Brief report

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SARS-CoV-2 antibodies among health care workers from a children's hospital

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ABSTRACT

Introduction. In Argentina, health care workers have been the first ones to receive the COVID-19 vaccine, but there are still few data on the production of anti-S IgG antibodies.

Objectives. To assess specific IgG against the SARS-CoV-2 spike protein (anti-S IgG) after the vaccination of health care workers from a children's hospital. To explore the association between the presence of these antibodies, age, and history of prior infection.

Population and methods. Cross-sectional study in 193 workers who received both doses of the two-component Sputnik V vaccine. The anti-S IgG antibody titer was measured and age, history of prior SARS-CoV-2 infection, and date of vaccination were recorded.

Results. Anti-S IgG antibodies were produced in 98.6% of the subjects. The titer was higher in those with prior infection ($p < 0.001$), but no relationship was established with subjects' age.

Conclusion. We provide data on post-vaccination production of IgG anti-S antibodies among health care workers from a children's hospital and explore some predictors.

Key words: *COVID-19, COVID-19 serological test, COVID-19 vaccines, health care workers.*

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INTRODUCTION

The population of health care workers plays a strategic role to adequately sustain the functioning and response of the health care system in the face of a pandemic, and protecting them is essential.[1]

According to the National Ministry of Health of Argentina, 63 837 cumulative cases of COVID-19 had been registered in this group until December 11th, 2020, which accounted for 4.3% of the total number of cases in our country.[2]

As of January 2021, Argentina decided health care workers should be vaccinated against COVID-19 in the first instance, according to a prioritization scheme by exposure and strategic role.[2]

The Sputnik V vaccine uses recombinant adenovirus 26 and adenovirus 5 vectors that contain the genetic material for the expression of the SARS-CoV-2 S-protein. The vaccination schedule includes 2 doses, with an interval of at least 21 days between doses. Developed antibodies are considered neutralizing antibodies and confer immunity to viral infection.[3]

The study of the characteristics and time course of the antibody response developed with vaccination provides important information on the protective capacity elicited by the proposed schedule. For this purpose, we assessed the production of anti-S IgG antibodies among workers from a children's hospital. In addition, we analyzed the association among the magnitude of antibody titers, subjects' age, and a history of prior infection before the vaccination.

MATERIAL AND METHODS

Population

This was a cross-sectional study in 193 health care workers from Hospital General de Niños Pedro de Elizalde (HGNPE) who received 2 doses of the Sputnik V vaccine as per the established schedule. The minimum time between the second dose and sample collection for anti-S IgG antibody determination was 14 days. Immunocompromised subjects due to pre-existing diseases or immunosuppressive treatment were excluded.

Methods

The determination of anti-S IgG antibodies in serum was performed by automated chemiluminescence (semi-quantitative MAGLUMI® SARS-CoV-2 S-RBD IgG [SNIBE]).

In addition, a questionnaire was administered to record the date of birth and vaccination and the history of prior SARS- CoV-2 infection.

Statistical considerations

The adjustment to normality of the distribution of anti-S IgG values was assessed (Kolmogorov-Smirnov test), and median and interquartile range (IQR) were determined. The Mann-Whitney U test and the Kruskal-Wallis test were used to compare antibody titers among different groups. Significance level: $p < 0.05$. IBM SSPS Statistics 20.0 was used for data processing.

Ethical considerations

The study was authorized by the Ethics and Research Committee of HGNPE. The informed consent of all participants was obtained.

RESULTS

A total of 193 subjects were included; their average age was 43.5 years ± 15.4 years; 18.1% were males. Prior SARS-CoV-2 infection was reported in 36 subjects (18.2%) (*Table 1*).

The median interval between the second vaccine dose and sample collection was 83 days (IQR: 64–111).

Anti-S IgG antibodies developed in 98.96% (95% confidence interval: 96–99) of the study

Table 1. Antibody titer (anti-S IgG) in the study population. Distribution by time elapsed since vaccination and history of prior SARS-CoV-2 infection (n = 193)

Days after vaccination	Prior infection		
	Yes (n = 36)	No (n = 157)	*p**
< 60	300.7 (172.2–692.1)	63.7 (25.2–92.7)	0.004
60–90	160.5 (69.4–488.5)	27.6 (15.4–61.8)	< 0.001
> 90	110.4 (66.6–255.6)	18.1 (8.2–39.7)	< 0.001

**Mann Whitney U test.*

The values correspond to AU/mL. They are expressed as median and interquartile range.

population. Only 2 subjects had a titer below the test detection value (0.57 and 0.79 AU/mL, respectively; cut-off: 1.00 AU/mL).

The median antibody titer in the study population was 37.2 AU/mL (IQR: 14.6–80.1). It was significantly higher in subjects with a history of prior infection compared to those who did not have COVID-19 before (163, IQR: 69.8–469.1 AU/mL versus 26.2, IQR: 11.6–61.2 AU/mL).

Due to the wide variation in the time elapsed between the second dose and sample collection, the population was stratified into time intervals: less than 60 days after vaccination, between 60 and 90 days after vaccination, and more than 90 days after vaccination. No differences were observed in anti-S IgG antibody titers (74.1, IQR: 29–181.5; 47.6, IQR: 18.8–86.7; and 21.7, IQR: 9.4–57.1, respectively; $p = 0.1$).

To assess probable variation in antibody production based on age, the population was stratified into 4 groups: < 30 years, 30–39 years, 40–49 years, and > 49 years. No significant differences were observed in anti-S IgG antibody titers based on age (35.4, IQR: 13.9–77.5; 41.6, IQR: 13.8–83.5; 23.7, IQR: 13.9–61.8; and 47.8, IQR: 15.3–95.7, respectively; $p = 0.3$).

Females showed a higher antibody titer than males; this was a small but statistically significant difference (39.9 AU/mL, IQR: 16.8–85.2 versus 23.3 AU/mL, IQR: 7.3–65.3; $p = 0.04$).

Once the population was stratified by age and time after vaccination, significantly higher antibody levels were observed in those with a history of prior infection (*Tables 1 and 2*).

DISCUSSION

The production of antibodies is one of the immune responses resulting from vaccination, and the time assessment of this response is indicative of the kinetics of such production. Variables such as the time elapsed since the administration of the second dose or subjects' age could somehow condition the level of antibodies produced. In this study, 98.96% of the population generated anti-S IgG antibodies, a proportion similar to that observed in studies with different populations and other analytical methodologies.[4–6]

The stratification of participants into intervals of time after vaccination allowed us to verify the magnitude of antibodies based on these intervals. This is the result of a balance between antibody production and the normal physiological process of antibody clearance over time. The greater response observed in subjects vaccinated within the prior 60 days compared to those with longer assessment intervals would be indicative of the balance mentioned above. The results of this study are consistent with previous data showing that antibody titers developed after the second dose were significantly higher in subjects with prior infections.[5,7]

Regarding the adequate humoral immune response, it is known that it increases slowly since childhood, reaches its maximum level in young adulthood, and then decreases. Immunosenescence, an inexorable phenomenon, does not have a fixed starting date, and a more complete assessment of the immune system is necessary to study it, taking into account the effector and memory cell response, and not only the production of antibodies. Regardless of the concept mentioned before, in this study, we did not observe significant differences in antibody production among subjects of different ages, although the upper age limit of our population was 67 years, and it would not be appropriate to extrapolate this conclusion to older subjects. Previous studies also found no correlation

Table 2. Antibody titer (anti-S IgG) in the study population. Distribution by age and history of prior SARS-CoV-2 infection (n = 193)

Days after vaccination	Prior infection		
	Yes (n = 36)	No (n = 157)	*p**
< 30	149.2 (75.8–237.1)	31.1 (13.8–72.6)	0.01
30–39	209.3 (52.3–722.9)	27.2 (9.6–53.2)	< 0.001
40–49	115.5 (43.4–395.9)	18.9 (10.9–38.8)	< 0.001
> 49	171.9 (121.4–727)	28.4 (12.1–75.7)	< 0.001

**Mann Whitney U test.*

The values correspond to AU/mL. They are expressed as median and interquartile range.

between anti-S IgG response and age, suggesting that this variable would not be a determining factor in the antibody response in cohorts of healthy individuals and within a certain age range.[8,9]

In this study, in addition to the previously studied conditions, we also assessed the potential relation between the level of antibodies and subjects' sex, based on reports suggesting that males had a greater susceptibility to severe COVID-19.[10–12] We found a significant difference in this regard, but given its size, its clinical implication should be assessed.

A limitation of this study is that it was carried out in a convenience sample, which included 193 of the almost 1800 workers of the HGNPE. All health care workers were invited to participate and the first subjects who volunteered were included, until the sample was complete. Other limitations include the subjectivity of the information about prior infection because it was based on personal reference and the variability in the time after vaccination when measuring antibodies.

Nevertheless, this study provides local data on a phenomenon that profoundly affected society.

CONCLUSION

Our results contribute to serological reports to determine the post-vaccination immunogenicity in different cohorts, adding evidence for future health decisions. ■

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