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Immune-Metabolic Stress In Purulent Inflammatory Diseases. Cystitis.

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ABSTRACT

The article provides data on the correction of immune-metabolic disorders occurring in patients suffering from purulent inflammatory diseases of the urinary system. The study included healthy people and patients suffering from acute cystitis, having exacerbation of chronic cystitis, pyelonephritits, salpingo-oophoritis. All patients were preliminary categorized into 5 groups. The following parameters were studied in each group: influence of the disease stages and their combinations on the immunologic and metabolic status parameters, as well as their correlations. Immunologic investigation was performed using flow cytofluorometry technique. Oxygen-dependent metabolism of neutrophils was conducted by the nitro blue tetrazolium test. Content of circulating immune complexes was determined spectrophotometrically by Haskova technique using polyethylene glycol: serum immune globulins of the main classes were determined by a turbidimetric method; cytokines were determined by the immunoenzyme method. The research data obtained demonstrated direct correlations between immunologic and metabolic findings in patients suffering from various types of purulent inflammatory diseases of the urinary system, which proved integration of mechanisms of the immuno-oxidant stress.

Keywords: immune-metabolic disorders, cystitis, immunologic parameters, metabolic parameters.

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INTRODUCTION

Urgency of the performed research study is determined by the high incidence of the immune-metabolic disorders. Purulent inflammatory disorders of the urinary system appear to be the cause of development of deuteropathies with high risk of chronicity and disablement [1, 2].

This fact might correlate with the decreased general expressiveness of the population immunity, ageing of the humankind, incidence of nosocomial infections, malnutrition, bad habits and others. In recent decades clinical peculiarities of infectious diseases have modified changing the emphasis of their incidence towards intracellular parasitizing, mixed contamination, prevalence of in apparent clinical forms [3-5].

Currently, changes of the immune-metabolic immunity, diagnostic methods of these conditions with detection of signaling laboratory markers remain under investigated.

The given pathological processes of the human body are based on the immune-metabolic disorders that result in clinical-laboratory characteristics of diseases and appear to be pathogenetic targets for treatment/correction. However, direct correlation between immunologic and metabolic parameters, though unanimously recognized, is not practically documented [6-8].

MATERIALS AND METHODS

The study included healthy people and patients suffering from acute cystitis, having exacerbation of chronic cystitis, combined exacerbation of chronic cystitis and chronic pyelonephritis and salpingo-oophoritis. All the patients were categorized into 5 groups, 22-25 people in each group; influence of the disease stages and combinations on the immunologic and metabolic status parameters, as well as their correlations, were studied in each group of patients.

Clones and subclones of lymphocytes were identified in the immunological study by the NAVIOS Beckman Coulter flow cytofluorometry using monoclonal antibodies CYTO-STATtetraCHROM; phagocytic absorbing capacity was also characterized. Oxygen-dependent metabolism of neutrophils was assessed by the nitro blue tetrazolium test; content of circulating immune complexes was determined spectrophotometrically by Haskova technique using polyethylene glycol; serum immune globulins of the main classes were determined by a turbidimetric method on the biochemical analyzer Chospitec, Holland; cytokines were determined by the immunoenzyme method using sets of reagents of the “Protein contour” company (“Proteinovyi kontur” – Russian version) [1]. Free radical oxidation parameters of lipids and proteins – diene conjugates, ketodienes, malondialdegyde (MDA), bi-tyrosine linkages, Schiff’s bases, – and parameters of the antioxidant defense system – superoxide dismutase (SOD), catalase, vitamin E, systemic thiols, protein thiols, non-protein thiols, plasma anti-oxidative activity – were also determined in patients.

Primary products of free radical oxidation - diene conjugates and ketodienes – were determined by the group of UV-spectrophotometry methods; the secondary product of free-radical oxidation – MDA - was determined by the reaction with 2-thiobarbituric acid; final products of free radical oxidation - Schiff’s bases – were determined by the fluorescence technique. The antioxidant defense system of free radical oxidation regulation was characterized by enzymatic – SOD, ceruleoplasmin, catalase – and non-enzymatic - plasma anti-oxidative activity, vitamin E, systemic thiols, protein thiols, non-protein thiols – mechanisms [9].

Validity of the results obtained was assured by application of the modern panel of planning methods – randomization, representation of the groups of patients depending on their gender, age, severity of the diseases based on random numbers and representativeness of the sample according to the L.E. Kholodov, V.P. Yakovlev formula [1] and statistical analysis of the obtained results using parametric (Student’s) and non-parametric (Wilcoxon-Mann-Whitney) criteria depending on the normal distribution of the parameters. Signaling tests were determined using coefficient of diagnostic consideration (Kj) calculated on the formula [10], where $^{2}{}_{1}$ и $\delta^{2}{}_{2}$ – mean root square deviations, M_1, M_2 – mean values of the parameters of the compared groups; the lower was the Kj module, the higher was the level of parameters deviations from the target level,

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$$Kj = \frac{2 \cdot (\delta_1^2 + \delta_2^2)}{(M_2 - M_1)^2}$$

Key parameters were formalized into the standard formulas of the immune system disorders and metabolic disorders calculated with reference to normal values in healthy people. Association of the key immunologic and metabolic parameters was characterized by determining the number of strong correlations of formulas summands and a coefficient > 0.6. [1].

RESULTS AND DISCUSSION

Summarized (Σ), stimulated (+), suppressed (-) variations were grouped by the methods of parameter investigations – hematologic, immunologic, metabolic – and by the components of the immunity system – cellular, B-dependent, phagocytic, cytokine, as well as by the parameters of free radical oxidation and the antioxidant defense system. Integral assessment of the variations was ranked on the scale into insignificant (the 3rd rank) under the relevant variation of the parameter value in 0-33% of patients, average (the 2nd rank) - in 34-66% of patients, significant (the 1st rank) – in more than 66% [11].

Frontal analysis of the total laboratory investigations of patients with primary acute cystitis and exacerbation of chronic cystitis given in Table 1 demonstrated complete absence of changes in hematological tests. However, it was registered that the number of T-cells, their regulatory subpopulations reduced against the accumulation of various types of natural killers; this process was more expressed in acute cystitis. B-component was characterized by more activity in acute cystitis. Changes of absorbing and metabolic functions of phagocytes in both groups were quantitatively similar; however, they were observed to be disbalanced in acute cystitis, and suppressed in chronic cystitis. Variations of cytokine concentrations and free radical oxidation and anti-oxidant defense system products, at the same time, prevailed in patients with exacerbation of chronic cystitis, with predominant activation.

Table 1: Frontal analysis of the relevant variations of laboratory findings from the norm in patients suffering from cystitis

1 (a): Hematologic parameters

Parameters	Acute cystitis	Exacerbation of chronic cystitis	Exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis	Exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis
Leukocytes			+	+
Lymphocytes			-	-
Stab			+	+
Segmentonuclear			+	+
Eosinophils			+	+
Monocytes			+	+
Erythrocyte sedimentation rate (ESR)			+	+

1 (b): Cellular parameters

Parameters	Acute cystitis	Exacerbation of chronic cystitis	Exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis	Exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis

T	-	-	-	
T-helpers	-	-	-	-
T-cytotoxic		-	-	+
T-regulatory			-	-
T-activated	+	-	+	+
$NK_{T\text{-dependent}}$	+		+	+
$NK_{regulatory}$	+	+	+	+
$NK_{cytotoxic}$	+	+	+	

1(c): Humoral parameters

Parameters	Acute cystitis	Exacerbation of chronic cystitis	Exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis	Exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis
B	+	+	+	
IgM	+	+	+	+
IgG	+		+	-
IgA	+	-	+	-
Circulating immune complexes (CIC)	+	+	+	+
Medium weight molecules (MWM)			+	+

1(d): Phagocytic parameters

Parameters	Acute cystitis	Exacerbation of chronic cystitis	Exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis	Exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis
CD11b				-
CD18				
Phagocytic index (PhI)	+	-	+	-
Phagocytic number (PhN)	+	-	+	-
Nitro Blue Tetrozolium spontaneous (NBT_{spont})	-		-	-
Nitro Blue Tetrozolium activated (NBT_{activ})		-	-	-

1(e): Cytokine parameters

Parameters	Acute cystitis	Exacerbation of chronic cystitis	Exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis	Exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis
IL2			-	
IL4		-	-	-
IL6		+	+	
IL8	+		+	
IL10				
Tumor necrosis factor (TNF)		+	+	+

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1(f): Lipid and protein free radical oxidation parameters

Parameters	Acute cystitis	Exacerbation of chronic cystitis	Exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis	Exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis
Malondialdegyde (MDA		+	+	+
Diene conjugates			-	+
Ketodienes		+	-	+
Schiff's bases	+			+
Bi-tyrosine linkages	+	+	-	+
Plasma antioxidative activity	-	-	-	-
Vitamin E		-	-	-
Superoxide dismutase (SOD),	-	+		-
Ceruleoplasmin		+	-	-
Systemic thiols	-	-		-
Non-protein thiols			-	-
Protein thiols			-	-
Catalase	-	-	-	-

Notes: +/- relevantly stimulated/ suppressed parameters compared to the normal level; other designations are given above.

Range of laboratory test changes were wider in patients with combined pathologies – exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis and exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis. Hematologic markers of inflammation in both cases were stimulated, except the reduced number of lymphocytes. Content of T- and NK-subpopulations changed differently directed: it was reduced in the former and increased in the latter, respectively, and humoral and free radical oxidation dependent parameters, on the contrast, were activated in exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis and suppressed in exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis combinations. In combination of cystitis with pyelonephritis absorbing phagocytic function was stimulated, metabolic function was inhibited; in exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis both functions were suppressed. Interleukins mainly reacted in exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis, and anti-oxidant defense system mechanisms were equally suppressed in both combinations of pathological processes.

As shown in Table 2, stimulation of free radical oxidation parameters and reduction of anti-oxidant defense system parameters was the general tendency of variations of metabolic immunity summands. Thus, quantitatively, activation of free radical oxidation was demonstrated in 60% of parameters in patients with acute cystitis and exacerbation of chronic cystitis, in 80% of parameters in patients with exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis, in 100% of parameters in patients with exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis. Qualitatively, accumulation of malondialdehydes and ketodienes was registered in all 4 nosological entities of disorders; accumulation of bi-tyrosine linkages was registered in exacerbation of chronic cystitis, exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis, exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis; accumulation of diene conjugates was registered in combination of two pathological processes; accumulation of Schiff's bases was registered in exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis.

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Table 2: Changes of metabolic immunity in cystitis

Parameters	Norm	Acute cystitis	Exacerbation of chronic cystitis	Exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis	Exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis
Lipid and protein free radical oxidation					
MDA, µM/l	1.36+-0.1	1.9+-0.2*	1.7+-0.08*	1.87+-0.2*	2.6+-0.7*
Diene conjugates, relative density unit/ml	30.3+-0.04	30.5+-0.1	31.5+-1.5	27.8+-0.06*	33.5+-0.2*
Ketodienes «- «	19.2+-0.02	20.2+-0.05*	25.0+-0.1*	25.6+-0.5*	26.6+-0.6*
Schiff's bases «- «	30.04+-2.9	40.7+-7.7*	32.7+-5.1	32.3+-2.5	35.0+-1.9*
Bi-tyrosine linkages, relative units/ml	0.3+-0.02	0.3+-0.1	0.37+-0.006*	0.34+-0.05*	0.36+-0.07*
Anti-oxidant system					
Plasma anti-oxidative activity, µM/l	65.3+-1.3	44.9+-0.5*	33.3+-1.8*	45.2+-2.1*	44.4+-2.5*
Vitamin E, µM/l	20.9+-3.8	22.6+-2.6	15.8+-0.6*	14.7+-1.5*	13.0+-2.0*
SOD, µM/ml	0.9+-0.03	0.7+-0.08*	1.0+-0.02*	0.6+_0.01	0.55+-0.08*
Ceruleoplasmin, µM/l	264.2+-29.9	288.4+-21.2	386.8+-31.9*	238.9+-31.1*	220.7+-22.4*
Systemic thiols, mM/l	44.52+-0.85	41.0+-2.0*	34.28+-11.7*	45.8+-1.3	34.6+-4.3*
Non-protein thiols, mM/l	23.86+-0.71	24.9+-2.7	26.2+-2.9	17.5+-0.4*	19.9+-0.6*
Protein thiols, mM/l	38.8+-0.82	36.1+-3.0	35.6+-2.2*	30.2+-0.7*	31.1+-0.4*
Catalase, µM/l*min	31.1+-1.43	24.7+-1.0*	28.0+-0.9*	25.5+-1.8*	26.9+-1.4*

Notes: *significance of deviations from the norm, P <0.05.

Summands of the anti-oxidant defense system was suppressed in 50% of parameters in patients with acute cystitis, in 75% of parameters in patients with exacerbation of chronic cystitis, in 88% of parameters in patients with exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis, 100% of parameters in patients with exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis. Distribution of enzymatic and non-enzymatic mechanisms was observed as follows: catalase and superoxide dismutase were inhibited in all cases; ceruleoplasmin was increased in chronic cystitis and reduced in its combinations with other purulent inflammatory disorders. Plasma anti-oxidative activity, at the same time, was reduced in all nosological entities; concentration of vitamin E and protein thiols was reduced in exacerbation of chronic cystitis, exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis, exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis; concentration of systemic thiols was reduced in acute cystitis, exacerbation of chronic cystitis and exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis; concentration of non-protein thiols was reduced in combined pathology.

Table 3 demonstrates a formalized assessment of total variations of immune-metabolic parameters from the norm in patients with cystitis.

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Table 3: Formalized rank assessment of total variations of immune-metabolic parameters from the norm in patients with cystitis

Disorders	Frontal analysis			Grouped parameters									CL	Σ of ranks	variations
	Σ	+	-	H	I	M	Detailed values								
							C	B	Ph	Cy	F	A			
Acute cystitis	2	3	3	3	2	2	1	1	2	3	2	2	2/4	36	IV
Exacerbation of chronic cystitis	2	3	3	3	2	1	2	2	3	2	2	2	3/3	30	III
Exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis	1	2	2	1	1	1	1	1	1	1	1	1	5/2	20	II
Exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis	1	2	2	1	1	1	1	1	1	2	1	1	7/I	18	I

Notes: Σ/+/- sum/stimulating/suppressed parameters; H-hematologic, I-immunologic, M-metabolic, C-cellular, B - B-dependent, Ph – phagocytic, Cy – cytokine, F – free radical oxidation, A – antioxidant defense system – grouped parameters; CL – correlation links of the cellular component of the immunity to the free radical oxidation parameter; 1/2/3 – sufficient/moderate/insufficient rank of variations; I-IV – decreasing total levels of parameter variations.

As shown in Table 3, predominant variation of the 1st rank was registered in >60% of tests in patients with purulent inflammatory pathology; predominant variation of the 2nd rank was registered in 33-66% of tests in patients with mono acute and chronic cystitis. Moreover, percentage of stimulated and suppressed parameters was relevantly average in exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis and exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis.

Variations of the grouped hematologic parameters appeared to be relevant in the combined pathology and insignificant in the monopathology. Metabolic and immunologic parameters significantly varied in patients with exacerbation of chronic cystitis, exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis, exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis and exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis, exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis, respectively.

Reaction of the separate components of the immunity demonstrated equally maximal variation of the 1st rank of the cellular and humoral tests in exacerbation of chronic cystitis, exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis, exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis, moderate variation of the 2nd rank – in exacerbation of chronic cystitis. Phagocytosis was maximally modified in patients with combined pathology, moderately modified in patients with acute cystitis, insignificantly modified in patients with chronic cystitis. Variations of cytokine were significant in exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis, moderate – in exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis and exacerbation of chronic cystitis, insignificant – in acute cystitis.

Perversion of mechanisms of lipid and protein free radical oxidation and the anti-oxidant defense system was universally similar in all four variants of purulent inflammatory diseases of the urinary tract and corresponded to the following decreasing rating of variations of the parameters from the norm: exacerbation

of chronic cystitis + exacerbation of chronic pyelonephritis, exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis, exacerbation of chronic cystitis, acute cystitis.

Comparative expressiveness of pathologic changes in patients with acute and chronic cystitis and their combinations with nephritis and salpingo-oophoritis revealed the most variations from the norm: in exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis, next - exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis, then – exacerbation of chronic cystitis and acute cystitis.

Application of the coefficient of diagnostic value allowed determining signaling tests of diagnostic variations of the immunologic and metabolic status parameters, and formalizing them as diagnostic formulas, see Table 4.

Table 4: Signaling tests of the key formulas of the immune-metabolic disorders and their correlations

Disorders	Formula of the immune system disorders	Formula of the metabolic disorders	Correlation links
Acute cystitis	$Tc^{+}{}_{3}IgM^{+}{}_{3}$ $MWM^{+}{}_{3}$	$AOD^{-}{}_{2}C^{-}{}_{1}SOD^{-}{}_{1}$	**$Tc^{+}{}_{3}$ –BL**; $MWM^{+}{}_{3}$ **-VE**
Exacerbation of chronic cystitis	$Th^{-}{}_{2}IgA^{-}{}_{2}$ $IL8^{+}{}_{3}$	$CP^{+}{}_{2}ST^{-}{}_{3}PAA^{-}{}_{2}$	$Th^{-}{}_{2}$**+DK;**$IL8^{+}{}_{3}$ **-VE,-ST**.
Exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis	$L^{+}{}_{3}T^{-}{}_{3}PhN^{-}{}_{3}$	$KD^{+}{}_{2}MDA^{+}{}_{2}SOD^{-}{}_{2}$	**$L^{+}{}_{3}$ +DK**; $T^{-}{}_{3}$**+ScB,-SOD**; $PhN^{-}{}_{3}$**-C,-NPT**
Exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis	$IgA^{+}{}_{3}Tac^{+}{}_{2}NBTactiv^{-}{}_{3}$	$MDA^{+}{}_{3}SOD^{-}{}_{2}AOD^{-}{}_{2}$	$IgA^{+}{}_{3}$ **–MDA,+AOD**;$Tac^{+}{}_{2}$**+CP,+ST**; $NBTactiv^{-}{}_{3}$**+BL,+SOD, +C.**

Notes: parameters that have valid correlations are given **in bold**; other designations are as follows: Tc – T cytotoxic, IgM - immune globulins of class M, MWM - medium weight molecules, Th – T-helpers, IgA – immune globulins of class A, IL8 – interleukins 8, L – leukocytosis, T – T-cells, PhN – phagocytic number, Tac – T active, NBTactiv – Nitro Blue Tetrazolium activated, AOD – anti-oxidant defense system, C – catalase, SOD – superoxide dismutase, CP – ceruleoplasmin, ST – systemic thiols, PAA – plasma anti-oxidative activity, KD – ketodienes, MDA – malondialdehyde, BL – bi-tyrosine linkages, VE – vitamin E, DK – diene conjugate, ScB – Schiff's bases, NPT – non-protein thiols.

Thus, T-cytotoxic lymphocytes, immune globulins of class M, medium weight molecules – all with the stimulating vector of the 3rd degree - proved to be the key parameters of the formula of the immune system disorders **in acute cystitis**. **Chronic cystitis** was characterized by the reduced number of T-helpers, IgA against the accumulation of anti-inflammatory interleukin 8. **Overburdening of cystitis by pyelonephritis** resulted in leukocytosis, T-cells failure, suppression of the absorbing phagocytic function of the 3rd degree. Finally, **combination of exacerbation of chronic cystitis with exacerbation of chronic salpingo-oophoritis** provided predominant hyper immune-globulinemia of class A, stimulation of the content of T-active lymphocytes, inhibition of oxygen metabolism of neutrophils of maximal or moderate expressiveness.

Basic metabolic parameters selected for the formula of the metabolic disorders were estimated to have their own peculiarities in patients with various diseases. It should be noted that composition of the standard formulas was original on the criteria – the order of the location, the vector and degree of variations from the norm – in all cases. Thus, **in acute cystitis** an anti-oxidant parameter – plasma anti-oxidative activity moderately decreased against the suppression of two enzymatic mechanisms of the anti-oxidant defense system – catalase and superoxide dismutase. **In exacerbation of chronic cystitis** stimulation of the enzyme ceruleoplasmin and reduced level of non-enzymatic systemic thiols and plasma anti-oxidative activity were predominant. In **exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis** predominant

accumulation of free radical oxidation parameters – ketodienes, malondialdehyde - in combination with inhibited concentration of the anti-oxidant enzyme superoxide dismutase was observed. In **exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis** the level of malondialdehyde of the 3rd degree appeared to increase significantly, the enzymatic and non-enzymatic mechanisms of the anti-oxidant defense system – superoxide dismutase and plasma anti-oxidative activity – appeared to inhibit significantly.

Analysis of the calculated formulas demonstrated that different immune metabolic parameters relating to various components of the immune status, processes of protein and lipid peroxidation, the anti-oxidant system dependent on the type of purulent inflammatory disorders were distinctly involved in the typical laboratory pathology.

Detection of strong correlations of signaling tests in formulas of the immune system disorders and metabolic disorders provided determinative information identifying integrity of the immune metabolic mechanisms of pathologies in patients with various purulent inflammatory diseases, see Table 4.

The increased number of T-cytotoxic suppressors was stated to negatively correlated with the free radical oxidation parameter – bi-tyrosine linkages, and immune-active medium weight molecules were correlated with the non-enzymatic factor of the anti-oxidant defense system - vitamin E **in acute cystitis**. Character of correlations modified **in chronic cystitis**: the reduced number of T-helpers concordantly variated with the level of diene conjugates, and the excessive amount of interleukin 8 negatively depended on the vitamin E and systemic thiols concentration. **In exacerbation of chronic cystitis + exacerbation of chronic pyelonephritis** leukocytes formed positive correlation with diene conjugates, T-cells formed negative correlation with Schiff's bases and superoxide dismutase, the phagocytic number also formed negative correlation with catalase, non-protein thiols. **In exacerbation of chronic cystitis + exacerbation of chronic salpingo-oophoritis** the number of strong correlations were maximal and equal 7. Content of IgA negatively depended on the amount of malondialdehyde and positively depended on plasma anti-oxidative activity; the number of T-active cells concordantly positively changed together with ceruleoplasmin and systemic thiols, nitro blue tetrazolium activated test positively changed together with three tests – bi-tyrosine linkages, superoxide dismutase, catalase.

The obtained research data on the direct correlation of immune and metabolic parameters in patients suffering from various types of purulent inflammatory diseases of the urinary system, kidneys, uterine appendages gave evidence of developing the integrative mechanism of pathology – the immune-oxidant stress, the fact being of theoretical and practical significance.

CONCLUSIONS

Analysis of the considerable amount of clinical material – data of more than 100 patients suffering from 4 types of purulent inflammatory diseases of the urinary system – allowed determining typical changes of general, detailed at the level of the immune components, parameters as well as metabolic parameters of lipid and protein free radical oxidation and anti-oxidant defense with formalization of signal tests in the diagnostic formulas. Direct correlation between key immune metabolic tests of patients indicating at the integration of immune anti-oxidant stress mechanisms was found out.

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