

The relationship between AB0 blood groups and COVID-19

AB0 kan grupları ile COVID-19 arasındaki ilişki

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Abstract

Aim: Although COVID-19 infection spreads very quickly, not every individual is infected at the same rate. It should be investigated whether blood groups affect this difference in susceptibility to COVID-19. This study was conducted to investigate whether there was a relationship between AB0 and Rh blood groups and COVID-19 patients.

Methods: A total of 535 patients suspected of COVID-19 who were admitted to the emergency departments and pandemic polyclinics of 3 different hospitals were included in this prospective cohort study. The patients were divided into two groups as those with positive and negative results according to the swab test. According to the ABO and Rh subgroups of the patients whose blood groups were known, each patient was evaluated for the presence of COVID-19. The data on patients' age, gender, complaints during the admission, blood groups, and swab test results were recorded in the study forms, and statistical analyses were performed.

Results: The mean age of the patients was 45.5 (22.2) years. There were 291 (54.40%) males and 244 (45.60%) females. It was observed that most patients had A Rh + blood group (n=225, 42.1%). When age groups were compared in terms of gender, swab test results, and blood groups, no significant differences were found ($P=0.307$, $P=0.316$ and $P=0.694$, respectively).

Conclusion: We found that no specific blood group increased the risk of getting infected with COVID-19. However, according to our results, those with A Rh - and A Rh +, 0 Rh - and AB Rh - blood groups had a higher risk of catching COVID-19, while those with 0 Rh + blood group had a lower risk.

Keywords: Blood group, COVID-19, Pandemic, Infection

Öz

Amaç: COVID-19 enfeksiyonu toplumda çok hızlı yayılmasına rağmen her birey aynı hızla enfeksiyona yakalanmamaktadır. Bireylerin COVID-19'a yakalanmasındaki bu farklılıkların temelinde genetik olarak kan gruplarının bir etkisinin olup olmadığı araştırılmalıdır. Bu çalışma ABO ve Rh kan grupları ile COVID-19 hastaları arasında bir ilişki olup olmadığını araştırmak amaçlı yapılmıştır.

Yöntemler: 3 farklı hastanenin acil servis ve pandemi polikliniklerine başvuran toplam 535 Covid-19 şüpheli hasta bu prospektif kohort çalışmasına dahil edildi. Hastalar, alınan sürüntü testine göre pozitif ve negatif sonuç olmak üzere iki gruba ayrıldı. Kan grupları belli olan hastalardan ABO ve Rh alt gruplarına göre her hasta Covid-19 varlığı açısından değerlendirildi. Hastaların yaş, cinsiyet, başvuru anındaki şikayetleri, kan grupları ve sürüntü test sonuçları verileri çalışma formlarına kayıt edilip istatistiksel analizleri yapıldı.

Bulgular: Hastaların yaş ortalaması (standart sapması) 45,5 (22,2) yıl idi. Toplam 291 (%54,40) erkek ve 244 (%45,60) kadın hasta vardı. Kan gruplarına bakıldığında en fazla 225 (%42,1) ile A Rh + kan grubuna sahip hastalar olduğu görüldü. Yaş gruplarıyla; cinsiyet ile ve sürüntü test sonuçları ile kan grupları arasında karşılaştırıldığında anlamlı bir farklılık bulunmadı (sırasıyla $P=0,307$, $P=0,316$, $P=0,694$).

Sonuç: Spesifik bir kan grubunda COVID-19'a yakalanma riskinde artış olmadığı görüldü. Ancak A Rh - ve A Rh +, 0 Rh - ve AB Rh - kan gruplarının COVID-19'a yakalanma riskinin yüksek olduğunu, 0 Rh + kan grubunda ise hastalığa yakalanma riskinin daha düşük olduğunu tespit ettik.

Anahtar kelimeler: Kan grubu, Covid-19, Pandemi, Enfeksiyon

Introduction

Coronaviruses (CoV) are a large family of viruses that can present with a wide range of disease severity, from a mild infection to more serious ones, such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The most common symptoms of the infection are fever, cough, and dyspnea. In more serious cases, pneumonia, severe acute respiratory infection, renal failure and death in advanced clinical conditions may occur [1]. The pandemic caused by the novel SARS CoV-2 (SARS-CoV-2) has rapidly spread all around the world since the end of 2019 as Coronavirus Disease 2019 (COVID-19) and has been declared a pandemic by the World Health Organization [2].

In many studies, it has been reported that susceptibility to viral infections is associated with AB0 blood groups. It has been observed that the 0-blood group has a protective effect against blood-borne infections and that people with A blood type are more likely to be infected with hepatitis B and HIV viruses. Norwalk virus and hepatitis B virus are also known to be associated with blood groups [3-5]. Various genetic factors affecting susceptibility towards SARS and its prognosis have been identified [6]. Furthermore, in few studies on SARS-CoV-1, it has been demonstrated that there is a relationship between the risk of infection and the blood groups and that the 0 blood group is partially protective against SARS-CoV-1 [7, 8].

Although COVID-19 infection spreads very quickly, not every individual is infected at the same rate. It should be investigated whether blood groups affect this difference in susceptibility to COVID-19, for which no predictive biological marker has been identified yet. In this study, we aimed to investigate whether AB0 blood groups are biological markers and whether there is any relationship between susceptibility to COVID-19 and AB0 blood groups.

Materials and methods

The study began after receiving the ethical approval numbered 80576354-050-99/147 and dated 6/25/2020 from Kafkas University Ethics Committee.

In this prospective cohort study, the patients suspected of COVID-19 who were admitted to the emergency departments and COVID-19 pandemic polyclinics of tertiary hospitals in Kars, Erzurum, and Malatya with any symptoms were examined. Within the scope of the study, the patients or their parents, if any, were informed about the aim of the study.

Patients' age, gender, complaints for admission, blood groups, reverse-transcriptase polymerase chain reaction (RT-PCR), and chest computed tomography (CT) findings were recorded. All patients with radiological imaging chest CT findings compatible with COVID-19 were included in the study. In radiological imaging, ground-glass appearance specific to COVID-19, the presence of consolidation areas and paving stone appearance were considered in favor of COVID-19.

A nasopharyngeal swab was taken from the patients whose tomography findings were compatible with COVID-19. The swab results were recorded as positive and negative. It was checked whether the ABO and Rh blood groups of the admitted patients were registered in the hospital automation system or

whether they had an official document indicating their blood groups. The blood groups of the patients, whose blood type was known, were recorded. No interventional procedure was performed on the patients for blood group determination. All age groups were included in our study. The patients whose blood group could not be learned in any way, whose RT-PCR result was unknown and who were pregnant were excluded from the study.

Statistical analysis

SPSS 22.0 (SPSS Inc., Chicago, IL, United States) program was used to analyze the data obtained. We expressed continuous variables as mean (standard deviations) or median (interquartile range (IQR)). Categorical data were presented as numbers (percentage). A normality analysis was performed. Non-parametric tests were performed for non-normally distributed independent variables. The Pearson chi-square test and Z test were used for statistical analysis. $P < 0.05$ was considered statistically significant.

Results

A total of 535 patients from three different centers were included in the study. The mean age of all patients was 45.5 (22.2) years. There were 44 (8.25%) patients aged between 0-18 years, 357 (66.75%) aged between 19-65 years, and 134 (25.0%) aged 66 years and over. Among all, 291 (54.40%) were male and 244 (45.60%) were female.

When the patients' complaints for admission to the emergency department were evaluated, it was determined that the most common complaint was fever ($n=246$, 46.0%), followed by sore throat ($n=125$, 23.4%), shortness of breath, and cough ($n=91$, 17.0%) and muscle and joint pain ($n=73$, 13.6%).

The most frequent blood groups of the patients were A Rh + ($n=225$, 42.1%), followed by 0 Rh + ($n=122$, 22.8%), B Rh+ ($n=68$, 12.7%), AB Rh+ ($n=38$, 7.1%), A Rh- ($n=35$, 6.5%), 0 Rh- ($n=29$, 5.4%), B Rh- ($n=10$, 1.9%), and AB Rh- ($n=8$, 1.5%).

Test results of 155 (29.0%) patients were positive, and 380 (71.0%) patients were negative.

There were no significant differences in terms of blood groups according to age ($P=0.307$), genders according to blood groups ($P=0.316$), and RT-PCR results according to blood groups ($P=0.694$) (Table 1).

Table 1: Distribution of blood groups according to age, gender, and RT-PCR test results

		Blood Groups (n (%))								P-value
		0 Rh-	0 Rh+	A Rh-	A Rh+	B Rh-	B Rh+	AB Rh-	AB Rh+	
Age	0-18	1 (2.3%)	5 (11.4%)	2 (4.5%)	23 (52.3%)	1 (2.3%)	6 (13.6%)	1 (2.3%)	5 (11.4%)	0.307
	19-65	23 (6.4%)	82 (23.0%)	20 (5.6%)	154 (43.1%)	7 (2.0%)	47 (13.2%)	5 (1.4%)	19 (5.3%)	
	≥66	5 (3.7%)	35 (30.6%)	13 (9.7%)	48 (35.8%)	2 (1.5%)	15 (11.2%)	2 (1.5%)	14 (10.4%)	
Gender	Male	18 (6.2%)	73 (25.1%)	17 (5.8%)	115 (39.5%)	8 (2.7%)	34 (11.7%)	6 (2.1%)	20 (6.9%)	0.316
	Female	11 (4.5%)	49 (20.1%)	18 (7.4%)	110 (45.1%)	2 (0.8%)	34 (11.7%)	2 (0.8%)	18 (7.4%)	
RT-PCR	Positive	8 (5.2%)	33 (21.3%)	9 (5.8%)	66 (42.6%)	3 (1.9%)	19 (12.3%)	1 (0.6%)	16 (10.3%)	0.694
	Negative	21 (5.5%)	89 (23.4%)	26 (6.8%)	159 (41.8%)	7 (1.8%)	49 (12.9%)	7 (1.8%)	22 (5.8%)	
Total		29 (5.4%)	122 (22.8%)	35 (6.5%)	225 (42.1%)	10 (1.9%)	68 (12.7%)	8 (1.5%)	38 (7.1%)	

When we compared our patients with the blood group data of Turkey's population, we observed some differences. In Turkey, it was observed that individuals of a certain blood group

did not have a high rate of catching the disease. However, 0 Rh - ($P<0.001$), A Rh + ($P=0.040$), A Rh - ($P<0.001$), and AB Rh - ($P<0.001$) blood groups had a high rate of getting infected. It is observed that only patients in the 0 Rh + ($P<0.001$) blood group contracted the disease less often (Table 2). No difference was found between the rates of catching the disease between individuals with B Rh + ($P=0.320$), B Rh - ($P=0.547$), and AB Rh + ($P=0.606$) blood groups (Table 2).

Table 2: Comparison between the study group and blood groups in Turkey's population

Blood Groups	Study Group (%)	Turkey's Population (%)	%95CI	P-value	Z
0 Rh (+)	22.8	29.8	0.1924 - 0.2636	0.004	3.5
0 Rh (-)	5.4	3.9	0.4978 - 0.5822	0.001	7.1
A Rh (+)	42.1	37.8	0.3792 - 0.4628	0.040	2.1
A Rh (-)	6.5	5.0	0.6161 - 0.6839	0.001	6.9
B Rh(+)	12.7	14.2	0.0988 - 0.1552	0.320	1
B Rh(-)	1.9	1.8	0.1568 - 0.2232	0.547	0.6
AB Rh (+)	7.1	7.2	0.6715 - 0.7485	0.606	0.5
AB Rh(-)	1.5	1.0	0.1197 - 0.1803	0.001	3.9

Discussion

A large number of studies have begun to be conducted on COVID-19, which is expressed as severe acute respiratory syndrome caused by SARS-CoV-2 that emerged in Wuhan city of China in December 2019 [9, 10]. In these studies, parameters such as risk factors for the mortality of patients, epidemiological characteristics of the disease, and susceptibility to COVID-19 were investigated [2, 11, 12]. The investigation of whether SARS-CoV-2 infects cells according to ABO blood groups constituted the subject of the study. It has been demonstrated that SARS-CoV infects individuals according to ABO blood groups and can synthesize ABH antigens in pneumocytes, the enterocytes of the small intestine, and kidney distal tubular epithelial cells [13]. Nevertheless, there is no study on the use of biological markers to predict susceptibility to COVID-19. There have not been enough studies indicating the relationship between ABO blood groups and COVID-19. In our study, we examined the relationship between COVID-19 and the blood groups of 535 patients treated for COVID-19 and found that there was no direct relationship between COVID-19 and a specific blood group.

In a study conducted in Wuhan, ABO blood groups of 265 patients infected with COVID-19 were retrospectively analyzed, and blood groups of the patients diagnosed with COVID-19 were A in 39.3%, B in 25.3%, AB in 9.8%, and 0 in 25.7% [14]. Compared to the control group, the rate of those with blood group A was significantly higher (39.3% vs. 32.3%, $P=0.017$) while those with blood group 0 was significantly lower (25.7% vs. 33.8%, $P<0.001$) among COVID-19 positive patients [14]. In another study conducted during the SARS outbreak in Hong Kong, it was reported that individuals with 0 blood group had a much lower risk of getting infected by SARS-CoV compared to other blood groups [7]. In our study, in accordance with the literature, the ratio of blood group A was higher (48.6% vs. 42.8%) in COVID-19 patients compared to Turkey's average. Analysis of blood group A according to Rh + and Rh - revealed that the rates of patients with A Rh+ and A Rh- blood groups were significantly higher compared to Turkey's average (42.1% vs. 37.8%, and 6.5% vs. 5%, respectively). In addition, ratio of COVID-19 patients with blood group 0 was lower than Turkey's average (28.2% vs. 33.7%), in accordance with the literature. Analysis of blood group 0 according to Rh + and Rh - revealed that the rates of patients with 0 Rh+ blood group was lower

compared to Turkey's average (22.9% vs. 29.8%), and that of patients with 0 Rh- blood group was higher (5.4% vs. 3.9%). We can say that individuals with 0 Rh - blood group may have a lower ratio of catching COVID-19. However, individuals with A Rh +, A Rh - and 0 Rh + blood groups may be at higher risk.

There are studies showing that the risk of infection increases in individuals with A blood group. However, the risk of infection decreases in individuals with 0 blood group when the distributions of ABO blood groups of COVID-19 patients are compared with the local population [14,15]. While our results resembled the afore-mentioned studies, it was observed that the risk of infection increased not only in the A blood group but also in the AB Rh - blood group.

In a study including 186 COVID-19 patients with a mean age of 42 years, the percentage of female patients was 46.2% [16]. Our study was consistent with the literature; the mean age of the patients was 45.52 years, and 45.60% (244 patients) were females. In a study which compared the blood groups of COVID-19 patients according to age groups and genders, no significant differences were found ($P=0.314$ and $P=0.314$, respectively) [17]. The same was true for our results.

In another study evaluating the blood groups of COVID-19 patients, it was determined that blood group A was the most common (57%), followed by blood group 0 (24.8%). When the healthy control group and the COVID-19 patient group were compared, the ratio of COVID-19 infection was statistically significantly higher in those with blood group A (57% - 38%, $P<0.001$) [16]. It is reported that blood group A Rh+ is the most common, with 37.8% of all blood groups throughout Turkey [18]. Likewise, in our study, we most frequently found blood group A with 48.6% and blood group 0 with 28.2% in patients with COVID-19. The least common blood group was AB with 8.6%. When the blood groups of COVID-19 patients were compared with Turkey's average, the incidence of infection was statistically higher in those with A Rh + and A Rh -. Although AB Rh - was the least common blood group in the population, the incidence of infection was statistically higher in COVID-19 patients. There was no statistically significant difference between COVID-19 patients with B Rh +, B Rh - and AB Rh + blood groups and the normal population.

In order to obtain more accurate and reliable results in studies on blood groups in COVID-19 patients, we believe that it will be more accurate to compare the blood groups of individuals with COVID-19 disease with the blood groups of the general population in the regions where the disease is present. We can say that the relationship between COVID-19 disease and blood groups should not be evaluated alone, and the rate of catching to COVID-19 depends on many factors.

Limitations

Considering the differences in the distribution of blood groups according to the regions, our first limitation is that our study was conducted in a specific region. Another limitation is that not all risk factors of COVID-19 patients included in the study can be ruled out.

Conclusion

Although there is no increase in the risk of catching COVID-19 in a specific blood group, we can say that A blood group (A Rh - and A Rh +), 0 Rh - and AB Rh - blood groups

have a higher risk of catching COVID-19. On the contrary, O Rh + blood group has a lower risk of catching the disease, and B blood group (B Rh+ and B Rh -) and AB Rh + blood group are at the same risk as the population.

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