

## **Original Research Article**

### **A Study to Determine an Association Between ABO Blood Groups and Coronavirus Disease 2019**

#### **ABSTRACT**

Title of the article: A Study to Determine an Association Between ABO Blood Groups and Coronavirus Disease 2019

Introduction- The Coronavirus pandemic has led millions to succumb to the disease across the world, and overwhelmed the health care system. In this study we aimed at identifying whether the risk of Covid-19 infection is associated with ABO blood groups.

Methods-We obtained data of 7056 Covid-19 confirmed cases from Yashwantrao Chavan Memorial Hospital, Pune.

Results- The results showed that a significantly higher proportion of individuals with blood group A and AB tested positive for Covid-19, while a significantly lower proportion of individuals with O blood group tested positive for the same.

Conclusion-Therefore, routine ABO testing of Covid-19 patients could guide in decision-making and management of Covid-19.

**KEYWORDS-** Histo Blood group antigens, Pandemic, Susceptibility

#### **INTRODUCTION**

On March 11, 2020, the World Health Organization declared Covid-19 a global pandemic, indicating significant global spread of the virus that knew no boundaries as it spread to all continents. The virus being extremely contagious led to millions being succumbed to the disease across the world, crippled economies and overwhelmed the health care system leaving the entire human population gripping with terror. The ongoing crisis has indeed changed the world fabric with no country being capable enough to tackle this alone. Covid-19 has put not only our

healthcare and safety mechanisms, but also nations together to wage war against the common enemy. The Covid-19 pandemic has spurred researchers to find characteristics that render individuals more susceptible to the virus, as well as risk factors that intensify its severity and progression. There is currently no biological marker known to predict the susceptibility to Covid-19 and mounting evidence from across the globe seems to suggest that blood type could play a role in the risk of infection and determining the severity of the symptoms.

A study conducted in China compared the ABO blood group distribution of 2,173 patients with Covid-19 confirmed by RT-PCR test from three hospitals in Wuhan and Shenzhen, China with that in normal people from the corresponding regions. The results showed that blood group A was associated with a higher risk for acquiring Covid-19 compared to non-A blood groups, whereas blood group O was associated with a lower risk for the infection compared with non-O blood groups <sup>[1]</sup>. A large retrospective review by Harvard Medical school showed there appeared to be a greater chance of people with blood types B and AB tested positive for the virus and that symptomatic people with blood type O were less likely to test positive. However, no significant association between blood type and worsening of the disease was seen <sup>[2,3]</sup>.

These contradictions to literature have added ambiguity to the field. Moreover, there is a paucity of data regarding the relationship between ABO blood typing and severity of Covid-19 disease. If we can understand how the virus interacts preferentially with the receptors found on respiratory epithelium in people with different blood groups, we may be able to find new drugs or methods of prevention. Also, stringent monitoring of those individuals with susceptible blood groups can be done to prevent them from landing up with serious complications of Covid-19. This study aims at identifying whether the risk of Covid-19 infection is associated with ABO blood groups in a tertiary care hospital.

**AIM-** To determine an association between ABO blood group and Covid-19 susceptibility in the Indian population.

**OBJECTIVES-** To evaluate the risk of developing Covid-19 in individuals with different blood groups.

## **METHODOLOGY**

**Comment [MOU1]:** Citer les revues de Goel et al et de Le Pendu et al, ainsi qu'au moins une méta-analyse récente.

**Type of study-** Hospital based study

**Study population-** Individuals coming to the hospital for Covid-19 testing

**Place of study-** Dr. D.Y Patil Medical College, Pimpri, Pune

**Study duration-** 6 Months

**Sample size-** 7056 individuals

**Data collection-** The data was obtained from Yashwantrao Chavan Memorial Hospital, Sant Tukaram Nagar, Pimpri, Pune and comprised of Blood group wise segregation of Covid positive patients in the year 2020-2021.

**Measurements-**

Case definition - A confirmed Covid-19 case was any individual who tested positive for SARS-CoV-2 via a nasopharyngeal (NP) swab. Presence of SARS-CoV-2 virus in the Nasopharyngeal sample was tested by polymerase chain reaction (PCR) analysis.

Statistical analysis- Chi-squared ( $X^2$ ) Test of goodness of fit was used to compare the distributions of blood groups between samples. Statistical values were considered significant at  $p < 0.05$ . Statistical analysis was performed using Epi-info statistical software (version 7) and Microsoft Excel.

**Selection criteria-**

Inclusion criteria: All individual who tested positive for Covid-19 by RT-PCR

Exclusion criteria: All individuals who tested negative for Covid-19.

**RESULTS**

**Table I: Blood group pattern and Covid-19 susceptibility**

**Comment [MOU2]:** Even if the severity status is not known at the individual level, it would be important to give the proportion of positive patients diagnosed at the hospital who were not severely affected and required no hospitalization, those who required a short hospitalization in standard care and those who required were admitted in intensive care

**Comment [MOU3]:** How were blood groups obtained. Were all patients admitted tested for ABO, or was it a subgroup with ABO types known in advance..?

**Comment [MOU4]:** The 3 tables could be easily merged into one single table

Blood Group	Covid-19 susceptibility[(n%)]
<b>A</b>	1970(27.91)
<b>B</b>	2251(31.90)
<b>AB</b>	709(10.04)
<b>O</b>	2126(30.13)
<b>Total</b>	7056

## DISCUSSION

**Comment [MOU5]:** The results and discussion sections could be merged

As of October 13, 2021 approximately 34 million people succumbed to the coronavirus in India. Table 2 shows the blood group distribution pattern across India; O being the most common blood group (37%) closely followed by B (33%), followed by A (23%) while AB is the least prevalent at 7% <sup>[4]</sup>. A study conducted in Pune found a similar pattern of blood group distribution indicating no significant geographical variation in distribution <sup>[5]</sup>. The results of our study show a positive association between Blood group and susceptibility to Covid-19. A significantly higher proportion of individuals with blood group A and AB tested positive for Covid-19, while a significantly lower proportion of individuals with O blood group tested positive for the same. These findings are consistent with literature findings of the past.

### Analysis of susceptibility to Covid-19 infection

Out of the 7056 Covid positive sample we obtained, 27.91% patients belonged to A blood group, while 31.90% belonged to B, 10.04% to AB and 30.13% to O blood group. As shown in Table 3, we extrapolated the data obtained to that of the general population of India and using Chi-square of goodness of fit; a chi-square value of 122.889 was obtained and a p value of 0.000 indicated a significant statistical association between Covid-19 and Blood group.

We observed that a significantly higher proportion of individuals with A and AB blood group tested Covid positive [Observed=27.91%; Expected=23%;  $p < 0.05$ ] and AB [Observed=10.04%; Expected=7%;  $p < 0.05$ ], while a significantly lower proportion of individuals with O blood group tested positive for Covid-19 [Observed=30.13%; Expected=37%;  $p < 0.05$ ]. Our results are similar to findings of past literature as most studies identified a higher proportion of blood group A, and a lower proportion of blood group O being susceptible to the Corona virus. However, through our study we additionally found that blood group AB was also more susceptible to Covid-19.

The possible mechanisms to explain the differences in SARS-CoV-2 infection by ABO type are as follows: -

Each RBC expresses about 2 million copies of genetically encoded Histo-blood group antigens (HBAG) on its surface. In addition to serving as antigenic barriers during transfusion, transplantation and pregnancy, HBAG oligosaccharides physiologically influence hemostasis and, therefore, confer disease risks in infectious and non-infectious diseases. Multiple mechanisms have been proposed by which HBAGs can interact with pathogens at the portal of entry, or alter disease progression/severity, as well as affect clinical presentation. Individuals who express a specific HBAG are more susceptible to infection, whereas individuals without it are completely resistant or, at least, protected from severe disease<sup>[6]</sup>.

**Comment [MOU6]:** Cite Stowell et al instead

With respect to Covid-19; Firstly, HBAG glycans on SARS-CoV-2 S protein enhance the affinity of the Coronavirus to ACE-2 receptor, its cellular receptor. Alternatively, HBA glycans on target cells can serve as receptors for SARS-CoV-2<sup>[4]</sup>. Secondly, anti-A and/or anti-B antibodies present in blood group O individuals could bind to corresponding antigens on the viral envelope and contribute to viral neutralization, thereby preventing target cell infection. Hence, the SARS-CoV-2 spike (S) protein when bound by human anti-A antibodies (present in O and B blood group individuals), is blocked from binding to angiotensin converting enzyme-2 receptor, thereby preventing its entry into the lung epithelial cells<sup>[6]</sup>. Thirdly, emerging evidence suggests that receptor-binding domain (RBD) of SARS-CoV-2 may share sequence similarity to an ancient lectin family known to bind blood group antigens. SARS-CoV-2 RBD binds the blood group A expressed on respiratory epithelial cells, which could explain the linkage between blood group A and SARS-CoV-2 infection<sup>[6]</sup>.

**Comment [MOU7]:** Cite Wu et al instead

**Comment [MOU8]:** Cite Boukhari et al

**Comment [MOU9]:** see the above remark about the Wu et al citation these two corresponding sentences could be merged.

**Table II: Blood group pattern distribution in the Indian Population**

Blood Group	Percentage (%)
A	23
B	33
AB	7
O	37

**Table III: Extrapolation of Covid-19 susceptibility to the entire population of India**

<b>Blood Group</b>	<b>Observed[(n%)]</b>	<b>Expected[(n%)]</b>
<b>A</b>	1970(27.91)	1623(23)
<b>B</b>	2251(31.90)	2328(33)
<b>AB</b>	709(10.04)	494(7)
<b>O</b>	2126(30.13)	2611(37)
<b>Total</b>	7056	7056

**Limitations-**We lack data regarding outcomes of Covid-19 infection and hence cannot comment upon the possible association between Covid-19 severity and Blood group. Additionally, we lack demographic data of individuals (e.g. Age and other comorbidities) which could be confounding factors.

## CONCLUSION

To conclude we would like to state that routine ABO testing of Covid-19 patients could guide in decision-making, for instance, escalating care provided to individuals with higher risk blood groups. If verified by future studies, the findings of our study would have several potential clinical implications. Firstly, people with blood group A and AB might need stronger and stringent personal protection to reduce the chance of infection; Secondly, SARS-CoV-2-infected patients with blood group A and AB might need to receive more vigilant surveillance and aggressive treatment. However, the role of ABO blood group in Covid-19 disease requires additional study; likewise, people with any blood group would need to exercise the wisdom of careful practice to avoid SARS-CoV-2 infection.

## REFERENCES

1. Zhao J, Yang Y, Huang H, Li D, Gu D, Lu X *et al.* Relationship Between the ABO Blood Group and the Coronavirus Disease 2019 (COVID-19) Susceptibility *Clinical Infectious Diseases* 2020, Available on <https://doi.org/10.1093/cid/ciaa1150> [Last assessed on 15 July, 2021]

2. Latz C, De Carlo C, Boitano L, Maximilian C, Patell , Conradet M *et al.* Blood type and outcomes in patients with COVID-19, *Annals of hematology* 2020, doi:10.1007/s00277-020-04169-1
3. Almadhi M, Abdulrahman A, Alawadhi A, Rabaan A, Atkin S, Al Qahtani M; The effect of ABO blood group and antibody class on the risk of COVID-19 infection and severity of clinical outcomes. *Scientific Reports* 2021, Available on <https://doi.org/10.1038/s41598-021-84810-9> [Last assessed on March 11, 2021]
4. Pal GK, Pal P, Nanda N; *Comprehensive textbook of Medical Physiology, Blood, Blood groups*, 3<sup>rd</sup> edition, Elsevier.
5. Purandare VR, Prasad NB; Distribution of ABO blood groups in healthy young adults in Pune city. *International Journal of Basic and Applied Medical Sciences*. ISSN: 2277-2103 (Online).
6. Goel R, Bloch E, Pirenne F, Al-Riyami A, Crowe E, Dau L *et al.* ABO blood group and COVID-19: a review on behalf of the ISBT COVID-19 Working Group. *The International Journal of Transfusion Medicine* 2021, 12. 10.1111/vox.13076