Original Article

Association Between Comorbidities and Outcome of COVID-19 Patients at dr. M. Djamil General Hospital Padang

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Abstract

Background: COVID-19 has spread rapidly throughout the world with high morbidity and mortality estimated up to 20%. This number will increase with the presence of comorbidities. Comorbidities were associated with complex clinical management and impacted on COVID-19 disease outcomes. This study aims to determine the association between comorbidities and the outcome of COVID-19 patients at Dr. M. Djamil Hospital.

Method: We conducted an observational study with a retrospective cohort design on COVID-19 patients treated at Dr. M. Djamil Hospital. Data were taken from medical records from January to March 2021. Association between comorbidities and the outcome of COVID-19 patients was analyzed by Chi-Square or Fisher Exact Test.

Results: The majority patientss were female (56.4%) and ages above 50 years old (64.3%) were the majority of patients. The most common was hypertension (36.56%). The longest length of stay of COVID-19 patients was more than 21 days (52.9%). The outcomes of COVID-19 patients were recovered (59.5%), recovered with sequelae (5.7%), and died (34.8%). Diabetes mellitus affected the end of treatment outcome. There was no relationship of type of comorbidity with length of stay. The more co-morbidities a patient suffers, the condition when infected with COVID-19 will get worse.

Conclusion: The number of comorbidities affects the outcome of COVID-19 patients. Diabetes mellitus is most common that affects the end of treatment outcome for COVID-19 patients at Dr. M. Djamil Hospital.

Keywords: comorbidities, COVID-19, end of treatment outcome, length of stay, outcome COVID-19

INTRODUCTION

Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2) or known as COVID-19 is a new type of outbreak and currently a global pandemic.[1,2] Reports of COVID-19 cases in Indonesia at the end of February 2021 showed new cases were decreased by 8.5% with the death rate increasing by 74.8%. The number of confirmed cases recorded on March 11, 2021, was around 1,403,722 cases, 38,049

death cases and 611,097 were declared cured.[3]

Based on the data from the West Sumatra Provincial Health Office as of March 11, 2021 as much as 29,985 people tested positive for COVID-19, 659 of them died and 28,297 were declared cured, while in the COVID-19 case in Padang City 14,820 people tested positive for COVID-19, 288 of them died and 14,188 were declared cured.[4,5]

The COVID-19 pandemic has spread rapidly throughout the world with high morbidity and mortality estimated at up to 20%.[6] The morbidity and mortality will increase in the presence of comorbidities. SARS-CoV-2 has the ACE-2 receptor which is found on the surface of the host cell and is used to enter the cell. Comorbidity is associated with increased expression of the ACE-2 receptor and higher release of proprotein convertase, thereby increasing the amount of virus that enters the host cell. Meta-analysis studies report that hypertension, diabetes mellitus, chronic respiratory disease, cardiovascular disease, and obesity may be risk factors for worse outcomes.[7–9]

Research conducted by Khedr et al showed that the most frequent comorbid in the group studied was cardiovascular disease (69%) followed by diabetes mellitus (54.2%). Clinical improvement was noted in nearly 68% of hospitalized COVID-19 cases (improved and discharged from the hospital) with a significantly lower frequency of cure in comorbid patients (59% vs. 81%) and a significantly higher mortality rate in cases with comorbidities.[8,9] Comorbidities will affect the length of stay of COVID-19 patients, a study conducted by Thiruvengadam et al stated that patients with two or more comorbidities had a longer length of stay compared to patients without comorbidities. The study conducted by Guan et al found that COVID-19 patients with any comorbidity will produce a worse outcome than those without comorbidities and the number of comorbid also correlates with a worse outcome.[10,11]

METHOD

An observational analytic study with a retrospective cohort design was conducted in the COVID-19 isolation room at Dr. M. Djamil General Hospital Padang. The time of this study was carried out from January to September 2021. The study population was all COVID-19 patients who were treated in the COVID-19 isolation room of Dr. M. Djamil General Hospital Padang from January 1, 2021 to March 31, 2021.

The inclusion criteria for patients sampling were COVID-19 patients with positive nasopharingeal swab for SARS-CoV-2 who were treated in the COVID-19 isolation room, Dr. M Djamil General Hospital Padang for the period January 1 to March 31, 2021, and has complete medical record data, aged >18 years. Meanwhile, the exclusion criteria are patients who go home at their request while still being treated for COVID-19 and patients with mild clinical degrees.

This research has been approved by the Research Ethics Committee of Dr. M.

Djamil General Hospital Padang on April 23, 2021 with No. 146/KEPK/2021.

Data analysis was carried out descriptively and analytically. Bivariate analysis was used to find association between independent and dependent variables with a statistical test that was by the data scale, namely the test Chi-square. If the value of P<0.05, then there is an association between the independent variable and the dependent variable. This analysis uses the statistical test Chi-square or Fisher's Exact Test if the data obtained does not meet the requirements for the test Chi-square.

RESULTS

In total 227 confirmed COVID-19 patients in this study, the characteristics of the research subjects are presented in Table 1. The highest age group was found to be over 50 years old as many as 146 people (64.3%). According to gender, the majority were women as many as 128 people (56.4%). As much as 91 people (40.1%) had 1 comorbid and based on the presence of comorbidities in confirmed COVID-19 patients, hypertension was the most common, as many as 83 people (36.56%).

From the data, it was found that 120 people (52.9%) of confirmed COVID-19 patients had length of stay for 21 days. The outcomes of patients who recovered, recovered with sequelae, and died were 135 people (59.5%), 13 people (5.7%), and 79 people (34.8%) respectively.

Table 1. Characteristics of COVID-19 Patients (N=227)

Patient Characteristics	N	%
Ages		
<50 years	81	35.7%
50-59 years	63	27.8%
60-69 years	50	22.0%
≥70 years	33	14.5%
Gender		
Female	128	56.4%
Number of Comorbidities		
No Comorbid	49	21.5%
1 Comorbid	91	40.1%
>1 Comorbid	87	38.4%
Comorbid Types		
Cardiovascular Disease	38	16.8%
CAD	24	10.6%
HHD	5	2.2%
CHF	9	4.0%
Hypertension	83	36.6%
Mild	35	15.4%
Moderate	46	20.3%
Severe	0	0%
Hypertensive Crisis	2	0.9%
Diabetes Mellitus	75	33.0%
Controlled	13	5.7%
Uncontrolled	62	27.3%
Chronic Lung Disease	10	4.4%
Pulmonary Tuberculosis	7	3.1%
Asthma	2	0.9%
COPD	1	0.4%
Chronic Kidney Disease	28	12.3%
Stadium 1	1	0.4%
Stadium 2	2	0.9%
Stadium 3	1	0.4%
Stadium 4	0	0%
Stadium 5	24	10.6%
Cerebrovascular Disease	4	1.8%
Stroke	4	1.8%
Chronic Liver Disease	4	1.8%
Immunodeficiency	2	0.9%
HIV	2	0.9%
Obesity	14	6.2%
Mild (stage 1)	0	0%
Moderate (stage 2)	0	0%
Severe (stage 3)	14	6.2%
Malignancy	14	6.2%
Length of Stay		
<21 Days	107	47.1%
≥21 Days	120	52.9%
Patient Outcomes		
Recovered	135	59.5%
Recovered with Sequelae	13	5.7%
Died	79	34.8%

Note: CAD=Coronary Artery Diseasel; HHD=Hypertensive Heart Disease; CHF=Congestive Heart Failure; COPD=Chronic Obstetric Pulmonary Disease; HIV=Human immunodeficiency virus

Table 2. Association between Comorbid Types and Length of Stay of COVID-19 Patients

Comorbid Types	Length of Stay		P
	≥21 Days n (%)	<21 Days n (%)	
Cardiovascular Disease			
None	94 (49.7)	95 (50.3)	0.070
CAD	16 (66.7)	8 (33.3)	
HHD	5 (100.0)	0 (0.0)	
CHF	5 (55.6)	4 (44.4)	
Hypertension			
None	71 (49.3)	73 (50.7)	0.536
Mild	20 (57.1)	15 (42.9)	
Moderate	28 (60.9)	18 (39.1)	
Hypertensive Crisis	1 (50.0)	1 (50.0)	
Diabetes mellitus			
None	70 (46.0)	82 (54.0)	0.074
Controlled	5 (38.5)	8 (61.5)	
Uncontrolled	40 (64.5)	22 (35.5)	
Chronic Lung Disease			
None	113 (52.1)	104 (47.9)	0.589
Pulmonary Tuberculosis	5 (71.4)	2 (28.6)	
Asthma	1 (50.0)	1 (50.0)	
COPD	1 (50.0)	0 (0.0)	
Chronic Kidney Disease			
None	102 (51.3)	97 (48.7)	0.298
Stadium I	0 (0.0)	1 (100.0)	
Stadium II	2 (100.0)	0 (0.0)	
Stadium III	1 (100.0)	0 (0.0)	
Stadium IV	0 (0.0)	0 (0.0)	
Stadium V	15 (62.5)	9 (37.5)	
Cerebrovascular Disease			
None	116 (52.0)	107 (48.0)	0.124
Yes	4 (100.0)	0 (0.0)	
Chronic Liver Disease			
None	117 (52.5)	106 (47.5)	0.624
Yes	3 (75.0)	1 (25.0)	
Immunodeficiency			
None	119 (52.9)	106 (47.1)	1.000
HIV	1 (50.0)	1 (50.0)	
Obesity			
None	111 (52.1)	102 (47.9)	0.544
Severe (stage 3)	9 (64.3)	5 (35.7)	
Malignancy			
None	112 (52.6)	101 (47.4)	0.956
Yes	8 (57.1)	6 (42.9)	

Note: CAD=Coronary Artery Diseasel; HHD=Hypertensive Heart Disease; CHF=Congestive Heart Failure; COPD=Chronic Obstetric Pulmonary Disease; HIV=Human immunodeficiency virus

The association between the types of comorbidities and the length of stay of confirmed COVID-19 patients can be seen in Table 2. The three most common comorbidities in this study are diabetes mellitus, hypertension, and cardiovascular disease.

Tabel. 3 Association between Comorbid Types and the End of Treatment Outcome of COVID-19 Patients

Comorbid Types	End of Treatment Outcome			P
	Recovered n (%)	Recovered with Sequelae n (%)	Died n (%)	
Cardiovascular Disease				
None	115 (60.8)	10 (5.3)	64 (33.9)	0.483
CAD	14 (58.3)	2 (8.3)	8 (33.3)	
HHD	1 (20.0)	0 (0.0)	4 (80.0)	
CHF	5 (55.6)	1 (11.1)	3 (33.3)	
Hypertension				
None	93 (64.6)	9 (6.3)	42 (29.2)	0.315
Mild	20 (57.1)	2 (5.7)	13 (37.1)	
Moderate	21 (45.7)	2 (4.3)	23 (50.0)	
Hypertensive Crisis	1 (50.0)	0 (0.0)	1 (50.0)	
Diabetes mellitus				
None	104 (68.4)	8 (5.2)	40 (26.4)	<0.001*
Controlled	8 (61.5)	0 (0.0)	5 (38.5)	
Uncontrolled	23 (37.1)	4 (6.5)	35 (56.4)	
Chronic Lung Disease				
None	129 (59.4)	13 (6.0)	75 (34.6)	0.703
Pulmonary Tuberculosis	3 (42.9)	0 (0.0)	4 (57.1)	
Asthma	2 (100.0)	0 (0.0)	0 (0.0)	
COPD	1 (100.0)	0 (0.0)	0 (0.0)	
Chronic Kidney Disease				
None	125 (62.8)	9 (4.5)	65 (32.7)	0.101
Stadium I	0 (0.0)	0 (0.0)	1 (100.0)	
Stadium II	1 (50.0)	0 (0.0)	1 (50.0)	
Stadium III	1 (100.0)	0 (0.0)	0 (0.0)	
Stadium V	8 (33.3)	4 (16.7)	12 (50.0)	
Cerebrovascular Disease				
None	134 (60.1)	12 (5.4)	77 (34.5)	0.155
Yes	1 (25.0)	1 (25.0)	2 (50.0)	
Chronic Liver Disease				
None	133 (59.6)	12 (5.4)	78 (35.0)	0.245
Yes	2 (50.0)	1 (25.0)	1 (25.0)	
Immunodeficiency				
None	134 (59.6)	13 (5.8)	78 (34.7)	0.869
HIV	1 (50.0)	0 (0.0)	1 (50.0)	
Obesity				
None	130 (61.0)	12 (5.6)	71 (33.3)	0.165
Severe (stage 3)	5 (35.7)	1 (7.1)	8 (57.1)	
Malignancy				
None	127 (59.6)	11 (5.2)	75 (35.2)	0.352
Yes	8 (57.1)	2 (14.3)	4 (28.6)	

Note: *=statistically significant (P<0.05); CAD=Coronary Artery Diseasel; HHD=Hypertensive Heart Disease; CHF=Congestive Heart Failure; COPD=Chronic Obstetric Pulmonary Disease; HIV=Human immunodeficiency virus

The association between the types of comorbidities and the length of stay of confirmed COVID-19 patients carried out statistical tests with the results of all comorbidities showing no significant results (P>0.05), so there was no association between certain types of comorbidities and the length of stay of confirmed COVID-19 patients.

The association between the types of comorbidities and the end of treatment outcome for confirmed COVID-19 patients can be seen in the Table 3. Underlying diseases of uncontrolled diabetes mellitus became the most comorbid deaths (56.5%). Patients who recovered with the most sequelae were found in stage 5 chronic kidney disease (16.7%) and uncontrolled diabetes mellitus (6.5%). Coronary artery disease, moderate hypertension, and uncontrolled diabetes mellitus had the highest end-of-care status, namely (58.3%), (45.7%), and (37.1%).

The association between the types of comorbidities and the end of treatment outcome for confirmed COVID-19 patients carried out statistical tests as in Table 3. There was a significant association beetween the types of comorbid diabetes mellitus and end of treatment outcome confirmed COVID-19 patients with P<0.001.

The association between the number of comorbidities and the length of stay of confirmed COVID-19 patients can be seen in Table 4. A hundred twenty-two patients with length of stay of 21 days, more than half of the total patients (66.7%) had >1 comorbid, no comorbid (49.0%), and 1 comorbid (41.8%). The results of the statistical test showed that there was a significant association between the number of comorbidities and the length of stay of confirmed COVID-19 patients (P<0.05).

The association between the number of comorbidities and the outcome of confirmed COVID-19 patients which can be seen in Table 5. Of the 79 patients who died, less than half of patients (47.1%) had >1 comorbid, 1 comorbid (33.0%), and no comorbid (16.3%). The results of the statistical test showed that there was a significant association between the number of comorbidities and the final status of care for confirmed COVID-19 patients (P<0.05).

Tabel 4. Association between the Number of Comorbidities and the Length of Hospitalization of COVID-19 Patients

Number of Comorbidities	Length of Stay		Total n (%)	P
	≥21 Days n (%)	<21 Days n (%)		
None	24 (49.0)	25 (51.0)	49 (100.0)	
1 Comorbid	38 (41.8)	53 (58.2)	91 (100.0)	0.003*
>1 Comorbid	58 (66.7)	29 (33.3)	87 (100.0)	
Total	120 (52.9)	107 (47.1)	227 (100.0)	

Tabel 5. Association between the Number of Comorbidities and the End of Treatment Outcome for COVID-19 Patients

Number of Comorbid	End of Treatment Outcome			Total n (%)	P
	Recovered n (%)	Recovered with Sequelae n (%)	Died n (%)		
None	38 (77.6)	3 (6.1)	8 (16.3)	49 (100.0)	
1 Comorbid	57 (62.6)	4 (4.4)	30 (33.0)	91 (100.0)	0.005*
>1 Comorbid	40 (46.0)	6 (6.9)	41 (47.1)	87 (100.0)	
Total	135 (59.5)	13 (5.7)	79 (34.8)	227 (100.0)	

DISCUSSION

This study found the highest incidence of COVID-19 at the age of more than 50 years as many as 146 people. A study by Verma found that the highest age group was in the range of 50-75 years as much as 46.7%, followed by >75 years at 32% and age <50 years at 21.2%.[12] Older people who suffer from COVID-19 are more susceptible to worsening clinical conditions, even death, due to decreased function of T cells and B cells, and excessive cytokine production resulting in a prolonged inflammatory response.[9]

Based on the gender characteristics of COVID-19 patients, the majority are women. The results are different from those obtained in study by Surendraet et al in Jakarta, in that study mostly in men (52%).[13] The results of other studies conducted by Verma et al, Giannouchos et al, also found that the prevalence of males was the highest.[12,14] Males are more susceptible to infection which is associated with increased immune reactivation to viral infections. This situation is different for females due to antibody production was increase, so that they are effectively resistant to infection.[15] Women are less susceptible than men due to innate immunity, steroid hormones, and factors related to sex chromosomes.[16]

Comorbidity is a condition that is susceptible to infection due to a prolonged pro-inflammatory state and dysfunction of innate and adaptive immunity. In patients with obesity, diabetes, or cardiovascular disease, increased ACE2 expression was found to increase the susceptibility to SARS-CoV-2 infection. In addition, pulmonary function abnormalities and microangiopathy associated with obesity and diabetes will increase viral diversity and titer, and prolong viral shedding.[17] In this study, some patients had comorbid CAD (10.6%), HHD (2.2%), and CHF (4%). Verma et al's study found comorbid CAD 6.1% and CHF 6.0%.[12] Patients with mild hypertension were 15.4%, moderate was 20.3%, and a hypertensive crisis was 0.9%. Research conducted by Verma et al, Giannouchos et al, Wei et al, and Surendra et al found that hypertension comorbidities were 34.7%, respectively; 20.9%; 16.3%, and 19%.[12–14,18]

Patients who had diabetes mellitus were controlled as much as 5.7% and uncontrolled as many as 27.3%. The results of the study of Giannouchous et al, Surendra et al, and Wei et al are almost similar to the results of this study, which found the number of COVID-19 patients with comorbid DM was 17.5%; 12%; 8.6%.[13,14,18]

In diabetic patients there will be an accumulation of activated innate immune cells in metabolic tissues resulting in the release of inflammatory mediators, especially interleukin (IL)-1β and tumor necrosis factor (TNF)-α which will lead to insulin resistance and B cell damage. Furthermore, metabolic diseases can reduce immune function by disrupting macrophage function and lymphocytes so that a person is susceptible to disease.[19]

The percentage of patients who have chronic lung diseases such as tuberculosis is around 3.1%, asthma is 0.9%, and COPD is 0.4%. A total of 10.6% of patients with chronic kidney disease are at stage 5. Study by Verma showed that patients with comorbid renal failure were about 20.6%,[12] on the other hand, Giannouchos et al., Surendra et al., Fresan et al. only had 2.3%; 3%; 2.3%.[13,14,20] Stroke in this study was found to be 1.8%. Only 1.8% of patients in this study had chronic liver disease. The research conducted by Surendra et al. showed that the number of COVID-19 patients with liver disease was 0.7%.[13]

There were 6.2% of patients with severe obesity. Surendra et al research found that obese patients were around 0.8%. A total of 6.2% of patients in this study had malignancy. COVID-19 patients with malignancy in the study of Surendra et al were 0.5%.[13] Only 0.9% of patients in this study had HIV. Similar results were obtained in the studies of Giannouchos et al, Surendra et al, COVID-19 patients with comorbid immunosuppression of about 1.6%; 0.7%.[13,14]

This study showed that most of them were treated for 21 days or more, namely 52.9%. The results of study by et al found that the median length of patient care was 24 days with a range of 13 to 36 days.[13] The median length of stay in the Sanyaolu study was about 12 days.[21] Outcomes of patients obtained in this study, more than half recovered with a percentage of 59.5%, followed by death by 34.8%, and recovery with sequelae of 5.7%. Research by Osibogun et al. showed that 3.34% of patients died and 78.98% recovered.[22]

Based on the severity of COVID-19, patients with severe COVID-19 effects will increase the mortality rate. The statement is in line with the results of the study by Osibogun which got a mortality rate at a critical degree of 100%, severe 23.53%, moderate (2.67%), and mild (0.37%).[22] The mortality rate was significantly increased in cases with comorbidities in Khedr et al's study (P<0.001).[9] In this study, it was found that the comorbidity that had a significant relationship to the outcome was diabetes mellitus, while the length of stay did not have a significant relationship with each comorbid.

COVID-19 patients who have comorbid cardiovascular disease in study by Fresan et al showed that cardiovascular disease was correlated with a statistically high risk of COVID-19 hospitalization and severity (OR=1.33; 95% CI=1.13-1.58; P<0.001 and aRR=1.61; 95% CI=1.13-2.30, P=0.008).[20] Previous cardiovascular disease contributed to 5 times higher risk to experience severe COVID-19. Meta-analysis showed that cardiovascular disease comorbidities were at high risk for severe COVID (OR=3.15; 95% CI=2.34-4.25), death (OR=3.23; 95% CI=2.28-4.57) and outcome fatal in patients in all age groups (OR=3.11; 95% CI=2.55-3.79).[23]

Patients with a history of cardiovascular disease become unstable and caused an increased incidence of

coronary disease, heart failure, and arrhythmias in SARS-CoV-2 infection. It's caused by an imbalance between metabolic demands and decreased cardiac work and is associated with an inflammatory response and myocardial damage.[17]

Study by Fresan et al showed that hypertension was associated with COVID-19 treatment and severity but was not statistically significant (OR=1.22; 95% CI=1.06-1.41; P=0.005; OR=1.53; 95% CI=1.11-2.10; P=0.009).[20] Meta-analysis showed that hypertension was at high risk for severe COVID (OR=2.42; 95% CI=1.98-2.96), death (OR=2.60; 95% CI=2.11-3.20) and fatal outcome in patients in all ages (OR=2.50; 95% CI=2.49-4.88).[23]

Dysregulation of the immune system in hypertensive patients is related to the severity of COVID-19. Monocytes in hypertensive patients are pre-active which produce more IL-6 after stimulation by angiotensin II or lipopolysaccharide and found an increase in CD8+ T cells that produce TNF. These CD8+ T cells are unable to fight off viral infections and result in the overproduction of cytokines.[24]

Patients with diabetes died in study by Wen et al as much as 11%. On the other hand, those who did not have diabetes experienced death as much as 3% with P<0.001.[15] Patients with diabetes mellitus 3.69 times the risk of dying from COVID-19.[22] Meta-analysis showed that comorbid diabetes mellitus was at higher risk for severe COVID (OR=2.47; 95% CI=1.86-3.27), death (OR=2.11; 95% CI=1.63-2.73) and the outcome was fatal in patients in all age groups (OR=2.25; 95% CI=1.89-2.69).[23]

Diabetes is one of the most common and most dangerous metabolic diseases characterized by chronic inflammatory conditions that lead to metabolic and vascular abnormalities that affect the response to pathogens.[24] Type 2 diabetes mellitus is associated with chronic inflammation induced by excess visceral adipose tissue. This inflammatory condition affects glucose homeostatic regulation and peripheral insulin sensitivity. Chronic hyperglycemia and inflammation can cause an abnormal and ineffective immune response by stimulating the synthesis of proinflammatory cytokines and oxidative markers that cause tissue inflammation. In addition, diabetic patients are at high risk of developing an uncontrolled hypercoagulable state and inflammatory response.[25]

Potential mechanisms that make diabetic patients more susceptible to the risk and severity of COVID-19 include the role of hyperglycemia, high cellular affinity binding, efficient viral entry, decreased viral clearance, impaired T cell function, hyper inflammation, cytokine storm syndrome, and the presence of cardiovascular disease.[24,25]

Pulmonary disease can be a strong predictive comorbid predictor of poor outcome and death (OR=4.17; 95% CI=2.67-6.50 and OR=3.23; 95% CI=2.55-4.32, respectively).[17] Studies Alwafi et al and published reports of similar

studies found that patients with chronic lung diseases, particularly COPD, was found as a higher risk factor to the outcome of patients COVID-19 heavier. This is because the patient's lung function has decreased.[26]

Study by Fresan et al showed that chronic kidney disease was associated with a high risk of hospitalization and severity of COVID-19 (OR=1.52; 95% CI=1.21-1.91; P<0.001 and OR=1.78; 95% CI=1.14-2.76, P=0.010).[20] Study by Osiboguns showed that patients with kidney disease were 12.53 times more likely to die from COVID-19.[22] Chronic kidney disease is associated with inflammation and dysregulation of immune function which increases the risk of mortality in COVID-19. This is due to overexpression of tubular cells in COVID-19 patients with kidney disease characterized by elevated serum creatinine and urea nitrogen.[27]

Study by Fresan et al showed that cerebrovascular disease was associated with a high risk of hospitalization and severity of COVID-19 (aRR=1.41; 95% CI=1.04-1.92; P=0.025 and aRR=1.91; 95% CI=1.13-3.25; P=0.016).[23] This is caused by cerebrovascular disease that can cause disability. SARS-CoV-2 can cause direct damage to nerves or vascular events such as stroke, and increased proinflammatory cytokines will damage vascular endothelium and increase blood coagulability.[28]

Previous studies have described a higher mortality rate in a chronic liver disease infected with COVID-19. The results of the logistic regression analysis of Alwafi et al study showed the odds ratio of death was 1.92 with 95% CI=1.65-8.63.[27] Study by Zhou et al found that there was no significant association between comorbid chronic liver disease and the severity of COVID-19 (OR=1.54 95% CI=0.95-2.49).[17] COVID-19 patients with chronic liver disease are prone to adverse outcomes such as death or longer hospital stays compared to patients without chronic liver disease. Laboratory findings emphasize the negative impact of SARS-CoV-2 infection on liver function.[26]

Patients with obesity experienced 7% mortality and those without obesity experienced approximately 4% mortality (P<0.001). Obesity is associated with impaired lung function that occurs due to a decrease in lung compliance, expiratory reserve volume and functional capacity, and an increase in cytokines.[15]

The study findings of Alwafi et al stated that mortality was high and the hospital stay period was longer in COVID-19 patients with malignancy. The nature of cancer and the therapeutic use of antineoplastic agents that attack the immune system will increase fatal outcomes and more severe COVID-19 infections.[26]

Patients with HIV are 12.21 times at risk of dying from COVID-19.[27] Patients with HIV have decreased TCD4+ cells and develop T-cell dysfunction and inflammation, which increases the risk of severe outcomes in viral infection.[29]

The findings of Richardson et al showed that patients had more than one comorbid as many as 88%, followed by having 1 comorbid at 6.3%, and those without comorbid at 6.1%.[8] Study by Giannochous showed that approximately 40% of patients had one or more comorbidities.[14] This study found a significant association between the number of comorbidities on length of stay and outcome (P=0.003). Research conducted by Osibogun showed that 8,47% of patients with 1 comorbid died and 91.53% recovered, while 28.86% of patients with 2 or more comorbidities died and 71.74% recovered with an OR=4.25; 95% CI=2.31-7.84; P<0.001.[24]

Patients with two or more comorbidities were four times more likely to die than patients with one comorbid.[22] Having one or more comorbidities is closely related to a poor outcome, this is because multiple comorbidities contribute to the complexity of the disease and patients are more susceptible to adverse effects.[14]

Jang's study in Korea showed that more comorbidities were associated with a longer length of stay (P<0.001) with a mean length of stay for no co-morbidities, one co-morbidity, two co-morbidities, and three or more co-morbidities, respectively, which was 20.7±13.4; 24.1±15.8; 26.8±17.8; and 26.2±17.9.[30]

In this study, there are several limitations including this study using a retrospective cohort design with data collection through medical records.

CONCLUSION

The characteristics of the most COVID-19 patients at Dr. M. Djamil General Hospital Padang were female and more than 50 years old. There was no correlation between the type of comorbid and the length of stay, while there was a relationship between the number of comorbidities with the length of stay and the final status of the patient's care. Diabetes mellitus is related to end-of-care status. Thus, a multidisciplinary team is needed in the treatment and close monitoring of inflammatory markers is carried out so that the outcome of COVID-19 patients with comorbid diabetes mellitus can be better.

REFERENCES

1. Zhai P, Ding Y, Wu X, Long J, Zhong Y, Li Y. The epidemiology, diagnosis and treatment of COVID-19. *Int J Antimicrob Agents*. 2020;55(5).
2. Wang R, Pan M, Zhang X, et al. Epidemiological and clinical features of 125 Hospitalized Patients with COVID-19 in Fuyang, Anhui, China. *Int J Infect Dis*. 2020;95:421-428.
3. Satuan Tugas Penanganan COVID-19. Analisis Data Covid-19 Indonesia Update Per 28 Februari 2021. Satuan Tugas Penanganan COVID-19. https://covid19.go.id/p/berita/analisis-data-covid-19-indonesia-update-28-februari-2021. Published 2012.
4. Tim IT DISKOMINFO Sumbar. Data pantauan COVID-19 provinsi sumatera barat. Pemerintah Provinsi Sumatera

Barat. https://corona.sumbarprov.go.id/. Published 2021. Accessed March 13, 2021.
5. Pemerintah Kota Padang. Kondisi Covid-19 Kota Padang. Pemerintah Kota Padang. http://corona.padang.go.id/. Published 2021. Accessed September 19, 2022.
6. Wu YC, Chen CS, Chan YJ. The outbreak of COVID-19: An overview. *J Chinese Med Assoc*. 2020;83(3):217-220.
7. Ejaz H, Alsrhani A, Zafar A, et al. COVID-19 and comorbidities: Deleterious impact on infected patients. *J Infect Public Health*. 2020;13(12):1833-1839.
8. Richardson S, Hirsch JS, Narasimhan M, et al. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area. *JAMA*. 2020;323(20):2052-2059.
9. Khedr EM, Daef E, Mohamed-Hussein A, et al. Impact of comorbidities on COVID-19 outcome. *medRxiv Prepr Serv Heal Sci*. 2020.
10. Thiruvengadam G, Lakshmi M, Ramanujam R. A Study of Factors Affecting the Length of Hospital Stay of COVID-19 Patients by Cox-Proportional Hazard Model in a South Indian Tertiary Care Hospital. *J Prim Care Community Health*. 2021;12.
11. Guan W, Liang W, Zhao Y, et al. Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. *Eur Respir J*. 2020;55(5):640.
12. Verma AA, Hora T, Jung HY, et al. Characteristics and outcomes of hospital admissions for COVID-19 and influenza in the Toronto area. *CMAJ*. 2021;193(12):E410-E418.
13. Surendra H, Elyazar IR, Djaafara BA, et al. Clinical characteristics and mortality associated with COVID-19 in Jakarta, Indonesia: A hospital-based retrospective cohort study. *Lancet Reg Heal - West Pacific*. 2021;9:100108.
14. Giannouchos T V., Sussman RA, Mier JM, Poulas K, Farsalinos K. Characteristics and risk factors for COVID-19 diagnosis and adverse outcomes in Mexico: an analysis of 89,756 laboratory–confirmed COVID-19 cases. *Eur Respir J*. 2021;57(3).
15. Wen S, Prasad A, Freeland K, et al. Clinical Characteristics and Outcomes of COVID-19 in West Virginia. *Viruses*. 2021;13(5).
16. Das SK. The Pathophysiology, Diagnosis and Treatment of Corona Virus Disease 2019 (COVID-19). *Indian J Clin Biochem*. 2020;35(4):385-396.
17. Zhou Y, Yang Q, Chi J, et al. Comorbidities and the risk of severe or fatal outcomes associated with coronavirus disease 2019: A systematic review and meta-analysis. *Int J Infect Dis*. 2020;99:47-56.
18. Wei ZY, Qiao R, Chen J, et al. The influence of pre-existing hypertension on coronavirus disease 2019 patients. *Epidemiol Infect*. 2021;149.

19. Yang J, Zheng Y, Gou X, et al. Prevalence of comorbidities and its effects in patients infected with SARS-CoV-2: a systematic review and meta-analysis. *Int J Infect Dis*. 2020;94:91-95.
20. Fresán U, Guevara M, Trobajo-Sanmartín C, Burgui C, Ezpeleta C, Castilla J. Hypertension and Related Comorbidities as Potential Risk Factors for COVID-19 Hospitalization and Severity: A Prospective Population-Based Cohort Study. *J Clin Med*. 2021;10(6):1-12.
21. Sanyaolu A, Okorie C, Marinkovic A, et al. Comorbidity and its Impact on Patients with COVID-19. *SN Compr Clin Med*. 2020;2(8):1069-1076.
22. Osibogun A, Balogun M, Abayomi A, et al. Outcomes of COVID-19 patients with comorbidities in southwest Nigeria. *PLoS One*. 2021;16(3):e0248281.
23. Bae SA, Kim SR, Kim MN, Shim WJ, Park SM. Impact of cardiovascular disease and risk factors on fatal outcomes in patients with COVID-19 according to age: a systematic review and meta-analysis. *Heart*. 2021;107(5):373-380.
24. Mitra P, Suri S, Goyal T, et al. Association of Comorbidities with Coronavirus Disease 2019: A Review. *Ann Natl Acad Med Sci*. 2020;56(2):102-111.
25. Corrao S, Pinelli K, Vacca M, Raspanti M, Argano C. Type 2 Diabetes Mellitus and COVID-19: A Narrative Review. *Front Endocrinol (Lausanne)*. 2021;12.
26. Alwafi H, Naser AY, Qanash S, et al. Predictors of Length of Hospital Stay, Mortality, and Outcomes Among Hospitalised COVID-19 Patients in Saudi Arabia: A Cross-Sectional Study. *J Multidiscip Healthc*. 2021;14:839-852.
27. Biswas M, Rahaman S, Biswas TK, Haque Z, Ibrahim B. Association of Sex, Age, and Comorbidities with Mortality in COVID-19 Patients: A Systematic Review and Meta-Analysis. *Intervirology*. 2021;64(1):36-47.
28. Siepmann T, Sedghi A, Barlinn J, et al. Association of history of cerebrovascular disease with severity of COVID-19. *J Neurol*. 2021;268(3):773-784.
29. Rossouw TM, Boswell MT, Nienaber AG, Moodley K. Comorbidity in context: Part 1. Medical considerations around HIV and tuberculosis during the COVID-19 pandemic in South Africa. *South African Med J*. 2020;110(7):621-624.
30. Jang SY, Seon JY, Yoon SJ, Park SY, Lee SH, Oh IH. Comorbidities and Factors Determining Medical Expenses and Length of Stay for Admitted COVID-19 Patients in Korea. *Risk Manag Healthc Policy*. 2021;14:2021-2033.