



## Original Article

## Evaluation of the Relationship between ABO Blood Groups and Severity and Mortality in Patients with Covid-19

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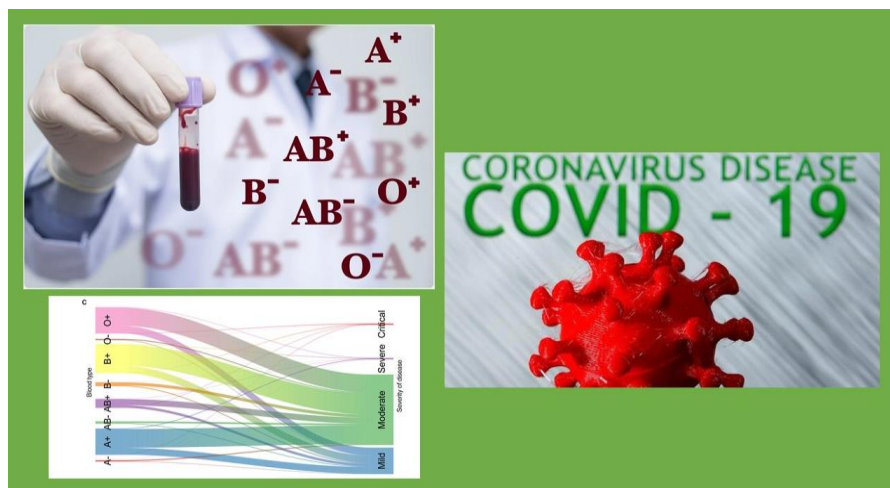
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## ABSTRACT

The aim of this study was to investigate the relationship between ABO blood groups and the rate and severity of morbidity and mortality in patients with Covid-19 in Zahedan. The present study is a descriptive-analytical study and includes a sample of 349 patients with Covid-19 referred to hospitals in Zahedan from March 2016 to August 2017. The sampling method was census and for data collection, case studies and checklists were used. The data were analyzed by Chi-square test through SPSS software. Among the 328 patients, 132(41%) had blood type O, 92(28%) had blood type A, 80(24%) had blood group B and 24(7%) had AB blood type. There was no significant relationship between blood groups and age ( $P < 0.150$ ). Patients in the age group of 30-60 years with 208 (63.4%) had the highest number, of whom 78 (23.8%) had blood type O. There was a significant relationship between blood groups and gender ( $P = 0.001$ ), so male patients with 178 (54.3%) were more, of whom 72 (22%) had blood type O. There was no significant relationship between blood groups and place of hospitalization ( $P < 0.121$ ); however, inpatient department patients with 150 (45.7%) had the highest number, of whom 62 (41.3%) had blood type O. There was no significant relationship between blood groups and severity of covid-19 ( $P < 0.121$ ); however, patients with moderate severity had the highest number with 150 (45.7%) patients, of whom 62 (41.3%) had blood type O.

## GRAPHICAL ABSTRACT



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## Introduction

A new study on patients with the coronavirus in China found a link between blood types A-B-O and the coronavirus [1-3]. According to experiments, whether people with different blood types have more complications of coronary heart disease or whether the owners of this blood type suffer from higher mortality than others is an unknown and under investigation [4-6]. From health care results tested on 1,559 people at NYP Hospital in New York with specific blood types, the proportion of patients with blood type A was higher than that of blood groups and the share of patients with blood type O was higher among patients. The corona was smaller. It is also important to note that in both cases the result occurred only in Rh-positive blood groups. Studies [7] have also shown that the effect of blood type is not explained by the risk factors we consider (age, sex, high blood pressure, diabetes, overweight, and chronic cardiovascular and lung disorders) [8-10].

In a review of NYP hospital data [11] with data previously reported by China, for blood types A and B and a decrease in blood groups O among patients with coronary artery disease compared with the general population, the data obtained provided strong evidence for a correlation.

According to a study by Southern University of Science and Technology in China [12], people with blood type A have a significantly higher risk of getting the corona virus than non-A blood types. In addition, according to researchers, people with blood type O compared People with non-O blood types have a significantly reduced risk of developing the disease [13-15]. This study was designed to investigate the relationship between ABO blood groups and their response to coronary artery syndrome. Using one-way analysis of variance and meta-analysis were analyzed. The subjects included 1,775 patients with coronary artery disease, including 206 deaths from Jinni Nathan Hospital in Wuhan, as well as 113 and 285 other patients with the disease from Renin Hospital in Wuhan University and Shenzhen Hospital, respectively [16-18].

The results showed that the distribution of blood groups in Wuhan is as follows: 31% had blood

type A, 24% had blood type B, 9% had blood type AB, and 34% had blood type O. Among coronary heart disease patients in Wuhan, 38% had blood type A, 26% had blood type B, 10% had blood type AB, and 25% had blood type O [19]. Compared with the proportion of blood groups in the region, these data suggest that blood type A is more susceptible to the virus than other blood types, while blood type O is less likely to develop coronary heart disease. However, the researchers also noted that no blood type is immune to the corona virus, so should people with blood type A be more concerned than others? Dr. Petrie and Dr. Hawkins (2019) believe this is not true; "If you have blood type A [20].

People with blood type A should not worry, because blood type does not seem to be the main cause of the virus and its infection. This research is still under review and its results have not been confirmed yet, and it is just a hypothesis as well as research on a small sample. "Blood type can definitely not cause people to be afraid or confident, and we all need to know.

The effect of age and gender on the distribution of blood group A-B-O in patients with coronary artery disease from two Wuhan hospitals was studied [21-23]. The researchers concluded that age and gender had little effect on the distribution. According to the results of research done by researchers at world-renowned universities such as the University of Virginia [24], blood groups differ in their sugars and proteins, and this difference leads to immunity or susceptibility of the blood group to the virus [25]. Despite these research findings, the medical community agrees that no blood type is immune to viral and infectious diseases; Massoud Mardani, a member of the Scientific Committee on Coronation also emphasizes that the link between blood type and coronary heart disease is still under investigation. Not observing social distancing will certainly not protect you from being infected with the Corona virus. People with blood type A should not be worried about getting the virus; however, a study [26] of the effect of blood type on people getting coronavirus has pointed out some interesting factors in how to develop treatment to fight Covid 19. There are

many microorganisms that cause infections in the human body and bind to human cells by binding to sugars on the surface of cells. "The best example of an infection binding to sugar on the surface of cells is the flu," said Petri. (2019) The flu virus binds to a sugar in human cells called sialic acid. Tamiflu is a drug that inhibits the ability of the flu to bind to these sugars, and is an excellent example of how the interaction of noramine (an acidic amino sugar in the blood) helps identify an effective antiviral drug [27-29].

### Material and methods

This descriptive-analytical (cross-sectional) study was conducted with all patients with Covid-19 who had referred to hospitals in the city of Zahedan (Bu Ali, Khatam al-Anbia and Ali Bin Abi Talib). The inclusion criteria and diagnosis of Covid-19 that were recorded in the files were positive PCR test in one turn, negative PCR test in the first turn and positive in the second turn, and CXR. It had confirmatory findings and CT scan did

too. After coordinating and referring to the hospital archives, the researcher recorded the required information from the files in a special form. The researcher used hospital records to collect data, including age, gender, the severity of infection (mild: patient in need of outpatient treatment and home quarantine, moderate: inpatient ward, severe: the need for mechanical ventilation, hospitalized in ICU), blood type (A, B, AB, O), place of hospitalization and what happened finally (death or survival). Data were analyzed using descriptive and analytical statistical tests using SPSS software version 22 and considering the significance level of  $p < 0.05$ . Also, the confidentiality of patients' information and their preservation were considered.

### Result and Discussion

Among the 328 patients, 132(41%) were of blood type O, 92(28%) with blood type A, 80(24%) with blood group B and 24(7%) had AB blood type (Table 1).

**Table 1:** Frequency distribution of blood groups in patients

Blood type	A	B	AB	O	Total
Number of patients	92 (28%)	80 (24%)	24 (7%)	132 (41%)	328 (100%)

There was no significant relationship between blood groups and age ( $P < 0.150$ ). Patients in the age group of 30-60 years with 208 (63.4%) had the highest number, of whom 78 (23.8%) had blood type O (Table 2). There was a significant

relationship between blood groups and gender ( $P = 0.001$ ), so male patients with 178 (54.3%) were more, of whom 72 (22%) had blood type O (Table 2).

**Table 2:** Frequency distribution of blood groups in patients based on demographic information

Blood type		A	B	AB	O	total
Sex	Male	56	46	4	72	178
	Female	36	34	20	60	150
	total	92	80	24	132	328
Age	Under30years	26	16	8	32	82
	30-60 years	58	56	16	78	208
	Over 60 years	8	8	0	22	38
	total	92	80	24	132	328

There was no significant relationship between blood groups and place of hospitalization ( $P < 0.121$ ); however, inpatient department patients

with 150 (45.7%) had the highest number, of whom 62 (41.3%) had blood type O (Table 3).

**Table 3:** Frequency distribution of blood groups in the patients based on the place of hospitalization

<b>blood type</b> <b>place of hospitalization</b>	<b>A</b>	<b>B</b>	<b>AB</b>	<b>O</b>	<b>Total</b>
<b>Outpatient</b>	36	36	16	56	144
<b>Inpatient department</b>	48	32	8	62	150
<b>ICU</b>	8	12	0	14	34

There was no significant relationship between blood groups and severity of covid-19 ( $P < 0.121$ ); however, patients with moderate severity had the

highest number with 150 (45.7%) patients, of whom 62 (41.3%) had blood type O (Table 4).

**Table 4:** Frequency distribution of blood groups in the patients based on the severity of Covid-19

<b>blood type</b> <b>severity</b>	<b>A</b>	<b>B</b>	<b>AB</b>	<b>O</b>	<b>Total</b>
<b>Low</b>	36	36	16	56	144
<b>moderate</b>	48	32	8	62	150
<b>Sever</b>	8	12	0	14	34

The mortality rate in this study was 0.097; 31.2% of patients with blood group A, 37.6% of patients with blood group B, and 31.2% of patients with blood group O died. In blood group AB, the disease did not lead to death. There was a

significant relationship between blood type and mortality rate  $\{(P < 0.05)\}$  (table 5)}. Among 296 improved patients, 27.7% had blood type A, 22.9% had blood type B, 8.1% had blood type AB and 41.3% had blood type O (Table 5).

**Table 5:** Frequency distribution of blood groups in the patients based on the outcome

<b>blood type</b> <b>outcome</b>	<b>A</b>	<b>B</b>	<b>AB</b>	<b>O</b>	<b>Total</b>
<b>recovery</b>	82 (27.7%)	68 (22.9%)	24 (8.1%)	122 (41.3%)	296
<b>death</b>	10 (31.2%)	19 (37.6%)	0 (0%)	10 (31.2%)	32 (100%)

In the present study, out of 328 patients, 132 (40.3%) were blood type O, 92(28%) were blood type A, 80 (24.4%) were blood group B and 24 (7.3%) were blood type AB. There was no significant relationship between blood groups and age ( $P < 0.50$ ); but patients in the age group

of 30-60 years with 208 (63.4%) had the highest number, of whom 78 (23.8%) had blood type O. There was a significant relationship between blood groups and gender ( $P = 0.001$ ), so that male patients with 178 (54.3%) were more, of whom 72 (22%) had blood type O. There was no

significant relationship between blood groups and place of hospitalization ( $P < 0.121$ ), but hospitalized patients with 150 (45.7%) had the highest number, of whom 62 (18.9%) had blood type O. There was no significant relationship between blood groups and outcome ( $P < 0.50$ ), but the recovered patients were more with 296 (90.2%) patients, of whom 122 (37.2%) had blood type O. There was no significant relationship between blood groups and severity of infection ( $P < 0.121$ ) while patients with moderate severity had the highest number with 150 patients (45.7%), of whom 62 patients (18.9%) had blood type O.

On the other hand, experts warn that these findings may reduce the care of people with blood type O, because they think they are immune to the virus. The study was conducted at a time when large populations around the world were not yet infected with the virus, and the World Health Organization (WHO) believes a sample of 2,000 is not necessarily a small number, but only a fraction of the approximately 700,000 was confirmed worldwide by March 30, 2016. In the future, new evidence of a link between blood groups B, AB and Covid 19 will certainly be discovered, as well as more data on the recent link between blood types A and O and the corona virus.

People with blood types (+ o) and (-o) negative were 12 percent less likely to get the corona virus. The study also found that people with a negative blood type (O-, A-, B- -AB) were, on average, 21 percent less likely to be infected with Covid-19 than people with a positive blood type. According to the results, people with blood type O or a negative blood type were 13% and 19% less likely to develop severe coronary symptoms or die from the disease, respectively. Negative blood (-o) was 26 percent less likely to develop coronary heart disease and 28 percent less likely to develop severe coronary heart disease or disease. Researchers have found that people with blood type O and negative blood types are slightly less likely to develop SARS-CoV-2 infection, as well as severe cases of Covid-19 or death from the disease. According to the latest statistics of the WHO website, 62,621,466 people worldwide are infected with the corona virus and

1,459,000 people have lost their lives due to this disease.

Factors such as age and health conditions can also affect how people resist corona. Undoubtedly, this study can be of great help in identifying and protecting people at risk, while it will play an important role in the treatment and production of drugs and vaccines for this disease. Of course, there have been previous reports about the effect of blood type on the symptoms of different people. The study looked at the genes of more than 1,600 patients in Italy and Spain who had experienced respiratory failure following Covid-19 and found that people with blood type A were 50 percent more likely to need respiratory equipment [30]. China has already achieved similar results by conducting similar studies. The group's lead researcher at Biotech 23 May, also reported on the link between Covid-19, blood clotting and cardiovascular disease. A study has found that people with blood type O coronary tests were 9 to 18 percent less likely to be positive than people with other blood types [31]. Although the evidence was convincing, the researcher said there was still a long way to go. However, a study by researchers at the Toronto Institute for Clinical Evaluation Science (2013) showed that past research by other biotech institutes and companies has been correct, and there is a significant relationship between the incidence of Covid 19 and blood type [32].

Studies have shown that the amino acid serine virus is vital after the virus binds to human cells via the ACE protein 2 during the fusion process of the host virus. Based on what is known from previous studies on serine, binding to host cells is likely to occur through O glycosylation. Symptoms of the disease appear more frequently in patients with non-O blood groups, which targets the role of viral serine saccharides of blood groups A, B, and AB in the glycosylation process [37-39]. Thus, the innate immune system and its association with ABO H blood groups may play a major role in 2-SARS-CoV infection. In contrast, the production of non-immune IgM antibodies is not restricted to B cells, which can develop spontaneously in mouse and human epithelial cells. Previous studies have linked IgM to A-like/ Tn antigen, serine or threonine-

associated GalNAc saccharide. IgM is formed under the phenotype (ABO (H) and is produced at the cell surface and plasma proteins. Serine alone appears to affect the response of this antibody and bind to different epitopes [33]. Blood group O retains high anti-glycan, anti-A and anti-B activities and loses anti-H activity. Anti-A levels in blood group B and anti-B levels in blood group A are lower than those in blood group O. Anti-A and anti-B antibodies are only produced in blood type O. In addition, IgG, a secondary antibody, appears to be restricted to anti-A and B only in this blood group. 2-SARS-CoV probably works by combining ABO (H) blood types or by mimicking the metabolic pathways of glycosylation of the human immune system [34]. In all blood groups, infection occurs with the A-like/ Tn intermediate junction. In blood group O, this is replaced by mucin-type focusing and a hybrid type H antigen is produced; therefore, in blood groups A, B, and AB, it is possible that the intermediate A-like/ Tn junction be replaced by the formation of mucin type A and/ or B and anti-A-isoagglutinin or anti-B, and the level decreases. In blood type O, there is the least contact with the virus, which binds to the virus only by the formation of type H antigen [35]. When it loses only anti-H isoagglutinin, but maintains IgG secondary responses, the greatest protection of this group occurs [36]. In blood type A, anti-A and anti-H formations are blocked, anti-B levels are low, and IgG is not produced [37]. In blood type B, anti-B and anti-H are blocked, anti-A is low and IgG is not produced. Blood type AB is also the least protected against pathogens and has the most contact with the virus; therefore, the absence of anti-A and B antibodies in blood groups A, B and AB protects the cells from reacting to complementary structures and cannot prevent the formation of composite structures in the later stages of the infection [38]. It is likely that in 2-SARS-CoV infection, autoimmune processes, especially in non-O blood groups, may play a role in the development of severe symptoms [39]. However, this article emphasizes the point that an individual's risk of contracting 2-SARS-CoV or a serious illness cannot be predicted solely on the basis of a

person's blood type (ABO) dependence, as there are many other risks [40].

## Conclusion

The present study showed there was a significant relationship between A, B and O blood groups and the mortality rate in patients with the covid-19 disease, and reported that it was higher in blood group B. This relationship also exists between blood types and gender; blood type does not affect increasing the severity of the disease and guidelines set by the Center for Disease Control and Prevention (CDC), WHO, and health authorities, such as social distance, hand hygiene, and mask use must be followed exactly. There was a significant relationship between A, B and O blood groups and the mortality rate in patients with covid-19 disease; it was higher in blood group B. This relationship also existed between blood types and gender.

Mortality rate in this study was 0.097; 31.2% of patients with blood group A, 37.6% of patients with blood group B and 31.2% of patients with blood group O. In blood group AB, the disease did not lead to death. There was a significant relationship between blood type and mortality rate  $\{(P < 0.05)$  (table 5)}. Among 296 improved patients 27.7% have blood type A, 22.9% had blood type B, 8.1% blood type AB and 41.3% had blood type O.

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## Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

## Conflict of Interest

The authors declare no conflicts of interest.

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