DOI: 10.1111/ajt.16618

COVID-19 infection in solid organ transplant recipients after SARS-CoV-2 vaccination

To the Editor:

The prevalence and mortality of COVID-19 are higher in solid organ transplant recipients (SOTs) compared to the general population.[1-3] Two SARS-CoV-2 messenger RNA (mRNA) vaccines have been approved by the FDA; both are 95% efficient in preventing COVID-19 in the general population. The efficacy of these vaccines in SOTs remains to be unknown as immunocompromised patients have been excluded from the vaccine studies. Initial reports indicate low immunogenicity in SOTs with only 11%–17% having detectable antispike antibody 20–28 days after one vaccine dose.[4,5] This finding concerned the transplant community but there is hope that the second vaccine dose will be more efficacious.

After obtaining Mayo Institutional Review Board (IRB) approval, we reviewed the records of 7 SOTs (2 heart, 1 lung, 1 heart/kidney, 1 kidney/pancreas, and 2 kidney alone) who received either 1 (n = 2, 28%) or 2 (n = 5, 71%) doses of the BNT162b2 (Pfizer-BioNTech) or the mRNA-1273 (Moderna) SARS-CoV-2 mRNA vaccines and developed COVID-19 after a median of 28 (6–44) days of their last dose. Demographics of these patients are summarized in Table 1. Five of the 7 (71%) patients had blood type A, 1 had AB, and 1 had O blood type. All patients were symptomatic. Fever developed in 4 (57%), 4 (57%) had hypoxia/dyspnea, and 2 (28%) had diarrhea. Diagnosis was confirmed in all patients with polymerase chain reaction (PCR) of nasal swabs. Six of the patients had antibodies to COVID-19 tested at presentation. Of these, five patients had undetectable antispike antibodies and one patient, who had received his second mRNA-1273 vaccine dose 44 days prior, had low titer antispike antibody (1.4 U/ml, reference range <0.8 U/ml). None of the six tested had detectable nucleocapsid antibody. Five patients required hospitalization, four due to hypoxia and lung infiltrates that required supplemental oxygen but no intubation, while one patient was hospitalized with acute kidney injury from severe vomiting and diarrhea. All hospitalized patients received remdesivir, three received dexamethasone, four received convalescent plasma, and two received tocilizumab. Two patients had received monoclonal antibody treatment. Antimetabolites were discontinued in three of five hospitalized patients. All five patients were discharged, three on supplemental oxygen. Clinical presentation, management, and outcome of these seven patients are summarized in Table 2.

Of the 1624 SOT recipients transplanted in our center over the last 6 years who are Florida residents, 629 (39%) received two doses and 163 (10%) have received one dose of the BNT162b2 (Pfizer-BioNTech) or the mRNA-1273 (Moderna) SARS-CoV-2 mRNA vaccine. Five out of the seven patients in this report were Florida residents suggesting a post-vaccination infection rate of approximately 0.6% which is much higher than the rate of 0.05% reported in the general population,[6] but this needs to be confirmed with more complete vaccination data.

In conclusion, we report seven SOTs with undetectable or low titer antispike antibodies who developed COVID-19 infection after receiving one or two doses of the SARS-CoV-2 mRNA vaccine. The clinical presentation and course of these patients were comparable to those of SOTs who had COVID-19 infection and have not been vaccinated.[2] This finding suggests that SOTs are still at risk of acquiring COVID-19 infection even after vaccination and calls to continue measures to prevent COVID-19 infection including masking, social distancing, and regular hand hygiene in these patients even after receiving the required doses of the SARS-CoV-2 vaccine. Our findings also call for further research to study the efficacy of vaccination, to examine the post-vaccination infection rate, and to identify methods to boost the vaccine-related immune response in these immunocompromised patients.

KEYWORDS

clinical research/practice, editorial/personal viewpoint, infection and infectious agents – viral, organ transplantation in general, patient safety

DISCLOSURE

The authors of this manuscript have no conflicts of interest to disclose as described by the *American Journal of Transplantation*.

Hani M. Wadei[1]
Thomas A. Gonwa[1]
Juan C. Leoni[1]
Sadia Z. Shah[1]
Nabeel Aslam[2]
Leigh L. Speicher[2]

[1]*Department of Transplant, Mayo Clinic, Jacksonville, Florida*
[2]*Department of Internal Medicine, Mayo Clinic, Jacksonville, Florida*

TABLE 1 Baseline characteristics of 7 SOT recipients who had COVID-19 infection after SARS-COV-2 mRNA vaccination

Patient	Organ	Age	Gender	Race	Blood type	Cause of organ failure	Previous organ Tx	Induction IS	Maintenance IS	Rejection history	Years from Tx to COVID-19	Vaccine name	Number of doses	Days from last vaccine dose to COVID-19 diagnosis
1	Double Lung	64	M	C	A	COPD	No	ATG	Bela/Pred/MMF	Yes	7.37	Pfizer/ BioNTech	2	35
2	Heart/ Kidney	68	M	C	A	ICM/FSGS	No	ATG	Tac/MMF/Pred	No	3.21	Pfizer/ BioNTech	2	26
3	Kidney	60	M	AA	A	DM	No	Alemtuzumab	Tac/MMF/Pred	No	1.3	Moderna	2	44
4	Kidney	42	M	AA	O	HIVAN	Yes	ATG	Tac/MMF/Pred	No	0.58	Pfizer/ BioNTech	1	6
5	Kidney Pancreas	43	M	C	A	DM	No	ATG	Tac/MMF/Pred	Yes	11.35	Moderna	1	28
6	Heart	69	M	C	AB	ICM	No	Basiliximab	Tac/MMF/Pred	No	0.85	Pfizer/ BioNTech	2	6
7	Heart	67	M	C	A	NICM	No	Basiliximab	Tac/MMF/Pred	No	0.58	Moderna	2	19

Abbreviations: AA, African American; ATG, antithymocyte globulin; Bela, Belatacept; C, Caucasian; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; HIVAN, HIV associated nephropathy; ICM, ischemic cardiomyopathy; IS, immunosuppression; M, male; MMF, mycophenolate mofetil; NICM, nonischemic cardiomyopathy; Pred, prednisone; Tac, Tacrolimus.

TABLE 2 Clinical presentation, serological findings, and outcome of 7 SOT recipients who had developed COVID-19 infection after SARS-COV-2 vaccination

Patient	Presentation	Hospitalization, duration	Hypoxia (O_2 Sat < 92% on RA)	Lung infiltrate	Intubation	Lymphopenia (absolute lymphocytes <900/mcL)	AKI (Cr >0.3 mg/dl from baseline)	Antispike antibody at COVID-19 diagnosis	Antinucleocapside antibody at COVID-19 diagnosis	IS management	COVID-19 specific treatment	Outcome
1	Fever, rigors, SOB	Yes, 5 days	Yes	Bilateral R>L	No	Yes	No	Negative	Negative	MMF held	MAB1, Remd, Dexa, CP, Tocilizumab	DC on RA
2	Fever, chills, SOB, cough, N/V	Yes, 8 days	Yes	Bilateral R>L	No	Yes	No	Negative	Negative	MMF dose reduced	Remd, Dexa, CP	DC on 2 L O_2
3	Cough	No	No	None	No	Yes	No	Pos (1.4 U/ml)	Negative	No change	None	Recovered
4	N/V, diarrhea	Yes, 3 days	No	None	No	Yes	Yes	Negative	Negative	MMF held	Remd	DC on RA
5	Fever, cough, SOB	Yes, 11 days	Yes	Bilateral	No	Yes	Yes	Negative	Negative	MMF held	Remd, Dexa, CP, Tocilizumab	DC on 2 L O_2
6	Cough, runny nose	No	No	N/A	No	No	No	ND	ND	No change	MAB 2	Recovered
7	Cough, chills, weakness	Yes, 5 days	Yes	Bilateral	No	Yes	Yes	Negative	Negative	No Change	Remd, CP	DC on 2 L O_2

Abbreviations: CP, convalescent plasma; DC, discharged; Dexa, dexamethasone; L, left; MAB 1, bamlanivimab; MAB2, casirivimab/imdevimab; N/V, nausea and vomiting; ND, not done; R, right; RA, room air; Remd, remdesivir; SOB, shortness of breath.

Correspondence:
Hani M. Wadei
Email: wadei.hani@mayo.edu

ORCID

Hani M. Wadei https://orcid.org/0000-0003-4886-0897

REFERENCES

1. Hasan I, Rashid T, Suliman S, et al. Predictors of disease severity and outcome of hospitalized renal transplant recipients with COVID-19 infection: a systematic review of a globally representative sample. *Rom J Intern Med*. 2021;59(1):10-42.
2. Pereira MR, Mohan S, Cohen DJ, et al. COVID-19 in solid organ transplant recipients: Initial report from the US epicenter. *Am J Transplant*. 2020;20(7):1800-1808.
3. Akalin E, Azzi Y, Bartash R, et al. Covid-19 and kidney transplantation. *N Engl J Med*. 2020;382(25):2475-2477.
4. Boyarsky BJ, Werbel WA, Avery RK, et al. Immunogenicity of a single dose of SARS-CoV-2 messenger RNA vaccine in solid organ transplant recipients. *JAMA*. 2021. https://doi.org/10.1001/jama.2021.4385
5. Benotmane I, Gautier-Vargas G, Cognard N, et al. Weak anti-SARS-CoV-2 antibody response after the first injection of an mRNA COVID-19 vaccine in kidney transplant recipients. *Kidney Int*. 2021. https://doi.org/10.1016/j.kint.2021.03.014
6. Keehner J, Horton LE, Pfeffer MA, et al. SARS-CoV-2 infection after vaccination in health care workers in California. *N Engl J Med*. 2021. https://doi.org/10.1056/NEJMc2101927