In-Hospital Protocal for Acute Ischemic Stroke: Evidence Regarding Neuroprotection, Mechanical Thrombectomy, and Rehabilitation Delivered by Physicians, Physiotherapists, and Nurses

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Abstract

Background: Acute ischemic stroke (AIS) remains among the leading causes of mortality and functional disability worldwide. The consolidation of mechanical thrombectomy as the standard of care for large vessel occlusions has revolutionized disease management, increasing cerebral reperfusion rates and improving clinical outcomes. However, the persistence of neurological deficits in a subset of reperfused patients highlights the need for complementary strategies focused on neuroprotection and multidisciplinary rehabilitation. In this context, structured in-hospital protocols play a fundamental role in integrating reperfusion therapies, neuroprotective measures, and functional recovery.

Objective: To analyze the scientific evidence related to neuroprotective strategies applied to acute ischemic stroke, emphasizing their association with mechanical thrombectomy and their integration into in-hospital care and multidisciplinary rehabilitation protocols.

Methods: A systematic review was conducted in accordance with the PRISMA 2020 guidelines. Searches were performed in PubMed/MEDLINE, Scopus, Web of Science, Embase, Cochrane Library, SciELO, and the Virtual Health Library (VHL) databases, including studies published between 2013 and 2026. Clinical trials, observational studies, systematic reviews, meta-analyses, and clinical guidelines related to mechanical thrombectomy, cerebral neuroprotection, in-hospital stroke protocols, and multidisciplinary rehabilitation were selected. After applying eligibility criteria, 75 studies were included in the qualitative synthesis.

Results: The studies demonstrated that mechanical thrombectomy constitutes the primary reperfusion strategy for patients with large vessel occlusion, presenting a significant impact on reducing functional disability. Neuroprotective measures, including the management of blood pressure, blood glucose, body temperature, and oxygenation, proved fundamental in minimizing secondary brain injury and enhancing the benefits of reperfusion. Furthermore, care in Stroke Units and the integrated practice of physicians, nurses, and physical therapists contributed to the reduction of in-hospital complications, improvement of neurological outcomes, and increased functional independence. Early mobilization, respiratory management, and structured rehabilitation programs were highlighted as essential components of post-stroke recovery.

Conclusions: The association between mechanical thrombectomy, neuroprotective strategies, and multidisciplinary rehabilitation forms the basis of modern in-hospital protocols for acute ischemic stroke. The integration of these interventions promotes the preservation of the ischemic penumbra, reduces complications, and improves functional outcomes. The strengthening of Stroke Units and the development of novel neuroprotective approaches represent promising perspectives for optimizing the care of patients affected by this condition.

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1. Introduction

Stroke remains one of the leading causes of mortality and disability worldwide, representing a major challenge for healthcare systems due to the high socioeconomic and functional impact of its sequelae. Ischemic stroke accounts for approximately 85% of cases and results from the interruption of cerebral blood flow, leading to the formation of an infarct core surrounded by a

potentially salvageable region known as the ischemic penumbra. The preservation of this viable tissue constitutes the primary objective of current therapeutic strategies, as it is directly related to the functional recovery of patients (CAMPBELL; KHATRI, 2020; POWERS *et al*., 2019) [12, 54].

In recent decades, the treatment of acute ischemic stroke (AIS) has undergone significant transformations with the consolidation of reperfusion therapies. Intravenous thrombolysis with alteplase remains the first-line treatment for eligible patients within the recommended therapeutic window, while mechanical thrombectomy has been established as the standard of care for individuals with intracranial large vessel occlusion (LVO) (POWERS *et al*., 2019; BERGE *et al*., 2021) [54, 5]. Several studies have demonstrated that early reperfusion is associated with reduced disability and increased rates of functional independence after stroke (EMBERSON *et al*., 2014; SAVER *et al*., 2015) [21, 61].

The efficacy of mechanical thrombectomy was proven by major randomized clinical trials that demonstrated its superiority over medical management alone. Trials such as MR CLEAN, ESCAPE, EXTEND-IA, SWIFT PRIME, and REVASCAT showed consistent benefits in neurological recovery and a reduction in functional dependence among patients undergoing endovascular reperfusion (BERKHEMER *et al*., 2015; CAMPBELL *et al*., 2015; GOYAL *et al*., 2015; SAVER *et al*., 2015; JOVIN *et al*., 2015) [6, 15, 24, 61, 30]. Subsequently, the DAWN and DEFUSE-3 trials extended the therapeutic window for cases selected by advanced neuroimaging methods, reinforcing the importance of individualized assessment and the organization of in-hospital stroke protocols (NOGUEIRA *et al*., 2018; ALBERS *et al*., 2018) [50, 1].

Despite the advances provided by reperfusion strategies, a significant proportion of patients remain with severe neurological deficits, even after successful recanalization of the occluded vessel. This phenomenon suggests that the restoration of blood flow alone is not always sufficient to prevent the progression of neuronal injury, especially in situations of delayed reperfusion, cerebral edema, and ischemia-reperfusion injury (CHAMORRO; DIRNAGL; URRA; PLANAS, 2016; SAVITZ *et al*., 2017) [17, 59].

In this context, neuroprotective strategies have attracted growing interest within the scientific community, as they seek to preserve cerebral cellular integrity before, during, and after reperfusion. Such approaches include strict blood pressure control, maintenance of normoglycemia, prevention of hyperthermia, optimization of tissue oxygenation, inflammatory modulation, and the investigation of pharmacological agents capable of reducing secondary neuronal damage (POWERS *et al*., 2019; DAMMAVALAM; AGHAEBRAHIM; RAI, 2024) [54, 19]. Although many neuroprotective agents have shown promising results in experimental models, the translation of these benefits into clinical practice still represents a significant challenge (NEUHAUS *et al*., 2017; DIRNAGL; ENDRES, 2014) [48, 20].

The era of mechanical thrombectomy has brought new perspectives to cerebral neuroprotection, given that achieving rapid reperfusion allows for the enhanced effectiveness of adjunctive therapies aimed at preserving the ischemic penumbra. Recent studies have evaluated pharmacological and non-pharmacological strategies associated with reperfusion, including neuroprotective agents, optimized hemodynamic management, and specific neurocritical care protocols (HILL *et al*., 2020; WANG *et al*., 2026) [28, 68]. These advances reinforce the need to integrate neuroprotection into established in-hospital protocols for the treatment of acute stroke.

Concurrently, the concept of the in-hospital stroke protocol has evolved beyond the simple execution of thrombolysis or thrombectomy, incorporating a continuous and multidisciplinary approach from patient admission to the rehabilitation phase. The implementation of specialized Stroke Units has demonstrated a reduction in mortality, a decrease in in-hospital complications, and a significant improvement in functional outcomes, highlighting the importance of care organization and the integrated performance of healthcare teams (STROKE UNIT TRIALISTS' COLLABORATION, 2013; POWERS *et al*., 2019) [62, 54].

In this scenario, multidisciplinary practice assumes a fundamental role. Neurologists, intensivists, interventional radiologists, nurses, physical therapists, occupational therapists, speech-language pathologists, and other professionals contribute in a complementary manner to the comprehensive care of patients affected by acute ischemic stroke. The integration of rapid diagnosis, effective reperfusion, clinical neuroprotection, and early rehabilitation is directly associated with improved neurological and functional recovery (WINSTEIN *et al*., 2016; MINELLI *et al*., 2022) [70, 42].

Physical therapy holds a special prominence within this multidisciplinary approach, operating from the acute phase through respiratory management, prevention of immobility-associated complications, early mobilization, and the stimulation of neuroplasticity. Evidence shows that physical therapy interventions initiated early can contribute to motor recovery, reduced length of hospital stay, and improved functional independence in stroke survivors (LANGHORNE; BERNHARDT; KWAKKEL, 2011; POLLOCK *et al*., 2014; VEERBEEK *et al*., 2014) [32, 52, 67].

Time remains one of the main prognostic determinants in acute ischemic stroke. The concept that "time is brain" remains widely validated, demonstrating that delays in symptom recognition, neuroimaging acquisition, or the initiation of reperfusion therapies result in progressive neuronal loss and worse functional prognosis (SAVER, 2006; MERETOJA *et al*., 2014; RIBO *et al*., 2016) [60, 41, 56]. Therefore, the efficiency of in-hospital protocols and the integration across different stages of care constitute essential factors for optimizing clinical outcomes.

Given the growing expansion of evidence related to mechanical thrombectomy, cerebral neuroprotection, and multidisciplinary rehabilitation, it is essential to synthesize the knowledge available in the scientific literature. Thus, this systematic review aims to analyze current evidence on neuroprotective strategies applied to acute ischemic stroke, emphasizing their integration with mechanical thrombectomy and their relevance to in- hospital care and multidisciplinary recovery protocols.

2. Objectives

2.1. General Objective

To analyze the available scientific evidence regarding neuroprotective strategies employed in the management of acute ischemic stroke, emphasizing their association with mechanical thrombectomy and their applicability to in-hospital care and multidisciplinary rehabilitation protocols.

2.2. Specific Objectives

- To identify the main neuroprotective strategies utilized during the in-hospital care of patients with acute ischemic stroke undergoing mechanical thrombectomy;
- To evaluate the effects of neuroprotective interventions on patients' clinical, neurological, and functional outcomes;
- To analyze the influence of early reperfusion and mechanical thrombectomy on the preservation of the ischemic penumbra and on neurological recovery;
- To investigate the contribution of clinical, hemodynamic, and metabolic support measures as neuroprotective components of stroke protocols;
- To describe the multidisciplinary approach, with an emphasis on medical and physical therapy involvement, during the acute and rehabilitation phases of ischemic stroke;
- To synthesize current evidence to support the implementation and improvement of evidence-based in-hospital stroke protocols.

3. Methods

3.1. Study Design

This systematic literature review was conducted in accordance with the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA 2020) guidelines, aiming to identify, select, critically appraise, and synthesize the scientific evidence related to neuroprotective strategies associated with mechanical thrombectomy in acute ischemic stroke and their integration into in-hospital care and multidisciplinary rehabilitation protocols.

3.2. Search Strategy

The literature search was performed in the PubMed/MEDLINE, Scopus, Web of Science, Embase, Cochrane Library, SciELO, and Virtual Health Library (VHL) databases.

Controlled descriptors from the Medical Subject Headings (MeSH) and Health Sciences Descriptors (DeCS) were used, combined with the Boolean operators AND and OR.

The search strategy was constructed using the following terms:

- ("Acute Ischemic Stroke" OR "Ischemic Stroke") AND
- ("Mechanical Thrombectomy" OR "Endovascular Treatment") AND
- ("Neuroprotection" OR "Neuroprotective Strategies") AND
- ("Stroke Protocol" OR "Stroke Unit" OR "Hospital Protocol") AND
- ("Rehabilitation" OR "Physical Therapy" OR "Multidisciplinary Care")

The search strategy was adapted to the specific syntax of each database.

3.3. Inclusion Criteria

The following were included:

- Randomized controlled trials;
- Prospective and retrospective observational studies;
- Systematic reviews and meta-analyses;
- National and international guidelines;
- Studies involving adult patients diagnosed with acute ischemic stroke;
- Research addressing mechanical thrombectomy, cerebral neuroprotection, in-hospital stroke protocols, or multidisciplinary rehabilitation;
- Articles published in English, Portuguese, or Spanish.

3.4. Exclusion Criteria

The following types of records were excluded::

- Case reports;
- Case series with small sample sizes;
- Conference abstracts without full text available;
- Letters to the editor;
- Experimental studies conducted exclusively in animals;
- Duplicate records across databases;
- Articles lacking direct relevance to neuroprotection, mechanical thrombectomy, or in-hospital care for ischemic stroke.

3.5. Study Selection

The study selection process was conducted in three stages:":

1. Identification of records from databases;
2. Screening of titles and abstracts;
3. Full-text review of potentially eligible reports.

Two independent reviewers performed all stages of the selection process. Disagreements were resolved by consensus or by consultation with a third reviewer.

3.6. Data Extraction

The following data were extracted:

- Author(s) and year of publication;
- Country of study;
- Study design;
- Sample size;
- Characteristics of the study population;
- Neuroprotective strategy investigated;
- Type of endovascular intervention;
- Neurological and functional outcomes;
- In-hospital mortality;
- Functional score (modified Rankin Scale – mRS);
- Authors' main conclusions.

3.7. Methodological Quality Assessment

The methodological quality of the included studies was assessed using the appropriate tools for each study design:

- RoB 2 (Risk of Bias 2) tool for randomized controlled trials;
- Newcastle-Ottawa Scale (NOS) for observational studies;

- AMSTAR 2 for systematic reviews;
- AGREE II for clinical guidelines.

3.8. Data Synthesis

A narrative and descriptive synthesis of the results was conducted, grouping the studies into thematic categories related to:

- Mechanical thrombectomy;
- Pharmacological neuroprotection;
- Non-pharmacological neuroprotection;
- In-hospital care for acute stroke;
- Hemodynamic and metabolic control;
- Specialized stroke units;
- Early multidisciplinary rehabilitation;
- Physical therapy intervention and functional recovery.

The process of study identification, screening, eligibility, and inclusion was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. Initially, systematic searches were performed in the PubMed/MEDLINE, Scopus, Web of Science, Embase, Cochrane Library, SciELO, and Virtual Health Library (VHL) databases, resulting in the identification of a substantial number of publications potentially relevant to the proposed topic.

Following the removal of duplicate records and those deemed ineligible based on pre-established methodological criteria, the remaining studies underwent title and abstract screening. Subsequently, potentially eligible articles were evaluated in full to determine their adherence to the inclusion and exclusion criteria defined for this systematic review.

At the end of the selection process, 75 studies met all methodological criteria and were included in the qualitative synthesis. The selected studies comprised randomized controlled trials, observational studies, systematic reviews, meta-analyses, and clinical guidelines, allowing for a comprehensive analysis of the evidence related to neuroprotective strategies, mechanical thrombectomy, in-hospital stroke protocols, and multidisciplinary rehabilitation. Full details of the study selection stages are presented in Figure 1

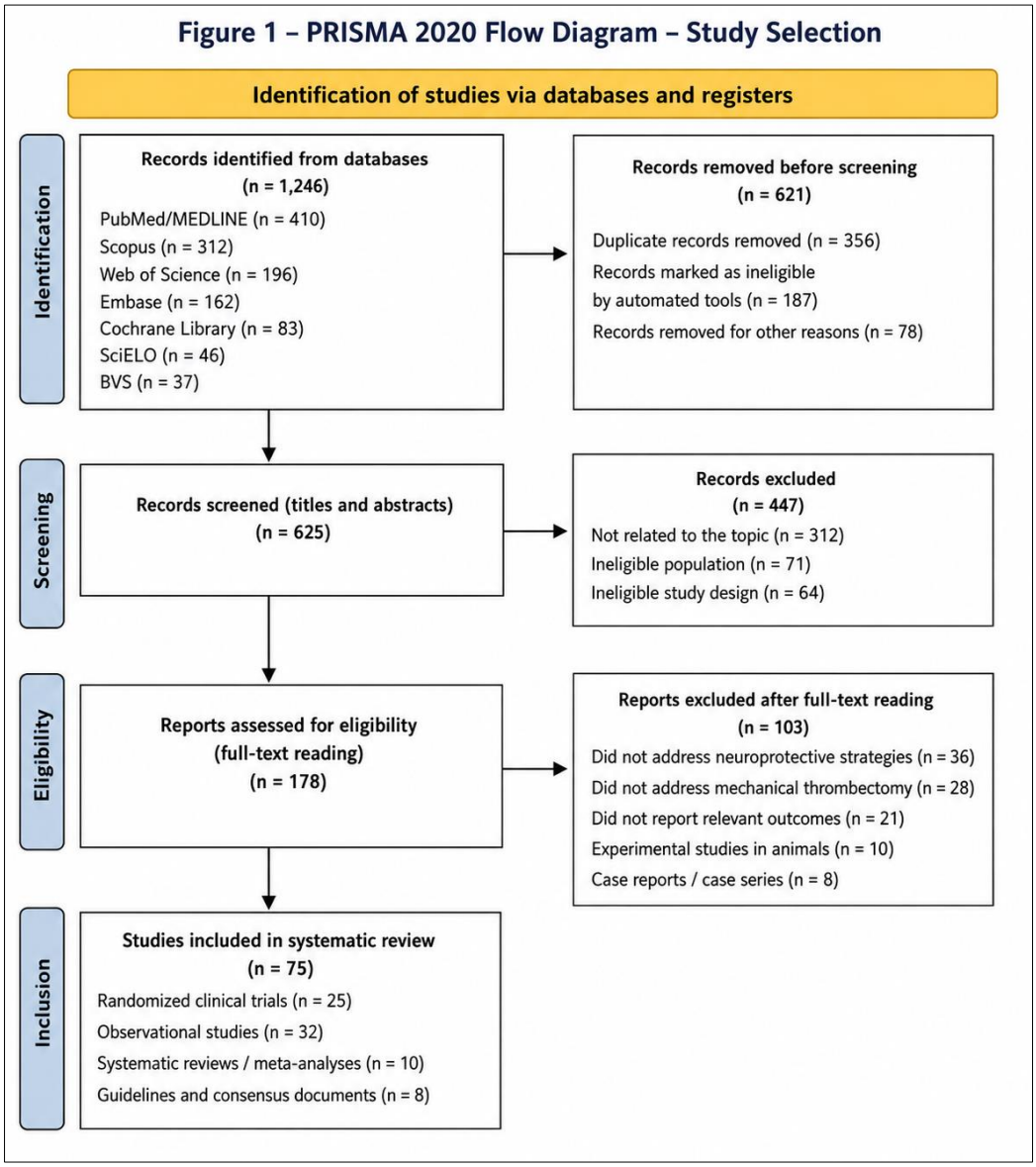

Fig 1: PRISMA 2020 flow diagram demonstrating the identification, screening, eligibility, and inclusion phases of studies selected for the systematic review on neuroprotection, mechanical thrombectomy, and multidisciplinary rehabilitation in acute ischemic stroke. Adapted from the PRISMA 2020 statement.

4. Results

The analysis of the 75 included studies demonstrated that the in-hospital medical protocol for acute ischemic stroke treated with mechanical thrombectomy involves an organized sequence of interventions aimed at reducing time to cerebral reperfusion, preserving the ischemic penumbra, and minimizing neurological and systemic complications (TABLE 1).

A consensus was observed among major international guidelines regarding the importance of early symptom identification, rapid vascular neuroimaging, appropriate selection for reperfusion therapies, and the adoption of neuroprotective measures throughout the hospitalization period.

The studies highlighted that the integration of intravenous thrombolysis, mechanical thrombectomy, intensive monitoring, and care in specialized stroke units is associated with improved functional outcomes and lower mortality rates. Subsequently, the involvement of the multidisciplinary team, particularly during the early rehabilitation phase, proved crucial for enhancing the neurological and functional recovery of patients.

Table 1: Main components of the in-hospital medical protocol for patients with acute ischemic stroke treated with mechanical thrombectomy, identified in the studies included in the systematic review.

Phase of Care	Recommended Medical Management	Clinical Objective	Key Evidence
Early recognition	Administration of screening scales (FAST, Cincinnati, NIHSS)	Rapid stroke identification and protocol activation	Powers *et al*. (2019); Turc *et al*. (2019)
Initial care	Immediate stroke team activation	Reduction of door-to-imaging and door-to-reperfusion times	Saver (2006); Meretoja *et al*. (2014)
Clinical assessment	Hemodynamic stabilization, neurological assessment, and continuous monitoring	Assessing eligibility for reperfusion	Powers *et al*. (2019)
Neuroimaging	Non-contrast CT plus CT angiography	Rule out hemorrhage and identify large vessel occlusion	Campbell *et al*. (2015); Jovin *et al*. (2015)
Thrombolysis eligibility screening	Intravenous alteplase administration	Early recanalization and penumbra preservation	Emberson *et al*. (2014); Berge *et al*. (2021)
Mechanical thrombectomy eligibility screening	Clinical and radiological evaluation for endovascular therapy	Cerebral reperfusion of occluded large vessels	Berkhemer *et al*. (2015); Goyal *et al*. (2015)
Extended therapeutic window	CT or MRI perfusion for advanced patient selection	Expanding therapeutic eligibility	Nogueira *et al*. (2018); Albers *et al*. (2018)
Blood pressure control	Blood pressure management within target ranges	Prevention of hypoperfusion and intracranial hemorrhage	Yang *et al*. (2022); Powers *et al*. (2019)
Blood glucose control	Correction of hyper- or hypoglycemia	Minimizing secondary neuronal injury	Powers *et al*. (2019)
Temperature control	Prevention and management of hyperthermia	Reduction of cerebral metabolism and inflammatory response	Chamorro *et al*. (2016); Dammavalam *et al*. (2024)
Oxygen saturation maintenance	Maintenance of oxygen saturation ≥94%	Preserving neuronal viability	Powers *et al*. (2019)
Clinical neuroprotection	Metabolic, hemodynamic, and inflammatory control	Preserving the ischemic penumbra	Savitz *et al*. (2017); Wang *et al*. (2026)
Stroke Unit Care	Admission to a Stroke Unit	Mortality reduction and functional improvement	Stroke Unit Trialists' Collaboration (2013)
Post-thrombectomy monitoring	Serial neurological assessment and complication monitoring	Early detection of neurological deterioration	Martins *et al*. (2020); Turc *et al*. (2019)
Prevention of complications	Prophylaxis for VTE, aspiration, and infections	Reduction of hospital morbidity	Winstein *et al*. (2016)
Early rehabilitation	Immediate referral to a multidisciplinary team	Maximizing functional recovery	Langhorne *et al*. (2011); Winstein *et al*. (2016)

Source: Compiled by the authors (2026).

The studies included in this systematic review demonstrate that physical therapy plays a fundamental role in all phases of the acute ischemic stroke hospital protocol (Table 2).

Physiotherapeutic interventions commence upon admission to the Stroke Unit, encompassing early functional assessment, respiratory monitoring, safe mobilization, and the prevention of complications secondary to immobility. It was observed that early mobilization, when performed in an individualized and clinically safe manner, is associated with shorter hospital stays, improved functionality, and greater independence in activities of daily living.

Additionally, respiratory physiotherapy techniques helped mitigate pulmonary complications, whereas motor, balance, and gait training programs enhanced neuroplasticity and functional outcomes. Altogether, these findings highlight the necessity of active physiotherapist involvement in specialized multidisciplinary stroke teams, proving vital to the neurological and functional recovery of patients following mechanical thrombectomy.

Table 2: Main physiotherapeutic interventions in the acute ischemic stroke hospital protocol for patients undergoing mechanical thrombectomy, as identified in the systematic review studies.

Care Phase	Physiotherapist Role	Clinical Objective	Observed Benefits	Key Evidence
Hospital admission	Initial functional assessment and risk stratification	Determine baseline motor and respiratory limitations	Individualized rehabilitation planning	Winstein *et al*. (2016); Minelli *et al*. (2022)
Stroke Unit	Respiratory and functional monitoring	Early identification of clinical changes	Reduced pulmonary complications	Winstein *et al*. (2016)
Bedridden patients	Repositioning and therapeutic positioning	Prevent pressure injuries and deformities	Lower incidence of musculoskeletal complications	Langhorne *et al*. (2011)
Acute phase	Safe early mobilization	Reduce deleterious effects of prolonged bed rest	Shorter hospital stay and improved functionality	Bernhardt *et al*. (2015); Langhorne *et al*. (2018)
Acute phase	Passive and active-assisted exercises	Preserve joint range of motion	Prevention of contractures and stiffness	Pollock *et al*. (2014)
Acute phase	Postural control training	Improve body stability	Reduced fall risk	Veerbeek *et al*. (2014)
Acute/Subacute phase	Static and dynamic balance training	Restore functional independence	Enhanced motor performance	Veerbeek *et al*. (2014); Pollock *et al*. (2014)
Motor deficit	Neuromuscular facilitation and motor stimulation	Facilitate cortical reorganization	Neuroplasticity enhancement	Langhorne *et al*. (2011)
Critical patients	Preventive respiratory physiotherapy	Maintain adequate pulmonary ventilation	Reduction of atelectasis and pneumonia	Winstein *et al*. (2016)
Pulmonary secretions	Bronchial hygiene techniques	Improve mucociliary clearance	Lower incidence of respiratory infections	Minelli *et al*. (2022)
Mechanical ventilation	Ventilatory management and weaning	Optimize gas exchange	Increased independence in ADLs	Winstein *et al*. (2016)
Post-thrombectomy	Supervised progressive mobilization	Early functional recovery	Greater locomotor capacity	Bernhardt *et al*. (2015)
Gait deficits	Assisted gait training	Restore mobility	Greater locomotor capacity	Mehrholz *et al*. (2017)
Motor rehab	Muscle strengthening exercises	Recovery of strength and function	Improved global functional capacity	Veerbeek *et al*. (2014)
Functional rehab	Transfer training and basic activities	Promote functional independence	Reduced post-discharge dependency	Pollock *et al*. (2014)
Discharge planning	Family guidance and therapeutic continuity	Ensure rehabilitation follow-up	Better long-term recovery	Winstein *et al*. (2016); Minelli *et al*. (2022)

Source: Compiled by the authors (2026).

Evidence from the analyzed studies confirms that nursing is central to the acute ischemic stroke hospital protocol, performing tasks ranging from initial symptom recognition to discharge planning. Primary responsibilities involve 'Stroke Code' activation, serial monitoring of neurological and hemodynamic status, safe pharmacological administration, and prophylaxis of complications related to hospitalization (Table 3).

The literature demonstrates that clinical surveillance by the nursing team contributes directly to the early detection of neurological deterioration, rigorous control of physiological factors associated with neuroprotection, and a reduction in adverse events. Furthermore, health education and the coordination of multidisciplinary care have proven fundamental in ensuring therapeutic continuity, treatment adherence, and improved functional outcomes following hospital discharge.

Consequently, nursing is established as a cornerstone of modern stroke protocols, actively participating in reperfusion, neuroprotection, and rehabilitation strategies.

Table 3: Main nursing interventions in the acute ischemic stroke hospital protocol for patients undergoing mechanical thrombectomy, as identified in the systematic review studies.

Care Phase	Nursing Role	Clinical Objective	Observed Benefits	Key Evidence
Initial triage	Stroke symptom recognition and "Stroke Code" activation	Reduce treatment delays	Faster door-to-imaging and door-to-needle times	Powers *et al*. (2019); Turc *et al*. (2019)
Hospital admission	Admission assessment and risk stratification	Prioritize eligible patients for reperfusion	Enhanced diagnostic and therapeutic speed	Powers *et al*. (2019)
Acute phase	Continuous vital signs monitoring	Early detection of clinical instability	Reduced neurological and cardiovascular complications	Powers *et al*. (2019)
Acute phase	Serial neurological monitoring (NIHSS, GCS)	Early detection of neurological deterioration	Prompt intervention for complications	Martins *et al*. (2020)
Pre-thrombectomy	Preparation for diagnostic and therapeutic procedures	Ensure patient safety	Reduction in procedural delays	Turc *et al*. (2019)
During thrombectomy	Assistance to the medical team and clinical monitoring	Maintenance of hemodynamic stability	Increased procedural safety	Nogueira *et al*. (2018)
Blood pressure control	Frequent blood pressure monitoring	Prevent intracranial hemorrhage and hypoperfusion	Better neurological prognosis	Yang *et al*. (2022)
Glycemic control	Monitoring and correction of glycemic levels	Minimize secondary neuronal injury	Reduced metabolic adverse events	Powers *et al*. (2019)
Thermal control	Temperature monitoring and	Reduce hyperthermia	Reduced secondary neuronal	Chamorro *et al*. (2016)

	antipyretic measures	associated with poor outcomes	damage	
Oxygen therapy	Saturation control and respiratory support	Ensure adequate cerebral oxygenation	Preservation of neuronal viability	Powers *et al*. (2019)
Vascular access care	Maintenance of catheters and venous access	Ensure safe medication administration	Lower incidence of infectious complications	Winstein *et al*. (2016)
Aspiration prevention	Swallowing assessment and proper positioning	Reduce aspiration pneumonia	Reduced hospital morbidity	Winstein *et al*. (2016)
Pressure injury prevention	Repositioning and skin care	Preserve skin integrity	Reduced immobility-related injuries	Stroke Unit Trialists' Collaboration (2013)
VTE prophylaxis	Application of prescribed preventive measures	Reduce thromboembolic events	Reduced hospital mortality	Powers *et al*. (2019)
Medication administration	Safe execution of medical orders	Ensure therapeutic effectiveness	Lower incidence of medication errors	Winstein *et al*. (2016)
Patient/Family education	Guidance on stroke, risk factors, and treatment	Promote therapeutic adherence	Reduced hospital readmission rates	Minelli *et al*. (2022)
Discharge planning	Care coordination and continuity	Facilitate hospital-to-home transition	Improved functional recovery	Royal College of Physicians (2023)
Multiprofessional rehab	Integration with PT, SLP, and OT	Promote global recovery	Enhanced functional outcomes	Winstein *et al*. (2016); Langhorne *et al*. (2011)

Source: Developed by the author (2026).

4.1. Introduction to the Acute Ischemic Stroke Hospital Care Protocol

Acute ischemic stroke (AIS) represents a major neurological emergency in clinical practice, accounting for substantial rates of mortality, functional disability, and socioeconomic burden worldwide. The rapid interruption of cerebral blood flow triggers a cascade of pathophysiological events that can lead to irreversible neuronal death in the absence of early therapeutic intervention. In this context, the implementation of standardized hospital protocols has become one of the most effective strategies to reduce diagnostic delays, optimize clinical decision-making, and improve outcomes for patients affected by this condition (Powers *et al*., 2019; Campbell & Khatri, 2020) [54, 12].

Over the last few decades, significant advances have occurred in the treatment of acute ischemic stroke, particularly with the consolidation of intravenous thrombolysis and mechanical thrombectomy as reperfusion therapies capable of restoring cerebral blood flow and salvaging the ischemic penumbra. However, the success of these interventions relies directly on the speed and efficiency of hospital care, reinforcing the need for well-structured clinical protocols that are integrated across different healthcare disciplines (Berkhemer *et al*., 2015; Goyal *et al*., 2015; Nogueira *et al*., 2018) [6, 24, 50].

Beyond reperfusion therapies, the adoption of neuroprotective measures constitutes an essential component of modern stroke management. Strategies such as rigorous blood pressure control, maintenance of normoglycemia, prevention of hyperthermia, adequate oxygenation, and continuous neurological monitoring contribute to minimizing secondary brain injury and maximizing the benefits derived from vascular recanalization. Consequently, neuroprotection has come to be considered a complementary and indispensable phase within contemporary acute ischemic stroke management protocols (Chamorro *et al*., 2016; Savitz *et al*., 2017; Dammavalam, Aghaebrahim, & Rai, 2024) [17, 59, 19].

Stroke patient care also requires a multidisciplinary approach, involving physicians, nurses, physical therapists, speech-language pathologists, occupational therapists, and other specialized professionals. The integration of these teams enables not only clinical stabilization and acute treatment but also early initiation of rehabilitation, a factor associated with a reduction in complications, shorter hospital stays, and improved long-term functional outcomes (Winstein *et al*., 2016; Minelli *et al*., 2022) [70, 42].

Given this scenario, the development of a standardized hospital protocol aims to systematically organize all stages of care, from early symptom identification and 'Stroke Code' activation to cerebral reperfusion, intensive monitoring, neuroprotection, and multidisciplinary rehabilitation. The implementation of these evidence-based measures contributes significantly to improving the quality of care, reducing mortality, and maximizing the functional recovery of patients affected by acute ischemic stroke."

4.2. Standardized Protocol for The Management of Acute Ischemic Stroke

- **Objective**

To standardize hospital care for patients with suspected or confirmed acute ischemic stroke, ensuring early identification, rapid diagnostic confirmation, appropriate indication of intravenous thrombolysis and/or mechanical thrombectomy, application of neuroprotective strategies, and timely initiation of multidisciplinary rehabilitation.

- **Target Audience**

Adult patients with suspected acute ischemic stroke presenting with sudden onset of focal neurological deficits, including motor, sensory, visual, speech, balance, or consciousness impairments.

- **Multidisciplinary Team**
  - Emergency physician;
  - Neurologist;
  - Radiologist;
  - Interventional neuroradiologist;
  - Nurse;
  - Nursing technician;
  - Physical therapist;
  - Speech-language pathologist;
  - Occupational therapist;
  - Pharmacist;
  - Social worker and psychologist (as indicated/required).

- **Initial Care Workflow**

Table 4

Step	Action	Responsible Professional
Triage	Recognize stroke signs and activate "Stroke Code"	Nursing
Initial Assessment	ABCDE evaluation, vital signs, capillary blood glucose, and symptom onset time	Physician and Nursing
Neurological Scale	Perform NIHSS and Glasgow Coma Scale (GCS)	Physician
Neuroimaging	Request non-contrast head CT, CT angiography, and/or perfusion imaging (as indicated)	Physician / Radiology
Therapeutic Decision	Assess eligibility for thrombolysis and/or thrombectomy	Neurology / Stroke Team
Treatment	Initiate reperfusion within the shortest possible time	Medical Team
Monitoring	Neurological, blood pressure, glycemic, thermal, and respiratory control	Physician / Nursing / Physical Therapy

- **Immediate Medical Management**

1. Confirm symptom onset time or "last known well" time.
2. Evaluate contraindications for intravenous thrombolysis.
3. Order essential laboratory tests without delaying neuroimaging.
4. Perform non-contrast head CT to rule out intracranial hemorrhage.
5. Order CT angiography (CTA) in suspected large vessel occlusion.
6. Indicate intravenous thrombolysis for eligible patients.
7. Indicate mechanical thrombectomy for patients with large vessel occlusion meeting clinical and radiological criteria.
8. Manage blood pressure according to therapeutic targets.
9. Correct significant hypo- or hyperglycemia.
10. Treat fever and maintain normothermia.
11. Maintain oxygen saturation ≥ 94%.
12. Avoid hypotension, hypoxia, hyperthermia, and hyperglycemia.

- **General Criteria for Mechanical Thrombectomy**

Mechanical thrombectomy should be considered in patients with:

- Acute ischemic stroke;
- Large intracranial vessel occlusion;
- Disabling neurological deficit;
- Imaging findings excluding intracranial hemorrhage;
- Presence of potentially salvageable brain tissue (penumbra);
- Appropriate therapeutic window or patient selection through advanced imaging in the extended window.

- **In-Hospital Neuroprotective Strategies**

Table 5

Strategy	Goal/Target
Oxygenation	Maintain $SpO_2 \geq 94\%$
Blood pressure	Avoid hypotension and severe hypertension
Temperature	Treat fever and maintain normothermia
Glycemia	Avoid hypo- and hyperglycemia
Hydration	Maintain euvolemia
Head of bed	Elevate to 30° when indicated
Swallowing	Assess before oral intake
Mobilization	Initiate after clinical stability
Neurological monitoring	Perform serial NIHSS/Glasgow assessments
Complication prevention	Prevent aspiration, VTE, pressure injuries, and infections

- **Nursing Care**

Nursing staff shall act in triage, "Stroke Code" activation, continuous monitoring, safe medication administration, and blood pressure, glycemic, and thermal control. Additionally, nursing responsibilities include the prevention of aspiration pneumonia, pressure injuries, and complications related to immobility.

- **Physical Therapy Care**

The physical therapy team must conduct early respiratory and motor assessments, implement therapeutic positioning, prevent pulmonary complications, and provide progressive mobilization, postural control training, strengthening exercises, assisted gait training, and functional discharge planning.

- **Multidisciplinary Rehabilitation**

Rehabilitation must be initiated early, following clinical stabilization, and involves physical therapy, speech-language pathology, occupational therapy, nursing, medicine, nutrition, and psychology. The primary objective is to reduce disability, prevent complications, and promote functional independence.

- **Post-Reperfusion Monitoring**

Following thrombolysis and/or mechanical thrombectomy, the patient must remain in a monitored unit or Stroke Unit, with:

- Serial neurological assessments;
- Strict blood pressure control;
- Surveillance for intracranial hemorrhage;

- Glycemic and thermal control;
- Swallowing assessment;
- Prevention of respiratory and thromboembolic complications;
- Follow-up neuroimaging as clinically indicated.

- **Quality Indicators**

- **Discharge Criteria**

Discharge should be planned following clinical and neurological stability, the establishment of a secondary prevention plan, family education, prescription of a rehabilitation program, optimization of vascular risk factors, and referral for outpatient follow-up.

Table 6

Indicator	Target
Door-to-Physician time	≤ 10 minutes
Door-to-Imaging time	≤ 20 minutes
Door-to-Needle time	≤ 60 minutes
Door-to-Puncture time	As fast as possible
Swallowing assessment before oral intake	100%
Rehabilitation initiation after stability	Within 24–48 hours
Discharge on secondary prevention	100%
Referral to rehabilitation services	100%

- **Final Considerations**

The acute ischemic stroke hospital protocol must integrate rapid diagnosis, cerebral reperfusion, clinical neuroprotection, and multidisciplinary rehabilitation. Coordinated efforts among physicians, nursing staff, physical therapists, and other healthcare professionals are essential to reduce mortality, minimize sequelae, and improve functional outcomes for patients.

5. Discussion

The results of this systematic review demonstrate that the implementation of structured hospital protocols for acute ischemic stroke care is directly associated with reduced mortality, decreased functional disability, and improved clinical outcomes. The consolidation of intravenous thrombolysis and, notably, mechanical thrombectomy has transformed stroke management over the last two decades, enabling previously unattainable rates of cerebral reperfusion and significantly expanding the possibilities for neurological recovery (POWERS *et al*., 2019; TURC *et al*., 2019) [54, 65].

The studies analyzed demonstrate that mechanical thrombectomy is currently the standard of care for patients with large intracranial vessel occlusion. Clinical trials such as MR CLEAN, ESCAPE, SWIFT PRIME, EXTEND-IA, and REVASCAT have shown consistent benefits in functional independence and reduced disability at three-month follow-up, consolidating the superiority of the endovascular approach compared to clinical treatment alone (BERKHEMER *et al*., 2015; CAMPBELL *et al*., 2015; GOYAL *et al*., 2015; SAVER *et al*., 2015; JOVIN *et al*., 2015) [6, 15, 24, 61, 30]. Furthermore, the DAWN and DEFUSE-3 trials have extended the therapeutic window for cases selected via advanced neuroimaging, allowing a greater number of patients to benefit from mechanical reperfusion (NOGUEIRA *et al*., 2018; ALBERS *et al*., 2018) [50, 1].

However, despite the advances observed in vascular recanalization, several studies have indicated that successful reperfusion does not always result in satisfactory neurological recovery. This finding reinforces the importance of secondary injury resulting from processes of excitotoxicity, neuroinflammation, oxidative stress, and ischemia-reperfusion injury, mechanisms that remain active even after the restoration of cerebral blood flow (CHAMORRO *et al*., 2016; SAVITZ *et al*., 2017) [17, 59]. In this context, neuroprotective strategies emerge as complementary tools capable of enhancing the benefits of mechanical thrombectomy and preserving brain areas that remain viable.

The literature analyzed demonstrated that clinical measures considered neuroprotective are already part of the routine in modern stroke protocols. Rigorous control of blood pressure, blood glucose, body temperature, and oxygenation has been associated with reduced cerebral infarct expansion and improved functional outcomes (POWERS *et al*., 2019; YANG *et al*., 2022) [54, 71]. Although several pharmacological agents have been investigated over the years, clinical results still remain limited when compared to the benefits observed in experimental models. Recent studies suggest that the combination of neuroprotective therapies and early reperfusion may represent one of the primary areas for future development in the treatment of acute ischemic stroke (HILL *et al*., 2020; WANG *et al*., 2026) [28, 68].

Another relevant aspect identified in this review was the importance of organizational structure through Stroke Units. Data showed that patients treated in specialized centers exhibit lower mortality, fewer hospital complications, and a higher probability of functional recovery compared to those treated in conventional units (STROKE UNIT TRIALISTS' COLLABORATION, 2013) [62]. These results reinforce that therapeutic success depends not only on available technology but also on the efficiency of care workflows and the integration among involved professionals.

Nursing stands out as a fundamental element for the success of hospital protocols. Rapid symptom identification, Stroke Code activation, continuous monitoring of neurological and hemodynamic parameters, and the prevention of hospital-related complications have proven to be determinant for the safety and effectiveness of the treatment. The continuous involvement of the nursing team allows for the early detection of neurological deterioration and contributes directly to the implementation of neuroprotective measures recommended by international guidelines (WINSTEIN *et al*., 2016; ROYAL COLLEGE OF PHYSICIANS, 2023) [70, 57].

Likewise, physical therapy plays an indispensable role throughout the entire care process. Studies have shown that early mobilization, progressive motor training, respiratory management, and the prevention of complications associated with immobility significantly contribute to patients' functional recovery. Furthermore, the early stimulation of cerebral neuroplasticity promotes neural reorganization and

maximizes the gains achieved through reperfusion therapies (LANGHORNE; BERNHARDT; KWAKKEL, 2011; POLLOCK *et al*., 2014; VEERBEEK *et al*., 2014) [32, 52, 67].

The concept of multidisciplinary care has also been widely consolidated in the literature. Integration among neurologists, intensivists, nurses, physical therapists, speech-language pathologists, occupational therapists, and other professionals allows for a more comprehensive approach to patient needs, favoring both neurological recovery and social and functional reintegration after hospital discharge (WINSTEIN *et al*., 2016; MINELLI *et al*., 2022) [70, 42].

Finally, the results reinforce that time remains one of the primary prognostic determinants in acute ischemic stroke. The concept of "time is brain" remains current, demonstrating that delays at any stage of care significantly reduce the benefits of cerebral reperfusion and increase the likelihood of permanent disability (SAVER, 2006; MERETOJA *et al*., 2014; RIBO *et al*., 2016) [60, 41, 56]. Thus, efficient hospital protocols, combined with neuroprotective strategies and early rehabilitation, constitute the fundamental pillars for optimizing clinical outcomes in acute ischemic stroke.

6. Final Considerations

This systematic review demonstrated that mechanical thrombectomy represents one of the most significant evolutions in the treatment of acute ischemic stroke, providing high rates of cerebral reperfusion and better functional outcomes when performed early and in appropriately selected patients. However, optimal neurological recovery does not depend exclusively on vascular recanalization; it is strongly influenced by the implementation of neuroprotective strategies and the quality of multidisciplinary care provided throughout the entire hospital stay.

The evidence analyzed indicates that neuroprotective measures based on hemodynamic, metabolic, and respiratory control play a fundamental role in preserving the ischemic penumbra and reducing secondary brain damage. Furthermore, the integrated performance of medical, nursing, and physical therapy teams has proven essential for preventing complications, ensuring continuous clinical monitoring, and facilitating the early initiation of functional rehabilitation.

The results also reinforce the importance of Stroke Units and standardized hospital protocols as tools capable of reducing the time to reperfusion, improving care safety, and increasing the chances of functional independence after a cerebrovascular event. In this context, the integration of rapid diagnosis, mechanical thrombectomy, neuroprotection, and multidisciplinary rehabilitation must be considered an indispensable component of modern stroke care systems.

Finally, it is observed that further research is necessary to deepen the understanding of specific neuroprotective therapies associated with mechanical thrombectomy, particularly regarding their clinical efficacy, applicability across different populations, and impact on long-term outcomes. The consolidation of these strategies could contribute significantly to the refinement of hospital protocols and to the reduction of the global burden of acute ischemic stroke.

References

1. Albers GW, Marks MP, Kemp S, *et al*. Thrombectomy for stroke at 6 to 16 hours. N Engl J Med. 2018;378:708-718.
2. Anadani M, Alawieh A, Vargas J, *et al*. First pass effect and outcome after thrombectomy. Stroke. 2019;50:2140-2146.
3. Anderson CS, Huang Y, Lindley RI, *et al*. Intensive blood pressure reduction with intravenous thrombolysis: ENCHANTED. N Engl J Med. 2019;380:1935-1945.
4. Bendszus M, Fiehler J, Subtil F, *et al*. Endovascular thrombectomy for acute ischaemic stroke with established large infarct: TENSION. Lancet. 2023;402:1753-1763.
5. Berge E, Whiteley W, Audebert H, *et al*. ESO guidelines on intravenous thrombolysis for acute ischaemic stroke. Eur Stroke J. 2021;6:I-LXII.
6. Berkhemer OA, Fransen PSS, Beumer D, *et al*. A randomized trial of intraarterial treatment for acute ischemic stroke. N Engl J Med. 2015;372:11-20.
7. Bernhardt J, Hayward KS, Kwakkel G, *et al*. Agreed definitions and shared vision for new standards in stroke recovery research. Int J Stroke. 2017;12:444-450.
8. Bernhardt J, Langhorne P, Lindley RI, *et al*. Very early mobilisation after stroke: AVERT trial. Lancet. 2015;386:46-55.
9. Bracard S, Ducrocq X, Mas JL, *et al*. Mechanical thrombectomy after intravenous alteplase versus alteplase alone. Lancet Neurol. 2016;15:1138-1147.
10. Broderick JP, Palesch YY, Demchuk AM, *et al*. Endovascular therapy after intravenous t-PA versus t-PA alone for stroke. N Engl J Med. 2013;368:893-903.
11. Campbell BCV, De Silva DA, Macleod MR, *et al*. Ischaemic stroke. Nat Rev Dis Primers. 2019;5:70.
12. Campbell BCV, Khatri P. Stroke. Lancet. 2020;396:129-142.
13. Campbell BCV, Majoie CBLM, Albers GW, *et al*. Penumbral imaging and functional outcome in acute ischemic stroke. JAMA Neurol. 2019;76:1295-1303.
14. Campbell BCV, Mitchell PJ, Churilov L, *et al*. Tenecteplase versus alteplase before thrombectomy. N Engl J Med. 2018;378:1573-1582.
15. Campbell BCV, Mitchell PJ, Kleinig TJ, *et al*. Endovascular therapy for ischemic stroke with perfusion-imaging selection. N Engl J Med. 2015;372:1009-1018.
16. Chamorro A, Blasco J, López A, *et al*. Complete reperfusion is required for maximal benefit after thrombectomy. Stroke. 2017;48:1848-1854.
17. Chamorro Á, Dirnagl U, Urra X, Planas AM. Neuroprotection in acute stroke. Lancet Neurol. 2016;15:869-881.
18. Ciccone A, Valvassori L, Nichelatti M, *et al*. Endovascular treatment for acute ischemic stroke. N Engl J Med. 2013;368:904-913.
19. Dammavalam V, Aghaebrahim A, Rai AT. Neuroprotection during thrombectomy for acute ischemic stroke: a review. Int J Mol Sci. 2024;25:891.

20. Dirnagl U, Endres M. Found in translation: preclinical stroke research predicts human pathophysiology. Stroke. 2014;45:1510-1518.
21. Emberson J, Lees KR, Lyden P, *et al*. Effect of treatment delay on alteplase in acute ischemic stroke. Lancet. 2014;384:1929-1935.
22. Fischer U, Kaesmacher J, Strbian D, *et al*. Thrombectomy alone versus intravenous alteplase plus thrombectomy: SWIFT DIRECT. Lancet. 2022;400:104-115.
23. Gittler M, Davis AM. Guidelines for adult stroke rehabilitation and recovery. JAMA. 2018;319:820-821.
24. Goyal M, Demchuk AM, Menon BK, *et al*. Randomized assessment of rapid endovascular treatment of ischemic stroke. N Engl J Med. 2015;372:1019-1030.
25. Goyal M, Fargen KM, Turk AS, *et al*. 2C or not 2C: defining successful reperfusion after thrombectomy. J Neurointerv Surg. 2014;6:83-86.
26. Goyal M, Menon BK, Hill MD, Demchuk A. Consistently achieving computed tomography to endovascular reperfusion below 90 minutes. Stroke. 2014;45:e252-e256.
27. Goyal M, Menon BK, van Zwam WH, *et al*. Endovascular thrombectomy after large-vessel ischaemic stroke: a meta-analysis. Lancet. 2016;387:1723-1731.
28. Hill MD, Goyal M, Menon BK, *et al*. Nerinetide for acute ischaemic stroke: ESCAPE-NA1 trial. Lancet. 2020;395:878-887.
29. Huo X, Ma G, Tong X, *et al*. Trial of endovascular therapy for acute ischemic stroke with large infarct: ANGEL-ASPECT. N Engl J Med. 2023;388:1272-1283.
30. Jovin TG, Chamorro A, Cobo E, *et al*. Thrombectomy within 8 hours after symptom onset. N Engl J Med. 2015;372:2296-2306.
31. Kidwell CS, Jahan R, Gornbein J, *et al*. A trial of imaging selection and endovascular treatment for ischemic stroke. N Engl J Med. 2013;368:914-923.
32. Langhorne P, Bernhardt J, Kwakkel G. Stroke rehabilitation. Lancet. 2011;377:1693-1702.
33. Langhorne P, Collier JM, Bate PJ, *et al*. Very early versus delayed mobilisation after stroke. Cochrane Database Syst Rev. 2018;CD006187.
34. Lapergue B, Blanc R, Gory B, *et al*. Effect of endovascular contact aspiration vs stent retriever on revascularization. JAMA. 2017;318:443-452.
35. LeCouffe NE, Kappelhof M, Treurniet KM, *et al*. A randomized trial of intravenous alteplase before endovascular treatment. N Engl J Med. 2021;385:1833-1844.
36. Liebeskind DS, Bracard S, Guillemin F, *et al*. eTICI reperfusion: defining success in endovascular stroke therapy. J Neurointerv Surg. 2019;11:433-438.
37. Martins SCO, Mont'Alverne FJA, Rebello LC, *et al*. Thrombectomy for stroke in the public health care system of Brazil. N Engl J Med. 2020;382:2316-2326.
38. Maus V, Behme D, Kabbasch C, *et al*. Maximizing first-pass complete reperfusion with thrombectomy. Clin Neuroradiol. 2018;28:327-338.
39. Mehrholz J, Thomas S, Elsner B. Treadmill training and body weight support for walking after stroke. Cochrane Database Syst Rev. 2017;CD002840.
40. Menon BK, Buck BH, Singh N, *et al*. Intravenous tenecteplase compared with alteplase for acute ischemic stroke: AcT trial. Lancet. 2022;400:161-169.
41. Meretoja A, Keshtkaran M, Saver JL, *et al*. Stroke thrombolysis: save a minute, save a day. Stroke. 2014;45:1053-1058.
42. Minelli C, Bazan R, Pedatella MT, *et al*. Brazilian Academy of Neurology practice guidelines for stroke rehabilitation. Arq Neuropsiquiatr. 2022;80:753-774.
43. Mistry EA, Mistry AM, Nakawah MO, *et al*. Mechanical thrombectomy outcomes with and without intravenous thrombolysis. Stroke. 2017;48:2450-2456.
44. Mitchell PJ, Yan B, Churilov L, *et al*. Endovascular thrombectomy versus bridging thrombolysis: DIRECT-SAFE. Lancet. 2022;400:116-125.
45. Mocco J, Zaidat OO, von Kummer R, *et al*. Aspiration thrombectomy after intravenous alteplase versus alteplase alone. Stroke. 2016;47:2331-2338.
46. Muir KW, Ford GA, Messow CM, *et al*. Endovascular therapy for acute ischaemic stroke: PISTE trial. J Neurol Neurosurg Psychiatry. 2017;88:38-44.
47. National Institute for Health and Care Excellence. Stroke rehabilitation in adults. NICE guideline NG236. London: NICE; 2023.
48. Neuhaus AA, Couch Y, Hadley G, Buchan AM. Neuroprotection in stroke: the importance of collaboration and reproducibility. Brain. 2017;140:2079-2092.
49. Nogueira RG, Frei D, Kirmani JF, *et al*. Safety and efficacy of 3D stent retriever thrombectomy: Trevo Registry. Stroke. 2018;49:1711-1717.
50. Nogueira RG, Jadhav AP, Haussen DC, *et al*. Thrombectomy 6 to 24 hours after stroke. N Engl J Med. 2018;378:11-21.
51. Oliveira AJF, *et al*. Mechanical thrombectomy for acute ischemic stroke: systematic review and meta-analysis. Einstein. 2022;20:eRW6642.
52. Pollock A, Baer G, Campbell P, *et al*. Physical rehabilitation approaches for recovery after stroke. Cochrane Database Syst Rev. 2014;CD001920.
53. Powers WJ, Derdeyn CP, Biller J, *et al*. 2015 AHA/ASA focused update on endovascular treatment. Stroke. 2015;46:3020-3035.
54. Powers WJ, Rabinstein AA, Ackerson T, *et al*. Guidelines for the early management of patients with acute ischemic stroke: 2019 update. Stroke. 2019;50:e344-e418.
55. Renú A, Millán M, San Román L, *et al*. Intra-arterial alteplase after successful thrombectomy: CHOICE trial. JAMA. 2022;327:826-835.
56. Ribo M, Molina CA, Cobo E, *et al*. Association between time to reperfusion and outcome after thrombectomy. JAMA Neurol. 2016;73:190-196.
57. Royal College of Physicians. National Clinical Guideline for Stroke. 7th ed. London: RCP; 2023.
58. Sarraj A, Hassan AE, Abraham MG, *et al*. Trial of endovascular thrombectomy for large ischemic strokes: SELECT2. N Engl J Med. 2023;388:1259-1271.
59. Savitz SI, Baron JC, Yenari MA, Sanossian N, Fisher M. Reconsidering neuroprotection in the reperfusion era. Stroke. 2017;48:3413-3419.
60. Saver JL. Time is brain—quantified. Stroke. 2006;37:263-266.
61. Saver JL, Goyal M, Bonafe A, *et al*. Stent-retriever thrombectomy after intravenous tPA. N Engl J Med. 2015;372:2285-2295.

62. Stroke Unit Trialists' Collaboration. Organised inpatient stroke unit care for stroke. Cochrane Database Syst Rev. 2013;CD000197.
63. Suzuki K, Matsumaru Y, Takeuchi M, *et al*. Effect of mechanical thrombectomy without vs with intravenous thrombolysis: SKIP trial. JAMA. 2021;325:244-253.
64. Thomalla G, Simonsen CZ, Boutitie F, *et al*. MRI-guided thrombolysis for stroke with unknown onset time. N Engl J Med. 2018;379:611-622.
65. Turc G, Bhogal P, Fischer U, *et al*. ESO–ESMINT guidelines on mechanical thrombectomy in acute ischaemic stroke. J Neurointerv Surg. 2019;11:535-538.
66. Turk AS, Siddiqui A, Fifi JT, *et al*. Aspiration thrombectomy versus stent retriever thrombectomy: COMPASS trial. Lancet. 2019;393:998-1008.
67. Veerbeek JM, van Wegen E, van Peppen R, *et al*. What is the evidence for physical therapy poststroke? PLoS One. 2014;9:e87987.
68. Wang Y, Xu J, Zhao Z, Yang R, Zhou X, Yang Z. Mechanism-informed neuroprotection in acute ischemic stroke treated with thrombectomy. Front Pharmacol. 2026;17:1843513.
69. Wesley MJ, *et al*. Neuroprotective agents with reperfusion therapies in acute ischemic stroke: a systematic review. 2025.
70. Winstein CJ, Stein J, Arena R, *et al*. Guidelines for adult stroke rehabilitation and recovery. Stroke. 2016;47:e98-e169.
71. Yang P, Song L, Zhang Y, *et al*. Intensive blood pressure control after thrombectomy: ENCHANTED2/MT. Lancet. 2022;400:1585-1596.
72. Yang P, Zhang Y, Zhang L, *et al*. Endovascular thrombectomy with or without intravenous alteplase: DIRECT-MT. N Engl J Med. 2020;382:1981-1993.
73. Yoshimura S, Sakai N, Yamagami H, *et al*. Endovascular therapy for acute stroke with large ischemic region: RESCUE-Japan LIMIT. N Engl J Med. 2022;386:1303-1313.
74. Zaidat OO, Castonguay AC, Linfante I, *et al*. First pass effect: a new measure for stroke thrombectomy. Stroke. 2018;49:660-666.

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