Vaccination of Recovered Patients Activates the Immune System against SARS Coronaviruses

Colleagues at the Paul-Ehrlich-Institut (PEI) and the Goethe University Frankfurt/Main investigated the antibody response to COVID-19 in a longitudinal study. Antibody response against SARS-CoV-2 decreased over time. Study participants who were later vaccinated with the BioNTech (Comirnaty) mRNA vaccine showed not only an increase of the antibody titre against SARS-CoV-2, but also against several SARS-CoV-2 variants and SARS-CoV-1, against which no titres were previously present. The titre against the common cold coronavirus NL-63 remained unaffected. Viruses reported on the results in its edition from 23 April 2022.

Scientists working with Professor Barbara Schnierle, Head of the "AIDS, New and Emerging Pathogens" Section of the "Virology" Division at the Paul-Ehrlich-Institut (PEI), together with researchers from the University Hospital of the Goethe University Frankfurt/Main have conducted a long-term study on humoral, i.e. antibody-mediated immunity in recovered COVID-19 patients. Virus neutralisation tests were used to determine the activity of the antibodies as a concentration of neutralising antibodies in the serum (titre) against various coronaviruses.

The study examined sera from 80 COVID-19 patients at the Goethe University Hospital Frankfurt/Main who were PCR positive between 5 March and 14 July 2020. 86 percent of them had a mild disease course, 14 percent were seriously ill. 51 women and 29 men aged 18 to 75 years participated in the study.

Blood was collected from participants in the longitudinal study for up to 537 days after a positive PCR test. Not only antibodies against the original Wuhan strain (wild type) of the coronavirus SARS-CoV-2, but also antibodies against the common cold coronavirus NL-63 were analysed.

The concentration (titre) of the neutralising antibodies directed against SARS-CoV-2 decreased over time after COVID-19 disease. The value halved after 140 days on average. This confirms the results of other comparable studies.

Antibodies to human coronaviruses causing common colds can be detected in the serum of most people. There were concerns that pre-existing antibodies against NL-63 could prevent the formation of antibodies against SARS-CoV-2, since only antibodies against homologous (similar amino acid sequence) epitopes of the coronavirus might be induced.

In the present study, the activity and concentration of the antibodies against NL-63 were evaluated. The titre of NL-63 neutralising antibodies was also reduced, with a half-life of 218 days on average, i.e. somewhat slower than the neutralising antibody titre against wild-type SARS-CoV-2 after COVID-19 disease.

These results indicate that the increase in neutralising antibodies against SARS coronaviruses after infection has no influence on the neutralisation of common cold coronaviruses and therefore these concerns have been resolved.
Some of the study participants (13 persons) were vaccinated after recovering from COVID-19 disease. After 35 days (± 10 days), the scientists investigated how the antibody response against the wild-type variant and the virus variants Delta and Omicron of SARS-CoV-2 and against SARS-CoV-1 and NL-63 developed before and after vaccination.

Neutralising antibody titres increased significantly towards wild-type, Delta and Omicron variants of SARS-CoV-2 and SARS-CoV-1 after vaccination. However, the vaccine did not produce antibodies against coronavirus NL-63. Here, too, there is no indication of a cross-neutralisation (mutual influence) of the immune response between SARS-CoV-2 and NL-63. The spike protein of NL-63 differs significantly from that of SARS-CoV-2 (31 percent identical amino acid sequence). In contrast, the spike proteins of the SARS-CoV-2 wild type are more similar to SARS-CoV-1 (76 percent) or the variants Delta (99 percent) and Omicron (97 percent).

The recovered patients examined developed COVID-19 during a period in which the Omicron variant was not yet present. No Omicron-neutralising antibodies were found in their serum after the infection.

The longitudinal study shows that the antibody response after an infection with SARS-CoV-2 slowly wanes over time, but can be reactivated and further increased by a COVID-19 vaccination. The antibodies produced after vaccination had a much broader range of activity and neutralised variants of SARS-CoV-2, in some cases also the virus variant Omicron, and SARS-CoV-1 in the laboratory test (in vitro).

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