TEHE EFFECT 0F GRADED MOTOR IMAGERY ON UPPER EXTRIMTY FUNCTION ON STROKE PATIENT

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ABSTRACT

Background: *Stroke is damage that occurs in the brain suddenly, progressively, and quickly which can be caused by blood vessel disorders. This disorder can cause symptoms such as paralysis or weakness in the face and limbs, speech problems, vision problems, even decreased consciousness. The prevalence of stroke with upper limbs disorders is 40-57%. Stroke sufferers with these disorders have difficulty carrying out daily activity. Graded Motor Imagery is a complex exercise that combine three training techniques to activate the brain by stimulating it through visual, tactile, and propioceptive means so that the brain will give commands to the motor to carry out a measured movement.* ***Purpose:*** *To determine the effect of graded motor imagery on improving upper extremity function in stroke patients.* ***Method:*** *Pre-experimental research design – one group pretest-posttest. The sample size was 11 people taken using the purposive sampling method with inclusion and exclusion criteria carried out 3 times a week for 6 weeks.* ***Result:*** *The average upper extremity function before the intervention was 46,09 and after the intervention was 55,00 with a value of p = 0,00 (p<0,05). The average lower extremity function before the intervention was 29,09 and after the intervention was 29,82 with a value of p = 0,02 (p<0,05). Meanwhile, the average of severity stroke before the intervention was 8,09 and after the intervention was 5,73 with a value of p = 0,00 (p<0,05).* ***Conclusion:*** *Graded Motor Imagery was significant in improving upper extremity function in stroke patients. This particular exercise may serve as a supplementary therapeutic modality for post stroke patient, specifically targeting upper limb dysfunction, within both hospital settings and physiotherapy facilities.*

Keywords : *Stroke; graded motor imagery; upper limbs functions; severity of stroke.*

INTRODUCTION

Stroke is a leading cause of death and long-term disability that significantly impacts a person's quality of life, affecting not only patients but also their families and the surrounding community. In 2019, the incidence of stroke was approximately 12.2 million years, leading to a prevalence of 93.81 million cases and a death rate of 7.44 million in 2021 (Feigin et al., 2022; Martin et al., 2024). In Indonesia, the prevalence of stroke, based on medical diagnosis, remains high at 10.9%, with the province of DKI Jakarta reporting a rate of 12.2%. The highest prevalence occurs in individuals aged 75 years and older, accounting for 55% of cases (Kementerian Kesehatan, 2019).

Stroke results in brain damage characterized by local or global nerve dysfunction

due to non-traumatic disruptions in blood circulation, manifesting suddenly, progressively, and rapidly (Hutagaluh, 2019; Siregar & Anggeria, 2019). Stroke can produce a range of symptoms, including facial or limb paralysis (hemiparesis, hemiplegia), aphasia, visual disturbances, and altered consciousness. Hemiparesis, or muscle weakness in one part of the body, is a significant factor contributing to the loss of motor function (Potter et al., 2022; Sari et al., 2023; Siregar & Anggeria, 2019; Zhuang et al., 2021).The prevalence of stroke accompanied by upper limb dysfunction is notably high, ranging from 40% to 57%. Patients experiencing upper extrimity dysfunction are particularly vulnerable to challenges in performing daily activities (Activities of Daily Living) (Dalton et al., 2024). If these patients do not receive appropriate interventions, they may struggle with essential tasks such as dressing and self-care (Ain et al., 2021).

The rising prevalence of stroke-related disabilities in Indonesia underscores the need for effective rehabilitation measures aimed at improving the quality of life for affected individuals (Venketasubramanian et al., 2022). One promising exercise therapy for addressing upper extremity dysfunction is Graded Motor Imagery (GMI). A study by Ji et al. (2021)found that administering GMI five times a week for eight weeks effectively improved upper extremity function (UEF) in stroke patients. Similarly, (Welage et al. (2023) reported that GMI interventions twice a week for six weeks significantly enhanced UEF in stroke patients, suggesting that this exercise should become a standard component of stroke rehabilitation. Moseley et al. (2012) also emphasized that provided carefully monitored the dosage and technique of GMI, could stimulate the brain to issue directives for performing coordinated movements.

Cengkareng Regional Hospital stands as one of the healthcare establishments found within the DKI Jakarta region, possessing a Medical Rehabilitation Polyclinic that encounters a markedly significant incidence of upper extremity functional decline, estimated at roughly 28%. Given these factors, researchers were interested in exploring "The Effect of Graded Motor Imagery on Improving Upper Extremity Function in Stroke Patients at RSUD Cengkareng."

METHODS

This study was conducted at the Physiotherapy Clinic of Cengkareng Hospital from January to February 2024. Using the Lemeshow & Lwanga (1991) algorithm of two sided hypothesis testing for a population mean, a sample size of eleven individual was

determined. Purposive sampling was used to choose the participants based on inclusion and exclusion criteria. Inclusion criteria included: 1) Willing to participate in the study; 2) Aged ≥ 15 years; 3) Stroke severity score > 6; 4) Having a history of stroke in the last 1 year; 5) Fugl-Meyer assessment upper extremity (FMA-UE) score < 6; 6) Fugl-Meyer assessment lower extremity score ≤ 34. While the exclusion criteria included: 1) In a long-term bed rest position; 2) Having musculoskeletal disease; 3) Having visual impairment; 4) Using walking aids, such as wheelchairs; 5) Having neuromuscular diseases other than stroke.

The dependent variable in this study was upper extremity function (UEF) measured by the Fugl-Meyer Assessment (FMA). While the independent variable was a GMI intervention carried out 3 times a week for 6 weeks. In addition, to select respondents, stroke severity (SS) was also measured using the National Institute of Health Stroke Scale (NIHSS), only patients with an NIHSS score > 6 would be respondents.

Data analysis used in this study consisted of univariate and bivariate analysis. Univariate analysis was carried out using the mean value, standard deviation, minimum and maximum values, and the estimated mean interval value with a 95% confidence level, frequency and proportion values, according to the data scale of each variable. While the bivariate test used a paired sample t-test for upper extremity function and Wilcoxon for stroke severity. Both tests were chosen because the results of the data normality test with the Shapiro-Wilk Test showed that the extremity function data were normally distributed while the stroke severity data were not normal, as in table 1 below:

Table 1

Results of Normality Test of UEF and SS Data

Variabel	Mean ± SD	P-value	Annotation
UEF before intervention	46,09±7,13	0,25	normally distributed
UEF after intervention	55,00±6,27	0,07	normally distributed
SS before intervention	8,09±2,34	0,00	not normally distributed
SS after intervention	5,73±2,61	0,00	not normally distributed

RESULTS AND DISCUSSION

Results

Characteristics of respondents

Characteristics of respondents based on gender distribution in the study was relatively almost the same, although male respondents have a slightly larger percentage, namely 54.5%, while women are only 45.5%. For age characteristics, it ranges from 47-73 years with a distribution of 54.5% classified as pre-elderly (45-59 years) and 45.5% elderly (60-74 years). For more details, see table 2 belows:

Table 2

Distribution of Respondent Characteristics

Caracteristic		n	(%)	Mean±SD	95 CI*	Min-Max
Gender	Men	6	54,5			
	Women	5	45,5			
Age	45-59	6	54,5	60,27±8,92	54,28- 66,27	47-73
	60-74	5	45,5			

Upper Extremity Function and Stroke Severity

Based on data processing, it was known that the upper extremity function value before the intervention was around 35-55 with a median of 46, an average of 46.09, and a standard deviation of 7.13. After the intervention, the upper extremity function value increased with a range of 47-66, an average of 55.00, a median of 55, and a standard deviation of 6.27. The results of the paired sample t-test showed a probability value of 0.00 which indicated a significant difference of 8,90 in the average UEF value before and after the intervention, as seen in table 3 bellows:

Table 3

Results of Hypothesis Testing of UEF and SS Respondents Before and After Intervention

Variabel		Min - Max	Median	Mean±SD	Δ Mean±SD	*P-value*
UEF	Pre-test	35-55	46	46,09±7,13	8,90 ± 0,85	0,00
	Post-test	47-66	55	55,00±6,27		
SS	Pre-test	7-15	7	8,09±2,34	-2,36 ± -0,26	0,00
	Post-test	4-13	5	5,73±2,61		

Table 3 also showed the average stroke severity before the intervention was 8.09 with a standard deviation of 2.34, and after the intervention there was a decrease to 5.73

with a standard deviation of 2.61. While the minimum and maximum values before the intervention were 7-15 while after 4-13. The probability value of 0,00 indicated that decrease in stroke severity mean before and after the intervention of -2.36 with a standard deviation was statistically significant.

Discussion

This study was conducted to determine the effect of GMI on improving UEF in stroke patients. Both globally and in Indonesia, stroke is the leading cause of death and disability. Stroke occurs when the blood supply to the brain is disrupted, either due to blockage (ischemic) or rupture of blood vessels (hemorrhagic) which can cause various short-term and long-term impacts on a person's body, mind, and quality of life (Venketasubramanian et al., 2022; Zhao et al., 2022). The results of the data analysis showed that the percentage of male respondents was slightly higher (54.5%), compared to females (45.5%). This is in line with research conducted by Ji et al. (2021) which also found that male respondents had a higher percentage than females. Basic Health Research conducted by the Ministry of Health of the Republic of Indonesia in 2018 also showed that the prevalence of stroke in the population aged 15 years and over with male gender was also higher than females, namely 11 per 1000 population. While females were 10.9 per 1000 population (Kementerian Kesehatan, 2019).

Functional disorders of the upper extremities are the most common result of stroke with a percentage of 85% (Ingram et al., 2021). Various rehabilitations have been used to improve upper extremity function and reduce disability. Various motor training programs have been widely used in the rehabilitation of stroke patients who have achieved quite significant improvements in quality of life. In this study, giving GMI 3 times a week for 6 weeks can improve UEF from 46.09 to 55.00. In addition, this study also found that GMI can reduce stroke severity from moderate neurological deficit (8.09) to mild neurological deficit (5.73).

The results of this study were in line with the findings of Polli et al. (2017) which found that giving GMI with a duration of 1 hour, 5 times a week for 4 weeks could improve UEF. Another study conducted by Ji et al. (2021) also supported this study. In that study, Ji et al. (2021) found that GMI with an intervention dose of 5 times a week for 8 weeks could improve UEF from an average of 28.18 to 30.24 with a probability value of 0.001.

GMI is a rehabilitation process used to treat pain and train the brain to perform measurable movements. Graded Motor Imagery (GMI) was introduced for upper limb rehabilitation that combines several rehabilitations, namely Implicit Motor Imagery (IMI), Explicit Motor Imagery (EMI), and Mirror Therapy (MT) (Polli et al., 2017). Graded Motor Imagery (GMI) is a rehabilitation approach that has been shown to have a positive impact on post-stroke recovery, especially in terms of motor function, pain management, and sensory-motor integration. This approach involves a gradual process designed to engage the brain's motor tissue without requiring physical movement, making it very useful for individuals with severe motor disorders. GMI can restore motor function, increase strength and dexterity, reduce pain and stiffness, increase sensory and motor integration, and improve perception (Kementerian Kesehatan, 2019).

GMI utilizes the principle of neuroplasticity to reorganize the brain and restore impaired body functions. By gradually activating the brain through safe steps, GMI helps the brain relearn movement patterns without exacerbating pain or trauma. This exercise can increase neuroplasticity in post-stroke recovery during functional recovery through repeated practice. Functional recovery can be influenced by intrinsic activity in active networks, cognitive function, progressive exercise, motivation, and environmental support. Good motivation will trigger the secretion of neuromodulators such as dopamine and acetylcholine which can increase the potential action in synapses and cortical changes (Hasanah et al., 2019; Moseley et al., 2012; Polli et al., 2017).

Neuroplasticity is the brain's ability to adapt after receiving environmental stimulation. Exercise that occurs in the early phase of rehabilitation is believed to have significant results on the mechanism of neuroplasticity (Hasanah et al., 2019). Based on the results obtained, this study has limitations, namely that the determination of the criteria for stroke sufferers is not specific enough so that it cannot be used as a reference for effective training for specified type of stroke.

CONCLUSION

Motor Imagery given 3 times a week for 6 weeks can improve upper extremity functional ability and reduce stroke severity. This exercise can be an alternative additional therapy for post-stroke patients with upper extremity dysfunction both in hospitals and physiotherapy clinics.

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