



Effect of Repetitive Transcranial Magnetic Stimulation (rTMS) in Post-Stroke Lower Limb Motor Recovery: A Systematic Review

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Article History :

Received date : 2024/10/17

Revised date : 2024/11/24

Accepted date : 2025/12/18

Published date : 2025/03/05



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E-ISSN :

ISSN 3048-1368



P-ISSN

ISSN 3048-1376



ABSTRACT

Introduction : Transcranial magnetic stimulation (TMS) is a non-invasive technique that offers potential for enhancing motor function recovery after stroke by modulating brain activity. Among the different forms of TMS, repetitive TMS (rTMS) has been identified as a promising tool for stimulating brain regions associated with lower limb movement and improving motor function. This review aimed at assessing the effect of in rTMS in post-stroke lower limb motor recovery. **Methodology :** This systematic review followed PRISMA guidelines and included randomized controlled trials examining the effects of rTMS on lower limb motor recovery in post-stroke patients. Eligible studies involved adult stroke patients with motor dysfunction, and interventions included rTMS alone or combined with rehabilitation or medication therapy. The primary outcome assessed was motor function, with various measurement tools used. A comprehensive literature search was conducted across multiple databases, and data extraction and quality assessment were done independently by the authors using the Modified Jadad Scale. **Results :** A total of 14 randomized controlled studies were included in this review, involving 277 participants with varying stroke types and severities. The studies assessed the effects of low- frequency (1 Hz) and high-frequency (5-20 Hz) rTMS, combined with rehabilitation therapies, on lower limb motor recovery. The results showed significant improvements in lower limb motor function, balance, and spasticity, particularly with both high or low-frequency rTMS combined with other rehabilitation therapies. High-frequency rTMS also yielded positive effects, particularly in walking speed and gait symmetry. **Conclusion :** The rTMS procedure consistently showed improvements in lower motor function, balance, and gait in post-stroke patients compared to sham and control interventions

Keywords: Repetitive Transcranial Magnetic Stimulation (rTMS), Post-Stroke Lower Limb Motor Recovery

INTRODUCTION

Stroke is a leading cause of mortality among noncommunicable diseases and is also a major contributor to disability. Around 34% of global healthcare spending is directed towards stroke management. It affects individuals of all ages, with more than half of patients experiencing motor dysfunction. This impairment severely hinders their ability to carry out daily activities, placing a significant burden on their families.^{1,2} Approximately 80% of stroke patients experience motor dysfunction in either their upper or lower limbs after the event. While many stroke patients show some improvement in walking ability after standard rehabilitation, many still experience gait abnormalities such as hip joint abduction and external rotation, knee hyperextension, foot drop, varus, and reduced support time on the affected side.^{3,4}

Approximately 70% of individuals with lower limb impairment are unable to walk independently in the early stages after a stroke, and only half of them regain independent walking ability after rehabilitation. Upper and lower limb paresis is a key predictor of long-term functional recovery following a stroke that seriously affect the quality of life of patients. Natural rehabilitation for motor recovery of the limbs is often limited therefore, the development of new strategies to enhance functional recovery essential.³ Transcranial magnetic stimulation (TMS) is a non-invasive brain stimulation technique for nerve modulation and stimulation that utilizes electromagnetic induction to adjust cerebral cortical excitability over short or long periods by applying time-varying magnetic pulses locally. It can stimulate neuroplastic changes and aid in the restoration of brain function.^{5,6} TMS encompasses three types of stimulus paradigms: single-pulse TMS (sTMS), double-pulse TMS (pTMS), and repetitive TMS (rTMS). sTMS and pTMS are primarily used in research to identify cortical functions and assess cortical excitability. The rTMS involves a series of TMS pulses delivered at the same intensity to a specific cortical region, which helps regulate brain activity and can induce long-term effects, such as facilitation or inhibition.^{7,8}

Different brain functions require adjustments in the intensity, frequency, stimulation positions, and coil directions of rTMS to achieve optimal therapeutic

outcomes.⁵ Previous studies have shown that rTMS can stimulate the brain areas associated with lower limb movement, helping patients improve motor function. When combined with traditional physiotherapy and occupational therapy, rTMS can enhance the rehabilitation process and promote better motor function recovery.^{9,10} There are ongoing debates regarding the benefits of rTMS. Some systematic reviews have suggested that the current evidence does not fully support the routine use of rTMS for stroke treatment, even though many studies show positive effects on stroke patients.⁶ Given these controversies, This systematic review aims to evaluate the current evidence on the impact of rTMS on post-stroke lower limb motor recovery, examining its therapeutic potential, the parameters used, and the stroke populations most likely to benefit from this intervention.

METHODOLOGY

Eligibility Criteria

This systematic review were reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) ¹¹. We included randomized controlled studies that focused on the role of repetitive transcranial magnetic stimulation (rTMS) in post- stroke lower limb motor recovery. Studies that exclusively examined adult stroke patients via computed tomography (CT) or magnetic resonance imaging (MRI) with lower limb motot dysfunction, regardless of the type, severity, location, or progression of the disease, were included in this review. The intervention could include rTMS alone, rTMS combined with rehabilitation therapy, or rTMS with conventional medication therapy. The intervention parameters, including time, coil position, frequency, intensity, and duration, were not restricted. The minimum required number of participants was six, and only studies published in English were included.

Control groups in the included studies were sham-rTMS, sham plus rehabilitation, rehabilitation, or no treatment. Studies that did not have appropriate control groups or sham intervention groups were excluded from the analysis. Exclusion criteria were studies involving stroke patients combined with other conditions, such as Parkinson's disease or spinal cord injury, were excluded. Studies using combining two or more rTMS

techniques were excluded. Additionally, studies that combined rTMS with electrical stimulation methods, such as transcranial direct current stimulation (tDCS) or transcutaneous electrical nerve stimulation (TENS), were also excluded. Studies not published in English or those that did not meet the minimum participant requirement of six were excluded from the review. The primary outcome assessed was motor function, with no restrictions on the instruments used for measurement, such as the Fugl-Meyer Assessment for the lower limbs (FMA-LL).

Search Strategy and Study Selection

The literature search was conducted on February 25, 2025, and was finished on the same day. We systematically searched and obtained the papers from Pubmed, NCBI, Google Scholar, Science Direct. The search terms used included (“stroke” OR “cerebrovascular” OR “CVA” OR “cerebral infarction” OR “cerebral hemorrhage” OR “brain infarction” OR “brain hemorrhage” OR “Stroke[Mesh]”) AND (“lower limb” OR “lower extremity” OR “hip” OR “thigh” OR “knee” OR “leg” OR “ankle” OR “foot” OR “lower limbs” OR “ambulation” OR “walking” OR “gait”) AND (“rTMS” OR “repetitive transcranial magnetic stimulation”) AND (“randomized controlled trial” OR “RCT”). All records were then inputted into Rayyan software, which can detect duplicates and allow all authors to collaborate in selecting relevant studies. Authors conducted the initial search and imported all studies from various academic databases to the Rayyan software. Another author would then cross-check all the initial searches. All authors independently screened all available studies. All conflicts met during the screening process were resolved by discussion among the group until a conclusion was reached. If any missing or further data were needed, corresponding authors were sent an email of inquiry once.

Data Extraction and Quality Assessment

The data extraction process was done independently by authors and was checked by another author. The authors recorded study characteristics (author, year of publication, location, and study period), stroke type, protocol for both control group and intervention group, instruments or parameters used to evaluate lower limb function, and the main

results. All authors independently assessed the quality of each included study using the Modified Jadad Scale.

RESULTS

Study Selection and Characteristics

The initial search yielded 320 records, and 255 were screened after removing duplicates. A total of 159 studies were excluded after title and abstract screening, leaving 74 reports to be further assessed for eligibility. Studies with incorrect outcomes, no full paper, theoretical or review-based studies, unclear control group, and stroke with other neurological disorders were excluded. This left a total of twelve studies. Additional hand-searching yielded two more studies. A total of fourteen randomized controlled studies were included in the systematic review (Figure 1). The studies included in this review were assessed using the Modified Jadad Scale. All included studies were rated “high quality” based on the and therefore were included in the review.

This systematic review included fourteen studies that evaluated the effect of rTMS on lower limb motor recovery in post-stroke patients. Eight studies used low-frequency rTMS, while six studies used high-frequency rTMS. The studies involved a total of 277 participants, with 147 in the experimental groups and 130 in the control groups. The participants had a mix of ischemic, hemorrhagic, and mixed stroke types, ranging from acute to chronic stages post-stroke. In terms of the stroke severity and motor dysfunction, the studies included patients with varying degrees of disability, from mild to moderate impairments. The primary outcome measures commonly used across the studies included the Fugl-Meyer Assessment for lower limbs (FMA-LL), Berg Balance Scale (BBS), Modified Ashworth Scale (MAS), Postural Assessment Scale for Stroke (PASS) and various gait parameters, such as walking speed, stride length, and gait symmetry.

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The most commonly used coil type in the studies was the figure-of-eight coil, which targets specific brain areas like the motor cortex and lower limb regions. Other coils, such as the circular coil, double-cone coil, and H-coil, were used in specific studies to provide broader or deeper stimulation depending on the targeted brain region and the

intervention goals. The experimental group received either low-frequency rTMS (1 Hz) or high-frequency rTMS (5- 20 Hz), combined with rehabilitation therapies such as conventional physical therapy, task- oriented training, and movement therapy. The studies that used low-frequency rTMS showed significant improvements in various outcome parameters.^{9,10,12–17} For the low-frequency rTMS, the intervention protocols varied across studies, with rTMS applied at different frequencies and intensities, typically targeting the motor cortex of the affected hemisphere. The most common protocol was 1 Hz rTMS with 90% resting motor threshold (RMT), delivered for 15-20 minutes per session, with frequencies of 5 sessions per week for durations ranging from 2 to 6 weeks.

In some studies, rTMS was combined with conventional rehabilitation or task-oriented training, which further enhanced the outcomes. In terms of motor recovery, the majority of studies demonstrated significant improvements in lower limb motor function, balance, and spasticity. For instance, Wang et al. (2024) reported notable improvements in the Fugl-Meyer Assessment for lower limb (FMA-LL), Berg Balance Scale (BBS), and Modified Barthel Index (MBI) scores in the LF-rTMS group compared to the control and sham groups.⁹ Similarly, Chen et al. (2023) found that low-frequency rTMS combined with motor rehabilitation (MRP) improved spasticity and motor function in stroke patients with hemiparesis.¹⁰

Additionally, Sharma et al. (2020) showed no significant changes in the FMA-LL scores in their study, suggesting some variability in the effectiveness of the intervention protocol. Other studies, such as those by Rastgoo et al. (2016) and Lin et al. (2015), indicated significant reductions in muscle spasticity and improvements in motor function, walking ability, and mobility post-intervention in the experimental group when compared to the control group.^{13,18} Additionally, in the study by Kim et al. (2014), real rTMS intervention led to significant improvements in walking ability and balance, compared to both pre-intervention and sham rTMS.¹⁶

Various studies in this review employed various high-frequency rTMS protocols targeting different areas and brain regions.^{19–24} In one study, Wang et al. (2019) reported significant improvements in walking speed, gait symmetry, and motor function in stroke patients who received rTMS applied to the tibialis anterior hotspot, compared to both pre- intervention levels and the sham rTMS group.¹⁹ Study by Cha et al. (2017)

found that combining high-frequency rTMS with ankle strengthening exercises resulted in positive effects on motor function recovery in subacute stroke patients, especially in 10-meter walking speed and plantarflexion peak torque.²⁰ However, Gu et al. (2017) showed no significant improvement in motor function after combining high-frequency rTMS applied to the left dorsolateral prefrontal cortex with movement therapy.²⁵

In terms of balance, Choi et al. (2016) found that rTMS applied to the 9th thoracic erector spinae motor hotspot significantly improved balance function when compared to both pre-intervention and sham stimulation, highlighting the potential of rTMS in enhancing post-stroke balance.²² Similarly, Ji et al. (2016) observed significant improvements in both static and dynamic balance following rTMS targeting the lesioned hemisphere, compared to pre-intervention and sham rTMS, underscoring the role of rTMS in promoting balance recovery.²³ Furthermore, Chieffo et al. (2014) conducted a comparison between a 30-minute real rTMS intervention (20Hz) for 10 sessions over 3 weeks and sham rTMS, specifically examining its effects on lower limb functions and walking ability in stroke patients. The findings revealed that the real rTMS intervention led to significant improvements in the lower limb functions of the stroke patients.²⁴

DISCUSSION

This review investigates the effects of low-frequency and high-frequency rTMS on various lower limb motor recovery outcomes in stroke patients. The analysis presents both the beneficial effects and some variability in the effectiveness of the intervention protocols across studies. Motor impairment is a major cause of long-term disability after a stroke globally, with over 60% of stroke survivors still experiencing motor impairments despite intensive rehabilitation.⁵ It was discovered that stroke disrupts the balance of activity between the two brain hemispheres. The interhemispheric competition hypothesis suggests that the motor cortex of the unaffected hemisphere is inhibited, while the motor cortex of the affected hemisphere becomes exaggerated.^{6,26}

The rTMS has become a painless, non-invasive method for stimulating the brain, offering support for stroke survivors during their rehabilitation process. The rTMS is a stimulation technique that involves a series of consecutive stimuli applied to the same cortical region, using different frequencies and inter-sequence intervals, and has been

demonstrated to regulate cortical excitability and promote cortical restoration, with its effects primarily dependent on the stimulation frequencies.^{5,6} These processes refer to the ability of rTMS, depending on the stimulation frequency used, to either strengthen or weaken synaptic connections in the brain, creating lasting changes in neural activity, similar to the mechanisms observed in learning and memory at the cellular level.²⁷

Conventional rTMS methods include high-frequency (HF-rTMS) stimulation (>5 Hz) and low-frequency (LF-rTMS) stimulation (≤ 1 Hz).⁵ The majority of studies that used low-frequency rTMS showed significant improvements in various aspects of motor recovery for stroke patients, particularly in lower limb motor function, balance, and spasticity. In several studies, the combination of low-frequency rTMS with conventional rehabilitation or task-oriented training enhanced the overall outcomes, highlighting the synergistic effects of combining rTMS with physical therapy. For instance, studies by Wang et al. (2024) and Chen et al. (2023) observed significant improvements in motor function, spasticity, and balance following the addition of motor rehabilitation protocols to the rTMS treatment.^{9,10} These findings suggest that rTMS may serve as a valuable adjunct to traditional rehabilitation therapies by accelerating motor recovery and promoting better functional outcomes.⁶

Low-frequency rTMS may induce a short-term reduction in cortical excitability in the affected hemisphere, such as in motor evoked potential. This inhibition of cerebellar excitability caused by low-frequency rTMS may further enhance the ability to adapt to learning during conventional stroke rehabilitation, thereby improving walking ability.^{6,10,15} However, not all studies in this review reported consistent results, indicating some variability in the effectiveness of rTMS across different protocols. For example, Sharma et al. (2020) did not observe significant changes in the FMA-LL scores, suggesting that the effectiveness of low-frequency rTMS may depend on various factors such as patient characteristics, timing of intervention, and the specific rehabilitation protocols used.²⁸

This review found that high-frequency rTMS has shown promise in enhancing lower limb motor function in stroke patients, with several studies in this review demonstrating significant improvements in walking speed, gait symmetry, and overall motor recovery. One study by Cha et al. (2017) combined high-frequency rTMS with

ankle strengthening exercises and found positive effects on motor function recovery in subacute stroke patients. Notable improvements were observed in 10-meter walking speed and plantarflexion peak torque.²⁰ This combined approach underscores the synergistic potential of integrating rTMS with physical therapy, as the enhanced cortical excitability from rTMS may help the brain respond more effectively to motor rehabilitation exercises. High-frequency rTMS increases the amplitude of motor evoked potential and cortical excitability in the unaffected hemisphere, potentially reducing interhemispheric competition and gradually aiding in the improvement of motor ability. When applied following a stroke, rTMS should ideally help suppress "maladaptive plasticity" or enhance adaptive plasticity during rehabilitation. These objectives can be accomplished by modulating local cortical excitability or altering connectivity within neuronal networks.⁶

The study presents valuable findings on the effects of repetitive transcranial magnetic stimulation (rTMS) on lower limb motor recovery in stroke patients. However, several limitations must be considered when interpreting the results. One major limitation is the heterogeneity in rTMS parameters and settings across the included studies. This variability includes differences in the coil types used, the intensity of rTMS applied to the affected or unaffected hemisphere, and the stimulation frequencies. While some studies used figure-of-eight coils, others employed double-cone coils and H-coils, which have different field penetrations. Another limitation concerns the timing of rTMS application in relation to stroke onset. Research has suggested that early application of rTMS after stroke onset leads to higher recovery levels. However, the benefits of rTMS have also been observed in patients with chronic stroke. In this review, improvements in lower limb function were noted in both chronic and non-chronic stroke patients, but the variation in time intervals between stroke onset and intervention in the included studies makes it challenging to determine the most effective timing for rTMS administration. Furthermore, the small sample size in the included studies may also potentially reduce the reliability of these findings.

CONCLUSION

The rTMS procedure consistently showed improvements in lower motor function, balance, and gait in post-stroke patients compared to sham and control interventions. However, the

extent of improvement varied depending on stroke type, the region targeted for stimulation, and the combination of rTMS with other rehabilitation therapies. These findings suggest that rTMS may be a promising adjunctive treatment for post-stroke lower limb motor recovery, although further studies with standardized protocols are needed to clarify optimal treatment parameters and identify patient populations most likely to benefit from this intervention.

DISCLOSURE STATEMENT

- Disclosure Statement : The authors have no conflicts of Interest to declare
- Funding Sources : None
- Acknowledgements : -
- Author Contribution : All authors discussed and contributed the final content for journal submission and publication.

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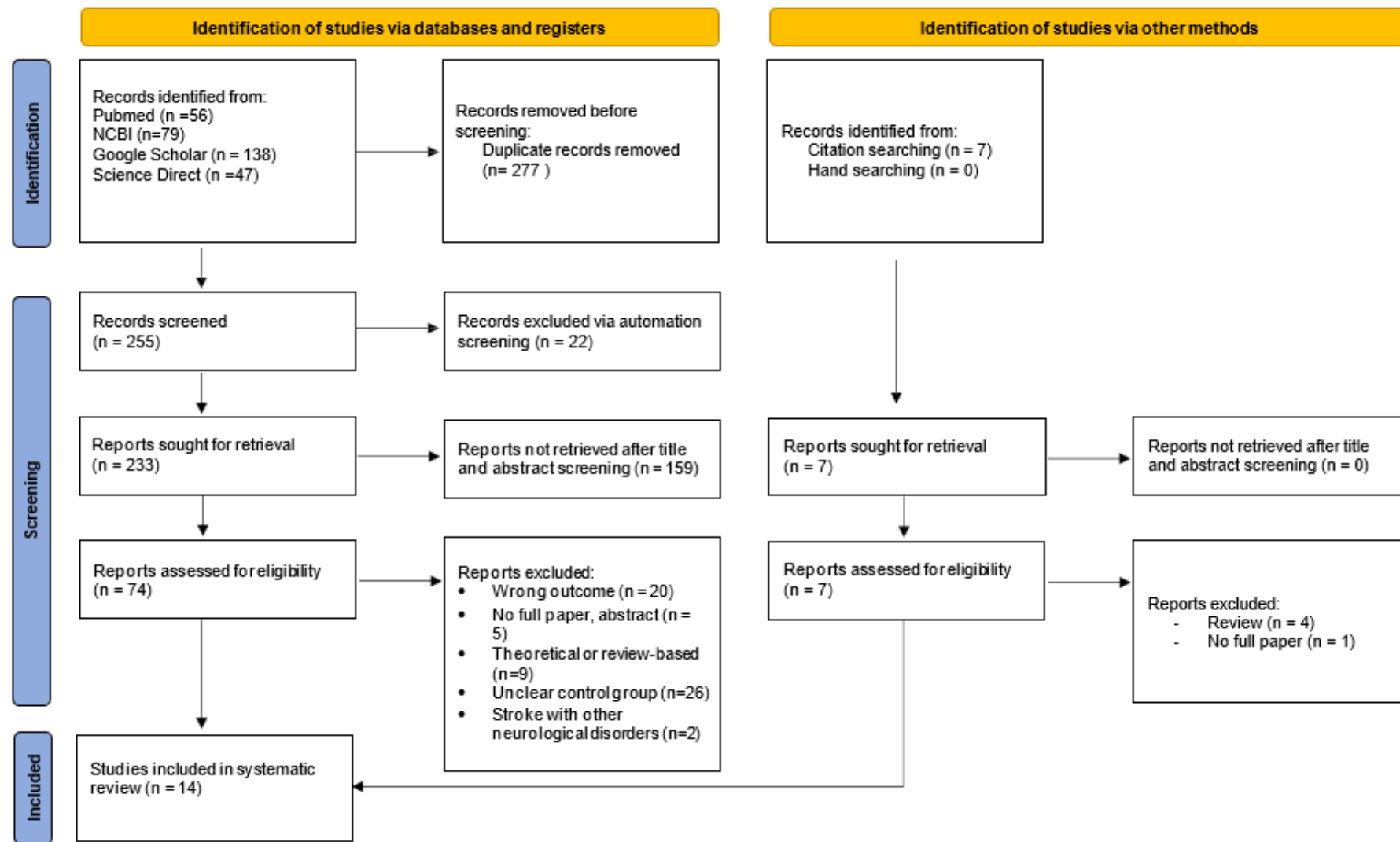


Figure 1. PRISMA flowchart for selection of included studies

Table 2. Summary of study included

No	Author (year)	Study Location	Number of Participants		Stroke type	Intervention		Coil Type	Outcome Parameters	Main Results
			Experimental group	Control group		Experimental	Control			
Low-frequency rTMS										
1	Wang et al. (2024) ⁹	China	27	25	Ischemic and hemorrhagic stroke with onset ranging 14-45 days	rTMS (1 Hz, 90% RMT, each sequence lasts 10 s with a 5-s interval, and this is repeated for 60 sequences, totaling 15 min and 600 pulses. 15 min per session, once a day, and 5 days/week);6 weeks + Conventional rehabilitation	Sham rTMS	Figure-of-eight coil	Fugl-Meyer Assessment for lower limb (FMA-LL), Berg Balance Scale (BBS), Modified Barthel Index (MBI)	The LF-rTMS group showed significant improvements in FMA-LE, BBS, MBI, and gait parameters compared to the control and sham groups

2	Chen et al. (2023) ¹⁰	China	21	39	Subacute ischemic and hemorrhagic stroke (1-6 months)	rTMS (1200 pulses, 1 Hz, 90% RMT, 20 min once a day, 6 days/week); 4 weeks + MRP + Routine rehabilitation	MRP + Routine rehabilitation n MRP: 20–30 min every day for 4 weeks Routine rehabilitation: 40 min of	Circular coil /contralesional M1	Modified Ashworth Scale (MAS), Fugl-Meyer Assessment for upper limb FMA-UL), Fugl-Meyer Assessment for balance function (FMA-BL), Brunnstrom score,	Low frequency rTMS combined with MRP had better efficacy on spasticity and motor function in stroke patients with hemiparesis than MRP alone
3	Sharma et al. (2020) ²⁸	India	47	49	Ischemic stroke within 15 days	rTMS (1 Hz, 110% RMT, 750 pulses, 75 trains, 45 seconds inter-train interval, daily, 5 sessions/week, 2 weeks, 10 sessions); combined with conventional physical therapy.	Sham rTMS (45-minute conventional physical therapy, 90 ± 7 days post-recruitment)	Figure-of-eight coil	MBI, FMA-UL, FMA-LL, Hamilton Depression, MRS, NIHSS	No significant change difference in FMA-LL

4	Rastgoo et al. (2016) ¹³	Iran	10	10	Unilateral hemiparesis due to first-ever stroke	rTMS (LE motor cortex of unaffected hemisphere, 90% resting MT, 1 Hz, 20 minutes, 1000 pulses, 5 sessions/week); 5 days	Sham rTMS	Figure-of-eight coil	FMA-LL, Muscle spasticity, walking ability	rTMS significantly reduced muscle spasticity and improved motor function in stroke patients relative to both pre-intervention and sham stimulation.
5	Lin et al. (2015) ¹⁴	Taiwan	16	16	Unilateral hemiplegia due to first-ever stroke (either infarction or haemorrhage) that occurred 10–90 days earlier	rTMS (UH rectus femoris hotspot, 130% MT, 1 Hz, total 900 pulses, 15 minutes) + 45 minutes PT; 15 consecutive weekdays	Sham rTMS + 45 minutes PT; 15 consecutive weekdays (Sham: customized coil produced similar sounds)	Figure-of eight coil	Postural Assessment Scale for Stroke Patients (PASS), balance subscale of the Performance Oriented Mobility Assessment (POMA-b), FML, Barthel Index (BI), and Timed Up and Go test,	Both groups showed significant improvements, but the real rTMS group had greater gains in PASS, POMA, and BI scores, and more patients regained mobility compared to the sham rTMS group.

6	Elkholy et al. (2014) ¹⁵	Egypt	30		Stroke affecting frontal and/or parietal lobes with mild degree of spasticity	rTMS (left hemisphere hotspot, 2 G, 1 Hz, 20 minutes, 0.5–1 Hz frequency, 3 sessions/week); 6 weeks + physical therapy	Physical Therapy	Double-cone coil	Muscle tone, walking, cadence, walking speed, sensorimotor recovery	rTMS resulted in significant improvements in muscle tone walking, cadence, walking speed, sensorimotor recovery in stroke patients when compared to both the pre-intervention and control groups.
7	Kim et al. (2014) ¹⁶	Korea	22	10	Acute first-ever ischaemic cerebellar or brain stem stroke with symptoms of ataxia.	rTMS (cerebellar hemisphere ipsilateral to the ataxia side, 100% resting MT, 1 Hz, total 900 pulses, 15 minutes); five days	Sham rTMS; five days (Sham: coil perpendicular to the scalp)	Figure-of eight coil	Berg balance scale	Real rTMS intervention notably enhanced walking ability and balance in stroke patients when compared to pre-intervention and sham stimulation.
8	Wang et al. (2012) ¹⁷	Taiwan	14	14	Unilateral hemiparesis secondary to stroke with postonset duration >6 months	rTMS (UH rectus femoris hotspot, 90% resting MT, 1 Hz, total 600 pulses, 10 minutes) + task oriented training (six workstations, 30 minutes); 10 consecutive weekdays	Sham rTMS + task-oriented training (six workstations, 30 minutes); 10 consecutive weekdays (Sham: coil perpendicular to the scalp)	Figure-of eight coil	LE-FM, 3.66 m speed, MEP	The combination of real rTMS and task-oriented treatment led to significant improvements in motor control and walking ability in stroke patients compared to pre-intervention and sham rTMS combined with task-oriented treatment.

High-frequency TMS

9	Wang et al. (2019) ¹⁹	Taiwan	8	6	Unilateral hemiparesis post-stroke	rTMS (tibialis anterior hotspot, 90% resting MT, 5 Hz, 15 minutes, 12 seconds train, 48 seconds interval, 3 sessions/week); 3 weeks	ShamrTMS	Figure-of-eight coil	Walking speed, gait symmetry, lower limb functions and muscle activity	Significant improvement walking speed, gait asymmetry, and motor function in stroke patients when compared to pre-intervention and sham stimulation.
10	Cha et al. (2017) ²⁰	Korea	10	10	Subacute stroke	rTMS (AH primary motor area, 90% resting MT, 10 Hz, 10 seconds, 50 seconds interval, 10 minutes) + ankle strengthening exercise; five days/week × eight weeks	Ankle strengthening exercise for 10 minutes daily; five days/ week × eight weeks	Figure-of eight coil	10-m speed, plantarflexion peak torque, MEP	Strengthening exercise integrated rTMS has positive effects on motor function recovery in subacute stroke patients.

11	Gu et al. (2017) ²⁵	Korea	12	12	Cerebral infarcts, intracerebral hemorrhages	rTMS (left dorsolateral prefrontal cortex, 110% MT, 10 Hz, 5 seconds, 1 minute interval, 20 trains, total 1000 pulses) 5 sessions/ week + movement therapy six days/ week; two weeks	Sham rTMS 5 sessions/ week + movement therapy six days/week; two weeks (Sham: coil perpendicular to the scalp)	Figure-of eight coil	Motricity Indices (MI-LE), modified Brunnstrom Classification (MBC), and Functional Ambulatory Category (FAC) assessments.	No significant improvement in patients' motor function
12	Choi et al. (2016) ²²	Korea	15	15	Chronic stroke in middle cerebral artery	rTMS (9th thoracic erector spinae motor hotspot, 90% resting MT, 10 Hz, 5 seconds	Sham rTMS	Figure-of eight coil	Balance	Significant improvement in balance function in stroke patients compared to both pre-intervention

						train, 25 seconds interval, 1,000 pulses, 10 minutes)				and sham stimulation.
13	Ji et al. (2016) ²³	Korea	15	15	Ischemic and hemispheric stroke	rTMS (lesioned hemisphere hotspot, 10 Hz, 15 minutes, 10 seconds train, 50 seconds interval, 2,000 pulses, 5 sessions/week); 4 weeks	Sham rTMS	Figure-of eight coil	Static balance and dynamic balance	Significant improvement in both static and dynamic balance in stroke patients compared to pre-intervention and sham rTMS
14	Chieffo et al. (2014) ²⁴	Israel	10	10	First stroke in middle cerebral artery	rTMS (tibialis anterior hotspot, 90% of resting MT or up to 82% maximal stimulation output, 20 Hz, 30 trains, 60 seconds interval, total 1500 pulses, 30 minutes); 11 sessions, 3 weeks	Sham rTMS; 11 sessions, three weeks (Sham: coil with similar acoustic artifact and some scalp sensation)	H-coil	LE-FM	Real rTMS intervention led to significant improvements in lower limb function in stroke patients when compared to pre-intervention and sham stimulation.