Third-Dose Immunogenicity of the COVID-19 mRNA Vaccine in HIV-Positive Individuals

Alessandro Marino*

Editorial Office, Journal of Internal Medicine, Belgium

Corresponding Author*

Alessandro Marino
Editorial Office, Journal of Internal Medicine, Belgium
E-mail: alessmarino@gmail.com

Received: 06-June-2022, Manuscript No. IJCRIMPH-22-72977; **Editor assigned:** 10-June-2022, PreQC No. IJCRIMPH-22-72977(PQ); **Reviewed:** 18-June-2022, QC No. IJCRIMPH-22-72977(Q); **Revised:** 24-June-2022, Manuscript No. IJCRIMPH-22-72977(R); **Published:** 30-June-2022, doi: 10.35248/1840-4529.22.14.6.369

Abstract

We examined anti-RBD, micro neutralization assay, and IFN- production in 216 PLWH on ART with advanced disease receiving the third dose of an mRNA vaccine after a median of 142 days from the second dose in order to investigate the safety and immunogenicity of SARS-CoV-2 vaccine third dose in people living with HIV (PLWH). At least one adverse effect, usually a minor one, is seen in 68% of PLWH. Particularly when a heterologous combination with mRNA-1273 is used as the third shot, the humoral response after the third dose was strong and higher than that attained with the second. Cell-mediated immunity, however, does not change. Our findings suggest the third dose's utility for PLWH who are currently undergoing suppressive ART and who have significant immune dysregulation.

Keywords: SARS-CoV-2 • Vaccine • Reading problems

Introduction

According to data from the World Health Organization up until December 27th 2021, the COVID-19 pandemic caused more than 270 million confirmed illnesses and around 5 million fatalities. More than 7 million doses of effective SARS-CoV-2 vaccinations have been delivered worldwide, and they have proven to be a highly effective method of reducing the disease burden, especially in those who are at a high risk of contracting a severe COVID-192. Furthermore, real-world data indicate that an effective vaccination can prevent fatal illness even in the presence of variations of concern (VoCs), such as the Gamma and Delta variants. Recent studies have indicated that the vaccine effectiveness for the B.1.1.529 (Omicron) variant is much lower than that seen with the delta form, decreasing antibody-mediated neutralization and perhaps raising the risk of reinfections. Recent research has shown a considerable rise in neutralization against Omicron following a booster dosage, however this rise was less pronounced than that seen with ancestral type or Delta, pointing to the possibility of cross-reactivity between neutralizing antibody responses. Despite differences between studies, People Living With HIV (PLWH) appear to be at a high risk for negative clinical outcomes from COVID-19. There is some evidence for higher hospitalization and mortality rates, which may be related to low neutralizing antibody titers, which reflect a weakened immune response to the natural infection of SARS-CoV-2, the presence of additional comorbid conditions, and low socioeconomic status or occupational risk. These findings are in line with the hypothesis that HIV infection may make other viral agents, including influenza, more susceptible to a subpar serological response. In PLWH on stable ART and with CD4 counts greater than 350 cells/mm, only one randomized, phase 2/3 trial in the UK has characterized the immunogenicity to a prime-boost dosage of the chimpanzee adenovirus-vectored ChAdOx1-nCoV-19 vaccine as well as its persistence after 6 months. At 6 months, this follow-up analysis revealed a reduction in humoral and cell-mediated immunity, but there was no discernible difference from a cohort of HIV-uninfected people who had the same vaccination. Only a few observational studies on mRNA vaccines in PLWH have been conducted to date, and all of them demonstrated a satisfactory humoral and T cell immune response in PLWH on ART and with CD4 T cell counts above 200 cell/mm^3 after the primary vaccination cycle. However, no data were available regarding the efficacy and safety of additional or booster doses in the HIV-infected population, particularly in individuals with low CD4 count. We previously stated that mRNA vaccination can induce a strong humoral and cellular immune response against SARS-CoV-2 in the majority of PLWH receiving ART, especially in those with complete immune recovery after suppressive therapy, even though such response was noticeably worse in PLWH with current CD4 T-cell 200/mm^3 compared to those with>500 cell/mm^3 and HIV-uninfected controls. These results suggest that chronic persistent dysregulation in the ART-treated population may affect effector immune response to SARS CoV2 immunization. The Italian government approved the third dose of the anti-SARS-CoV-2 mRNA vaccine to be administered on September 10, 2021, to PLWH who had a CD4 T cell count below 200 cell/mm^3 and/or a history of AIDS at the time of their first dose. This study aimed to evaluate the association between immune response, current CD4 T cell count, and specific vaccination sequence, as well as to identify the reactogenicity and level of immunogenicity in PLWH following the third dosage, compare those levels to those achieved following the second dose.

Discussion

In this investigation, we discovered that in PLWH eligible for the third dosage who had already received the full mRNA 2-dose vaccination cycle, a third dose of the anti-SARS-CoV-2 mRNA vaccine generated a significant humoral and T specific cell response. It's interesting to note that the T cell-mediated response, neutralising antibodies, and anti-RBD IgG all increased significantly. An important point to note is that the amount of anti-RBD IgG, neutralising antibodies attained after the third dose was higher than what was seen one month after the second dose of the primary cycle. Our data cannot rule out a difference in the magnitude of response and risk of no-response when comparing participants with poor CD4 count recovery on ART (PCDR) with those with high CD4 count recovery on ART, despite the lack of a significant association between the current level of CD4 count and the response (HCDR). Comparing the results attained post-second dose with those shown post-third dose, however, suggested that the amount of T cell mediated response was more steady. Anti-RBD and nAb responses were comparable to those of the HIV Negative Control Group (HCWs), which were not noticeably different. The findings, however, contained strong support for a smaller mean difference in IFN-gamma between PLWH and controls. These findings are crucial because they demonstrate that PLWH appear to have a compromised T-cell mediated response relative to the general population, despite a strong response to a third dosage. These results appear to be comparable between HIV positive and HIV negative participants, which is in accordance with recent findings on the characterisation of the humoral and SARS-CoV-2 T-cell specific response in PLWH following a moderate COVID19. Additionally, we discovered a significant difference in terms of T-cell specific response in PLWH that was lower than that seen in the HIV negative control group, and we contend that the size of the naive CD4 T cell pool influences the overall magnitude of SARS-CoV-2-specific T cell responses. This suggests that insufficient immune reconstitution on ART may compromise immune responses to SARS-CoV-2 and vaccine effectiveness in PLWH. The observed increase in humoral response in our setting is also in line with the theory that the third dose induces a strong B cell memory response, which was previously induced by the primary vaccination series, and it emphasises the ability of the SARS-CoV-2 mRNA vaccines to stimulate an adequate humoral response. These findings may be important since they provide fresh information on PLWH's immune response to an additional mRNA vaccination. PLWH had lower surrogate virus neutralisation test response and a trend toward lower IgG response, especially among those with lower CD4$^+$ T-cell counts and who received the BNT162b2 vaccine (vs mRNA1273), according to a recent matched case-control study on humoral response to primary mRNA vaccination cycle in HIV positive and HIV negative individuals. This study highlights the need to identify groups that have reduced response to SARS-CoV-2 vaccination in order to set an ideal vaccinationComparing these response rates to those seen in other immunocompromised individuals, they are astounding. In people with Chronic Lymphocytic Leukaemia (CLL), the rate of anti-RBD response after a third dosage was 72%, and it was even lower when limited to patients receiving chemoimmunotherapy (60%). Only around 70% of patients receiving hemodialysis who did not respond well to the first two doses of the vaccine were able to produce effective antibody titres after the third dosage. Our results, however, are consistent with a recent report on immunogenicity in patients with solid and hematologic cancers. Additionally, in a different study, an immediate antibody response to booster administration of the BNT162b2 vaccine was seen in nearly all patients with solid organ tumours, including those who were receiving active systemic chemotherapy.

The third dose as well as the initial immunisation cycle were successful in boosting the Spike-specific T cell response. However, in contrast to the formation of antibodies, the T cell response induced by the third dosage was comparable to that brought about by the primary vaccination cycle, indicating that the first two doses are still sufficient to induce a completely T-cell immunisation. The additional third dose can significantly increase the T cell response, which decreased over time after the first two doses. After receiving their third dose of the vaccine, the majority of our PLWH who had severe immunodeficiency at the time of their first dose of the vaccine showed an anti-RBD IgG response (95.5%), nAbs response (86.3%), and T cell immunity (70%) that seems remarkable given the population's severe and persistent immunologic dysregulation, which is caused by a decreased T and B cell functionality brought on by lingering inflammation and immune-senescence processes. Given the patients' status as having chronic immunological dysregulation and the fact that depletion of viral-specific T and B cell clones is seen even in PLWH responders to antiretroviral therapy, the achieved responses are particularly impressive combinatorial antiretroviral therapy (cART). Although cART permanently suppresses HIV-RNA, restores $CD4^+$ T cells, and corrects HIV-related immunological dysfunction, a persistent immunopathology, such as that seen in HIV chronic illness, can impair the effectiveness of vaccination-induced immune responses. A third dosage had the best effect on our sample of advanced PLWH that had previously been activated by a full cycle immunisation. This study appears to indicate that successful cART can limit HIV replication and improve immunological function, even in individuals with low CD4 counts or those who have had AIDS-related illnesses. But more research is needed to completely understand how HIV-related immunosuppression affects how long vaccine-induced immunity lasts. Indeed, it's been said that the CD4 count is the first to appear. The CD4 T cells and the ongoing mild inflammatory milieu in chronic PLWH may inhibit the development of efficient and long-lasting memory B and T cell immunity. We found a significant difference in humoral response when comparing participants with poor CD4 count recovery on ART with those having a high CD4 count recovery, despite the fact that the data overall provided little evidence for an association between current level of CD4 count and response to vaccination. The results for the other replies also tended to favour those with PCDR over those with HCDR, while they were not statistically significant, perhaps due to insufficient statistical power. To address this issue, which is essential for properly designing the upcoming vaccine regimens, additional research is required. Our data are consistent with the findings of another recent study showing higher immunogenicity and significantly enhanced effectiveness of two doses of mRNA1273 compared with BNT162b2 and with the hypothesis that the observed higher vaccine response with the mRNA-1273 could be related to the additional week between administrations, higher vaccine dose, differences, or other factors, even though formal conclusions regarding the clinical significance of this observed difference cannot be made. Additionally, it has been demonstrated that the T cell response brought on by both vaccination and spontaneous infection is capable of effectively recognising the Omicron variation (70%–80% of CD4 and CD8 T cells cross-recognize Omicron), helping to protect against severe COVID-19. Therefore, by raising the titer of neutralising antibodies and producing a powerful and cross-reactive T cell response, vaccination in PLWH could considerably lower the chance of developing severe Omicron illness. Despite these drawbacks, the results reported here show that in PLWH who had advanced disease at the time of their first vaccination dose, administering a second dose of the SARS-CoV-2 mRNA vaccine at least four months after the first two doses resulted in noticeably higher levels of boosted immunity after initial course. These preliminary findings suggest to support the choice to administer a short-term third dosage to this subset of PLWH, even if more and larger trials are necessary to demonstrate the therapeutic benefit of the third dose.

Cite this article: Marino A. Third-Dose Immunogenicity of the COVID-19 mRNA Vaccine in HIV-Positive Individuals. Int. J. Collab. Res. Intern. Med. Public Health. 2022, 14 (06), 001-002