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Table 1 | Clinical characteristics of patients on peritoneal dialysis who seroconverted after the first or second dose of the mRNA-1273 vaccine

Characteristic	Seroconverted after only the first dose (n = 20 [62.5%])	Seroconverted after the second dose (n = 11 [34.38%])
Age, yr	62.2 ± 16.0	65.7 ± 16.3
Male sex	9 (45)	2 (18.2)
Diabetes	3 (15)	3 (27.3)
HbA_{1C}	5.5 ± 0.8	5.6 ± 0.9
Body mass index, kg/m^2	26.4 ± 4.2	26.2 ± 6.5
Overweight	7 (35)	2 (18.2)
Obesity	6 (30)	2 (18.2)
Immunosuppressive therapy	2 (10)	2 (18.2)
Charlson index	4.95 ± 2.16	5.18 ± 2.48
Albumin, g/dl	4.00 ± 0.33	3.92 ± 0.56
C-reactive protein, mg/dl	0.57 ± 1.11	0.62 ± 1.15
Vitamin D_3, ng/ml	19.35 ± 10.87	18.57 ± 5.67
Lymphocytes, $\times 10^6$	1450 ± 79	1254.55 ± 628
Hemoglobin, g/dl	11.82 ± 1.79	10.97 ± 1.69
Dialysis vintage, mo	64.48 ± 122	26.49 ± 20
Weekly Kt/V	2.02 ± 0.43	1.88 ± 0.41
Anti-S1 IgG titer, U/ml	17.53 ± 32.89	76.81 ± 70.45

Anti-S1 IgG, IgG antibodies to the receptor-binding domain of the S1 spike antigen of severe acute respiratory syndrome coronavirus 2; HbA_{1C}, glycated hemoglobin. Data are expressed as mean ± SD or n (%).

of the S1 spike antigen of SARS-CoV-2, at 3 moments: before administering the first dose, before administering the second dose, and 3 weeks after the latter (see Figure 1).

Two of 34 patients had positive serology at baseline and were thus excluded from the analysis of seroconversion after vaccination. From the remaining 32, 20 (62.5%) generated detectable IgG antibodies to the receptor-binding domain of the S1 spike antigen of SARS-CoV-2 after only 1 dose whereas 11 (34.38%) responded only after 2 doses were administered. Demographic characteristics, comorbidities, and laboratory parameters were analyzed, seeking correlation between them and either the humoral response intensity (IgG antibodies to the receptor-binding domain of the S1 spike antigen of SARS-CoV-2 titers) or its velocity (seroconversion after 1 dose vs. seroconversion after 2 doses). However, no statistically significant differences were observed between groups (see Table 1). Only 1 patient did not seroconvert after completing vaccination, and, although the patient was a 77-year-old diabetic obese man, we did not find any compelling reason for this lack of response.

SARS-CoV-2 vaccination is of particular importance in high-risk populations such as patients on peritoneal dialysis. The 97% of response observed, high in comparison to kidney transplant recipients (25%)[4] and similar to patients on hemodialysis (90%),[5] reinforces the idea that this population should be vaccinated as soon as possible as most of them seroconvert and are therefore likely protected from severe coronavirus disease 2019.

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Occurrence of severe COVID-19 in vaccinated transplant patients

To the editor: Vaccination plays a paramount role in the current coronavirus disease 2019 (COVID-19) pandemic response. Although mRNA-based vaccines elicit a strong immune response in the general population, the immunization rates of immunocompromised patients—including solid organ transplant recipients—have not been specifically investigated in mRNA-1273 and BNT162b2 pivotal trials.[1,2] This knowledge gap should be addressed urgently, as these patients are highly prone to developing severe COVID-19.

Here, we describe a total of 55 solid organ transplant recipients (52 kidney and 3 simultaneous kidney–pancreas) who developed COVID-19 after receiving 2 doses of mRNA-based severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) vaccines. A total of 9 and 46 patients received the mRNA-1273 (Moderna) and the BNT162b2 (Pfizer-BioNTech) vaccine, respectively. The study sample included 32 men and 23 women (median age: 60 years, interquartile range: 49−67 years; mean time from transplantation: 66 months, interquartile range: 33−138 months). Six patients were treated with belatacept, and 1 with rituximab. COVID-19 symptoms appeared after a median of 22 days after the second vaccine dose (interquartile range: 13−36 days; Figure 1). Of the 55 patients, 15 (27%) required hospitalization for oxygen therapy. Of these, 6 were admitted to an intensive care unit, and 3 died. Among the 25 patients with available data on anti–SARS-CoV-2 antibodies between the second vaccine dose and the onset of COVID-19 symptoms, 24 had negative serology, and 1 had positive results with weak antibodies levels (577 AU/L on the day of the second

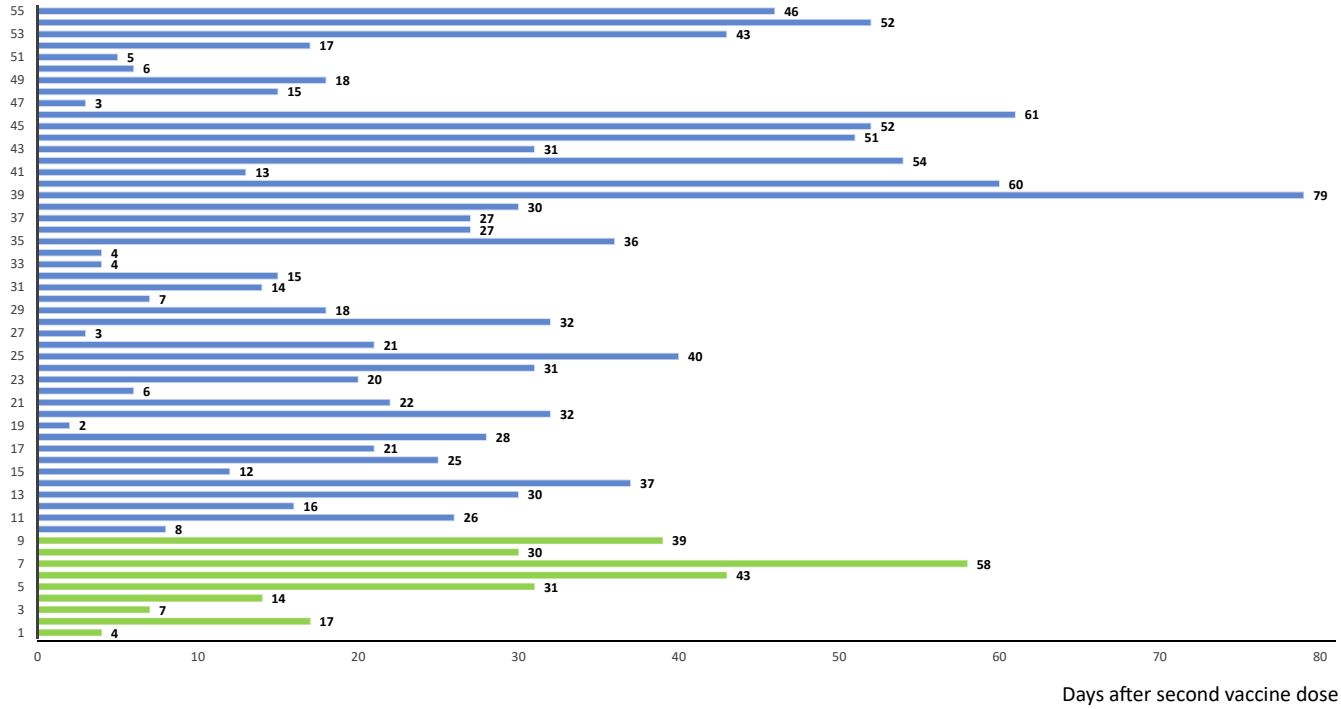

Figure 1 | Time from the second vaccine dose to the onset of coronavirus disease 2019 (COVID-19) symptoms in each kidney transplant recipient. Y-axis represents each patient case. In all cases, the second dose was administered at a timepoint from February 8 to April 22, 2021. Green bars indicate patients who received the Moderna vaccine; blue bars indicate patients who received the Pfizer/BioNTech vaccine.

injection; Architect Abbot test). SARS-CoV-2 sequencing, which was performed in 24 cases, revealed 5 wild-type viruses, 17 UK variants, 1 Marseille variant, and one B 1.160 variant.

Growing evidence indicates that solid organ transplant recipients who receive mRNA-based vaccines have low immunization rates, with <50% of patients showing antibodies against the SARS-CoV-2 spike protein.[3,4] Although immunosuppressive drugs are thought to play a key role in this phenomenon, the occurrence of severe COVID-19 after mRNA-based vaccination in immunocompetent or immunocompromised subjects has not yet been reported. A potential explanation for persisting disease susceptibility may lie in an absent humoral response, coupled with a limited or insufficient T-cell response, even after the second vaccine dose.

Vulnerable immunocompromised patients who are nonresponsive to mRNA-based SARS-CoV-2 vaccines should undergo close serologic follow-up and/or maintain strict sanitary protection measures. Other management strategies may include priority vaccination of the patients' households and the development of more-effective vaccination schemes.

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Evidence of cell-mediated immune response in kidney transplants with a negative mRNA vaccine antibody response

To the editor: Benotmane *et al.* have demonstrated that only 48% of renal transplant patients (RTxP) develop a serologic response after vaccination with an mRNA-based severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) vaccine.[1] Likewise, we reported that only 22% of RTxP develop anti–SARS-CoV-2 IgG after vaccination with the mRNA-based SARS-CoV-2 vaccine BNT162b2 (Pfizer-BioNTech).[2] To further characterize the immunologic response, we measured the cellular response to BNT162b2 vaccination in 7 RTxP

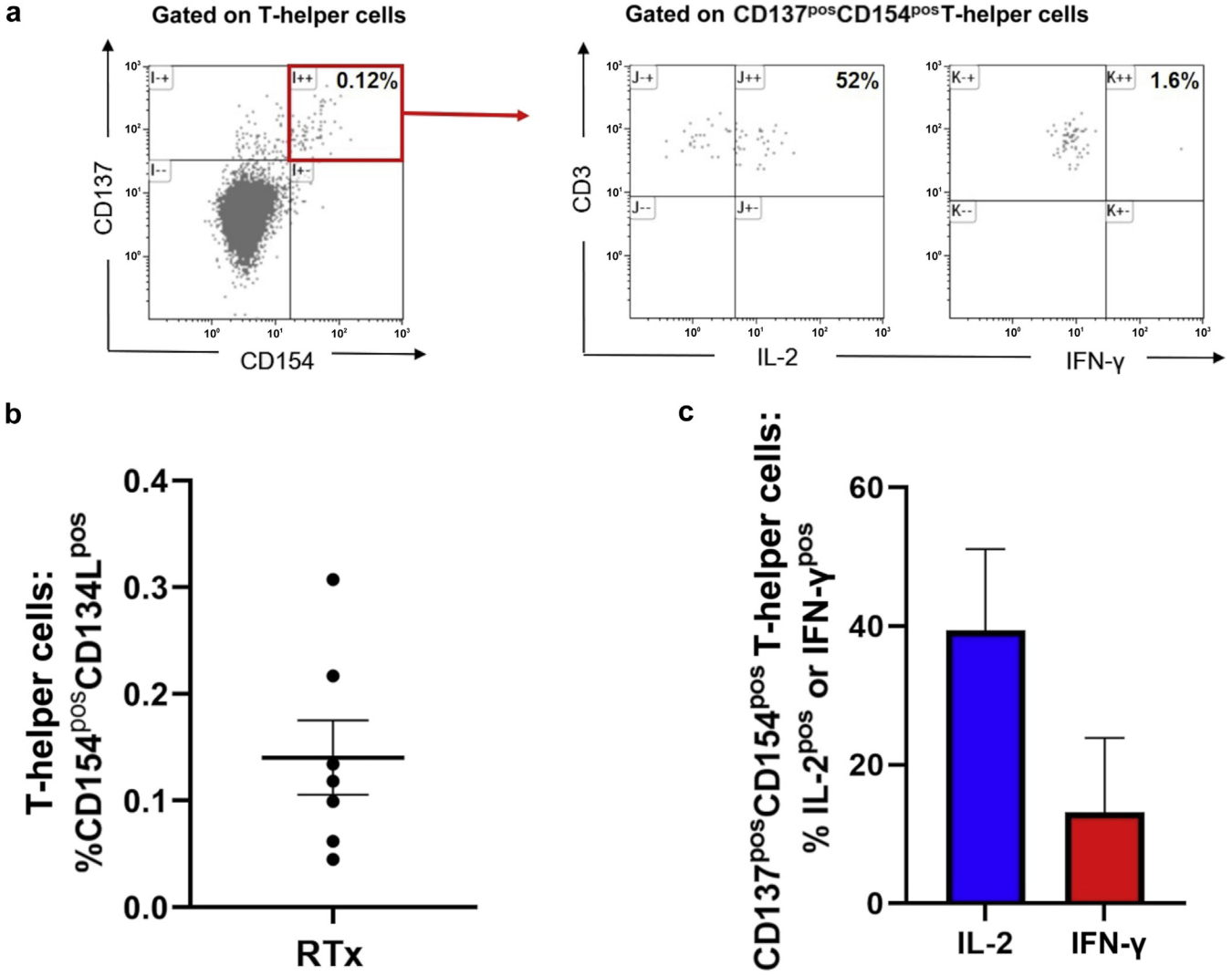

Figure 1 | S-protein–reactive T-helper cells in renal transplant patients after vaccination. (**a**) Peripheral blood mononuclear cells were freshly isolated from whole blood and cultured for 16 hours in the presence of overlapping peptide pools for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) spike protein and brefeldin A. T cells coexpressing CD154 and CD137 were defined as S-protein–specific. The cytokine profile of S-protein–specific T cells was characterized, and interleukin-2 (IL-2)/interferon-γ (IFN-γ) expression was determined. (**b**) In all 7 patients, S-protein–specific T-helper cells were detectable. (**c**) S-protein–specific T-helper cells produced IL-2 and IFN-γ. Pos, positive.