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ROLE OF VIOLATIONS PROOXIDANT-ANTIOXIDANT HOMEOSTASIS IN THE PATHOGENESIS OF EXPERIMENTAL PERIODONTITIS IN RATS

РОЛЬ ПОРУШЕНЬ ПРООКСИДАНТНО-АНТИОКСИДАНТНОГО ГОМЕОСТАЗУ В ПАТОГЕНЕЗІ ЕКСПЕРИМЕНТАЛЬНОГО ПАРОДОНТИТУ У ЩУРІВ

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Abstract

In the experiment on 30 white non-linear rats found that the pathogenesis of experimental periodontitis significant role played violation prooxidant-antioxidant homeostasis, manifested by activation of lipid peroxidation and decrease activity of antioxidant enzymes, as evidenced by the reduction of antioxidant-prooxidant index as serum, and in periodontal tissue homogenate. The use of exogenous melatonin in experimental periodontitis reduces the generation of free radicals and leads to normalization prooxidant-antioxidant homeostasis confirming the feasibility of its use in pathogenetic therapy of inflammatory diseases periodontal tissues.

Keywords: periodontitis, lipid peroxidation, antioxidant protection, melatonin.

Резюме

В експерименті на 30 білих нелінійних щурах встановлено, що у патогенезі експериментального пародонтиту значну роль відіграє порушення прооксидантно-антиоксидантного гомеостазу, що проявляється активацією процесів перекисного окиснення ліпідів і зменшенням активності ферментів антиоксидантного захисту, про що свідчить зниження антиоксидантно-прооксидантного індекса як у сироватці крові, так і в гомогенаті тканин пародонту. Застосування екзогенного мелатоніну при експериментальному пародонтиті зменшує генерацію вільних радикалів та призводить

до нормалізації прооксидантно-антиоксидантного гомеостазу, що підтверджує доцільність його застосування в патогенетичній терапії запальних захворювань тканин пародонту.

Ключові слова: пародонтит, перекисне окиснення ліпідів, антиоксидантний захист, мелатонін.

Periodontal disease include the most common diseases and occupy, according to WHO, second only to tooth decay and aged over 40 are even more likely than caries [6, 16].

The high prevalence of periodontal disease requires finding the best means of prevention and treatment methods taking into account the pathogenetic mechanisms of development. Increased peroxidation processes play a significant role in the pathogenesis of many diseases, including inflammatory injury periodontal tissue [12, 13]. In normal conditions the processes of oxidation and restore balance. If the increased flow of xenobiotics, depot depletion of antioxidants, poor nutrition and other negative impacts arising oxidative stress, which is typical for abuse prooxidant antioxidant balance and dominated the first and the development of oxidative damage [11]. In this regard, in order to stabilize cell membranes and improve reparative processes in recent years, increasingly used antioxidants [10].

It is known that melatonin is one of the most powerful antioxidants, which in addition antiradical action stimulates the activity of antioxidant enzymes. Melatonin belongs to the universal antioxidant, it acts as a direct and indirect antioxidant. The universality of its property as viewed as caused by water and in lipids, which enables him to penetrate into all tissues and the environment [7].

The above was the basis for the selection of melatonin as an antioxidant pharmacotherapy experimental drug for inflammatory diseases.

Materials and methods. Experimental studies performed on 30 white rats weighing 180-200 Nonlinear hours on a standard diet of food and water in accordance with sanitary norms [9]. Experiments conducted in accordance with international principles of "the European Convention for the Protection of vertebrate animals used for experimental and other scientific purposes" (Strasbourg, 1986) and "general ethical principles of experiments on animals" (Ukraine, 2001).

The experimental periodontitis in rats caused by use of light consistency diet high in carbohydrates by AI Evdokimov [4] modification by OI Sukmanskyy and OA Makarenko

[15]. The composition of this diet is: wheat flour - 34%, skimmed cow's milk 30% starch - 20%, sugar - 15%, table salt - 1%. To accelerate the simulation in addition to the diet of rats added peroxided sunflower oil (1 ml per rat), which is obtained by heating in the presence of 2% copper sulfate for 6-10 hours to reach peroxide number above 30 units. [8].

On the state of the LPO and AOS judged the concentration of MDA, ceruloplasmin activity, catalase in serum and homogenate gum tissue and antioxidant-prooxidant index (API) is calculated as the ratio of catalase to a concentration of MDA [1].

Tissue homogenates obtained by centrifugation in a centrifuge RS-6 at 3000 rev / min for 15 min at 4 ° C.

For evaluation of lipid peroxidation and antioxidant enzyme activity using spectrophotometric methods for two beam spectrophotometer "Specord UV VIS" (Germany, 1999). The concentration determined by MDA-TBA method [5, 14].

The level of ceruloplasmin in serum were determined by Ravin using as substrate paraphenylenediamine (PPD) [3].

The activity of catalase was determined by Jilin S. [2]. Indicators were determined at 60 and 90 days of experiment (immediately after the simulation periodontitis and 30-day treatment melatonin).

Analysis of the research showed that long-term modeling of periodontitis using carbohydrate diet soft consistency with lack of protein, macro and micronutrients, bioantioxidants, polyphenols on the background had peroxided oil use led to pronounced dystrophic-inflammatory process in the soft tissues of rats with periodontal characteristic clinical signs - hyperemia, swelling, bleeding gums marginal land, exposing the necks of the teeth, molars mobility. This is confirmed significant metabolic disturbances in the periodontal tissues, as evidenced by the data obtained by us during the experiment.

In rats with experimental periodontitis 60 day experiment took place activation of lipid peroxidation and reduced antioxidant protection. This is evidenced by increasing the concentration of MDA in serum of 2.5 times compared with intact control and reduction of catalase activity 1.9 times (Table 1). API in conditions of experimental periodontitis has decreased in 4.8 times. The level of ceruloplasmin in the control group of animals almost 2 times the level of this indicator in the group intact, indicating the presence of inflammation 60 day experimental modeling of periodontitis in rats.

Table 1. Indicators of lipid peroxidation and antioxidant system in blood serum of rats with experimental periodontitis treatment and the conditions of melatonin (M ± m; n = 10).

Indexes M ± m	Groups		
	I intact rats	II control pathology (rats with experimental periodontitis)	III rats with periodontitis + Melatonin
60 day			
Ceruloplasmin, mg /%	28±2,0	55±4,4*	57±4,8*
Catalase, mAbs / l	0,57±0,05	0,30±0,02*	0,28±0,01*
MDA, mmol / l	1,0±0,07	2,5±0,10*	2,3±0,07*
API	0,57±0,03	0,12±0,02*	0,12±0,04*
90 day			
Ceruloplasmin, mg /%	27±2,5	48±3,2*	30±2,9#
Catalase, mAbs / l	0,55±0,04	0,35±0,07*	0,51±0,03#
MDA, mmol / l	1,1±0,04	2,2±0,15*	1,2±0,08#
API	0,50±0,02	0,16±0,01*	0,43±0,05#

Notes:
1. * - p <0,05 compared with the rate in the group of intact animals;
2. # - p <0,05 compared with the rate in the group of control animals;
3. n - the number of animals in the group.

On day 90 of the experiment, the animals due to the transition to a standard vivarium ration, there was a tendency to normalization of the studied parameters but disturbances of lipid peroxidation and AOC maintained, as evidenced by improving performance and ceruloplasmin MDA compared with intact control 1.8 and 2 times, respectively, and reduced activity of catalase by 1.6 times and API index 3.1 times.

Unlike the control group, the animals treated with melatonin at day 90 of the experiment catalase activity, which utilizes hydrogen peroxide in the body [12] has increased 1.5 times. The level of MDA decreased in 1.8 times. API has increased 2.7 times.

That is, under the influence of exogenous melatonin is activation of antioxidant system and reduce the activity of LPO.

At the same time, the level of ceruloplasmin returned to normal, indicating absence of acute inflammation. This is due to the ability of ceruloplasmin increase the stability of cell membranes, destroy oxygen free radicals and thus prevent lipid peroxidation processes [10, 11].

Modeling periodontitis in rats also led to depletion of AOC in the gum tissue, as evidenced by decreased activity of catalase for 60 days and 2.7 times the activation of LPO, indicating an increase in MDA concentration 1.7 times (Table 2). API has decreased by 4 times.

On day 90 of the experiment studied parameters in the control group of rats changed and tended to normalize, but differed significantly from that of intact control.

On day 90 of the experiment after 30 days of treatment occurred melatonin normalization prooxidant-antioxidant state: catalase activity increased in 1,6 times, the MDA level decreased in 1.3 times. API has increased 2.2 times.

The results of research coincide with the literature on the antioxidant properties of melatonin, which findings that it is a powerful converter hydroxyl ions, which protects DNA and other systems from oxidative damage [7].

Thus, in the pathogenesis of periodontitis significant role played by activation of lipid peroxidation and antioxidant defense mechanisms abuse. The use of powerful antioxidant melatonin leads to normalization of antioxidant-prooxidant index in periodontitis and is a promising tool for treatment.

Table 2. Indicators of lipid peroxidation and antioxidant system in gum tissue homogenate of rats with experimental periodontitis treatment and the conditions of melatonin (M ± m; n = 10).

Indexes M ± m	Groups		
	I intact rats	II control pathology (rats with experimental periodontitis)	III rats with experimental periodontitis + Melatonin
60 day			
Catalase, mAbs / g	4,1±0,3	1,8±0,2*	2,1±0,1*
MDA, mmol / g	17,1±1,4	28,4±2,1*	25,2±2,1*
API	0,24±0,03	0,06±0,02*	0,08±0,01*
90 day			
Catalase, mAbs / g	3,9±0,2	2,2±0,1*	3,6 ±0,2#
MDA, mmol / g	16,3±1,2	23,8±1,2*	17,7±1,4#
API	0,24±0,01	0,09±0,01*	0, 20±0,02*/#

Notes:

1. * - p <0,05 compared with the rate in the group of intact animals;
2. # - p <0,05 compared with the rate in the group of control animals;
3. n - the number of animals in the group.

Findings

1. In the pathogenesis of experimental periodontitis significant role played violation prooxidant-antioxidant homeostasis, manifested by activation of lipid peroxidation and reduced antioxidant enzyme activity both in serum and in periodontal tissue homogenate.

2. The use of exogenous melatonin in experimental periodontitis reduces the generation of free radicals and leads to normalization prooxidant-antioxidant homeostasis confirming the feasibility of its use in pathogenetic therapy of inflammatory diseases periodontal tissues.

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