Infection Diseases and Organ Transplantation

SARS-CoV-2 Antibody Kinetics after Two Doses of mRNA Vaccination in Solid Organ Transplant Recipients: Multicenter Study

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Background

The infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has resulted in a global pandemic. With respect to transplant management, the SARS-CoV-2 outbreak presents a very serious problem for the treatment of immunosuppressed recipients. Therefore, vaccination has been initiated worldwide for infection control. However, low reactivity of antibody production after vaccination is a concern among solid organ transplantation (SOT) recipients. There is no statistical evidence of antibody acuity after vaccination or efficacy among SOT recipients. Furthermore, the period of antibody titer peak and kinetics after the second dose of vaccination is unknown.

We conducted a multicenter study (across Tokyo, Osaka, and Kyoto) including kidney, liver, heart, lung, and simultaneous pancreas-kidney (SPK) recipients.

Materials and methods

This clinical trial was conducted from March 2021 to March 2022 and included kidney, liver, heart, lung, and SPK recipients. This multicenter study included six hospitals in Tokyo, Osaka, and Kyoto for data collection. All participants were administered two doses of mRNA vaccine (BNT162b2, Pfizer, or mRNA-1273, Moderna), as indicated. Serum samples from each patient were subsequently collected before the first (pre1) and the second doses of vaccination (pre2) and at 1 (1M), 3 (3M), and 6 months (6M) after the second dose of vaccination. For the assessment of SARS-CoV-2 antibodies, SARS-CoV-2 S-IgG and N-IgG levels were measured (Elecsys®, Roche).

Results

A total of 631 patients were enrolled. Of these, 28 patients who had infection, were positive for N-IgG antibody, or both, within the test period were excluded, and the remaining 603 recipients were the participants in this study.

First, among SOT recipients, the S-IgG antibody titer gradually increased and persisted within 6 months after the two vaccination doses. All types of SOT recipients showed a gradual elevation of the S-IgG antibody titer. The kidney, Lung, and SPK transplant recipients showed poorer antibody titer elevations than other organ transplants.

Second, when all types of SOT recipients were classified by age (<45, 45–54, 55–64, and ≥65 years), the older age groups showed significantly poorer antibody titer elevation than younger age groups.

Third, when all types of SOT recipients were divided into four groups by period after transplantation (<2, 2–5, 6–10, and > 10 years); those with shorter periods after transplantation showed significantly poorer antibody titer elevation than those with longer periods.
Finally, regarding the use of immunosuppressants, steroid and MMF users showed significantly poorer antibody titer elevation than those who did not use these drugs.

Conclusion

According to previous reports, only approximately 20–55% of SOT recipients acquire antibodies after the second vaccination dose. In contrast, our study showed that the rate at which SOT recipients acquired SARS-CoV-2 antibodies was approximately 40% one month after vaccination. However, the rate gradually increased and reached approximately 70% 6 months after the second vaccination dose, which was significantly higher than that in previous reports. Furthermore, in most SOT recipients, peak antibody titers were observed 6 months after the second vaccination dose.

Older age, a short period after transplantation, and use of immunosuppressive drugs were risk factors for the low reactivity of antibody production, similar to previous reports.