A STUDY OF BLOOD GROUP IN COVID-19 PATIENTS IN TERTIARY CARE HOSPITAL OF AHMEDABAD CITY, GUJARAT, INDIA - AN INSTITUTIONAL STUDY

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ABSTRACT

Introduction: The associations between ABO system of blood and COVID-19 infection in various studies provide reason to think true associations may be in reality between blood type and incidence of COVID-19 and death due to COVID-19. **Objectives:** To estimate frequency of COVID-19 illness in different ABO blood systems and also to find linkage between the ABO system of blood and degree of COVID-19 illness. **Methods:** A prospective cohort study was conducted on all COVID-19 patients (Patients were grouped A positive and A negative blood groups into 1st group and other blood types such as B, AB, and O, irrespective of their Rh status, into 2nd group) admitted at Tertiary Care Hospital of Ahmedabad City, Gujarat, India during the four months of study duration. **Results:** COVID-19 infection was found in 380 (63.3%) male. Mean age was 56.46 ±15.35 years in which 26.8% patients were in age group of 60 to 70 years. Among total 600 patients, 35% of patients were having B positive type of blood followed by O positive type of blood (25%). There were 25% of patients having overall co-morbidity like diabetes. And 8% of B positive patient having co-morbidity and amongst the, 1.2% patients were admitted to Intensive Care Unit. Case fatality rate was 7.5%. Among B positive blood group patients, 37.8% deaths occurred. **Conclusion:** Patients having blood group O may have lower chances of ICU admission as compared to other blood groups.

Keywords: Blood group, COVID-19, Comorbidity, ICU, Mechanical Ventilation

INTRODUCTION

Virus SARS-COV2, the infectious agent for COVID-19 illness, is a great public health threat and the world is facing the COVID-19 pandemic (Rothan and Byrareddy, 2020). The global population is affected greatly by SARS-COV2 virus; those who are elder, male and with associated illnesses such as coronary heart disease, high blood pressure, higher blood sugar, and respiratory diseases have demonstrated additional susceptibility to severe disease (Shi et al., 2020).

Histo-blood group antigens is human cells and tissues that include red cells which contain complex carbohydrate-based antigens. Histo-blood group antigens are expressed on the plane of the red blood cell (RBC) membranes and play a vital part in acquiring or reducing the probability of getting COVID-19 infection (Bai et al., 2020; Lai et al., 2020; J and R, 2017). Various research studies have been done to know the percentage of various types of

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blood groups in COVID-19 patients and to know the impact of the ABO blood system on getting the COVID-19 illness. (Lei and Hilgenfeld, 2017;VM et al., 2018; Lu et al., 2020; S et al., 2020;; N et al., 2020; Wu et al., 2020).

At this time, many research studies have suggested a linkage between various ABO blood grouping and chances to get COVID-19 illness, its importance in the development of the illness in patient, and consequences of the disease. In a number of research findings, the linkage between the ABO blood system and COVID-19 was found. According to various published studies, protective effect was shown by blood group O against COVID-19 illness. People with O type of blood group have low chances of developing COVID-19 illness and those of blood group O are also less susceptible to infection, or most of the patients having O blood group are asymptomatic so these patients do not seek out COVID-19 testing (Zhang et al., 2021).

Various modifiable and non-modifiable factors responsible for development of COVID-19 illness and death are already known, including increasing age, gender, high risk behavior like smoking habit, high blood pressure, diabetes mellitus and chronic coronary and vascular diseases and respiratory illness. The linkage observed between the ABO blood system and COVID-19 infection in various studies provides reason to think true associations may be in reality between the ABO system and incidence of COVID-19 and COVID-19-related death (Zietz, Zucker and Tatonetti, 2020a).

The incidence, severity of the disease, and deaths due to COVID-19 infection were usually found in A or B or AB blood group people while blood type O had protective effect against the COVID-19 illness (Samra, Habeb and Nafae, 2021).

Blood group having Rh - negative may protect against the risk of mechanical ventilation (intubation) and death (Zietz, Zucker and Tatonetti, 2020b).

There are studies done in 2021 which established the linkage between the ABO blood system and development of COVID-19 illness. Linkage of the ABO blood system with severity and deaths in patients of blood transfusion during their admission to hospital was found. A type of blood and O type of blood of COVID-19 blood donors present a high and low possibility of getting COVID-19, respectively. Risk of death among A type group was significantly bigger than in O type patients (Muñiz-Diaz et al., 2021). In a study conducted in the United States of America (USA), blood type O (45%) was the most common reported in COVID-19 patients. But, there was no relationship established between any type of blood and severity of COVID-19 illness even in hospital admission and intubation (CA et al., 2020).

Finding the determinants associated with development of COVID-19 disease is critical to ensure that those people at great probability of getting infection can think of additional steps for prevention of getting the COVID-19 infection. In addition to the above, identifying patients having more chances for development of severe disease or higher risk of death may guide practicing doctors better for anticipating patient end results, permitting for further focused allocation of bounded critical care materials, money and staff of the nation during the global pandemic of COVID-19.

The ABO blood system may impact getting COVID-19 and the severe degree of the disease. This research is to compare whether blood type is linked for risk of developing COVID-19 illness and death.

METHODS

A prospective longitudinal study was conducted on all COVID-19 patients admitted at COVID-19 designated hospital of Ahmedabad City for the study period through pre-tested and pre-structured questionnaire. All COVID-19 patients admitted at the designated tertiary care

hospital of the Ahmedabad city between August and November, 2020 were included in the current study. The selection of the participants was limited to COVID-19 patients who were above 18 years of age with confirmed COVID-19 infection. In this study, patients admitted during the study period were purposively included in the study. Study participants included all COVID-19 positive in-patients (RT-PCR test positive or Rapid Antigen Test - RAT test Positive) admitted at a tertiary care Covid hospital during a four month period.

Patients who have blood disorders like hemoglobinopathies, and also laboratory confirmed negative for COVID-19 by RT-PCR assay for both groups were excluded from the current study. For the association, two groups of patients were made. Patients were grouped A positive and A negative blood groups into 1st group (Exposed) and other blood types such as B, AB, and O, irrespective of their Rh status, into 2nd group (Non-exposed). An assumption was made that the expected proportions to be cured from COVID-19 by day 14 in 1st group (blood group A) and in 2nd group (blood groups B, O, AB) are 70% and 90%, respectively. Thus, we required a total of 527 samples at a 1:2 ratio, which would provide a power of at least 98% in two-tailed tests and a p value less than 0.05, to detect significant differences between the groups. Therefore, considering a 10% dropout rate, we needed 580 samples in total (Sample Size Calculator by Raosoft, Inc., 2022).

Outcomes of all patients were recorded and all patients were followed till discharge or death. No loss to follow-up and drop out of patient happened during the study period. Exposure was defined as patients having blood group "A" while patients having other blood group "Non-A" were unexposed group during the analysis of the data. Out of total 602 patients who were screened, a total of 600 patients were eligible and enrolled in the study. Total 45 patients died due to COVID-19, and 555 patients completed the follow-up. The statistical analysis was done for 600 patients.

Outcome variables were death, discharge patients, ICU admission. Independent variables were age, sex, blood group, Rh status, comorbidity. Data were entered in MS Excel sheet. All statistical analyses (percentage, mean, $\chi 2$ test, p value) were conducted in Microsoft Excel and WHO Epi info version 7.2.The current study was sanctioned by Institutional Committee of Ethics & Clinical Trial Registration (CTRI) number for this COVID-19 trial is CTRI/2021/01/030344.

RESULTS

There were 220 females (36.7%) and 380 males (63.3%) in the current study (n=600).

Table 1. Basic characteristics of COVID-19 patients stratified by types of blood group

Characteristics	Blood Group				$\chi 2$ test (p value)
	O	A	B	AB	
Gender					
Female	60	60	81	19	1.2 (0.76)
Male	107	89	147	37	
Age groups (in years)					
15-25	04	03	08	01	25.7 (0.10)
25-35	18	13	24	03	
35-45	24	17	24	13	
45-55	26	23	35	12	
55-65	51	58	60	10	
65-75	32	22	51	15	
>=85	12	13	26	02	
Comorbidity status					
Present	48	38	57	13	1.0 (0.80)
Absent	119	111	171	43	

As shown in Table 1, the Male : Female ratio was 1.72 having COVID-19 infection (n=600). Males were almost 1.7

times acquiring COVID-19 infection as compared to females. Mean age was 56.46 ±15.35 years in which 29.8% COVID-19 patients fell between 55-65 years of the age group. Distribution of the ABO blood system group in COVID-19 patients was as 35% patients having B+ (positive) blood group followed by O+ (positive) blood group (25%), A+ (positive) blood group (23%), AB positive (25%), B negative (3%), O negative (2%). There were 26% of patients having overall co-morbidity like diabetes, hypertension, kidney injury, coronary artery disease, emphysema, chronic bronchitis, cancer, etc. Among a total 156 COVID-19 patients having comorbidity, death occurred in 18 (11.5%) patients while among a total 444 COVID-19 patients not having any comorbidity, death occurred in 6.1% patients. There were 8% patients of the B blood group positive patients having comorbidity like diabetes, hypertension, etc., and amongst them 1.2 % patients were required to be admitted into Intensive Care Unit (ICU) and 0.8% were on artificial respiration (mechanical ventilation).

Table 2. Outcome of COVID-19 patients in accordance to blood group

Blood group	**Rh status**	**Discharged**	**Death**	**χ2 test (p value)**
A	Positive	129	09	7.74 (0.051)
	Negative	10	01	
	Total	139	10	
B	Positive	194	17	
	Negative	15	02	
	Total	209	19	
AB	Positive	48	04	
	Negative	04	00	
	Total	52	04	
O	Positive	142	12	
	Negative	00	13	
	Total	142	25	

Case fatality rate was 7.5% and amongst 45 total deaths, 37.8% deaths occurred in B positive blood group patients. Table 2 depicts that statistically significant difference was not observed for ABO blood system and survival of patients suffering from COVID-19 illness. (χ2 value 7.74, p value 0.051).

Table 3. Relationship of ABO blood system and comorbidity with the degree of severity of COVID-19

Comorbidity	**Blood group**	**Discharged (%)**	**Death (%)**	**χ2 test (p value)**
Present	A	31 (81.6)	07 (18.4)	4.95 (0.03)
	B	52 (91.2)	05 (8.8)	
	AB	12 (92.3)	01 (7.7)	
	O	43 (89.6)	05 (10.4)	
	Total	138 (88.5)	18 (11.5)	
Absent	A	108 (97.3)	03 (2.7)	
	B	157 (91.8)	14 (8.2)	
	AB	40 (93.0)	03 (7.0)	
	O	112 (94.1)	07 (5.9)	
	Total	417 (93.9)	27 (6.1)	
Total		555 (92.5)	45 (7.5)	

Table 3 shows that outcomes with ABO blood system of COVID-19 patients were significantly associated (p value 0.051). The association of outcome of COVID-19 patients with comorbidity was also significant (χ2 test value 4.95**,** p value 0.03). There were 11.1% patients having comorbidity.

There was no significant linkage established between both ABO-Rh system of blood grouping and severity of COVID-

19 illness ($\chi 2$ 1.6, p value >0.05). In the present research study, 10.7% people having AB blood group were admitted in Intensive Care Unit following A grouping (8.7%), B grouping (8.3%) and lastly amongst O Blood grouping (6.0%). A total 8% COVID-19 patients ICU care facilities as they developed into severe disease.

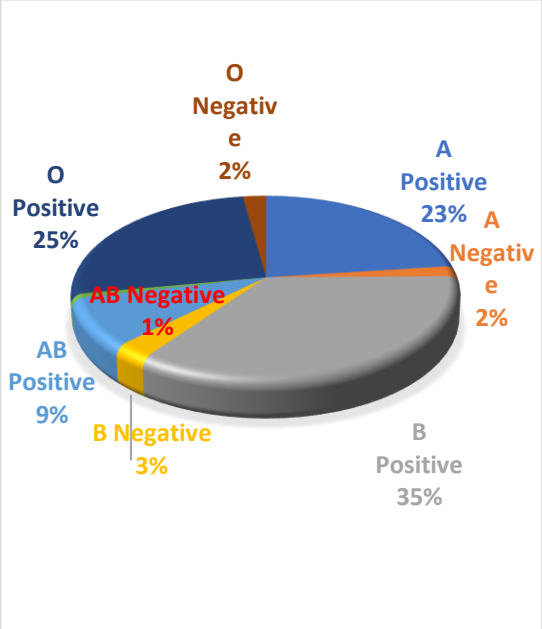

Figure 1. ABO group distribution of COVID-19 indoor patients

Figure 1 shows that the maximum patients were blood group A (35%) followed by O positive (25%).

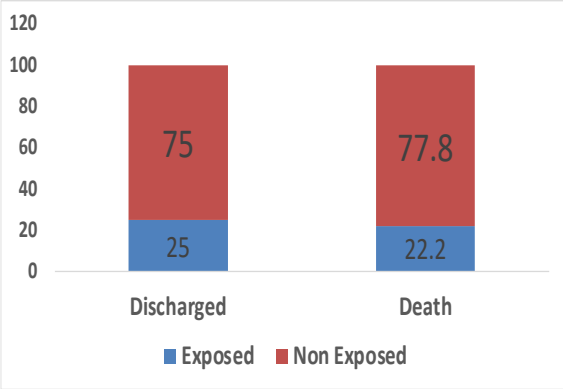

Figure 2. Outcome of COVID-19 patients according to exposure status

Figure 2 shows the outcome (death) was 7.5 % for the total population (n=600), 10 (22.2%) in 1st group, and 35 (77.8%) in 2nd group (RR, 0.87; 95% CI, 0.44–1.70; p = 0.68).

Table 4. Association of ABO blood system with admission in intensive care unit of COVID-19

ABO System Of Blood	ICU admission required (%)		$\chi 2$ test (p value)
	Yes	No	
A	13 (8.7)	136 (91.3)	1.62 (0.66)
B	19 (8.3)	209 (91.7)	
AB	06 (10.7)	50 (89.3)	
O	10 (6.0)	157 (94.0)	
Total	**48 (8.0)**	**552 (92.0)**	

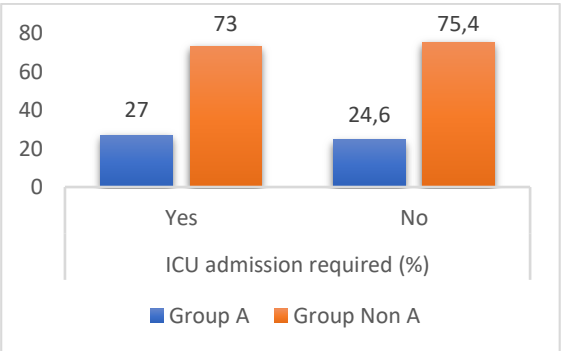

Figure 3. Risk ratio of blood group according to their ICU admission

Figure 3 depicts the Relative Risk (RR) among exposed group A and non-exposed group (Non-A) was found 1.12 (CI 0.61 to 2.06, p value 0.7062).

DISCUSSION

COVID-19 infection was found in 380 (63.3%) males. Mean age was 56.46 ±15.35 years in which 26.8% patients were in age group of 60 to 70 years. Among a total 600 patients, 35% of patients had B positive type of blood followed by O

positive (25%). There were 25% of patients having overall co-morbidity like diabetes and 8% of B positive patients having co-morbidity and, amongst them, 1.2% patients were admitted to Intensive Care Unit. Case fatality rate was 7.5%. Among B positive blood group patients, 37.8% deaths occurred.

The outcome (death) was 7.5% for the total population (n=600), 10 (22.2%) in 1st Group, and 35 (77.8%) in 2nd Group (RR, 0.87; 95% CI, 0.44–1.70; p = 0.68). Numerous research studies have also been found to establish linkage between COVID-19 disease incidence and the ABO blood system. In the current study, 380 male (63.3%) out of total 600 patients were having COVID-19 infection. In another study conducted at the state of Massachusetts, 1289 tested COVID-19 positive with a common studied blood type. A total 123 (9.5%) out of 484 were admitted to the Intensive Care Unit, 108 patients (8.4%) needed intubation to provide mechanical ventilation, three (0.2%) required extracorporeal membrane oxygenation (ECMO) and out of that 89 (6.9%) died. As many as 34.2%, 15.6%, 4.7% and 45.5% COVID-19 patients had blood type of A, B, AB, and O, respectively. No linkage was found between the ABO system and severe condition of COVID-19 illness described as mechanical ventilation - intubation or death (Latz et al., 2020) while in a large multi-institutional retrospective review, data differed to the study of Zhao et al. (2020) in the Wuhan incident as they found a linkage between ABO system of blood and deaths.

In another study, of COVID-19 disease patients, 32.9% were male, and the patients had 52 years of median age (interquartile range (IQR) 40-67) (Barnkob et al., 2020). Most common blood group among COVID-19 patients was B positive (35%) followed by O positive (25%), and blood group A (23%). In a similar type of research study, percentage of A type of blood among COVID-19 disease patient was in range of 28.8% and 44.4% (Pourali et al., 2020). Amongst total participants of the control group, authors found an excessive numbers of blood group O (46.46%), followed by B (24.57%), A (21.91%) and AB (7.06%).

In a study conducted at Dhaka Medical College Hospital, among the infected individuals, patients having blood group A were 32.8%, blood group B were 33.7%, blood group O were 21.5%, and blood group AB were 11.9%. (Mahmud et al., 2021a). In other study carried out by the blood centre of Dhaka Medical College, the percentage of various ABO systems among people were 21.8%, 37.5%, 8.9% and 31.8% blood group A, B, AB, and type O. respectively. Blood group A was observed more among the patients positive for COVID-19. (Karim et al., 2015). In many studies, significant difference was established in the distribution of the ABO system in the COVID-19 patients. In COVID-19 patients the ratio of blood group A to O was the reverse of the ratio observed among healthy volunteers in the control group. Observed results in cohort of convalescent blood donors previously who got infection with virus SARS-CoV2, found group A patients were more common than non-A patients (OR: 1.2; 95% CI: 1.1–1.4; $p<0.05$), while donors having O blood group were under-represented in contrast to non-O donors (OR: 0.8; 95% CI: 9 [0.7–0.8]; $p<0.05$) and the variations were very statistically significant (Muñiz-Diaz et al., 2021).

Data from one study at Vancouver General Hospital found high percentage of COVID-19 patients with blood group A or AB that required mechanical ventilation compared with patients with blood group O or B (Hoiland et al., 2020). Rh status of blood group and severe degree of COVID-19 was not found significant (p value >0.05). ICU admission was required less (6%) in COVID-19 patients having O blood group than other blood group patients. In comparison with type O blood group, blood group A was not linked with hospitalization (OR, 0.89 [95% CI, 0.80-0.99]; p value

0.03), or ICU admission (OR, 0.84 [95% CI, 0.69-1.02], p value 0.08). likewise, types B and AB were not linked with fatal consequences more than type O (Anderson et al., 2021). A total 27% patients admitted in exposed group required ICU admission as compared to 24.6% among non-exposed (Non-A blood group). The Relative Risk (RR) among exposed group A and non-exposed group (Non-A) was found 1.12 (CI 0.61 to 2.06, p value 0.7062).

According to research studies conducted among patients having positive RT-PCR for SARS-Cov 2019, blood group was associated with chances of mechanical ventilation (intubation) or death. A blood group had no significant association with COVID-19 illness, a greater number of COVID-19 illness was found among participants having blood group B; blood group AB was also associated with greater number of positive COVID-19 cases, while blood group O was linked with lower rate of positivity of COVID-19. Patients with blood group types B and type AB who underwent COVID-19 testing were more likely to get positive results as compared to people having Rh+ positive status, and O blood group people were less likely to get positive results. (CA et al., 2020). In a study conducted in Brazil, no such significant relationship between the ABO system with ICU admission rate and deaths was observed in different research studies (Yaylacı et al., 2020)

According to a scientific report published by Marwa Ali Almadhi, of COVID-19 patients requiring ICU admission, 40.8% had blood group O, 30.1% were B group, 23.5% were blood group A, and 5.6% were hAB group. Of the total COVID-19 positive patients who didn't require ICU admission, 45.8% had O type of blood, 27.4% had B type, 21.8% were of blood group A, and 5.0% were of AB type. No significant difference in distribution among blood groups was observed (1.9, p value 0.60). Also there was no significant association found to severe illness of COVID-19 disease with the ABO system (Ali Almadhi et al., 123AD). In other study, it was found probability of testing COVID-19 positive and degree of severe COVID-19 illness may be low among people having O type of blood and Rh-negative blood groups (Ray et al., 2021). There were mostly similar results found in distribution of the blood group B amongst COVID-19 patients (35%) and amongst general population (35.5%) in India (Agrawal et al., 2014). Acik and Bankir (2021) also observed no significant linkage between ABO blood system and other patient's characteristics and other clinical features and deaths in a study conducted in Adana, Turkey (. In a similar study conducted in Bangladesh, 16.1% patients were deteriorated to the next level of severe disease, including 20.6% in 1st group and 13.9% in 2nd group (RR, 1.49; 95% CI, 0.94–2.35; p = 0.09). The number of patients who remained positive after 14 days of testing was 13.7%; among them, 19% patients were in 1st group and 11.1% were in 2nd group (RR, 1.71; 95% CI, 1.04–2.81; p = 0.04).(Mahmud et al., 2021b).

In the present study, there was association found between the incidence of disease, degree of severity, and death rate of COVID-19 with the ABO blood system. There was incidence of severity of disease more common in patients having other than type O blood group while O blood group has protective effect against severe COVID-19 illness. But due to limited sample size it may not be generalized to the general population. More research studies are needed to establish the linkage between the ABO blood system and degree of severity of COVID-19 illness. Here also in the current study, we have included only hospitalized COVID-19 positive cases.

The study may give clues to clinicians about patients' susceptibility and development of severity in respect to blood group. Findings of the study can be incorporated in hospital policy for better patient management. In addition, this was an observational epidemiological research study, and while efforts were done to

control for confounders, there is always the possibility that unmeasured confounding is driving the results of the study.

The present study was conducted only in a tertiary care center among admitted patients. And that was among small sample size. Such type of study may be done at district or state level for the generalization of the study findings.

CONCLUSION

There was maximum COVID-19 infection in patients having B positive blood group (35.2%). Patients having B positive blood group with co-morbidity have more chance of ICU admission. There was no difference found in distribution of the blood group B amongst COVID-19 (35%) and amongst general population (32 to 35%). Patients who have O type of blood may have lower chances of admission in ICU in comparison with the patients having other types of blood group.

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