Testing tuberculosis vaccine combinations for COVID-19

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Credit: National Cancer Institute

Researchers at the University of Sydney and Centenary Institute are repurposing an existing tuberculosis vaccine to see if it can be used in a new way against COVID-19 to develop a novel vaccine.

The vaccine candidate, which Australian researchers have called BCG:CoVac, combines the vaccine for tuberculosis, Bacille Calmette-

Guérin (BCG) with major components of the SARS-CoV-2 virus. The SARS-CoV-2 virus is the pathogen that causes the COVID-19 disease.

The study is part of a collaboration between the University of Sydney and the Centenary Institute to examine the immune response created by new vaccine candidates, including BCG:CoVac.

Lead investigator Professor Jamie Triccas, from the School of Medical Sciences, Faculty of Medicine and Health, and the Charles Perkins Center said the team was motivated to apply their expertise in studying vaccines to assess the effectiveness of this new formulation.

"We have over two decades of experience in the development and testing of tuberculosis vaccines, which will be applied for the assessment of BCG:CoVac," said Professor Triccas.

"There have yet to be studies published that combine BCG and components of the SARS-CoV-2 virus as part of a new vaccine design, and we're excited to test their potential."

Early results promising

The researchers' early unpublished results from pre-clinical testing in mice show BCG:CoVac stimulated an immune response aimed to control virus infection in humans.

In mice vaccinated with BCG:CoVac, the vaccine induced high levels of SARS-CoV-2-specific antibodies. The role of these antibodies is to bind the virus and help eliminate it from the body. The vaccine also triggered a strong anti-viral response by T cells (a type of immune cell).

Both these types of immune responses are thought to be important to ensure clearance of the SARS-CoV-2 virus from infected individuals.

Importantly, preliminary data also showed BCG:CoVac did not create high levels of inflammatory responses, which is a common barrier and concern in vaccine design.

"These initial results are very promising. BCG:CoVac is making the type of immune response that we predict is needed to control SARS-CoV-2 infection in humans," said Professor Triccas.

"We are currently determining how well the antibodies generated after vaccination can 'block' the virus from infecting cells and thus provide protection from disease."

Using the TB vaccine as a vehicle

In BCG:CoVac, the BCG vaccine is used as a vehicle to deliver distinctive proteins that originate from the SARS-CoV-2 virus surface. The goal is for the human immune system to develop a memory of SARS-CoV-2 and develop immunity.

There is currently global interest in the BCG vaccine, which is being investigated in ongoing clinical trials as a possible intervention to protect vulnerable people during the COVID-19 pandemic.

This is because of suggestions the BCG vaccine has other beneficial effects on the immune system that could protect against other infections. A 2019 observational study reported the vaccine is related to fewer deaths from certain infections other than from TB in low-income countries.

However, current COVID-19 related studies only investigate the protective effects of the BCG vaccine by itself.

Dr. Claudio Counoupas, research scientist at the Centenary Institute and

co-lead on the project, said: "Combining a part of the SARS-CoV-2 virus with BCG is key to this new vaccine. This provides a specific 'memory' immune response against the virus that could provide long-term protection against disease. Our on-going studies will determine how long the immune response lasts after vaccination in animal models. This is important information for future human testing of our vaccine."

Professor Triccas said animal studies were necessary to ensure the vaccine is inducing the right type of immune response.

"These are critical before moving any candidate vaccine into human clinical trials."

Provided by University of Sydney