



Evaluation of distribution of ABO blood group system in covid-19 positive patients in a tertiary care hospital in Kerala

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Abstract

Introduction: The Corona Virus Disease 2019, caused by the novel Coronavirus SARS-CoV-2 is an acute respiratory and systemic illness and is declared as a global pandemic by WHO on the 11th of March 2020. India has emerged as one of the worst-hit nations by novel Coronavirus pandemics in terms of total number of cases. Alterations in the haematological parameters are noted in COVID-19 infection. Recent evidence suggests blood typing also may affect the risk of COVID-19 infection. This study is conducted to assess the association between the ABO blood group and COVID-19 infection.

Aims and objectives

1. To study the distribution of ABO and Rh blood group systems in COVID-19 infection.
2. To study the age group and gender distribution of patients with COVID-19 infection.
3. To study the association of ABO and Rh blood group systems with COVID-19 infection.

Materials and methods: The study was approved by the ethical committee of the Government Medical College, Palakkad (IEC/GMCPKD/26/20/80). 2500 COVID-19 positive patients of all age groups tested by (Real-Time

PCR)RTPCR or Rapid Antigen testing method, admitted to Government Medical College Palakkad and District Hospital Palakkad from July 2020 to January 2021 were included in this study. Blood samples were collected from COVID-19-positive patients in the Regional Diagnostic Centre, District Hospital, Palakkad. COVID-19-positive patients who were asymptomatic and those in which haematological investigations were not performed due to mild symptoms were excluded from this study. ABO blood group typing was done by the tile method. Values and results will be taken from the laboratory records and medical records.

Results and conclusion: This study has found that the O blood group is protective against COVID-19 infection and the B blood group and Rh-positive individuals are more prone to get COVID-19 infection. Since many other factors also influence the etiopathogenesis of COVID infection, many more studies in this area should come to substantiate the above results.

Keywords: ABO Blood Group, Rh Typing, Covid-19 Infection.

Introduction

The Corona Virus Disease 2019, caused by novel Coronavirus SARS-CoV-2 is an acute respiratory and

systemic illness. It is declared a global pandemic by WHO on the 11th of March 2020.^[1] India has emerged as one of the worst-hit nations by the novel Coronavirus pandemic in terms of the total number of cases.^[2] The role of blood groups in susceptibility and resistance to various infectious diseases has been reported so far. However, the association of blood groups with susceptibility to COVID-19 infections or related death are limited in the literature.^[3] In the present study we tried to decipher the distribution of blood group typing in COVID-19 POSITIVE patients in the Kerala population. A complete pathological examination has always been considered an important tool to better understand the pathophysiology of diseases, especially when the knowledge of an emerging disorder is limited and the impact on the healthcare system is significant.^[4]

The ABO gene is located on the long arm of the 9th chromosome. It consists of 7 exons and codes for glycosyltransferases. The enzyme glycosyltransferases transfer specific sugar residues to H substance, and it is responsible for the formation of antigens in blood groups A and B. The enzyme encoded by the A allele uses the donor uridine-diphosphate-n-acetyl galactosamine (UDP-GalNAc) and converts H into antigen A. Similarly, glycosyltransferase coded by allele B, transfers the donor uridine-diphosphate-galactose (UDP-galactose) to the acceptor H leading to the formation of antigen B. In contrast, allele O produces non-functional enzymes owing to deletion at the 261st nucleotide leading to a pre-termination of the translational process. Antigen-A-bearing individuals have anti-B in their serum. Blood group O has both antibodies A and B in their serum.^[3] Corona virus is enveloped with spike glycoproteins.^[5] Angiotensin convertase enzyme (ACE) which activates angiotensin plays an important role in hypertension. ACE 2 is considered to be the primary receptor for Covid

virus.^[6] Covid virus attaches to the ACE2 receptor with the help of spike proteins.^[5] SARS Covid virus attaches to the carbohydrates that determine the ABO blood groups which are seen on the mucous membrane of the respiratory tract.^[6] Individuals with blood group O were less susceptible to SARS and blood group A is a partial risk factor for COVID-19 infection. Blood groups B and AB were not significantly associated with COVID-19 infection in a study done by Pourali et al.^[6] In a study done by Zietz M, the risk of COVID-19 infection is more seen in non-O type.^[7] ACE2 activity is more seen in blood group B than in the O group. Anti A antibodies prevent the binding of covid virus to the ACE2 receptor thereby protecting against the infection.^[8] According to Pourali et al, the O blood group have a low ACE level and blood group A have more ACE level.^[6]

In the past, there have been several studies on the association of the ABO blood group with diseases. Individuals with the blood group O were reported to be more susceptible to Cholera in Gangetic plain populations and Helicobacter pylori infection. However, blood group O was found to be less susceptible to Dengue and SARS (Severe Acute Respiratory Syndrome) viruses. Several studies have found a strong association between the ABO blood group and COVID-19 with morbidity and mortality.^[9] Previous reports have demonstrated the association of the ABO blood group system with susceptibility to a wide range of virus infections such as Severe Acute Respiratory Syndrome, symptomatic West Nile Virus, Human Immunodeficiency Virus, Hepatitis B and Norwalk virus.^[3]

The ABO blood type is administered by the gene ABO, present at chromosome 9. Studies have found that this gene modulates the COVID-19 susceptibility directly or indirectly. Several variants of this gene affect morbidity

and mortality in COVID-19 and many other diseases. ABO blood type is a potential risk factor for various diseases such as cancer, myocardial infarction, acute kidney injury, and venous thromboembolism, ischemic stroke, type 2 diabetes. [8] So studies are needed to confirm the association of blood groups and the susceptibility of COVID-19 infection.

Materials and methods

This is a cross sectional study that was conducted at Government Medical College, Palakkad. The Ethical Committee of Government Medical College, Palakkad reviewed and approved the study.

(IEC/GMCPKD/26/20/80). COVID-19-positive patients of all age groups tested by RT-PCR or Rapid Antigen testing method, admitted to Government Medical College Palakkad and District Hospital Palakkad from a period of July 2020 to January 2021 were included in the study. COVID-19-positive patients who were asymptomatic and those in which haematological investigations were not performed due to minimal symptoms were excluded from the study. Blood samples were collected from COVID-19-positive patients in the Regional Diagnostic Centre, District Hospital, Palakkad and ABO blood group typing done by tile method. A total of 2500 COVID-19-positive patients were studied. The distribution and significance of ABO and Rh typing were compared with the control group population extracted from 2 review studies done in Kerala (Abhishekh B,2011^[11], Soonam John,2017^[12])

Statistical analysis

An analysis, using SPSS(Statistical Package for Social Sciences) version 22, was performed concerning the main study aim. Descriptive characteristics for participants are expressed as means and standard deviation (SD) for continuous variables, and number and percentage for categorical variables. The chi-square test was used to find the association. The odds ratio and 95%

confidence interval were also calculated. P value <0.05 is taken as significant.

Results

A total of 2500 COVID positive patients were studied, among this the order of frequency of blood group was O group (35.04%) followed by, B (30.6%), A (27.1%) and AB (7.2%) from the highest to lowest. The frequency distribution of blood group typing is given below(See Table 1). Among the 2500 COVID positive patients, 1624(65%) were males and 876(35%) were females. The minimum age in our study is 0.019 years (7 days)and the maximum age is 96 years and the mean age and the Standard deviation are 48.67 and 18.76 respectively. The maximum numbers of patients were coming under 50-60 years of age. The minimum number of patients was under 90-100 years of age. (See Table 2).

104(4.2%) COVID positive patients were ≤ 18 years and 2396(95.8%) were >18 years of age.(See Table 3). Among 2500 patients, 2355 were Rh-positive patients and 145 were Rh-negative patients. (See Table 4)

Table 1: Blood group distribution

Blood Group	Number	Percentage
A Positive	642	25.7
B Positive	731	29.2
AB Positive	171	6.8
O Positive	811	32.4
A Negative	35	1.4
B Negative	35	1.4
AB Negative	10	0.4
O Negative	65	2.6
Total	2500	100

Table 2: Age group and gender distribution

Age group (years)	Male	Percentage	Female	Percentage	Total
0-10	23	76.7	7	23.3	30
10-20	83	67.5	40	32.5	123
20-30	236	65	127	35	363
30-40	280	72.2	108	27.8	388
40-50	281	65.7	147	34.3	428
50-60	287	64.9	155	35.1	442
60-70	246	62.3	149	37.7	395

70-80	142	58.7	100	41.3	242
80-90	42	50	42	50	84
90-100	4	80	1	20	5
Total	1624	65	876	35	2500

Graph 1: Age group and gender distribution among paediatrics and adult cases

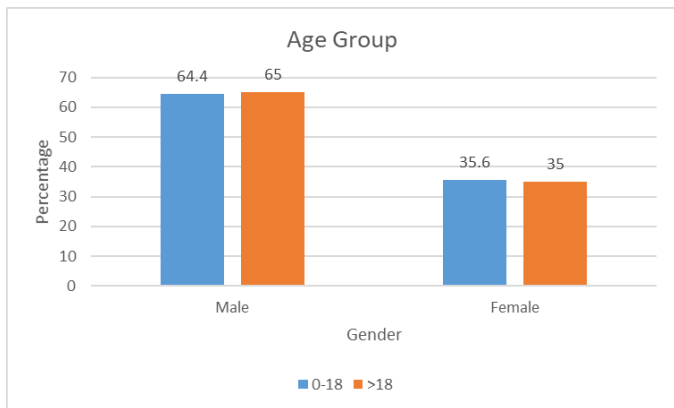


Table 3: Rh typing distribution

Blood group	Rh +ve	Rh -ve	Total
A	642	35	677
B	731	35	766
AB	171	10	181
O	811	65	876
Total	2355	145	2500

A chi-square test was done. The p-value of the O blood group is < 0.05 which means significant and the odds ratio is 0.847 which is less than 1, so the O blood group is having less risk for COVID infection which otherwise means the O blood group is protective against COVID infection.

The p-value of the B blood group is also < 0.05 which means significant and the odds ratio is 1.120 which is greater than 1, so the B blood group is more prone to get COVID infection.

P value of A and AB blood groups are > 0.05 , which means not significant. (See Table

Table 4: Blood group type distribution among our study and control group.

Blood group	Our study	Control group	P value	Odds ratio	95%CI
O	876(35%)	22776(38.9%)	< 0.001	0.847	(0.779-0.922)
A	677(27.1%)	15366(26.2%)	0.350	1.044	(0.954-1.142)
B	766(30.6%)	16565(28.3%)	0.011	1.120	(1.027-1.222)
AB	181(7.2%)	3851(6.6%)	0.191	1.109	(0.950-1.294)
Total	2500	58558			

The chi-square test was done. The p-value of Rh-positive COVID-positive cases is significant and the odd's ratio is 1.726, which means Rh-positive patients are having a chance to get an infection. (See Table 6)

Table 5: Rh-type distribution among our study and control group

Rh typing	Our Study	Control	P value	Odds ratio(95% CI)
Rh+ve	2355	52938	< 0.001	1.726(1.456-2.046)
Rh-ve	145	5626		
Total	2500	58558		

Discussion

According to WHO, there have been 627,104,342 confirmed cases of COVID-19 infection including 6,567,552 death globally and in India 44,653,592 confirmed cases of COVID-19 were reported till October 31, 2022. [Age, sex, various chronic illnesses and laboratory findings are the known risk factors for COVID-19 infection. The biological factors which determine the susceptibility to SARS CoV 2 virus and the severity of COVID-19 infection have to be studied. ABO blood grouping may have an association with COVID-19 infection.^[8]In this study we found that among the 2500 random COVID-19 confirmed cases who came to District Hospital Palakkad, 811(32.4%) were O positive, 731(29.2%) were B positive, 642(25.4%) were A positive, 171(6.8%) were AB positive, 65(2.6%) were O negative, 35 cases(1.4%) each of A and B negative and 10(0.4%) were AB negative. In the study done by Padhi et al, among 35,513 healthy cases in the kerala population, 13489(37.983%) were O group,

10313(29.04%) were B group, 9306(26.204%) were A group and 2405(6.772%) were AB group.^[3] Abhishek B in a study done among 27719 healthy donors in Thiruvananthapuram 11,101 were O blood group, 7264 were A group, 7591 were B type and 1763 were AB blood group. Among this 6585, 679, 6732, 859, 10095, 1006, 1616 and 147 were A Positive, A negative, B positive, B negative, O positive (36.4%), O negative, AB positive and AB negative (0.5%) respectively.^[11] In a study done by Soonam John among 30,839 donor population in the Department of Transfusion Medicine, Government Medical College, Thiruvananthapuram, the most common blood group was O positive (10518, 34.11%) and the least common was AB negative (159, 0.52%) which was almost similar to our study which confirms the common trend of blood group typing among the population in Kerala and verifies the authenticity of sample population which represent the state data.^[12]

Study	Our study	Samra et al ^[8]	El Shitany et al ^[5]	Rana et al ^[13]	Usul et al ^[14]
Males	1624(65%)	59.7%	15.2%	1800(70%)	69.3%
Females	876(35%)	40.3%	84.8%	786(30%)	30.7%
Total cases	2500	507	726	2586	163

In a study done by Rana et al, among 2586 corona patients, the gender distribution is almost similar to our study. ABO distribution based on gender shows no difference except in the B group where male patients are more likely to develop COVID-19 infection than female patients.^[13]

In a study done by Usul et al, among 163 COVID-positive patients, 69.3% were males and 30.7% were females which is almost in concordance to our study.^[14]

The mean age distribution in our study is 48.66 and the minimum and maximum are 0.019 and 96 respectively. The mean age distribution in a study done by Samra et al is 54.6.^[8] In the present study, 153(6.12%) patients were <20 years of age and 2347(93.88%) were >20 years. In a study done by El Shitany et al among 726 COVID-19

patients, 1.3% were <20 years and 98.7% were >20 years. Among this 596(82.1%) were coming under 20-40 years and 104(14.3%) were coming under 40-60 years and 17(2.3%) were >60 years.^[5] In our study, a maximum number of patients (442, 17.68%) were of 50-60 years of age and the minimum were of 90-100 (5, 0.2%) years. In our study, 876 (35.04%) patients have the O group, 766(30.6%) patients have the B group, 677(27.08%) patients have the A group and 181(7.2%) patients have AB group. In a study done by Rana et al, among 2586 corona patients most number patients were of the B group (1081, 41.8%) followed by the A group (774, 29.9%), O group (548, 21.19%) and AB group (183, 7.07%). In a study done by Zhao et al in China 1775 patients with COVID-19 frequency distribution of ABO blood groups were 37.8%, 26.4%, 10.0%, and 25.8% for A, B, AB, and O, respectively.^[15] In a study done by Saify et al among 301, confirmed COVID cases, 112(37.21%) were A group, 98(32.56%) were O group, 61 (20.26%) were B group and 30(9.97%) were AB group.^[16] A study by Singh et al on 509 COVID-positive samples in Uttar Pradesh, the most common blood group was the B group (0.354) followed by the O group (0.279), A group (0.204) and AB group (0.163).^[7] In a study by Samra et al, among 507 COVID-19 patients, 366 cases (72.18%) were A positive, 15(2.95%) were A negative, 18(3.5%) were B positive, 11((2.16%) were AB positive, 94(18.5%) were O positive and 3(0.59%) were O negative.^[8] In our study 642 cases were A positive, 35(1.4%) were A negative, 731(29.2%) were B positive, 171((6.8%) were AB positive, 811(32.4%) were O positive, 65(2.6%) were O negative, 35 cases (1.4%) were B negative and 10 (0.4%) were AB negative. Saify et al reported 245 (81.4%) and 56 (18.6%) cases of Rh-positive and Rh-negative COVID-19 cases respectively.^[16] Samra et al reported 489(96.4%) Rh-

positive and 18 (3.6%) Rh-negative cases^[8] In a study by Rana et al, 2536 cases(98.07%) were Rh positive and 50(1.93%) were Rh negative.^[13] In our study 2355(94.2%) cases were Rh positive and 145 (5.8%)cases were Rh negative, which is in concordance with the previous studies in the literature which means Rh Positive individuals are more prone to develop COVID 19.

Limitations

The major limitation of this study is that it does not consider other parameters like underlying comorbidities, hematological parameters, etc which can also affect the pathogenesis of the disease.

Conclusion

Our study has found that the O blood group is protected against COVID-19 infection and the B blood group is more prone to get COVID-19 infection. This study also states that Rh-positive individuals are having more chances to get COVID-19 infection. To the best of my knowledge, this is the first study in Kerala conducted to know the association between the ABO blood group and COVID-19 infection. However, the association of ABO and Rh blood groups cannot itself predict the susceptibility to COVID-19 infection since many other factors also play an important role in the etiopathogenesis of COVID-19 infection. So, many more studies should come to ascertain the role of blood groups and COVID-19 infection.

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