

Indicators of Basal Blood Flow in Periodontal Microvessels in Children with Diabetes Mellitus

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Abstract

Diabetes mellitus is one of the socially significant health problems. The relevance of the study is due to the high prevalence of this disease, early disability of patients, as well as economic problems associated with the implementation of therapeutic and diagnostic measures.

The aim of the study was to determine the background parameters of basal blood flow in periodontal microvessels in children aged 12-15 years with type 1 diabetes mellitus.

The study involved 67 children with type I diabetes mellitus, who were divided into 2 groups.

The first group included 32 people who were diagnosed for the first time and the duration of the disease did not exceed two years, the second group consisted of 35 children whose prescription of the disease exceeded three years.

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Introduction

The smallest functional units of the periodontal vascular system are arterioles, venules and capillaries. The local needs of periodontal tissues are determined by the amplitude of microvascular oscillations. The participation of microcirculation vessels in the metabolism of periodontal tissues consists of the area of microvessels and the difference in pressure in them at the entrance and exit of blood^{1,2,3}. Periodontal tissues, which perform numerous functions, are the subject of research by specialists in applied and clinical significance⁴.

In this regard, many methods have been proposed to study the maxillofacial region and the periodontal complex in people at different periods of ontogenesis, both under normal conditions and under various pathological conditions⁵. The positive effect of complex methods of treatment of patients with major dental diseases on periodontal tissues was

noted. Special attention is paid to children with endocrinopathies, in particular with diabetes mellitus, which is currently a fairly common pathology. Numerous methods of examination of tissues and organs of the oral cavity in children with this pathology have been proposed. Special attention is paid to studies of the microcirculatory bed of periodontal tissues in children with this pathology^{6,7}. Taking into account the urgency of the problem, we continued to monitor the children taking into account the duration of the underlying disease and paid special attention to the analysis of background indicators of basal blood flow, which was the purpose of our work.

The aim of the study. To determine the background parameters of basal blood flow in periodontal microvessels in children aged 12-15 years with type 1 diabetes mellitus.

Materials and methods

Background indicators of basal blood flow in periodontal microvessels were determined in children aged 12-15 years in two clinical groups diagnosed with type 1 diabetes mellitus. The first group included 32 people who were diagnosed for the first time and the duration of the disease did not exceed a two-year period. The second

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clinical group included children whose disease duration exceeded 3 years, and there were 35 children in this group. The comparison group consisted of children without pathology of the endocrine and digestive systems. In all cases, the main diagnosis was made in a hospital. Permission to conduct this research was obtained from the Ethics Committee. The parents of the children gave informed consent in accordance with the general requirements for the ethics of scientific research. The LAKK-OP laser analyzer was used in the study. The study was conducted taking into account the recommendations of specialists. Generally accepted indicators were evaluated. Neurogenic vascular tone, myogenic tone and bypass rate were determined. Neurogenic tone was calculated by the ratio of the product of the standard deviation of the microcirculation index to the average arterial pressure by the product of the largest amplitude of perfusion fluctuations in the neurogenic range by the arithmetic mean of the microcirculation index. When calculating myogenic tone, the ratio of the product of the root-mean-square deviation of the microcirculation index by arterial pressure by the product of the amplitude of oscillations of the myogenic range by the arithmetic mean of the microcirculation index was also used. The bypass rate was estimated by the ratio of myogenic vascular tone to neurogenic. Statistical data were processed by the method of variation statistics using a personal computer software package.

Results

As a result of the study of children in the comparison group, it was found that the neurogenic tone of periodontal microvessels was 2.07 ± 0.49 relative units, myogenic tone was 2.58 ± 0.69 , and the bypass index was 1.26 ± 0.18 units. In children of clinical group 1, neurogenic tone was reduced by $18.4 \pm 1.3\%$ and amounted to 1.69 ± 0.35 relative units. Myogenic tone was significantly higher by $12.8 \pm 0.7\%$ (2.91 ± 0.94 rel. units). There were also higher bypass rates, which amounted to 1.73 ± 0.31 units. At the same time, group 2 children had a decrease in neurogenic and myogenic vascular tone (1.88 ± 0.41 and 2.47 ± 0.58 , respectively) compared with children without pathology of the endocrine and digestive systems, and the

frequency of bypass surgery increased by $3.9 \pm 0.2\%$ (1.31 ± 0.26 units). As a result of the assessment of neurogenic vascular tone, it was found that the aggravation of microcirculation disorders of periodontal vessels in children with type 1 diabetes mellitus creates conditions for microthrombosis, contributing to local tissue ischemia, blockage of blood flow, hemorrhages. A decrease in neurogenic and myogenic tone in children with a disease duration of more than three years reflects a decrease in the activity of sympathetic adrenergic influences and a decrease in the barrier function of periodontal vessels. Fluctuations in the bypass index indicate that in the early stages of the underlying disease, there is an increase in blood flow through the arteriovenular shunt with a decrease in neurogenic and an increase in myogenic tone; at later stages, there is a redistribution of blood flow in favor of the link that provided transcapillary nutrient intake, with normalization of the bypass index and myogenic vascular tone. The results obtained indicate the need for such studies to assess the effectiveness of therapeutic measures carried out both in the clinic of endocrinology and in clinical dentistry.

Discussion

Diabetes mellitus gives many complications from periodontal tissues: vascular lesions, bleeding gums, purulent exudate, decreased resistance of periodontal tissues, dystrophy of the alveolar process⁸. One of the most serious disorders in periodontal tissues in diabetes mellitus are vascular disorders. They develop due to spastic changes in blood vessels and capillaries, as well as disorders of the functions of the blood itself. With these disorders, there is a thickening of blood vessels, a violation of the permeability of vascular walls, which leads to slowing down the intake of nutrients and reducing tissue resistance to microorganisms^{9,10}. Changes in periodontal vessels in diabetes mellitus are so specific that they are designated by the term "diabetic periodontopathy"¹¹. According to Alekseev O. A. (2020), during capillaroscopy in 107 patients with diabetes mellitus, it was noted that out of 63 patients with severe diabetes mellitus, only 10 patients had capillaries unchanged. 41 patients with moderate severity of sugar diabetes in 7 people, capillaries are normal, and in 13 people with mild diabetes

mellitus in 4 patients, capillaries are normal, and in the rest are elongated and narrowed¹². In patients with diabetes mellitus, immunity plays an important role. Changes in carbohydrate metabolism cause disorders on the part of the immune system, resulting from the weakening and damage to the functions of macrophage and neutrophil cells. There is an increase in immunoglobulins A and G along with a decrease in immunoglobulins M and with a decrease in T and B lymphocytes¹³. Against the background of a decrease in the resistance of periodontal tissues to the action of local factors, the role of microorganisms increases, and a high concentration of glucose in the gingival fluid in diabetes mellitus promotes the reproduction of microorganisms, resulting in the rapid formation of tartar¹⁴. Some researchers conclude that in diabetes mellitus, bone tissue is most often affected, and dystrophy of the alveolar process occurs¹⁵. As you know, insulin deficiency inhibits activity osteoblasts, causing metabolic acidosis, leading to increased activity of osteoclasts. As a result, osteoporosis occurs - a disease that is characterized only by a decrease in bone mass with the unchanged mineral composition of the remaining part of it¹⁶. This study provides information about the state of periodontal disease in children with type I diabetes mellitus, which can be used in the preparation of preventive and therapeutic programs.

Conclusions

The high level of the bypass index with relative normalization of neurogenic and myogenic vascular tone confirms the presence of low efficiency of blood flow in periodontal microvessels in children with type 1 diabetes mellitus, which can be used when choosing methods of complex therapy for children.

Declaration of Interest

The authors report no conflict of interest.

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