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ANTIOXIDANT SYSTEM AND THE ROLE OF FREE RADICALS IN THE DEVELOPMENT OF ACUTE RHINOSINUSITIS IN PATIENTS WITH DIABETES MELLITUS

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Introduction. The problem of treatment of paranasal sinusitis remains relevant due to the steady increase in the incidence of them. A special group is made up of patients with diabetes mellitus (DM). They are more susceptible to infection, the source of which is often the pathology of the ENT organs with its rapid development and subsequent complications, the basis for the development of which is oxidative stress. The conditions for its formation arise with an increase in the content of oxidation substrates and a decrease in the activity of natural antioxidants.

Materials and methods. The antioxidant defense system includes a number of complex, highly specialized elements of various nature: metal chelates - transferrin, ceruloplasmin, which inhibit the initiation phase of lipid peroxidation (LPO), superoxide dismutase (SOD), catalase, glutathione peroxidase, glutathione transferase, as well as substances that interrupt LPO by capturing free radicals - vitamin E, ascorbate, reduced glutathione, coenzyme Q, uric acid, bilirubin. Under normal conditions, the antioxidant defense system neutralizes the toxic effect of reactive oxygen species. Another enzyme, the enzyme glutathione peroxidase in mitochondria, converts superoxide radicals into H_2O_2, and then into water and oxygen. The second way is possible, where by means of diffusion they are excreted into the cytoplasm and detoxification by catalase occurs in peroxisomes. SOD acts as a catalyst in the dismutation reaction of the superoxide radical with the formation of H_2O_2 and O_2. The rate of this reaction is 10,000 times higher than under physiological conditions. There are two forms of this enzyme: copper-zinc-containing and manganese-containing. The manganese-containing isoform is found in the mitochondria, while the copper-zinc-containing form has the highest concentration in the pancreatic islets. The second enzyme involved in the reaction to neutralize H_2O_2 is catalase. As a rule, it is included only in conditions of acute rhinosinusitis, and up to this point it can be considered inert in relation to lipid peroxides and hydrogen peroxide. In addition, outside the cell, its activity drops rapidly, so it is located intracellularly. Oxidized modified proteins activate proteolysis, aggravating destructive processes and inflammation, damage DNA, reduce the function of carrier proteins, change the activity of ATPase, and cause disruption of the respiratory chain cascade.

Results. Reduced activity of the enzymes of glycolysis and hyperglycemia leads to the formation of free radicals during the oxidation of glucose. Hyperinsulinemia contributes to the development of oxidative stress. As a result of activation of the sympathetic nervous system, catecholamines and increased production of non-esterified fatty acids trigger another chain of reactions, the product of which is free radicals. In diabetes, there is a decrease in antioxidant activity. Under conditions of hyperglycemia, the production of glutathione slows down, followed by a decrease in NO activity. And all this leads to the development of endothelial dysfunction, which results in atherosclerosis and other angiopathies that are characteristic of diabetic patients. In the development of complications of diabetes mellitus, tissue hypoxia and ischemia in the development of oxidative stress are important. A decrease in plasma tocopherol levels and vitamin E deficiency in the elderly may indicate the development of diabetes mellitus. In patients with DM, point mutations in mitochondrial DNA accumulate over time. Mitochondrial dysfunction and excess free radicals are manifested by gluco- and lipotoxicity, which provoke apoptosis and cell necrosis.

Conclusions. Oxidative stress caused by hyperglycemia triggers the mechanism of damage to β-cells of the pancreatic islets and thereby accelerates the progression of diabetes mellitus. Thus, the study of the processes occurring in the body of this category of patients, as well as the impact on them in combination with classical treatment, is a promising direction.