

Nursing Intervention with The Optimisation of Progressive Muscle Relaxation (PMR) and Range of Motion (ROM) on Blood Pressure and The Functional Ability of Stroke Patient: Case Study

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ABSTRACT

Introduction – Stroke is the second leading cause of death and the third leading cause of disability in the world and almost 13,7 million will have a stroke each year. Almost 2,1 million Indonesian people experiences stroke. Stroke will influence in functional ability such as hemiparesis or motoric dysfunction. Another pharmacology treatment, non-pharmacology also needed in this situation. The Progressive Muscle Relaxation (PMR) and Range of Motion (ROM) were both of non-pharmacology treatment which can improve the functional ability of stroke patient.

Purpose – The purpose of this study is to optimisation of PMR and ROM on blood pressure and the functional ability of stroke patients.

Methodology/Approach – The method used is a case study in one patient with the history of hypertension. The instruments used in this report are a sphygmomanometer to measure blood pressure and a muscle strength scale to measure muscle strength in stroke patients. On the muscle strength scale, a value of 0 indicates complete paralysis and a value of 5 indicates normal muscle strength & normal full range of motion against resistance and full gravity.

Findings – There were improvement for functional ability of motoric dysfunction in stroke patients. These finding confirm that the combination between PMR and ROM improved the motoric dysfunction in stroke patients.

Originality – This study is an original study in patients with stroke.

Keywords: Stroke, PMR, ROM, Motoric Dysfunction

INTRODUCTION

According to the World Stroke Organization (WSO) Global Stroke Fact Sheet 2022, worldwide one in six people will experience a stroke. More than 13.7 million will have a stroke each year and 5.8 million a year will die from a stroke (WSO, 2022). So that globally, more than 80 million people can survive a stroke. As many as 70% of stroke events are ischemic (9.5 million) and others are hemorrhagic strokes (Phipps & Cronin, 2020).

According to Hathidara et al. (2019), stroke is the second leading cause of death and the third leading cause of disability in the world. The absolute number of people experiencing death and disability from stroke has increased and is becoming the highest burden in low and middle-income countries. Indonesia is a middle-income country, and the prevalence of stroke has increased compared to 2013. The prevalence of stroke itself increased from 7% to 10.9% or 2.1 million people (Kemenkes, 2019).

The number of stroke patients in Indonesia is inseparable from the accompanying risk factors. One of the

risk factors for stroke is hypertension. 34.1% of the population in Indonesia aged >18 years have hypertension. The islands of Java and Kalimantan have dominated the highest order of hypertension prevalence in 2018 (Kemenkes, 2019). Indonesia ranks fourth highest after Kiribati, Tonga, and Tuvalu in the top 10 countries with the largest increase in hypertension prevalence between 1990 and 2019 for the female gender category (WHO, 2021).

This is what causes the infrequent symptoms seen in the early stages to the occurrence of severe long-term complications such as chronic kidney disease, stroke, or heart disease (Singh et al., 2017). So that stroke patients caused by hypertension, in addition to being given pharmacological therapy, also need to be given non-pharmacological therapy such as Progressive Muscle Relaxation (PMR) (Herawati & Azizah, 2016).

PMR is a therapy that works by inhibiting the autonomic nervous system and the central nervous system so that later it will increase parasympathetic activity which can reduce heart rate so that cardiac output decreases and ultimately blood pressure can also decrease (Rosdiana & Cahyati, 2019). One of the studies related to PMR was from Arisjulyanto (2018), that PMR therapy can help decrease blood pressure.

In addition to therapy decrease blood pressure, don't forget that stroke patients experience a decrease in functional ability. The decrease is like the occurrence of hemiparesis and hemiplegia, so that it can cause immobility (Srinayanti et al., 2021). The immobility of the patient's condition can cause a decrease in muscle strength, flexibility, and joint stiffness which can lead to contractures so that the patient can experience disability and decrease in carrying out daily activities (Cahyati et al., 2018).

Providing PMR and Range of Motion (ROM) intervention can be an independent task for a nurse in providing nursing care so that the patient's condition can improve. Even the PMR and ROM intervention is already in *Standar Intervensi Keperawatan Indonesia* (SIKI). So, purpose of this study is to optimisation of PMR and ROM on blood pressure and the functional ability of stroke patients.

METHOD

This report uses case studies. A case study is a research to be able to collect, organize, and analyze data related to several cases involving the researcher's problem. Data collection from assessment to nursing evaluation was carried out in the internal medicine ward of the UII Hospital in February 2022.

The inclusion criteria applied in this report were stroke patients with hypertension who were treated for at least five

days and were willing to be given intervention by signing the informed consent form. If the patient has gone home before five days, it is necessary to replace another patient with the same criteria. Data collection techniques using observation, interviews, and documentation. Data analysis was carried out using narrative analysis.

The instruments used in this report are a sphygmomanometer to measure blood pressure and a muscle strength scale to measure muscle strength in stroke patients. On the muscle strength scale, a value of 0 indicates complete paralysis and a value of 5 indicates normal muscle strength & normal full range of motion against resistance and full gravity.

Before giving the PMR intervention, the researchers conducted an assessment and measurement of blood pressure using a sphygmomanometer to measure blood pressure before and after being given PMR therapy. In addition to PMR therapy, the patient also received a passive ROM intervention. Before and after giving passive ROM, the researchers conducted an assessment of muscle strength in patients.

After obtaining data from the results of the assessment, the data is used for establishing nursing diagnoses and guidelines for determining nursing care plans. Then the patient was given an explanation regarding the PMR intervention and programmed ROM.

RESULT

Mr. F born on March 25, 1977 has been hospitalized in the Salvia ward since February 20, 2022 with complaints of not being able to move his limbs since the morning. From the results of the medical diagnosis, the patient was diagnosed with a non-hemorrhagic stroke. Medical history Mr. F has a history of hypertension since 2022 and has anti-hypertensive drugs amlodipine 10 mg 1x1 and captopril 25 mg 3x1 which are taken irregularly. Even the patient is also an active smoker since the age of 20 years. The patient said that none of his immediate family had a stroke.

The results of the observations showed that the patient's speech was slurred, when he smiled or spoke asymmetrically, and had aphasia. The results of the examination of muscle strength showed that the muscle strength of the extremities of the left hand and foot was 3 and the extremity of the right hand and foot was 5. The results of TTV patient's blood pressure was 188/96 mmHg, pulse 111 x/minute, temperature 36.6oC, RR 20 x/minute, and 97% SpO2.

The result of the CT-Scan examination was a cerebral infarction in the right parietooccipital lobe area. As for the patient's laboratory results and the normal range is erythrocytes 6.04 (3.8-5.2), hemoglobin 16.7 g/dL (11.7-15.5), hematocrit 48% (35-47), eosinophils 1% (2-4), lymphocytes 24.8% (25-40).

Mr. F received drug therapy with aspirin 80 mg 1x1, amlodipine 10 mg 1x1, captopril 25 mg 3x1, neurosanbe 1A 3 ml 1x1. The main nursing diagnosis based on the Standar Diagnosis Keperawatan Indonesia (SDKI) is the risk of ineffective cerebral perfusion with hypertension risk factors characterized by subjective data the patient said he had a history of hypertension since 2020, the patient said he did not routinely take anti-hypertensive drugs, and the patient said he liked savory food. The objective data itself is the result of blood pressure 188/96 mmHg, pulse 111 x/minute, CT scan results. Cerebral infarction in the right parietoccipitalis lobe, and left limb paralysis with a score of 3.

The goals and outcomes of nursing are that after 5 days of nursing action, it is expected that cerebral perfusion

(L.02014) will improve with the outcome criteria: level of consciousness Mr. F was maintained composmentis (GCS 15), blood pressure fell from 188/96 mmHg to 134/69 mmHg, and there were no signs of intracranial increase.

The nursing interventions carried out were neurological monitoring (I.06197) such as monitor vital signs, monitor for increased intracranial pressure, head position 15-30 degrees, teach PMR therapy to lower blood pressure, collaborative administration of 80 mg aspirin 1x1, collaboration 10 mg amlodipine 1x1, and the collaboration of giving captopril 25 mg 3x1.

While the implementation of nursing is done after the intervention planning. The implementation of PMR therapy was carried out for 5 days from February 20, 2022 to February 24, 2022. There were a total of 14 movements in PMR therapy that the patient had to do. All these movements are performed twice each repetition and hold the position for 10 seconds and in a tense condition, when stretched lasts for 15-20 seconds.

Before the patient was given PMR therapy, blood pressure was measured first and then PMR therapy was given. It should also be remembered that PMR therapy should not be given at the same time or near the patient taking anti-hypertensive drugs because it is feared that there will be biased results related to the effectiveness of PMR therapy. Therefore, the researchers gave PMR therapy 3 hours after the patient took his anti-hypertensive drug. After giving PMR therapy, it is continued with blood pressure measurement to determine the difference in blood pressure before and after PMR therapy.

Furthermore, formative evaluation has been carried out on every single intervention carried out and a summative evaluation has been carried out at the end of each shift. After five days of PMR therapy, the patient's blood pressure, which was initially 188/96 mmHg, decreased to 134/69 mmHg on the fifth day. PMR implementation actions are described in table 1 below:

Table 1. Result of Blood Pressure Before and After PMR

Day	Blood Pressre (mmHg)				
	1	2	3	4	5
Before	188/ 96	168/ 88	163/ 82	153/ 76	141/ 76
After	179/ 89	161/ 84	154/ 72	146/ 72	134/ 69

(Source: Data obtained in 2022)

From the results of giving PMR therapy for five days, it can be said that PMR therapy can help to significantly lower the patient's blood pressure. Based on the results of the five times of PMR therapy, it was obtained that the average decrease in the patient's systolic pressure was 7.8 mmHg and the diastolic pressure was 6.4 mmHg. The average result is certainly very good considering the therapy given is non-pharmacological therapy in the form of PMR therapy.

In addition, stroke patients also experience limb weakness, so that a second diagnosis can be made based on the IDHS, namely impaired physical mobility associated with decreased muscle strength marked by subjective data the patient said he could not move his left hand and leg since February 20, 2022. While the objective data were the results CT-Scan susp. Cerebral infarction in the right parietoccipitalis lobe, the patient had left hemiparesis, and left extremity muscle strength of 3 and right extremity of 5.

The goal and the results of nursing are that after 5 days of nursing action, it is expected that the patient's physical mobility (L.05042) will improve with the criteria for improving left extremity movement marked by being able to

lift the left extremity and the muscle strength of the left extremity improves from 3 to 4.

Nursing interventions carried out were with mobilization support (I.05173) such as identifying physical complaints, monitoring physical tolerance for movement, involving families to help patients improve movement, facilitating movement, doing passive ROM, and collaboration with physiotherapists.

The nursing implementation is carried out after the preparation of the intervention plan. The implementation of passive ROM therapy was carried out for five days from February 20, 2022 to February 24, 2022. Passive ROM was carried out on Mr. F includes flexion, extension, abduction, adduction, and rotation movements at each joint. ROM movements are performed twice a day.

Then formative evaluation has been carried out on every single intervention carried out and summative evaluation has been carried out at the end of each shift. After five days of nursing implementation, the patient's left extremity movement has improved and the muscle strength of the left extremity has become 4. ROM measures are described in table 2 below:

Table 2. Result of Muscle Strength Before and After ROM

Muscle Strength					
Day	1	2	3	4	5
Top left	3	3	3	3	4
Bottom left	3	3	3	3	4

(Source: Data obtained in 2022)

DISCUSSION

The aim of this study was to optimize PMR and ROM interventions on blood pressure and functional ability of stroke patients. According to Boehme et al. (2017), non-modifiable risk factors or also known as risk markers for stroke are age, race, ethnicity, genetics, and gender.

Based on the results of the nursing assessment, the patient was male with the age of 45 years. This is in line with research from Wajngarten & Silva (2019) which says that adult men have a higher incidence of stroke when compared to women. The incidence will reverse at the age of 75 years so that women will suffer a stroke more than men. This is because when in middle age, women will experience menopause and begin to lose female sex hormones (Roy-O'Reilly & McCullough, 2018).

The age of the patient who was 45 was also the reason for the occurrence of stroke. According to Kuriakose & Xiao (2020), the current worrying trend is the increase in the incidence of stroke in people aged 20 to 54 years from 12.9% to 18.6%. However, overall stroke will increase with age, which is doubling after the age of 55 years. Furthermore, there are modifiable risk factors. Modifiable risk factors are the most important because later intervention strategies aimed at reducing these risk factors can reduce the risk of stroke. Modifiable risk factors include hypertension, hyperlipidemia, smoking, and diabetes mellitus (Murphy & Werring, 2020).

Based on the results of the study, patients have modifiable risk factors for stroke such as hypertension, non-adherence to taking anti-hypertensive drugs because they do not experience symptoms, and also smoking. This is in accordance with previous studies which state that hypertension is a major risk factor for cardiovascular disease (Lopes et al., 2018). Cardiovascular diseases such as stroke, heart attack, heart failure, and kidney disease

(Arum, 2019). Hypertension can cause stroke because the increase in blood pressure that increases slowly can damage the walls of blood vessels by hardening the arteries and encouraging the formation of blood clots and aneurysms (Budi & Bahar, 2017).

Mr. F who does not comply with taking anti-hypertensive drugs because he does not experience symptoms can be a factor in the occurrence of stroke. According to research from Mekonen et al. (2020), hypertensive patients who do not adhere to medication will experience a 4 times greater risk of stroke when compared to patients who adhere to medication. According to Lee et al. (2017), in general, patient non-adherence to treatment is caused by conditions or factors related to drugs. These factors include drug dosing schedules, side effects, types of drugs, and patient factors such as lack of awareness of the disease, the importance of medication, forgetting to take medication, and lack of economic power.

In addition, smoking lifestyle factors can also affect the occurrence of stroke (Feigin et al., 2017). An average smoker has twice the probability of suffering from it compared to a non-smoker (Kuriakose & Xiao, 2020). Smoking can cause stroke because it can increase the tendency of blood cells to clump together in artery walls, reduce the ability of High Density Lipoprotein (HDL) to get rid of excessive Low Density Lipoprotein (LDL) cholesterol, reduce the amount of HDL, and can increase fat oxidation that plays a role in the development of atherosclerosis (Budi & Bahar, 2017).

Therefore, in addition to pharmacological therapy, patients also need to take non-pharmacological therapy to control blood pressure in order to avoid recurrent strokes. One of the non-pharmacological therapies to lower blood pressure is PMR. According to Akhriansyah (2019), PMR therapy is a technique created by Dr. Edmund Jacobson in the United States and became one of the special techniques to relieve muscle tension.

PMR is a type of exercise that involves stretching and relaxing large muscle groups, from the hands to the feet (Astuti et al., 2019). A number of studies have found that PMR can lower blood pressure and reduce anxiety in different groups of patients. PMR itself is very simple, safe, inexpensive, and a non-pharmacological method that is easy to apply and has become an integral part of nursing care in recent years (Sahin & Basak, 2020).

The decrease in blood pressure in Mr. F is in line with research conducted by Arisjulyanto (2018) which stated that there was a decrease in the average blood pressure of 10.306 mmHg in the intervention group ($p = 0.000$). PMR therapy can lower blood pressure because it can inhibit the work of the central nervous system and autonomic nervous so that later it can increase the activity of the parasympathetics which can eventually decrease heart rate resulting in a decrease in cardiac output and ultimately a decrease in blood pressure (Korkut et al., 2021).

In addition, PMR therapy can reduce both systolic and diastolic blood pressure because when doing PMR therapy in a calm, relaxed, and concentrated state, there will be a decrease in secretion of CRH or Corticotropin Releasing Hormone and also ACTH or Adrenocorticotrophic Hormone in the hypothalamus (Sabar & Lestari, 2020). So that it can result in a decrease in sympathetic nerve activity resulting in the release of adrenaline and non-adrenaline which results in a decrease in heart rate, dilated blood vessels, reduced blood vessel resistance, and a decrease in heart pumping so that the arterial blood pressure of the heart will decrease (Astuti et al., 2019).

Based on these two explanations, of course PMR therapy is more or less the same as other relaxation therapies

where the principle is by inhibiting the stress response of the sympathetic nerves, arteries and veins along with other body muscles so that they become relaxed (Pamungkas et al., 2016). With the relaxation of these muscles, it can affect the decrease in norepinephrine hormone levels in the body (Rahmawati et al., 2018).

According to Herawati & Azizah (2016), PMR therapy can be done in a sitting position with movements such as the following:

- Exercise the muscles of the hand by grasping the right hand while clenching it tightly while feeling the tension. Then release like punching. After completing the movement on the right hand, then continue the same movement for the left hand.
- Exercise the back arm muscles by straightening the arm and moving the wrist in dorsi flexion so that the muscles in the hand and forearm stretch again, don't forget to position your fingers facing the ceiling.
- Exercise the biceps by grasping both hands like fists, then bringing them to the shoulders so that the biceps tighten.
- Exercise the shoulder muscles by lifting both shoulders up at a height until they touch both ears. This movement can result in tension in the neck, shoulders, and upper back.
- Train the forehead muscles with the movement of frowning and eyebrows until they become wrinkled.
- Exercise the dead muscles by moving your eyes tightly closed so that you can feel the tension around the eyes and the muscles that control movement of the eyes.
- Exercise the jaw muscles by clenching the jaw, then continue to bite the teeth so that the tension in the area around the jaw muscles can be reduced.
- Exercise the muscles around the mouth by pursing the lips as hard as possible so that you will feel the tension in the area around the mouth.
- Exercise the neck muscles by laying down the head, then pressing the head on the back so that the patient can feel the tension in the back neck area and upper back.
- Exercise the anterior neck muscles by lowering your head until you feel tension in the anterior neck area.
- Next arch your back, stretch your chest, and feel the tension in your upper back area for 10 seconds and then relax. Then take a deep breath and hold it, please feel the tension from the muscles around the chest. Hold this position, then relax, and take a deep breath in from your stomach.
- The next step is to tighten the abdominal muscles so that the stomach feels very hard. Please hold on and relax.
- Extend both legs, straight in front until the patient can feel tension in the back of the thigh area. Please hold on and relax.
- Tighten your calf muscles by stretching your legs and pointing your toes up (ie toward your head). Please hold on and relax.

In addition, the patient also had hemiparesis in the left extremity. The hemiparesis is the result of a stroke. Stroke patients experience hemiparesis due to abnormalities in the brain, namely the central nervous system that is used to control and initiate movements of the musculoskeletal system (Wist et al., 2016). Stroke patients if they experience hemiparesis and are not treated properly can lead to impaired function, impaired daily activities, incurable disability, and decreased mobility (Anggriani et al., 2018).

So that a form of nursing intervention that can be done in stroke patients to prevent complications, especially in patients with impaired mobility is to perform ROM (Susanti & Bistara, 2019).

ROM exercises can be joint movements that aim to maintain and maintain muscle strength, stimulate blood circulation, prevent deformities, and maintain joint mobility (Anggriani et al., 2018). Mr. F experienced an increase in muscle strength to 4 after doing ROM. These results are in accordance with research from Susanti & Bistara (2019) which obtained results of an increase in muscle strength ($p = 0.000$).

ROM exercises can induce stimulation so that it can increase the activation of muscles and neuromuscular. The presence of neuromuscular stimulation can increase the excitability of the nerves in the extremities. Especially the parasympathetic nerves will stimulate the production of acetylcholine so that contractions can occur (Susanti & Bistara, 2019). Then the smooth muscle mechanism of the extremities also occurs which increases metabolism in the mitochondria to be able to produce ATP which will later be used by the smooth muscles of the extremities as a form of contractile energy and can increase the smooth muscle tone of the extremities (Prabowo & Nisak, 2020).

CONCLUSION AND RECOMMENDATION

The assessment of Mr. F with the main complaint of hypertension and decreased muscle strength can be overcome by carrying out the implementation which is carried out for five days. The implementation is not only PMR and ROM, but the patient is also still given pharmacological therapy. PMR therapy has been shown to reduce blood pressure from 188/96 to 134/69 mmHg. Similarly, the patient's muscle strength increased from 3 to 5 after five days of passive ROM administration.

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