Relationship between the ABO blood group and the severity of COVID-19 patients

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Abstract

Patient with severe COVID-19 may have exaggerated defense response causing Systemic Inflammatory Response Syndrome (SIRS). Antibody, one of immune response, not only fights foreign substances but also used as blood grouping. This study aims to determine the relationship between blood group and severity of COVID-19 symptoms. This is a retrospective descriptive study. The data was taken cross-sectionally on COVID-19 subjects confirmed RT-PCR positive with severe and non-severe degrees with blood type examination results. The secondary data were taken from the Laboratory Information System and medical records on period January-December 2020. The statistical analysis uses chi-square. From 92 subjects, the most common blood group among all COVID-19 patients (in order) is O (40,2%), A (28,3%), B (22,8%), AB (8,7%); among the severe patient group is A (37.0%); among the non-severe patient group is O (47.8%) $p>0.05$; while among the subject with comorbidities (76.1%) $p<0.05$ is A (40.0%). Anti-A antibody is more protective and it blocks the interaction between SARS-CoV-2 and ACE-2 receptor. The absence of anti-A in blood group A and AB causes these blood groups found in the severe patient group. The presence of anti-A in blood types O and B causes the majority of non-severe degree. Although there is no significant difference between severe and non-severe groups based on blood group, Anti-A antibodies are more protective and blocks the interaction between SARS-CoV-2 and the ACE-2 receptor.

Keywords: COVID-19; severity; blood group ABO

1. Introduction

Coronavirus Disease 2019 (COVID-19) is a disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). This virus has caused a global pandemic with more than 23 million cases worldwide and a death rate between 1.4%-5%.[1,2,3,4]

The binding of SARS-CoV-2 with Angiotensin converting enzyme 2 (ACE2) causes varying degrees of severity. Based on the COVID-19 Prevention and Control Guidelines issued by the Ministry of Health of the Republic of Indonesia No. HK.01.07/MENKES/413/2020 states that the severity of COVID-19 is classified into 5 criteria: (1) without symptoms (asymptomatic), (2) mild illness without complications, (3) moderate illness with mild pneumonia, (4) severe illness with severe pneumonia, and (5) critical illness with Acute Respiratory Distress Syndrome (ARDS) and Multiple Organ Dysfunction Syndrome (MODS).2 These criteria are also used by the Guidelines for the diagnosis and treatment of coronavirus disease 2019 (COVID-19) in China. Severity is characterized by the presence of one of the following symptoms: (1) shortness of breath or respiratory rate 30 breaths per minute; (2) oxygen saturation 93% at rest; (3) partial pressure of arterial oxygen

(PaO2)/fraction of inspired oxygen (FiO2) 300 mmHg; and (4) lesions that have developed more than 50% within 24-48 hours as seen on chest X-ray.[5,6]

In severe COVID-19 patients, the immune response may be exaggerated and cause a systemic cytokine storm that triggers the systemic inflammatory response syndrome (SIRS). Excessive systemic inflammatory response can cause systemic endothelial injury (endotheliopathy) and hypercoagulable states that increase the risk of systemic macro-thrombosis and micro-thrombosis, which play a role in the process of Multiple Organ Dysfunction Syndrome (MODS) and Acute Respiratory Distress Syndrome (ARDS), and can cause death in COVID-19 patients.[3,7]

Severe COVID-19 patients often have coagulation disorders (coagulopathy) that require blood transfusions, and in non-severe COVID-19 conditions there can be a sudden worsening where there is no definitive therapy. In this situation, the alternative therapy given is convalescent plasma. In convalescent plasma transfusion, it is necessary to check blood group as one of the pre-transfusion examinations.[7] Blood types consist of protein molecules, namely antigens and antibodies. Antibodies as an immune response to fight foreign substances, but can also be used as blood grouping.

Patients with comorbidities such as diabetes mellitus, hypertension, and cardiovascular disease have an increase in ACE2 receptors. Elderly patients who have comorbidities such as cardiovascular disease, hypertension, chronic kidney disease, and diabetes mellitus have a greater risk factor for SARS-CoV-2. Patients with cancer are more susceptible because of the systemic immunosuppressive state caused by chemotherapy and surgery. If the above medical conditions are infected with SARS-CoV-2, the symptoms will tend to be more severe.[2,3]

A recent study in Wuhan, regarding the possibility that people with type A blood type are more susceptible to infection with SARS-CoV-2 and have more severe symptoms. Meanwhile, patients with type O blood are said to be more resistant to SARS-CoV-2 and their symptoms tend to be milder. It is hypothesized that the decreased susceptibility of individuals with blood type O and the increased susceptibility of individuals with blood type A to SARS-CoV-2 infection are associated with blood group antibodies, especially anti-A. Anti-A antibodies present in individuals with blood type O are more protective and will block the interaction between SARS-CoV-2 with the ACE-2 receptor expressed by target cells. Blood types that have anti-B tend to be heavier.[13,14,15]

ABO blood type can influence SARS-CoV-2 infection and the severity of the resulting COVID-19.[13] Research in the city of Beijing, Wuhan on blood type and SARS-CoV-2 infection, researchers found that patients with blood type A showed higher rates of infection, associated with serum levels of inflammatory cytokines.[9,10] A study by Ryan L. Hoiland, et al., hypothesized that: (1) There is a greater proportion of severe COVID-19 patients with blood type A or AB requiring blood transfusions than in severe COVID-19 patients with blood type O or B, (2) Extreme cytokine elevation in severe COVID-19 patients with blood type A or AB compared to blood group O or B.[13] The purpose of this study was to determine the relationship between ABO blood type and the severity of COVID-19 patients at RSUP DR. Hasan Sadikin Bandung.

2. Research Elaborations

This research method is a cross sectional study with a descriptive design. Retrospective data retrieval using secondary data taken from the Laboratory System Information (LIS) and medical records. The inclusion criteria for the subjects of this study were COVID-19 patients who were confirmed by Real Time-PCR examination within 48 hours of admission to the hospital and were treated in a special isolation room for COVID-19 Dr. RSUP. Hasan Sadikin Bandung during the period January 2020 December 2020, the criteria for severe and not severe COVID-19 when entering the treatment room were in accordance with the COVID-

19 Prevention and Control Guidelines from the Ministry of Health. The exclusion criteria for the subjects of this study were severe COVID-19 patients with incomplete blood group data from the Laboratory System Information (LIS). This study uses all medical record data that meet the inclusion criteria, patients diagnosed with severe COVID-19.

All research data were recorded using Microsoft Excel software for further analysis using chi-square. All data on the characteristics of research subjects will be tabulated against the severity of the disease (severe/not severe). The data in the study are presented in the form of diagrams and frequency distribution tables.

3. Results

The characteristics of a total of 92 research patient data by type of blood group based on age, gender, and comorbid are described in table 1 below.

Table 3.1 Patient characteristics by severity of COVID-19

Variable	Total n=92	Severity degree		p-value
		Severe n=46	Non-Severe n=46	
	n (%)	n (%)	n (%)	
Age (year)				
1 – 17	7 (7,6)	3 (6,5)	4 (8,7)	0,620
18 – 46	19 (20,7)	9 (19,6)	10 (21,7)	
47 – 65	46 (50,0)	26 (56,5)	20 (43,5)	
>65	20 (21,7)	8 (17,4)	12 (26,1)	
Sex				
Man	54 (58,7)	31 (67,4)	23 (50,0)	0,090
Woman	38 (41,3)	15 (32,6)	23 (50,0)	
Comorbid				
With comorbid	56 (60,9)	35 (76,1)	21 (45,7)	0,003*
Without comorbid	36 (39,1)	11 (23,9)	25 (54,3)	

Note: Analysis using Chi Square test

The number of confirmed COVID-19 subjects in this study was 92 people. Based on age, the most confirmed patients with COVID-19 occurred in the 47-65 years age group, namely 50.0% of the subjects. Based on gender, the number of male subjects was more than female subjects, namely 58.7% for male subjects and 41.3% for female subjects. Subjects who had more comorbidities in severe than non-severe degrees were statistically significant ($p<0.05$).

In the severe group, the most occurred in the 47-65 years age group, namely 56.5% of the subjects. Based on gender, the number of male subjects was more than female subjects, namely 67.4%. The majority in this group had comorbidities as much as 76.1%.

In the non-severe group, the majority occurred in the 47-65 years age group, namely 43.5% of the subjects. Based on gender, the number of male and female subjects was the same, namely 50.0%. In this group slightly more without comorbid, that is as much as 54.3%. The results of the relationship between blood type and the severity of COVID-19 can be seen in table 2.

Table 3.2 Relationship between blood type and COVID-19 severity

Variable	Total n=92 (%)	Severity degree		p-value
		Severe n=46 (%)	Non-Severe n=46 (%)	
Blood type				
A	26 (28,3)	17 (37,0)	9 (19,6)	0,280
B	21 (22,8)	10 (21,7)	11 (23,9)	
AB	8 (8,7)	4 (8,7)	4 (8,7)	
O	37 (40,2)	15 (32,6)	22 (47,8)	

Note: Analysis using Chi Square test

Table 2 shows the relationship between blood type and the severity of COVID-19. It was found that the most common type of blood group was blood type O, which was 40.2%. The severe grade group tended to have more blood type A by 37.0%, while the non-severe group had more blood type O by 47.8%, but not statistically significant (p>0.05). The results of the relationship between blood type and severity of COVID-19 with and without comorbidities can be seen in Table 3.

Table 3.3 Relationship between blood type and severity of COVID-19 with comorbid and without comorbid

Comorbid	Blood type	Total n=92 (%)	Severity degree		p-value
			Severe n=46 (%)	Non-severe n=46 (%)	
Yes		n=56	n=35	n=21	
	A	18 (32,1)	14 (40,0)	4 (19,1)	0,136
	B	9 (16,1)	7 (20,0)	2 (9,5)	
	AB	5 (8,9)	3 (8,6)	2 (9,5)	
	O	24 (42,9)	11 (31,4)	13 (61,9)	
No		n=36	n=11	n=25	
	A	8 (22,3)	3 (27,3)	5 (20,0)	0,947
	B	12 (33,3)	3 (27,3)	9 (36,0)	
	AB	3 (8,3)	1 (9,0)	2 (8,0)	
	O	13 (36,1)	4 (36,4)	9 (36,0)	

Note: Analysis using Chi Square test

Table 3 shows the relationship between blood type and severity of COVID-19 with and without comorbidities. The group with the most comorbidities was in the severe degree, namely blood type A (40.0%), while the non-severe degree was blood type O (61.9%). The group without comorbidities was mostly found in the severe degree, namely blood type O (36.4%), while the non-severe degree was blood type O and B (36.0%) but not statistically significant.

4. Discussion

In this study, the results obtained based on gender, the number of male subjects was more than female subjects, which was 58.7%. Based on the age of the subject, the most confirmed cases of COVID-19 occurred in the 47 – 65 years age group, namely 50.0% of the subjects. Subjects who had more comorbidities in severe than non-severe degrees were statistically significant (p <0.05). The number of subjects in the severe degree group tended to have more blood type A, which was 37.0%, while the non-severe group had more blood type O, which was 47.8% but not statistically significant (p >0.05), this is because in this study using a minimum

number of samples, not based on the number of equal proportions between the types of blood groups for which the blood group examination was performed. These results are in accordance with research conducted by Ryan L. Hoiland, et al., who hypothesized that: (1) In blood type A or AB there is an extreme increase in cytokines compared to blood type O or B, (2) COVID-19 patients with blood type A or AB shows more degrees of weight.[13] This is because blood types A and AB do not have anti-A, where anti-A is more protective and will block the interaction between SARS-CoV-2 and the ACE2 receptor.[12,13]

The anti-A properties in protecting SARS-CoV-2 can be seen from the research in Wuhan proposed by Ray, J. G, et al, that people with type A blood type are more likely to be infected with SARS-CoV-2 and have more severe symptoms. Meanwhile, patients with type O blood are said to be more resistant to SARS-CoV-2 and their symptoms tend to be milder.[13,14,16]

The limitation of this study is the unequal proportion of the blood groups of the research subjects between blood types, so that it can lead to biased results. Therefore, further research is needed with an equal proportion between blood types.

5. Conclusion

In conclusion, severe COVID-19 was more common in patients with blood type A, while patients with blood type O had fewer severe symptoms, although this result was not statistically significant. This is attributed to the more protective properties of Anti-A against SARS-CoV-2. As a suggestion, it is hoped that there will be other studies with more complete data such as data on previous medical history, history of giving blood transfusions, history of co-morbidities to get better research results.

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