World Journal of Pharmaceutical Science and Research
www.wjpsronline.com
Review Article
ISSN: 2583-6579
SJIF Impact Factor: 5.111
Year - 2025
Volume: 4; Issue: 5
Page: 510-518

ADVANCED MANAGEMENT OF ACUTE ISCHEMIC STROKE

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Article Received: 4 August 2025 | | ***Article Revised: 25 September 2025*** | | ***Article Accepted: 16 October 2025***

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How to cite this Article: Dr. R.V. S. S. Latha Sri, A. Chandra Sekhar, R. Srinivas, S. Divya, T. Vamsi, Dr. J. N. Suresh Kumar (2025) ADVANCED MANAGEMENT OF ACUTE ISCHEMIC STROKE. World Journal of Pharmaceutical Science and Research, 4(5), 510-518. https://doi.org/10.5281/zenodo.17483876

ABSTRACT

Ischemic stroke is a leading cause of disability and death globally this requires prompt and advanced management to decrease the neurological damage and to optimize recovery. Furthermore, the article explores the integration of neuroprotective agents, rehabilitation strategies, and secondary prevention measures in a comprehensive approach to ischemic stroke care. Recent advancements in the understanding of ischemic injury mechanisms and thrombolysis have revolutionized stroke treatment. This article reviews the latest strategies in the acute management of ischemic stroke with a focus on thrombectomy, thrombolysis, and emerging neuroprotective agents. Additionally, we explore the role of advanced imaging techniques in patient selection for interventional therapies, as well as the impact of personalized medicine in optimizing outcomes. The article also highlights the evolving management of comorbidities, rehabilitation approaches, and secondary prevention measures to reduce the risk of recurrent strokes. By synthesizing clinical guidelines, this review aims to provide a comprehensive overview of current and future directions in the advanced management of ischemic stroke.

KEYWORDS: Acute ischemic stroke, Advanced management, neuro protection.

INTRODUCTION

Stroke is the second most leading cause of death in world wide, that significantly impacts quality of life. Current therapies are limited, highlighting the need for improved understanding of ischemic brain damage mechanisms and new treatment strategies. The concept of a "multiple molecular penumbra" has emerged to better explain ischemic brain

processes. Potential treatment approaches are divided into two main categories: Neuroprotection: Aims to prevent neuron death during the acute phase of cerebral ischemia. Stem Cell Therapy: Seeks to repair damaged neuronal networks by introducing new neurons and glial cells during the chronic phase. Both strategies are essential for advancing stroke treatment.[1]

In this review article, we focus on our findings with advanced management in Acute ischemic stroke. In India from 1990 to 2021 47% of stroke cases had been increased More than 75% of stroke victims live in low- and middle-income countries. Air pollution is a major risk factor for stroke in low- and middle-income countries. The prevalence of stroke varies by age, sex, caste, education, employment, and wealth.[2]

The clinical manifestations of stroke are highly variable because of brain vasculature and its anatomy, Ischemic stroke caused by reduction of blood flow and formation of infraction. Which leads to neuronal cell death common symptoms (BEFAST) are followed by table no 1.[3]

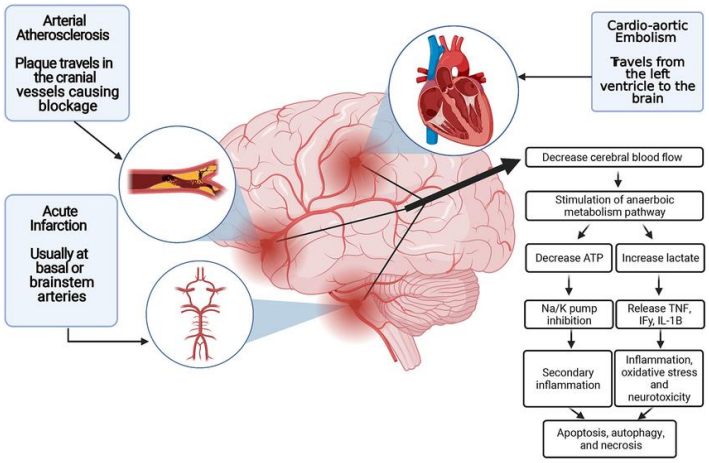
Etiology of stroke was important to guide the effective treatment and secondary prevention, causes include 1.Coagulation disorders, 2. Hematological diseases, 3. Cardiac causes like HTN, Cardiomyopathy, Endocarditis. 4. Dissection of cerebral arteries, 5. Vasculitis, Infections.[4]

Table 1: Early detection of stroke BEFAST.

Balance, Acute or sudden onset of loss of balance and coordination.
Eyes, Blurred vision, vision loss.
Facial weakness or facial asymmetry.
Arm and leg weakness.
Speech difficulty / slurred speech.
Time is brain, time to activate stroke system and stroke clock.

In initial stroke evaluation examine the Medical history, Brain imaging via computed tomography (CT) Followed by Magnetic Resonance Imaging (MRI), along with Cardiac assessment using Electrocardiogram(ECG) will be helpful for diagnosis. Additional testing Intracranial and extra cranial blood vessel wall imaging to confirm.[6] Cerebral angiography.

Ischemic stroke Pathogenesis figure no.1.[5]



The 8 D's of Stroke Care

Detection: Rapid recognition of stroke symptoms.

Dispatch: Early activation and dispatch of emergency medical services (EMS).

Delivery: Rapid EMS identification, management and triage.

Door: Appropriate triage to a stroke center.

Data: Rapid triage, evaluation and management in the emergency department.

Decision: Stroke expertise and therapy selection.

Drug: Fibrinolytic therapy or Intra arterial strategies.

Disposition: Rapid admission to critical care unit.

PRE- HOSPITALSTROKE MANAGEMENT

Public education for rapid stroke response: public health leaders and medical professionals should implement long term education program on ischemic stroke symptoms and the importance of quickly calling 108. These programs should targets diverse groups by race, ethnicity, age and sex to reduce disparities in stroke outcomes. Recent studies have shown that the application of mobile stroke unit has led to higher rates and low the time to iv-tPA administration and hospital arrival with regular ambulance transports to the emergency departments.

Recent data indicate that 60% of patients with signs or symptoms of acute stroke access their initial medical care via local EMS, which confirms the role of EMS in the chain of survival. Notably an estimated 19% to 60% of stroke patient present within 3 hours of stroke and14% to 32% of those arrive within 2 hours of symptoms onset

• Emergency Department, Stroke Teams, and Stroke Code

A stroke can provide around the clock services for patients with stroke. Such team consists of physicians with expertise in emergency medicine, vascular neurology / neurosurgery and radiologist; advance care providers, nurses, clinical pharmacist, therapists and Technion's; and laboratory personal. In ED, the efficiency and aquracey of recognition of stroke syndrome can be performed with tell medicine. In stroke team remote evaluation using a digital observational camera study, two-way audiovisual consultation was superior to telephone-based consultation in accurately identifying stroke patient, yielding a higher rate of IV-tPA with similar proportion in ICH but without effect on overall functional outcomes.

In the new era of recanalization for AIS with LVO, telemedicine systems have aided in increasing the recognition of stroke patients in need of endovascular therapies leading to better functional outcomes and quality of life.[7]

NEUROIMAGING

Neuroimaging plays a critical part in the opinion and operation of ischemic stroke. The primary imaging modalities include. Acute Reperfusion remedy

• IV alteplase

Within 4.5 hours of stroke onset The American Heart Association (AHA)/ American Stroke Association (ASA) recommends IV alteplase (TPA) within 4.5 hrs for cases who satisfy addition criteria and have symptom onset or last given birth within 3 hours. IV TPA should be administered at 0.9 mg/ kg, with a outside cure of 90 mg. The first 10 of the cure is given as a gelcap over the first nanosecond, and the remainder is given over the coming 60 beats. The time

has been extended to 4.5 hours for named campaigners. Addition criteria include opinion of ischemic stroke with" measurable neurological insufficiency," symptom onset within 3 hours before treatment, and age 18 times or aged.

Healthcare providers should review the refuse criteria for thrombolytics before administering TPA. According to the FDA, the contraindications to IV thrombolysis include active internal bleeding, recent intracranial surgery or severe head trauma, intracranial conditions that may increase the trouble of bleeding, bleeding diathesis, severe unbridled hypertension, current intracranial hemorrhage, subarachnoid hemorrhage, and a history of a recent stroke. Healthcare providers must consider the treatment benefits and pitfalls for cases who present between 3 hours and 4.5 hours from symptom onset. Fresh relative rejection criteria for this case order include age aged than 80 times, NIHSS> 25, oral anticoagulant use, and a history of diabetes and former ischemic stroke.[8]

• MRI- guided thrombolysis for stroke with unknown time of onset

Almost of these cases wake up with an acute stroke. The cases will be ineligible for IV thrombolytic operation because their last known normal will be at bedtime. The WAKE- UP Stroke Trial used the mismatch between a positive DWI MRI arrangement showing an acute ischemic infarction and a negative faculty MRI sequence indicating that the infarct occurs within 4.5 hours of the MRI. DWI is positive within 29 beats of an acute infarct. Faculty sequence will not be positive until about 4.5 hours after an acute infarct. The mismatch indicates that the stroke passed within 4.5 hours, and thus, IV thrombolytic will be preferred. The WAKE- UP Stroke Trial indicated the positive result.[9]

• IV tenecteplase

Within 4.5 hours of stroke immediately. Another fibrinolytic agent, Tenecteplase(TNK), may be recommended option to alteplase. TNK has advantages over TPA with its longer half- life and can be administered as a single intramuscular(IM) cure rather than a 1- hour IV infusion of TPA. TNK can be given at a cure of 30 to 50 mg IV gelcap over 5 sec formerly (rested on weight). TNK is also cheap to take because it's given as a single IM cure. TNK has come the fibrinolytic agent of choice for numerous stroke centre's, especially during the COVID- 19 epidemic. Recent studies have shown that TNK appeared to have effectiveness and safety lives analogous to TPA. The 2023 AHA guidelines state that choosing TNK over TPA in cases of indications for IV fibrinolytic who are also eligible to feel pain mechanical thrombectomy may be reasonable. A cure of 0.6 mg/ kg, compared to 0.25 mg/ kg, showed ineffective.[10]

• Endovascular operation (thrombectomy) for acute ischemic stroke with large infarct

Two large trials published in 2023, the ANGEL ASPECT Trial and the SELECT 2 Trial, showed positive results with endovascular thrombectomy procedure for cases with high ischemic strokes due to LVO and an Alberta Stroke Program Early CT Score. The cases presented within 24 hours. Their NIHSS score is> 6. The issues are better among cases treated with thrombectomy than those on standard medical operation.[11]

ACUTE HOSPITAL MANAGEMENT

- **Blood pressure**

Blood pressure As part of cerebral autoregulation, blood pressure is generally elevated during the acute phase of AIS, maximizing perfusion in the ischemic areas. still, severe hypertension can lead to hemorrhagic transformation of the infarct, hypertensive encephalopathy, as well as cardiopulmonary and renal complications. Current AHA- ASA companion- lines recommend permissive hypertension with a blood pressure thing of lower than or equal to 220/120 mm Hg for the first 24 – 48 hours. Yet, these blood pressure variables only apply if the case is n't witnessing any acute

inter- vention analogous as IV- tPA or EVT. However, the trouble of hemorrhagic transformation increases and the blood pressure should be lowered to lower than or equal to 185/110 mm Hg former to IV- tPA administration and to lower than or equal to 180/105 mm Hg formerly.[8] IV- tPA has been given, If the case receives IV- tPA. Reperfusion injury and hemorrhagic metamorphosis are of concern in the case of EVT; thus, blood pressure must be nearly covered during and after EVT.

The mean systolic BP is 135 mm Hg to 150 mm Hg Antihypertensive options include the following

Labetalol 10 to 20 mg IV

Nicardipine 5 mg/ hour IV every five to fifteen twinkles.

Hydralazine and enalaprilat, Clevidipine 1 to 2 mg/hr IV

- **Temperature**

Hyperthermia> 38 °C should be avoided and treated rightly. Antipyretics analogous as acetaminophen may be used. Common sources of infection, analogous as pneumonia and urinary tract infections, should be ruled out. There's shy data to support remedial hypothermia in acute ischemic strokes presently. A retrospective study recently demonstrated an association between a peak temperature> 39 °C(100.4 °F) in the first 24 hours and an increased risk of in- hospital mortality.

- **Glucose**

Levels of glucose should be maintained between the range of 140 to 180 mg/dl in the first 24 hours. Healthcare providers should treat blood glucose.

- **Nutrition**

Early enteric feeding should be encouraged. For cases with dysphagia, use a nasogastric tube to promote enteric feeding. Percutaneous gastrostomy tube is recommended if the patient have difficulty in swallowing for prolonged period. Beforehand feeding has been demonstrated to have an absolute reduction in the trouble of death.

- **DVT prophylaxis**

Intermittent pneumatic compression is recommended for all immobile cases unless contraindications live. The European Stroke Organization recommended acutely intermittent pneumatic compression for all immobile stroke cases. They also recommended low- cure heparin or low molecular weight heparin for DVT prophylaxis if the benefit outweighs the trouble of bleeding.

- **Depression screening**

There is a chances of depression After the ischemic stroke and if it rates between 18 to 33 it should be considered. trouble factors are womanish commerce, large strokes, a stroke affecting the anterior areas, and poor social support. picky serotonin reuptake impediments are the voguish specifics for post- stroke depression.

- **Cerebellar/ Cerebral oedema**

Cerebral edema occurs with acute ischemic stroke, first due to cytotoxic edema with cell lump, followed by vasogenic edema when the blood- brain hedge is lost. The degree and volume of cerebral edema supplement well with the size of the stroke. Cerebral edema is not significant clinically clinically in lacunar infraction. still cerebral edema may come characteristic, performing in worsening of the stroke symptoms and worse in impairment of knowledge due to

herniation. After 3to 5 days cerebral edema occurs in ischemic stroke. Cerebellar edema complicates cerebellar infarctions, and clinicians must know that these cases can fleetly decompensate. The increased ICP can beget gumming hydrocephalus on the fourth ventricle or beget trans tentorial herniation of the superior vermis and downcast cerebellar tonsillar herniation. Changing signs or worsening internal status, dropped position of knowledge, respiratory abnormalities, change in pupillary size, posturing, and death. Beforehand recognition and opinion of intracranial hypertension due to cerebral edema are essential in minding for acute stroke cases to meliorate issues. gain neurosurgical discussion beforehand. A ventriculost omy is indicated to relive increased intracranial pressure by draining cerebrospinal fluid from the ventricles. A decompressive suboccipital craniectomy is largely recommended in cerebellar edema with mass effect cases.[12,13]

- **Seizures**

Post- stroke seizures do in about 10 of cases, substantially hemorrhagic strokes or cortical infarcts. still, antiepileptic medicines are indicated for a short period, generally 1 month, If the patient exploits a seizure within the first 2 weeks. Long- term anticonvulsant remedy will be indicated if the seizure occurs latterly, for weeks or months after a stroke. still, the routine precautionary use of antiepileptic medicines is n't recommended.[14]

- **Cardiac evaluation**

Cardiac covering for atrial fibrillation or other arrhythmia is recommended in the first 24 hours. An original troponin is recommended because there's an association between stroke and coronary roadway complaint.

- **Antiplatelet treatment**

Aspirin is the only antiplatelet agent that has been proven effective for the acute treatment of ischemic stroke; there are several antiplatelet agents proven for the secondary prevention.

- **Anticoagulation treatment**

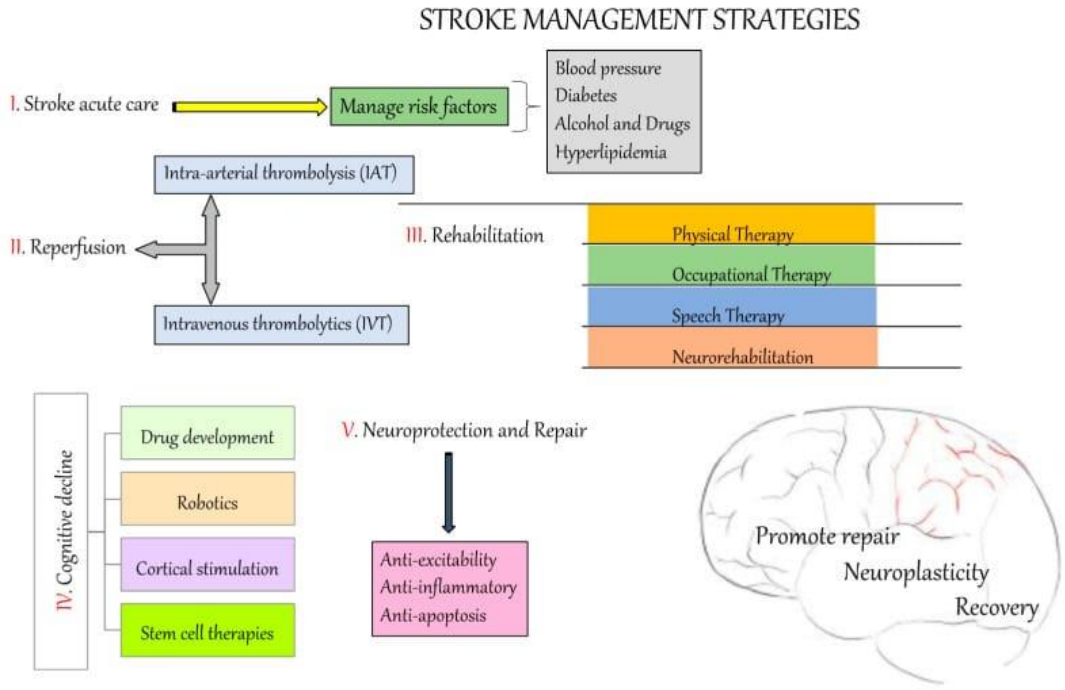
Number of clinical trials have failed to demonstrate benefit of anticoagulation in the primary treatment of atherothrombotic cerebral ischemia. Several trials have investigated antiplatelet vs. anticoagulants medications given within 12-24 hours of the initial event. No additional befits have been seen with subcutaneous heparin when compared with aspirin a part from this heparin increased the bleeding risks. Several trials of LMWHs have also shown no symmetrical benefit in AIS. Furthermore, trials generally have shown an excess risk of brain and systematic hemorrhage with acute anticoagulation.[15]

- **Neuroprotection**

The concept of neuroprotection provide treatment that prolongs the brain tolerance to ischemia. Drugs that block the excitatory amino acids pathways have been shown to protect neurons and glia in animals, but despite multiple human trials, they have not yet been proven to the beneficial. Hypothermia is a powerful neuroprotective treatment in patients with cardiac arrest and is neuroprotective in animals' model of stroke, but it has not been adequately studied in patients with ischemic stroke and is associated with an increasing pneumonia rate that could adversely impact stroke outcomes.

- **Statins**

High-intensity statins (atorvastatin 80 mg daily or rosuvastatin 20 mg daily) are considered for patients younger than 75 years with clinical atherosclerotic cardiovascular disease. Patients on statins therapy before the ischemic stroke are continued with statins.[16]



CONCLUSION

The advanced management of ischemic stroke have provided significant improvements in recent years, leading to better patient outcomes and reduced disability. Preventive support particularly with the use of intravenous thrombolysis and mechanical thrombectomy, have proven to be lifesaving for patients with acute ischemic stroke. Advancements in neuroimaging techniques have further enhanced our ability to select appropriate candidates for these therapies. Additionally, applying unique medicine to personalized patients, neuroprotective agents, and comprehensive rehabilitation strategies is increasingly recognized as crucial in optimizing recovery and preventing recurrence. However, challenges remain in ensuring equitable access to advanced treatments, particularly in rural and underserved regions. Moving forward, the role of artificial intelligence, telemedicine, and multidisciplinary collaboration will be essential in advancing ischemic stroke management. Continued research and innovation are key to overcoming existing barriers and improving long-term outcomes for stroke patients. The future of ischemic stroke care lies in a more precise, individualized approach that combines advanced technology with timely, patient health care interventions.

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