

The Association of COVID-19 Patient Comorbidities With Mortality at Pertamina Jaya Hospital Central Jakarta

Siti Nurhayati, Ida Safitri Laksanawati, Rizaldi Taslim Pinzon

Faculty of Medicine, Public Health, and Nursing, Gadjah Mada University, Yogyakarta, Indonesia

Abstract

Introduction: The COVID-19 pandemic is a disease outbreak caused by SARS-CoV-2; as of July 20, 2021, there were 2,950,058 positive cases and 76,200 deaths in Indonesia. COVID-19 patients with comorbidities are mostly hypertension (50%), diabetes mellitus (37.2%), and heart disease (16.7%). This study aims to prove how comorbidities affect the mortality of COVID-19 patients at Pertamina Jaya Hospital, Central Jakarta.

Method: This study is a retrospective cohort analysis. The sample comprised 500 patients, 250 comorbid groups, and 250 without comorbidities. The secondary data source is medical records of COVID-19 patients at Pertamina Jaya Hospital from April 2020 to September 2021. Data analysis using univariate, bivariate, and multivariate.

Result: Multivariate analysis with logistic regression resulted in a value of (32.197 95% CI 9.714 - 106.718) so that there is an influence on the risk of death with a comorbid history in COVID-19 patients. The relative risk value proves that hypertension has a 3-fold risk of death (3.124 95% CI 1.441 - 6.773), diabetes mellitus is 2.5 times (2.521 95% CI 1.055 - 6.024), while heart disease is 2.3 times (2.325 95% CI 1.169 - 4.622).

Conclusion: Hypertension, diabetes mellitus, and heart disease are comorbidities that are predictors of mortality for COVID-19 patients due to a higher risk of death.

Keywords: Comorbidities, Hypertension, Diabetes Mellitus, Heart Disease, COVID-19 Mortality

Hubungan Komorbiditas Terhadap Mortalitas Pasien COVID-19 Di Rumah Sakit Pertamina Jaya Jakarta Pusat

Siti Nurhayati, Ida Safitri Laksanawati, Rizaldi Taslim Pinzon

Fakultas Kedokteran, Kesehatan Masyarakat dan Keperawatan, Universitas Gadjah Mada, Yogyakarta, Indonesia

Abstrak

Pendahuluan: Pandemi COVID-19 adalah wabah penyakit yang disebabkan SARS-CoV-2, terhitung sejak 20 Juli 2021 terdapat 2.950.058 kasus positif dan 76.200 kematian di Indonesia. Pasien COVID-19 dengan riwayat penyakit penyerta (komorbid) terbanyak adalah hipertensi (50%), diabetes melitus (37,2%) dan penyakit jantung (16,7%). Penelitian ini bertujuan untuk membuktikan bagaimana pengaruh komorbid terhadap mortalitas pasien COVID-19 di Rumah Sakit Pertamina Jaya, Jakarta Pusat.

Metode: Penelitian ini menggunakan desain kohort retrospektif untuk menganalisis data. Sampel berjumlah 500 pasien, 250 kelompok komorbid dan 250 kelompok tanpa komorbid. Sumber datanya adalah sekunder yaitu catatan rekam medis pasien COVID-19 di Rumah Sakit Pertamina Jaya periode April 2020 - September 2021, kemudian data dianalisis secara univariat, bivariat dan multivariat.

Hasil: Analisis multivariat menggunakan regresi logistik menunjukkan bahwa pasien COVID-19 dengan riwayat komorbid memiliki peningkatan risiko kematian, dengan odds ratio sebesar 32,197 (95% CI: 9,714 – 106,718), menandakan adanya hubungan signifikan antara riwayat komorbid dan risiko kematian pada pasien COVID-19. Lebih lanjut, analisis relative risk mengungkapkan bahwa pasien dengan hipertensi memiliki risiko kematian yang meningkat tiga kali lipat (RR: 3,124; 95% CI: 1,441 – 6,773), pasien dengan diabetes melitus memiliki risiko 2,5 kali lipat (RR: 2,521; 95% CI: 1,055 – 6,024), dan pasien dengan penyakit jantung memiliki risiko 2,3 kali lipat (RR: 2,325; 95% CI: 1,169 – 4,622).

Kesimpulan: Hipertensi, diabetes melitus, dan penyakit jantung adalah komorbiditas yang menjadi faktor prediktor mortalitas Pasien COVID-19 karena risiko kematian lebih tinggi.

Kata kunci: Komorbiditas, Hipertensi, Diabetes Melitus, Penyakit Jantung, Mortalitas COVID-19

Introduction

On March 11, 2020, the WHO declared COVID-19 a global pandemic. The COVID-19 pandemic is an outbreak caused by the SARS-CoV-2 virus. When infected, the virus attacks the upper respiratory tract, leading to an infection with typical symptoms such as fever, dry cough, and shortness of breath.¹ COVID-19 is a highly transmissible virus and, to date, has spread to various countries worldwide, including Indonesia. The WHO reported that as of July 20, 2021, the number of recorded COVID-19 cases during the pandemic in all countries amounted to 190,770,507 confirmed

positives, with as many as 4,095,924 deaths.²

In Indonesia, the Ministry of Health reported 2,950,058 positive cases and 76,200 deaths as of July 20, 2021. Jakarta is the first gateway for the SARS-CoV-2 virus to enter Indonesia. Based on national data, it is reported that in July, Jakarta ranked first in the prevalence of COVID-19 cases. The number of confirmed cases was 855,199 positive cases. According to data published by the COVID-19 pandemic task force team, the history of comorbidities in COVID-19 patients is 50% hypertension, 37,2% diabetes mellitus, and 16,7% heart disease.³

Based on the above data report, these three comorbidities are commonly found in COVID-19 patients in Indonesia. Moreover, hypertension is one of the primary diseases that cause death in the world. In addition, hypertension can also kill slowly and cause complications in other organs.^{4,5} According to Henry Surendra et al.,⁶ their research in 2021 on COVID-19 patients at 55 hospitals in Jakarta showed that deaths occurred in patients with comorbid hypertension by 42%, diabetes mellitus by 29%, and heart disease by 22%. Several studies mention that hypertension has a relationship with the incidence of COVID-19 infection, where hypertension will aggravate the infection and cause death.^{7,8}

A systematic review revealed that, out of 2,893 COVID-19 positive patients with documented comorbidities across 13 studies, 748 (29.3%) were found to have hypertension, which has been associated with exacerbating COVID-19 severity.⁹ Additionally, a comparison of hypertension prevalence between survivors and non-survivors among 219 COVID-19 patients showed that 64.2% of survivors and 35.8% of non-survivors had hypertension. The condition is reported to potentially worsen inflammation by 2.5 times, increasing the risk of mortality, particularly in the elderly population.⁷

Another study related to COVID-19 patients with comorbidities was conducted by Cipto Mangunkusumo General Hospital Jakarta in 2020. The subjects of the study were the elderly group of 44 patients. From the results of the study, it was found that chronic diseases were often seen, namely diabetes mellitus 5%, hypertension 14%, and malignancy 3%. In addition, 6% of patients with multi-comorbid were found. However, the numbers obtained are not too large, but these cases have contributed to the mortality rate of COVID-19 patients with comorbidities in Indonesia.¹⁰

Pertamina Jaya Hospital is one of the State-Owned Hospitals (BUMN) appointed by the government as a COVID-19 Referral Hospital. It has contributed to handling the COVID-19 pandemic in Jakarta for two years. From the results of preliminary data collection, there are records of deaths of COVID-19 patients from April 2020 to September 2021; as many as 635 patients died out of a total number of inpatients of 3,886 patients. Based on this description, the researcher is interested in further proving how comorbidities affect the mortality of COVID-19 patients at Pertamina Jaya Hospital, Central Jakarta.

Method

This study is an analytic type with a retrospective cohort design, namely observation of events that have occurred.¹¹ The aim is to look for related factors and causes of the influence of comorbidities (as independent variable) on the risk of death (as dependent variable) of COVID-19 patients at Pertamina Jaya Hospital, Central Jakarta. The retrospective cohort study used two groups: the exposed group (the group exposed to risk factors) and the unexposed group (the group not exposed to risk factors).¹² The study subjects were COVID-19 patients who were documented as receiving treatment in the hospital. The inclusion criteria were as follows: patients diagnosed with COVID-19, who have comorbid conditions such as hypertension, diabetes mellitus, heart disease, and are aged 18 years or older. The exclusion criteria included patients with incomplete medical records and those who were referred to other facilities or discharged.

This research data is secondary; the source comes from the Medical Records of COVID-19 patients from April 2020 to September 2021. The sampling technique used non-probability consecutive sampling with a 2-proportion difference formula;¹³ obtained a sample of 500 patients, 250 patients for the comorbid group (exposed) and 250 for the group without comorbid (unexposed). Table 1 presents the variables, operational definitions, and measurement parameters.

Data processing techniques were done by checking data (editing), coding, and entering data (data entry). Data were then statistically analyzed using univariate, bivariate, and multivariate analysis using SPSS software. Univariate analysis aims to describe the characteristics of the variables included and examined in the study. Bivariate analysis shows the statistical relationship between the independent and dependent variables.¹⁴ Variables with statistically significant relationships (p -value < 0.05) through the chi-square test will be selected as candidate models to be continued in multivariate logistic regression analysis. Logistic regression was performed using the Enter method by including all variables for multivariate analysis.¹⁵ Research results are presented statistically descriptively.

Ethics Committee of the Faculty of Medicine UGM and Pertamina Jaya Hospital, Central Jakarta with No.003/EC/RSPJ/2021 and Ref. Number KE/FK/0093/EC/2022 was approved for this research.

Table 1. Operational Definition and Measurement of Variables

Variable/Indicator	Definition	Methods and Measuring Tools	Measuring Results	Scale
Comorbidity				
Hypertension	Patients with SBP \geq 140 mmHg and BBP \geq 90 mmHg who are taking antihypertensive medication are recorded by medical records.	View medical records	Yes / No	Nominal
Diabetes mellitus	Patients with GDN > 110 mg/dL, GD 2 hours PP > 200 mg/dL, or HbA1c > 6.5% receive insulin or oral anti-diabetes mellitus (DM) medication and are recorded medically.	View medical records	Yes / No	Nominal
Heart Disease/ Cardiovascular	Patients diagnosed as having coronary heart disease, cardiomegaly, and heart failure based on the results of anamnesis, ECG, and radiology examinations, which are recorded in the medical record.	View medical records	Yes / No	Nominal
Age	It is a period since a person existed and can be measured using time units. Advanced age with risk: age > 65 years. Early old age: 60-64 years old.	View medical records	< 60 years / > 60 years	Nominal
Gender	Biological characteristics seen from external appearance. Male and female.	View medical records	Male /Female	Nominal
Risk of Death/Mortality COVID-19 Patients	Is a COVID-19 patient who is declared dead and recorded in the medical record.	View medical records	Yes / No	Nominal

Result

Sample Selection

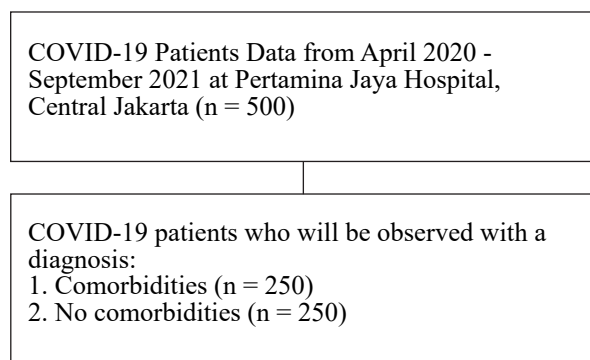


Figure 1. Sample Selection Chart

A total of 500 COVID-19 patients recorded in patient medical records from April 2020 - September 2021 at Pertamina Jaya Hospital, Central Jakarta, were sampled in this study. From the selection of inclusion criteria, 250 patients had comorbidities (hypertension, diabetes mellitus, heart disease), and 250 patients without comorbidities. The most prevalent comorbidities among COVID-19 patients in Indonesia, according to a publication from the Ministry of Health, are hypertension (primary, 50%), diabetes mellitus (secondary, 37.2%), and cardiac disease (16.7%).³ Study-

ing these three comorbidities is of the utmost importance; therefore, this research is limited to and focuses on them exclusively.

Then, all patient data based on medical records were collected and analyzed, starting from univariate, bivariate, and multivariate data in each group.

Sample Characteristic

COVID-19 patients with comorbidities at Pertamina Jaya Hospital were 52% male and 48% female. On average, 67% of patients were over 60; the remaining 33% were under 60. Of the total sample (500 patients), 37% experienced the risk of death and 63% survived. In terms of comorbidities in 500 patients, hypertension is the most common comorbidity (43%) of medically recorded COVID-19 patients, followed by diabetes mellitus (41%) and heart disease (10%).

Outcome with Risk of Death

Based on Table 3, in the comorbidity sample group, 172 patients (92%) died, and 78 patients (25%) were declared alive. In contrast to the group without comorbidities, 235 patients (75%) were reported alive, and only

Table 2. Analyses Univariate Result of Research Subject Characteristics

Charasteristic	Frequency (n = 500)	(%)
Mortality Risk		
Deceased	187	37
Survived	313	63
Comorbidity		
Positive	250	50
Negative	250	50
Hypertension		
Positive	215	43
Negative	285	57
Diabetes Mellitus		
Positive	203	41
Negative	297	59
Heart Disease		
Positive	50	10
Negative	450	90
Gender		
Male	263	52
Female	238	48
Age		
< 60 years	337	67
> 60 years	163	33

15 patients (8%) died. In the history of the hypertension group, 156 patients (83%) died, and 59 (19%) lived. Meanwhile, in the group without a history of hypertension, 31 patients (17%) died, and 254 patients (81%) survived. In the group with a history of diabetes mellitus, 132 patients (71%) died, and 71 patients (23%) survived. Meanwhile, in the group without a history of diabetes mellitus, 55 patients (29%) died, and 242 patients (77%) survived. In contrast to the group with a heart disease history, 28 patients (15%) died, and 22 patients (7%)

are still alive. Meanwhile, in the group without heart disease history, 159 patients (85%) died, and 291 patients (93%) survived.

The Risk of Death of COVID-19 Patients

Based on Table 4, comorbidities can increase the risk of death as the relative risk (RR) value in the logistic regression produced (32.197 95% CI 9.714-106.718), meaning that patients with comorbidities experience a 32-fold risk of death compared to patients who do not have a history of comorbidities. Hypertension predicts mortality risk in COVID-19 patients compared to protective factors as the resulting RR value (3.124 95% CI 1.441 - 6.773); this means that the level of risk of death of COVID-19 patients with comorbid hypertension is very high up to 3 times compared to those who do not have comorbid hypertension. Patients with comorbid diabetes mellitus have 2.5 times the mortality risk as the RR value result (2.521, 95% CI 1.055-6.024). Finally, patients with comorbid heart disease had a mortality risk of 2.3 times as per the resulting RR value (2.325 95% CI 1.169-4.622).

Discussion

Based on the results of multivariate analysis, the resulting RR value was quite significant in each group of COVID-19 patients with comorbidities of hypertension, diabetes mellitus, and heart disease. In line with the results of some previous studies that hypertension, diabetes, and heart disease as a patient's congenital disease affect the level of COVID-19 severity, this, of course, can worsen the patient's condition and ultimately lead to death.¹⁶⁻¹⁸

Table 3. Bivariate Analyses Result of Comparison with Mortality Risk

Variable	Deceased n (%)	Survived n (%)	RR 95% CI	p-value																																																
Comorbidity +	172 (92)	78 (25)	34,547 (19,217 – 62,107)	0,000																																																
Comorbidity -	15 (8)	235 (75)			Hypertension +	156 (83)	59 (19)	21,664 (13,428 – 34,952)	0,000	Hypertension -	31 (17)	254 (81)	Diabetes Mellitus +	132 (71)	71 (23)	8,180 (5,423 – 12,339)	0,000	Diabetes Mellitus -	55 (29)	242 (77)	Heart Disease +	28 (15)	22 (7)	2,329 (1,290 – 4,206)	0,004	Heart Disease -	159 (85)	291 (93)	Gender					Male	117 (63)	145 (46)	1,937 (1,337 – 2,804)	0,000	Female	70 (37)	168 (54)	Age					< 60 years	88 (47)	249 (80)	4,377 (2,942 – 6,513)	0,000	> 60 years
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Hypertension -	31 (17)	254 (81)			Diabetes Mellitus +	132 (71)	71 (23)	8,180 (5,423 – 12,339)	0,000	Diabetes Mellitus -	55 (29)	242 (77)	Heart Disease +	28 (15)	22 (7)	2,329 (1,290 – 4,206)	0,004	Heart Disease -	159 (85)	291 (93)	Gender					Male	117 (63)	145 (46)	1,937 (1,337 – 2,804)	0,000	Female	70 (37)	168 (54)	Age					< 60 years	88 (47)	249 (80)	4,377 (2,942 – 6,513)	0,000	> 60 years	99 (53)	64 (20)						
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Table 4. Multivariate Analyses Result: Influence of Comorbidities on Mortality Risk

Variables	RR	95% CI	p-value
Comorbidity +	32,197	9,714 – 106,718	0,000
Hypertension +	3,124	1,441 – 6,773	0,004
Dm +	2,521	1,055 – 6,024	0,038
Heart Disease +	2,325	1,169 – 4,622	0,016
Male	1,069	0,639 – 1,786	0,800
Age	1,173	0,667 – 2,061	0,580

The group of patients with hypertension increases up to 3 times the risk of death compared to patients who do not have hypertension; this result is in line with previous research conducted in Jakarta, where 795 COVID-19 patients (19%) were recorded to have a history of hypertension comorbidity, 201 of these 795 patients (42%) died.⁶ The similarity of this study with previous studies is that the percentage of the number of comorbid hypertension consistently ranks first; some other research results are also the same. This means that COVID-19 patients will experience the risk of death with a history of hypertension at Pertamina Jaya Hospital, Central Jakarta.

The most prevalent comorbidity among COVID-19-infected patients is hypertension, which is associated with elevated mortality and hospitalization risk. Initial suspicions suggest that inhibitors of the renin-angiotensin-aldosterone system may elevate the susceptibility to contracting the COVID-19 virus and exacerbate the severity of the illness, as indicated by the findings of Peng et al.¹⁶ However, it ultimately demonstrates that the administration of anti-hypertensive medications does not worsen the severity of COVID-19 infection in individuals with hypertension and may potentially contribute to the development of more effective drug therapy approaches for COVID-19 patients who also have hypertension.

Further support for this notion is provided by the findings of additional research, which demonstrate that ACE and ARB can potentially elevate ACE2 and that the pathophysiological consequences of this can exacerbate lung damage. Conversely, experimental investigations suggest that ACE2 might protect against lung injury via the mechanism by which it converts angiotensin II into angiotensin. This process diminishes the inflammatory impact of angiotensin II while augmenting the potential anti-inflammatory capability of angiotensin I. Consequently, ARB and ACE inhibition may

reduce the risk of acute respiratory distress syndrome, myocarditis, and acute renal injury in patients inflicted with COVID-19.¹⁹

Antihypertensives RAS and ACE2 play a crucial role in patients due to their ability to physiologically affect mechanisms regulating blood pressure. In addition to this, RAS plays a significant role in the management of hypertension-induced organ damage (HMOD), including chronic kidney failure, arteriosclerosis, ventricular hypertrophy, and heart failure. Additional research indicates that RAS is risk-free and ought not to be discontinued. Several cardiovascular and hypertension scientific communities at the national and international levels advise that COVID-19 patients continue to receive antihypertensive medications, notably ACE and ARB.²⁰ As a result, hypertensive COVID-19 patients necessitate hospitalization, particularly male patients or those aged 60 years and older, to prevent an increase in the patient mortality rate. Further clinical investigation is warranted to identify additional factors that may impact the mortality rate of COVID-19 patients who also have hypertension beyond the scope of the dimensions and indicators examined in this research.

COVID-19 patients with comorbid diabetes mellitus in this study experienced a risk of death 2.5 times compared to patients who did not have a history of diabetes mellitus. This result follows previous research, proving that angiotensin-II in diabetic patients plays a role in processing human cell infection.²¹ The point is that when the patient's body is in a hyperglycemic state, ACE2 prevents insulin secretion from the pancreas and blocks the overactive RAS so that the morphology of the virus in the cell lives and replicates well; this condition causes COVID-19 patients with a history of diabetes to be more prone to death. SARS-CoV-2 infection also increases the risk of thromboembolism and causes cardiopulmonary failure more frequently in diabetic than non-diabetic patients. All of these mechanisms are now believed to

contribute to the poor prognosis of COVID-19 patients with diabetes mellitus.²² Therefore, it is essential for COVID-19 patients with a history of diabetes mellitus to carry out cardiovascular risk factor management and strict glycemic control; drugs used for diabetes mellitus must also be adapted for patients who are at high risk of being infected with SARS-CoV-2.

COVID-19 patients with comorbid heart disease in this study experienced a 2.3 times greater risk of death compared to patients who did not have heart disease. The results of some older research prove that COVID-19 patients with comorbid heart disease have a higher mortality rate; this is due to the SARS-CoV-2 infection itself (such as coronary artery disease and hypertension), which makes patients have difficulty in the respiratory system, such as ARDS, can even cause necrosis and worsen myocardial infarction and ultimately heart failure and death.^{23,24}

Other studies have also stated that patients who have risk factors and heart (cardiovascular) disease are at higher risk when suffering from COVID-19 because there are disorders that arise, such as arterial thrombotic complications (with the presentation of acute coronary syndrome), venous thromboembolic complications, myocarditis, arrhythmias, to heart failure.²⁵ Please also note that some therapies used by COVID-19 patients can cause different effects on the cardiovascular system, so monitoring is needed to minimize unwanted side effects.^{18,26} The use of drugs turns out to affect the risk of death of COVID-19 patients with comorbid heart disease; it has been proven in a study conducted in Brazil, it turns out that the use of hydroxychloroquine, which at that time was recommended by the Ministry of Health as a therapeutic drug, can cause severe complications and even death for COVID-19 patients who have heart disease.²⁷

Conclusion

Based on data analysis, research results, and discussion conducted, comorbidity predicts the death of COVID-19 patients; comorbidity is proven to affect the mortality of COVID-19 patients at Pertamina Jaya Hospital, Central Jakarta. Partially, COVID-19 patients who have comorbidities of hypertension have a three times risk of death, diabetes mellitus has a 2.5 times risk, and heart disease has a 2.3 times risk of mortality compared to COVID-19 patients who do not have comorbidities.

Several suggestions might be submitted. It is expected to collect complete patient data such as laboratory, ECG, and radiology for further research. Then, add other variables, such as the severity of the patient's illness or those that are aligned, and support this research so that it can have implications for cluster research involving many other health disciplines later.

Research Limitations

1. Due to the scarcity of information obtained from the hospital, the MANOVA method cannot be applied to the analysis.
2. Patients exclusively diagnosed with hypertension, diabetes mellitus, and heart disease are the subject of this research; the variable severity of the diseases is also excluded.
3. Rely solely on secondary data obtained from hospital patient medical records. It is advisable to advance this research to the experimental phase to characterize mortality consequences for COVID-19 patients with comorbidities precisely by their clinical classification.

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