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Recommendation for Universal Vaccine Development against COVID-19

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Description

Both novel and conventional vaccination tactics have been implemented worldwide since the onset of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) producing Coronavirus Disease 2019 (COVID-19) pandemic [1-5]. The global mortality rate ranges from roughly 0.2% to 4.0% [6]. Medical progress in the treatment and prevention of this infectious disease has helped, but the disease is still widespread and persistent enough to be a major public threat despite these advances. There have been several outbreaks of potentially fatal COVID-19 variations, prompting the development of multiple vaccines and treatments, each with its own advantages and disadvantages. Many approaches have only just begun to be studied or tested on humans.

Recent research has led to the development of a universal influenza vaccine, which has the potential to “take off the table” the risk of both seasonal and pandemic influenza [7]. A "universal vaccine”, according to the criteria established by the National Institute of Allergy and Infectious Diseases (NIAID) in 2018, must have an effectiveness rate of at least 75% across all age groups for a period of at least one year against all influenza A strains [8]. Knowledge and tools gained from the development of a universal vaccine against influenza that was found to be effective may be applied to the creation of a novel universal vaccine against COVID-19.

Various than the protein containing the Receptor-Binding Domain (RBD), other antigen options for the development of a universal COVID-19 vaccine are discussed in a recent review [9]. One example is the S2 regions. In a recent study, researchers Kevin, et al. revealed that mice vaccinated against an S2-targeted strain developed antibodies that could neutralize a wide variety of alpha- and beta-coronaviruses. Vaccination directed against S2 may also be used as a means to generate herd immunity to COVID-19, as was hypothesized [10]. Many vaccines have focused on the hemagglutinin stalk rather than the head since it tends to alter less frequently. Unfortunately, the immune response to the stalk is not as strong [11]. In contrast, SARS-CoV-2's S2 subunit stores a significant number of epitopes recognized by antibodies in response to SARS-CoV-2 infection or immunization [12,13]. Other SARS-CoV-2 Variants of Concern (VOCs), such as Beta (B.1.351), Gamma (B.1.1.28), Delta (B.1.617.2), and Omicron (B.1.1.529), are resistant to neutralization [11-13]. VOCs evade protection by substituting amino acids in the less conserved S1 subunit of the S protein. 71 of the alterations in the Alpha, Beta, Gamma, Delta, and Omicron S proteins are in S1, 33 of which are shared, and 12 are in S2, none of which are shared. Omicron subvariants may be unique SARS-CoV-2 serotypes due to their high number of S1 substitutions and capacity to escape earlier S variant-induced antibodies. Anti-SARS-CoV-2 antibodies bind to specific epitopes in the S2 subunit [14,15]. Despite the higher sequence conservation in S2 among SARS-CoV-2 variants and other CoVs, repeated infections with homologous and heterologous SARS-CoV-2 strains appear to focus the antibody repertoire on more variable and likely more immunogenic epitopes in S1's RBD and N-terminal domain [15]. The extents, to which S2-targeting antibodies contribute to the protection, as well as the limits of cross-reactive immunity, are still being debated. Several S2-specific monoclonal antibodies with significant neutralizing activity were identified during the previous SARS-CoV pandemic and the current SARS-CoV-2 pandemic [16,17], implying that broad protection against numerous CoVs may be achievable by targeting the S2 subunit [18]. The S2 vaccination extends the antibody response to highly conserved epitopes, laying the groundwork for the development of a possible universal vaccine [19].

Conclusion

Despite progress, a universal vaccination remains elusive. "Original antigenic sin" or imprinting is a serious challenge. The immune response to any virus strain is triggered in large part by the same B cells that emerged after a person's initial virus encounter, even when the strain is mismatched. The duration of "universal" vaccine protection and the longevity of the immunological memory generated by vaccination are both open questions. As conclusion, COVID-19 has the potential to develop into an endemic and seasonal illness, comparable to influenza. In light of this information, we may suggest that research on a universal vaccine be begun as soon as possible as a preventative step.

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Conflict of Interest

The authors have no conflicts of interest.

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