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Exercise Habits and Family Disease History as Determinant of Activity Intolerance and ECG Patterns of Patients with Acute Coronary Syndrome (ACS)

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ABSTRACT

Acute Coronary Syndrome (ACS) occurs due to blockage of coronary blood vessels which causes a decrease in oxygen flow and advanced conditions has an impact on physical activity. Factors associated with activity intolerance and ECG patterns suc as: sex, age, education, history of previous illnesses, exercise habits, family history of illness. The study involved all patients diagnosed with NSTEMI in the ICCU room at RSUD Dr. Harjono, a sample of 30 respondents was selected using a consecutive sampling technique. This research was analyzed by multivariate analysis. The result of this research showed that factors that influence the tolerance of the activities of patients with coronary heart disease were sports habits and a history of previous illnesses. The respondent's habit of exercising affected the complaints that arise during the activity (each p-value was less tha 0.05). As conclusion, factors that affect the activity intolerance of coronary heart disease patients are physical exercise habits and family history of disease.

Keywords: determinant factors; activity intolerance; ECG patterns; acute coronary syndrome

INTRODUCTION

Diseases that cause prolonged myocardial ischemia and result in death of the heart muscle (myocardial infarction), herein after known as acute coronary syndrome (ACS) or acute coronary syndrome [(1)]. ACS occurs due to inadequate oxygen flow to the heart muscle due to fault/occlusion of the coronary arteries [(2)]. The decrease in oxygen supply will have an impact on daily activities (activity daily living) from light to heavy activities. In addition, it also causes ventricular contraction failure and continues to decrease cardiac output which is characterized by hemodynamic instability [(3)].

Based on the predictions of the American Heart Association about the prevalence of disease in Asia will be dominated by heart and blood vessel disease [(1)]. World Health Organization (WHO) supports this by mentioning that more than 17 million deaths are caused by heart disease. Indonesia, through Riskesdas 2018 recorded that 1.5% or 15 out of 1,000 of its population suffer from ACS [(4)]. Prevalence of ACS cases in East Java province in 2013 based on doctor's diagnosis was 0.5% or around 144,279 patients [(5)]. In 2016 RSUD Dr. Harjono Ponorogo reported a number of 237 cases/year (an average of 32 cases/month) of ACS patients undergoing inpatient treatment in the ICCU Room. Whereas in 2017, there were 256 cases or an average of 21 cases/month [(6)]. The results of Ryandini's research conducted at National Cardiovascular Center Harapan Kita were 31 patients with cardiovascular disorders, 55% of whom were diagnosed with ACS. As many as 40% of this number, experience activity intolerance to carry out daily activities [(7)].

Acute Coronary Syndrome (ACS) which occurs due to obstruction of the coronary arteries and causes ischemia in the heart muscle due to reduced blood flow and oxygen, 40% of that amount, experiencing activity intolerance to carry out daily activities [8]. The imbalance between the supply and demand for oxygen in the coronary arteries causes the patient to experience dyspnea/tachypnea and chest pain. This occurs due to the accumulation of lactic acid production and the occurrence of anaerobic metabolism [9]. The end result of anaerobic metabolism is energy of 2 ATP per 1 glucose molecule from the normal energy requirement of 36 ATP (aerobic metabolism). The effects that appear on the patient are weakness and fatigue (activity intolerance) and disturbances in carrying out activities from mild to severe levels [10].

In the event of an acute attack, ACS patients are required to rest/immobilize to reduce the workload of the heart and minimize oxygen demand [11]. After the condition is stable, there are no complaints of chest pain within 8 hours after the attack, there are no signs of heart failure and significant ECG changes with abnormal rhythms, then the ACS patient should undergoing early mobilization [12]. However, in this condition, heart patients tend to be afraid to do activities and prefer to bed rest. This condition can have a negative impact on the patient [13].

Nurses in the cardiac intensive care unit need to provide intervention for post-attack physical rehabilitation programs in ACS patients [14]. This exercise program is useful for evaluating the patient's hemodynamic response, which can be seen from complaints during activity (respiratory, shortness of breath), pulse rate, oxygen saturation, blood pressure, energy level and cardiac recording (ECG) [15]. Every exercise activity in every phase of the physical rehabilitation program will have the effect of changing on the patient's hemodynamics, including tachycardia, hypotension, decreased SvO2 [16]. Patients who experience tolerance to activity and show decreased physiological signs of activity intolerance [10]. This is indicated by the outcome criteria or outcomes according to the SLKI including: decreased pulse frequency, decreased fatigue complaints, dyspnea during decreased activity, dyspnea after decreased activity, improved blood pressure and improved ECG ischemia [15].

Activity intolerance and ECG patterns of ACS patients are influenced by several factors, namely: disease process factors, energy levels, age and development, circulatory status, neurological, psychological [17]. The various factors that influence activity intolerance and the ECG patterns in ACS patients indicate that nurses need to determine the problems. So they can modify or provide special and optimal treatments and able to analyze nursing diagnoses for patients. Previous research related to the topic of this research is the influence of increased activity tolerance based on hemodynamic status in Patienst Coronary Hearth Disease After Physical Rehabilitation of Phase I (Inpatient) [18]. Novelty of this study compared to previous research is to describe the factors that influence activity intolerance and the pattern of ECG picture.

The importance of the nurse's role in identifying the determinants or the most influence factors in the activity intolerance levels and the ECG patterns of ACS patients were formulated in this study: What are the determinants that affect activity intolerance and the ECG patterns in Acute Coronary Syndrome (ACS) patients?. The purpose of this paper is to provide an overview of the determinant factors that affect activity intolerance in ACS patients in the ICCU room of RSUD Dr. Harjono Ponorogo.

METHODS

This research was observational analytic without control group. The population in this study were all ACS patients in the NSTEMI category who were undergoing inpatient treatment in the ICCU room at RSUD Dr. Harjono Ponorogo in Juli – October 2019. A sample of 30 respondents was taken using a consecutive sampling technique that met the following inclusion criteria: patients with ACS in the post-attack NSTEMI category who had been declared stable by the doctor in charge, the patient was conscious, and willing to be involved as respondents. Patients with exclusion criteria: systolic blood pressure >150 mmHg, fever >37,5 ºC, ACS patients with musculoskeletal problems (weakness/paralysis/disability), tachycardia (pulse >130 beats/min), Congestive Heart Failure (CHF) functional class III- IV. While the drop out criteria were: NSTEMI patients who experienced weakness during phase I exercise activities, patients who suddenly appeared complaints of peripheral insufficiency during phase I activity exercises, ECG changes during rehabilitation (SVT, AV Block, VES, VT), when performed during exercise, there was an increase in systolic BP >20 mmHg.

Interview used questionnaire to collect the data. After the data was collected, the data was then tested for normality and homogeneity tests were found to be not normally distributed. Furthermore, the test of multiple linear regression analysis was performed.

RESULTS

Characteristics of Respondent

Characteristics of respondents in this study aims to describe respondents based on several characteristics such as: Sex, Age, Education, Disease History, Sports Habits, Family Disease History.

Table 1. Characteristics of respondent in the ICCU Room of RSUD Dr. Harjono Ponorogo

Characteristics of respondent	Frequency	Percentage
Sex		
Man	13	43.3
Woman	17	56.7
Age		
46-55 years old	17	56.7
56-64 years old	6	20.0
>65 years old	7	23.3
Education		
No school	4	13.3
Basic education (SD, SMP)	24	80.0
Secondary education (SMA)	2	6.7
College (Diploma/Bachelor)	0	0.0
Past medical history		
Hypertension	6	20.0
Diabetes mellitus	5	16.7
Stroke	0	0.0
Others (asthma, osteoporosis)	19	63.3
Sports Habits		
Routine	0	0.0
Not a routine	5	16.7
Never	25	83.3
Family disease history		
Hypertension	9	30.0
Diabetes mellitus	5	16.7
ACS	2	6.7
Others (asthma/stroke/bone)	14	46.6

Table 1 shows that the gender of the respondents 56.7% was female, the age of the respondents was 56.7% in the late elderly category, the education level of the respondents was 80.0% in basic education, while for a history of previous diseases 63.3% had experienced stroke/asthma/bone/etc., for exercise habits a total of 83.3% of respondents stated that they had never done sports, and for a family history of disease as many as 46.6% of respondents in their family had asthma/stroke/lung disease, etc.

Table 2. Characteristics of respondents to complaints during activity (shortness of breath, respiration rate)

Variable	β	t	p
(Constant)		1.214	0.238
Sex	0.101	0.530	0.602
Age	-0.084	-0.396	0.696
Education	0.176	0.781	0.443
Past medical history	-0.259	-1.194	0.245
Sports habits	0.471	2.381	0.026
Family disease history	0.056	0.291	0.774

Table 2 describes that there was no influence between the general data characteristics of respondents on the results of the complaint variable felt during activities because the p-value >0.05. Except for exercise habits (p-value <0.05).

Table 3. Characteristics of respondents to systolic blood pressure

Variable	β	t	p
(Constant)		5.682	0.000
Sex	-0.112	-0.590	0.561
Age	0.164	0.780	0.444
Education	-0.055	-0.249	0.806
Past medical history	-0.228	-1.059	0.438
Sports habits	-0.216	-1.104	0.282
Family disease history	0.467	2.467	0.022

Based on table 3, it can be seen that the general data characteristics of the respondents had no effect on the results of the systolic blood pressure variable because the p-value >0.05. Except for the characteristics of family history of disease that have an influence on systolic blood pressure (p-value <0.05).

Table 4. Characteristics of respondents to diastolic blood pressure

Variable	β	t	p
(Constant)		5.724	0.000
Sex	-0.341	-1.822	0.082
Age	-0.329	-1.585	0.127
Education	-0.016	-0.070	0.944
Past medical history	0.385	1.765	0.091
Sports habits	0.074	0.383	0.706
Family disease history	0.327	1.749	0.094

Table 4 describes that the general data characteristics of the respondents had no effect on the results of the diastolic blood pressure variable because the p-value >0.05.

Table 5. Characteristics of respondents to oxygen saturation

Variable	β	t	p
(Constant)		7.672	0.000
Sex	-0.097	-0.458	0.651
Age	-0.318	-1.349	0.191
Education	-0.167	-0.665	0.513
Past medical history	-0.113	-0.458	0.651
Sports habits	-0.024	-0.109	0.914
Family disease history	-0.119	-0.557	0.583

Based on table 5, it can be seen that the general data characteristics of the respondents had no effect on the results of the oxygen saturation variable (SaO_2) because the p-value wass >0.05.

Table 6. Characteristics of respondents to heart rate (pulse rate)

Variable	β	t	p
(Constant)		4.845	0.000
Sex	-0.040	-0.188	0.853
Age	0.020	0.085	0.933
Education	0.077	0.310	0.760
Past medical history	0.341	1.388	0.179
Sports habits	-0.085	-0.391	0.700
Family disease history	0.214	1.012	0.322

Table 6 shows that the general data characteristics of the respondents had no effect on the results of the heart rate variable because the p-value was >0.05.

Table 7. Characteristics of respondents to energy level (length of exercise ability)

Variable	β	t	p
(Constant)		2.063	0.051
Sex	-0.043	-0.205	0.840
Age	-0.332	-1.440	0.164
Education	-0.065	-0.265	0.794
Past medical history	0.237	0.979	0.338
Sports habits	-0.011	-0.051	0.960
Family disease history	0.080	0.385	0.704

Table 7 describes that the general data characteristics of the respondents had no effect on the results of the energy level (the length of exercise ability) because the p-value was >0.05.

Table 8. Characteristics of respondents to ECG pattern

Variabel	β	t	p
(Constant)		2.279	.033
Sex	-.034	-.158	.876
Age	-.071	-.297	.770
Education	-.057	-.226	.823
Past medical history	-.375	-1.502	.147
Sports habits	.052	.234	.817
Family disease history	-.060	-.280	.782

Based on table 8, the characteristics of the respondents had no effect on the results of the ECG pattern variables because the p-value was >0.05.

DISCUSSION

The results of the study, in table 1, show that the characteristics of female respondents are slightly higher (56.7%) than male respondents. Menopausal women (over 50 years old), have a high risk of developing coronary heart disease. This is due to the drop in estrogen levels which functions to protect blood vessels and an increase in LDL cholesterol in the body, thereby increasing the risk of heart problems. The American Heart Association (AHA) reports that more than 1/3 of cardiovascular disease (coronary heart) occurs in adult women.

The respondent's age (56.7%) belongs to the category of early elderly age (46-55 years). The prevalence of coronary heart disease increases five times at the age of 40-60 years, because the function of the heart has decreased (vasoconstriction of blood vessels) which reduces blood flow to the heart muscle which in the long term causes necrosis of the heart muscle. The risk of plaques build up in the walls of arteries often occurs with aging. Aging is also closely related to total cholesterol levels in the blood (hypercholesterolemia), which narrowing or blockage the blood vessels which increasing in blood pressure and causing coronary heart disease.

Past/previous medical history experienced by respondents such as Hypertension (20.0%) and Diabetes Mellitus (16.7%). High blood pressure contributes 10.09 times (95% CI 8.48-12.01) at risk for coronary heart disease (Susilawati, Ghani, & Novriani, 2016). Hypertension causes the heart pumps and pushes blood into the arteries harder, so that the heart muscle becomes thick and bulky. The impact is a decrease in vascular elasticity which causes rhythm and heart rate disturbances. Diabetes mellitus in adults has a 2-4 times greater risk of developing heart disease. Diabetes mellitus accelerates tissue degeneration and dysfunction of the endothelium, causing thickening of the basement membrane of vascular capillaries and coronary arteries which results in constriction of blood flow to the heart [(19)].

Multivariate analysis with multiple linear regression between respondent characteristics and activity tolerance (complaints during activity, systolic/diastolic blood pressure, oxygen saturation, heart rate, energy level) and ECG images have no effect on the results of activity tolerance variables and ECG images, except for the characteristics of exercise habits. effect on complaints of activity (shortness of breath/breathing frequency) with p-value 0.026 (p-value<0.05). In addition, the characteristics of family history of disease also affect the systolic blood pressure of CHD patients with a p-value of 0.022 (p-value <0.05).

Physical exercises have an impact on changes in cardiac output and redistribution of blood supply from inactive organs to active organs [(20)]. Physical exercise makes a person have the ability to inspire longer, but it is also able to remove more metabolic waste through expiration. This is because the muscles in the area around the lungs are trained to do more work [(21)]. During physical activity, muscles need adequate oxygen as fuel so that energy distribution is smooth and stable. The way to increase oxygen reserves is to increase the respiratory rate and it is correlated with an increase in the vital capacity of the lungs. This proves that respondents who have a habit of doing physical activity have a tendency not to get tired easily and do not complain of shortness of breath when doing cardiac physical rehabilitation programs. Regular activity will lower systolic blood pressure, reduce levels of catecholamine hormones, cholesterol and blood fats circulating in the circulation and increase levels of HDL, a lipoprotein that improves coronary circulation [(22)].

Previous Disease History (Diabetes mellitus) tends to develop atherosclerosis at an earlier age than those without a history of DM. This is because insulin which is in charge of metabolizing fat cannot perform its function optimally, causing cholesterol levels in serum to increase, and lipoprotein levels to be lower in patients with diabetes mellitus.

CONCLUSION

Based on result of this study, factors that affect the activity intolerance of coronary heart disease patients are physical exercise habits and family history of disease. Physical exercise affect complaints during activities (complaints of shortness of breath and an increase in breathing frequency). Family history of disease related to

blood pressure. Health workers (nurses and doctors), need to include physical exercise since being hospitalized (inpatient) until the time of rehabilitation at home so that ACS patients do not complain of shortness of breath and fatigue. In addition, ACS patients with family members suffering from the same disease need to be screened regularly and increase promotive and preventive efforts.

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