



American Stroke Association®
A division of the American Heart Association.

Together to End Stroke®



**GUIDELINES FOR THE EARLY
MANAGEMENT OF PATIENTS
WITH ACUTE ISCHEMIC STROKE:
2019 Update to the 2018 Guidelines for the Early
Management of Acute Ischemic Stroke**

A Summary for Healthcare Professionals from the American Stroke Association

KEY TAKEAWAYS

The 2019 guideline updates the 2018 acute ischemic stroke (AIS) guideline with content based on recent clinical trials and clarifies previous recommendations. The guideline is a comprehensive one, addressing AIS management from acute symptoms onset in the prehospital phase through two weeks post-acute stroke. It provides guidance on which patients are eligible to receive IV alteplase, mechanical thrombectomy and other care to reduce long-term morbidity. This summary focuses on recommendations related to the diagnosis of acute ischemic stroke and its treatment with IV alteplase and/or mechanical thrombectomy.

- IV alteplase within 4.5 hours of stroke onset remains the standard of care for most ischemic stroke patients, providing the opportunity for more favorable outcomes. Patients eligible for IV alteplase should receive it, even if mechanical thrombectomy is being considered.
- Mechanical thrombectomy evaluation and treatment should occur as rapidly as possible to ensure the treatment of as many eligible patients as possible.
- Mechanical thrombectomy is recommended within 16 hours and reasonable up to 24 hours in selected patients with AIS with large vessel occlusion in the anterior circulation greater than 6 hours from symptom onset who meet certain advanced imaging criteria.
- The benefits of both IV alteplase and mechanical thrombectomy are time dependent. The earlier the treatment within the time window, the greater the benefit to patients.

Regional systems of early stroke care should be developed that coordinate first-contact services with local and regional hospitals to achieve minimum delay time from symptom onset to definitive treatment.

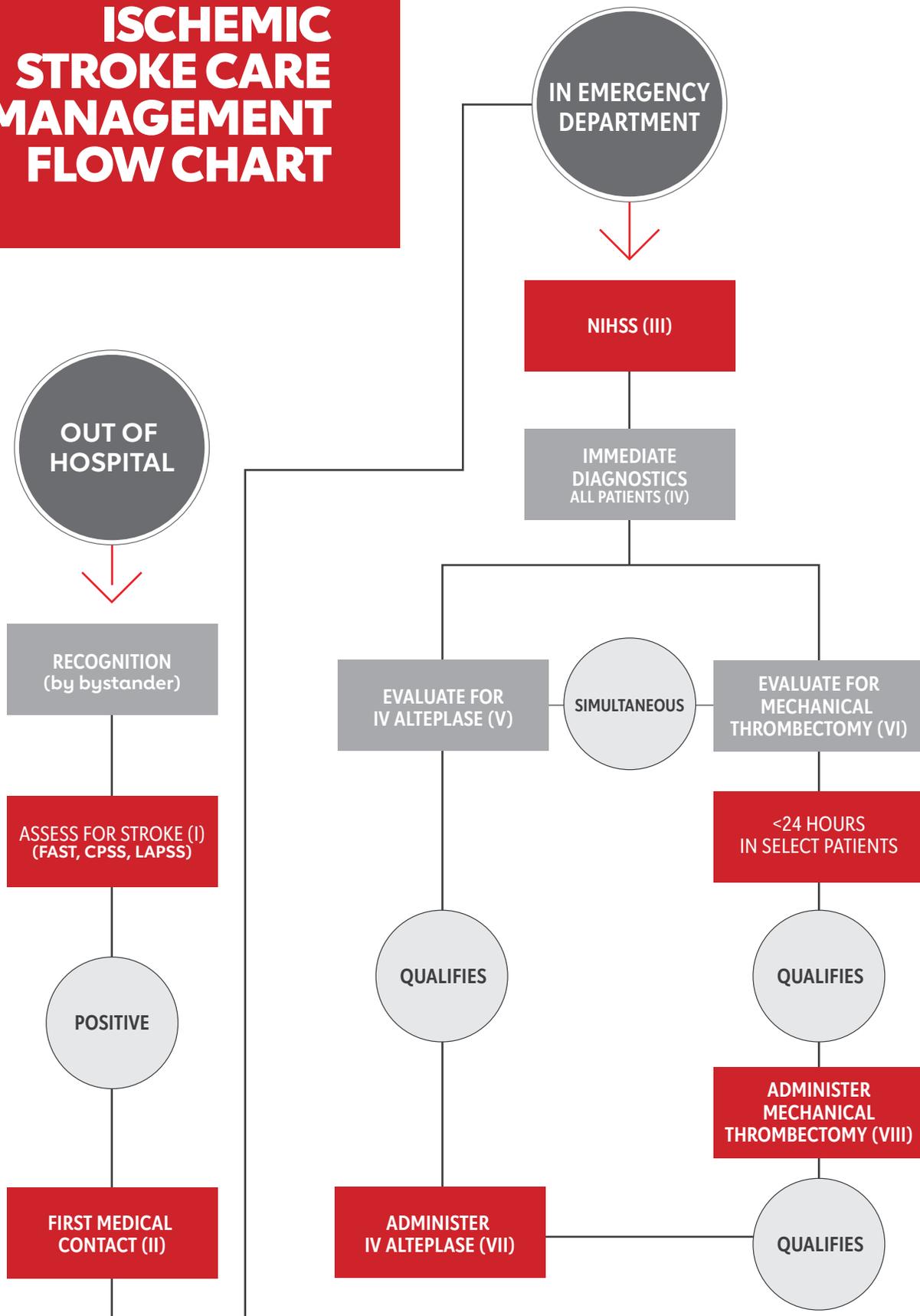
- Recommend brain imaging studies, in most cases non-contrast computed tomography (CT), be performed as quickly as possible for patients who may be candidates for IV alteplase and/or mechanical thrombectomy.
- Time from symptom onset to IV alteplase should be as short as possible and never more than 4.5 hours.
- Time from first stroke symptom to mechanical thrombectomy should be as quickly as possible within up to 24 hours in select patients.
- To achieve expedited care, public awareness of the signs of stroke and importance of calling 9-1-1 immediately by the community is needed.¹

The path to achieve these goals is represented in the flow chart on the next page

PLEASE REFER TO THE FULL GUIDELINES, AVAILABLE AT STROKE.ORG/AISTOOLKIT, FOR MORE DETAIL ON SPECIFIC RECOMMENDATIONS.

REFERENCES: 1. Guidelines for the Early Management of Patients with Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. 2. Modified from Kothari RU, Pancioli A, Liu T, Brott T, Broderick J. Cincinnati Prehospital Stroke Scale: reproducibility and validity. *Ann Emerg Med*. 1999;33:373-378. With permission from Elsevier. http://www.strokeassociation.org/idc/groups/stroke-public/@private/@wcm/@hcm/@gwtg/documents/downloadable/ucm_428607.pdf 3. Summer D, Leonard A, Wentworth D, et al. Comprehensive Overview of Nursing and Interdisciplinary Care of the Acute Ischemic Stroke Patient. *Stroke* 2009;40:2911-2944.

EARLY ACUTE ISCHEMIC STROKE CARE MANAGEMENT FLOW CHART



PLEASE REFER TO THE FULL GUIDELINES, AVAILABLE AT [STROKE.ORG/AISTOOLKIT](https://stroke.org/aistoolkit), FOR MORE DETAIL ON SPECIFIC RECOMMENDATIONS.

TEXT COPY FOR NUMBERED SECTIONS OF THE FLOW CHART

EMS Team to identify if there is evidence of an Acute Ischemic Stroke

- I** Assess for stroke using a validated screening tool, such as F.A.S.T., Cincinnati Prehospital Stroke Scale, or Los Angeles Prehospital Stroke Screen³

F

Face Drooping

A

Arm Weakness

S

Speech Difficulty

T

Time to Call 911

**also note time of day – hour and minute*

- II** First Medical Contact (EMS Provider)¹ – Assess and manage ABCs (airway, breathing, circulation)

- Check and monitor blood pressure, but do not treat
- Initiate cardiac monitoring
- Provide supplemental oxygen to maintain O₂ saturation > 94%
- Establish IV access
- Determine blood glucose and treat accordingly
- Determine time of symptom onset or last known normal, and obtain family contact information, preferably a cell phone
- Triage and rapidly transport patient to the closest healthcare facility able to administer IV alteplase
- Notify hospital of pending stroke patient arrival
- For patients who are not eligible for IV thrombolysis and have a strong probability of large vessel occlusion (LVO) stroke, follow

procedures that should be established to transport patient to the closest healthcare facility able to perform mechanical thrombectomy

- III** NIHSS in Emergency Department

- IV** Immediate Diagnostics¹

- Brain imaging study as quickly as possible. In most cases, noncontrast computed tomography (NCTT) will provide the necessary information
- Blood glucose level (only the assessment of blood glucose must precede the initiation of IV alteplase in all patients)
- Oxygen saturation
- Platelet count
- Markers of cardiac ischemia
- Prothrombin time (PT)/INR
- Activated partial thromboplastin time (aPTT)
- ECG

Immediate Diagnostics – Select Patients¹

- For patients who otherwise meet criteria for mechanical thrombectomy, a noninvasive intracranial vascular study is recommended during the initial imaging evaluation of the acute stroke patient but should not delay administration of IV alteplase if indicated

TEXT COPY FOR NUMBERED SECTIONS OF THE FLOW CHART: *Continued*

V

IV alteplase eligibility¹

Indications (Class I Recommendations

-- Recommended Care)

- **If within 3 hours of onset and:**
 - ≥ 18 years of age
 - Severe stroke
 - Mild but disabling stroke
- **If 3–4.5 hours from onset, 18–80 years of age, and:**
 - Without a history of both diabetes mellitus and prior stroke
 - NIHSS score ≤25
 - Not taking any OACs
 - Without imaging evidence of ischemic injury involving more than one third of the MCA territory
- **If BP can be lowered safely and maintained < 185/110 mm Hg**
- **With blood glucose > 50 mg/dL**
- **With mild to moderate early ischemic changes on NCCT**
- **With antiplatelet drug monotherapy or combination therapy**
- **With end stage renal disease with normal aPTT**

Additional Recommendations (Class IIa and IIb).

Situations requiring individual patient risk benefit assessment for which administration of IV alteplase may be considered

- **If 3–4.5 hours from onset**
 - >80 years of age (COR IIa)
 - Both prior stroke and diabetes mellitus (COR IIb)
 - Mild but disabling stroke (COR IIb)
 - NIHSS > 25 (COR IIb)
- **Pre-existing disability (mRS ≥ 2 COR IIb)**
- **Pre-existing dementia (COR IIb)**
- **Moderate to severe ischemic stroke with early improvement but remain moderately impaired and potentially disabled (COR IIa)**
- **Seizure at the time of onset, if evidence suggests that residual impairments are secondary to stroke (COR IIa)**
- **Initial blood glucose levels <50 or >400 mg/dL that are subsequently normalized (COR IIb)**
- **Clinical history of potential bleeding diathesis or coagulopathy (COR IIb)**
- **History of warfarin use and an INR ≤1.7 or a PT <15 s (COR IIb)**
- **Lumbar dural puncture in the preceding 7 days (COR IIb)**
- **Arterial puncture of a noncompressible blood vessel in the preceding 7 days (COR IIb)**
- **Recent major trauma (within 14 days) not involving the head (COR IIb)**
- **Major surgery in the preceding 14 days (COR IIb)**
- **History of gastrointestinal or genitourinary bleeding (>21 days) (COR IIb)**
- **Women who are menstruating and do not have a history of menorrhagia (COR IIa)**
- **Women with recent or active history of menorrhagia without clinically significant anemia or hypotension (COR IIb)**
- **Recent or active vaginal bleeding causing clinically significant anemia (after emergency consultation with a gynecologist) (COR IIa)**
- **Extracranial cervical arterial dissection (COR IIa)**
- **Intracranial arterial dissection (COR IIb)**
- **Small or moderately-sized unruptured and unsecured intracranial aneurysm (COR IIa)**
- **Giant unruptured and unsecured intracranial aneurysm (COR IIb)**
- **Unruptured and untreated intracranial vascular malformation, if high likelihood of morbidity and mortality outweigh the anticipated risk of ICH (COR IIb)**
- **Small number of cerebral microbleeds (CMBs) demonstrated on MRI (COR IIa)**

TEXT COPY FOR NUMBERED SECTIONS OF THE FLOW CHART: *Continued*

- Previously high burden of CMBs (>10) demonstrated on MRI if there is potential for substantial benefit (COR IIb)
- Extra-axial intracranial neoplasm (COR IIb)
- Concurrent acute MI, followed by percutaneous coronary angioplasty and stenting if indicated (COR IIa)
- MI in the past 3 months: Non-STEMI or STEMI involving the right or inferior myocardium. (COR IIa)
- MI in the past 3 months: STEMI involving the left anterior myocardium (COR IIb)
- Major AIS likely to produce severe disability and acute pericarditis (COR IIb), after urgent consultation with cardiologist
- Moderate AIS likely to produce mild disability and acute pericarditis (COR IIb)
- Major or moderate AIS likely to produce severe or mild disability and known left atrial or ventricular thrombus (COR IIb)
- Major AIS likely to produce severe disability and cardiac myxoma or papillary fibroelastoma (COR IIb)
- AIS due to complications of cardiac or cerebral angiographic procedures (COR IIa)
- Systemic malignancy and >6 month life expectancy in the absence of other contraindications (COR IIb)
- Pregnancy, when anticipated benefits of treating severe or moderate stroke outweigh increased risk of uterine bleeding (COR IIb)
- Early postpartum period (<14 days after delivery) (COR IIb)
- History of diabetic hemorrhagic retinopathy or other hemorrhagic ophthalmic conditions but potential increased risk of visual loss should be weighed against anticipated benefits (COR IIa)

- Sickle cell disease in adults (COR IIa)
- Hyperdense middle cerebral artery sign (COR IIa)
- Illicit drug use (COR IIa)
- Stroke mimics (COR IIa)

Contraindications (Class III -- Harm)

- CT reveals an acute intracranial hemorrhage
- CT brain imaging exhibits extensive regions of clear hypoattenuation
- Prior ischemic stroke within 3 months
- Recent severe head trauma within 3 months
- Acute head trauma (Posttraumatic infarction that occurs during the acute in-hospital phase)
- Intracranial/spinal surgery within the prior 3 months
- History of intracranial hemorrhage
- Symptoms and signs most consistent with a subarachnoid hemorrhage
- Structural GI malignancy
- Gastrointestinal bleeding event within 21 days
- Platelets <100 000/mm³
- INR >1.7
- aPTT >40 s
- PT >15 s
- Treatment dose of LMWH within the previous 24 hours
- Taking direct thrombin inhibitors or direct factor Xa inhibitors unless laboratory tests are normal or the patient has not received a dose of these agents for >48 hours (assuming normal renal metabolizing function)
- Symptoms consistent with infective endocarditis
- Known or suspected to be associated with aortic arch dissection
- Intra-axial intracranial neoplasm

Contraindications (Class III -- No Benefit)

- Otherwise eligible patients with mild but nondisabling stroke

TEXT COPY FOR NUMBERED SECTIONS OF THE FLOW CHART: *Continued*

VI Evaluate for Mechanical Thrombectomy (< 24 hours)¹

- Evaluation for IV alteplase and evaluation for mechanical thrombectomy happens simultaneously
- Within 6 hours:
 - Prestroke mRS score 0–1
 - Causative occlusion of the ICA or proximal MCA (M1)
 - Age ≥18 years
 - NIHSS score of ≥6
 - ASPECTS of ≥6
 - Within 6–24 hours
 - Causative occlusion of the ICA or M1
 - Meets eligibility criteria for DAWN or DEFUSE3 trials

VII Administer IV alteplase¹

- Infuse 0.9 mg/kg (maximum dose 90 mg) over 60 minutes, with 10% of the dose given as a bolus over 1 minute
- IV alteplase remains the recommended therapy, but it may be reasonable to choose tenecteplase (single IV bolus of 0.25-mg/kg, maximum 25 mg) over IV alteplase in patients without contraindications for IV fibrinolysis who are also eligible to undergo mechanical thrombectomy
- Admit the patient to an intensive care or stroke unit for monitoring for at least 24 hours
- If the patient develops severe headache, acute hypertension, nausea, or vomiting or has a worsening neurological examination, discontinue the infusion (if IV alteplase is being administered) and obtain emergent CT scan
- Measure BP and perform neurological assessments every 15 minutes during and after IV alteplase infusion for 2 hours, then every 30 minutes for 6 hours, then every hour until 24 hours after IV alteplase treatment

- Increase the frequency of BP measurements if systolic BP is >180 mm Hg or if diastolic BP is >105 mm Hg. Administer antihypertensive medications to maintain blood pressure at or below these levels
- Abciximab should not be administered concurrently with IV alteplase
- IV aspirin should not be given within 90 minutes after the start of IV alteplase
- The efficacy of IV glycoprotein IIb/IIIa inhibitors tirofiban and eptifibatid coadministered with IV alteplase is not well established (COR IIb)
- Delay placement of nasogastric tubes, indwelling bladder catheters, or intra-arterial pressure catheters if the patient can be safely managed without them
- Obtain a follow-up CT or MRI scan at 24 hours after IV alteplase before starting anticoagulants or antiplatelet agents

VIII Administer Mechanical Thrombectomy¹

- Stent retrievers remain the recommended choice of device for mechanical thrombectomy. The use of other devices as first line may be reasonable in some circumstances. The use of a proximal balloon guide catheter or a large-bore distal-access catheter, rather than a cervical guide catheter alone, in conjunction with stent retrievers may be beneficial
- In patients who undergo mechanical thrombectomy, it is reasonable to maintain blood pressure ≤180/105 during and for 24 hours after the procedure



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