Humoral Response to mRNA versus an Adenovirus Vector-Based SARS-CoV-2 Vaccine in Dialysis Patients

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Patients on maintenance dialysis may be immunocompromised and have comorbidities that modulate the response to coronavirus disease 2019 (COVID-19) vaccines. We conducted a quality improvement project to characterize the antibody response to COVID-19 vaccination in two dialysis clinics in Arizona, comparing the response to the single dose of Ad26.COV2.S vaccine administered in the dialysis clinic, or the two-dose mRNA vaccine (mRNA-1273 or BNT162b2) administered in the community.

Antibody response was assessed using a semiquantitative chemiluminescent assay for IgG directed against the receptor binding domain of the S1 subunit of severe acute respiratory syndrome coronavirus 2 spike antigen (ADIVIA Centaur XP/XPT sCOV; Siemens Healthcare Diagnostics Inc.; Tarrytown), with an index range of 0.5–750. Indices of ≥1.00 were considered reactive (1). Although a relationship between index value and clinically relevant immunity has not been defined, indices >7 meet the US Food and Drug Administration requirement of an acceptable level of a neutralizing titer (2,3). Measurements were conducted on remnant blood samples from routine blood work. All available samples were assessed; however, many patients were vaccinated before the start of the quality improvement project and did not have prevaccination measurements.

All patients (n=76) included in the analysis had completed vaccination with Ad26.COV2.S (n=45) or mRNA (n=31), with a mean time between doses of 27 and 25.5 days for mRNA-1273 and BNT162b2, respectively) vaccines, and postvaccination antibody results available ≥14 days after the final vaccination dose. Prevaccine antibody measurements were available for 45 patients (59%). Multiple measurements were obtained for 72 out of 76 patients. First (≥14 days postvaccination) and last (most recent) antibody measurements are presented in this letter. Patients were classified as having a history of COVID-19 (n=12) if they had a confirmed diagnosis in their electronic medical record (n=3), had antibodies detected in prevaccine samples (n=2), or both (n=7). There have been no documented patients with COVID-19 among the 76 who were vaccinated after a median follow-up of 91 days (interquartile range, 84.5–99) after final vaccination.

Among patients with no COVID-19 history, at first antibody measurement (mean 22 days [range 14–33] after full vaccination for Ad26.COV2.S and 24 days [range 14–44] for mRNA), 33% versus 93% had detected antibody levels (>1) in response to Ad26 versus mRNA, respectively. When applying more stringent criteria for response, 8% versus 82% had adequate antibody levels (>7) in response to Ad26.COV2.S versus mRNA, respectively, at first measurement. At the last antibody measurements (mean 52 days [range 40–66] after full vaccination for Ad26.COV2.S and 68 days [range 39–103] for mRNA), 38% versus 82% had detected antibody levels (>1) in response to Ad26.COV2.S versus mRNA, respectively. When applying more stringent criteria for response, 15% versus 71% had adequate antibody levels (>7) in response to Ad26.COV2.S versus mRNA, respectively at last measurement.

Among patients with prevaccination COVID-19 history, at first antibody measurement (mean 22 days [range 14–33] after full vaccination for Ad26.COV2.S and 28 days [range 18–41] for mRNA), 89% versus 100% had detected antibody levels (>1) in response to Ad26.COV2.S versus mRNA, respectively. When applying more stringent criteria for response, 78% versus 100% had an adequate antibody levels (>7) in response to Ad26.COV2.S versus mRNA, respectively, at first measurement. At the last antibody measurements (48 mean days [range 35–61] after full vaccination for Ad26.COV2.S and 57 days [range 46–72] for mRNA), 86% versus 100% had detected antibody levels (>1) in response to Ad26.COV2.S versus mRNA, respectively. When applying more stringent criteria for response, 71% versus 100% had adequate antibody levels (>7) in response to Ad26.COV2.S versus mRNA, respectively, at last measurement. All patients who were mRNA vaccinated with history of COVID-19 had the maximum detected response (750 index) at both time points (Figure 1).

Limitations of the quality improvement project include the small sample size and lack of random assignment of vaccine type due to the observational nature of the project. Also, we were not able to measure
prevaccination antibody levels for 41% of patients. However, because all dialysis clinics were screening for symptoms at dialysis treatments, it is unlikely that many patients who were symptomatic were missed. Patients who are asymptomatic could lead to some misclassification. We would expect this to be nondifferential and not bias results by vaccine type because there would be no reason that patients who are asymptomatic would have been more likely to receive one vaccine type over another. Another limitation is the short duration of follow-up on antibody levels. For instance, only 15% of patients with no COVID-19 history vaccinated with Ad26.COV2.S had an adequate response at last antibody measurement, taken an average of 52 days (range 35–61) after vaccination. Another study (not in patients on dialysis) has shown the detection of antibodies in 100% of patients who are Ad26.COV2.S vaccinated by day 57, thus, some patients on dialysis included in this analysis may have yet to develop antibodies (4).

In summary, markedly fewer patients on dialysis vaccinated with Ad26.COV2.S had detectable or adequate antibody response at either first or last antibody measurements when compared with patients vaccinated with mRNA vaccines. Our results demonstrate the need for monitoring of antibody response in patients on dialysis, along with potential management of patients with no response. Further studies with larger sample sizes and longer follow-up are needed, but these data would suggest consideration of mRNA vaccines over Ad26.COV2.S for patients on dialysis.

Disclosures
A. Fadia reports employment with Arizona Kidney Disease and Hypertension Centers; reports serving as medical director at Fresenius Kidney Care dialysis unit; and reports receiving research funding from GlaxoSmithKline. C. Johnson reports employment with Spectra Laboratories and ownership interest in Fresenius Medical Care. C. Mullon reports employment with Fresenius Medical Care North America, reports having stock in Fresenius Medical Care as an employee of the company, and reports receiving funding from Fresenius Medical Care for research activities. C. Mysayphonh reports employment with Fresenius Medical Care North America. L.A. Dahne-Steuber reports employment with, and owns stock in, Fresenius Medical Care North America and is the President of Spectra Laboratories. J. DeLisi reports employment with Spectra Laboratories. J.G. Mulhern reports serving as medical director at Fresenius Kidney Care dialysis unit and reports receiving research funding from Boehringer Ingelheim, Calliditas, and Reata Pharmaceuticals. J.L. Hymes is the Chief Medical Officer of Fresenius Kidney Care and reports having an ownership interest in DaVita, Fresenius Medical Care, and Nephroceuticals. J. Willetts reports employment with Fresenius Medical Care Global Medical Office. L.H. Ficociello reports employment with Fresenius Medical Care Global Medical Office. M.C. Pollan reports employment with Siemens Healthcare Diagnostics and owns stock in Siemens Healthineers. M.S. Anger is the Chief Medical Officer of Fresenius Renal Therapies Group and reports receiving research funding from Fresenius Medical Care. R.J. Kossmann reports employment with Fresenius Medical Care North America, reports ownership interest in Advanced Renal Technologies and Fresenius Medical Care North America, and reports serving on the Board of Directors of Advance Renal Technologies and on the Scientific Advisory Board of Vifor Pharma. R. Patel reports employment with Desert Kidney Associates and reports serving as medical director of Fresenius Medical Care dialysis unit.
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**References**


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