Original Article

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Asymptomatic COVID-19 Infection among Healthcare Workers in Dedicated Tertiary Care Facility of Kolkata, India

Internal Medicine Section

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ABSTRACT

Introduction: In view of the present Coronavirus Disease 2019 (COVID-19) pandemic it is of utmost importance to look out for the 'trojan horse' that is the asymptomatic population who are potential for spreading the disease. Healthcare Workers (HCWs) are the most vulnerable group. The possibility of having the infection does not always correlate well with the symptoms. It urges the need for development of certain special plans beyond continuous surveillance and symptom monitoring.

Aim: To explore asymptomatic COVID-19 infection among HCWs as a potential source of transmission.

Materials and Methods: This hospital-based cross-sectional study was conducted at Medical College and Hospital, Kolkata, West Bengal, India, from June 2020 to September 2020. The data were collected from 714 HCWs over a period of three months of study period, with the help of a standard questionnaire and blood sample was analysed by serological assessment of Immunoglobulin G (IgG) for Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) by EUROIMMUN Kit, Enzyme-Linked Immunosorbent Assay (ELISA). Epi info software 7, available from the World Health Organisation (WHO) site was used to manage and analyse the data.

Results: The mean age was 35.30±11.79 years. Out of 714 people, 54.8% (391/714) were male and 45.2% (323/714) were female. In this survey, 9.16% of HCWs in COVID-19 designated duties were IgG positive; whereas 21.89% of HCWs designated in other parts of area were detected to be IgG positive. Seroprevalence was least amongst nursing staffs with 5.41% (8/148); among doctor's it was 9.62% (41/426). Most interestingly among ward boys and cleaners this prevalence was found to be 29.90% (29/97) being the highest. Overall seroprevalence for IgG against SARS-CoV-2 was found to be 12.75% (91/714).

Conclusion: This serosurvey at this tertiary COVID-19 care facility is a unique venture to look for the possible sources of super-spread. The high rate of sero-positivity among ward boys and cleaners might be due to their lack of knowledge and training regarding steps to prevent a droplet borne pandemic. This study also points out that if adequate precautions are taken, infectivity is not to an alarming extent, even in a full-fledged COVID-19 care hospital.

Keywords: Coronavirus disease 2019, Euroimmun kit, Immunoglobulin G, Serosurvey, Serological study

INTRODUCTION

On December 31, 2019, China reported a cluster of pneumonia cases of unknown cause that would later be identified as Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) [1-4]. Patients with the illness, called Coronavirus Disease 2019 (COVID-19), frequently present with fever, cough, and shortness of breath within 2-14 days after exposure [5]. As of 21st September 2021, over 228 million COVID-19 cases and 4.6 million deaths have been reported globally [6]. In recognition of the widespread global transmission of COVID-19, the World Health Organisation (WHO) declared COVID-19 to be a pandemic on 11th March 2020 [7]. A total of 15,65,645 cases were reported in West Bengal with 7674 active cases [8]. With case numbers and deaths, surging and making the curve grow steeper every day; it implies that a lot needs to be explored about this virus and the havoc it is creating on humans.

Unlike Severe Acute Respiratory Syndrome (SARS) or Middle East respiratory syndrome, COVID-19 was less virulent, with a lower mortality rate [9-11]. Nevertheless, low virulence and longer incubation periods resulted in a significant number of asymptomatic carriers. These people might not take adequate precautions and thus could become a source of transmission [12]. Thereby, a large part of transmission remains subclinical [13]. There have been studies that have revealed infections spread by patients in the incubation period and by the asymptomatic carriers [14]. Asymptomatic transmission could further increase the risk of super-spreading in hospitals [15].

With less research in this area [16], present study aimed to cover the proportion of asymptomatic Healthcare Workers (HCWs) who might be involved in transmission of the COVID-19 infection in an otherwise non infected patient in a hospital setting. Thus, HCWs could be a potential carrier of the disease and identifying them at the right moment can serve as barrier to transmission.

MATERIALS AND METHODS

This hospital-based, cross-sectional study was conducted at Medical College and Hospital, Kolkata, West Bengal, India, from June 2020 to September 2020, on 714 HCWs. The ethical clearance was obtained from the Institutional Ethics Committee (approval no. MC/KOL/IEC/NON SPON/717/06/2020). This study was a joint venture between the Department of General Medicine and Department of Biochemistry of this Hospital (the largest and longest serving COVID-19 care facility hospital of West Bengal, possibly the entire Eastern and North-eastern India). A written informed consent was taken from all the participating HCWs.

Sample size calculation: Considering the worst case scenario method to calculate the required sample size, authors considered prevalence (p) as 50% and q (1-p) as 50%, z was considered at 99% confidence level with absolute error of 5% (d). It came out to be 660. Moreover, 10% excess data was considered due to attrition factor resulting in a target sample size of 720.

Inclusion criteria: Cases were defined as HCWs indulged in designated COVID-19 or suspect wards and other parts of the hospital were included in the study.

Exclusion criteria: Individuals with age group <18 years and HCWs with previous laboratory diagnosed COVID-19 were excluded from the study.

Procedure

A complete questionnaire could be obtained from 725 subjects and collection blood sample was drawn in all 714 subjects. Thus, 11 subjects had to be excluded from data analysis and study population contains 714 subjects.

A brief history on the presence of symptoms like fever, cough, conjunctivitis etc., and any past medical history was taken. The data was collected from HCWs with the help of a self-made questionnaire (containing variables like job designation, type of COVID-19 designated duty, duration of such duty, episode of influenza like illness). The blood samples were collected from the HCWs for a period of three months from June 2020 to September 2020. A brief clinical examination was performed before drawing the samples and they were analysed by serological assessment of Immunoglobulin G (IgG) for COVID-19, Enzyme-Linked Immunosorbent Assay (ELISA), using EUROIMMUN kit {specificity of the Anti-SARS-CoV-2 ELISA (IgG) amounted to 99.6%} from serum samples. The standardised sensitivity of the kit was predetermined in reference to the kit manufacturer's instructions. The cut-off value:

- ≥0.8- Positive
- >1.1- Strong positive.

STATISTICAL ANALYSIS

The data were entered in MS Excel and double-checked to avoid any error in the data entry. Epi info software 7, downloaded from the WHO site was used to manage and analyse the data. The hypothesis testing was done using Chi-squared test and the data were carefully described by tabular as well as graphical means.

RESULTS

Total 714 HCWs volunteered for sero-survey. Amongst them mean age was 35.30 with a standard deviation of 11.79. Out of 714 people, 54.8% (391/714) were male and 45.2% (323/714) were female. Among the HCWs, there were 426 physicians, 148 nursing staffs, 97 ward staffs and cleaners and 22 technicians [Table/Fig-1]. It is also noted that 97 out of the total 714 (13.85%) have less than undergraduate level qualification. In addition, 513 HCWs were posted in COVID-19-designated duties and 201 HCWs did not have any COVID-19 duties [Table/Fig-1].

A total of 91 (12.4%) HCWs out of the total 714 were IgG positive for COVID-19 irrespective of the duties assigned [Table/Fig-2]. Among them, 44 were not assigned any COVID-19 duties. The distribution of positive and negative IgG levels was further tabulated based on whether or not the HCW was posted in COVID-19 duty [Table/Fig-3]. In this serosurvey, 21.89% people among HCWs not involved in COVID-19 designated duty were positive for IgG, which was much higher than the persons doing COVID-19 designated duties (9.16%) which were statistically significant.

Demographic profile	Male (391)	Female (323)	Total (714)
Age distribution (years)			
18-34 years	207	214	421
35-50 years	105	74	179
Above 50	79	35	114
Professional group bifurcation			
Physicians	295	131	426
Nursing staffs	-	148	148
Technicians	10	12	22
Ward staffs and cleaners	72	25	97
Others	14	7	21
Educational qualification			
Less than undergraduate	72	25	97
Undergraduate and above	319	298	617
Distribution of HCWs in COVID-19 designated duties			
Critical Care Unit (CCU)	29	24	53
Fever clinic	2	0	2
Operation theatre	5	2	7
Swab collection	11	6	17
Ultrasound	1	2	3
Wards	218	164	382
Wards+CCU	25	15	40
Wards+Fever clinic	2	1	3
Others*	2	4	6
History of flu like illness			
Age distribution	Yes	No	Total
18 to 34 years	79	342	421
35 to 50 years	16	163	179
Above 50	6	108	114

[Table/Fig-1]: Showing demographical data of the study population.
*include duty as counsellor for COVID-19 patients, bedside physiotherapy, co-ordinators in floor etc.

In the study, it was evident that not a great amount of positivity was found from the highly COVID-19 exposed areas. 22% positivity was found in people who were not indulged in COVID-19 direct exposure compared to 18.59% further stratified into 9.16% among people doing COVID-19 ward duty, 9.43% among people doing COVID-19 Critical Care Unit (CCU) duty. Moreover the duration of COVID-19 duties was not significantly related to IgG positivity.

Maximum positivity rate/seroprevalence for IgG was found to be among ward staff and cleaners (29, 29.9%) (p-value<0.0001) when compared to other groups [Table/Fig-4,5]. In this survey, seroprevalence was least amongst nursing staffs with 5.41% seroprevalence (8/148); among doctor's it was 9.62% (41/426); most interestingly we stratified the others group further and among ward boys and cleaners this prevalence was found to be 29.90% (29/97) being the highest. When the population was analysed as per educational qualification into postgraduate/graduate/less than graduate strata persons belonging to 'less than undergraduate' group had maximum incidence of sero-positivity with 29.9% (29/97).

Levels of IgG based on duties assigned											
IgG status	Critical Care Unit (CCU)	Fever clinic	NO	Operation theatre	Swab collection	Ultrasound	Wards	Ward and CCU	Ward and fever clinic	Others	Total
Negative	48	2	157	6	16	3	347	35	3	6	623 (87.3%)
Positive	5	0	44	1	1	0	35	5	0	0	91 (12.7%)
Total	53	2	201	7	17	3	382	40	3	6	714

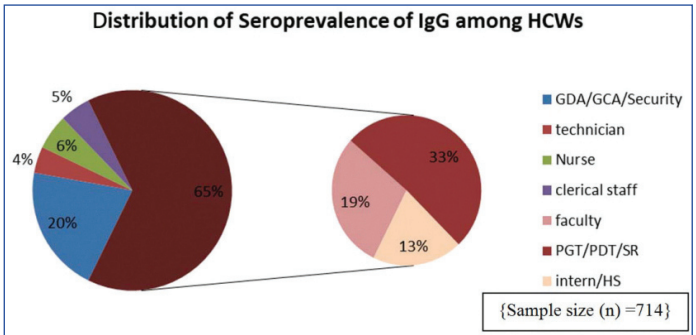
[Table/Fig-2]: Level of IgG based on designated duties.
NO: Not involved in designated duties; Others- include duty as counsellor for COVID-19 patients, bedside physiotherapy, co-ordinators in floor etc.

Immunoglobulin G (IgG)	COVID-19 duty		Total
	No	Yes	
Negative	157 (78.11%)	466 (90.84%)	623 (87.25%)
Positive	44 (21.89%)	47 (9.16%)	91 (12.75%)
Total	201	513	714

[Table/Fig-3]: Showing distribution of IgG status as per COVID-19 designated duty {Sample size (n) =714}.
Chi-squared: 21.011: p-value <0.0001

Healthcare workers	Positive	Negative	Total
Faculty	12 (9.68%)	112 (90.32%)	124
PGT/PDT/SR	21 (9.13%)	209 (90.87%)	230
Intern/HS	9 (1.40%)	64 (98.60%)	72
Ward staffs and cleaners	29 (29.9%)	68 (70.10%)	97
Nursing staff	8 (5.41%)	140 (74.59%)	148
Technician	6 (27.27%)	16 (72.73%)	22
Clerical staff and supervisor	6 (28.57%)	14 (71.43%)	21
Total	91 (12.74%)	623 (87.26%)	714

[Table/Fig-4]: Distribution of IgG results as per designation
Chi-squared=50.665, df=6, p-value <0.0001; PGT: Postgraduate trainee; PDT: Post doctoral trainee; SR: Senior residents; HS: Housestaff



[Table/Fig-5]: Distribution of HCWs as per designation and IgG status. (Small circle is representative of the doctor population in our study comprising of faculty, PGT/PDT/SR/intern/HS).
GDA: Group D assistant; GCA: Group C assistant; PGT: Postgraduate trainee; PDT: Post doctoral trainee; SR: Senior residents; HS: Housestaff

DISCUSSION

It is of utmost importance to look out for the 'trojan horse' that is the asymptomatic HCWs who can potentially spread the disease in the hospital set-up and subsequently, outside, in the community. Strictly adhering to infection prevention and control measures like mask-wearing, using protective gears, and frequent surveillance testing can prevent spread.

In this study sample, 391 subjects were male and 323 were females. Positivity among male HCWs was 63/391 (16.11%) and females 28/323 (8.67%). A similar study by Wattal C et al., involving 1033 HCWs shows that seropositivity was significantly lower among females 114/545 (20.9%) than among males 153/488 (31.4%), (p-value <0.001) [16].

In the same study by Wattal C et al., the seropositivity among doctors 16/240 (6.7%, p-value<0.001), the technical staff was 12/89 (13.4%, p-value <0.001), and nurses were 53/297 (17.8%, p-value <0.001). Seroprevalence in the former was much lower than that seen in security staff 32/53 (60.4%, p-value <0.001), sanitary workers 49/89 (55.42%, p-value <0.001), and ward boys 28/68 (41.2%, p-value <0.001) [16]. The present study resonates with their study. It shows the least seropositivity among nursing staff with seroprevalence 8/148 (5.41%) and doctors with 41/426 (9.62%) seroprevalence. The highest was noted in ward boys and cleaners, 29/97(29.90%). This may be attributable to the difference in educational qualification and awareness about COVID-19 infection prevention and control guidelines. This study reveals people belonging to the 'less than undergraduate' group had a maximum incidence of seropositivity with 29/97 (29.90%). In this serosurvey, 44/201 (21.89%) HCWs not involved in COVID-19-designated duty tested positive for IgG, and only 47/513 (9.16%) tested positive among HCWs doing COVID-19-designated duty.

A similar finding was noted in a study by Khan MS et al., which showed HCWs who had worked at a dedicated COVID-19 hospital had a lower seroprevalence of 0.6% (95% CI, 0.2%-1.9%) and a lower multivariate-adjusted risk of seropositivity (odds ratio, 0.21; 95% CI, 0.06-0.66) compared to 2.8% seen in HCWs doing non COVID-19 duty [17]. Also, all 140 samples collected from ICU/HAU and emergency at Royal Columbian Hospital were negative for COVID-19 in a study done by Deady B et al., [18].

In the study carried out by Olayanju O et al., in Nigeria 60/133 (45.1%) HCWs were seropositive for SARS-CoV-2. Among them 25/55 (45.0%) doctors, 8/33 (23.3%) nurses, 3/19 (16.7%) health assistants, 1/18 (6.7%) laboratory scientists and technicians, and 1/8 (8.3%) non medical staff. This discrepancy in Nigeria is most likely due to the lack of protective gears and minimum surveillance provided to the HCWs who attended COVID-19 positive patients at the peak of the pandemic [19]. Data concerning COVID-19-infected asymptomatic HCWs is limited. Hence, this study delves into this aspect and also resurfaces other studies to highlight one of the vital modes of community spread of the infection that is otherwise generally disregarded.

Limitation(s)

The sample size was small and taken from a single tertiary care centre. Hence, the results cannot be generalised. The asymptomatic COVID-19 positive cases were not followed-up in the next two weeks. The patients who developed symptoms in those days were erroneously categorised as asymptomatic patients. There was no provision for separating the symptomatic and asymptomatic patients suffering from COVID-19 in wards. So, authors could not judge the transmission probability from an asymptotic patient exposure. Also, this study measured the IgG levels only which develop almost two weeks after an active infection. Thus, it limits authors ability to segregate the asymptomatic HCWs as a possible carrier of the disease early on.

CONCLUSION(S)

This serosurvey has documented high seroprevalence among ward boys as well as cleaners and low seroprevalence among nurses and doctors. The knowledge of this disease as a droplet-borne infection, awareness, and education regarding adherence to strict precaution measures like wearing masks, protective gear, and hand hygiene at all times is the key to infection prevention and control. COVID-19 designated duties and hours spent in COVID-19 patient care are not significantly associated with disease transmission. Early detection of disease by frequent facility-based surveillance is required to prevent cross-infection in the hospital and super-spread of infection in the community.

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