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Clinical Course of COVID-19 Infection in a Hemodialysis Patient Despite Prior SARS-COV-2 Vaccination: A Case Report

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Abstract

The authors describe the clinical course of a hemodialysis patient with COVID-19 infection of the upper-respiratory tract despite prior SARS-COV-2 vaccination with two courses of BNT162b2 mRNA dosages.

Learning Points

1. *A full course of COVID-19 BNT162b2 mRNA vaccination in hemodialysis patients does not preclude wild type infection.*
2. *Even mild symptoms not typical for COVID-19 infection should prompt PCR-testing in vaccinated hemodialysis patients.*
3. *Completion of SARS-CoV-2 vaccination seems to mitigate the course of subsequent infection by the wild type of the virus towards less severe courses.*
4. *These data should be recognized when deciding on preventive measures and hygiene concepts in dialysis centers with so far relevant proportions of unvaccinated dialysis patients.*

Keywords: *COVID-19, vaccination, BNT162b2, hemodialysis, ESRD, antibody titer*

Introduction

Patients on chronic hemodialysis are more likely to suffer from multiple chronic diseases as e.g., hypertension, diabetes, obesity, or systemic inflammation. Furthermore, in hemodialysis patients chronic t-cellular defects with reduced host immunity and impaired responses to vaccination have been described for decades (**1**). Additionally, these patients must travel to their dialysis centers three times a week increasing the risk of acquiring air borne infections. Consequently, hemodialysis patients do not only carry a 5-16 times higher risk of SARS-VoV-2 infection as comparedwith the general population (**2**) but also a particular high mortality rate close to 20% or above after SARS-CoV-2 infection (**3,4**). As of today, still every ESRD patient on hemodialysis is suspected to develop a severe clinical course with life-threatening complications after acquisition of SARS-CoV-2. Furthermore, the proven associations of older age, heart disease and markers of frailty with mortality add to the so far increased risk in this vulnerable patient population (5).

Case Description

The 66-year-old female patient was admitted to the hospital for further evaluation and surveillance after

positive oro-pharyngeal swap testing for SARS-CoV-2 in her nursing home residency. The test was performed after complaining about slight symptoms of cough and nasal discharge without fever or systemic symptoms. She has been on chronic hemodialysis three times per week for about four years due to a combination of hypertension and interstitial nephritis. Her medical condition was further characterized by the presence of atherosclerosis with secondary left-sided subclavian-steal syndrome, obesity stage III (WHO) with obstructive sleep apnea and osteoporosis with lumbar spine fractures. Several weeks before admission, she has received the second course of COVID-19 BNT162b2 mRNA vaccination. On admission the patient was afebrile and orthopneic without signs of pulmonary distress. Oxygen saturation showed normal values above 90%. CRP level was only slightly elevated and within known ranges prior to infection (**Table 1**). CT-scan of the thorax was unremarkable without signs of lower respiratory tract infection by the SARS-CoV-2 virus (**Figure 1**). To test for the efficacy of the reported vaccination, SARS-CoV-2 IgG antibodies were ordered showing a highly positive IgG-titer that remained positive during the hospital stay. Despite these high antibody titers, the patient has been repeatedly tested positive during her hospital stay. Finally, 20 days after admission, the ct value was above the limit of 30 and the patient was discharged to her nursery home without further complications on follow-up at her home dialysis center.

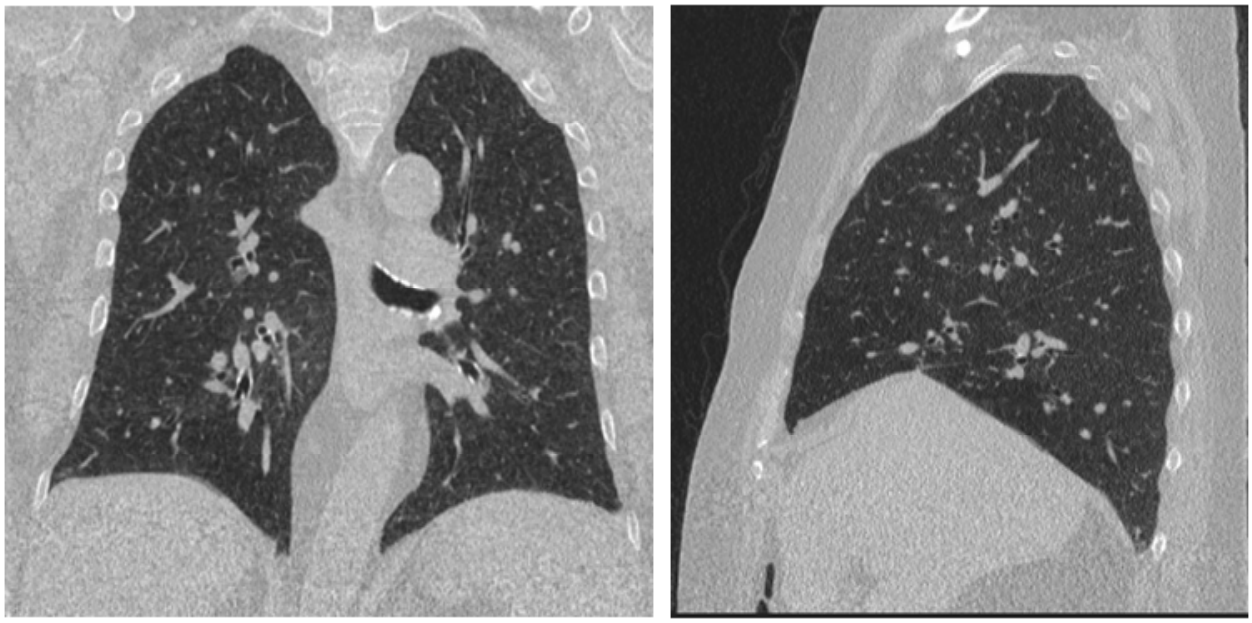

Figure 1 and 2. *Body-mass index adapted low-dose computer tomography of the chest in a 66-year-old female hemodialysis patient with positive oro-pharyngeal SARS-CoV-2 PCR swaps despite two prior courses of BNT162b2 mRNA vaccination. The CT-graph is remarkable of the absence of signs of lower respiratory pulmonary tract infection by the COVID-19 virus (1 mm, B50f, window: width 2000, length -400; Siemens SOMATOM As+).*

Discussion

An increased tendency to develop systemic infections as well as a reduced immune response after prophylactic vaccinations have been known for decades in patients with end-stage renal disease on renal replacement therapy. This and the often concomitant multimorbidity of these patients are partly responsible for the high mortality risk of this patient group caused by SARS-CoV-2. For this reason, many professional societies have called for early immunization of these persons, not least in the hope of an attenuated course after wild type virus infection despite unmeasurable antibody titers.

This case report is remarkable in several ways: 1. we could document a highly effective antibody formation after two dosages of BNT162b2 mRNA vaccination on dialysis, 2. despite these titers, the patient developed replicative infection of the upper respiratory tract with COVID-19, 3. Representing a potential source of infection in susceptible subjects of the respective

dialysis unit, 4. most presumably due to the prior successful immunization the patient experienced a remarkably uncomplicated clinical course. This is contrary to a clinical case vignette of a 51 year-old hemodialysis patient who developed a severe course after SARS-CoV-2 infection despite prior detection of IgG-antibodies 4 weeks earlier. Nevertheless, the authors raised the question of a false positive IgG-antibody test result leaving the patient susceptible to SARS-CoV-2 infection (**6**). Other explanations might be cross reactivity of the assay with different corona virus strains or IgG-antibodies without neutralizing capacity.

Several investigations have so far shown a positive antibody titer response in end-stage-renal disease patients (ESRD) (**7**). Despite diminished antibody titers as compared to healthy cohorts, the success of modern vaccination methods with mRNA or vector based vaccines is reassuring given the reported low responses e.g. after repeat hepatitis B vaccination over the last decades (**1**). The clinical course of our patient also gives hope that a successful vaccination, analogous to the healthy population, will also only result in localized infection of the upper respiratory tract in hemodialysis patients upon re-exposure to the wild type virus. Nevertheless, high rates of patients denying vaccination and relevant proportions of patients with no or reduced antibody titers raise concerns on canceling of hygiene measures in dialysis facilities too early.

A recent survey report on the acceptability of SARS-CoV-2 vaccination in dialysis units in the USA showed that 20% out of 1500 dialysis patients had been hesitant to seek vaccination when offered (**8**). Although there might be substantial selection bias in this sample (only 14% eligible patient answered the survey), the work indicates that a relevant proportion of hemodialysis patients are and will probably remain without humoral protection despite the offer of vaccination. This group will continue to be exposed to an increased risk of infection, e.g. through mutated virus variants. A hitherto unpublished survey at our own dialysis facility showed that about 1 out of 31 staff personnel (3,2%), and 4 out of 87 (4,5%) hemodialysis patients have refused vaccination so far. Given these data further management of hygiene concepts in dialysis units will remain to be under discussion.

In conclusion, to the best of our knowledge, we describe for the first time the serological and clinical course of SARS-CoV-2 infection and replication within the upper-airways in a chronic hemodialysis patient despite a full antibody response following two course of BNT162b2 mRNA vaccination. The efficacy of current vaccination method in reducing severe course in ESRD patient with mutated SARS-CoV-2 variants still needs to be clarified.

Table 1

Days after admission	First	Last
Creatinine mg/dl	5.50	6.35
eGFR (CKD-EPI)	8	7
Albumin g/dl	3,9	3,7
CRP mg/dl	2.8	3.4
Leucocytes /µl	6.67	5.67
Procalcitonin ng/ml	0.54	0.41
Anti-SARS-CoV-2 IgG	>100	>100
SARS-CoV-2 PCR ct	14	32

Clinical evolution of laboratory parameters from first day of admission to discharge; eGFRin ml/min/1,73 m^2 BSA.

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