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THE ROLE OF CONNECTIVE TISSUE METABOLIC PROCESSES IN THE DEVELOPMENT OF PATHOLOGICAL PROCESSES AT INFLAMMATION OF DIFFERENT INTENSITY IN PARODONTIUM

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Abstract

The objective. To study metabolic processes in connective tissue (CT) at different intensity of inflammation in parodontium. **Materials and methods.** The research is conducted on the sample of oxyproline, which is one of the indicators in the study of metabolic processes in the CT. This amino-acid presents in the blood in the free state, reflects the processes of collagen degradation in the form of protein-binding oxyproline and has no unambiguous interpretation. **Results**. At low intensity of the imflammation in the periodontium (stomatitis and alveolitis), the synthesis and collagen degradation are in relative equilibrium, and an increase in its intensity (gingivitis and especially periodontitis) leads to its violation. **Conclusions**. It has been established that the CT plays an important role in the development of pathological processes in periodontal tissues. The concentration of free and peptide-linked oxyproline in serum is higher in the groups of patients with more severe periodontal inflammation (periodontitis and gingivitis).

Key words: oxyproline, connective tissue, periodontal tissue.

Introduction. Connective tissue (CT) occupies a special place in the body. The CT components play an important role in the functioning of the parenchymal organs, vessels, the heart, the stomach, the intestine, not only as a structural component, but also as a carrier of one of these mechanisms. Due to the general molecular mediators of the regulation of CT cells and other cells of organs, cells of the immune system, etc., the reactivity of CT significantly reflects on the development of inflammatory, destructive and protective processes at various acute and chronic pathological conditions [1].

Fibroblasts, as the main cells of CT, produce collagen and glycosaminoglycans. In the inflammation center there are continuous biosynthesis and collagen catabolism processes provided by the production of specific collagenases by fibroblasts, macrophages, neutrophils, epithelial cells, and other cells. Violations of fibroblasts functions are the basis of chronic erosive-ulcerative processes.

One of the indicators used to study CT metabolism is the level of oxyproline in the blood serum, which reflects the intensity of collagen formation.

Oxyproline is one of collagen's amino acids of collagen. In the blood it may be in the free, peptide- and protein-bound form. The level of free oxyproline (FO) in serum reflects the processes of collagen degradation, the level of protein-binding oxyproline (PBO), the protein biosynthesis processes. Literary data on the content of peptide-linked oxyproline (PLO) have no unambiguous interpretation. It is believed that its content reflects simultaneously the degree of decay and synthesis of collagen [2].

In the literature available, we did not see works on studying CT metabolic disorders during periodontal tissue diseases.

The objective of the work is to study changes in CT metabolism in the development of pathological process in parodontium soft tissues.

Materials and methods of research. The experiments were carried out in 4 groups of non-linear male rats weighing 280.0 ± 40.0 g, which were divided into the following groups: Group 1 – rats with modeled stomatitis [3]; Group 2 - animals with alveolitis reproduced by method [4]; Group 3 - rats with gingivitis reproduced by method [5]; Group 4 - rats with periodontitis modeled by the method [6]. Each group had 10 animals.

Determination of FO levels, PBO and PLO in serum was carried out by the method of P. N. Sharaev, which is based on the determination of the optical density of the red chromogen obtained as a result of the oxidation of oxyproline molecule by chloramine B and condensation of its products oxidation with para-dimethylaminobenzaldehyde. "Pure for analysis" and "chemically pure" reagents were used. Preparation of oxyproline gauge solution

was carried out by Pierce (the Netherlands) reagents. The results obtained were expressed in μmol / L [2].

Experimental manipulations were carried out in accordance with the principles of the European Convention for the Protection of Vertebrate Animals (Strasbourg, 1986), "General Principles of Animal Experiments", approved by the I National Congress on Bioethics (Kyiv, 2001) and the requirements of the "Procedure for holding by scientific institutions researches and experiments on animals»(2012) [7].

Statistical processing of the results obtained was carried out using a nonparametric method with Mann-Whitney U-test [8]. The results at $p<0.05$ considered to be reliable.

Results and discussion. The concentration of oxyproline different fractions in blood serum showed the following tendencies: FO level increased in all groups under study with an increase of parodontoium pathological process severity. Statistical significance in comparison with control was observed in groups 3 and 4. FO concentration in these groups was higher by 37% and 85% respectively to control ($p <0.05$ in both cases).

Table

Content of connective tissue metabolites in serum at parodontium diseases

Group	Free oxyproline (FO), mkmol/l	Peptide-binding oxyproline (PLO), mkmol/l	Protein-binding oxyproline (PBO), mkmol/l
Control	12.02±0.36	8.71±0.16	97.2±3.08
Gr. 1	13.2±0.42	11.08±0.39	124±2.9
Gr. 2	13.99±0.43	23.7±0.56	110±2.72
Gr.3	16.4±0.53	28.6±1.33	101±2.67
Gr.4	22.2±1.09	42.5±1.4	94.5±2.67

Note: * - $p <0.05$ in comparison with the control group of animals.

In studying PLO concentration in serum, similar patterns were found. In groups 2, 3, 4, the level of PLO increased in comparison with the control group's indicators in 2.7; 3.3 and 4.9 times respectively. Statistical significance in these groups was high: $p <0.05$.

The level of PBO was significantly increased in groups 1 and 2 in comparison with control by 28% and 14% respectively ($p <0.05$). At the same time the following tendency was observed: with the increase of the severity of the pathological process in the periodontium, the content of PBO decreases from elevated values in group 1 to virtually normal in groups 3 and

4.

It is believed that the concentration of FO in serum reflects the intensity of collagen collapse, while the content of PLO reflects both the degree of decay and biosynthesis. The process of collagen synthesis is usually accompanied by an increase in the level of PBO. Our studies confirm the well-known literary data that inflammation is accompanied by activation of both the synthesis and collagen collapse.

These processes are naturally reflected in the elevated levels of FO, PLO, and PBO in serum in groups 1 and 2. Moreover, these groups do not show significant changes in the ratio of binding oxyproline and PLO, which may indicate a balance in the synthesis and collagen collapse in the CT system as a whole. Changes in the inflammation cell are compensatory and do not go beyond the physiological capabilities of the system. In groups 3 and 4, with increased concentration of binding oxyproline and PLO, the content of PBO remains within the normal range. The divergence of changes in the indicators, reflecting the synthesis and collapse of collagen, may indicate that the CT system is largely involved in metabolic processes.

Thus, it can be assumed that the transmission of inflammation on CT occurs only at significant volumes of damage and a significant duration of the process. It can be one of the factors of the pathological process chronization and relapse's risk. However, the question of the degree of involvement of the CT system in the pathological process and the mechanisms of such a process is not clear enough. Transmission of inflammation on ST can be as one of the pathological factors acting on the principle of positive feedback and only as a consequence of processes in the inflammation focus.

Conclusions:

1. Connective tissue plays a significant role in the development of pathological processes in the tissues of parodontium.

2. With low intensity of the inflammatory process in parodontium (stomatitis and alveolitis), the synthesis and collagen degradation is in relative equilibrium, and an increase in its intensity (gingivitis, and especially, periodontitis) leads to a disturbance of this equilibrium.

3. The concentration of free and peptide-linked oxyproline in blood serum is higher in groups with more severe inflammation in the parodontium (periodontitis and gingivitis).

CONFLICT OF INTEREST STATEMENT: There is no conflict of interest.

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