THE EFFECT OF BLOOD GROUPS ON THE PROGNOSIS OF PATIENTS WITH COVID-19

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ABSTRACT

Purpose: This study was conducted to investigate the effect of blood types on the prognosis of Covid-19 Disease caused by severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV2) virus.

Method: Our study was designed as descriptive cross-sectional. Between April and December 2020, 216 patients who were hospitalized and treated were screened. Age, gender, blood groups, length of stay and response to treatment of these patients were examined and the data were evaluated statistically.

Findings: The mean age of all cases was 61.99±17.42 years, 59.20 ±17.49 years (n: 173, 80.10%) for those who were cured, 73.18±11.84 years for those who died (n: 43) , 19.90%). The hospital stay was found to be 5.98±4.57 days for the patients who died and 10.06±4.86 days for those who were discharged with recovery. The genders were equal. In cases infected with Covid-19 (n:216); we observed that A, B, AB and O blood group rates were 50.9%, 16.7%, 6.5% and 25.9%, respectively. In patients who died; It was found in 35.9%, 18.6%, 7.0% and 34.9%. It was determined that the hospital stay and recovery rates of young patients were better (p<0.05). In other patients, the prognosis worsened with increasing age and shorter hospital stays (p<0.05).

Conclusion: When evaluated as a percentage, it was observed that people with A blood group were more susceptible to Kovid-19 infection but had a better prognosis and O blood group was less sensitive but had a worse prognosis. However, there was no statistical difference. In addition, no significant relationship was found between death rates and blood groups (p=0.086).

Keywords: Blood type, Covid-19, Death, Healing, Prognosis.

KAN GRUPLARININ COVİD-19 LU HASTALARIN PROGNOZLARI ÜZERİNE OLAN ETKİSİ

ÖZET

Amaç: Kan gruplarının, şiddetli Akut Solunum Yolu Sendromu Koronavirüsü-2 (SARS-CoV2) virusunun sebep olduğu Covid-19 Hastalığının prognozuna etkisini araştırmak amacıyla bu çalışma yapılmıştır.

Yönrem: Çalışmamız tanımlayıcı kesitsel olarak tasarlanmıştır. Nisan-Aralık 2020 tarihleri arasında hospitalize edilerek tedavi gören 216 hasta taranmıştır. Bu hastaların yaş, cinsiyet, kan grupları, yatış süreleri ve tedaviye cevapları incelenmiş ve veriler istatistiksel olarak değerlendirilmiştir.

Bulgular: Tüm vakaların yaş ortalaması 61,99±17,42 yıl, iyileşenlerin 59,20 ±17,49 yıl (n:173, %80,10), ölenlerin 73,18±11,84 yıl (n:43, %19,90) idi. Hastanede kalış süreleri ölen hastaların 5,98±4,57 gün, taburcu olanların 10,06±4,86 gün olarak bulundu. Çalışmamızda cinsiyetler birbirine yakın sayıdaydı. Covid-19 ile enfekte (n:216) vakada A; B; AB ve O kan grubu oranları sırasıyla %50,9; %16,7; %6,5 ve %25,9 olduğunu gözledik. Ölen hastalarda ise %35,9; %18,6; %7,0 ve %34,9 oranında bulundu. Genç hastaların hastanede kalma süreleri ve iyileşme oranlarının daha iyi olduğu saptandı (p<0,05). Diğer hastalarda yaş arttıkça ve hastanede kalma süreleri kısaldıkça prognoz kötüleşiyordu (p<0,05).

Sonuç: Yüzdesel olarak değerlendirildiğinde, A kan grubuna sahip kişiler Covid-19 enfeksiyonuna daha duyarlı ama prognozları daha iyi ve O kan grubu daha az duyarlı ama prognozları daha kötü olduğu gözlendi. Ama

istatiksel olarak bir fark olmadığı saptandı. Ölüm oranları ile kan grupları arasında da anlamlı bir ilişki saptanmadı (p=0,086).

Anahtar kelimeler: Covid-19, Kan grubu, Ölüm, Şifa, Prognoz.

1. Introduction

Coronaviruses are RNA viruses and are known to cause infections in humans and animals since the 1960s, but have been responsible for pandemics in the last 20 years [1]. In December 2019, a new pandemic occurred in Wuhan, China [2,3] and caused the deaths of more than 6,6 million people as of now [4]. While coronaviruses can cause infections such as asymptomatic infections, respiratory system infections and diarrhea in humans and animals, the new type of Corona virus (SARS-CoV2) can cause respiratory distress, multiorgan failure and deaths [5,6].

Karl Landsteiner was divided into AB0 blood groups according to the proteins on the erythrocytes in 1901. Later, the Rh +/- system was described by showing that the antiserum obtained by administering the erythrocytes taken from Rhesus monkeys to rabbits agglutinated the erythrocytes in 85% of the people. Currently, there are 34 blood group systems recognized by the International Blood Transfusion Association (ISBT) [7]. There are studies indicating that blood group proteins act as receptors for some infections and are susceptible to some infections. Likewise, there are publications stating that there is a relationship between blood groups and various diseases such as diabetes and pancreatic cancer [7,8].

In various studies, it has been stated that SARS-CoV2 causes more infections in blood group A, but blood group 0 is slightly more protected. It is said that it has no effect on prognosis and they also stated that new studies are needed on this subject [9,10]. This study was conducted to investigate whether blood groups have an effect on Covid-19 patients, the age of occurrence, gender of these patients, the length of stay in the intensive care unit in the hospital, and most importantly, their mortality.

2. Material-Method

Our study was conducted in a cross-sectional descriptive style. Patients hospitalized in the Pandemic service followed by us at Kütahya Evliya Celebi Training and Research Hospital were included in our study. Children and pregnant womens were not included in our study. Patients who deteriorated while being treated in our service were followed up in terms of prognosis and included in our study. Patients with unknown blood type were excluded from the study. A total of 216 patients who were treated in the hospital between April and September 2020 were included in the study, with the permission decision of Kütahya Health Sciences University Non-Interventional Ethics Committe dated 16.12.2020 and numbered 2020/17 and the necessary approvals from the health directorate. Their age, gender, blood type, number of days of hospital treatment and post-treatment prognosis were recorded. The data were recorded in the SSPS (Statistical Packageforthe SocialScience, Inc.; Chicago, IL, USA) 18.0 package program and statistical analysis was performed. Numerical variables were represented by mean, ± standard deviation and median (minimum, largest), categorical variables were represented by number (n) and percentage (%). In comparison of categorical variables of the patient and control groups, t test, anova, and chi-square test of significance were used. Whether the numerical data are normally distributed or not was checked with the Kolmogrow Smirnov Test, and the homogeneity of the variances was checked with the Levene test. A $p < 0.05$ value in statistical differences was considered statistically significant.

3. Results

The mean age of Covid-19 patients participating in our study was 61.99±17.42 years, those who recovered with healing were 59.20 ±17.49 years (n: 173, 80.10%), those who died were

73.18±11.84 years (n:43, 19.90%). The hospital stay was found to be 5.98±4.57 days for the patients who died and 10.06±4.86 days for those who were discharged with recovery. In our study, the number of women (n:109, 50.5%) was higher (Table 1).

Table 1: Age, gender information of Covid-19 patients.

	Frequency (n)	**Percent (%)**
Age(year)		
Under 20	2	0.9
20-40	25	11.6
41-64	79	36.6
65 and over	110	50.9
Gender		
Male	107	49.5
Female	109	50.5
TOTAL	**216**	**100.0**

In cases infected with Covid-19 (n:216), A; B; AB and O blood group rates were 50.9%, 16.7%, 6.5% and 25.9%, respectively. It was found in 85.6% (n:185) of Rh positive patients. While 80.1% (n: 173) of our patients were cured and discharged, 19.9% (n: 43) died (Table 2).

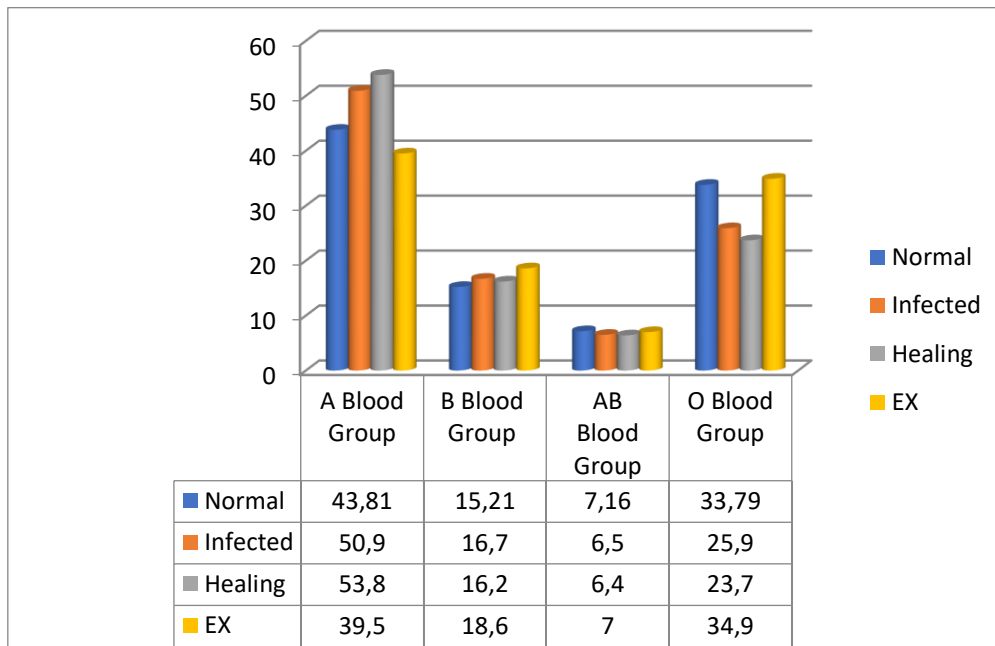**Table 2:** Blood type, Rh factor, length of hospital stay and prognosis of Covid-19 patients.

	Frequency (n)	**Percent (%)**
ABO blood groups		
A	110	50.9
B	36	16.7
AB	14	6.5
0	56	25.9
Rh Factor		
Rh+	185	85.6
Rh-	31	14.4
Length of Stay		
1-5 days	48	22.2
6-10 days	92	42.6
11-15 days	59	27.3
16 days and over	17	7.9
Prognosis		
Heal	173	80.1
EX	43	19.9
TOTAL	**216**	**100.0**

No statistically significant difference was found between the blood groups and the duration of hospital stay and prognosis (healing or ex-statement) of Covid-19 patients ($p < 0.05$) (Graph 1). Patients with A blood group with Covid-19 are less likely to be EX (Table 3).

Table 3: Blood type, Rh factor, length of hospital stay and prognosis of Covid-19 patients

	Normal Population (%)	Across Covid-19 Patients (%)	Discharged with Healing (%)	In dead Covid-19 patients (%)	Average length of stay in hospital (days ±SD)	p
ABO blood groups						
A	43.81	50.9	53.8	39.5	9.38±4.916	
B	15.21	16.7	16.2	18.6	9.72±5.921	**P>0.05**
AB	7.16	6.5	6.4	7.0	9.57±7.133	
0	33.79	25.9	23.7	34.9	8.61±4.194	
Rh Factor						
Rh+	87.31	85.6	86.1	83.7	9.22 ±5.02	**p>0.05**
Rh-	12.69	14.4	13.9	16.3	9.45 ±5.43	
TOTAL (%)	**100.0**	**100.0**	**100.0**	**100.0**		

Presence of anti-A agglutinin A and AB blood groups have higher cure rates, while EX rates are observed less, while those with B and O blood groups are less susceptible to Covid-19 infection, but higher mortality rates are observed (Graph 1-2).

	A Blood Group	B Blood Group	AB Blood Group	O Blood Group
Normal	43,81	15,21	7,16	33,79
Infected	50,9	16,7	6,5	25,9
Healing	53,8	16,2	6,4	23,7
EX	39,5	18,6	7	34,9

Graphic 1: Proportions of blood types in the Normal population, in hospitalized patients due to Covid, and in EX patients due to Covid
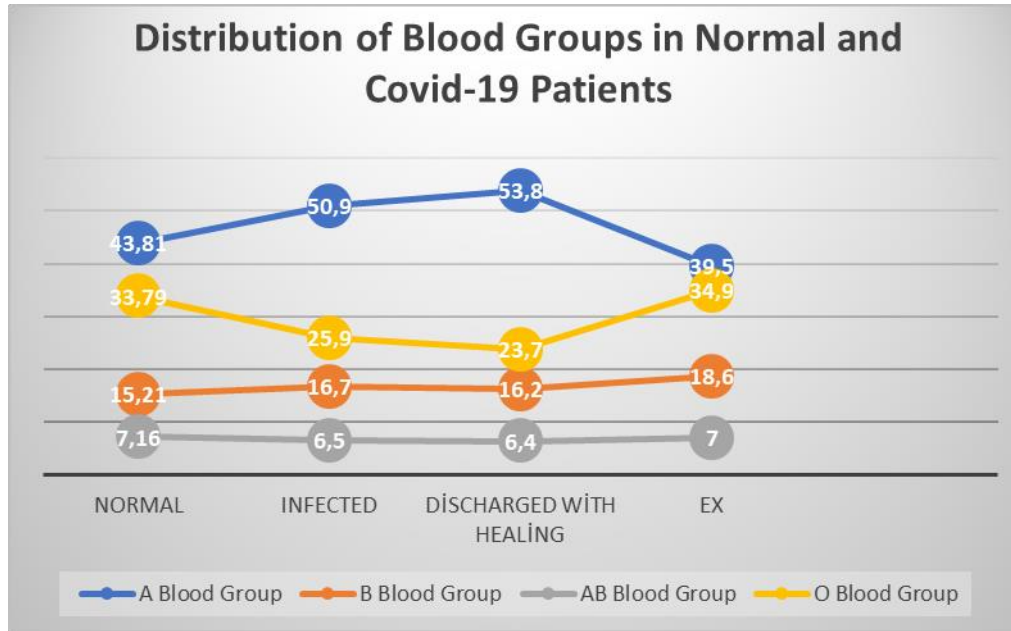
Graphic 2: Another graph showing the blood group ratios in the normal population,
in hospitalized patients due to Covid, and in EX patients due to Covid.

A correlation was found between the prognosis (healing/death rates) of Covid-19 positive cases and the length of stay in the hospital ($p<0.05$). In other words, those who were cured and discharged stayed in the hospital longer than those who died (Table 3). It was determined that those who found healing were hospitalized for an average of 10.06 ± 4.86 days, while those who died were hospitalized for 5.98 ± 4.57 days. When the relationship between the prognosis and age of patients with Covid-19 was examined, a significant difference was found ($p<0.05$). The mean age of the patients who recovered and recovered was 59.20 ± 17.49 years (n:173, 80.10%), while the mean age of the patients who died was 73.18 ± 11.84 years (n:43, 19.90%). Mortality rates of Covid-19 patients increased with increasing age (Table 3).

Table 3: Examination of the factors associated with the cure and death rates of Covid-19 patients.

Comparison of different factors with Cure or death rates in Covid-19 Patients	p	
Age (year)	**0.000**	**P<0.05**
Gender	0.110	
Rh factor	0.689	
Length of stay	**0.000**	**P<0.05**
Blood Group	0.086	

4. Discussion

It has been discussed since the first day of the pandemic that some blood groups are more prone to Covid-19 disease, while others are more resistant. According to Fan et al. and Hoiland et al. they stated that there may be a relationship between blood groups and the course and prognosis of Covid-19 disease [9,10]. Our study was conducted to investigate this long-discussed issue. In this study, patients who were treated due to Covid-19 and whose blood groups were certain were included. It has been investigated whether there is a relationship between blood groups and prognosis. As a result of our study, it was found that there is no relationship between blood types and the prognosis of Covid-19 disease.

In our research, we found that Covid-19 did not cause serious infections in children and adolescents that would require treatment in the hospitalization unit. In the study conducted by Dong et al. on 2143 pediatric cases, no severe infection was observed in the pediatric age group due to Covid-19 [11].

The general prediction is that death rates due to Covid-19 increase with age. Studies have found that susceptibility to symptomatic infection increases with age. To sum up, symptomatic Covid-19 infection and susceptibility to complications increase with age [12]. In Korea, death rates due to Covid-19 in the general population were observed to increase to 0.29% in the 50-59 age group, 1.05% in the 60-69 age group, 5.3% in the 70-79 age group and 15.47% over the age of 80 [13]. In our study, death rates were higher in the elderly population (n: 43, mean age 73,18±11,84 years). It was found that the prognosis worsened with increasing age.

It was previously found that deaths due to Covid-19 were more common in male (68.42%). This was explained by the fact that comorbid conditions such as cardiopulmonary diseases, smoking and coronary heart disease were observed more frequently in male [14]. In a study conducted by Li et al. by collecting data from 1994 patients who were treated for Covid-19 between December 2019 and February 2020, it was found that Covid-19 infection was observed 60% more frequently in male [15]. In another study conducted by Wu et al. on 72314 cases, it was stated that it was observed more frequently in male with 51.1% in China [16]. In some recent studies, he explained that the opposite, Covid-19 disease is more common, especially in women. There are studies reporting that this difference in gender may arise from social and cultural differences between different countries [17]. One of the reasons women are less affected has been linked to the extra X chromosome and sex hormones. Congenital and adaptive immune systems in women are better than male. Studies have shown that this difference makes women more resistant to bacterial, viral, parasitic and fungal infections and malignancies, and more susceptible to autoimmune diseases [18].

It was found that the longer the duration of stay in the hospital (10.06±4.86 days), the better the prognosis. In the elderly, the opposite happened. In other words, the duration of stay in the hospital was shortened (5.98±4,57 days) and the prognosis worsened in elderly patients. The main reason for this can be explained by the advanced age of cases, the decreased residual potential of the organs with age, the high rate of co-morbid diseases and the more organ damage seen in the elderly population.

In a study conducted by Eren on the incidence of AB0 blood groups in Istanbul, A blood type was 43.81%; B blood group 15.21%; AB blood type is 7.16% and 0 blood group is 33.79%. In the case infected with Covid-19 (n: 216) we observed that A; B; AB and 0 blood group rates are 50.9%, 16.7%, 6.5% and 25.9% respectively. In other words, Covid-19 disease was observed more frequently in the A blood group and less in the 0 blood group. In summary, for Covid 19 infection, the sensitivity to infection was higher in the A blood group and could be infected more easily, while the sensitivity was lower in the B and 0 blood types [19].

Fan et al. In his study of 105 Covid-19 patients and 103 control groups, they found that those with blood type A were more prone to Covid-19 infection, and it was more common in women, in particular. Similarly, in our study, we found that blood group A is more sensitive to Covid-19. In our study, women and men in the hospital patients (n: 216) were almost equal. But in dead cases due to Covid-19 (n: 38), men (68.42%) were more affected [9].

In the study of Gür et al. on 535 patients (155 of these patients were Covid-19 positive cases) who applied to the emergency service and pandemic outpatient clinic, Covid-19 disease was observed more common in men (54%) and A Rh (+) (42.1%) blood group. More specific results were observed in our study, both because it was conducted on patients in the hospital and

because more cases were included. In our country, Covid-19 infection was more common in the A blood group and Covid-19 was detected more frequently in Rh (+) cases. When the Rh blood group is examined, Rh (+) is observed at a rate of 87.31% in the normal population, while Rh (-) is observed at a rate of 12.69%. In our study, when the Rh factor was examined in people with Covid-19, Rh (+) was observed at a rate of 85.6%, Rh (-) 14.4%, and Rh (+) 83.7% and Rh (-) 16.3% in the deceased, respectively. That is, there was no significant difference (p> 0.01). It means that ABO blood groups were more important than Rh in sensitivity to Covid - 19 [19,20].

In a study conducted by Hoiland et al. with 125 positive cases, they investigated blood groups and ventilator requirement rates and the severity of Covid-19 disease. As a result, they found that A and AB blood groups required longer mechanical ventilators and hospital, and their prognosis was worse than blood groups B and 0. They interpreted it as follows; These two blood groups (B and 0 blood groups) contain Anti-A antibodies. They interpreted that the titer of anti-A antibodies may affect the severity of Covid-19 infection. Similar blood group sensitivity was observed in SARS CoV-1 infection, suggesting that ACE-2 receptors could be antagonized by this antibody [21]. Although Hoiland et al. Found these findings, they could not clearly show the relationship between AB0 blood group and susceptibility to SARS CoV-2 infection and recommended new studies. On the other hand, we found that the A blood group is more susceptible to the SARS CoV-2 infection, and the 0 blood group is more protected. In addition, when the blood groups of Covid-19 patients were compared among themselves, we found that the prognosis was better in the A and AB blood groups without anti-A agglutinin. In other words, while death rates are lower, healing rates are higher in cases with Covid-19 disease in the A and AB blood groups; at the same time mortality rates were higher and healing rates were lower in the B and 0 blood groups. The common feature of the B and 0 blood groups was the presence of anti-A hemagglutinin in both (Graphic 1-2) [10].

In a five-center study by Latz et al., They could not find a relationship between the AB0 blood group and the severity of the Covid-19 disease. He said that new studies should be done because there is not enough data between Rh and Covid-19. In our study, we found that it was more frequently infected with Covid-19 disease in blood group A and less in blood group 0. In addition, we found that while the infection rates were low in the AB and 0 blood groups containing anti-A antibodies, the mortality rate was higher (on a percentage basis among themselves) [22].

Zietz et al. Found that there were more infections in A, AB and B blood groups except for the 0 group, the rate of intubation decreased in the A blood group compared to the 0 blood group, and that there was an increase in the AB and B blood groups. He predicted that Rh (-) blood groups could have a protective effect. In our study, we found similar relationships between Covid-19 and A blood type and 0 blood group. Although it was observed that Rh (-) ratios were increased in infected and dead patients, a complete statistical relationship was not found. Since the blood group prevalence of the population studied by Zietz et al. May differ from the population in which we conducted our study, some results were thought to be inconsistent. However, all these studies have shown us that there may be a relationship between AB0 blood groups and Covid-19 [23].

In the study of Dal et al., it was found that there was an increase in the rate of hospitalization of patients with male gender, advanced age and A blood group. This was in line with our study. In the continuation of their study, when the O blood group and non-O blood group were compared, they found that hospital admission rates, mechanical ventilator requirements and death rates were not affected. In our study, we found that AB and O blood groups were slightly

more sensitive. In the same study, Rh (+) and Rh (-) factors were compared and it was observed that there was no significant difference as in our study [24].

In another study by Gündüz et al., it was found that being Rh(+) in children increases the risk of contracting Covid-19 disease, and having A blood group increases the risk of developing symptoms. In particular, the connection between the Rh factor and Covid 19 disease has not been detected in studies carried out to date. But Gündüz and his friends have determined that there is a relationship. We reached similar results for A blood group, but we could not find similar findings for Rh blood group [25].

Our study was conducted in a limited area and in a limited population. However, similar findings were found in other studies. In summary, the prognosis was affected positively as the age increased and the length of hospital stay increased. In addition, while A blood group is more susceptible to Covid-19 infection, O blood group is more resistant. When the prognosis is examined, mortality rates are slightly higher in B and O blood groups containing anti-A antibodies, while mortality rates are lower in A and AB blood groups that do not contain anti-A antibodies. It was observed that recovery rates were higher in patients with A and AB without anti-A antibodies, especially in blood group A (Graph 1). When analyzed statistically, it was found that there was no significant relationship between blood groups and the course and mortality of Covid-19 disease ($p>0.05$). However, as we mentioned at the beginning, the limitation of our study is that it was probably conducted in a narrow and limited area. Therefore, such studies need to be repeated in larger populations.**Conflict of Interest:** No conflict of interest was declared by the authors.

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