ORIGINAL ARTICLE

Association and Outcome of ABO-Rh Blood Group among 294 COVID-19 Patients admitted in A Dedicated Hospital

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Abstract:

Aim: The rapid global spread of the novel corona virus SARS-CoV-2 has strained healthcare and testing resources, making the identification and prioritization of individuals most at-risk became a critical challenge. Recent evidence suggests blood type may affect the risk of severe COVID-19.Method: In this cross-sectional observational study, among 1348 admitted patients in Holy Family Red Crescent Medical College who tested positive for RT-PCR, 294 patients were included with known blood type to assess the association between ABO and Rh blood types and demographic profile, co-morbidities, clinical outcomes, and changes in the biomarkers. Result: among 294 patients admitted to the hospital with COVID-19, the mean age was 48 to 49 years. Out of all patients, 211 were male, and 83 were female, with a ratio of 1: 2.54. The highest numbers of patients were between 50-59 years. The highest percentage of diabetic patients were present in the AB blood group (54%), and hypertensive patients in the O and Rh-negative blood group (40.29%, 60%) which were statistically not significant. Other than that, COPD, IHD, and CKD were observed. Symptoms of patients were categorized as inflammatory and neurological. Shortness of breath (52.41%), fever (38.43%), and cough (28.23%) were observed among inflammatory symptoms, which were statistically significant and lethargy (16.25%) was only remarkable neurological involvement. Among all ABO blood groups, 'A' blood group of patients, present with a higher percentage of both inflammatory and neurological symptoms. Among the Rh blood group, Rh-negative patients did not present with diarrhea, sore throat, lethargy, anosmia, and loss of taste. Changes in biomarkers levels were also observed in all blood groups. Conclusion: COVID-19 patients with blood group A or B are at increased risk of disease severity with the highest number of co morbidities and symptoms compared with patients with blood group O or AB.

Key words: COVID-19, ABO blood group, Rh-positive, Rh-Negative.

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Introduction:

More than two years have passed world has fought against the COVID-19 pandemic with 527,269,092 confirmed cases and 6,299,913 death cases reported worldwide as of May 22, 2021[1]. Many countries including Bangladesh fight with 2nd wave with a new delta variant of corona virus more intensely with 1,953,204 confirmed cases and 29,128 deaths[2]. Several risk factors for COVID-19 morbidity and mortality are well known, including old age, sex, smoking habits, hypertension, diabetes, and cardiovascular and respiratory diseases.

Previous several studies suggested associations between blood group and other diseases and infections, including SARS-CoV-1[3,4,5]. Zhao et al first reported this observation. In their study, SARS-Cov-2 patients were detected in Wuhan and Shenzhen provinces of China, with blood group A people at risk of COVID-19 infection and mortality, and blood group O showing a decreased risk[6]. Several studies held in China, Turkey, Italy, and Spain, show similar findings[7-12].

The ABO blood type features polymorphisms within the ABO gene. This ABO gene is related to the risk factors for COVID-19 morbidity and mortality. Zeitz et al show ABO blood type has an association with the activity of the angiotensin-converting enzyme, red blood cell count, hematocrit and hemoglobin concentration, and blood glycoproteins like Von-Willebrand factor, ischemic stroke, myocardial infarction, coronary artery disease, type-2 diabetes, and venous thromboembolism. These conditions are also relevant for COVID-19[13]. Like ABO, the Rh type is also responsible for type compatibility and immune response. Rh phenotypes (positive and negative Rh blood types) are associated with very few diseases compared to ABO[14].

Here in this study, we observe the association between ABO and Rh type blood group with demographic profile, co-morbidities, clinical outcomes, and changes in the biomarkers of COVID-19 patients in a COVID dedicated hospital in Dhaka city.

Materials and Method:

The protocol of this study was reviewed and approved by the designated hospital authority and the institutional ethics board of Holy Family Red Crescent Medical College. Informed consent from the patient was waived by the Ethical Committee for this study due to its retrospective and observational nature, and the pandemic situation. This cross-sectional observational study was done on patients admitted in the intensive care unit (ICU) and general ward of one of the tertiary care hospitals in Dhaka, designated as "COVID-dedicated" from May to September 2020 by the Government of Bangladesh. All RCT-PCR positive (by nasopharyngeal swab) patients who were treated with HFRCMCH, with a blood group confirmation report, within the period of the study were included. Patients who have no data about the blood group were excluded from the study.

Hospital records of all 1348 admitted patients were screened. All the data is recorded in a customized form. A total of 294 patients' record files, were included as per availability of confirmation of blood group report and other data from the hospital records (non-electronic). Among them, 76 patients were admitted to ICU and 218 patients were in the general ward. These record files were divided into six groups, 88 patients in 'A' blood group, 111 in the 'B' group, 67 in the 'O' group, and 24 in the 'AB' group. A total of 283 patients were included in the Rh-positive group, whereas 9 patients were in the Rh-negative group. Chi-squared (X2) and one-way ANOVA tests were used to compare the distributions of blood groups. Statistical values were reported with 95% confidence intervals and considered significant at $p<0.05$. Statistical analysis was performed using SPSS version 21.0.

Results:

Table 1 shows, that among 294 patients admitted to the hospital with COVID-19, the mean age of all six groups ranges from 48.83(±15.6) to 58.86(±16.32) years. No statistically significant difference was revealed in the 10-year age range between the ABO group and the Rh group. Out of all patients, 211 were male, and 83 were female, with a ratio of 1: 2.54. In the histogram, the highest number of patients were in 50-59 years (71) and the least single number Table-I: Frequency distribution of patients according to blood groups and age ranges

Table-I: Frequency distribution of patients according to blood groups and age ranges

	ABO Blood Group					Rh Blood Group	
	A	**B**	**O**	**AB**		**Rh (+) ve**	**Rh (–) ve**
Mean age	48.83± 15.6	48.94± 16.53	49.04± 15.69	49.88± 17.11		58.86± 16.32	49.1± 15.27
Female: Male	1:2.13	1:2.63	1:2.94	1:3		1:2.59	1:1.5
Age Range							
0-19	01 (1.12%)	-	-	-	**Statistical Significance Among ABO**	01 (0.35%)	-
20-29	10 (11.23%)	15 (13.16%)	09 (13.43%)	03 (12.5%)		36 (12.72%)	01 (10%)
30-39	16 (17.97%)	22 (19.29%)	06 (8.95%)	05 (20.83%)		47 (16.6%)	02 (20%)
40-49	14 (15.73%)	24 (21.05%)	13 (19.40%)	01 (4.17%)		50 (17.66%)	02 (20%)
50-59	25 (28.09%)	18 (15.79%)	20 (29.85%)	09 (37.5%)	X^2=17.9028.	68 (24.38%)	03 (30%)
60-69	15 (16.85%)	23 (20.17%)	13 (19.40%)	05 (20.83%)	p=.118673 ^{ns}	54 (18.37%)	01 (10%)
70 & above	08 (8.98%)	12 (10.52%)	06 (8.95%)	02 (8.33%)		28 (9.89%)	01 (10%)
Total	89 (30.27%)	114 (38.77%)	67 (22.79%)	24 (8.16%)		284 (96.59%)	10 (3.4%)

^{ns} = not significant at p < .05

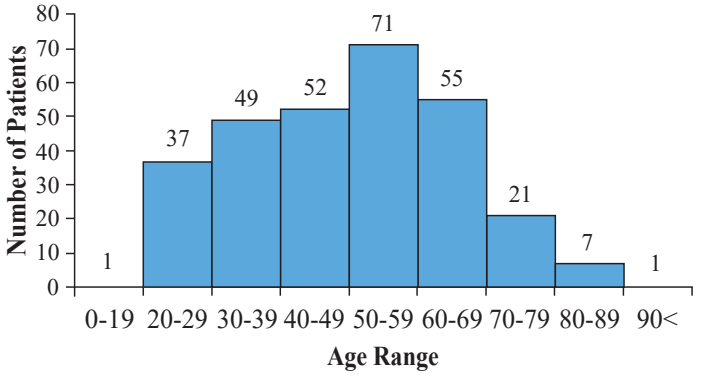

Figure-1: Histogram of patients' distribution according to age ranges

Table- II and Figure- 2 show frequency distribution and percentages of co-morbidities among ABO blood group of COVID-19 patients, the highest number of patients presents with diabetes mellitus (39.45%) and hypertension (36.73%) than other co-morbidities like ischemic heart disease (9.18%), chronic kidney disease (6.12%), chronic obstructive pulmonary disease (5.1%), others like thyroid-related disorder and neoplasm (12.58%). No statistically significant difference was present between all groups. Among six groups, the highest percentage of diabetic patients present in the AB blood group (54%), and hypertensive patients in the O and Rh-negative blood group (40.29%, 60%) were statistically not significant. The absence of COPD in the O group, IHD in the AB group, and both CKD and COPD were observed in the Rh-negative group of patients. f patient (1, 1) in both 0-19 and above 90 years of age group.

Table- II: Frequency Distribution of Co-Morbidity in ABO blood groups of COVID-19 patients

Co-morbidities	ABO Blood Group				Statistical Significance Among ABO
	A (n= 89)	B (n=114)	O (n=67)	AB (n=24)	
HTN	32 (35.95 %)	43 (37.72%)	27 (40.29 %)	06 (25 %)	X^2=14.8909 p=.247459 ns
DM	34 (38.20%)	44 (38.59%)	25 (37.31%)	13 (54 %)	
CKD	05 (5.61 %)	04 (3.51 %)	04 (5.97 %)	05 (20.83%)	
COPD	06 (6.74 %)	06 (5.26 %)	-	03 (12.5%)	
IHD	08 (8.99 %)	11 (9.65%)	08 (11.94 %)	-	
Others	12 (13.48 %)	15 (13.16%)	09 (13.43 %)	01 (4.1 %)	

ns = not significant at p < .05

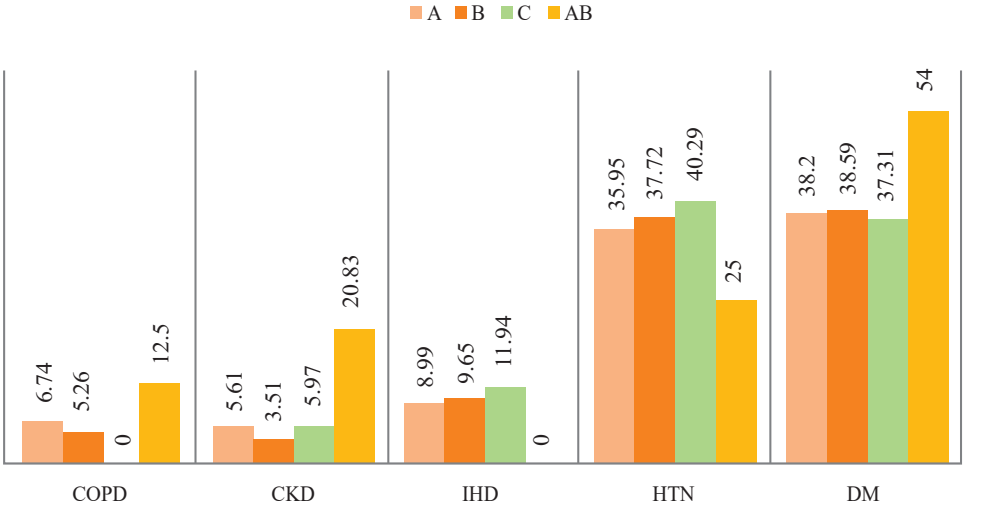

Figure-2: Percentage of Co Morbidity in ABO blood groups of COVID-19 patients

Table III shows the presenting symptoms of the patients were variable. The highest percentage of symptoms were shortness of breath (52.41%), fever (38.43%), cough (28.23%) followed by diarrhea (12.72%), and sore throat (2.12%) among inflammatory symptoms, which were statistically significant. In the case of neurological symptoms patients presented in higher percentage was lethargy (16.25%) followed by loss of taste (11.66%), myalgia (10.88%), and anosmia (2.47%), which were not statistically significant. Among all ABO blood groups, 'A' blood group of patients, present with a higher percentage of both inflammatory and neurological symptoms. Among the Rh blood group, Rh-negative patients did not present with diarrhea, sore throat, lethargy, anosmia, and loss of taste.

Table-III: Symptoms present in ABO blood groups of COVID-19 patients

Symptoms		ABO Blood Group				Statistical significance Test
		A (n= 89)	B (n=114)	O (n=67)	AB (n=24)	
Inflammatory	Fever	33 (37.5%)	45 (40.54%)	29 (43.28%)	07 (29.16%)	X^2=30.6594. p=.00222 *
	Cough	16 (18.18%)	33 (29.72%)	23 (34.32%)	11 (45.83%)	
	Diarrhea	22 (25%)	05 (4.5 %)	04 (5.9%)	05 (20.83%)	
	SOB	54 (61.36%)	49 (44.14%)	37 (55.22%)	13 (54.16%)	
	Sore Throat	06 (6.81%)	02 (01.8%)	01 (1.47%)	01 (4.16%)	
Neurological	Lethargy	27 (30.68%)	09 (8.1 %)	07 (10.44%)	03 (12.5%)	X^2=.0012. p=.834207^{ns}
	Myalgia	18 (20.45%)	03 (2.7%)	05 (07.46%)	06 (25%)	
	Anosmia	04 (4.54 %)	01 (0.9%)	02 (2.95%)	-	
	Loss of taste	20 (22.72%)	06 (5.4%)	04 (5.9%)	03 (12.5%)	

* = significant at p < .05, ns = not significant at p < .05.

Table- IV shows change in the level of biomarkers in ABO and Rh blood group of COVID-19 patients.

Table IV: Change in Biomarkers in different blood groups (Median IQR)

Biomarkers Median (IQR)		ABO Blood Group				Rh Blood Group	
		A (n= 89)	B (n=114)	O (n=67)	AB (n=24)	Rh (+)ve (n=284)	Rh (-)ve (n= 10)
Inflammatory	D Dimer	0.2 (0.1- 0.42)	0.16 (0.1- 0.29)	0.15 (0.1- 0.52)	0.17 (0.11- 0.45)	0.17 (0.1- 0.42)	0.29 (0.13-0.5)
	CRP	12 (6- 24)	18 (6- 48)	12 (6- 27)	24 (6- 36)	13.5 (6- 29.25)	15 (6- 42)
	Ferritin	378 (183- 797)	331 (172- 647)	332 (151-621)	383 (165- 826)	360 (177- 713)	122 (81- 433)
Hematological	Total WBC	7.5 (5.7- 9.42)	6.95 (4.97- 9.32)	7.4 (5.9- 10.9)	8.25 (6.12- 13.46)	7.4 (5.5- 9.7)	6.7 (5.57- 9.92)
	Lymphocyte	26.5 (15- 36)	25.5 (15.12- 35)	24 (11- 37)	21.5 (13.5- 36)	24 (14.75- 36)	32 (18.25- 36.5)
	Neutrophil	67 (55.5- 87.5	69 (59- 80.75)	68.5 (56- 84)	73.5 (56.25- 82)	69 (57-82)	62 (57-75)
	Platelet	264 (211- 333)	242 (193.5- 302)	267 (216.5- 349)	292 (248- 324.75)	260 (208.5- 319)	255 (243-307)
	HCT	41 (36.3- 44.17)	39.8 (36.7- 42.6)	40.1 (36.6- 43.3)	38.1 (35.2- 44.35)	40 (36.55- 43.3)	40.65 (36.5- 44.52)
Hepatic	SGPT	45 (28- 69)	45 (28- 65)	42 (30- 54.5)	42 (28- 95)	44 (29- 67)	32 (25.5- 39.75)
	Prothrombin Time	14 (13-15)	14 (13- 16)	14 (13- 16.36)	14 (13- 14.7)	14 (13- 15.9)	13.85 (13- 15.75)
	APTT	42.7 (37.3- 49.08)	44.8 (37.62-42.07)	45.4 (38.9- 51.5)	42.75 (35.5- 48.1)	43.75 (37.8- 49.04)	41 (35-47)
	INR	1.07 (1.005- 1.21)	1.08 (1- 1.23)	1.1 (1.005-1.3)	1.08 (1- 1.28)	1.08 (1.01- 1.24)	1.06 (1- 1.21)
Renal	Serum Creatinine	1.09 (0.96- 1.295)	1.1 (0.98- 1.28)	1.12 (0.95-1.25)	1.13 (1.02- 1.20	1.11 (0.97- 1.29)	1.12 (0.86- 1.17)
Metabolic	HbA_1C	6.35 (5.75- 6.925)	6.4 (5.8- 7.37)	6.8 (5.9- 7.9)	6 (5.8- 6.65)	6.4 (5.8- 7.4)	6.5 (5.9- 10.2)
	Total Cholesterol	160 (109- 178.7)	145.5 (121.5- 170)	144 (117- 168)	162 (116- 195)	147.5 (116- 174)	178.5 (141- 201.2)
	Triglyceride	175.5 (115- 279)	163.5 (118- 220)	149 (101- 274)	154 (104.5- 235)	164 (109- 240)	228.5 (122- 271.5)
	HDL	29.5 (24- 37.5)	27 (23.75-37.25)	29 (23- 37)	27 (24- 39.5)	28 (24- 37.75)	34 (23.75- 38.5)
	LDL	85.5 (51.5- 111)	73 (57- 110.25)	75 (56- 90)	77 (65.5- 125)	74.5 (55- 104)	100 (85-114.75)
Cardiac	Cardiac Troponin I	0.014 (0.006- 0.045)	0.011 (0.009- 0.028)	0.017 (0.004- 0.168)	0.022 (0.014- 0.737)	0.015 (0.005- 0.052)	0.012 (0.005- 0.028)

Discussion:

The number of patients acquiring COVID-19 infection is dramatically increasing, and prior vaccination programs started globally. It directly affects the efficiency of healthcare systems around the world. Therefore, early detection of severe cases is inescapable for rapid triaging of patients. While the clinical presentation, existing co morbidities, level of radiological infiltration, and the blood oxygen saturation of COVID-19 patients may indicate the need for their admittance to ICUs, several laboratory parameters may facilitate the assessment of disease severity.

Among 294 cases the highest frequency of disease positivity was observed in blood group 'B' (114) and the lowest frequency in 'AB' (24). A similar result shows in Akram et al, the majority (39.8%) were identified as having blood group B in nangladesh[15]. Regarding the association between blood group and risk of COVID-19 infection, most studies show similar results that blood group A was associated with an increased frequency amongst COVID-19 individuals and risk of infection, and conversely, that blood group O was associated with a decreased frequency and risk of infection[6–11].

COVID-19 patients who have co-morbidity like diabetes mellitus, hypertension, ischemic heart disease, chronic kidney disease, and bronchial asthma have a higher risk of disease severity, which leads to ICU admission and even mortality. Other observational studies of Bangladesh[16,17,18] and foreign countries[9] support similar findings. In our study, diabetes mellitus and hypertension are most predominant compared to any other co-morbidity in all blood groups. The absence of COPD in the O group, IHD in the AB group, and both CKD and COPD were observed in the Rh-negative group of patients. In this study, patients present with various inflammatory and neurological symptoms, which were almost similar to many studies. But the predominant symptoms vary in a different types of blood groups. Among them, the 'A' blood group of patients, presented with a higher percentage whereas Rh-negative patients did not present with diarrhea, sore throat, lethargy, anosmia, and loss of taste. Several studies in Bangladesh[16,17,18] and worldwide show patients with COVID-19 show similar symptoms [9,14].

In this study, we observed changes in several biomarkers levels like hematological, inflammatory, hepatic, renal, and metabolic between different blood groups of the COVID-19 patients, which help to reflect on disease severity. Several studies also report a change in biomarkers in different blood groups of COVID- 19 patients[19,20].

Conclusion:

The results of this study concluded that COVID-19 patients with blood groups A and B are at increased risk of disease severity with the highest number of co morbidities and symptoms compared with patients with blood group O or AB, in our population. More research is needed to know the underlying mechanisms.

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