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Peculiarities of changes in endogenous intoxication indicators in the dynamics of the experimental periodontitis development

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Abstract

The aim of our work was to investigate the peculiarities of changes in endogenous intoxication rates: medium mass molecules (MMM) and erythrocyte intoxication index (EII) in the blood of guinea pigs in the experimental periodontitis formation.

The results of biochemical studies showed that at all stages of the development of experimental periodontitis, there is a consistent increase in the degree of endogenous intoxication with their dominance on the 15th day of the experiment relative to the control, namely, the content of medium-mass molecules (MMM254, MMM280) and the erythrocyte intoxication index (EII) increased in blood, respectively, by 24.8% ($p \leq 0.05$), 28.2% ($p \leq 0.05$) and 34.7% ($p \leq 0.05$) compared to the first group of animals, which indicates an increase in the processes and the important role of metabolites of endogenous intoxication and their participation in the mechanisms of formation of experimental periodontitis.

Key words: periodontitis; stress; endogenous intoxication; medium mass molecules; erythrocyte intoxication index.

Особливості змін показників ендогенної інтоксикації в динаміці розвитку експериментального пародонтиту

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Метою нашої роботи було дослідити особливості зміни показників ендогенної інтоксикації: молекул середньої маси (МММ) та еритроцитарний індекс інтоксикації (ЕІ) у крові морських свинок при формуванні експериментального пародонтиту (ЕП).

Результати біохімічних досліджень показали, що на усіх етапах розвитку експериментального пародонтиту відбувається послідовне зростання ступеня ендогенної інтоксикації з домінуванням їх на 15-у добу експерименту відносно контролю, а саме підвищувався вміст молекул середньої маси (МСМ₂₅₄, МСМ₂₈₀) і еритроцитарного індексу інтоксикації (ЕІ) в крові відповідно на 24,8 % ($p \leq 0,05$), 28,2 % ($p \leq 0,05$) і 34,7 % ($p \leq 0,05$) в порівнянні з першою групою тварин, що вказує на посилення процесів та важливу роль метаболітів ендогенної інтоксикації та їх участь в механізмах формування експериментального пародонтиту.

Ключові слова: пародонтит; ендогенна інтоксикація; молекули середньої маси; еритроцитарний індекс інтоксикації.

Introduction. According to the data of the World Health Organization, the prevalence of dental diseases ranges from 75 to 95% among children and reaches almost 100% in adults [1]. At the same time, epidemiological studies have shown a high prevalence of diseases in periodontal tissues both in the world (80%) and in Ukraine (60–70%) [5]. Diseases of periodontal tissues occupy one of the first places in terms of frequency and distribution among dental diseases, and are also a complex problem that is becoming large-scale.

Generalized periodontitis develops under the influence of local and general factors, but bacterial is considered to be the leading factor [8]. Periodontal pathogens trigger a number of protective reactions that lead to the development of inflammation [5, 8]. Polymicrobial and the special complexity and variety of etiological factors of this disease were formed due to the dependence of the pathology on the type of microorganisms that directly cause the active disease [1].

From various scientific sources, it is known about the importance of endogenous intoxication in the pathogenesis of many pathological processes of the body [2]. Endogenous intoxication is a non-specific syndrome characteristic of many diseases. Forecasting the course of various toxic conditions, many diseases that are accompanied by intoxication syndrome, the choice of a method of detoxification therapy and other treatment methods are difficult without an objective assessment of the level of endogenous intoxication (EI) [6]. During various pathological processes, especially during their long course, a significant amount of metabolic products accumulates in the biological fluids of the body, most of which are included in the so-called medium mass molecules (MMM), that are, substances of medium molecular weight (from 300-500 to 5000 D), which adversely affect metabolic processes in the body [6, 7]. MMM are present in a small amount in the body of healthy people. The main part of MMM consists of peptides, glycopeptides, degradation products of fibrinogen, albumin, thrombin, collagen fragments, other substances of a protein nature, as well as derivatives of lipids, phospholipids, etc. This indicator is used as a marker of intoxication of various genesis to determine the degree of severity of the pathological process [7].

Taking into account the above, the aim of our work was to investigate the role of endogenous intoxication indicators violations in the blood of guinea pigs in the experimental periodontitis (EP) formation.

Material and methods of research. Experimental studies were performed on 40 guinea pigs (males), kept on the standard diet of the vivarium of Danylo Halytsky Lviv National Medical University. Guinea pigs were divided into four groups (10 in each): the first - intact animals - control; the second (experimental) group - animals with experimental periodontitis (3rd day), the third group included guinea pigs with EP on the 5th day of model process, to IV - animals with EP on the 15th day.

Experimental periodontitis was modeled by the method of ZR Jogan (1983) [3]. We selected fixed days (3rd, 5th and 15th) for studies that corresponded to the classic stages of

acute inflammation. All experiments on laboratory animals carried out with following the European Convention for the protection of vertebrate animals used for experimental and other scientific purposes (Strasbourg, 1986), Council Directive 2010/63 / EU, the Law of Ukraine 3447- IV "protection animals from the cruelty," the general ethics of animal experimentation adopted by the first national Congress on bioethics in Ukraine (2001).

The study material was collected under ether anesthesia. We estimated the level of endogenous intoxication by medium mass molecules and erythrocyte intoxication index (EII) . In all groups of guinea pigs there were determined the MMM concentration in blood in the wave of 254 nm and 280 nm by IA Volchehorskiy, DA Dyatlova, EI Lvovska and others methods [10] and EII by DK Shmojllova methods [9]. Numerical results were adapted with static method using Student's criteria.

Results of the study and their discussion

The results of biochemical studies showed that on the 3rd day of EP formation, there is a sequential increase in the content of MMM254 and MMM280 in the blood by 17.0% ($p < 0.05$), 20.4% ($p < 0.05$), respectively, against the control groups of animals (Fig. 1). On the 5th day of the experiment, the level of MMM254 increased by 21.5% ($p < 0.05$), while MMM280 increased by 23.2% ($p < 0.05$) compared to the intact group of animals. On the 15th day of EP, there was an growth in the content of MMM254 by 24.8% ($p < 0.05$) and MMM280 by 28.2% ($p < 0.05$) compared to the first group of guinea pigs.

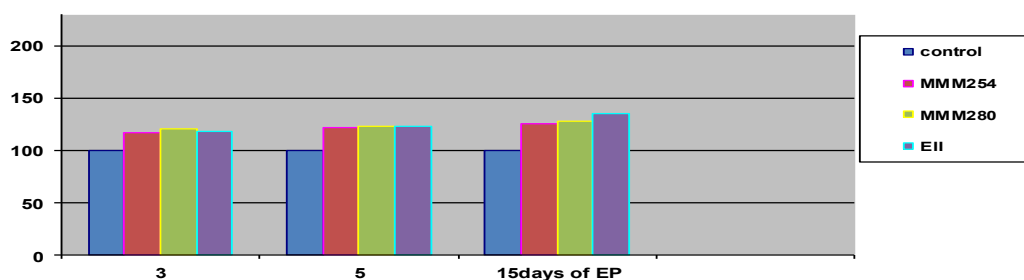


Fig.1 - The level of endogenous intoxication in the blood of guinea pigs in the dynamics of the formation of EP (% of control)

Equally important for characterizing the state of endogenous intoxication in EP is the definition of another indicator called the erythrocyte intoxication index.

As can be seen from our research, the content of the erythrocyte index of intoxication underwent a similar vector of changes, as well as MMM in the dynamics of the development of experimental periodontitis in the blood (3rd, 5th and 15th days), in particular, EII in the blood on the 3rd day of the experiment in the experimental group showed an increase of 18.2% ($p < 0.05$) in EP compared to the intact group. This indicator on the 5th day of the experiment elevated by 22.4% ($p < 0.05$) in the experimental group against the control. In the latest term of our study, on the 15th day of the experiment, an increase in EII was observed by 34.7% ($p < 0.05$) compared to the first group (Fig. 1).

Thus, determination of indicators of endogenous intoxication in the blood showed their increase at all stages of the formation of experimental periodontitis with their dominance on the 15th day of the experiment relative to the control, which indicates the strengthening of intoxication processes in this experimental model.

Conclusions. The obtained data indicate the stimulation of endogenous intoxication processes at all stages of the development of experimental periodontitis, which were especially most pronounced on the 15th day of the experiment. Thus, complex biochemical studies of markers of endogenous intoxication in animals of different groups (intact and with EP on the 3rd, 5th, and 15th day) proved that the greatest formation of endogenous intoxication products occurs at the late stages of their formation, which indicates an important role of metabolites of endogenous intoxication and their participation in the mechanisms of EP formation.

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