Letters

RESEARCH LETTER

Spike Antibody Levels of Nursing Home Residents With or Without Prior COVID-19 3 Weeks After a Single BNT162b2 Vaccine Dose

Recent studies have suggested that, to reach immunity, immunocompetent SARS-CoV-2 seropositive adults may only require 1 dose rather than 2 doses of a messenger RNA vaccine[1,2]; however, these studies did not include older adults. Older adults living in nursing homes are at higher risk for severe COVID-19, and the immune response to the vaccine may differ from that of younger, healthier adults.

Related article

We compared IgG antibody levels after a single dose of BNT162b2 (Pfizer-BioNTech) vaccine in nursing home residents with or without prior COVID-19.

Methods | Between March and June 2020, we studied residents from nursing homes in Montpellier, France, facing a COVID-19 outbreak.[3] As soon as a resident developed COVID-19, the testing recommendations from the European Geriatric Medicine Society were followed[4] in that all residents were repeatedly tested using reverse transcriptase–polymerase chain reaction (RT-PCR) on nasopharyngeal swabs until no new cases were diagnosed. Participants provided written informed consent and the study was approved by the Montpellier University hospital institutional review board.

Six weeks after the end of the outbreak, all residents underwent blood testing for levels of IgG antibody against the SARS-CoV-2 nucleocapsid (N) protein.[3] All residents from 6 nursing homes were offered a first vaccine dose in January 2021. Three weeks later, all residents underwent blood testing to quantitatively assess IgG antibody levels against the SARS-CoV-2 spike (S) protein and N protein. Levels of IgG antibody against the SARS-CoV-2 receptor-binding domain were quantified using the SARS-CoV-2 IgG II Quant assay (Abbott Diagnostics). The results were expressed as arbitrary units (AU) per milliliter (positive threshold: 50 AU/mL; upper limit: 40 000 AU/mL). The IgG antibodies against the SARS-CoV-2 N protein were detected using the SARS-CoV-2 IgG assay (Abbott Diagnostics). The results were expressed as the signal to cutoff ratio (Abbott Alinity; Abbott Diagnostics) (positive threshold: 0.8 signal to cutoff ratio).

In residents with or without a prior history of COVID-19, we compared IgG antibody levels against SARS-CoV-2 proteins S and N by using 2-sided Wilcoxon Mann-Whitney tests. The statistical significance threshold was set at 5%. Analyses were performed using SAS Enterprise Guide version 7.3 (SAS Institute Inc).

Results | Of the 102 residents, 60 had no prior SARS-CoV-2 infection (COVID-19), 36 had a positive RT-PCR result and were seropositive for SARS-CoV-2 N-protein IgG in June 2020, and 6 had a positive RT-PCR result or were seropositive for SARS-CoV-2 N-protein IgG. Of the 36 residents who had a positive RT-PCR result and were seropositive for SARS-CoV-2 N-protein IgG in June 2020, 26 remained seropositive in January-February 2021 (72.2%).

All 36 residents with prior COVID-19 were seropositive for S-protein IgG after 1 vaccine dose vs 29 of 60 residents (49.2%) without prior COVID-19. Among residents with prior COVID-19, the median level of S-protein IgG was 40 000 AU/mL or greater (interquartile range [IQR], 22 801-≥40 000 AU/mL) vs 48.0 AU/mL (IQR, 14.0-278.0 AU/mL) in those without prior COVID-19 ($P < .001$; **Table**).

One resident with a positive RT-PCR result in April 2020 tested seronegative for N-protein IgG in June 2020 and January 2021; the resident had a robust S-protein IgG level (≥40 000 AU/mL). Five residents were found to be seropositive for N-protein IgG in June 2020 while having repeated negative RT-PCR results in April 2020. All 5 of these residents had high levels of S-protein IgG antibody (median, ≥40 000 AU/mL; IQR, ≥40 000-≥40 000 AU/mL). Among the 6 residents with a positive RT-PCR result or who were seropositive for N-protein IgG, the levels of S-protein IgG antibody were significantly higher

Table. Demographic Characteristics and Seroconversion Level of 96 Residents by COVID-19 Status During Past 7 to 10 Months

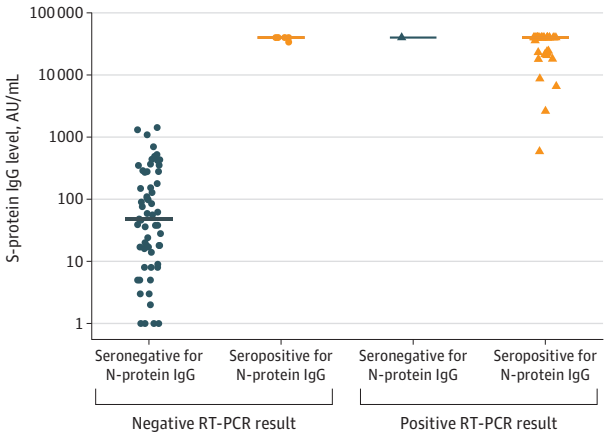
	Prior COVID-19		
	Yes (n = 36)[a]	No (n = 60)[b]	*P* value
Age, mean (SD), y	89.06 (6.69)	83.91 (8.38)	.002
Sex			
Female	29 (80.5)	42 (70.0)	.25
Male	7 (19.5)	18 (30.0)	
SARS-CoV-2 IgG level, No. (%)			
N protein >0.8 signal to cutoff ratio	26 (72.2)	0	<.001
S protein >50 AU/mL	36 (100)	29 (49.2)	<.001
S-protein IgG antibody, median (IQR) [range], AU/mL	≥40 000 (22 801-≥40 000) [588-≥40 000]	48.0 (14.0-278.0) [1-1426]	<.001

Abbreviations: AU, arbitrary units; IQR, interquartile range.

[a] Positive reverse transcriptase–polymerase chain reaction (RT-PCR) result for COVID-19 and seropositive for N-protein IgG.

[b] Negative RT-PCR result for COVID-19 and seronegative for N-protein IgG.

Figure. Levels of IgG Antibody Against the SARS-CoV-2 Spike (S) Protein After a Single Dose of Vaccine in Nursing Home Residents



Between March and June 2020, nursing home residents facing a COVID-19 outbreak had repeated reverse transcriptase–polymerase chain reaction (RT-PCR) testing. They underwent testing for IgG antibodies against the SARS-CoV-2 nucleocapsid (N) protein 6 weeks after the end of the outbreak. There were 60 residents who had no prior SARS-CoV-2 infection (repeated negative RT-PCR result for COVID-19 and were seronegative for N-protein IgG after the outbreak) and 42 had SARS-CoV-2 infection (COVID-19). Of the 42 residents who had SARS-CoV-2 infection, 36 had a positive RT-PCR result and were seropositive for N-protein IgG, 5 had repeated negative RT-PCR results but were seropositive for N-protein IgG after the outbreak, and 1 had a positive RT-PCR result during the outbreak but was seronegative for N-protein IgG after the outbreak. Levels of S-protein IgG that were measured 3 weeks after a single BNT162b2 vaccine dose was administered in January 2021 (1 dot per resident) were significantly lower in residents without prior COVID-19 vs those with prior COVID-19 ($P < .001$). Among residents with prior COVID-19, levels of S-protein IgG were not statistically significantly different between residents with a positive RT-PCR result for COVID-19 and were either seropositive or seronegative for N-protein IgG compared with those with a negative RT-PCR result for COVID-19 and were seropositive for N-protein IgG ($P = .25$). The horizontal blue and orange lines represent median values for S-protein IgG.

than among the 60 without prior COVID-19 ($P < .001$) and were not statistically significantly different from the 36 who had a positive RT-PCR result and were seropositive for N-protein IgG ($P = .26$; **Figure**).

Discussion | This preliminary study suggests that a single dose of BNT162b2 vaccine may be sufficient to obtain a high level of S-protein IgG antibody in nursing home residents previously diagnosed with COVID-19 based on RT-PCR results. This is in line with results based on IgG to spike trimer and neutralization antibody titers reported among health care workers with prior COVID-19 (diagnosed using SARS-CoV-2 IgG).[2]

Measuring S-protein IgG antibody levels just before the second vaccine dose could be useful in determining whether a second dose is required in individuals whose infection history is unknown. This could limit possible adverse effects related to reactogenicity in previously infected patients and spare precious vaccine doses. Limitations of the study include the small sample size, with possible lack of representativeness, and the lack of neutralization assays.

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