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Spleen Damage in Coronavirus Infection

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Abstract: According to statistics, 96% of those with severe COVID-19 have lymphopenia, that is, a decrease in the absolute number of lymphocytes in the blood. One of the reasons is the ability of SARS-CoV-2 to directly affect the tissues of lymphoid organs: the spleen and lymph nodes of the mediastinum, which was proven during the autopsy of deceased patients. In addition, it has been proven that coronavirus can affect lymphocytes and induce their apoptosis through signaling pathways. The mechanisms of spleen damage in COVID-2019 are poorly understood. This review focuses on spleen damage in coronavirus infection.

Keywords: spleen, coronavirus infection, hepatotoxicity.

Relevance. On March 11, 2020, WHO declared a pandemic of severe acute respiratory syndrome (SARS) caused by type 2 coronavirus (SARS-CoV-2), coining the term coronavirus disease 2019 (COVID-19) [1]. The source of SARS-CoV-2 has not yet been accurately determined, although there are suggestions about the zoonotic nature of the infection [2]. Person-to-person transmission occurs through close contact with an infected person pathogen by airborne droplets and dust into the respiratory tract, contact and fecal-oral transmission routes are also described [3]. The average age of patients is approximately 51 years, the most severe forms developed in patients 60 years of age and older. Among the patients, the following comorbidities were often noted: diabetes mellitus (20%), arterial hypertension (15%), other cardiovascular diseases (15%). The clinical picture is characterized fever, dry cough, shortness of breath, muscle pain, skin rash. The clinical spectrum of COVID-19 infection varies from asymptomatic or oligosymptomatic forms to clinical conditions characterized by respiratory failure, with the development of systemic manifestations in the form of sepsis, septic shock and multiple organ dysfunction syndrome (MODS), requiring mechanical ventilation and support in the intensive care unit. therapy [1]. Most publications noted that the average age of patients was 58-59 years and was predominantly in the range from 15 to 89 years. Some authors noted that no significant gender differences were found, other studies noted that there is a lower prevalence of the disease in females (56% of men) [1, 2].

A mild form of coronavirus can also lead to serious consequences for the body. This conclusion was made by the British researchers of the Coverscan group. They analyzed more than 200 patients with mild COVID-19 and found that almost 70% of them had damage to one or more organs. In particular, we are talking about the lungs, heart and pancreas. Also, the virus often affected the kidneys, liver and spleen.Coronavirus penetrates from the lungs to other organs, spreading with blood and lymph, Russian scientists from the Federal State Budgetary Institution National Research Center for Hematology, Peoples' Friendship University of Russia and Moscow State University named after M.V. Lomonosov. However, severe impairment of liver, kidney and heart functions in COVID-19 is not always caused by direct infection of these organs with SARS-CoV-2. Adkhamjon Abdullaev, one of the authors of the work, a senior researcher at the Laboratory of Molecular Hematology at the National Medical Research Center for Hematology, told Gazeta.Ru in more detail about the results of the study published in the journal Viruses. “The study is devoted to the quantitative assessment of viral load in the tissues of the lungs, lymph nodes of the mediastinum, heart, liver, kidneys, spleen and brain,” the scientist said.

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Earlier studies were limited to simply detecting infection in tissues, without quantifying viral load. The researchers decided to clarify what level of viral load is needed for SARS-CoV-2 to spread from the lungs to other organs.

Scientists analyzed tissue samples from 36 patients who died from COVID-19. In 30.5% of patients, the virus was present only in the lungs, and in 63.9%, several organs were affected at once. SARS-CoV-2 RNA was found in 86.9% of cases in the lymph nodes, in 56.5% of cases in the heart, in 52.2% in the spleen, in 47.8% in the liver, in 26% in kidneys and in 13% of cases - in the brain. The study showed that the spread of coronavirus particles from the lungs to other organs was typical mainly for patients who had an exudative (initial) phase of inflammation in the lung tissue and a high viral load of SARS-CoV-2.

Scientists from the National Medical Research Center for Hematology and Moscow State University, together with Russian colleagues, have found out how SARS-CoV-2 reduces the number of lymphocytes.

And now Russian scientists have proven another mechanism of lymphocyte damage - direct infection of immune cells with SARS-CoV-2 viral particles.

For the study, scientists used tissue from the lungs and lymph nodes of 36 patients who died from coronavirus. RNA was isolated from them, which was then converted into complementary DNA through reverse transcription. To assess the spread of coronavirus in tissues, experts used PCR.

Patients were divided into three groups according to the level of coronavirus in tissues and organs. The first group included three patients whose tissues did not contain SARS-CoV-2, and the second group included three patients with disseminated coronavirus lung disease. In patients from the third group, covid affected the lymph nodes and spleen.

It turned out that patients from the second group, on average, were admitted to the hospital 18.5 days before death, and the level of lymphocytes was reduced in 58.3% of them. Patients from the third group died within 7 days after being admitted to the hospital, and lymphopenia occurred here in 71.4% of cases. Scientists attribute this to a higher viral load in patients of the third group.

At the same time, scientists found correlations between the severity of lymphopenia and viral load in the lymph nodes and spleen. Lymphocyte deficiency was also observed in those patients whose lymph nodes and spleen were not affected by the virus, while some patients with affected organs did not have lymphopenia.

However, transmission electron microscopy allowed scientists to make another unexpected discovery: they found virions directly inside lymphocytes. A vesicle with numerous SARS-CoV-2 virus particles was found in the cytoplasm of one of the lymphocytes. This is the first known case of direct coronavirus infection of lymphocytes in patients with COVID-19, the researchers said.

The results of the study confirm the hypothesis that the cause of lymphopenia may not be damage to the lymphatic tissues, but the ability of SARS-CoV-2 to penetrate directly into lymphocytes and actively multiply inside them, exerting a cytotoxic effect.

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