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ANTIBODY RESPONSE TO SARS-COV-2 WITHIN HEALTHCARE WORKERS: A SINGLE-CENTER STUDY IN KAZAKHSTAN

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Abstract

The first severe acute respiratory syndrome coronavirus 2 outbreak was reported in December 2019, and the virus has rapidly spread worldwide. The antibody response in infected patients remains largely unknown, and the clinical value of antibody testing has not been fully demonstrated. In the period from the end of June to July in Kazakhstan, there was a sharp increase in the incidence.

Present study aimed to evaluate the incidence rate and the development of immune response among healthcare workers during the height of the severe acute respiratory syndrome coronavirus 2 pandemic in Kazakhstan.

The prospective study was carried out on the basis of the Syzganov National Scientific Center of Surgery in the period from July 2020 to August 2020. The project involved 248 people.

In total, there were 50 men and 198 women under study, aged 21 to 80 years, with the average age of men being 43.3 ± 0.2 years, women - 37.4 ± 0.3 years. The total percentage of antibody detection was 11.7% (29 participants). The largest percentage of the development of an immune response was among junior medical personnel IgG was detected in 10 (4%)Immunoglobulin M (IgM) in 1 (0.4%), while among the middle and senior medical personnel IgG and IgM was 7 (2.8%) and 1 (0.4%), respectively. Antibodies were not detected among paraclinical and technical personnel. Of the 29 seropositive results, IgG was detected in 24, IgM in 3, and IgG + IgM in 2, respectively.

The presence of immune response among medical personnel, a significant percentage of infection was in clinical personnel compared to paraclinical and technical personnel. The majority of subjects with a seropositive result had an asymptomatic course.

Keywords: *healthcare workers, COVID-19, severe acute respiratory syndrome coronavirus 2, IgM, IgG, Kazakhstan.*

Introduction

The first severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreak was reported in December 2019, and the virus has rapidly spread worldwide and become a pandemic within 3 months [*Zhu N et al., 2020*].

Severe cases of COVID-19 might eventually develop acute respiratory distress syndrome (ARDS), septic shock, multiple organ failure, bleeding, and coagulation dysfunction [*Chen N et al., 2020; Huang C et al., 2020*] and is featured by pneumonia, lymphopenia, exhausted lymphocytes, and elevated serum levels of proinflammatory cytokines characterized as a cytokine storm [*Zhuang M et al., 2020*]. Two previously identified coronaviruses, SARS-CoV and MERS-CoV (Middle East respiratory syndrome coronavirus), caused severe pneumonia but, unlike SARS-CoV-2, exhibited only limited person-to-person spread, resulting in dramatically lower numbers of confirmed cases (8,100 and 2,500, respectively) [*Sariol A, Perlman S, 2020*].

The novel coronavirus SARS-CoV-2 is a newly emerging virus. The antibody response in infected patients remains largely unknown, and the clinical value of antibody testing has not been fully demonstrated [*Mangalmurti N, Hunter A, 2020*].

At the time of submission of the article (October 18, 2020), 39 596 858 confirmed cases of COVID-19, including 1 107 374 deaths, were registered worldwide at WHO (2020).

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Kazakhstan is also one of the countries severely affected by COVID-19. In the period from the end of June to July in Kazakhstan, there was a sharp increase in the incidence, moreover, today Kazakhstan is in the "red" zone of most countries of the world due to the disappointing epidemiological situation. According to the official portal of Covid-19 in Kazakhstan [*MH RK, 2020*], at the time of submission of the article (October 18, 2020) the number of registered cases of SARS-COV-2 reached more than 109 thousand, as well as pneumonia with signs of coronavirus infection in more than 35 thousand cases.

A great public response in the country was the incidence of the dramatic number of infected healthcare workers in infection hospitals, as well as provisional hospitals, which covered the entire Republic. Moreover, institutions that were not engaged in the diagnosis and treatment of patients with COVID-19 (Scientific centers, non-infection multidisciplinary hospitals, non-infection private medical centers), but in which a large number of infected among the medical staff were detected, were quarantined. The reason for this crisis in the Healthcare system was many factors that are clarifying up to this time. According to Wang J. and co-authors, the increase in awareness of personal protection, sufficient personal protective equipment, and proper preparedness and response would play an important role in lowering the risk of infection for healthcare workers [*Wang J et al., 2020*].

Currently, the real time Reverse transcription polymerase chain reaction (RT-PCR) assay is the gold-standard method to diagnose SARS-CoV-2. However, false-negative cases have been reported due to problems with sample collection and transportation, RNA extraction, enzyme inhibitors, and the RT-PCR method [*Yang Y et al., 2020*]. By contrast, conventional serological assays, such as the enzyme-linked immunoassay (ELISA) for specific IgM and IgG antibodies, have a high-throughput advantage, and they avoid false-negative cases that occur with the RT-PCR method [*Xiao S et al., 2020*]

To overcome it is possible, due to the uniting the knowledge and will of all doctors in the world

Thus, we initiated a study to determine the percentage of morbidity among medical institutions in institutions not related to the provision of medical services to patients with COVID-19.

Present study aimed to evaluate the incidence rate and the development of immune response among healthcare workers during the height of the SARS-COV-2 pandemic in Kazakhstan.

MATERIAL AND METHODS

The prospective study was carried out on the basis of the Syzganov National Scientific Center of Surgery in the period from July 2020 to August 2020. The project involved 248 people, consisting of junior (medical orderly), middle (nurses, laboratory assistants, pharmacists) and senior medical staff (doctors), as well as paraclinical (social workers, medical registrars, managers, scientific and educational department, administration) and technical staff (technical department, security, catering workers). Before the start of the study, a questionnaire was conducted for the presence of current or past symptoms (fever, cough, weakness, rapid breathing), as well as the presence of significant comorbidities (diabetes mellitus, cardiovascular or cerebrovascular pathology, chronic respiratory diseases, oncology).

The serum was collected at distinctive time points, and SARS-CoV-2–specific antibodies were detected using "New Coronavirus (2019-nCoV) Antibody Detection Kit" (Innovita, China). By enzyme-linked immunosorbent assay to assess the presence of an immune antibodies IgG, IgM was performed. Upon detection of the acute phase of the virus within medical stuff went into quarantine for a period of 2 weeks, followed by repeated testing.

The study protocol was approved by our Institutional Local Research Ethics Committee (26/07/2020), and the study protocol was developed by conforming with the ethical standards of the Declaration of Helsinki (1964). All participants in the study submitted informed consent.

RESULTS

In total, there were 50 men and 198 women under study, aged 21 to 80 years, with the average age of men being 43.3 ± 0.2 years, women - 37.4 ± 0.3 years. The total percentage of antibody detection was 11.7% (29 participants). The largest percentage of the development of an immune response was among junior medical personnel IgG was detected in 10 (4%) IgM in 1 (0.4%), while among the middle and senior medical personnel IgG and IgM was 7 (2.8%) and 1 (0.4%), respectively. However, in two cases, one each in senior and middle medical personnel, there was the presence of IgG + IgM antibodies. An-

Table 1

The presence of an immune response among different categories of medical workers

Category	N=248	IgG n (%)	IgM n (%)	IgG+IgM n (%)
Junior medical stuff	68	10 (4.0%)	1 (0.4%)	0 (0%)
Middle medical stuff	102	7 (2.8%)	1 (0.4%)	1 (0.4%)
Senior medical stuff	63	7 (2.8%)	1 (0.4%)	1 (0.4%)
Paraclinical personnel	10	0 (0%)	0 (0%)	0 (0%)
Technical and other personnel	5	0 (0%)	0 (0%)	0 (0%)

tibodies were not detected among paraclinical and technical personnel (Table 1).

During the study, a significant number (n = 18; 62%) of medical personnel with a seropositive result had no symptoms. Of the 29 seropositive results, IgG was detected in 24, IgM in 3, and IgG + IgM in 2, respectively. IgG antibodies were detected in 4 patients with significant comorbidities. The detailed structure of seropositive exposure can be examined in table 2.

Table 2

Features of subjects with a seropositive result

	N=29	IgG	IgM	IgG+IgM
Male	8 (27.5%)	6 (20.6%)	2 (6.9%)	0 (0%)
Female	21 (72.5%)	18 (79.4%)	1 (3.4%)	2 (6.9%)
Presence of current symptoms	3 (10.3%)	0 (0%)	2 (6.9%)	1 (3.4%)
Presence of past symptoms	8 (27.5%)	7 (24.1%)	1 (3.4%)	0 (0%)
Asymptomatic	18 (62.0%)	17 (58.6%)	0 (0%)	1 (3.4%)
Presence of significant comorbidities	4 (13.7%)	4 (13.8%)	0 (0%)	0 (0%)

Conclusion

Thus, in the course of studying the presence of immune response among medical personnel, a significant percentage of infection was in clinical personnel compared to paraclinical and technical personnel, of which junior medical personnel had the highest number of antibodies. This is due to the fact that clinical personnel are in direct contact with patients. The majority of subjects with a seropositive result had an asymptomatic course. Further research in this field is needed.

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