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ESTIMATION OF SARS-COV-2 SPECIFIC ANTIBODIES SEROPREVALENCE IN HEALTHCARE WORKERS IN DISTRICT UDAIPUR, INDIA

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ABSTRACT

Background: Current pandemic caused by Novel coronavirus (COVID-19) causes clinical symptoms from fever to acute respiratory distress syndrome but may remain mild or asymptomatic. To evaluate the cumulative prevalence of SARS-CoV-2 infection in a community and know how immune response develops in the population, reliable assay alongwith RT-PCR for detection of SARS-CoV-2 antibodies is needed. Healthcare workers (HCWs) represent a high-risk population for infection with SARS-CoV-2.

Methods: We evaluated total antibodies recognizing the SARS-CoV-2 receptor-binding domain (S1-RBD) or the Spike protein over a period of six months in a total of 310 healthcare workers engaged in hospital using SARS-CoV-2 Total antibody assay kit.

Findings: The overall seroprevalence found in our analysis was 41.93%. In case of males the percentage positive was found to be significantly higher at 43.91%, compared to females at 36.25%. Seroprevalence was significantly higher in 50 years above age group in comparison to 20-50 years old aged healthcare workers. The seroprevalence was higher in doctors, nursing staff and lab technicians than other healthcare professionals as 44.6%.

Conclusions: This study showed high seroprevalence of SARS-CoV-2 in healthcare workers which means remaining proportion of the healthcare workers are still susceptible to the infection. Good compliance to infection eradication and control measures, adequate PPEs, and early detection and isolation of healthcare workers infected with SARS-CoV-2 are mandatory to reduce the risk of SARS-CoV-2 infection.

KEYWORDS : COVID-19, SARS-CoV-2 antibody, Seroprevalence, Healthcare workers

1. INTRODUCTION

Novel coronavirus (COVID-19) outburst was unpredicted and spread quickly around the entire world. It was first identified in Wuhan, China in Dec 2019 [1]. WHO declared it a public health emergency of international concern in January 2020 and subsequently, described as a pandemic in March 2020 [2, 3]. It was caused by severe acute respiratory syndrome virus 2 (SARS-CoV2) similar to SARS-CoV (2002) and the MERS-CoV (2012) [4, 5]. By the end of December, 2020, more than 80 million cases of COVID-19 and 1.77 million deaths were registered worldwide. India has become the focal point of the COVID-19 episode and became second most influenced nation on the planet with 10.2 million cases and 1.63 lakh deaths, reflecting it remains a continuing threat to health and socio-economic well-being.

The diagnosis and management of COVID-19 are based on the detection of SARS-CoV-2 in patients presenting clinical signs or in suspected cases, by RT-PCR [6, 7], but a significant number of asymptomatic or sub-clinically infected individuals are likely to remain undetected. Therefore, the surveillance of confirmed COVID-19 cases might not be representative for a particular community [8, 9] and the actual number of people exposed to, or infected with, are underestimated [8-10]. Therefore, in addition to RT-PCR based detection, serological screening is a key tool to evaluate the cumulative prevalence of SARS-CoV-2 infection in a community. The prevalence of specific serum antibodies (IgG and/or IgM) against SARS-CoV-2 could give a indication of exposure to SARS-CoV-2 in a population [8, 10]. Because of an evident perseverance of antibodies to SARS-CoV-2 (especially IgG) after viral clearance [8], it is expected that serological monitoring and surveillance give significant datasets to estimate the cumulative prevalence of SARS-CoV-2 infection in a population [8, 11] and may even indicate the immune status of individuals or populations [7]. Since December 2020, several seroprevalance studies have been reported from different countries, including India, Brazil, China, Iran, Italy, Spain, USA, Switzerland [12-19].

Knowing the prevalence of COVID-19 infection among healthcare workers is crucial, as their role in the pandemic implies high risk of exposure against this pathogen. Due to the poor handling of personal protective equipment, hospital staff plays the role of asymptomatic carriers for transmission of infection to society and also for their family members. Previous studies have reported COVID-19 seroprevalence rates of up to 17.4% among the healthcare workers [20-24]. Further, detection of prevalence among healthcare workers in various areas of hospital helps to minimize this risk of infection in hospital staff. Therefore, we initiated a seroprevalence study in healthcare workers to evaluate the spread of SARS-CoV-2 in Govt. M.B. Hospital, Udaipur between August to December 2020. It included all employees, such as doctors, nurses, laboratory technicians, administrative and other staff.

2. MATERIALS AND METHODS

Study design and participants

This study is a prospective, single□centre observational study conducted between August 2020 to December 2020. A total of 310 healthcare workers of RNT Medical College and associated Govt. M.B. Hospital, Udaipur who regards himself/herself had risk of exposure to COVID-19 and whether they had symptoms or not were recruited in this study with approval of institutional ethical committee (approval no. RNT/Stat./IEC//2020/SPL-3). COVID-19 RT-PCR positive healthcare workers were excluded from the study. All participants were categorized on the basis of age and gender.

Serological testing and data analysis

Blood samples were collected from all participants. Subsequently, serum was separated and SARS-CoV-2 antibodies were detected using SARS-CoV-2 Total antibody assay kit (Siemens Health Care Diagnostics Inc, NY, USA). This kit has high sensitivity and specificity for the detection of SARS-CoV-2 infection when the samples have been taken two weeks after the onset of symptoms. QC and calibration of this kit was performed as per manufacturer requirements. Descriptive analyses were made on baseline characteristics and the number of observations showed as numbers and percentages.

3. RESULT

A total of 310 healthcare workers were recruited in this study including 230 male and 80 females. The percentage of male healthcare worker was higher than females. Out of 310, 204 doctors (65.81%), 50 nursing

staff (16.13%), 20 lab technicians (6.45%), 30 other staff (9.68%) and 6 administrative staff (1.93%) were included. These healthcare workers were categorized in two age groups: below 50 and above 50 years old. Demographic data are shown in Table 1.

The overall seroprevalence found in our analysis was 41.93%. In case of males the percentage positive was found to be significantly higher at 43.91%, compared to females at 36.25%. In case of above 50 years old age, seroprevalence is significantly higher in compare to age group below 50 years old aged healthcare workers. The seroprevalence was higher in doctors and nursing staff than other healthcare professionals with having 44.6%. The result of health care workers for antibody testing is displayed in Table 1, Fig.1.

4. DISCUSSION

The aim of the study was to determine the seroprevalence of SARS-CoV2 in healthcare workers in Govt. M.B. Hospital, Udaipur, India. The results of our study showed that nearly 41.93% of the healthcare workers have evidence of recent SARS-CoV-2 infection. A large proportion of the healthcare workers is, still susceptible to the infection. Of the 310 participants, who found positive for anti-SARS-CoV-2 antibodies, did not report any history of COVID-19 like symptoms. Several studies on healthcare workers conducted across the world have reported seroprevalence ranging from 0% in Malaysia to 23% in Delhi [25, 26]. In other countries, similar seroprevalence studies shows 13.7% in USA, 6.4% in Belgium, 10.3% in Spain, 9.4% in Denmark, 10.6% in UK and 17.14% in China [21, 27-31]. These variations may depend on the period of study, the stage of the epidemic in the area at the time of the study, hand sanitization, use of PPE kits and the accuracy of the antibody detection test used. One possible explanation for the high seroprevalence in our healthcare workers is relatively high prevalence of infections in our city, resulting high number of COVID-19 patients admitted in hospital. The higher seroprevalence might also indicator that the local safety precaution is not effective.

We found significantly higher seroprevalence in male healthcare worker in compare to female healthcare worker. Iversen et al also reported higher seropositivity in male healthcare worker in compared to female healthcare worker [21]. In contrast, no seropositivity difference found between male and female healthcare workers in study reported by Basteiro et al [20]. A seroprevalence study across different age group was also included and it was found that people above 50 years of age had a higher rate of presence of SARS-CoV-2 specific IgG antibodies as compared to the young (<50 years), which suggest that age is one of the risk factor for infection. Several studies reported high risk of infection in old age people (32). Our study showed that administrative and other staff had lower rate of seroprevalence whereas doctors, nursing staff and laboratory technicians had a higher rate. Reason behind this could be that physicians and nursing staff move in and around wards and ICU areas among COVID-19 patients and lab technicians routinely handle biological samples of patients with poor compliance of infection prevention and control measures whereas administrative and other staff rarely come in contact with COVID patients.

The level of IgM increased during the first week after SARS-CoV-2 infection, peaked 2 weeks while IgG antibodies appear 10–11 days after symptoms or two weeks after infection and are maintained at a high level for an extended period [15, 25]. Immediately after infection, the IgG titers are negative and thus do not help in the diagnosis of the infection in the early stage. Therefore, we used SARS-CoV-2 Total antibody assay to detect both IgM and IgG antibodies using. Detection of infection by the use of SARS-CoV-2 specific IgM and IgG antibodies has several advantages. As compared to RT-PCR based detection of infection, the antibody-based tests are cheaper and faster. They also pose less danger of infection for healthcare workers since patients may disperse the virus during respiratory sampling. Also, blood samples show reduced heterogeneity compared to respiratory specimens [23].

In summary, this study along with other studies, highlights importance of SARS-CoV-2 antibodies in seroprevalence studies which could guide to effectively control SARS-CoV-2 transmission in the hospital settings.

4. CONCLUSION

In conclusion, Healthcare workers in this study were at high risk of SARS-CoV-2 infection as compared with other studies of healthcare workers from other countries. Among different group of healthcare workers, doctors, nursing staff and laboratory technicians had a higher rate of infection. As, healthcare workers face direct contact of patients with known and unknown COVID-19 status, this data suggests use of ineffective safety precautions. Therefore, Good compliance to infection eradication and control measures, adequate PPEs, and early detection and isolation of healthcare workers infected with SARS-CoV-2 are mandatory to reduce the risk of SARS-CoV-2 infection. Moreover, this study among healthcare workers also gives information regarding the level of exposure in healthcare workers and identification of high-risk occupation in healthcare workers.

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Conflict of interest

The authors declare that there are no conflicts of interest.

Table 1 Demographic data of healthcare workers with percentage positivity

Parameter	Group	Total number (n, %)	Positivity (n, %)
Gender	Male	230 (74.19%)	101 (43.91%)
	Female	80 (25.80%)	29 (36.25%)
Age	20 – 50 years	170 (54.83%)	58 (34.12%)
	Above 50	140 (45.17%)	62 (44.29%)
Healthcare professionals	Physicians	204 (65.8%)	91 (44.6%)
	Nursing staff	50 (16.13%)	21 (42%)
	Lab technicians	20 (6.45%)	8 (40%)
	Other staff	30 (9.68%)	9 (30%)
	Administrative staff	6 (1.93%)	1 (16.67%)

**Overall seroprevalence: 130/310 (41.93%)*

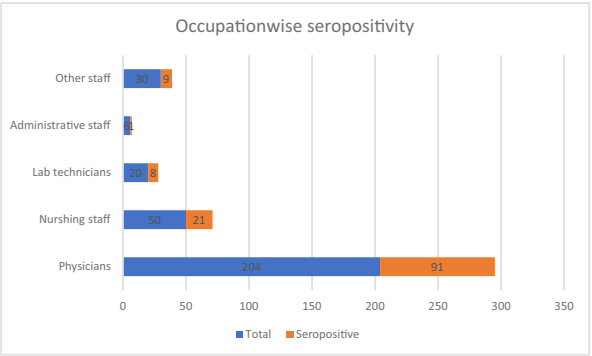

Fig. 1 Distribution of seroprevalence among healthcare workers based on their occupation. The seroprevalence was highest in physicians (44.6%), followed by nursing staff (42%), lab technicians (40%), other staff (30%) and administrative staff (16.67%).

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