Summary

Respiratory diseases, including COVID-19 caused by the SARS-CoV-2 virus, pose a global public health challenge. The COVID-19 pandemic, declared by the WHO in March 2020, has significantly impacted society, the economy, and healthcare systems. Effective management of droplet-transmitted diseases, including COVID-19, requires deep understanding of transmission mechanisms, preventive measures, and treatment strategies.

The research was conducted in two stages, taking into account the evolving pandemic situation. The aim of the first stage of this study was to assess the presence of anti-SARS-CoV-2 antibodies in COVID-19 convalescents and their production depending on disease severity, inflammatory parameters, gender, age, and vaccination status. In the second stage, the frequency of antibody occurrence in the general population during four pandemic waves was assessed, along with differences in antibody production between patients and healthy individuals. The frequency of asymptomatic infections was also analyzed based on anti-N antibody status and vaccination history. The study was approved by the Bioethics Committee of the Medical University of Białystok (approval numbers: APK.002.346.2020 and APK.002.259.2020).

In the first stage, 322 patients (282 hospitalized at the Clinic of Infectious Diseases and Neuroinfections, Medical University of Białystok, and 40 patients with mild COVID-19 symptoms isolated at home), both male and female (165 females and 157 males), with a history of SARS-CoV-2 infection were included.

In the second stage, the study population comprised two groups:

Group I consisted of individuals after COVID-19 (232 hospitalized patients). Patients were evaluated six months after infection.Group II comprised 544 patients from the Białystok PLUS study cohort. The Białystok PLUS study provides information on the local community's health status through analysis of tests and surveys conducted on a carefully selected cohort representative of the local population. Blood samples from patients with confirmed SARS-CoV-2 infection and individuals from the local population were used for the study.

Blood sample analysis results were obtained using standard biochemical methods. Anti-SARS-CoV-2 IgG antibody titers were determined quantitatively using the LIAISON

SARS-CoV-2 S1/S2 IgG assay, while anti-N protein antibodies were detected qualitatively using the Elecsys Anti-SARS-CoV-2 (COBAS) immunoassay.

The study found that the humoral immune response to SARS-CoV-2 infection persists for over 6 months. The observed anti-S antibody titers against SARS-CoV-2 were significantly higher in patients with a history of severe COVID-19 and vaccinated individuals. Additionally, a statistically significant correlation was observed between antibody production against SARS-CoV-2 and the severity of inflammation during the acute phase of the disease. It was observed, that the immune response to COVID-19 infection was independent of gender. Identification of individuals with positive anti-N antibody titers without a history of COVID-19 underscores the existence of asymptomatic infection cases in the population.

The obtained results reflect the situation in the Polish population during the COVID-19 pandemic. The results provide significant information on seropositivity during the pandemic. The findings confirm that serological studies are essential tools both for individual patients and for the entire society, serving as significant instruments in pandemic control strategies.