Indonesian Journal of Medicine (2024), 09(02): 214-221
Masters Program in Public Health, Universitas Sebelas Maret

Case report
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The Impact of Inducing Compelled Body Weight Shifts in Improving Dynamic Balance on Non-Hemorrhagic Stroke Patients

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Received: 13 January, 2023; Accepted: 17 February, 2024; Available online: 10 April, 2024

ABSTRACT

Background: Stroke is a brain attack that occurs suddenly where there is partial or complete disruption of brain function as a result of disruption of blood flow due to blockage or rupture of certain blood vessels in the brain, causing brain cells to lack blood, oxygen or nutrients and ultimately can cause These cells die in a relatively short time. In general, strokes are divided into 2, namely hemorrhagic and non-hemorrhagic strokes. Balance disorders due to loss or decreased motor function make stroke patients vulnerable to falls. The aim of this research is to determine the effect of giving Compelled body weight shift on non-hemorrhagic stroke to improve dynamic balance.

Subjects and Method: This research was a quasi experiment conducted in Sri Meranti Village, Rumbai, Pekanbaru, Indonesia, from June 2023. 12 non-hemorrhagic stroke patients were selected using purposive sampling. The dependent variable was dynamic balance. The independent variable was compelled body weight shift. Body dynamic balance was measured using Berg balance scale. Body dynamic balance before and after intervention was examined using .

Results: There was a significant increase in balance between the control group and the experimental group in non-hemorrhagic stroke sufferers after the compelled body weight shift was carried out ($p<0.001$).

Conclusion: Compelled body weight shift balance training can be used to improve the body dynamic balance in non-hemorrhagic stroke patients.

Keywords: compelled body weight shift, dynamic balance, non-hemorrhagic stroke

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Cite this as:
Anugrah WN, Sudaryanto WT (2024). The Impact of Inducing Compelled Body Weight Shifts on Non-Hemorrhagic Stroke Patients to Improve Dynamic Balance. Indones J Med. 09(08): 214-221. https://doi.org/-10.26911/theijmed.2024.09.02.08.

BACKGROUND

Stroke is a brain attack that occurs suddenly where there is partial or complete disruption of brain function as a result of disruption of blood flow due to blockage or rupture of certain blood vessels in the brain, causing brain cells to lack blood, oxygen or nutrients and ultimately can cause The death of these cells occurs in a relatively short time (Irfan, 2012).

Stroke is a condition used to describe neurological changes caused by disturb-

ances in blood circulation to parts of the brain. According to the American Heart Association (2022), stroke accounts for approximately one in every 77.2 million deaths in the United States in 2021. Stroke is increasingly becoming a serious problem faced by almost the entire world. According to the American Heart Association (AHA), in America every year 50-100 out of 100,000 people suffer from it. In ASEAN countries, stroke is also a problem. From data from the Center for Health Data and Information, Indonesia is the country in Southeast Asia with the highest death rate due to stroke, followed by the Philippines, Singapore, Brunei, Malaysia and Thailand. The results of basic health research showed that the prevalence of stroke was 10.9 per mile, with the highest area in East Kalimantan (14.7 per mile) and the lowest in Papua Province (4.1 per mile). (Fawwaz et al, 2023)

In a stroke, paralysis or weakness (hemiparesis) occurs on one side of the body, including the upper limbs, trunk and lower limbs. Hemiparesis is a complication that often occurs after a stroke. It was found that 70-80% of patients who had a stroke experienced hemiparesis (Katan & Luft, 2018). Stroke patients will usually experience sensory and motor disorders, decreased muscle strength, loss of sensation, and decreased coordination abilities. Then post-stroke patients will experience difficulty controlling balance and postural control. The importance of postural control in walking will minimize the risk of falls in stroke patients (Chung et al., 2013).

Patients with hemiparetic stroke will experience various balance disorders. Impaired standing balance in hemiparetic stroke patients is related to the inability to regulate body weight transfer and decreased muscle movement ability resulting in decreased body balance. Balance involves various movements in each body segment supported by the musculoskeletal system and fulcrum. The ability to balance body mass with a fulcrum will enable humans to carry out activities effectively and efficiently (Irfan, 2010).

By overcoming the problem of the risk of falls in post-stroke patients, problems such as balance and functional disability can be overcome or eliminated. To reduce the symptoms mentioned above, non-pharmacological measures are needed, namely physiotherapy. Physiotherapy measures that can be carried out include giving forced body weight shifts.

Compelled body weight shift is a weight shift therapy that involves forcibly shifting body weight in the affected direction by inserting a shoe insole on the unaffected lower extremity in overcoming paretic foot learning disabilities accompanied by exercise therapy. Compelled body weight shift with exercise therapy for stroke sufferers can improve balance and gait speed (Syekh Mania, 2015)

SUBJECTS AND METHOD

1. Study Design

This was a quasi-experiment conducted in Sri Meranti Village, Rumbai, Pekanbaru, Indonesia, from June 2023.

2. Population and Sample

Total sample of 15 non-hemorrhagic post-stroke patients aged 20 to 80 years old was selected purposively. The inclusion criteria comprise the ability to stand and maintain balance with minimal assistance, comprehension and adherence to instructions, and walking five meters without support. Patients presenting serious and unstable medical conditions, a medical history including neurological diseases such as Parkinson's, Alzheimer's, multiple sclerosis, additional significant comorbidities, contractures, and

deformities, were excluded from the study. Three participants dropped out as they did not undergo therapy and did not complete the assessment. The total sample consisted of 12 participants divided into two groups: the treatment group (6 participants) received Compelled body weight shift training, while the control group (6 participants) only received usual care (health education).

3. Study Variables

The dependent variable was body dynamic balance. The independent variable was training using Compelled body weight shift.

4. Operational Definition of Variables

Compelled body weight shift exercise is a method of forcing the body's weight towards the affected lower extremity. Physical exercises such as bridging, mobility in the lumbar and pelvic areas, muscle strengthening exercises and walking exercises using shoes with 10 mm insoles inserted in them accompanied by these physical exercises cause a shift in the line of gravity from the unaffected foot to the paretic foot, which ultimately results in a transfer of body weight. the same load to both lower legs and also the same load on both legs so that there is an increase in proprioceptive stimulation in all joints of the paretic leg which leads to joint stability. (Siddharth, 2014). Compelled Body Weight Shift (CBWS) is carried out with a frequency of 6 times per week for 2 weeks and an intensity of 1 hour conventional physiotherapy treatment session consisting of active movement exercises, postural strengthening, functional exercise correction (Lobo, 2021).

Dynamic balance is the ability to maintain balance when moving. The quality of body balance depends on the integrity of the central nervous system, peripheral nervous system, and musculoskeletal system. Improvement in balance will be evaluated using the BBS measuring instrument. By using the BBS examination form, patients are asked to carry out 14 types of static and dynamic balance tests on a scale of 0-4 on the BBS form. The patient's test procedure is assessed when carrying out the 14 types of tests, according to the criteria developed by Berg with a Maximum Total Score of 56. Interpretation Score: 0-20 Must use a wheelchair (wheelchair bound), 21-40 Walks with assistance, 41-56 independent.

5. Study Instruments

The balance instrument in non-hemo-ragic post-stroke patients was measured using the Berg Balance Scale (BBS) measurement and then recorded on the observation sheet.

6. Data analysis

Gender was described in frequency (n) and percent (%). Mean score of body dynamic balance pre and post intervention was measured using independent t test.

7. Research Ethics

This research was supported by an ethical permission letter, including informed consent, and confidentiality signed during the research process. The ethical consideration letter for this research was obtained from the Research Ethics Committee Educational Installation at TK.II Hospital 04.05.01 dr. Sodjono, Magelang, Indonesia, No. 210/EC/V/2023.

RESULTS

1. Univariate Analysis

Mean of age of participants was 51 years old. The average BMI was 23.96 kg/m², with values ranging from 20.76 to 28.34 kg/m², indicating that the BMI of the research subjects falls within the normal body weight range.

Table 1. summarize of continous data

Variable	n	Mean	SD	Minimum	Maximum
Age (years old)	12	51.75	6.99	45	66
Body balance score					
Pre intervention	12	36.75	1.54	35	40
Post intervention	12	39.92	2.27	36	43
Body weight (kgBB)	12	61.92	8.66	48	80
Body height (m)	12	160.5	6.50	150	170
Body mass index (kgBB/m^2)	12	23.96	2.25	20.76	28.34

Table 2. Gender distribution of study participants

Gender	Frequency	Percentage (%)
Male	5	41.7 %
Female	7	58.3 %

Table 3. Mean difference of body dynamic balance between groups, before and after intervention

Group	n	Mean	SD	p
Pre intervention				
Intervention (compelled body weight shift)	6	36.83	1.83	0.862
Control (usual care and health education)	6	36.67	1.37	
Post intervention				
Intervention (compelled body weight shift)	6	38.17	1.47	0.002
Control (usual care and health education)	6	41.67	1.37	

DISCUSSION

Stroke is a neurological deficit that occurs suddenly due to vascular disorders in the form of a lack of oxygen supply to the brain that lasts more than 24 hours, resulting in damage or necrosis of brain tissue. In general, strokes are divided into 2, namely hemorrhagic and non-hemoragic strokes (Aditya et al., 2022). Stroke also known as cerebrovascular accident (CVA) is an acute neurological injury in which the blood supply to parts of the brain is disrupted (Kumar et al., 2012). According to the American Heart Association (2016), stroke is the main preventable cause of disability. 70-80% of stroke cases experience muscle weakness, the remainder experience symptoms such as motor disorders. Apart from that, stroke patients also experience functional disorders. Stroke disorders, both motoric and sensory, result in imbalance in the form of muscle weakness, impaired control and lack of flexibility in balancing the body (Pradesti & Indriyani, 2020).

In a stroke, paralysis or weakness (hemiparesis) occurs on one side of the body, including the upper limbs, trunk and lower limbs. Hemiparesis is a complication that often occurs after a stroke. It was found that 70-80% of patients who had a stroke experienced hemiparesis (Katan & Luft, 2018). Stroke patients will usually experience sensory and motor disorders, decreased muscle strength, loss of sensation, and decreased coordination abilities. Then post-stroke patients will experience difficulty controlling balance and postural control. The importance of postural control in walking will minimize the risk of falls in stroke patients (Chung et al., 2013). Stroke patients experience balance problems and decreased coordination by 70-80%. Balance disorders due to loss or decreased motor function

make stroke patients vulnerable to falls. Apart from that, patients also tend to experience depression because they are afraid of falling (Mauni et all., 2020).

Factors influencing the incidence of risk factors, prognosis of stroke attacks and quality of life, namely average age 70.3 years, female gender, time to attack 13.4 hours. Based on the analysis of risk factors for the occurrence of stroke, the main factor causing stroke is hypertension, apart from that, other risk factors are smoking, diabetes mellitus and dyspidemia, resulting in ischemic stroke and hemorrhagic stroke. Based on this, it is necessary to provide knowledge about stroke factors to reduce the incidence rate. stroke (N&B 2015). Stroke risk factors can be categorized as modifiable and non-modifiable factors. Risk factors that can be modified are hypertension, smoking, diet and activity, while risk factors that cannot be modified are age, gender, and race or ethnicity (main, 2022).

Literature studies that have been carried out state that women tend to have more risk factors for cardioembolic stroke than men and this tends to be experienced by housewives 2 . This is confirmed by research conducted by Kristie that stroke is the third leading cause of death in women in New Zealand after heart disease and cancer. The high mortality, morbidity and disability experienced by women who experience stroke causes an imbalance in the ecosystem within the family, especially which focuses on being a housewife, because housewives are believed to have a multifunctional role in caring for children, husbands or completing all household matters.

The physiological and epidemiological aspects of stroke that occur in women are stimulated by vascular biological factors, preeclampsia, hormonal risk factors for peripartum disease, hemodynamics, hypertensive disorders in pregnancy, especially preeclampsia/toxemia, systemic multiorgan endotheliopathy, psychological disorders from stress to depression 4. This stroke risk factor is proven by data showing that female patients who experience a stroke tend to have night shift work (7%), work as housewives (46.8%), private employees (10.6%), farmers (7.9%) and self-employed (7.3%) and the main trigger for experiencing a stroke is stress 5. Research conducted in Indonesia also presented data that the majority of stroke sufferers who were female, namely 42%, were housewives (Dewi, 2023).

One of the balance measuring tools that can be used is the Berg balance scale. Balance assessment is carried out using the Berg Balance Scale (BBS). BBS consists of 14 movement tasks, namely standing, sitting then standing, standing without assistance for 2 minutes, standing with eyes closed, standing with legs together, standing then sitting, sitting without assistance behind him, moving with and without assistance, reaching for something with arms within reach, picks up an object from the floor, turns to look behind him, turns 3600, alternately places 1 foot on a chair, places 1 foot in front, stands on one foot. The balance assessment takes an average of 15 minutes (Berg, Wood-Dauphinee, et al, 1992 in Park & Lee, 2016). One of the non-pharmacological treatments that can be given for non-hemorrhagic stroke is giving forced body weight shifts.

According to (Syekh Mania, 2015) Compelled body weight shift is a weight shift therapy that involves forcibly shifting body weight in the affected direction by inserting a shoe insole on the unaffected lower extremity in overcoming paretic foot learning disabilities accompanied by exercise therapy.

To achieve forced weight transfer, individuals with hemiparesis included in the experimental group were given a 0.6 cm shoe lift made from medium hardness foam material, whereas for the control group no shoe lift was given. Thus, each subject included in the experimental group wore shoes with attached (insole) on the non-painful limb during the treatment period. Subjects in both groups received similar physical therapy treatment (Mohapatra, 2012). Compelled body weight shift with exercise therapy for stroke sufferers can improve balance and gait speed.

After research was carried out and there was a difference in improving balance in the experimental group and the control group, it showed that there was effectiveness in using this non-pharmacological therapy, namely forced body weight shift. This can be seen from the respondents who were given the intervention, their walking balance improved and became better. The use of shoe insoles given to the unaffected lower leg for post-stroke patients has shown significant differences in qualitative parameters before and after. If the use of shoe insoles accompanied by physical exercise is carried out regularly it will cause a shift in the line of gravity of the unaffected leg to the paretic leg which ultimately results in the transfer of equal body weight to both lower legs and also the same load on both legs resulting in increased proprioceptive stimulation in all joints of the paretic leg which leads to joint stability. This increase in proprioceptive stimulation can result in increased activation of the central nervous system as well as the cortical spinal level, and can cause effective reorganization of the brain, thereby enhancing motor relearning in patients.

After measuring balance in non-hemorrhagic post-stroke patients, both in the treatment group who were given the Compelled body weight shift treatment and the control group who were given exercise therapy and education, the results were an increase in balance. It was found that there was a significant effect of Compelled body weight shift on improving dynamic balance in non-hemorrhagic stroke sufferers with a value of 0.000 < 0.05.

AUTHOR CONTRIBUTION

Welya Nesvi Anugrah is the main researcher on the chosen topic. He collected data and then analyzed the data and then wrote the publication manuscript. Wahyu Tri Sudaryanto is the member who assisted in preparing the publication manuscript.

FINANCIAL SUPPORT AND SPONSORSHIP

This study is self-funded.

ACKNOWLEDGEMENT

Researchers are very grateful to dr. Soedjono Magelang Hospital.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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