Pushing the reset button on autoimmune disease

At Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), patients with severe forms of autoimmune diseases are being treated with cells from the body that have been genetically modified, which are known as CAR T cells. This study is the first of its kind in the world. Physicians were astounded to find that the therapy is like pushing a reset button: immediately after receiving treatment the autoimmune disease was resolved completely and did not return.

“CAR stands for chimeric antigen receptor, which is an artificial receptor,” explains Prof. Dr. Andreas Mackensen, director of the Department of Medicine 5 – Hematology and Oncology. “Immune cells, or T cells, from the patient are genetically engineered in the laboratory to add the CAR. The CAR recognizes special antigens on the surface of the target cells and destroys them.” Cell therapy with CAR-T cells is already being successfully used to treat leukemia and lymphoma, says Mackensen.

In patients with autoimmune diseases, the CAR-T cells were programmed to render harmless the B cells that form antibodies against the body’s own cells.

Systemic lupus erythematosus (SLE), also known as red wolf disease, is a severe form of autoimmune disease that most frequently occurs in young women and forms antibodies that attack the body’s DNA. This leads to the inflammation of internal organs such as the kidneys, lungs and heart. Oftentimes, SLE patients need high dosages of corticosteroids and immunosuppressive drugs to keep the disease in check.

“We have been able to help six young patients who were suffering from a life-threatening form of SLE and cure them of the disease completely by treating them with CAR T cells,” says Prof. Dr. Georg Schett, director of the Department of Medicine 3 – Rheumatology and Immunology. They are the first patients in the world who have received treatment with CAR T cells. Case histories of the first five patients will now be published in Nature Medicine. “What is special about this is that a single infusion of CAR T cells brought down the inflammation and autoimmune response like a house of cards, and the patients were able to stop all therapy including corticosteroids.”

CAR T cell specialist Prof. Dr. Dimitros Mougiakakos from the University of Magdeburg, who was also involved in the study, speaks of a “reset button” that was activated in the immune system of the affected patients by the administration of CAR T cells. “It is astounding that 100 days after CAR T cell therapy, the B cells came back, but the disease continues to stay away,” says Mougiakakos. “When the immune system of treated patients is examined, it is surprising that the newly-emerged B cells are ‘naive’, similar to a baby. We can therefore be confident is saying that a reset button really has been pressed here,” says Prof. Dr. Gerhard Krönke, who was also involved in the study.

The treatments were performed at the Deutsches Zentrum Immnuntherapie (DZI) in Erlangen and supported by Collaborative Research Center 1181 (Checkpoints for Resolution of Inflammation; spokesperson: Prof. Dr. Georg Schett). The scientists are now planning a basket clinical trial at the beginning of 2023, in which patients with various forms of severe autoimmune diseases will be able to receive therapy with CAR T cells.
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