

Physiotherapy Management of Left Hemiparesis Following Non-Hemorrhagic Stroke: A Case Report

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Abstract

Background: Non-hemorrhagic stroke commonly causes hemiparesis, balance impairment, gait dysfunction, and reduced functional independence. Detailed reports of individualized multimodal physiotherapy in routine clinical practice remain limited.

Objective: To describe the clinical outcomes of an individualized physiotherapy program in a patient with left hemiparesis following non-hemorrhagic stroke.

Methods: A CARE-compliant case report was conducted in a 59-year-old man approximately two months after stroke onset. The patient presented with left hemiparesis, muscle weakness, gait dysfunction, and impaired dynamic balance. A five-session individualized program included infrared therapy, active-assisted and resisted exercises, proprioceptive neuromuscular facilitation, heel slides, bridging, education, and a home exercise program. Outcomes were assessed using Manual Muscle Testing, the Five Times Sit-to-Stand Test, and the Barthel Index.

Results: Quadriceps strength improved from grade 3 to 4 and tibialis anterior strength from grade 2 to 3. Five Times Sit-to-Stand performance improved from 13 to 11 seconds, and the Barthel Index increased from 90 to 95. Ambulation progressed from tripod-assisted to independent walking.

Conclusion: Individualized multimodal physiotherapy was associated with short-term improvements in muscle strength, balance, walking ability, and functional independence in this patient. These findings are limited to a single case and require confirmation in larger prospective studies.

Keywords

Stroke; Hemiplegia; Physical Therapy Modalities; Activities of Daily Living; Postural Balance

Introduction

Stroke remains one of the leading causes of mortality and long-term disability worldwide, imposing substantial health, social, and economic burdens on individuals, families, and healthcare systems. According to the World Stroke Organization Global Stroke Fact Sheet 2025, approximately 12 million new stroke cases occur annually, while more than 94 million people are living with the consequences of stroke globally.¹ Although advances in acute stroke management have contributed to declining mortality rates in many countries, the number of stroke survivors experiencing persistent functional impairment continues to increase, creating an expanding demand for comprehensive rehabilitation services. Consequently, optimizing functional recovery has become a major priority in contemporary stroke management.^{2,3}

Non-hemorrhagic stroke, also referred to as ischemic stroke, accounts for approximately 80–85% of all stroke cases and results from cerebral arterial occlusion leading to impaired cerebral perfusion and irreversible neuronal injury. Depending on the anatomical location and extent of brain damage, patients frequently develop neurological deficits, particularly unilateral muscle weakness, impaired postural control, balance dysfunction, gait disturbances, and limitations in activities of daily living (ADL). These impairments substantially reduce functional independence, increase the risk of falls, prolong caregiver dependence, and negatively affect quality of life. Therefore, restoring motor function and promoting functional independence constitute the principal objectives of post-stroke rehabilitation.^{3,4}

Physiotherapy is an essential component of multidisciplinary stroke rehabilitation because it aims to restore motor performance, improve mobility, enhance functional capacity, and maximize participation through individualized therapeutic interventions. Contemporary rehabilitation guidelines recommend a combination of evidence-based exercise approaches, including muscle strengthening, task-oriented training, gait training, balance training, postural control exercises, and neuromuscular facilitation techniques to promote functional recovery after stroke. These interventions are designed to facilitate neuroplasticity, improve motor relearning, and enhance the integration of sensory and motor functions, thereby supporting the recovery of meaningful daily activities.^{5,6}

Recent evidence consistently supports the effectiveness of exercise-based rehabilitation in improving functional outcomes among stroke survivors. A scoping review by Ren et al. reported that structured exercise interventions are associated with improvements in muscle strength, mobility, balance, and walking performance across different stages of stroke rehabilitation.⁶ Similarly, Shahid et al. concluded that combining resistance exercise, balance training, functional exercise, and task-oriented interventions provides greater improvements in motor performance and functional ability than isolated therapeutic approaches.⁴ Furthermore, an umbrella review conducted by Shrestha et al. demonstrated that exercise-based rehabilitation consistently improves physical function, mobility, and participation in individuals recovering from stroke, highlighting the importance of individualized rehabilitation programs tailored to patients' clinical characteristics and functional goals.⁷

Despite the growing body of evidence derived from randomized controlled trials, systematic reviews, and meta-analyses, most published studies have evaluated the efficacy of individual rehabilitation techniques under controlled experimental conditions involving relatively homogeneous patient populations. In routine clinical practice, however, physiotherapists rarely rely on a single intervention. Instead, rehabilitation programs are typically individualized and integrate multiple therapeutic modalities according to the patient's neurological deficits, functional limitations, treatment goals, clinical progression, and response to therapy. Consequently, the implementation of multimodal physiotherapy in real-world clinical settings may differ substantially from standardized intervention protocols used in experimental research. Although this individualized clinical reasoning represents an essential component of neurological physiotherapy, detailed descriptions of its practical application remain relatively scarce in the literature.⁵⁻⁷

Case reports provide valuable complementary evidence by documenting individualized patient management, clinical decision-making, intervention adaptation, and short-term therapeutic outcomes that are often not fully captured in large experimental studies. In accordance with the CARE Guideline, well-documented case reports contribute to clinical education by illustrating the rationale underlying treatment selection, implementation, and outcome evaluation within authentic healthcare settings. Such reports also facilitate knowledge translation by bridging the gap between evidence generated in controlled research environments and its application in everyday clinical practice.⁸

Therefore, this case report aims to describe the physiotherapy management of a 59-year-old man with left hemiparesis during the subacute phase following non-hemorrhagic stroke and to document changes in muscle strength, dynamic balance, walking ability, and functional independence after five sessions of individualized multimodal physiotherapy. Consistent with the methodological characteristics of a case report, this study is intended to describe clinical observations from a single patient rather than establish treatment effectiveness or infer causal relationships between the intervention and clinical outcomes.

Methods

This study was conducted using a descriptive case report design and was prepared in accordance with the CARE REport (CARE) Guideline to ensure comprehensive and transparent reporting of patient characteristics, clinical reasoning, therapeutic interventions, and clinical outcomes.⁸ A case report design was selected because it enables an in-depth description of individualized physiotherapy management and its associated clinical observations in routine practice rather than evaluating treatment efficacy or causal relationships.

The patient was a 59-year-old man diagnosed with non-hemorrhagic stroke by a neurologist based on neurological examination and computed tomography (CT) findings. At the initial physiotherapy assessment, approximately two months after stroke onset, the patient was in the subacute phase and presented with left hemiparesis characterized by reduced muscle strength of the upper and lower extremities, impaired postural control, decreased dynamic balance, gait dysfunction requiring a tripod for ambulation, and limitations in functional independence. This case was selected because it represents a common neurological presentation encountered in clinical physiotherapy while requiring an individualized multimodal rehabilitation program based on comprehensive functional assessment and clinical reasoning, thereby providing educational and clinical value consistent with the objectives of the CARE Guideline.⁸

The study was conducted at the Physiotherapy Department of Wangaya Regional General Hospital, Denpasar, Indonesia, between 17 and 22 April 2026. The patient completed five consecutive physiotherapy sessions, each lasting approximately 45–60 minutes. All assessments and interventions were performed by the same licensed physiotherapist to ensure consistency in treatment delivery and outcome measurement. Baseline evaluation was conducted immediately before the first treatment session (T1, pre-intervention), whereas the final evaluation was performed after completion of the fifth session (T2, post-intervention) using identical assessment procedures.

Baseline clinical information was obtained through patient interview, physical examination, and review of medical records. The assessment included demographic characteristics, medical history, present illness, neurological findings, risk factors, medication history, and functional status. Physiotherapy examination comprised observation, palpation, range-of-motion assessment, manual muscle testing, postural evaluation, balance assessment, transfer ability, gait analysis, and activities of daily living. Radiological confirmation using CT imaging was incorporated with neurological and physiotherapy findings to establish the physiotherapy diagnosis, determine rehabilitation goals, and guide intervention planning.

Outcome evaluation focused on changes in muscle strength, dynamic balance, and functional independence. Muscle strength was assessed using Manual Muscle Testing (MMT), an ordinal clinical scale ranging from 0 to 5 that demonstrates acceptable intra-rater and inter-rater reliability when performed by trained clinicians.⁹ Dynamic balance and lower-extremity functional performance were evaluated using the Five Times Sit-to-Stand Test (5STS), a valid and reliable measure widely used in neurological rehabilitation to assess transitional movements, lower-limb functional strength, and fall risk.¹⁰ Functional independence was measured using the Barthel Index (BI), a validated instrument commonly employed to evaluate independence in basic activities of daily living among individuals recovering from stroke.¹¹

The physiotherapy program was individualized according to the patient's clinical presentation, rehabilitation goals, and response to treatment. The intervention consisted of infrared therapy, active-assisted exercise, active-resisted exercise, proprioceptive neuromuscular facilitation (PNF), heel-slide exercise, bridging exercise, patient education, and a structured home exercise program. The combination of interventions was selected because the patient demonstrated impairments in muscle strength, motor control, trunk stability, balance, and gait that could not be adequately addressed by a single therapeutic modality. Contemporary evidence supports multimodal exercise-based rehabilitation for promoting neuroplasticity, motor relearning, and functional recovery following stroke.^{5,7}

To facilitate reproducibility in accordance with the Template for Intervention Description and Replication (TIDieR) Checklist, the detailed intervention protocol is presented in Table 1. The table summarizes the therapeutic components, dosage, progression criteria, and delivery procedures applied throughout the rehabilitation program.

Table 1. Individualized Physiotherapy Intervention Protocol

Intervention	Protocol
Infrared therapy	Applied before exercise for 10–15 minutes at a distance of approximately 45–50 cm to provide superficial heating and prepare soft tissues for therapeutic exercise.
Active-assisted exercise	Upper and lower extremities of the affected side; 2–3 sets of 8–12 repetitions.
Active-resisted exercise	2–3 sets of 8–12 repetitions using manual resistance adjusted to patient tolerance; resistance was progressively increased when all repetitions were completed with appropriate movement quality and without compensatory strategies.
Proprioceptive neuromuscular facilitation	Diagonal movement patterns of the upper and lower extremities; 10–15 repetitions for each pattern.
Heel-slide exercise	2–3 sets of 10 repetitions.
Bridging exercise	2–3 sets with a 5–10-second hold for each repetition.
Patient education	Education regarding positioning, prevention of contracture, fall prevention, energy conservation, and the importance of continued exercise.
Home exercise program	Heel-slide exercise, bridging exercise, self-assisted upper-limb exercise, and weight-shifting practice using a tripod, performed daily according to written and verbal instructions provided by the physiotherapist.

As summarized in **Table 1**, all interventions were delivered once daily over five consecutive treatment sessions. Exercise intensity was individualized according to patient tolerance, movement quality, fatigue level, and clinical response. Progression was implemented when the patient completed the prescribed repetitions without excessive fatigue, pain, or compensatory movement patterns. Conversely, exercise intensity was reduced whenever deterioration in movement quality or exercise intolerance was observed. Treatment fidelity was maintained by applying the same intervention sequence, comparable session duration, standardized exercise protocol, and a single treating physiotherapist throughout the study, while allowing minor adjustments in exercise intensity according to daily clinical performance without altering the overall rehabilitation strategy.

No adverse events, including musculoskeletal injury, falls, excessive pain, hemodynamic instability, or other complications requiring discontinuation of treatment, were observed during the intervention period. Clinical outcomes were evaluated by comparing measurements obtained before the first treatment session and after completion of the fifth session. Because this investigation involved a single patient, no inferential statistical analysis was performed. Instead, changes in MMT grades, 5STS performance, and BI scores were described descriptively to illustrate short-term clinical changes following the individualized physiotherapy program.

The chronological progression of the patient's clinical management, from stroke onset and diagnosis through physiotherapy assessment, intervention, and post-treatment evaluation, is illustrated in Figure 1 to comply with the CARE Guideline and provide a clear overview of the sequence of clinical events.

Results

The patient completed all five scheduled physiotherapy sessions without interruption, and no adverse events occurred throughout the intervention period. All outcome assessments were successfully completed at baseline before the first treatment session (T1, pre-intervention) and immediately after completion of the fifth treatment session (T2, post-intervention). No participant withdrawal, protocol deviation, or modification of the planned rehabilitation program was required during the observation period.

To provide a comprehensive overview of the patient's clinical progression, changes in muscle strength, dynamic balance, and functional independence before and after the intervention are summarized in **Table 2**. These outcomes were selected because they represent the primary rehabilitation goals identified during the initial physiotherapy assessment.

Table 2. Clinical Outcomes Before and After the Individualized Physiotherapy Program

Outcome Measure	Baseline (T1)	Post-intervention (T2)
Manual Muscle Testing (MMT)		
Shoulder flexors	Grade 4	Grade 4
Shoulder extensors	Grade 4	Grade 4
Elbow flexors	Grade 4	Grade 4
Elbow extensors	Grade 4	Grade 4
Wrist flexors	Grade 4	Grade 4
Wrist extensors	Grade 4	Grade 4
Hip flexors	Grade 3	Grade 3
Hip extensors	Grade 3	Grade 3
Knee extensors (Quadriceps)	Grade 3	Grade 4
Ankle dorsiflexors (Tibialis anterior)	Grade 2	Grade 3
Five Times Sit-to-Stand Test	13 s	11 s
Barthel Index	90	95
Walking ability	Ambulation using tripod	Independent ambulation

Abbreviations: MMT = Manual Muscle Testing; T1 = pre-intervention; T2 = post-intervention.

As presented in Table 2, improvements were observed in selected outcome measures following completion of the rehabilitation program. Muscle strength increased in the quadriceps from grade 3 to grade 4 and in the tibialis anterior from grade 2 to grade 3, whereas muscle strength in the remaining evaluated muscle groups remained unchanged during the observation period. Performance on the Five Times Sit-to-Stand Test improved from 13 seconds at baseline to 11 seconds following the intervention. Functional independence, assessed using the Barthel Index, increased from 90 to 95 points. In addition, the patient progressed from ambulation with a tripod to independent walking by the end of the fifth treatment session.

To facilitate understanding of the sequence of clinical management and outcome assessment, the patient's chronological progression is illustrated in Figure 1.

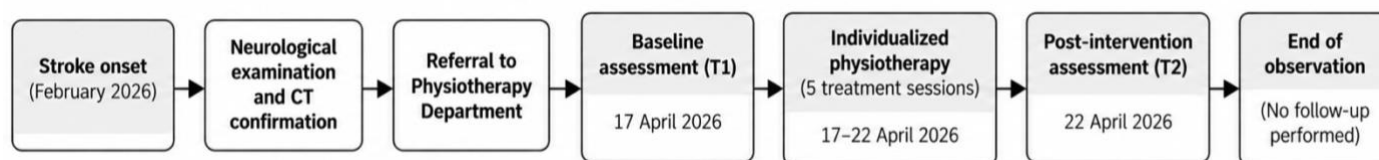


Figure 1. Timeline of Clinical Management and Outcome Assessment

Figure 1 demonstrates the chronological sequence of patient management from stroke onset through diagnosis, physiotherapy referral, baseline assessment, intervention, and final evaluation. The observation period was limited to five consecutive treatment sessions, and no additional follow-up assessment was conducted after completion of the intervention. Consequently, the findings reported in this case represent short-term clinical observations obtained during the defined rehabilitation period.

Because this study was designed as a case report involving a single patient, no inferential statistical analysis was performed. Clinical outcomes are presented descriptively to document changes observed during routine physiotherapy management without attempting to infer causality or treatment effectiveness.

Discussion

This case report described the short-term clinical outcomes of an individualized multimodal physiotherapy program in a 59-year-old man with left hemiparesis during the subacute phase following non-hemorrhagic stroke. After five treatment sessions, improvements were observed in lower-extremity muscle strength, dynamic balance, walking ability, and functional independence. Specifically, quadriceps strength increased from grade 3 to grade 4, tibialis anterior strength improved from grade 2 to grade 3, the Five Times Sit-to-Stand Test (5STS) time decreased from 13 to 11 seconds, the Barthel Index (BI) increased from 90 to 95 points, and the patient progressed from tripod-assisted ambulation to independent walking. Because this study involved only a single patient without a comparison group, these findings should be interpreted as individual clinical observations rather than evidence of treatment efficacy or causality.

The observed improvement in muscle strength may be explained by the combined effects of progressive therapeutic exercise and neurological recovery.¹² Following stroke, muscle weakness is not solely attributable to reduced muscle force production but also results from impaired motor unit recruitment, disrupted corticospinal activation, altered neuromuscular coordination, and secondary disuse-related muscle atrophy.¹³ Consequently, rehabilitation strategies that integrate active movement, progressive resistance training, and neuromuscular facilitation aim to improve voluntary motor activation while promoting more efficient motor control.¹⁴ The combination of active-assisted exercise, active-resisted exercise, and proprioceptive neuromuscular facilitation (PNF) implemented in this patient was intended to facilitate motor relearning by repeatedly activating weakened muscle groups within functional movement patterns. These interventions are consistent with contemporary neurorehabilitation principles emphasizing repetitive, task-specific practice and progressive overload to enhance neuroplasticity and functional recovery.^{5,7}

The present findings are consistent with recent evidence supporting exercise-based rehabilitation following stroke. Ren et al. reported that structured exercise interventions are associated with improvements in muscle strength, mobility, and functional performance across different stages of stroke rehabilitation through mechanisms involving enhanced neuromuscular adaptation and cortical reorganization.⁶ Similarly, Shahid et al. concluded that multimodal physiotherapy programs integrating strengthening exercises, balance training, and functional task practice produce clinically meaningful improvements in motor performance compared with isolated interventions.⁵ Although these studies involved larger populations and higher levels of evidence than a single case report, the direction of improvement observed in the present patient is compatible with previously reported rehabilitation outcomes. Nevertheless, the contribution of each therapeutic component cannot be distinguished because all interventions were delivered simultaneously as part of an individualized rehabilitation strategy.

In addition to improvements in muscle strength, the patient demonstrated better dynamic balance and walking ability following the intervention. The reduction in 5STS completion time from 13 to 11 seconds suggests improved lower-extremity functional performance and transitional mobility. The 5STS is recognized as a multidimensional functional assessment reflecting lower-limb strength, postural control, coordination, and transfer ability rather than isolated muscular performance.¹⁰ Therefore, the observed improvement most likely reflects enhanced integration of multiple motor functions required during everyday activities.

Several components of the rehabilitation program may have contributed to these functional changes. Bridging exercise was prescribed to improve trunk stability and pelvic control, both of which are essential prerequisites for efficient standing balance and gait.¹⁵ Heel-slide exercise facilitated lower-limb motor control throughout the swing phase of walking, whereas PNF promoted coordinated multijoint movement patterns through proprioceptive stimulation.¹⁴ Collectively, these interventions were designed to improve movement quality rather than focusing exclusively on isolated muscle strengthening. Such an integrated approach is supported by current rehabilitation frameworks emphasizing restoration of coordinated functional movement instead of treating individual impairments independently.^{5,7}

The patient's progression from tripod-assisted ambulation to independent walking further supports the observed improvement in functional mobility. Previous studies have demonstrated that gait-oriented rehabilitation combined with progressive balance training can enhance walking performance by improving postural stability, weight transfer, and lower-limb coordination. A randomized controlled trial by Lee et al. reported that task oriented treadmill gait training improved gait function, balance ability, and functional activities in patients with subacute stroke.¹⁶ Likewise, systematic reviews consistently conclude that multimodal exercise programs contribute to better walking ability and community mobility, particularly when interventions are individualized according to patient-specific functional deficits.^{6,7} Although walking performance in the present study was evaluated descriptively rather than through standardized gait analysis, the transition to independent ambulation represents a clinically meaningful functional change during the observation period.

Functional independence also improved, as demonstrated by the increase in BI score from 90 to 95. Although the absolute numerical change was modest, it reflected improved performance in activities requiring greater lower-extremity strength, postural control, and coordinated movement, particularly stair negotiation. Improvement in ADL represents an important rehabilitation outcome because restoration of independence is a primary objective of post-stroke physiotherapy.¹⁷ Rather than emphasizing isolated physiological recovery, rehabilitation ultimately seeks to maximize patients' ability to perform meaningful daily activities safely and independently.¹⁸

These findings are consistent with previous literature demonstrating that improvements in motor performance frequently translate into better functional independence.¹⁷ Basheikh and Badahdah reported that structured home-based exercise programs

combined with professional supervision were associated with improved ADL performance among stroke survivors.¹⁹ Similarly, umbrella reviews have demonstrated that exercise-based rehabilitation enhances participation and functional capacity across multiple rehabilitation settings.⁷ The inclusion of patient education and a structured home exercise program in the present case may therefore have supported continued practice outside supervised treatment sessions, potentially reinforcing motor learning and functional adaptation during the rehabilitation period.

Interpretation of these findings should also consider the potential contribution of spontaneous neurological recovery. During the subacute stage of stroke, functional improvement may occur naturally through resolution of cerebral edema, restoration of cerebral perfusion, synaptic reorganization, and spontaneous neuroplastic changes independent of rehabilitation interventions.^{3,20} Consequently, the clinical improvements observed in this patient are likely to reflect the combined influence of natural biological recovery and individualized physiotherapy rather than the isolated effect of the intervention itself. Because this case report lacks a control condition, the relative contribution of each factor cannot be determined.

Several limitations should be acknowledged when interpreting the findings of this report. First, the study involved only a single patient, limiting external validity and precluding generalization to broader stroke populations. Second, the absence of a comparison group prevents causal inference regarding the relationship between physiotherapy and observed clinical improvements. Third, the observation period was limited to five treatment sessions without medium- or long-term follow-up, making it impossible to determine the sustainability of functional gains. Fourth, multiple therapeutic modalities were delivered concurrently according to routine clinical practice; therefore, the independent contribution of each intervention cannot be quantified. Finally, patient-reported experience was unavailable because patient perspective was not collected during treatment. Despite these limitations, the report provides a detailed description of individualized clinical decision-making, intervention delivery, and outcome assessment that may assist clinicians managing patients with similar clinical presentations while contributing practical evidence to complement findings from higher-level study designs.

Overall, this case illustrates how an individualized multimodal physiotherapy program can be implemented within routine neurological rehabilitation using standardized clinical outcome measures and structured therapeutic progression. Although the findings should not be interpreted as evidence of treatment effectiveness, they provide clinically relevant observations regarding short-term functional changes following individualized rehabilitation and may inform future prospective studies employing larger sample sizes, longer follow-up periods, and comparative research designs to further evaluate multimodal physiotherapy for individuals recovering from non-hemorrhagic stroke.

Conclusion

This case report describes the short-term clinical outcomes of an individualized multimodal physiotherapy program for a patient with left hemiparesis following non-hemorrhagic stroke. After five treatment sessions, improvements were observed in lower-extremity muscle strength, dynamic balance, walking ability, and functional independence, as reflected by changes in Manual Muscle Testing, Five Times Sit-to-Stand Test performance, Barthel Index score, and progression from tripod-assisted to independent ambulation. These observations suggest that a structured rehabilitation program integrating therapeutic exercise, proprioceptive neuromuscular facilitation, functional training, patient education, and home exercise may support functional recovery during the subacute phase of stroke rehabilitation.

However, because this report describes the clinical course of a single patient without a comparison group or long-term follow-up, the findings should not be interpreted as evidence of treatment effectiveness or causal relationships. Further prospective studies with larger sample sizes, controlled study designs, standardized intervention protocols, and extended follow-up are required to determine the effectiveness of individualized multimodal physiotherapy for individuals recovering from non-hemorrhagic stroke.

Author Contribution

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Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this article.

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Ethics Statement

Written informed consent was obtained from the patient for participation and publication of this case report, including anonymized clinical information and outcome data. Patient confidentiality has been strictly maintained by removing all personally identifiable information. This case report was conducted in accordance with the ethical principles of the Declaration of Helsinki. Where applicable, institutional requirements for ethical review of a single case report were followed.

References

1. Feigin VL, Brainin M, Norrving B, Martins SO, Pandian J, Lindsay P, et al. World Stroke Organization: Global Stroke Fact Sheet 2025. *Int J Stroke*. 2025;20(2):132-144.
2. GBD 2021 Stroke Risk Factor Collaborators. Global, regional, and national burden of stroke and its risk factors, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet Neurol*. 2024;23(10):973-1003.
3. Bernhardt J, Hayward KS, Kwakkel G, Ward NS, Wolf SL, Borschmann K, et al. Agreed definitions and a shared vision for new standards in stroke recovery research: the Stroke Recovery and Rehabilitation Roundtable taskforce. *Int J Stroke*. 2017;12(5):444-450.
4. Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, et al. Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2016;47(6):e98-e169.
5. Shahid J, Kashif A, Shahid MK. A comprehensive review of physical therapy interventions for stroke rehabilitation: impairment-based approaches and functional goals. *Brain Sci*. 2023;13(5):717.
6. Ren S, Wan Q, Liu Y. Effects of exercise intervention on physical mobility in stroke patients: a scoping review and research progress. *Front Neurol*. 2025;16:1609242.
7. Todhunter-Brown A, Sellers CE, Baer GD, Choo PL, Cowie J, Cheyne JD, et al. Physical rehabilitation approaches for the recovery of function and mobility following stroke. *Cochrane Database Syst Rev*. 2025;(2):CD001920.
8. Riley DS, Barber MS, Kienle GS, Aronson JK, von Schoen-Angerer T, Tugwell P, et al. CARE guidelines for case reports: explanation and elaboration document. *J Clin Epidemiol*. 2017;89:218-235.
9. Cuthbert SC, Goodheart GJJ. On the reliability and validity of manual muscle testing: a literature review. *Chiropr Osteopat*. 2007;15:4.
10. Mong Y, Teo TW, Ng SS. 5-repetition sit-to-stand test in subjects with chronic stroke: reliability and validity. *Arch Phys Med Rehabil*. 2010;91(3):407-413.
11. Mahoney F, Barthel D. Functional evaluation: the Barthel Index. *Md State Med J*. 1965;14:61-65.
12. Kane E, Ward NS. Neurobiology of stroke recovery. In: Platz T, editor. *Clinical Pathways in Stroke Rehabilitation: Evidence-based Clinical Practice Recommendations*. Cham (CH): Springer; 2021. p. 1-13.
13. Uribin MA, Collinger JL, Wittenberg GF. Corticospinal recruitment of spinal motor neurons in human stroke survivors. *J Physiol*. 2021;599(18):4357-4373.
14. Nguyen PT, Chou LW, Hsieh YL. Proprioceptive neuromuscular facilitation-based physical therapy on the improvement of balance and gait in patients with chronic stroke: a systematic review and meta-analysis. *Life (Basel)*. 2022;12(6):882.
15. Moreno-Segura N, Martín-San Agustín R, García-Bafalluy S, Escriche-Escuder A. Effects of core training on trunk function, balance, and gait in stroke patients: a systematic review and meta-analysis of randomised controlled trials. *Clin Rehabil*. 2022;36(12):1635-1654.
16. Lee MH, Jung YB, Hwang S, Kim YJ, Kwon KM. The effect of task-oriented treadmill gait on the improvement in gait function, balance ability and functional activities in subacute stroke patients: results of a randomized controlled trial. *J Korean Soc Phys Med*. 2023;18:133-144.
17. Li X, He Y, Wang D, Rezaei MJ. Stroke rehabilitation: from diagnosis to therapy. *Front Neurol*. 2024;15:1402729.
18. Kim DY, Ryu B, Oh BM, Kim DY, Kim DS, Kim DY, et al. Clinical practice guideline for stroke rehabilitation in Korea-Part 1: rehabilitation for motor function (2022). *Brain Neurorehabil*. 2023;16:e18.
19. Basheikh MA, Badahdah AA. Efficacy of home-based physical exercise in stroke survivors: a systematic review and meta-analysis of randomized controlled trials. *Arch Rehabil Res Clin Transl*. 2025;7:100494.
20. Krakauer JW, Carmichael ST, Corbett D, Wittenberg GF. Getting neurorehabilitation right: what can be learned from animal models? *Neurorehabil Neural Repair*. 2012;26(9):923-931.