



A comparative study between the persistent COVID 19 variants: Alpha, beta, gamma, delta and omicron

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Abstract

COVID-19, a trending thread to the present world is not a single type of virus, instead it's a group of virus which genetic material is single stranded RNA molecules that can easily make more and more copies which help the virus particles to be spread out in a large population. Starting its journey in December, 2019 from China as SARS-CoV-2 it have already showed several strains with various type of infectivity and till today it is running its Kingdom. Coronavirus contain various strains such as Alpha, Beta, Gamma, Delta, Epsilon, Eta, Zeta, Iota, Theta, Kappa and Lambda in which Alpha, Beta, Gamma and Delta are variant of Concerns (VoCs) which means they are more developed in transmissibility, infectivity and decreasing the effectiveness of vaccines and other strains are known as Variant of Interest (VoIs) which means this strains are in dormant state but anytime they can be converted into VoCs. These variants Alpha (B.1.1.7), Beta (B.1.351), Gamma (P.1) and Delta (B.1.617.2) had already run over their kingdom and now it's the of omicron the trending (B.1.1.529). Though all of this strains are of coronavirus but they are not similar in character, they are different either in transmissibility or in severity. This present study is all about the comparison of the VoCs of COVID-19.

Keywords: COVID 19 variants, Alpha, beta, gamma, delta and omicron

Introduction

In the earth history covid 19 is one the most horrible disaster which beings its journey from December, 2019 in China, in 7th January 2020 it was temporarily named 2019-nCoV. It's a zoonotic disease that means the transmission of its causative agent starts from any animal to human and other creatures, and it is come to know that SARS-CoV-2 had been spread from animals like bats, snakes, and pangolins available in the market of Wuhan. This virus, a highly microscopic element becomes a global concern due to which already millions of lives have been lost. COVID-19, the pandemic have drawn a great impact on both the mental and physical health of various individuals. Not only the healthcare workers that have undergone excessive stress due to this pandemic; the common population has been suffering from psychiatric symptoms as well. The growing concern among the people about the possibility of acquiring SARS-CoV-2 infection has greatly increased depression, stress, confusion, and anxiety. For this highly microscopic element today the entire human civilization is in a great denger. Coronavirus is not a single type of virus, instead it's a group of virus that contains several types of viral strains, which are variable due to mutation in their genomic sequence that's why these strains are called Variant. Due to the monitoring of Centers for Disease Control and Prevention (CDC). The first SARS-CoV-2 virus is B.1.1.7. This is called the alpha variant that was initially detected in the United Kingdom. B.1.351 is the beta variant that was first found in South Africa. P.1 is the gamma variant

that was first detected in Brazilian travelers. Then the variant of SARS-CoV-2 known as delta (B.1.617.2) variant that was originally found in India in December 2020. This delta variant was spread over 60 countries very fast because of its capability to invade the host's and this begun the 2nd Wave of COVID 19. Approx over 26% of the Indian population was infected with the delta variant in a three-months period because of its high transmission rate that was most likely due to the immune evasive property of this strain. According to various health reports the symptoms of alpha and delta variants are almost similar but the delta variant were injecting very fast and were making rapidly growing viral load on the respiratory tract that's why the patients were gotten ill very fast and got a little time for recovery, so it caused a large number of death. But this devastating virus did not stop its journey in delta strain.

It further mutated and come in an updated version named as Omicron (B.1.1.529) Omicron the trending fear to the mankind, was first detected in South Africa in 24th November 2021. Omicron is a strong variant of SARS-CoV-2 because having mutation in both structural and non-structural proteins, the level of mutations that have led to the serious concerns over vaccine failure, immune escape and increased transmissibility have not been seen previously which was not found in other variants of concern (VOCs). Molecular modeling and mutational analysis have been conducting to understand the enhancements of transmissibility and effectiveness of new variant.



Fig 1

Spike Proteins

Spike Protein or peplomer is a large structural proteins that’s projecting from the surface of the enveloped viruses. Depending on the size and variety of virus the number of amino acid present in spike Protein may vary from 1160 to 1400. It’s plays a crucial role in penetrating the host surface and initiating infection. The S proteins of coronaviruses can be divided into two important functional subunits, including the N-terminal S1 subunit, which forms the globular head of the S protein, and the C-terminal S2 region, which forms the protein stalk and is directly embedded into the viral envelope.

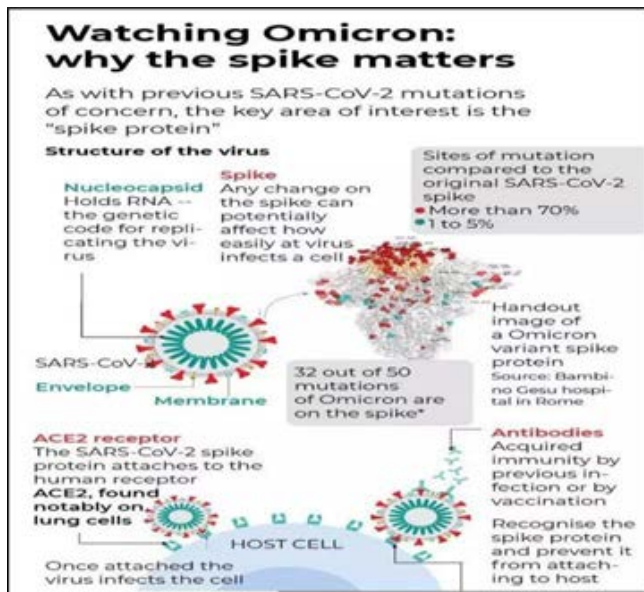


Fig 2

1. Spike protein of SARS-COV-2 alpha variant

Severe acute respiratory syndrome (SARS) is a newly emerging infectious disease caused by a novel coronavirus, SARS-coronavirus (SARS-CoV). The SARS-CoV, B.1.1.7 alpha variant protein consists of two subunits; The S1 subunit contains a receptor-binding domain that is involved with the host cell receptor angiotensin-converting enzyme 2 and mediates fusion between the S2 subunit viral and the host cell membrane.

The S protein plays a key role in neutralizing antibody and T-cell responses during SARS-CoV infection, as well as in bringing about immune immunity.

2. Spike Protein of delta variant

In order for SARS-CoV-2 to infect our cells, its spikes must first attach to a receptor called ACE2. The spikes then dramatically change shape, folding into themselves. This jack-knifing motion fuses the outer membrane of the virus with our cell membrane, allowing the virus to enter. Using two types of cell-based assayed, Chen and colleagues have shown that Delta Spike specializes in protein, particularly in membrane fusion. This allows a simulated delta virus to infect human cells much faster and more efficiently than the other five SARS-CoV-2 variants. Delta had the advantage, especially when the ACE2 receptor in the cell was relatively low.

3. Spike Protein of omicron variant

The Omicron variant has a total of 50 mutations, including 32 mutations in the spike protein alone. The spike protein – which forms the nucleus extending outward from the SARS-CoV-2 virus – helps the virus to attach to the cell so that it can enter.

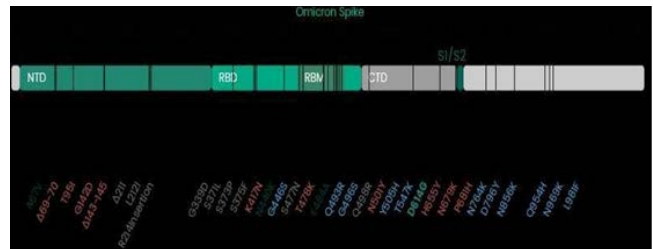


Fig 3

Mutation

Coronavirus is a group of RNA virus that contain single stranded RNA molecules and can make huge copies by transcription. The most remarkable gene mutation that destruct to admit the delta mutation to be the most transferable variant yet are the mutations found in the spike proteins. The spike gene mutation in delta variant are T478K, D614G, d960N, T19R, L452R. The most remarkable mutation occur in the L452R and P681R spike protein. The L452R mutation exchanges an arginine for a leucine molecule at the position of 452 that allow the spike proteins to attache with ACE2 receptor in higher affinity which is found in human host cells that allows the spike proteins to bind and it may assist to evade vaccine-stimulated antibodies to bind to the spike protein as long as the ACE2 receptor attached with the spike protein with a higher sympathy. This are being attacked by CD8 T cells. In case of Omicron variant there is no huge difference in mutation but this difference is very significant. In this case more than 30 spike proteins are mutated in which 15 spikes are from RBD region. Not only have the spike protein mutations, in Omicron variants mutation also occurred I both structural and non-structural proteins including nsp3, nsp4, nsp5, nsp12 and nsp14. The spike proteins almost same to the previous variant where mutation took place such as K417, T478, E484, N501 that’s are reported on SARS-COV-2 VOCs. Omicron spikes contain three deletions i.e, Δ69-70, Δ143-145 and Δ211, besides this one highly charged insertion at 214 position in the spike i.e, ins214EPE occur that's why RB Domic has a great binding affinity to ACE2 receptor that

increase its transmissibility. Some therapeutic antibodies like – Bamlanivimab, AZD1061, AZD8895, CT-p59, Etesevimab, Imdevimab, Casirivimab were choiced to investigate the RBD[^]omicresistance to these antibodies. In many cases the rate of infective depends on its rate of mutation. So as the rate of mutation is much more higher than the previous VoCs, Omicron possess higher infectivity power.

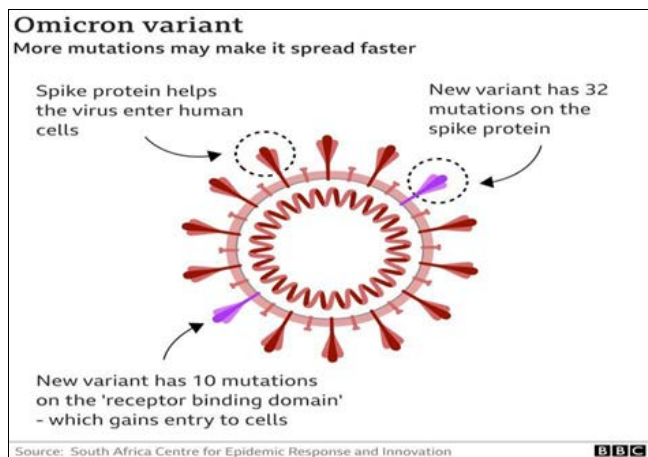


Fig 4

Symptomatic comparison

From the beginning of COVID-19 to today's Omicron every strains shows almost similar symptoms such as scratchy or sore throat along with nasal congestion, dry cough and muscle pain, especially low back pain headache, congestion, sinus pressure and sinus pain. Coronavirus symptoms vary depending on the patient's vaccine status as if the patient was vaccinated with the original or any strains of coronavirus he will face some non-critical symptoms as sinus pain, sinus pressure, congestion, headache etc, but while the patient was not vaccinated he must have to face shortness of breath and cough and some other flu like symptoms. One main difference between Omicron and other VoCs is Omicron take a much shorter incubation time comparing with the other strains. After entering into a human body Omicron strats to show symptoms in about three days whereas previous strains take atleast five to six days to expose. Besides this there are no notable difference between Omicron and the previous strains of COVID-19.



Fig 5

Clinical severity and lethality

Most of the cases of Omicron are seen as less severe than delta, not need to hospitalization. There are no case of any patients in intensive care unit. The symptoms of the disease is very less as compare to delta virus. Delta virus is more lethal than omicron variant. But as this new variant is almost asymptomatic, the rate of transmission is very higher. It is difficult to detect the infected person without testing. Omicron could even result in milder disease than other variants, but scientists are still waiting on data to know how well antibodies hold up against the variant.

Effectivity of vaccine

Efficacy and effective are different. Efficacy is calculated on the trail value and effectiveness is on the real world value. Almost all the corona virus vaccine that are used now have similar efficacy and effectiveness against delta variant. Vaccine is the biological preparation that boost immune response against any particular infectious pathogen. All most all the corona virus vaccine have near about 85-95 percent effectiveness against delta variant. But the new data of omicron variant is estimated that vaccine have about 30-40 percent effectiveness to prevent disease and about 70 percent effectiveness to prevent severity of disease. Finally, vaccines protect not only those who are vaccinated, but those who can't get vaccinated as well. Vaccinated people are less likely to spread COVID-19, which reduces new infections and offers protection to society overall.

Conclusion

As Coronavirus is a group of RNA virus, it contains several number of strain, not only the pre-existing strains, this group of virus can produce several new viruses by rapid mutation which become more infective to the hosts. So it is difficult and probably impossible to predict what is the last strain of COVID-19 or after which strain the world will get salvation from this pandemic. How terrible a strain that is dependent on its mutation. All previous strains has mutation in their spike proteins whereas Omicron have mutation in both structural and non-structural proteins and its a large number of spike proteins have mutation that is much more in number than others. So Omicron is more transmissible than other strains but doing many tests and researches it had been observed that delta strain is more infective than omicron. Research works and studies are continuing on this coronavirus and many more informations will be come out in future but people have to live by making mask and sanitizer as their companion because it is quite impossible to predict the ending time of this devastating COVID-19.

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