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Assessment of the Relationship between ABO Blood Group and Susceptibility, Severity, and Mortality Rates in COVID-19

Bahar Mahmood Baig[1], Abdolhakim Abarian[2], Siamak Baghaei[3], Sima Soroush[4], Somayeh Ataee Rad[5], Soodabeh Pooromidi[5], Ehsan Moradi-Joo[6], Bita Gorjizadeh[7], Mohsen Davarpanah[8*]

[1]School of Nursing and Midwifery, Islamic Azad University, Tehran Medical Branch, Tehran, Iran.
[2]Department of Pediatrics, School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
[3]Department of Internal Medicine, Islamic Azad University, Ahvaz Branch, Ahvaz, Iran.
[4]Department of Pediatric Nursing Education, Behbahan Faculty of Medical Sciences, Behbahan, Iran.
[5]School of Nursing and Midwifery, Ahvaz Jundishapur University of Medical sciences, Ahvaz, Iran.
[6]Faculty of Management and Medical Information Sciences, Kerman University of Medical Sciences, Kerman, Iran.
[7]Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz Iran.
[8]Educational and Therapeutic Hospital of Sina Hospital, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

ABSTRACT

A relationship has been identified between the blood group and infectious diseases. COVID-19 is an infection caused by a new coronavirus designated as SARS-CoV-2, which has rapidly spread worldwide. In this retrospective study, COVID-19 patients who were referred to Razi Hospital in Ahvaz from February 2020 to May 2020 were evaluated and analyzed using SPSS v.16.0. The relationship between the ABO blood group and COVID-19 was assessed using the Kruskal Wallis test and Spearman correlation coefficient.

The frequencies of blood types O, AB, B, and A were 40.2, 11.8, 25.5, and 22.5%, respectively, Among the 8016 COVID-19 patients, the frequencies of blood types O, AB, B, and A were 41.9, 9.3, 25.7, and 23.1%, respectively, and no significant difference was observed in terms of the distribution of blood groups between the healthy and infected people (P = 0.34, 95% CI = 0.66-1.23). In addition, patients admitted to the ICU ward had blood groups of O, AB, B, and A, with a percentage of 21.3, 31.29, 33.6, and 35.3%, respectively. Furthermore, dead patients had A, B, AB, and O blood types with a percentage of 10.0, 11.4, 11.05, and 16.3%, respectively. A significant relationship was observed between the blood group and disease severity and death in COVID-19 patients (p=0.05, 95% CI = 1.02–1.73). The study showed that people with blood types A and O are at higher and lower risk of infection, severity, and death from COVID-19, respectively.

Keywords: SARS-CoV-2 COVID-19, ABO blood group, Infection, Severity, Death.

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Corresponding author: Mohsen Davarpanah
E-mail ✉ davarpanah301@gmail.com
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INTRODUCTION

On 31 December 2019, an "unknown viral pneumonia" first occurred in Wuhan, China named the 2019 novel Coronavirus (2019-nCoV) [1, 2] and On 11 February 2020, the International Committee on Taxonomy of Viruses reported that the new coronavirus can infect humans like SARS CoV-2 [3], The WHO

named the disease as COVID-19 [4]. Coronaviruses are a group of enveloped, ssRNA+ viruses with high diversity, [5]. Studies have reported that SARS-CoV2 is spreading rapidly around the world [6]. Numerous studies have been conducted to find the relationship among various blood groups with infectious diseases and non-infectious ones such as salivary gland tumor [7], peptic ulcer [8], and verities of cancers [9].

Microorganisms, especially viruses, have receptors in some blood groups to simplify colonization and incursion of the body's immune system. [10, 11]. Epitopes on the human cell surfaces are Landsteiner's ABO blood. The antigenic causes of B and A blood groups are three types of cells trisaccharide moieties. In addition to the effect of heredity, environmental factors can affect the transmission of blood groups to the next generation. There is a link between blood types and susceptibility to viral infections. For example, hepatitis B and Norwalk viruses have obvious blood group susceptibility [12, 13]. There are also reports that people with blood type O are less likely to get infected by SARS coronavirus [14]. During the study of Zhou *et al.* on Coronavirus patients in Wuhan of china, participants with blood groups of A and O had the highest and lowest risk of this disease, respectively [15]. Regarding the rare studies conducted in this unknown field and the new nature of this virus and also, nonexistence of studies in Iran specially posing the need for more studies in different regions, we investigated the incidence of SARS CIVID-19 disease in different blood types in Ahvaz city.

MATERIALS AND METHODS

This study was cross-sectionally conducted on COVID-19 patients referred to Razi Hospital in Ahvaz during the outbreak of COVID-19 in Khuzestan province (from February 2020 to May 2020) after getting permission from Ahvaz Medical University of Science, and obtaining Ethical code and informed consent of patients. The statistical population was divided into two groups including the experimental group with COVID-19 and the control group who were healthy individuals referred to Center of Blood Transfusion. In order to diagnose patients in the experimental group with COVID-19 infection, clinical symptoms and pulmonary involvement on CT scan of the lung reviewed and some tests were done twice through sending the samples prepared using two nasal and throat swabs for RT-PCT test with the approval of a lung specialist. Moreover, ABO and RH blood groups of COVID-19 patients were determined by referring to patients' records. Also, the blood samples of healthy asymptomatic ones (referred to Center of Blood Transfusion) were collected and determined using the slide and tube method. In this study, data were analyzed by SPSS-22 software to measure the distribution of each blood group in healthy and infected individuals, and their relationship was examined through the Chi-square test.

RESULTS AND DISCUSSION

Among the 8016 COVID-19 infected patients referred to Razi hospital in Ahvaz city, 286 (35%) were females and 530 (65%) were males, and out of 1329 healthy individuals, 558 (42%) were females and 771 (58%) were males. The mean age of participants with COVID-19 was 44.44 with a standard deviation of 9.9, and in healthy ones, it was 44.08 with a standard deviation of 10.2, while there was no significant difference regarding age and gender.

The results of distribution percentage of ABO blood groups in patients showed 184 (22.5%), 208 (25.5%), 96 (11.8%), 328 (40.2%) for A, B, AB, and O, and, in healthy individuals, 307 (23.1 %), 341 (25.7%), 124 (9.3%), and 557 (41.9%), and the Rh in patients group was positive among 770 (94.4%) and negative among 46 (5.6%), respectively. No significant difference was observed in the distribution of blood groups between healthy and infected individuals **(Table 1)**.

Table 1. Distribution of the ABO blood group and demographic data of COVID-19 patients and normal control groups.

	Age	sex		Blood group				RH		p-value
		Male	Female	A	B	AB	O	Pos(+)	Neg(-)	
Control group	44.1±10.1	771(58%)	558(42%)	307(23.1%)	341(25.7%)	124(9.3%)	557(41.9%)	1285(96.7%)	3.3%(44)	0.34
Patient	45.44±9.9	530(65%)	286(35%)	184(22.5%)	208(25.5%)	96(11.8%)	328(40.2%)	770(94.4%)	46(5.6%)	

A significant relationship was observed between the ABO blood group and disease severity and death in COVID-19 patients. In this way, the number of patients hospitalized in the general ward was 581 (71.2%) and in the ICU ward was 235 (28.8%); while the number of patients admitted to ICU ward in ABO blood groups for O, AB, B, and A was 70 (21.3%), 30 (31.29%), 70 (33.6%), and 65 (35.3%), respectively. Furthermore, the number of dead patients with O, AB, B, and A blood types were reported as 33 (10.0%), 11(11.4%), 24 (11.05%), and 30 (16.3%), respectively **(Table 2)**.

Table 2. The relationship between blood group, and disease severity and death of COVID-19 patients.

	Blood group					p-value
	A	B	AB	O	Total	
general ward	119(64.7%)	138(66.3%)	66(68.8%)	258(78.7%)	581(78.7%)	0.05
ICU	65(35.3%)	70(33.7%)	30(31.2%)	70(21.3%)	235(28.8)	
Expired	30(16.3%)	24(11.5%)	11(11.5%)	33(10.1%)	98(12%)	

Studying the ABO blood group in a population is not only of importance in blood transfusion, but also in organ transplantation, genetic research, and the relationship with certain diseases. The results of the current study indicated that no significant relationship was observed between COVID-19 infection and blood groups.

The study showed that the risk of COVID-19 varies with blood groups. For example, blood type A has the highest risk of infection, and O has the lowest risk of infection, so, it shows that the ABO blood group can be a biomarker for COVID-19 differential susceptibility. Previous studies have stable with homogeneous risk schemes for other viral infections. For example, the study of Cheng *et al.* showed that in Hong Kong, the susceptibility of SARS-CoV infection varied with the ABO blood group [14]. Moreover, the study of Wang *et al.* showed that there is a significant relationship between the ABO blood group and SARS COVID-19 infection so that the O and A groups had the lowest and highest risk of infection, respectively [16].

In this study, a significant difference was observed in terms of hospitalization in the general/ICU ward, as well as death in ABO blood groups. In terms of disease severity and mortality, the highest and lowest rates of death were found in A and O blood groups, respectively, which is consistent with previous studies in the field of the relationship between severity/death of COVID-19 patients and their ABO blood group. For example, Alkhikani *et al.* indicated the highest rate of death caused by COVID-19 in blood group A [17]. In addition, Michelle's article could not represent strong evidence on the relationship between death from COVID-19 and its severity (intubation and intensive care unit) with the ABO blood group, however, blood type A had the highest risk of infection.

The Study of Patrice *et al.* showed that anti-A antibodies specifically inhibit the adhesion of SARS-CoV S protein-expressing cells to the cell lines expressing ACE2. Considering the nucleic acid sequence similarity and receptor ACE2, the binding similarity between SARS-CoV-2 and SARS-CoV [18-20], the higher and lower susceptibility of blood groups A and O for COVID-19 may be related to the natural anti-blood group antibodies, especially anti-A antibody in the blood. This theory needs straight and complete investigations to be proven. Other mechanisms may also be involved in the ABO blood type-differentiated susceptibility to COVID-19, which needs more studies.

CONCLUSION

For the first time in Iran, we reported the relationship between ABO Blood type and rate of susceptibility to COVID-19 as well as its severity and mortality rate. People with blood groups O and A were reported to have the lowest and highest rates of susceptibility to COVID-19, as its severity and mortality, respectively. The study has its advantages: (1) People with blood group A should pay special attention to the use of personal protective equipment to lower the SARS Cov-2 risk; (2) The severity of the disease is higher in cases with blood type A and may cause undesirable complications; (3) It is also necessary to observe social distance in COVID-19 patients with blood

group A; (4) Identifying high-risk patients with blood type A is very important to reduce complications and death rate. The implementation of these cases should be noted. Also, a lot of attention should be paid to using this study in the clinical field. This study is the beginning of a wider study.

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CONFLICT OF INTEREST: None

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