

SARS-CoV-2 vaccine breakthrough reinfection in a health-care worker of Iraq: A case report

Dlshad Abdullah Hasan^a, Sazan Qadir Maulud^b, Paywast Jamal Jalal^c, Priyanka^d, and Om Prakash Choudhary^e

^aPublic Health Laboratory Management-Erbil, Kurdistan Region of Iraq; ^bDepartment of Biology, College of Education, Salahaddin University-Erbil, Erbil, Kurdistan Region of Iraq; ^cDepartment of Biology, College of Science, University of Sulaimani, Sulymani, Kurdistan Region of Iraq; ^dDepartment of Veterinary Microbiology, Mahatma Jyotiba Fule College of Veterinary and Animal Sciences, Jaipur, India; ^eDepartment of Veterinary Anatomy and Histology, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (I), Selesih, Aizawl, India

ABSTRACT

The COVID-19 pandemic has severely affected the entire globe since the first isolation of SARS-CoV-2 from patients with severe respiratory illness in Wuhan, China. Although the global vaccination drive is in full swing, many cases of reinfection have also been reported after vaccination. Currently, there is a scarcity of data available on the reinfection and vaccine breakthrough infections in Iraq. In this letter, we have presented a case report on the SARS-CoV-2 vaccine breakthrough reinfection in a health-care worker after completion of the double-dose vaccination. An increased symptom severity was reported on the second infection, which was confirmed to be of Delta variant. Such vaccine breakthrough infection reports have raised important questions regarding the duration of vaccine-mediated immunity and vaccine effectiveness against all circulating variants. These have further emphasized the importance of following non-pharmaceutical interventions by fully vaccinated individuals, especially at health-care settings.

ARTICLE HISTORY

Received 2 February 2022
Revised 7 March 2022
Accepted 17 March 2022

KEYWORDS

SARS-CoV-2; COVID-19; health worker; reinfection; RT-PCR; variants; vaccination

Introduction

Since the first report of coronavirus disease 2019 (COVID-19) from Wuhan, China, in late 2019, the disease has spread globally, infecting millions of people and causing a large number of deaths in many countries. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), an RNA virus, is prone to mutations. Several mutations have been reported worldwide in the spike (S) gene, including receptor-binding domain (RBD) region, accounting for the increased transmission and infectiousness of the virus, and causing the emergence of new variants, which might escape the vaccine-induced immunity elevating the risk of breakthrough infections and reinfections of COVID-19.^{1,2} Vaccine breakthrough cases are defined as instances in which an individual tests positive for COVID-19 at least 14 days following the completion of any COVID-19 vaccine series.³ There is currently a scarcity of data available on the reinfection and vaccine breakthrough infections in Iraq with two studies reporting the recurrent COVID-19 infection cases, one being in a health worker.^{4,5} In this report, we present the case details of a fully vaccinated health worker in the city of Erbil (Kurdistan region of Iraq), who was subsequently infected with SARS-CoV-2.

Case presentation



We present a COVID-19 case that had two reverse transcription-polymerase chain reaction (RT-PCR) proven breakthrough infections following full immunization with Oxford/AstraZeneca COVID-19 vaccine (AZD1222). A 42-

year-old man working as a pharmacist at Erbil teaching hospital had received his first vaccine dose on April 4, 2021 and the second dose on June 5, 2021. The patient had no history of any chronic disease. On August 9, 2021, he attended the primary health-care center with a history of contact with a confirmed COVID-19 case. A nasopharyngeal swab was taken to test the presence of SARS-CoV-2 by RT-PCR at the Central Public Health Laboratory (CPHL), a test center for SARS-CoV-2 in the Erbil city, Kurdistan region, Iraq. The RT-PCR test revealed the patient to be positive for SARS-CoV-2. At that time, he had symptoms of mild fever, sore throat, fatigue, and headache, with a history of 5 days. He was not hospitalized but entered a self-quarantine until he tested negative.

After nearly ten weeks of testing negative for SARS-CoV-2 PCR, on October 30, 2021, the patient presented to the COVID-19 treatment center with symptoms of fever, chills, sore throat, runny nose, headache, fatigue, and muscle ache in the leg and back. All these symptoms were stronger than the first episode of the disease. He tested positive for SARS-CoV-2 using RT-PCR in a nasal swab sample taken 3 days after the onset of the symptom. The patient was treated with the standard therapeutic regime as per the established COVID-19 protocol until he recovered and tested negative.

Procedures

All the standard protocols have been followed to obtain the RT-PCR results for this case report. Written consent has been taken from the patient to publish this case report.

CONTACT Om Prakash Choudhary  dr.om.choudhary@gmail.com  Department of Veterinary Anatomy and Histology, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (I), Selesih, Aizawl, Mizoram 796015, India.

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Discussion

COVID-19 vaccines are a critical tool for controlling the ongoing global pandemic and overall data on the vaccination suggests long-term protective immunity; however, several reports of reinfection cases and infections following the vaccination have been reported worldwide.⁶

Since vaccines are not 100% effective at preventing infection, some people who are fully vaccinated will still get COVID-19, especially being a health-care worker, a blood-group A person, or having low antibody (IgG) titers. According to the Centers for Disease Control and Prevention (CDC), the SARS-CoV-2 infection after 2 weeks of being fully vaccinated with an approved COVID-19 vaccine is referred to as a “vaccine breakthrough infection.”⁷

With the emergence of new SARS-CoV-2 multiple variants of concern like Alpha (B.1.1.7), Beta (B.1.351), Gamma (P.1), Delta (B.1.617.2), Omicron (B.1.1.529), and other variants; besides the Epsilon (B.1.427/B.1.1429), Zeta (P.2), Eta (B.1.525), Theta (P3), Iota (B.1.526), and Kappa (B.1.617.1),^{8–10} the vaccine breakthrough infection reports around the world have escalated.² This has put the effectiveness of current vaccines under the scanner and has raised some important questions, such as how long would the vaccine-mediated immunity last, would one vaccine be sufficient to cover all the SARS-CoV-2 variants, etc.

Here, we describe the clinical case of a health worker with no history of infection before the vaccination, who became infected twice with SARS-CoV-2 after completing the double-dose vaccination and subsequent contact with an infected person. The variant responsible for the first breakthrough reinfection was unknown, while the second breakthrough reinfection was confirmed to be of the Delta variant. The patient was not taking any immunosuppressive drugs, and he did not suffer from any of the immunological disorders that may facilitate infection. While writing this case report, there exists a rarity of such case reports following full vaccination (breakthrough reinfection) in the literature. Shastri *et al.* have reported a case infected with different variants of concern in the first and the second breakthrough infection, and they labeled the second episode as “breakthrough reinfection.”¹¹

In our case report, the first breakthrough infection occurred after 64 days of the second vaccine dose and the subsequent breakthrough reinfection after a time interval of 82 days. Comparably, a study conducted in India among the health-care workers has reported breakthrough infection time intervals of 6–64 days after two doses of COVID-19 vaccine and a time range of 2–53 days after a single dose.¹²

Similar to the several other studies that have reported the COVID-19 cases with increased symptom severity in the second infection, our case also showed an increased symptom severity during his breakthrough reinfection.^{13,14} However, it is thought that most of the reinfections are mild and it is more likely for patients with the mild or asymptomatic disease to get re-infected. The assumed causes of the increased severity of reinfection may include the higher viral dose, more virulence, or antibody-dependent enhancement.^{14,15} The results from this case report have highlighted that there are

chances of reinfection from SARS-CoV-2 even after full vaccination against COVID-19; hence, all the precautionary measures should be taken, such as hand washing, use of face masks, and social distancing.¹⁶

Conclusions

Overall, this case report confirms a rare SARS-CoV-2 vaccine breakthrough infection and reinfection despite the complete primary immunization with a dual dose of COVID-19 vaccine. This emphasizes the importance of following all the precautionary measures, such as face masks, hand hygiene, and social distancing by fully vaccinated individuals to protect themselves and others, especially at healthcare workplaces. Further studies should be conducted to better understand the mechanisms involved in breakthrough infection in order to control and reduce the worldwide infection rates.

Acknowledgments

All the authors acknowledge and thank their respective Universities and Institutes.

Authors' contribution

DAH did the ideation, conceptualization, data curation, writing original draft, reviewing, and editing. SQM executed the conceptualization, writing original draft, reviewing, and editing. PJJ, PR, and OPC did the reviewing and editing. All authors critically reviewed and approved the final version of the manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Ethical approval

This article does not require any human/animal subjects to acquire such approval.

Funding

The author(s) reported that there is no funding associated with the work featured in this article.

ORCID

Sazan Qadir Maulud  <http://orcid.org/0000-0002-2399-3055>

Priyanka  <http://orcid.org/0000-0003-4039-0157>

Om Prakash Choudhary  <http://orcid.org/0000-0001-6929-675X>

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