

Seroprevalence of Anti-SARS-CoV-2 IgG Antibodies amongst Health Care Workers: A Tertiary Cancer Centre Study in Chhattisgarh State of Central India

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Introduction

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is a beta coronavirus that causes the Coronavirus Disease 2019 (COVID-19) and global pandemic. People who are infected with SARS-CoV-2 may express signs and symptoms of acute respiratory illness, such as fever, cough, shortness of breath, but can also be asymptomatic. Symptomatic, pre-symptomatic and asymptomatic SARS-CoV-2 carriers all can be potential sources for viral transmission [1]. As of December 31st, 2020, nearly 82 million COVID-19 cases have been reported worldwide, causing 180,1095 deaths, of which approx. 10 million confirmed cases and 148,738 deaths were reported in India [2]. Real-Time Reverse Transcription Polymerase Chain Reaction (rRT-PCR) detecting viral genes (e.g. envelope proteins, nucleocapsid proteins, RNA-dependent RNA polymerase genes, and the N1, N2, and N3 target genes) is the current gold standard for the diagnosis of COVID-19. Upper respiratory specimen, such as nasopharyngeal swab and oropharyngeal swab, are commonly used for diagnostic testing [3]. Apart from molecular the use of a serological test to detect anti-SARS-CoV-2 antibodies could be a better way to estimate the burden of SARS-CoV-2 infection than the PCR method, and help improve understanding of the associated epidemiology [4].

Ours is a tertiary care cancer Centre located in central India which is also a designated COVID 19 treatment facility since the beginning of the pandemic. Since our staff is involved in management of COVID 19 infected patient, they are also at an increased risk of exposure.

While a few of them developed COVID 19 infection, many did not report any symptoms. Therefore we planned to conduct a COVID-19 sero survey study to demonstrate Seroprevalence of the SARS-CoV-2 antibody amongst health care workers and determine the effectiveness of all the control measures put in place.

Methods

Design

This was a cross-sectional survey study examining SARS-CoV-2 antibody prevalence among 100 frontline health care workers involved in COVID-19 patient's care and who had never been positive for COVID-19. Informed consent was taken from each participant. The study design was based on the World Health Organization population-based seroepidemiological investigational protocol for COVID-19 virus infection [5].

Subject recruitment was done from October 23, 2020, to October 28, 2020, and prevalence estimates reflect this specific snapshot in time as it is not known how long antibodies persist after infection. One month follow up was done for all who developed anti SARS-CoV-2 IgG antibody.

Participants

Participants were invited to participate in this study voluntarily. Informed consent was taken from each participants after due explanation about the testing methodology. Inclusion criteria were -

healthcare workers involved in patient care directly (doctors, nurses, housekeeping staff and dietician) or indirectly (security and front office/ billing staff) for at-least 6 months were included in the study while those who were COVID-19 positive in the past were excluded.

Materials

Assay

Anti-SARS-CoV-2 IgG test was performed using the VITROS Anti-SARS-CoV-2 IgG Reagent Pack and the VITROS Anti-SARS-CoV-2 IgG Calibrator on the VITROS Eci Immunodiagnostic Systems. It's an immunometric technique based on chemiluminescent immunoassay for the qualitative detection of IgG antibodies to SARS-CoV-2 in human serum. Testing requires 20 µl of serum or 2 mL of whole blood. This test classifies individuals into negative (SC ratio ≥ 1) and positive (SC ratio ≥ 1) for Anti-SARS-CoV-2 IgG antibody.

Demographic

Demographic data included age, sex and occupation. 73% of staff were directly involved in handling of COVID patients/samples and this included doctors, nurses, housekeeping staff and Microbiology lab technicians and 27% of staff were involved with other patient related activities e.g. security and front office/ billing staff (Table 1). All participants were in the age group of 25-45 years, with median age being 30.

Results

Our study showed the prevalence of anti SARS-CoV-2 IgG antibody was 9.0%, of which 66.66% were males and 33.33% were females as shown in figure 1a.

Out of all sero-positive cases, 7 were directly involved in patient care which includes 6 nurses (21.4%) and 1 doctor (4.34%). One Microbiology lab technician (9.0%) involved in COVID testing and another billing staff (6.6%) was also found to be positive as depicted in figure 1b.

Nurses had the highest rate of sero-prevalence as compared to others. Housekeeping and security staff had no antibodies against SARS-CoV2 as shown in figure 2.

Signal cut off ratio of Eci platform for all positive cases were ranges from 1.91 to 13.10 (mean value - 6.69). None of the sero-positive cases complained of any symptoms suggestive of COVID in past 3 months and nor did they develop any signs and symptoms related to COVID-19 disease in subsequent one month of follow up.

Discussion

Nosocomial spread of infectious pathogens has been well known and SARS CoV2 is a new addition to the list. The pandemic has seen many frontline workers getting infected and a few of them

even succumbing to COVID infection. This can be primarily due to inappropriate/inadequate personal protective equipments, breaches in infection control practices, long exhausting hours of duty and poor engineering controls and per-existing medical illnesses [6].

It is important to have adequate engineering processes as well as infection prevention practices in place, as well as full support from hospital management, in order to prevent the transmission of SARS CoV2 inside the hospital.

Ours is a tertiary care dedicated cancer hospital in central India catering mostly to the rural and tribal population of Chhattisgarh. A part of the hospital was designated as COVID treatment Centre while the other half continued to treat cancer patients. Early in the pandemic, the hospital management along with the Infection control team formulated a policy on co-management of COVID and Cancer treatments and measures to safeguard the health and safety of all our staff were put in place. Amongst 508 total staff in the hospital 31 (6.1%) contracted with COVID-19 infection and subsequently got recovered without much complications. These staff was excluded from the study.

As per the government norms, social distancing, thermal screening and compulsory masks for all were initiated. All the visitors to the hospital were screened at fever clinic first and any positive findings were investigated. No admissions to Inpatient were permitted without a negative COVID result.

A rapid response team was formed for intimation of any information related to COVID patient. A separate entry and exit for these patients was planned along with all the support services.

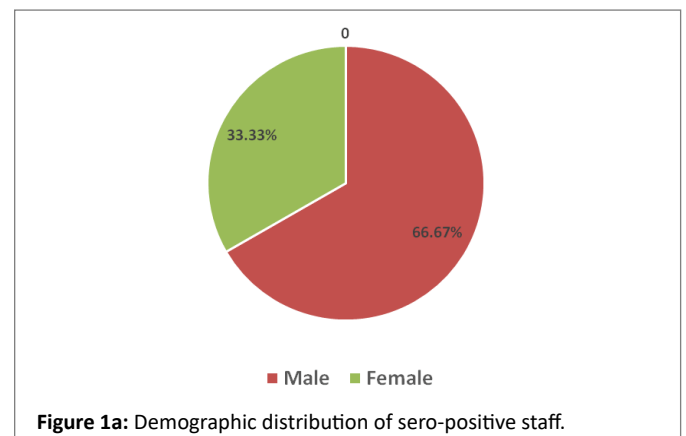
All staffs (clinical, para-clinical as well as support services) were rigorously trained on infection prevention practices and training on donning and doffing of PPE was provided to all. N95 masks were distributed to all with training on appropriate use and extended reuse.

Dedicated staff were identified and put on COVID duty. The roster was so designed to allow adequate quarantine in case of any suspected infection. Staffs were encouraged to report any symptoms early to the infection control team and take leave till symptoms resolved.

With all these measures in place we had only a limited number of COVID infections in our staff. SARS-CoV2 is known to cause mild symptomatic/ asymptomatic infections in young population. Hence, we wished to evaluate the prevalence of COVID-19 subclinical infection and the development of anti SARS-CoV-2 IgG antibody in the health care workers involved actively in the patient care during

Table 1: Demographic characteristics of participants.

S. No	Categories	Sample, n=100
1	Doctors	23
2	Nurses	28
3	Housekeeping staff	11
4	Lab Technician	11
5	Administrative staff	15
6	Security staff	12



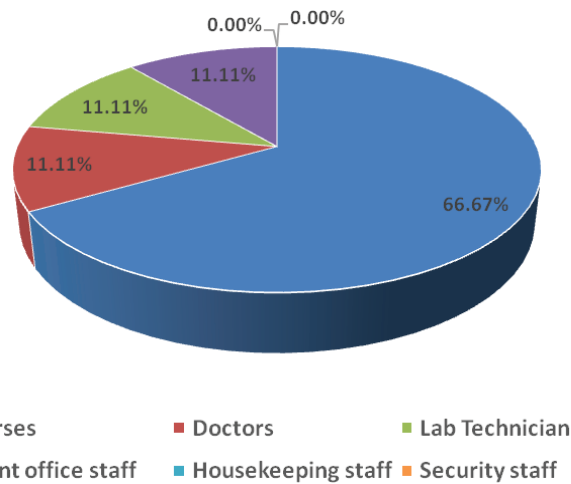


Figure 1b: Profession wise distribution of sero-positive staff.

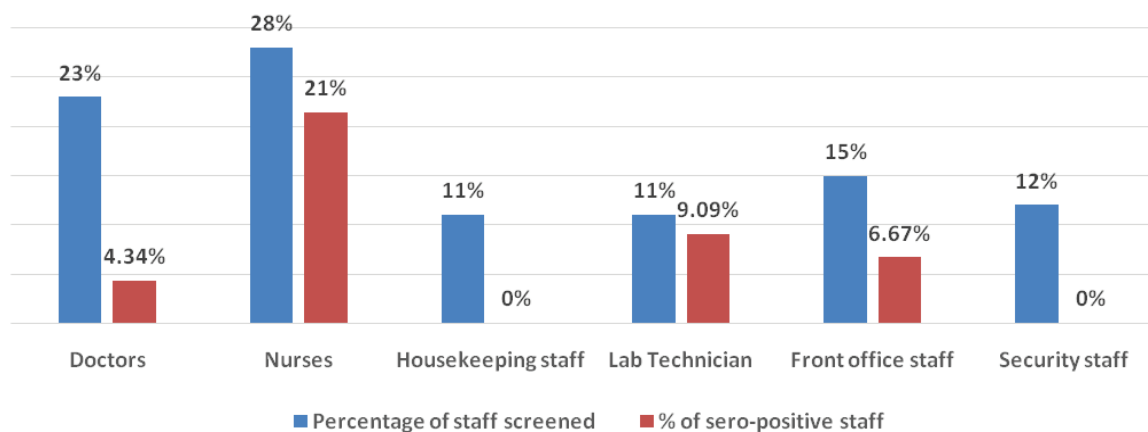


Figure 2: Categorical distribution of the participants and their sero-positivity.

COVID-19 pandemic and correlate with the effectiveness of infection control measures put in place.

The seroprevalence rate in our study was found to be 9%. These results are far below the data published by other authors in our country. Indian Council of Medical Research (ICMR) conducted a national sero survey between 17th December 2020 to 8th January 2021 in which 21.4% of 28,589 people surveyed above 18 years of age showed exposure to the virus. Another group of 7,171 healthcare workers were also included in the survey and the sero prevalence was found to be 25.7%. Statistically it was not different between doctors, nurses, field staff & paramedics, but it was highest among doctors and nurses with 26.6% as against the administrative staff which was 24.9% [7].

According to one population-based survey, the positive prevalence of anti-SARS-CoV-2 IgG or IgM in hospitals was 2.5 percent (170/6919), which was higher than the rate in the community (0.8 percent, 81/10,449). The positive rate for HCWs in Wuhan, Hubei (3.8 percent, 27/714) was the highest in that report [8].

From April 22 to April 30, 2020, 3056 workers in a tertiary centre in Belgium were systematically screened using a single-lane rapid IgG/IgM lateral flow assay directed to the nucleocapsid protein of SARS-CoV-2 (COVID-19 IgG/IgM Rapid Test Cassette; Multi-G). In total, 197 employees (6.4 percent, 95 percent confidence interval 5.5-7.3 percent) had SARS-CoV-2 IgG antibodies [9].

In Germany, 316 HCWs who had been in direct contact with COVID-19 patients underwent semi-quantitative ELISA testing in a survey conducted from March 25 to April 21, 2020, and the seroprevalence was found to be 1.6% (n = 5) [10].

A multicenter analysis in the United Kingdom found that seroprevalence was 10.6% among 405 asymptomatic HCWs and 44.7 percent among 1299 symptomatic HCWs [11]. Another study in the UK found a seropositivity rate of 31.6 percent among HCWs, with the highest rate (34.7 percent) among those employed in clinical settings with direct patient contact and the lowest among those working in non-clinical settings without patient contact (22.6%) [12].

In comparison, a study in the United States found that employees with strong COVID-19 exposure had antibody prevalence comparable to those with minimal or no exposure, implying that using PPE to prevent COVID-19 infection in HCWs is safe [8]. Another study showed similar findings, i.e. that seroprevalence was lower among personnel who reported always wearing a face covering while caring for patients (6%), compared with those who did not (9%) [13]. Overall seroprevalence was 13.7 percent (n = 5523) in the largest cohort sample, which enrolled 40,329 HCWs in New York City; however, only 9.0 percent (n = 3077) of the 34 251 without PCR testing were seropositive [13].

Conclusion

The seroprevalence of anti-SARS-CoV-2 antibody can vary across different regions and populations. Although HCWs, especially those caring for COVID-19 patients, are considered a high-risk group, the seroprevalence in this group also depends on the adherence to infection control practices. Although the extent at which positive SARS-CoV-2 antibodies produce or persist in asymptomatic or subclinical infection, as well as whether antibodies confer protective immunity and how long that immunity lasts, antibody testing remains a valuable tool for evaluating the prevalence of a disease in a population following a subclinical infection. Our results reflect antibody positivity in the front line health care workers in this tertiary care hospital because of infection with SARS-CoV-2 during active patient care. This study also underscores the importance of implementation and training of infection control practices to all the clinical as well as non-clinical staff during a pandemic to control the nosocomial spread of infection. Further longitudinal serological studies are needed to determine ongoing disease incidence as well as the extent and duration of immunity to SARS-CoV-2.

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