Seroprevalence of Immunoglobulin G antibodies to SARS-COV-2 in asymptomatic healthcare workers in a South Indian Tertiary care NephroUrology Center

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Abstract

SARS-CoV-2 (Severe acute respiratory syndrome corona virus 2) Seroprevalence studies are being conducted all over the world to identify the level of exposure to the virus, in different groups of population. These include laboratory based serological tests to detect the presence of antibodies in response to an exposure/infection with the SARS-CoV-2 virus. The aim of the study was to know the prevalence of SARS-CoV-2 IgG Antibodies in Health Care Workers (HCWs) of our hospital. A cross-sectional serological study was conducted in a tertiary care center for Nephrourology in Bangalore, Karnataka, India. The HCWs of the hospital, of age group 20 to 60 were included in the study and were tested for the presence of SARS-CoV-2–specific IgG antibodies by Luminescence Immuo Assay method (CLIA). Prevalence was calculated, significance among the subgroups was analyzed using chi-square test and p value. 95 HCWs underwent testing, 6 were positive for IgG antibodies, with a Sero-prevalence rate of 6.3%. There was no significant difference in prevalence rate between male and female, and also between different age groups. It was concluded that serological studies to detect SARS-CoV-2–specific antibodies in HCWs might be helpful to detect the immune status of HCWs. Routine application of these tests in HCWs would aid in work stratification of HCWs in managing the covid 19 pandemic.

Keywords: SARS-CoV-2, Corona Virus, antibodies, Health Care Workers

Introduction

A novel corona virus which belongs to the group of severe acute respiratory syndrome viruses, was first identified in Wuhan, china in the year 2019 in the month of December[1]. The virus created panic all over the world because of its alarming spread, a high-level infectivity, and the severity infection. The World Health Organization (WHO) declared the virus as a pandemic in march 2020[2,3]. The disease caused by this virus is named as covid-19, and the main route of spread of this infection is by respiratory route from person to person [4].

Virus is most contagious when a patient is symptomatic. However, there are evidences to prove that covid-19 human-to-human transmission might be occurring even during the asymptomatic incubation period which is 2 to 9 days[5,6]. Thus, early detection of the infection followed by isolation of the infected person is very important in order to reduce the spread of virus. Diagnostic test which is widely used all over the world is Polymerase chain reaction(PCR) which is molecular testing that detects the presence of the viral genome on a on a nasal or throat swab and it gives the current infection status of the individual[7].

PCR is reliable as long as the person is shedding the virus, and is not of a use when viral load becomes undetectable around 3 to 5 days after the patient becomes asymptomatic[8]. Hence clearly there is a great role of serological testing to detect the viral antibodies which can detect a prior infection or immune status of the individual to the ongoing pandemic.

   Health care workers (HCW) are the high-risk group for contracting the virus as they are in close contact with affected. Once infected, they pose a risk to the patients they are catering to and also to their coworkers. This transmission cycle which occurs between the HCWs and the patients might lead to most of the HCWs getting exposed to the virus invariably. Hence seroprevalence (SP) studies in this subgroup of the population i.e. HCW s would give us a useful information about the level of exposure among the hospital personnel, high risk group among the HCWs. Knowing immune status of the HCWs through these SP studies, we can make an educated decision about quarantining HCWs, and stratify them.

We conducted this seroprevalence study among the HCWs of our hospital which is a tertiary centre for kidney and urological care, to know the immune status of our HCWs.

Materials And Methods

This was a cross-sectional serological study conducted between between 13th July 2020 to 20th July 2020, at the Institute of NephroUrology, a 150 bedded government aided tertiary care centre for nephrourology care in Bangalore. The health care workers(HCWs) of the hospital, between the age group of 20 to 60 years were included in the study and were tested for the presence of SARS-CoV-2–specific IgG antibodies by Luminescence Immunoassay (CLIA). HCW categories included doctors (Nephrologist, Urologists, Anesthetists', Lab doctors), nursing staff (emergency department, covid isolation wards, Intensive care units, outpatient departments, operation theatres), Technicians (laboratory, ultrasound, dialysis), housekeeping staff and administrative staff.

Inclusion criteria: 1) Full time HCW.   2) Age above 20 years. 3) Having no symptoms of covid 19 at the time of sample collection.

Exclusion criteria: 1) Symptomatic HCWs.   2) HCWs on quarantine.

Methodology

Laboratory testing for SARS-CoV-2–specific IgG antibodies was done using chemiluminescent microparticle immunoassay (CMIA) test. The commercially available test kit from Abbott Architect was used.

Sample Collection and Reporting:

A random blood sample was collected using aseptic precautions, from the participants of the study and serum sample was used for the analysis after centrifugation for twenty minutes. IgG antibody levels were expressed as the ratio of the chemiluminescence signal over the cutoff (S/CO) value. A S/CO value higher than 1.4 for IgG was regarded as positive. Tests with borderline results were repeated.

Statistical analysis

Data were analysed by Statistical Package for Social Science (SPSS) version 17.Prevalence rate was calculated , and significance among the groups was assessed using chi-square test and p value. P value <0.05 was considered significant.

Results

A total of 95 HCWs including 54 males and 41 females were tested for the presence of IgG antibodies against SARS COV-2. Of the total participants, 6 were seropositive for IgG antibodies, with the prevalence rate of 6.3%.

On comparison, seroprevalence was higher in males compared to females though the difference was not statistically significant (p value- 0.6). (Table-2). HCW with the younger age group (21-40) had higher seroprevalence than that of the older age group (41 - 60) which was not statistically significant again (p value- 0.785). (table- 3)

On analyzing the seroprevalance rate among different subgroups of HCWs it was found to be high in housekeeping staff with a rate of 13%. (table-4) .However more studies on HCWs with larger sample size might be more conclusive.

Though previously rt PCR positive HCW were excluded from the study, they were also tested for the presence of IgG antibodies, and all (five out of five) of them had positive antibody titers giving high sensitivity (true positives)report for the test method. These were used as disease controls for the study.

Discussion

An antibody, also called an immunoglobulin, is a protective protein produced in response to exposure to an antigen by the B lymphocytes, a part of body immune system[9]. Antibodies are antigen specific, and hence the antibodies produced in the body following covid 19 infection will protect the body against a repeat covid infection. This is due to immonological memory an important feature of immune response[9].

IgM antibodies are produced immediately after infection, and remain for a very short duration, whereas IgG are produced after a week period ,increase in titre and remain in blood for a long period. The use of both antibodies for detecting the immune status of the individual is advantageous[10-12]. In a recent study on antibody respone to Covid infection by zhao j et al,in 173 patients, it was shown that the presence of antibodies in first week was <40% in first week of symptoms onset, and rapidly increased to 100.0% , 94.3% (IgM), and 79.8% (IgG) by 15 days of symptoms onset[12]. Another study by shu h et al found in their study that both the IgM and IgG antibody levels peaked at around 18 days and 23 days, followed by IgM levels fell to below the baseline level at 36th day , whereas IgG maintained at a relatively high level[13]. Even though both IgG AND IgM aid in the diagnosis of covid 19 infection, IgG is more reliable and sensitive marker to detect the immune status of the individual due to its prolonged half life. In the present study we have incorporated only IgG levels in HCWs of our hospital due to lack of resources.

So far, numerous studies have proved the presence of infection in asymptomatic individuals[14,15]. Currently, the total reported cases of COVID-19 all over the country are mostly limited to symptomatic individuals, and those in close contact with confirmed patients resulting in a large number of sub clinical and asymptomatic infected individuals left undetected.

The diagnostic test of choice is RT-PCR(Reverse transcription – Polymerase chain reaction) which detects viral RNA but test has its own limitations as the test is very sensitive to the method of assay, transportation of specimen, and timing of the sample collection[16,17]. Hence inclusion of serological test which detect IgG and IgM antibodies in vulnerable group is very important to assess the cumulative prevalence of SARS-CoV-2 infection.

We have enrolled only asymptomatic HCWs in the study because all symptomatic HCWs will be subjected to RT-PCR as per the hospital infection control committee (HICC) protocol and will be quarantined for the incubation period. We have excluded all HCWs in quarantine from our study. Our aim was to identify any past infection in our HCWs so that we can quantify the exposure risk and immune status of HCWs.

In our study the seroprevalence rate was found to be 6.3%, which indicates there might be lower degree of immunity in our subgroup, it gave an idea about the most affected and susceptible group of HCWs to exposure. The highest prevalence rate (13%) was among house keeping staff in our study. Though large studies need to be conducted to arrive at any conclusion, these studies will definitely give a peace of mind to the HCWs as they will have an idea of their own state of exposure and immunity to the viral infection.

Limitations Of The Study

1)Testing IgM antibodies along with IgG antibodies would give a better result than IgG alone, but due to lack of resourses we have done only IgG.

2)Study in large population or high sample size will give a better result.

Conclusion: Seroprevalence studies of SARS-CoV-2 for in HCWs should become a part of routine investigations which aid in the work stratification of HCWs in managing the pandemic situation according to their immune status. These studies if conducted in large scale at community level, will give an information about the community prevalence of the infection. This in turn would give us valuable information on seroprevalence and subsequent development of herd immunity and their correlations.

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Table 1; Seroprevalence of IgG in HCWs

Total HCW tested	No of asymptomatic HCW with IgG positive	Seroprevalence of IgG in asymptomatic HCW s
95	6	6.3%
HCW: health care worker, IgG: immunoglobulin G		

Table 2: Distribution of IgG positives in males and female HCW s

HCW S	IgG positive	IgG negative	Total	χ^2 value	P value
Males	4	50	54	0.252	0.615
Females	2	39	41		
Total	6	89	95		
χ^2: chi square value, P value <0.05 is significant					

Table 3:Distribution of IgG positives in males and female HCW s

HCWS Age group	IgG positive	IgG negative	Total	χ^2 value	P value
20- 30	2	30	32	0.0741	0.785
31-40	3	40	44		
41- 50	1	13	13		
51-60	0	6	6		
Total	6	89	95		

Table 4 :Distribution of IgG seroprevalance among the different categories of HCWs

Category of HCW s	IgG positive	IgG negative
Doctors	1	24
Nurses	1	27
Technicians	2	26
Housekeeping staff	2	15
Administration	0	3