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Sars-Cov-2 Specific Antibody Detection in Health Care Workers in Tertiary Care Hospital

Muhammad Anwar, Mirza Waseem Javed, Nadia Parvez, Majid Latif*, Muhammad Yasir Rafiq*

Combined Military Hospital Kohat/National University of Medical Sciences (NUMS), Pakistan, *Combined Military Hospital Mailsi/National University of Medical Sciences (NUMS), Pakistan,

ABSTRACT

Objective: To estimate the sero-positivity of SARS-CoV-2 in health care workers based on specific antibodies in a tertiary care hospital.

Study Design: Comparative cross-sectional study.

Place and Duration of Study: Combined Military Hospital Kohat Pakistan, Jun to Jul 2020.

Methodology: 292 Health Care Workers from different departments were included by non-probability consecutive sampling. They were divided into three groups (High risk, Intermediate risk and low risk) according to the exposure risk to COVID-19 patients. In addition, serum samples for SARS- CoV-2 specific quantitative antibodies were collected. The odds ratio for SARS-CoV-2 Ab risk was calculated for different risk groups and male and female health care workers.

Result: Out of 292 Health Care Workers, 243 (83.22) were male, and 49 (16.78) were female, with a mean age of 34.64±7.25 years. SARS- CoV-2 specific Ab was detected in 43 (14.72) individuals. The risk of sero-positivity was higher in the high-risk group than the intermediate-risk group (Odds ratio 1.171 vs 0.878) and higher in the intermediate-risk group than the low-risk group (odds ratio 1.120 vs 0.747). The risk was also higher in females than in males (Odds ratio 1.676 vs 0.878).

Conclusion: The sero-positivity of SARS-CoV-2 in healthcare workers in tertiary care hospitals is high. The results indicate that we must improve our local hygiene and protective standards.

Keywords: COVID-19, Health care workers, SARS- CoV-2 Ab.

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INTRODUCTION

With over 323000 reported cases across Pakistan current COVID-19 pandemic continues to be a great challenge for healthcare workers.[1] On Jun 1, 2020, HCWs were placed on high priority in testing criteria issued by Govt. of Pakistan.[2] 21 of SARS cases in the 2003 epidemic were HCWs, and those were hospital acquired.[3] Health care workers are at high risk of contracting this highly contagious disease due to repeated close contact with COVID-19 patients during long duty hours, community and household transmission and improper personal protective equipment (PPE) technique.[4,5] Asymptomatic cases,[6,7] can transmit the disease, and routine testing is only done on symptomatic patients.Therefore SARS-CoV-2 seroprevalence is underestimated. Underreporting, testing only symptomatic cases and high clinical demands due to the rapid spread of the disease have limited our investigation and understanding of the exposure of HCWs to COVID-19.[8] However, it is very important to know the COVID-19 status of HCWs as these asymptomatic individuals will spread the disease to colleagues, patients and other people, and it is also important while assigning them duties in different departments to maintain staff during this pandemic.[9] A study in China reported that SARS-CoV-2 infection was 17.4. There is a difference in infection rates among HCWs at different hospitals. Infection rates in HCWs were low (1.5) in Santa Calra County, Cali-fornia and high in England (18).[10]

Polymerase Chain Reaction (RT-PCR) test from respiratory samples confirms the disease.[8] However, 11–14 days post first symptom SARS-CoV-2 antibody test becomes positive due to seroconversion.[9] SARS-CoV-2 antibody detection in HCWs shows less chance of acquiring COVID-19 but not absolute immunity.[10] Recently Roche diagnostics has developed a highly specific quantitative SARS-CoV-2 Ab assay on a sophisticated automated immunoassay analyzer. This assay is primarily designed to detect more mature high-affinity Ab for return work fitness, donor fitness for convalescent plasma and to estimate seroprevalence studies.

Our study aimed to report seropositivity of SARS-CoV-2 infection in HCWs of our hospital. This is important in assessing the efficiency of hospital infection control policies to prepare the hospital better,

Correspondence: Dr Mirza Waseem Javed, Department of Chemical Pathology, Combined Military Hospital, Kohat, Pakistan

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ensure the safety of both HCWs and patients, and halt the nosocomial spread of this disease.

METHODOLOGY

This comparative cross-sectional study was carried out at the Department of Pathology in collaboration with the Department of Medicine, Combined Military Hospital Kohat Pakistan, from Jun to Jul 2020.

Inclusion Criteria: Health Care Workers (HCW) from different departments were included in the study

Exclusion Criteria: HCW who acquired COVID-19 infection during leave were excluded from the study.

292 Health Care Workers (HCW) were included through non-probability consecutive sampling after informed consent. The sample size was calculated using the WHO sample size calculator for incidence estimation with a relative precision of 0.10 and confidence of 95.[11] This project was reviewed and approved by the IRB of CMH Kohat Pakistan (Certifi-cate no. E-2004 dated 04 Sep 2020). Selected subjects were divided into three groups (High-risk, Inter-mediate-risk and low-risk) according to the exposure risk to COVID-19 patients. The high-risk group inclu-ded HCW working in COVID-19 wards, emergencies, fever clinics, laboratory reception, and dealing with PCR samples. The intermediate-risk group included those working in outdoor patient departments, opera-tion theatres and radiology departments, and the low-risk group included HCWs working in administration. Serum samples for SARS- CoV-2 specific quantitative antibody were collected in plain tubes and analyzed on a Roche E411 automated immunoassay analyzer using an electrochemiluminescent method.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Mean and SD were calculated for quantitative variables like age and percentages were calculated for qualitative variables like gender, professional categories and risk groups. The odds ratio for SARS- CoV-2 Ab risk was calculated for different risk groups and male and female HCWs.

RESULT

Of 292 HCWs, 243 (83.22) were male, and 49 (16.78) were female, with a mean age of 34.64±7.25 years. Of these, 40 were doctors, 21 nurses, and 231 were paramedical staff, as shown in Table-I. SARS-CoV-2 specific Ab was detected in 43 (14.72) individuals. Risk for SARS- CoV-2 specific Ab was higher in females 22.44 than in males 13.16 (Odds ratio with 95 confidence interval: 1.676 vs 0.878).

Table-I: COVID-19 Ab Frequencies in Different Health Care Workers (n=292)

Parameters	COVID-19 Ab	
	Positive Frequency (%)	Negative Frequency (%)
All cases	43 (14.72)	249 (85.28)
Male	32 (13.16)	211 (86.84)
Female	11 (22.44)	38 (77.56)
Doctors	5 (12.5)	35 (87.5)
Nurses	4 (23.52)	17 (76.48)
Paramedics	34 (17.25)	197 (82.75)

Risk of seropositivity was higher in high-risk group 18.18 than intermediate-risk group 14.24 (Odds ratio with 95 confidence interval: 1.171 vs 0.878) and higher in intermediate-risk group 14.24 than low-risk group 10.0 (odds ratio with 95 confi-dence interval: 1.120 vs 0.747). Results of the odds ratio were shown in Tables-II & III.

Table-II: Odds ratio for Risk estimation of seroconversion for COVID-19 across male female cases with 95 confidence interval(n=292)

COVID-19 Antibody	Gender	
	Male Frequency (%)	Female Frequency (%)
Positive	32 (13.16)	11(22.44)
Negative	211 (86.84)	38(77.56)
Odds ratio with 95 Confidence Interval	0.878 (0.731-1.055)	1.676 (0.931-3.017)

Table-III: Odds ratio for risk estimation of seroconversion for COVID-19 across different risk groups cases with 95 confidence interval(n=292)

COVID-19 Antibody	Risk Categories Frequency (%)			
	High Risk vs Intermediate Risk		Intermediate Risk vs Low Risk	
Positive	18 (18.18)	19 (14.24)	19 (14.24)	6 (10.0)
Negative	81 (81.82)	114 (85.76)	114 (85.76)	54 (90.0)
Odds ratio with 95 Confidence Interval	1.171 (0.809-1.696)	0.878(.628-1.228)	1.120 (0.878-1.429)	0.747 (0.359-1.551)

DISCUSSION

We studied the seropositivity of SARS-CoV-2 infection in HCWs in our setup with unknown COVID-19 status at the screening time. The route of exposure of HCWs, whether inside or outside the hospital, cannot be identified.[12] The mental health of HCWs in the current COVID-19 pandemic is very important in preserving their confidence and availability.[13] In a large Spanish reference hospital, the seropositivity of SARS-CoV-2 was 9.3 (54 out of 578).[14] In March 2020, in Noord-Brabant, the Nether-lands,

within two days, 1,097 HCWs in nine hospitals were tested; 45 (4.1) were positive.[15]

In England, the study showed 282 (18) out of 1533 symptomatic HCWs were positive for COVID-19 infection.[16] In another study in England, Rivett *et al.* noted that 3 of HCWs tested positive. This study stressed the asymptomatic carriage of infection.[17] Korth *et al*. studied seropositivity of SARS CoV-2 antibodies in HCWs of University Hospital Essen, Germany. SARS-CoV-2-IgG antibodies were positive in 1.6 (5 of 316) HCWs. The seropositivity was more in the intermediate-risk-group vs. high-risk-group (2/37 (5.4) vs. 3/244 (1.2), p=0.13).[11]

Our results show that SARS- CoV-2 specific Ab was detected in 43 out of 292 (14.72) individuals. The risk of seropositivity was higher in the highrisk group 18.18 than intermediate-risk group, 14.24 (Odds ratio with 95 confidence interval: 1.171vs 0.878) and higher in the intermediate-risk group 14.24 than in the low-risk group 10.0 (odds ratio with 95 confi-dence interval: 1.120 vs 0.747). In our hospital, different Personal Protective Equipment (PPE) was used in different departments. A full viral suite along with a face shield and N 95 mask was used in the high-risk group. This group included HCWs dealing with COVID-19 patients or patient samples daily (COVID-19 wards, emergencies, fever clinics and laboratory reception and dealing with PCR). Intermediate-risk group (HCWs working in out-door patient departments, operation theatres and ra-diology departments) used disposable surgical gowns, masks and gloves. Finally, the low-risk group (HCWs working in administration) used only disposable masks. As expected, the high-risk group showed the highest rate, but the exact mode of transmission was unclear. Fre-quency was also higher in female HCWs than the male HCWs, although both used the same PPE in their respective departments. The difference in infection rates among HCWs at different hospitals highlights the variability across hospitals in different medical systems and the need for more studies on COVID-19 in HCWs. This study exa-mines the impact of COVID-19 emergencies on HCWs in CMH Kohat. This highlights that PPE and hygiene are crucial to protect against COVID-19 in a hospital setup. The study also shows that implementing poli-cies is also important as the seropositivity rate was different in different departments. This study also highlights an overview of the current status of the development of herd immunity in population.[18]

CONCLUSION

The sero-positivity of SARS-CoV-2 in healthcare workers in tertiary care hospitals is high. The results indicate that we must improve our local hygiene and protective standards.

Conflict of Interest: None.

Author's Contribution:

MWJ: Direct Contribution, MA:, NP:, ML:, MYR: Intellectual contribution.

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