ORIGINAL RESEARCH PAPER

Medical Microbiology

SEROPREVALENCE OF SARS-COV 2 IGG ANTIBODY AMONG HEALTHCARE WORKERS IN A TERTIARY CARE INSTITUTE OF SOUTH WEST BIHAR

KEY WORDS:

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INTRODUCTION

The emergence of SARS-CoV-2 was first observed when cases of unexplained pneumonia were noted in the city of Wuhan, China [1]. The causative virus of COVID-19 was rapidly isolated from patients and sequenced, with the results from China subsequently being shared and published in January 2020. [2] The findings showed that it was a positive-stranded RNA virus belonging to the Coronaviridae family (a subgroup B betacoronavirus) and was new to humans. In the early work, analysis of the genomic sequence of the new virus (SARS-CoV-2) showed high homology with that of the coronavirus that caused SARS in 2002-2004, namely SARS-CoV (another subgroup B betacoronavirus) [3]. As with the coronaviruses that cause SARS and MERS, human-to-human transmission of SARS-CoV- 2 was soon established, [4] but the virus demonstrated much greater infectivity than these other two coronaviruses. [5]

SARS-CoV-2 shows a broad tissue tropism, in particular, binding through its spike protein to angiotensin-converting enzyme 2 (ACE2). It also directly infects endothelial cells lining the blood vessels, unusually for a human respiratory virus. Other novel pathological features of the virus are hypercoagulability and the excessive multi-organ immune system response and long-term sequelae. People infected with SARS-CoV-2 appear to be most infectious at the time of onset of symptoms but were also infectious in the days before onset. Infections can be asymptomatic, cause a mild illness or result in severe disease and death.

In India, the first case of COVID-19 was reported on January 30, 2020 [6]. As of June 20, 2020, 395,048 laboratory-confirmed cases and 12,948 deaths were reported from India. There is a wide variation in the reporting of cases across the States/Union Territories across the districts within each State [7]. Knowledge about the true extent of infection is critical for an effective public health response to COVID-19. Facility-based surveillance efforts, though useful to understand the trend of infection in sentinel populations, are not population representative. Population-based seroepidemiological studies are therefore recommended to measure the extent of the spread of infection in an area and recommend containment measures accordingly [8, 9].

Evidence before this study showed that the seroprevalence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) antibodies is important to understand the transmission dynamics of the virus; estimate total infections, including mild and asymptomatic individuals who might not receive testing; and inform the possibility of transmission interruption through the depletion of susceptible individuals, if seroconversion is associated with robust immunity.

The increasing national seroprevalence in India suggests a growing epidemic moving from urban to rural areas, but most of the population remains susceptible to infection. Continued expansion of testing capacity and stringent application of infection control measures remain warranted. Further rounds of the national serosurvey are planned and should provide crucial information on the rate of seroconversion, informing overall public health strategy and action.

AIM

The purpose of this study was to study the seroprevalence of SARS-Cov-2 IgG antibody by mini-vidas automated system among health care workers in a tertiary- care institute of south-west bihar .

Inclusion Criteria:

All the health care workers from our institution involved in directly or indirectly with patient care activities were included.

Exclusion Criteria:

health care workers with incomplete schedules were excluded out.

MATERIALS AND METHODS

Study type and design

An observational study with a cross-sectional design was conducted at Narayan Medical College & Hospital, Sasaram, Bihar. The total duration of the study was 3 months that was from January 2021 to March 2021. This included planning of the study, data collection, data analysis, and report writing. Data collection was before the vaccination of the individual.

Study population and sampling

All the health care workers at the Narayan Medical College & Hospital, Sasaram who are involved in patient care directly or indirectly constituted the study population for the current study. The said population comprised of doctors, nursing staff, laboratory technicians, and sanitation staff. A circular on the letterhead of the college was issued with the permission of the college authority and circulated across all the departments and all unit heads to intimate people from various sections about the purpose and importance of the study. A week-long blood collection camp was set up in the department of Microbiology for the collection of samples from the individuals who came to enroll in the study. The enrollment and participation were completed voluntarily. A total of 473 health care workers attended the collection camp. Considering the inclusion and exclusion criteria, 462 were included in the study but the analysis could be performed on 440 participants as the rest 22 schedules were incomplete.

Data collection

A pre-designed pre-tested semi-structured schedule was given to each study participant on arrival in the camp, after

obtaining informed written consent from them. Completed schedules were collected from them. 3-4 ml of blood sample was collected from each individual while maintaining septic precautions.

A 3 to 5 ml venous blood sample was collected and sent to the microbiology laboratory to further processing. Blood samples were centrifuged at 3000 rpm to separate serum and analyzed for SARS CoV2 IgG estimation using a mini-VIDAS automated analyzer following the manufacturer's instructions.

Study variables

The schedule comprised of their socio-demographic details that include age in completed years and gender, king of work involved in the hospital (doctors and others), exposure to confirmed COVID-19 case or their body fluids during duty, use of personal protective equipment (PPE) during duty, maintaining COVID-19 related precautions outside the workplace, personal history that included smoking and alcohol intake, any known chronic co-morbidity status, history of prior COVID infection detected by reverse-transcriptase-polymerase chain reaction (RTPCR) or rapid antigen test for SARS-CoV-2, steam inhalation, intake of Hydroxychloroquine (HCQ), Azithromycin, Zinc, and Vitamin C.

Operational definitions

a) Full PPE – Use of goggles, N-95 mask, gown covering the whole body except hand, foot, and face, double gloves, and shoe covers were taken as full PPE.
b) IgG seropositive for SARS-CoV-2 - Serum IgG level of 1.00 or higher was considered as IgG seropositive for SARS-CoV-2.

Ethical issues

Ethical clearance was obtained from Institutional Ethics Committee. Informed written consent forms were obtained from all the participants. The study ensured anonymity and confidentiality of data. The study was designed, conducted, and reported abiding by the declaration of Helsinki.

STATISTICAL ANALYSIS

IBM Statistical Package for Social Sciences (SPSS version 22) was used for data analysis. Schedules that were filled up were considered for data analysis. Descriptive analysis was performed and reported in form of numbers and percentages to show the distribution of the study participants according to their background characteristics and IgG seropositivity for SARS-CoV2. Inferential statistics were performed to find out univariate and multivariable determinants of IgG seropositivity among the study subjects. Logistic regression analysis was performed to determine association. Attributes that were found to be significant ($P<0.05$) in univariate logistic regression were only entered in the multivariable logistic regression model using the forced entry method. The strength of association was reported in terms of Crude Odds Ratio and Adjusted odd ratio. The Insignificant Hosmer-Lemeshow test ($P\geq0.05$) indicated modal fit for the multivariable logistic regression model.

RESULTS

Outcome variable

Serum IgG for SARS-CoV-2 was performed on the samples collected. Approximately one-third of the samples (36.8%) were seropositive for SARS-CoV-2. The median IgG value was 0.21 while it ranged from 0.00 to as high as 37.16, and the interquartile range is 0.15 to 21.5.

Characteristics of the study participants

The age of the study participants ranged from 17 to 69 years with a median of 31 years. The Interquartile range was 25 to 38 years. The male-female ratio being as high as 9.1, shows a male predominance in participation. Doctors comprised 18.6% of the participants, the rest were nurses, lab technicians, ward boys, and sanitation staff. The Majority of the study subjects (63.6%) reported direct exposure to confirmed COVID-19 cases or their body fluids during the performance of their duties. A complete PPE usage was lacking as only 35.2% of the total study population practiced the correct and ideal PPE. Rest either resorted to the use of mask and gloves (46.1%) or only mask (18.7%). Among all, 7.9% gave a positive history of confirmed COVID-19 infection with either RT-PCR or Rapid Antigen Test, at least once since March 2020. As far as COVID-19 related precautions outside the workplace are considered, 17.8% reported to practice steam inhalation at least once a day and 89.8% reported usage of masks regularly even when outside the workplace. 4.8% of the individuals were currently smoking and none of the participants reported consumption of alcohol since the alcohol ban has been imposed in the state of Bihar. These various characteristics of the study sample concerning their IgG status have been depicted in a tabular form in number and percentage (Table 1).

Predictors of seropositivity for SARS-CoV-2

Univariate logistic regression analysis showed that gender, healthcare workers other than doctors, use of full PPE, and prior COVID-19 infection were the statistically significant factors that affect IgG seropositivity for SARS-CoV-2. All these were put into multivariable logistic regression analysis by the forced entry method. The results of which showed that healthcare workers other than doctors and prior COVID infection were significant determinants of IgG seropositivity for SARS-CoV-2 (Table 2).

Table 1: Distribution of the study participants according to their background characteristics and seropositivity for SARS-CoV-2. (N=440)

Characteristic	Total		IgG seropositive for SARS-CoV-2	
	Number	%	Number	%
Age in completed years				
Less than 31	234	53.2	80	34.2
More than or equal to 31	206	46.8	82	39.8
Gender				
Male	319	72.5	109	34.2
Female	121	27.5	53	43.8
Type of health care workers				
Doctors	82	18.6	23	28.0
Others	358	81.4	139	38.8
Exposure to patients or their body fluids during work	280	63.6	82	29.3
PPE use				
Full PPE	155	35.2	41	26.5
Mask with gloves	203	46.1	84	41.4
Only mask	82	18.7	37	45.1
Positive history of COVID-19 infection	35	7.9	27	77.1
Currently smoking	21	4.8	1	4.8
Use of mask outside the workplace	395	89.8	52	11.8
Steam inhalation	78	17.8	19	24.3

Table 2: Univariate and multivariable logistic regression analysis to find out predictors of seropositivity for SARS-CoV-2 among the study participants (N = 440)

Characteristic	Seropositivity against SARS-CoV-2	
	COR (95% CI)	AOR (95% CI)
Age		
Less than 31	1.5 (0.4 - 2.1)	
More than or equal to 31	Ref	--
Gender		
Male	1.9 (1.1 – 2.5)*	1.7 (1.0 – 2.1)
Female	Ref	Ref
Type of health care workers		
Doctors	0.6 (1.4 – 2.2) *	0.3 (1.3 – 1.8) *
Others	Ref	Ref
Exposure to patients or their body fluids during work (Yes)	1.3 (0.4 - 1.8)	--
PPE use		
Full PPE	0.4 (1.6 - 3.2) *	0.2 (0.9 – 2.8)
Mask with gloves and only mask	Ref	Ref
Positive history of COVID-19 infection (Yes)	2.2 (1.6 – 2.9) *	1.3 (1.2 – 2.5) *
Currently smoking (Yes)	1.0 (0.8 – 4.5)	--
Use of mask outside the workplace (Yes)	1.8 (0.4 – 3.2)	--
Steam inhalation (Yes)	2.2 (0.2 – 4.2)	--

* Significant attributes

DISCUSSION

The current study estimated IgG seropositivity for SARS-CoV-2 and some of the factors that might influence it among doctors and other staff of a tertiary care institute delivering COVID-19 related support and care in Southwest Bihar.

We concluded that 36.8% of our HCWs were seropositive for SARS-CoV-2. This finding is higher than some of the Indian researchers, by Prakash et al. [10] and Kumar et al. [11] and some foreign studies conducted in past like one in Belgium by Martin et al. [12]. Some of the prior Indian studies as by Baveja et al. [13], as well as European studies like one by Schmidt et al. [14], Amendola et al. [15], Sotgiu et al. [16], Garcia-Basteiro et al. [17], and an American study by Mughal et al. [18], reported it to be very less compared to our findings. This wide variation of the finding may be attributed to many factors like variation in study subject selection, different techniques used for serum IgG for SARS-CoV-2 estimation, socio-cultural differences, and to variation in immune responses which is likely to be influenced by genetic, ethnic, and climatic factors. [19,20]

We did not find any significant association between age and SARS-CoV-2 IgG seropositivity. This was in line with the results of Kumar et al. [11] and Martin et al. [12]. But there was a statistically significant association between seropositivity and gender as males were more likely to be IgG seropositive compared to females. This was in line with the findings of Kumar et al. [11] and Amendola et al. [15] who reported similar observations. This might be because Indian men are more into various outdoor activities like household items, groceries, etc. and high mobility in comparison to their female counterparts are at more risk of contracting SARS-CoV-2 infection.

In our study, the type of work the concerned heathcare worker was involved in, emerged as a significant influencer of IgG seropositivity to SARS-CoV-2. We found that staffs other than doctors were more likely to be IgG seropositive for the disease. Here the educational level of the study subjects as well as their attitude and behavior might have played a role doctors by virtue of their professional training likely to be more aware of infection prevention and control (IPC) measures to be taken for contagious diseases like COVID-19. Thus, they might have taken more precautions in comparison to the other staff to get themselves protected from SARS-CoV-2 infection. transmission.

We found that odds of being IgG seropositive among those who had prior COVID infection was 2.2 as compared to those who never had a known history of being infected with the virus. This was in concordance with the findings of Kumar et al. [11] and Garcia-Basteiro et al. [17]. This was an obvious finding as acquiring infection of an infectious disease agent is the only way to develop immunity against that particular disease in absence of an effective vaccine. Use of full PPE kit or N95 mask along with gloves although have shown significant association with IgG seropositivity in univariate analysis got neutralized in the multivariable model which signifies their limited role in immunity development against SARS-CoV-2 and their interaction with the type of the health care workers as doctors showed more professional precautions compared to other categories of staffs. Thus, use as supportive measures should be continued as it has some implications on the immune system of the individual.

Limitations:

Small sample size, non- health care workers could be involved, some of the factors that might have influenced the outcome could not include due to non-availability of full information and complete proforma.

CONCLUSION:

The majority of the HCWs were found to be IgG seronegative for SARS-CoV-2. Occupation and prior SARS-CoV-2 infection were found to be significant multivariable determinants of IgG seropositivity for SARS-CoV-2 in the study subjects. Infection prevention and control (IPC) measures should be followed till the majority of the population gets vaccinated and even beyond that till WHO recommends keeping themselves and their contacts protected from SARS-CoV-2. Serum IgG antibody surveillance for SARS-CoV-2 may be a useful strategy to track the progress of the COVID-19 pandemic by assessment of immunity level for the disease among the population at increased risk such as HCWs.

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