Chapter 8
Management of Ischemic Stroke in the ICU

8.1 Introduction

Ischemic stroke is a medical emergency characterized by the sudden loss of blood circulation to an area of the brain, resulting in neurological dysfunction. It remains the leading cause of disability and a major contributor to mortality worldwide. Effective management of ischemic stroke in the intensive care unit (ICU) requires prompt intervention to restore blood flow, minimize brain damage, and optimize recovery [1, 2] (Ref. Algorithm 8.1).

1. **Assess Time to Symptoms**

The management of ischemic stroke is highly dependent on the time elapsed since symptom onset, as well as patient-specific factors [3, 4].

Time to Symptoms <4.5 H

- Intravenous Thrombolysis:
  (a) Administer intravenous (IV) alteplase (tPA) or, as an alternative, tenecteplase in specific cases such as wake-up strokes, where patients were last known to be well more than 4.5 h earlier (MRI to identify diffusion-positive FLAIR negative lesions).
  (b) Avoid alteplase if patient received LMWH within 24 h.
  (c) Dose: 0.9 mg/kg; maximum dose 90 mg over 60 min. Initial 10% dose-bolus over 1 min.
  Indications: Acute ischemic stroke within 4.5 h of symptom onset.
- Contraindications: (Ref. Table 8.1 for full list).
  (a) Recent major surgery or trauma.
  (b) Active internal bleeding or known bleeding disorders.

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Table 8.1 Contraindications

Contraindications
Severe head trauma in previous 3 months
Symptoms suggestive of subarachnoid hemorrhage
Previous ICH
Intracranial/spinal surgery in previous 3 months
Intracerebral neoplasm
Infective endocarditis
Aortic arch dissection
Elevated blood pressure (systolic >185 mm hg or diastolic >110 mm hg) that cannot be lowered safely
Active internal bleeding
Acute bleeding diathesis, including but not limited to:
Platelet count <100,000/mm^3
Heparin received within 48 h with an elevated aPTT (>40 s)
Current use of treatment doses of low-molecular-weight heparin within the previous 24 h (not applicable to DVT prophylactic dosages of low-molecular-weight heparin)
Current use of anticoagulant with INR > 1.7 or PT > 15 s
Current use of direct thrombin inhibitors or direct factor Xa inhibitors
CT demonstrates infarction (hypodensity) >1/3 cerebral hemisphere
CT demonstrates an acute ICH
Relative contraindications
Mild and nondisabling or rapidly improving stroke symptoms
Very severe neurology deficits (NIHSS score > 25) within the 3 to 4.5 h window
Pregnancy
Seizure at onset (consider alteplase if neurologic deficits are thought to be caused by a stroke)
Arterial puncture at noncompressible site in previous 7 days
Untreated intracranial arteriovenous malformation
Untreated giant intracranial aneurysm
Recent major surgery or serious trauma (within previous 14 days)
Recent gastrointestinal or urinary tract hemorrhage (within previous 21 days)
Ischemic stroke within previous 3 months
Recent ST-elevation acute myocardial infarction (within previous 3 months)
Blood glucose concentration < 50 mg/dL (2.7 mmol/L) (consider IV alteplase if deficits still present after glucose normalization)

(c) Severe uncontrolled hypertension (systolic BP > 185 mmHg or diastolic BP > 110 mmHg).
(d) History of intracranial hemorrhage.

- Monitoring: Continuous neurological assessments and monitoring for signs of hemorrhagic transformation (e.g., worsening headache, acute hypertension, nausea/vomiting, or sudden neurological deterioration).

Time to Symptoms—4.5–6 H

- IV thrombolysis is not indicated. Proceed to Step 2 for further evaluation.

Time to Symptoms—6–24 H

- Mechanical Thrombectomy:

- Indications: Large vessel occlusions (LVOs, middle cerebral artery and internal carotid artery) within 6–24 h of symptom onset, pre-stroke mRS (modified Rankin score) score 0–1, NIHSS Score ≥ 6, and Alberta Stroke Program Early CT Score ASPECTS ≥6.

Thrombectomy for Posterior Circulation Stroke: Mechanical thrombectomy is recommended for vertebrobasilar artery occlusions up to 12 h from symptom onset.

2. **Medical Management**

Antiplatelet Therapy: Start Aspirin (160-300 mg) within 24–48 h of stroke onset if no thrombolysis.

Start dual antiplatelet therapy with aspirin (160–300 mg) and clopidogrel or ticagrelor within 24–48 h for minor stroke or transient ischemic attack (TIA), particularly when thrombolysis has not been performed.

Statins: Initiate high-intensity statin therapy to manage hyperlipidemia and reduce the risk of recurrent stroke.

Risk Factor Management: Control hypertension, diabetes, and encourage smoking cessation. Implement lifestyle changes and secondary prevention strategies to minimize future stroke risk.

3. **Blood Pressure Management**

Pre-thrombolysis: Target systolic blood pressure (SBP) < 185 mmHg and diastolic blood pressure (DBP) < 110 mmHg to minimize the risk of hemorrhagic transformation during thrombolysis.

Post-Thrombolysis: Maintain SBP < 180 mmHg and DBP < 105 mmHg for 24 h following thrombolysis to prevent complications and ensure optimal cerebral perfusion.

4. **Imaging and ASPECTS**

ASPECTS (Alberta Stroke Program Early CT Score)

- ASPECTS Overview: ASPECTS is a standardized scoring system to assess early ischemic changes in the brain and guide treatment decisions, particularly for thrombolysis and thrombectomy.
- Scoring:
- ASPECTS starts with a perfect score of 10. One point is subtracted for each region showing ischemic changes (focal swelling, hypodensity, or loss of gray-white differentiation).
- A score of 7–10 suggests a favorable prognosis, whereas a score of 0–3 indicates extensive ischemic changes and poorer outcomes.

Role of Imaging

- Advanced imaging modalities such as CT perfusion or MRI with diffusion-weighted imaging (DWI) and FLAIR mismatch help assess tissue salvage potential in patients presenting 6–24 h after symptom onset.

5. **Consider Decompressive Craniectomy**
   Indications: Decompressive craniectomy should be considered for malignant middle cerebral artery (MCA) infarction with significant brain swelling.

- Criteria:
  - Large infarct size.
  - Neurological deterioration.
  - Signs of herniation.
- Timing: Perform within 48 h of stroke onset for the best outcomes.

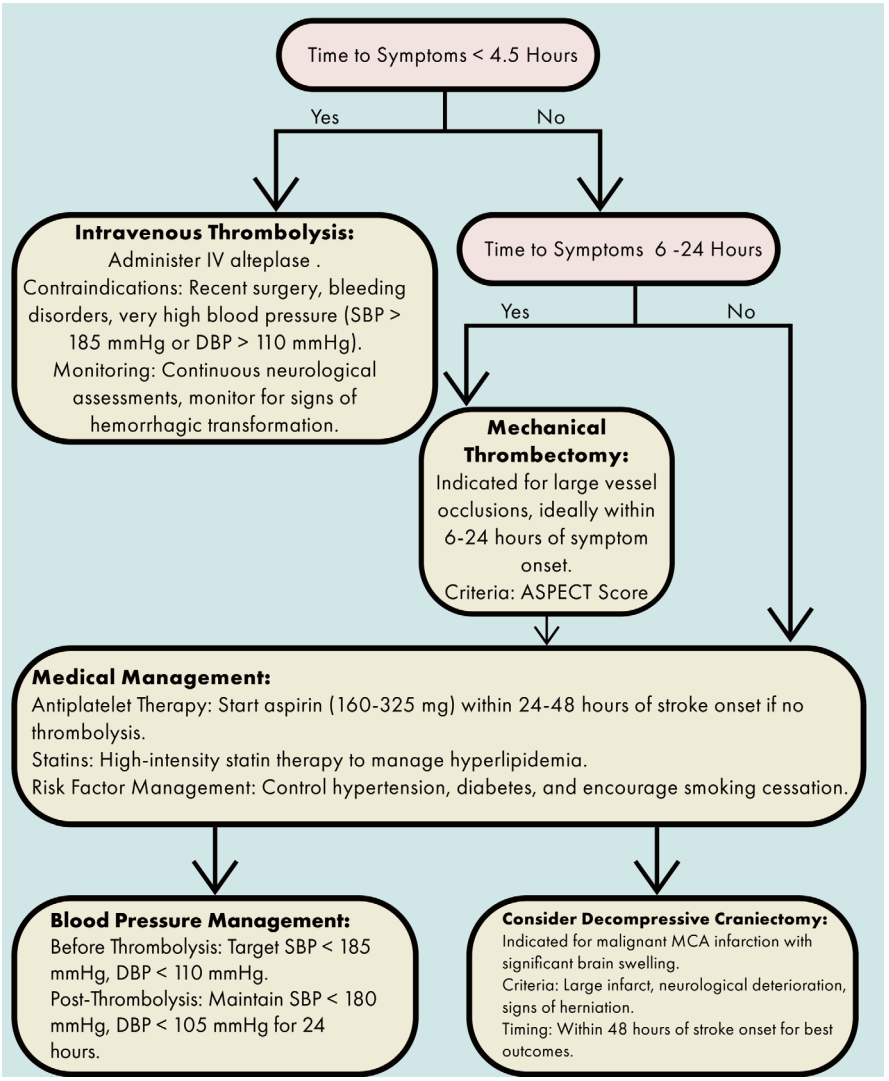
6. **Multidisciplinary Stroke Team and Continuum of Care**
   Pre-hospital and Acute Management: It is essential to establish pre-hospital stroke systems, including public awareness programs, EMS stroke assessment tools, and protocols for rapid hospital transport. Stroke teams should be ready to mobilize before the patient's arrival.

   Rehabilitation and Recovery: Post-stroke rehabilitation begins early and continues after discharge. Stroke patients should have access to multidisciplinary care, including physical therapy, occupational therapy, and psychological support. Telerehabilitation and early supported discharge play key roles in post-stroke care.

8.2 Conclusion

Managing ischemic stroke requires a dynamic and systematic approach based on the time of symptom onset, clinical status, and imaging findings. The integration of thrombolysis, mechanical thrombectomy, medical management, and early rehabilitation can significantly improve patient outcomes. Close adherence to the most recent guidelines and individualized patient care will optimize stroke recovery and reduce complications.

Algorithm 8.1: Management of ischemic stroke in the ICU



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