fortune Journals

Research Article

JOURNAL OF WOMENS HEALTH AND DEVELOPMENT

ISSN: 2644-2884

ABO-RH Blood Group and the Risk of COVID-19 in the Moroccan Population

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Abstract

Introduction: Given the rapid spread, significant morbidity, and mortality associated with COVID-19, there has been scientific interest in obtaining data detailing the factors influencing the risk of COVID-19 infection. This study aimed to reveal a possible association between the ABO-Rh system and the risk of COVID-19 in the Moroccan population.

Materials and Methods: This is an analytical cross-sectional study. This was performed on 1094 patients for the diagnosis of COVID-19 by RT-PCR at the Moulay Ismail military hospital in the province of Meknes. All RT-PCR-negative individuals were used as a comparison group.

Results: Among the 1094 individuals who were diagnosed, RT-PCR for the detection of SARS-CoV-2 was positive for 242 individuals. A comparison of the proportions of blood groups of the two groups showed that the proportion of blood group A in patients with COVID-19 was significantly higher than that in people in the comparison group (P = 0.007), while the proportion of blood group O in patients with COVID-19 was significantly lower than that in people in the control group (P = 0.017). A comparison of the Rh blood group of the two groups did not find a significant association (P = 0.608).

Conclusion: As demonstrated by several previous studies, we concluded that blood group A was associated with a higher risk of acquiring COVID-19. In addition, the blood group O was associated with a lower risk of infection.

Keywords: ABO/Rh Blood groups; COVID-19; SARS-CoV-2; Moroccan population

Introduction

The 21st century has seen six global health emergencies declared by the World Health Organization (WHO), three of which were caused by viruses from the coronavirus group. The most recent is a new Coronavirus, which was identified on January 7, 2020, and subsequently named SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2). The disease was named COVID-19 (Coronavirus Disease 2019). On March 11, 2020, the World Health Organization declared the SARS-CoV-2 a global pandemic [1, 2]. Based on clinical observations, patient age, male gender, and presence of certain underlying pathologies (primarily cardiovascular disease, chronic obstructive pulmonary disease, and diabetes) have been highlighted as risk factors predisposing to infection with SARS-CoV-2 and higher severity [3]. More recently, epidemiological and molecular studies have reported preliminary

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Citation: Reda Karami, Mourad Belaouni, Elhoucine Malki, Rabii El Bahraouy, Mohammed Er-Rami, Lhoussain Louzi, Khalid Lahmadi. ABO-RH Blood Group and the Risk of COVID-19 in the Moroccan Population. Journal of Women's Health and Development 7 (2024): 01-05.

Received: January 16, 2024
Accepted: January 22, 2024
Published: February 02, 2024

Karami R, et al., J Women's Health Dev 2024
DOI:10.26502/fjwhd.2644-288400113

evidence of a correlation between the risk of contagion by SARS-CoV-2 and the erythrocyte phenotype determined by the ABO-Rh system, the exact mechanisms of which are not yet well determined [4, 5]. However, the association between blood groups and vulnerability or resistance to certain infectious pathologies has been demonstrated by older studies. In this context, we conducted a study on the association between ABO blood groups and COVID-19 infection in the Moroccan population through patients tested for SARS-CoV-2 at the Moulay Ismail Military Hospital in Meknes.

Materials and Methods

This is an analytical cross-sectional study involving male military personnel sharing the same workplaces for the diagnosis of COVID-19 at the Moulay Ismail Military Hospital in the province of Meknes, Morocco. The diagnosis was made after the appearance of pulmonary symptoms in a few individuals. On admission, all individuals underwent a complete physical examination and rapid serological test for the specific detection of IgM and IgG antibodies against the novel coronavirus. Sociodemographic, epidemiological, and clinical data have been specified on the information sheets. The detection of SARS-CoV-2 in nasopharyngeal and oropharyngeal samples was performed by real-time reverse transcription-polymerase chain reaction (RT-PCR) using the GeneFinder™ COVID-19 PLUS Real*Amp* Kit (OSANG Healthcare Co, Ltd., Korea) according to the manufacturer's instructions on the CFX96™ Real-Time amplification system (Bio-Rad Laboratories, Inc. USA). Testing for anti-SARS-CoV-2 antibodies was used to detect old infection (RT-PCR negative) and in conjunction with epidemiological and clinical data for interpretation of questionable results. ABO-Rh blood typing was performed on a sample taken from an EDTA tube using an agglutination technique with two complementary tests, Beth Vincent (globular test) and Simonin (serum test). Our comparison group (COVID-19 negative) comprised all individuals with RT-PCR and negative serology. Statistical analysis was performed using Epi-Info™ (version 7.2 CDC Atlanta, USA). Proportions were compared using the chi-square test or Fisher's exact test. The means were compared using the Student's test. A difference was statistically significant for $P < 0.05$. An odds ratio (OR) with a 95% confidence interval (CI) was used as a measure of association.

Results

This study involved 1094 individuals diagnosed with COVID-19. This is a relatively young male population. The average age was 36.32 years (standard deviation of 7.12 years, extremes ranging from 22 to 55 years). RT-PCR for the detection of SARS-CoV-2 was positive for 242 individuals. Eighty-sixty-six RT-PCR-negative individuals were used as a control group. The difference between the mean age of patients (35.13 years, SD = 7.189) and that of controls (36.66 years, SD = 1.070) was significant, indicating that the youngest in this community were at a higher risk of SARS-CoV-2 infection ($P = 0.003$) (Table 1).

The frequency distribution of blood groups A, B, AB, and O in the patients was 39.67%, 13.22%, 5.79%, and 41.32%, whereas in the controls it was 30.28%, 12.21%, 5.63%, and 51.88%, respectively. When blood groups of COVID-19 patients were compared with the control group, it was found that the proportion of blood group A in patients with COVID-19 was significantly higher than that in the control group (39.67% vs. 30.28%, $P = 0.007$), while the proportion of blood group O in COVID-19 patients was significantly lower than that in the control group (41.32% vs. 51.88%, $P = 0.017$). These results revealed a significantly increased risk of COVID-19 in blood group A, with an odds ratio of 1.513 (95% CI 1.125-2.035), and a decreased risk of COVID-19 in blood group O, with an odds ratio of 0.697 (95% CI 0.522-0.931). A comparison of the Rh blood groups of the two groups did not find a significant association ($P = 0.608$) (Table 1). Clinically, 17.36% (n = 42) of SARS-CoV-2 RT-PCR-positive subjects were asymptomatic. All symptomatic patients presented with mild COVID-19. The most frequent symptoms were anosmia and/or ageusia (n = 90), diarrhea (n = 82), cough (n = 62), sore throat (n = 60), breathing difficulties (n = 47), and asthenia (n = 44). The relationship between the clinical expression of COVID-19 and the distribution of ABO blood groups was only significant for headaches. COVID-19 patients in group AB were more at risk of headache ($p < 0.001$) (Table 2).

Table 1: Comparison between patients and controls concerning the ABO/Rh blood group.

	Control	COVID-19	χ^2	OR	*P*
	n=852	n=242		(CI à 95%)	
Age, mean (SD)	36,66 (7,07)	35,13 (7,189)	-	-	0,003
A (%)	258 (30,28)	96 (39,67)	7,165	1,513 (1,125 - 2,035)	0,007
B (%)	104 (12,21)	32 (13,22)	0,097	1,096 (0,716 - 1,676)	0,754
AB (%)	48 (5,63)	14 (5,79)	0	1,028 (0,577 - 1,899)	1
O (%)	442 (51,88)	100 (41,32)	5,643	0,697 (0,522 - 0,931)	0,017
Rh+ (%)	785 (92,14)	226 (93,39)	0,261	1,205 (0,685 - 2,121)	0,608

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Karami R, et al., J Women's Health Dev 2024
DOI:10.26502/fjwhd.2644-288400113

Table 2: Relationship between the distribution of ABO blood groups and clinical characteristics in patients with COVID-19.

Clinical characteristic	Blood types				χ^2	P
	A	B	AB	O		
Symptomatic						
Yes	80 (83.33%)	28 (87.50%)	12 (85.71%)	80 (80%)	1,137	0.768
No	16 (16.67%)	4 (12.50%)	2 (14.29%)	20 (20%)		
Anosmia/Ageusia						
Yes	36 (37.50%)	18 (56.25%)	6 (42.86%)	30 (30%)	7,386	0.061
No	60 (62.50%)	14 (43.75%)	8 (57.14%)	70 (70%)		
Diarrhea						
Yes	41 (42.71%)	10 (33.33%)	6 (42.86%)	25 (25%)	7,462	0.058
No	55 (57.29%)	20 (66.67%)	8 (57.14%)	75 (75%)		
Cough						
Yes	22 (22.92%)	6 (18.75%)	4 (28.57%)	30 (30%)	2,231	0.525
No	74 (77.08%)	26 (81.25%)	10 (71.43%)	70 (70%)		
Sore throat						
Yes	23 (23.96%)	11 (34.37%)	4 (28.57%)	22 (22%)	2,137	0.544
No	73 (76.04%)	21 (65.63%)	10 (71.43%)	78 (78%)		
Breathing difficulties						
Yes	20 (20.83%)	7 (21.88%)	5 (35.71%)	15 (15%)	3,869	0.276
No	76 (79.17%)	25 (78.12%)	9 (64.29%)	85 (85%)		
Asthenia						
Yes	15 (15.63%)	6 (18.75%)	2 (14.29%)	21 (21%)	1,105	0.776
No	81 (84.37%)	26 (81.25%)	12 (85.71%)	79 (79%)		
Headaches						
Yes	13 (13.54%)	4 (12.50%)	10 (71.43%)	11 (11%)	35,101	< 0.001
No	83 (86.46%)	28 (87.50%)	4 (28.57%)	89 (89%)		
Myalgia/arthralgia						
Yes	15 (15.62%)	2 (6.25%)	4 (28.57%)	15 (15%)	3,998	0.261
No	81 (84.38%)	30 (93.75%)	10 (71.43%)	85 (85%)		
Fever						
Yes	1 (1.04%)	0 (0%)	0 (0%)	7 (7%)	7,380	0.0607
No	95 (98.96%)	32 (100%)	14 (100%)	93 (93%)		

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DOI:10.26502/fjwhd.2644-288400113

Discussion

Similar to recently reported results, the objective of this work was to investigate the association between ABO-RH blood groups and the risk of COVID-19 in the Moroccan population. To our knowledge, our study is the first of its kind in Morocco to seek this association. COVID-19 is the latest deadly zoonosis, and since its onset, it has affected millions of people around the world. Several risk factors, including advanced age, male gender, and the presence of chronic underlying co-morbidities, have been established to be attributed to a higher likelihood of being infected with SARS-CoV-2 [6, 7]. Inconsistent with published data, we found that COVID-19 affects younger people more. This can be explained by the way of life and grouping that follow a hierarchical pattern. Indeed, the youngest are more in contact in workplaces and share guest rooms for four or more people, while the oldest (often older) share individual or two-person workspaces and individual guest rooms. Comparing the ABO blood groups of our COVID-19 patients with the control group, we found that there was a significantly increased risk of COVID-19 in patients with blood group A and a significantly lower risk for patients with blood group O. This finding is consistent with the literature data [8, 9]. Similar associations have been reported between ABO phenotypes and susceptibility to several bacterial and viral pathogens, indicating vulnerability or resistance. It has been suggested that certain viruses perform their roles by binding to ABO blood antigens. This is an example of Norwalk-like viruses and caliciviruses that are spread by interaction with antigens of the ABO blood group system [10, 11]. Therefore, some strains of rotavirus find their way back through the cells of the gastrointestinal tract thanks to antigens associated with blood group A [12]. The association between the ABO blood group phenotype and the likelihood of being infected with SARS-CoV, the causative agent of severe acute respiratory syndrome (SARS), has been demonstrated. Yufeng Cheng et al. investigated the prevalence of SARS disease among hospital staff in Hong Kong who were exposed unprotected to infected patients, finding that people with blood group O had a lower likelihood of infection [13]. Chen et al. proposed a mechanism by which the coronavirus spike protein (S), heavily N-glycosylated, binds with high affinity to the human angiotensin-converting enzyme 2 (ACE2) [14]. It has been shown that ACE2 is an obligatory cell receptor although other receptors may participate in the infection process [14, 15]. Patrice Guillon et al. used in vitro cell binding tests and a mathematical model of cell viral transmission. They claimed that natural or monoclonal anti-A antibodies specifically inhibited the adhesion of the SARS-CoV (S) Spike protein to its ACE2 cell receptor [12]. Given the structural similarity between the receptor binding domains of SARS-CoV and SARS-CoV-2 [16] and the use of the same receptor, ACE2, to enter target cells [16, 17], the aforementioned mechanisms could be extended to SARS-CoV-2.

Our study did not find a clear association between the ABO blood group and the clinical expression of COVID-19. An exception was made for headaches where patients with AB blood type were more likely to have AB ($P < 0.001$). Numerous studies published in this regard have indicated that the ABO blood group does not influence the symptoms of COVID-19 [18, 19]. This study had certain limitations that could lead to some bias in the results. First, the study population consisted exclusively of relatively young males. Second, there is a lack of other data (weight, underlying pathologies, smoking, etc.) that are predisposing factors to the risk of infection with SARS-CoV-2.

Conclusions

As previous studies on COVID-19 and this study have shown, the statistically significant association between the ABO blood group and susceptibility to COVID-19 is clear. Blood group A was associated with a higher risk of acquiring COVID-19 than non-A blood groups, whereas blood group O was associated with a lower risk of infection than non-O blood groups. The distribution of blood groups in the population can be useful for understanding the kinetics of the epidemic at the local level and for establishing a health policy aimed at reducing viral spread. Further studies are needed to determine the exact mechanism by which the ABO blood group influences susceptibility to COVID-19, which could be useful for patient management and disease control.

Conflicts of interest

The authors declare that they have no conflict of interest regarding the publication of this paper.

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