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Original Research Article

Seropositivity of Anti-SARS CoV2 IgG antibodies in health care workers of an Indian tertiary care hospital during COVID-19

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ABSTRACT

Purpose: Health care workers [HCW] are at a higher risk of infection SARS CoV2 infection due to frequent and close contact to patients with COVID-19.
Methods: Serum samples from 500 HCW's were tested for SARS CoV2 IgG antibodies in October 2020. A questionnaire was used to collect demographic and clinical data. All these HCWs were tested for COVID-19, in 2nd week of September 2020, as a hospital policy.
Results: Anti SARS CoV2 antibodies were detected in 128/ 500 [25.6%] HCWs. A total of 195/ 500 [39%] enrolled cases had already tested positive for Covid-19 at least once in last six months by RT-PCR. Sixty eight percent of HCWs with previous COVID-19 positivity by RT- PCR tested positive for Anti SARS CoV2 antibodies, whereas only 2.76% of asymptomatic HCWs tested positive. Of 121 anti SARS-CoV-2 IgG positive persons, 70 [57.85%] had CT value < 25. Low CT value and asymptomatic cases had a strong reverse statistically significant association with SARS CoV2 IgG antibody positivity.
Conclusions: We report that sero-conversion rate in HCWs is similar to that in general population suggesting that preventive practices used in hospitals are satisfactory. Cases with low viral counts in respiratory sample and asymptomatic cases have lower rate of seroconversion.

1. Introduction

Since its emergence, severe acute respiratory syndrome coronavirus (SARS CoV2), which causes COVID-19, has become a pandemic. Due to the nature of their work, health care workers (HCW) are at a higher risk of infection by coronavirus disease 2019 (COVID-19) across the world. Mounting evidence from international sources suggests that healthcare workers (HCW) have been disproportionately affected despite the use of personal protective equipment (PPE) [1–4]. The infection with the SARS CoV2 usually leads to sero-conversion 11–14 days after the first symptoms [5]. The prevalence of antibody positivity is an indicator of exposure. Serological testing provides an opportunity to study retrospective evidence of infection [6].

Hospital where the study was conducted has been treating COVID19 patients since March 2020 and the protocols for infection control and diagnosis/ treatment/ isolation of infected HCWs are in place, as per national guidelines. This study was conducted to estimate the seropositivity of anti- SARS CoV2 antibodies (IgG) in HCWs of a tertiary care hospital of north India during October 2020.

2. Materials and methods

A total of 500 health care workers including consultants, residents, nursing staff, laboratory workers, ward boys, guards and some of office workers, working at King George's Medical University, Lucknow, India were enrolled in this one point cross-sectional sero-surveillance study. The study was conducted in October 2020 and was approved by institutional ethics committee of King George's Medical University at Lucknow, India. Consent was obtained from all participants. Clinical details regarding demographic data, occupation, COVID-19 status in past, residential address, nature of work (either direct involvement with COVID-19 area/not) were collected. All these HCWs had been tested as the study was conducted in October 2020 and HCWs tested in September 2nd week for COVID-19, as a hospital policy.

Single serum sample collected from each participant was tested for anti- SARS CoV2 IgG antibodies using a semi-quantitative enzyme-linked immunosorbent assay (ELISA) (Kavach, Trivitron Healthcare Private Limited, India) according to the manufacturer's instructions.

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3. Results

A total of 500 HCWs were enrolled, age ranged from 21 to 65 years (mean age 36.23) and male to female ratio was 1.5:1. Anti SARS CoV2 antibodies were detected in 128/ 500 (25.6%) HCWs. Sero-positivity was similar in different age and sex groups. Sero positivity was higher among wardboy/ guard [6/10; 60%] followed by lab workers (33/ 91; 36.26%), consultants (10/ 45; 22.22%), resident doctors (39/ 191; 20.41%) and nursing staff (8/ 40; 20%) (Table 1). However the difference amongst groups was not statistically significant. Rate of sero-positivity was higher in staff working directly in contact with COVID-19 patients (59/ 207, 28.5%) than those not working directly in contact with Covid-19 patients (69/ 293, 23.54%), however, the difference was not statistically significant (p value 0.2119) (Table 1). Sixty two percent of HCWs with previous COVID-19 like symptoms tested positive for Anti SARS-CoV-2 antibodies, whereas only 2.76% of asymptomatic HCWs tested positive. Sero positivity was significantly higher in HCWs with previous COVID like symptoms compared to asymptomatic HCWs (P value = 0.0001, HR = 0.01,95% CI = 0.00–0.02), z statistics = 11.547) (Table 1).

A total of 195/ 500 (39%) enrolled cases had already tested positive for COVID-19 at least once in last six months by RT-PCR. Only 121/195 (62.05%) subjects had detectable antibodies in their serum and 74 (37.94%) subjects did not have detectable antibodies in their serum. Of 121 persons with antibodies positive against SARS CoV2, 70 (57.85%) had CT value less than 25 and 51 had CT value more than 25 at the time of RT-PCR positivity (P value = 0.0001, HR = 3.54,95% CI = 1.8637–6.7305, z statistics = 3.860). Of 74 subjects who were RT-PCR positive and antibodies negative, 18/ 74 (24.32%) had CT value less than 25 at the time of RT-PCR positivity and 56/ 74 (75.67%) had CT value more than 25 at the time of RT-PCR positivity (P value = 0.001, HR = 0.23, 95% CI = 0.1232–0.4450, z statistics 4.431.) There was a strong statistically significant association between low CT value (interpreted as high viral load) and anti SARS CoV2 IgG antibody positivity (HR = 4.27) (Table 2).

Seven persons who had never tested positive by RT-PCR for COVID-19 in past, had detectable antibodies in serum, may be because they had asymptomatic infection.

Table 2
Sero-positivity of RT-PCR positive HCWs grouped by CT value of RT-PCR.

RTPCR positive for COVID- 19 (N = 195)	CT value at time of diagnosis	
	≤25	>25–33
Seroconverted	70	51
Not Sero-converted	18	56
HR	4.27	
TOTAL	88	107

Abbreviations: HCW- Health Care Worker; RTPCR-Real Time Polymerase Chain Reaction; CT-Cut off Threshold; HR-Hazard Ratio.

4. Discussion

This study aimed to determine the SARS CoV2 seropositivity in healthcare workers of the King George's Medical University India. Total 25.6% of healthcare workers were seropositive for SARS CoV2 by October 2020. Table 3 lists some of the relevant and similar studies done in HCW both in India and across the world in chronological order. Sero-positivity varied from time to time and place to place.

Table 3
Studies reporting sero-positivity against SARS-CoV-2 in HCWs.

Time of study	Country of study	Sample size	Percentage of Anti-SARS-CoV-2 IgG antibodies positive cases %
January–June 2020 [7]	England	6858	9.3
March–June 2020 [8]	Germany	871	4.36
March 24 - April 4, 2020 [9]	USA	285	33
28 March - 9 April 2020 [10]	Spain	578	9.34
24/25 April 2020, 2020 [11]	UK	545	24.4
May 12 - May 15, 2020 [12]	China	191	0.0
June 2020 [13]	India	2905	2.5
June 2020 [14]	India	244	19.26
July 2020 [15]	India	1122	11.94

Table 1
Demographic details and sero-positivity to SARS-CoV-2 among HCWs stratified in different groups.

	Antibody Reactive		Antibody Non-Reactive		Antibody reactive/ Total subjects (%)	Antibody negative subjects with past h/o COVID-19 positivity/Total subjects in group (%)
	RT PCR positive	RT PCR negative	RT PCR positive	RT PCR negative		
				Work profile		
Consultant	10	0	7	28	10/45 (22.22)	7/45 (15.55)
Resident	33	6	21	131	39/191 (20.41)	21/191 (23.07)
Nursing staff	8	0	10	22	8/40 (20)	10/40 (25)
Lab worker	32	1	7	51	33/91 (36.26)	7/91 (7.6)
Ward boy and Guard	6	0	2	2	6/10 (60)	2/10 (20)
Other	32	0	27	64	32/122 (26.22)	27/122 (22.13)
				Gender		
Male	78	5	51	168	83/302 (27.48)	51/302 (16.88)
Female	43	2	23	130	45/198 (22.72)	23/198 (11.16
				Age		
≤35years	83	7	52	212	90/354 (25.42)	52/354 (14.68)
>35–65years	38	0	22	86	38/146 (26.02)	22/146 (15.06)
				Working environment		
Working in direct contact with COVID-19 patients	53	6	30	118	59/207 (28.5)	30/207 (14.49)
NOT working in direct contact with COVID-19 patients	68	1	44	180	69/293 (23.54)	44/293 (15)
				Symptom profile		
Symptomatic	115	4	20	35	119/174 (68.3)	20/174 (11.4)*
Asymptomatic	6	3	54	263	9/326 (2.76)	54/326 (16.5)
Total N = 500	121 (24.2%)	7 (1.4%)	74 (14.8)	298 (59.6%)	500	500

Abbreviations: HCW- Health Care Worker; RTPCR-Real Time Polymerase Chain Reaction.
*P value = 0.0001.

COVID 19 positivity in the city of study was highest in September 2020. Incidentally, one of the population serosurvey conducted by Uttar Pradesh Swasthya department along with King Georges Medical University same time i.e August–September 2020 has shown sero-positivity around 20% (unpublished data). We also did not find correlation of sero-positivity with direct contact of HCWs with COVID-19 patients. This gives the confidence that after using the protective measures as per institutional guidelines, HCWs in our setting were at no additional risk of exposure.

A study conducted on 191 HCWs in Wuhan, China shows 0.0% sero-positivity [12] while one study done in March–April 2020 showed 33% positivity [9]. A study from Mumbai, Maharashtra, India reported results similar to that of ours. They showed 70% positivity in cases with previous history of Covid-19 related symptoms, and 4.3% positivity in those who never showed any COVID-19 positivity or symptoms. One of the studies reported that in patients with laboratory-confirmed COVID-19, the IgM-positive rate was 19.3% in the first week, peaked in the fifth week (81.5%), and then decreased steadily to around 55% within 9–10 weeks. The IgG-positive rate was 44.6% in the first week, reached 93.3% in the fourth week, and then remained high. According to this study around 7% cases never seroconverted. Moreover, all of these were symptomatic cases [16]. Seroconversion rate in asymptomatic RT PCR positives is not predominantly reported in literature. However previous studies have already reported that patients with severe or critical COVID-19 displayed a more intense humoral response than moderate and mild cases [17].

We have shown significantly [HR-4.27] better seroconversion in HCWs who were RT-PCR positive with high viral load (70) than those who were RT-PCR positive with low viral load (18) shown in Table 2. CT value's inverse correlation with severity of disease and biological markers including CD8 positive cells and polymorphonuclear leucocytes is demonstrated in some studies [18]. Published data also indicated that CT values from diagnostic respiratory samples and the duration of disease are important elements to assess the infectivity of patients [19]. None of these studies show any correlation of viral load with seroconversion. Findings of one study are in contrast to our data which showed that the viral load as detected in respiratory sample was inversely associated with the development of specific SARS CoV2 IgG [20]. They have not discussed about asymptomatic cases. There is no data to correlate duration and level of viremia with viral load in respiratory samples. During August and September 2020 COVID-19 outbreak peaked in India. As per National policy every contact was traced and tested. Many of them were asymptomatic cases with low viral load and quarantined at home for at least 10 days. RT-PCR is a sensitive test. False positivity in a time of pandemic due to contamination of specimen cannot be ruled out. Some of the cases may be just carriers with dead or no replicating virus in throat.

5. Conclusion

We report that seroconversion rate in HCWs is similar to that in general population suggesting that preventive practices used in hospitals are satisfactory. Cases with low viral counts in respiratory sample and asymptomatic COVID-19 cases have lower rate of seroconversion.

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Author's contributions

All authors reviewed and approved the final version. AJ and SS conceived and executed study. AV did the tests and wrote first draft of manuscript. AKV supported AV.

CRediT author statement

Anuragini Verma: Designing, draft preparation. **Suruchi Shukla:** Conceptualization, Methodology, Writing- Original draft preparation. **Anil K. Verma:** Visualization, Investigation, Data analysis. **Bipen Puri:** Supervision. **Amita Jain:** Writing- Reviewing and Editing, Supervision.

Declaration of competing interest

The authors have declared no conflict of interest.

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