Discovery provides hope for early detection of serious COVID-19

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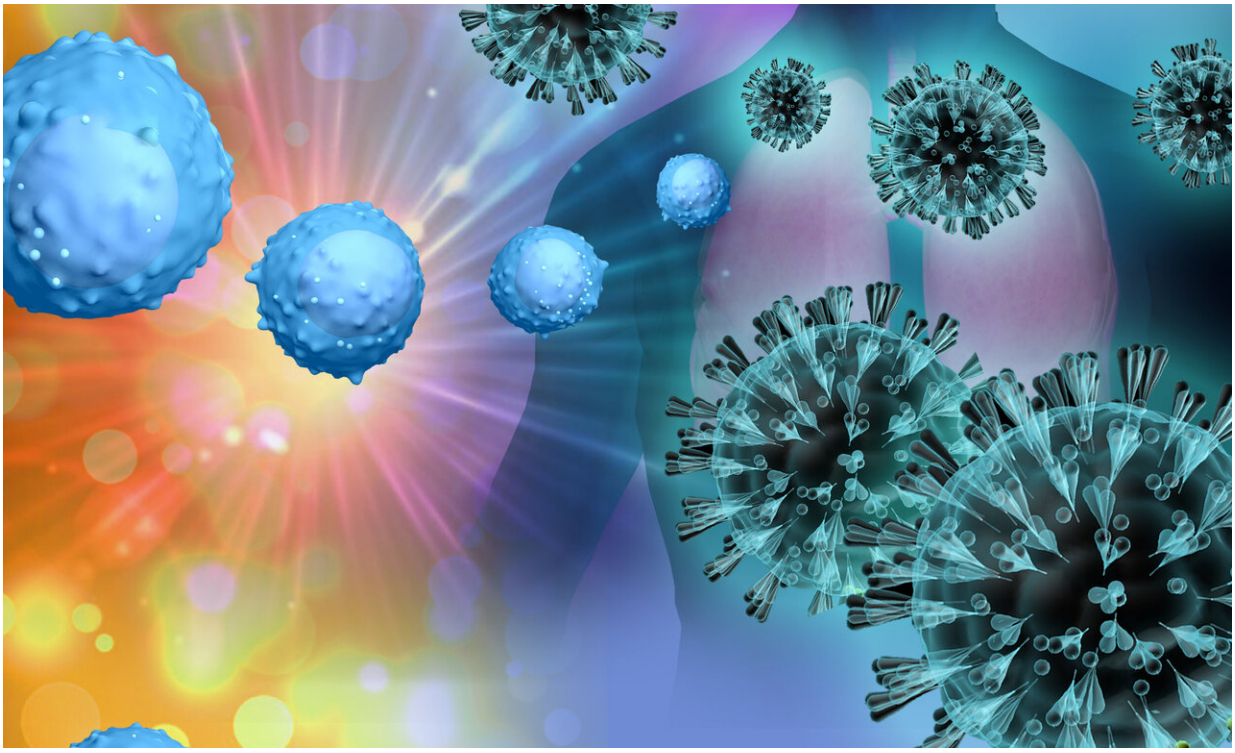

Credit: QIMR Berghofer Medical Research Institute

QIMR Berghofer researchers have developed a way of testing whether or not COVID-19 patients' immune systems are gearing up to fight the virus that causes the deadly disease.

They hope the discovery could be used to identify early on which

patients' immune systems are not responding appropriately, and who might therefore be at higher risk of becoming seriously unwell.

The prototype test detects high levels of two key chemical signals that are produced by T cells when they recognize SARS-CoV-2-infected cells and start to fight the infection. SARS-CoV-2 is the virus that causes COVID-19.

T cells are the immune cells that recognize and destroy cells infected with SARS-CoV-2. They typically mount an early response, even before the body starts to produce antibodies. Most importantly, T cells develop a lasting memory of viral infections, which enables the immune system to respond rapidly in the event of reinfection.

Study leader and the head of QIMR Berghofer's Translational and Human Immunology Group, Associate Professor Corey Smith, said the researchers examined blood donated by 44 Queenslanders who had recovered from COVID-19. He said their goal was to find out which combination of viral peptides could be used to stimulate T cells in the laboratory and allow researchers to measure their response to SARS-CoV-2.

"T cells produce a range of signaling molecules when they fight viruses," Associate Professor Smith said.

"These signaling molecules are basically indicators of whether T cells are responding to the SARS-CoV-2 virus and are mobilizing the immune army to launch an attack.

"If we can find a way to detect whether or not they are present, then we can find out whether or not a patient's immune system is responding as it should.

"We isolated the T cells from the donated blood, exposed them to viral peptides, and measured the production of a number of different signaling molecules. We then compared the levels produced by T cells from the recovered COVID-19 patients with levels released by T cells from 20 healthy donors who had never been infected with SARS-CoV-2.

"We found that T cells from people who had recovered from COVID-19 produced larger amounts of the signaling molecules interferon gamma and interleukin-2, which are involved in killing virus-infected cells and encouraging other T cells to come to the infected area.

"We screened a range of SARS-CoV-2 peptides to work out which combination could be used to detect a successful T cell immune response, which we can then measure by detecting these two key signaling molecules.

More than 66.9 million cases of COVID-19 have been reported worldwide and the disease has caused more than 1.53 million deaths, according to Johns Hopkins University data. In Australia 908 people have died from the disease, and there have been more than 27,965 reported infections.

QIMR Berghofer researcher Dr. Katie Lineburg said while Australia had been largely successful in controlling infection rates, a blood test for early immune response to the virus could particularly help other countries experiencing second and third waves.

"Now that we've refined a way to detect whether or not T cells are reacting to SARS-CoV-2, we believe this information could be used to develop a blood test," Dr. Lineburg said.

"A blood test could help doctors identify patients whose T cells have not started mounting an immune response and who are therefore not fighting

the virus and are at higher risk of becoming seriously unwell. Those patients could then be monitored more closely to ensure they receive treatment early, rather than waiting until they experience severe symptoms.

"While the world waits for a vaccine to be rolled out, it's clear the virus will continue to spread and people will continue to get sick, placing more pressure on health systems. A blood test that could detect whether a patient is developing an effective immune response would be another important tool in managing how countries deal with the pandemic.

"This prototype test and our enhanced understanding of COVID-19 was only made possible by the generous actions of Queenslanders who donated blood samples for this study.

"These are the first results from this COVID-19 study, and we will follow up with as many participants as possible in future, to improve our understanding of long-term immunity to the virus."

More than 60 Queenslanders who tested positive for COVID-19 donated blood for the project. Forty-four samples were used for the analysis, which included 17 men and 27 women aged between 20 and 75. The remaining samples are still being analyzed.

Details of the study have been published in the journal *Clinical & Translational Immunology*.

More information: Katie E Lineburg et al. Rapid detection of SARS-CoV-2-specific memory T-cell immunity in recovered COVID-19 cases, *Clinical & Translational Immunology* (2020). DOI: 10.1002/cti2.1219