「Nanoparticle COVID-19 Vaccine: Possible Pan-virus Vaccine to End the Coronavirus Pandemic」

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The development of coronavirus vaccines will apparently be recorded as a milestone in the history of medicine, creating in a matter of months what had before taken up to a decade. However, with the sudden surge of cases tied to the new variants of coronavirus, people have start worrying about more coronavirus outbreaks in the future and new variants' implication on the vaccine efficacy. Although some vaccine makers claimed that their vaccines are still quite effective, some vaccines have been found to have insufficient protection. People can't help but wonder if there will be a single vaccine to work against all coronaviruses?

Researchers are also eager to develop such pan-coronavirus vaccine, hoping to bring the COVID-19 pandemic completely under control. Fortunately, a recent study led by California Institute of Technology, Oxford University and Rockefeller University confirmed that their nanoparticle vaccine can successfully trigger immune response to resist a variety of coronaviruses including the novel coronavirus in mice. The relevant research results were published in the journal Science. [1]

The vaccine technology used in this study is called "mosaic nanoparticle", which is shaped like a cage made up of 60 identical proteins, each of which has a small protein tag that functions like a piece of Velcro. The mosaic nanoparticle allows the receptor binding region (RBD) of different coronavirus spike proteins to be mixed together with the nanoparticle cage structure. Each virus tag stuck to a tag on the cage, resulting in a nanoparticle presenting spikes representing different coronavirus strains on its surface. [1]

The researchers made 4 different nanoparticle vaccines, one is homotypic particle showing only SARS-CoV-2 RBD, and the other three are mosaic particle showing 4 or 8 different coronavirus RBDs, including the SARS-CoV-2, coronaviruses isolated from bats and pangolins. After inoculation, the antibodies subsequently produced by mice were able to react to many different strains of coronavirus. Importantly, the antibodies were reactive to related strains of coronavirus that were not present on the nanoparticle. This suggests that, by presenting the immune system with multiple different coronavirus variants, the immune system learns to recognize common features of coronaviruses and thus could potentially react to a newly emerging coronavirus. In addition, compared with the homotypic particle, the mosaic particle (mixed vaccine) has no weakened resistance to the novel coronavirus.

"SARS-CoV-2 is unlikely to be the last coronavirus to cause a pandemic," says Björkman, the leader of this study. "Our results show that it is possible to raise diverse neutralizing antibody responses, even

against coronavirus strains that were not represented on the injected nanoparticle. So, we are hopeful that this technology could be used to protect against future animal coronaviruses that cross into humans. In addition, the nanoparticles elicit neutralizing responses against SARS-CoV-2, so it could be possible to use them now to protect against COVID-19 as well as other coronaviruses with pandemic potential." [2]

Although the team is still studying the mechanism underlying this phenomenon, the results are promising. And a nanoparticle-based COVID-19 vaccine may have many advantages. It is cheap, safe, and effective. It may be easier to store and transport than currently available vaccines. Among the COVID-19 vaccines currently under development worldwide, there are also companies using similar strategies, hoping to create a vaccine that can resist multiple coronaviruses at the same time. For example, VBI Vaccines in the United States, using its "enveloped virus-like particle" technology platform, has developed a vaccine VBI-2901 that can simultaneously present the SARS-CoV-2, SARS virus and MERS virus. In animal experiments, the vaccine can not only stimulate antibodies against the above three viruses, but the antibodies produced can also identify human coronavirus OC43 (one of the coronaviruses that commonly cause the common cold) that does not exist in the vaccine. Currently, this vaccine is expected to start phase 1/2 clinical trials in the second half of this year.

Reference:

1. Alexander A. Cohen et al. 12 Feb 2021. "Mosaic nanoparticles elicit cross-reactive immune responses to zoonotic coronaviruses in mice" *Science.*
2. 12 Jan 2021. "Nanoparticle Immunization Technology Could Protect Against Many Strains of Coronaviruses" *California Institute of Technology News Release.*