International Journal of Applied Pharmaceutics

ISSN- 0975-7058 Vol 14, Issue 3, 2022

Review Article

OMICRON SARS-CoV-2 VARIANT, B.1.1.529: SEVERITY, TRANSMISSION, MUTATION, AND EFFICACY OF CURRENT VACCINES

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Received: 10 Feb 2022, Revised and Accepted: 02 Apr 2022

ABSTRACT

The Omicron variant (B.1.1.529) is a variant of SARS-CoV-2 with more than 50 mutations; this led to increase transmissibility or lead to immune escape. Therefore, WHO predicts it to be more dangerous than the previous variant, although it is not as severe as the previous variant. This review aims to provide an overview of SARS-CoV-2 symptoms, severity, mutations, and the effectiveness of treatments and vaccines against this novel coronavirus, as well as the effectiveness of current diagnostic tests.

Keywords: COVID-19, Omicron (B.1.1.529), Spredability, Treatment, Vaccine, Diagnosis

DOI: https://dx.doi.org/10.22159/ijap.2022v14i3.44376. Journal homepage: https://innovareacademics.in/journals/index.php/ijap

INTRODUCTION

COVID-19 has been in the human population for over two years now, and it was announced as a pandemic by WHO on 11th march 2020, causing severe disease in some populations and resulting in a pandemic that continues to put a severe strain on health care and economies worldwide. The pandemic has been enhanced by continuous mutation of the previously detected SARS-CoV-2 in Wuhan, China, which has brought the emergence of variants that have caused transmission and mortality rates to go high [1]. On the other hand, many of the variants were observed with the different protein sequences of the genome. The alpha (B.1.1.7), beta (B.1.351), gamma (P.1), delta (B.1.617.2), and omicron (B.1.1.529) variants are among the variants. Recently, the Omicron variant found in South Africa and Botswana as the variant of concern and was named B.1.1.529 on 26 November 2021 by the World Health Organization Technical Advisory Group SARS-CoV-2 Virus Evolution. The immediate apprehensions about Omicron are whether it is more contagious or severe than other variants of concern [2, 3]. Moreover, concerns on transmissibility and immune escape have created anxieties in people, and whether the effectiveness of vaccines that have been produced is a concern to whether the variant can circumvent them [4].

Understanding the spread, severity, and vaccine efficacy are underway through ongoing research to learn and find solutions on the Omicron variant. Therefore, the aim of this paper is to provide a review to learn and know what we have at hand with the new Omicron variant to protect ourselves and our loved ones. Giving an overview of the spread, symptoms, Severity, effectiveness of Prior SARS-CoV-2 Infection, mutation in the SARS-CoV-2, effect of this mutation to bind with receptor and increase transmission, the effect of the available vaccine against omicron after the mutation, effectiveness of Current Tests and treatment, and risk communication and community engagement.

Spread and symptoms

The Omicron variant proliferates faster than the original SARS-CoV-2 virus that causes COVID-19 and the emerged variants such as the Delta variant. Centers for Disease Control presumes that individuals with Omicron disease can transmit the virus to others even when immunized or lacking symptoms. This is because the Omicron variant may readily escape antibodies than prior variants, thus aggregating cases of reinfection and mild breakthrough infections in vaccinated individuals. Understanding of the Omicron variant has increased with experts knowing how the variant affects vaccinated people, unvaccinated or those who have previously had COVID-19 infection [5]. For instance, people exposed to Omicron appear to get sick faster and may have symptoms different from those of other variants [6].

Consequently, persons infected can present with symptoms similar to other variants. Some of the symptoms include Cough, fatigue, congestion, runny nose, sore throat, and headache. The presence and severity of symptoms are affected by coronavirus vaccination status, other health conditions, history of prior infection, and age [7].

Severity

Omicron infection mainly causes less severe disease than infection with prior variants. Centers for Disease Control and Prevention (2022) states that Preliminary data propose that Omicron may cause more mild disease. However, some individuals may still have severe disease, need hospitalization, and die from the variant infection. Even if only a small percentage of people with Omicron infection need hospitalization, the large size of incidents could overwhelm the healthcare system [8]. Consequently, Karim and Karim (2021) says that previous variant of concern data suggests that vaccinated people are expected to experience a lesser risk of acute disease from the Omicron infection. Thus, it is essential to protect oneself from being infected [9].

Effectiveness of Prior SARS-CoV-2 Infection

Omicron has been identified in more than a hundred and seventy countries across the World Health Organization (WHO) regions as of 20 January 2022 [10]. It has an extensive growing benefit over the Delta variant hence replacing it. With much evidence suggesting an increased risk in reinfection with Omicron, the evidence is still limited as research and data are collected. Early findings suggest a lowered risk of hospitalization of Omicron in contrast to the delta variant. However, World Health Organization advises that the variant should not be discharged as minor as intensified transmission could lead to further hospitalization. An increase in hospitalization can cause strain in the health care workers and healthcare system, leading to more deaths than containment [9, 10]. Epidemiologic curves continue to dissociate between incident cases, hospital admissions, and deaths related to widespread waves due to prior variants. This is probably owed to a mixture of the low inherent severity of Omicron, as suggested by several studies from different settings. The vaccine's effectiveness is more conserved against severe disease than against infection. However, high hospital and ICU admission levels are reported in most countries, given that transmission levels are higher than ever seen before during the pandemic [7, 10].

The mutation in the SARS-CoV-2

The Omicron variant has several new transformations both in structural and non-structural proteins. Omicron has more than 30

mutations and some deletions, some of which intersect with those in other variants of interests such as the delta, alpha, gamma, and beta. Precisely, eleven mutations, including six deletions and one insertion, are positioned in the N-terminal domain, while another 15 mutations are found in the receptor-binding domain. Furthermore, five mutations exist between the S1/S2 site and receptor-binding domain. Five mutations, all unique, appear in the S2 subunit [11, 12]. These deletions and mutations lead to complex viral binding affinity, increased transmissibility, and higher antibody escape. Nevertheless, there is uncertainty of how the variant will influence viral behavior and vulnerability to native and vaccine-mediated immunity due to the effects of most of the Omicron mutations that are not known [9].

The non-structural proteins contain mutations in the nsp3, nsp4, nsp5, nsp6, nsp12, and nsp14. Additionally, Omicron holds modifications in other structural proteins, including membrane (M), Nucleocapsid (N), and Envelope (E) [13]. Since nucleocapsid is extremely immunogenic, these mutations can help leak the host's immune response. Nearly half of the mutations have the latent to diminish therapeutic effectiveness and increase ACE2 binding [14]. Omicron variant and its susceptibility to infect vaccinated individuals is a significant cause of concern. This concern has been demonstrated by people vaccinated from South Africa and Hong Kong being reinfected.

The effect of this mutation to bind with receptor and increase transmission

The Omicron spike results enable well-organized access into some human cell lines and strongly bind human ACE2 advocate that the Omicron variant instantly infects human cells. Hoffmann *et al.* advocate that the Omicron spike mutations are well-matched with vigorous usage of varied ACE2 orthologues for entry and might have extended the Omicron variant's ability to infect animal species [14]. The omicron receptor-binding domain has an amplified electrostatic surface latent but a reduced attraction for the ACE-2 receptor. Likewise, the N-terminal domain has reduced surface latent and a slight affinity for lipid amounts. The omicron variant is projected to be less fusogenic and hence less infective than the delta variant due to a linear restructuring of the S1-S2 cleavage site. Generally, these viral constraints propose that Omicron does not have a substantial infection benefit over the delta variant. However, Omicron significantly affects neutralizing determinants, signifying that current vaccines may present little defense against the variant [15]. There is substantial indication that immune evasion interjects to the speedy spread of Omicron; however, more investigation is required to understand better the comparative involvement of fundamentally increased transmissibility and immune evasion in describing transmission dynamics [10].

Receptor-binding domain (RBD) ^{Omicron}-ACE2 interaction also has a higher affinity than Wuhan Hu-1 and the other variant such as Alpha, Beta, and Delta (Fig.1) [17]. The binding affinity of 5.5±1.4 nM, indicating that the RBD ^{Omicron}-ACE2 interaction has a five-fold higher affinity compared to the 27.5±4.8 nM affinity of the RBD$^{Wuhan-Hu-1}$-ACE2 interaction that we reported recently (fig. 1) [17].

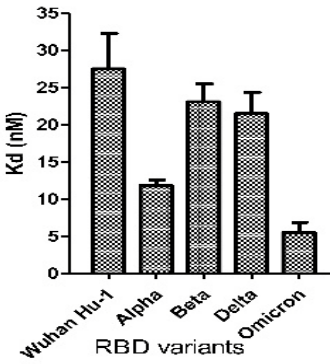

Fig. 1: Affinities of ACE2 binding to RBD variants. RBD Omicron-ACE2 interaction also has a higher affinity than Wuhan Hu-1 and the other variant such as alpha, beta, and delta [17]

The effect of available vaccine against omicron after the mutation

Vaccination is the primary approach to ending COVID-19 pandemic devastations. However, inequalities in immunization delivery and the development of new SARS-CoV-2 variants frighten the treatment method. Various SARS-CoV-2 variants of concern have occurred recently, and the Delta variant is currently leading the pandemic. These variants of concern display enhanced transmissibility and immune evasion, connected to mutations in the viral spike protein [11]. The rise, quick transmission, and global distribution of the highly transformed Omicron variant have elevated worries that the variant may soon turn out to be internationally leading. Several preventive approaches might be unproductive against the variant. According to studies conducted by Hoffmann *et al.*, the omicron variant escaped antibody-mediated and was not substantially repressed by two antibody combinations used for COVID-19 treatment. Inhibition by antibodies stimulated by two immunizations with BNT was effectively reduced with Delta variant spikes. Heterologic immunizations and a BNT booster shot induced considerable neutralizing antibodies against the Omicron spike and may extend some defense against the variant [11].

RNA-dependent RNA polymerase and the main protease of SARS-CoV-2 are target compounds for antiviral drugs such as remdesivir and molnupiravir and main protease inhibitor PF-07304814,5. However, omicron variants present mutations in these compounds, raising concern about the reduced efficiency of the drugs against the variant. However, Takashita *et al.* (2022) research suggests that remdesivir, molnupiravir, and main protease inhibitor PF-07304814,5 show effectiveness for treating patients affected with the omicron variant [16, 17].

Effectiveness of current tests

Current COVID-19 therapeutic and treatment protocols are still effective in diagnosing the Omicron variant. The omicron variant is visible on broadly used Polymerase chain reaction (PCR) programs except for monoclonal antibodies, in which information on the omicron variant's exposure is not yet presented. Studies are unending to establish any effect on other tests, including rapid antigen detection tests [19, 18]. The diagnostic precision of regularly used PCR and the WHO emergency use listing (EUL) accepted antigen detection rapid diagnostic tests (Ag-RDT) assays does not seem to be significantly affected by Omicron. However, analysis of the proportional sensitivity of Ag-RDTs is ongoing [20, 21]. The majority of Omicron variant sequences stated include a deletion in the S gene, which can cause an S gene target failure in some PCR assays. As a growing marginal of widely shared sequences lacks this deletion, using S gene target failure as a substitution indicator to monitor for Omicron will miss Omicron lineages lacking this deletion. Current community health prevention evaluates such as physical distancing, hand hygiene, mask-wearing, evasion of surrounded spaces, and outdoor preference have continued to be operative against previous variants and must be as successful against the omicron variant [9].

Effectiveness of current treatments

The struggle against some antibodies used for COVID-19 treatment suggests that the Omicron spike may as well evade antibodies generated upon contagion and vaccination. Serum and plasma gathered from mild and severe COVID-19 repressed access driven by the Omicron spike 80-fold less proficiently compared with the B.1 and 44-fold less powerful as compared with the Delta spike, with 9 out of 17 sera testing negative on being incapable of counteracting elements having Omicron spike [11]. Neither the alpha nor the Delta variant prevailed, signifying the antibodies elevated against the virus circulating at the onset of the pandemic suggest petite to no defense against the Omicron variant [11].

Corticosteroids and Interleukin-6 receptor blockers are effective for handling severe COVID-19 patients and are expected to be effective with the Omicron variant [19]. Though, primary data from non-peer-reviewed journals propose that some of the monoclonal antibodies obtained against SARS-CoV-2 may have reduced neutralization against Omicron. Individually testing for monoclonal antibodies

need to be conducted for their antigen binding and virus neutralization, and the studies should be prioritized. Preliminary *in vitro* data suggest that antivirals retain activity against Omicron [10]. With monoclonal antibody treatment remaining effective against Omicron, public health agencies work with healthcare providers to ensure that effective treatments are used appropriately to treat patients [8].

Treatment with a vaccine against the omicron variant is suggestively smaller than the Delta variant. Andrews *et al.* discoveries reveal that vaccination with BNT162b2 or ChAdOx1 is inadequate to yield satisfactory levels of protection against infection and mild disease with the Omicron variant. However, they suggest that boosting with BNT162b2 will significantly increase safety against acute disease and will likely offer even superior levels of protection against a severe and deadly illness [21, 22].

Risk communication and community engagement

Early communication on evidence-based information on Omicron or any other COVID-19 variant is essential. It will help the public learn what is expected and what guidance has changed. The information provided will help individuals and communities to have timely, accessible, and accurate information on how to protect themselves and be encouraged to take up treatment measures such as being vaccinated and continue with the protective behaviors to reduce transmission and infection. COVID-19 and its variant are sometimes present, and matters on the defense offered by existing vaccines will remain to prevail [23, 24]. Vaccines against SARS-CoV-2 will be required for years to come, and the vaccines will alter as variants become too deviating. Currently, accessible vaccines will offer protection against occurring variants of COVID-19. Nevertheless, multivalent vaccines may be more potent in the longer term [25-28].

CONCLUSION

The omicron variant differs from the previous variant in different ways. Omicron has a higher mutational capacity than earlier variants, resulting in a high transmission rate. The study's conclusions are purely for public awareness of the new variant. The above information also provides information on symptoms observed with Omicron, the effects of available vaccines, treatment and diagnosis.

FUNDING

None

ACKNOWLEDGEMENT

The author is grateful to the Middle East University (MEU), Amman, Jordan, for the financial support granted to cover the publication fee of this research article.

AUTHOR CONTRIBUTION

All the work have been carried out by me

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