CASE REPORT

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Foot-core stability in non-hemorrhagic stroke: A case report

Yulia Dini Wahyuni[1*], Arif Pristianto[1], Elif Nur Efendi[2]

[1]Physiotherapy Profession Study Program, Faculty of Health Sciences, Universitas Muhammadiyah Surakarta, Indonesia;
[2]Fisioterapi Clinic, Magetan, East Java, Indonesia.

*Corresponding author:
Yulia Dini Wahyuni;
Physiotherapy Profession Study Program, Faculty of Health Sciences, Universitas Muhammadiyah Surakarta; Indonesia;
J130225101@student.ums.ac.id

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ABSTRACT

Introduction: Stroke is a neurological deficit or apoplexy that occurs suddenly due to vascular disturbances. Exercise delivery, the function of the foot-core system (foot-core stability), and the potentially beneficial effects of training have received increasing attention in the clinical and athletic fields because of the critical role of the intrinsic leg muscles as local stabilizers and direct sensors of foot deformation.
Case description: The research was a case study of an elderly patient aged 67 years diagnosed with hemiparesis non-hemorrhagic stroke. This case was taken at the Magetan Physiotherapy Clinic from December 7 to December 27, 2022. Physiotherapy problems in this case included pain, muscle weakness, limited joint motion, and impaired standing balance.
Results: The results obtained after administering physiotherapy interventions and exercise therapy can improve the functional abilities of the body experiencing weakness, increase proprioception in patients and provide foot-core stability that can help with problems.
Conclusions: Physiotherapy interventions with exercise therapy could increase proprioception and provide foot-core stability for stroke patient's with severe disability.

Keywords: exercise therapy, foot core stability, foot core system, hemiparesis stroke, non-hemorrhagic stroke.
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INTRODUCTION

A stroke is a neurological deficit/apoplexy that occurs suddenly due to blood vessel 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, stroke is divided into hemorrhagic (bleeding) and non-hemorrhagic (blockage) strokes.[1] Hemiparesis is a complication that often occurs after a stroke. It was found that 70-80% of stroke patients had hemiparesis.[2] Hemorrhagic and non-hemorrhagic strokes can cause problems or disorders in stroke sufferers both physically and psychologically, according to the location of the damage in the brain. For this reason, stroke sufferers must undergo a relatively long recovery period.[3]

Stroke has the impact of impairing nerve function due to non-traumatic cerebral circulation problems. These nerve abnormalities impair motor, sensory, and cognitive abilities.[4] Stroke patients may develop muscle weakness, stiffness, paralysis, hypertonia, and enhanced physiological reflexes due to motor and sensory problems.[5,6] Physiotherapy plays an essential role in post-stroke rehabilitation. Physiotherapy can help restore the loss of movement function due to stroke and help regain patient strength to return to activities independently.[7]

The problems of physiotherapy in stroke patients are hemiparesis or hemiplegia of the limbs, balance disorders, sensory disturbances, motor disturbances, postural alignment/postural control, gait disturbances, and impaired functional ability and daily activities.[8] Exercise delivery and function of the foot-core stability system and the potentially beneficial effects of exercise have received increasing attention in the clinical and athletic fields because of the critical role of the intrinsic foot muscles as local stabilizers and direct sensors of foot deformation.[9] Extrinsic foot muscle tendons' orientations demonstrate their ability to support and control the foot dome's longitudinal and transverse components. During dynamic operations, these global movers provide both absorption and propulsion capabilities.[10]

Increased loading on foot (foot-core stability) causes a progressive decrease in the medial longitudinal arch, and activation of the intrinsic foot muscles can control and even counteract this deformation by stiffening the arch structure, showing essential implications for how forces are transmitted during locomotion and postural.[11] When the plantar muscles weaken or deform, the foot arches collapse, reducing a person's capacity to adjust to movement and, as a result, static and dynamic balancing ability.[12,13]

Treatment of hemiparesis stroke consists of short-term and long-term goals.[14] The short-term goals are to improve the patient's coordination, train the balance of sitting and standing to reduce pain, and increase the patient's muscle strength. The long-term goal is to restore the patient's upper and lower extremities' function to optimize activity and daily living (ADL) so that the patient can return to normal activities.[15] Therefore, the number of reports regarding foot-core stability in non-hemorrhagic stroke remains tiny. Given this discrepancy, this report aims to describe foot core stability

in non-hemorrhagic stroke cases.

CASE DESCRIPTION

The patient was on behalf of Mr W, 67, an old male diagnosed with a non-hemorrhage stroke. Complaints felt by the patient were numbness and weakness on the left side of the body and a feeling of heaviness in the body, unstable balance, and lack of coordination between the stability of the legs and the body in moving/carrying out daily activities. At each meeting, the patient received infrared intervention, electrical stimulation for 15 minutes, strengthening, scapula mobilization, pelvic mobilization, knee and ankle mobilization for 5-7 repetitions and held for 8 seconds, and passive and active exercises for 1-3 sets. The patient's vital signs are stable because the patient has a history of hypertension co-morbidities. This study used the case study method in patients with left hemiparesis non-hemorrhagic stroke in January 2022. This case was taken at the Magetan Physiotherapy Clinic. In December, the patient underwent a physiotherapy program for four meetings. The measurement tool used by researchers is the numeric rating scale (NRS) to evaluate the level of pain felt by patients with a scale of 1-10 (interpretation 0: no pain, 1-3: mild pain, 4-6: moderate pain, 7-10: severe pain). Manual muscle test (MMT) evaluates muscle strength in scapula, pelvic, knee, and ankle mobilization. Segment Foot-core stability is applied to determine the score to improve coordination, improve motor balance and develop motor control programs.

METHODS

Measuring instrument

The information for this research study was qualitative information about the pain measurement used a numeric rating scale, the muscle strength used a manual muscle test, the range of motion of the joint used a goniometer to find out how much movement the joint, the researchers used the foot-core stability segment to measure foot-core stability in non-hemorrhagic strokes to determine the patient's balance level in daily activities. The observations of this intervention will be cross-checked through interviews with therapists and families to establish its effectiveness. The measurements consist of monitoring the balance on items and the (Table 3).

Intervention

A patient receives infrared intervention, electrical stimulation for 15 minutes, exercise therapy in the form of (strengthening, scapula mobilization, pelvic mobilization, knee, and ankle mobilization for 5-7 repetitions and held for 8 seconds, and passive and active exercises for 1-3 sets) as well as stabilization of foot-core stability to increase muscle strength to relieve pain, strengthen muscles, improve coordination, improve motor balance and develop a motor control program.

Evaluation

The results were obtained on examination of pain on the baseline to 4th meeting using NRS (Figure 1). Silent pain at baseline and 1st meeting obtained results with a value of 0/10, namely the absence of pain. On pain examination 2nd to 4th meeting, there was no pain at rest, with a value of 0/10. Tenderness at baseline was obtained with a value of 3/10, namely moderate pain. There is a decrease in the 3rd to 4th meeting, namely with a value of 2/10, namely mild pain. Motion pain at baseline to 2nd meeting obtained a value of 5/10, namely moderate pain. On 4th meeting, the pain had begun to decrease with a value of 4/10, namely moderate pain.

Examination of muscle strength using MMT shown in Table 2. was increased muscle strength from baseline to 4th meeting in the shoulder, elbow, wrist, hip, knee, and ankle areas. In the shoulder joint and elbow joint from baseline, the value is 3+, that is, it can fight gravity and/1 full range of motion (ROM) and can fight resistance at least up to 4th meeting, there is a change in value 4, namely against gravity, full ROM and against moderate resistance, the wrist joint from from T0 the value is 3, namely can fight gravity and / 1 full range of motion (ROM) until there is a change in value 4, namely fighting gravity, full ROM and fighting moderate resistance, in the hip joint and knee joint from baseline the value is 3+, namely can fight gravity and / 1 full range of motion (ROM) and against minimum resistance up to 4th there is a change in the number 4 namely against gravity, full ROM and against moderate resistance, and at ankle from 3 which is slightly against gravity / 1 entire Range Of Motion ROM to 3+ which is able to fight gravity and/1 full range of motion (ROM) and against minimum resistance, then for the dextra side the value is 5 which is full ROM and can fight maximum resistance.

On examination of the range of motion of the left shoulder joint baseline, the movement of the extension was 35°, flexion was 150°, adduction was 65° and abduction was 120°. At the elbow joint dextra extension movement is 0°, flexion is 145°, supination is 85° and pronation is 75°. At the wrist joint, dorsiflexion is 0° and plantar flexion 75°. At the lower extremity, hip joint flexion is 100° and extension 5°, abduction 40° and adduction 10°, knee joint flexion 120° and extension 0°, and on the ankle dorsiflexion 15° and palmar flexion 30°.

On examination, researchers used the

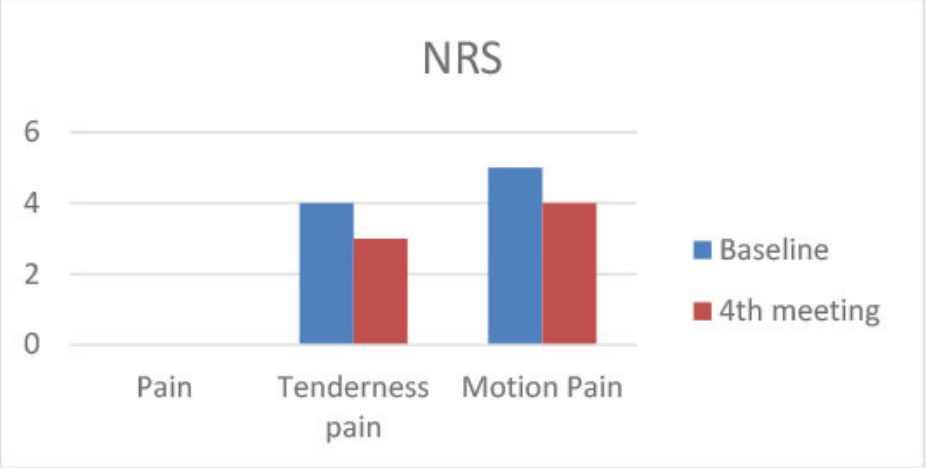

Figure 1. Numeric rating scale.

Table 1. Manual muscle testing examination

Regio	Movement	Left (Baseline)	Right (Baseline)	Left (4th)	Right (4th)
Shoulder	Flexion	3+	3	4	5
	Extention	3+	3	4	5
Elbow	Flexion	3+	5	4	5
	Extention	3+	5	4	5
	Prontion	3+	5	4	5
	Supination	3+	5	4	5
Wrist	Dorsi Flexion	3	5	3	5
	Palmar Flexion	2+	5	3	5
	Ulnar Deviation	3	5	3	5
	Radial Deviation	3	5	3	5
Hip	Flexion	3+	5	4	5
	Extension	3+	5	4	5
	Adduction	3+	5	4	5
	Abduction	3+	5	4	5
Knee	Flexion	3+	5	4	5
	Extension	3+	5	4	5
Ankle	Dorso Fleksi	3	5	3	5
	Plantar Fleksi	3	5	3	5

Table 2. Range of motion examination

Regio	Left	Right	Normal Value
Shoulder	S: 35°-0°-150°	S: 50°-0°-170°	S: 50°-0°-170°
	F:120 °-0°-65°	F: 135°-0°-100°	F: 170°-0°-75°
Elbow	S: 0°-0°-145°	S: 0°-0°-150°	S: 0°- 0°- 150°
	R: 85°-0°-75°	R: 100°-0°-40°	R: 90°- 0°-80°
Wrist	S: 0°-0°-75°	S: 0°-0°-70°	S: 0°- 0°- 60°
Hip	S: 5°-0°-100°	S: 15°-0°-170°	S: 15°- 0°- 125°
	F: 40°-0°-10°	F:45°-0°15°	F: 45°- 0°- 15°
Knee	S: 0°-0°-120°	S: 0°-0°-135°	S: 0°- 0°- 135°
Ankle	S: 15°-0°-30°	S: 20°-0°-35°	S: 20°- 0°- 35°

foot-core stability segment to measure foot-core stability in non-hemorrhagic strokes to determine the patient's balance level in daily activities. The lowest score for this segment is 0, which means there are obstacles in using torso balance as sitting balance, sitting to standing, effort to rise (sitting to standing), initial standing balance (first 5 seconds), standing feet together, therapist giving encouragement three times on the chest, standing with feet together and closing eyes, turning 360 degrees, standing up to sitting to standing), initial standing balance (first 5 seconds), standing feet together, the therapist pushes three times on the chest.

RESULTS

At the 1st meeting, the results of measurements using the numeric rating scale gave a score of 0 for pain at rest in the non-pain category, and for tenderness, the value was 2-3, which means the patient feels mild pain. The patient scores 5 for motion pain, indicating severe pain in the right side's upper and lower extremity muscle groups. After four meetings with the researchers, The patient said the pain had subsided. The patient does not feel pain when in a stationary position and feels tenderness and motion. Still, the pain that is felt is not like the initial meeting, meaning that patient 2's tenderness indicates mild pain, and when moved, a score of 5 indicates moderate pain. At the 2nd meeting, the mean pain score did not change significantly for pain. Changes in pain appeared to decrease at the fourth visit after routine therapy by providing modalities and reducing activities that burden the right side of the body.

Evaluation of muscle strength using MMT. At the 1st meeting, the researcher scored 3 for flexion, extension, abduction, and adduction of the dextra shoulder, where it is interpreted that the patient can move the full ROM joint against gravity. The researcher gives a score of 3 for the dorsi flexion muscle, the right hand, which is interpreted that the patient can move the full ROM joint against gravity. In the flexion muscle group, adduction extension, and right hip abduction, the researcher gave a value of 3+, as well as in the flexion muscle group of the right knee, the researcher gave a value of 3+, which is interpreted that the patient was able to move the full ROM joint against gravity with minimal resistance. In the dorsiflexion and plantar flexion muscle group, the researcher gave a value of 3. At entering the second meeting, there was

Table 3. Balance level examination

No	Interruption	Patient Reaction	Score (1st)	Score (4th)
1	Sitting balance	1: Lean/slide 2: Quiet and safe	1	1
2	Sitting to standing	0: Unable without assistance 1: Able with the help of hands 2: Able with no assistance	1	1
3	Attempt to get up (sitting to standing)	0: Unable without assistance 1: Able with more than one attempt 2: Able with one attempt	1	2
4	Initial standing balance (first 5 seconds)	0: Unsteady 1: Stable with help 2: Stable without assistance	1	2
5	Standing balance	0: Unsteady 1: Wide base/assist stable 2: Narrow base stable/no assistance	1	2
6	Standing feet together, the therapist pushes three times on the chest	0: Wob 1: stable 2: React will stagger	1	2
7	Stand with your feet together and close your eyes	0: Unsteady 1: Stable	0	1
8	Rotates 360º degrees	0: The step is not continuous 1: steady unsteady continuous step	0	0
9	Stand to sit	0: Insecure (misplacement, sitting by dropping into a chair); 1:Using your hands to sit slowly; 2: Be safe and sit down slowly	1	1
		Total balance score	7	12

no change; at the 3rd meeting, there was a change in muscle strength with a value of 3+. At the 4th meeting, there was an increase in the right leg muscles and could be given a score of 4.

In the areas of the right shoulder, elbow, hip, and knee, muscle strength changes with the interpretation of value against gravity, full (ROM), and moderate resistance. The patient can move his hands actively in several directions but still experiences limitations and pain when moved. The researcher then measured the joint's range of motion using a goniometer to determine how much movement the joint made. In the sagittal movement of the shoulder region, the value is S: 45°-0°-150° limited to flexion and extension movements. In frontal movements, the value is 120°-0°-65° limited to abduction and adduction movements. In the sagittal movement of the elbow region, the value is S: 0°-0°-145° limited to flexion-extension movements, and in rotational movements, the value is R: 85°-0°-75° limited to supination and pronation movements. And in the sagittal movement of the wrist, the value is S: 0°-0°-75° limited to dorsi and plantar flexion movements.

Then to the lower extremity in the hip sagittal movement, the value is S: 5°-0°-1-100° limited to flexion and extension. In the frontal movement, the value is F: 40°-0°-10° limited to abduction and adduction. The value of the sagittal knee movement is 0°-0°-120° limited to flexion and extension movements. In the sagittal movement of the ankle, the value is 15°-0°-30° limited to dorsiflexion and plantar flexion movements. Patients' range of motion increases at the fourth meeting in the ankle region due to decreased pain. It is supported by therapist education for patients to do exercises regularly.

Researchers used the foot-core stability segment to measure foot-core stability in non-hemorrhagic strokes to determine the patient's balance level in daily activities. The lowest score for this segment is 0, which means there are obstacles in using torso balance as sitting balance, sitting to standing, effort to rise (sitting to standing), initial standing balance (first 5 seconds), standing feet together, therapist giving encouragement three times on the chest, standing with feet together and closing eyes, turning 360 degrees, standing up to sitting to standing), initial standing balance (first 5 seconds), standing feet together, the therapist pushes three times on the chest. The patient was still in the category of severe disability. Still, it was seen that several question items had decreased, such as pain reduction, self-care, muscle strength, and household chores. To write or drive the patient's vehicle still.

DISCUSSION

Physiotherapy therapy provides therapeutic effects such as maintaining and increasing joint range of motion, increasing muscle strength, endurance, coordination, posture, balance, and functional abilities.[16] The provision of a mobilization program in a particular region adjusts to the movement ability and ROM.[17] Movement exercises or active and passive physical activities that are systematically structured and repeated with the correct movement patterns will

provide correct information to the brain, return musculoskeletal function to normal and improve functional abilities.[18]

According to Pristianto et al. (2018), muscle contraction activates tension-producing sites in muscle fibres. Muscle contraction depends on the number of motor units stimulated, and the greater the resistance, the more motor units are stimulated, thereby muscle strength and power. Exercise therapy aims to continue with the normalization of tone, development of normal functional patterns, prevention of contractures and deformities, functional independence of the patient, and achieving patient safety.[19] It is necessary to perform therapy, such as normalizing muscle tone and strengthening weak antagonistic muscles.[20]

Body positioning can improve blood circulation, provide appropriate sensory information, and improve postural stability and strength to improve functional activity in patients with acute ischemic stroke. In a lying position, the patient needs a good prone position and utilizes the pillow as a support so that the pelvis does not fall backward. It increases the hip extension of the hip joint, which is useful for the walking process so that the hip joint will be mobile and not rotate externally. This position stabilizes the muscles of core stability, such as m. tranversus abdominis, m. multifidus, m. internal oblique, m. external oblique, m. rectus abdominis, m. sacrospinalis (longissimus thoracis and diaphragm), m. latissimus dorsi, m. gluteus maximus and m. trapezius, an increase in muscle core will cause nerve conductivity which can improve intermuscular coordination and increase reaction speed and the mobility of motion function at the position change.[21]

Recently, with the development of foot and ankle biomechanics, several researchers have explored the role and mechanism of the foot core system in human postural stability. Previous studies suggested that the weakness of foot core stability is related to the decline of postural stability, the functions of the foot arch (passive subsystem) and foot sensory (neural subsystem) were associated with postural stability, and they declined with age. The intrinsic foot muscles and extrinsic foot muscles, which constitute the foot active subsystem, also play an active role in maintaining foot core stability. Studies have speculated that the intrinsic foot muscles provide local dynamic support for the foot arch.[22]

This research has several limitations that need to be considered. First, the study design is a case study, so it cannot be generalized to all patients with non-hemorrhagic stroke conditions. Second, the study was conducted over approximately three weeks because of the limited study time and the inability to evaluate the long-term effects of therapy.

CONCLUSION

After going through four meetings with researchers on a patient with the initials Mr W is 67 years old with a non-hemorrhage stroke. The patient was still in the category of severe disability. Still, it can be seen that several question items have decreased, such as pain reduction, self-care, muscle strength, and household chores. To write or drive the patient's vehicle was still difficult. The patient's vital signs are stable and the patient has a history of hypertension co-morbidities.

CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

ETHICAL CONSIDERATION

The authors had requested the patient's and parent's consent before reporting the condition, and they had been permitted to write and publish the work.

FUNDING

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AUTHOR CONTRIBUTION

YDW, AP, and ENE conceived the study design, collected the data, performed data analysis, and interpreted the results; YDW, AP, and ENE prepared the manuscript, reviewed the results, and approved the final version.

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