Analysis of Risk Factors for Acute Myocardial Infarction

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Abstrak

Penyakit kardiovaskular merupakan penyebab kematian terbanyak di dunia. Salah satu bagian dari penyakit kardiovaskular adalah infark miokard akut. Terdapat faktor risiko yang berpotensi seperti usia, jenis kelamin, genetik, riwayat hipertensi, merokok, dislipidemia, dan diabetes melitus. Penelitian ini bertujuan untuk menganalisis factor-faktor yang berhubungan dengan kejadian infark miokard akut. Penelitian ini dilaksanakan pada bulan Oktober 2023, dengan menggunakan jenis penelitian observasional analitik dan desain cross-sectional. Penelitian ini menggunakan data rekam medis pasien IMA periode Juni 2022 – Juni 2023. Sampel penelitian adalah responden yang terdiagnosis infark miokard akut di RS ROEMANI yang diambil melalui total sampling. Inklusi sebanyak 60 orang dan eksklusi sebanyak 14 responden. Analisis data menggunakan uji chi-square. Hasil uji statistik menunjukkan bahwa hubungan bermakna dengan kejadian infark miokard akut antara lain hipertensi (p=0,001), diabetes melitus (p=0,022), merokok (p= 0,045), dan tidak dislipidemia (p=0,639). Kesimpulan, terdapat hubungan yang signifikan antara hipertensi, diabetes melitus, dan kejadian infark miokard akut. Sementara itu, dislipidemia tidak memiliki hubungan yang signifikan dengan kejadian infark miokard akut.

Kata Kunci: analisis; faktor risiko; infark miokard akut; usia; jenis kelamin

Abstract

Cardiovascular disease is the most common cause of death in the world. One part of cardiovascular disease is acute myocardial infarction. There are risk factors that have the potential such as age, gender, genetics, hypertension, smoking, dyslipidemia, and diabetes mellitus. This study aims to analyse the risk factors associated with acute myocardial infarction. This study was conducted in October 2023, using an analytical observational study type and cross-sectional design. This study used medical record data from AMI patients from June 2022 - June 2023. The study sample was respondents diagnosed with acute myocardial infarction at ROEMANI Hospital taken through total sampling. Inclusion was 60 and exclusion was 14 respondents. Data analysis uses the chi-square The results showed that those who had a significant relationship with the incidence of acute myocardial infarction included hypertension (p = 0.001), diabetes mellitus (p = 0.022), smoking (p = 0.045), and those who did not dyslipidemia (p=0.639). In conclusion, there is a significant relationship between hypertension, diabetes mellitus, and the incidence of acute myocardial infarction. At the same time, dyslipidemia does not have a significant relationship with the incidence of acute myocardial infarction.

Keywords: analysis; risk factors; acute myocardial infarction; age; gender

Introduction

Cardiovascular disease remains the leading cause of death in the world. One part of cardiovascular disease is acute myocardial infarction(1). Acute myocardial infarction (AMI) is a disease caused by a lack of coronary artery blood flow due to narrowing due to atherosclerosis which makes the heart's oxygen supply and needs inadequate(2). According to the World Health Organization (WHO), cardiovascular diseases include coronary heart disease, acute myocardial infarction, rheumatic heart disease and stroke have an estimated 17.7 million deaths in 2015. In developing countries, the mortality rate reached 2,470,000 (9.4%) (3). Deaths in Indonesia due to cardiovascular disease reached 651,481 people per year and coronary heart disease 245,343 deaths. The results of Basic Health Study (RISKESDAS) in 2013 showed that the highest prevalence of cardiovascular disease in Indonesia was IMA at 2,650,340 people. (0.5%) then increased in 2018 with a prevalence of 1,5% (4) . The prevalence of acute myocardial infarction in Central Java reached 0.5% from doctor-diagnosed interviews and 1,4% from symptoms (5). The results of a preliminary study that I conducted on June 9 2023 at ROEMANI Muhammadiyah Hospital Semarang showed that the incidence of acute myocardial infarction in January-May 2023 reached 29 cases

There are risk factors that have the potential to increase the risk of acute myocardial infarction such as age, gender, genetics, lack of physical activity, history of hypertension, stress, smoking, dyslipidemia, diabetes mellitus and nutritional status (6). Both well-off and poor people in Indonesia have insufficient knowledge about balanced nutrition. This will put a person at risk of developing an acute myocardial infarction (1). The risk factors above will develop progressively so that acute myocardial infarction will occur.

Methods

This study is quantitative analytic with a design cross-sectional, carried out in October 2023 at ROEMANI Muhammadiyah Hospital Semarang. The study sample was medical record data from patients who were diagnosed with acute myocardial infarction at ROEMANI Muhammadiyah Hospital Semarang in June 2022-June 2023. A sampling technique was used. total sampling. The data source was obtained from secondary data. Data analysis between independent and dependent variable was chi-square.

Study Results

Table 1. Characteristics of respondents AMI patient during June 2022- June 2023 at ROEMANI Muhammadiyah Hospital Semarang

Variabel	Frequency	Percentage
Age		
< 55 years	15	25 %
> 55 years	45	75 %
Gender		
Woman	26	56,7 %
Man	34	43,3 %
Hypertension		
Yes	35	58,3%
No	25	41,7%
Blood Sugar		
Normal	24	40 %
Pre-Diabetes	12	20 %
Diabetes	24	40 %
Dyslipidemia		
Yes	44	73,3%
No	16	16,7%
Smoking		
Yes	27	45%
No	33	55%
Acute Myocardial Infarction (IMA)		
STEMI	27	45%
NSTEMI	33	55%
Total	60	100%

Table 1, The majority of respondents were >55 years old, 45 people (75%%), male, 34 people (43.3%), most of the respondents had a history of hypertension, 35 people (58.3%), respondents with a history of normal blood sugar were 24 people (40%) while respondents with a history of diabetes were 24 people (40%), most respondents had a history of dyslipidemia as many as 44 people (73.3%), most respondents not smoke as many as 33 people (55%), and respondents with a history of STEMI numbered 27 people (45%) while respondents with a history of NSTEMI numbered 33 people (55%).

Table 2. Relationship between hypertension, blood glucose, dyslipidemia, and smoking of acute myocardial infarction

Variable	Acute myocardial infarction				p-value
	STEMI		NSTEMI		
	N	%	n	%	
Hypertension					
Yes	22	36,5	13	21,7	0,001
No	5	8,3	20	33,3	
Blood glucose					
Normal	7	11,7	17	28,3	0,022
Pre-diabetes	4	6,7	8	13,3	
Diabetes	16	26,7	8	13,3	
Dyslipidemia					
Yes	19	31,7	25	41,7	0,639
No	8	13,3	8	13,3	
Smoking					
Yes	16	26,7	11	18,3	0,045
No	11	18,3	22	36,7	

In Table 2, it can be seen that there were STEMI respondents with hypertension 36,7%, NSTEMI respondents with hypertension 21,7% and p-value 0.001 that means there is a significant relationship hypertension with acute myocardial infarction. Most STEMI with diabetes 26,7%. In contrast NSTEMI, most blood sugar is normal 28,3%. There is a significant relationship between diabetes with acute myocardial infarction p-value 0,022. Dyslipidemia in STEMI and NSTEMI 31,7% and 41,7%. But, no significant relationship with acute myocardial infarction because p-value 0,639. Most smoking occurs in STEMI 26,7% and NSTEMI non-smoker 36,7%. So, there is a significant relationship between smoking with acute myocardial infarction.

Discussion

Based on study that has been conducted, the majority of respondents in this study were over 55 years old, namely 45 respondents, this is evidence that age influences the process of acute myocardial infarction (AMI). Age is one of the risk factors for AMI where increasing age will increase the risk of AMI. Based on study at Al-Ihsan Hospital 2015, CHD sufferers were found to be more common in the age group > 55 years. The older a person is, the greater the possibility of plaque forming on the walls of blood vessels, which will cause oxygen intake to the heart to decrease so that heart muscle cell death (myocardial infarction) can occur(7). In this study, the majority of respondents were male. This is by medical record data of patients

diagnosed with acute myocardial infarction at ROEMANI Muhammadiyah Hospital Semarang for the period June 2022 – June 2023, where there are more male patients than female. This is also similar to study, where the majority of patients suffering from ACS were male. The WHO statement stated that more male patients were diagnosed with coronary heart disease than female. This is because women who are not yet in menopause have high levels of the hormone estrogen, which has a protective effect against coronary heart disease(6,8).

In this study, the majority of respondents experienced hypertension. In study conducted the majority of ACS patients experienced hypertension with a percentage reaching 65%. These results support the theory that hypertension was ACS risk factors. Every 10 mmHg increase in systolic blood pressure or 5 mmHg increase in diastolic blood pressure can increase the ACS risk factors(9,10). The majority of respondents experienced dyslipidemia. This is in line with in previous study that the majority of patients diagnosed with CHD are accompanied by dyslipidemia. Dyslipidemia is characterized by an increase in LDL-cholesterol on lipid profile examination. The relationship between LDL and CHD exists in the process of atherosclerosis. The atherosclerosis process begins with damage or dysfunction of the endothelium in the artery walls(5).

In this study, the majority of respondents has normal and high blood sugar levels (diabetes). This is in line with in previous study, where DM respondents were 35% of SKA patients out of 100 respondents. In study, the prevalence of diabetes mellitus was 21%. Diabetes mellitus with poor blood glucose control is one of the cause cardiovascular mortality in diabetes patients(10). The majority of respondents did not have a history of smoking. This is in line with previous study where the majority of patients with CHD did not have a history of smoking(11,12).

In this study, the majority of IMA respondents experienced hypertension. Based on the results of the analysis test using the test chi square was found that hypertension had a significant relationship with the incidence of acute myocardial infarction. This is in line with study at RSUP Dr. Mohammad Hoesein Palembang, stated that there is a significant relationship between hypertension and acute myocardial infarction ($p = 0,008$). In line with a study which examined hypertension as a predictor of death in STEMI patients, finding 66.8 ± 11.9 years vs. 62.1 ± 13.4 years, and significantly different $P<0.001$(9,13). Several studies also suggest that the group of patients with hypertension has a 4.889 times greater risk of experiencing STEMI than the group of non-hypertensive patients. This is because hypertension affects the performance

of the heart by increasing the burden on the heart, causing left ventricular hypertrophy and accelerating the onset of atherosclerosis. After all, high and persistent blood pressure will cause direct trauma to the walls of the coronary arteries, making it easier for coronary atherosclerosis to occur(6,10,14).

Narrowing of the blood vessels will cause blood flow to be obstructed so that the oxygen supply to the heart is reduced. Lack of oxygen causes the heart muscle to become weak, chest pain, heart attack, and even sudden death. Apart from that, environmental influences can also activate the sympathetic nervous system in the form of catecholamines and norepinephrine. Neurotransmitters will increase heart rate followed by an increase in cardiac output so that blood pressure increases and the arteries thicken and stiffen. Chronic hypertension will manifest as Acute Coronary Syndrome, the difference between STEMI and NSTEMI is occlusion. If STEMI is characterized by total occlusion in all layers of the myocardium and an ECG examination shows ST-segment elevation, whereas NSTEMI is characterized by partial occlusion in the myocardial layer and an ECG examination shows ST segment elevation or no ST-segment elevation(15,16).

The findings in this study showed that the majority of patients had diabetes mellitus, most commonly found in patients with a history of STEMI. In line with the previous study, it is explained that DM was strongly negative in patients with STEMI treated with thrombolysis, with a higher in-hospital mortality rate compared with non-diabetic patients (28% vs 13%) with p-value < 0.001)(17). Several studies that have been carried out have found that most patients with a history of DM have a history of STEMI(18). This is caused by the process of thickening of the basement membrane of the capillaries and coronary arteries, resulting in the narrowing of blood flow to the heart. The incidence of heart attacks increases 2 to 4 times greater in patients with diabetes mellitus. People with diabetes mellitus tend to experience more rapid endothelial degeneration and dysfunction. Diabetes mellitus is associated with physical-pathological changes in the cardiovascular system. These include endothelial dysfunction and blood vessel disorders which ultimately increase the risk of CHD(19).

Based on the results of this study, there is no significant relationship between dyslipidemia and the incidence of acute myocardial infarction, because some of the data taken were not real-time and not all patients diagnosed with acute myocardial infarction have their lipid profile checked. This is in line with previous study, which stated that 5 people with CHD had high total cholesterol levels, much less than 13 people with normal total cholesterol levels.

In contrast to study at the Cardiac Polyclinic at Ahmad Yani Hospital Metro Lampung, it was shown that 62 respondents suffered from dyslipidemia and obtained a statistical test result of p-value = 0.000, where dyslipidemia was related to the incidence of Acute Coronary Syndrome(14).

Dyslipidemia causes damage to the blood vessel endothelium. If endothelial death occurs as a result of oxidation, it causes an inflammatory response. Where the angiotensin II response causes impaired vasodilation and triggers a prothrombic effect involving platelets and coagulation factors. This produces a protective response where lesions will form fibro-fatty and fibrous, inflammation-driven atherosclerotic plaques. The plaque that occurs can become unstable and rupture, resulting in Acute Coronary Syndrome. Increased levels of triglycerides and small particles of LDL are very significant risk factors for myocardial infarction because decreased levels of HDL-C and increased triglycerides cause metabolic disorders that have detrimental consequences for the individual(20,21).

This study was in line with study on installation of the Cardiovascular and Brain Centre (CVBC) RSUP Prof. DR. R. D. Kandau Manado obtained study results namely $p = 0.000 < 0.005$(4,22). Smoking is a major risk factor for heart disease, including heart attack and stroke, and also has a strong association with acute myocardial infarction. So, quitting smoking will reduce the risk of heart attack. Cigarettes contain dangerous substances such as nicotine, CO, and oxidative gas. Most of these substances (around 90%) are quickly metabolized by the liver and then excreted through the kidneys. The remaining amount of the substance will remain in the bloodstream for 6-8 hours. Because it takes a long time and not all substances that enter the body are metabolized, people who smoke for a long time and in large quantities cause a build-up of these substances. Prolonged accumulation of nicotine, CO, and oxidative gases causes increased lipolysis, increased fibrinogen, and decreased NO release(11,19,23)

The findings in this study also showed that more smoking patients had a history of STEMI. Based on the results of study at Sidoarjo District Hospital, the results showed that 24 respondents were diagnosed with STEMI, of which 15 respondents had heavy smoking behaviour, 5 respondents did not smoke, and 3 people had smoking behaviour. In smokers, the blood that should carry oxygen is replaced by carbon monoxide(19). Smoking can cause an increase in the concentration of cholesterol, triglycerides, and low-density lipoprotein (LDL). Excessive LDL will accumulate over time and will harden and can narrow the lumen of the

arteries, causing damage to the walls of the coronary arteries which will lead to acute myocardial infarction or elevation myocardial infarction (STEMI)(7). In addition, blood which should carry oxygen is replaced by carbon monoxide as a result of smoking behaviour. The longer this happens and the greater the quantity of cigarettes consumed, the more content will accumulate in the coronary arteries which can lead to acute myocardial infarction, such as in patients diagnosed with STEMI(12,24).

Conclusions

Based on the results of study that risk factors for acute myocardial infarction, the following conclusions were obtained the majority of acute myocardial infarction patients are aged ≥ 55 years, male, accompanied by hypertension, diabetes mellitus, and dyslipidemia, and do not have a history of smoking. There is a significant relationship between hypertension, diabetes mellitus, smoking, and the incidence of AMI, but there was no significant relationship between dyslipidemia and the incidence of AMI.

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