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Do Levels of SARS-CoV-2 Anti-Spike Antibody Titers After Vaccination Predict Future Infections in Hemodialysis Patients?

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Abstract

Background: There are few data on whether higher severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) antibody titers correlate with subsequent infection in the general population, much less in the dialysis patients.

Methods: Fifty-four hemodialysis patients who had antibody titer measured against SARS-CoV-2 after vaccination were retrospectively looked at after 6 months. Rates of subsequent coronavirus disease 2019 (COVID-19) infection were correlated with initial antibody titers.

Results: The mean antibody titer in the patients who subsequently developed SARS-CoV-2 infection was 437 relative fluorescent units (RFU) as compared with mean antibody titer of 1,436 RFU in patients who did not developed infection.

Conclusion: It seems higher antibody titers are in general protective against subsequent infection; however, some patients developed subsequent infection despite having high antibody titers.

Keywords: SARS-CoV-2; COVID-19; Antibody titer; Vaccination

Introduction

Starting in December of 2019, a novel coronavirus (severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)) was causing severe respiratory disease in a group of patients in Wuhan, China. In March of 2020, the disease (coronavirus disease 2019 (COVID-19)) caused by this novel virus (SARS-CoV-2) was declared a worldwide pandemic. By the end of 2020, several vaccines were developed and were administered first to the most vulnerable and then to the general population to combat the spread of COVID-19. Dialysis patients were among some of the first patients to develop COVID-19 in the United States and were again vaccinated relatively early on in 2021. Dialysis patients infected with COVID-19 are also found to have mortality rates of 20-30% which is much higher than that of the general population (1-3%) [1, 2]. Studies among dialysis patients have found lower antibody titers among dialysis patients after vaccination than the general population but still adequate levels in 80-90% of this group of patients [3, 4]. Whether higher antibody titer after vaccination is protective against future infection is logical but solid data are lacking.

Materials and Methods

In early October 2021, all fully vaccinated (two doses of BNT162b2/mRNA-1273 vaccine or one dose of Ad26.CoV2.S vaccine) hemodialysis patients at our hospital outpatient dialysis center who consented to take part in the study had their blood taken for measurement of anti-spike antibody titers. A few patients already had booster shots at the time of the blood draw and some received further booster shot in the following 2 - 3 months. In January and February of 2022, a number of these patients developed documented COVID-19 likely due to Omicron variant. Subsequently the antibody titers in October were correlated with development of COVID-19 infection later on. The study was approved by our local IRB (#21-34302) and informed consent was obtained in study participants.

Results

A total of 54 hemodialysis patients had a SARS-CoV-2 anti-spike antibody level checked in first week of October 2021 at a single dialysis center. The average antibody level in these patients was 1,288 ± 175 relative fluorescent units (RFU) (average ± standard error of the mean) with a median of 186 RFU. During the rest of 2021, there were no documented COVID-19 infections among these patients. However, in January and February of 2022, eight of these patients tested positive for SARS-CoV-2. The mean antibody titer in this group of patients was

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Table 1. Characteristics of Patients Who Tested Positive for SARS-CoV-2

Pos date (all 2022)	Age	Sex	Vaccine type	Vaccine dates (all 2021)	Ab titer (RFU)	Titer date
February 11	54	Female	Pfizer	March 22, April 12, October 27	121	October 4
January 7	63	Male	Pfizer	March 18, April 8, October 25	237	October 4
January 22	68	Female	Moderna	January 23, February 20, October 26	401	October 4
January 11	55	Male	Pfizer	March 24, April 22, October 20	240	October 4
January 28	41	Female	Pfizer	March 17, April 14, November 18	57	October 4
January 3	49	Female	Moderna	April 7, May 5, October 8	104	October 4
January 13	72	Male	Moderna	January 23, February 20, September 2	2232	October 4
January 19	45	Male	Pfizer	March 17, April 7, October 26	104	October 4

SARS-CoV-2: severe acute respiratory syndrome coronavirus 2; RUF: relative fluorescent units.

437 ± 259 RFU and the median antibody titer was 179 RFU. Among the patients who did not develop COVID-19 infection, the mean antibody titer was 1,436 ± 422 RFU and the median titer was 186 RFU. The difference was statistically significant with a P-value of 0.003 (with patients who did not have COVID-19 infection having a statistically higher antibody titer at baseline).

Out of the eight patients who subsequently tested positive for SARS-CoV-2, one had prior booster shot before the antibody titers were measured, six received booster shots later in the month of October and one received booster shot in November (Table 1). Out of the patients who did not test positive later for SARS-CoV-2, 10 had prior booster shots, 21 had boosters later in October, seven in November, four in December, three in January of 2022 and one patient never received a booster shot. Out of the eight patients who subsequently developed COVID-19 infection, six were mildly symptomatic and two were completely asymptomatic. One patient had to be hospitalized not for medical reasons but for social reason to avoid infecting others. The patient with the antibody level of 2,232 RFU remained asymptomatic.

Discussion

Whether one can use antibody titer against SARS-CoV-2 to determine the risk of future infection has not been studied extensively. To our knowledge, one of the few papers available so far in the dialysis population was published in October of 2022 [5]. In this paper, the authors looked at 3,576 patients on dialysis who had receptor-binding domain antibody levels (RBD IgG) checked in December of 2021. During follow-up until end of January of 2022, 340 (7%) patients went on to develop COVID-19 infection. However not all of these patients were vaccinated. In fact, almost 24% of the patients had never received a vaccine dose. The risk of infection was 2.1 - 3.2 times higher in the group with RBD IgG index levels less than 23 than among those with higher antibody titers.

An earlier paper from the same group also looked at RBD IgG values and correlated them to risk of COVID-19 infection in 4,791 dialysis patients. Here only 53% of the patients were vaccinated against SARS-CoV-2 infection [6]. The antibody levels were checked a median of 21 days before breakthrough infections which occurred in 56 (1%) patients. This study was done during the delta outbreak of late 2021. The authors also found that the antibody response wanes quickly in 5 - 6 months with 20% of vaccinated patients having undetectable antibody responses as opposed to only 7% of patients, two to four weeks after vaccination. Undetectable antibody levels were associated with an 11 times higher risk of infection as compared to antibody levels of greater than 23 (index RBD values).

Studies in non-dialysis patients seem to be even fewer in number. In 2020, Addetia et al studied an outbreak of COVID-19 disease in a fishery vessel. They found that high anti-spike antibody levels from previous infection were protective for recurrence of COVID-19 infection [7]. The numbers were small and only three people had detectable antibody titers who subsequently did not develop infection. Khoury et al analyzed the existing vaccine studies to conclude that higher antibody titers are highly protective of future infections [8], despite not having any data of their own.

Here preliminary data are presented looking at the correlation of antibody titer with the risk of developing SARS-CoV-2 infection 3 - 4 months later. The average antibody titer was indeed lower in patients who developed SARS-CoV-2 infection later at a time of a COVID-19 surge. Interestingly, the median antibody levels were not that different and one patient who subsequently developed SARS-CoV-2 infection actually had a very high antibody titer of over 2,000 RFU. Our study was different than two previously published articles (with dialysis patients) in the following aspects. First all of the patients studied in this paper were previously vaccinated. Second, we studied outcomes 3 - 4 months after measuring antibody titers as vaccinations are not offered every month. Thus, it would be also useful to know not only if the antibody titers remain adequate with passage of time but also that the risk of infection is lower a few months later after adequate antibody titers. Third, since we have significantly fewer patients at one center, we were able to determine that even one patient who had very high antibody titers, still developed COVID-19 infection 3 - 4 months later documenting that even very high antibody levels are not exclusive of future infection. At this time, it does not seem one can follow antibody titers to determine the need for further boosters in dialysis patients. However, there seems to be an association between higher antibody titer and lower risk of infection.

Acknowledgments

None to declare.

Financial Disclosure

None to declare.

Conflict of Interest

None to declare.

Informed Consent

Informed consent was obtained from all participating patients.

Author Contributions

RS was involved in the design, obtaining data, analyzing data and writing the manuscript. EF was involved in collecting data, communicating with lab, and obtaining patient consents.

Data Availability

The authors declare that data supporting the findings of this study are available within the article.

References

1. Speer C, Goth D, Benning L, Buylaert M, Schaier M, Grenz J, Nusshag C, et al. Early humoral responses of hemodialysis patients after COVID-19 vaccination with BNT162b2. Clin J Am Soc Nephrol. 2021;16(7):1073-1082.
2. Lacson E, Jr., Argyropoulos CP, Manley HJ, Aweh G, Chin AI, Salman LH, Hsu CM, et al. Immunogenicity of SARS-CoV-2 vaccine in dialysis. J Am Soc Nephrol. 2021;32(11):2735-2742.
3. Jager KJ, Kramer A, Chesnaye NC, Couchoud C, Sanchez-Alvarez JE, Garneata L, Collart F, et al. Results from the ERA-EDTA Registry indicate a high mortality due to COVID-19 in dialysis patients and kidney transplant recipients across Europe. Kidney Int. 2020;98(6):1540-1548.
4. Salerno S, Messana JM, Gremel GW, Dahlerus C, Hirth RA, Han P, Segal JH, et al. COVID-19 risk factors and mortality outcomes among medicare patients receiving long-term dialysis. JAMA Netw Open. 2021;4(11):e2135379.
5. Montez-Rath ME, Garcia P, Han J, Cadden L, Hunsader P, Morgan C, Kerschmann R, et al. SARS-CoV-2 infection during the omicron surge among patients receiving dialysis: the role of circulating receptor-binding domain antibodies and vaccine doses. J Am Soc Nephrol. 2022;33(10):1832-1839.
6. Anand S, Montez-Rath ME, Han J, Garcia P, Cadden L, Hunsader P, Morgan C, et al. SARS-CoV-2 vaccine antibody response and breakthrough infection in patients receiving dialysis. Ann Intern Med. 2022;175(3):371-378.
7. Addetia A, Crawford KHD, Dingens A, Zhu H, Roychoudhury P, Huang ML, Jerome KR, et al. Neutralizing antibodies correlate with protection from SARS-CoV-2 in humans during a fishery vessel outbreak with a high attack rate. J Clin Microbiol. 2020;58(11):e02107-20.
8. Khoury DS, Cromer D, Reynaldi A, Schlub TE, Wheatley AK, Juno JA, Subbarao K, et al. Neutralizing antibody levels are highly predictive of immune protection from symptomatic SARS-CoV-2 infection. Nat Med. 2021;27(7):1205-1211.

