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EDITORIAL

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COVID-19 vaccine-induced immunity: Head-to-head comparison of mRNA (BNT162b2) versus inactivated (CoronaVac) vaccines

The public health benefits of vaccination are unequivocal: eradication of smallpox; near eradication of polio; elimination of maternal and neonatal tetanus; and control of several vaccine-preventable diseases. Emergence of infectious diseases such as SARS-CoV-2 has demanded development of new vaccines. From December 2019 onwards, scientists were joined by diverse stakeholders to develop and deploy safe as well as effective COVID-19 vaccines. By joining human and financial resources, the development of COVID-19 vaccines was done at an unprecedented speed without compromising quality, safety and efficacy. The availability and widespread use of different COVID-19 vaccines have prompted scientists to conduct comparisons on their effectiveness.[1]

Currently, there are several COVID-19 vaccines available, which are developed using different platforms. Two examples include the mRNA (BNT162b2) and inactivated (CoronaVac) COVID-19 vaccines.[2] There is a growing body of evidence showing that COVID-19 vaccine-specific immunity (specifically neutralizing antibodies) is a reliable marker of protection against COVID-19.[3] Therefore, evaluation of immune responses that are specific to COVID-19 vaccines is a critical undertaking, especially when comparing different types of the vaccines. Due to multiple co-variates related to settings where different types of COVID-19 vaccines are used as well as the priority to rapidly deploy these life-saving vaccines, comparative studies on the performance of these vaccines are challenging to conduct.

There is paucity of studies reporting head-to-head comparisons of available COVID-19 vaccines, particularly with respect to vaccine-induced immunity. In a recent publication in *Respirology*, Mok et al. conducted a head-to-head comparative study of BNT162b2 and CoronaVac vaccine-induced immunity among 18–79 years old matched healthy adults without prior infection with SARS-CoV-2.[4] For comparisons, the authors assessed SARS-CoV-2-specific humoral response induced by vaccination through the surrogate virus neutralization test and plaque reduction neutralization test. Additionally, the authors used intracellular cytokine staining to compare specific T-cell (CD4+ and CD8+) immunity to structural and spike proteins post-vaccination.

A key finding from the study was, 1 month after a two-dose schedule of each of the vaccines, BNT162b2 induced significantly higher binding and neutralizing antibodies than CoronaVac. Specifically, neutralization antibody titres were nearly four-fold higher for BNT162b2- than CoronaVac-vaccinated individuals.[4] In contrast, frequencies of vaccine-induced CD4+ and CD8+ T cells were greater for CoronaVac than BNT162b2-vaccinated individuals. Broadly, humoral response to SARS-CoV-2 is strongly associated with protection, whereas T-cell immunity to SARS-CoV-2 is thought to be important in preventing severe clinical outcomes. As variants of concern show abilities to evade neutralizing antibodies induced by vaccines, scientists are increasingly exploring the possibility of developing T-cell-based COVID-19 vaccines. Therefore, enhanced understanding of detailed SARS-CoV-2 T-cell immunity as well as the clinical relevance of the immunity is a public health priority.

The qualitative and quantitative differences in the vaccine-induced specific immunity from the head-to-head comparisons are likely to have clinical relevance in the long term. Higher immunogenicity as well as efficacy have been reported for BNT162b2 than CoronaVac vaccination.[5,6] Taken together, evidence from the comparisons of the two vaccines imply, in countries where both vaccines are in use, the boosting strategies should be different. In fact, a study in Brazil has shown a significant increase in antibody response with heterologous (two doses of CoronaVac followed by a booster dose of BNT162b2) compared to homologous (three doses of CoronaVac only) vaccination strategy.[7]

Similar to any other COVID-19 vaccines currently in use, the overall effectiveness of BNT162b2 and CoronaVac is affected by many factors such as age, time post-vaccination due to waning of vaccine-induced immunity and emergence of variants of concern of SARS-CoV-2, just to name a few. Following vaccination, current evidence suggests more neutralization antibody titres against SARS-CoV-2 are better than less. Therefore, it seems rational that in the context of unlimited supply and access to the two vaccines, preference would be given to BNT162b2 than CoronaVac. However, the real-world experience is far from the context of unlimited supply and access. Therefore, the public health benefits for using all available COVID-19 vaccines that have been authorized for use, including CoronaVac, are substantial. Emerging evidence on the improved efficacy of heterologous vaccination strategy will further strengthen the case of using a combination of vaccines from different platforms to achieve maximum public health benefits from COVID-19 vaccination.

Variable effectiveness of different COVID-19 vaccines has been reported.[8] Furthermore, and more generally, waning of COVID-19 vaccine-induced immunity has been widely reported after primary vaccination as well as after booster vaccination. Waning of immunity to SARS-CoV-2 following natural infection has also been reported. As transition from a pandemic to endemic state continues for COVID-19, an improved understanding of population

immunity against SARS-CoV-2 will become increasingly important. Therefore, more comparative studies on vaccine-induced immunity, heterologous vaccination and natural infection-induced immunity will be critical to inform practices and policies.

As the knowledge of COVID-19 vaccine-induced immunity improves with respect to clinical relevance, so will be the utilization of comparative studies such as the one conducted by Mok et al., for evidence-informed decision-making with respect to the choice of vaccines to use in each setting. At present and with many settings experiencing limited access to COVID-19 vaccines, the public health priority will remain to vaccinate as many people and as rapidly as possible with the available, authorized, safe and effective vaccines. Both BNT162b2 and CoronaVac COVID-19 vaccines are safe and integral in response to the pandemic.

KEYWORDS
inactivated, mRNA, vaccine-induced immunity

CONFLICT OF INTEREST

None declared.

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