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ANALYSIS OF RISK FACTORS FOR THE INCIDENCE OF CONGESTIVE HEART FAILURE (CHF) IN CENTRAL SULAWESI: A HOSPITAL-BASED STUDY

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ABSTRACT

Background: Congestive Heart Failure (CHF) is a serious non-communicable disease (NCD) that has an increasing prevalence in Indonesia. Several risk factors may explain the development of the disease.
Aim: The aim of the research to examine the risk factors that may contribute to the incidence such as comorbid hypertension, hypercholesterolemia, smoking habits, and family history of heart disease.
Methods: The method using case-control study enrolled 96 participants (case: 48 patients CHF, control: 48 patients non-CHF) with purposive sampling method. Data analysis was performed using univariate and bivariate analysis. Risk analysis was performed using odd ratio test.
Results: The highest risk factor was hypertension (OR=3.3; 95%CI=1.448-7.785; p=0.004). Hypercholesterolemia (OR=2.8; 95%CI=1.236-6.665; p=0.013), smoking behavior (OR=2.8; 95%CI=1.221-6.423; p=0.013), and family history (OR=2.3; 95%CI=1.040-5.498; p=0.038) had relatively similar risk contributions to the incidence of CHF.
Conclusion: This was a hospital-based study that found that factors such as hypertension, hypercholesterolemia, smoking habits, and family history are risks for CHF. Hypertension was a major contributor to the incidence of CHF.

Key words: Congestive Heart Failure (CHF), risk factors, hypertension, Indonesia.

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INTRODUCTION

Noncommunicable diseases (NCDs) kill more than 36 million people every year [1]. By 2030, it is estimated that three-quarters of all deaths worldwide will be caused by NCDs. Of the total deaths from NCDs, 45% are caused by cardiovascular diseases, accounting for 17.7 million of the total 39.5 million deaths [2]. Based on data from the Global Health Data Exchange (GHDE), the incidence rate of congestive heart failure in 2020 will be 64.34 million cases of congestive heart failure, or 8.52 per 1000 people diagnosed with heart failure worldwide [3]. The risk of death from congestive heart failure is 5-10% per year in mild congestive heart failure and continues to increase to 30-40% in severe congestive heart failure [4]. Indonesia is the fourth country in Southeast Asia with the highest number of heart failure patients after the Philippines, Myanmar and Laos [5]. This number is predicted to be the second leading cause of death in Indonesia after stroke. Based on diagnosis and symptoms, heart failure was highest in North Kalimantan (2.2%), while Central Sulawesi itself ranked third with a prevalence of 1.9% [6].
The heart is responsible for pumping blood throughout the body. The performance of this organ is optimal when the heart muscle, heart valves, and pumping rhythm are in good condition. If there is an abnormality in any of the heart's components, it can cause a disturbance in the process of the heart pumping blood, resulting in failure of the blood pump. Heart failure is a condition in which the heart cannot pump enough blood to meet the body's needs. Congestive heart failure is both right heart failure and left heart failure [7].
Congestive Heart Failure (CHF) is defined as a complex set of symptoms caused by structural and functional abnormalities of the heart [8]. Factors that increase the risk of developing CHF include age, gender, history of hypertension, blood cholesterol levels, smoking history, alcohol consumption, family history, genetic factors, and nonadherence to treatment. Smoking is a risk factor for heart disease. Smoking accelerates the heart rate, reduces the heart's ability to transport and

deliver oxygen, lowers the level of HDL-C (good cholesterol) in the blood, and causes activation of platelets, the blood clotting cells [9]. Smoking is also a contributing factor to high blood pressure. The incidence of hypertension is six times higher in people with heart failure than in those without high blood pressure [10]. High serum cholesterol levels (hypercholesterolemia) are also a risk factor for CHF because they can trigger the formation of atherosclerosis. Coronary atherosclerosis can lead to abnormalities in myocardial function due to impaired blood flow to the heart muscle [11].

According the high number of CHF incidence in Central Sulawesi [6], the aim of the study was to investigate the risk factors that may contribute to the incidence. Meanwhile, the risk factors that would be examined in the current study were have been reported in previous studies such as comorbid hypertension, smoking habits, family history of heart disease and hypercholesterolemia [8-11]. However, as our best knowledge, the research of CHF incidence in Central Sulawesi currently limited and this would be study that help to enrich information about the disease.

METHODS

Design, participants, and setting

This was a case-control study in which the case was defined as a patient with a diagnosis of CHF and the control was defined as patient without any symptoms of or diagnosed as CHF. The case and control were gender matched with a sample ratio of 1:1. Therefore, the case was 48 people and the control was also 48 people with a total of 96 participants. The sample was collected by purposive sampling method. This study enrolled the participants from outpatient record in cardiac unit/poly in Undata Hospital, Central Sulawesi Province from December 2022 - February 2023. This research was approved by the Ethics Committee of the Faculty of Public Health.

Medical Records

Patient data, including all required variable information, such as comorbid (i.e., hypertension), hypercholesterolemia, smoking behavior, and family history, were obtained from medical records. Hypertension was defined as systolic blood pressure of 140 mmHg and diastolic blood pressure of 90 mmHg (high risk: ≥ 3 recorded hypertensions; low risk: <3 recorded hypertensions). Hypercholesterolemia defined as total body cholesterol above the threshold (high risk: ≥240 mg/dl; low risk: <240 mg/dl). Smoking behavior was defined as the respondent's cigarette consumption habit (high risk: smoking/active smoker; low risk: non-smoker). Family history was the information about family members or relatives who had been diagnosed with or had ever experienced CHF (high risk: had family history; low risk: no family history).

Statistical analysis

The necessary data is then extracted from medical records and entered into data software for analysis. The analysis was performed in univariate and bivariate level. The characteristic of the variables analyzed with univariate by frequency (n) and prencetage (%). Meanwhile, the bivariate analysis was performed using chi-square test and the risk factor analysis was performed using odd ratio (OR) test with confidence interval (CI) 95% or alpha (α) 0.05. Statistical analysis was performed using IBM SPSS for Windows, version 25.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Table 1. Characteristics of Respondents

Characteristics	Frequency (n=96)	Percentage (%)
Age (years)		
24-31	1	1.0
32-39	3	3.1
40-47	6	6.3
48-55	16	16.7
56-63	32	33.3
64-71	24	25.0
72-79	8	8.3
80-87	6	6.3
Sex		
Male	58	60.4
Female	38	39.6

Table 1 shows that the dominant age characteristics of the respondents were in the age group 56-63 years, namely 32 people (33.3%) and most were male, 58 people (60.4%).

Table 2. Variables characteristics

Characteristics	Frequency (n=96)	Percentage (%)
Hypertension		
High	52	54,2
Low	44	45,8
Hypercholesterolemia		
High	56	58,3
Low	40	41,7
Smoking behavior		
High	52	54,2
Low	44	45,8
Family history		
High	53	55,2
Low	43	44,8

A total of 52 people (54.2%) of the patients who received outpatient care at the cardiac clinic of Undata Hospital had a high risk of hypertension, 56 people (58.3%) had a high risk of hypercholesterolemia, 52 people (54.2%) had a high risk of smoking behavior, and as many as 53 people (55.3%) had a family history of CHF (Table 2).

Table 3. Proportion of variables and odd-risk analysis between case and control

Variables	CHF		p-value	OR (95%CI)
	Case (n=48)	Control (n=48)		
Hypertension				
High	33 (68.8)	19 (39.6)	0.004	3.3 (1.448 –7.785)
Low	15 (31.3)	29 (60.4)		
Hypercholesterolemia				
High	34 (70.8)	22 (45.8)	0.013	2.8 (1.236 – 6.665)
Low	14 (29,2)	26 (54.2)		
Smoking behavior				
High	32 (61.5)	20 (38.5)	0.013	2.8 (1.221 – 6.423)
Low	16 (36.4)	28 (63.6)		
Family history				
High	33 (58.9)	23 (41.1)	0.038	2.3 (1.040 – 5.498)
Low	15 (37.5)	25 (62.5)		

CHF= Congestive Heart Failure

Table 3 shows that the proportion of cases with high risk of hypertension (68.8%), hypercholesteremia (70.8%), smoking behavior (61.5%) and family history of CHF (58.9%) was higher compared to controls, where all variables were significant (p<0.05) risk factors for CHF. The highest risk factor was hypertension (OR=3.3; 95%CI=1.448-7.785; p=0.004). Hypercholesteremia (OR=2.8; 95%CI=1.236-6.665; p=0.013), smoking behavior (OR=2.8; 95%CI=1.221-6.423; p=0.013), and family history (OR=2.3; 95%CI=1.040-5.498; p=0.038) had relatively similar risk contributions to the incidence of CHF.

DISCUSSION

This study aims to provide an observational view of the risk factors for the incidence of CHF in Undata Hospi-

tal, Central Sulawesi Province. It was found that hypertension, hypercholesterolemia, smoking behavior and family history were significant risk factors for CHF.

There is an association between people who have a history of high blood pressure and the incidence of CHF. Someone who has hypertension is more likely to be diagnosed with congestive heart failure (CHF). This is in line with research conducted by Priandani which shows that as many as 40 respondents (74.1%) of patients with hypertension suffer from CHF where there was a relationship between high blood pressure and CHF conditions with a risk of 4.0 times [12]. Blood pressure is a significant prognostic factor for the development of heart failure. Blood pressure is an indicator of cardiac health. In heart attack patients, high blood pressure increases the workload on the heart, while low blood pressure indicates that the heart is failing [13]. Many factors cause high blood pressure, one of which is sodium intake [14,15]. The food consumption pattern of people in Central Sulawesi, which is mostly a type of food that comes from marine sources and is high in sodium, has the potential to cause hypertension. High blood pressure can cause enlargement and stiffness of the heart muscle, making it difficult for the heart to pump blood effectively. This can cause weakness in the heart and eventually lead to heart failure. The high workload of the heart along with increased blood pressure can also cause the left ventricular wall to contract, so a person with a history of hypertension may be more likely to develop CHF than those without a history of hypertension [12,13,16,17].

There is a significant relationship between hypercholesterolemia and the incidence of congestive heart failure (CHF). Individuals who have hypercholesterolemia are more at risk of being diagnosed with CHF. This is consistent with research conducted by Halimmudin, which shows that there is a significant relationship between high cholesterol levels in a person (hypercholesterolemia) and the incidence of CHF [18]. Hypercholesterolemia causes problems, especially in the blood vessels and the brain. When cholesterol levels in the body exceed normal limits, it causes atherosclerosis. Arterial walls that experience atherosclerosis become thick and stiff due to increased cholesterol deposits, so they go through a process of contraction, stiffness, and inflexibility, and harden so that there is a blockage in the blood vessels [17,19,20]. Hypercholesterolemia is caused by the patient's tendency to eat high-fat foods [21-23]. Excessive eating habits have a high risk of hypercholesterolemia. Not a few typical foods in Palu City contain high fat such as coconut milk, this is what makes Palu City residents not a little affected by high cholesterol, and lack of exercise makes cholesterol increase faster. Reducing the intake of high fat foods and exercising more often are good efforts to reduce the risk of high cholesterol. Persistent high cholesterol also causes changes in blood viscosity, or blood thickening. This condition has an effect on increasing vascular resistance and causes an increase in blood pressure and hemodynamic problems, thereby increasing the state of complications and increasing vascular retention. In addition, there can be a decrease in blood circulation and cause clinical symptoms, namely easy fatigue in activities and increased risk factors for mortality in congestive heart failure (CHF) patients [17,18].

There is an association between smoking behavior and the incidence of CHF. People who smoke are more likely to be diagnosed with congestive heart failure (CHF) than people who do not smoke. This is in line with research conducted by Priandani, which shows the results that respondents who smoke the majority are diagnosed with CHF. The study also found that people who smoke are 4.8 times more likely to be diagnosed with CHF than people who do not smoke [12]. Smoking is one of the risk factors for CHF because cigarettes contain nicotine, which stimulates the heart to work faster and can increase blood pressure, and CO_2 absorbs more oxygen in the blood. Smoking can worsen the situation in the blood vessels, leading to blockages in the blood vessels. Cigarettes are one of the risk factors that can trigger the occurrence of cardiovascular disease, when cigarettes are consumed continuously and for a long time can cause CHF [24,25].

There is a significant relationship between family history of heart disease and the incidence of CHF. People with a family history are more likely to be diagnosed with CHF than people without a family history. This is consistent with research conducted by Yunita, which found that the majority of respondents with a family history also have CHF [26]. This study is also consistent with research conducted by Purbianto, who found a significant relationship between family history and the incidence of CHF, with a 4.2-fold risk [27]. The presence of a family history of heart disease may increase the risk of developing atherosclerosis. Family history can also reflect strong environmental factors, such as lifestyle and dietary habits, and when a family member has a family history of heart disease caused by an unhealthy cholesterol profile, it is often passed on from one generation to the next [28]. The factor of bad lifestyle habits is very influential, such as smoking or unhealthy eating habits that are passed down from one generation to the next [29]. Because the lifestyle of the next generation in a family also plays a role in increasing the experience of heart disease. Based on the above explanation, the researcher concludes that someone who has a family history of heart disease also has a higher risk of developing CHF compared to those who do not have a family history of heart disease.

CONCLUSION

This study was a hospital-based study which found factors such as hypertension, hypercholesterolemia, smoking behavior and family history are risks for CHF. Hypertension was a major contributor to the incidence of CHF.

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