



Association between Major Blood Groups (ABO and RhD) and Coronavirus Disease 2019 among Sudanese Patients at Khartoum State

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Abstract

Background:

The origin of ABH substance is a molecular polymorphs of monosaccharides in erythrocytes surface molecules, rather than Rhesus molecules which is a protein in nature, as amino acids polymorphs, Coronavirus disease 2019 (COVID-19) is a major public health problem worldwide.

Aim:

The aim of this study was to determine the association between the major blood groups and COVID-19 among COVID-19 Sudanese patients at Khartoum state.

Methods:

A descriptive, hospital based case-control study, was conducted at Khartoum state Sudan, during the period from November 2020 to March 2021. The laboratories included were Jabra hospital, Best care hospital, Fedail hospital, and the National Public Health Laboratory. The DIAMED gel card (DiaClon ABD, BIO-RAD) method of ABO and RhD typing procedure was adopted. A statistical analysis was made using SPSS version 22 for Chi-square and Odds ratio calculations. The statistical significance was measured in P value 0.05. The results were displayed in table. The ABO and RhD blood groups quality control was performed to facilitate and acceptability of test results.

Ethical approval was obtained from the Federal Ministry of Health, Khartoum.

Results:

A total of two hundred and forty individuals were enrolled. One hundred and twenty were COVID-19 positive (case group) of Sudanese patients, and a control group of one hundred and twenty healthy Sudanese individuals. The frequency of O, A, B and AB in the case group were 76 (63.33%), 22 (18.33%), 18 (15.00%) and 4 (3.33%), respectively. The frequency of the control group were 73 (60.83%), 24 (20.00%), 20 (16.67%) and 3.0 (2.50%), respectively. The frequency of RhD blood group in the case

group was 97 (80.83%) RhD positive and 23 (19.16%) were RhD negative whereas, the control group 95 (79.16%) were RhD positive and 25 (20.83%) were RhD negative.

There were no significant association between the COVID-19 positive and the blood group O, A, B and AB (P value 0.8469, 0.7871, 0.7631 and 0.7103) respectively, and the Odds ratio (0.9605, 1.0909, 1.1111 and 0.7500). There were no significant association between the COVID-19 and the RhD blood group (P value 0.9143 and 0.7922), respectively, and the Odds ratio (0.9794 and 1.0870).

Conclusion:

The O blood group was the most frequent blood group among COVID-19 positive patients followed by A and B blood groups. The AB blood groups were less common, but the RhD positive was most common than RhD negative among COVID-19 positive patients.

Keywords: ABO, RhD, COVID-19, Sudanese

Introduction

The global pandemic of Coronavirus 2019 disease (COVID-19) was started in early year of 2020, which affected many categories of the population [1-3, 7]. The COVID-19 as communicable disease was originated from human coronaviruses causing severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 (Baltimore classification)). It is a positive-sense single stranded RNA (+ssRNA) virus with single linear segment with many of mutation detected on phylogenetic analysis [4-5].

The illnesses of human coronaviruses ranged from common cold to severe disease such as Middle East Respiratory Syndrome (MERS), and the SARS-CoV-2 was the seventh known coronavirus that infect people; 229E, NL63, OC43, HKU1, MERS-CoV and original SARS-CoV. [6-10].

The diagnosis of COVID-19 based on the nucleic acid amplification tests, such as reverse transcriptase polymerase chain reaction (RT-PCR), and coupled with clinical presentations of patient. Sometimes severe presentations were adhered with some chronic disorders, but the individual without chronic disorders were as clear as real pathogenesis of COVID-19 on the lung. The effect of COVID-19 on the oxygen saturation in the lung based on gaseous exchange of erythrocytes on the lung alveoli, sometime secondary bacterial infection may lead to adverse effects and congestion of the lung and death [11-17].

The human blood contains many categories of cells; one of these cells, is the erythrocytes that are responsible for the gaseous exchange. The outer layer of erythrocyte membrane is composed of many peripheral molecules with different biochemical nature. The ABO and RhD blood groups revealed major blood groups and the origin of ABO blood

groups were A, B, and H substances as monosaccharides as terminal sugar polymorph of outer erythrocyte membrane rather than Rhesus molecules protein in nature, as amino acids as polymorphs and the D molecule was most potent common molecule in the population than other E, C, e, and c molecules [18-22].

Previous studies highlighted on special blood antigens and introduced an association with some diseases or severity theories based on distributions of these substances or molecules in the study populations worldwide. Several studies showed an association of blood groups with infectious agents. These studies were done on a large scale with many details of both and the host erythrocyte surface molecules play as invader receptors, in receptor-ligands interaction for pathogen invasion process [23-29].

The aim of this study was to determine the association between ABO and RhD blood groups and COVID-19 among COVID-19 Sudanese patients at Khartoum state.

Materials and Methods

The present study descriptive, hospital based case-control study was conducted in Khartoum state, Sudan, during the period from November 2020 to March 2021. It included Jabra, Best care, Fedail hospitals and the National Public Health Laboratory, Federal Ministry of Health patients were PCR positive for SARS-CoV-2 and for COVID-19. And none of the RT-PCR patients had chronic or autoimmune diseases. The age ranged between 18 to 50 years old, and gender was approximately equal in percentage. The laboratory findings of RT-PCR (SARS-CoV-2) positive were matched with the clinical presentation for COVID-19. All enrolled patients were firstly

exposed for COVID-19 present in special hospital quarantines with adequate ventilation system, if required. The parallel control group of Sudanese healthy individuals for ABO and RhD blood group were randomly selected and were matched in both gender and age for case group. The total study population was two hundred and forty divided in two arms. One hundred and twenty as patients and one hundred and twenty as control group. The blood specimens were collected by the nurse staff at the quarantine units in each hospital using aseptic non-traumatic collection procedure. 2.5 ml of blood were drawn in K3 EDTA container, gently mixed and kept at 4° C refrigerator until used. The specimens were then centrifuged and the haemolysed or cloudy specimens were excluded from the study the ABO and RhD blood groups were performed at the National Public Health Laboratory, using acrylamide gel card technique.

DIAMED gel card (DiaClon ABD, BIO-RAD) containing six columns in each card to detect the A, B and RhD substances in the surface of erythrocytes. In each column acrylamide gel particles and monoclonal antibodies against specific substances (A, B and RhD). Each one column, gel particles were trapped for aggregated erythrocytes based on density degree of A,B, substances and D molecule on the surfaces of erythrocytes by column aggregation technology (CAT). One percent erythrocytes were prepared by taking 50ul of packed erythrocytes diluted in 500ul of kit buffer, incubated for 15 mins in column incubator then centrifuged incolumn centrifugator for 15 mins. Statistical analysis were made using SPSS version 22 for calculation of Chi- square and Odd ratio. The statistical significance was measured in P value 0.05. The results were presented in tables and figures. The ABO blood group quality control was performed to facilitate acceptability of test result.

Ethical approval was obtained from the Fedral Ministry of Health, Khartoum, Sudan.

Results

A total of two hundred and forty individuals were enrolled in this study. They were divided in two groups (case and control groups). The case group was composed of one hundred and twenty COVID-19 positive Sudanese patients and an equal number of the control group of apparently health Sudanese individuals. The mean age was 35.7 ± 2.2 and 33.2 ± 5.1 year for case and control groups, respectively. The distribution of gender in the case group was 51% males and 49% females and the control group was 48% males and 52% females. The distribution of O, A, B, and AB for the case group was 76 (63.33%), 22 (18.33%), 18 (15.00%) and 4 (3.33%), respectively; and for control group was 73 (60.83%), 24 (20.00%), 20 (16.67%) and 3.0 (2.50%), respectively.

The distribution of RhD blood group, for the case group, was 97 (80.83%) RhD positive and 23 (19.16%) were RhD negative and for the control group, 95 (79.16%) were RhD positive and 25 (20.83%) were RhD negative. (Table1).

There were no significant association between the COVID-19 and the blood group O, A, B and AB (P value (0.8469, 0.7871, 0.7631 and 0.7103), respectively and the Odds ratio was (0.9605, 1.0909, 1.1111 and 0.7500), respectively.

There were no significant association between the COVID-19 and the blood group RhD (P value (0.9143 and 0.7922), respectively and the Odds ratio was (0.9794 and 1.0870).

Table 1. Distribution of ABO and RhD blood groups among the study population:

ABO & RhD	Case group		Control group		Odds ratio	P. value
	Absolute	Percent	Absolute	Percent		
O	76.0	63.33%	73.0	60.83%	0.9605	0.8469
A	22.0	18.33%	24.0	20.00%	1.0909	0.7871
B	18.0	15.00%	20.0	16.67%	1.1111	0.7631
AB	4.0	3.33%	3.0	2.50%	0.7500	0.7103
RhD Positive	97.0	80.83%	95.0	79.16%	0.9794	0.9143
RhD Negative	23.0	19.16%	25.0	20.83%	1.0870	0.7922

Discussion

The present study addressed the association between COVID-19 and the distribution of major blood groups (ABO and RhD types). The blood groups are surface erythrocytes molecules and most probably associated with some infectious agents and may play in receptors or ligands for penetration of host cells and have a role in pathogenesis based on density of these surfaces molecules.

The present study showed no significant association between COVID-19 and blood groups O, A, B, and AB the study population based on comparing between study population groups case group and control group. (P value (0.8469, 0.7871, 0.7631, and 0.7103), respectively and Odds ratio (0.9605, 1.0909, 1.1111, and 0.7500), respectively. This is in agreement with same trend in studies conducted by Mohamed et al [23], Boudin et al [24], Wu et al [25], and Flegel et al [26], who found the same distributional trend of ABO in their study population. However, our results are in consistent with studies conducted by Taha et al [27], and Ad'hiah et al [28]. These authors reported a high prevalence of blood group A than blood group O. However our findings were as same as trends of frequency of ABO as in biological fact for distribution of ABH alleles frequency. This difference may be due to geographical distance, race, immunological status or genetic discriminations. This might indicate that the role of ABO in the COVID-19 pathogenesis is not clear yet.

There was no significant association between COVID-19 and RhD blood groups; RhD positive or RhD negative in study population. The case and control groups (P value (0.9143 and 0.7922), respectively; and Odds ratio (0.9794 and 1.0870), respectively. These findings are inconsistent with the study conducted in Kunduz-Afghanistan [29], who reported a strong association between Rh negative as general phenotype with COVID-19. This inconsistency may be attributed to variation of phenotype D frequency in our study population. Saify and colleagues had studies about Covid-19 and RhD coupled between ABO and RhD but they are different in nature and population distribution of ABO and RhD blood groups [29]. The novelty in the present study is the use of specific gel techniques for blood phenotyping rather than monoclonal antibodies. This technique is easy in procedure and results interpretations but relatively expensive.

As a matter of fact, the ABH substance is present in the surface of erythrocytes and other human cells based on ABH blood type and mode of inheritance, but RhD only with surface of erythrocytes if inherited genes in genome of individual.

Conclusions and Recommendations

In conclusion O blood group is the most frequent blood group among COVID-19 positive patients followed by A and B blood group; and AB blood groups are less common, but the RhD positive is most common than RhD negative among COVID-19 patients.

Our results clearly showed the conformational distribution of ABO and RhD in COVID-19 Sudanese patients as population frequency of ABO and RhD. There was no association between COVID-19 and major blood groups as ABO and RhD at Khartoum state, Sudan.

There is a need for community at large study to include all Sudan states. Wide genome scan study for Sudanese COVID-19 patients to expand the association of infectious communicable diseases in general especially COVID-19 with major blood groups system, including all Rh system phenotypes, cell culture techniques for each especial ABO phenotype for alveolar cell with simulation of lung COVID-19 infection and electron-microscopy view.

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