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THE RELATIONSHIP BETWEEN HISTORY OF HYPERTENSION AND ISCHEMIC ELECTROCARDIOGRAM FINDINGS IN CHRONIC HEART FAILURE PATIENTS

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ABSTRAK

Gagal jantung adalah kondisi di mana jantung tidak mampu memompa darah secara efektif ke seluruh tubuh akibat adanya gangguan struktur dan fungsi jantung. Gagal jantung merupakan salah satu komplikasi serius dari hipertensi yang dapat mempengaruhi aktivitas listrik jantung dan menghasilkan abnormalitas pada elektrokardiogram (EKG). Penelitian ini bertujuan untuk mengetahui hubungan antara riwayat hipertensi dengan gambaran abnormalitas elektrokardiogram pada pasien gagal jantung kronik. Penelitan ini menggunakan desain potong lintang (cross-sectional) dengan menggunakan data primer yaitu rekam EKG dan hasil rekam EKG diinterpretasikan oleh satu orang ahli. Populasi pada penelitian ialah seluruh pasien gagal jantung kronik di Poliklinik Jantung Rumah Sakit Muhammadiyah Palembang yang telah memenuhi kriteria inklusi dan eksklusi. Hasil penelitian didapatkan 30 sampel, mayoritas pasien gagal jantung kronik memiliki riwayat hipertensi sebanyak 25 orang (83,3%). Hasil uji statistik fisher exact test antara riwayat hipertensi dan gambaran abnormalitas EKG didapatkan nilai p = 0,622 (p > 0,05). Hal ini menandakan tidak terdapat hubungan antara riwayat hipertensi dengan gambaran iskemik elektrokardiogram pada pasien gagal jantung kronik.

ABSTRACT

The Relationship Between a History of Hypertension with Abnormal Ischemic Electrocardiogram Findings in Chronic Heart Failure Patients. Heart failure is a condition in which the heart is unable to pump blood effectively throughout the body due to structural and functional impairments. It is a serious complication of hypertension, which can affect the heart's electrical activity and lead to abnormalities on electrocardiograms (ECG). This study aimed to determine the relationship between a history of hypertension and ECG abnormalities in chronic heart failure patients. This study used a cross-sectional study design, using primary data from ECG recordings, and ECG recording results interpreted by one expert. The study population included all chronic heart failure patients at the Cardiology Clinic of Muhammadiyah Palembang Hospital who met the inclusion and exclusion criteria. A total of 30 samples were analyzed. Among the patients, 25 (83,3%) had a history of hypertension. The results of the Fisher Exact Test statistical test between history of hypertension and abnormal ECG images obtained a value of p = 0,622 (p > 0.05). These findings indicate no association between a history of hypertension with ECG ischemic in chronic heart failure patients.

INTRODUCTION

Cardiovascular disease remains a serious challenge as it is the leading cause of death among non-communicable diseases, according to World Health Organization (WHO) data from 2021. In that year, cardiovascular diseases accounted for 20.5 million deaths, affecting more than half a billion people worldwide.[2] In Indonesia, the number of deaths due to cardiovascular diseases reaches 651,481 annually. Various types of cardiovascular diseases include hypertension, heart failure, coronary heart disease, stroke, and others. [3]

Heart failure is a condition in which the heart is unable to pump blood effectively due to structural and functional abnormalities, leading to increased intracardiac pressure or decreased cardiac output. [4] According to Global Health Data Exchange 2020, there were 64.34 million cases of congestive heart failure, with an incidence rate of 8.52 per 1,000 population. [5] In Indonesia, congestive heart failure is the second leading cause of death after stroke. The 2018 Basic Health Research (RISKESDAS) recorded a prevalence of congestive heart failure of 1.5%, equivalent to approximately 1,017,290 diagnosed cases and prevalence of hypertension in individuals aged ≥18 years in Indonesia was 34.1%. Moreover, hypertension contributed to 427,218 deaths in Indonesia.[6]

Electrocardiography (ECG) is a supporting diagnostic tool for both acute and chronic heart failure.[7] ECG abnormalities are associated with a history of hypertension.[8] According to a study conducted by Nikolaidou, the most common ECG abnormalities in heart failure patients include left ventricular hypertrophy, prolonged PR interval, atrial fibrillation, pathological Q waves, and Left Bundle Branch Block (LBBB).[9]

Most etiology of heart failure is ischemic heart diseases. Hypertension is one of risk factor of ischemic heart diseases. Chronic heart failure can be a condition resulting from ischemia.[10] ECG in heart failure patient describe various of structural abnormalities and etiology of heart failure. ECG pattern of ischemic heart diseases include ST-T wave changes, pathological Q waves. Otherwise, most of patient with hypertension associated with left ventricle hypertrophy pattern in their ECG.[11] Therefore, ischemic ECG pattern in patient heart failure with hypertension show the mechanism related to ischemia. The aim of this study to describe relationship between history of hypertension and ischemic ECG finding in heart failure patient.

METHOD

This design of this study is observational with a cross-sectional approach. The study was conducted at the Cardiology Clinic of Muhammadiyah Hospital Palembang from November to December 2024. The variables examined include the history of hypertension in patients with chronic heart failure and electrocardiographic findings, categorized into ischemic and non-ischemic types. ECG was interpreted by one expert. ECG pattern of ischemic heart diseases include ST-T wave changes and pathological Q waves. The sample was selected using purposive sampling. Inclusion criteria were patients with chronic heart failure who were willing to participate, had accessible ECG records, and met other specified criteria. Patients with conditions such as tremors, and psychiatric disorders were excluded from the study. History of hypertension were collected through interview and ECG recordings were performed with standart procedure. Data analysis included univariate analysis for frequency distribution and variable characteristics, as well as bivariate analysis using Fisher's Exact test to examine the relationship between hypertension history and ECG

abnormalities, with a significance level of $p < 0,05$. This study had been approved by ethical committee of Muhammadiyah Medical Faculty with number 089/FC/KBHKI/FK-UMP/XI/2024.

RESULT

The distribution of chronic heart failure patients by age at the Cardiology Clinic of Muhammadiyah Hospital Palembang indicates that the largest group is aged between 45 and 55 years, accounting for 9 patients (30%). A smaller group of patients, 2 individuals (6,7%), are under 45 years of age, while 5 patients (16,7%) fall within the 56-60 year range. In addition, the mean of age are over 62 years old, demonstrating that chronic heart failure is more commonly seen in middle-aged to elderly patients at this clinic.

In terms of gender distribution, of the total 30 chronic heart failure patients, a significant majority are male, with 25 patients (83,3%), while female patients represent a smaller proportion, with only 5 patients (16,7%). This shows a clear gender disparity in the occurrence of chronic heart failure at this clinic, with men being more affected than women.

Regarding the history of hypertension, the majority of the patients have hypertension, with 25 patients (83,3%) reporting a history of high blood pressure and duration more than 5 years (70%). This suggests a strong association between hypertension and chronic heart failure in this patient population.

Finally, when analyzing electrocardiogram (ECG) findings in relation to a history of hypertension, it was observed that a majority of patients with a hypertension history (70%, or 21 patients) displayed ischemic patterns on their ECG, while the remaining 9 patients (30%) showed non-ischemic patterns. This finding indicates that ischemic changes are more prevalent among chronic heart failure patients with hypertension, reinforcing the relationship between the two conditions.

Table 1. Frequency Distribution of Heart Failure Patients Based on Characteristics (Age and Gender), History of Hypertension, and Electrocardiogram Abnormalities

Variable	Frequency	Percentage
Age		
< 45	2	6,7%
45-55	9	30%
56-60	5	16,7%
61-65	2	6,7%
66-70	8	26,7%
> 70	4	13,3%
Mean	62 years old	
Gender		
Male	25	83,3%
Female	5	16,7%
History of Hypertension		
Yes	25	83,3%
No	5	16,7%
Hypertension duration		
<5 tahun	21	70%
>=5 tahun	9	30%

Electrocardiogram Abnormalities		
Ischemic	21	70%
Non Ischemic	9	30%

The statistical analysis using the Fisher's exact test yielded a p-value of 0,622 (p > 0,05). Since the p-value is greater than 0,05, this indicates that there is no significant relationship between a history of hypertension and electrocardiogram abnormalities in chronic heart failure patients at the Cardiology Clinic of Muhammadiyah Hospital Palembang (Table 2).

Table 2. Relationship Between History of Hypertension and Electrocardiogram Abnormalities

History of Hypertension	Electrocardiogram Abnormalities				p-Value*
	Ischemic		Non Ischemic		
	n	%	n	%	
Yes	18	72	7	28	
No	3	60	2	40	0,622
Total	21	70	9	30	

*Fisher Exact Test

DISCUSSION

The results of this study indicate that the distribution of chronic heart failure patients at the Cardiology Clinic of Muhammadiyah Hospital Palembang shows that the majority of patients fall within the age range of 45-55 years. This finding is consistent with the study conducted by Susilo (2021), which revealed that most heart failure patients are between 46-65 years old. As age increases, the risk of developing heart failure rises due to the natural decline in heart function associated with the aging process.[12] Additionally, congestive heart failure (CHF) is more commonly observed in individuals over 40 years old, which is linked to structural changes in blood vessels caused by atherosclerosis. This condition can obstruct blood flow to the heart, leading to an imbalance between myocardial oxygen demand and supply, thereby contributing to the progression of cardiovascular disease.[13]

Chronic heart failure patients at the Cardiology Clinic of Muhammadiyah Hospital Palembang are predominantly male. This finding is consistent with a study conducted by Hamzah (2016), which stated that the majority of chronic heart failure patients are male. This difference can be attributed to the role of estrogen in females, which has a protective effect against cardiovascular diseases. Estrogen helps maintain blood vessel function and reduces the risk of heart damage, providing women with greater protection against heart failure during their productive years. However, after entering menopause, estrogen levels decline, leading to an increased risk of heart failure in older women. Meanwhile, men are more susceptible to this condition from around the age of 50, as they do not have the same hormonal protection.[14]

The majority of chronic heart failure patients at the Cardiology Clinic of Muhammadiyah Hospital Palembang are known to have a history of hypertension. Hypertension plays a crucial role in the development of heart failure, particularly chronic heart failure, as highlighted in a study by.[15] The Framingham Heart Study revealed that hypertension leads to heart failure in 91% of patients over 20 years old, with the risk being twice as high in men and three times as high in women with hypertension. Similar findings were reported in the study by Waty & Hasan (2020) at H. Adam Malik

General Hospital in Medan, which showed that most cases of heart failure are caused by hypertension, reinforcing the role of hypertension as a primary risk factor for the onset of heart failure.[16]

Hypertension triggers the body to activate compensatory mechanisms, such as thickening of the ventricular walls and abnormal accumulation of collagen fibrils. This process results in an increase in the mass of the left ventricular muscle, leading to reduced elasticity, impaired relaxation capacity, and filling of the left ventricle. As a consequence, diastolic dysfunction occurs, which over time can progress to heart failure with preserved ejection fraction.[17]

Among the 30 patients based on history of hypertension, the majority showed ischemic patterns on their electrocardiogram (ECG), with 21 patients (70%) exhibiting ischemic changes and 9 patients (30%) showing non-ischemic changes. This indicates that most chronic heart failure patients with a history of hypertension have ischemic findings on their ECG. In total, 30 cases with various ECG abnormalities were observed among patients with chronic heart failure. These findings contrast with the study by Taufikurrahman *et al*. (2019) conducted at the Internal Medicine Clinic of RS H. Damanhuri Barabai, which focused on ECG patterns in patients with electrical disturbances in the heart. The study concluded that common ECG findings include changes in heart structure and arrhythmias, often referred to as non-ischemic conditions, such as left ventricular hypertrophy (LVH) and atrial fibrillation. Hypertension, when sustained over time, can lead to changes in the myocardium, blood vessels, and the heart's electrical conduction system.[18] These alterations trigger conduction disturbances, left atrial enlargement, and impairments in both systolic and diastolic functions, which contribute to the occurrence of atrial fibrillation.[19]

The statistical analysis using the Fisher's exact test yielded a p-value of 0,622 ($p > 0,05$). Since the p-value is greater than 0,05, this indicates that there is no relationship between a history of hypertension and electrocardiogram abnormalities in chronic heart failure patients at the Cardiology Clinic of Muhammadiyah Hospital Palembang. According to Taufikurrahman *et al*. (2019), hypertension is one of the main factors that trigger ventricular enlargement, abnormal blood flow in coronary arteries, and both systolic and diastolic dysfunction, collectively referred to as Hypertensive Heart Disease (HHD), which can potentially lead to heart failure. When left ventricular hypertrophy occurs, the myocardium requires more oxygen to function. This is consistent with the study conducted by Taufikurrahman which stated that the electrocardiogram (ECG) findings in heart failure patients caused by hypertension typically show structural changes in the heart, such as left ventricular hypertrophy (non-ischemic) rather than ischemic pattern.[18] This suggests that there is no relationship between a history of hypertension and ischemic ECG findings. The lack of a relationship between a history of hypertension and electrocardiogram abnormalities in this study may be attributed to the use of antihypertensive medications, which can reduce left ventricular mass and prevent a decrease in oxygen supply to the heart, thus preventing ischemic ECG changes.[20]

CONCLUSION

There is no relationship between a history of hypertension and ischemic electrocardiogram findings in chronic heart failure patients. It is necessary to optimize routine screening programs in order to detect risks at an earlier stage.

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