Original Article

The Role of ABO and RH Blood Groups in COVID-19 Disease Susceptibility in Jordan

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Abstract

Introduction: Blood group phenotypes have been linked to susceptibility to several infectious illnesses. Coronavirus disease 2019 is a new disease caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which has spread fast over the world. The aim of the study is to assemble critical information between ABO blood types and COVID-19 infection

Methods: This detailed analysis of COVID-19 illness was based on data obtained from 2 laboratories from December 2021 to the end of April 2022, a questionnaire (survey) was done to make sure we get as many patients as possible for accuracy, the study take 198 patient and analyzed using Excel.

Results: The findings show that those with blood type A are more likely to get infected with the SARS-CoV-2 virus, whereas those with blood type O are far less likely to become infected, followed by blood group AB, and blood group B comes after A in relation of infection ratios.

Conclusions: If the present study's findings are confirmed by more research, they are believed to have therapeutic implications. Individuals with blood type A may require additional protection to lower their risk of infection. The ABO blood type can aid in the treatment of COVID 19 infection.

Keywords: blood types, coronavirus, histo-blood antigen, infection.

INTRODUCTION

On December 31, 2019, the Hubei Provincial Health Commission in China initially identified a cluster of unexplained pneumonia cases. A total of 27 cases were first reported, (1) followed by an outbreak on a greater scale. This was a new coronavirus, according to next-generation sequencing (2019-nCoV). (2)

COVID-19 has become a worldwide issue due to its simplicity of transmission and rapid spread through close contact. Symptoms appear after the incubation period, which can last anywhere from 2 to 14 days after virus contact. (2)

COVID-19 infection can cause mild to severe symptoms in those who are afflicted. Dry cough, fever, and weariness are all common minor symptoms, acute respiratory syndrome, septic shock, or death can occur in severe cases. (3,4) Age, sex, smoking, hypertension, diabetes, and chronic cardiovascular and respiratory disorders are all recognized to be risk factors for COVID-19 morbidity and death. (4)

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Access this article online

Quick Response Code:

Website: www.pnrjournal.com

DOI: 10.47750/pnr.2022.13.04.218

How to cite this article: Noor Z. Algaralleh, Dr. Maissa Al-shawagfeh, The Role of ABO and RH Blood Groups in COVID-19 Disease Susceptibility in Jordan, J PHARM NEGATIVE RESULTS 2022;13: 1552-1556.

ABO blood types are carbohydrate epitopes found on the surface of human cells discovered by Landsteiner. The tri-saccharide molecules GalNAc1–3-(Fuc1,2)-Gal- and Gal1–3-(Fuc1,2)- Gal- are antigenic determinants for the A and B blood Groups, respectively, whereas the antigen for the O blood type is Fuc1,2-Gal-. (5)

The ABO blood type is a hereditary feature that cannot be changed. Individuals can be classified as A, B, AB, or O based on the presence or absence of antigens on erythrocyte surfaces. Also Depending on the presence of the Rhesus (Rh) factor, blood types can be classified as positive or negative.

Blood types can be linked to illnesses and health through functions that are depending on their structure (6, 7). The antigens of the ABO blood groups are among the most important and well- studied, and they were the first to be identified [8]. RBCs' glycoconjugate structures serve as receptors for exogenous ligands, viruses, bacteria, and parasites, as well as transporters, channels, structural proteins, adhesion molecules, and enzymes [9].

Although blood types are inherited genetically, environmental variables can impact which blood types in a population are handed down to the next generation more frequently the ABO blood type has been linked to viral Infection susceptibility. (10)

ABO blood types have previously been linked to viral respiratory illnesses including influenza A (H1N1) and acute respiratory syndrome in a number of investigations (SARS) (11,12) It was also discovered that those with blood type O were less susceptible to getting the SARS coronavirus. (13)

So, it's important to identify consistent risk factors so that people at higher risk of illness should add greater steps to avoid infection. Furthermore, knowing which patients are most likely to have a poor prognosis or die might assist doctors better predict patient outcomes, allowing for more Focused administration of limited critical care services throughout epidemics. (14)

The objective of this study is to study and discover the association between blood type, COVID-19 infection rates, genetics, and the underlying biological pathway that affects susceptibility and severity. It is critical to understand the potential risk factor's influence in order for relevant individuals to take further care to avoid infection. (15)

MATERIALS AND METHODS

The study is undertaken 198 patients from December 2021 to the end of April 2022.

Of them 109 were men and the remainder (89) were females, mainly Lives in Amman and Zarqa

Patients with chronic diseases or diseases that make them more susceptible to infection, such as diabetes, were excluded

The data was collected from 2 private laboratory and a questionnaire (survey)

The questionnaire was included the age, gender and if the participant suffered from COVID-19 in the last three month also we collected for the Symptoms he/she had and their blood group, all information kept confidential to help protect patient privacy and only used for research purposes (for statistical scientific research purposes)

Any patient who has not been tested for the disease was excluded to maintain the accuracy of the results

A Positive real-time reverse transcriptase polymerase-chain reaction test of SARS-CoV-2 on nasal and pharyngeal swab specimens from patients confirmed the diagnosis of COVID in the lab using the antibiotic abCyclerQ device, and the blood group was tested by ABO blood typing by mixing the samples with antibodies against type A, B and Rh factor. (According to the manufacture protocol)

We had challenges about thoroughly investigate the relationship of blood types and COVID-19 severity since we couldn't contact all the patients and know their specific symptoms.

All information was obtained and analyzed with the standard Excel program.

RESULTS

A total of 198 were reported; 133 from laboratories and 65 from the survey, with 109 men (55.05 %) and 89 females (44.9%)

The mean of ages was 37.96 with range 15 – 71 years (Those with B blood group have the highest age average); Table I shows specific distribution among blood groups and gender.

Table I: the distribution of blood group among patients infected with COVID-19

blood type	Age average (years)	male	female
A	36.89	45	40
B	40.88	31	21
AB	38.77	19	17
O	35.32	14	11

According to the findings, eighty-five of the patients who had COVID infections have A blood group, 52 have B blood group, 36 have AB blood group, and the rest -25- carries O blood group as the figure I shows.

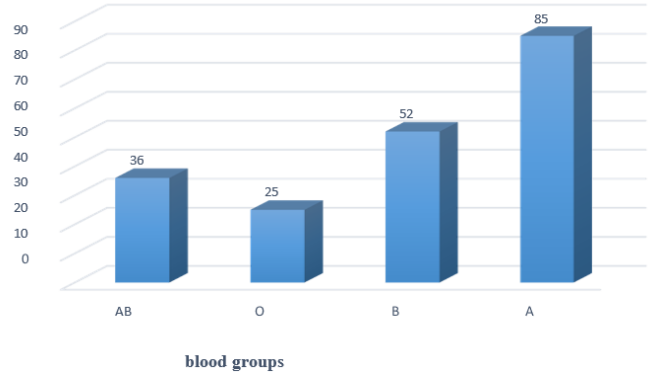

Figure 1: number of infections with their blood group

The blood group A show the highest result and was the highest blood group that was collected whereas the O blood group was the lowest The ABO blood group distribution was 42.98% for A, 26.09% for B, 18.02% for AB and 12.9 % for O (figure II).

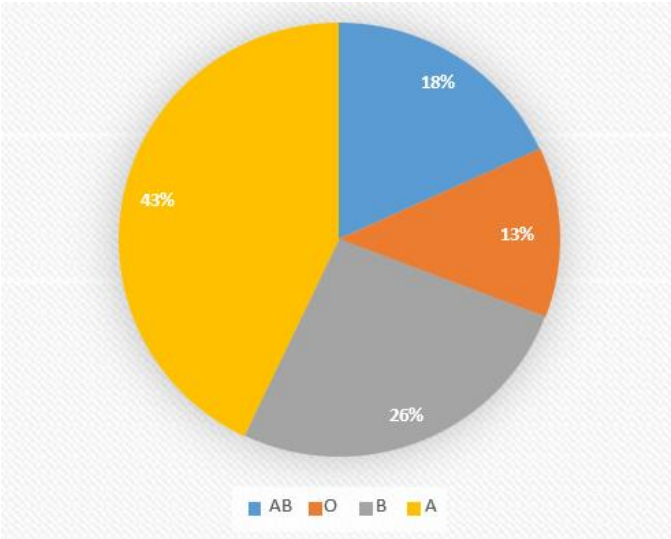

Figure II: blood distribution percent among infected patients

In terms of RH, the results revealed a significant difference between positive and negative Rh, with positive values being greater in all blood groups than negative ones, the table II contains specifics about the findings.

Table II: distribution of positive and negative Rh between patients

blood type	Rh+	Rh -	% for positiveRh *	%for negativeRh*
AB	24	12	12.13%	6.85%
O	18	7	9.10%	3.92%
A	59	21	29.78%	11.95%
B	34	18	17.17%	9.10%
Total	135	63	68.18%	31.82%

*The percent calculated according to the total number of patients

This figure shows the comparisons between positive and negative in the same blood group, which shows that the ratios of positive outperformed in all blood types (figure III)

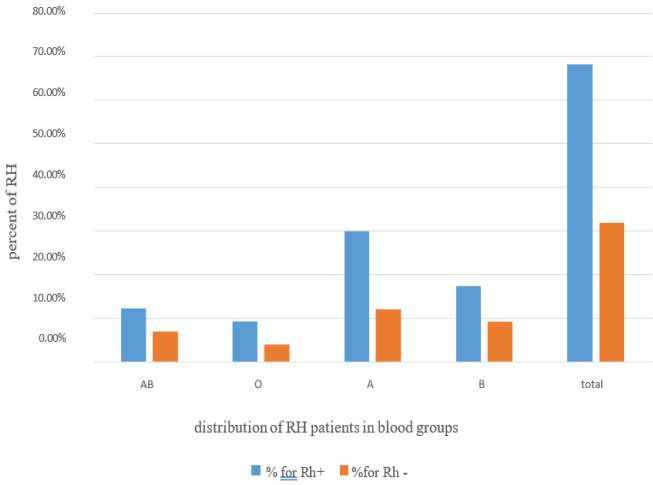

Figure III: the RH positive and negative in each blood group

DISCUSSION

We discovered that ABO blood types had varied chances of infection with COVID-19, The results show that patients with A+ blood type had the greatest ratios of COVID infections, while those with O- blood group had significantly the lowest infectious rate, which found that ABO blood types might be utilized as a biomarker to predict SARS- CoV infection risk, When Rh (D)+ and Rh (D) COVID-19-infected individuals are compared , Rh (D)+ individuals are statistically more at risk of infection than Rh (D) negative individuals,

During the study we also noticed that males had higher percent of infections than female.

In this study, Males were more frequently encountered than females, previous studies also demonstrated that male cases outnumbered female cases, and males tended to have a more severe disease or at a critical status of illness (16)

Male gender is largely connected with cardiovascular risk factor (heart disease, diabetes and hypertension) and high-risk behaviors (social isolation, specific occupational exposures, and cigarette use). Female sex hormones may potentially have an impact on immune response management (17).

As for blood groups, we also discovered that ABO blood types had varying chances of infection with COVID-19. Blood group A was related with a higher risk, but blood

group O was correlated with a lower risk. These findings are consistent with prior research that identified comparable risk patterns of ABO blood groups for different coronavirus infections. For example, Cheng et al. showed that the ABO blood group systems distinguished COVID infection susceptibility in Hong Kong (15).

We discovered that blood group O had a decreased risk of infection. Guillon et colleagues discovered that anti-A antibodies selectively blocked SARS-CoV S protein-expressing cells' adherence to ACE2-expressing cell lines. (18)

Studies have indicated a mechanism through which ABO histo-blood groups interact with viruses. ABO histo-blood antigens influence the immune system and influence pathogen dissemination via the host's natural antibodies and complement pathways (19)

According to the results, naturally existing anti-carbohydrate antibodies may have a similar impact. Besides than inhibiting virus attachment to its receptor, normal antibodies may prevent viral particles from entering or opsonize viral particles (7), resulting in enhanced mediated neutralization. Furthermore, it has recently been demonstrated that normal antibodies might contribute to the development of (cytotoxic T cells) against the infection. These extra protective procedures may have been used to protect group (O) members during the SARS pandemic (20).

The relationship might be due to anti-histo-blood group antibodies preventing the virus from adhering to its receptor on host cells Given that the SARS-Cov and SARS viruses are genetically related, and the protective pattern of the O histo-blood group in both viruses is comparable (18).

Considering the similarities in nucleic acid sequence and receptor angiotensin-converting enzyme 2 (ACE2) binding between SARS and SARS-CoV-2 (21), the lower susceptibility of blood group O and higher susceptibility of blood group A for COVID-19 could be attributed to the presence of natural anti-blood group antibodies, particularly anti-A antibodies.

The assumption for Rh susceptibility is not totally relevant in our communities since the distribution of Rh positive in Jorden is significantly higher than the distribution of Rh negative, therefore the results might be attributable to destitution rather than susceptibility.

Conclusion

The research shows that the ABO blood type system is important in susceptibility to protection against COVID-19.

It can be concluded that Individuals in group A appear to be at a higher risk of COVID, whilst those in group O appear to be at a lower risk.

Individuals with blood type A may require specifically strengthened protection to reduce the risk of infection. ABO blood type can help in COVID 19 infection treatment. Our discoveries underlying molecular mechanism will require more investigation.

Recomendation

The current study's findings are expected to have therapeutic implications if further research confirms them, Furthermore, research in populations with an equal ratio of positive and negative RH is required to obtain a real result concerning the virus's susceptibility on the patient.

Acknowledgements

The authors would like to thank Al-Balqa Applied University in Jordan for their support, as well as the laboratories that assisted us in data collecting and individuals who participated in the survey.

References

1. Chan, J. F. et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet (2020). 395, 514–523
2. Fang B., Liu L., Yu X., Li X., Ye G., Xu J., et al.. Genome-wide data inferring the evolution and population demography of the novel pneumonia coronavirus (SARS-CoV-2). Biorexiv (2020) DOI:10.1101/2020.03.04.976662
3. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. The Lancet 2020 (15;395(10223):470-473.)
4. Rothe C, Schunk M, Sothmann P, et al. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. N Engl J Med. 2020. (5;382(10):970-971)
5. Yang X, Cai S, Luo Y, et al. Extracorporeal membrane oxygenation for coronavirus disease 2019-induced acute respiratory distresssyndrome: a multicenter descriptive study. Crit Care Med 2020 (48(9):1289-1295)
6. Zheng, Z. et al. Risk factors of critical & mortal COVID-19 cases: a systematic literature review and meta-analysis. J. Infect. 2020 (81, 16–25).
7. Batool Z, Durrani SH, Tariq S. Association of ABO and Rh blood group types to hepatitis B, hepatitis C, HIV and syphilis infection, a five year' experience in healthy blood donors in a tertiary care hospital. J Ayub Med Coll Abbottabad 2017(29(1):90-92.)
8. S. G. Sandler and D. Mallory, "Biological functions of blood groups in health and disease," Haematologia (Budap) .1995;27(1):1-13..
9. FARHUD DD, YEGANEH MZ. A brief history of human blood groups. Iranian J Public Health 2013; 42(1): 1–6.
10. F. Yamamoto, E. Cid, M. Yamamoto, and A. Blancher, "ABO Research in the Modern Era of Genomics," Transfusion Medicine Reviews, 2012 (08.002 ppt. 113–118).
11. J. P. Cartron and Y. Colin, "Structural and functional diversity of blood group antigens," Transfusion Clinique et Biologique, 2001,(73;4 ppt 163–199)
12. Lindesmith L, Moe C, Marionneau S, et al. Human susceptibility and resistance to Norwalk virus infection. Nat Med 2003. (9(5):548-53)
13. Lebiush M, Rannon L, Kark JD The relationship between epidemic influenza (A(H1N1)) and ABO blood group. J Hyg (Lond), 1981. (87(1):139-46)
14. Mackenzie JS, Fimmel PJ The effect of ABO blood groups on the incidence of epidemic influenza and on the response to live attenuated and detergent split influenza virus vaccines. J Hyg (Lond), (1978. 80(1): 21–30)
15. Yunfeng Cheng, Gregory Cheng, C H Chui, F Y Lau, Paul K S Chan, Margaret H L Ng, Joseph J Y Sung, Raymond S M WongABO blood group and susceptibility to severe acute

respiratory syndrome. JAMA 2005 (293(12):1450-1.)
16. Ge H, Wang X, Yuan X, Xiao G, Wang C, Deng T et al The epidemiology and clinical information about COVID-19. Eur J Clin Microbiol Infect Dis. 2020 (39(6): 1011–1019.)
17. Channappanavar R, Fett C, Mack M, Ten Eyck PP, Meyerholz DK, Perlman S Sex-Based Differences in Susceptibility to Severe Acute Respiratory Syndrome Coronavirus Infection. J Immunol 2017 (15;198(10):4046-4053)
18. (18) Guillon P, Clément M, Sébille V, et al. Inhibition of the interaction between the SARS-CoV spike protein and its cellular receptor by anti-histo-blood group antibodies. Glycobiology; 2008 (18(12):1085-93)
19. Cooling L. Blood groups in infection and host susceptibility. Clin Microbiol Rev . 2015 ((3):801-70. doi: 10.1128)
20. Durrbach, A., Baple, E., Preece, AF, Charpentier, B., Gustafsson, K. Virus ¨recognition by specific natural antibodies and complement results in MHC I cross-presentation. Eur J Immunol, (37(5): 1254–1265) .2007
21. Wan Y, Shang J, Graham R, et al. Receptor recognition by novel coronavirus from Wuhan: An analysis based on decade-long structural studies of SARS. J. Virol 2020 94(7); 341-349)
22. Li J, Wang X, Chen J, et al: Association between ABO blood groups and risk of SARS-CoV-2 pneumonia. Br J Haematol 2020.,(ppt: 190:24–39)