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SPECIFIC ASPECTS OF PERFORMING AMPUTATIONS FOR PURULENT COMPLICATIONS OF DIABETIC FOOT SYNDROME

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Annotation. In patients with purulent-necrotic processes in diabetes mellitus, the condition of the IL-1B, IL-2, IL-4, IL-6, IL-8, IL-10, TNF-α, INF system based on the dynamics of cytokine levels was studied. Complex surgical treatment of the drug Reomannisol corrects the balance of cytokines, allowing them to have an antioxidant effect on the cytokine system.

Keywords: diabetic foot syndrome, cytokine system, complex treatment, Rheomannisol.

Introduction. Diabetes mellitus (DM) is a chronic autoimmune disease. When purulent-necrotic lesions of diabetic heel syndrome appear, an inflammatory reaction appears and manifests itself in the form of a local reaction, which can lead to a systemic response. As a result of bacterial action, under the influence of humoral factors, activation occurs in the main phagocytosis cells – neutrophils (polymorphonuclear leukocytes), monocytes (macrophages) and platelets. Activated cells begin to produce inflammatory mediators (cytokines) into the blood, which are involved in the regulation of vascular tone, hemostasis, and cell proliferation. Atherosclerosis of blood vessels in patients with diabetes occurs 8-10 years earlier than in the general population. Therefore, an inflammatory reaction occurs against the background of changes in metabolism and circulatory disorders. The pathogenetic mechanism of diabetes is complex, but the latest research data suggests that the participation of cytokines plays a large role in this disease. Cytokines are conditionally anti-inflammatory: natural immune regulators involved in inflammatory formation (IL-1, IL-2, IL-6, IL-12, TNF-α) and anti-inflammatory by pancreatic β-cells that depressant to insulin production: special immune regulators of inflammatory response (IL-4, IL-10, IL-13, INF-γ) these cytokines have protective and antidiabetic effects. In addition, there are cytokines that regulate specific immune reactions (IL-2 and IL-4, transformative growth factor (TGF-β va et al.). It is involved in protein activation, differentiation and growth of mature lymphocytes. A number of cytokines (IL-1, IL-6, TNF-α, erythropoietin) can also have effects such as distension, which is simple hormones. In addition, a similar single cell can secrete several different cytokines and the same cytokines at the same time, or different cells can produce several different or identical cytokines. Therefore, the importance of cytokines in the formation of diabetes mellitus, on the one hand, and in the formation of an inflammatory reaction, on the other, is interesting to obtain information about the state of the cytokine in patients with DFS. The state of the cytokine system at the time of the development of purulent-necrotic processes in patients with DFS is completely unclear. Given the lack of research, DFS is solved by the dynamic state of the cytokine system in patients with purulent-necrotic processes and recurrence of purulent-necrotic processes. It was decided to study the dynamics of cytokine levels in the blood serum of anti - inflammatory cytokines-interleukins IL-1β, IL-2, IL-6, IL-8, tumor necrosis factor-TNF-α, as well as gamma-interferon (IFN-γ) and anti-inflammatory interleukins IL-4, IL-10 patients. In our opinion, perhaps the imbalance of cytokines will help predict the course of the purulent-necrotic process and determine the tactics of surgical treatment. In addition, the state of the cytokine balance is of interest in patients with recurrence of purulent-necrotic complications of DFS. Cytokine management balance is currently seen as a new direction of immunotherapeutic effects in the treatment of patients with purulent-necrotic lesions of DFS.

The purpose of the work. By studying the dynamics of anti-inflammatory cytokine levels: analysis of the need and possibility of immunocorrection by studying cytokine status in IL-1β, IL-2, IL-4, IL-6, IL-8, IL-10, TNF-α, INF-γ patients on the development and recurrence of purulent-necrotic processes of DFS.

Table 1. In normal patients, the amount of cytokines and the number of cells in the peripheral blood serum

Cytokines	Concentration of cytokines in blood plasma, pg/ml	Production of cells in blood culture, pg/ml	
		Spontaneous	Induced
IL-1β	0-50	0-50	1000-5000
IL-2	0	0	2-10 ED/ml
IL-4	0-50	30-50	100-400
IL-6	0-50	30-50	1000-3000
IL-8	0-50	30-100	1000-5000
IL-10	0-50	30-50	1000-3000
TNF-α	0-50	30-50	500-3000
INF-γ	0-10	10-100	1000-5000

Table 2. Characteristics of operations in group I

Type of operation	Frequency of operations (n=60)	
	abs.	%
Amputations at the hip level	20	33,3
Amputations at the lower leg level	6	10
Amputations at the foot level	12	20
Amputations at the level of the fingers	11	18,3
Amputations at the level of the fingers	7	11,7
Necrectomy	4	6,7

Materials and methods. The concentration of cytokines in the blood plasma was determined using the StatFax 2100 immunological complex (manufactured by Cytokin LLC, St. Petersburg) by enzyme immunoassay (IFA). The obtained results are carried out using descriptive and non-parametric statistical methods on a personal computer with mathematical processing using Statistica 6.0 software (Table 1). Control parameters of the manufacturer's cytokine norms were used - the normative parameters obtained as a result of testing the donors were obtained from the manufacturer Cytokin LLC, St. Petersburg, Russian Federation. Plasma collection and cytokine level testing were performed on day 1 before surgery and on days 3, 5, 7, and 10 after surgery. The study was conducted in three phases and, accordingly, the patients were divided into 3 research groups: Group I (control group) - blood serum of

patients with purulent-necrotic lesions of diabetes for the study of the cytokine system; II group (comparison group) - blood serum obtained during the treatment of patients with purulent-necrotic lesions of diabetes with ozone therapy and peosorbilact - 200.0 ml (YURIYA-FARM LLC, Ukraine); Group III (main group) - blood sera obtained during the treatment of patients with purulent-necrotic lesions of diabetes with ozone therapy and reomannisol - 200.0 ml (REKA-MED FARM LLC, Uzbekistan).

Determination of ozone concentration. To prepare an ozonated physiological solution, we ozonate 200.0 ml of physiological solution for 10 minutes at a concentration of 3-4 mg/l at a concentration of 3-4 mg/l and for 10 minutes in the apparatus "Medozons Beauty" (MEDOZONS LLC, Russia), then its dose is determined by the following formula:

$$D=C \times V \times t;$$

D – ozone concentration dose;

C – ozone concentration, mg/l;

V - oxygen exit rate, l/min;

t – time, min;

The purulent area of each patient is washed 3 times a day with ozonized physiological solution for 15-20 minutes. The number of operations is greater than the number of patients. This is explained by the fact that various operations were performed in one patient to preserve the quality of life and ability to work: necrotomy - 20%, amputation at the level of fingers - 22.9%, amputations at the level of the foot - 2.9%.

Table 3. Characteristics of operations in group II

Type of operation	Frequency of operations (n=40)	
	abs.	%
Amputations at the hip level	23	65,7
Amputations at the lower leg level	0	0
Amputations at the foot level	2	5,0
Amputations at the level of the fingers	8	22,9
Amputations at the level of the fingers	5	14,3
Necrectomy	7	20

However, high amputations were performed when the tactics of saving vital organs were ineffective or when there was no prospect of saving the leg at the time of the initial examination - 65.7%.

Materials and methods of the third stage – main group. Taking into account the information obtained about the state of the cytokine system in patients with purulent-necrotic processes of DFS, it was decided to study the antioxidant effect of ozone therapy and the drug Reomannisol. The research group consists of 40 patients. With the neuropathic form of DFS - 16 people: 4 men and 12 women, and the neuroischemic form of DFS - 24 patients: 8 men and 16 women, aged 50 to 75 years. In the

anamnesis, there were multiple recurrences of purulent-necrotic complications (from 2 to 4 times). The duration of diabetes is from 5 to 20 years. The goal of surgery and conservative treatment algorithm is to preserve the function of the leg or reduce the level of amputation. Reomannisol was used from the first day of hospitalization to study the antioxidant and peripheral blood circulation effects of the drug in complex treatment. According to the scheme, 200.0 ml of solution was administered intravenously 1 time per day for 10 days. Plasma sampling and cytokine levels were performed on the first day before and/or after surgery, and then on days 3, 5, 7, 10, and 12 again blood plasma was taken and the level of cytokines was determined.

Results and discussions in the third group. Table 6 lists the procedures performed in patients of group III.

Table 4. Characteristics of operations in group III

Type of operation	Frequency of operations (n=35)	
	abs.	%
Amputations at the hip level	10	28,6
Amputations at the lower leg level	1	2,9
Amputations at the foot level	1	2,9
Amputations at the level of the fingers	15	42,8
Amputations at the level of the fingers	11	31,3
Necrectomy	15	42,9

Operations performed to save the leg: necroctomies - 42.9%, sequestrectomy - up to 31.3%, amputations at the level of toes - 42.8%, amputations at the level of the heel - 34.3%. In addition, the number of high amputations: at the hip level - 28.6%, at the heel level - 2.9%. Compared to the second group, the number of upper amputations decreased from 65.7% to 28.6%.

Summary. In the case of purulent-necrotic processes in DFS, the adequate introduction of the cytokine system is characterized by the slowing down of the local process, corresponding to acute inflammation, but increases the tendency of the process to go into a chronic state. With the recurrence of purulent-necrotic inflammation, there is a chronization of the process and a secondary immune deficiency, which does not allow the cytokine system to adequately join the anti-inflammatory system. Reomannisol allows us to consider it a physiologically active compound with clear antioxidant activity. Reomannisol has an antioxidant effect on the cytokine system, correcting the cytokine balance. It can decrease the function of pro-inflammatory and anti-inflammatory cytokines, interferons. Reomannisol is effective in preventing recurrence of purulent-necrotic lesions of DFS in conditions of secondary immunodeficiency, so it is a necessary drug in the main therapy complex.

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