The effect of light massage on blood pressure and mean arterial pressure in tuberculosis patients

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Abstract Tuberculosis is still a significant problem in the health sector, including the side effects of its treatment. Side effects include indigestion, nausea, joint pain, dizziness, reddish urine, itching, redness of the skin, liver disorders, joint pain, and vascular disorders such as paresthesia and even hypertension. Light massage is a massage therapy in the form of gentle movements on the soft tissues of the body, including rubbing and rubbing movements. This skin stimulus will provide a sense of comfort, relax tension in muscles and improve blood circulation. This study aimed to determine the effect of light massage therapy on blood pressure and mean atrial pressure (MAP) in tuberculosis patients. This study used a experimental design, pre-post control group design. The sample size of this study was 60 respondents. The sampling technique used was simple random. The results showed that most respondents were female (56.7%) with active phase treatment 76.7% in the intervention group and 73.4% in the control group. There was a significant difference in systolic blood pressure and MAP ($p < 0.05$), and there was no significant difference in diastolic blood pressure between the intervention and control groups ($p > 0.05$). Light massage can reduce systolic blood pressure and MAP. Further research is needed to increase the duration and frequency of light massage interventions

1. Introduction

Tuberculosis is a type of infectious disease caused by Mycobacterium tuberculosis. Until now, tuberculosis is still the most dangerous infectious disease in the world. Around 10.0 million (range, 9.0–11.1 million) people suffering from TB in 2018 were reported by the World Health Organization reports, this figure has remained stable in several years. Between countries around the world the burden of disease varies, from five to more than 500 new cases per 100,000 population per year. 2018 estimated 1.2 million deaths from TB among HIV-negative people (27% decrease from 1.7 million in 2000), and an additional 251,000 deaths (range, 223,000-281,000) among HIV-positive people (60% decrease of 620,000 in 2000)[1]. The problem that occurs is the success rate of TB treatment, which continues to decline in Indonesia.

Taking pyrazinamide drugs in the long term can inhibit uric acid excretion, causing hyperuricemia [2]. Increased blood uric acid levels can cause hypertension. This is related to uric acid's effect on increased oxidative stress and activation of the renin-angiotensin system, where this will trigger endothelial dysfunction and peripheral vessel vasoconstriction so that hypertension can occur. Henri Huchard stated the hypothesis that atherosclerosis associated with hypertension was found in 3 groups, namely the group experiencing gout, the group that consumed fatty foods and all groups associated with hyperuricemia. The results of experimental experiments on rabbit test animals that were injected with uric acid, these experiments showed the results of an increase in blood pressure (BP). The study showed that the induction of mild hyperuricemia in rats led to hypertension. This is due to two mechanisms. The first mechanism is that uric acid induces renal vasoconstriction. The second mechanism is hyperuresemia, which causes a progressive renal microvascular disease that causes the proliferation of vascular smooth muscle cells, activates the local angiotensin renin system, and stimulates the production of various inflammatory mediators [3].

Management of hypertension can be carried out through pharmacological and non-pharmacological methods, one of which is a complementary therapy, including acupressure, aromatherapy, distraction techniques, and relaxation techniques, including massage therapy ([4]. Light massage is a massage therapy in the form of gentle movements on the soft tissues of the body, including rubbing and rubbing movements, this skin stimulus will provide a sense of comfort, relax tension in muscles and increase blood circulation and reduce high blood pressure [5]. Seeing this phenomenon, the underlying researchers will conduct research with the title The Effect of light massage on BP and MAP for tuberculosis patients. This study aimed to determine the effect of light massage therapy on BP and MAP in tuberculosis patients.

2. Methods

This study used experimental design pre-post control group design. The sample size was 60 respondents, 30 intervention groups and 30 control groups. The sampling technique used is simple random sampling. The inclusion criteria included active phase tuberculosis respondents, adults aged 20-60 years, received category 1 OAT, cooperative and willing to be respondents, while the exclusion criteria were respondents experiencing skin disorders and refusing light massage. Data collection was carried out by making two groups of patients, namely a group of residents who were given 1 time light massage therapy for 30 minutes and a group without any action. BP and MAP measurements were carried out using a calibrated sphygmomanometer. The measurement results are written in the observation sheet. Measurement of BP and MAP in the intervention group and the control group were carried out 2 times, before being given therapy and immediately after therapy.

3. Result

3.1. Characteristics of the respondents

Table 1. Characteristics of the respondents

Variable	Intervention group (%)	Control group (%)
Gender		
Male	43,3	43,3
Female	56,7	56,7
Treatment phase		
Intensive	76,7	73,4
Advanced	23,3	26,6

The study results in table 1 show the characteristics of the majority of respondents are female and with the intensive treatment phase.

3.2. Description of Mean BP and MAP Before and After Intervention

Table 2 shows the mean blood pressure and mean atrial pressure within the normal range.

Table 2. Description of Mean BP and MAP Before and After Intervention

Variabel	Intervention group Mean ± SD	Control group Mean ± SD
Sistolic BP before intervention	131,2± 14,6	131,1 ± 11,9
Sistolic BP after intervention	123.9± 13,2	129,6± 10,3
Diastolic BP before intervention	77,7± 7,8	76,7± 10,3
Diastolik BP after intervention	72,3± 7,3	76± 8,8
MAP before intervention	95,5± 7,8	94,8± 9,5
MAP after intervention	89,6± 6,8	93,9± 8,2

3.3. The Results of Differences in BP and Prior MAP With After Intervention

Table 3. The Results of Differences in BP and Prior MAP With After Intervention

Variable	*p value* Intervention	*p value* Control
Sistolic BP	<0,001 [a]	0,076 [b]
Diastolic BP	<0,001 [b]	0,569 [b]
MAP	<0,001 [a]	0,261 [a]

a = dependent t-test, b = Wilcoxon

Table 3 shows the differences in BP and MAP in the intervention group showed a significant difference (p <0.05), while in the control group, there was no significant difference (p> 0.05).

3.4. Effect of Light Massage on Intergroup

Table 4. Effect of Light Massage on Intergroup

Variabel	Homogeneity Test	*p value*
Sistolic BP	0,172	0,050*
Diastolic BP	0,090	0,08
MAP	0,472	0,03*

*= significantly different

Table 4 shows that the systolic, diastolic, and MAP blood pressure data before intervention are homogeneous (p> 0.05). The results of the systolic blood pressure difference test and mean atrial pressure after the intervention showed a significant difference (p <0.05), while the diastolic blood pressure showed no significant difference between groups (p> 0.05).

4. Discussion

Tuberculosis treatment consists of 2 stages, namely the intensive stage, which aims to effectively reduce the patient's body's number of germs. Furthermore, the advanced treatment is aimed at killing any remaining bacteria in the body and preventing recurrence. Treatment with OAT, especially Pyrazinamide and ethambutol, has side effects in the form of paresthesia or tingling in the toes due to uric acid metabolic disorders, which causes an increase in uric acid levels in the blood so that it disrupts blood circulation if it lasts in the long term, especially those who get treatment to the advanced phase [6, 7].

The majority of respondents in this study were still in the intensive treatment phase with an average treatment period of 1-2 months. Based on that time, if it is related physiologically, there are no side effects of OAT, a small number of patients who say they are inflamed with strangulation, if seen from the results of measurements, the majority of blood pressure values are still in the normal range

Table 4 shows the difference in systolic BP and MAP between the intervention and control groups, while no difference was found for diastolic BP ($p = 0.08$). The massage technique is performed using a variety of pressure movements as well as pressure to manipulate muscles and other soft tissues, so that the fingers relax as a result of an increase in blood and oxygen circulation, this can reduce pain caused by circulatory disorders. Massage is a technique that integrates the sensory nervous system which influences the activity of the autonomic nervous system. Gentle massage can cause stimulation that makes a person relax. The benefit of massage to improve surface circulation, lowering blood pressure so that it can improve blood circulation in the tissues, reduce the workload of the heart, improve circulation, stimulate blood flow throughout the deeper blood vessels, accelerate metabolic waste and nutrition, reduce anxiety and depression, promote calm, well-being emotional, positive energy, and happiness, and relaxation. Previous studies showed that elderly massage could reduce the circulation so that lower blood pressure in elderly hypertension. This reduction through a body mechanoreceptor which then regulates pressure, touch, and warmth into a relaxation mechanism. Mechanoreceptors are cells that transmit signals to the central nervous system and produce mechanical stimuli. Massage carried out for 10-15 minutes for 3 days can reduce symptoms of systolic and diastolic blood pressure [8].

Massage is well known to the public as a way to reduce fatigue, relieve stress and increase comfort and relaxation. The results of an experimental study of back massage intervention which was carried out for 20 minutes were able to reduce heart rate (HR), systolic BP and increase a positive mood. An experimental study conducted by Olney on hypertensive individuals who received 10 minutes of massage 3 times a week for 10 sessions was compared to a control group who received 10 minute rest sessions 3 times per week for 10 sessions. Significant reductions were observed in systolic and diastolic BP for the massage group. The results of a single blind clinical trial conducted on 50 pre hypertensive women were randomized to either Swedish massage or relaxation lying down for 10–15 minutes for 10 sessions over 3.5 weeks. Women who received massage therapy experienced a significant reduction in systolic and diastolic BP during the massage and 72 hours after the massage. Kaye et al. conducted a study with 263 healthy volunteers and found a significant reduction between systolic and diastolic BP and HR after 45-60 minutes indepth tissue massage sessions [9].

Massage performed has varied benefits and is still conflicting between studies. The results of massage research can optimize patient vital signs, be able to lower systolic BP and increase diastolic BP, lower heart rate (HR), and respiratory rate (RR). However, different studies have reported that massage does not affect physiological parameters such as BP, pulse and respiration. The conflicting results from previous studies with this study may be due to the different types of massage and duration of massage. In this study, massage did not affect diastolic blood pressure because there was only one course of light massage therapy. The mechanism of parasympathetic activation after whole-body messages reduces physiological responses. Massage has a mechanical effect on increasing circulation, increasing blood flow to certain areas, removing useless metabolic products, increasing joint mobility, relieving pain and reducing muscle

tension. Massage is able to provide a psychological effect, namely being able to provide benefits including reducing psychological fatigue, relaxing the mind, and increasing feelings of well-being, as a result of increasing endorphine.

Cortisol and epinephrin decreased. As a result, the vessels become dilated, blood flow increases in the body's superficial vessels, and blood pressure decreases. Massage increases the pressure on the tissues. Then the pressure gradient between the tissues and blood vessels will increase, facilitating the movement of fluids between the tissues and blood vessels and vice versa. The movements adjust physiological criteria such as blood pressure [10].

This study's results are similar to those of previous studies that showed significant changes of vital signs before and after the intervention. Changes in systolic, diastolic and MAP blood pressure after a 15-minute massage session in the intervention group patients showed an overall decrease in values (all $p < 0.001$). Massage techniques are easy to learn, safe, non-pharmacological, and cost-effective that can be practiced by family members, caregivers and other personnel for therapeutic purposes [11].

An increase in peripheral blood circulation during the massage will increase the temperature of the neuromuscular system locally. There is an increase in temperature up to 42^{o}C with a massage so that it reduces the activity of type II afferent nerves, which increases type Ib nerve activity and stimulates an increase in alpha motor nerve activity, which ultimately decreases muscle tone and causes a decrease in muscle spasm and general relaxation [12].

MAP is the average arterial pressure throughout one cardiac, systolic, and diastolic cycle [13]. To fill vital organs requires maintenance of a MAP of at least 60 mmHg. If the MAP falls below this point for a long time, ischemia and infarction may occur. If the MAP drops significantly, blood will not flow to the brain tissue, loss of consciousness will occur, and neurological death will occur. The body has several protective mechanisms to regulate MAP and ensure that adequate perfusion levels are maintained for the function of all organs [14].

MAP regulation exists at the cellular level through complex interactions between the cardiovascular, renal, nervous, and autonomic systems. The cardiovascular system determines MAP through COP and SVR. COP is regulated at the level of intravascular volume, preload, afterload, myocardial contractility, heart rate, and conduction velocity. Regulation of SVR through vasoconstriction and dilation of vessels [14]. The variable that has the most influence in determining SVR is the blood vessels' diameter. The diameter of these blood vessels is influenced by local mediators and the autonomic nervous system. Endothelial cells lining blood vessels produce and respond to vasoactive substances to dilate or constrict vessels depending on the needs of the body [14]. The autonomic nervous system has an important role in regulating MAP via the baroreceptor reflex. The arterial baroreceptors found in the carotid sinus and aortic arch act via a negative feedback system to maintain MAP within the normal range. [14].

Massage provides sympatholytic effects through physiological and psychological mechanisms, improves the function of the hypothalamic-pituitary-adrenocortical axis, and increases blood circulation, which can enhance endothelial cell function. Massage stimulates increased vasodilation of blood vessels by increasing local vasodilators such as nitric oxide, prostacyclin and histamine to lower blood pressure. Massage will mediate vasodilation of blood vessels and muscle tone, indirectly reduce blood viscosity which ultimately lowers blood pressure and MAP. Massage will decrease the vagal nerve and nervous system regulation due to stimuli in limbic and neural activities, reducing stress and increasing positive and uplifting feelings. Decreased activity of the hypothalamic-pituitary-adrenocortical axis will reduce cortisol and catecholamines. This contributes to increasing vasodilation, resulting in decreased blood pressure and MAP [15].

The results of light massage performed on the face, chest, arms and legs with light pressure and the treatment duration have not affected the patient's peripheral circulation. Researchers did not thoroughly massage all of the patient's muscles. Massaging the large muscles in the legs can improve blood

circulation. When massaging the leg muscles, gradually increase the pressure to these muscles to loosen the tension to improve blood flow to the heart. Massage on the feet ends with a massage on the feet' soles, which will stimulate and rejuvenate the feet, thereby restoring the balance system and helping relaxation [16].

5. Conclusion

Based on the analysis, the provision of light massage in this study showed significant differences in systolic BP and MAP between the intervention and control groups, and there was no significant difference in diastolic BP. The intervention was carried out only once so that the effect on diastolic BP was not optimal. Suggestion: light massage can be used by clinic and community nurses to lower blood pressure and keep MAP within normal limits. Light Massage can be used for the development of complementary nursing courses.

Acknowledgments

Thank you to the Rector and LPPM Jenderal Soedirman University, as well as all parties who have helped in this research.

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