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ORIGINAL ARTICLE

Risk factor for covid-19 patients on ventilators at gatot soebroto army hospital

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ABSTRACT

COVID-19 is a disease caused by the SARS-CoV-2 virus. More than 90% of patients on ventilators with COVID-19 infections develop pneumonia, and 40% develop ARDS. The severity of the disease is influenced by a number of variables, such as age and comorbid factors. In July 2021, Indonesia experienced a very high increase, namely 948,467 new positive cases and 20,877 deaths. This study aimed to identify the risk factors for COVID-19 patients on ventilators at the Gatot Soebroto Army Hospital. The descriptive research method was employed. Data collection was taken from medical records. The sample in the study was 76 people who were COVID-19 patients on ventilators at the Gatot Soebroto Army Hospital from July to September 2021. The majority of COVID-19 patients were adults (60.5%) and male (53.9%). The results of the CT-value examination showed 63.2% of patients had CT values <29 (strong positives). The results of the D-dimer examination found that 94.7% of patients had abnormal results ≥500 ng/dL, and the results of the radiological examination found that 96.1% of patients indicated pneumonia. Patients with comorbid conditions included 46.1% with diabetes mellitus, 44.7% with hypertension, 31.6% with obesity, and 5.3% with cardiovascular disease. It was found that 80.3% of patients died at the end of treatment.

Keyword: COVID-19, Gatot Soebroto Army Hospital, SARS-CoV2, Severity, Ventilator

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INTRODUCTION

Severe Acute Respiratory Syndrome Coronavirus-2 (SARSCoV-2) was first discovered in Wuhan, China. Cases increased rapidly from December 31 to January 3, 2020, with 44 cases reported. Since then, WHO declared COVID-19 a pandemic on March 12, 2020, after the virus spread rapidly around the world. There were 634,835 cases and 33,106 deaths worldwide as of March 29, 2020. The death rate for SARS-CoV-2 is 2.9%, SARS-CoV is 9.6%, and Middle East respiratory syndrome coronavirus (MERS-CoV) is 36%, causing severe pneumonia.[1,2] In July 2021, Indonesia experienced a very high increase from the previous month, namely an increase in 948,467 new positive cases and 20,877 deaths. In August, the increase was higher, namely 988,567 positive cases and 47,713 deaths. In September, cases were still relatively high, with 284,844 positive cases and 17,505 deaths.[3] The severity of COVID-19 is influenced by a number of variables, such as age and comorbid factors. Common comorbid factors such as hypertension, diabetes, lung disease (ARDS), and obesity.[4] Obese patients have a higher risk for other diseases, such as diabetes, hypertension, and cardiovascular disease, that increase the severity and risk of death in COVID-19 patients.[5] Foncea *et al.*'s observations in 2020 showed that the need for mechanical ventilation was significantly higher in obese patients, which was around 81.8%, compared to thin patients, which was only 41.9%.[4] In a study by Arthur Simonnet *et al.* in France, it was found that the proportion of patients requiring invasive mechanical ventilation increased in obese patients with BMI > 30 compared to patients with BMI <25.[6]

Radiological examination has an important role in the diagnosis of COVID-19. Disease progress can be assessed and observed through radiological examination. Radiological examination may reveal a lung infection if virological tests come back negative in some cases.[7] A typical RT-PCR test will have a maximal value of 40 thermal cycles. The lower the CT value, the higher the amount of viral genetic material in the sample. A 3-point increase in CT values is roughly equivalent to a 10-fold decrease in viral genetic material.[8] D-dimer is the end product of the denaturation of fibrin crosslinks by the action of plasmin in the fibrinolytic system. The D-dimer test is used to check for thrombosis. A positive test result indicates the presence of a blood clot.[9] An increase in D-dimer concentration in serum indicates a process of intravascular coagulation.[10] The highest value of D-dimer was 3,600 ng/mL, and the lowest was 100ng/mL, with an average of 1,800 ng/mL.[9] D-dimer will increase significantly in severe COVID-19 patients.[8]

Based on the background, namely the high number of cases of COVID-19 in the period from July to September and several factors that cause COVID-19 patients to use a ventilator, such as age, gender, patient comorbid factors (Obesity, Diabetes Mellitus, Hypertension, and Cardiovascular Disease), as well as the results of supporting examinations (D-dimer, Radiology, and CT-Value), the authors are interested in researching "Description of COVID-19 Patients with Ventilators at Gatot Soebroto Army Hospital for the Period of July-September 2021". Researchers also looked at the outcome of patients on ventilators during treatment, whether they recovered or died. This research was taken at Gatot Soebroto Army Hospital because this hospital is the main referral hospital for COVID-19 patients and is the highest referral hospital in the Indonesian National Armed Forces (TNI).

METHOD AND SUBJECT

The research method used is descriptive. The research approach is cross-sectional. The population of this study is all COVID-19 patients with ventilators who were treated at the COVID ICU on the 1st floor of the Soehardo pavilion and were recorded in the patient medical records at the Gatot Soebroto Army Hospital for the period from July to September 2021. The sample size calculation for the study was conducted using the total sampling method. This method considers all medical record data for COVID-19 patients at the Gatot Soebroto Army Hospital in the period of July to September 2021. In total, 76 people were included in the sample size calculation.

Sampling data was collected in December 2022. The inclusion criteria in this study were all COVID-19 patients on ventilators at the Gatot Soebroto Army Hospital for the period July-September 2021 and the availability of medical records for COVID-19 patients on ventilators. An analysis of the data, conducted using univariate or descriptive methods, aims to identify the risk factors for COVID-19 patients on ventilators at the Gatot Soebroto Army Hospital between July and September 2021, including age, gender, history of comorbid factors (Diabetes Mellitus, Hypertension, Obesity, and Cardiovascular Disease), as well as the results of investigations (D-dimer, Radiology, and CT-Value).

Frequency distribution and percentages are employed in the presentation of data. This research has obtained ethical approval from the Head of the Commission Ethics of Health Research, Faculty of Medicine, Jenderal Achmad Yani University of Cimahi, number 089/UM1.12/2022, dated December 6, 2022, regarding Ethics Approval. After obtaining permission from the ethics committee and submitting permits to the Gatot Soebroto Army Hospital to obtain permission to collect medical record data, the response to the application for research permits and data collection at the Gatot Soebroto Army Hospital was stated in letter Number B/172/I/2023.

RESULT AND DISCUSSION

The study was conducted at the Gatot Soebroto Army Hospital in December 2022. There were 76 COVID-19 patients on ventilators at the Gatot Soebroto Army Hospital from July to September 2021 who met the inclusion criteria for this study.

Table 1 Characteristics of Age and Patient's Gender

No	Characteristics	Amount	Percentage
1	**Gender**		
	Male	41	53.9 %
	Female	35	46.1 %
	Total	**76**	**100%**
2	**Age**		
	Adolescents: <20 years	3	3.9 %
	Adults: 20-60 years	46	60.5 %
	Elderly: > 60 years	27	35.5 %
	Total	**76**	**100%**

The results of the analysis are presented in Table 1. There are more male COVID-19 patients with ventilators than females, namely 41 patients (53.9%). It is consistent with the theoretical review, which indicates that males are more at risk of being infected with COVID-19 than females. It is known that males express ACE2 more frequently, making them more susceptible to SARS-CoV-2 infection. As ACE2 expression is encoded by a gene on the X chromosome, it has the potential to be increased in heterozygous females and homozygous males.[11]

In this study, 46 adult patients (age group 20-60 years) were treated with COVID-19 on ventilators (60.5%). This means that adult patients dominate the population of COVID-19 patients on ventilators. According to a theoretical review, productive-age people are most likely to develop COVID-19 due to their high mobility and activity outside the home. According to CSIS, the adult age group that has high mobility and activity is a source of infection transmission.[12]

Table 2. Supporting Examination Results

No.	Variable	Amount	Percentage
1	**CT value**		
	CT ≥ 29 (Weak positive, moderate)	28	36.8%
	CT<29 (Strong positive)	48	63.2%
	Total	**76**	**100%**
2	**D-dimers (ng/dL)**		
	Normal < 500 ng/dL	4	5.3%
	Abnormal ≥500 ng/dL	72	94.7%
	Total	**76**	**100%**
3	**Radiology examination**		
	Pneumonia	73	96.1%
	Not Pneumonia	3	3.9%
	Total	**76**	**100%**

The results of the analysis presented in Table 2 show that 63.2% of patients had a CT value <29 which was included in the strong positive category. Patients in critical or severe conditions with a ventilator have a tendency to have a low CT value. This is consistent with the theory that a high viral load correlates with a low CT value and vice versa. Research by Zhou *et al.* reported that the mean CT values of asymptomatic patients (APs) were 39, significantly higher than the mean CT values of asymptomatic patients in the incubation period (APIs). Another study conducted by Liu *et al.* reported that the CT value of severe COVID-19 cases was significantly lower than that of mild cases. The average viral load in severe cases was about 60 times higher than in mild cases, suggesting that higher viral loads may be associated with more severe clinical symptoms.[13]

The results of the abnormal D-dimer examination characteristics were 72 patients (94.7%). Theoretically, a significant increase in D-dimer often occurs in severe COVID-19 patients. D-dimer has been shown to be a useful biomarker for levels of severity, describing the state of severe inflammation and procoagulability of COVID-19.[8–10] Thromboembolic events, particularly venous thromboembolism (deep vein thrombosis and pulmonary embolism), are frequent complications in hospitalized COVID-19 patients.

Pulmonary embolism is thought to contribute to the high mortality rate in COVID-19 patients.[14,15]

Based on X-ray radiological examination in patients with COVID-19 on a ventilator, 73 patients indicated pneumonia (96.1%). More than 90% of patients on ventilators with COVID-19 infection have pneumonia, and about 40% of them develop ARDS.[16] On chest x-ray examination, the most common abnormality found is airspace opacity in the form of consolidation and ground-glass opacity (GGO).[7] Grounds glass opacity (GGO) is an increased attenuation of the lung parenchyma with hazy opacity without obscuring the pulmonary vessels and underlying bronchial structures so that pulmonary vascular patterns can still be seen.[17]

Table 3. Comorbid Factors in COVID-19 patients

No.	Variable	Amount	Percentage
1	**DM comorbid**		
	DM	35	46.1%
	No DM	41	53.9%
	Total	**76**	**100%**
2	**HT Ccomorbid**		
	Hypertension	34	44.7%
	No Hypertension	42	53.3%
	Total	**76**	**100%**
3	**Obesity comorbid**		
	Obesity	24	31.6%
	No Obesity	52	68.4%
	Total	**76**	**100%**
4	**Cardiovascular disease comorbid**		
	Comorbid	4	5.3%
	No comorbid	72	94.7%
	Total	**76**	**100%**

The results of the analysis are shown in Table 3. DM comorbidities in COVID-19 patients on ventilators in this study were found in 35 patients (46.1%). Diabetes mellitus (DM) will increase the severity and mortality of COVID-19 patients, especially type 2 DM. ACE-2 expression was found to be higher in patients with type 1 and type 2 diabetes. Furin, a type 1 membrane protease that helps the entry of SARS-CoV-2 into cells and facilitates viral replication, also increases in diabetic patients.

Comorbid Hypertension (HT) in COVID-19 patients with ventilators in this study was found in 34 patients (44.7%). The high prevalence of HT in COVID-19 patients with severe and critical conditions (on ventilators) is due to increased expression of ACE-2 in hypertensive patients suffering from COVID-19.[5] ACE2 functions as a negative regulator of the RAAS and plays a role in the degradation of angiotensin-2, which results in heptapeptide production. Angiotensin-2, as part of the RAAS, binds to the receptor angiotensin-2 type 1 (AT1) and causes vasoconstriction, resulting in an increase in blood pressure.[18]

Obese patients reached 31.6% in this study. Obesity affects the size, function, and expansion of the lungs, which can affect the severity of the disease.

Diaphragmatic contractility decreases due to decreased forced expiratory volume in one second (FEV1) and forced volume capacity (FVC) in obese individuals.[5] Obesity can reduce the expiratory reserve volume, functional capacity, and adjustment of the respiratory system, which can worsen the prognosis and increase the risk of pulmonary complications in obese COVID-19 patients. Adipose tissue produces large amounts of adipokines, which act as signaling molecules with various effects on organ systems, including the lungs. Obese patients have lower adiponectin levels and higher leptin levels. Excess leptin causes a more pro-inflammatory state, leading to impaired immune system function.[4,6]

In this study, there were 4 patients with cardiovascular disease comorbidity among COVID-19 patients with ventilators, or 5.3%. In this study, the comorbid cardiovascular diseases were Hypertensive Heart Disease, in three patients and Heart Failure in one patient. Patients with cardiovascular comorbidities will be susceptible to infection with SARS-CoV-2, with more severe clinical manifestations due to increased ACE2 expression.

Patients with comorbid cardiovascular disease are relatively unstable when infected with SARS-CoV-2.[15] ACE2 acts as a site for the entry of the SARS-CoV-2 virus into cells. ACE2 also functions as a negative regulator of the RAAS and plays a role in the resulting degradation of angiotensin-2 and the production of a heptapeptide called angiotensin 1–7. When overstimulated, angiotensin-2 can negatively impact the cardiovascular system, causing hypertension, inflammation, myocardial fibrosis, and hypertrophy, all of which ultimately lead to heart failure.[18]

Table 4. Mortality Rate in COVID-19 Patients With Ventilators

Treatment Exit Status	Amount	Percentage
Live	15	19.7%
Die	61	80.3%
Total	**76**	**100%**

The mortality rate for COVID-19 patients with ventilators in this study was 61 patients (80.3%). The distribution of patients who lived and died can be seen in Table 4. In the study of Gibson *et al*., mortality in COVID-19 patients who have ARDS undergoing treatment in the ICU is as much as 26-61.5%, while in patients who use ventilators, the mortality rate ranges from 65.7% to 94%.[19] According to Sanyaolu *et al*., 86% of COVID-19 deaths are due to the presence of one or more comorbidities in the patient.[20]

Table 5. Distribution of Mortality Rate in COVID-19 Patients with Ventilators at the Gatot Soebroto Army Hospital for the July – September 2021 period

No	Distribution of Patient Mortality Rates	Living Patient		Patient Died	
		Amount	Percentage	Amount	Percentage
1	Based on Gender				
	Male	7	46.7%	37	60.6%
	Female	8	53.3%	24	30.4%
	Total	**15**		**61**	
2	Based on Age group				
	Adolescent < 20 years	3	20.0%	3	4.9%
	Adult 20-60 years	7	46.7%	39	63.9%
	Elderly >60 years	5	33.3%	19	31.2%
	Total	**15**		**61**	
3	Based on the Number of Comorbids				
	No Comorbid	6	40.0%	8	13.1%
	1 Comorbid Disease	6	40.0%	24	39.3%
	2 Comorbid Diseases	2	13.3%	21	34.5%
	3 Comorbid Diseases	1	6.7%	8	13.1%
	Total	**15**		**61**	
4	Weight condition based on BMI				
	Obesity	4	26.7%	20	32.8%
	Not Obese	11	73.3%	41	67.2%
	Total	**15**		**61**	

Co-morbidities are more common in patients with severe COVID-19. According to a study, the presence of disease co-morbidities in COVID-19 patients almost tripled the severity of the disease. Chronic conditions that cause dysregulation of major physiological systems, including the hypothalamus-pituitary-adrenal axis, the sympathetic nervous system, and the immune system, are pathophysiological mechanisms associated with a higher risk of severity in COVID-19 patients with co-morbidities. The cellular immune system is affected by the accumulation of proinflammatory cytokines caused by this chronic nature. Patients suffering from comorbid conditions are more likely to have a weakened immune system as a result of this condition.[21]

CONCLUSION

Based on the results of the research that was conducted to find out the description of COVID-19 patients with ventilators at the Gatot Soebroto Army Hospital for the July-September 2021 period, it can be concluded that the majority of COVID-19 patients were adults (60.5%), male sex (53.9%), CT-value examination showed 63.2% of patients had CT values <29 (strong positives), D-dimer examination found 94.7% of patients had abnormal results ≥500 ng/dL, and radiological examination results found 96.1% of patients indicated pneumonia, and the most common comorbid was diabetes melitus.

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DECLARATION OF INTEREST

There is no conflict of interest in this scientific article.

REFERENCE

1. Ciotti M, Ciccozzi M, Terrinoni A, Jiang W, Wang C, Bernardini S, et al. Critical Reviews in Clinical Laboratory Sciences The COVID-19 pandemic. Crit Rev Clin Lab Sci [Internet]. 2020;0(0):1–24. Available from: https://doi.org/10.1080/10408363.2020 2 0.1783198
2. Susilo A, Rumende CM, Pitoyo CW, Santoso WD, Yulianti M, Herikurniawan H, et al. Coronavirus Disease 2019: Tinjauan Literatur Terkini. J Penyakit Dalam Indones. 2020;7(1):45.
3. Indonesia KKR. Peta Sebaran Transmisi Lokal dan Wilayah Terkonfirmasi [Internet]. Infeksi Emerging. 2022. Available from: https://infeksiemerging.kemkes.go.id/ dashboard/covid-19
4. Aqmarina NW, Risanti ED, Mahmudah LN., Jatmiko SW. Obesitas Sebagai Faktor Risiko Keparahan Pada Covid-19. Proceeding of The URECOL. 2021;(November 2020):371–7.
5. Rahayu LA, Admiyanti JC, Khalda YI, Adha FR, Agistany NFF. Hipertensi, Diabetes Melitus dan Obesitas Sebagai Faktor Komorbiditas Utama Terhadap Mortalitas Pasien Covid-19 : Sebuah Studi Literatur. J Ilm Mhs Kedokt Indones. 2021;9:90–7.
6. Sista K. Waspadai Obesitas dan Pengaruhnya Terhadap Keparahan Penyakit COVID-19 [Internet]. Instalasi Promosi Kesehatan dan Pemasaran RSUP dr. Soeradji Tirtonegoro. 2020 [cited 2022 Jul 6]. Available from: https://rsupsoeradji.id/waspadai-obesitas-dan-pengaruhnya-terhadap-keparahan-penyakit-covid-19/
7. Yanti B, Hayatun U. Peran Pemeriksaan Radiologis Pada Diagnosis Coronavirus Disease 2019. J Kedokt Syiah Kuala. 2019;20:53–7.
8. Wijayanti LE, Aryani D, Wahyu S. Hubungan Nilai CT Pada Pasien Terkonfirmasi COVID-19. J Kesehat Tambusai. 2022;3:96–103.
9. Permana A, Yari CE, Aditya AK. Gambaran D-Dimer Dan Limfosit Pada Pasien Terkonfirmasi COVID-19 Di RS Haji Jakarta. J Ilm Anal Kesehat. 2021;7(1):62–71.
10. Wahyu W, Putra S. Hubungan konsentrasi serum C- Reactive Protein dan D-dimer dengan derajat keparahan dan mortalitas pasien COVID-19. Intisari Sains Medis. 2021;12(2):680–5.
11. Putri NAP, Putra AE, Mariko R. Hubungan Usia, Jenis Kelamin Dan Gejala Dengan Kejadian COVID19 di Sumatera Barat. Maj Kedokt Andalas. 2021;44(2).
12. Elviani R, Anwar C, Sitorus RJ. Gambaran usia pada kejadian covid-19. J Unja. 2021;277:6–11.
13. Siappa O, Pratiningrum M. Hubungan Gejala Klinis Dengan Nilai CT Pada Pemeriksaan Realtime PCR SARS-CoV-2. J Ked Mulawarman. 2021;8(April):89–99.
14. Matsushita K, Marchandot B, Jesel L, Ohlman P, Morel O. Impact of COVID-19 on the Cardiovascular System : A Review. J Clin Med. 2020;
15. Willim HA, Ketaren I, Supit AI. Dampak Coronavirus Disease 2019 terhadap Sistem Kardiovaskular. e-CliniC. 2020;8(28):237–45.
16. Hobohm L, Sagoschen I, Barco S, Schmidtmann I, Espinola-Klein C, Konstantinides S, et al. Trends and Risk Factors of In-Hospital Mortality of Patients with COVID-19 in Germany: Results of a Large Nationwide Inpatient Sample. Viruses. 2022;14(2).

17. Fitri IC, Singh G, Amin Z. Diagnosis Banding Ground Glass Opacities Pada CT-Scan Toraks Di Era COVID-19. Indones J Chest. 2021;8(1):37–58.
18. Petrovic V, Radenkovic D, Radenkovic G, Djordjevic V. Pathophysiology of Cardiovascular Complications in COVID-19. Front Physiol. 2020;11(October):1–11.
19. Putra MK, Utariani A, Soemartono C, Semedi BP, Hardiono. Penggunaan Ventilatory Ratio dan Alveolar Dead Space Fraction sebagai Prediktor Mortalitas pada Pasien COVID-19 dengan Acute Respiratory Distress Syndrome. J Anestesi Perioper. 2021;9(1):10–7.
20. Suryaputra GP, Apriningsih H, Wardani MM. Hubungan Komorbid dengan Mortalitas dan Lama Rawat Inap pada Pasien COVID-19 di Rumah Sakit UNS Surakarta. Plex Med J. 2022;1(1):32–41.
21. Karya KWS, Suwidnya IM, Wijaya BS. Hubungan penyakit komorbiditas terhadap derajat klinis COVID-19. Intisari Sains Medis. 2021;12(2):708–17.