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Description of Clinical Severity, Laboratory Results, and ECG of COVID-19 Patients with Cardiovascular Comorbidities who Received Doses I And II of The COVID-19 Vaccine at H. Adam Malik General Hospital

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ABSTRACT

Introduction: COVID-19 patients with comorbidities (hypertension or cardiovascular disease) have a high mortality rate and are at high risk of showing severe symptoms of COVID-19. One of the preventions to avoid COVID-19 is to vaccinate against COVID-19. The COVID-19 vaccine has proven safe and effective in patients with comorbidities because the vaccine can prevent severe symptoms of COVID-19. The study aims to describe the clinical severity, laboratory results, and ECG of COVID-19 patients with cardiovascular co-morbidities who received the first and second doses of COVID-19 vaccination at Haji Adam Malik General Hospital from April to August 2021.

Method: A descriptive retrospective study using a cross-sectional study design. Total sampling was used. The subjects were COVID-19 patients with cardiovascular comorbidities, which fits the inclusion and exclusion criteria.

Results: Out of the 71 COVID-19 patients with cardiovascular comorbidities, the majority were found to be male patients (57.7%), aged ≥ 65 years (22.5%), with comorbid hypertension (84.5%), and had received vaccine dose II (97.2%). Most patients had mild symptoms (47.9%), abnormal ECG results (73.2%), and varied laboratory results.

Conclusion: Most patients had received the second COVID-19 vaccine, showing moderate symptoms of COVID-19, abnormal ECG results, and varied laboratory results.

Keywords: Cardiovascular Comorbidities, Clinical Severity, COVID-19 Vaccination, ECG, and Laboratory Results

ABSTRAK

Pendahuluan: *Pasien COVID-19 yang memiliki komorbid (hipertensi atau penyakit kardiovaskular), memiliki angka mortalitas yang tinggi dan berisiko tinggi menunjukkan*

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gejala COVID-19 derajat berat. Salah satu pencegahan agar terhindar dari COVID-19 adalah dengan melakukan vaksinasi COVID-19. Dimana, vaksin COVID-19 terbukti aman dan efektif pada pasien yang memiliki komorbid, dikarenakan vaksin dapat mencegah gejala COVID-19 derajat berat.

Tujuan: *Untuk mengetahui gambaran keadaan klinis, hasil laboratorium, dan EKG pasien COVID-19 dengan komorbid kardiovaskular yang mendapatkan vaksinasi COVID-19 dosis I dan II di RSUP Haji Adam Malik Medan pada periode April hingga Agustus 2021.*

Metode: *Deskriptif retrospective dengan desain cross-sectional study. Teknik pengambilan sampel yang digunakan berupa total sampling. Subjek penelitian ini merupakan pasien COVID-19 dengan komorbid kardiovaskular, yang sesuai kriteria inklusi dan eksklusi.*

Hasil: *Dari 71 pasien COVID-19 dengan komorbid kardiovaskular, ditemukan sebagian besar pasien laki-laki (57,7%), usia ≥ 65 tahun (22,5%), dengan komorbid hipertensi (84,5%), dan sudah mendapatkan vaksin dosis II (97,2%). Sebagian besar pasien bergejala ringan (47,9%), hasil EKG abnormal (73,2%), dan hasil laboratorium yang beragam.*

Kesimpulan: *Sebagian besar pasien telah mendapatkan vaksin COVID-19 dosis II dan menunjukkan gejala COVID-19 derajat sedang, hasil EKG yang abnormal, dan hasil pemeriksaan laboratorium yang beragam.*

Kata Kunci: *EKG, Hasil Laboratorium, Keadaan Klinis, Komorbid Kardiovaskular, Vaksinasi COVID-19*

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1 Introduction

Coronavirus Disease 2019, or COVID-19 for short, is an infectious disease that attacks the respiratory tract. COVID-19 disease is caused by the *Severe Acute Coronavirus Respiratory Syndrome Corinavirus-2* virus, or what is often referred to as SARS-CoV-2.[1] In COVID-19 patients with comorbid, such as hypertension or cardiovascular disease, have a high mortality rate and a high risk of showing severe symptoms of COVID-19 infection. COVID-19 patients with hypertension have a 2.5 times higher risk of showing severe symptoms of COVID-19 infection. Meanwhile, COVID-19 patients with cardiovascular comorbidities have a mortality rate five times higher than COVID-19 patients without comorbidities.[2]

The death rate for COVID-19 cases in Indonesia is higher than the global death rate. This happens because most of the COVID-19 patients in Indonesia have comorbidities and are of advanced age [3]. The comorbidities often found in COVID-19 patients are hypertension, cardiovascular and cerebrovascular disease, and diabetes mellitus.[4] One way to prevent COVID-19 is by getting the COVID-19 vaccine.[5]

Based on this description, researchers are interested to know the description of clinical severity, laboratory results, and ECG of COVID-19 patients with cardiovascular comorbidities who received doses I and II of the COVID-19 vaccine at Haji Adam Malik General Hospital from April to August 2021.

2 Method

This research is retrospective descriptive research. The data that was obtained was secondary data from the medical records of the Haji Adam Malik General Hospital in Medan from April 2021 to August 2021, the data that were taken were inpatients. The sampling technique used was total sampling, and the sample taken fit the inclusion and exclusion criteria. The inclusion criteria for this study were COVID-19 patients with cardiovascular comorbidities who were treated at Haji Adam Malik Hospital in Medan from April 2021 to August 2021. As well as the exclusion criteria in this study were patients with malignancy because studies show that cancer patients with COVID-19 infection have poor clinical outcomes [6]. The sample size obtained was 71 samples.

3 Results

Based on data taken through the medical records of the Adam Malik Haji Center General Hospital Medan in the period April 2021 to August 2021. The characteristics of the study sample are based on the frequency distribution of individual characteristics. Most of the COVID-19 patients with cardiovascular comorbidities at Haji Adam Malik General Hospital from April to August 2021 are male patients aged under 65 years and have one cardiovascular comorbid. Most of the patients had received the second dose of the COVID-19 vaccine and showed moderate symptoms of COVID-19 infection and abnormal ECG results (Table 1)

Table 1 Frequency Distribution of Individual Characteristics

Demographic Characteristics	n (%)
Sex	
Male	41 (57,7)
Female	30 (42,3)
Age	
< 65 years	55 (77,5)
≥ 65 years	16 (22,5)
Cardiovascular Comorbid	
1 Comorbid	62 (87,3)
2 Comorbidities	6 (8,5)
3 Comorbidities	3 (4,2)
Vaccination Status	
Primary Vaccine Doses I	2 (2,8)
Primary Vaccine Doses II	69 (97,2)
Clinical Severity	
Moderate	34 (47,9)
Severe	22 (31)
Critical	15 (21,1)
ECG's Results	
Normal	19 (26,8)
Abnormal	52 (73,2)
Total	71 (100)

Characteristics of COVID-19 patients with cardiovascular comorbidities at Haji Adam Malik General Hospital from April 2021 to August 2021, based on the distribution of cardiovascular

comorbidities suffered by patients. Most COVID-19 patients with cardiovascular comorbidities at Haji Adam Malik Hospital in Medan from April 2021 to August 2021 had comorbid cardiovascular diseases in the form of hypertension The distribution of cardiovascular comorbidities can be seen in (Table 2).

Table 2 Distribution of Cardiovascular Comorbid

Cardiovascular Comorbidities	Frequency (n)	Percentage (%)
Coronary Heart Disease		
Yes	9	12,7
No	62	87,3
Stroke		
Yes	9	12,7
No	62	87,3
Heart Failure		
Yes	5	7
No	66	93
Hypertension		
Yes	60	84,5
No	11	15,5

In addition, the laboratory test results of COVID-19 patients with cardiovascular comorbidities at Haji Adam Malik General Hospital from April 2021 to August 2021 were also obtained. the results of laboratory reference values in the book Mosby's Diagnostic & Laboratory Test Reference Fifteenth Edition [7], and journals that include several laboratory results reference [8–11], the majority of COVID-19 patients with co-morbidities cardiovascular disease at Haji Adam Malik General Hospital Medan from April 2021 to August 2021, laboratory results were obtained in the form of decreased hemoglobin and hematocrit values in male patients, lymphocytes, and electrolytes in the form of sodium. Improved laboratory results on leukocytes, neutrophils, neutrophil-lymphocyte ratio (NLR), c-reactive protein (CRP), prothrombin time (PT), thrombin time (TT), fibrinogen, d-dimer, procalcitonin, SGOT, SGPT, urea, creatinine, random blood glucose tests, and troponin-I. As well as average laboratory results for hemoglobin and hematocrit results in female patients, platelets, partially activated thromboplastin time (aPTT), international normalized ratio (INR), and electrolytes in the form of potassium and chloride (Table 3)

Table 3 Distribution of Laboratory Results

Laboratory Results	n (%)	Mean	SD
Hematology Tests			
Hemoglobin (g/dL)			
Male	41 (57,7)	12,924	2,210
Female	30 (42,3)	12,213	1,859
Hematocrit (%)			
Male	41 (57,7)	37,744	6,687
Female	30 (42,3)	36,177	5,860
Thrombocyte ($10^3/\mu$l)	71 (100)	273,202	125,966
Leucocyte ($10^3/\mu$l)	71 (100)	12,124	6,873
Neutrophil (%)	71 (100)	79,099	12,497
Lymphocyte (%)	71 (100)	13,123	10,379
RNL	71 (100)	14,852	16,413
CRP (mg/dL)	71 (100)	1,744	2,042
PT (seconds)	71 (100)	13,696	1,778
aPTT (seconds)	71 (100)	36,010	8,377
TT (seconds)	71 (100)	21,982	16,829
INR	71 (100)	1,0108	0,184
Fibrinogen (mg/dL)	71 (100)	645,310	241,412
D-dimer (ng/mL)	71 (100)	1.519,83	2.097,58
Procalcitonin (ng/mL)	54 (76,1)	3,5383	11,860
Clinical Chemistry Tests			
Heart Function (IU/L)			
SGOT	71 (100)	52,86	43,305
SGPT		43,44	33,631
Renal Function (mg/dL)			
Ureum			
Male	41 (57,7)	66,88	64,323
Female	30 (42,3)	49,90	63,483
Creatinine			
Male	41 (57,7)	2,5571	2,557
Female	30 (42,3)	1,6797	1,679
Blood Glucose (mg/dL)			
Random Blood Glucose Test	71 (100)	178,86	101,356
Electrolytes (mEq/L)			
Sodium	71 (100)	134,27	8,514
Potassium		4,285	0,8232
Chloride		100,59	5,027
Cardiac Enzyme (ng/mL)			
Troponin I	42 (59,15)	0,8648	3,254

4 Discussion

Most COVID-19 patients with cardiovascular comorbidities are male, following research which states that the male sex has a higher risk of contracting COVID-19 due to hormonal and chromosomal factors.[12] Most patients were aged <65 years and had one cardiovascular comorbid, hypertension, followed by coronary heart disease, stroke, and heart failure, following

research which states that the comorbid often found in COVID-19 patients is hypertension.[4] A person with hypertension has a 3,284 times higher risk of being infected with COVID-19 compared to someone without comorbid hypertension,[12] because hypertensive patients routinely take angiotensin-converting enzyme inhibitor (ACEI) drugs and angiotensin receptor blockers (ARB). ACEI and ARB drugs will inhibit the expression of angiotensin-converting enzyme 1 (ACE1) and increase the expression of angiotensin-converting enzyme 2 (ACE2). Considering that the entrance for SARS-CoV-2 is through the ACE2 receptor, this will increase the risk of contracting COVID-19 and will exacerbate the symptoms that will be felt by patients with hypertension.[2]

A total of 69 COVID-19 patients with cardiovascular comorbidities had received the second dose of the COVID-19 vaccine and showed moderate symptoms of COVID-19 infection. This is in line with research, which states that the COVID-19 vaccine has proven safe and effective for patients with comorbidities because vaccines can prevent severe symptoms of COVID-19 infection**.**[13]

The majority of COVID-19 patients with cardiovascular comorbidities showed abnormal EKG results, such as abnormal sinuses (sinus tachycardia, sinus bradycardia, or atrial fibrillation), presence of deviation axis, LBBB, RBBB, ST elevation, ST depression, T inversion, and other ECGs components, which are either elongated or shortened. Abnormal ECG results, such as arrhythmias and conduction disturbances, are more commonly found in COVID-19 patients. Several factors that can cause arrhythmias are myocardial infarction, myocarditis, shock, hypoxia, and electrolyte disturbances.[14] About 27.8% of COVID-19 patients in Wuhan have high troponin levels, which indicates damage to the heart muscle.[15] Damage to the heart muscle of a COVID-19 patient can occur due to a cytokine storm which will make white blood cells stick to blood vessels, thus increasing the risk of thrombus formation. In addition, inflammation can cause blood vessels to constrict and cause the blood supply to flow to the myocardium to decrease and cause myocardial infarction.[16,17] *H*emoglobin and hematocrit decreased in male patients. In patients with COVID-19, anemia often occurs due to inflammatory processes, iron deficiency, or vitamin deficiency.[18] In addition, there was an increase in leukocyte and neutrophil values in COVID-19 patients, indicating an inflammatory process in a person's body.[19,20] A decreased lymphocyte count, or what is often called lymphopenia, indicates an infection with a virus. However, researchers still do not know precisely how lymphopenia occurs in viral infections.[21] A study shows that COVID-19 patients with laboratory results of lymphopenia will have a poor prognosis**.**[22]

High neutrophil-lymphocyte ratio (NLR) and c-reactive protein (CRP) results. NLR is a predictive factor for COVID-19 patients; if a COVID-19 patient is found aged ≥ 50 years and has an NLR value < 3,13, then the patient must be isolated in the hospital, and monitored supported care is carried out. However, if the RNL value is ≥ 3,13, the patient must be treated in the ICU with a

breathing apparatus [23]. CRP is an inflammatory biomarker in the body where an elevated CRP indicates an inflammatory process in a person's body.[24]

COVID-19 patients with cardiovascular comorbidities also undergo blood coagulation tests in the form of PT, aPTT, TT, and INR. Where the results of PT and TT are obtained, which are elongated. Most COVID-19 patients have prolonged PT results,[25] where one indication of a prolonged PT value is the presence of intravascular coagulation**.**[7] The results of prolonged TT values, one of the common causes is hypofibrinogenemia, as is often found in patients suffering from intravascular coagulation or patients taking thrombin-inhibiting drugs, such as heparin.[9]

Values of fibrinogen, d-dimer, and procalcitonin were increased. An increased fibrinogen value can occur when there is inflammation in the body or necrosis in the tissue. In addition, a person with a high fibrinogen value has a high-risk factor for coronary heart disease, myocardial infarction, or stroke**.**[7] A study shows that patients with severe COVID-19 infection have high fibrinogen values.[26] Most COVID-19 patients also have high d-dimer results, where high d-dimer values can be caused by hypoxemia or excess blood clots, which can cause venous thrombosis or pulmonary embolism.[7,25] A high procalcitonin result may indicate a severe bacterial infection or sepsis.[7]

In COVID-19 patients with cardiovascular comorbidities, liver function tests were also carried out in SGOT and SGPT, which showed increased SGOT results. An elevated SGOT value can indicate damage to an organ with the SGOT enzyme, such as the liver. In addition, the patient was also examined for kidney function, namely urea, and creatinine, which showed increased results. Increased urea and creatinine values can indicate a problem with the kidneys. According to researchers, high urea values can increase the occurrence of insulin resistance and reduce insulin secretion.[27] This is in line with blood glucose results, where the average blood glucose level is high. In addition, a disturbance in kidney function can cause the secretion of the hormone erythropoietin to decrease, which can cause anemia or polycythemia.[28]

Decreased electrolyte values in sodium and increased troponin-I values are obtained, low sodium values can be caused by several things, such as kidney damage, diarrhea, vomiting, or diuretic drugs.[29] Troponin-I is a marker used to detect damage to the heart muscle.[7] A high average troponin-I value is obtained in COVID-19 patients with cardiovascular comorbidities, and this indicates that the majority of patients have damage to the heart muscle

5 Conclusion

Most COVID-19 patients with cardiovascular comorbidities from April to August 2021 were males younger than 65 years with hypertension. Most of the patients had received the second dose of the COVID-19 vaccine, experienced moderate symptoms of COVID-19 infection, showed abnormal EKG results, and varied laboratory results.

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