



Received: 15 April, 2021

Accepted: 25 March, 2022

Published: 26 March, 2022

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Keywords: Seroprevalence SARS-CoV-2; Seroprevalence in HCW; Seroprevalence India

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Research Article

Changing seroprevalence to SARS-CoV-2 in health care workers during COVID-19 pandemic

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Abstract

Background and objective: The entire world is reeling under the COVID-19 pandemic caused by coronavirus SARS-CoV-2. A longitudinal study was planned to understand the evolving pattern of seroprevalence of anti-SARS CoV-2 antibodies in a cohort of health care workers.

Method: A prospective study was conducted among the health care workers categorized as doctors, nursing staff, paramedical staff, and housekeeping staff. A qualitative estimation of total antibodies (IgM+IgG+IgA) against SARS-CoV-2 was carried out using an ELISA kit in July and November 2020.

Results: Total 443 blood samples were collected on July 20 and 214 samples in November. A cohort of 140 health care workers was selected from July to November 2020 data. The overall seroprevalence in HCWs was 8.35% in July 2020 and it increased to 26.63% in November 2020. The overall seroprevalence in the HCW cohort also revealed an increase from 12.14%. 30.71%. In the cohort of healthcare workers, there was a constant seroprevalence in nursing staff (10.5%) and housekeeping staff (25%) while a statistically significant ($p=0.002$) rise in seroprevalence rate (12.6 to 41.37) was noted in the paramedics.

Conclusion: The seroprevalence of anti-SARS-CoV2 antibodies in asymptomatic HCWs increased from 8.35% to 26.63% over a period of 4 months. A significant rise in seroprevalence was noted amongst nurses ($p=0.0005$) and paramedics ($p=0.007$). The seroprevalence data of the cohort group revealed a statistically significant rise in seroprevalence in paramedics ($p=0.002$) as compared to other categories of healthcare personnel.

Abbreviations

COVID-19: Coronavirus Disease 2019; SARS CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; HCW: Healthcare Worker

Introduction

Coronavirus Disease 2019 (COVID-19) is an acute respiratory disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS CoV-2). India is the second-worst affected country in the world after the US and has the third-largest number of COVID-19 deaths after the US and Brazil.

Disease surveillance forms the foundation stone to understand disease transmission and disease epidemiology and

also enables public health scientists to make informed decisions on mass vaccination [1]. In order to control the pandemic, the Indian government is implementing an ambitious vaccine rollout. As of date, 5.3 million Indian healthcare workers have received the first dose of the vaccine in just 3 weeks, which is probably the fastest vaccine rollout in the world. At this juncture understanding seroprevalence of anti-SARS-CoV-2 antibodies in the resident population and its changes in course of the pandemic can offer greater insight into the whole issue of immunity against the disease. Seroprevalence studies can help to estimate the extent of infection as well as the rate of asymptomatic infection [2]. Most of the SARS-CoV2 seroprevalence studies done so far have been population-based cross-sectional studies [1,3-5].



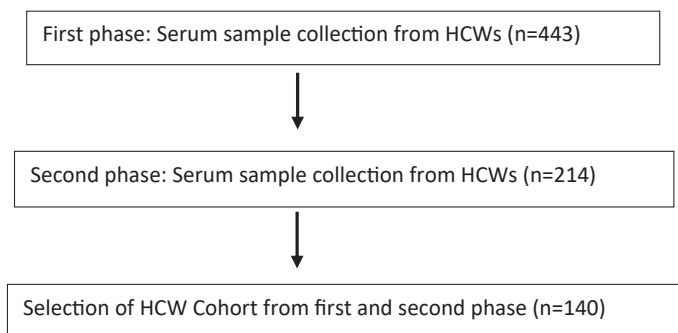
Healthcare workers (HCWs) represent a high-risk group for SARS CoV-2 infection. This is due to their increased risk of exposure in their work environment. They can also contract the infection from their family and social contacts. This, longitudinal study was planned to understand the evolving pattern of seroprevalence of anti-SARS CoV-2 antibodies in a cohort of health care workers as they faced an upsurge of cases in a tertiary care hospital in North India.

Method

A prospective study was conducted among the health care workers (doctors, nursing staff, paramedical staff, and housekeeping staff) working in a 410-bedded COVID hospital. The nursing staff was directly involved in patient care while paramedical staff includes laboratory technicians involved in COVID diagnosis and radiographers involved in X-ray, CT scan, etc. COVID-19 protective protocols as defined by WHO and ICMR were strictly implemented in the hospital. An ELISA-based antibody testing strategy was used as the surveillance method. The seroprevalence was estimated in Jul 2020 and again in Nov 2020. Two milliliter serum sample was collected from all the consenting HCWs. Those who refused consent or those in whom venipuncture was contraindicated were excluded. An Indian Council of Medical Research approved ELISA kit (Microlisa by J Mitra) for qualitative estimation of total antibodies (IgM+IgG+IgA) against SARS-CoV-2 was used. Microlisa is a double antigen sandwich ELISA method with a sensitivity of 96.72% and specificity of 100%, and the outcome was defined as the presence or absence of antibodies against the SARS-CoV-2.

Statistical analysis

Chi-square test was done to analyze the change in prevalence is statistically significant or not.



Result

A total of 443 blood samples were collected in July 2020 and 214 in November 2020. The cumulative number of hospitalized COVID-19 cases in the hospital at the two sampling points were 32 and 396 respectively. A cohort of 140 HCWs was sampled twice (i.e., in both July and November). The overall seroprevalence was 8.35% in July 2020 and it increased to 26.63% in November 2020. The change in seroprevalence in different types of HCWs

is depicted in Table 1. The change in seroprevalence among doctors, nurses was 11.5% and 28.7 % respectively. The change in seroprevalence among paramedics and housekeeping staff was 7.8% and 15.3% respectively. A statistically significant rise in seroprevalence was noted among the nursing staff and paramedical staff. Among the cohort of 140 health care workers, 17 HCWs had baseline antibodies. Amongst these 17, only 2 revealed the absence of antibodies after 3 months. Among the cohort of 140 health care workers, 17 HCWs had baseline antibodies. Amongst these 17, only 2 revealed the absence of antibodies after 3 months.

Of the 443 people, 140 HCWs were longitudinally followed up till November 2020. The seroprevalence data of the cohort group revealed a change in seroprevalence in paramedics and doctors only Table 2.

Prior to the first survey none of the doctors, nurses, paramedics, or housekeeping staff had suffered from COVID-19 or reported contact with a positive case apart from the hospital setting. Despite this 37 HCWs revealed the presence of antibodies at baseline. The number of HCWs who were diagnosed to have COVID-19 between July and November 2020 was 15. Overall seroprevalence in this cohort increased from 12.14%. 30.71%.

Table 1: Seroprevalence data in July and November.

Seroprevalence in each category	July 2020 (n=443) %	November 2020 (n=214) %	P-value
Doctors	9	20.5	0.24
Nurses	8	36.7	0.0005
Paramedics	8.5	16.3	0.007
Housekeeping staff	4.7	20	0.25

Table 2: Seroprevalence data in a cohort of health care workers.

Seroprevalence in HCW cohort (n=140)	First phase: July 2020 (%)	Second phase: November 2020 (%)	P-value
Doctors (n=11)	9	18	0.53
Nurses (n=38)	10.5	10.5	--
Paramedics (n=87)	12.6	41.37	0.002
Housekeeping staff (n=4)	25	25	--

Discussion

Health care workers are at higher risk than all other front-line workers in acquiring COVID-19 infection despite adopting all standard precautions. There is a wide variation in seroprevalence amongst HCWs. It ranges from 3-4% in China to 20% in the USA and Italy [6]. In a recent study on seroprevalence in the state of Karnataka in India, 1907 rural and urban households were surveyed in five regions of the state [7]. 1197 blood samples and 1341 nasopharyngeal swab samples were collected. These represent 72.7% and 73.3% of surveyed households respectively. The overall seroprevalence of IgG anti-SARS CoV-2 antibodies in rural and urban areas and the state as a whole were 37.4% (95%CI 32.9-41.8%), 45.6% (95%CI 38.1-53.1%), and 39.6% (95% CI 35.7-43.4%)



respectively. The adjusted proportion of positive SARS-CoV-2 PCR tests for rural, urban and state were 3.6% (95% CI 2.2-4.9); 6.8% (95% CI 3.5%-10.1%) and 4.3% (95% CI 3.1-5.7%) respectively. The adjusted seroprevalence of SARS-CoV-2 across Karnataka was 46.7%. This meant that about 31.5 million residents had been infected. In the same state, only 327076 cases were reported till 29 Aug 2020.

But these only point prevalence studies. Serial surveys in HCWs are a tool to identify interventions that could reduce this risk of contracting the infection. As the SARS-CoV-2 disappears from the COVID-19 patient within a few weeks and antibodies against SARS-CoV-2 persist for a longer time [8]. An attempt was made to look at antibody response. The overall seroprevalence recorded in this study was 8.35% in July which was lower than other Indian studies (11.94%) and that from the UK (18%) and comparable to that from Netherlands (9%) [3,9]. This baseline seroprevalence was probably due to asymptomatic infections or undiagnosed illness. The higher rise in seroprevalence among the nursing staff (36.7%) in November 2020 (second phase) may be due to the longer duration of exposure of nursing staff while taking care of ventilated patients and their proximity to patients shedding the virus. The overall seroprevalence for SARS-CoV-2 increased from 8.35% to 26.63% over a period of 4 months without any major COVID-19 outbreak occurring in the hospital. This implies that asymptomatic infection was occurring despite best personal protection practices being followed.

Two HCWs revealed the absence of antibodies (2/37) in the second phase as compared to the first, the rest (35/37) showed the presence of antibodies in both phases. The persistence of SARS-CoV-2 antibodies for >3 months is widely reported [8]. But the disappearance of antibodies in these two otherwise healthy personnel cannot be easily explained.

WHO has encouraged the conduct of longitudinal COVID-19 seroepidemiological surveys to understand the trends of infection [2]. This study focused on documenting change in seroprevalence from baseline over a period when COVID-19 cases were being actively managed in the hospital. To the best knowledge of the authors, this is a unique longitudinal cohort study in health care workers. The cohort data revealed a significant rise in seroprevalence in paramedic staff as compared to doctors, nursing staff, and housekeeping staff. This presence of antibodies in HCWs at baseline indicates asymptomatic infection with SARS-CoV-2. This may be due to exposure to asymptomatic COVID-19 cases in hospital out-patient clientele and emergency admissions. All cases getting admitted to the hospital since the onset of the pandemic have been tested for COVID-19 by micro-RT PCR. The possibility of community-acquired exposure also cannot be ruled out. The constant seroprevalence rate in nursing and housekeeping staff indicates the presence of antibodies even after 3 months as well adherence to COVID-19 prevention protocols. A major limitation of this study was qualitative antibody estimation instead of quantitative method. The quantitative titers would have helped to understand the rise or fall in antibody titers, especially in the cohort after 3 months.

Conclusion

The baseline seroprevalence of SARS-CoV-2 in asymptomatic HCWs was 8.35% and it rose to 26.63% over a period of 4 months. A significant rise in seroprevalence was noted in nursing staff and housekeeping staff. 35/37 HCWs demonstrated the presence of antibodies against SARS-CoV-2 after a period of 3 months. Overall seroprevalence in the HCW cohort also revealed an increase from 12.14% to 30.71%.

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