Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Future studies will be needed to determine the pathophysiology of kidney function decline after ICIs and evaluate strategies to slow eGFR decline.

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Supplementary Material

Supplementary File (PDF)

Figures S1-S2; Item S1; Tables S1-S6.

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Long-term Antibody Response to the BNT162b2 Vaccine Among Maintenance Hemodialysis Patients

To the Editor:

Patients undergoing maintenance hemodialysis (MHD) are known to have impaired immunologic responses to pathogens and vaccines. Their early humoral response to coronavirus disease 2019 (COVID-19) vaccines is reduced compared to that of healthy controls,[1,2] raising concerns of waning long-term immunity. Here, we report on antibody titers against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) 6 months after receiving the BNT162b2 (Pfizer-BioNTech) vaccine.

Our center provides dialysis treatment to 150 MHD patients. Israel's national vaccination strategy prioritized MHD patients. Patients not previously infected with SARS-CoV-2 were given 2 doses of BNT162b2 21 days apart, while those who recovered from COVID-19 received 1 dose, according to the national vaccination policy. The first doses were administered on December 12, 2020 and continued through January 2021 (Fig S1). Detailed methods are in Item S1.

Antibodies targeting SARS-CoV-2 spike protein S1 were measured using the Abbott AdviseDx SARS-CoV-2 IgG II Quant assay on an Architect i200SR analyzer. A cutoff of ≥50 AU/mL was considered a meaningful antibody response, as previously suggested.[2] The study was approved by the Institutional Review Board, and informed consent was obtained from all 105 participants.

Average time from first vaccine dose to serological testing was 177 ± 28 days. Seven participants (6.7%) were previously infected with SARS-CoV-2 and received only 1 dose; the remaining 98 were vaccinated twice.

Mean age was 69.8 ± 14.2 years, 69 (67%) were male, and mean dialysis vintage was 32.2 ± 27.3 months. A total of 87 (82.8%) patients developed anti-S1 antibody level ≥50 AU/mL, including all 7 who recovered from COVID-19 and were vaccinated once and 80 of 98 (82%) who received 2 doses.

Among the 80 patients with anti-S1 antibody level ≥50 AU/mL, mean levels were 951 ± 2129 AU/mL, significantly lower than the level observed in the 7 who had recovered from COVID-19 (11,771 ± 17,764 AU/mL; $P < 0.001$) (Fig 1).

Among those vaccinated twice, 18 of 98 (19%) had low or undetectable antibody levels, despite comparable intervals after the first vaccine dose (179.2 ± 14.3 vs 179.4 ± 22.5 days in those with anti-S1 antibody level ≥50 AU/mL, $P = 0.9$). Except for long-term immunosuppressive therapy, baseline characteristics between the groups were similar (Table 1). Baseline characteristics of recovered patients are detailed in Table S1.

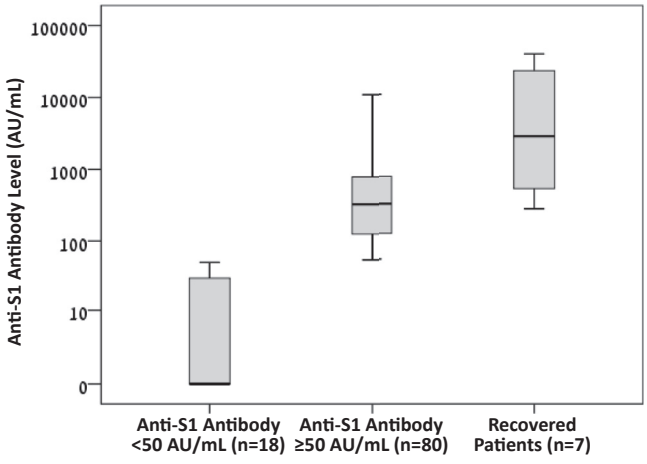

Figure 1. Logarithmic scale box plot of antibody levels among groups with high (≥50 AU/mL) and low (<50 AU/mL) antibody responses, and those who recovered from SARS-CoV-2 infection.

Among 6 of 98 who were receiving immunosuppressive therapy, only 1 developed anti-S1 antibody level ≥50 AU/mL. Long-term immunosuppressive therapy was the most important predictor of low antibody levels among patients vaccinated twice (odds ratio, 30.4; $P < 0.001$; Table S2). Two patients had undetectable antibody levels: 1 treated with rituximab for idiopathic membranous nephropathy and the other receiving VCD protocol (bortezomib, cyclophosphamide, dexamethasone) for multiple myeloma.

Antibody levels were inversely correlated with age (Spearman $\rho = -0.312$, $P = 0.001$). Among patients older than 80 years, mean antibody levels were lower (257 ± 362 AU/mL) than in those aged 18-49 ($P = 0.002$) and 50-59 ($P = 0.003$) years and were nominally less than the mean in all other patients (1,947 ± 6,235 AU/mL, $P = 0.2$, Fig S2).

Dialysis adequacy, vintage, and laboratory test results (ie, C-reactive protein, albumin) were not associated with antibody levels.

High rates of humoral response were found among MHD patients who were not receiving immunosuppressive therapy. Among this group, anti-S1 antibody level ≥50

Table 1. Baseline Characteristics of Study Cohort Who Were Vaccinated Twice

Characteristic	Anti-S1 Antibody Level <50 AU/mL (n = 18)	Anti-S1 Antibody Level ≥50 AU/mL (n = 80)	*P*
Age, y	74.3 ± 11.9	69.3 ± 14.8	0.2
Male sex	14 (78%)	51 (64%)	0.3
Dialysis vintage, mo	30.6 ± 19.9	30.3 ± 25.1	0.9
Dry weight, kg	72.8 ± 17.1	78.4 ± 20	0.3
Diabetes mellitus	8 (44%)	56 (70%)	0.04
Hypertension	13 (72%)	65 (81%)	0.4
Ischemic heart disease	9 (50%)	27 (34%)	0.2
Heart failure	5 (28%)	27 (34%)	0.6
Peripheral vascular disease	0 (0%)	11 (14%)	0.1
Chronic lung disease	3 (17%)	10 (13%)	0.6
Active malignancy	1 (5.6%)	1 (1.2%)	0.2
Long-term immunosuppressive therapy	5 (28%)	1 (1%)	<0.001
Hemoglobin, g/dL	10.7 ± 1.6	10.5 ± 1.2	0.5
Serum creatinine, mg/dL	6.6 ± 1.9	7.4 ± 2.4	0.3
Total calcium, mg/dL	8.3 ± 0.6	8.5 ± 0.8	0.4
Phosphorus, mg/dL	4.9 ± 1.3	5.3 ± 1.5	0.5
Serum albumin, g/dL	3.4 ± 0.6	3.7 ± 0.4	0.07
C-reactive protein	3.9 ± 5.7	1.6 ± 2.3	0.03
Neutrophil-to-lymphocyte ratio	4.4 ± 2	3.9 ± 2.2	0.5
Kt/V	1.22 ± 0.21	1.29 ± 0.23	0.2
Urea reduction ratio	64.8 ± 7.3	67.1 ± 6.4	0.2

Values presented as absolute number (percentage) or mean ± standard deviation. $P < 0.05$ considered statistically significant. Abbreviation: AU, arbitrary units.

AU/mL was detected in 100%, 93%, and 89% of patients less than 60, 70, and 80 years, respectively. This suggests that age and immunosuppressive therapy are the main predictors of humoral response to BNT162b2 among MHD patients.

This study had several limitations. Sample size was relatively small. Serological tests were performed only once for each participant, and earlier antibody levels were not available. Previous studies reported high rates of early (14-30 days) seroconversion after BNT162b2, exceeding 90%.[2-4] While we suspect the lower rates in our study may result from decay of the humoral response over time, we cannot exclude that low antibody levels at 6 months postvaccination represent weak initial vaccine responses. This distinction may prove critical to clarify when considering additional "booster" vaccine doses. Other parts of the immune system, most importantly the cellular response, were not assessed. While serology is commonly used as a surrogate marker for protection from COVID-19, the clinical implications of antibody levels have not been validated. Two recent studies reported that postvaccination antibody titers are highly predictive of immune protection from COVID-19,[5,6] and a real-world study also reported that breakthrough COVID-19 correlates with low antibody titers the week before infection.[7] However, the protective threshold antibody level is currently unknown.

Our findings of high antibody levels among MHD patients who recovered from COVID-19 correlate with previous studies of vaccinated MHD patients,[4,8,9] and with data in the general population. In addition, a large study found sustained antibody levels in seropositive MHD patients, even without vaccination.[10]

In summary, hemodialysis patients maintain a significant humoral response following BNT162b2 vaccine, especially in the absence of immunosuppression.

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Supplementary Material

Supplementary File (PDF)

Figures S1-S2; Item S1; Tables S1-S2.

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