IMMUNE DISORDERS OF DENTOALVEOLAR ANOMALIES IN SCHOOLCHILDREN

Abstract

Increasing in IL-1, IL-6, IL-8 and TNF-α level in blood and oral fluid indicates an increase in antigenic stimulation of monocyte-macrophage, lymphoid cell elements, endothelial cells, fibroblasts of various organs and tissues, specifies systemic inflammatory response syndrome development and protective-adaptive reactions and maladaptation reactions formation at children with DAA.

Key words: antigens, inflammation, immunity, oral fluid

INTRODUCTION

Using in clinical practice of immunologic analysis shows that frequency of the main stomatology diseases, and in particular DAA (dental alveolar anomalies), it is in direct or mediated condition dependence in both general, and local oral cavity immunity factors [1, 2]. However, local immunity is not a simple reflection in maintenance of the whole body immunity, and it caused by independent system, in particular production of the sIgA (secretory immunoglobulin A), that has expressed also on the systemic immunity formation. There are the components of congenital, cellular and humoral immunity for maintenance of immune homeostasis and control of microbial colonization in saliva [3, 4, 5].

The lysozyme is an important congenital antimicrobial factor, which takes place from epithelial salivary ducts and due to its enzymes is able to destroy the peptidoglycan bacteria paries [6, 7, 8]. Main immune component of the saliva is secretory immunoglobulin A, which is characterized by antigen specificity for local bacteria, fungi and viruses. Humoral immunity factors as well wide array of inflammatory mediators, including IL-4 and IL-8 (interleukins) relates. These cytokines are responsible for a local immune regulation, and they are informative indicators of the oral cavity immune homeostasis [9, 10].

The goal of present research is studying in comparative aspect of local

immunologic ratings of the oral liquid and blood at schoolchildren with dental alveolar anomalies.

MATERIAL AND METHODS

Immunologic status in unstimulated oral liquid (UOL) and blood has been conducted at 18 healthy schoolchildren aged from 7 to 14 with intact teeth, as well as 64 schoolchildren with DAA. Diagnosis was based on Angle's classification. All patients with DAA were passed a clinical examination, including anamnesis collection and medical screening. Anthropometric studies of face and head at all children and teenagers, as well as jaws control-diagnostic models analysis of were conducted. Teeth dimension ratio, tooth width ranges by Pont, sagittal variations by Korkhaus's method was studied, dental arch segments ratio - by Gerlach, tooth ranges shapes, its correlation, as well as location of individual teeth in sagittal, transverse and vertical planes were evaluated. In addition, it was used X-ray examination (orthopantomography, teleroentgenography, intraoral contact radiography). A lateral teleroentgenograms analysis of the head has been conducted by Schwartz's method.

UOL sampling at each surveyed person was conducted at clinic on an empty stomach from 8 to 9 a.m. Patients were asked not to carry out stimulating salivation procedures, previously professional teeth cleaning at all surveyed patients groups was conducted. UOL sampling in 0,9 ml for element composition study was made just from oral cavity. Then mixed saliva centrifuged during 15 minutes at 8000 rpm. The supernatant part of the UOL was poured into plastic test tubes and stored at 30°C. The pro-inflammatory and anti-inflammatory cytokines (IL-1, IL-2, IL-4, IL-6, IL-8, IL-10 and TNF-α) study in blood and oral fluid by enzyme-linked immunosorbent assay method using test systems produced by JSC «Vector-Best» (Novosibirsk, Russia) was determined. Mathematical processing of the obtained results were carried out parametric statistics method on a personal computer using by «Statistica 6.0» program, which was included descriptive statistics, differences significance by Student's data assessment and correlation analysis with correlation coefficients reliability assessment. It was used $P<0,05$

value at reliability of differences assessing.

RESULTS AND DISCUSSION

Study results analysis presented in table 1 has allowed finding revealed certain features of blood cytokine profile.

The cytokines of the «first generation» are included IL-1α, IL-6. Our studies showed an increase in blood concentration of IL-1α at children with DAA by an average of 2,6 times at comparison with healthy children. It known, that IL-1α is inducible protein, which synthesizes in response to infection or tissue damage at interaction of antigens with a group of «Toll-like» receptors. At the same time it is a multifunctional cytokine, activates neutrophils, T- and B-lymphocytes, proteins synthesis stimulates at “acute phase”, phagocytosis, and hematopoiesis, renders pyrogenic effect, and induces production of such cytokines as IL-2, IL-4, IL-6, IL-10 et al.

Table 1

Comparative assessment of cytokine content rates in blood at children with DAA

Ratings	Health children (n=18)	Children with DAA (n=64)
TNF-α pkg/ml	12,67±0,78	33,41±3,24*
IL-1α pkg/ml	10,23±1,34	26,45±1,33*
IL-2 pkg/ml	1,19±0,09	7,87±0,67*
IL-4 pkg/ml	1,18±0,12	2,13±0,02*
IL-6 pkg/ml	22,45±1,87	41,56±3,23*
IL-8 pkg/ml	1,67±0,13	4,09±0,32*
IL-10 pkg/ml	13,18±1,12	6,14±0,51*

Note: * - significance of differences (P<0,05)

Therefore, the fact of IL-1α content increasing in blood at schoolchildren with DAA, revealed by us, testified with high probability of infectious-allergic nature development inflammatory process. Thus, respectively monitoring of these ratings will allow using as an objective criterion of the risk to development of

inflammatory processes in oral mucosa as dynamic changes that content in schoolers' blood with DAA.

In common with IL-1 as pro-inflammatory cytokines of the “first generation” and IL-6 is integral to determining feasibility its level in the blood of schoolchildren with DAA [10]. The obtained data testified to an increase in the blood content of the IL-6 pro-inflammatory cytokine by 1.9 times, in comparing with a group of healthy children. As we know that IL-6 synthesizes by various cellular elements of monocyte-macrophage and lymphoid systems, fibroblasts, endothelial cells, mesenchymal cells [11, 12]. As we have been indicated above the TNF-α and IL-1α level in the blood significantly increased in children with DAA as inducers of IL-6 production [13]. Concerning importance of increase of the content IL-6 that has been revealed by us in blood at schoolers with DAA, it is to be noted that specified cytokine has system an effect to organism as activation of B-lymphocytes and humoral immune reactions, stimulation of synthesis of acute-phase proteins by hepatocytes, strengthens hematopoiesis [9, 12]. Thus, IL-6 level increasing in children blood with DAA, on the one hand, demonstrates in development of inflammatory process of infectious-allergic nature, and on the other hand - causes development of the complex of protective-adaptive reactions at the expense of activation of specific and nonspecific resistance mechanisms [3, 5].

Tumor necrosis factor (TNF) is a cytokine that takes a special place among pro-inflammatory cytokines, which has an ability to stimulate other IL-1, IL-6 pro-inflammatory cytokines production, activates B-dependent and T-dependent immune responses [8, 11]. Significant increase in blood level of TNF-α at DAA in schoolchildren by 2.6 times against the control children group was showed in our studies (table 1). According to the literature [4], the TNF-α prominent vasodilation effect development in infectious diseases is a prognostic unfavorable sign, and in some cases in combination with TNF with an increase in IL-1a in blood indicates a possible development of progressive hypotension until bacteria toxic shock development.

It is known that IL-8 belongs to the category of second-generation cytokines,

has chemokine properties, and is an activation factor for neutrophils and monocytes [9]. Our research results were indicated an increase IL-8 level in blood of schoolchildren with DAA up to 2.5 times. According to literature, an increase IL-8 level in blood, as a rule, is associated with the development of an acute or chronic inflammatory process [3, 7]. Similar dynamics noted with respect to IL-2 cytokine, where its concentration in blood exceeded an initial level at 6.6 times.

IL-4 and IL-10 are anti-inflammatory cytokines [2]. The anti-inflammatory interleukins indicators were as a same type, i.e. tended to decrease as can see from presented research findings [1]. At the same time, the average IL-4 indicators among schoolchildren with DAA were 2,13±0.02 pkg/ml, which is 18% higher than initial values. The other dynamics noted relative to IL-10, where IL-10 level was 6,14±0.51 pkg/ml, which is 53,5% lower than initial values.

Cytokines level study in oral fluid in schoolchildren with DAA was next task of our research. Analysis results presented in table 2 allowed us to identify certain features of the cytokine blood profile. As can be seen from the presented study results, children with DAA are lead to an increase IL-1 level in oral fluid about 2 times in comparing with a healthy children group. It is known that IL-1α is an inducible protein, synthesized in response to infection or tissue damage during antigens interaction with Toll-like receptor group, at the same time induces such cytokines as IL-2, IL-4, IL -6, IL-10 and others production.

Referring to presented research results, an increase in IL-2 concentration by 4,0 times, IL-4 - by 4,7 times and IL-6 - by 2,3 times were observed. Other dynamics noted relatively to IL-10 concentration, which in oral fluid decreased at 2,3 times. An increase in IL-6 level in oral fluid of children with DAA, on the one hand, manifests in inflammatory process development of an infectious-allergic nature, and on the other hand, causes the development of protective-adaptive reactions complex due to specific and non-specific mechanisms of resistance [4, 10, 13].

Table 2

Comparative assessment of cytokines content in oral fluid of

schoolchildren with DAA

Ratings	Health children (n=18)	Children with DAA (n=64)
TNF-α pkg/ml	4,63±0,31	22,56±2,13*
IL-1α pkg/ml	6,21±0,45	12,34±0,87*
IL-2 pkg/ml	0,29±0,01	1,22±0,14*
IL-4 pkg/ml	1,03±0,01	4,81±0,2*1
IL-6 pkg/ml	11,08±1,04	25,34±2,45*
IL-8 pkg/ml	2,87±0,25	7,01±0,61*
IL-10 pkg/ml	5,17±0,43	2,25±0,17*

According to literature, an increase in TNF and IL-1α might indicate a progressive hypotension development up to a bacterial-toxic shock development. TNF concentration in oral fluid has been showed an increase the level in it by an average 4,9 times comparing with healthy children in our studies [2, 3].

According to literature, an increase in IL-8 level, as a rule, is associated with an acute or chronic inflammatory process development [5-8]. As research results noted, the IL-8 concentration in oral fluid of children with DAA increased by an average of 2,4 times in comparing with healthy schoolchildren group. Analysis research results of anti-inflammatory cytokines (IL-4, IL-10) showed that its concentration in oral fluid in children with DAA were of the same type changes.

CONCLUSION

1. Concurrent increase in blood and oral fluid of the IL-1α, IL-6, IL-8 and TNF-α level are a manifesting symptom of DAA at schoolchildren.
2. Increasing of the IL-1 in IL-6, IL-8, TNF-α level in blood and oral fluid indicates an increase in antigenic stimulation of monocyte-macrophage, lymphoid cell elements, endothelial cells, fibroblasts of various organs and tissues, indicates systemic inflammatory response syndrome development and protective-adaptive reactions and maladaptation reactions formation at children with DAA.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

References

1. Belockij S.M., Avtalion R.R. Inflammation. Cell mobilization and clinical effects // Moscow: BINOM publishing, 2008. - 240 p.
2. Gil'miyarova F.N., Radomskaya V.M., Ryskina E.A. et al. Analytical approaches to study of metabolism indices in the oral fluid // Moscow: Book publishing, 2006. – 312 p.
3. Daminov T.O., Yakubov R.K. Dentition system assessment at children with gastrointestinal tract pathology // Stomatology. 2001;4:63-65.
4. Dubnikova E.V. System of pro-and anti-inflammatory cytokines in children with chronic gastroduodenitis // Modern problems of science and education. 2012;1:0421200037\0055.
5. Chesnokova NP, Mihajlova AV. Infection process. Reduction // Moscow: Natural science academy, 2006. - 434 p.
6. Ignatov MYu., Cybikov NN, Domanova ET. et al. Content of some cytokines and autoantibodies to them in serum, oral and periodontal fluid with odontogenic abscesses of the maxillofacial area // Stomatology. 2010;5:15-16.
7. Kolotova NN, Ron' GI, Kolotova GB et al. Immunological indicators of oral fluid in patients with rheumatoid arthritis // Ural Medical Journal. 2012;8:9-12.
8. Ketlinskij SA, Simbircev AS. Cytokines // St. Petersburg: Foliant publishing. 2008. - 552 p.
9. Korotkova MO, CHirkov VI, Nasybullina GM. Problems and prospects of improving schoolchildren health at municipal level // Hygiene and sanitary. 2007;3:53-55.
10. Lapin YE. State policy in children's health protection field //

Healthcare of the Russian Federation. 2010;1:14-19.

11. Markelova EV, Milekhina SA, Shushanyan LS. The role of local cytokine imbalance in caries pathogenesis at children // Fundamental research. 2011;5:104-108.

12. Browning DD, Diehl WC, Hsu M. Autocrine regulation of interleukin - 8 production in human monocytes. Am. J. Physiol. Lung Cell Mol. Physiol. 2000;279:1129-1136.

13. Ishihara K, Hirano T. IL-6 autoimmune disease and chronic inflammatory proliferative disease. Cytokine Growth Factor Rev. 2002;13:357-368.