EFFECT OF MIRROR THERAPY ON UPPER EXTREMITY MOTOR FUNCTION IN STROKE PATIENTS

Salsabila Nuru Ramadhani [1*], Wa Ode Sri Asnaniar [2], Ernasari [3], Safruddin [4], Rahmat Hidayat [5]
[1, 2, 3, 4, 5] Universitas Muslim Indonesia, Indonesia
Corresponding Email: [1*] salsabila2nov@gmail.com

ABSTRACT

Stroke is one of the leading causes of disability and often results in impaired upper extremity motor function, which affects daily activities and quality of life. This study aimed to determine the effectiveness of mirror therapy in improving upper extremity motor function in stroke patients. This study used a quantitative method with a quasi-experimental non-equivalent control group pretest-posttest design. A total of 50 respondents were selected using consecutive sampling and divided into intervention and control groups, each consisting of 25 respondents. The intervention group received mirror therapy, while the control group received routine hospital therapy. Motor function was measured using the Fugl-Meyer Assessment for Upper Extremity (FMA-UE). The results showed improvement in both groups. The intervention group's mean score increased from 52.32 to 55.88, while the control group's score increased from 48.40 to 49.32. Statistical analysis showed significant improvements before and after intervention in both groups; however, no significant difference was found between groups after intervention (p=0.110). Mirror therapy may contribute to improvements in upper extremity motor function when used alongside routine rehabilitation. However, its superiority over routine rehabilitation alone was not demonstrated in this study.

Keywords: Stroke, Mirror Therapy, Motor Function, Upper Extremity, Rehabilitation.

INTRODUCTION

Stroke remains one of the leading causes of mortality and long-term disability worldwide (Chen et al., 2025). According to the World Stroke Organization, more than 12 million individuals experience a new stroke annually, while approximately 94 million people are currently living with the consequences of stroke. The lifetime risk of stroke is estimated to affect one in four adults globally (Feigin et al., 2025). Although advances in acute stroke management have improved survival rates, a substantial proportion of survivors continue to experience persistent functional impairments that limit independence and reduce quality of life (Pramudya et al., 2025). Consequently, improving post-stroke rehabilitation outcomes has become a major priority in neurological healthcare and rehabilitation research.

Motor impairment of the upper extremity is among the most common and disabling consequences of stroke. Approximately 70–80% of stroke survivors experience upper limb dysfunction during the acute phase, and many continue to suffer from residual impairments during the chronic stage. Upper extremity deficits may include muscle weakness, abnormal muscle tone, impaired coordination, reduced dexterity, and limited voluntary movement. These impairments significantly affect the performance of activities of daily living (ADL), such as eating, dressing, grooming, writing, and object manipulation (Kurnia & Idris, 2020). Compared with lower extremity recovery, restoration of upper limb function is generally slower and often incomplete, resulting in prolonged disability and dependence on caregivers.

Various rehabilitation approaches have been developed to improve upper extremity

motor recovery following stroke. Conventional rehabilitation programs typically include range-of-motion exercises, strengthening exercises, task-oriented training, and occupational therapy (Wiśniowska-Szurlej et al., 2025). More recently, interventions such as Constraint-Induced Movement Therapy (CIMT), robotic-assisted therapy, virtual reality-based rehabilitation, and Mirror Therapy (MT) have gained considerable attention. Among the available rehabilitation interventions, Mirror Therapy has gained considerable attention due to its simplicity, low cost, accessibility, and ease of implementation. Furthermore, it can be applied in a wide range of healthcare facilities and community-based settings without requiring sophisticated equipment, making it a practical option for post-stroke rehabilitation (Gonzalez-Santos et al., 2020).

Mirror Therapy was first introduced as a visual feedback intervention in which a mirror is positioned along the patient's midsagittal plane, creating the illusion that movements performed by the unaffected limb are being executed by the affected limb (Putri & Wasilah, 2023). This visual illusion is believed to stimulate cortical reorganization, activate mirror neuron systems, and enhance neuroplasticity processes associated with motor recovery. Neuroimaging studies have demonstrated that observing reflected movements can increase activity in motor-related cortical areas, thereby facilitating motor relearning and functional improvement of the paretic upper extremity (Gandhi et al., 2020).

Studies comparing Mirror Therapy with Constraint-Induced Movement Therapy (CIMT) have shown that both interventions are effective in improving upper limb function and hand dexterity. However, the differences in their effectiveness are not always statistically significant, although CIMT has been reported to be slightly superior in enhancing motor strength (de Sire et al., 2025). Furthermore, studies investigating Task-Based Mirror Therapy (TBMT) have demonstrated variable outcomes due to differences in patient characteristics and the specific aspects of motor function being assessed. This trial aimed to evaluate the effectiveness of TBMT in post-stroke hand function recovery and to explore the underlying neural mechanisms. The primary outcome measures included the Fugl-Meyer Assessment for Upper Extremity (FMA-UE) and the Modified Barthel Index (MBI) (Liu et al., 2024). These findings suggest that Mirror Therapy has substantial potential as an adjunctive rehabilitation strategy for upper extremity recovery.

Despite the growing body of evidence, important gaps remain in the current literature. Previous studies have reported inconsistent findings regarding the magnitude of therapeutic effects. Differences in treatment duration, intervention frequency, stroke severity, stage of recovery, outcome measures, and study populations contribute to variations in reported outcomes (Muhsinin et al., 2025). Moreover, there is currently no universally accepted Mirror Therapy protocol for upper extremity rehabilitation after stroke. Most existing studies have been conducted in high-income countries, while evidence from developing countries, including Indonesia, remains limited. Consequently, the generalizability of current findings to diverse healthcare settings requires further investigation.

In addition to the research gap, a practice gap remains evident in routine rehabilitation services. Despite growing evidence supporting its effectiveness, Mirror Therapy remains underutilized in clinical rehabilitation practice. Rehabilitation programs continue to rely primarily on conventional therapeutic approaches, resulting in limited integration of evidence-based adjunctive interventions such as Mirror Therapy. This discrepancy between emerging scientific evidence and clinical practice highlights the need for further evaluation of Mirror Therapy in real-world rehabilitation settings. Generating local evidence may facilitate the translation of research findings into routine clinical practice, strengthen evidence-based rehabilitation strategies, and support the adoption of accessible interventions for stroke survivors in resource-limited settings. Accordingly, evaluating the effectiveness of Mirror Therapy among patients with stroke in Indonesia may provide valuable insights into its

applicability within routine rehabilitation services and contribute to the growing evidence base supporting its clinical implementation.

Accordingly, this study aimed to determine the effectiveness of Mirror Therapy in improving upper extremity motor function among patients with stroke. The findings are expected to contribute to the development of evidence-based rehabilitation strategies and support the integration of Mirror Therapy into stroke rehabilitation programs.

Based on the existing evidence and the identified research and practice gaps, it was hypothesized that patients receiving Mirror Therapy in addition to routine rehabilitation would demonstrate greater improvement in upper extremity motor function than patients receiving routine rehabilitation alone.

METHOD

This study employed a quasi-experimental design using a non-equivalent control group pretest–posttest approach to examine the effects of Mirror Therapy on upper extremity motor function among patients with stroke. The study was conducted in the Medical Rehabilitation Unit of a provincial neurological referral hospital in South Sulawesi, Indonesia, from December 2025 to February 2026.

The study population consisted of patients diagnosed with non-hemorrhagic stroke who experienced upper extremity motor impairment and were undergoing rehabilitation services. A total of 50 participants were included in the study, comprising 25 participants in the intervention group and 25 participants in the control group. Participant characteristics included age, sex, educational level, duration of stroke, affected body side, and comorbid conditions. The intervention group received Mirror Therapy in addition to routine rehabilitation, whereas the control group received routine rehabilitation alone.

Participants were recruited using a consecutive sampling technique. All patients who met the eligibility criteria during the study period were invited to participate until the required sample size was achieved. Recruitment was conducted within the Medical Rehabilitation Unit where stroke patients routinely attended rehabilitation services.

Eligible participants were individuals aged 15 years and older who had experienced non-hemorrhagic stroke within the previous one to six months, were fully conscious (Glasgow Coma Scale score of 15), able to follow simple verbal instructions, and had not previously received Mirror Therapy for upper extremity rehabilitation. Exclusion criteria included severe comorbid conditions that could interfere with participation, inability to maintain a sitting position during therapy sessions, and inability to complete the intervention program. Because this study employed a quasi-experimental non-equivalent control group design, participants were allocated to intervention and control groups according to the existing rehabilitation schedule and service availability rather than through random assignment.

Prior to participation, all eligible patients received information regarding the study objectives, procedures, benefits, and potential risks. Written informed consent was obtained from all participants. Participation was voluntary, and no financial incentives were provided.

Ethical approval was obtained from the Health Research Ethics Committee of Universitas Muslim Indonesia (Approval No. 1027/A.1/KEP-UMI/XII/2025). All procedures complied with the ethical principles of autonomy, beneficence, non-maleficence, justice, confidentiality, and anonymity. Participants were allowed to withdraw from the study at any time without affecting their rehabilitation services.

Sample size was determined using the Lemeshow formula for health research. Because the accessible population consisted of only 58 eligible stroke patients undergoing rehabilitation during the study period, a finite population correction was applied. Using a 95% confidence

level (Z = 1.96), an estimated proportion of 0.50, and a margin of error of 10%, the minimum required sample size was calculated as 50 participants.

The intended sample size was 50 participants, and the final sample achieved this target without attrition. Twenty-five participants were included in the intervention group and twenty-five participants in the control group. No interim analyses or stopping rules were implemented because the intervention period and study duration had been predetermined before data collection commenced.

The primary outcome was upper extremity motor function assessed using the Fugl-Meyer Assessment for Upper Extremity (FMA-UE). The FMA-UE is a standardized instrument widely used to evaluate motor recovery following stroke. The instrument consists of 33 items distributed across four domains: upper extremity movement (18 items), wrist function (5 items), hand function (7 items), and coordination/speed (3 items). Total scores range from 0 to 66, with higher scores indicating better motor performance (Hijikata et al., 2020).

The instrument was adopted from previously validated studies and was not developed by the researchers. Previous studies have demonstrated excellent validity and reliability of the FMA-UE in assessing upper extremity motor recovery after stroke. FMA-UE assessments were conducted by trained rehabilitation personnel familiar with the instrument and its scoring procedures.

Demographic and clinical variables collected included age, sex, educational level, duration of stroke, affected body side, and comorbid conditions such as hypertension, diabetes mellitus, heart disease, hypercholesterolemia, and hyperuricemia. These variables were collected to describe participant characteristics and identify factors potentially associated with motor recovery (Hijikata et al., 2020).

The intervention consisted of Mirror Therapy administered according to a standardized operating procedure. A mirror measuring approximately 30 × 30 cm was positioned vertically along the participant's midsagittal plane. The unaffected upper limb was placed in front of the mirror, while the affected upper limb was positioned behind the mirror and hidden from view. Participants were instructed to observe the mirror reflection of movements performed by the unaffected limb while simultaneously attempting to imagine and execute the same movements with the affected limb. The visual illusion generated by the mirror was intended to stimulate motor cortical activation and facilitate neuroplastic adaptation (Pratiwi, 2017).

During each session, participants performed a series of upper extremity exercises, including shoulder flexion, elbow flexion and extension, wrist movements, hand opening and closing, and object manipulation tasks while maintaining visual focus on the mirror reflection. Mirror Therapy was administered for 30 minutes per session, five sessions per week, for two consecutive weeks in addition to routine rehabilitation services.

Data were collected through direct observation, structured questionnaires, clinical records, and motor function assessments. Baseline measurements (pre-test) were conducted before the intervention, whereas follow-up measurements (post-test) were obtained after completion of the two-week intervention period.

To enhance measurement quality, standardized assessment procedures were applied throughout the study. The same FMA-UE instrument was used at both measurement points, and all assessments were performed consistently across participants. Pre-test and post-test assessments were conducted under comparable environmental conditions to minimize measurement variability. Repeated observations through pre-test and post-test assessments were used to evaluate changes in motor function over time.

Data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics were used to summarize participant characteristics and study variables. Continuous variables were presented as means, standard deviations, medians, minimum values, and maximum values, whereas categorical variables were summarized using frequencies and percentages.

Data normality was assessed using the Shapiro–Wilk test. Because the outcome data were not normally distributed, non-parametric statistical tests were applied. Within-group differences between pre-test and post-test FMA-UE scores were analyzed using the Wilcoxon Signed Rank Test. Between-group differences in post-test FMA-UE scores were evaluated using the Mann–Whitney U test. Statistical significance was established at $p < 0.05$. Statistical analyses were conducted according to the pre-specified analysis plan.

RESULTS AND DISCUSSION

Results

1. Participant Characteristics

A total of 50 stroke patients participated in the study, including 25 participants in the intervention group and 25 participants in the control group. Most participants were of productive age (15–64 years), accounting for 80% of the intervention group and 68% of the control group. The intervention group was predominantly male (76%), whereas females constituted the majority of the control group (64%). Hypertension was the most common comorbidity in both groups. Detailed participant characteristics are presented in Table 1.

Table 1

Participant Characteristics

	Intervention Group		Control Group	
	n	**%**	**n**	**%**
Age				
Productive age (15–64 years)	20	80%	17	68%
Non-productive age (≥65 years)	5	20%	8	32%
Sex				
Male	19	76%	9	36%
Female	6	24%	16	64%
Educational Level				
Elementary School	1	4%	5	20%
Junior High School	4	16%	5	20%
Senior High School	10	40%	6	24%
Higher Education	10	40%	9	36%
Duration Since Stroke Onset				
1 month	2	8%	5	20%
2 month	5	20%	4	16%
3 month	4	16%	2	8%
4 month	4	16%	3	12%
5 month	1	4%	2	8%
6 month	9	36%	9	36%
Affected Side of the Body				
Right	16	64%	14	56%
Left	9	36%	11	44%
Comorbidities				
Hypertension	19	76%	17	68%
Diabetes Mellitus	3	12%	3	12%
Heart Disease	0	0%	2	8%
Hypercholesterolemia	2	8%	2	8%
Hyperuricemia	1	4%	1	4%
Total	25	100	25	100

Source: Primary Data, 2026

Note. Codes used in the dataset were as follows: age category (1 = productive age, 15–64 years; 2 = non-productive age, ≥65 years); sex (1 = male, 2 = female); educational level (1 = elementary school, 2 = junior high school, 3 = senior high school, 4 = higher education); affected side of the body (1 = right, 2 = left); comorbidities (1 = hypertension, 2 = diabetes mellitus, 3 = heart disease, 4 = hypercholesterolemia, 5 = hyperuricemia)

2. Changes in Upper Extremity Motor Function

The mean FMA-UE score in the intervention group increased from 52.32 ± 15.48 at baseline to 55.88 ± 14.31 following the intervention, representing a mean improvement of 3.56 points. In the control group, the mean score increased from 48.40 ± 13.99 to 49.32 ± 14.43, corresponding to a mean improvement of 0.92 points. Descriptive statistics of FMA-UE scores are presented in Table 2.

Table 2

Upper Extremity Motor Function Scores

Group	*Measurement*	*n*	*Mean*	*Median*	*SD*	*Min.*	*Max.*
Intervention Group	Pre-test	25	52.32	60	15.483	16	66
Intervention Group	Post-test	25	55.88	62	14.313	19	66
Control Group	Pre-test	25	48.40	47	13.994	15	66
Control Group	Post-test	25	49.32	47	14.430	15	66
Total	—	**50**	—	—	—	—	—

Source: Primary Data, 2026

3. Within-Group Comparisons

The Wilcoxon Signed Rank Test revealed a statistically significant improvement in upper extremity motor function in the intervention group following Mirror Therapy ($Z = -4.217$, $p < .001$). A significant improvement was also observed in the control group ($Z = -3.169$, $p = .002$). These findings indicate that upper extremity motor function improved significantly over time in both groups.

Table 3

Within-Group Comparison of FMA-UE Scores

GROUP	***Z***	***ρ-VALUE* (*ASYMP. SIG.* 2-*TAILED*)**
INTERVENTION	-4,217	**0,000**
CONTROL	**-3,169**	**0,002**

Source: Primary Data, 2026

4. Between-Group Comparison

The Mann–Whitney U test showed no statistically significant difference in post-intervention FMA-UE scores between the intervention and control groups ($U = 231.00$, $Z = -1.600$, $p = .110$). Although the intervention group demonstrated a greater numerical improvement than the control group, the difference did not reach statistical significance.

Table 4

Between-Group Comparison of Post-Test FMA-UE Scores

Comparison	***U***	***Z***	***ρ-value* (*Sig.*2-*tailed*)**
Post-test (Intervention vs Control)	231.000	-1.600	0.110

Source: Primary Data, 2026

These findings indicate that both groups experienced improvement in upper extremity motor function during the study period. However, the additional benefit of Mirror Therapy beyond routine rehabilitation was not statistically significant.

DISCUSSION

1. Participant Characteristics

The majority of participants in both groups were of productive age (15–64 years), accounting for 80% of the intervention group and 68% of the control group. Male participants predominated in the intervention group, while females were more common in the control group. Hypertension was the most frequent comorbidity in both groups, followed by diabetes mellitus and hypercholesterolemia. Most participants had experienced stroke for approximately six months, indicating that the majority were in the subacute phase of recovery.

The predominance of productive-age participants supports recent evidence indicating that stroke is increasingly affecting younger and economically active populations due to the accumulation of vascular risk factors, including hypertension, diabetes mellitus, obesity, smoking, and physical inactivity (Bukhari et al., 2023). Hypertension was the most prevalent comorbidity in this study, reinforcing its established role as the leading modifiable risk factor for stroke (Koga, 2026). The high proportion of participants in the subacute stage is particularly relevant because neuroplasticity remains active during this period, allowing greater responsiveness to rehabilitation interventions (Sarzyńska-Długosz, 2023). Consequently, the demographic and clinical characteristics of the participants suggest a population with considerable potential for motor recovery following rehabilitation.

2. Changes in Upper Extremity Motor Function

The present study demonstrated improvements in upper extremity motor function following the intervention period. In the intervention group, the mean FMA-UE score increased from 52.32 ±15.48 at baseline to 55.88 ± 14.31 after treatment, representing an average improvement of 3.56 points. In contrast, the control group showed a smaller increase from 48.40 ± 13.99 to 49.32 ± 14.43, corresponding to an improvement of only 0.92 points.

These findings suggest that participants who received Mirror Therapy experienced greater functional gains than those receiving routine rehabilitation alone. The observed improvement may be explained by the neuroplasticity mechanism stimulated through visual feedback provided by the mirror (Zhang et al., 2022). During Mirror Therapy, patients observe the reflection of the unaffected limb, creating the illusion that the affected limb is moving normally. This visual illusion activates motor-related cortical regions and enhances sensorimotor integration, thereby facilitating cortical reorganization and motor recovery.

Furthermore, repeated exposure to mirror-induced visual feedback may strengthen motor learning processes and improve voluntary movement control. The findings are also consistent with the motor relearning theory, which emphasizes repetitive task practice as a key component of neurological recovery (Mehrabi et al., 2025). Therefore, the greater improvement observed in the intervention group suggests that Mirror Therapy may provide additional stimulation capable of enhancing upper extremity motor function in patients with stroke.

3. Within-Group Comparisons

The Wilcoxon Signed Rank Test revealed significant improvements in upper extremity motor function within both groups. The intervention group demonstrated a statistically significant increase in FMA-UE scores following Mirror Therapy ($Z = -4.217$, $p < .001$), while the control group also showed significant improvement ($Z = -3.169$, $p = .002$).

The significant improvement observed in the intervention group supports the theoretical foundation of Mirror Therapy. Visual feedback generated through mirror reflection is believed to activate the mirror neuron system and motor cortex, promoting neural reorganization and facilitating motor recovery (Mehrabi et al., 2025).

Interestingly, significant improvement was also observed in the control group. This finding may be explained by the routine rehabilitation services received by all participants, including physiotherapy, occupational therapy, and functional exercise programs. In addition, most participants were in the subacute stage of stroke recovery, during which spontaneous neurological recovery and ongoing neuroplastic adaptation commonly occur. Therefore, the observed improvements in both groups likely reflect the combined effects of rehabilitation interventions and natural recovery processes following stroke.

4. Between-Group Comparison

The Mann–Whitney U test demonstrated no statistically significant difference in post-intervention upper extremity motor function between the intervention and control groups ($U = 231.000$, $Z = -1.600$, $p = .110$). Although the intervention group showed greater numerical improvement in FMA-UE scores than the control group, the magnitude of the difference was insufficient to reach statistical significance. These findings indicate that the addition of Mirror Therapy did not produce a statistically superior outcome compared with routine rehabilitation alone during the study period.

However, the absence of a significant between-group difference does not necessarily imply that Mirror Therapy was ineffective. In stroke rehabilitation research, both intervention and control groups frequently demonstrate functional improvements over time due to ongoing rehabilitation and spontaneous neurological recovery. This pattern was evident in the present study, as the control group also experienced a significant improvement in upper extremity motor function ($p = .002$). Consequently, when both groups improve simultaneously, the difference between post-intervention outcomes may become too small to be detected as statistically significant.

Several factors may explain these findings. First, participants in both groups continued to receive routine rehabilitation services, including physiotherapy, occupational therapy, and functional exercise programs. These interventions are well established as effective approaches for promoting motor recovery after stroke and may have contributed substantially to the improvements observed in both groups (Kolmos et al., 2025). Furthermore, motor recovery following stroke is influenced by rehabilitation intensity, repetition, task-specific training, and patient engagement rather than by a single intervention alone (O'Flaherty & Ali, 2024).

Second, most participants were in the subacute phase of stroke recovery, during which spontaneous neurological recovery and neuroplastic adaptation remain active. During this period, improvements in motor performance may occur regardless of the specific rehabilitation strategy received. Therefore, part of the observed functional recovery may reflect the natural recovery process that commonly occurs during the first months after stroke. From a theoretical perspective, Mirror Therapy facilitates motor recovery through visual feedback mechanisms that create the illusion of normal movement in the affected limb. This visual illusion is believed to activate motor-related cortical regions, stimulate the mirror neuron system, and promote cortical reorganization associated with neuroplasticity. Nevertheless, previous literature suggests that the effectiveness of Mirror Therapy is influenced by several factors, including stroke stage, severity of impairment, intervention dosage, treatment duration, and the type of concurrent rehabilitation received. Consequently, therapeutic responses may vary considerably across patient populations and clinical settings (Zhou et al., 2025).

The present findings are consistent with studies reporting that both intervention and control groups may demonstrate significant improvements in upper extremity motor function

without statistically significant differences between groups. At the same time, other studies and meta-analyses have reported additional benefits of Mirror Therapy when combined with conventional rehabilitation (Okamura et al., 2024). These inconsistent findings suggest that the effectiveness of Mirror Therapy may be context-dependent and influenced by methodological and clinical factors.

Several study-specific factors may also have contributed to the non-significant between-group result. The relatively short intervention period of two weeks may not have been sufficient to generate a measurable advantage beyond routine rehabilitation. In addition, the limited sample size may have reduced statistical power, increasing the likelihood that clinically meaningful differences were not detected statistically. Variations in participant characteristics, including age, stroke duration, baseline motor function, and severity of impairment, may have further influenced treatment outcomes and reduced the magnitude of between-group differences.

Despite the lack of statistical significance, the greater numerical improvement observed in the intervention group suggests that Mirror Therapy may still provide additional clinical benefits when integrated into conventional rehabilitation programs. Given its low cost, simplicity, and minimal equipment requirements, Mirror Therapy remains a feasible adjunctive intervention, particularly in resource-limited rehabilitation settings.

LIMITATION OF THE STUDY

Several limitations should be considered when interpreting the findings of this study. First, the study employed a quasi-experimental design without random assignment, which may have introduced selection bias and limited causal inference. Second, the sample size was relatively small and recruited from a single rehabilitation center, which may restrict the generalizability of the findings.

Third, the intervention period was limited to two weeks. A longer duration of Mirror Therapy may have produced greater improvements and potentially revealed differences between groups that were not detected in the present study. Fourth, participants in both groups continued to receive routine rehabilitation services, making it difficult to isolate the specific contribution of Mirror Therapy to motor recovery. Finally, the study focused exclusively on upper extremity motor function and did not assess other relevant outcomes, such as activities of daily living, quality of life, or long-term functional independence.

Future studies should employ randomized controlled trial designs, larger and more diverse samples, longer intervention periods, and broader outcome measures to further clarify the effectiveness of Mirror Therapy in stroke rehabilitation.

CONCLUSIONS AND SUGGESTIONS

Mirror therapy was associated with improvements in upper extremity motor function among stroke patients receiving the intervention. However, no statistically significant difference was found between the intervention and control groups after treatment. Therefore, although mirror therapy may be considered a complementary rehabilitation approach, its superiority over routine rehabilitation alone could not be confirmed in this study.

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ETHICAL CONSIDERATIONS

Ethical approval for this study was obtained from the Health Research Ethics Committee of Universitas Muslim Indonesia (Approval No. 1027/A.1/KEP-UMI/XII/2025). All participants were provided with information regarding the study objectives, procedures, potential benefits, and risks prior to enrollment. Written informed consent was obtained from all participants before data collection. The study was conducted in accordance with the ethical principles of autonomy, beneficence, non-maleficence, justice, confidentiality, and anonymity.

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Conflict of Interest Statement

The authors declare that they have no known financial or non-financial competing interests that could have appeared to influence the work reported in this paper.

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