Volume. 7 Number. 1
Period: January - June 2023; page 22-30
p-ISSN : 2580-1112; e-ISSN : 2655-6669

journal homepage: https://ejournal.akperfatmawati.ac.id
DOI: https://doi.org/10.46749/jiko.v7i1.114

Jurnal Ilmiah Keperawatan Orthopedi (JIKO)
Article history:
Received: February 18, 2022
Revised: January 23 2023
Accepted: February 12, 2023

Pelvic Stability Training on Movement Control, Pelvic Muscle Strength, Walking Speed, and ADL in Post-Stroke Patients: CASE STUDY

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Abstract

A cute hemiparesis can develop in response to a variety of cerebral diseases including intracerebral hemorrhage and ischemic stroke, Pelvic stability training is an exercise protocol designed based on neurophysiological and biomechanical aspects of pelvic stability designed based on the performance of each patient so as to increase pelvic stability. pelvic stability training is carried out for 30 minutes, 3 times per week, for 3 weeks. Pelvic stability training (PST) exercises have been shown to improve motor function in the lower extremities both in muscle strength, and to help meet ADL.

Keywords: Pelvic Stability Training, Rehabilitation, Muscle Strength, ADL, Stroke

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Introduction

Stroke is defined as a disruption of the blood supply to the brain, usually due to the rupture of a blood vessel or blockage by a blood clot. This leads to disruption of oxygen and nutrient supply in the brain and damage to brain tissue (World Health Organization, 2016).

Stroke has an impact on a person, such as paralysis, speech disorders, emotional disorders, pain, sleep disorders, depression, and dysphagia (Ayis et al., 2015; Prasetyanto, D., & Yona, S. 2019). This is because stroke can show major or minor symptoms and also be permanent or persistent, including visual disturbances, impaired motor and speech functions, and also paralysis (Irfan, 2010; Liu, Shi, Shi, Hu, & Jiang, 2016).

According to the American Academy of Neurology (2017), a common disability that is often found in stroke patients is paralysis or weakness on one side of the body, called hemiplegia. A common impact after a person has a stroke is hemiparesis (National Stroke Association, 2016).

Hemiparesis occurs due to blockage of the carotid or basilar artery, causing a deficit in the frontal cortex region supplied by the middle and anterior cerebral arteries, where an occluded anterior choroidal artery can affect the internal capsule. Acute hemiparesis can develop in response to a wide variety of cerebral diseases, including intracerebral hemorrhage and ischemic stroke (Kim Min Chan, 2018).

Hemiparesis after stroke affects gait and impairs almost 80% of stroke survivors (Weiss, 2010). Data from 28 hospitals in Indonesia explain that

patients who experience motor disorders are around 90.5% (Misbach & Soertidewi, 2011).

Neurological deficits, especially in motor disorders, can cause a person with a stroke to experience depression due to limits in movement and the activities of daily life (Katherine Salter, 2016). About two-thirds of patients after stroke show poor walking ability, and 72% of them show severe lower limb motor deficits during the sub-acute and chronic stages of stroke recovery. After stroke, inappropriate muscle activity patterns associated with spasticity and weakness, soft tissue stiffness of the lower extremities, and postural deviations of the body and pelvis may affect the overall postural control system.

The pelvis, being the main structure connecting the trunk to the lower extremities, supports the weight of the body and transfers its load to the lower limbs. Also, the pelvis is part of the lower body when a person is in a sitting position, so it becomes a functional component of the lower limbs when a person stands and walks.

Nurses, as an important part of the rehabilitation process of stroke patients, have a role in fulfilling mobilization needs (Kozier, Erb, Berman, & Snyder, 2011). Mobilization is a physiological need for all humans (Potter & Stockert, 2009). Mobilization is needed by the body to maintain body function, improve blood circulation, help breathing become better, maintain muscle tone, and facilitate elimination (Kozier, Erb, Berman, & Snyder, 2011).

So a nursing intervention is needed that can support the patient's mobilization needs, one of which is optimizing pelvic balance stability. Pelvic stability refers to the ability to coordinate activity between the lower trunk and proximal hip muscles during balance tasks and functional mobility, where the pelvis is responsible for dynamic proximal stability to allow effective lower extremity mobility.

Pelvic stability training is an exercise protocol designed based on the neurophysiological and biomechanical aspects of pelvic stability. Muscle selectivity and co-contraction of the lower and proximal hip muscles are achieved through training and reinforced through therapeutic guidance and irradiation strategies in lying, sitting, and standing positions. Exercise sets and intensity are designed based on each patient's performance so as to improve pelvic stability (Dubey et al., 2018).

Methods

This type of descriptive design is to describe the implementation of pelvic stability training therapy on movement control, pelvic muscle strength, walking speed, and ADL in post-stroke patients. The approach used is to provide nursing assistance through assessment, planning, implementation, and nursing evaluation. Subjects taken will be adjusted to the inclusion criteria. The inclusion criteria are as follows:

1. Patients with the first episode of hemorrhagic or ischemic stroke
2. Have the ability to understand simple verbal commands.
3. Have the ability to stand with or without manual assistance or mobility aids.
4. Brunnstrom scored above 3, which assesses limb motor recovery.

   while the exclusion criteria include having other neurological and musculoskeletal dysfunctions such as cerebellar lesions, perceptual dysfunction, and a history of lower extremity or pelvic fractures in the previous 6 months, which may potentially affect balance performance and walking ability. Data collection tools or instruments in the preparation of this case study

used a surgical medical nursing assessment format, FMA and Barthel Index Measurement observation sheets and several questions developed by the author.

Results and Discussion

The application of pelvic stability training (PST) to improve pelvic muscle strength, walking speed, and ADL in post-stroke patients in the lower extremities was carried out for 4 weeks, starting from December 23, 2020, to January 17, 2021. This application was carried out on 10 patients undergoing outpatient care. During this time, there were 14 stroke patients who experienced hemiparesis, and there were 9 people who did not fit the inclusion criteria due to decreased consciousness and cognitive impairment, so that the patients who followed the pelvic stability training (PST) intervention until completion were 5 stroke patients.

Patient Characteristics

The description of patient characteristics based on the evaluation of the results of the application of pelvic stability training (PST) can be seen in the following description:

Table 1. Mean Age Distribution of Patients Applying pelvic stability training (PST) Intervention (n=5)

Variabel	Mean±SD	Min-Max
Age	51,40±11,63	33-64

Based on table 1 above, the mean age of stroke patients involved in this application is 51.40, with a standard deviation of 11.63.

The results of the analysis of the effect of pelvic stability training (PST) on increasing upper muscle strength based on differences before and after intervention can be seen in the following table.

Table 2. Differences in muscle strength in patients' pre- and post-intervention applications of pelvic stability training (PST)

Variabel	Mean±SD	Mean	Min-Max	95% CI	Pvalue
Pre intervention muscle strength	3,00±0,00	0,20	3-3	-1,7-0,64	0,04
Post intervention muscle strength	4,20±0,44		3-5		

Table 2 shows that there is an effect of pelvic stability training (PST) on increasing muscle strength in the lower extremities. Value = 0.04

Pelvic Stability Training (PST) Evaluation

Pelvic stability training (PST) exercises are performed by the patient for 30 minutes according to the schedule agreed upon by the patient. FMA and Barthel Index measurements were taken before performing pelvic stability training (PST) exercises and measured again after 3 weeks. The following are the results of measurements taken before and after the provision of pelvic stability training (PST):

Table 3: Differences in FMA Scores Before and After Pelvic Stability Training (PST) Exercise

Variabel	Mean±SD	Mean	Min-Maks	95%CI	*Pvalue*
Pre FMA	11,80 ±2,049		10-15	-19,82-14,98	

Variabel	Mean±SD	Mean	Min-Maks	95%CI	*Pvalue*
Post FMA	29,20 ± 1,78	17,4	28-32		0,000

Judging from table 3 above, the mean FMA score before pelvic stability training (PST) was 11.80 with a standard deviation of 2.049, and the mean FMA score after pelvic stability training (PST) was 29.20 with a standard deviation of 1.78. The table above shows the effect of pelvic stability training (PST) on FMA scores with a p value of 0.00.

Table 4: Differences in Barhel Index Scores Pre and Post Pelvic Stability Training (PST) Exercise

Variabel	Mean±SD	Mean	Min-Ma	95%CI	*Pvalue*
Pre Barthel Indeks	5,80 ±0,837		5-7		
Post Barthel Indeks	13,60 ± 1,140	7,8	12-15	-9,84-5,76	0,000

Judging from table 4 above, the mean Barthel Index score before pelvic stability training (PST) was 5.80 with a standard deviation of 0.837, and the mean Barthel Index score after PST was 13.60 with a standard deviation of 1.140. The table above shows the effect of pelvic stability training (PST) on the Barthel Index score with a p value of 0.000.

Discussion

From the data of this study, it was found that the number of men was four more than the number of women. In an article also explains the difference from gender in stroke patients where the number of men is more than women (Hiraga, 2017). in this study men are more at risk of stroke in middle-aged age than women, this is due to the lifestyle of men such as smoking and drinking alcohol.

Pathophysiologically, the smoking pattern will leave nicotinic acid and catecholamines in the blood, which will result in platelet adhesion so that a thrombus is formed, which will block the blood vessels and result in ischemic stroke. Whereas in women where stroke sufferers are more at an older age it is often associated with a longer life expectancy of women, on average at 75 years and above (Yu Ce, et el, 2015). In addition, women have several fundamental stroke risks, such as the use of oral contraceptive pills (OCP), pregnancy, menopause, and hormone replacement therapy (HRT) (Roy-O'Reilly et al., 2018).

From this application, data related to muscle strength was obtained, where the hand muscle strength increased with a p value of 0.04 (p 0.05), which explained that there was a difference in leg muscle strength between before and after the intervention. The increase in muscle strength of respondents is likely due to the physiological and natural response of

respondents. In some cases, full recovery of trunk muscle function can occur after a stroke.

It is thought that the return of muscle strength function, especially in the extremities, is due to reperfusion of ischemic areas and resolution of cerebral edema, which have contributed to a decrease in the level of consciousness (Brenner, 2018). Naturally, passive movement will stimulate functional electricity in the muscles.

Functional Electrical Stimulation (FES) of the muscles will induce cyclic movement and has been shown to improve motor function in stroke patients (Brenner, 2018). In this group, the pelvic stability training (PST) exercise activities of the respondents made it possible to stimulate movement in their muscles, so that several respondents experienced increased muscle strength.

So that physiologically the more often the muscles are trained and stimulated will increase the activation of chemicals in metabolic, neuromuscular and muscle processes. Smooth muscles on actin and myosin filaments have chemical properties and interact with each other. The interaction process is activated by calcium ions and ATP and then turns into ADP to provide energy for muscle contraction.

In addition, in line with the increase in muscle strength, it will affect the assessment of the FMA and Barthel Index, which show the effect of pelvic stability training (PST) with a p value of 0.000.

The application of pelvic stability training (PST) to increase pelvic muscle strength, walking speed, and ADL in post-stroke patients in the lower extremities During this time, 14 stroke patients who experienced hemiparesis were obtained, and there were 9 people who did not fit the inclusion criteria due to decreased consciousness and cognitive impairment, so that the patients who followed the pelvic stability training (PST) intervention until completion were 5 stroke patients. In the application of EBN, four of them are male and one is female. In an article also explains the difference from gender in stroke patients where the number of men is more than women (Hiraga, 2017). In addition, women have several fundamental stroke risks, such as the use of oral contraceptive pills (OCP), pregnancy, menopause, and hormone replacement therapy (HRT) (Roy-O'Reilly et al., 2018).

Pelvic stability training (PST) exercises were performed by the patient for 30 minutes according to the schedule agreed upon by the patient. Measurements of muscle strength exercises were performed by the patient for 30 minutes according to the schedule agreed upon by the patient.

Measurements of muscle strength (FMA and Barthel Index) were taken before doing pelvic stability training (PST) exercises and measured again after 3 weeks. In this application, different results are obtained for each patient so as to provide an overview of the process that is taken into consideration in each EBN intervention. The results of the process for each patient are as follows:

Patient 1

In this patient, the initial assessment before the intervention of pelvic stability training (PST) using FMA obtained a value of 12, and muscle strength was at a value of 3 and a Barthel index of 6. At the time of implementation, the patient was very enthusiastic about doing pelvic stability training (PST) exercises and following each stage in this exercise process. During the pelvic stability training (PST) exercise, several difficulties were found in the patient, including the patient getting tired easily and it taking longer to do the exercise each session, so that when accumulated, the exercise could run between 25 and 30 minutes in each session.

This patient often says "mas I rest first for a minute, tired".

In each session, the patient always asks for a short break of about 1-2 minutes to

relax his muscles and gather energy for the next session. This can also be seen from the patient's sweating when doing pelvic stability training (PST) exercises. During the application of EBN, the patient and family are very enthusiastic and often ask when the exercise can be done again at the end of each exercise: "When will this exercise be done again?" "Let me walk again soon." From here, it can be seen how much motivation there is in the patient for doing this exercise, but because this exercise is only done three times a week, the patient again asks, "What if it were done every day?" So back in the initial journal, it was still explained that pelvic stability training (PST) exercises were carried out three times a week.

In the application process to make it easier to do pelvic stability training (PST) exercises, we recommend that patients train the extremities that are not experiencing weakness. This is intended to help patients recognize and feel the movement of this exercise under normal conditions. so that it can provide an overview of the extremities that experience weakness when this exercise is performed.

At the time of the exercise on the normal extremity, fatigue was obtained after completing the session, as can be seen from the patient's expression, "It was tired too," so it is necessary to consider resting again before continuing to the extremity that has weakness. During the exercise process, there were no significant obstacles because the patient was very cooperative and enthusiastic.

This patient underwent pelvic stability training (PST) in the hospital on the 5th floor of Building A for 1 week after passing the acute phase and the remaining 2 weeks at home and in the clinic when controlling in the hospital with the same intensity, namely training done 3 times a week. After 3 weeks of evaluation of the pelvic stability training (PST) exercise process, the FMA value was 28, muscle strength was at a value of 5, and the Barthel index was 15. These results are very visible when the patient can also walk, even if not very fast.

Patient 2

In this patient, the initial assessment before the intervention of pelvic stability training (PST) using FMA obtained a value of 10, and muscle strength was at a value of 3 and a Barthel index of 5. Unlike patient 1, this patient seemed less enthusiastic about doing pelvic stability training (PST) exercises; this was reflected in her facial expressions, and she rarely spoke when the nurse assisted in pelvic stability training (PST) exercises. Even so, the patient continued to do the exercises according to the stages of the pelvic stability training (PST) exercise process.

Learning from the experience of patient 1, every exercise per session the patient is given the opportunity to rest 1-2 minutes and in this patient the pelvic stability training (PST) exercise time can be between 30-45 minutes depending on the length of the patient's break in each session. Just like the previous patient, the patient also said, "Tired, mas, rest first" at the end of each session.

In its application, it was found that there were difficulties in stages 1-3 on the extremities that experienced weakness, which was illustrated by no movement to movements that were not in accordance with the stages, and the patient complained that it was "difficult to move," so that the nurse needed help to straighten and correct the movement by helping to lift and model pelvic movements with the help of the nurse's hand to the patient, and helping to move the feet on the ball correctly using the nurse's hand. This is different from patient 1, where even though it is not perfect, the patient can try to do stages 1-3 movements with his own ability without the help of a nurse.

In the process of pelvic stability training (PST) in this patient, there was better motivational progress in the second week, where the patient had begun to be enthusiastic about doing the exercise

movements with minimal assistance from the nurse when performing movements in stages 1-3. This was illustrated when the patient said, "I am getting used to the exercise movements and can do it without help." In addition, the patient also asked, "I have done it regularly according to the schedule; when will I be able to walk?" This question illustrates the patient's motivation and desire to walk immediately, which were not obtained in the first week. At the time of entering the second week the patient was allowed to go home so that the exercises were carried out in the clinic during control and at home according to instructions 3 times a week.

After 3 weeks of evaluation of the pelvic stability training (PST) exercise process, the FMA value was 26, muscle strength was at a value of 4, and the Barthel index was 12. Although the results are not as good as patient 1, from these results, it can also be seen the positive effect of pelvic stability training (PST), where there is a difference in value from the first measurement before training to the last measurement after training.

Patient 3

In this patient, the initial assessment before the intervention of pelvic stability training (PST) using FMA obtained a value of 15, and muscle strength was at a value of 3 and a Barthel index of 5. In patient 3, she was very eager to do pelvic stability training (PST), this was illustrated by the phrase "let's do the exercise immediately, so I can walk quickly and go home" with this motivation providing positive energy in doing every exercise.

In its application, there is not much difference between patients 1 and 2 in the obstacles to doing pelvic stability training (PST) exercises. However, there are several stages where, in addition to resting, patients also ask for a drink because they are thirsty during exercise. In addition, learning from the experiences of patients 1 and 2, we adjusted the stages of this patient's training according to the constraints of the previous patient so that this patient can provide a better process when doing pelvic stability training (PST) exercises and a minimum of complaints when doing so.

Although there are no complaints in this patient, there are several things that can be used as input on the application of pelvic stability training (PST). Because this patient is a little fat, it looks difficult to do the movements in stage 1, so it requires the help of a nurse in doing it. Besides that, it is also necessary to have a flat and rather hard mat or mattress in carrying out this action so that the patient's body does not go down on a soft mat because of his excessive weight, and also a hard mat that can be used as a pedestal when doing pelvic stability training (PST) exercises.

In its application after the acute phase, the patient is treated for 5 days, and the rest of the time, the patient continues pelvic stability training (PST) at home and at the clinic during transfer to the hospital. After 3 weeks of evaluation of the pelvic stability training (PST) exercise process, the FMA value was 28, muscle strength was at a value of 4, and the Barthel index was 13. The results of this evaluation illustrate that this exercise also has a positive impact on patient 3, as can be seen from the change in value.

Patient 4 and Patient 5

Learning from the experience of patients 1-3 on pelvic stability training (PST) exercises provides a lot of input on the application of PST to patients 4 and 5, so that in patients 4 and 5, there are no obstacles or complaints from patients either when implementing the stages of training or obstacles related to training instruments and evaluation instruments.

In patient 4, the initial assessment before the intervention of pelvic stability training (PST) using FMA yielded a value of 10, muscle strength was at a value of 3, and the Barthel index was at 6. And when evaluated the process for 3 weeks the FMA value was 26 and muscle strength was at a

value of 4 and barthel index 13.

Whereas in patient 5, the FMA value was obtained at a value of 10, muscle strength was at a value of 3, and the Barthel index was at 5. And when evaluated the process for 3 weeks the FMA value was 24 and muscle strength was at a value of 4 and barthel index 12.

The increase in muscle strength of the respondent is likely due to the physiological and natural response of the respondent. In some cases, full recovery of trunk muscle function can occur after a stroke. It is thought that the return of muscle strength function, especially in the extremities, is due to reperfusion of ischemic areas and resolution of cerebral edema, which have contributed to a decrease in the level of consciousness (Brenner, 2018).

Naturally, passive movement will stimulate functional electricity in the muscles. Functional Electrical Stimulation (FES) of the muscles will induce cyclic movement and has been shown to improve motor function in stroke patients (Brenner, 2018). In this group, the pelvic stability training (PST) activity of the respondents made it possible to stimulate movement in the muscles, so that several respondents experienced increased muscle strength. so that the more often the muscles are trained and stimulated, the greater the activation of chemicals in metabolic, neuromuscular, and muscle processes. where fine muscles on actin and myosin filaments have chemical properties and interact with each other.

The interaction process is activated by calcium ions and ATP and then turns into ADP to provide energy for muscle contraction. In addition, in line with the increase in muscle strength, it will affect the assessment of the FMA and Barthel Index so that this physiological background has a positive effect on stroke patients who experience hemiparesis and who have performed pelvic stability training (PST) exercises.

Conclusion

There is a difference in the average muscle strength, FMA, Barthel Index before and after pelvic stability training (PST), it is known that the average lower extremity motor muscle strength before and after pelvic stability training (PST) intervention. Pelvic stability training (PST) has been shown to improve lower extremity motor function both muscle strength, and help in fulfilling ADLs.

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