The Relationship between Hypertension and Myocardial Infarction at Haji General Hospital Medan in 2019

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Abstract:- **Myocardial infarction is known as a heart attack. It is a state of the formation of necrotic areas in the myocardium from occlusion of the coronary artery. In 2018, the estimated 17.3 million deaths in the world are caused by cardiovascular disease, especially coronary heart disease or myocardial infarction. One of the major risk factors of myocardial infarction is hypertension. The purpose of this study was to determine the relationship between hypertension and myocardial infarction at Haji General Hospital Medan in 2019. This type of research is an analytic study with cross sectional design with a sample of 47 people who were taken with total sampling and test bivariate selected is the Chi Square test.**

The results showed that 40.4% of myocardial infarction patients ≥65 years old, 61.7% of patients with myocardial infarction male gender, 44.7% of myocardial infarction patients are diagnosed as STEMI, 72.3% of patients suffering from hypertension and myocardial infarction there is a significant relationship between hypertension and myocardial infarction with a probability value (p) = 0.002.

Keywords:- *Myocardial Infraction, Hypertension, RSU Haji Medan.*

I. INTRODUCTION

More than 36 million people die from Non-Communicable Diseases (NCD) or about 63% of all deaths every year. Globally, NCD is the number one cause of death every year is cardiovascular disease. Cardiovascular disease is a disease caused by disorders of heart and blood vessel function such as coronary heart disease, heart failure, hypertension and stroke.(1)

Myocardial infarction, known as a heart attack, is a condition in which the formation of areas of necrosis in the myocardium due to coronary artery occlusion.

In 2018, it was estimated that 17.3 million deaths in the world were caused by cardiovascular disease. The deaths caused by cardiovascular disease, especially coronary heart disease and stroke are expected to continue to increase to reach 23.3 million deaths in 2030. (1)

The prevalence of coronary heart disease in Indonesia in 2018 based on doctor's diagnosis was 0.5% or an estimated 883,447 people, while based on doctor's diagnosis/symptoms, it was 1.5% or estimated at around 2,650,340 people. (2)

In North Sumatra Province, the estimated number of people with coronary heart disease based on doctor's diagnosis is 44,698 people or 0.5%, while based on diagnosis/symptoms as many as 98,336 people or 1.1 %. (2)

One of the main risk factors for coronary heart disease, especially myocardial infarction, is hypertension. Hypertension is the most common condition in primary care and can lead to myocardial infarction, stroke, kidney failure and death if it is not detected early and treated appropriately (1).

Hypertension can cause the damage to blood vessels walls, thereby accelerating the accumulation of atherosclerotic plaque which is the cause of myocardial infarction. Uncontrolled hypertension is also called the "*silent killer*" sometimes has no symptoms so that unconsciously it has damaged the arteries, heart and other organs. (3)

Hypertension or high blood pressure is an increase in arterial pressure above the value of 140/90 mmHg. In 2019 World Health Organization (WHO) report it is stated that hypertension is a risk factor that ranks first as the leading cause of death in the world. More than one billion people in the world are affected by hypertension, and nearly three-quarters of this number or about 636 million live in developing and developing countries with limited health care facilities and poor awareness of controllers. Therefore, the prevalence of hypertension is predicted to increase by 60% or around 1.56 billion in 2025. (4)

The complications of hypertension cause about 9.4 million deaths worldwide each year. Hypertension causes at least 45% of deaths due to heart disease and 51% of deaths due to stroke.(1)

The prevalence of hypertension in the United States is estimated at 28.6% in 2017 to 2018. (4)

The prevalence of hypertension in Indonesia obtained by measuring blood pressure at the age of 18 years is 26.5%. The prevalence of hypertension in North Sumatra Province itself is 24.7%. There was an increase in the prevalence of hypertension based on the interviews (whether diagnosed by a health worker and taking antihypertensive medication) from 7.6% in 2017 to 9.5% in 2018. (2)

The prevalence of hypertension continues to increase every year, from the initial survey that has been carried out, the incidence of coronary heart disease including high blood pressure in the Cardiology section of Haji General Hospital Medan in 2019 and there is no research data linking hypertension with the incidence of myocardial infarction at Haji General Hospital Medan in 2019. Therefore, researchers are interested in conducting research on the relationship between hypertension and the incidence of myocardial infarction at Haji General Hospital Medan in 2019.

Based on the description of the background above, the problem in this study is whether there is a relationship between hypertension and the incidence of myocardial infarction at Hajj General Hospital Medan in 2019?

II. RESEARCH METHODOLOGY

The type of research used in this study is an analytical study with a cross-sectional *cross-sectional* research design, namely by observing the incidence of myocardial infarction and assessing its relationship with hypertension. *Cross sectional* design is a research design in which the data collection or the variables to be studied are in the form of dependent and independent variables, assessed simultaneously at one time in this study through medical records. The main advantage of the *cross sectional* design is that this design is relatively easy, inexpensive and the results can be obtained quickly and can be used to study many variables at once.

This research was carried out from February to March in 2020, with the installation of medical records at Haji General Hospital Medan on Rumah Sakit Haji Street, Medan Estate. The population is the whole of the research subjects. The population that will be used in this study comes from secondary data, namely the medical records of patients suffering from myocardial infarction from January to December in 2019 at Haji General Hospital Medan. Based on data from the medical record section at Haji General Hospital Medan in 2019, there were 47 patients suffering from myocardial infarction.

The sample is part of the population which is selected in a certain way so that it is considered to be able to represent the population. The sample of this study was all patients suffering from myocardial infarction at Haji General Hospital Medan from January to December in 2019, totaling 47 people. In this study, the sample size was determined using the *total sampling* technique.

Sampling in this study is not based on chance (non-probability sampling). In this study, we will use *total sampling* technique, namely a sampling technique when all members of the population are used as samples. The sample that will be used in this study comes from secondary data, namely the medical records of patients suffering from myocardial infarction from January to December in 2019 at Haji General Hospital Medan.

The independent variable (independent, causal, risk) is a variable which, if it changes, it will result in a change in the dependent variable. The independent variable in this study was hypertension.

The dependent variable (dependent, effect, result, *outcome*) is a variable whose value will change with the changes in the independent variable. The dependent variable in this study is myocardial infarction.

The data used in this study is only the secondary data, namely the results of the medical records of patients with myocardial infarction from January to December in 2019 at Haji General Hospital Medan. This data was obtained from the Medical Records section of Haji General Hospital Medan then the data to be studied were patients who had hypertension. The required medical record data is printed and entered into the *checklist form* that has been provided.

All data that has been transferred to the *checklist form* is then processed using a computer program in accordance with the research objective, namely to determine the relationship between hypertension with the patients diagnosed with myocardial infarction. Data analysis methods used in this study include: Univariate analysis is used to describe data such as mean, median, mode, proportion and so on. Univariate analysis in this study is each variable in the frequency distribution table. Bivariate data analysis was used to state the analysis of two variables, namely one independent variable and one dependent variable that was suspected to be related. The normality test of the data was using the Shapiro-Wilk test because the number of research samples was less than 50 samples, if the significance is < 0.05, it can be concluded that the myocardial infarction data is not normally distributed. Therefore, the chosen bivariate test is the *Chi Square* Test. The *Chi-Square* test, also known as the Kai Square test, is a non-parametric statistical test that uses two variables. With a nominal size scale and can also be used to assess the association between two variables using cross tabulation. *Chi-Square* test at a significant level = 0.05, if $p > 0.05$ then Ho is accepted while Ha is rejected. If $p < 0.05$ then Ho is rejected or failed to be accepted, while Ha is accepted.

III. RESEARCH RESULT

The description of the characteristics of the patients suffering from myocardial infarction which observed were age, gender, ECG features, level of hypertension and the proportion of patients with myocardial infarction who had hypertension. The description of the characteristics of

patients with myocardial infarction can be seen in the following table.

Table 1 Frequency Distribution of Patients with Myocardial Infarction based on Age		
Age	Frequency	Percentage (%)
< 45 years old	3	6,4
45-54 years old	11	23,4
55-64 years old	14	29,8
≥65 years old	19	40,4
Total	47	100

Based on table 1, it can be seen that the age frequency of patients with myocardial infarction is the most aged ≥65 years old as many as 19 people (40.4%), followed by the age group 55-64 years old with 14 people (29.8%), the age group 45- 54 years old as many as 11 people (23.4%) and the least is the age group <45 years old, as many as 3 people (6.4%).

Table 2 Frequency Distribution of Myocardial Infarction Patients based on Gender		
Gender	Frequency	Percentage (%)
Male	29	61,7
Female	18	38,3
Total	47	100

Based on table 2, it was found that the patients suffering from myocardial infarction with male gender were the most patients, amounting to 29 people (61.7%) while the patients in female gender only amounted to 18 people (38.3%).

Table 3 Frequency Distribution of Myocardial Infarction Patients Based on ECG Features		
EKG Features	Frequency	Percentage (%)
Unrecorded	17	36,2
NSTEMI	9	19,1
STEMI	21	44,7
Total	47	100

Based on table 3, it can be seen that the patients suffering from myocardial infarction who have an ECG features as STEMI are 21 people (44.7%), while the patients with myocardial infarction with an unrecorded ECG features are 17 people (36.2%) and the most Few were the patients with myocardial infarction who were diagnosed with NSTEMI as many as 9 people (19.1%).

Table 4 Distribution of the frequency of hypertension against the patients with myocardial infarction		
Hypertension	Frequency	Percentage (%)
Hypertension (+)	34	72,3
Hypertension (-)	13	27,7
Total	47	100

Based on table 4, it was found that there were 34 patients with myocardial infarction who also suffered from hypertension (72.3%) while those who did not suffer from hypertension were 13 people (27.7%).

Table 5 Frequency Distribution of Myocardial Infarction Patients Based on Hypertension Level		
Hypertension Level	Frequency	Percentage (%)
Normotension	10	21,3
Prehypertension	3	6,4
Hypertension grade I	14	29,8
Hypertension grade II	20	42,6
Total	47	100

Based on table 5, it can be seen that the frequency of patients with myocardial infarction based on the highest level of hypertension is hypertension grade II, which is 20 people (42.6%) followed by hypertension grade I as many as 14 people (29.8%), who have normal blood pressure or normotension as many as 10 people (21.3%) and the least is prehypertension as many as 3 people (6.4%).

The results of the data normality test in this study are as follows.

Table 6 Data Normality Test						
	Kolmogorov-sminov			Shapiro-Wilk		
	Statistics	Df	Sig.	Statistics	df	Sig.
Myocardial Infarction	453	47	,000	,560	47	,000

Based on table 6 above, through the Shapiro-Wilk test, the significance value for myocardial infarction is 0.000, where if the significance value is <0.05, it can be concluded that the myocardial infarction data is not normally distributed. Therefore, the bivariate test chosen in this study is the *Chi Square* Test which is a non-parametric statistical test.

The following are the results of statistical analysis of the relationship between hypertension and myocardial infarction.

Table 7 Relationship between hypertension and myocardial infarction			
Hypertension	Myocardial Infarction		P Value
	F	%	
Hypertension (+)	34	72,3	
Hypertension (-)	13	27,7	0,002
Total	47	100	

Based on table 7 regarding the relationship between hypertension and the incidence of myocardial infarction through statistical tests using the *Chi Square* test, it shows

that there is a significant relationship between hypertension and the incidence of myocardial infarction with a probability value (p) = 0.002 where if the p value <0.05 then Ho is rejected or failed to be accepted while Ha was accepted.

IV. RESEARCH DISCUSSION

Sample Characteristics Based on Age

The research results on the sample characteristics based on age according to table 1, it was found that the frequency of the age of myocardial infarction patients was the most aged 65 years old as many as 19 people (40.4%) and the least was the age group < 45 yearsold , namely 3 people (6.4%).

With the increasing age, a person will get older as well as parts of the human body including the heart so that it decreases the ability to function properly and when combined with risk factors such as hypertension, this has the potential to increase the occurrence of myocardial infarction.

Myocardial infarction, like other diseases of the heart and blood vessels, has both modifiable and irreversible risk factors. There are three biological risk factors that cannot be changed, namely age, gender and family history. The association between age and onset of myocardial infarction may reflect longer exposure to atherogenic factors. The incidence of myocardial infarction caused by atherosclerotic plaques is not a sudden event, but its formation takes a long time. The formation of atherosclerosis begins at an early age, namely since childhood and it progresses progressively and in old age, it leads to arterial blockage which results in heart muscle death or myocardial infarction. (5)

Sample Characteristics Based on Gender

Based on table 2, it was found that the patients suffering from myocardial infarction with male gender were the most patients, amounting to 29 people (61.7%) while female patients only amounted to 18 people (38.3%).

In the United States, symptoms of myocardial infarction or coronary heart disease before the age of 60 years are found in one in five men and one in seventeen women. This means that men have a risk of coronary heart disease two to three times greater than women. (6)

The incidence rate of myocardial infarction is higher in men than in women, but after menopause, there is almost no difference in the incidence between men and women. This difference is due to a hormonal process in which the female hormone estrogen affects the atherosclerosis process through various mechanisms. (7) Estrogen provides a protective effect against risk factors for myocardial infarction such as increasing HDL cholesterol levels, lowering LDL cholesterol levels and total cholesterol and increasing postprandial lipid metabolism. Estrogen also has an acute vasodilator effect on blood vessels walls and an atero protective effect including the inhibition of smooth muscle cell proliferation so that at the age before menopause, the incidence of myocardial infarction is more common in men.

Furthermore, the risk of myocardial infarction in women and men is the same after menopause. In addition, things that affect the high risk for the male gender to the incidence of myocardial infarction are multifactorial where smoking habits, hypertension, stress factors and lack of physical activity are more experienced by men.(7)

Sample Characteristics Based on ECG Features

Based on table 3, it can be seen that the patients suffering from myocardial infarction diagnosed as STEMI were 21 people (44.7%), while the least were the patients with myocardial infarction diagnosed with NSTEMI, namely 9 people (19.1%). The results of this lipid profile greatly affect the process of atherosclerosis formation which will take place more quickly in the STEMI type so that it will cause sudden occlusion (blockage) in coronary blood flow. If the blockage causes total coronary artery occlusion (100% occlusion), the patient will have *ST Elevated Myocardial Infarction* (STEMI) and the electrocardiogram (ECG) will find ST segment elevation in two or more leads facing certain areas of the heart. If the blockage is non-occlusive (not 100%), it is called Non *ST Elevated Myocardial Infarction* (NSTEMI) and on the ECG picture there is no ST segment elevation. (8)

Characteristics of Hypertension against the Patients with Myocardial Infarction

Based on table 4, it was found that there were 34 patients with myocardial infarction who also suffered from hypertension (72.3%) while those who did not suffer from hypertension were 13 people (27.7%).

These results support the theory that hypertension is one of the causes of myocardial infarction. High blood pressure and setting cause direct trauma to the walls of coronary arteries, thus facilitating the occurrence of coronary atherosclerosis. This causes angina pectoris, coronary insufficiency and myocardial infarction more common in hypertensive patients than normal people. (9)

Complication that occurs in essential hypertension is usually due to the changes in arterial and systemic arterial structure, especially in untreated cases. At first there will be hypertrophy of the tunica media which is followed by local hyalinization and thickening of the fibrosis of the tunica intima and eventually narrowing of blood vessels will occur. The most dangerous place is when it affects the myocardium, systemic arteries and arteries, coronary and cerebral arteries and blood vessels of the kidneys.(10)

Sample Characteristics Based on Hypertension Level

Based on table 5, it can be seen that the frequency of patients with myocardial infarction based on the highest level of hypertension is hypertension grade II, which is 20 people (42.6%) followed by hypertension grade I as many as 14 people (29.8%), who have normal blood pressure or normotensive as many as 10 people (21.3%) and the least is prehypertension as many as 3 people (6.4%).

High blood pressure usually causes stretching that can injure the endothelium, especially in the branching or bend

areas. Repeated injury causes inflammation which ultimately facilitates the formation of atherosclerosis plaque with all its consequences. The Framingham's study in the United States for 18 years old on the patients with angina pectoris and myocardial infarction aged 45-75 years old found that systolic hypertension was a triggering factor for angina pectoris and myocardial infarction. The study also found that hypertensive patients with myocardial infarction had three times greater mortality than normotensive patients with myocardial infarction. The results of the Framingham's study also found a relationship between myocardial infarction and diastolic blood pressure. The incidence of myocardial infarction was twice as large in the diastolic blood pressure group of 90-100 mmHg compared to the diastolic blood pressure of 85 mmHg, while the diastolic blood pressure of 105 mmHg increased to four times greater. (11)

Relationship between Hypertension and Myocardial Infarction

Based on table 6 above regarding the relationship between hypertension and the incidence of myocardial infarction, 34 patients with myocardial infarction also suffer from hypertension (72.3%) while those who do not suffer from hypertension are 13 people (27.7%). Here it can be seen that there is a significant relationship between hypertension and the incidence of myocardial infarction through statistical tests with *Chi Square* test with probability value (p) = 0.002. The results of this study indicate that hypertension experienced by a person can affect the occurrence of myocardial infarction in himself.

Hypertension increases the risk of atherosclerosis two to three times greater than people with normal blood pressure. Reducing systolic pressure by 12-13 mmHg alone can reduce the risk of developing myocardial infarction by 21%

Complication of the heart due to hypertension that most often occur are left ventricular failure due to hypertrophy of the ventricles and coronary heart disease such as angina pectoris and myocardial infarction. From several studies, it was found that ± 50% of patients with myocardial infarction suffer from hypertension and 75% of left ventricular failure is caused by hypertension. Increased systemic blood pressure increases resistance to pumping of blood from the left ventricle, as a result ventricular hypertrophy occurs to increase the force of contraction The need for oxygen by the myocardium will increase due to the hypertrophy of the ventricles, resulting in an increase in the workload of the heart which will eventually lead to angina and myocardial infarction.In addition, an increase in blood pressure greatly accelerates the process of atherosclerosis formation, high and persistent blood pressure will cause direct trauma to the walls of the coronary arteries, thus facilitating the occurrence of coronary atherosclerosis (coronary factor) so that rupture and the occlusion of blood vessels occur 20 years earlier than normotensive people. This causes angina pectoris, coronary insufficiency and myocardial infarction which is more common in hypertensive patients than normal people. (12)

V. CONCLUSIONS AND SUGGESTIONS

Based on the results of research that has been conducted regarding the relationship between hypertension and the incidence of myocardial infarction at Haji General Hospital Medan in 2019, it was concluded that myocardial infarction patients aged 65 years were the most, namely 19 people (40.4%). Myocardial infarction patients with male gender were the most patients, amounting to 29 people (61.7%). Myocardial infarction patients diagnosed as STEMI were the most, amounting to 21 people (44.7%). There were 34 patients with myocardial infarction who also suffered from hypertension (72.3%). There is a significant relationship between hypertension and the incidence of myocardial infarction with a probability value (p) = 0.002.

As suggestion for the health services, especially Haji General Hospital Medan so that they can improve the health service program planning in providing care facilities for the patients with myocardial infarction and hypertension. By increasing the role of medical students as prospective doctors to further understand about myocardial infarction and hypertension according to their competence so that later they can become primary care doctors who are able to treat the patients with myocardial infarction and hypertension so that later it is expected to reduce the incidence of these diseases. This research is expected to be a guideline or source of information for further research and expand the scope of the research. It is highly recommended to every reader who is over 20 years old to do regular blood pressure checks, this is to avoid the risk of atherosclerosis which can cause myocardial infarction in the future.

RESEARCH LIMITATIONS

Limitations in this study are related to the incidence of myocardial infarction as the dependent variable where there are modifiable and irreversible risk factors for myocardial infarction. The independent variable in this study as one of the modifiable risk factors for myocardial infarction is hypertension. Myocardial infarction most often occurs in someone aged over 45 years with various comorbidities such as hypertension, high cholesterol, diabetes mellitus, kidney failure, heart failure and others. It is very difficult to obtain the data of the patients with myocardial infarction who only have comorbid hypertension. Therefore, it is expected for further research to conduct research with a research design that can further refine this research, for example by using a *case control* or *cohort* design so that the results which are obtained can be more accurate.

REFERENCES

[1]. Williams B, Mancia G, Spiering W, Rosei EA, Azizi M, Burnier M, et al. 2018 practice guidelines for the management of arterial hypertension of the European society of cardiology and the European society of hypertension ESC/ESH task force for the management of arterial hypertension. Vol. 36, Journal of Hypertension. 2018. 2284–2309 p.

[2]. Kemenkes RI. Hasil Riset Kesehatan Dasar Tahun 2018. Kementrian Kesehat RI. 2018;53(9):1689–99.

[3]. Park HW, Kang MG, Kim K, Koh JS, Park JR, Jeong YH, et al. Long-term prognosis and clinical characteristics of patients with newly diagnosed diabetes mellitus detected after first acute myocardial infarction: From KAMIR-NIH registry. Korean Circ J. 2018;48(2):134–47.

[4]. Benjamin EJ, Muntner P, Alonso A, Bittencourt MS, Callaway CW, Carson AP, et al. Heart Disease and Stroke Statistics-2019 Update: A Report From the American Heart Association. Vol. 139, Circulation. 2019. 56–528 p.

[5]. Swamy NA, et al. Clinical profile of myocardial infarction in elderly of rural population. MedPulse Int J Med. 2019;12(3):131–4.

[6]. Ruiz-Meana M, Boengler K, Garcia-Dorado D, Hausenloy DJ, Kaambre T, Kararigas G, et al. Ageing, sex, and cardioprotection. Br J Pharmacol. 2020;177(23):5270–86.

[7]. Nadar SK, Lip GYH. The heart in hypertension. J Hum Hypertens [Internet]. 2021;35(5):383–6. Available from: http://dx.doi.org/10.1038/s41371-020-00427-x

[8]. Ibanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J. 2018;39(2):119–77.

[9]. Bahall M, Seemungal T, Legall G. Risk factors for first-time acute myocardial infarction patients in Trinidad. BMC Public Health. 2018;18(1):1–8.

[10]. Hayashi R, Iso H, Yamagishi K, Yatsuya H, Saito I, Kokubo Y, et al. Working hours and risk of acute myocardial infarction and stroke among middle-aged japanese men: The Japan public health center-based prospective study cohort II. Circ J. 2019;83(5):1072–9.

[11]. Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, Prabhakaran D, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75(6):1334–57.

[12]. Canto JG, Kiefe CI, Rogers WJ, Peterson ED, Frederick PD, French WJ, et al. Number of coronary heart disease risk factors and mortality in patients with first myocardial infarction. JAMA - J Am Med Assoc. 2011;306(19):2120–7.