



Research Article

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Association of ABO and RH Blood Group with Mild COVID-19 Infection in Egyptian Persons



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Abstract

Background & objective: Studies on severe COVID-19 suggested an association between blood group A and higher risk of SARS-CoV-2 infection and severe outcome while blood group O has a protective role against infection. The polymorphism in ABO blood group system has been postulated as being one of the major proposed mechanisms for COVID-19 susceptibility and disease outcomes. Naturally occurring anti-A antibodies present in persons with blood groups O and B could be partially protective against SARS-CoV-2 infections. However, individual difference and geographical areas may influence the results of available studies. We aimed at investigating the possible association between the ABO and Rh blood group and COVID-19 susceptibility in mild COVID-19 infected Egyptian persons.

Methods: The present study included 50 Egyptian subjects in the age range (20 -30 years old) (16 were medical staff, 31 were non-medical staff and 3 had medical problems). The frequency of ABO and Rh blood group among our subjects was calculated.

Results: Our results showed that mild COVID-19 infection was more common in females (30 persons, 60%) than males (20 persons, 40%). The highest frequency of mild COVID-19 infection was among subjects with blood group O (22 patients, 44%) and Rh positive (46 persons, 92%). There was no difference between patients with blood group O versus non group O as regards sex ($X^2 = 1.096$, $p = 0.387$) and Rh type ($X^2 = 3.416$, $p = 0.121$).

Interpretation & conclusion: We concluded that Rh negative is protective against COVID-19 infection while Blood group O is partially protective. Blood group A may present with mild symptoms under certain circumstances.

Keywords: ABO blood group; Rh type; Susceptibility; Mild COVID-19

Introduction

ABO blood group is genetically determined trait with polymorphic expression among different individuals and populations [1]. There is an association between ABO blood group and several diseases including cancers, cardiovascular diseases, rheumatic diseases, and infectious diseases [2]. There is an ongoing concern in the possible role of ABO blood group in infectious disease. Many blood groups can act as receptors for bacteria, and parasites facilitating their colonization and invasion. In addition, blood groups can serve as false receptors, preventing binding to target tissue. Bacteria can also stimulate formation of antibodies against ABO blood group antigens (ABO antibodies) which can be considered part of the innate immune system against some enveloped viruses and bacterial pathogens carrying ABO-active antigens. Blood groups can also evade the host clearance mechanisms [1].

There is increased susceptibility of ABO blood groups to many viruses such as Middle East Respiratory Syndrome (MERS) [3], human immunodeficiency virus [4], hepatitis B [3], norwalk virus, dengue virus, rotavirus, [4] and SARS coronavirus [3]. The association between SARS-CoV-2 infection and ABO and Rh blood group has been reported by studies from several parts of the world including China. Persons with blood group A are highly susceptible to COVID-19 infection, while the rate and severity of COVID-19 infection seems less among blood group O persons. Rh (D) positive blood group is also associated with increased COVID-19 infection and mortality. The underlying mechanism explaining this association needs to be investigated. Several theories have been proposed to elaborate the mechanism of this association [2].

Aim of the work

We aimed at investigating the possible association between ABO and Rh blood group and COVID-19 susceptibility to mild infection in Egyptian subjects.

Materials and methods

The present study included 50 randomly selected adult Egyptian subjects with mild COVID-19 infection diagnosed according to the Centers for Disease Control (CDC) guidelines. SARS-COV-2 diagnosis was confirmed via VIASURE SARS-CoV Real Time PCR of nasopharyngeal swab (CerTestBiotec, Spain) in all cases. They were subdivided into medical staff (16 doctors and nurses), 31 of non-medical staff and 3 patients with medical problems. Thirty subjects were females and twenty were males. Their ages ranged from 20 to 30 years which is the commonly encountered age group in our mildly infected patients. Subjects with different age categories and those having moderate or severe COVID-19 infection were excluded from the study. Data were collected during the period from January 2021 to June 2021.

Statistical Analysis

The distribution of ABO and Rh blood group were presented as frequency and percentages. Comparison between O and non O blood group as regards sex and Rh type was done using chi square test. The test was carried out with Statistical Package for the Social Sciences (SPSS) version 21 (SPSS, Inc., Chicago, IL, USA). A p-value of less than 0.05 was considered significant.

Results

Mild COVID infection was more common in females (30 patients, 60%) than males (20 patients, 40%) (Table 1). The highest frequency of COVID-19 infection was present in subjects with blood group O (22 patients, 44%) while its frequency in other blood groups was 28%, 20%, and 8% for blood group A, B, and AB respectively (Table 2). Out of the 50 studied subjects, 46 subjects (92%) were Rh negative (Table 3). Comparison between patients with blood group O versus non group O as regards sex ($\chi^2 = 1.096$, $p = 0.387$) and Rh type ($\chi^2 = 3.416$, $p = 0.121$) was shown in table 4.

Table 1: Sex distribution among the studied cases.

Parameter	Blood group (n=50)	
	Male (n=20)	Female (n=30)
1. ABO blood group		
A	5 (25%)	9 (30%)
B	4 (20%)	6 (20%)
AB	4 (20%)	-
O	7 (35%)	15 (50%)
2. Rh type		
Rh positive	18 (90%)	28 (93.33%)
Rh negative	2 (10%)	2 (6.67%)

Table 2: Frequency of ABO blood group among mild COVID-19 infected cases.

Parameter	ABO blood group (n=50)	
	Number	Percent
A	14	28%
B	10	20%
AB	4	8%
O	22	44%

Table 3: Frequency of Rh type among mild COVID-19 infected cases.

Parameter	Rh type (n=50)	
	Rh positive (n=46)	Rh negative (n=4)
A	11 (23.91%)	3 (75%)
B	9 (19.56%)	1 (25%)
AB	4 (8.7%)	-
O	22 (47.83%)	-

Table 4: Comparison of blood group O versus non-O in mild COVID-19 infection.

Parameter	O (n=22)	Non O (n=28)	X ²
Sex			
Male	7 (31.82%)	13 (46.43%)	1.096
Female	15 (68.18%)	15 (53.57%)	p=0.387
Rh type			
Positive	22 (100%)	24 (85.71%)	3.416
Negative	-	4 (14.29%)	p=0.121

P value is considered significant if less than 0.05.

Discussion

The association between ABO blood group and COVID infection is still a matter of debate [3,4]. Most of the studies suggest that group O individuals had a lower risk of SARS-CoV-2 infection and less severe COVID-19 disease outcome. However, these findings are not conclusive and not fully understood. The conflicting results in different studies could be attributed to the selected populations and their different geographical areas [5]. Our results showed the presence of an association between mild COVID-19 infection and blood group O (44% of our subjects) followed by group A (28% of our subjects) and group B (20%). Rh negative blood group constitutes 92% of our subjects with mild COVID infection (46 subjects).

The proposed mechanism which explains the increased susceptibility of blood group A to COVID-19 infection include the existence of naturally occurring anti-A antibodies in the plasma of blood groups O and B persons and their absence in blood group A. These antibodies bind SARS-CoV-2 S protein blocking its interaction with ACE2 on the cell surface of epithelial cells in the

respiratory tract thus prevent viral entry into the lung epithelium. Additional proposed mechanisms are: i. CoV-2 replication in the host epithelium produces ABH glycan antigens similar to those of the host A or B antigens according to the host blood group. For example, if the SARS-CoV-2 is expressing A antigens, then individuals with blood group A or AB will face a greater risk of infection, as they lack the anti-A antibodies while individuals with blood group B or O will show protection to some extent due to the presence of anti-A antibodies, ii. In individuals with blood group A, factor VIII and VWF express A antigens, leading to increase in their concentration and life span and increased patient susceptibility to infection and iii. the potential role of the genetic variation in non-O blood groups in increasing COVID-19 infection severity for e.g. the rs657152 polymorphism, a variant located at the ABO locus [5], is associated with the occurrence of respiratory failure in COVID-19. Another e.g. is the upregulation of the activity of ACE 2 receptors by the four non-O blood groups gene polymorphisms (rs495828, rs8176740, rs8176746 and rs12683493) [6]. These results may be of value in the future to deliver personalized medicine to more susceptible individuals [5].

Sex and Rh type do not explain the protective role of blood group O in our cases as there is no statistically significant difference in their frequencies between blood group O and non-group O. The higher frequency of COVID-19 infection in blood group O than B may be explained by the type of anti-A antibodies present in those persons. Anti-A antibodies in the blood group O are from IgG class while those in the blood group B are from IgM class. This may make anti-A present in blood group O more protective than the antibodies produced by the blood group B [5].

Conclusion

Rh negative is protective while blood group O is partially protective against COVID-19 infection in Egyptian subjects. Blood group A may present with mild symptoms under certain circumstances. Further studies on mild COVID-19 infected patients on larger scale are still needed to confirm these results

and to know which factor (s) determine the severity of COVID-19 infection in blood group A

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No funding was received by the authors for conducting this study.

Compliance with Ethical Standards

Conflict of Interest

The authors declare they have potential conflicts of interest, neither financial nor non-financial

Human and animal Rights

The study was approved by the Ethics Review Board of Alexandria University, Faculty of Medicine.

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