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Review Article

The COVID-19 delta or detrimental variant?

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ABSTRACT

The delta variant of COVID-19 also known as B.1.617.2 is more contagious than the alpha variant and henceforth this variant has led to a sudden spike in the cases of COVID-19 all over the world. It is indeed a matter of surprise that in countries where most of the population were vaccinated, still there was an upturn in the number of COVID-19 infections. Though some of the vaccine companies have reported that their vaccine can effectively provide shielding against this variant too, but still we need to understand why is this variant more transmissible and how did it became a dominant strain in such a short span of time and what are the measures that can be taken to prevent the most widely spread delta-variant of this virus. An overall review regarding the delta B.1.617.2 variant along with its pathogenicity is done in this article.

1. Introduction

The vaccines are being distributed all over the world and the management is trying their best to make sure the even distribution of the available vaccines and active participation of the community. The new SARS-CoV-2 variants, the B.1.1.7 (alpha) and B.1.617.2 (delta) variants, are causing numerous symptomatic outcomes.[1–3] Nearly 188 million people has been infected by Covid-19 virus and more than 4 million deaths has been caused around the globe. In addition to the increased mortality rate of this virus, the continuous pandemic has not only caused detrimental impacts on physical but also on mental status of individuals as well as community as whole. General population as well as healthcare workers have undergone excessive stress and anxiety as a result of this lockdown and pandemic.[4] The fear of acquiring Covid-19 infection among general population is increasing day by day and it has also further led to increased depression, anxiety, confusion among them. According to one study conducted in Italy amount of physical activity per week has been reduced since this pandemic has started.[5] Rate of deaths due to cardiac issue has been significantly increased as a result of physical inactivity.[6]

Four variants of this virus has been found by the CDC. The first SARS-CoV-2 virus is B.1.1.7. This variant is called as alpha variant and first case of this was reported in United Kingdom.[7] The other variant i.e. B.1.351 is called as beta-variant and it's first case was detected in South Africa. The gamma variant is P.1 and was initially detected in travellers of Brazil. In India, the first case of delta variant was found in December of 2020.[8] This delta variant of the Covid-19 virus has spread globally and effected more than 60 countries The rapid spread of this virus has been justified by it's ability to invade individual's immune system.[6] Within 3 months period more than 26% of Indian populace was affected by this delta variant. The immune system evasion property makes this delta strain more transmissible. In addition to this, the loss in immunity of population during the period of second wave was also accounted to this delta strain.[8]

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Despite of following lockdown restrictions and numerous vaccination programs there have been surge in cases of Covid-19 worldwide.[9] Through the Indian context, the SARS-CoV-2 B.1.617.2 (Delta) variant was first reported in Maharashtra during 2020 and now has spread throughout India, displacing the B.1.1.7 (Alpha) variant and other pre-existing lineages.

Virus not only causes ill-effects on individual's physical health but also effects their overall health; thus, this article focuses on the pathogenicity, signs and symptoms of the most widely spread delta- variant of this virus. The delta-variant has led to sudden spike in the cases of COVID-19 in countries like India, US, Europe and all over the globe.

2. Pathogenesis of the Delta-Variant Virus[10]

The pathogenesis of the Delta- variant has been shown in flow Chart 1.

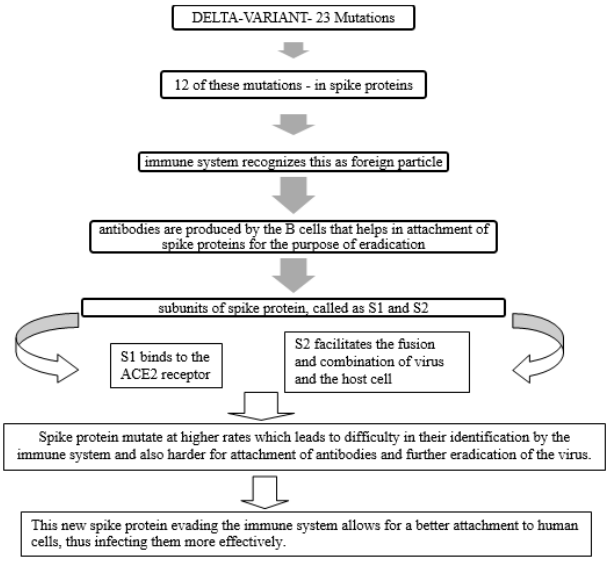


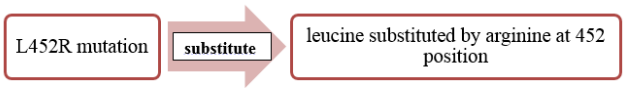
Chart 1: Pathogenesis of delta- variant virus

3. Mutations of Delta- Variant

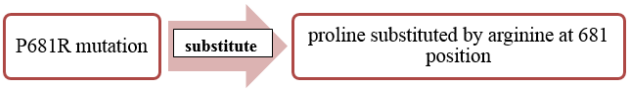
The spike gene mutations in this B.1.617.2 variant are -

1. T19R,
2. L452R,
3. T478K,
4. D614G,
5. P681R, and
6. d960N, with deletions at positions 157 and 158.

L452R and P681R spike protein mutations are most notable among all variants.



According to a study it has been suggested that ACEII receptor affinity increases and further facilitates the attachment of spike protein. ACEII receptor commonly found in human cells or host cells allows the binding of spike protein of Delta-variant of this Covid-19 virus. The antibodies stimulated by vaccines are evaded helping in attachment of spike proteins.[11] While some other studies reported that the prime cells responsible for virus eradication i.e. CD8 T cells attacks the evasion of Delta-variant and this is facilitated by the L452R mutation.[12]



This mutation helps in the cleavage of precursor spike protein and two separate S1 and S2 activated forms of spike protein are formed.[13,14] in addition to this it also helps and facilitates the fusion and combination of the delta-variant of this virus and host cell.

4. Distribution of Delta-Variant

The Delta-Variant spreads twice as easily and rapidly when compared to the alpha variant as stated by the CDC.[15] The WHO Coronavirus (COVID-19) Dashboard has reported numerous infectious and death cases till date, the second wave started around February, 2021 which comprised of higher cases of delta-variant infected cases than the previous spike.[15] According to American Society for Microbiology reports, 83% and 90% of total Covid-19 cases are infected with delta-variant in US and UK respectively. In addition to this they also reported 40–60% increased transmissibility of this delta variant as compared to the alpha variant, which itself was twice as contagious as the original strain from Wuhan.[16] It is even apparent on a qualitative level that the infection and death rates spiked much more rapidly despite occurring in a much shorter timeframe. The peak of infected cases in the first and second wave were 5,001,049 and 5,703,208 respectively; the peak death rate in the first and second wave was 101,084 and 96,684 respectively; and the first wave gradually increased over March, until it rapidly spiked from about October 2020 to February 2021, when the second wave rapidly spiked from February 2021 to about June, 2021.[17] Based on the quantitative level, there has been increase in the hospitalization, ICU admissions and death rates with value of 108%, 235% and 133% respectively than the original variant.[18]

Besides decreased efficacy in the ability of the vaccines to prevent infection, characteristics of infected individuals may further lead to the problems of spreading the virus to other individuals. According to a study there is no difference found between the viral loads of fully vaccinated individuals with breakthrough infections and an unvaccinated patients.[19] Few studies also found that, among infected patients those who were not hospitalized reported with higher viral loads than those who were hospitalized.[20] The treatment of Covid-19 along with the quarantine period usually depends on symptoms of infected individuals and not necessarily on viral loads, the infected persons can still continue to spread this variant despite all the community efforts.

5. Symptoms Associated with Delta-Variant

Most common symptoms of Delta-variant includes[21]

1. Fever,
2. Cough,
3. Shortness of breath,
4. Vomiting,
5. Diarrhea,
6. Sore throat, and
7. Headache

Other symptoms include[22]

1. Myalgias,
2. Loss of taste,
3. Loss of smell,
4. Fatigue, and
5. Rhinorrhea

The symptoms of Delta-variant and Alpha-Variant are quite similar but according to some studies, patient infected with Delta-variant shows more severe symptoms when compared to those infected with Alpha- variant. The viral loads in the respiratory tract are also found to be higher in Delta-Variant patients.[17]

6. Discussion

The B.1.617.2 variant has now become the most widely spread variant of COVID-19 virus. There are chances of emergence of more strain from this delta variant as more people get infected. The severity of disease can be minimized with the help of vaccines, but vaccines alone are not enough to prevent cases of COVID-19. Booster doses and teenager vaccination programmes not only help in increasing immunity at individual level but also at community level. Besides all these, non-pharmacological interventions and precautionary measures like wearing masks, using sanitizers, washing hands on regular basis etc. has been suggested to provide most feasible and effective method to prevent the symptoms caused by the delta variant. The delta variant has spread globally and caused numerous infective cases even in areas with high vaccination coverage. Better treatment modalities and advancements are required for patients infected with delta-variant as the symptoms of this virus are more severe than other variants. There exists a lot of literature about other variants of this virus, but we still lack in-depth knowledge of the delta-variant.

7. Conclusion

We need more literature to completely assess the delta variant, this review focused more on pathogenesis, what factors make this delta variant more contagious, the symptoms associated with it, and the effect of this virus on individual as well as community level. It is thought that the variant's higher infectivity is due to combination of key mutations increasing the affinity of spike protein for binding of ACE-II further leading to reduced efficacy of vaccines against it, and higher viral loads in infected people. More research work and literature is required to elucidate the unique and varying symptoms of this strain, as well as infectivity of this virus. Hopefully, this newfound literature will guide through the pathogenecity and help us through new treatment modalities. Besides all these the most effective and efficient way is to prevent the virus using various precautionary measures and also through implementation of effective vaccination programs and other community policies.

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None.

9. Conflict of Interest

The authors declare no conflict of interest.

References

1. Bernal JL, Andrews N, Gower C, Gallagher E, Simmons R, Thelwall S, et al. Effectiveness of Covid-19 vaccines against the B.1.617.2 (delta) variant. *N Engl J Med*. 2021;385(7):585–94.
2. Pritchard E, Matthews PC, Stoesser N, Eyre DW, Gethings O, Vihta KD, et al. Impact of vaccination on new SARSCoV- 2 infections in the United Kingdom. *Nat Med*. 2021;27:1370–8.
3. Pouwels KB, Pritchard E, Matthews PC, Stoesser N, Eyre DW. Impact of delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK. 2021;doi:10.1101/2021.08.18.21262237.
4. Shigemura J, Ursano RJ, Morganstein J, Kurosawa M, Benedek DM. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: Mental health consequences and target populations. *Psychiatry Clin Neurosci*. 2020;74(4):281–2.
5. Maugeri G, Castrogiovanni P, Battaglia G, Pippi R, Agata V, Palma A, et al. The impact of physical activity on psychological health during Covid-19 pandemic in Italy. *Heliyon*. 2020;6(6):e04315.
6. Doukky R, Mangla A, Ibrahim Z, Poulin MF, Avery E, Collado FM, et al. Impact of Physical Inactivity on Mortality in Patients With Heart Failure. *Am J Cardiol*. 2016;117(7):1135–43.
7. Callaway E. Delta Coronavirus Variant: Scientists Brace for Impact. *Nature*. 2021;595(7865):17–8.

8. Yang W, Jeffrey S. COVID-19 Pandemic Dynamics in India and Impact of the SARS-CoV-2 Delta (B.1.617.2) Variant. *MedRxiv*. 2021;doi:10.1101/2021.06.21.21259268.
9. Irfan U. How the Delta Variant Is Altering the Course of the Pandemic. *Vox Media*;Available from: www.vox.com/22547537/delta-coronavirus-variant-COVID-19-vaccines-masks-lockdown.
10. Shiehzadegan S, Alaghemand N, Fox M, Venketaraman V. Analysis of the Delta Variant B.1.617.2 COVID-19. *Clin Pract*. 2021;11(4):778–84.
11. Starr TN, Greaney AJ, Dingens AS, Bloom JD. Complete Map of SARS-CoV-2 RBD Mutations That Escape the Monoclonal Antibody LY-CoV555 and Its Cocktail with LY-CoV016. *bioRxiv*. 2021;doi:10.1101/2021.02.17.431683.
12. Koshy J. Corona virus| Indian 'Double Mutant' Strain Named B.1.617. The Hindu; 2021. Available from: https://www.thehindu.com/news/national/indian-double-mutant-strain-named-b1617/article34274663.ece.
13. Haseltine W. An Indian SARS-CoV-2 Variant Lands in California. More Danger Ahead?; 2021. Available from: https://www.forbes.com/sites/williamhaseltine/2021/04/12/an-indian-sars-cov-2-variant-lands-in-california-moredanger-ahead/?sh=6f92503b3b29).
14. Bertram S, Dijkman R, Habjan M, Heurich A, Gierer S, Glowacka I, et al. TMPRSS2 Activates the Human Coronavirus 229E for Cathepsin-Independent Host Cell Entry and Is Expressed in Viral Target Cells in the Respiratory Epithelium. *J Virol*. 2013;87(11):6150–60.
15. CDC. Delta Variant: What We Know about the Science. COVID-19; 2021. Available from: https://www.cdc.gov/coronavirus/2019-ncov/variants/delta-variant.
16. WHO. WHO Coronavirus (COVID-19) Dashboard; 2021. Available from: https://covid19.who.int/.
17. Hagen A. How Dangerous Is the Delta Variant (B.1.617.2)? American Society for Microbiology; 2021. Available from: https://asm.org/Articles/2021/July/How-Dangerous-is-the-Delta-Variant-B-1-617-2.
18. Lang K. Delta Variant has 235% Higher Risk of ICU Admission than Original Virus; 2021. Available from: https://www.medicalnewstoday.com/articles/COVID-19-which-vaccines-are-effective-against-the-deltavariant#Very-high-levels-of-protection-against-hospitalization.
19. Tucker R. COVID Delta Variant Viral Load Similar in Vaccinated and Unvaccinated. Hospital Healthcare Europe; 2021. Available from: https://hospitalhealthcare.com/COVID-19/COVID-delta-variant-viral-load-similar-in-vaccinated-and-unvaccinated/.
20. Argyropoulos KV, Serrano A, Hu J, Black M, Feng X, Shen G, et al. Association of Initial Viral Load in Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Patients with Outcome and Symptoms. *Am J Pathol*. 2020;190(9):1881–7.
21. UC Davis Health. Delta Variant: 8 Things You Should Know. Coronavirus; UC Davis Health: Sacramento, CA, USA, 2021. Available from: https://health.ucdavis.edu/coronavirus/COVID-19-information/delta-variant.
22. Tellez D, Dayal S, Phan P, Mawley A, Shah K, Consunji G, et al. Analysis of COVID-19 on Diagnosis, Vaccine, Treatment, and Pathogenesis with Clinical Scenarios. *Clin Pract*. 2021;11(2):309–21.

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