

## Case Report

DOI: 10.18502/fem.v5i2.5627

## COVID-19 Reinfection in a Healthcare Worker; Is There a Definitive Immunity Against SARS-CoV-2?

Sayyed Reza Ahmadi<sup>1</sup>, Saeideh Anvari Ardakani<sup>2</sup>, Navid Kalani<sup>3</sup>, Seyed Reza Habibzadeh<sup>1</sup>, Elnaz Vafadar Moradi<sup>1</sup>, Mahdi Foroughian<sup>1\*</sup>

1. Department of Emergency Medicine, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

2. Department of Neurology, Mashhad University of Medical Sciences, Mashhad, Iran.

3. Research Center for Social Determinants of Health, Jahrom University of Medical Sciences, Jahrom, Iran.

\*Corresponding author: Mahdi Foroughian; Email: foroughianmh@mums.ac.ir

Published online: 2020-12-20

### Abstract

**Introduction:** While our knowledge is limited about COVID-19 immunity, recent cases of reinfection have raised concerns.

**Case presentation:** Here, we report a case of COVID-19 reinfection after three months from recovery in a healthcare worker with negative IgM and IgG at the second infection and positive nasopharyngeal swab Reverse transcription polymerase chain reaction (RT-PCR) test despite being discharged with two negative RT-PCR tests at the first admission. Symptoms at first admission were fever, headache, sore throat, diarrhea, and vomiting and got changed to myalgia and anosmia.

**Conclusion:** The strength of this case report is the long period (three months) between the infection and reinfection while other cases reported in literature were reinfected less than one month after their first infection.

**Key words:** Case Report; COVID-19; Immunity; Reinfection; SARS-CoV-2

**Cite this article as:** Ahmadi SR, Anvari Ardakani S, Kalani N, Habibzadeh SR, Vafadar Moradi E, Foroughian M. COVID-19 Reinfection in a Healthcare Worker; Is There a Definitive Immunity Against SARS-CoV-2? *Front Emerg Med.* 2021;5(2):e24.

### INTRODUCTION

The outbreak of the COVID-19 disease caused by SARS-CoV-2 virus, and its rapid spread to most parts of the world prompted the World Health Organization (WHO) to declare a state of pandemic (1, 2). There is still no information available about the immune system function against COVID-19, and whether humans can develop immunity against further exposures to the virus is also a mystery. Getting infected with SARS-CoV-2 activates the immune system, but some people may have better immune responses than others (3). Studies have been conducted on the antibodies of this virus, and we know that both types of antibodies (immunoglobulin "M" and "G") may appear in the host body for a while, but the exact timing is not yet identified (3). These immune responses may provide short-term or long-term protection. Some viruses, such as polio and rubella, produce antibodies that remain for life; however, the lifespan of the antibodies is unknown for the new coronavirus. While our knowledge about immunity against COVID-19 is limited, some reports of reinfection with SARS-CoV-2 have raised concerns. In this paper, we report a probable case of

reinfection of COVID-19 with new symptoms in Iran after three months from recovery.

### CASE PRESENTATION

The case was a 33-year-old healthcare worker (the physician of a COVID-19 ward) who was hospitalized on 27<sup>th</sup> February (the first month after the emergence of COVID-19 in Iran) for symptoms including headache, fever (38.6 °C), and sore throat. A nasopharyngeal and oropharyngeal swab test analysis by reverse transcription polymerase chain reaction (RT-PCR) revealed the presence of SARS-CoV-2. On the third day of hospitalization, diarrhea and vomiting were added to the patient's symptoms. Neutralizing antibody test (IgM and IgG) for COVID-19 had not yet been developed and available in Iran on his first hospital admission. The patient's para-clinical data showed increased C-reactive protein (CRP) levels and lymphopenia, as shown in table 1. The patient was prescribed hydroxychloroquine, oseltamivir, azithromycin, diphenhydramine, and acetaminophen at the time of hospitalization and was discharged after 14 days with two repeated nasal swab tests in 24 hours

**Table 1:** The case's laboratory data

Test	At the first admission	At the second admission
White Blood Cell (WBC) count per microliter	$16.2 \times 10^3$	$6.4 \times 10^3$
Differentiation	Neutrophils %	80
	Lymphocytes %	42.2
Red Blood Cell (RBC) count per microliter	$6.55 \times 10^6$	$6.04 \times 10^6$
Platelet count per microliter	$303 \times 10^3$	$231 \times 10^3$
C-Reactive Protein (CRP)	30	1
RT-PCR of the nasopharyngeal swab tests	Positive	Negative between the admissions
IgM	NA	Negative
IgG	NA	Negative

NA: not available

with negative results. Para-clinical data also improved at discharge.

About three months later, he developed the symptoms myalgia and anosmia. The nasopharyngeal and oropharyngeal swab test turned out positive in the RT-PCR analysis, but at the time, the patient's laboratory data were completely normal and no increased CRP level was noted (Table 1). At this time, both neutralizing antibody tests for COVID-19, i.e. IgM and IgG, were negative. About ten days after the second admission, the patient's symptoms improved, and the RT-PCR analysis of the nasopharyngeal and oropharyngeal swab tests showed negative results and the patient was discharged.

## DISCUSSION

This paper reports on a case of COVID-19 reinfection after three months from the first infection. Before reviewing the literature, we should provide a clear definition of COVID-19 reinfection. Kirkcaldy et al. provided an acceptable definition as follows: A new infection after clearance of the body from SARS-CoV-2 that is molecularly different from the previous SARS-CoV-2 viral agent. The final confirmation of COVID-19 reinfection is only possible with viral genomic comparisons (3). Neutralizing antibody tests may still be premature for determining immunity against the new coronavirus. Clinical relapse is indicated by the absence of enough neutralizing antibodies. Reinfection may also occur due to new coronavirus families (229E-NL63-OC43) (3).

Dabiao et al. reported COVID-19 reinfection in a 46-year-old woman. The first symptoms of the infection were fever, cough, and sore throat. The patient's high-resolution-computed tomography (HRCT) showed evidence of COVID-19. The RT-PCR performed from the oropharyngeal swab was positive for COVID-19. Twelve days after their onset, the patient's symptoms were fully improved. In their case, the criterion for body clearance of SARS-CoV-2 was a double negative RT-PCR test

with nasopharyngeal and oropharyngeal swabs. Nonetheless, on the 17<sup>th</sup> day, the patient's RT-PCR test with nasopharyngeal and oropharyngeal swabs proved positive again. A neutralizing antibody test (IgM and IgG) for COVID-19 was not performed in their case (4).

Fu et al. reported three patients who had recovered from COVID-19 and were later re-admitted for this viral infection. At their second admission, the patients' IgM was negative but their IgG was positive. The patients' RT-PCR tests were negative when being discharged and going into quarantine after the first admission. Meanwhile, about one month later, at the second admission, the RT-PCR test turned out positive for all three patients. At both hospital admissions, the patients' IgM was negative and IgG was positive (5).

In the study by Lau et al., a 58-year-old woman infected with SARS-CoV-2 was discharged from the hospital after two negative neutralizing antibody and RT-PCR tests. Nonetheless, after 22 days, the patient developed new symptoms and the RT-PCR with nasopharyngeal swab and IgM test were positive while the IgG test was negative (6).

Some researchers have investigated the subject of immunity against COVID-19 in animal models. In one study by Bao et al., they infected four rhesus monkeys and ensured their complete recovery and negative PCR testing and then induced a second exposure to the virus, but their RT-PCR tests did not become positive again (7). In another study by Chandrashekar et al. on second contamination and the re-exposure of rhesus monkeys, protective immunity was induced (8).

Overall, the reported cases of reinfection all showed positive PCR test results over a short span of time (mostly in less than one month) after the first infection. In our case, however, reinfection occurred after about three months. Wang et al. hypothesized that reinfection may occur because the residual viruses could go to the nasopharynx area and make the RT-PCR tests positive again (9). Despite the other reported cases, our case was a

healthcare worker. Due to the state of the epidemic in Iran and the urgent need for the services of more healthcare workers, our patient started working at the COVID-19 ward 14 days after the first hospitalization and the new infection could be due to the frequent exposures to COVID-19 patients in the hospital.

In our case, the long span of time from the first admission to the second time, could be explained by the discussed hypothesis. Since the existing neutralizing antibody tests are still premature, and reinfection confirmation is only possible if a new virus genome is compared with the previous sample based on RNA molecule sequences, and since no studies have yet been able to provide this information, many questions remain unanswered. Comparing different studies has led to very divergent results, which shows the involvement of various factors in the issue. Sampling methods, the accuracy of the tests, the pattern of virus activity in different communities, the severity of the COVID-19 infection and the immune system's response to it, and other possible factors may all affect our findings (10). Based on the findings reported by Sayak's study, the sampling method was taken into consideration in our study and the author believes that the likelihood of recurrence is low and the reported cases were more due to sampling errors and test results. Nonetheless, he suggests that a minimum quarantine of 14 days be observed for recovered patients after discharge (11).

## REFERENCES

1. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *Int J Surg*. 2020;76:71-6.
2. Coronaviridae Study Group of the International Committee on Taxonomy of Viruses. The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nature Microbiology*. 2020;5(4):536-44.
3. Kirkcaldy RD, King BA, Brooks JT. COVID-19 and Postinfection Immunity: Limited Evidence, Many Remaining Questions. *JAMA*. 2020;323(22):2245-6.
4. Chen D, Xu W, Lei Z, Huang Z, Liu J, Gao Z, et al. Recurrence of positive SARS-CoV-2 RNA in COVID-19: A case report. *Int J Infect Dis*. 2020;93:297-9.
5. Fu W, Chen Q, Wang T. Letter to the Editor: Three cases of re-detectable positive SARS-CoV-2 RNA in recovered COVID-19 patients with antibodies. *J Med Virol*. 2020; [Epub ahead of print].
6. Luo A. Positive SARS-Cov-2 test in a woman with COVID-19 at 22 days after hospital discharge: A case report. *J Tradit Chin Med Sci*. 2020; [Epub ahead of print].
7. Bao L, Deng W, Gao H, Xiao C, Liu J, Xue J, et al. Reinfection could not occur in SARS-CoV-2 infected rhesus macaques. *BioRxiv*. 2020; Preprint.
8. Chandrashekar A, Liu J, Martinot AJ, McMahan K, Mercado NB, Peter L, et al. SARS-CoV-2 infection protects against rechallenge in rhesus macaques. *Science*. 2020;369(6505):812-7.
9. Wang M, Hu Z, Liu J, Pang P, Fu G, Qian A, et al. Positive RT-PCR Test Results in Discharged COVID-19 Patients: Reinfection or Residual? *Research Square*. 2020; Preprint.

## CONCLUSIONS

The reinfection hypothesis could not be ruled out and there is still a long way to go to find a definitive answer. The only important thing is that a standard protocol should be developed in hospitals for discharging patients, since post-recovery reinfection is possible. A quarantine after discharge is therefore necessary for COVID-19 patients and being a survivor does not rule out COVID-19 reinfection.

## ACKNOWLEDGEMENTS

The Clinical Research Development Unit of Peymanieh Hospital is pleased to assist in the implementation of this research and to help reform this article.

## AUTHORS' CONTRIBUTION

All the authors fulfil the criteria of authorship based on the recommendations of the International Committee of Medical Journal Editors (ICMJE).

## CONFLICT OF INTEREST

None declared

## FUNDING

None declared

10. Hatami N, Ahi S, Sadeghinikoo A, Foroughian M, Javdani F, Kalani N, et al. Worldwide ACE (I/D) polymorphism may affect COVID-19 recovery rate: an ecological meta-regression. *Endocrine*. 2020; [Epub ahead of print].
11. Roy S. COVID-19 Reinfection: Myth or Truth? *SN Compr Clin Med*. 2020; [Epub ahead of print].