Vol. 5, No. 8, August 2024
E-ISSN: 2723-6692
P-ISSN: 2723-6595
http://jiss.publikasiindonesia.id/

The Relationship between ABO Blood Type and Outcomes in Severe and Critical COVID-19 Patients in the Covid ICU of the Hospital. Dr. M. Djamil Padang

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KEYWORDS
COVID-19; Blood Type; Patient Outcomes

ABSTRACT
The spread of the Coronavirus Disease represents the most significant global health threat in recent decades. Blood type is among the risk factors associated with COVID-19, with certain blood types linked to increased severity and higher mortality rates. This research aims to assess the relationship between ABO blood type and outcomes in severe and critical COVID-19 patients in the ICU at RSUP Dr. M. Djamil Padang. The study is an observational analytical research utilizing a cross-sectional approach. Data were gathered from the medical records of COVID-19 patients from January to September through a total sampling method, resulting in 124 individuals meeting the inclusion criteria. The data were analyzed **utilizing** the Chi-Square test. The discoveries uncovered that male patients (54%) dwarfed female patients (46%). The larger part of patients were within the age range of 56-65 for years (33.9%). Patients with blood sort O were more predominant among those with extreme COVID-19 (31.3%) and basic COVID-19 (38.0%). The foremost common result was passing, happening in 56.0% of serious cases and 53.7% of basic cases. There was no factually noteworthy relationship between ABO blood sort and results in serious and basic COVID-19 patients, with a p-value of 0.778 (>0.05). The study concludes that there's no measurably critical affiliation between ABO blood sort and outcomes in extreme and basic COVID-19 patients within the ICU at Dr. M. Djamil Padang hospital.

1. Introduction

The spread of Corona Virus Disease has been the most serious global health threat in recent decades. The case of this disease was first reported in the city of Wuhan, Hubei Province, Southern China, on December 8, 2019 (Asselah et al., 2021). This virus outbreak was later named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV2) and caused the Coronavirus Disease-2019 (COVID-19) disease to continue to spread widely in various countries (Siagian, 2020).

The total number of global confirmed cases of COVID-19 as of November 2021 is 253,640,693 cases with 5,104,899 deaths (CFR 2.01%); in Indonesia, the COVID-19 outbreak is still ongoing, and even its spread continues to expand to almost all regions in Indonesia (Susiwijono, 2020). Based on a report by the Indonesian Ministry of Health, as of November 2021, Indonesia recorded 4,251,423 people confirmed positive for COVID-19, with 143,685 deaths (CFR: 3.38%) related to COVID-19, while West Sumatra has a cumulative confirmed case of 89,860 cases (Annisa, 2021). Epidemiological ponders have appeared that 6 to 10% of patients create a more extreme frame of COVID-19 and will require seriously care unit (ICU) affirmation due to intense hypoxemia and respiratory disappointment. The detailed passing rate in patients with serious COVID-19 within the ICU ranges from 50-65% (Oliveira et al., 2021).

Commonly detailed complaints in COVID-19 patients are chest torment, spewing, queasiness, sore throat, sniffling, nasal blockage, anosmia, dyspepsia, hasty on the skin, and myalgia or fatigue (Lotfi et al., 2020). COVID-19 cases, based on the severity of symptoms, are divided into asymptomatic, mild, moderate, severe, and critical. Some people infected with the COVID-19 virus with mild complaints or no symptoms can recover without special treatment. In contrast, patients with severe and critical COVID-19 require intubation in the ICU and are prone to complications (Lotfi et al., 2020; National Institutes of Health, 2021).

Numerous studies have examined the risk factors associated with COVID-19, with some suggesting a connection to blood type. Blood type is a distinctive characteristic of an individual's blood, determined by the variations in carbohydrates and proteins present on the surface of the red blood cell membrane. Blood type antigens can influence disease susceptibility through various mechanisms, such as acting as receptors or decoys for infectious agents and altering the immune response via anti-ABO antibodies (Leaf et al., 2020).

Blood types can be classified and often used in general into 2 groups, namely ABO blood type, and rhesus blood type (Rh factor). The ABO blood type system is associated with many bacterial and viral infections, such as helicobacter pylori, norovirus, hepatitis B virus, SARS-COV and MERS-COV (Wu et al., 2020). Several studies in China and the United States suspect a link between ABO blood type and COVI9-19 infection related to death (Cooling, 2015; Leaf et al., 2020).

Zhao J (2021) identified that individuals with blood type A face a greater risk of contracting COVID-19. Additionally, these patients exhibit higher rates of disease severity and mortality. Conversely, those with blood type O are linked to reduced severity and mortality rates. Cheng et al. (2020) observed that the ABO blood type system influences susceptibility to SARS-CoV infection in Hong Kong. When comparing individuals with non-O blood types to those with blood type O, the latter group shows a lower likelihood of infection. The propensity for infection and the severity leading to death are lower in individuals with blood type O and higher in those with blood type A for COVID-19, likely due to the presence of natural antibodies, particularly anti-A antibodies, in the blood.

In addition to anti-A antibodies, the link between blood group A and severe COVID-19 is associated with elevated activity of angiotensin-converting enzyme 1 (ACE-1), which predisposes individuals to cardiovascular complications. Elevated levels of von Willebrand factor (VWF) and factor VIII may also contribute to severe outcomes in individuals with blood group A. These factors increase the risk of thromboembolic disease and the severity of COVID-19, potentially resulting in fatal outcomes (R. Goel et al., 2021).

Based on the description above, researchers feel the need to research the relationship between blood type and outcomes in severe and critical COVID-19 patients in the ICU of COVID-19 Hospital. Dr. M. Djamil Padang. Aims to provide more vigilant surveillance and aggressive treatment for vulnerable blood types.

2. Materials and Methods

Types and Design of Research

This study is an umbrella study with a type of observational analytical research with a Cross-Sectional Study approach, which is a study that studies the relationship between independent variables (ABO blood type) and dependent variables (patient outcomes) simultaneously or at a time in a population. Location and time of research: This research was conducted at the ICU COVID RSUP from August 2021 to January 2022.

Population, Samples, and Sampling Techniques

This study's population is all severe and critical COVID-19 patients treated at the RSUP COVID ICU. Dr. M. Djamil Padang in January-September 2021. The sample is the entire population that meets the inclusion and exclusion criteria.

1. Inclusion Criteria for Severe and Critical COVID-19 Patients at the ICU COVID RSUP. Dr. M. Djamil Padang in January – September 2021 was examined for blood type.
2. Exclusion Criteria; Severe and critical COVID-19 patients at the ICU COVID RSUP. Dr. M. Djamil Padang in January – September 2021 who was examined for blood type with incomplete medical record data.

The test estimate of this think about is the number of serious and basic COVID-19 patients treated within the COVID Hospital ICU. Dr. M. Djamil Padang in January-September 2021 who met the incorporation and prohibition criteria. The inspecting method carried out in this ponder is add up to testing where the number of tests is rise to to the populace (National Institutes of Health, 2021; Stasi et al., 2020).

Data Analysis

A univariate analysis was performed to illustrate the frequency distribution of the research variables. Then, the data is presented as a frequency distribution table. Bivariate analysis was carried out to determine whether there was a relationship between each independent and dependent variable. Bivariate analysis in this study uses *the chi-square test* with data interpretation. If the p-value < 0.05, then there is a significant difference between the linked variables. The Fisher test will be an alternative when the Chi-Square test does not meet the.

3. Result and Discussion

Research has been carried out in the ICU of the hospital. Dr. M. Djamil Padang in January-September 2021 with secondary data from medical records. Samples that met the inclusion criteria and did not meet the exclusion criteria were used as samples in this study, and there were a total of 124 samples. Based on this research, the following research results were obtained:

Frequency Distribution of Age, Gender, Comorbid Factors of Patients

Age, gender, and comorbid components of extreme and basic COVID-19 patients **within the**ICU of the hospital. Dr. M. Djamil Padang can be seen as follows:

Table 1 Distribution of age frequency, gender, and comorbid factors

Category	*f*	Percentage (%)
Age		
26-35 years old	7	5,6
36-45 years old	10	8,1
46-55 years old	29	23,4
56-65 years old	42	33,9
>65 years	36	29
Gender		
Male	67	54
Female	57	46
Comorbid factors		
Hypertension	15	12,1
Diabetes	30	24,2
CKD	4	3,2
heart disease	3	2,4
Others	23	18,5
None	60	48,4

Based on table 1, it is known that the most age ranges for severe and critical COVID-19 patients in hospitals. Dr. M. Djamil Padang was 56-65 years old (late elderly) as many as 42 people (33.9%), with the most results being male with 67 people (54%), and the majority of patients did not have comorbidities as many as 60 people (48.4%).

Distribution of ABO Blood Type Frequency in Severe and Critical COVID-19 Patients

In severe and critical COVID-19 patients, an overview of the spread of ABO blood types is as follows:

Table 2 Distribution of ABO blood type frequencies in severe and critical COVID-19 patients

Category	COVID-19		Total
	Weight	Critical	
	n(f)	n(f)	
Blood Type			
Blood type A	4(25,0)	32(29,6)	36(29,0)
Blood type B	4(25,0)	25(23,1)	29(23,4)
Blood type AB	3(18,7)	10(9,3)	13(10,5)
Blood type O	5(31,3)	41(38,0)	46(37,1)
Total	**16(100)**	**108(100)**	**124(100)**

Based on table 2, it can be concluded that in the ICU of the hospital. Dr. M. Djamil Padang, the most blood type is blood type O, namely in severe COVID-19 as many as 5 people (31.3%) and in critical COVID-19 as many as 41 people (38.0).

Distribution of Output Frequencies in Severe and Critical COVID-19 Patients

External frequency distribution in severe and critical COVID-19 patients in the ICU of the hospital. Dr. M. Djamil Padang can be seen as follows:

Table 3 Distribution of external frequencies in severe and critical COVID-19 patients

Category	COVID-19		Total
	Weight	Kritis	
	n(f)	n(f)	
Exteral			
Death	9(56,0)	58(53,7)	67(54,0)
Life	7(44,0)	50(46,3)	57(46,0)
Total	**16(100)**	**108(100)**	**124(100)**

Based on table 3, it can be seen that the percentage of patients with an outcome of death is greater than life, namely in severe COVID-19 as many as 9 people (56.0%) and in critical COVID-19 as many as 58 people (53.7%).

Analysis of the Relationship between ABO Blood Type and Outcomes of Severe and Critical COVID-19 Patients in Hospitals. Dr. M. Djamil Padang

The bivariate analysis used in this study was the *Chi-square test* with a 4x2 table. The analysis can be seen in the following table:

Table 4 Bivariate analysis of the relationship between ABO blood type and the outcomes of severe and critical COVID-19 patients

Category	COVID-19			*p*
	Death	Life	Total	
	n(f)	n(f)		
Blood Type				
Blood Type A	21(58,3)	15(41,7)	36(100)	
Blood Type B	14(48,3)	15(51,7)	29(100)	0,778
Blood Type AB	6(46,2)	7(53,8)	13(100)	
Blood Type O	26(56,5)	20(43,5)	46(100)	
Total	**67(54,0)**	**57(46,0)**	**124(100)**	

Based on the results of the statistical test carried out, insignificant results were obtained between ABO blood type and outcomes in severe and critical COVID-19 patients with a value of p=0.778 (p>0.05).

Responsive Features

According to the findings presented in Table 1, the characteristics of the study respondents are detailed by age, gender, and comorbid factors. The predominant age group among severe and critical COVID-19 patients in the ICU at RSUP Dr. M. Djamil Padang is 56-65 years old (final elderly), as many as 42 people (33.9%). The rest are in the range of >65 years (seniors), as many as 36 people (29%), 46-55 years, as many as 29 people (23.4%), 36-45 years, as many as 10 people (8.1%), and only 7 people (5.6%) in the range of 26-35 years. Based on gender, the results were

obtained that the most severe and critical COVID-19 patients were in the ICU of the hospital. Dr. M. Djamil Padang is male, with 67 people (54%), while females are 57 people (46%).

These findings are in line with a study conducted in the ICU in the Lombardy region, Italy, by Grasselli et al. (2020) with a retrospective cohort study where of 1,591 critically ill COVID-19 patients, the average age was 63 years (56-70 years), and 1304 people (82%) were male. Based on existing research, it is suspected that male sex is a risk factor for COVID-19. This gender tendency may be related to much higher rates of smoking in men than females(Cai, 2020; World Health Organization, 2020) .

Kalantari et al. (2020) Kalantari et al. (2020) conducted a study in Iran that focused on suspected COVID-19 cases within the 50-59 age range. Among 161 suspected cases in this age group, 102 were confirmed positive through RT-PCR testing, with 16 (15.6%) resulting in death. The study also indicated that the infection was primarily transmitted by groups with relatively high mobility, particularly younger individuals. In Italy, the spread of COVID-19 has affected all age groups. Initially, the majority of reported cases were among the elderly, but as the virus continued to spread, increasing numbers of younger individuals became infected.

Judging from the comorbid factors experienced by severe and critical COVID-19 patients in the ICU of the hospital. Dr. M. Djamil Padang is quite varied, including diabetes in 30 people (24.2%), hypertension in 15 people (12.1%), CKD in 4 people (3.2%), heart disease in 3 people (2.4%), others 23 people (18.5%), and no comorbid factors 60 people (48.4%). These findings are in line with research conducted by Huang et al. (2020), showing that comorbidities in COVID-19 patients are dominated by DM (20%), followed by hypertension and other heart diseases with a percentage of 15%. However, a study conducted by Fried et al. in 2020 showed that out of 11,721 patients, the percentage of patients with hypertension (46.7%) was greater than that of diabetes (27.8%) (Fried et al., 2021).

ABO blood type in severe and critical COVID-19 patients

Based on Table 2, it can be concluded that in the ICU of the Hospital. Dr M. Djamil Padang's blood type is blood type O, and as many as 46 people with details of severe COVID-19 in as many as 5 people (31.3%) and critical COVID-19 in as many as 41 people (38.0%). There were 36 patients with blood type A; 4 people (25.0%) were diagnosed with severe COVID-19, and 32 people (29.6%) were diagnosed with severe COVID-19. There were 29 patients with blood type B; 4 people (25.0%) were diagnosed with severe COVID-19, and 25 people (29.6%) were diagnosed with chilis COVID-19. There were 13 patients with blood type AB, with details of 3 people (18.7%) with severe COVID-19 and 10 people (9.3%) with critical COVID-19.

This finding is in accordance with research conducted by Eduardo where from 2017, 913 people (44.8%) were found to have blood type O, 816 people (40.1%) with blood type A, 237 people (11.6%) with blood type B, and 71 people (3.5%) with blood type AB (A. Goel et al., 2012). In 2020, Joel also conducted a study with the results of 225,556 people who met the inclusion criteria and the exclusion of the study obtained the results of 44.3% have type O, 4.5% have type AB, 14.9% have type B, and 36.3% have blood type A (Ray et al., 2021).

In the same year, Latz et al. (2020) conducted a study involving 1,289 patients who tested positive for COVID-19. The distribution of blood types among these patients was as follows: 440 (34.2%) had blood type A, 201 (15.6%) had blood type B, 61 (4.7%) had blood type AB, and 587

(45.5%) had blood type O. In Saudi Arabia, Badedi et al. (2021) conducted a study on the clinical characteristics and blood type of ABO in COVID-19 patients, from 404 samples obtained the majority of patients, 252 patients (62.4%) had blood type O, 103 (25.5%) had blood type A, 41 had blood type B (10.1%), and 8 had blood type AB (2.0%). Zietz also conducted research related to finding a relationship related to COVID-19 with blood type where out of 14,112 patients obtained results 6161 patients (47.2%) had blood type O, followed by 4298 patients (32.9%) with blood type A, 2033 patients (15.6%), and 559 patients (4.3%).

In contrast to this study, Zhao et al. (2021) examined the distribution of ABO blood groups among 1,775 COVID-19 patients in China and compared it with 3,694 ABO types from a healthy population. Their results showed that individuals with blood type O were less frequently infected (25.8%) than those in the healthy control group (33.8%). Conversely, blood group A was more common among infected individuals (37.7%) compared to the healthy controls (32.2%). This study supports several theories explaining differences in COVID-19 infection rates based on ABO blood type. For example, anti-A and/or anti-B antibodies (present in individuals with blood type O) might bind to the corresponding antigens on the viral envelope, assisting in virus neutralization and preventing infection of target cells. The COVID-19 virus and its spike protein (S) can be bound by anti-A isoagglutinins (such as those found in individuals with blood types O and B), potentially blocking the interaction between the virus and ACE2, thus inhibiting entry into pulmonary epithelial cells. (R. Goel et al., 2021).

The total of patients included in various studies varied widely, ranging from a few thousand to less than a hundred. However, it produces very similar results despite the high difference in statistical power. This can be explained if the phenotypic effect of ABO is stronger in certain geographic areas, significant differences between groups can be identified with a smaller number of cases. Conversely, in regions where the effect is weaker due to the relative phenotypic frequency of ABO blood types, especially the high prevalence of blood type O, a much larger number of patients is required to document significant deviations in the distribution of ABO blood types among patient groups (Pendu et al., 2021).

Outcomes in Severe and Critical COVID-19 Patients

Based on table 5.3, from 124 patients in the COVID ICU OF RSUP. Dr. M. Djamil Padang who was diagnosed with severe and critical COVID-19 was obtained by 67 people, including 9 people (56.0%) who died with details of severe COVID-19 as many as 58 people (53.7%). In comparison, patients with live outcomes in severe COVID-19 were 7 people (44.0%) and in critical COVID-19 patients as many as 50 people (46.3%).

This finding is in line with the 2021 Destylia study in North Sumatra, there were 69 people (92%) moderate COVID-19 patients who recovered, 13 people (76.5%) severe Covid-19 patients who recovered and 4 people (22.2%) critical COVID-19 patients recovered. The most deceased patients were found in COVID-19 patients of critical degree, namely 13 people (72.2%) (Destylya, 2021). Khan et al. (2021), also in a cross-sectional study of medical records, stated an increase in disability associated with the degree of illness associated with death from COVID-19. Knowledge of COVID-19 factors can increase maximum effort in the therapy of patients with COVID-19, thus requiring more intensive monitoring or COVID-19 treatment. Zietsz also conducted a study on severe COVID-19 with deaths from 4530 patients. The patients with the most deaths were patients

with blood type O, namely 166 patients, followed by patients with blood type A with 104 patients, 46 patients with blood type B, and 15 patients with blood type AB (Mahmud et al., 2021).

The high mortality rate of the Coronavirus is caused by several factors, namely individual factors and factors from outside the individual. Individual factors include age; biologically, the elderly population will experience an ageing process characterized by a decrease in physical endurance. This can cause the body to be more susceptible to certain diseases. Half of Indonesia's elderly experience health complaints, and the percentage is increasing as the elderly age. According to statistical data on the elderly population by the Central Statistics Agency (BPS), 1 in 4 elderly people have been sick in the past month. In addition to age, there is also a disease history factor that is one of the factors that cause death (Ilpaj & Nurwati, 2020).

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The data analysis results from this study, utilizing the chi-square test, yielded a p-value of 0.778. This indicates that there is no statistically significant relationship between ABO blood type and the outcomes of severe and critical COVID-19 patients in the ICU at Dr. M. Djamil Padang Hospital. Thus, no significant association was found between blood type and patient outcomes in these severe and critical cases within the ICU at this hospital.

This study aligns with the findings of Mahmud et al. (2021)., who observed that the patient's blood type had no impact on the severity of COVID-19 ($p = 0.62$). On univariate analyses performed by Latz et al. (2020), no association was found between blood type and one of the markers of peak inflammation. In multivariate analysis, blood type was not independently associated with the risk of intubation or death.

However, in contrast to the results of the study conducted by Takagi (2020), who conducted a study related to the relationship between ABO blood type and death, the results showed that blood type O was independently associated with lower covid-19 deaths ($p = 0.02$). In addition, there is also a study by Ray et al. (2021) that has registered 225,556 cases of COVID-19. The study reported that blood type O represented a lower risk of developing severe outcomes or death compared to non-O blood types.

These findings are not significant because, among patients who underwent COVID-19 tests during the study period, there were some differences in patients who were known to have a previous ABO blood type that was unknown. For example, patients whose blood type is known to have more comorbidities than patients whose ABO status is unknown. The various studies also differed in many other aspects, including the number of patients included, case definitions and the frequency of ABOs in diverse study populations. These different settings can seriously affect the results of the study 19 (Pendu et al., 2021; Ray et al., 2021).

As individuals age, the body undergoes various declines due to the aging process. The immune system, which serves as the body's defense mechanism, becomes less effective compared to its function in youth. This decline contributes to the elderly's increased susceptibility to various diseases, including COVID-19, caused by the Coronavirus (World Health Organization, 2020). This susceptibility might be due to the reduced protective effect of blood type O in individuals over the age of 70. If blood type O does provide protection against COVID-19 infection, those with this blood type might remain asymptomatic and therefore not undergo viral testing. It is hypothesized that the

interaction between blood type and COVID-19 infection arises from natural antibodies to blood type antigens, which may serve as part of the innate immune response to neutralize virus particles. Furthermore, blood type antigens could act as auxiliary receptors for the virus, and individuals who can express these antigens on epithelial cells, known as secretors, may have a higher risk of being affected by COVID-19 (Pendu et al., 2021; Ray et al., 2021).

Research Limitations

This research also has limitations. This study uses secondary data, namely Medical Record data for the January-September period. Research using secondary data is sometimes inaccurate, and data collection on medical records sometimes has incomplete data, so the data is considered "missing cases" and cannot be included in the research.

4. Conclusion

Based on research conducted on "The Relationship between ABO Blood Type and Outcomes in Severe and Critical COVID-19 Patients in the ICU of the Hospital. Dr. M. Djamil Padang", It can be concluded that the majority of severe and critical COVID-19 patients in the ICU at Dr. M. Djamil Padang Hospital are male, aged between 56 and 65 years, with diabetes being the most common comorbidity. Among these patients, blood type O is the most prevalent, followed by blood types A and B, with blood type AB being the least common. Additionally, 54.0% of these patients did not survive. There was no statistically significant relationship between blood type and outcomes for severe and critical COVID-19 patients in the ICU at Dr. M. Djamil Padang Hospital. Recommendations based on the study results include: Further research with a larger sample is needed to confirm these findings. The importance of considering risk factors other than blood type in managing critical COVID-19 patients. Suggest focusing on clinical interventions that are proven to be effective, regardless of the patient's blood type.

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