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The role of odontogenic infection in inflammatory periodontal diseases in combination with cardiovascular diseases.

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Abstract: The purpose of this study is to assess the role of the pathogenicity of odontogenic infection in the development of CVD. The objects of the study were 64 patients, of which group I included 31 patients who were at the stages of treatment for CVD, in which the pathogen "(Porphyromonas gingivalis) was detected by microbiological examination. Group 2 (34) patients were patients with CVD without periodontal pathology. Used microbiological, immunological and enzyme immunoassay methods revealed a high prevalence of gingivitis, respectively, in patients with CVD. A decrease in the synthesis of a chemotactic factor in patients with CVD is accompanied by a significant decrease in the content of IL-8 in mixed saliva, which leads to a reduction in the life span of neutrophils.

Keywords: periodontitis, CVD, phagocytosis, chemotaxis, IL-8, odontogenic infection.

Introduction

The problem of the relationship between dental status and the general condition of a person is relevant at all times. The question of the influence of the state of the oral cavity on the development of general somatic pathology of the body, in particular, diseases of the cardiovascular system, is especially acute (3,4). An analysis of the literary sources of the given problem should indicate the relevance of studying the relationship between diseases of the oral cavity and general somatic pathology.

As you know, the oral cavity is a specific, special, complex and independent microbiocenosis, with stable conditions for the existence and maintenance of bacteria. As a result, the species and quantitative composition of microorganisms in the oral cavity is very diverse. In the oral cavity, populations of microorganisms are constantly changing both in morphological and physiological terms, self-regulating "living" systems, which, under certain conditions, such as a decrease in the level of resistance, stressful effects, can change, and lead to a predisposition to the occurrence of various acute and chronic inflammatory diseases of the oral cavity.

The most common cause of inflammatory processes in the oral cavity is due to the pathological effects of obligate anaerobes and facultative anaerobic cocci. (1,3,4.). According to numerous researchers, in the etiopathogenesis of inflammatory periodontal diseases, the main place is occupied by periodontopathogenic microflora - Treponema denticola, Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis, Streptococcus mutans, Peptostreptococcus anaerobius, Neisseria sp., Corinebacterium sp., S. sanguis, S. sobrinus, S. oralis, S. salivarius and S. macacae, etc. At the same time, the severity and severity of inflammation depend on the type and pathogenicity of these microorganisms (2,5). In turn, the relationship of the microflora of the oral cavity with diseases of various organs and systems of the body

characterizes the polymorbidity of pathologies. At the same time, oral dysbacteriosis exacerbates the severity and prognosis of concomitant disease, and an effective fight against dysbiotic disorders in the oral cavity gives the best results in the treatment of the main concomitant pathology.

The comorbidity of cardiovascular diseases and periodontal pathology has been noted by many authors (1,2,3), however, the microbiological and immunological components of this state of the oral cavity have not been fully studied, which, in our opinion, is one of the main links in the development of cardiovascular pathology. In this regard, the necessity and timeliness of this study is beyond doubt. The aim of this study was to study the role of the pathogenicity of odontogenic chronic infection in the course of diseases of the cardiovascular system of the body.

Material and research methods

To achieve the goal and implement the set tasks, we conducted a comparative study of the characteristics of microbiocenosis and the severity of general and local immunity of the oral cavity in patients with gingivitis combined with cardiovascular disease (CVD). This study was conducted at the clinical bases of the Department of Dentistry BukhMI. The objects of the study were 64 patients who were divided into the main study group and the control group.

Of these, group I included 31 patients (22 men and 9 women) aged 18 to 65 years (mean age 47.6 years) who were at the stages of treatment for CVD in whom microbiological examination revealed the pathogen "(*Porphyromonas gingivalis* ". Group 2 - (34) patients were patients with CVD without periodontal pathology. The control group consisted of 14 people aged 18 to 65 years (9 men and 5 women) who applied for dental care at the Department of Dentistry BSMI.

The diagnosis of "healthy" was made on the basis of the clinical and radiological picture and the conclusions of the therapist. Comprehensive dental examination and laboratory examination of patients of 3 groups was carried out at the clinical bases of BSMI. To assess the hygienic state of the oral cavity, the following indices were used: the index of caries intensity of permanent teeth KPU (h), the simplified index of oral hygiene IGR-U, the papillary-marginal-alveolar index, the assessment of bleeding of the gingival sulcus according to the M.R. Muhlemann method, the periodontal index (PI) according to A. Russel, gingivitis index GI. In addition, the presence of non-carious lesions of the teeth and diseases of the oral mucosa (OM) was noted in the dental chart. The study of the composition of the microflora of the oral cavity for the presence of pathogenic and opportunistic microflora in the examined persons was out in the microbiological laboratory of the BSMI.

To conduct a microbiological study, all patients were sampled with a sterile cotton swab, which was then placed in a tightly closed sterile tube. The material was taken on an empty stomach, before brushing the teeth. With the help of the cultural method of bacteriological research, identification and counting of pure cultures of certain microorganisms is carried out, which makes it possible to most accurately judge the etiological affiliation of the obtained microorganisms. The number of colonies of microorganisms was expressed using units of CFU/ml. Identification of

the obtained cultures of microorganisms was carried out in accordance with the determinant of bacteria Bergey (1997) and guidelines for microbiology. The immunological study was carried out on the basis of the clinical laboratory of BSMI.

To assess local and general immunity, blood was taken in the morning, on an empty stomach, as well as oral fluid. The evaluation of indicators of both cellular and humoral immunity was carried out using the enzyme immunoassay method.

The concentration of interleukin 8 was determined by enzyme immunoassay on a Mindray analyzer using reagents from Human. Determination of the phagocytic function of free oral neutrophils

liquids were evaluated by the ability to absorb latex particles according to the method Freidlin. To study the ability of neutrophils to free oral liquid to phagocytosis 0.2 ml of oral secretion suspension was mixed with 0.02 ml of latex suspension with a diameter of 1.7 μm (10 particles/ml), obtained from All-Union Research Institute of Synthetic Rubber. Academician S. V. Lebeden (Saint Petersburg). After a half-hour incubation at 37°C, smears were prepared, dried, fixed with 96% ethanol, and stained Romanovsky-Giemsa.

When analyzing phagocytosis, the activity, intensity of phagocytosis, and phagocytic number were calculated. Phagocytosis activity was calculated as the number of neutrophils containing latex particles per 100 counted cells. The intensity of phagocytosis was determined by the number of latex particles per 100 cells in terms of 1 cell. The results are presented as the arithmetic mean with the value of the standard deviation. The significance of differences was assessed using the STATISTICA software package using Student's t-test

Research results and discussion

An analysis of the dental status of patients with CVD showed that periodontal diseases in this group of patients result from the accumulation of plaque, with or without the development of an inflammatory process, destruction of the periodontium, including the gum itself, periodontal ligament and alveolar bone. Clinically, the gingival sulcus deepens, forming a periodontal pocket, the attachment of the gingiva to the root surface is disrupted, while the biofilm on the surface of the teeth migrates apically, attachment of connective tissue and alveolar bone loss, gingival loss occur.

When studying the papillary-marginal-alveolar index PMA in the modification of C. Parma (1960) in the main group of patients, on average, it was $62.3 \pm 4.6\%$, which corresponds to an average degree of inflammation. A mild degree of gingival inflammation according to this index is observed in 31.7%, a severe degree - 6.0%. In the control group, this indicator was significantly lower and equal to $19.8 \pm 2.1\%$, which is typical for mild inflammation.

When studying the condition of the periodontium using the GI gingivitis index, it was found that the average value in the main group is 1.98 ± 0.14 , which corresponds to moderate inflammation in the gums. Mild inflammation (an index in the range (from 0.1 to 1.0) was determined in 24.5% of patients; moderate

inflammation (within 1.1 - 2.0) - in 72.1% and severe inflammation (interval of 2.1- 3.0) - 3.4%. patients, and moderate - in 24%.

The highest prevalence among periodontal diseases in the main study group, as shown in the table, was marked by catarrhal marginal gingivitis and hypertrophic gingivitis, respectively, in 46 and 12 patients with CVD. At the same time, CHPST in patients with CVD was observed in 6 patients of the main group and averaged 9.3%. It should be noted that the group of gingivitis included catarrhal and hypertrophic gingivitis and amounted to 71.9% and 18.8%, respectively.

Table

Index assessment of the state of periodontal tissues in patients with CVD (M±m)

Periodontal disease	1 - group (n=31)	Group 2 (n=33)	Control group (n=14)
RMA, %	62,3±4,6%	27,3±2,1%	19,8±2,1%
Bleeding score by	1,5±0,67	0,7±0,62	0,4±0,12
M.R.Muhlemann method	3,6±0,51	1,8±0,24	1,4±0,37
PI by A. Russel	3,1±0,44	1,9±0,13	1,3±0,95
CPITN	1,9±0,14	0,9±0,08	0,3±0,04

Various microorganisms, including *Porphyromonas gingivalis*, colonize the glycoprotein-containing layer (plaque) above and below the gingival margin to form supragingival and subgingival layers of plaque. Further, bacterial-endothelial cellular interactions occur in periodontal pockets, creating and exchanging signals between microorganisms and neighboring cells of the immune system. *Porphyromonas gingivalis* are attracted to and metabolized through receptor-mediated endocytosis in the cells of the epithelium lining the gingival sulcus. Thus, endotoxin (eg, lipopolysaccharide)-producing *Porphyromonas gingivalis* are protected from the immune system and can replicate within cells and possibly spread systemically through the circulation, inducing a generalized immune response. Analysis of the structure of periodontal diseases in the examined patients with CVD is presented in the table.

Table

The structure of periodontal diseases in patients with CVD (abs. number and %)

Diseases periodontal	1 - group (n=31)		Group 2 (n=33)		Control group (n=14)	
	abs. number	%	abs. number	%	abs. number	%
Healthy periodontium	-	-	4	11,8	9	64,3
Catarrhal marginal gingivitis	22	71,9	-	-	-	-
hypertrophic gingivitis	6	18,8	-	-	-	-
Acute periodontitis	-	-	-	-	-	-
Chronic generalized moderate periodontitis	3	9,3	30	88,2	5	35,7
periodontal disease	-	-	-	-	-	-

The anti-infective protection of mucous membranes, along with the epithelial barrier, includes the cellular link of anti-infective protection, humoral immunity factors and normal microflora of the oral cavity, which exists in the form of biofilms on the surface of the epithelium or in planktonic form in the free oral fluid. To assess the functional activity of neutrophils in free oral fluid, spontaneous and latex-induced reduction of NBT to diformazan was studied, and the ability of neutrophils to phagocytosis of latex particles was determined.

As can be seen from the presented research results, the parameters of the NBT-test of oral fluid neutrophils in patients with CVD had a peculiar dynamics when compared with those of healthy individuals. Thus, during a spontaneous test, the activity of neutrophils in CVD patients decreased by an average of 1.75 times, while with an induced decrease in NCT, the activity of neutrophils was more pronounced and, on average, it decreased by 3.5 times when compared with healthy individuals, thereby indicating very low phagocytic activity of neutrophils. Показатели интенсивности фагоцитоза у обследуемых лиц имели схожую динамику. As you know, porphyromonas (*Porphyromonas gingivalis*) is a bacteria that actively contribute to inflammation. As a rule, these bacteria are located on the areas of the gums that are directly adjacent to the tooth. They are obligately anaerobic and often form protective biofilms based on resistant tooth tissues.

This is how dental plaque is formed. Therefore, as the disease progresses, acute

inflammation becomes chronic. The reason for this is *P. gingivalis*, which disrupts the synthesis of the chemotactic factor IL-8 and the adhesion molecule E-selectin in the gum cells in order to normally feed on activated neutrophils. As can be seen from the presented research results (table), a decrease in the synthesis of the chemotactic factor in patients with CVD is accompanied by a significant decrease in the content of IL-8 in mixed saliva, which leads to a reduction in the life span of neutrophils. As a result, neutrophils become the main mediators involved in damage to the gums and alveolar bone during the development of periodontitis. One of the important indicators of the course of the inflammatory process is the intensity of phagocyte mobility (chemotaxis). It is the mobility of macrophages that is one of the mechanisms that determine the number of cells - phagocytes in the focus of inflammation and ultimately determine the effectiveness of the phagocytic process.

Analysis of the presented research results indicates a decrease in the intensity of macrophage chemotaxis. One of the reasons for the decrease in the intensity of neutrophil chemotaxis and the decrease in the level of IL-8 is the high demand for neutrophils by pathogens. This is probably why the blocking of chemotaxis has a short duration in time, which leads to excessive accumulation of neutrophils in the focus of inflammation.

Thus, in patients with periodontitis, a pronounced absolute leukocytosis was found in the periodontal tissues and in the oral fluid, which indicates the preservation of signs of local inflammation. Thus, the primary damage to periodontal tissues caused by (*Porphyromonas gingivalis*) begins to gradually increase over time. In this case, the subsequent inflammatory process spreads from the gum to the alveolar bone along the periodontium, neurovascular bundles. In the places where the vessels exit the alveolar bone, the inflammatory process of bone begins fabrics.

Conclusions

1. The highest prevalence among periodontal diseases in the main study group, as shown in the table, was catarrhal marginal gingivitis and hypertrophic gingivitis, respectively, in 46 and 12 patients with CVD.
2. Endotoxin (eg, lipopolysaccharide) - producing *Porphyromonas gingivalis*, are protected from the immune system and can multiply within cells and possibly spread systemically through the circulation, causing a generalized immune response.
3. The decrease in the synthesis of the chemotactic factor in patients with CVD is accompanied by a significant decrease in the content of IL-8 in mixed saliva, which leads to a reduction in the life span of neutrophils. As a result, neutrophils become the main mediators involved in damage to the gums and alveolar bone during the development of periodontitis.
4. Primary damage to periodontal tissues caused by *Porphyromonas gingivalis* over time, the damage zone begins to gradually increase. In this case, the subsequent inflammatory process spreads from the gum to the alveolar bone along the periodontium, neurovascular bundles.

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