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SHORT COMMUNICATION

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Lack of immune response after mRNA vaccination to SARS-CoV-2 in a solid organ transplant patient

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Abstract

The recent approval and distribution of vaccines against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) have been a major development in the fight against the current coronavirus disease 2019 (COVID-19) pandemic. The first two vaccines approved in the United States, mRNA-1273, and BNT162b2, are both messenger RNA (mRNA) based and highly effective in immunocompetent persons, but efficacy in patients on immunosuppressants has not been established. Additionally, data suggests these patients are less likely than immunocompetent people to develop neutralizing antibodies after COVID-19 infection. Given the high risk of poor outcomes in organ transplant and immunosuppressed patients, effective vaccination is paramount in this group. We present the first reported case of a solid organ transplant patient who failed to achieve seroconversion after two doses of mRNA vaccine. This case has significant implications about how immunosuppressed patients should be counseled about SARS-CoV-2 vaccination and the protection provided. Physicians should remain clinically suspicious for infection with SARS-CoV-2 despite vaccination status in solid organ transplant patients.

KEYWORDS

disease control, epidemiology, immnopathology, immune responses, neutralization, systemic immunity, SARS coronavirus, transplantation, vaccines/vaccine strains, virus classification

1 | INTRODUCTION

The recent approval and distribution of vaccines against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) have been a major development in the fight against the current coronavirus disease 2019 (COVID-19) pandemic. The first two vaccines approved in the United States, mRNA-1273, and BNT162b2, are both messenger RNA (mRNA) based and highly effective. In Phase 3 trials, the two agents led to a 94% decrease in symptomatic COVID-19 cases, including severe cases.[1,2] In Phase 2 trials, measured immunogenicity was universally induced in otherwise healthy adults, including the elderly.[3,4]

Patients on immunosuppressant medications have been generally excluded from the trials upon which approval of these vaccines are based.[5] Based on prior experience with other vaccines, it is possible that severely immunocompromised hosts and those with diminished protective responses may be less able to form appropriate immune responses to vaccination,[6] potentially diminishing or even eliminating the protective effect against SARS-CoV-2. This could have serious implications for these patients and those close to them. We present the first reported case of a solid organ transplant (SOT) patient who failed to achieve seroconversion after two doses of mRNA vaccine.

1.1 | Case report

The patient is a 55-year-old Caucasian female, 4 years status post bilateral lung transplant for idiopathic bronchiectasis. She has no other significant comorbidities and has done well posttransplant with

only one hospitalization for a nontraditional presentation of Bell's Palsy. Her posttransplant medication regimen has been stable and comprises prednisone 5 mg daily, mycophenylate 1000 mg twice daily, tacrolimus 2 mg twice daily, alendronate 70 mg weekly, aspirin 81 mg daily, azithromycin 125 mg daily, famotidine 20 mg daily, rosuvastatin 20 mg daily, sulfamethoxazole-trimethoprim single strength daily, magnesium oxide 400 mg twice daily, calcium citrate 400 mg twice daily, vitamin D3 1000 IU daily, and a daily multivitamin. Routine laboratory testing at the time of vaccination was consistent with appropriate therapeutic blood levels of tacrolimus.

The patient received the first dose of BNT162b2, Lot number EL 1284, on December 28, 2020, and reported mild right deltoid pain at the injection site. She received the second dose of the same vaccine, Lot number EL 1283, on January 18, 2021, in the opposite arm and again reported only mild injection site pain. She took acetaminophen 650 mg every 6 h for 24 h after this second injection. Aside from the injection site pain, she remained otherwise asymptomatic. Sixteen days after the second vaccine dose, the patient had the Coronavirus SARS-CoV2 immunoglobulin G Ab test performed. The results returned a negative/nonreactive result indicating a lack of seroconversion.

2 | DISCUSSION

Solid organ transplant patients are at high risk of poor outcomes with COVID-19 with mortality rates reported from 13% to 30%.[7–9] Thus effective prevention is paramount in this group. Vaccination has emerged as an effective form of prevention, potentially allowing high-risk individuals to resume a more normal lifestyle without strict isolation from other people. However, little is known about vaccine effectiveness in SOT patients, as patients on immunosuppressant medications were excluded from the preliminary and Phase 3 vaccine trials.[1–4] Phase 3 trials of both mRNA-1273 and BNT162b2 did include a small number of human immunodefeciency virus (HIV)-positive patients, but the results were not stratified by HIV status, and the number of enrolled HIV-positive patients was quite small.[1,2] A small study of 187 transplant patients showed no serious adverse events with SARS-CoV-2 vaccination, but no data on efficacy was reported.[10]

Although immunogenicity has not been well described in SOT patients post-vaccination, several studies have reported on the rate of seroconversion in this patient group post-COVID-19 infection. These patients appear to be less likely than immunocompetent patients to develop neutralizing antibodies postinfection.[11–13] Burack et al.[13] evaluated 70 posttransplant patients who contracted COVID-19 and found that only half had nucleocapsid antibodies at 7 days after infection. Similarly, Boyarski et al.[11] found a 77% seroconversion rate among 18 COVID-19 infected SOT patients at 90 days. Interestingly, there were 2 lung transplants in this study and neither had developed antibodies. Chavarot et al.[12] found that SARS-CoV-2 antibodies go away quickly in transplant patients after infection.

A direct link between lack of antibody formation and risk for infection has not been established. Whether postinfection or post-vaccination, no study has evaluated the likelihood of infection or re-infection in those with a robust antibody response versus those without one. Given the current understanding of mechanisms behind vaccine efficacy, however, our case, in conjunction with evidence that COVID-19 infected SOT patients are less likely to develop a measurable immune response,[11–13] raises serious concerns that these patients may remain vulnerable to COVID-19 infection, including possibly severe infections, even after vaccination or previous infection. These findings have important implications regarding how immunocompromised patients should be counseled about whether or not to receive vaccination and how to adjust their behaviors afterwards.

3 | CONCLUSION

We report a case of a lung transplant patient who failed to develop neutralizing antibodies to SARS-CoV-2 after receiving two doses of the BNT162b2 mRNA vaccine. More data is urgently needed on the serologic and clinical efficacy of currently available vaccines in organ transplant and other severely immunocompromised patients. Until more data becomes available, these patients should be advised that vaccination may not confer the same degree of immunity reported in currently available studies and physicians should remain clinically suspicious for infection with SARS-CoV-2 in solid organ transplant patients regardless of vaccination status.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests.

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