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An Insight into ABO Blood Group and Susceptibility to COVID19 (SARS-CoV-2) in Darjeeling Hill Region, West Bengal, India

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Author's contribution

The sole author designed, analysed, inteprted and prepared the manuscript.

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ABSTRACT

Introduction: Recent research studies have linked the relationship between ABO blood group and COVID19infection. The study aims to analyze the possibility of a correlation between the ABO blood group distribution and its possible impact on the infection and susceptibility to COVD19 virus in Darjeeling.
Methods: A total sample of 234 COVID19 positive patients confirmed by the severe acute respiratory syndrome, corona virus test (RT-PCR) were collected from Darjeeling District Hospital, Darjeeling (COVID Cell Records). The patients were visited in their given address and were asked to fill up a questionnaire.

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Results: The 234 COVID-19-infected patients were of blood group, A (55.4%), B(20.9%), AB(11.8%), O (23.6%), 97.86% were Rh positive. A statistically significant association of severe acute respiratory syndrome coronavirus 2 infection was observed for blood group A (55.4% vs 34.34%; odds ratio=1.83, 95% confidence interval=1.41–2.37). The association of SARS Coronavirus 2 for blood group AB was (11.8% vs 9.6%; odds ratio=1.18, 95% confidence interval=0.78–1.78). However, there was no association of severe acute respiratory syndrome coronavirus 2 infection for, B (20.9% vs 22.66%; odds ratio=0.84, 95% confidence interval=0.60–1.16) and with O (23.6% vs 30.37%; odds ratio=0.513, 95% confidence interval=0.35–0.70).
Discussion: This study reported blood group A to be most susceptible and blood group O least susceptible to severe acute respiratory syndrome coronavirus 2 infection which was found to be strikingly consistent with findings of the Meta-analysis of data from Wuhan, Shenzhen and NYP/CUIMC. Distributions of blood groups between New York City data from the NYP/CUIMC EHR system.

Keywords: COVID19 infection; severe acute respiratory syndrome; ABO blood group; Darjeeling Hill Region.

1. INTRODUCTION

"Coronaviruses (CoV) are a large family of viruses that cause illness ranging from the common cold to more severe diseases such as Middle East respiratory syndrome (MERS)-CoV and severe acute respiratory syndrome (SARS)-CoV. The World Health Organization (WHO) Emergency Committee on 30th of January 2020 declares severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) a global health emergency based on growing case notification rates at Chinese and international locations" [1]. "The first case of coronavirus disease 2019 (COVID-19) was officially reported in India on January 27, 2020" [2].

"ABO and Rh blood group systems have be known to be associated with many diseases including cancerous, infectious, non-infectious, bacterial and viral diseases. Studies have reported the association of blood groups A and O with higher and lower odds for coronavirus disease 2019 positivity, respectively" [3-7]. "Recently, a study on COVID-19 patients in Wuhan and Shenzhen, China discovered associations between ABO blood types and infection" [3]. "Michael Zietz and Nicholas P. Tatonetti further investigated the association between ABO+Rh blood type and SARS-CoV-2 by using observational data on 1559 individuals tested for SARS-CoV-2 with known blood type in the New York Presbyterian (NYP) hospital system" [8]. "The relationship between ABO blood group and the development of severe acute respiratory syndrome coronavirus (SARS-CoV) infection in a group of health care workers who were exposed to an index SARS patient and who were not wearing any personal protective equipment was reported" [5].

"Subsequently various studies were reported regarding Epidemiological and clinical characteristics, risk factors for mortality of patients infected with SARS-CoV-2, and risk factors in the susceptibility to SARS-CoV-2 included age and chronic disease have been reported" [9-12]. "A number of risk factors for COVID-19 infection, morbidity, and mortality are known, including age, sex, and a number of chronic conditions and laboratory findings" [3]. "The novel Coronavirus disease (COVID-19, caused by the SARS-CoV-2 virus) has in a short duration spread rapidly across the globe" [13-14]. "The novel coronavirus is related to the viruses that cause the deadly diseases severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS)" [15].

In our study an attempt is made to analyze the possibility of a correlation between the ABO blood group distribution and its possible impact on the infection and susceptibility to COVD19 virus in Darjeeling Hill Region. Furthermore only a very limited studies has been conducted to understand the distribution of ABO group frequency and its association with COVID19 infection. The ABO blood group frequency study does give us an insight into various aspects of the infectious disease and will help in the long run to efficiently manage the deadly pandemic.

2. METHODS

2.1 Study Design

The case study was conducted from May 2022 to October 2022 in the Darjeeling District of the state of West Bengal. A list of COVID-19 positive cases confirmed by the severe acute respiratory

syndrome, corona virus test (RT-PCR) were taken from Darjeeling District Hospital, Darjeeling (COVID Cell Records) and COVID Help Desk. During the survey study period, several hundred COVID19 cases were reported in the district, out of which only a total 234 COVID19 positive patients volunteered to participate in the case study. The participating cases were contacted by telecommunication and after taking prior consent; the cases were visited in their given address and were asked to fill up a questionnaire. The data collected took into account the patient's name, sex, age Blood Group type, profession, co-morbidity, whether type of vaccine, treatment, post covid complications etc.

The distribution of A,B,AB,O blood group in General Population (Control) was determined from 9030 individuals, from Darjeeling Hill Region. The collection of ABO Blood group data was collected from Blood donation camps organized by Red Cross Society, Darjeeling, and collection of data was also done from the recorded data of District Hospital, Darjeeling and Primary Health care units in Darjeeling rural areas, Sub-Divisional Hospital, Kurseong. Further, blood group data of individuals were also collected from diagnostic laboratories.

2.2 Statistical Analysis

The data were entered in Excel and analyzed using the Statistical Package for Social Sciences version 20. Data were expressed in percentage, mean value, median, Chi-square test was used to determine the association of SARS-CoV-2 infection in ABO blood groups. The odds ratio (OR) at 95% confidence interval (CI) was presented to show the strength of association. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

The prevalence of the distribution COVID19 (SARS-CoV-2) infection and susceptibility in Darjeeling Hill population and its possible correlation with ABO blood group frequency were studied. A total sample of 234 COVID19 positive patients confirmed by the severe acute respiratory syndrome, corona virus test (RT-PCR) were collected from Darjeeling District Hospital, Darjeeling (COVID Cell Records) and the patients were visited in the given address and were asked to fill up a questionnaire. A prior consent was taken from the patients for the collection of COVID19 related data.

In the 234 COVID-19-infected patients, the frequencies of A, B, O, and AB were A (55.4%), B(20.9%), AB(11.8%), O (23.6%). Of the patients, 98.12% were Rh positive. Comparative study of ABO distribution prevalence of the COVID19 patients from Darjeeling (Table 1) was made with the ABO distribution pattern seen in general population in Darjeeling Hill Region.(Table 2). "The prevalence of the distribution of A,B,AB,O blood group in General Population was determined for total 9030 individuals, out of which 7124 and 1906 individuals were from Darjeeling and Kurseong respectively(Darjeeling Hill Region). The frequency of ABO blood group distribution in the Darjeeling Hill Region were A (37.34%) and O (30.37%) followed by B(22.66%), AB (9.61%)), The frequency was in the order of A>O>B>AB" [16].

Table 1. Distribution of ABO blood group in COVID19 positive patients in Darjeeling Hill region

Blood group	COV+ Patients	COV+ Patient %
A	122	55.4%
B	46	20.9%
AB	26	11.8%
O	42	23.6%

Table 2. Distribution of ABO blood group in General population in Darjeeling Hill region [9]

Blood group	General Population	Population (%)
A	3372	37.34%
B	2047	22.66%
AB	868	9.61%
O	2743	30.37%

On comparing COVID19 population and General population (Control) of Darjeeling Hill Region, it was seen that blood group A (Fig. 1) was significantly more frequent and the blood group O (Fig. 2) was less frequent in COVID-19 patients as compared to the control group. Blood Group A(Fig. 1) had a significantly higher risk for COVID-19 infection as compared to non-A blood groups, whereas Blood group O (Fig. 2) had a significantly lower risk for the infectious disease compared with non-O blood groups (Table 3).

The current study revealed that a statistically significant association of severe acute respiratory syndrome coronavirus 2 infection was observed for blood group A (55.4% vs 34.34%; odds ratio=1.83, 95% confidence interval=1.41–2.37). The blood group AB between COV+ and general population (11.8% vs 9.6%; odds ratio=1.18, 95% confidence interval=0.78–1.78). However, there was no association of severe acute respiratory syndrome coronavirus 2 infection for, B (20.9% vs 22.66%; odds ratio=0.84, 95% confidence interval=0.60–1.16) and O (23.6% vs 30.37%; odds ratio=0.513, 95% confidence interval=0.35–0.70).

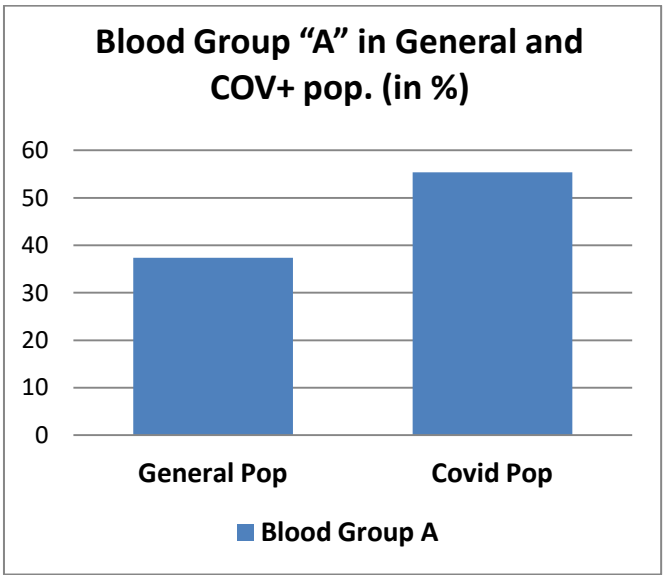

Fig. 1. Comparison of Blood Group “A” in general and COV+ pop (In Darjeeling Hill Region)

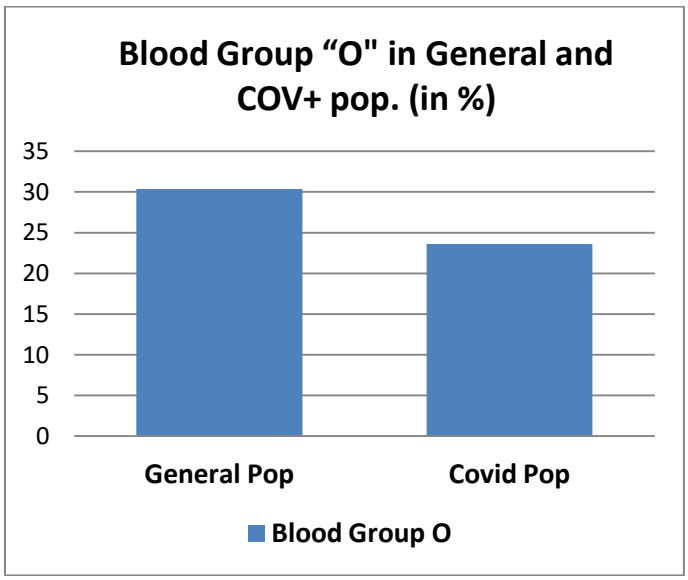

Fig. 2. Comparison of Blood Group “O” in General and COV+ pop (In Darjeeling Hill Region)

Table 3. ABO blood group distribution difference between COVID SAR2 patients and General public of Darjeeling region

ABO blood groups	A	B	AB	O	
Darjeeling general Pop. n(%)	3372 (34.34%)	2047 (22.66%)	868 (9.61%)	2743 (30.37%)	
COV+ Patients, n(%)	122 (55.4%)	46 (20.9%)	26 (11.8%)	42 (23.6%)	
χ2	19.23	0.3005	1.0996	2.68	
p-value	0.000012	0.583	0.2943	0.1012	
OR	1.83	0.84	1.18	0.513	95%
CI	1.41 – 2.37	0.60 - 1.16	0.78 - 1.78	0.35 - 0.70	

OR: odds ratio; CI: confidence interval; P-valve at p<0.05

"In this regard a similar study was designed to investigate the relationship between the ABO blood group and COVID-19 susceptibility by Jiao Zhao, of The Southern University of Science and Technology, Shenzhen, and colleagues looked at blood types of 2,173 patients with COVID-19 confirmed by the severe acute respiratory syndrome, corona virus test from 3 hospitals in Wuhan (Jinyintan), Wuhan (Renmin)and Shenzhen, China, with normal individuals in corresponding regions" [3] (Table 4). "Michael Zietz and Nicholas P. Tatonetti further investigated the association between ABO+Rh blood type and SARS-CoV-2 by using observational data on 1559 individuals tested for SARS-CoV-2 with known blood type in the New York Presbyterian (NYP) hospital system" [8]. It was found that individuals with blood types "A" group (A-positive, A-negative and AB-positive, AB-negative) were at a higher risk of contracting the disease as compared with non-A-group types (Fig. 3) People with "O" blood had a lower risk of getting infection as compared to other types (Fig. 4).

It is significant to note that data analysis of COVID19 infection of Darjeeling Hill Region for Blood Group "A" (Fig. 1) and blood Group "B" (Fig. 2) was found to strikingly correlate with findings of the Meta-analysis of data from Wuhan, Shenzhen [3] and NYP/CUIMC.

4. DISCUSSION

From the data analysis of the COVID19 patients from the Darjeeling Hill Regions, it was seen that blood group A was found to be more susceptible to COVID-19 infection, whereas population with blood groups O at a lower risk of COVID-19 infection. In the current study a consistent negative association was seen between O blood groups and COVID-19. These results are consistent with an association discovered for SARS-CoV-1, in which O blood groups were significantly less common among SARS patients. The literature suggests that blood type O may serve as a protective factor, as individuals with blood type O are found COVID-19 positive at far lower rates. This could suggest that blood type O individuals are less susceptible to infection, or that they are asymptomatic at higher rates and therefore do not seek out testing.

"The variation in susceptible to COVID-19 infection is speculated to be a result of potentially numerous factors including ABO antibodies, levels of interleukin-6, carbohydrate clustering, and transmembrane proteases" [17-19]. "The higher levels of interleukin-6 in blood group O may contribute to the lower risk of SARS-CoV-2 infection" [20]. "The higher titer of anti-A and anti-B antibodies have been speculated to provide protective role against SARS-CoV-2 virus by neutralizing its proteins" [21]. "There have been studies indicating the predictive effect of ABO blood groups on the Helicobacter pylori, Norwalk virus, and SARS-CoV" [22].

"Genetic associations and potential molecular mechanisms that drive the relationship between blood type and COVID-19 were studied and a strong association between a locus on a specific gene cluster on chromosome three (chr3p21.31) and outcome severity, such as respiratory failure" [18].

"Cellular models have suggested an explanation for blood type modulation of infection, evidencing that spike protein/Angiotensin-converting enzyme 2 (ACE2)-dependent adhesion to ACE2-expressing cell lines was specifically inhibited by monoclonal or natural human anti-A antibodies" [18]. The study explains why an individuals with non-A blood types, specifically O, or B blood types, which produce anti-A antibodies, may be less susceptible to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection due to the inhibitory effects of anti-A antibodies.

Table 4. Meta-analysis of data from Wuhan, Shenzhen [3] and NYP/CUIMC. Distributions of blood groups between New York City data from the NYP/CUIMC EHR system [8]

Blood group	NYP general pop.	NYP COV+	Shenzhen general pop.	Shenzhen COV+	Wuhan general pop.	Wuhan Jinyintan COV+	Wuhan Renmin COV+
A	32.7% (35643)	34.2% (233)	28.8% (6728)	28.8% (82)	32.2% (1188)	37.7% (670)	39.8% (45)
B	14.9% (16229)	17% (116)	25.1% (5880)	29.1% (83)	24.9% (920)	26.4% (469)	22.1% (25)
AB	4.2% (4582)	3.1% (21)	7.3% (1712)	13.7% (39)	9.1% (336)	10% (178)	13.3% (15)
O	48.1% (52406)	45.7% (312)	38.8% (9066)	28.4% (81)	33.8% (1250)	25.8% (458)	24.8% (28)

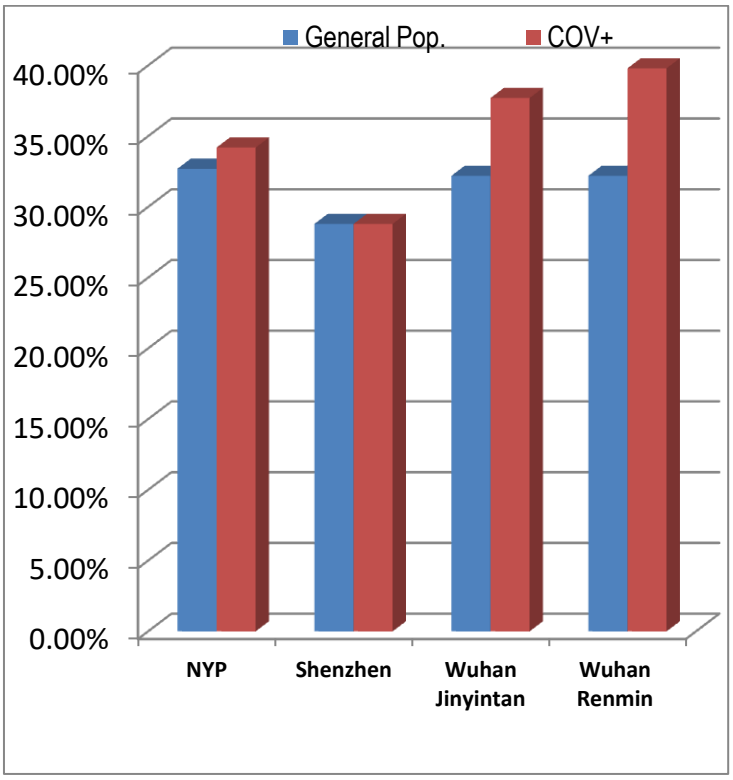

Fig. 3. Comparison of Blood Group "A" in General and COV+ pop [8]

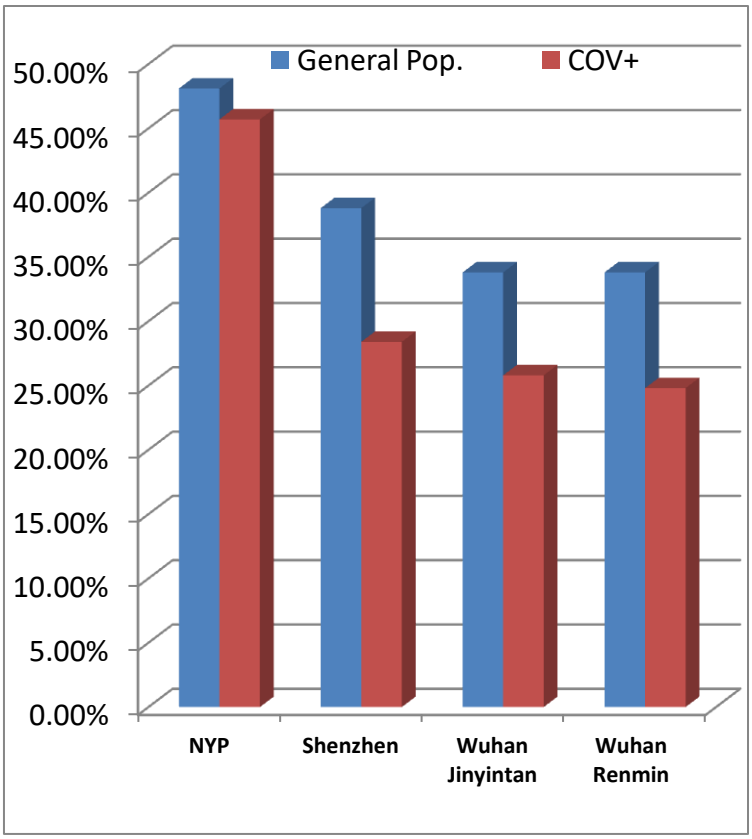

Fig. 4. Comparison of Blood Group "O" in General and COV+ pop [8]

"It is to be noted that recent studies from various locations have shown contrasting results and some have failed to show any association" [23-27]. No association was found between blood groups and susceptibility to severity of disease and mortality in this study.

"A meta-analysis of NYP data and the data reported from the China study found enrichment for A and B and depletion of O blood groups among COVID-19 patients compared to the general population" [8]. "Pooled data analyses conducted by the researchers showed that blood group A had a significantly higher risk for COVID-19 infection as compared to non-A blood groups, whereas blood group O had a significantly lower risk for the infectious disease compared with non-O blood groups" [3].

5. CONCLUSION

The recent pattern of COVID19 (SARS-CoV-2), infection, susceptibility and mortality has a definite correlation with the ABO blood group frequency in the population. The ABO blood group frequency study does give us an insight into various aspects of the infectious disease and will help in the long run to efficiently manage the deadly pandemic. Moreover the present data may also be useful in population genetics studies, population migration patterns, forensics and genetic studies and genetic counseling and investigating disease infection.

CONSENT

A prior consent was taken from the patients for the collection of COVID19 related data.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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