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Skuteczność leczenia osoczem ozdrowieńców oraz wybrane aspekty
odpowiedzi immunologicznej w przebiegu choroby COVID-19

Rozprawa na stopień doktora nauk medycznych i nauk o zdrowiu

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6. Streszczenie w języku angielskim

EFFECTIVENESS OF CONVALESCENT PLASMA THERAPY AND SELECTED ASPECTS OF THE IMMUNE RESPONSE DURING COVID-19

COVID-19 pandemic, caused by the SARS-CoV-2 coronavirus, was declared by the World Health Organization on March 11, 2020. The first cases of the disease were observed in Chinese city of Wuhan in November 2019. The new pathogen was named SARS-CoV-2, isolated and identified in January 2020. The first confirmed case of COVID-19 in Poland was reported on March 4, 2020. The SARS-CoV-2 virus is a single-stranded positive-sense RNA virus and belongs to the Coronaviridae family. It has a spherical shape with numerous spike proteins on its surface, giving it a characteristic crown-like appearance, from which it derives its name. It is closely related to other coronaviruses such as SARS-CoV and MERS-CoV. The SARS-CoV-2 virus has a high mutation potential, resulting in identification of wide range of many variants such as Alpha, Beta, Gamma, Delta, and Omicron. The COVID-19 symptoms can vary but the most common ones include fever, cough, headache, fatigue, and muscle pain. Approximately one-third of infected individuals do not show any symptoms. Neutralizing antibodies have the ability to bind and destroy the virus.

Objective

The study aimed to evaluate the effects of convalescent plasma therapy in the group of COVID-19 patients hospitalized at the MSWiA hospital. As part of the observation, the impact of factors such as comorbidities and age on therapy's effectiveness was also assessed. An additional objective was to evaluate the duration of the immune response in the form of IgG neutralizing antibodies directed against the S1/S2 subunits of the SARS-CoV-2 virus.

Material and methods

In the study assessing the effectiveness of convalescent plasma therapy, a total of 102 patients received the treatment. The plasma was obtained from a group of 49 convalescent donors. The study took place from April 24, 2020, to August 28, 2020. The criteria for qualifying as a plasma donor aligned with the blood donation criteria set by the Ministry of Health, with the additional requirement that candidates had to be male and have confirmed SARS-CoV-2 infection, along with documented recovery confirmed by two negative PCR test result. Each donor could provide up to three units of plasma. The level of neutralizing antibodies was measured using the Liaison SARS-CoV-2 S1/S2 IgG test. During the study, 56 patients received one unit of plasma, 38 received two units, and 8 patients received three units of convalescent plasma.

The second study aimed to determine the duration and strength of the immune response in a group of COVID-19 convalescent individuals. It involved 38 patients who were also plasma donors in the previous study. The observation took place from March 15, 2020, to June 26, 2021. The measurement of antibody levels was conducted at the Central Clinical Hospital of The Ministry of the Interior Affairs and Administration in Warsaw. During the observation, the predominant variant of the virus was the B.1.1.7 variant – Alpha, characteristic of the first phase of the pandemic. The observation of the duration of the humoral response to the primary infection was discontinued, among other reasons, due to the introduction of mass COVID-19 vaccinations.

Results

In the study evaluating the efficacy of convalescent plasma therapy, a significantly lower mortality rate was observed in the group of patients receiving this treatment (13.7% mortality in the plasma group compared to 34.3% mortality in the control group). The study also demonstrated a higher clinical benefit in group of patients, who received convalescent plasma at an early stage of the disease (within 72 hours of symptom onset), in the group of patients with severe course of COVID-19 and in group of patients with comorbidities, especially with presence of cardiac insufficiency and active cancer. In the second study, which evaluated the duration of the humoral immune response in COVID-19 convalescent patients, it was found that after 12 months from infection, over 56% of observed patients still had a protective level of neutralizing antibodies.

Conclusions

The convalescent plasma treatment has proven to be an effective therapy, reducing mortality. This study also allowed to identify a group of patients who benefited the most – group of patients with severe COVID-19 and those with underlying medical conditions. Second study showed that administering a booster dose of COVID-19 vaccine is necessary, especially in the group of patients with immunodeficiencies and pre-existing medical conditions.