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mRNA COVID-19 Vaccination in Active COVID-19–Infected Acute Myeloid Leukemia Patient

To the Editor:

We present a case of a 64-year-old Chinese female with intermediate risk acute myeloid leukemia (with t(9;11)(p21.3;q23.3); KMT2A–MLLT3, who had undergone induction chemotherapy with a continuous infusion of standard-dose cytarabine 100 mg/m^2 for 7 days with daunorubicin 60 mg/m^2 for 3 days (DA60 3+7). Following her induction, she achieved morphological remission with evidence of minimal residual disease on flow cytometry. As she declined allogenic stem cell transplant postinduction therapy, she continued with 1 cycle of continuous infusion standard-dose cytarabine 100 mg/m^2 for 7 days with daunorubicin 45 mg/m^2 for 3 days (DA45 3+7) and 2 cycles of intermediate-dose cytarabine with daunorubicin (MODAC).

During her admission for planned 2nd cycle of MODAC, she was found to have persistent neutropenia with nonproductive cough and fever. Nasal swabs were positive for both human coronavirus 229E (HCoV 229E) and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Chemotherapy was then postponed due to coronavirus disease 2019 (COVID-19) infection. Patient also had not received prior COVID-19 vaccination. Initial chest radiographs showed few faint patchy airspace opacities in bilateral mid and lower zones of the lungs. Subsequent computed scan of the thorax identified scattered peripheral ground-glass pulmonary opacities congruent with COVID-19 pneumonia. She was started on an initial 5-day course of remdesivir followed by another 10 days of remdesivir due to suspicion for recrudescent COVID-19 infection as evidenced by the persistent polymerase chain reaction positivity for SARS-CoV-2 for more than a month (Table). This was further supported with evidence of viable SARS-CoV-2 in viral cultures (Table). Serology demonstrated evidence of COVID-19 infection but insufficient serological response despite recovering from native disease (Table).

In view of the patient's prolonged infection, Pfizer-BioNTech mRNA COVID-19 vaccination was administered to boost the immune response and assist in the virological clearance of the SARS-CoV-2 viral infection (Table). Two days following vaccination, SARS-CoV-2 was undetectable based on cycle threshold cutoff value of 40 and remained persistently negative thereafter. Unfortunately, the patient had morphological relapse after clearance of SARS-CoV-2. The patient was offered azacytidine and venetoclax chemotherapy for her relapsed disease. Serology postvaccination showed good immunological response to the mRNA COVID-19 vaccination despite ongoing chemotherapy (Table).

Scant literature suggests acute myeloid leukemia patients with COVID-19 can have their therapy adjusted to avoid intensive chemotherapy.[1] Other centers have proceeded with intensive chemotherapy after obtaining a SARS-CoV-2 undetectable on polymerase chain reaction.[2] For her, in view of persistent cytopenia, fever, and radiological findings, the chemotherapy was postponed until virological clearance. During her vaccination the patient was monitored inpatient for severe immune reactions such as anaphylactic reactions, thrombocytopenia, myocarditis/pericarditis, or antibody-dependent enhancement side effects, which did not occur.[3] This may partly be due to her severe immunocompromised status. Interestingly, she achieved a good serological response 28 days after first vaccination dose. This might be due to either vaccination triggered immune response or a delayed response to her prior COVID-19 infection.

Data is limited for acute myeloid leukemia with COVID-19, and to our knowledge, this is the first case report of a Pfizer-BioNTech mRNA COVID-19 vaccination given during an active COVID-19 infection in an immunocompromised patient to clear the infection. In conclusion, this case highlights the difficulties of treating hematological malignancies in the current pandemic. More vaccination studies

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Table Summary and Sequence of Coronavirus Investigations

Days	Cycle Threshold Values (cycles)	Serology C Pass (%)	Serology Roche N (U/mL)	Roche S (U/mL)	SARS-CoV-2 Culture	Respiratory Multiplex	Key Events
04/23/2021						Coronavirus 229E detected	
04/29/2021	16.22						
05/02/2021	14.6						
05/03/2021		0	0	1.18			**Start of first cycle of 5 days of Remdesivir**
05/07/2021							**End of first cycle of 5 days of Remdesivir**
05/112021	16.3						
05/12/2021	21.6	0	0	1.09	Positive for viable and infective virus	Coronavirus 229E not detected	**Start of second cycle of 10 days of Remdesivir**
05/16/2021	22.7						
05/19/2021	26.5						
05/21/2021							**End of second cycle of 10 days of Remdesivir**
05/25/2021	38.3						
05/27/2021	30.2						
05/30/2021	35.1						
06/02/2021	38.8						
06/04/2021		20.97	8.2	0.593			
06/07/2021	34.9						
06/09/2021							**First Pfizer-BioNTech vaccination**
06/11/2021	PCR undetectable						**First Negative PCR nasopharyngeal swab**
06/12/2021	PCR undetectable						
06/30/2021							**Second Pfizer-BioNTech vaccination**
07/01/2021	PCR undetectable	94.465	29.08	175.9			
07/07/2021	PCR undetectable	98.845	29.6	894.5			

PCR = polymerase chain reaction; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.
Cycle threshold values refer to the number of PCR cycles required for viral RNA to be amplified to reach a detectable level.
Serology C pass, refers to the percentage of neutralizing antibodies toward the receptor binding domain of the SARS-CoV-2 virus spike protein.
Serology Roche N refers to the titers of antibodies specific to the nucleocapsid core protein for the SARS-CoV-2 virus.
Roche S refers to the titers of antibodies specific to the SARS-CoV-2 virus spike protein.
SARS-CoV-2 culture refers to the viral culture of the SARS-CoV-2 virus that demonstrates viable virions capable of infecting human cells.

should be conducted on immunocompromised patients who have active or recovered from COVID-19 infection to better understand the durability of the immune response toward native COVID-19 infection, COVID-19 vaccination, or a hybrid of both.

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