiac disease first of all, involves a violation of humoral regulation of the intestine against the atrophic changes in the mucosa, as well as non-specific metabolic disorders in a child with severe malabsorption.

Based on this, the patient’s management with celiac disease should include an ultrasound of the pancreas, an assessment of its exocrine function (the best method is to determine the elastase-1 in motion, but can be used indirect methods such as lipidogram feces), as well as to determine the activity of pancreatic enzymes in the blood (trypsin, lipase or elastase-1 in the blood (trypsin, lipase or elastase-1 in the blood). A comprehensive treatment of celiac disease should include preparations of pancreatic enzymes (eg Creon ®), with the great pathogenetic importance. The use of the drug Creon 10000 is properly to apply in most cases.

According to a retrospective analysis of children with celiac disease at the age of 11 months to 6 years, the introduction of these drugs in the treatment shortens cupping diarrhea syndrome, as well as intensify the recovery of the nutritional status of patients. Data concerning somatometric indicators and dynamics of protein metabolism are presented in Table 2 и 3.

BMI in 2 months differs in the final value. In the future, this factor, as well as others, almost leveled. These changes are characterized by a normalization of motion - as its frequency and consistency. The correlation between the frequency of motion and BMI is strong negative significant ($r = 0,72$; $p < 0,05$). In this case, normalization of body weight happens not only due to the recovery processes of absorption (normalization of motion frequency as a reflection of this process), because BMI recovery is slightly advance such indicators of motion.

Positive dynamics is observed for the key indicators of protein metabolism: the levels of total protein, albumin and transferring confirms the positive direction of nutritional status. Dynamics of transferrin is the most indicant, showing the real effect of the therapy. Differences in total protein dynamics in children treated and untreated by enzyme preparations also vary (drawing 1). These indicators are also associated with motion frequency, although in this case we can speak about tendency.

The obtained data point at the importance of the state of exocrine pancreatic secretion to restore the nutritional status of celiac disease, as well as the need for the appointment of high-level preparations of pancreatic enzymes in order to reduce the time the recovery.

Thus, pancreatic enzymes are trophological important factors that ensure recovery of the patient's nutritional status in a wide range of pathology, and pancreatic enzyme preparations should be used in integrated circuits for their correction.