Multi-peptide vaccine against SARS-CoV-2 shows strong T-cell immune response

At the University Hospital Tübingen, clinical evaluation of an in-house developed vaccine (CoVac-1) against SARS-CoV-2 was started in November 2020 under the direction of Prof. Dr. Juliane Walz in the CCU Translational Immunology of the Medical Clinic (Medical Director Prof. Dr. Helmut Salih). Now the results of the Phase I study are available and demonstrate a potent activation of the T-cell response against the coronavirus.

The results recently have been published in the renowned journal Nature. The study is currently in the second phase. The aim of this novel vaccine candidate is to induce a broad and strong T-cell mediated immune response against SARS-CoV-2 in patients with antibody deficiency in order to prevent severe COVID-19 disease.

T-cells play a central role in COVID-19 disease. This has already been demonstrated by the research team led by Prof. Walz, head of the clinical study, in several scientific publications. In the course of this research, SARS-CoV-2-derived peptides were identified, analyzing blood samples of individuals who had survived COVID-19, that are important for recognition and long-term protection by T-cells. "Those peptides that play a significant role in long-term immunity after SARS-CoV-2 infection are now used in our CoVac-1 vaccine," explains Juliane Walz. Peptides are short proteins that are presented on the surface of tumor cells, but also on virus-infected cells, to the immune system and here specifically to T-cells. This enables the immune system to recognize "foreign" and infected cells and to eliminate them. The idea for the vaccine comes from cancer immunotherapy, one of the main research focuses of the Tübingen immunologists.

Phase I study results

CoVac-1 was evaluated in a Phase I clinical trial in healthy volunteers between 18 and 80 years of age. Here, an extremely potent activation of the T-cell response against SARS-CoV-2 was demonstrated with good tolerability.

A total of 36 subjects were vaccinated within the study. Mild side effects such as headache and fatigue were observed in a few participants; serious side effects did not occur. All subjects experienced local induration at the injection site. "This local reaction is expected and desired for our vaccine. It is due to the formation of a depot at the injection site, which prevents rapid degradation of the vaccine and thus enables a long-lasting immune response," explains Dr. Jonas Heitmann, one of the first authors of the study.

All study participants showed the desired broad and strong T-cell immune response against SARS-CoV-2 four weeks after vaccination. In initial follow-up studies up to three months after vaccination, these immune responses persisted. Furthermore, the CoVac-1 induced T-cell response was shown to exceed that reported in convalescent individuals following natural infection and it is also more potent than T-cell immunity generated by approved mRNA or vector vaccines. In contrasted to previously approved vaccines, CoVac-1-induced T-cell immunity is directed not only against the spike protein but against various viral components. Thus, the efficacy of the vaccine was shown to be not negatively affected by any of the known SARS-CoV-2 variants.

In-house vaccine development, manufacturing and testing

CoVac-1 is produced in the peptide laboratory and the so-called GMP (Good Manufacturing Practice) unit of the University Hospital and Medical Faculty in Tübingen. Here, too, the long-standing experience and expertise in the production of vaccines for cancer patients is being drawn upon. The clinical evaluation of the vaccine is performed in the CCU Translational Immunology, a unique facility in Germany within the Department of Internal Medicine of the University Hospital, which was established to test innovative immunotherapy concepts as quickly as possible in early clinical trials so that patients can benefit as quickly as possible from new research findings.

Further development of CoVac-1

Based on these study results, a Phase II study investigating CoVac-1 in patients with congenital or acquired immunoglobulin deficiency was initiated in June. The study population comprises, for example, leukemia or lymphoma patients who are unable to build up sufficient antibody-mediated immunity due to their disease or B-cell depleting therapies

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