What is the SARS-CoV-2 Vaccine Response in Patients Undergoing Hemodialysis?

By Nestor Toapanta and María José Soler

Chronic kidney disease is one of the risk factors that has been associated with higher risk of infection and mortality from SARS-CoV-2 (1, 2). The increased rate of SARS-CoV-2 infection has been related to the transportation and greater hospital exposure of patients (3, 4). In addition, the higher mortality rate has been, in part, ascribed to alterations in the immune system.

Vaccination against SARS-CoV-2 infection has raised hopes for the pandemic to end. Recent studies reported that the BNT162b2 (Pfizer-BioNTech) vaccine against SARS-CoV-2 is effective for symptomatic COVID-19 in the general population, being 94% after the second dose (5). However, little is known about the response in patients undergoing hemodialysis because these patients have not been included in clinical trials. Patients undergoing hemodialysis are known to have frequent infections, as well as a suboptimal response to vaccines, in part, due to alterations in both innate and adaptive immunity (6, 7) (Table 1).

Grupper et al. (8) evaluated the humoral response in 56 patients on hemodialysis against a control group composed of 95 healthcare workers after receiving two doses of the BNT162b2 vaccine (Pfizer-BioNTech). They demonstrated that dialysis patients developed a lower titer of anti-SARS-CoV-2 antibody than the control group, 21 days after vaccination (median dialysis patients 171 U/mL, interquartile range [IQR] 477.7 versus median controls 2500 U/mL, IQR 943.5), with an inverse correlation between age and immunoglobulin G6 (IgG6) levels (8). In another study with 81 patients on hemodialysis, 43 patients (53%) had an antibody titer lower than 200 U/mL, 22 patients (27%) had a titer lower than 29 U/mL, and 7 patients (9%) had no detectable antibodies at all (9). In concordance, Torreggiani et al. (10) demonstrated that about one-third of patients on hemodialysis develop neutralizing antibodies after the first dose of the BNT162b2 COVID-19 mRNA vaccine and that these are at low titers, as could be expected in a high-comorbidity cohort (median Charlson comorbidity index = 8).

A group from Israel (11) reported the following findings alter vaccination in 160 patients on chronic dialysis (127 hemodialysis and 33 peritoneal dialysis patients): 1) a lower response rate to the vaccine, 2) a lower anti-spike antibody level, and 3) a higher rate of COVID-19. Frantzen et al. (12), with the same vaccine, also demonstrated in a large population of hemodialysis patients (n = 244) that these patients are a hyporesponsive population with a 91% antibody-positivity rate, and only 60% of the patients presented an antibody level above 200 U/mL. Agur et al. (13) also evaluated seropositivity against the BNT162b2 vaccine (Pfizer-BioNTech) in 122 patients on hemodialysis and 22 patients on peritoneal dialysis who received two doses, 21 days apart, and a follow-up of up to 8 weeks after the second dose. These patients developed 93.4% antibodies at 36 days (IQR 32–40). Interestingly, a younger age was associated with higher antibody titers, whereas lack of response to the vaccine was associated with lower albumin and higher doses of iron sucrose administered (13). In this study, the seropositive response for SARS-CoV-2 anti-spike IgG at 2–6 weeks following the second dose of the BNT162b2 vaccination seems to be similar in hemodialysis and peritoneal dialysis patients (13). Lacson et al. (14) studied seropositivity after vaccination against SARS-CoV-2 infection in 186 patients on hemodialysis with two vaccines: BNT162b2/Pfizer (n = 148) and mRNA-1273/Moderna (n = 18). Overall, they did not find differences between the two vaccines. In addition, the seropositive rate was 165/186 (88.7%), with 70% at maximum titer with IgG levels, although in patients who had previously had the SARS-CoV-2 infection, the seropositivity was 100% (97% with IgG levels at the maximum titer) (14).

The evidence, to date, suggests that the majority of patients on hemodialysis seroconvert after the administration of the two doses of the vaccine (80%–96%); however, advanced age plays an important role in the development of antibodies. With the consideration that the population on hemodialysis is mostly elderly, it is convenient to study whether they require a third dose of the vaccine, especially in those patients who have not had COVID-19. In addition, the inclusion of these patients in clinical trials to evaluate their immunogenicity against the vaccine is an unmet need. To date, the studies on the effectivity of the SARS-CoV-2 vaccination in dialysis patients have been focused on the antibody response, and there is a clear gap of knowledge on its effectivity in terms of COVID-19 infection and severity of the disease. Currently, studies to assess long-term efficacy and safety of SARS-CoV-2 vaccination in patients on dialysis or after kidney transplantation are ongoing. ■

Nestor Toapanta, MD, and María José Soler, MD, PhD, FERA, are nephrologists with the Vall d'Hebron University Hospital Nephrology Department, Vall d'Hebron Institute of Research, Barcelona, Spain.

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Table 1. Studies demonstrating response to the vaccine against SARS-CoV-2 in hemodialysis patients after the second dose

Study	No. of patients on HD	Age	Measure of antibody time, days	Seroconversion, %
Grupper et al. (8)	56	74 ± 11	30 (27–34)	96.0
Simon et al. (9)	81	67 (34–86)	21	80.0
Torreggiani et al. (10)	101	69 ± 15	21	35.0*
Frantzen et al. (12)	244	76 ± 13	30	91.0
Agur et al. (13)	122	72 ± 12	36 (32–40)	93.4
Lacson et al. (14)	186	68 ± 12	23 ± 8	88.7

*Determinations of antibodies at 21 days after the first dose. HD, hemodialysis.