Original Article

Immunological survey of COVID-19 among medicos of tribal preponderant state of India

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Abstract

Background: Immunological Survey or serosurveys have yielded useful information regarding the spread of the COVID-19 pandemic in the general population, but the impact of the continuing pandemic on the medical students in India is yet to be fully recognised. In this study we assessed the students who had received at least two doses of the COVID-19 vaccine for their antibody response. **Methodology:** A Hospital based, age-stratified, cross-sectional Analytical study design was adopted for the survey, carried out in tribal state of India among medical students. Consecutive sampling method was used where serum samples were tested for antibodies against the SARS-CoV-2 nucleocapsid (N) protein. **Result:** The vaccinee group comprised of 187 students mostly aged between 18-23 years 68.4% were females, 56.6 % were vaccinated with covishield. The mean IgG (Immunoglobin G) titre was 7343.74 AU/Ml, less than 1000 AU/Ml was found in 8% of participants, while more than 8000 AU/Ml was found in 32.1%. Participants who got the covaxin vaccine had a higher median IgG titre (median 6491.8 AU/mL, interquartile range 8898 AU/mL).The antibody titre of male was 0.328 times lower than that of female. **Conclusion:** Despite the fact that covishield's mean antibody titre was higher, covaxin's protection lasted longer.

Keywords: Covaxin, COVID-19, covishield, immunological survey

Background

World Health Organization (WHO) reported 642,924,560 confirmed cases of coronavirus disease-19 (COVID-19), including 6,625,029 deaths till December 2022,[1] vaccine-induced protective immunity has been largely attributed to the function of antibodies, specifically neutralizing antibodies (nAbs), which block the entry of the virus into target host cells, thus preventing infection. Because of their ability to provide immediate protection upon exposure, the elicitation of nAbs have long been the primary goal of vaccination against many pathogens, including Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). In line with this, a major focus has been placed on understanding the magnitude, protective capacity and durability of antibody responses in humans infected with SARS-CoV-2. Several studies have reported sero-conversion in COVID-19 patients.[2-6] A recent study was carried out on 1343 COVID-19 patients showed that over 99% of PCR (polymerase chain reaction)-positive patients develop anti-spike binding antibodies.[2]

Infection with a pathogen frequently leaves an imprint on the immune system, a phenomenon known as immunological memory, which can protect a person from a subsequent infection for decades. This is accomplished by inducing antigen-specific

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memory B and T lymphocytes, as well as a long-lasting antibody response that prevents reinfection. Primary care physicians are one of the groups at risk of COVID-19, and these people can be an important source of infection for vulnerable patients as they are primary contacts with them. Therefore, achieving a high level of vaccination among medicos is very important to prevent an increase in the number of patients and for proper functioning of our health system. Many viral infections exhibit natural immunity.[7] However, the extent to which SARS-CoV-2 infection can protect against subsequent reinfection is unknown. Although vaccine does not provide complete 100% protection, it protects from severe complications and mortality, especially the medically vulnerable peoples. Furthermore, if there is protection against reinfection, how long it lasts is currently a hotly debated topic. Many studies indicated a decline in antibody titres over the course of 8 weeks following resolution of symptoms.[5,8-12]

We report on the dynamics of the antibody response in such native subjects who have received 2nd dose of COVID-19 vaccine. In this study, we have thrown light on requirement of booster dose of vaccine depending upon sustaining level of antibody titre in both study groups. We then reviewed the immunogenicity of the vaccinated candidates and the duration of protection from SARS-CoV-2 so that this study can be harnessed to develop revised policy on novel vaccines. In this study, we find out the antibody response among students who have received two doses of COVID-19 vaccine and estimate the duration of protection.

Materials and Methods

It was a hospital-based cross-sectional study conducted at Rajendra Institute of Medical Sciences (RIMS), Ranchi, Jharkhand. All medical Students of Rajendra institute of Medical Sciences, Ranchi who were willing to participate (whether History of infection or without infection) and have received 2 doses of COVID-19 vaccine were included in the study. Consecutive sampling was used for sample selection. Pretested semi-structured questionnaire was used for collecting data prepared in Google form which includes the basic information like demographic profile, vaccination details, adverse events, blood group and history of infection. Study was conducted after approval of the Institutional Ethics committee (IEC) of Rajendra Institute of Medical Sciences, Ranchi (IEC No. 395-07/01/21). Explicit documentation of immunization status was taken from the hospital's registered vaccine centre after taking approval of the nodal officer of that facility. Self-reported immunization status was verified and confirmed through immunization centre records, vaccination certificate, or any potential data source. Vaccine documentation includes data on vaccination date, vaccine brand and infection information. After taking proper informed consent from the students for antibody titre, their blood samples were taken in ethylenediamine tetra acetic acid (EDTA) vials. All the blood samples were run at 10,000 RPM for 10 minutes in a centrifuge machine with proper balancing, to separate the plasma. Separated plasma of all the blood samples were tested for anti SARS CoV-2 IgG antibodies against spike receptor-binding domain (RBD) of SARS-CoV-2 by using an automated chemiluminescent micro particle immunoassay (CMIA) test both for the qualitative as well as quantitative detection with Abbott, Architect i1000SR model by using SARS CoV-2 IgG II Quant assay reagent in the Department of Blood centre of RIMS, Ranchi. According to the manufacturer's instructions, Plasma samples were considered positive when the IgG levels was found to be ≥50 AU/ml. As part of quality control, both positive and negative controls of anti-SARS-CoV-2 IgG antibodies against the spike receptor binding domain (RBD) of SARS-CoV-2 were run daily prior to analysis of test samples. Template was generated in Microsoft Excel and was analysed using Statistical Package for Social Sciences (SPSS) software version 22(SPSS Ic.IBM, NY, US). Univariate analysis and bivariate logistic regression were used to find out the Significant association between the variables and "*P*-value" was considered to be nonsignificant if *P* value was found to be ≥0.05 and significant if found <0.05.

Result

The vaccinee group comprised of 187 students mostly (81.3%) aged between 18 and 23 years 68.4% were females, 56.6% were

Table 1: The profile of students

Variables	Category	Frequency (*n*=187)	Percentage
Age	18-23 years	152	81.3
	23-28 years	23	12.3
	>28 years	12	6.4
Gender	Male	59	31.6
	Female	128	68.4
Ethnicity	Non-Tribal	140	74.9
	Tribal	47	25.1
Presence of co morbidity	Present	9	4.8
	Absent	178	95.2
Type of vaccine taken	Covaxin	83	44.4
	Covishield	104	55.6

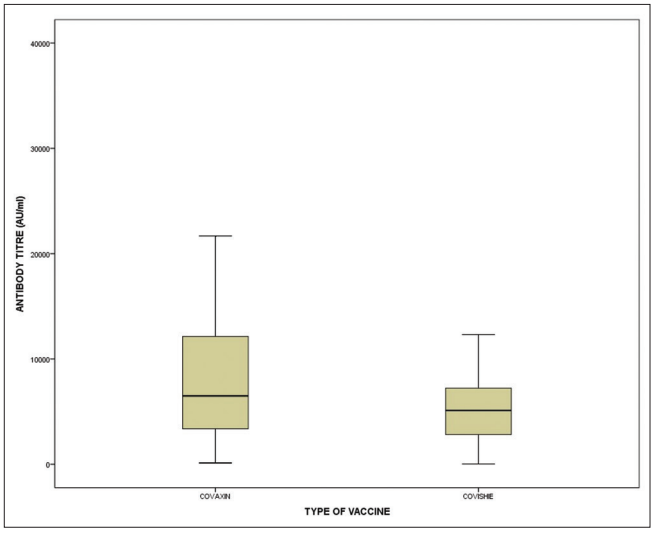

Figure 1: Stem-and-leaf plot for antibody titre (AU/ml) with type of vaccine

vaccinated with Covishield. History of COVID infection was present in 27.3% participants [Table 1].

The mean IgG titre was 7343.74 AU/Ml, less than 1000 AU/Ml was found in 8% of participants, while more than 8000 AU/Ml was found in 32.1%. Participants who got the Covaxin had a higher median IgG titre (median 6491.8 AU/mL, interquartile range 8898) [Figure 1].

Up to 12 months after vaccination, it was found that the mean antibody titre for Covishield was higher than that for Covaxin, but after 12 months, the Covaxin titre was higher than the Covishield titre [Figure 2].

In Univariate analysis, it was observed that the mean antibody titre was higher in female individuals (6608.09 AU/Ml) compared to male participants (5193.35 AU/Ml) and it was statistically significant (*P* value < 0.05).We did a binary logistic regression analysis, to determine the independent predictors of SARS-CoV-2 antibody titre, comorbidity, gender, ethnicity and vaccine type. The male's antibody titre was 1.328 times higher than the female's [Table 2].

Table 2: Binary logistic regression analysis of determinants of antibody titre

Variables	*P*	AOR	95% confidence interval	
			Lower bound	Upper bound
Age				
18-28 years	0.999	1.080	0.892	1.357
>28 years			Reference	
Gender				
Male	0.014*	1.328	0.135	0.798
Female			Reference	
Ethnicity				
Tribal	0.844	1.094	0.449	2.662
Non -Tribal			Reference	
Suffering from any disease				
Yes	0.434	2.459	0.258	23.478
No			Reference	

*Significant

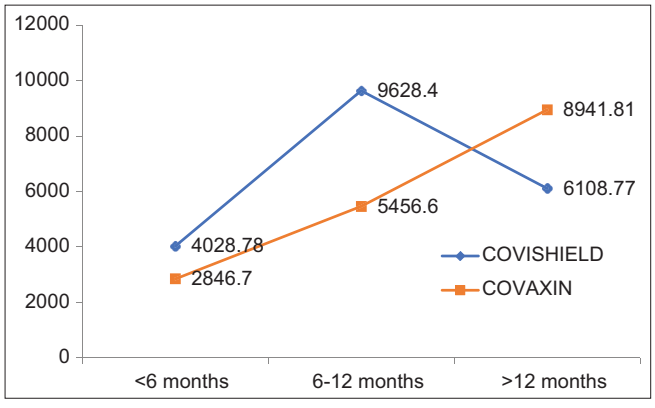

Figure 2: Showing mean antibody titre among vaccinee according to the vaccine brand

Discussion

In this study, we evaluated the titre of two COVID-19 vaccines, which are used in India, i.e. Covishield and Covaxin. Both the vaccines elicited a good antibody response after the two doses. While both vaccines showed an increase in seropositivity rate, after the second dose, the mean antibody titre was higher for Covishield than Covaxin. This was similar to the other study Singh AK *et al.*[13] However, we observed that after 12 months, Covishield antibody titre begins to fall but Covaxin titre continued to rise and it exceeded that of Covishield. This indicates that the duration of protection is more with Covaxin. The reason is probably, Covaxin is used, along with immune stimulants commonly known as vaccine adjuvants (Alhydroxiquim-II), to improve the immune response and provide longer-lasting immunity.[14] We found that IgG titre was high in male than female as in the study of Singh AK *et al.*[13] Covaxin (6491.8, IQR-8898) had a higher median IgG titre after two doses than Covishield (5116.6, IQR-4423), but Singh AK *et al.* found that Covishield has comparatively increased seropositivity and median antibody titre than Covaxin after the two doses. However, they compared antibody titters following both the first and second doses in their studies. Unfortunately, due to logistical issues brought on by the lockdown, we were unable to measure the baseline anti-spike antibody titre before and after the first dose in our research. Age, ethnicity and any comorbidity had no discernible impact on seropositivity of both vaccines.

Conclusion

The results of our study suggest that both vaccines cause seropositivity after two doses. Notably, after the second dose, the Covishield recipient had significantly higher antibody titres than his Covaxin recipient. However, after 1 year, Covishield titres declined, while Covaxin titres remained high.

Key take home messages

Primary care Physician can consider findings of this research article in the planning and management of the spread of infection and thus reducing the burden of healthcare system.

Considering that family physicians are the first point of contact with people, which is our major concern. So, a good antibody titre among the family physicians can halt the spread of infection to the vulnerable population and those with chronic diseases who are more susceptible in getting the infection and coming in contacts with them.

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Conflicts of interest

There are no conflicts of interest.

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