Effect of Progressive Muscle Relaxation on Blood Pressure Reduction in Hypertensive Patients

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***Abstract*—Hypertension is one of the most influential risk factors for the incidence of heart disease and blood vessels. The purpose of this study to determine the effect of progressive muscle relaxation on blood pressure decrease in hypertensive patients. This study aims to determine the effectiveness of progressive muscle relaxation to decrease blood pressure. This study using a quasy experimental design, by non equivalent control group. Fifty sample were recruited by consecutive sampling with the criteria that they had hypertension with systolic blood pressure ≥140-160 mmHg and/or diastolic blood pressure ≥90 - 100 mmHg, aged <60 years. Sample divided into 2 groups. The treatment group was given progressive muscle relaxation for 3 consecutive days and measured the systolic and diastolic blood pressure. Data were analyzed by Paired t test, wilcoxon sign rank test, Independent t test, and Mann Whitney test with significance level of 95%. The result showed that there was significant effect of progressive muscle relaxation on decreasing systolic blood pressure (p=0.00) but not for diastolic blood pressure (p=0.39). The progressive muscle relaxation effective to decrease blood pressure on hypertensive patient. Suggested nurses apply this intervention in helping to lower the patient's blood pressure.**

***Keywords*—blood pressure, hypertension,muscle, relaxation**

I. INTRODUCTION

The high incidence of hypertension in Indonesia is a result of hypertension becoming a public health problem. Hypertension is one of the most influential risk factors for the incidence of heart disease and blood vessels [1]. The prevalence of hypertension in the population aged 18 years and over according to data riskesdas in 2014 in Indonesia was 31.7% [1]. Based on the annual report of all hospitals in East Java Province in 2012 most cases of inpatients in public hospitals type A are hypertension [2].

Preliminary study in the last 1 year the number of outpatient hypertension patients in Lawang Hospital were totally about 3267 people. Treatment in hypertensive patients is pharmacological therapy, such as diuretic, sympathetic, beta-blocker and vasodilator medications,and not yet applied nonpharmacologic therapy for patients with hypertensionRisk factors that occur in primary hypertension include age, sex, family disease history, obesity, smoking, high saltintake, alcohol consumption, and emotional stress [3].

Hypertension is often called the silent killer because the disorder in hypertension in the early stages is asymptomatic, but can result in permanent damage to vital organs. Prolonged vasoconstriction of blood vessels can result in permanent damage to the kidneys. In addition to damage to the kidneys, hypertension can also result in permanent damage to the brain and heart [4].Uncontrolled patterns of living behavior can increase the risk of long-term complications of the cardiovascular disease in hypertensive patients, such as myocardial infarction, heart failure, stroke,renal failure, and early mortality[3].

The management of hypertension can be used with pharmacology and non-pharmacology. Pharmacologic treatment consists of administering diuretic, sympathetic, beta-blocker and vasodilator drugs that have side-effects of decreased cardiac output. While non-pharmacological handling is a treatment that includes weight loss, regular exercise, low-salt diet and fat and complementary therapies [6]. Complementary therapy is widely used to treat hypertension because it is natural and does not cause harmful side effects. Complementary therapies that are natural therapeutic treatments includeherbal therapy, nutrition therapy, progressive muscle relaxation, meditation, laughter therapy, acupuncture, aroma therapy, and reflexology. Complementary therapies to treat hypertension include progressive muscle relaxation therapy, music therapy, aerobic and yoga aerobics [5].

Jacobson's progressive muscle relaxation is a skill that can be learned and used to reduce or eliminate tension and experience comfort without depending on things or subjects outside of himself. Jacobson progressive muscle relaxation can help lower blood pressure in patients with hypertension, insomnia and asthma and can fight anxiety, stress or tension with tense or relaxed muscles so that one can eliminate muscle contraction and become relaxed [6]. The rationale of this exercise method is the control of the nervous system contained in the body of the central nervous system and autonomic nervous system. At the time a person experiences tension and anxiety the nervous system that works is the sympathetic nervous system which is the autonomic nervous subsystem, so the heart rate, blood pressure, the number of breathing, the blood flow to the muscle, the dilation of the pupil often increases.

II. METHODS

1) Research Ethics

Data were collected after obatining permission from Ethic commission of State Health Polytecnic of Malang.

Informed consent was performed to the respondents. They were explained about the objective of this study, the procedure, and the data collection process. They were also asked to sign informed consent form. The respondents could withdraw anytime they want from this study. Confidentiality was the most important thing to maintain for the respondents in this study.

2) Population and sample

Fifty hypertensive patients in the outpatient clinic Lawang Hospital were recruited by consecutive sampling on July 2017. The inclusion criteria for sample were as follows:

1) people who had hypertension with systolic blood pressure ≥140 - 160 mmHg and / or diastolic blood pressure ≥90 - 100 mmHg

2) people aged <60 years. Exclusion criteria for sample were respondents who have a history of heart disease complications. Sample divided into 2 groups by random allocation, 25 respondents as treatment group, and 25 others as control group

3) Intervention

The treatment group was given progressive muscle relaxation 3 times with interval of 1 day (1 day practice, 1 day break etc). Each exercise is given for 15-20 minutes. Blood pressure is taken every before and after progressive muscle relaxation

4) Collecting data procedure

Digital sphygmomanometer that has been calibrated was used to measure the blood pressure.The determination of treatment or control group is based on the time of meeting with the respondent. The first respondent will be treated as the treatment group until 25 people are reached, then the next 25 people will be the control group. Treatment group was given progressive muscle training 3 times with interval of 1 day (1 practice day, 1 rest day). Each exercise is given for 15-20 minutes. Initial blood pressuremeasurements (pre-test) are performed every time before progressive muscle exercises are given, as well as the final post-test blood pressure measurements performed after each progressive muscle workout.

The criteria of blood pressure (JNC VIII) as follows:

- Normal: Systolic <120 mmHg, diastolic <80mmHg
- Pre-Hypertension: Systolic 120-139 mmHg, diastolic 80-89 mmHg
- HypertensionStage I: systolic 140-159 mmHg, diastolic 90-99 mmHg
- HypertensionStage II: systolic >160 mmHg, diastolic >100 mmHg

5) Data Analysis

Normality test data was done before determining statistical test using Spahiro-Wilk test. To analyze the difference systolic blood pressure before and after test, we used Paired T test, and we used Wilcoxon Sign Rank test for diastolic blood pressure. Independent Sample T Test were using to analyze the difference systolic blood pressure between treatment group and control group use and use Mann Whitney test for diastolic blood pressure.

III. RESULT

1) Characteristic of Respondents

This studyshows that some of characteristic observed from respondent, as follow:

TABLE 1 : CHARACTERISTICS OF CONTROL AND TREATMENTGROUP'S RESPONDENTS

SubjectCharacteristic	Control		Treatment	
	n	Percentage (%)	n	Percentage (%)
Gender				
Male	3	12	5	20
Female	22	88	20	80
Age (years old)				
46-55	1	4	24	96
>55	24	20	1	4
Smoking Background				
Yes	3	12	4	16
No	22	88	21	84
Hypertension Family's Background				
Have	12	48	11	44
Don't Have	13	52	14	46
Anti Hypertensive Drug				
Valsartan	25	100	25	100

The observation showed that systolic blood pressure in treatment group and control group in pre-test varied. The highest variation was on the 3rd day, the difference was 4.4 mmHg higher in the treatment group. The mean systolic blood pressure of the treatment group on the pre-test at 3 consecutive days was 150.5 mmHg while the control group 150.6 mmHg (Figure 1). Figure 1 shows the mean diastolic blood pressure group in the pretest for 3 consecutive days higher than the control group. The biggest difference on day 2 is 1.9 mmHg. The mean diastolic blood pressure of treatment group on the pre-test at 3 consecutive day measurements was 89.0 mmHg while the control group 88.2 mmHg.

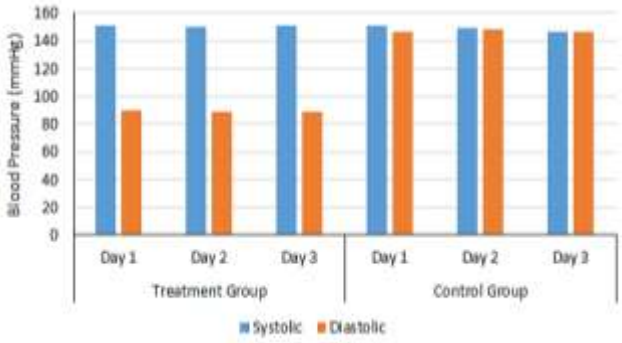

Figure 1. Mean of systolic and diastolic blood pressure at pretest

Figure 2 shows the mean systolic blood pressure for treatment group in posttest for 3 consecutive days was lower than control group by difference of 6.4-8.4 mmHg. The mean systolic blood pressure of the treatment group at post-test at 3 consecutive days was 139.9 mmHg while the control group 148.7 mmHg. The mean diastolic blood pressure of treatment group in posttest for 3 consecutive days was lower than control group with difference of 2.2 – 5,5 mmHg. The mean diastolic blood pressure of the treatment group on the post-test at 3 consecutive day measurements was 83.5 mmHg while the control group 87.5 mmHg.

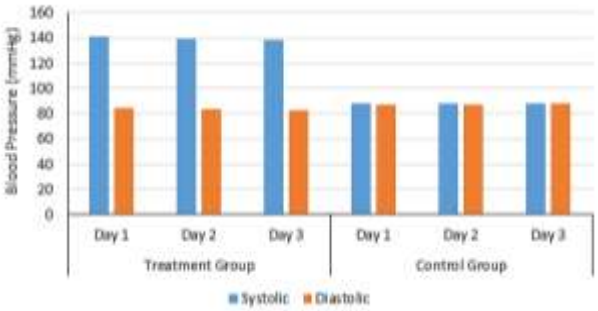

Figure 2. Mean of systolic and diastolic blood pressure at posttest

The systolic blood pressure data are all normally distributed, while the diastolic blood pressure data are all not normally distributed. The results of different systolic blood pressure test in the treatment group and control group between pre-test and post-test using paired-t-test both obtained p = 0.00 (<0.05) which means there is a significant difference pressure systolic blood in the treatment group between pre-test and post-test. The results of different diastolic blood pressure test in the treatment group group between before and after the progressive muscle relaxation action using Wilcoxon sign rank test obtained p = 0.00 (<0.05) and control group obtained p= 0.002 (< 0.05) which means there is a significant difference pressure systolic blood in the treatment group between before and after test.

Based on the independent sample t test, there was no difference in systolic blood pressure between the treatment group and the control group on the pre-test with p = 0.944 (>0.05) means that was a significant difference in systolic blood pressurebetween the treatment group and the control group on the post-test with a value of p = 0.00(<0.05). The different test with independent t test obtained p value = 0.39 meaning there is no significant difference between treatment group and control group in pre-test, in other words diastolic blood baseline data of both groups are the same.

IV. DISCUSSION

A person will be said to have hypertension when having systolic blood pressure ≥ 140 mmHg and / or diastolic blood pressure ≥ 90 mmHg, on repeated examination. Systolic blood pressure is the main measurement on which to determine the diagnosis of hypertension. The division of the severity of hypertension in a person is one of the basic determination of hypertensive management. The cause of hypertension has not been ascertained in more than 90 percent of cases. In cases where there is absolutely no obvious cause or factor, hypertension is known as primary hypertension [7]. There are several factors that may increase the risk, according states the risk factors that occur include age, gender, family history, obesity, serum lipids, smokers and diets contain lots of fat, and emotional stress [8]. Age factor is very influential on hypertension because with increasing age then the higher risk of hypertension. Incidence of hypertension increases with age. This is often caused by a natural change in the body that affects the heart, blood vessels and hormones. Hypertension in people aged less than 35 years will increase the incidence of coronary artery disease and premature death [9].

Adult blood pressure increases with age, in elderly the systolic blood pressure increases with respect to decreased elasticity of blood vessels. Primary hypertension arises between the ages of 30-50 years, the incidence rate increases at the age of 50-60 years from the age of 60 years and over [9]. Primary hypertension affects middle age and old adulthood. Age affects baroreceptor in the setting of blood pressure. The arteries become less compliant so the pressure in the blood vessels increases. This condition most often increases the age-related systolic pressure

Researchers argue that the more age increases the higher the blood pressure of a person, it is related to changes in anatomical and physiological structures, especially from the cardiovascular system. Due to the aging process of heart and vascular ability in pumping blood less efficient. Heart valves become thicker and stiffer, elasticity of blood vessels decreases.The accumulation of fat and calcium increases so that facilitate the occurrence of a hypertension disease. This opinion is strengthened from the results of research conducted by researchers that most respondents aged between 46-55 years (table 1).

1) Systolic and diastolic blood pressure treatment and control groups on posttest

Figure 2 shows the mean systolic blood pressure for treatment group in posttest for 3 consecutive days was lower than control group by difference of 6.4-8.4 mmHg. The management of hypertension can be used with pharmacology and non-pharmacologic. Pharmacologic treatment consists of administering diuretic, sympathetic, beta-blocker and vasodilator drugs that have side-effects of decreased cardiac output. While non-pharmacological handling is a treatment that includes weight loss, regular exercise, low-salt diet and fat and complementary therapies [4].

Antihypertensive drugs are drugs used to treat hypertension. Antihypertensives are also given to individuals who are at high risk for cardiovascular disease and those at risk for both stroke and myocardial infarction. Drug administration does not mean keeping individuals away from healthy lifestyle modifications such as losing weight, reducing salt and alcohol consumption, quitting smoking, reducing

stress and exercising [9]. All respondents in this study received valsartan as a hypertension drug (table 1). Valsartan function inhibits the effects of a chemical compound called angiotensin II. Angiotensin II has the effect of narrowing the blood vessels, so by inhibiting theeffects of these compounds, valsartan will relax and dilate the blood vessels. As a result, blood pressure will decrease and the heart more easily pump blood throughout the body, as well as increase the supply of blood and oxygen to the heart.

Hypertension or high blood pressure can increase the burden of the heart and blood vessels. As a result the heart and blood vessels can not function normally. This condition can damage the blood vessels of the brain, heart, kidneys, causing stroke, heart failure or kidney failure. With effects created by valsartan, the burden of the heart will decrease. Lowering blood pressure will reduce the risk of stroke and heart attack [7].The results of this study in figure 2 shows the blood pressure in the treatment group and the control group undergoing changes on post-test that can be caused by pharmacological therapy in both, because each respondent consume anti-hypertensive drugs to help lower blood pressure. Drugs consumed by respondents will relax and dilate blood vessels. As a result, blood pressure will decrease and the heart more easily pump blood throughout the body, as well as increase the supply of blood and oxygen to the heart.

2) Differences in systolic blood pressure between pre-test and post-test on treatment and control groups

The results of this study in accordance with the theory that progressive muscle relaxation is a method to help reduce stress so that the body muscles become relaxed. Progressive muscle relaxation aims to reduce anxiety,stress, tense muscles and difficulty sleeping. As the body and mind relax, automatically the tension that often makes the muscles tightened will be ignored [10].

Relaxation is one of the techniques in behavioral therapy developed by Jacobson and Wolpe to reduce tension and anxiety. The use of relaxation in the clinical field has begun since the 20th century, when Edmund Jacobson did research and reported it in a book. In his book Jacobson explains what a person does when he is tense and relaxed. As the body and mind relax, automatically the tension that often makes the muscles tightened will be ignored [5].

Progressive muscle relaxation technique is a deep muscle relaxation technique that does not require imagination, persistence, or suggestion. Based on the belief that the human body responds to anxiety and events that stimulate the mind with muscle tension. The progressive muscle relaxation technique focuses on a muscle activity by identifying the tense muscles and then decreasing the tension by performing relaxation techniques to get relaxed feelings [10].

The rationale of the method of relaxation training is in the human nervous system there is the central nervous system and autonomic nervous system. The function of the central nervous system is to control the desired movement, for example the movement of the hands, feet, neck and fingers. The autonomic nervous system functions to control automatic movements such as digestive and cardiovascular functions. The autonomic nervous system consists of two interrelated subsystems of the sympathetic nerves and the parasympathetic nerves [11].

Sympathetic nerves work to increase stimulation or spur the organs of the body, stimulate increased heart rate and breathing and cause peripheral vascular constriction and enlargement of central blood vessels, lowering the temperature and endurance of the skin and will inhibit the process of digestif and sexual. The parasympathetic nerves work to stimulate the rise of all functions derived by the sympathetic nervous system [6].

At the time people experience tension and anxiety that work is the sympathetic nervous system so that heart rate, blood pressure, the number of breathing, blood flow to muscle and dilated pupils often increase. Under conditions of continuous stress may appear negative effects on health such as high blood pressure, high cholesterol, gastrointestinal distress and weaken the immune system [13]. Relaxation provides the opposite activity with the negative continuous effects of chronic stress. Some changes due to relaxation techniques are lowering blood pressure, decreasing heart frequency, reducing cardiac dysrhythmias, reducing oxygen demand and oxygen consumption, reducing muscle tension, decreasing metabolic rate, increasing brain alpha waves that occur when the client is conscious, not focusing attention and relax, fitness, improve concentration and improve the ability to cope with stressors [5].

Progressive muscle relaxation techniques is being used in order to make respondents can be relaxed and calm. It is caused by the aroused parasympathetic nervous system and decreases all parts of the body work. It causes lower blood pressure, lowered heart rate, reduced cardiac dysrhythmias, reduced oxygen demand and oxygen consumption, reduced muscle tension, lowered metabolic rate, increased brain alpha waves that occur when the client is conscious, improves fitness, improves concentration and improves ability to overcome stressors [12]. This is in accordance with (figure 1 and 2) which shows a decrease in blood pressure before a progressive muscle relaxation technique is given and after aprogressive muscle relaxation technique is given.

Hypertension can be caused by several factors such as the condition of age, environment, heredity, unbalanced lifestyle, and stress [13]. It causes physiological changes in the body such as the thickening of the arterial wall due to the accumulation of collagen substances in the muscle layer, so that the blood vessels will become narrowed and become stiff starting at age 45 years. There was also an increase in peripheral resistance and sympathetic activity as well as a lack of baroreceptor sensitivity (blood pressure regulator) and renal renal blood flow and glomerular filtration rate decreased. This is in accordance with the results of research showing average respondents aged between 45-55 years.

The relationship between the environment with the occurrence of hypertension disease sometimes can not be explained directly. Because the general environmental impact on hypertension is not direct. Environmental factors such as social, economic, cultural environments increase the risk of hypertension by influencing behavior that then shapes the lifestyle of a community. Environmental factors that can not be controlled by researchers [5]. Environmental factors such as social, economic, cultural environments increase the risk of hypertension by influencing behavior that then shapes the lifestyle of a community. Environmental factors that suppress the respondent can cause the respondent to be stressed, thus stimulating the kidney gland releases the hormone adrenaline and spur the heart beat faster and stronger, so that blood pressure will increase. Stress can increase blood pressure for a while and when the stress is gone the blood pressure can be normal again [12].

The presence of genetic factors in certain families will also cause the family has a risk to suffer from hypertension. This is associated with elevated intracellular sodium levels and low ratio of potassium to sodium. Individuals with elderly people with hypertension are twice as likely to have hypertension as those who have no family with a history of hypertension. In addition, 70-80% of cases of essential hypertension with a family history of hypertension were found [8].

Stress was believed to have a relationship with hypertension. It is presumably through sympathetic nervous activity that can increase intermittent blood pressure. Besides, it can also stimulate the kidney gland to release the hormone adrenaline and stimulate the heart beat faster and stronger, so that blood pressure will increase. If the stress lasts long enough, the body will try to make adjustments resulting in organic abnormalities or pathological changes. Symptoms that will appear in the form of hypertension or mag disease. Stress can increase blood pressure for a while and when the stress is gone the blood pressure can be normal again [7].

3) Differences in blood pressure between the treatment and control groups

Based on the independent sample t test, there was no difference in systolic blood pressure between the treatment group and the control group on the pre-test with p = 0.94(>0.05) means that here was a significant difference in systolic blood pressure between the treatment group and thecontrol group on the post-test with a value of p = 0.00(< 0.05) meaning H0 was rejected. Meanwhile, the different test with independent t test obtained p value = 0.39 which is there is no significant difference between treatment group and control group in pre-test.

The mechanisms that control the constriction and relaxation of blood vessels lie at the center of the vasomotor, the medulla in the brain. From this vasomotor center begins the sympathetic nerve pathway, which progresses downward into the spinal cord and exits from the spinal column of the spinal column to the sympathetic ganglia in the thorax and abdomen [10]. Vasomotor center stimulation is delivered in the form of an impulse that moves downward through the sympathetic nerves to the sympathetic ganglia. At this point, the pre-ganglion neuron releases acetylcholine, which will stimulate the post-ganglion nerve fibers into the blood vessels, which by removing norepinephrine results in constriction of the blood vessels. Various factors such as anxiety and fear can affect the vascular response to vasoconstrictor stimuli. Individuals with hypertension are very sensitive to norepinephrine, although it is not known clearly why it can occur [14].

The same time in which the sympathetic nervous system stimulates the blood vessels in response to emotional stimuli, the adrenal glands are also stimulated to result in additional vasoconstrictive activity. The adrenal medulla secretes epinephrine that causes vasoconstriction. The adrenal cortex secretes cortisol and other steroids, which can strengthen the vasoconstrictor response of the blood vessels [11].Vasoconstriction resulting in decreased blood flow to the kidneys, leading to renin release. Renin stimulates the formation of angiotensin I which is then converted into angiotensin II, a powerful vasoconstrictor, which in turn stimulates aldosterone secretion by the adrenal cortex. This hormone causes sodium and water retention by the renal tubules, causing an increase in intravascular volume. All these factors tend to trigger the state of hypertension [14].

Structural and functional changes in the peripheral vascular system are responsible for changes in blood pressure that occur in the elderly. These changes include atherosclerosis, loss of connective tissue elasticity, and a decrease in relaxation of smooth muscle of blood vessels, which in turn decreases the ability of distention and tensile strength of blood vessels. Consequently, large aorta and arteries decrease their ability to accommodate the volume of blood pumped by the heart (stroke volume), resulting in decreased cardiac output and increased peripheral resistance [14].

When performing progressive muscle relaxation exercises with a calm, relaxed state and full concentration of tense and relaxed muscles trained for 15 minutes then the secretion of CRH (corticotropin releasing hormone) and ACTH (adrenocorticotrophic hormone) in the hypothalamus decreases [11]. Decreased secretion of these two hormones cause sympathetic nerve work activities decreased, so that adrenaline and noradrenaline expenditure is reduced. The decrease in adrenaline and norepinephrine results in decreased heart rate, dilated blood vessels, reduced blood vessel resistance and decreased heart pumps so that cardiac arterial blood pressure decreases [15].

Researchers argue that the provisionof progressive muscle relaxation techniques is very influential in the decrease in blood pressure compared with respondents who did not get progressive muscle relaxation measures. The effect of progressive muscle relaxation techniques that make the

respondent relaxed, the progressive relaxation muscle relaxation technique can help to decrease the secretion of CRH (corticotropin releasing hormone) and ACTH (adrenocorticotrophic hormone) in the hypothalamus. Decreased secretion of these two hormones cause sympathetic nerve work activities decreased, so that adrenaline and noradrenaline expenditure is reduced. Decreased adrenaline and nor-epinephrine resulted in decreased heart rate, dilated blood vessels, reduced blood vessel resistance and decreased heart pumps so that cardiac arterial blood pressure decreased[11].

V. CONCLUSION

Progressive muscle relaxation effective to decrease blood pressure on hypertensive patient. Suggested nurses apply this intervention in helping to lower the patient's blood pressure. The effect of progressive muscle relaxation techniques that make the respondent relaxed and calm. The progressive muscle relaxation technique focuses on a muscle activity by identifying the tense muscles and then decreasing the tension by performing relaxation techniques to get relaxed feelings.

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