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# 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*.

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**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.

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