Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Indian Journal of Medical Microbiology 40 (2022) 166–168

Contents lists available at ScienceDirect

Indian Journal of Medical Microbiology

journal homepage: www.journals.elsevier.com/indian-journal-of-medical-microbiology

Case Report

A case with SARS-CoV-2 reinfection from India

Ashok Munivenkatappa [a,1], Rima R. Sahay [b,1], Gururaj R. Deshpande [b], Deepak Y. Patil [b], Anita M. Shete [b], Gajanan N. Sapkal [b], Ravish Kumar [c], Marappa Narayana [c], Pragya D. Yadav [b,*], Vijay Shettar [c]

[a] Indian Council of Medical Research-National Institute of Virology, Bangalore Unit, Karnataka, 560029, India
[b] Indian Council of Medical Research-National Institute of Virology, Pune, Maharashtra, 411021, India
[c] Employees' State Insurance Corporation Medical College and Hospital, Gulbarga, Karnataka, 585106, India

ARTICLE INFO

Keywords:
SARS-CoV-2
IgG antibodies
Reinfection
India
COVID-19

ABSTRACT

A healthcare worker presented with fever, cough, headache and tested positive by SARS-CoV-2 real time reverse transcriptase polymerase chain reaction (qRT-PCR). He got admitted to hospital and recovered after 14 days. After 2 months, as a screening protocol considering the high risk setup he got tested and again found to be positive for SARS-CoV-2 by qRT-PCR. Our patient had detectable levels of Anti-SARS-CoV-2 IgG antibodies during the reinfection but found negative for Neutralizing antibodies (NAb). Our findings suggest that the person after the initial infection might not develop the desired protective immunity to prevent the reinfection as demonstrated by absence of NAb.

1. Introduction

Health care workers being a high risk group for contracting the SARS-CoV-2 infection with the high probability of the re-infection [1]. The duration of immune response and waning immunity in SARS-CoV-2 cases remained unexplored considering the reinfection amongst the recovered cases. Here, we report a case of SARS-CoV-2 reinfection in a health care worker.

2. Case report

On 25th July 2020, a 23 year male, healthcare worker in a tertiary care hospital from Gulbarga, Karnataka, India presented with recurrent abdominal pain since three days; and moderate grade fever of 101°F, dry cough, malaise, headache from two days. He was a non-smoker, non-alcoholic and had the history of allergic rhinitis. However, he didn't have any history of underline co-morbid conditions including diabetes, hypertension, chronic pulmonary obstructive airway diseases or any other immunocompromised diseases. His vitals were stable; including the respiratory rate and oxygen saturation. Nasophyrangeal and orophyrangeal swabs were tested positive by SARS-CoV-2 real time reverse transcriptase polymerase chain reaction (qRT-PCR) [E gene- 32 Ct: RdRp-34 Ct] [2]. The chest X-ray revealed left middle and lower lobe homogenous opacity, suggestive of lobar pneumonia. He was provided with a supportive care in an isolation facility and started on intravenous (iv) antibiotic injections of Cefaperazone/Sulbactum 1.5 gm once a day (OD) along with iv steroid Dexamethasone 6mg OD for 7 days. Inj. Enoxaparin sodium 40mg was also given subcutaneously OD for 7 days. After two days, he lost sense of taste and smell. Clinical resolution occurred by 14th day and was discharged after being tested negative by qRT-PCR on August 14, 2020. Smell and taste sensation recovered gradually in a month. Anti-SARS-CoV-2 Immunoglobulin (Ig) IgM and IgG antibodies were not tested at this time due to unavailability of serum samples.

On 9th October 2020, convalescent serum sample was screened for Anti- SARS-CoV-2 IgG antibodies against the spike (S1) protein, receptor-binding domain (RBD), and nucleocapsid (N) protein by Enzyme Linked Immunosorbent Assay (ELISA) [3]. Both assays were developed and validated in house by ICMR-NIV Pune. Anti-SARS-CoV-2 IgG antibodies were detected by both the assays with the optical density (OD) of 1.243; Positive to negative ratio (P/N) of 8.57 for N protein ELISA and OD of 0.658 and P/N of 4.14 for S1-RBD ELISA. Same sample was tested for the neutralizing antibodies (NAb) titres by plaque reduction neutralization

* Corresponding author. Maximum Containment Facility, Indian Council of Medical Research-National Institute of Virology, Sus Road, Pashan, Pune, 411021, India.
E-mail addresses: ashokmniv@gmail.com (A. Munivenkatappa), dr.rima.sahay@gmail.com (R.R. Sahay), gndeshpande@gmail.com (G.R. Deshpande), patildeepak8@gmail.com (D.Y. Patil), anitaaich2008@gmail.com (A.M. Shete), gajanansapkalniv@gmail.com (G.N. Sapkal), drravish@rocketmail.com (R. Kumar), marappa003@gmail.com (M. Narayana), hellopragya22@gmail.com (P.D. Yadav), shettarv@gmail.com (V. Shettar).
[1] Contributed equally to the study & are first author.

https://doi.org/10.1016/j.ijmmb.2021.09.010
Received 2 July 2021; Received in revised form 22 September 2021; Accepted 24 September 2021
Available online 15 November 2021

(PRNT50) based assay [4] and was found positive.

On November 9, 2020, as a part of proactive screening of the health care staff considering high risk setting for SARS-CoV-2 in his hospital, he was again tested positive for SARS-CoV-2 by qRT-PCR (E gene- 29.5 Ct: RdRp- 30.9 Ct) (Fig. 1). This time, he was asymptomatic with stable vitals. Serum sample demonstrated the presence of Anti-SARS-CoV-2 IgG antibodies (OD- 1.098; P/N- 7.57 for N protein ELISA and OD- 0.67; P/N- 4.21 for S1-RBD ELISA) but the NAb were not detected. Anti-SARS-CoV-2 IgM antibodies were not detected. He remained asymptomatic during the course of infection and was kept in isolation and was discharged after 14 days.

On December 30, 2020, his serum sample was again tested and found positive for Anti-SARS-CoV-2 IgG antibodies (OD- 1.272; P/N- 8.77 for N protein ELISA and OD- 0.618; P/N- 3.88 for S1-RBD ELISA) and negative for NAb. There was no significant rise in any of the acute phase markers during first and the reinfection (supplementary table).

In order to characterize the SARS-CoV-2 at the two different time points of infection, next-generation sequencing was performed as described earlier [5]. Reference based mapping with Wuhan Hu-1 (accession number: NC_045512.2) could not retrieve SARS-CoV-2 sequences. This could be due to the high Ct values (low viral load) in the clinical samples at both the time of infection.

3. Discussion

The ICMR recent epidemiological study records 4.5% of SARS-CoV-2 reinfection in India [6]. The clinical, serological and the NAb titres confirm the SARS-CoV-2 reinfection among a young, immunocompetent health care worker. Similar study conducted by Mulder et al., [7] reported the absence of antibody response in patient post 6 days after second infection. However, our patient had detectable levels of IgG antibodies during the reinfection but found negative for NAb. Our findings suggest that the person after the initial infection might not develop the desired protective immunity to prevent the reinfection as demonstrated by absence of NAb. This might have implications on the current vaccine strategies against COVID-19. Tillett et al., had recently reported moderate to severe SARS-CoV-2 reinfection [8], while our case remained asymptomatic during the reinfection and his sera detected IgG antibodies. As individuals with mild or asymptomatic infection tend to have lower antibody levels than those with severe disease, and some studies have suggested waning of antibody levels occurs within several months after infection [9]. Our study also fulfils standard set of the criteria for high suspicion index of $\geq$90 days window, for determining the reinfection [10].

4. Conclusion

In most of the situation, absence of the clinical samples from the first infection makes it difficult to conclude the reinfection cases. Our study also emphasizes that all the high risk group including health care worker need to be proactively screened for SARS-CoV-2 irrespective of past COVID-19 infection.

Financial support

Financial support was provided by the Indian Council of Medical Research, New Delhi, at ICMR-National Institute of Virology, Pune for COVID-19 research.

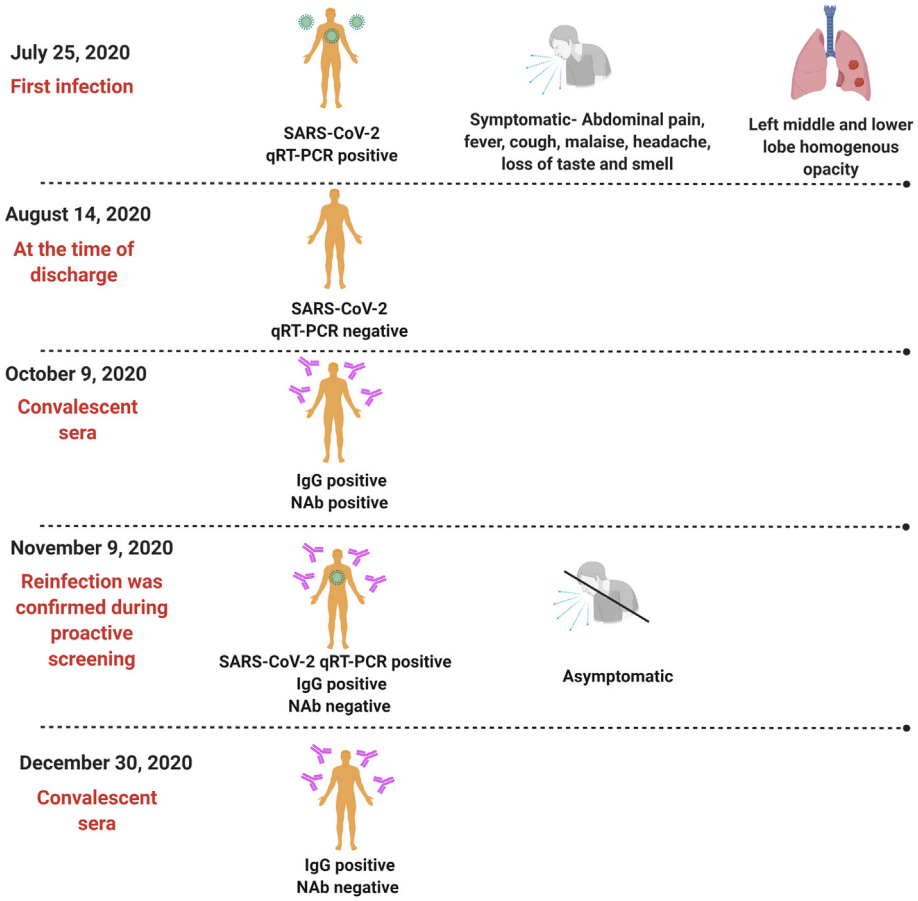

Fig. 1. Graphical presentation of the timeline for the SARS-CoV-2 reinfection.
(All the details in the figure are created by author themselves using the licensed version of the online software BioRender.com).

CRediT authorship contribution statement

PDY, AM, RRS: Conceptualization and Supervision. **PDY:** Funding acquisition and Project administration. **PDY, AM, RRS,GRD, DYP, AMS, GNS, RK, MN, VS:** Investigation and Resources. **RRS, AM, AMS, GRD:** Methodology and Formal analysis. **RRS:** Software. **PDY, GNS:** Validation. **PDY, RRS, AM:** Initial draft, writing, review & editing. **GRD, AMS, DYP, GNS, RK, MN, VS:** Review & editing.

Author contributions

PDY, RRS and AM contributed to study design, data collection, data analysis, interpretation, writing and critical review. DYP, GNS, AMS and GRD contributed to data analysis and interpretation, writing and critical review. RK, MN and VS contributed to data collection, writing and critical review.

Ethical statement

The informed written consent was taken from the patient.

Declaration of competing interest

None.

Acknowledgement

Authors gratefully acknowledge the encouragement and support extended by Prof. (Dr.) Priya Abraham, Director, ICMR-NIV, Pune. Authors are grateful to Col (Dr.) Sanjay Kumar, Neurosurgeon from the Department of Neurosurgery, Command Hospital (Southern Command), Armed Forces Medical College, Pune for the critical review on the manuscript. We thank the staff of Maximum Containment Facility, ICMR-NIV, Pune including Ms. Pranita Gawande, Mrs. Ashwini Waghmare, Mrs. Triparna Majumdar, Mrs. Savita Patil, Dr. Rajlaxmi Jain for providing excellent technical support.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijmmb.2021.09.010.

References

[1] Oster Y, Wolf DG, Olshtain-Pops K, Rotstein Z, Schwartz C, Benenson S. Proactive screening approach for SARS-CoV-2 among healthcare workers. Clin Microbiol Infect 2021;27(1):155. https://doi.org/10.1016/S0140-6736(20)30917-X.

[2] Choudhary ML, Vipat V, Jadhav S, Basu A, Cherian S, Abraham P, et al. Development of *in vitro* transcribed RNA as positive control for laboratory diagnosis of SARS-CoV-2 in India. Indian J Med Res 2020;151(2 & 3):251–4. https://doi.org/10.4103/ijmr.IJMR_671_20.

[3] Ella R, Siddharth R, Jogdand H, Sarangi V, Ganneru B, Prasad S, et al. Safety and immunogenicity clinical trial of an inactivated SARS-CoV-2 vaccine, BBV152 (a phase 2, double-blind, randomised controlled trial) and the persistence of immune responses from a phase 1 follow-up report. Lancet Infect Dis 2021;21(7):950–61. https://doi.org/10.1016/S1473-3099(21)00070-0.

[4] Deshpande GR, Sapkal GN, Tilekar BN, Yadav PD, Gurav Y, Gaikwad S, et al. Neutralizing antibody responses to SARS-CoV-2 in COVID-19 patients. Indian J Med Res 2020;152(1–2):82. https://doi.org/10.4103/ijmr.IJMR_2382_20.

[5] Yadav PD, Nyayanit DA, Shete AM, Jain S, Majumdar TP, Chaubal GY, et al. Complete genome sequencing of Kaisodi virus isolated from ticks in India belonging to Phlebovirus genus, Family Phenuiviridae. Tick Borne Dis 2019;10(1):23–33. https://doi.org/10.1016/j.ttbdis.2018.08.012.

[6] Mukherjee A, Anand T, Agarwal A, Singh H, Chatterjee P, Narayan J, et al. SARS-CoV-2 re-infection: development of an epidemiological definition from India. Epidemiol Infect 2021;149. https://doi.org/10.1017/S0950268821000662. e82.

[7] Mulder M, van der Vegt DSJM, Oude Munnink BB, GeurtsvanKessel CH, van de Bovenkamp J, Sikkema RS, et al. Reinfection of SARS-CoV-2 in an immunocompromised patient: a case report. Clin Infect Dis 2021;73(9):e2841–42. https://doi.org/10.1093/cid/ciaa1538.

[8] Tillett RL, Sevinsky JR, Hartley PD, Kerwin H, Crawford N, Gorzalski A, et al. Genomic evidence for reinfection with SARS-CoV-2: a case study. Lancet Infect Dis 2021;21(1):52–8. https://doi.org/10.1016/S1473-3099(20)30764-7.

[9] Kirkcaldy RD, King BA, Brooks JT. COVID-19 and postinfection immunity: limited evidence, many remaining questions. JAMA 2020;323(22):2245–6. https://doi.org/10.1001/jama.2020.7869.

[10] Investigative criteria for suspected cases of SARS-CoV-2 reinfection (ICR). 2020. https://www.cdc.gov/coronavirus/2019-ncov/ph p/invest-criteria.html [accessed 1 March 2021].