Short Communication

Multi-factors Assessment in COVID-19 Patients: Fungal Infection, ABO Blood Group, and Age Factors

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Abstract

Background: The coronavirus disease 2019 (COVID-19) pandemic is a serious and global public health concern. Severity of infection, fatality rates, and treatment responses across different countries, age groups, and demographic groups suggest that the nature of infection is diverse. **Objectives:** Evaluation of several factors: presence of fungal infection, analysis of ABO blood group distribution pattern, age distribution, percentage of death, and well-being outcome for each blood group patient. **Materials and Methods:** Data collection included the presence of fungal infection and measurement of its percentage. Classification of patients according to ABO blood group and measuring their mean age distribution and death-wellbeing outcome. **Results:** This study showed the presence of 5% of fungal infection among the patients. This study showed that the distribution of ABO blood group in 90 patients with COVID-19 was as follows: 38.9% (35), 28.9% (26), 26.7% (24), and 5.6% (5) for O, A, B, and AB blood group patients respectively. The analysis of variance study revealed no significant difference in age distribution between different ABO blood group patients. The outcome for these patients was that 35.6% died and 64.4% recovered. A higher percentage of deaths occurred in patients with B blood group (approximately 45.8%, 11 out of 24 patients) and a lower percentage of deaths noted in patients with A blood group (about 34.6%, 9 out of 26 patients). The higher percentage of recovery was among O blood group patients with 71.4% (25 out of 35 patients). The lower percentage of recovery was among B blood group patients with 54.2% (13 out of 24 patients). **Conclusion:** This study concluded that despite the higher percentage of COVID-19 infections in patients with O blood group, its high good outcome is promising. On the other hand, this point must be taken into consideration while planning vaccinations, since patients with B blood group have a high percentage of deaths and lower percentage of recovery.

Keywords: ABO blood, COVID-19, fungal infection, patients

Introduction

The coronavirus disease 2019 (COVID-19) pandemic is a major challenge and has already caused close to 5.5 million infections and more than 350,000 deaths worldwide.[1] In order to understand and combat such a large-scale outbreak, the treatment and containment strategies must also consider the diversity of infection and potential differences such as the manner in which a population responds to the many variants that might exist. A number of studies on the genetic diversity of these viruses have been performed.[2] However, the exact reasons for these dramatically different mortality rates and possible differences in affected age groups are not very well understood. In many demographic studies, patient age has been recognized as one of the key factors predictive of clinical outcomes, including fatality rate and severity of symptoms.[3] The way in which a given viral variant might actually impact different patient age groups has not been well investigated. This study studied the age range in accordance with ABO blood group. The relationship between the ABO blood group and the incidence of COVID-19 infection and death has been investigated in several studies. The reported results were controversial. There were different risk factors for mortality in COVID-19 patients, including male

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gender, older age, diabetes, asthma, and other medical conditions.[4] Recently, some studies found an association between the ABO blood group and COVID-19 morbidity and mortality.[5] Because there is not yet much primary evidence regarding the association between blood groups and COVID-19 infection, upcoming relevant studies will be added to the results of the present meta-analysis.

Fungal co-infections are reported with increasing frequency and can be associated with severe illness and death.[6] Awareness of the possibility of fungal co-infection is essential to reduce delays in diagnosis and treatment in order to help prevent severe illness and death from these infections.

Patients hospitalized for COVID-19 are at risk for healthcare-associated infections (HAIs), including candidemia or bloodstream infections caused by *Candida*.[7] Fungal infections resistant to antifungal treatment have also been described in patients with severe COVID-19.[8] Early diagnosis and monitoring for *Candida* infections and antifungal-resistant infections (e.g., *C. auris*, azole-resistant *Aspergillus*) are key to reducing death from COVID-19 in patients with severe COVID-19 fungal co-infections.

Materials and Methods

Patients and study design

This cross-sectional study was conducted on patients with clinically and laboratory confirmed COVID-19 infections at Al-Noor Hospital in Al-Najaf Province, Iraq. This study was based on crowd-sourced data on COVID-19 patients. Information included the patient's age, weight, ABO blood group, presence of fungal infection, and outcome and well-being of the patient in the event of death. The patients were classified according to ABO blood group and mean age with standard deviation was estimated for each group. The percentages of deaths and well-being were determined, and a measurement of these percentages was also made for each ABO blood group classification.

Diagnosis of fungal infection was done depending on signs and symptoms. The important one is Thrush which causes curd-like white patches inside the mouth, especially on the tongue and palate and around the lips. If you try to scrape off this whitish surface, you will usually find a red, inflamed area, which may bleed slightly. There may be cracked, red, moist areas of skin at the corners of the mouth. Sometimes thrush patches are painful, but often they are not so. When *Candida* spreads to the bloodstream, it may cause a wide range of symptoms, from unexplained fever to shock and multiple organ failure.

Statistical analysis

Data are represented as mean ± SD and percentage. analysis of variance (ANOVA) test was used to measure the significant differences between variables. P value < 0.05 was considered statistically significant.

Ethical approval

The study protocol and patient consent forms were reviewed and approved by Al-Najaf Health Directorate Iraq, under reference No. 299 on April 12, 2021.

Results

This study showed the distribution of ABO blood group in 90 patients with COVID-19 as follows: 38.9% (35), 28.9% (26), 26.7% (24), and 5.6% (5) for O, A, B, and AB blood group patients, respectively. Age distribution among different ABO blood group patients was as follows: 54.457 ± 16.484 (range 27–85 year), 58.692 ± 17.391 (range 31–91 year), 54.291 ± 17.998 (range 26–85 year), and 50.4 ± 18.063 (range 30–69 year) for O, A, B, and AB blood group patients, respectively. The higher mean age was in patients with A blood group and the lower mean age was in patients with AB group, but statistically non-significant ($P > 0.05$).

By ANOVA test, study showed that there were no significant differences between these groups with P value = 0.66674 [Table 1, Figure 1].

Table 1: The distribution of ABO blood group in patients with COVID-19 and their mean age and SD. *F*-statistic value = 0.52429, *P* value = 0.66674

Data Summary				
Groups	**No. (%)**	**Mean**	**Std. Dev.**	**Std. Error**
Group O	35 (38.9%)	54.4571	16.4841	2.7863
Group A	26 (28.9%)	58.6923	17.3914	3.4107
Group B	24 (26.7%)	54.2917	17.9987	3.674
Group AB	5 (5.6%)	50.4	18.0638	8.0784

Analysis of variance summary					
Source	**Degrees of freedom (DF)**	**Sum of squares (SS)**	**Mean square (MS)**	***F*-stat**	***P*-value**
Between groups	3	467.4061	155.802	0.5243	0.6667
Within groups	86	25,556.3158	297.1665		
Total	89	26,023.7219			

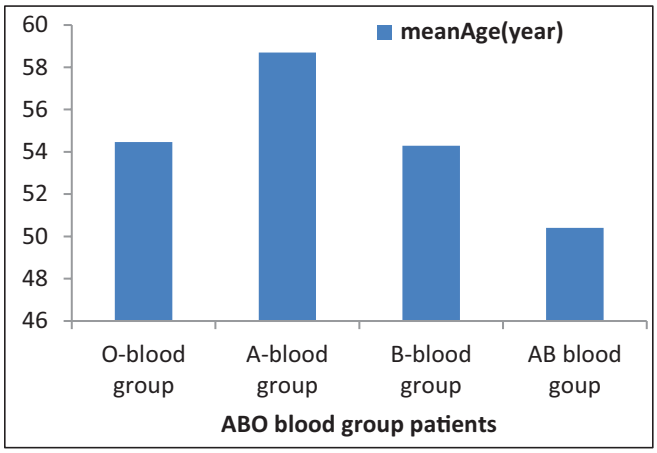

Figure 1: The distribution of ABO blood group in patients with COVID-19 and their mean age and SD

Table 2: Outcome of COVID-19 patients in accordance with ABO blood group

Blood group	No. (%) of patients died	No. of patients recovered
O	10 (42.8%)	25 (71.4%)
A	9 (34.6%)	17 (65.3%)
B	11 (45.8%)	13 (54.2%)
AB	2 (40%)	3 (60%)

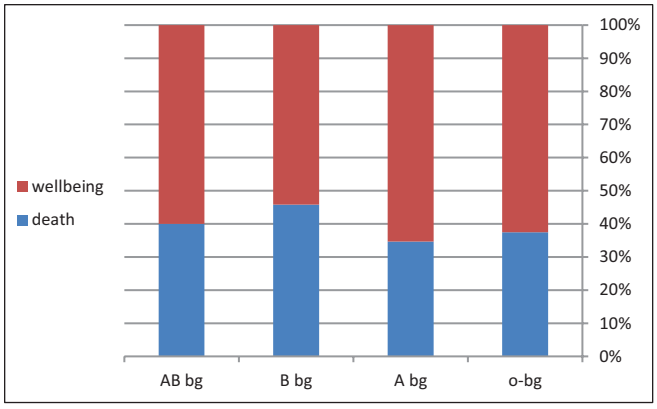

Figure 2: Outcome of COVID-19 patients in accordance with ABO blood group

Outcome for these patients was 35.6% deaths and 64.4% recovery.

A higher percentage of death in patients with B blood group (about 45.8%, 11 out of 24 patients), and a lower percentage of death in patients with A blood group (about 34.6%, 9 out of 26 patients). A higher percentage of recovery was noted among O blood group patients with 71.4% (25 out of 35 patients). A lower percentage of recovery was noted among B blood group patients with 54.2% (13 out of 24 patients) [Table 2, Figure 2].

The study showed that 52.2% of patients (47 out of 90 patients) were with diabetes mellitus. The examination for candidiasis revealed the presence of 5% of oral candidiasis.

Discussion

In many demographic studies, patient age has been recognized as one of the key factors predictive of clinical outcomes, including fatality rate and severity of symptoms.[3] This study showed the mean age of COVID-19 patients was 55.41 ± 17.04, in comparison with a study of Shandar Ahmad as six groups of patients have been identified from different geographical locations from where the infection was potentially carried. Patient age profiles of these groups originating from North America, the United Kingdom (UK), the European Union (EU), Asia, the Middle East, and other regions reveal that patients from each region have clearly distinct age distributions and that these groups tend to cluster to form two supergroups. The UK group, which looked similar to North America and Middle East in terms of average patient age, tended to cluster closer to the European Union and Asia group on account of a greater population density in the age range of 30–40 year, which suggests more younger people being infected in each of these three groups. The age profile differences observed between different conditions would be further confounded by additional factors such as (i) the degree and target population being tested, (ii) ethnic variations from one place to the other, and (iii) general population age variations. Taking the population data from a single country and origin of infection over the patient groups located in the same country reduces the differences between testing strategies, background population demographics, genetic variations, and time points of infection in a better way.[9]

This study showed the distribution of ABO blood group in 90 patients with COVID-19 as follows: 38.9% (35), 28.9% (26), 26.7% (24), and 5.6% (5) for O, A, B, and AB blood group patients, respectively, which means the higher percentage is in patients with O blood group and the lower percentage in patients with AB blood group. These results differed from other studies like Shandar Ahmad[9] which found frequency of blood groups A, B, O, and AB among COVID-19-infected individuals was estimated as 36.22%, 24.99%, 29.67%, and 9.29%, respectively, so the higher percentage of infection was in patients with A blood group then followed by patients with O blood group, whereas other results regarding percentage of B and AB blood group patients were close to the results of mentioned study.

Another study described a higher infection rate in group AB patients and a lower rate in group O patients.[10] In contrast, an additional study found no correlation between group A status and COVID-19; nonetheless, group O individuals had a lower risk of COVID-19 and group B and AB individuals had a higher risk.[11] One potential reason for these varying results is that many such studies did not account for various confounders including comorbidities.

Our study showed no significant difference in age and ABO distribution and this matched the finding of the study in Wuhan Jinyintan Hospital which found that age and gender do not have much effect on the distribution.[12]

The evaluation of the the results of patients was carried out and results showed a higher percentage of deaths among B blood group patients (about 45.8%), with a lower percentage of recovery (about 54.2%). Lower percentage of death was among A blood group patients with 34.6%. These results differed from the other study which reported a higher chance of mortality in patients of blood group A, and showed lower odds of death among people with blood group B. Their results were statistically non-significant. The higher percentage of recovery was among O blood group patients with 71.4% and this goes well with the other study which found the prevalence of death due to COVID-19 was significantly lower in blood group O compared to other blood groups. One of the explanations that anti-A and/or anti-B antibodies (e.g., present in group O individuals) could bind to corresponding antigens on the viral envelope and contribute to viral neutralization.[13] This could be due to in part that people with blood group O have higher interleukin 6 (IL-6) levels.[14] IL-6 is a proinflammatory cytokine that can be produced by many cells and which plays an important role in cell defense in the acute phase.[15] However, studies showed that IL-6 is associated with COVID-19 severity, as it can be part of a cytokine storm.[16] IL-6 could both play a protective role with its involvement in lung repair responses and exacerbate its role in COVID-19 infection.[17]

The researchers found that fungal infection (oral thrush) one of the findings of what is called Covid tongue besides having a dry mouth was the most common problem, followed by loss of taste (dysgeusia). This study showed the presence of 5% of patients with candidiasis.

The prevalence of fungal infections in patients suffering from COVID-19 as they may experience lymphocytopenia, hospitalization in the intensive care unit (ICU), broad-spectrum antibiotic and corticosteroid usage, intubation, cytokine storms, and having underlying diseases which make them severely immunocompromised.[18]

For this reason, the presence of fungal infection in our study may be attributed to many factors, one of them stated that 52% of the patients were diabetic and the regime of treatment involved high dose of steroids.

Conclusion

Early detection of fungal infection as a risk factor for this infection is common, so early treatment is important to prevent systemic candidiasis.

Other conclusions: Despite the higher percentage of COVID-19 infection in O blood group patients, its high good outcome is promising. On the other side, this point must be taken into consideration when planning vaccination, since patients with B blood group have a high percentage of deaths and a lower percentage of recovery.

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Conflicts of interest

There are no conflicts of interest.

References

1. https://www.who.int/emergencies/diseases/novel-coronavirus-2019. [last accessed on 22 Jan 2022].
2. Jebur MH, Hamawandi JA, Al-Hasnawy HH, Abdul-Lateef LA, Al-Charrakh AH. Covid-19, history and modern laboratory diagnostic techniques: A rapid review. J Pharm Negative Res 2022;13:321-6.
3. Bhopal R. COVID-19 worldwide: We need precise data by age group and sex urgently. BMJ 2020;369:m1366.
4. Williamson EJ, Walker AJ, Bhaskaran K, Bacon S, Bates C, Morton CE, *et al*. Factors associated with COVID-19-related death using OpenSAFELY. Nature 2020;584:430-6.
5. Fan H, Zhang L, Huang B, Zhu M, Zhou Y, Zhang H, *et al*. Retrospective analysis of clinical features in 101 death cases with COVID-19. medRxiv 2020. Available from: https://www.medrxiv.org/content/10.1101/2020.03.09.20033068v2.
6. Beer KD, Jackson BR, Chiller T, Verweij PE, Van de Veerdonk FL, Wauters J. Does pulmonary aspergillosis complicate COVID-19? External icon. Crit Care Exp 2020;2:e0211.
7. Al-Charrakh AH, Al-Mamory O, Al-Malaky KA. Antifungal susceptibility patterns of *Aspergillus* species isolated from patients with pulmonary diseases in Iraq. J Appl Pharm Sci 2018;8:88-93.
8. Alzaidi JR, Hussien FH, Al-Charrakh AH. The effect of vaginal Bacillus (*Lactobacillus acidophilus*) towards *Candida* spp. isolated from women with candidiasis. New Armenian Med J 2021;15:77-83.
9. Shandar A. Potential of age distribution profiles for the prediction of COVID-19 infection origin in a patient group. Inf Med Unlocked 2020;20:100364.
10. Abdollahi A, Mahmoudi-Aliabadi M, Mehrtash V, *et al*. The novel coronavirus SARS-CoV-2 vulnerability association with ABO/Rh blood types. Iran J Pathol 2020;15:156-60.
11. Latz CA, DeCarlo C, Boitano L, Png CYM, Patell R, Conrad MF, *et al*. Blood type and outcomes in patients with COVID-19. Ann Hematol 2020:1-6.
12. 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. Clin Infect Dis 2021;73:328-31.
13. Breiman A, Ruven-Clouet N, Le Pendu J. Harnessing the natural anti-glycan immune response to limit the transmission of enveloped viruses such as SARS-CoV-2. PLoS Pathog 2020;16:e1008556.
14. Naitza S, Porcu E, Steri M, Taub DD, Mulas A, Xiao X, *et al*. A genome-wide association scan on the levels of markers of inflammation in Sardinians reveals associations that underpin its complex regulation. PLoS Genet 2012;8:e1002480.
15. Zhang C, Wu Z, Li JW, Zhao H, Wang GQ. Cytokine release syndrome in severe COVID-19: Interleukin-6 receptor antagonist tocilizumab may be the key to reduce mortality. Int J Antimicrob Agents 2020;55:105954.
16. Ulhaq ZS, Soraya GV. Interleukin-6 as a potential biomarker of COVID-19 progression. Med Mal Infect 2020;50:382-3.
17. McGonagle D, Sharif K, O'Regan A, Bridgewood C. The role of cytokines including interleukin-6 in COVID-19 induced pneumonia and macrophage activation syndrome–like disease. Autoimmun Rev 2020;19:102537.
18. Gangneux J-P, Bougnoux M-E, Dannaoui E, Cornet M, Ralph ZJ. Invasive fungal diseases during COVID-19: We should be prepared. J Mycol Med 2020;30:100971.