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Clinical-Immunological Description of Urological Diseases in Patients with Tuberculosis

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Abstract: When tuberculosis is accompanied by urological diseases, changes in the patient's overall condition, as well as in the immune system, are observed. This is mainly characterized by a profound total secondary immunodeficiency of the T-cell system. When tuberculosis and urological diseases coexist, significant acute changes in the B-cell branch of the immune system (humoral immunity) were not observed, indicating that urological diseases do not have a practical negative impact on the B-cell branch of the immune system and that they are not a complicating factor for pulmonary tuberculosis in terms of humoral immunity.

Keywords: urological diseases, tuberculosis, immune system.

Introduction

The proportion of people suffering from multimorbidity on our planet is steadily increasing (1,2,4,7). It is characteristic that people infected with chronic infectious diseases such as tuberculosis and HIV also develop non-infectious diseases (3,5,6,9,10,11). The rapid increase in the number of non-infectious diseases has been reported mostly in low and middle-income countries. It is known that the course of urological diseases in patients with pulmonary tuberculosis has its own peculiarities. These characteristics are also related to the immune system of the organism, which is influenced by the severe progression of the underlying disease (7,8,12). However, it has not been shown which branch of the immune system is significant in the pathological process.

Aim of the Study: To examine the quantitative changes in different branches of the immune system in patients with urological diseases coinciding with pulmonary tuberculosis.

Materials and Methods: A total of 157 individuals treated at the Bukhara regional tuberculosis dispensary were studied. They were divided into three groups: the main group - patients diagnosed with urological diseases alongside pulmonary tuberculosis (n=117); the comparison group - patients diagnosed with pulmonary tuberculosis but without urological diseases (n=20); and the control group - healthy individuals without pulmonary tuberculosis or urological diseases (n=20).

The main group was further divided into three smaller subgroups:

- Subgroup 1a - patients with urinary stone disease (USD) coinciding with pulmonary tuberculosis (n=18);
- Subgroup 1b - patients with urinary tract infections (UTI) concurrent with pulmonary tuberculosis (n=54);
- Subgroup 1c - patients with benign prostatic hyperplasia (BPH) alongside pulmonary tuberculosis (n=45).

The presence of various urological diseases can be influenced differently by the underlying disease - pulmonary tuberculosis. This also leads to various changes in the quantitative indicators of the immune system. Therefore, studying and evaluating the immune system indicators in these urological diseases was conducted comparatively.

The condition of the immune system in patients and healthy individuals was assessed based on CD-differentiated and activation antigen expression. The following markers of immune competent cells were identified: CD3+, CD4+, CD8+, and lymphocytes. The expression of CD receptors was performed using LT series monoclonal antibodies from "Sorbtent" LLC, according to the method established by Garib F.Yu. et al. (1995) through a rosette formation reaction. The concentrations of IgM, IgA, and IgG in serum were determined by the radial immunodiffusion method of Mancini (1963). Cytokines in serum were detected using the "Cytokine" (RF) test kit by the ELISA method.

All tests were conducted at the Bukhara Regional Multidisciplinary Medical Center and the Institute of Immunology and Human Genomics of the Academy of Sciences of Uzbekistan.

Results and Analysis:

The influence of various urological diseases on the primary disease - pulmonary tuberculosis - is distinct. Additionally, there are various changes in the quantitative indicators of the immune system. For this reason, the study and evaluation of immune system indicators in these urological diseases were carried out comparatively.

The obtained results show that in all subgroups of the main group, the number of leukocytes significantly decreased compared to the control group (Table 1).

Table 1. Indicators of Immune Status in Patients with Pulmonary Tuberculosis Accompanied by Urological Diseases

Indicators	Control Group	Main Group		
		USD, n=18	BPH, n=54	UTI, n=45
Leukocytes, 10^9/L	6500±185	4648±253	4738±234	4064±228*
Lymphocytes	32.5±1.26	34.85±1.93	32.96±1.82	37.0±1.46
Lymphocytes per 1 µL of blood	2112±83	1649±99*	1538±97*	1482±76*
CD3+ cells %	59.5±1.16	42.38±1.67*	41.17±1.55*	43.45±1.62*
CD3+ cells per 1 µL of blood	1257±38	638±47*	626±46*	629±34*
CD4+ cells %	36.0±1.05	31.63±1.12*	30.51±1.09*	33.54±1.10
CD4+ cells per 1 µL of blood	760±32	448±37*	457±36*	483±23*
CD8+ cells %	23.5±0.82	27.0±1.27*	24.0±1.03	24.36±0.63
CD8+ cells per 1 µL of blood	496±29	339±30*	376±29*	360±24*
IRI, units	1.53±0.02	1.17±0.04*	1.97±0.04*	1.38±0.03*

*Statistically significant difference compared to the control group ($p < 0.05$).

Note: * indicates statistically significant changes compared to the control group ($p < 0.05$ - 0.001).

In these patients, the relative indicators of total lymphocyte counts showed no significant difference between the control and main groups ($p > 0.09$); however, significant differences were observed in the absolute counts of this parameter, with a reduction of 1.28 times in subgroup 1a, 1.37 times in subgroup 1b, and 1.43 times in subgroup 1c ($p < 0.05$). This indicates corresponding changes in leukocyte counts.

It is noteworthy that the most severe immunodeficiency among the cellular immunity parameters was observed in CD3+ cells, with a relative decrease in the main group of 1.40, 1.45, and 1.37 times, respectively ($p < 0.001$). A similar result was also noted in the absolute counts of CD3+ cells, with reductions of 1.97, 2.01, and 2.00 times, respectively ($p < 0.001$).

A significant decrease was uniformly observed in both the relative and absolute counts of CD3+ cells ($p < 0.05$ - $p < 0.001$). This indicates a total deficiency of this immune competent cell in patients of the main group. When evaluating the subpopulations of CD3+ cells (CD4+ and CD8+), it was determined that the total T-immunodeficiency was primarily due to the CD4+ cells, as their relative and absolute counts significantly decreased in the main group compared to the control.

In contrast, no clear differences were observed in the relative counts of CD8+ cells between groups.

The marker indicating the development of secondary immunodeficiency in the T-component of the immune system is the IRI, which was significantly reduced at values of 1.17±0.04, 1.27±0.04, and 1.38±0.05 units compared to the control group (1.53±0.02 units), clearly demonstrating a deficiency in this parameter. A similar deficiency in the T-component of the immune system was also noted in comparative analyses with the comparison group.

Thus, out of the 10 indicators describing the T-component of the immune system, a significant decrease was observed in 9 indicators (subgroup 1a) and 8 indicators (subgroups 1b and 1c) in the main group compared to the control group. The depth of secondary immunodeficiency was particularly characterized by the decrease in relative and absolute counts of CD3+ and CD4+ cells. The IRI, which genuinely assesses the deficiency in the T-component, indicated the development of secondary immunodeficiency and is described as an immunological marker for assessing secondary immunodeficiency in the T-component of the immune system. When pulmonary tuberculosis is combined with urological diseases, there are changes in the overall health of the patient as well as in their immune system, primarily characterized by profound total secondary immunodeficiency in the T-component of the immune system.

In contrast, when analyzing the humoral or B-component of the immune system in patients, similar significant results were not observed. The indicators in the main comparison and control groups were quite close, with no significant difference between the values ($p > 0.05$).

In terms of the concentrations of major immunoglobulins (IgA, IgG, IgM) in serum, a notable decrease was recorded in the main group compared to the control group for IgA and IgG ($p < 0.05$); however, no significant difference was found when compared to the comparison group ($p > 0.05$).

Thus, when pulmonary tuberculosis co-occurs with urological diseases, no significant changes in the B-component of the immune system (humoral immunity) were observed, proving that urological diseases do not negatively affect this component of the immune system.

Conversely, a significant and sharp increase was noted in the concentrations of pro-inflammatory and anti-inflammatory cytokines (IL-10 and TNF), with the main group's indicators significantly higher than those in the control and comparison groups ($p < 0.05$ - $p < 0.01$). This indicates that in patients diagnosed with pulmonary tuberculosis and concurrent urological diseases, the pathological process is exacerbated, along with a significant increase in the concentrations of both pro-inflammatory and anti-inflammatory cytokines.

In summary, no significant changes were observed in the B-component of the immune system (humoral immunity) when both pulmonary tuberculosis and urological diseases were present. The lack of difference in IgM concentrations, coupled with a slight difference in IgA and IgG concentrations in the main group compared to the control, and no practically notable difference from the comparison group suggests that urological diseases do not have a negative practical

impact on the B-component of the immune system, indicating that urological diseases are not a worsening factor for pulmonary tuberculosis.

The significant and sharp increase in concentrations of pro-inflammatory and anti-inflammatory cytokines (IL-10, TNF) in the blood serum of patients in the main group compared to the control and comparison groups further supports that the inflammatory process is intensifying and is a factor that exacerbates pulmonary tuberculosis progression.

Conclusions:

1. The profundity of secondary immunodeficiency when tuberculosis and urological diseases are present is characterized by a decrease in the relative and absolute counts of CD3+ and CD4+ cells. The IRI, which genuinely assesses the deficiency in the T-component, indicates the development of secondary immunodeficiency. Changes occur in the patients' immune systems, primarily characterized by profound total secondary immunodeficiency in the T-component.
2. Significant changes were not observed in the B-component of the immune system (humoral immunity) when tuberculosis and urological diseases coexist, proving that urological diseases do not have a negative practical effect on the B-component of the immune system, and do not worsen the condition of patients with pulmonary tuberculosis. The significant increase in concentrations of pro-inflammatory and anti-inflammatory cytokines (IL-10, TNF) in the blood serum of patients in the main group indicates that the inflammatory process is intensifying and is a factor that exacerbates the progression of pulmonary tuberculosis.

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