SARS Cov-2 Immune Response in Health Care Workers - is There Need for Antibody Titer Testing in Post Vaccinated Individuals

Leelambika C.[1], Prithvi Shankar[2], Shravan Kumar[3], Mohana Kumari Chidananda[4], Shilpa H.D.[5]

[1]Associate Professor, Department of Biochemistry, CDSIMER, Ramanagara, Karnataka, India.
[2]Associate Professor, Department of Biochemistry, Dr. Moopens Medical College, Wayanad, Kerala, India.
[3]Assistant Professor, Department of Biochemistry, ESIC Dental College, Kalaburagi, Karnataka, India.
[4]Assistant Professor, Department of Biochemistry, CDSIMER, Ramanagara, Karnataka, India.
[5]Professor, Department of Biochemistry, CDSIMER, Ramanagara, Karnataka, India.

Abstract

Background: Studying the immune response among health care workers in different areas is crucial for understanding the risk and vaccine deployment. Our study was designed to measure the immune response in post vaccinated health care workers and evaluate the immune response with type of vaccination. So that it can help in better management of the disease.

Methodology: SARS CoV-2 IgG-II levels were measured in health care workers post vaccinated with covishield and covaxin, also the effect of covid positivity on antibody response.

Results: Compared to males females had significant increase in reactivity (p=0.0227) with Median value of reactivity among males was 9.96 AU/mL[7.31-12.31] and of females was 5.4 AU/mL[0.53-14.77]. Median value of 12.035 AU/mL[6.11-74.9] in vaccinated was significantly increased (p=0.0008) compared to median value of 1.28 AU/mL[0.52-6.43] in non-vaccinated health care workers. Significant difference [p= <0.0001] as observed covid positive health care workers as compared to covid negative with median values of 59.4 Au/mL[47.56-167] and 6.11 Au/mL[0.54-11.96]. Vaccinated and non-vaccinated health care workers tested positive for covid are had median reactivity of 231.7 AU/mL[49.03-168.56] and 9.98 AU/mL [5.27-14.69] respectively. covid negative health care workers, vaccinated had median value of reactivity of 7.37 AU/mL[5.34-18.28] as compared to 1.27 Au/mL[0.45-4.03] in non-vaccinated [p=0.0131].

Conclusion: Seroprevalence among the health care workers has a varied response. State of covid positivity, vaccination, type of vaccination and infection along with vaccination affect the Antibody response. Thus measuring the immune response will guide us in taking precautions and better management of the disease.

Keywords: SARS CoV-2, Antibody Titer, Post Vaccination, Health Care Workers, Covid 1

Introduction

Covid 19 infection has infected nearly 219 different countries with affecting more than 101 million people globally [1]. Health care professionals play as important role in providing care and support [2]. Those working in close proximity with infected patients are comparatively considered to have higher risk of infection [2,3]. Studying the immune response among health care workers in different areas is crucial for understanding the risk and vaccine deployment. The key component of controlling the infection and protecting the healthcare workers is deployment of a safe and

effective SARS-CoV-2 vaccine. Different types of vaccine work in different ways to offer protection. The body is left with the supply of memory T lymphocytes as well as B lymphocytes.

Rapid development of vaccines against covid offers great promise for curbing spread of infection accelerating the timeline towards higher herd immunity. [4,5] SARS CoV-2 infection is associated with variable immune response in the infected population. The declining trend of the antibodies correlates with the short lived immunity. Further studies are needed to explore the probable reasons for the varied immune response. Not much studies have been done about the immune response post vaccination. Our study was designed to measure the immune response in post vaccinated health care workers and evaluate the immune response with type of vaccination.

Materials and Methodology

Study population and sample collection

Health care workers providing direct medical support and care - nursing staff, technicians, hospital attendants, doctors working at CDSIMER, Ramanagara with

SARS CoV-2 IgG II estimation were included in the study irrespective of age, gender, presence of co-morbidities, positivity for covid test. Healthcare workers not willing to give consent and without SARS CoV-2 IgG II estimation were excluded from the studies.

Biochemical Analysis

Serum separated from venous sample of the participants were utilized for the analysis of SARS CoV-2 IgG-II levels. Biochemical analysis was performed on Beckman Coulter Access 2 analyzer.

Statistical analysis

Normality of quantitative data was checked using Kolmogorov-Smirnov tests of Normality and was represented as mean and standard error of mean. Bonferrani Test was used for comparison between two normally distributed data. Mann-Whitney test was employed to compare skewed distribution data between two groups. The statistical analysis was performed using IBM SPSS statistics (version 22.0).

Results

A total of 50 health care workers were enrolled in the study. Among the heath workers 42% were reactive with ≥10 AU/mL SARS CoV-2 IgG II and 58% were non-reactive with <10 AU/mL SARS CoV-2 IgG II [Figure 1]. In the study 27 females were enrolled, 34.78% were reactive for antibody and out of 23 males recruited in the study 48.15% were reactive. Median value of reactivity among males was 9.96 AU/mL[7.31-12.31] and of females was 5.4 AU/mL[0.53-14.77]. Male had significant increase in reactivity as compared to females (p=0.0227) as shown in figure 2. Of the total health care workers 72% (36) were vaccinated and 28%(14) were not vaccinated. Among the vaccinated health care workers 88.8% had

been vaccinated with covishield and 11.1% with Covaxin. 52.8% of vaccinated individuals were reactive as compared to 14.29% reactive in non-vaccinated. Significant difference (p= 0.0133) was observed in reactivity between Vaccinated and non-vaccinated health care workers. Significant increase (p=0.0008) in the reactivity of the vaccinated as compared to non-vaccinated was observed with median value of 12.035 AU/mL[6.11-74.9] in vaccinated as compared to median value of 1.28 AU/mL[0.52-6.43] in non-vaccinated health care workers as observed in figure 3. 25% of persons vaccinated with covaxin and 56.25% of vaccinated with covishield were reactive for SARS COV2 II IgG with median value of 7.34 AU/mL (6.83-73.84) in Covaxin and 15.19 AU/mL (6.11-74.99) in Covishield vaccinated health care workers as shown in figure 4. SARS COV2 II IgG reactivity did not show any significant difference among the covaxin and covishield. Among the health care workers 26% were covid positive and 74% were covid negative, 84.61% of covid positive were reactive as compared to 27.03% reactivity in covid negative

individuals. There was significant difference in the reactivity in covid positive health care workers as compared to covid negative with median values of 59.4 Au/mL[47.56-167] and 6.11 Au/mL[0.54-11.96] respectively with p= <0.0001 as observed in figure 5. Health care workers who were positive for covid and were vaccinated showed reactivity in 90% as compared to non-vaccinated who showed only 50% reactivity. Median values of reactivity among vaccinated and non-vaccinated health care workers tested positive for covid are 231.7 AU/mL[49.03-168.56] and 9.98 AU/mL [5.27-14.69] respectively as shown in the figure 6. 36% of vaccinated health care workers with covid negative were SARS COV2 II IgG reactive as compared to 8.33% reactivity in covid negative, non-vaccinated individuals. In covid negative health care workers, median value of reactivity was 7.37 AU/mL[5.34-18.28] in vaccinated and 1.27 Au/mL[0.45-4.03] in non-vaccinated, with significant increase in vaccinated persons as compared to non-vaccinated p=0.0131 as shown in figure 7.
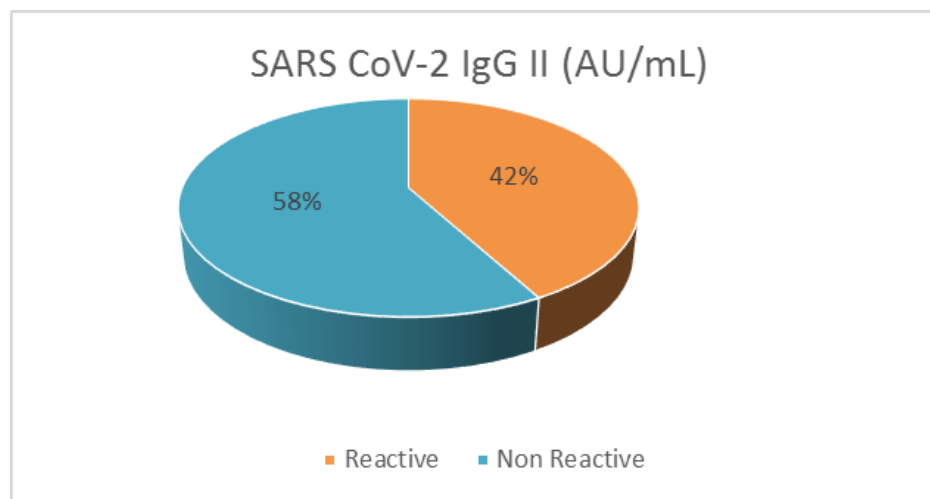

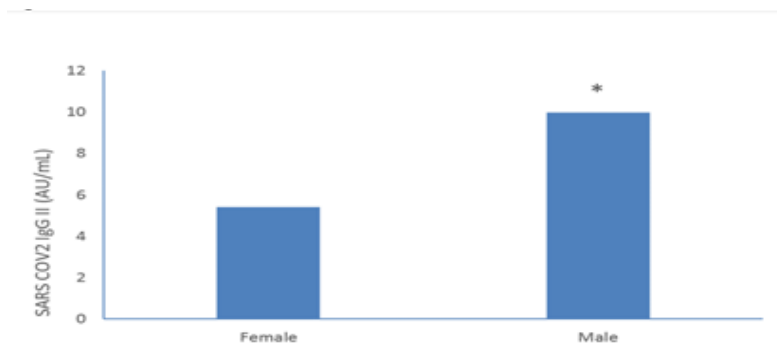**Figure 1: SARS CoV-2 IgG II reactivity among the healthcare workers.**

Figure 2: SARS COV2 IgG II reactivity in male and female healthcare workers (* =p 0.05).
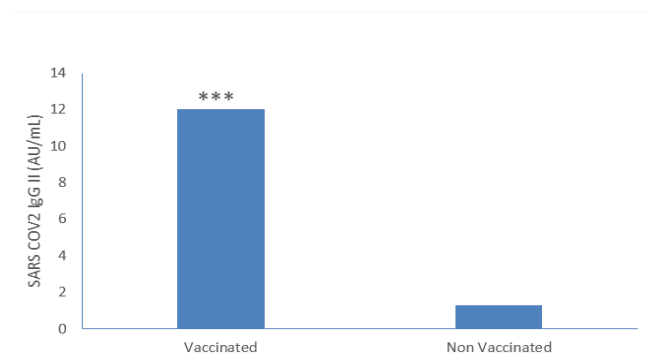

Figure 3: Median value of reactivity among the vaccinated and non-vaccinated health care Workers (* =p <0.001).**
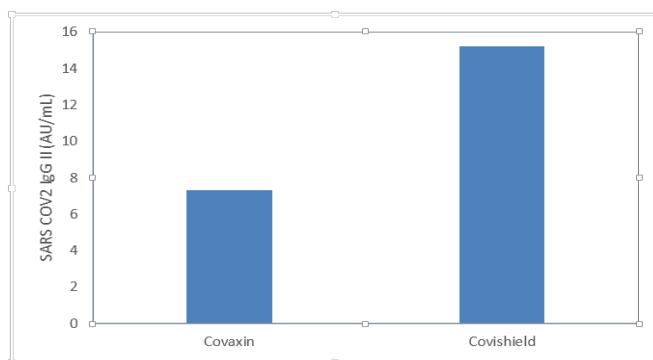

Figure 4: SARS COV2 II IgG reactivity in covaxin and covishield vaccinated health care workers.
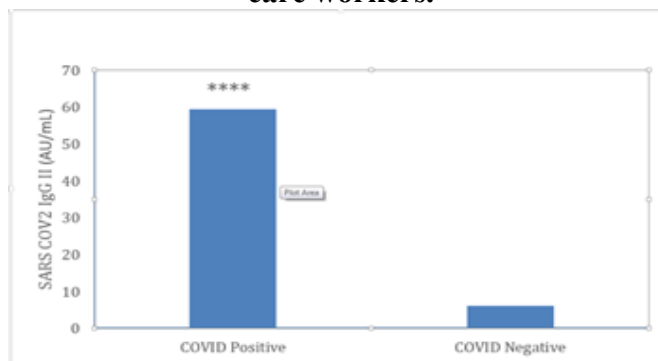

Figure 5: Median SARS COV2 II IgG reactivity in covid positive and covid negative health care workers (** =p <0.0001).**
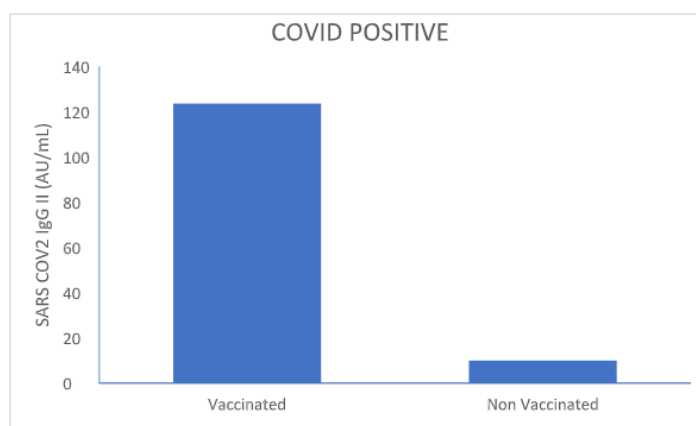
Figure 6: Median SARS COV2 II IgG reactivity in covid positive – vaccinated and non vaccinated health care workers.
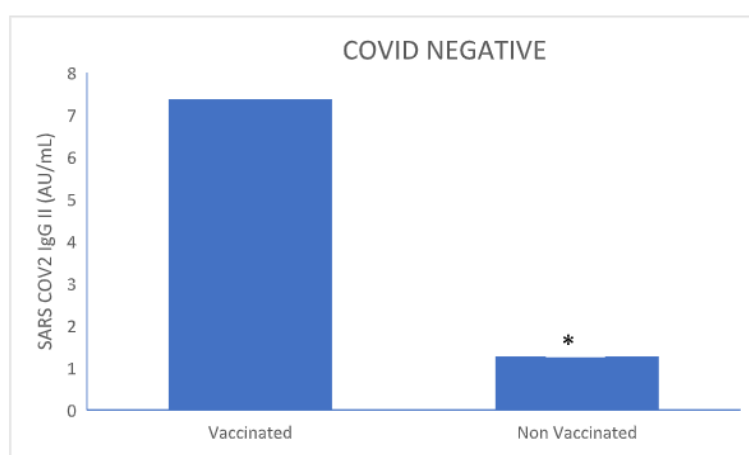

Figure 7: Median SARS COV2 II IgG reactivity in covid negative – vaccinated and non-vaccinated health care workers (* =p <0.05).

Discussion

Interpretation of the immune response correlation among SARS-CoV-2–infected persons can be complicated and sometimes misleading. Like other viral infectious diseases, viral loads are a major driver of induced immune responses. COVID 19 vaccination planning is dependent on the knowledge of association between measured immunity and clinical protection from SARS-CoV-2 infection. As shown in previous studies seroprevalence among the health care workers in our study was observed to be around 50% [6]. Thus, antibody response is not uniform among the health care workers irrespective of type of vaccination, presence, or absence of infection. Males had higher antibody response as compared to females in concurrence with previous studies indicating betters protection among the males [7].

Vaccination had increased the antibody response in health care workers indicating development of adaptive immunity in vaccinated induvial [8]. Indicating the efficacy of the vaccination in protecting the health care workers from Covid -19 infection. Percentage of health care workers vaccinated with covishield was higher as compared to covaxin. Seropositivity among covishield was greater than covaxin vaccinated health care workers as indicated in other studies [6]. Efficacy of different vaccines varies from person to person necessitating the

estimation of immune response among the vaccinated induvial to identify protection against Covid 19 infection. The antibody titer associated with different covid vaccination can be used as indicator of vaccine efficacy in comparison to new vaccines being developed. Covid positive tested healthcare workers had higher antibody response as compared covid negative [9].

Infection induced immune response in health care workers, as the immune response decreases with time, estimation of antibody titer can indicate whether there is a need for booster dose to protect the health care workers. Covid negative healthcare workers who were vaccinated had better immune response as compared to non-vaccinated induvial infection, and measurement of antibody titers will help to determine the need for booster doses or using other type of vaccination. Health care workers might have longer or shorter duration of immunity and might have risk of reinfection depending on their immune status, infection like previous studies [10]. Thus, vaccination protects the healthcare workers who are at increased risk of severity, cross immunity, age, cellular immunity or lack of neutralizing capacity. Vaccination of induvial who were positive for covid had significantly higher immune response due to additive effect of infection and vaccination [10]. Vaccination confers higher protection in health care workers who are at higher risk of exposure to infection and development of disease, thus measurement of antibody titer will help in deciding the need for further doses of vaccination. Measurement of antibody response in health care workers will help in determining the immune response, identifying the need to take protective measures to prevent infection, establish the vaccines with better immune response and identify the need for booster doses for long term protection against vaccination. [11]

Conclusion

In relation to Covid 19, health care workers show a warried immune response. Though the chances of exposure to covid infection is high, antibody response is not seen in all them. Antibody titer estimation is important to identify induvial not protected against the infection and further advocate vaccination in them. Vaccination is also not associated with 100% seroprevalence, hence estimation of antibody response will help in deciding the requirement of booster dose and changing the type of vaccination. In conclusion, estimation of antibody response will facilitate better understanding of seroprevalence among the heath care workers and further guide in taking precautions and managing the disease.

References:

1. Worldometer: coronavirus update. [Jan;2021];https://www.worldometers.info/coronavirus/ 2019
2. Profile of immunoglobulin G and IgM antibodies against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) Qu J, Wu C, Li X, et al. Clin Infect Dis. 2020;71:2255–2258.
3. Immune response to SARS-CoV-2 and mechanisms of immunopathological changes in COVID-19. Azkur AK, Akdis M, Azkur D, et al. Allergy. 2020;75:1564–1581. -
4. Polack FP, Thomas SJ, Kitchin N, et al. Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. *New England Journal of Medicine*. 2020;383(27):2603–2615.
5. 3. Omer SB, Yildirim I, Forman HP. Herd Immunity and Implications for SARS-CoV-2 Control. *JAMA*. 2020;324(20):2095–2096.
6. Murhekar MV, Bhatnagar T, Thangaraj JW, Saravanakumar V, Santhosh Kumar M, Selvaraju S, Rade K, Kumar CG, Sabarinathan R, Asthana S, Balachandar R.

Seroprevalence of IgG antibodies against SARS-CoV-2 among the general population and healthcare workers in India, June–July 2021: A population-based cross-sectional study. PLoS medicine. 2021 Dec 10;18(12):e1003877.

7. Chidananda MK, Zohmangaihi D, Ram S, Soni SL, Suri V, Malhotra P, Jassal RS, Kaur J, Verma I, Sharma S. Combined Analysis of Anti SARS-CoV-2 IgG and IgM Responses in COVID19 Patients in India. Indian Journal of Clinical Biochemistry. 2021 Oct;36(4):485-91.

8. Zhang S, Xu K, Li C, Zhou L, Kong X, Peng J, Zhu F, Bao C, Jin H, Gao Q, Zhao X. Long-Term Kinetics of SARS-CoV-2 Antibodies and Impact of Inactivated Vaccine on SARS-CoV-2 Antibodies Based on a COVID-19 Patients Cohort. Frontiers in immunology. 2022 Jan 27; 13:829665.

9. Imai K, Kitagawa Y, Tabata S, Kubota K, Nagura-Ikeda M, Matsuoka M, Miyoshi K, Sakai J, Ishibashi N, Tarumoto N, Takeuchi S. Antibody response patterns in COVID-19 patients with different levels of disease severity in Japan. Journal of medical virology. 2021 May;93(5):3211-8.

10. Dundar B, Karahangil K, Elgormus CS, Topsakal HN. Efficacy of antibody response following the vaccination of SARS-CoV-2 infected and noninfected healthcare workers by two-dose inactive vaccine against COVID-19. Journal of medical virology. 2022 Jun;94(6):2431-7.

11. IJ O., BU O., & SO N. Prevalence of Post-Operative Anaemia and its Complications among Obstetric and Gynaecological Patients in Enugu. Journal of Medical Research and Health Sciences, 2022; 5(9): 2250–2255.