DOI: https://doi.org/10.36811/rjnnd.2022.110005 RJNND: May-2022: Page No: 01-07

Research Journal of Neurology and Neuro Disorders
Research Article Open Access

Frequency of SARS-CoV-2 antibody among health care workers during first phase of COVID-19 pandemic

Shijaku E[2], Durro V[1], Alimehmeti I[3], Naco M[1], Resuli M[3] and Shijaku F[4]

[1]Microbiology service, University Hospital "Mother Tereza", "Faculty of Medicine" Medical University of Tirana
[2]Microbiology Service, University Hospital "Mother Tereza"
[3]Faculty of Medicine, Medical University of Tirana
[4]Faculty of foreign languages, Tirana

***Corresponding Author:** Vjollca Durro, Medical University Tirana, Faculty of Medicine, University Hospital "Mother Tereza", Tirana, Laboratory Service, Microbiology Laboratory, Phone: 0684032328; Email: vjollca.durro@fakultetimjekesise.edu.al; vjollcadurro@gmail.com

Received Date: *May 16, 2022 /* ***Accepted Date:*** *May 28, 2022/* ***Published Date:*** *May 31, 2022*

Abstract

Introduction: Healthcare workers are mostly at risk of SARS-CoV-2 infection than the rest of the population. The aim of this study is to evaluate the prevalence of Sars CoV-2 in the health care workers during the first phase of Sars Cov-2 pandemic, April -July 2020.

Material and Methods: This retrospective study was carried out in the health care workers serving at the Tirana hospitals from April to July 2020. Hospitals included in study are grouped into three groups related to their exposure to Covid -19 infection: The high-risk group, the medium risk group and low risk group. The age of HCWs included in the study varies from 20-68 years. Qualitative measurement of SARS-CoV-2 IgG and SARS-CoV-2 IgM antibodies was performed with fully automatic immunoassay based on Chemiluminescence (CLIA) method, using commercial kits/tests from manufacturer Shenzhen New Industries Biomedical Engineering Co., Ltd, Maglumi TM 800.

Results: Out of the 4077 HCWs tested 9.08%(370 cases) were antibody positive to SARS-CoV-2 virus. According to the type of antibody 5.69% were IgG positive, 2.50% were IgM positive and 0.88% were IgG and IgM positive. According to the exposure to risk the prevalence of antibody to SARS-CoV-2 virus was 18.6 % in high-risk group, 7.6% in medium risk group and 5.38 % in low-risk group. According to gender the prevalence of antibody were 12.55% in male and 7.85% in female. Regarding to age group, most of the tested HCWs belong to 40-60 age group, while the prevalence of anti IgG, IgM and IgM and IgG Sars Cov-2 virus was higher in the tested staff of over 60 years old.

Conclusion: Based on our first results, we emphasize the need for further testing to monitor the immune status of health care workers.

Keywords: SARS CoV-2 IgG; SARS CoV-2 IgM; Health Care Workers; Chemiluminescence Method

Cite this article as: Shijaku E, Durro V, Alimehmeti I, et al. 2022. Frequency of SARS-CoV-2 antibody among health care workers during first phase of COVID-19 pandemic. Res J Neuro N Disord. 4: 01-07.

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Introduction

Testing for SARS-CoV-2 infection with Rt PCR or serological testing that identifies the SARS-CoV-2 specific antibody is important in order to assess the spread of the infection, community transmission and identify individuals who have passed the infection [1-4]. Serology tests constitute an important tool in order to provide information about health conditions of the medical staff and are of great service to the health institutions, that the right strategy according to the epidemiological situation can be adopted [5]. Healthcare workers are mostly at risk of SARS-CoV-2 infection than the rest of the population, they are exposed to both the infection and the potentially infectious materials. Controlling health workers is an important element for the monitoring of nosocomial infections in order to prevent the spread of SARS-CoV-2 infection among health care personnel and health care beneficiaries [6-9]. The aim of this study is to evaluate the prevalence of Sars CoV-2 in the health care workers during the first phase of Sars Cov-2 pandemic, April -July 2020.

Material and Methods

Study population

This retrospective study was carried out in the health care workers serving at the Tirana hospitals from April to July 2020. Hospitals included in study are grouped into three groups related to their exposure to Covid -19 infection: The high-risk group: the dedicated Covid- 19 hospitals include three hospitals Covid 1, Covid 2 and infective pediatric service. The medium risk group: no dedicated Covid 19 hospitals include University Hospitals Centre "Mother Tereza" (UHMT), University Hospitals of Trauma (UHT), University Obstetric Gynecologic Hospitals (UOGH). The Low risk group**:** Administrative staff. The participation in the study of HCWs was not mandatory. The only exclusion criteria in the study were individuals who for personal reasons did not want to undergo the test.

All participants included in the study completed a standard questionnaire where some data was ensured on demographic and health characteristic such as age, place of residence, travel and contact history, co-morbidities and the presence or absence of Covid 19 clinical signs e.g. cough, fever, and respiratory signs, examinations performed as RT-PCR, CT. The age of HCWs included in the study varies from 20-68 years. Age calculation was based on identity card data, on year of birth and are grouped into three age groups. Processing the questionnaire data, we could obtain accurate data regarding the age for 2436 tested HCWs. The standard questionnaire was filled in at the time of blood sampling.

Laboratory testing

Qualitative measurement of SARS-CoV-2 IgG and SARS-CoV-2 IgM antibodies was performed with fully automatic immunoassay based on Chemiluminescence (CLIA) method, using commercial kits/tests from manufacturer Shenzhen New Industries Biomedical Engineering Co., Ltd, Maglumi TM 800. The sensitivity and specificity of test report from manufacture were: The CLIA method applied showed a sensitivity of 78.65 % and a specificity of 97.5% for SARS-CoV-2 IgM test and sensitivity of 91.21% and a specificity of 97.5% for SARS-CoV-2 IgG. A validation kit was performed by our laboratory using serum samples collected from 60*r*RT-PCR confirmed COVID-19 cases, and 86 negative serum sample of blood donors, as control group donated during November 2018 when covid infection did not exist. The unit of measurement of results expressed in AU / ml (Arbitrary Units per milliliter) and their interpretation were <**1.00** AU/ml no reactive, ≥ **1.00** AU/ml **reactive**.

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Interpretation

IgG positive indicates the HCW has passed covid-19 infection. IgM positive indicates that the HCW is in the acute phase of infection, while IgM positive and IgG positive indicates the recovery phase.

Statistical

Data entry and processing was performed using Microsoft Office Exel 10 and IBM SPSS Statistics version 20 and the Z-Score standard and hi square was used.

Results

A total of 4077 health care workers participated and had antibody to Sars CoV-2 virus tested. Out of the 4077 HCWs tested 9.08% (370 cases) were antibody positive to SARS-CoV-2 virus. According to the type of antibody 5.69% were IgG positive, 2.50% were IgM positive and 0.88% were IgG and IgM positive. According to the exposure to risk the prevalence of antibody to SARS-CoV-2 virus was 18.6 % in high-risk group, 7.6% in medium risk group and 5.38 % in low-risk group. According to gender the prevalence of antibody were 12.55% in male and 7.85% in female (Table 1).

Table 1: Characteristic, demographic and serological data of study population.

Variable	Total No. 4077	Positive No. 370 (seroprevalence 9.08%)		
		IgG No (%)	**IgM No (%)**	**IgG+IgM No (%)**
		232 (5.69%)	102 (2.5%)	36 (0.88%)
High risk Dedicated Covid-19 hospital	Total No.664	Positive No. 124 (seroprevalence 18.6%)		
	664 (16.28%)	67 (10.09 %)	34 (5.12%)	20 (3.01%)
Medium risk No- Dedicated Covid-19 hospital-	Total no. 2967	Positive No. 225 (seroprevalenca 7.6%)		
	2967 (72.77%)	150 (5.05%)	61 (2.05%)	14 (0.47%)
Low risk Administrative staff	Total No. 446	Positive No. 24(seroprevalenca 5.38%)		
	446 (10.93%)	15 (3.36%)	7 (1.56%)	2 (0.45%)
Gender	Positive male No. 133 (seroprevalenca 12.55%)		Positive female No. 237 (seroprevalenca 7.85%)	
Male	1059 (26 %)	81/7.65%	35/3.31%	17/1.61%
Female	3018 (74 %)	151 (5.00%)	67 (2.22%)	19 (0.63%)
	z score	3.1973	1.9451	2.9202
	p value	0.0014	0.0512	0.0035
Age (years)	Total No. 2436	Positive No.=177		
		IgG	IgM	IgG+IgM
20-39 yrs	1 141 (46.84%)	41 (3.59%)	23 (2.02%)	3 (0.26%)
40-59 yrs	1 209 (49.63%)	63 (5.21%)	21 (1.74%)	4 (0.33%)
Over 60 yrs	86 (3.53%)	12 (13.95%)	6 (6.98%)	4 (4.65%)
	Median 40.8 years (20-68yr), SD= 11.8			

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Table 2: The distribution of antibody during April-July.

Variable	Total number	IgG Positive No (%)	IgM Positive No (%)	IgG pos and IgM Pos. No (%)
April	248	31(12.50%)	12(4.84%)	9(3.63%)
May	1662	99 (5.96%)	59 (3.55%)	17 (1.02%)
June	1851	77(4.16%)	21(1.13%)	3(0.16%)
July	316	25(7.91%)	10(3.16%)	7(2.22%)
P value		0.05	0.05	<0.05

Table 3: RT-PCR and anti-Sars Cov-2

	No tested	IgG	IgM	IgM pos and IgG pos	Total
PRC pos	54(51.9%)	11(20.3%)	4(7.4%)	4(7.4%)	19(35%)
Pcr neg	50 (48.07%)	8(16%)	1(2%)	1(2%)	10(20%)
Total	104	19(18.26%)	5(4.80%)	5 (4.80%)	

Data on table 3 show that out of 50 HCWs with PCR negative result 10 HCWs had antibody to Sars Cov-2 during screening time, while Out of 54HCWs with PCR positive result 19 HCWs had antibody to Sars Cov-2.

Table 4: Seroprevalence and clinical symptoms.

Antibody positive	Respiratory sign	Temp	Contact patients	Contact out hospitals	Asymptomatic
370	165(44.5%)	84(22.6%)	26(7%)	13(3.5%)	121(32.7%)

Data on table No. 4 show that out of 370 HCWs anti- Sars Cov-2 positive 121 were asymptomatic and 248 HCWs had clinical sings.

Discussion

The first case in Albania was determined in March 9, 2020 followed by an increasing number of the infected people and cases of severe forms of COVID-19 disease and consequently an increase in the number of deaths. The distribution of the covid infected people, the number of hospitalizations and death rates vary in different countries as well as within the same country. So, each country had to establish its strategy to reduce the effect of the pandemic according to its characteristics [10]. In this situation, the Ministry of Health took measures ranging from increasing hospital capacity to drastic decisions limiting activities aimed at slowing the spread of the virus [11]. In absence of the specific medical treatment, the important measures taken to prevent the spread of this infection have been rapid diagnosis, isolation of positive cases, tracking and precautionary self-isolation of close contacts [12,13]. As part of its strategy, in April 2020 MoH decided to test the hospital health care personnel for antibody to Sars CoV-2 infection, based on the epidemiological situation of the covid infection in Albania, the capacity of health human resources in the hospitals and the spread of the infection among health care workers in hospitals. Screening the health care workers for antibody to Sars CoV-2 virus was intended for a rapid identification of the infection and isolation of the infected staff, so that to prevent the spread of the infection among the hospitals' staff and their family members and ensure the medical staff get soon back to work in this difficult situation [14-16].

It should be mentioned that during the study period, Tirana was among the Hot Spot cities in terms of the pandemic in our country.

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Serological assays identify SARS-CoV-2 antibodies (IgM and IgG), indicating acute and previous infection in the unvaccinated people [17-20]. HCWs from the dedicated covid hospitals accounted for 16, 2% of HCWs tested in this survey. Most of HCWs tested belong to the female gender74%, and to the age group 40-59 age, accounting for 49.6% (Table 1). Our data show that HCWs from the dedicated Covid-19 hospitals had a higher prevalence of antibody to Sars CoV-2 virus than others, so most of the staff who have passed the infection or were in the acute phase of recovery are from the high group risk/dedicated Covid-19 hospital. This change is statistically significant (p value<0.00001).The administrative staff had no contact with the patients in the hospitals, so this group had a lower prevalence than the other HCWs. In this study the administrative staff was considered as control group because of their risk of infection is the same as that of the general community.

These data show that HCWs in the dedicated covid-19 hospitals are more at risk of infection than others. The risk of the transmission of the infection is higher in this group of HCWs than others and the health care workers are more at risk than the rest of the population. Using protective clothing and self-isolation protocols in due time was very important in order to prevent the spread of the infection among the hospitals staff and ensure the return of the infected staff back to work in short time. The evaluation of the prevalence of antibody to Sars CoV-2 virus in HCWs according to gender shows that most of the infected HCWs were male. So, 7.65% of men tested have passed the infection, 3.3% were in an acute phase and 1.61% were in the recovery phase. This distribution was statistically significant (p value=0.0014). Regarding to age group, most of the tested HCWs belong to 40-60 age group, while the prevalence of anti IgG, IgM and IgM+IgG Sars Cov-2 virus was higher in the tested staff of over 60 years old. The data show that this age group was more at risk of infection than others.

After the first cases were determined in 9 March, 2020, Albania was in total lock-down for three months March-May 2020. Our data in this survey show that there was a decrease of the prevalence of IgG and IgM during the lock-down and an increase after the lock-down, during June to July (Table 2). This phenomenon was brought about by the rapid increase of the Covid infected people in our population after the lock-down, so the source of the infection of HCWs was not to be found only in the hospital area but also outside the hospitals. The transmission of covid infection in hospitals can occur from a patient to a HCW and between or among HCWs [21,22]. Based on the data collected from the questionnaires, results show that from 370 HCWs seropositive a figure of 26 (7%)had a contact history with the infected patients at the hospital, 13 (3.5%) had a contact history outside the hospitals, 165(44.5%) had respiratory signs, 84 (22.6%) had temperature and 121 (32.7%) had been asymptomatic. 7% of HCW were infected in their working place and 3.5% outside the hospitals(table No.4).The difference between symptomatic and asymptomatic groups was significant. We should note that we could collect no data on the time of performing the PCR test and the time of taking blood for serology from the questionnaire we conducted. Referring to our data (Table 3) 48.07% were negative and 51.92% were RT-PCR positive from the 104 HCWs tested with RT- PCR. Only 19 cases or 35% resulted antibody positive from the 54 HCWs infected with Sars CoV2 diagnosed positive with PCR. 10 cases or 20% from the 50 HCWs with negative PCR test resulted antibody positive.

To sum up, we hold that this is the first study for seroprevalence of Sars Cov-2 infection in HCWs and it most certainly has some limitations, for we lacked complete data from the questionnaires regarding the time when different examinations were carried out, their health status, incorrectness infilling the questionnaires. In order to ensure important conclusions regarding the prevalence of anti-SARS-CoV-2 antibodies, examinations

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performed and clinical signs we need to know the exact time when the examinations were carried out and the clinical signs started. As long as this data is missing, we cannot come to significant conclusions. Based on our first results, we emphasize the need for further serological testing to monitor the immune status of health care workers.

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