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Research Article
Susceptibility of Blood Groups Infection with COVID-19 Disease Among Sudanese Patients Suffering from Different Chronic Diseases

[1]Malaz Faroug Mohamed, [2]Albara Ahmad, [3]Osman Mohammed Elmahi, [4]Asaad Ma Babker and [5]Hisham Ali Waggiallah

[1]Department of Hematology, Faculty of Medical Laboratory Science, National University, Khartoum, Sudan
[2]Department of Hematology, Medical Laboratory Science Program, Alfajr College of Science and Technology, Khartoum, Sudan
[3]Department Histopathology and Cytology, Faculty of Medical Laboratory Sciences, Karary University, Khartoum, Sudan
[4]Department of Medical Laboratory Sciences, College of Health Sciences, Gulf Medical University, Ajman, UAE
[5]Department of Medical Laboratory Science, College of Applied Medical Science,
Prince Sattam Bin Abdulaziz University, Kingdom of Saudi Arabia

Abstract

Background and Objective: Coronavirus disease (COVID-19) has spread throughout the world. Several studies have indicated that ABO blood group polymorphism could be connected to COVID-19 vulnerability and clinical outcomes, nevertheless, the findings are debatable. The aim of this study was to determine the most blood groups susceptible for COVID-19 infection among Sudanese patients suffering from different chronic diseases. **Materials and Methods:** The research included 200 participants. A total of 100 samples were collected as a case study from patients who had been found to have COVID-19 and a total of 100 samples were collected as a control from non-COVID-19 patients. The data was then gathered using a formal interview questionnaire and analyzed using the Statistical Package for Social Sciences (SPSS). **Results:** A total of 200 individuals were involved 100 of them was Patients and 100 were control. 51.4% were female and 48.6% were male. Current study revealed statistically significant difference between cases and controls. Blood group distribution was O positive as 59 (42.1%) followed by A Positive as 36 (25.7%), B positive 16 (11.4%), AB was 9 (6.4%) and only one (0.7%) was AB negative. In this study, the most common of other disease of COVID-19 patients were Asthma (6%), stomach ulcer (1%), renal failure (10%), diabetes (12%), hypertension (24%), vein thrombosis (1%), thrombosis (1%), heart disease (2%) and sinusitis (1%). **Conclusion:** There is a relation between ABO blood grouping and COVID-19 virus infection. The blood group distribution was O positive at 59 (42.1%), A positive at 36 (25.7%), B positive at 16 (11.4%), AB positive at 9 (6.4%) and AB negative at one (0.7 %). Blood group AB is the least likely to be infected with the COVID-19 virus, although blood group O Positive is the most likely.

Key words: ABO blood group system, Rh D antigen, COVID-19, chronic diseases

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Corresponding Author: Hisham Ali Waggiallah, Department of Medical Laboratory Science, College of Applied Medical Science, Prince Sattam Bin Abdulaziz University, Kingdom of Saudi Arabia

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Coronavirus disease (COVID-19) has quickly spread around the world, resulting in a world wide high mortality and morbidity economic recession as well as a health problem in several countries and regions[1]. The World Health Organization (WHO) declared it a pandemic on March, 11, 2020, with 114 countries affected by that time[2].

Genetic variants in the ABO gene trigger the ABO blood group phenotype. This gene has been related to a number of other traits, most importantly risk factors for COVID-19 morbidity and mortality. ABO variants, for example, have been related to angiotensin-converting enzyme production, red blood cell count, hemoglobin concentration, hematocrit, von Willebrand factor and venous thrombosis in genome-wide association studies. According to a meta-analysis, a non-O blood type is one of the most significant genetic risk factors for venous thromboembolism, along with individual variants. These criteria apply to COVID-19 as well. Coagulopathy, for instance, is a common problem for COVID-19 patients and the risk of venous thromboembolism should be carefully controlled[3].

The multiple correlations between diseases and blood type as well as COVID-19 offer evidence to suggest that true relationships between blood type and morbidity and mortality due to COVID-19 which exist. Furthermore, previous research has found connections between ABO blood groups and a range of infections or disease severity after infections, such as SARS-CoV-1 and *P. falciparum*, *H. pylori* and Hepatitis B virus[4].

In contrast to ABO, Rh (D) phenotypes (positive and negative Rh blood types) are correlated with relatively few diseases. Rh type as ABO, is essential for type compatibility and immune response. If Rh (D) is mismatched between mother and offspring, for example, hemolytic disease of the newborn is a problem. Many researchers have discovered proof that Rh-positive people are shielded from the consequences of latent toxoplasmosis, despite the fact that Toxoplasma gondii is a eukaryotic parasite rather than a virus like SARS-CoV-2[5]. The aim of this study was to determine the most susceptible blood groups for COVID-19 Sudanese patients suffering from different chronic diseases.

MATERIALS AND METHODS

Study design: This research was a case study that was carried out in the state of Khartoum (Aliaa Hospital). The research was conducted from October, 2020 to January, 2021 in Sudanese patients with COVID-19 as the study population, with both genders participating. A structured questionnaire was created to collect personal information about the study group, such as age, gender, other diseases and disease duration.

Inclusion criteria: The research was carried out on patients who had been diagnosed with COVID-19 and were undergoing treatment.

Exclusion criteria: Non-COVID-19 patients were removed from this study.

Methods: A capillary blood was collected by finger pricking using 70% isopropanol and sterile disposable lancet. Three drops of the sample were added to a clean slide labeled with Anti-A, Anti-B and Anti-D.

Agglutination happened on slides containing cells positive (possessing the antigen) for the corresponding antigen when red cells were combined with different antisera (soluble antibody) reagents. There was no agglutination in the red cells that did not contain the corresponding antigen. Three drops of blood were applied to each labeled slide, followed by one drop of anti-sera A, anti-sera B and anti-sera D (Bio-Rad Laboratories, Inc.) and carefully mixed with a separate applicator stick, until agglutination was detected and the result was registered. Before using, all reagents were checked.

Agglutination of patient or control blood samples with anti-D serum (Bio-Rad Laboratories, Inc.) indicating the presence of the D antigen on the red blood cells. Absence of agglutination suggests a negative test result, indicating that the D antigen is not detectable. If Rh typing is negative, D^u typing will be done consequently[6].

D^u method (the indirect anti globulin): The indirect anti globulin test detects antibodies that can induce red cell sensitization *in vitro*. If serum contains both IgG antibodies and the corresponding antigens, red cell mixture incubation will allow the antibody to bind to the antigenic receptor on red cells.

In a 10×75 mm test tube, two drops of anti-D mixture (IgG and IgM) were added. One drop of washed 5% suspension of the test cell was applied, mixed well and the tube was incubated at 37°C for 15 min in LISS. After incubation, the mixture was centrifuged and the results were read and registered. The mixture was washed 3-4 times in large volume of saline and each wash was decanted fully. Two drops of anti-globulin reagent were applied, mixed thoroughly and incubated at room temperature for 4-5 min. The mixture was centrifuged at 3400 rpm for 15 sec and the final results were read and registered[6].

Ethical consideration: The study obtained ethical clearance from the National University and a written consent has been obtained from the participants after a good discussion with them and the result of the study would be utilized for their benefits.

Data analysis: The Statistical Package of Social Sciences (SPSS) was used for statistical analysis version 23. Frequency and student T-tests have been used to display the data. Reports were evaluated at significance of $p \leq 0.05$.

RESULTS

The study included 200 participants divided evenly into case (patients with COVID-19) and control groups (healthy). The demographic data were classified based on case group age, gender, other chronic disease and ABO blood group and Rh D antigen results. As shown in Fig. 1, the majority of participants were male 56% and female 44% for the case study and male 44% and female 56% for the control study. In our research, the most common blood type was O positive 24.5%, while AB positive was the least common (as shown in Fig. 2).

The following percentage distribution of chronic diseases other than COVID-19: Asthma (6%), stomach ulcer (1%), renal failure (10%), diabetes (12%), hypertension (24%), vein thrombosis (1%), thrombosis (1%), cardiac disease (2%) and sinusitis (1%) was illustrated in Fig. 3 When case and control were compared, there was a strong correlation since $p \leq 0.05$ as shown in Table 1. The presence of D antigen in case and control has no significant correlation as seen in Table 2 but there was a significant correlation when ABO and D antigen in case and control were compared $p \leq 0.05$ as shown in Table 3.

The study found a correlation between Renal Failure and the mean of duration of COVID-19 in the case group. The study also found no correlation between Asthma, Stomach Ulcer, Diabetes, Hypertension, Vein Thrombosis, Thrombosis, Heart diseases and Sinusitis (Table 4).

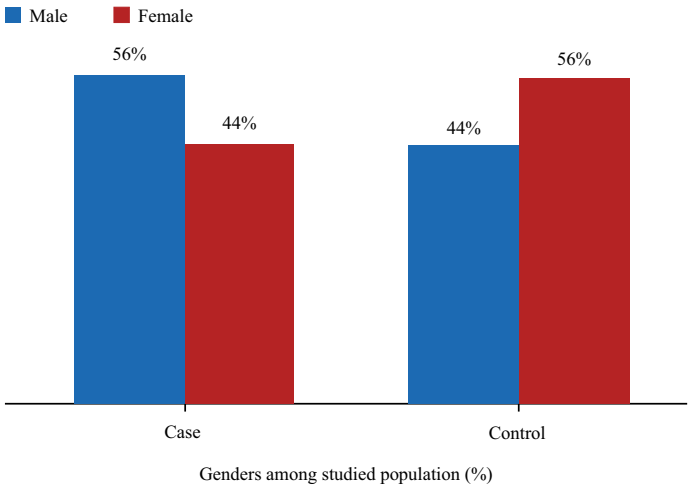

Fig. 1: Gender distribution in case and control

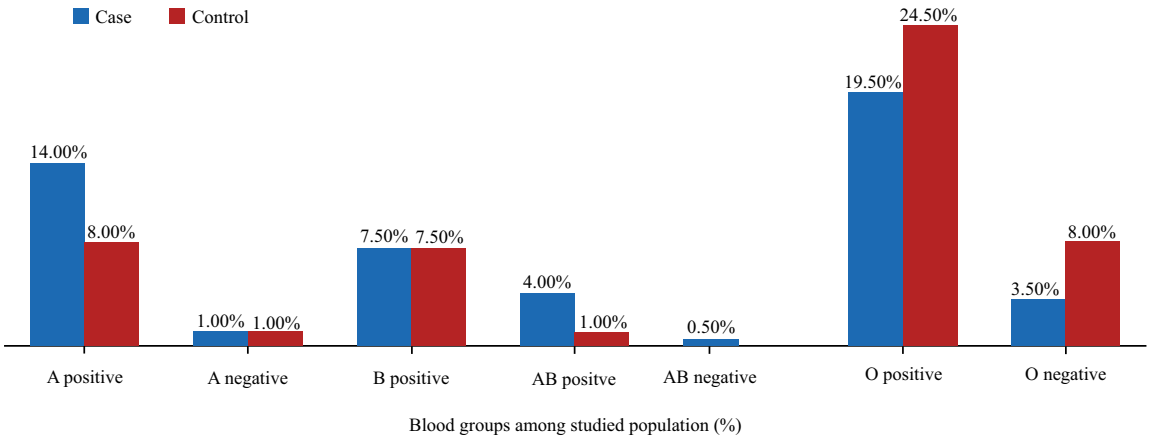

Fig. 2: Percentage of blood groups in the study population

Table 1: Correlation between ABO blood group among case and control study

		Status			
Blood group		Case	Control	Total	p-value
A	n	30	18	48	0.013*
	%	30	18	24	
B	n	15	15	30	
	%	15	15	15	
AB	n	9	2	11	
	%	9	2	5.5	
O	n	46	65	111	
	%	46	65	55.5	
Total	n	100	100	200	
	%	100	100	100	

*p≤0.05

Table 2: Correlation between Rh D antigen among case and control study

		Status			
RhD		Case	Control	Total	p-value
Positive	n	90	82	172	0.103
	%	90.0	82.0	86.0	
Negative	n	10	18	28	
	%	10.0	18.0	14.0	
Total	n	100	100	200	
	%	100.0	100.0	100.0	

*p≤0.05

Table 3: Correlation between ABO blood group and Rh D antigen among case and control study

		Status			
Blood group		Case	Control	Total	p-value
A positive	N	28	16	44	0.05
	%	28.0	16.0	22.0	
A negative	N	2	2	4	
	%	2.0	2.0	2.0	
B positive	N	15	15	30	
	%	15.0	15.0	15.0	
AB positive	N	8	2	10	
	%	8.0	2.0	5.0	
AB negative	N	1	0	1	
	%	1.0	0.0	0.5	
O positive	N	39	49	88	
	%	39.0	49.0	44.0	
O negative	N	7	16	23	
	%	7.0	16.0	11.5	
Total	N	100	100	200	
	%	100.0	100.0	100.0	

*p≤0.05

Table 4: Correlation between other diseases and Mean duration of COVID-19 among case group

Other diseases	Existence of disease	Frequency	Mean duration of COVID-19/days±SD	p-value
Asthma	Yes	6	16.00±6	0.605
	No	94	14.80±5.3	
Stomach ulcer	Yes	1	5.00±0.0	0.062
	No	99	15.00±5.27	
Renal failure	Yes	10	19.80±5.9	0.002*
	No	90	14.40±5.02	
Diabetes mellitus	Yes	12	13.80±5.12	0.396
	No	88	15.10±5.2	
Hypertension	Yes	24	15.00±4.8	0.917
	No	76	14.90±5.6	
Vein thrombosis	Yes	1	7.00±0.0	0.138
	No	99	14.90±5.4	
Thrombosis	Yes	1	15.00±0.0	0.985
	No	99	14.90±5.37	
Heart conditions	Yes	2	17.50±3.6	0.489
	No	98	14.90±5.4	
Sinusitis	Yes	1	10.00±0.0	0.359
	No	99	14.90±5.34	

*p≤0.05

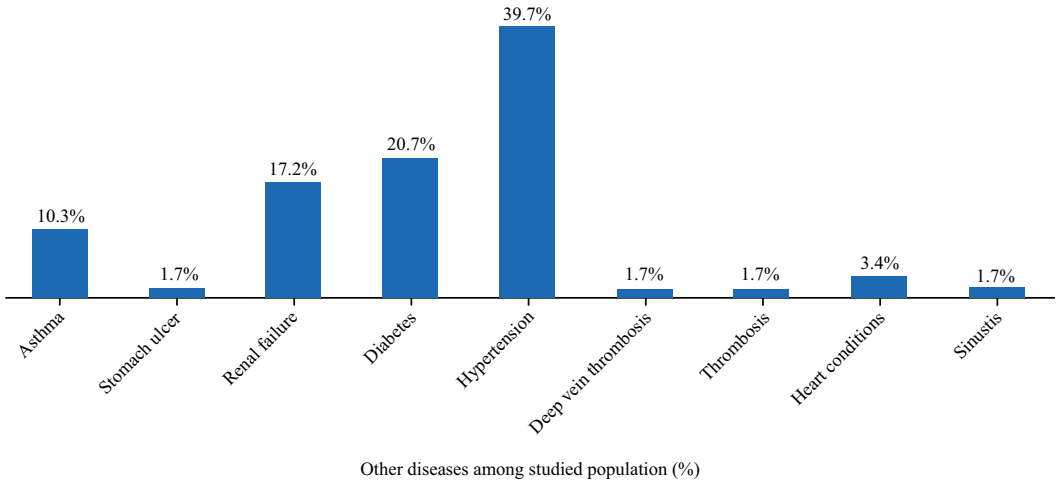

Fig. 3: Percentage of chronic diseases among study population

DISCUSSION

In current study, it has been found that ABO blood group system may have played an important role in the COVID-19 mode of infection. Blood group AB has the lowest chances of acquiring the COVID-19 virus, while blood group O Positive has the highest. Patients with renal failure are substantially more vulnerable to COVID-19 infection over an extended period of time.

Many chronic disorders, such as vascular disease, coronary heart disease and tumorigenesis, are statistically or biologically linked to ABO blood groups[7]. Studies on the relationship between blood groups and some viral infections have received much interest in recent years. Investigating the role of different blood groups in viral infection can be useful in evaluating a person's susceptibility to a virus. Previous research has found a connection between ABO blood groups and host susceptibility to infectious diseases such as SARS-CoV[8], malignant tumors[9], *Helicobacter pylori*[10], Norwalk virus[11] and hepatitis B virus[7]. The correlation between ABO blood groups and SARS-CoV, in particular, led to the presumption of a related susceptibility to COVID-19.

This study found no association between ABO blood groups and the distribution of Asthma, stomach ulcer, diabetes, hypertension, vein thrombosis, thrombosis, heart disease and sinusitis but there was a significant correlation between renal failure and duration of COVID-19.

The current study revealed that patients with blood group type O positive are the most likely to be infected with the COVID-19 virus, which was consistent with Flegel's studies in France, which found that patients with blood type O were more likely to be infected with COVID-19[12] and inconsistent with Boudin *et al*., 2020[13], which indicated that Canadian patients with blood type O were less likely to be infected with chronic diseases. While Ray *et al*., 2020 discovered that in Turkish patients with blood type O were less infected and those with blood type A were less correlated with mortality, they also discovered a negative harmonious relationship between the O blood group and COVID-19 exposure[14]. They found no significant link between blood group and the need for intubation or COVID-19-related mortality, which may be attributed to their small sample size. Zeng *et al*., 2020 discovered a higher risk of COVID-19 exposure in subjects with the A blood group in another study. In another study, individuals with blood group O were found to be less susceptible to extreme COVID-19 but they were unable to determine if having O blood group provided defense against the virus[15]. The authors concluded in a large multi-institutional retrospective study that there is no relationship between blood type and the likelihood of severity development, the need for intubation or death. These findings contradicted the findings of Zhao *et al*., 2020[16], who investigated the relationship between blood type and death rate in the Wuhan experience.

COVID-19 viruses developed in individuals from groups A, B, AB and O, respectively, express A, B, A and B antigens and none. Anti-A, anti-A, none and anti-A/anti-B/anti-A, B antibodies are present in people in groups A, B, AB and O, respectively[17]. Anti-A, Anti-B and Anti-A, Antibodies can reduce an individual's risk of infection from the SARS-CoV-2 virus, making type O individuals more vulnerable. The blockage may or may not be complete. However, once an infection has been created, individuals produce viruses of their own ABO types and the Anti-A, Anti-B and/or Anti-A, B antibodies they possess can no longer neutralize newly produced viruses.

Individuals with blood type O negative are at a lower risk of viral infection[17]. Anti-A, Anti-B and/or Anti-A, B antibodies can prevent the viral spike glycoprotein from interacting with cellular ACE2 receptors. This can prevent the SARS-CoV-2 virus from entering cells and neutralize it in a complement-dependent manner. It may also facilitate the production of cytotoxic T cells. Immunity to other viral antigens can develop as a result[17].

CONCLUSION

It is possible that the ABO blood group system played a significant role in the COVID-19 mode of infection. Blood group AB is the least likely to be infected with the COVID-19 virus, whereas blood group O Positive is the most likely.

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