

The Relationship between Comorbidities and Mortality among Covid-19 Patients at Raden Mattaher General Hospital in Jambi

Fesi Putri Alwi*, Makrup Efendy, Mara Imam Taufiq Siregar, Dicky Wahyudi, Wahyu Indah Dewi Aurora, Fitriyanti
Universitas Jambi, Indonesia
Email: ffessii053@gmail.com*

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Abstract

Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Patients with comorbidities have a higher risk of mortality compared to patients without comorbidities. Objective: This study aims to analyze the relationship between comorbidities and mortality in COVID-19 patients at Raden Mattaher General Hospital in Jambi. Methods: This study is an observational analytical study with a retrospective approach using a cross-sectional design. The minimum sample size was 133 patients with comorbidities and 133 patients without comorbidities. The study utilized secondary data in the form of medical records, and the analysis employed the Chi-Square test. Results: The study sample consisted of 294 patients. Regarding sample characteristics, the largest age group was 56–64 years (27.6%), and the sample was predominantly male (54.4%). The most common comorbidities were diabetes mellitus (21.1%), hypertension (10.2%), chronic kidney disease (9.2%), hypertensive heart disease (5.4%), acute kidney injury (2.4%), and tuberculosis (1.7%). The proportion of patients with a deceased status was (15.3%) Bivariate analysis results indicated an association between comorbidities and mortality among COVID-19 patients at Raden Mattaher General Hospital in Jambi, with a p-value of 0.006 ($p < 0.05$). Conclusion: There is an association between comorbidities and mortality in COVID-19 patients at Raden Mattaher General Hospital in Jambi.

INTRODUCTION

Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), a positively polarized single-stranded RNA virus from the family Coronaviridae. The virus was first identified in Wuhan, China, in December 2019, and quickly spread globally. The WHO designated the COVID-19 virus outbreak as a global pandemic on March 11, 2020, after previously declaring it a Public Health Emergency of International Concern (PHEIC) on January 30, 2020 (Alkautsar, 2021).

COVID-19 presents a diverse clinical spectrum, ranging from asymptomatic to severe symptoms. Common symptoms are fever, cough, and shortness of breath, in severe cases can develop into pneumonia, ARDS, kidney failure, and death, with an average incubation period of 5–6 days and a maximum of 14 days.

Various risk factors reported to be associated with the severity of COVID-19 include male gender, advanced age, and comorbidities. 75% of hospitalized patients with COVID-19 have at least one comorbidity, including hypertension, diabetes, cancer, neurodegenerative diseases, cardiovascular disease, obesity, and kidney disease.

Various studies show that patients with comorbidities have a higher risk of mortality compared to patients without comorbidities. Conditions such as diabetes mellitus, hypertension, and chronic kidney disease are comorbidities frequently found in COVID-19 patients and can increase the severity of the infection through various mechanisms, such as immune dysregulation, increased systemic inflammation, endothelial dysfunction, coagulation disorders, and hyperactivation of the RAAS pathway. In addition to the comorbidities already mentioned, renal involvement in COVID-19 patients is also a major concern. The incidence of acute kidney injury in COVID-19 patients is reported to range between 5–15% and increases significantly in patients with severe disease.

Globally, as of December 13, 2023, there were 772,386,069 confirmed cases of COVID-19 with 6,987,222 deaths. The results of the systematic review showed that the most common comorbidities found in COVID-19 patients were hypertension with a prevalence of around 20–22%, followed by diabetes mellitus at 9–11% and cardiovascular disease at 5–9%. In addition, the prevalence of other comorbidities such as cancer, COPD, cerebrovascular disease, and chronic kidney disease was reported at 3.9%, 3.1%, 3.0%, and 2.4%, respectively.

Indonesia reported the first case from March 2, 2020 to December 31, 2020, with 743,198 confirmed cases in Indonesia and 22,138 deaths with a CFR of 3.0% (Kementerian Kesehatan Republik Indonesia, 2021). The first case as of December 31, 2021, recorded 4,262,720 confirmed cases in Indonesia and 144,094 deaths with a CFR of 3.4% (Kementerian Kesehatan Republik Indonesia, 2022).

Based on medical record data at Raden Mattaher Jambi Hospital, it shows a significant increase in the number of COVID-19 cases and deaths during the 2020–2021 period. In 2020, there were 262 positive cases with 37 deaths, while in 2021 it increased to 1199 cases with 198 deaths. Of the total, there were 167 COVID-19 patients who were treated for comorbid diseases, including diabetes mellitus as many as 104 patients, hypertension 24 patients, chronic kidney disease 27 patients, and acute kidney disorders 12 patients. In addition, there were differences in mortality rates between comorbidities, namely in diabetes mellitus as many as 21 deaths, hypertension 1 death, chronic kidney disease 12 deaths, and acute kidney disorders 8 deaths. These data suggest that comorbidities, particularly kidney disorders, have a tendency to increase the risk of death in COVID-19 patients.

Although the relationship between comorbid diseases and mortality in COVID-19 patients has been widely reported, studies that specifically analyze the relationship between comorbid diseases and mortality in COVID-19 patients at Raden Mattaher Jambi Hospital are still limited.

Based on this background, it can be concluded that the presence of comorbidities can increase mortality higher in COVID-19 patients, but local data, especially in Jambi Province, are still limited. Therefore, this study was conducted to further study the "The relationship between comorbid diseases and mortality in COVID-19 patients at Raden Mattaher Jambi Hospital".

METHOD

This study is an analytical observational study with a retrospective approach using a cross-sectional design. The purpose of this study is to analyze the association between comorbidities and mortality in COVID-19 patients from May 2020 to December 2021 at Raden

Mattaher Regional General Hospital in Jambi. The population of this study consisted of all patients diagnosed with COVID-19 who were treated at Raden Mattaher Regional General Hospital in Jambi during the period from May 2020 to December 2021. Based on the unpaired categorical analytic formula, the minimum sample size was determined to be 133 for the group of patients with comorbidities and 133 samples for patients without comorbidities, which are representative of the population. Inclusion criteria: patients diagnosed with COVID-19 based on the results of RT-PCR or antigen tests recorded in the medical records at the Raden Mattaher General Hospital in Jambi, and patients with complete data regarding their history of comorbidities and mortality status. Exclusion Criteria: patients with incomplete medical records; patients with two or more comorbidities.

Data is collected from the patient's medical records as secondary data, then processed through the stages of editing, coding, tabulating, data entry, and cleaning. Data analysis was carried out univariate to describe the distribution of patient characteristics, as well as bivariate using the Chi-square test, with the help of SPSS software.

RESULTS AND DISCUSSIONS

The research has been conducted in the Medical Record Room of Raden Mattaher Jambi Hospital. This study uses secondary data, namely medical record data of COVID-19 patients at Raden Mattaher Jambi Hospital. In this study, there were 294 medical record data of patients diagnosed with COVID-19 in the period May 2020 - December 2021.

In this study sample, a univariate analysis was conducted to assess the distribution of patient characteristics based on age, sex, comorbid diseases, and mortality. In addition, bivariate analysis was also carried out to determine the relationship between comorbid diseases and mortality in COVID-19 patients.

Analysis of COVID-19 Patient Characteristics by Age

Table 1. Characteristics of COVID-19 patients by age

Characteristics of Research Subjects	Total	
	n	%
Age		
17-25	12	4.1
26-35	33	11.2
36-45	36	12.2
46-55	79	26.9
56-64	81	27.6
>65	53	18.0
Total	294	100

The results of the study show that the most common age group among COVID-19 patients was the 56–64 age group, with 81 patients (27.6%), followed by the 46–55 age group with 79 patients (26.9%), and the >65 age group with 53 patients (18.0%), the 36–45 age group with 36 patients (12.2%), the 26–35 age group with 33 patients (11.2%), and the 17–25 age group with 12 patients (4.1%).

Analysis of COVID-19 Patient Characteristics by Gender

Table 2. Characteristics of COVID-19 patients by gender

Characteristics of Research Subjects	Total	
	n	%
Gender		
Male	160	54.4
Female	134	45.6
Total	294	100

The results of the study show that the most common gender among COVID-19 patients was male, with 160 patients (54.4%), while female patients numbered 134 (45.6%).

Analysis of COVID-19 Patient Characteristics Based on Comorbid Diseases

Table 3. Characteristics of COVID-19 Patients by Comorbidity

Table 3. Characteristics of COVID-19 Patients by Comorbidity									
Characteristics of the Study Participants	Mortality Status				Total	p-value	OR	95% CI	
	Survival		Deceased						
	n	%	n	%					n
Type of Comorbidity									
Diabetes Mellitus	50	52.5	12	19.4	62	21.1	0.319	1.447	0.698-3.003
Hypertension	23	76.7	7	23.3	30	10.2	0.190	1.810	0.726-4.511
Chronic Kidney Disease	19	70.4	8	29.6	27	9.2	0.045	2.617	1.068-6.412
Acute kidney injury	4	57.1	3	42.9	7	2.4	0.075	4.375	0.945-20.251
Tuberculosis	5	100	0	0.0	5	1.7	1.000	-	-
Hypertensive Heart Disease	15	93.8	1	6.3	16	5.4	0.482	0.355	0.045-2.753

The results of the study showed that of the 147 patients with comorbidities, diabetes mellitus was the most common comorbidity, affecting 62 patients (21.1%), with an OR of 1.447 (95% CI: 0.698–3.003; $p = 0.319$), hypertension in 30 patients (10.2%) with an OR of 1.810 (95% CI: 0.726–4.511; $p = 0.190$), chronic kidney disease in 27 patients (9.2%) with an OR of 2.617 (95% CI: 1.068–6.412; $p = 0.045$), acute kidney injury in 7 patients (2.4%) with an OR of 4.375 (95% CI: 0.945–20.251; $p = 0.075$), tuberculosis in 5 patients (1.7%) with p-value of 1.000, and 16 patients (5.4%) with hypertensive heart disease, with an OR of 0.355 (95% CI: 0.045–2.753; $p = 0.482$).

Analysis of COVID-19 Patient Characteristics Based on Mortality

Table 4. Characteristics of COVID-19 patients by mortality

Characteristics of Research Subjects	Total	
	n	%
Status Mortalities		
Died	45	15.3
Survival	249	84.7
Total	294	100

The results showed that 45 patients (15.3%) died of COVID-19 patients, while 249 patients (84.7%) survived.

Association Between Comorbidities and Mortality Among COVID-19 Patients

Table 5. Association Between Comorbidities and Mortality Among COVID-19 Patients

Comorbidity	Mortality Status						p-value	OR	95% CI
	Survival		Deceased		Total				
	n	%	n	%	n	%			
With Comorbidity	116	78.9	31	21.1	147	100	0.006	2.539	1.288-5.004
Without Comorbidity	133	90.5	14	9.5	147	100			
Total	249	84.7	45	15.3	294	100			

The results of the study show that of the 147 COVID-19 patients with comorbidities, 31 patients (21.1%) died and 116 patients (78.9%) survived. Meanwhile, of the 147 patients without comorbidities, 14 patients (9.5%) died and 133 patients (90.5%) survived. The results of the bivariate analysis using the chi-square test showed a p-value of 0.006 ($p < 0.05$), indicating a statistically significant association between and mortality in COVID-19 patients at Raden Mattaher Regional General Hospital in Jambi, with an OR of 2.539 (95% CI: 1.288–5.004), indicating that COVID-19 patients who have comorbidities are approximately 2.5 times more likely to die than patients without comorbidities.

Patient Characteristics by Age

In this study, the 56–64 age group constituted the largest age group among COVID19 patients (27.6%). A similar age distribution was reported by Vermonte et al., which found that the largest proportion of COVID-19 patients in Indonesia was in the 50–59 years. A study by Salsabila et al. also showed that the majority of COVID-19 patients were aged ≥ 60 years, followed by the 56–59 age group. Advanced age is known to be one of the risk factors for worsening condition in COVID-19 patients because as a person ages, immune system function declines due to degenerative processes, making the body more susceptible to SARS-CoV-2

infection. In contrast by Marsika et al., which reported that the largest number of COVID-19 patients were in the 26–45 age group. A study by Rahmawati et al. also showed that the majority of patients were in the 35–54 age group because people in the productive age group have higher levels of outdoor activity, making them more frequently exposed to COVID-19.

Patient Characteristics by Gender

In this study, COVID-19 patients were predominantly male (54.4%) compared to females (45.6%). These results are consistent with the 2020 Indonesia Health Profile and the study by Djaharuddin et al., which also showed a predominance of male patients. This similarity in results is thought to be related to biological differences between men and women, in which the hormone estrogen in women has an immunomodulatory effect that can enhance the immune response to viral infections, whereas men are known to have higher expression of the ACE-2 receptor, making them more susceptible to SARS-CoV-2 infection. However, the results of this study are inconsistent with the study by Khaerunnisa et al. which reported a higher proportion of female patients (50.9%), a finding attributed in that study to women's greater susceptibility to stress when facing new situations.

Patient Characteristics Based on Comorbid Disease

Diabetes mellitus was the most common comorbidity among COVID-19 patients, affecting 62 patients (21.1%), and showed no significant association with mortality. These findings are consistent with those of Gupta et al., who reported diabetes mellitus as a comorbid condition with a high prevalence (16.8%) but associated with an increased risk of death (OR = 1.83; 95% CI = 1.61–2.05). This condition is associated with impaired glucose regulation, which leads to immune system dysfunction. The findings of Shang et al. also indicate an increased risk of mortality (OR = 2.21). This is linked to pulmonary dysfunction, a severe inflammatory response, increased ACE-2 expression, impaired T-cell function, and elevated IL-6 levels, all of which worsen the course of COVID-19.

Hypertension was found in 30 patients (10.2%) and showed no significant association with mortality. These findings are inconsistent with those of Choirunnisaa et al., who reported that hypertension increases the risk of death in COVID-19 patients (OR = 9.08; 95% CI = 4.6–17.84). Conversely, these findings are consistent with those of Lucyati et al., who found no significant association between hypertension and mortality in COVID-19 patients ($p = 0.087$). The findings of Sun et al. also indicate that hypertension is not directly associated with mortality but increases the severity of infection because it is generally accompanied by other comorbidities, making it difficult to determine the independent association between hypertension and mortality. These findings are also consistent with those of Azhar et al., who found no association between hypertension and the risk of death in COVID-19 patients.

Chronic kidney disease was found in 27 patients (9.2%) and was the only comorbidity significantly associated with mortality. These findings are consistent with those of Cai et al., who reported high mortality among patients with chronic kidney disease and COVID-19 (OR=5.81; 95% CI=3.78–8.94). This condition is associated with elevated levels of proinflammatory cytokines, which trigger oxidative stress and an inflammatory immune response, thereby increasing susceptibility to both bacterial and viral infections as well as the risk of pulmonary inflammation.

Acute kidney injury was found in 7 patients (2.4%) and showed no significant association with mortality. These findings are inconsistent with those of Wang et al., who reported a significant association between acute kidney injury and COVID-19 (OR=11.88; 95% CI=9.29–15.19). This condition is associated with the expression of the ACE-2 receptor in the kidneys, which facilitates the entry of SARS-CoV-2, accompanied by RAAS activation that triggers a cytokine storm, inflammation, fibrosis, and thrombosis in the nephrons.

Hypertensive heart disease was found in 16 patients (5.4%) and showed no significant association with mortality. These findings are inconsistent with those of Cordero et al., who reported an increased risk of death in patients with cardiovascular disease (OR = 4.33; 95% CI = 3.16–5.94). This condition is associated with worse clinical outcomes following COVID-19 infection. The findings of Burhan et al. also indicate that cardiovascular disease is associated with increased morbidity and mortality. This is linked to increased ACE-2 expression, susceptibility to SARS-CoV-2 infection, and an increased risk of acute heart failure due to impaired pathogen clearance and increased alveolar fluid.

Tuberculosis was found in 5 patients (1.7%) and showed no significant association with mortality. The findings of Faurin et al. indicate that tuberculosis increases the risk of SARS-CoV-2 infection through immunosuppression and increased ACE-2 receptor expression

Patient Characteristics Based on Mortality

In this study, the mortality rate among COVID-19 patients was 15.3%. This finding is consistent with the study by Hartantri et al., which reported a case fatality rate of 14.9% among COVID-19 patients. That study showed that advanced age is associated with an increased risk of death due to impaired immune system function and a high prevalence of comorbidities. A study by Surendra et al. also reported a mortality rate of 12% and indicated that advanced age, male gender, hypertension, diabetes mellitus, and chronic kidney disease are associated with an increased risk of death in COVID-19 patients. Furthermore, Saputra et al. stated that one of the leading causes of death in COVID-19 patients is Acute Respiratory Distress Syndrome (ARDS), which is triggered by a cytokine storm and can lead to lung damage and multi-organ failure.

Association Between Comorbidities and Mortality Among COVID-19 Patients

In this study, there was a significant association between comorbidities and mortality in COVID-19 patients ($p=0.006$; OR=2.539; 95% CI: 1.288–5.004) so it can be concluded that there is a statistically significant relationship between comorbid diseases and mortality in COVID-19 patients at Raden Mattaher Jambi Hospital. Patients with comorbid diseases tend to have worse clinical outcomes compared to patients without comorbidities, this condition is related to decreased immune function, chronic inflammation, and limited physiological reserves of the body in the face of infection.

The results of this study are in line with the study conducted by Guan et al. (2020), where out of 1590 patients in China, 399 of them had at least one comorbid disease, while the other 130 patients had two or more comorbid diseases. The results of the study show that comorbid disease is a condition that is often found in COVID-19 patients, the presence of comorbidities is known to aggravate the patient's condition because it causes immune dysregulation and chronic inflammation so that the body is more susceptible to severe infection due to SARS-

CoV-2. In addition, the results of this study are in line with research conducted by Azzahra et al., showing that COVID-19 patients with comorbidities died more (76.9%) compared to non-comorbid patients (23.1%), the Chi-Square test obtained a $P < 0.001$ ($P < 0.05$) score, indicating that the type of comorbidity has a significant relationship with mortality status. A study by Herlina et al. also explained that comorbidities can reduce the body's functional reserves, thereby diminishing its ability to fight infections. Furthermore, Jafrin et al. reported that a cytokine storm in patients with comorbidities can cause tissue damage, reduced lung capacity, and worsen clinical conditions, thereby increasing the risk of death in COVID-19 patients.

Research Limitations

1. There are medical record data that are incomplete, difficult to read, lost, or not found, so as to affect the results of the research.
2. This study only focused on comorbid factors and patient characteristics in the form of age and gender. In addition, there are still the possibility of other confounding variables that have not been studied, such as smoking status, time of disease onset, laboratory test results, and the severity of COVID-19 that can affect patient outcomes.

CONCLUSION

Based on the study results, there is a significant association between comorbidities and mortality rates among COVID-19 patients at Raden Mattaher General Hospital in Jambi. COVID-19 patients with comorbidities have a 2.539 times higher risk of death compared to patients without comorbidities. These findings indicate that the presence of comorbidities is a factor associated with an increased risk of mortality among COVID-19 patients at Raden Mattaher Regional General Hospital in Jambi.

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