

The Relationship Between the Blood Group and Susceptibility for COVID-19

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ABSTRACT — Specific ABO blood groups increase the susceptibility of individuals to viruses (e.g. SARS CoV-17 and Novovirus), hence any correlation with SARS CoV-19 is an important predictive index. This study aimed to determine any association between blood group and COVID-19 positive Paediatric patients and their clinical outcome. This retrospective cohort study, in Rajarajeswari Medical College and Hospital, Bangalore. Out of 113 patients admitted during the 4-month period, only 75 had a known blood type. 39 (52.0%) were symptomatic and 36 (48.0%) were asymptomatic. 74 (98.7%) patients received symptomatic treatment whereas 1 (1.3%) required intubation. There were no deaths during the course of this study. 23 (30.7%) were blood type A, 20 (26.7%) were blood type B, 11 (14.7%) were blood type AB and 21 (28.0%) were blood type O. Blood type A and B had higher odds of testing positive (AOR:1.30, CI:1.12-1.65 ; AOR:1.21, CI:0.94-1.38, respectively). Blood group AB had no correlation (AOR:1.00, CI:0.92-1.17). Blood type O had the lowest risk (AOR:0.82, CI:0.49-1.02) Rh+ status was associated with higher odds of testing positive. Blood type was not associated with ICU admission, intubation or death.

KEYWORDS — Blood group, Blood type, COVID-19, SARS-CoV2, Paediatric age group

INTRODUCTION

The novel Coronavirus disease, COVID-19, caused by the SARS-CoV-2 virus has spread rapidly across the globe and has caused over 132 million confirmed infections and over 2.87 million deaths worldwide [1]. India is where the Coronavirus disease has affected more than 13 million individuals and 166,000 people are deceased, as of April 2021 [2]. Those with co-morbidities and immunocompromised individuals, such as diabetes, cardiovascular diseases and pulmonary diseases and on long term immunosuppressives, are more vulnerable to this disease. Although various strides have been made with

regards to prevention and treatment of this disease, including the quick roll out of various vaccines, there continues to be a significant morbidity and mortality associated with this disease. Throughout this pandemic, there have been observations that certain characteristics and attributes, other than underlying co-morbidities may have a significant predilection for risk of infection with SARS-CoV-2 and a higher disease severity. There is no specific biomarker to predict the susceptibility to COVID-19, but recent reports have suggested that ABO blood groups might play a role in the infection. The carbohydrate epitopes that are present on the surface of human cells and antigenic determinants are specific for each blood group antigen. It has been observed that certain ABO blood groups can increase the susceptibility of individuals to certain viruses, for example SARS CoV-17 and Novovirus.

Various studies have shown the prevalence of the SARS-COV-19 in A and B blood groups and less prevalence in O blood groups. Zhau et al. [3] study in China showed that A blood groups were at a higher risk of the COVID-19 infection compared to the non-A blood groups and O blood groups had a lower infection rates compared to non-O blood groups. Barnkob et al. [4] reported that fewer infected people had blood group O compared to the other blood types. Li et al. [5] reported similar results. Hoiland et al. [6] reported that blood groups A and AB exhibit greater COVID-19 disease severity than people with blood groups O and B. Latz et al. [7] determined blood types B and AB and Rh positive patients were more likely to test positive than blood type O. Pourali et al. [8] conducted a meta-analysis study to assess the relationship of blood groups and onset of mortality of COVID-19 infection, which showed higher risk in blood group A than in blood group O, who are at a lower risk. Zietz et al. [9] reported that there is slightly increased infection in blood group O but risk of deaths were increased in blood group AB and decreased for blood group A and blood group B.

Blood group A and blood group B glycosyltransferases also affect the glycosylation in a various



cell types, such as respiratory tract epithelial cells and these shed the virus particles^[10,11].

Limited studies done in India to evaluate the relationship between ABO group of affected individuals and the outcome, especially in the paediatric age group. Using the admitted paediatric patients, this study aimed to determine if an association between ABO blood group and their susceptibility to test positive for COVID-19 disease and the disease severity during their course of infectivity.

At a molecular level, several hypothesis have been raised to determine why ABO blood group can be a factor in determining the vulnerability to the disease as well as determine the disease severity, such as the variable expression of ACE-2 expression in the airway epithelium. The carbohydrate epitopes present on the surface of human cells are ABO blood groups. In the A and B blood groups, there are antigenic trisaccharide moieties, such as GalNAc α 1-3-(Fuc α 1,2)-Gal β - and Gal α 1-3-(Fuc α 1,2)-Gal β -, respectively. In the O blood group, the antigen moiety is Fuc α 1,2-Gal β -. These moieties are what potentially influence the susceptibility to the COVID-19 disease.

METHODS

A hospital-based retrospective cross-sectional study was conducted at a tertiary care hospital in Bangalore, India, from July 1st, 2020 to October 20th, 2020. This hospital is a 150-pediatric bedded COVID-19 specialised hospital with a 6-bed PICU and 18-bed NICU.

Those who tested positive for COVID-19 and with a known blood type recorded were included in this study. The patient's demographics, symptomatology, laboratory markers of inflammation were noted. All children aged between 1 month and 18 years with positive RTPCR for COVID-19 infection (nasopharyngeal swab positive) were included in the study. After initial assessment in the Emergency Department, patient was admitted into the ward wherein a detailed clinical history and examination was done by the Paediatrician.

Statistical analysis was evaluation using Chi-square test and ANOVA test, were appropriate, in comparing the demographics, symptomatology, laboratory markers along with blood group across the patients. The clinical outcome of COVID-19 patients with the various blood groups were calculated using the OR with 95% CI, a two-tailed $p < 0.05$ was considered to be statistically significant. Age, gender, and Rh factor were determined for adjustment as the co-variables as they could be confounding factors for the overall data. Statistical analysis was conducted using Microsoft excel and analysed using SPSS version 22 software.

RESULTS

During this study, out of the 113 positive paediatric patients, only 75 paediatric patients had a known or tested blood group. Out of the 75, the patient's demographics was highlighted in Table I.

TABLE I : Demographics with blood types

Factor	BLOOD TYPE				P value
	A	B	AB	O	
N	23	20	11	21	
Age, mean (SD)	7.6 (5.2)	8.5 (5.1)	9.7 (4.9)	9.3 (5.1)	0.21
Days of admission, mean (SD)	9.8 (3.7)	7.7 (2.1)	8.6 (1.1)	8.1 (2.4)	0.37
Rhesus positive	20 (87.0%)	18 (90%)	8 (80.0%)	18 (85.7%)	0.72
Female gender	9 (39.1%)	8 (40%)	3 (30.0%)	8 (38.1%)	0.04

Out of these 75 patients, 1 (1.3%) was admitted to the ICU and the other 74 patients (98.7%) were admitted to ward. There were no deaths of any patients during the course of the study. Out of the 75 paediatric patients, 23 (30.7%) were blood type A, 20 (26.7%) were blood type B, 11 (14.7%) were blood type AB and 21 (28.0%) were blood type O.

39 (52.0%) were symptomatic and 36 (48.0%) were asymptomatic. There was no association between blood group type and ICU admission.

In the multivariable analysis, as indicated in Table II, blood type was not independently associated with the disease. Blood type A - reference ; Blood type B: AOR-0.69, 95% CI-0.44-1.12 ; Blood type AB: AOR-0.67, 95% CI-0.40-1.81 ; Blood type O: AOR-0.82, 95% CI-0.49-1.02 ; Rhesus positive group : AOR-1.12, 95% CI-0.92-1.48.

TABLE II : Demographics with blood types

Blood type	AOR	95% CI	p value
A	Ref *		
B	0.69	0.44-1.12	0.27
AB	0.67	0.40-1.81	0.62
O	0.82	0.49-1.02	0.20
Rhesus positive	1.12	0.92-1.48	0.11

* Adjusted for gender and rhesus factor

In relation to whether symptomatic COVID-19 paediatric patients, hence the disease severity, the study whether there is a correlation with positive testing, blood type A and B had higher odds of testing positive for the disease (Blood type A: AOR-1.30, 95% CI-1.12-1.65 ; Blood type B: AOR-1.21, 95% CI-0.94-1.38). Blood type O was associated with lower chances of testing positive (Blood type O: AOR-0.81, 95% CI-0.72-0.90). Blood type AB had no correlation with positive testing (Blood group AB: AOR-1.00, 95% CI-0.92-1.17). Rhesus positive blood was associated with higher chances and odds of positive testing (Rhesus positive : AOR-1.12, 95% CI-1.01-1.37) as shown in Table III.

Table III : Rate of symptomatology by blood type

Blood type	N positive (%)	Symptoms present	AOR (95% CI)	p value
A	23 (30.7%)	14 (60.9%)	1.30 (1.12-1.65)	0.096
B	20 (26.7%)	12 (60.0%)	1.21 (0.94-1.38)	0.088
AB	11 (14.7%)	4 (36.4%)	1.00 (0.92-1.17)	0.26
O	21 (28.0%)	9 (42.9%)	0.81 (0.72-0.90)	0.041
Rhesus positive	64 (85.3%)	34 (45.3%)	1.12 (1.01-1.37)	0.58

DISCUSSION

In this study there was no independent correlation with the COVID-19 disease and its association between ABO blood type.

There was an association between disease positivity and symptomatology in regards to certain blood types. Blood type A had a higher frequency of positive testing along with blood type B. Blood type AB showed no correlation with positive testing. In comparison to the study by Zhao et al., blood type A had a lower frequency of disease positivity than blood types B and AB. In this study, blood type O showed a less chance of testing positive for the COVID-19 disease. This is similar to studies done by Zhao et al., Barnkob et al., Li et al., and Hoiland et al. The results were varied from the study done by Zietz et al. Rhesus positivity showing higher chances of testing positive is similar to a study done by Latz et al., but as their study also mentions, requires further investigation, as rhesus negative blood types less in number and only were 10-20% within the blood groups.

LIMITATIONS

With a very small sample size, of 113 paediatric patients, out of which only 75 had a known or tested blood group type documented. In various studies and articles, COVID-19 positive paediatric patients have been relatively

asymptomatic or mildly symptomatic, leading to a bias in the results. In this study, no control group was assessed during the pandemic, which would have added to the results.

CONCLUSIONS

Although blood type alone was not associated with the disease, paediatric patients with a symptoms showed higher levels of positive testing with blood types A and B and Rhesus positive, and less likely with blood type O.

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