ORIGINAL ARTICLE

IgG Antibody Prevalence of COVID-19 among Healthcare Workers at a Tertiary Care Facility in Hyderabad, India

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ABSTRACT

Introduction: **Health care workers (HCWs) with SARS-CoV-2 seropositivity are an important source of COVID-19 spread. The present study aimed to assess the level of exposure of HCWs to COVID-19.**

Methods: **The COVID KAVACH IgG Microlisa IgG antibodies kit was used to determine the antibody prevalence in all HCWs at ESIC Hospital and Medical College.**

Results: **A total of 1200 HCWs were included in the study. Of the HCWs with positive rRT-PCR for COVID-19 at the time of participation, 40 of 97 (41.2%) were asymptomatic at the time of COVID-19 diagnosis, 46 of 97 (47.4%) had only mild disease, 9 of 97 (9.3%) had moderate disease, 2 of 97 (2.1%) had were severely ill. Of these, 24.9% were positive for IgG antibodies to Covid-19.**

Conclusion: **HCWs are at increased risk of infection when they work in hospitals. Infected HCWs are a potential risk to their families, patients, and colleagues; the seroprevalence of COVID-19 in HCWs is an indicator of susceptibility and should be monitored regularly as a best practice in hospitals.**

KEY WORDS

COVID-19, health care workers, seroprevalence, IgG antibodies, Covid Kavach

INTRODUCTION

COVID-19 is a new viral disease caused by SARS-CoV-2 that was first recognized in Wuhan, China in December 2019[1)]. Due to the spread of the infection, the World Health Organization (WHO) declared a pandemic of COVID-19 on March 11, 2020[2)]. The clinical manifestations of COVID-19 range from mild symptoms to severe pneumonia, acute respiratory distress syndrome, and death[3)]. Airborne transmission is the primary route of human-to-human transmission[4-6)]. Health care workers (HCWs) are the front-line workers who provide medical care to suspected and confirmed cases of COVID-19. Our hospital has implemented infection control and prevention measures since March 2020, including testing all symptomatic patients and HCWs, tracing contacts, and providing personal protective equipment If HCWs are infected with COVID-19, some immunity to COVID-19 is expected[7,8)]. Seroconversion usually occurs 11 to 14 days after infection. The pandemic is expected to continue until an effective vaccine is ready or herd immunity is reached. In order to ensure herd immunity, 60% to 80% of the population must be immune to COVID-19. However, up to four-fifths of those infected with COVID-19 are asymptomatic[11)]. Surveillance for seropositivity among health care workers and in the community is an important means of controlling the spread of COVID-19. Although there is growing evidence of an immunologic response to COVID-19, the time required to detect seroconversion and antibody levels is not yet well differentiated. Correlations between antibody levels and COVID-19 protection against reinfection and the duration of protective immunity need to be assessed[9)]. COVID-19 antibodies have been postulated to provide immunity against secondary infection. Knowledge of the level of immunity and duration of antibodies is currently ambiguous, but understanding a person's serological profile against COVID-19 may help guide policy makers. A study in Icelanders reported that antibodies to COVID-19 can rise and fall rapidly in the early stages, but remain stable for at least 4 months[12)]. These stabilized antibodies against COVID-19 provide reliable information on the seroprevalence status of the population and also guide potential immunization and vaccination strategies. Therefore, the present study aimed to estimate the seroprevalence of antibodies against COVID-19 in HCWs in our tertiary care hospital and to distinguish their antibody profiles.

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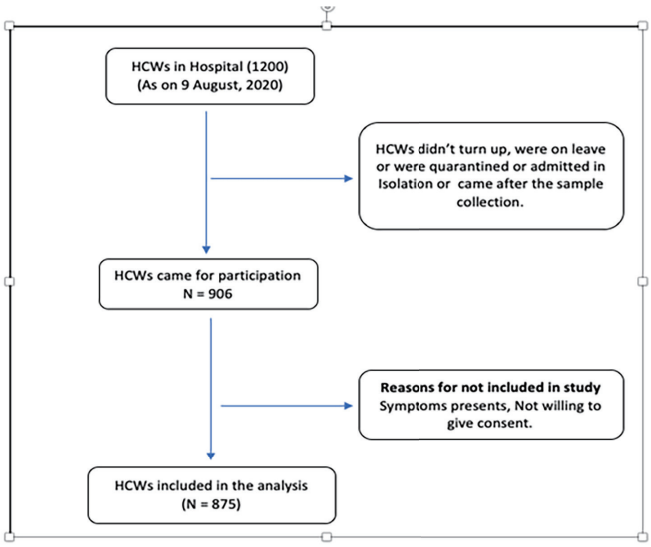

Figure 1: Flow diagram illustrating recruitment of the participants for the study

MATERIALS AND METHODS

This cross-sectional study was conducted from August 10, 2020 to August 25, 2020 at ESIC Hospital and Medical College, Hyderabad, India. Health care workers (HCWs) working in ESIC Hospital and Medical College (including various staff working in clinical, non-clinical, administrative, laboratory departments, housekeeping, security guards, etc.) were invited for serological screening. The screening invitation was posted on all hospital websites and various bulletin boards and was personally communicated to all departmental chiefs. A medical social worker, who took all precautions, was appointed in the laboratory to review the criteria for inclusion and exclusion and to obtain consent to participate in the study. HCWs with active symptoms suggestive of illness, such as fever or cold, and HCWs who could not give consent were excluded from the study. The required information was collected using a pre-designed proforma after informed consent was obtained. Demographic characteristics and occupation were also assessed. HCWs underwent blood sample collection for testing by trained clinical laboratory technicians. The collected blood samples were subjected to anti-SARS-CoV-2 human IgG ELISA. The kit used was COVID KAVACH IgG Microlisa (Microwell ELISA test for the qualitative detection of COVID-19 (SARS-CoV-2) IgG antibodies in human The sensitivity and specificity of the SARS-CoV-2 IgG ELISA kit are reported to be 92.1% and 97.7%, respectively. The sensitivity and specificity of the SARS-CoV-2 IgG ELISA kit are reported to be 92.1% and 97.7% respectively. The sensitivity of the SARS-CoV-2 IgG ELISA kit is reported to be 92.1% and the specificity is 97.7%. The results were interpreted using the OD value of the sample and the cut-off value calculated according to the manufacturer's instructions. On August 9, 2020, N = 1200 HCWs registered at ESIC Hospital participated in the study, of which 906 were included in the study. After reviewing the inclusion and exclusion criteria, 31 participants were excluded from the study (Figure.1). A total of 875 participants were included in the analysis, resulting in a study participation rate of 72.9%. All the data obtained in the study were entered and descriptive analysis was performed for p-value and odds ratio (OR) using MedCalc version 19.5.3 computer statistical software package. The level of significance was set at $p<0.05$ and 95% confidence interval (CI) was set. The study was approved by the Institutional Ethics Committee (IEC) and written informed consent was obtained from all patients.

RESULTS

The mean age of HCW participants was 37 years, with the highest number of participants (49.6%) between 31 and 40 years of age. 59.5% of the HCW participants were male and 40.5% were female. 147 (16.8%) of the 875 HCWs were physicians (junior residents/medical officers, senior residents, teaching faculty, specialists), 227 (25.9%) were paramedical staff (nurses, auxiliary nurses), and 501 (57.3%) were other staff (housekeeping staff, auxiliary nurses). Of the 875 HCWs, 147 (16.8%) were physicians (junior residents/medical officers, senior residents, teaching faculty, and specialists), 227 (25.9%) were paramedical staff (nurses and auxiliary nurses), and 501 (57.3%) were other staff (housekeeping staff, technical staff, administrative staff, and security staff). Of the HCW participants, 52.1% worked directly in COVID-19 designated areas. Of the HCWs, 8.9% reported having comorbidities; of the HCW participants, 37.6% had direct contact with patients with COVID-19 (family members or coworkers tested positive).

Ninety-seven (11.1%) HCWs were diagnosed as COVID-19 by real-time reverse transcription polymerase chain reaction (rRT-PCR) at the time of study participation. Of the HCWs with COVID-19 at the time of participation, 40 (41.2%) of the 97 were asymptomatic, and 46 (47.4%) had only mild illness (fever, cough, sore throat, nasal congestion, fatigue, headache). Another 9 (9.3%) had moderate disease (pneumonia with no signs of severe disease) and 2 (2.1%) had severe disease.

Among the participants, 218 (24.9%) were IgG antibody positive. 47.4% of HCWs diagnosed by rRT-PCR in the past did not show detectable antibodies in the seroprevalence test. The cumulative prevalence of patients who were rRT-PCR positive in the past and antibody positive at the time of survey recruitment was 264 (218 were IgG antibody positive and 46 were rRT-PCR positive). Thus, the cumulative prevalence of COVID-19 is 30.1%. Of these, 63.1% (167/264) had no symptoms associated with COVID-19 in the past month. 17.42% (46/264) had never been diagnosed with COVID-19 in the past.

In the present study, of the cases previously diagnosed with COVID-19 by rRT-PCR, 41% were asymptomatic, 48% were mildly symptomatic, 9.2% were moderately symptomatic, and 2% were severely symptomatic (Table 2). There were 218 antibody carriers, and age and gender were not associated with the presence of antibodies. Antibody prevalence was also not associated with blood type, whether the patient worked in a COVID-19 designated area, whether the patient had any comorbidities, or a history of contact with COVID-19 positive patients (Table 1).

In contrast, other HCW participants, such as housekeeping staff, technical staff, administrative staff, and security staff showed statistically significant positivity for IgG antibodies (154/218 [70.6%]). Being diagnosed previously for COVID-19 was associated with statistically significant antibody positivity with an odds ratio of 4.06 (95% CI, 2.63-6.26). With the increasing severity of the disease, the odds of seropositivity increased when compared with no previous disease and was found to be statistically significant.

DISCUSSION

Of the 875 HCWs enrolled, 1 in 4 were seropositive, suggesting past or current COVID-19 infection. In our study, the prevalence of COVID-19 IgG antibodies was 24.9%, which seems to be higher than the seroprevalence of 6.9% to 16.8% reported in other seroprevalence studies in India[13,14]. The high prevalence in our study was due to the late timing of the study, different study design, different serological assays, and the fact that our hospital serves both COVID-19 and non-COVID-19 populations, which exposed HCWs to asymptomatic infections and caused differences in infection prevention and control precautions This may be due to the fact that HCWs are exposed to asymptomatic infections and differences in infection prevention and control precautions. Several studies have reported a high prevalence of COVID-19 IgG antibodies. For example, a study in Spain reported that 31.6% of HCWs were IgG positive, while in several hospitals in Lombardy, Italy, 3% to 43% of administrative and medical staff were IgG positive[15,16]. An interesting study by Kumar *et al*. in Kerala, India[17] reported zero seroreactivity even five months after the first case was detected in that area.

IgG antibodies begin to rise above detectable levels about 14 days after the onset of symptoms, peak around the time of clinical recovery, and remain detectable for months or years after the infection has resolved[18]. As recommended by the ICMR, IgG antibodies were used in the present seroprevalence study. In the present study, COVID-KAVACH anti-SARS-COV-2 IgG targeting S1 spike protein was used[19,20]. Compared to other coronaviruses, the S1 protein is more specific and unique to COVID-19; in SARS-CoV-2 infection, S1 is more specific than S2 and nucleocapsid (N) proteins. The sensitivity of the test kit used in this study was over 90% and the specificity was almost 100%. In the present study, there was no difference in IgG antibody positivity according to age, which is consistent with studies done in this

Tables 1: Baseline characteristics and analysis of factors associated with having detectable antibodies

	Antibody Test +ve	*Antibody Test -ve*	*Total*	*OR*	*95% C. I of OR*	*P-Value*
Gender						
Male	123 (56.4)	398 (60.5)	521 (59.5)	0.84	0.62 - 1.15	0.2789
Female	95 (43.5)	259 (39.4)	354 (40.5)			
Age Group						
21-30	48 (22.0)	156 (23.7)	204 (23.3)	0.71	0.4 – 1.26	
31-40	102 (46.7)	332 (50.5)	434 (49.6)	0.7	0.42 – 1.19	0.4470
41-50	44 (20.2)	114 (17.3)	158 (18.1)	0.88	0.49 – 1.6	
> 50	24 (11.0)	55 (8.3)	79 (9.0)	Ref		
Designation						
Doctors	16 (7.3)	131 (20.0)	147 (16.8)	0.28	0.16 – 0.48	
Paramedical	48 (22.0)	179 (27.2)	227 (25.9)	0.6	0.42 – 0.88	0.0001*
Others	154 (70.6)	347 (52.8)	501 (57.3)	Ref		
Working in COVID-19						
Working	120 (55.0)	336 (51.1)	456 (52.1)	1.17	0.86, 1.59	0.4524
Not Working	98 (44.9)	321(48.8)	419 (47.9)			
Comorbidities						
Yes	14 (6.4)	61 (9.2)	75 (8.6)	0.67	0.37, 1.22	0.3176
No	204 (93.5)	596 (90.7)	800 (91.4)			
Contact with COVID-19 positive						
Yes	84 (38.5)	245 (37.2)	329 (37.6)	1.05	0.77, 1.44	0.7431
No	134 (61.5)	412(62.7)	546 (62.4)			
COVID-19 positive in past						
Positive	51 (23.3)	46 (7.0)	97 (11.1)	4.06	2.63, 6.26	0.0001*
Negative	167 (76.6)	611 (92.9)	778 (88.9)			
Type of disease						
Asymptomatic	17 (7.7)	23 (3.5)	40 (4.6)	2.7	1.41 – 5.18	
Mild	26 (11.9)	20 (3.0)	46 (5.3)	4.76	2.59 – 8.73	
Moderate	06 (2.7)	03 (0.4)	09 (1.0)	7.32	1.81 – 29.57	0.0001*
Severe	02 (0.9)	00 (0.0)	2 (0.2)			
No	167 (76.6)	611 (92.9)	778 (88.9)	Ref		
TOTAL	218 (24.9)	657 (75.1)	875 (100)			

* significant

field. [Brant-Zawadzki *et al*.[22] and Akinbami *et al*.[23] reported that the mean age of seropositive HCWs was lower than that of older age groups, which may be a result of measures to protect older workers from high-risk situations or preventive measures for older workers.

We adopted a similar policy of exempting older HCWs from posting in COVID-19 designated areas in order to minimize the risks associated with older HCWs. In the present study, there was no gender relationship with seropositivity, which is similar to the findings of Bevaja *et al*[13] in India. This may be due to the fact that both men and women were exposed to the same amount of COVID-19. In our study, other HCW participants such as housekeeping staff, technical staff, administrative staff, and security staff showed statistically significant positive results (70.6% for IgG antibodies compared to physicians and paramedics). Similarly, studies by Goenka *et al*[21] and Bevaja *et al*[13] reported that non-managerial staff, housekeeping, food and beverage staff, laboratory assistants/pharmacists and technicians had higher seroprevalence than doctors and nurses. This is thought to be due to the fact that these staff members move between different parts of the hospital, while nurses and doctors work in a clearly defined area. There was no relationship between complications and the prevalence of IgG antibodies to COVID-19. Similar results were observed in some Indian studies conducted by Kumar *et al*[17] and Baveja *et al*[13], where the presence of comorbidities did not affect the seropositivity rate. no significant relationship was found between seropositivity rate of HCWs and contact with known COVID-19 positive patients. No significant relationship was found between HCW seropositivity and contact with known COVID-19 positive patients. Similar results were also reported by Korth *et al*[24], who found a less significant seropositivity rate for contact with COVID-19 in different fields of work. This may be due to the influence of viral load, duration of exposure, and severity of illness on antibody formation. In our study, we found that among the cases diagnosed with COVID-19 by rRT-PCR in the past, 41% were asymptomatic, followed by 48% with mild disease, 9.2% and 2% with moderate and severe COVID-19, respectively. We also found that out of 218 seropositive patients, 7.7% were asymptomatic COVID-19 infected and 15.5% had COVID-19 compatible symptoms, which is less than the 75% COVID-19 compatible symptoms reported by Madhusudan *et al*[25]. Rudberg *et al*[26] found that 9% of seropositive found that 9% of HCWs were asymptomatic, and 7.7% of seropositive HCWs in our study had no prior symptoms.

CONCLUSION

Antibody screening for COVID-19 in the entire hospital can be considered for infection control. The seroprevalence of HCWs was found to be high, about 24.9%, indicating a high susceptibility of HCWs. HCWs are at an increased risk of infection when they work in hospitals, even if

Table 2: Distribution of Covid-19 serology in HCWs with Covid-19 positive or RT-PCR Positive.

Validity	*Serology Positive (%)*	*Serology Negative (%)*	*Total (%)*	*Odds Ratio*	*C.I*	*P-Value*
Asymptomatic	17 (33.3)	23 (50)	40 (41.23)	Ref		
Mild	26 (51)	20 (43.4)	46 (48)	0.57	0.24 -1.34	
Moderate	06 (11.7)	03 (6.5)	09 (9.2)	0.37	0.08 ─ 1.69	0.2180
Severe	02 (4)	0 (0)	02 (2.0)	0		
Total	51 (100)	46 (100)	97 (100)	-	-	-

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Ethical Permission: Obtained

community-acquired infections cannot be ruled out. Infected HCWs are a potential risk to their families, patients, and colleagues; the seroprevalence of COVID-19 in HCWs is an indicator of susceptibility and should be monitored regularly as a best practice in hospitals.

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