Double Vaccinated may Strike by Omicron Variant

To date, severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has claimed more than 5.31 million lives worldwide. Several coronavirus disease (COVID-19) vaccines have been developed by scientists that have received either approval or emergency use authorization, and, subsequently, vaccination programs have started in many parts of the world. The available vaccines have been designed against the spike protein of the original SARS-CoV-2 strain that was reported in Wuhan, China, in 2019. These vaccines elicit antibodies against the spike proteins as well as T cell responses that protect against severe disease.

Introduction

Since the beginning of the COVID-19 pandemic, the SARS-CoV-2 virus has evolved owing to mutations in the viral genome. The newly emerged SARS-CoV-2 variants are characterized to be more transmissible and virulent compared to the original strain. In addition, some of the variants can evade the immune responses induced via COVID-19 vaccination and natural infection.

Thorough genomic surveillance has indicated the emergence of thousands of individual mutations of the COVID-19 virus genomes at various locations. Some of the SARS-CoV-2 variants such as the Alpha, Beta, Gamma, and Delta contain mutations in the spike protein's Receptor Binding Motif (RBM). As per the mechanism of SARS-CoV-2 infection, the spike protein binds with ACE2 of the host cells, which is followed by fusion of membranes, and, subsequently, causes infection.

Previous studies have indicated that mutation in the spike region leads to an increase in the rate of transmission as it enhances the virus affinity towards ACE2 or leads to immune escape. These variants have been classified as variants of concern (VOC). At present, the Delta strain is regarded as the dominantly circulating strain of SARS-CoV-2.

Recently, another new VOC, known as Omicron (B.1.1.529), has been reported from South Africa. This variant has evoked greater concern in the scientific community due to its high transmission rate. Recent South African studies, based on the Omicron variant, indicated that this variant can infect a population where 60-80% of individuals show serological evidence of previous COVID-19 infection or vaccination. Although these studies have pointed out that Omicron can cause breakthrough infections, they did not indicate the manifestation of more severe infection.

Characterization of Omicron SARS-CoV-2 Variant of Concern

Scientists revealed that Omicron contains a large number of mutations in the spike protein compared to other VOCs. It includes thirty amino acid substitutions, six deletions of residues, and insertion of three residues. The mutations are predominantly present in the RBM region. This may be the reason why Omicron shows a high affinity for ACE2 that diminishes the neutralization activity of RBM-binding antibodies whose prime function has been to hinder interaction with ACE2.

Additionally, mutations are also found at the Receptor Binding Domain (RBD) of the spike protein and the N-Terminal Domain. Researchers believe that many mutations at the spike region are responsible for a higher affinity to ACE2 and evasion of the antibody response.

Efficacy of COVID-19 Vaccines against Omicron SARS-CoV-2 Variant

Largely, scientists are skeptical that the Omicron variant can infect vaccinated individuals. However, a new study published, conducted neutralization assays using an Omicron isolate obtained from patients residing in the United Kingdom. In this study, neutralizing assays were performed using sera samples collected from healthy vaccinated individuals who received two doses of the Oxford-AstraZeneca (AZD1222) vaccine or the Pfizer-BioNTech (BNT162b2) vaccine. Samples were collected four weeks after the second dose of vaccine, which was administered 8-11 weeks after the first.

This study cohort comprised twenty-two participants who received the AZD1222 vaccine and twenty-one participants who received the BNT162b2 vaccine. Scientists compared neutralization titers against Omicron with neutralization titers against Victoria (SARS-CoV-2/human/AUS/VIC01/2020), an early Wuhan-related isolate, and the Beta, and Delta variants. In this study, the neutralizing titers of the sera samples belonging to individuals who received the homologous AZD1222 vaccine lowered to below the detectable threshold in all but one participant. In addition, the median neutralizing titers of sera samples belonging to individuals who received homologous BNT162b2 also dropped significantly in the case of the Omicron variant. However, the neutralizing titer remained high against the Victoria strain.

In an ongoing study, the authors are studying the effectiveness of the COVID-19 booster strategy against the Omicron variant. This would help understand the effectiveness of the booster vaccination strategy to manage the newly emerged variant of concern, in terms of, disease severity and virus transmission. The authors indicated that the immune escape might lead Omicron to replace the Delta strain and become the leading strain worldwide. In this case, a new vaccine tailored specifically for the Omicron strain must be designed to protect individuals from infection.

The ineffectiveness of vaccines against the Omicron variant has made scientists consider shifting from monovalent vaccine design to multivalent vaccine formulations that are currently followed for influenza vaccine. At present, rapid vaccination of the unvaccinated group remains the priority to reduce transmission as well as decrease the severity of infection.

Source:

https://www.news-medical.net/news/20211213/Omicron-variant-may-strike-double-vaccinated.aspx