

ORIGINAL PAPER
RESPIRATORY MEDICINE

ABO blood groups in COVID-19 patients; Cross-sectional study

İhsan Solmaz¹  | Songül Araç² 

¹Department of Internal Medicine,
University of Health Sciences, Gazi Yasargil
Training and Research Hospital, Diyarbakır,
Turkey

²Department of Emergency Medicine,
University of Health Sciences, Gazi Yasargil
Training and Research Hospital, Diyarbakır,
Turkey

Correspondence

Songül Araç, Department of Emergency
Medicine, University of Health Sciences,
Diyarbakır Gazi Yasargil Training and
Research Hospital, Diyarbakır 21070,
Turkey.

Email: drsongularac@gmail.com

Abstract

Aim: The aim of this study was to investigate the ABO and Rh blood group distribution and clinical characteristics in patients with COVID-19.

Materials and Methods: The clinical characteristics and blood groups of 1667 patients who were hospitalised because of COVID-19 (with a positive PCR test) between 16 March and 10 July were reviewed cross-sectionally.

Results: When blood groups of patients diagnosed with COVID-19 and control group were compared, it was observed that there was an increase in the number of COVID-19 patients with blood groups A and AB, decrease in the number of COVID-19 patients with blood group O, a statistically significant increase in the number of individuals with blood group A in COVID-19 patients compared with healthy individuals, and almost significant increase in the number of COVID-19 patients with blood group AB and a very significant decrease in the number of COVID-19 patients with blood group O.

Conclusion: Our study has found that having blood group O may be protective, that blood group A may have greater susceptibility to the disease, but this does not affect the course of the disease and is not associated with mortality.

1 | INTRODUCTION

The number of SARS-CoV-2 (COVID-19) cases, which was recognised as a pandemic by the World Health Organization (WHO) in March, continues to increase rapidly worldwide.¹ As of July 2020, the number of COVID-19 patients reported by WHO has exceeded 13 million and the number of deaths 580 thousand. People most commonly affected by COVID-19 are those with chronic lung or cardiovascular diseases, men with hypertension and diabetes.² There are some parameters such as CRP, ferritin and LDH that can predict the clinical severity of COVID-19, but there are no biomarkers indicating a predisposition to COVID-19.³

The general blood group system called ABO discovered by Landsteiner is a kind of cell identity system determined by the antigenic structure located on the erythrocyte surface. The Rh system, known as to whether there is an antigenic structure or not, is another grouping.⁴ Blood groups are a qualitative characteristic in which there are no environmental effects, with all of the phenotypic variation being a reflection of the genetic structure. Blood group antigens are

genetically encoded and these antigens may be a predisposing factor for some diseases and a protective factor for some others. Studies have shown that some rheumatological diseases, viral infections such as Norwalk virus and Hepatitis B, and some types of cancer are associated with the ABO blood group.⁵⁻⁸ In addition, it has been found that the rate of infection with SARS coronavirus is lower in blood group O.⁹

By examining the relationship of the human blood group with virus infection, it is possible to determine the susceptibility of people with different blood types to viruses. There are some studies examining the relationship between COVID-19 and blood groups in the literature. The aim of this study was to investigate the ABO and Rh blood group distribution and clinical characteristics in patients with COVID-19.

2 | MATERIALS AND METHODS

This study was conducted retrospectively between March 16 and July 10 in Diyarbakır Gazi Yasargil Training and Research Hospital

with the data of patients who received inpatient treatment for COVID-19, obtained from the Hospital Information Management System. This study included 1667 patients who were admitted to the hospital, whose blood group information was registered in the system and who had a positive PCR test result, while patients whose blood group information was not registered in the system and those who had a negative PCR test result were excluded from the study. As the control group, data from the blood group study conducted with 127 091 people in our province in 2019 were used.¹⁰

2.1 | Statistical analysis

Statistical evaluation was performed using SPSS 22 for Windows (IBM SPSS Inc, Armonk, NY, USA). Chi-square test was used for the comparison of categorical data. $P < .05$ was considered statistically significant.

2.2 | Ethical approval

Ethical approval was obtained from the local Ethics Committee. The study was conducted in accordance with the Declaration of Helsinki.

3 | RESULTS

A, B, O, AB blood group distribution of individuals in our province was 39.7%, 18.6%, 33.6% and 8.1%, respectively. Rh (+), Rh (-) blood group distribution was 88.4% and 11.6%, respectively.

A, B, O, AB blood group distribution of 1667 patients, who were PCR-positive, was 45.17%, 18.65%, 26.81% and 9.35%, respectively. Rh (+), Rh (-) blood group distribution was 88.66% and 11.33%, respectively.

When the blood groups of patients diagnosed with COVID-19 and the control group were compared, there was an increase in the number of patients with COVID-19 in blood groups A and AB, a decrease in blood group O, and it was similar in blood group B and Rh. The statistical analysis showed that there was a very significant increase in the number of individuals with blood group A in COVID-19 patients compared with healthy individuals, and almost a significant increase in the number of COVID-19 patients with blood group AB and a very significant decrease in the number of COVID-19 patients with blood group O, and no significant difference in terms of B and Rh blood group systems (Table 1).

Of the patients, 175 (10.5%) were followed up in the intensive care unit and 89 (50.8%) died. When the blood group distribution of the patients taken to the intensive care unit was examined, A, B, O, AB blood group distribution of the patients was 42.28%, 21.14%, 26.85%, 9.71%, and Rh (+), Rh (-) blood group distribution was 92% and 8%, respectively. And when the blood group distribution of the deceased patients was examined, A, B, O, AB blood group distribution was 40.44%, 22.47%, 26.96%, 10.11%, and Rh (+), Rh (-) blood

What's known

- There are some studies examining the relationship between COVID-19 and blood groups in the literature.
- It has been found that the rate of infection with SARS coronavirus is lower in blood group O.

What's new

- Our study showed that there was a very significant increase in the number of individuals with blood type A in COVID-19 patients compared with healthy individuals, almost a significant increase in the number of AB blood group COVID-19 patients with blood group AB, and a very significant decrease in the number of COVID-19 patients with blood group O.

The implications of this paper

- Our study has found that having blood group O may be protective, that blood group A may have a greater susceptibility to the disease, but this does not affect the course of the disease and is not associated with mortality.
- We want to emphasise that the most important and easiest way to avoid COVID-19, regardless of the risk factor and the facilitating factor, is to maintain social distance, hand hygiene, and use of.

group distribution was 91.01% and 8.98%, respectively. When all COVID-19 patients and those in need of intensive care and deceased ones were compared statistically, although there were percentile differences in ABO blood group distribution, this was not statistically significant (Tables 2 and 3).

4 | DISCUSSION

A total of 1667 COVID-19 patients were included in our study. In COVID-19 patients, it was observed that the ratio of blood group A and AB was higher than in the healthy control group, and blood group O had a lower ratio. The statistical analysis showed that there was a very significant increase in the number of individuals with blood group A in COVID-19 patients compared with healthy individuals, almost a significant increase in the number of COVID-19 patients with blood group AB, and a very significant decrease in the number of COVID-19 patients with blood group O ($P < .001$, $P = .052$ and $P < .001$, respectively).

The ABO blood group system basically contains A and B antigens and their corresponding antibodies. The gene coding the antigen is located on chromosome 9q34.1-34.2. It consists of A, B and O alleles, and there are four phenotypes (A, B, O, and AB blood groups).^{11,12}

TABLE 1 Blood group distribution and analysis of COVID-19 patients and healthy individuals

	COVID-19 PCR (+) n (%)	Distribution of blood groups in Diyarbakir community n (%)	χ^2	P
Blood Group A	753 (45.17)	50 449 (39.7)	20.598	.000
Blood Group B	311 (18.65)	23 678 (18.6)	0.001	.979
Blood Group O	447 (26.81)	42 728 (33.6)	34.191	.000
Blood Group AB	156 (9.35)	10 236 (8.1)	3.771	.052
Rh+	1478 (88.66)	112 390 (88.4)	0.085	.771
Rh-	189 (11.33)	14 701 (11.6)	0.085	.771

	Intensive care n (%)	Total COVID-19 patients n (%)	χ^2	P
Blood Group A	74 (42.28)	753 (45.17)	0.533	.465
Blood Group B	37 (21.14)	311 (18.65)	0.639	.424
Blood Group O	47 (26.85)	447 (26.81)	0	.990
Blood Group AB	17 (9.71)	156 (9.35)	0	.986
Rh+	161 (92)	1478 (88.66)	1.475	.225
Rh-	14 (8)	189 (11.33)	1.475	.225

TABLE 2 Blood group distribution and analysis of all patients diagnosed with COVID-19 and those in need of intensive care

	Deceased Patients n (%)	Total COVID-19 patients n (%)	χ^2	P
Blood Group A	36 (40.44)	753 (45.17)	0.761	.383
Blood Group B	20 (22.47)	311 (18.65)	0.574	.449
Blood Group O	24 (26.96)	447 (26.81)	0	1
Blood Group AB	9 (10.11)	156 (9.35)	0.003	.959
Rh+	81 (91.01)	1478 (88.66)	0.262	.609
Rh-	8 (8.98)	189 (11.33)	0.262	.609

TABLE 3 Blood group distribution and analysis of all patients diagnosed with COVID-19 and deceased patients

Differences in blood group antigen expression may increase or decrease host susceptibility to many infections. Blood group antigens can play a direct role in infection by serving as receptors and/or cofactors for microorganisms, parasites and viruses. In addition, many blood group antigens facilitate intracellular uptake, signal transmission or cell adhesion through the organisation of membrane microdomains. Blood group antigens may alter the natural immune response to infection.¹³ Since the beginning of the COVID-19 pandemic, many studies have been conducted on this subject. Zhao J YY et al examined the ABO blood group distribution in 2,173 COVID-19 patients and showed that the frequency of blood group A was higher in COVID-19 patients than that of non-A blood groups and found that the blood group O was associated with a lower risk for infection compared with the non-O blood groups.¹⁴ Wu et al found similar results in their study on 187 COVID-19 patients and H. Goker et al in their study on 186 COVID-19 patients.^{15,16} In the study carried out by E. Arac et al, there was no significant difference between ABO blood groups, but strong significance was found in the Rh system.³ We believe that this study had some limitations due to the fact that PCR-negative patients were also included

in the study, the number of cases was small, the study was conducted at the beginning of the pandemic, and the prevalence of COVID-19 in some circles, especially amongst some families, rather than across community. In our study, we found that blood group A was more frequent than in community and statistically significant, blood group O was less frequent than in community and statistically significant, and blood group AB was more frequent than in the community, but it was not significant. We think that blood group A is more susceptible to COVID-19 and blood group O is protective.

When COVID-19 patients in need of intensive care and deceased patients were compared, blood groups were shown to have no significant effects on intensive care and mortality. ABO blood groups have been associated with cardiovascular diseases before.¹⁷ It is known that thrombotic risks decrease significantly in blood group O compared with non-O blood groups.^{17,18} Studies have shown that microthrombosis that develops in COVID-19 infection in the pulmonary vascular bed contributes significantly to acute respiratory syndrome; therefore, the use of prophylactic anticoagulants is also included in the guidelines.^{19,20} There are opinions arguing that the protective effect shown

in blood group O is based on this phenomenon.²¹ In this study, we found that blood groups were not statistically significant in predicting the patient's need for intensive care and mortality.

In conclusion, we believe that our study is important because it is a study with the highest number of COVID-19 patients diagnosed by PCR, which examined the blood group and COVID-19 relationship in our country. Our study has found that having blood group O may be protective, that blood group A may have greater susceptibility to the disease, but this does not affect the course of the disease and is not associated with mortality. We want to emphasise that the most important and easiest way to avoid COVID-19, regardless of the risk factor and the facilitating factor, is to maintain social distance, hand hygiene and use of masks. Although there is no significant difference between blood groups and intensive care and mortality, it can be concluded that individuals with blood group A should take stronger and stricter measures and COVID-19 patients with blood group A should be monitored more closely. Larger, multicentre and prospective studies should be conducted to determine the relationship between blood groups and COVID-19 and the protective role of blood group O.

DISCLOSURE

All authors certify that all conflicts of interest, including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in the manuscript (eg, employment/affiliation, grants or funding, consultancies, honoraria, stock ownership or options, expert testimony, royalties, or patents filed, received or pending), are the following: None.

AUTHORS' CONTRIBUTIONS

Study concept and design: SA and IS; Methodology: SA and IS; Data analysis and interpretation: SA and IS; Drafting of the manuscript: SA and IS; Critical revision of the manuscript: SA and IS; Statistical analysis: SA and IS. All authors read and approved the final version of the manuscript.

ETHICS, CONSENT AND PERMISSIONS

All patients gave their consent to participate in the study.

CONSENT TO PUBLISH

The authors have obtained consent to publish from the participant (or legal parent or guardian for children) to report individual patient data.

DATA AVAILABILITY STATEMENT

The authors declare that materials described in the manuscript, including all relevant raw data, will be freely available to any scientist wishing to use them for non-commercial purposes, without breaching participant confidentiality. Moreover, the authors ensure that their datasets are presented in the main manuscript.

ORCID

İhsan Solmaz  <https://orcid.org/0000-0002-6624-8063>
Songül Araç  <https://orcid.org/0000-0001-6830-3639>

REFERENCES

- AL-Khikani FH. Surveillance 2019 novel coronavirus (COVID19) spreading: Is a terrifying pandemic outbreak is soon? *Biomed Biotechnol Res J.* 2019;2020:812.
- Fasina FO. Novel coronavirus (2019-nCoV) update: What we know and what is unknown. *Asian Pacific J Tropical Med.* 2020;13:97.
- Arac E, Solmaz IH, Akkoc H, et al. Association between the Rh blood group and the covid-19 susceptibility. UHOD. *Int J Hematol Oncol.* 2020;30:81-86.
- Saylı BS. *Basic Medical Genetics.* Ankara, Turkey: Ankara University Faculty of Medicine Publications; 1982:430.
- Lindesmith L, Moe C, Marionneau S, et al. Human susceptibility and resistance to Norwalk virus infection. *Nat Med.* 2003;9:548-553.
- Batool Z, Durrani SH, Tariq S. Association of ABO And Rh blood group types to hepatitis B, hepatitis C, HIV and syphilis infection, a five year' experience in healthy blood donors in a tertiary care hospital. *J Ayub Med Coll Abbottabad.* 2017;29:90-92.
- Arac E, Solmaz I. Evaluation of blood groups in patients with anti TPO positive. *Asian J Med Sci.* 2019;10:67-70.
- Pelzer U, Klein F, Bahra M, et al. Blood group determinates incidence for pancreatic cancer in Germany. *Front Physiol.* 2013;4:118.
- Cheng Y, Cheng G, Chui CH, et al. ABO blood group and susceptibility to severe acute respiratory syndrome. *JAMA.* 2005;293:1450-1451.
- Arac E, Solmaz I, Samanci S. ABO and Rh blood groups frequency in men, women and neonates in Diyarbakir province. *Ann Med Res.* 2019;26:2876.
- Vasan SK, Rostgaard K, Majeed A, et al. ABO Blood Group and Risk of thromboembolic and arterial disease: a study of 1.5 million blood donors. *Circulation.* 2016;133:1449-1457.
- Amundadottir L, Kraft P, Stolzenberg-Solomon RZ, et al. Genome-wide association study identifies variants in the ABO locus associated with susceptibility to pancreatic cancer. *Nat Genet.* 2009;41:986-990.
- Cooling L. Blood groups in infection and host susceptibility. *Clin Microbiol Rev.* 2015;2:801-870.
- Zhao JYY, Huang H, Li D, et al. Relationship between the ABO blood group and the COVID-19 susceptibility. *MedRxiv.* 2020. <https://doi.org/10.1101/2020.03.11.20031096>
- Wu Y, Feng Z, Li P, Yu Q. Relationship between ABO blood group distribution and clinical characteristics in patients with COVID-19. *Clin Chim Acta.* 2020;509:220-223.
- Göker H, Aladağ Karakulak E, Demiroğlu H, et al. The effects of blood group types on the risk of COVID-19 infection and its clinical outcome. *Turk J Med Sci.* 2020;50:679-683.
- Wu O, Bayoumi N, Vickers MA, Clark P. ABO(H) blood groups and vascular disease: a systematic review and meta-analysis. *J Thromb Haemost.* 2008;6(1):62-69. <https://doi.org/10.1111/j.1538-7836.2007.02818.x>
- Jenkins PV, O'Donnell JS. ABO blood group determines plasma von Willebrand factor levels: a biologic function after all? *Transfusion.* 2006;46:1836-1844.
- Tang N, Li D, Wang X, Sun Z. Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. *J Thromb Haemost.* 2020;18:844-847.
- O'donnell J, Sharif K, Emery P, Bridgewood C, Mcgonagle D. Immune mechanisms of pulmonary intravascular coagulopathy in COVID-19 pneumonia. *Lancet Rheumatol.* 2020;2(1):e437-e445.
- O'Sullivan JM, Ward S, Fogarty H, O'Donnell JS. More on "association between ABO blood groups and risk of SARS-CoV-2 pneumonia". *Br J Haematol.* 2020;190:27-28.

How to cite this article: Solmaz İ, Araç S. ABO blood groups in COVID-19 patients; Cross-sectional study. *Int J Clin Pract.* 2021;75:e13927. <https://doi.org/10.1111/ijcp.13927>