

«TISSUE REACTIONS IN THE NORM, EXPERIMENT AND CLINIC»
**MORPHOLOGIC CHANGES OF BLOOD CELLS
IN PATIENTS WITH MODERATE COVID-19**

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Introduction. After three years of the outbreak of Coronavirus Disease 2019 (COVID-19) pandemic, main tasks as to treatment and vaccination are still pending their solution. Today, it is known that SARS-CoV 2 coronaviruses are intracellular viral infections having an inevitable negative impact on all cells of the human body, including the blood cells. It is established that COVID-19 patients can be classified into mild, moderate, and severe. Modern literature does not describe ultrastructural changes of circulatory blood cells in patients with moderate course of this disease.

Aim. To study the ultrastructural changes of blood cells in moderately severe patients with COVID-19.

Materials and methods. Ultrastructural study of blood cells was conducted in 20 patients with proven diagnosis of moderate COVID-19 infection receiving inpatient treatment at Lviv Regional Infectious Diseases Clinical Hospital (LRIDCH). Blood sampling in volume of 1 milliliter was carried out by LRIDCH laboratory technicians in compliance with all mandatory anti-epidemic and ethical norms. Patients gave their voluntary consent to the study of their biological material after they have been explained the purpose of this study. Blood samples were delivered to the electron microscopy laboratory of Danylo Halytskyi Lviv National Medical University,

where preparations were produced observing all anti-epidemic measures. The examining and photographing of the material was done with a UEMV-100K (Sumy, Ukraine) microscope at an accelerating voltage of 75 kV and screen magnification of 2000x–12400x.

Results. 20 patients were diagnosed as having moderate COVID-19. Their median age was 56 years, and 9 of them were females. The complete blood count alterations in COVID-19 patients are presented in research paper by Mariangela Palladino (2021). The results of electron microscopic examination of blood sediment of patients with moderate to severe course of COVID-19 show that it mainly consists of erythrocytes, granulocytes, and a much smaller amount of lymphocytes. Most erythrocytes have irregular shapes and different dimensions. There are planocytes, spherocytes, echinocytes, stomatocytes among erythrocytes as well as erythrocytes of other irregular shapes. Different electron density is characteristic of these erythrocytes. Erythrocytes of smaller dimensions are characterized by increased electron density, which is the initial sign of apoptosis. Hyaloplasm of echinocytes and semilunar erythrocytes mostly has a reduced electron density. Erythrocytes with increased electron density are characterized by disorganized plasmolemma with numerous and heterogeneous shapes and dimensions of defects. Completely destroyed erythrocytes in the form of «burned coals from the fireplace» were also found, which proves erythrocyte apoptosis or eryptosis. Cells of granulocytic series are characterized by the following changes: electron-bright cytoplasm with signs of disintegration, containing fat droplets, microvesicles, nuclear envelope is disorganized at many sites, or absent at all. Signs of disintegration, hypertrophied Golgi apparatus, a large number of mitochondria, including damaged ones, lysosomes, and microvesicles can also be observed in the lymphocyte cytoplasm. Nuclear envelope of these cells is absent at many sites.

Conclusions. The results of electron microscopic test of blood of patients with moderate COVID-19 indicate pronounced changes in the shape and dimensions of erythrocytes, as well as erythrocyte apoptosis. These changes may indicate impairment of the main transport function of erythrocytes and hypoxia of all organs of the patient's body. At the same time, various damages of lymphocytes and granulocytes are observed, which lead to severe course of the disease. The expression of ultrastructural changes in these blood cells directly depends on the severity of the course of COVID-19.

Key words: Coronavirus Disease 2019 virus, granulocytes, lymphocytes, erythrocyte apoptosis, electron microscopy.