ISSN: 0067-2904

Relationship between ABO Blood Groups and Rh Factor with COVID-19 in Nineveh Governorate

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Received: 15/2/2023 Accepted: 1/10/2023 Published: 30/11/2024

Abstract

ABO blood types and the Rh factor have recently been linked to an increased risk of developing the pandemic coronavirus disease 2019 (COVID-19) in individuals of different ethnic backgrounds. The conducted current study aimed to comprehend the relationship between this polymorphic apparatus and illness risk in Nineveh patients and healthy individuals. Recovery or death and two COVID-19 outcomes were also investigated. Many individuals including COVID-19 Nineveh patients had their ABO blood type and Rh factors determined. Thus, four groups (under therapy, rehabilitative, death, and healthy donors) were created from the research samples. The diagnosis kit RNA (PCR-Fluorescence Probing) was used to diagnose 2019 novel coronavirus (2019nCoV) for patients. The data was gathered from hospital records. The purpose of this study was to highlight significant data related to COVID-19 patients' infection, symptoms and prognosis with respect to ABO blood type and Rh factor. Results of the current study included links between Rh factor and ABO blood types with increased infection potential, longer incubation times and fatal acute outcomes. Knowing that COVID-19 predisposing factors might help with patient survival, illness treatment and studying viral path physiology. A total of 2480 samples were ،distributed to control group and hospitalized patients with definite COVID-19 infection in isolation in the hospital in Mosul City for the period between 2nd December 2021 and 5th March 2022. The blood samples were obtained from patients and healthy donors by using kit for blood type identification, while the blood types of the deceased were taken from the hospital records. Several statistical tests were also conducted to find out the differences between the aforementioned groups. ANOVA was performed to investigate the correlation of ABO blood types with incidence of COVID-19 patients. The variables adopted in the analysis were age and sex. The study found that the difference between the association of each blood group with that of cases was significantly correlated (p = 0.00001). Out of total 975 patients 30.2% had blood group A, 27.3% had group B, 26.8% had group O and 15.7% had blood group AB. The study found that the number of recovered patients in 18-30 years age group was not significant among male and female population, while number of patients in other age groups in both male and female patients who finally recovered, was significantly lesser among patients with blood groups A and AB. There was a significant number of patients with blood group B in all the age groups except 31-35 years old. The study concluded that blood group B patients were severely affected by COVID-19.

Keywords: COVID-19, Blood Groups, Age, Sex, Coronavirus

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العلاقة بين مجاميع الدم ABO وعامل Rh مع مرض فيروس كورونا 2019 في محافظة نينوى

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الخلاصة

ارتبطت مجاميع الدم**ABO** وعامل **Rh** مع زيادة الخطورة بالإصابة بفيروس كورونا الوبائي في الأشخاص من مختلف العروق والأصول. هدفت دراستنا إلى مقارنة العلاقة بين هذا المعقد المتعدد وخطورة المرض في مرضى محافظة نينوى وكذلك الاصحاء .هناك نتيجتين حتميتين للمرض وهما الموت أو التعافي .قسمت عينة الدراسة إلى أربعة مجاميع هم الأفراد تحت العلاج ، المتعافين من المرض، الموتى ،والاصحاء كمجموعة سيطرة.وقد استخدمت عدة **RNA** المجسي المتفلور في تشخيص المرض لدى أفراد العينة، وقد تم الحصول على نتائجهم من سجلات المستشفى قيد الدراسة.كان الغرض هذه الدراسة هو تسليط الضوء على المعلومات المتوفرة حول المرض من ناحية التشخيص والاعراض والنتيجة وعلاقتها بمجاميع الدم للأفراد وكذلك عامل **Rh** .حيث أشارت النتائج إلى أن هناك ارتباط بين العامل **Rh** ومجموعة الدم **ABO**مع كل من زيادة خطر الإصابة ،طول فترة الحضانة للفيروس و حدة القتل للفيروس .تساعد معرفة العوامل المسببة للإصابة في سرعة التعافي من المرض ،معالجة المرض ودراسة المسلك الفسلجي للفيروس .اشتملت عينة الدراسة على ٢٤٨٠ فرد توزعت بين مجموعة السيطرة ومجموعة المرضى في مستشفى العزل في مدينة الموصل للفترة بين ٢٠٢١\١٢\١٢ و ٢٠٢٢\٣\٥ .شخصت مجاميع الدم للمرضى والاصحاء باستخدام عدة خاصة بتشخيص صنف الدم اما الوفيات فقد تم الحصول على معلوماتهم من سجلات المستشفى .أنجزت عدد من الاختبارات الإحصائية لإيجاد الاختلافات بين مجاميع الدراسة .كما استخدم اختبار **ANOVA** لايجاد العلاقة بين صنف الدم والإصابة بالمرض .كذلك اشتملت الدراسة على تحليل عدد من المتغيرات بضمنها العمر والجنس .وجدت الدراسة اختلافات معنوية بين صنف الدم مع المجاميع قيد الدراسة عند مستوى معنوية $p= 0.00001$.شملت عينة المرضى والموتى والمتعافين ٩٧٥ فرد قسمت أصناف الدم فيها إلى ٣٠٢٪ صنف الدم **A** ، ٢٧.٣٪ صنف الدم **B** ، ٢٦.٨٪ صنف الدم صنف الدم **O** و ١٥.٧٪ صنف الدم **AB** كما وجدت الدراسة أن عدد الافراد المتعافين في المجموعة الواقعة بين ١٨−٣٠ سنة لم تكن معنوية بين الذكور والاناث.في حين كانت الاعداد معنوية في المجاميع الأخرى بين الذكور والاناث الحاملين لصنفي الدم **A** و **B** على التوالي .استنتجت الدراسة أن الأفراد الحاملين لصنف الدم **B** قد تأثروا بشدة من مرض كورونا.

Introduction

The World Health Organization (WHO) received many reports of pneumonia with an unknown cause from Wuhan, China at the end of 2019. These reported cases were determined to be caused by the novel coronavirus (2019-nCoV) which was later renamed severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) on January 7, 2020. As a result, the outbreak was given the label coronavirus illness (COVID-19) [1]. Coronaviruses (CoVs) are positively stranded RNA(+ssRNA) viruses that when viewed under an electron microscope, resemble a crown (corona is the Latin word for crown). This is due to the envelope that contains spike glycoproteins [2]. The severe acute respiratory syndrome corona virus (SARS-CoV-2) or the 2019 novel corona virus (2019-nCoV), as was initially known, swiftly spread throughout the world from its genesis in Wuhan City in the Chinese province of Hubei. Fever (not always), coughing, sore throats, headaches, lethargy, headaches, myalgia, and shortness of breath were among the usual clinical symptoms. Some symptoms were similar to those of other respiratory infections, making them virtually indistinguishable. It was possible for a subset of patients to develop pneumonia and respiratory failure, and die during the first week after contracting the disease [3]

People of all ages ran the danger of getting this infection and serious illness. Patients under 60 and those with underlying medical problems, however, were more likely to experience severe COVID-19 infection. As SARS-CoV-2, the disease's primary causative agent, largely affected the respiratory and vascular systems. COVID-19 is primarily regarded as a viral respiratory and vascular disorder. Blood groups specialize in the direct role of signal transducers, adhesion molecules, and pathogen receptors in the immune response to infections. Although, both biological and clinical effects of blood groups were discovered about a century ago, their full comprehension was yet to be reached. It has played a role not only with respect to haematology, transfusion and transplantation, but also in pathogenesis and awareness of a wide variety of diseases. Blood types A and B transferases are encoded by two codominant alleles at the ABO site (A and B alleles, respectively). A third recessive O allele code for inactive proteins lacks the activity of both transferases. Hence, the A, B, AB, and O ABO phenotypes were identified. Blood groups can be classified as positive or negative depending on whether the Rhesus (Rh) factor protein is present. ABO groups are genetically determined traits, and among populations that have been scanned so far, their gene polymorphism expression has been recorded. These groups tend to occur more frequently in certain races, and the ethnic populations (Orientals, Caucasians, and Negros) which exhibit significant differences [4]. Erythrocytes have an antigen on their surface which is called the Rhesus factor (Rh factor) as it was originally discovered in Rhesus monkeys.It is the most complex blood group system. Although there are more than 50 antigens in the Rh blood group system, D, C, E, and E are among the most often found antigens. Due to its high immunogenicity, Rh illness is primarily caused by D antigen. Based on the D antigen's presence or absence on the surface of red blood cells, an individual can either be Rh-positive or -negative [4]. The D, C, and E blood group antigens are transported by a family of 30-32 kDa hydrophobic trans membrane proteins that are not glycosylated and are absent from the red cells of uncommon Rh null people who exhibit various membrane abnormalities [5]. Rh proteins, which also carry Rh antigens, are only expressed on the surface of erythrocytes in the presence of RhAG. The Rh and RhAG proteins share over 40% of their amino acid sequences, indicating an evolutionary connection. As a group, they are termed the Rh protein family. The phrase Rh accessory proteins refer to a group of additional glycoproteins that are connected to the Rh protein family due to the absence or deficiency of these proteins in Rh null RBCs. The Rh complex combines the Rh family proteins and the Rh auxiliary proteins [6]. According to several articles, there is a link between COVID-19 susceptibility and ABO blood classes. Individuals in groups A and O demonstrate a higher and reduced chance of contracting an infection respectively. There was no connection found between ABO groups and mortality. Additionally, it was determined that ABO blood types were significant risk factors for the severity and fatality of COVID-19. Individuals in group A had a considerably higher mortality risk than those in group O. In the group of blood donors, the link between the ABO blood type and the risk of contracting COVID-19 infection was verified [7].

In the group of individuals who received blood transfusions while hospitalized, ABO blood types was also related to the severity of COVID-19 and mortality. Blood types A and O are therefore two crucial considerations. There is although disagreement about which blood type has the most sensitivity, despite various studies usually agreeing that blood group O acts as a protective factor. Many studies have noted an increased risk for blood groups B and AB, in contrast to other studies claiming that blood group A is the most at-risk kind [8]. According to a study, blood types A, B and Rh+ are more likely to contract COVID-19 infection. On the other hand, blood types O, AB, and Rh have a considerably reduced risk of contracting the virus. Blood types ABO and Rh have no effect on how disease develops and are not linked to mortality risk or susceptibility to serious illness. Additionally, we discovered that blood types

Rh+ and A are linked to a shorter recovery time, however Rh- and O are linked to a longer recovery time [9]

The seven exons that make up the ABO gene code for the glycosyltransferases, are responsible for producing antigens A and/or B. Researchers sampled 1980 patients with COVID-19 and respiratory failure from 7 locations in Spain and Italy for a meta-analysis and examined 8,582,968 single-nucleotide polymorphisms (SNPs). According to the study, there a correlation was detected between rs657152 at 9q34 and rs11385942 at 3p21.31. They discovered that COVID-19 is genetically related to gene cluster 3p21.31 which was observed in patients with respiratory failure when trans-ethnic genome-wide connectivity studies were used. Another study by Shelton *et al.* found a significant correlation between COVID-19 and blood type. Particularly, a link between infection and severity at a locus on chr3p21.31 was established [10].

Materials and Methods

This prospective study was conducted in Al-Hameyat Hospital in Iraq between 2nd December 2021 and 5th March 2022. The study considered distribution of RNA (PCR-Fluorescence Probing) diagnostic kit to 2480 individuals who visited Al-Hameyat hospital.. These individuals were also followed-up for the confirmed diagnosis of COVID-19. The age and genders of all these 2480 individuals were taken from the hospital record. They were asked to participate in the blood typing for the blood grouping. The blood was drawn by the hospital staff and the results were noted (ABO and Rh). Those who had confirmed the diagnosis of COVID-19 were under strict treatment of the hospital as per guidelines. The patients who did not cooperate were all excluded from the study, and hence did not complete the COVID-19 therapy despite confirmed diagnosis. The patients who had chronic pulmonary conditions or other underlying conditions were also excluded to prevent any bias in the study. The study process was well explained to the patients before conducting them into this research and proper consent was obtained from each of them. The study was carried out in accordance with the Declaration of Helsinki, as promulgated in 2013. After one month, the patients were again followed up for the disease outcome. Age, sex and blood groups correlation were analyzed using the Statistical Package for the Social Sciences (SPSS), Version 25 through employing ANOVA and Chi Square tests. The level of significance was considered to be $\alpha = 0.05$.

Results

The study determined the percentage of patients of each blood group in each study group. It was found that there were 975 cases (39.31%) in total, of which 260 patients (26.6% of 975 patients) were found to be under COVID-19 therapy, 550 patients (56.41%) recovered and 165 patients (17.9%) died towards the end of the study. Out of total 975 patients (all cases), 30.2% had blood group A, 27.3% of all the cases had group B, 26.8% had group O and 15.7% had blood group AB. It was observed that most of the cases belonged to blood group A and least percentage of COVID-19 patients belonged to AB blood group. The difference between the association of each blood group with that of cases was significantly correlated (p = 0.00001). Table 1 shows the detailed findings of the cases along with blood group.

Table 1: Detailed results of number of patients in each group with respective blood group

Groups	Number of Cases	A Group	B Group	O Group	AB Group	Chi Square	*p*-value	Rh +	Rh-	Chi Square	P-value
Control	1505	476(31.6%)	353(23.5%)	521(34.6%)	155(10.3%)			1262(8309%)	243(16.1)		
All Patients Cases	975	295(30.2%)	266(27.3%)	261(26.8%)	153(15.7%)	29.24	0.00001	846(86.8%)	129(13.2%)	3.94	0.05
Under Therapy	260	96(36.9%)	107(41.2%)	50(19.2%)	7(2.7%)	58.77	0.00001	232(89.2%)	28(11%)	4.93	0.03
Recovered	550	104(18.9%)	141(25.6%)	197(35.8%)	108(19.6%)	51.5	0.00001	466(85.1%)	84(14.9)	0.23	0.632
Deceased	165	95(57.5%)	18(10.9%)	8(4.8%)	44(26.6%)	101.8	0.00001	154(93.3%)	11(6.67%)	4.51	0.034
Total Number	2480	771(31.1%)	619(25%)	782(31.5%)	308(12.42%)			2067(83.3%)	413(16.7%)		

The study found that the significant difference of number of patients for each category (under the therapy either recovered or deceased) in each blood group for both male and female separately. All the age groups who received the therapy were significantly more with blood group B as compared to the controls. The same results were found in patients with A, AB, O and Rh negative.

Table 2: Patients receiving therapy with their blood groups in comparison with the controls

Groups	Cases	Male			Female		
		18-30	**31-55**	**>56**	**18-30**	**31-55**	**>56**
A Group	Control	82(30.6%)	110(33.8%)	71(33.2%)	72(27.5%)	95(31.7%)	46(33.8%)
	Under therapy	13(35.1%)	20(41.6%)	24(36.4%)	9(36%)	13(37.1%)	17(34.7%)
	p-value	0.55	0.24	0.66	0.23	0.46	0.88
	OR(CI)	1.2(**Ta**0.66-2.16)	1.41(0.8-2.5)	1.14(0.64-2.05)	1.45(0.8-2.63)	1.25(0.7-2.24)	1.05(0.58-1.87)
B Group	Control	68(25.4%)	73(22.5%)	52(24.3%)	62(23.7%)	70(23.3%)	28(20.6%)
	Under Therapy	15(40.5%)	19(39.6%)	26(39.4%)	12(48%)	15(42.9%)	20(40.8%)
	p-value	0.02	0.01	0.02	0.0005	0.0003	0.003
	OR(CI)	2.08(1.14-3.81)	2.23(1.21-4.12)	2.02(1.1-3.73)	2.92(1.6-5.35)	2.53(1.37-4.65)	2.61(1.4-4.88)
AB Group	Control	28(10.4)	36(11.1%)	20(9.3%)	30(11.5%)	33(11%)	8(5.9%)
	Under Therapy	1(2.8%)	2(4.2%)	1(1.5%)	1(4%)	1(2.9%)	1(2%)
	p-value	0.06	0.07	0.05	0.05	0.04	0.17
	OR(CI)	0.28(0.1-1.04)	0.34(0.1-1.1)	0.21(0.04-0.1)	0.31(0.01-0.1)	0.25(0.07-0.9)	0.32(0.06-1.6)
O Group	Control	90(33.6%)	106(32.6%)	71(33.2%)	98(37.3%)	102(34%)	54(39.7%)
	Under Therapy	8(21.6%)	7(14.6%)	15(22.7%)	3(12%)	6(17.1%)	11(22.5%)
	p-value	0.06	0.004	0.12	0.0001	0.007	0.01
	OR(CI)	0.55(0.29-1.03)	0.36(0.18-0.71)	0.61(0.32-1.13)	0.23(0.11-0.48)	0.4(0.2-0.8)	0.45(0.24-0.83)
Rh+	Control	225(83.6%)	269(84.6%)	176(82.2%)	224(85.2%)	254(82.7%)	114(85.1%)
	Under Therapy	29(87.9%)	64(92.8%)	44(84.6%)	22(91.7%)	56(91.8%)	17(81%)
	p-value	0.42	0.08	0.57	0.13	0.06	0.45
	OR(CI)	0.4(0.62-0.83)	2.34(0.91-6.02)	1.24(0.59-2.63)	2.03(0.82-5.03)	2.36(0.97-5.74)	0.75(0.36-1.58
Rh-	Control	44(16.4%)	49(15.4%)	38(17.8%)	39(14.8%)	53(17.3%)	20(14.9%)
	Under Therapy	4(12.1%)	5(7.2%)	8(15.4%)	2(8.3%)	5(8.2%)	4(19%)
	p-value	0.42	0.08	0.57	0.13	0.06	0.45
	OR(CI)	0.72(0.32-1.6)	0.43(0.17-1.1)	0.8(0.38-1.7)	0.49(0.2-1.22)	0.42(0.17-1.04)	1.33(0.62-2.8)

The study found that the number of recovered patients in 18-30 years age group was not significant among male population, while number of patients in other age groups in both male

and female patients who finally recovered was significantly lesser among blood groups A and AB patients, although significant difference was not noted among patients of other blood groups. Table 3 shows the detailed findings of patients who recovered.

Table 3: Recovered Patients with their blood groups as compared with the controls.

Groups	Cases	Male			Female		
		18-30	31-55	>56	18-30	31-55	>56
A Group	Control	82(30.6%)	110(33.8%)	71(33.2%)	72(24.5%)	95(31.7%)	46(33.8%)
	Recovered	23(20.7%)	12(15.8%)	6(14.6%)	35(22%)	16(16.7%)	12(17.9%)
	p-value	0.11	0.003	0.003	0.33	0.01	0.01
	OR(CI)	0.59(0.31-1.12)	0.37(0.19-0.73)	0.36(0.18-0.71	0.73(0.38-1.38)	0.44(0.22-0.85)	0.43(0.22-0.82)
B Group	Control	68(25.4%)	73(22.5%)	52(24.3%)	62(23.7%)	70(23.3%)	28(20.6%)
	Recovered	29(26.1%)	19(25%)	11(26.8%)	39(24.5%)	25	18(26.9%)
	p-value	0.87	0.74	0.63	0.87	0.62	0.32
	OR(CI)	1.1(0.56-1.1)	1.12(0.58-2.14)	1.17(0.62-2.21)	1.1(0.55-2)	1.18(0.62-2.24)	1.39(0.72-2.67)
AB Group	Control	28(10.4%)	36(11.1%)	20(9.3%)	30(11.5%)	33(11%)	8(5.9%)
	Recovered	19(17.1%)	16(21.1%)	8(19.5%)	31(19.5%)	20(20.8%)	14(20.9%)
	p-value	0.15	0.06	0.03	0.08	0.06	0.003
	OR(CI)	1.84(0.8-4.25)	2.15(0.98-4.74)	2.53(1.09-5.87)	2(0.91-4.48)	2.15(0.98-4.74)	4.16(1.6-10.8)
O Group	Control	90(33.6%)	106(32.6%)	71(33.2%)	98(37.3%)	102(34%)	54(39.7%)
	Recovered	40(36.1%)	29(38.1%)	16(39.1%)	54(34%)	35(36.5%)	23(34.3%)
	p-value	0.77	0.46	0.37	0.66	0.66	0.38
	OR(CI)	1.09(0.61-1.95)	1.24(0.67-2.22)	1.3(0.73-2.32)	0.88(0.49-1.57)	1.14(0.64-2.04%)	0.77(0.43-1.37)
Rh+	Control	225(83.6%)	269(85.6%)	176(82.2%)	224(85.2%)	254(82.7%)	114(85.1%)
	Recovered	65(84%)	109(83.3%)	88(85.4%)	51(85%)	85(84.2%)	68(86.1%)
	p-value	1	0.85	0.57	1	0.85	0.84
	OR(CI)	1(0.47-2.13)	0.93(0.43-1.99)	1.24(0.59-2.63)	1(0.46-2.17)	1.1(0.51-2.27)	1.1(0.49-2.38
Rh-	Control	44(16.4%)	49(15.4%)	38(17.8%)	39(14.8%)	53(17.3%)	20(14.9%)
	Recovered	12(15.6%)	21(16.2%)	15(14.6%)	9(15%)	16(15.8%)	11(13.9%)
	p-value	1	0.85	0.57	1	0.85	0.83
	OR(CI)	1(0.47-2.13)	1.08(0.5-2.32)	0.8(0.38-1.7)	1(0.46-2.17)	0.93(0.44-1.96)	0.92(0.42-2.03)

Table 4 shows the detailed findings of the patients who finally died of COVID-19. There was significantly a greater number of patients with blood group A in both genders as compared to the control group. Again, there was a significant number of patients with blood group B in all the age groups, except 31-35 years old. The study did not find any significant difference between the patients of Rh+ or Rh- with that of control.

Table 4: Patients (who finally died) with their blood groups as compared with that of the control.

Groups	Cases	Male			Female		
		18-30	31-55	>56	18-30	31-55	>56
A Group	Control	82(30.6%)	110(33.8%)	71(33.2%)	72(27.5%)	95(31.7%)	46(33.8%)
	Deceased	6(46.1%)	12(57.1%)	23(46.9%)	7(58.4%)	14(60.9%)	33(62.3%)
	p-value	0.005	0.001	0.04	0.0001	0.0001	0.0001
	OR(CI)	2.33(1.3-4.21)	2.6(1.45-4.56)	1.8(1.02-3.19)	3.55(1.97-6.41)	3.32(1.86-5.94)	3.17(1.78-5.65)
B Group	Control	68(25.4%)	73(22.5%)	52(24.3%)	62(23.7%)	70(23.3%)	28(20.6%)
	Deceased	2(15.4%)	3(14.3%)	6(12.2%)	1(8.3%)	2(8.7%)	4(7.5%)
	p-value	0.08	0.104	0.03	0.003	0.009	0.012
	OR(CI)	0.53(0.26-1.08)	0.55(0.26-1.13)	0.43(0.2-0.92)	0.28(0.12-0.65)	0.33(0.145-0.76)	0.33(0.14-0.78)
AB Group	Control	28(10.4%)	36(11.1%)	20(9.3%)	30(11.5%)	33(11%)	8(5.9%)
	Deceased	4(30.8%)	4(19.1%)	16(32.7%)	3(25%)	6(26.1%)	11(20.8%)
	p-value	0.0004	0.12	0.0001	0.02	0.008	0.003
	OR(CI)	4.04(1.86-8.81)	1.9(0.85-4.23)	4.98(2.23-11)	2.44(1.15-5.2)	2.84(1.32-6.14)	4.16(1.6-10.83)
O Group	Control	90(33.6%)	106(32.6%)	71(33.2%)	98(37.3%)	102(34%)	54(39.7%)
	Deceased	1(7.7%)	2(9.5%)	4(8.2%)	1(8.3%)	1(4.3%)	5(9.4%)
	p-value	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	OR(CI)	0.17(0.07-0.39)	0.17(0.07-0.39)	0.17(0.08-0.4)	0.14(0.06-0.32)	0.08(0.27-0.24)	0.15(0.07-0.33)
Rh+	Control	225(83.6%)	269(84.6%)	176(82.2%)	224(85.2%)	254(82.7%)	114(85.1%)
	Deceased	12(92.3%)	30(93.8%)	45(86.5%)	9(90%)	21(95.5%)	37(88.1%)
	p-value	0.09	0.044	0.33	0.29	0.006	0.54
	OR(CI)	2.19(0.89-5.38)	2.76(1.03-7.45)	1.47(0.68-3.19)	1.59(0.68-3.73)	4.92(1.59-15.19)	1.29(0.57-2.92)
Rh-	Control	44(16.4%)	49(15. 4%)	38(17.8%)	39(14.8%)	53(17.3%)	20(14.9%)
	Deceased	1(7.7%)	2(6.2%)	7(13.5%)	1(10%)	1(4.5%)	5(11.9%)
	p-value	0.09	0.044	0.44	0.29	0.59	0.54
	OR(CI)	0.46(0.19-1.12)	0.36(0.13-0.97)	0.74(0.35-1.59)	0.63(0.27-1.48)	0.7(0.21-2.28)	0.77(0.34-1.75)

Discussion

Although COVID-19 has a 1–14 days incubation period, it usually takes 3–7 days for symptoms to manifest. It has frequently been taken that the COVID-19 infection takes over than 14 days before manifesting any symptoms [11].

Blood type has been linked to a number of disease processes, including cancer and venous and arterial thromboembolism, as a risk factor. Blood group antigens contribute to infection directly through a number of methods. They can act as coreceptors and receptors for pathogens at the molecular level, and can also promote viral particle absorption inside the cells. Clinical studies have connected certain blood types to bacterial, parasites and viral illnesses [12]. There is growing evidence that certain viruses, such as SARS-CoV-2 and norovirus, are more susceptible to specific ABO blood groups than others [13]. Blood categories A and B showed more susceptibility to SARS-CoV-2 infection in patients with

coronavirus illness. On the other hand blood groups O and AB had a much-reduced probability of infection. There was a considerable increase in infected people with blood groups A and B when contrasting the prevalence of ABO and Rh blood groups among COVID-19-infected individuals with the general Delhi population [12]

The results of the study recommend that there was a significant relationship between blood groups and coronavirus susceptibility, severity, and mortality. In particular, the study found that people with blood group A were more likely to be infected with COVID-19 and needed treatment, whereas people with blood group AB were least likely to be infected. Furthermore, patients with blood group A had a higher mortality rate from COVID-19 than patients with other blood groups B, AB, Rh+ and Rh-.

These discoveries are predictable with other past investigations that have likewise detailed a relationship between blood groups and coronavirus results. For instance, a meta-analysis of ten studies found that people with blood group O had a lower risk of COVID-19 infection and severe disease [14]. This was in contrast with blood group A which was at a higher risk. Another study led in China found that patients with blood group A were at a higher risk of mortality from coronavirus in contrast with those with blood group O [13].

The result of the study indicated that among all the age groups who were receiving the therapy, number of blood group B patients was significantly higher as compared to the controls. Same results were found in patients with blood groups A, AB, O and Rh negative.
The COVID-19 pandemic has been the subject of a lot of research in the literature, and there are a lot of examples of studies that have looked at various aspects of the disease. Guan *et al.* [15] conducted a study and looked at the clinical characteristics of confirmed 1,099 Chinese patients with COVID-19. Fever, cough, and fatigue were the most common symptoms. The study also found that older patients and those with other health conditions had a higher mortality rate from the disease.

Another investigation by Zhu *et al.* [16] looked at COVID-19 potential for transmission and viral load in a group of 82 Chinese patients. The investigation discovered that viral burden was most noteworthy at the beginning of side effects and diminished over the long haul, and that transmission potential was most noteworthy during the main seven day stretch of side effects.

According to the findings of a study by Lai *et al.* [17] which researched the emotional well-being effects of coronavirus on patients in China, COVID-19 patients had worse mental health outcomes than the general population, as well as had higher levels of anxiety and depression than the general population.

These studies demonstrated numerous ways in which COVID-19 could affect patients and its complex nature. In addition, they emphasized the significance of continuing research in the pursuit of a deeper comprehension of the disease and the creation of efficient treatments and interventions.

The results of the study also recommended that patients with blood groups A and AB had a more extended recuperation time in contrast with those of other blood groups. The results agree with a past examination that showed a relationship between blood gathering and illness seriousness and result.
For instance, a review led by Zhao *et al.* [11] in Wuhan China, found that patients with blood group A were more likely to experience severe symptoms and require mechanical ventilation

than those with other blood groups. In a similar way, Zaidi *et al*. meta-analysis found that people with blood group A were more likely to get severe COVID-19 and hence needed to be hospitalized than people with other blood groups.

The instruments behind this affiliation are not yet completely comprehended, however it has been recommended that the ABO blood groups framework might impact the insusceptible reaction and influence the seriousness of disease.
When compared to the control group, the distribution of blood groups among patients who died from COVID-19 was significantly different (Table 4). The risk of dying from COVID-19 among patients with blood group A was significantly higher than that of the control group (OR = 2.33, p = 0.005). Likewise the risk of dying from COVID-19 in patients with blood group AB was significantly higher than that of the control group (OR = 4.04, p = 0.0004). Then again, patients with blood bunch O had a fundamentally lower hazard of catching the dust from coronavirus than the benchmark group (OR = 0.17, p = 0.0001). There was no huge distinction between patients with Rh+ and Rh-blood gatherings and the benchmark group.

This study's findings are in line with those of previous studies that suggested a link between COVID-19 outcomes and blood groups. For instance, a study by Zhao *et al.* [11] found that people with blood groups A and O were more likely to get COVID-19 than people with blood groups O. A study by Zietz *et al*. [14] discovered that patients with blood group A were more likely to require mechanical ventilation than those with blood group O.
Due to COVID-19 pandemic immense burden on healthcare systems all over the world, it became challenging to identify and prioritize those who were most at risk. Late exploration showed that an individual's blood classification might impact their powerlessness to coronavirus and the seriousness of their side effects.

This study looked at data from 14,110 people in the New York Presbyterian Hospital system who had been tested for COVID-19 and had known blood types. The specialists tracked down that people with non-O blood classifications had a somewhat higher pervasiveness of contamination. The study also found that people with blood type A had a lower risk of needing a ventilator, whereas people with blood types AB and B had a higher risk. Additionally, people with blood types A and B had a lower risk of death than those with blood type AB.

In general, the review recommended that an individual's blood classification could assume a part in their gamble of coronavirus seriousness. Nonetheless, more exploration was expected to completely comprehend the connection between blood classification and coronavirus. “Hepatitis B, dengue hemorrhagic fever and other infectious disorders have all been linked to the ABO blood group system [18]. ABO blood group system and COVID-19, a novel respiratory infectious disease, were researched in connected to 100 covid patients. A study was conducted which separated the study population into two subgroups and evaluated the relationship between controls and cases according to gender. In the case of samples, the correlation between both the ABO blood group and the lymphocyte count was discovered, considering lymphopenia as a characteristic of COVID-19. The average lymphocyte count was lowest in individuals with blood type A. However there was no statistically significant difference between them and other blood types. Our results showed that blood type A females were more likely to be susceptible to COVID-19 [19]

The purpose of the study was to identify whether there was any variation in COVID-19 testing positivity among different blood types and whether there was a relationship between

ABO blood type and COVID-19 severity as measured by intubation or death. A common procedure known as the univariate analysis was carried out to ascertain the independent impact of blood group on intubation and/or mortality and positive tests. Logistic regression was then utilized to analyze the results. The study concluded that in patients with COVID-19, blood type was not related to the risk of intubation or death. Blood types AB and B patients who underwent testing, had a higher likelihood of testing positive. However, blood type O patients had a lower probability. Rh+ patients had a higher likelihood of testing positive [20][21][22][23][24].

Conclusion

The study investigated the correlation between blood group, age, sex with that of the status of COVID-19 disease outcome. The study concluded that the mortality rate among patients of blood group A and B was significantly high. The study further showed that there was significantly lesser number of patients with blood groups A and AB who finally recovered. Most of the patients with blood group B received the therapy, as the mortality among this blood group was also high. This observation proved that the severity of COVID-19 was high among blood group B patients.

Acknowledgment:

I would like to express our sincere gratitude to all those who contributed to the successful completion of this research and the preparation of this paper As this work would not have been possible without their valuable support.

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