SARS-CoV-2 Microbiology Transmission Mutation and COVID-19 Prevention

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Introduction

In December 2019, the world was introduced to “Coronavirus Disease (COVID-19)”. This disease is regarded as the cause of a high rate of transmission and mortality. The common symptoms of the disease range from dry cough, fatigue, fever, and loss of taste and smell to increasingly serious indicators such as difficulty in breathing, chest pressure, and loss of motility or speech. Symptoms often become observable within 5-6 days of initial infection. However, symptom onset may also take around 14 days. Since its initial discovery as a novel human coronavirus, efforts have been mobilized to diagnose its microbiological bases. This essay aims to analyze the microbiology associated with this disease along with the symptoms it causes.

Microbiology

COVID-19 was primarily diagnosed among the cluster of patients linked to the Chinese seafood market in Wuhan, and this newly evolved strain poses a higher risk to the health of the global community. The recent outbreak of COVID-19 is the third of its kind, and it spread rapidly at the place of its origin and subsequently to the whole world. The severity of this disease and its highly infectious rate resulted in it being termed a global emergency, and later, it was acknowledged as a pandemic. Countries around the world opted for measures to curb the spread of this virus through various control and prevention strategies. Understanding the microbiological bases of the coronavirus is important for controlling the pandemic and developing appropriate treatment. These dynamics are essential for employing accurate methods of testing and interpretation of results.

The disease-causing virus belongs to the Coronaviridae family of viruses, order Nidovirales, and the subfamily Orthocoronavirinae. It causes infections in wide-ranging hosts and produces symptoms similar to common colds or fatal respiratory illnesses. COVID-19 is linked to pulmonary afflictions and is characterized by multiple lesions on the lungs. Regarded as the “severe acute respiratory syndrome (SARS)”, this strain of the virus is named “SARS coronavirus 2 (SARS-COV-2)”. The SARS-COV-2 is an “unsegmented, positive, enveloped, and single-stranded RNA virus”. The virus is enveloped by a nucleocapsid protein, which is arranged in a helix. This helical symmetry is an atypical characteristic of this RNA virus. This virus attaches to the host cell, i.e., the angiotensin enzyme 2,

with its spike protein. The spike protein lies in the virion and gives it a crown-like appearance. Its functional importance to the virus is due to its role in the admission of the virus into the host receptor. The transmembrane protein serine 2 facilitates membrane fusion. The membrane protein gives the virus its structure while the envelope protein plays multiple functions that include pathogenesis, assemblage, and release of the virion.

Although SARS-COV-2 is regarded as a member of the coronavirus family, the genetic structure of this virus is quite distinct. The genome of the virus that causes COVID-19 is closely related to others of its family, with a sequenced spike protein that is 1,273 amino acids in length. It also shows 27 amino acid replacements. The analysis of its evolutionary origin reveals an 88% similarity of SARS-COV-2 to two other bat-derived coronaviruses. The SARS-COV-2 is highly mutable due to its wide-ranging genetic variety and propensity to afflict a multitude of species. The mutations occur as a result of unstable RNA-dependent polymerase chains and the increased rate of recombination in the homologous RNAs. It not only has a range of host species but also affects multiple systems (Mohamadian et al., 2021).

The method employed for the diagnosis of COVID-19 is the RT-PCR (reverse-transcribed polymerase chain reaction). It is the most reliable and common method of diagnosis and is performed with the use of nasopharyngeal swabs or specimens collected from the respiratory tract. In the first week of infection or about 2 – 3 days before the onset of disease indicators, the viral RNA can be detected in the sample collected from the upper part of the respiratory tract. In the second week, however, a lower tract sample is preferred. This is especially true in the case of a negative test despite the occurrence of pneumonia. The SARS-COV-2 test has a clinical sensitivity of about 55 – 75%, and a negative result does not completely exclude the possibility of an infection. Likewise, positive viral RNA does not provide evidence of the presence of an active virus. The presence of SARS-COV-2 can also be detected through an antibody test, which indicates the host's immune system response to the virus. This test is becoming increasingly prevalent for surveillance of public health and diagnosis of the disease. However, it cannot be relied upon as the sole indicator for diagnosis. The antibodies may become detectable from 5 – 14 days after the initial infection. The clinical sensitivity of the microbiological diagnosis significantly increases when the two tests are integrated and applied as co-tests (Dhama et al., 2020).

Conclusion

Although the world is approaching a two-year mark since the onset of the first case of COVID-19, extensive measures are still required to curb the spread and control mortality. Different vaccines have been introduced for the masses, and this has resulted in a lower intensity of the symptoms. However, the application of vaccines is widely dispersed. This vaccine inequality results from barriers in the provision of vaccination for the masses and the unwillingness of the public to get vaccinated. The situation is further aggravated due to the mutant nature of the SARS-COV-2.

Works Cited

Dhama, K., Khan, S., Tiwari, R., Sircar, S., Bhat, S., Malik, Y. S., Singh, K. P., Chaicumpa, W., Bonilla-Aldana, D. K., & Rodriguez-Morales, A. J. (2020). Coronavirus Disease 2019–COVID-19. *Clinical Microbiology Reviews*, *33*(4), e00028-20. https://doi.org/10.1128/CMR.00028-20

Mohamadian, M., Chiti, H., Shoghli, A., Biglari, S., Parsamanesh, N., & Esmaeilzadeh, A. (2021). COVID-19: Virology, biology, and novel laboratory diagnosis. *The Journal of Gene Medicine*, *23*(2), e3303. https://doi.org/10.1002/jgm.3303