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Relationship between Blood Group and Risk of Infection, Intubation and Death in Covid Pandemic

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Background: Few people infected by the coronavirus become seriously ill, while others show mild symptoms or are asymptomatic. Recent research points out that the ABO blood group might play an essential role in a person's susceptibility and severity of COVID-19 infection. **Aims:** This study is conducted to find the relationship between ABO groups and COVID-19 infection. **Methods:** A total of 395 patients were included in this study. The study population was divided based on ABO blood groups into types A+, A−, B+, B −, AB, O+, and O−. **Results:** Blood group B was associated with high susceptibility to infection. We found slightly increased infection prevalence among the Rh factor positive blood group. The risk of infection was decreased among blood groups with Rh factor negative. Cases having blood group B have higher chances of covid-19 infection followed by AB and type O. **Conclusion:** We estimated Rh-negative blood types to have a protective effect for covid -19 infection. Our results add to the growing body of evidence suggesting blood group type may play a role in COVID-19 infection.

Keywords: COVID-19, ABO blood groups, Severity, Infection

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Introduction

The new infectious coronavirus disease 2019, called COVID-19, began to spread from China in December 2019 [1]. The most evident COVID-19 symptoms are pneumonia and respiratory failure, which reiterate the symptoms reported in the SARS (Severe Acute Respiratory Syndrome) epidemic of 2003 [2,3]. On 11 March 2020, the World Health Organization declared it a pandemic [4,5]. The novel Coronavirus disease (COVID-19, caused by the SARS-CoV-2 virus) has spread rapidly across the globe and has caused over 21.1 million confirmed infections and over 761,000 deaths worldwide as of August 17, 2020 [6].

Since specific biological rules characterize each disease, it is necessary to consider them to build an adequate mathematical model to describe real situations. The pattern comprises a first phase, indicated by an exponential increase of infections, and a later phase, social distancing measures reduces the spread of the disease, generally followed by a gradual decrease of daily infections. Finally, the number of daily infections becomes smaller than the daily recovered ones, thus allowing the number of infected individuals to decrease. Even if this general pattern has been reproduced around the world, the spread of the virus showed important local differences, mainly in the rate of the initial exponential spread. From this historical event, it is extremely difficult to understand if these patterns are the consequence of geographical inhomogeneities or if these are spurious correlations that are caused by the singularity of the observed event. Indeed, some works underlined as in the early stage of the epidemics, the recorded geographical pattern is characterized by the localization of most of the infection in temperate regions, distinguished by specific temperature and humidity characteristics [7,8]. Other hypothesized co-morbidities that may explain local differences are hypertension, obesity, and age distribution, which display heterogeneous regional distributions [9,10].

In particular, blood groups were recognized to influence susceptibility to certain viruses, including SARS-CoV-1 [11] and Norwalk virus [12]. Blood group A and B glycosyltransferases also affect glycosylation in many cell types, including epithelial cells in the respiratory tract and shed viral particles [13]. Recently, Zhao *et al.* [14] found that ABO blood groups presented a different risk to contract COVID-19 due to being exposed to SARS-CoV-2. Previously, for the similar coronavirus SARS-CoV responsible for SARS, Guillon *et al.* [15] investigated whether ABO antibodies could stop the interaction between the SARS-CoV receptor and ACE2. They found that the S protein expressed by A-positive–infected cells shares epitopes of the A histo-blood group in vitro, the adhesion of S protein and ACE2 can be inhibited by the anti-A natural antibody. The anti-A and anti-B natural antibodies being produced in individuals with blood group O could potentially block viral adhesion to cells, which could explain their lower risk of infection.

Starting from these experimental results regarding the SARS-CoV spike, Breiman *et al.* [16] extended the hypothesis to the new SARS-CoV-2, suggesting the different susceptibility of individuals with other ABO blood groups may have the same explanation.

Keeping these facts in mind, we conducted a study to discover association between blood group and COVID-19 infection. Because there is not much primary evidence regarding the association between blood groups and COVID-19 infection, upcoming relevant studies will be added to the present study results.

Material And Method

The study was conducted on 395 COVID-19-confirmed patients admitted to Government Medical College, Orai, Jalaun, UP, India, for two years. The Ethical Committee approved the study. Data were extracted from a number of COVID-19 infections in each blood group, A, B, O and AB. The required data were entered into Microsoft Excel spreadsheets and data analyzed on SPSS version 25.0. Standard error was calculated to assess the frequency of COVID-19 infection in each blood group.

Inclusion criteria: Inclusion criteria were as follows: Relationship between ABO blood group and COVID-19 infection; that reported frequency of COVID-19 among different ABO blood groups.

Exclusion criteria: Not confirmed case of COVID-19.

The diagnosis of COVID-19 was confirmed by a positive real-time reverse transcriptase-polymerase chain reaction test of SARS-CoV-2 on nasal and

Pharyngeal swab specimens from patients. ABO grouping was done through a blood grouping reagent anti-monoclonal diagnostic test kit manufactured by Mediclone Biotech Private Limited, India. To determine the severity of COVID-19 infection, ACEP2020 divided patient conditions into the following:

(A) Mild low risk.
(b) Mild at risk.
(c) Moderate.
(d) Severe.
(e) Critical.

We followed up the patients to know the prognosis of the disease, cured or died (from 14 to 39 days).

Results

Table 1: Distribution of cases according to age groups.

Age group	No. of cases	Percentage
0-20	25	6.33
21-30	71	17.97
31-40	34	8.61
41-50	59	14.94
51-60	102	25.82
61-70	72	18.23
>70	32	8.10
Total	395	100
Mean ±SD	48.72±18.19	

People of age group 40-70 years were more susceptible to covid-19 infection, more common 51-60 years of age group (25.82%). The mean age of covid-19 disease is 48.72±18.19 years.

Table 2: Distribution of cases according to sex.

Sex	No. of cases	Percentage
Male	262	66.33
Female	133	33.67
Total	395	100

There was a male preponderance of 66.33% in Covid-19 infected cases.

Table 3: Distribution of cases according to blood group.

Blood group	No. of cases	Percentage
A+	64	16.20
A-	10	2.53
B+	159	40.25
B-	10	2.53
AB+	38	9.62
AB-	0	0.00
O+	106	26.84
O-	8	2.03
Total	395	100

The maximum cases have blood group B 42.78% followed by O group 28.87%. Least no. of cases were having AB blood group.

Table 4: Distribution of cases according to Rh factor.

Rh factor	No. of cases	Percentage
Positive	367	92.91
Negative	28	7.09
Total	395	100

92.91% of covid-19 infections were Rh factor positive.

Discussion

A better understanding of COVID-19 is imperative, which has given the current pandemic's toll. We investigated whether blood type is relevant for the risk of infection, intubation and death. Overall, we found modest but consistent risk differences between blood types. After adjusting for ancestry (the relevant confounder for this analysis), estimated risk differences were larger for intubation and death outcomes than the initial infection. We assessed more considerable risk differences between Rh blood types than between ABO types, with Rh-negative individuals being at lower risk of all the three outcomes. Type A had a lower risk of infection and intubation, and death compared with AB and O blood groups. Only blood group B had inconsistent effects between Covid -19 infection, intubation and death. Cases having blood group B had increased risk of intubation and decreased risk of death compared to blood group O. We also found consistent evidence for protective associations between Rh-negative blood groups and SARS-CoV-2 infection.

Blood type appears to have a consistent effect, though the magnitudes of these effects on risk of intubation are modest, and our estimates have significant uncertainties relative to their magnitudes.

Our study suggests that maximum suspects were from blood group B 42.78%, O group 28.87%. Least no. of cases were having blood group AB.

In our study, 42.78% of cases infected by Covid-19

Were of blood group B, and the least no. of patients were of blood group AB. The activity of ACE2 in blood group B is much higher than in blood group O [17], leading to higher viral infection resulting in higher mortality and morbidity in patients of blood group B than blood group O.

In the SARS-CoV-1 epidemic, it was shown that anti-A antibodies in individuals with blood group O prevented the invasion of the S protein into the tissues [18]. It has been claimed that, due to the same mechanism, this will cause less infection in individuals with blood group O in the SARS-CoV-2 pandemic [19,20]. Although there are anti-A antibodies in blood group B, no published studies show that blood group B is less susceptible to SARS-CoV-2.

Individuals with blood group O have a lower angiotensin-converting enzyme (ACE) level, while blood group A has a positive association with ACE activity [21]. ACE is an enzyme that activates angiotensin; the lower level of this enzyme can thus reduce the risk of hypertension [22], which is a COVID-19 risk factor [23]. This is another proposed mechanism for developing more severe COVID-19 disease in blood group A and less severe disease in blood group O [21]. Although ACE2 is the virus receptor, it can have some benefits. For example, it can attenuate inflammatory response and redox stress; and it can counterbalance the ACE effect, and in the case of lower ACE levels, it can work even more effectively [21,24].

Although the primary receptor for SARS-CoV-2 is ACE2 [25], like many pathogens that bind to specific terminal carbohydrates [26], SARS-CoV-2 binds to the carbohydrates that determine the ABO blood groups, which are extensively expressed in the mucous membrane of the respiratory tract [25,27]. Therefore, blood group AB has the most contact and blood group O the least with the pathogen [25].

Results were also consistent with an association discovered for SARS-CoV-1, in which O blood groups were less common among SARS patients [28]. Our results are also most consistent with the results reported by Zhao et al. [29] and Ellinghaus et al. [30], non-O appears to be at greater risk of infection but a lesser chance of mechanical ventilation. However, the authors note that this decreased risk is not statistically significant at the 5% level. Unlike Ellinghaus et al., though,

We estimated a slightly higher risk for types B and AB relative to O for intubation.

Conclusion

In this novel study, we report an association between the ABO blood group and COVID-19 susceptibility, demonstrating the latter as a biomarker differentiating the former. In this study, there was an association between the ABO blood group and COVID-19 susceptibility and severity. Specifically, people with blood group B have a higher susceptibility and severity, whereas people with Rh factor negative have a lower chance of infection.

People with blood group B:

1) People with blood group B might need particularly strengthened personal protection to reduce the chance of infection.

2) SARS-CoV-2-infected patients with blood group B might need to receive more vigilant surveillance and aggressive treatment and close observation

What does the study add to existing knowledge?

It might be helpful to introduce ABO blood typing in managing COVID-19 infection. The interest of this study assists people in realizing the relationship between the ABO blood group and the condition, severity and demise of COVID-19. Moreover, further investigations and studies are recommended to clarify the present finding and provide more beneficial insights into COVID-19.

Author Contributions: Dr Renu Singh conceived the main idea, wrote the manuscript and performed the statistical analysis. Dr M.Siddiqui collected the data and critically revised the manuscript. Both the authors approved the manuscript final version and took responsibility for the integrity and accuracy of the data.

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