

Stroke: AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke (2019)

About the Guideline

- Experts of various medical backgrounds created these guidelines to provide recommendations for the care and management of adult patients with acute ischemic stroke (AIS).
- The American Heart Association (AHA) Stroke Council's Scientific Statements Oversight Committee selected the writing group, who created, evaluated, and approved the recommendations. Fourteen expert peer reviewers and members of the Stroke Council's Scientific Statements Oversight Committee and Stroke Council Leadership Committee reviewed the guidelines draft before release.
- These evidence-based guidelines update the 2018 guidelines and provide recommendations for care of AIS patients in the prehospital setting, urgent and emergency evaluation and treatment with IV and intra-arterial therapies; and management in the inpatient hospital setting, including secondary prevention measures that are initiated within two weeks after the stroke event.

Key Clinical Considerations

Become familiar with the recommendations and best-practice statements provided in these guidelines, especially if you work in an acute care setting.

Systems of Care

Hospital Stroke Teams

- In order to provide the fastest treatment times for patients who qualify for fibrinolytic therapy or mechanical thrombectomy, a stroke system of care must be in place.
- An acute multidisciplinary stroke team should consist of practitioners, nurses, and laboratory and radiology staff.
- The team should perform a neurologic examination as part of the initial assessment of any patient with suspected stroke.
- The team should assess a suspected stroke patient emergently with an organized protocol.
- Improved treatment performance can be achieved by implementing goals for emergency department door-to-fibrinolysis treatment and by examining the process.

Telemedicine

- The United States Food and Drug Administration approved teleradiology systems, which are recommended for the expeditious review of brain imaging for patients with suspected stroke who arrive at hospitals without in-house expertise to interpret images.
- Telestroke/teleradiology evaluations of AIS patients can be valuable in evaluating eligibility for IV alteplase administration.
- Telestroke and teleradiology systems may be as safe and beneficial as stroke centers when providing guidance for alteplase administration.
- According to new data, telephone consultation with a community physician to provide guidance for alteplase administration is safe and may be considered if a telestroke system or an in-person stroke team is unavailable.
- The use of telestroke systems is a reasonable option for triaging an AIS patient and transferring the patient to another facility for possible acute mechanical thrombectomy.

Emergency Evaluation and Treatment

Stroke Scales

- The use of a stroke severity scale is recommended.
- The National Institute of Health Stroke Scale (NIHSS) is the preferred stroke assessment tool.

Head and Neck Imaging

- Upon arrival at a hospital, a suspected stroke patient should undergo an emergency brain imaging study prior to determining specific treatment for AIS.
- The team should complete brain imaging studies as quickly as possible to determine who are candidates for mechanical thrombectomy, IV fibrinolysis, or both.
- Prior to IV alteplase administration, a non-contrast computed tomography (NCCT) or magnetic resonance (MR) imaging (MRI) is efficient at ruling out an intracranial hemorrhage (ICH).
- In some cases, computed tomographic angiography (CTA) with computed tomographic perfusion (CTP) or MR angiography (MRA) with diffusion-weighted magnetic resonance imaging (DW-MRI) or without MR perfusion is recommended.

IV Alteplase Eligibility

- IV alteplase administration is recommended for those eligible without first ruling out cerebral microbleeds (CMBs) via MRI.
- IV alteplase should be administered in those eligible as there is no benefit to delay treatment to perform multimodal neuroimaging (i.e., computed tomography [CT] or MRI perfusion).
- Benefit is found in performing an MRI first to identify diffusion-positive FLAIR-negative lesions in patients whose time of onset is unknown, as in wake-up stroke, or in those whose last known well is unclear. Some of these patients may benefit from IV alteplase if administered within 4.5 hours from onset.

Mechanical Thrombectomy Eligibility: Vessel Imaging

- For mechanical thrombectomy candidates, the team should perform noninvasive intracranial vascular imaging. If intracranial vascular imaging is not obtained during initial imaging, obtain as soon as possible, even during IV alteplase administration.
- For a patient with suspected large vessel occlusion (LVO) and who is a candidate for mechanical thrombectomy, it is reasonable to perform a CTA without a serum creatinine level if the patient has no history of renal impairment.
- For a patient who is a candidate for mechanical thrombectomy, it is reasonable to obtain imaging of the extracranial carotids and vertebral arteries along with intracranial circulation.
- In determining patient eligibility for mechanical thrombectomy, the team may reasonably consider collateral flow status.

Mechanical Thrombectomy Eligibility: Multimodal Imaging

- For patients within 6 to 24 hours from last known normal who have LVO in the anterior circulation, obtaining a CTP, or diffusion-weighted (DW) MRI, with or without MRI perfusion, is recommended.
- Determine mechanical thrombectomy eligibility based on CT and CTA or MRI and MRA already performed; no additional studies are recommended in those with AIS within 6 hours of last known normal with LVO and an Alberta Stroke Program Early Computed Tomography Score (ASPECTS) score greater than or equal to 6.

Other Diagnostic Tests

- Only blood glucose testing must occur before IV alteplase administration.
- A baseline electrocardiogram (ECG) and serum troponin level are recommended for an AIS patient but should not delay IV alteplase administration.
- In the absence of acute pulmonary, cardiac, or pulmonary vascular disease, the need for chest X-ray in the hyperacute stroke setting is unknown.

General Supportive Care and Emergency Treatment

Airway, Breathing, and Oxygenation

- For an acute stroke patient with a decreased level of consciousness or bulbar dysfunction that compromises the airway, airway support and ventilatory assistance are recommended.
- Maintain the oxygen saturation level above 94% with supplemental oxygen.
- If hypoxia is not present, supplemental oxygen is not recommended.
- Hyperbaric oxygen is not recommended and not beneficial, except in patients with air embolism.

Blood Pressure

- Correction of hypotension and hypovolemia is recommended to maintain adequate systemic perfusion.
- For patients who have not received IV alteplase but who have a planned mechanical thrombectomy, it is acceptable to maintain blood pressure (BP) less than or equal to 185/110 prior to the procedure.
- Before IV alteplase administration, the team should lower BP greater than 185/110 mm Hg using one of the following medications:
 - Labetalol 10 to 20 mg IV over 1 to 2 minutes; this may be repeated once.
 - Nicardipine 5 mg/hour IV titrated up by 2.5 mg/hour every 5 to 15 minutes to a maximum dose of 15 mg/hour. Once optimal BP occurs, adjust dosing to maintain appropriate BP limits.
 - Clevidipine 1 to 2 mg/hour IV titrated by doubling the dose every 2 to 5 minutes until the desired BP occurs. The maximum dose is 21 mg/hour.
 - Other agents, such as hydralazine and enalaprilat may also be considered.
- Do not give alteplase if the patient cannot achieve or maintain a BP of 185/110 mm Hg or less.
- Monitor the BP at the initiation, during, and after the administration of alteplase or other reperfusion treatment at the following intervals to maintain the BP at 185/110 mm Hg or less:
 - Every 15 minutes for 2 hours at the start of treatment, then
 - Every 30 minutes for 6 hours, then
 - Every hour for 16 hours.
- If the systolic BP exceeds 180 to 230 mm Hg or if the diastolic BP exceeds 105 to 120 mm Hg, treat with labetalol, nicardipine, or clevidipine. Consider IV sodium nitroprusside if elevated BP persists.
- Data on the usefulness of drug-induced hypertension in patients with AIS is not available.

Temperature

- Elevated temperature in a stroke patient requires treatment with antipyretics and determination of the source(s) of hyperthermia.
- Treatment of induced hypothermia for a patient with AIS has unclear benefits.

Blood Glucose Level

- A patient with AIS should receive treatment for hyperglycemia to maintain a blood glucose level between 140 and 180 mg/dL.
- In a patient with AIS, a blood glucose level below 60 mg/dL requires treatment.

IV Alteplase

General Principles

- IV alteplase administration should begin as soon as possible after determining a patient's eligibility.
- Don't delay IV alteplase administration and wait for symptom improvement.
- Practitioners should be ready to treat any of the side effects of IV alteplase that may occur, such as bleeding complications or angioedema, which may obstruct the airway.
- Decision-making for IV alteplase treatment should include a discussion of the risks and benefits.

Time Windows

- IV alteplase 0.9 mg/kg (maximum dose of 90 mg) over 60 minutes, giving the initial 10% of the dose as a bolus over 1 minute is recommended for the following patient groups:
 - Those with a symptom onset of less than 3 hours from last known normal or from baseline state;
 - Those who present within the 3- to 4.5-hour window from symptom onset or last known normal; and
 - Those experiencing wake-up stroke or whose time of onset is unknown or greater than 4.5 hours, with no signal change on FLAIR DW-MRI images, and whose lesion is less than 1/3 of middle cerebral artery (MCA) territory.

Mild Stroke

- Administer IV alteplase to a patient with a mild stroke with disabling symptoms who presents within the 3-hour window.
- Administer IV alteplase to a patient with a mild stroke with disabling symptoms who presents within the 3-to-4.5-hour window.
- IV alteplase is not recommended for an otherwise eligible patient with a mild stroke with nondisabling symptoms (NIHSS 0 to 5) who presents within the 3-hour window or the 3- to 4.5-hour window.

Other Specific Circumstances

- IV alteplase may be beneficial for a patient with known sickle cell disease who presents with AIS and who meets the criteria.
- IV alteplase can be beneficial for patients who present with a hyperdense MCA sign.

Bleeding Risk

- If the team has no reason to suspect abnormal results, obtaining serum coagulation or hematologic studies should not delay IV alteplase administration.
- If an MRI detects CMBs, proceed with IV alteplase as follows:
 - For patients with a small number (1 to 10): IV alteplase is reasonable for a patient who meets all other criteria.
 - For patients with a larger number (more than 10): IV alteplase may increase the risk of symptomatic intracerebral hemorrhage (sICH), but it may be reasonable if significant benefit is possible.

- The team should not give IV alteplase and abciximab together because the combination may cause harm.
- A patient who has been treated with full treatment dose of low-molecular-weight heparin (LMWH) in the previous 24 hours should not receive IV alteplase.
- Following the initiation IV alteplase, IV aspirin should not be administered within 90 minutes.

Post Alteplase Treatment

- In the 24 hours after IV alteplase treatment, the patient's BP should be maintained at less than 180/105 mm Hg.
- The risk of antithrombotic therapy given within the first 24 hours after IV alteplase administration is unknown. However, antithrombotic therapy may be considered after determining the necessity and considering the risks and benefits.

Other IV Thrombolytics and Sonothrombolysis

- A single dose of tenecteplase (0.25 mg/kg, maximum dose of 25 mg) instead of IV alteplase may be reasonable for those patients eligible for mechanical thrombectomy and without contraindications to fibrinolysis.
- For a patient with minor neurologic impairments and no major intracranial occlusion, a single IV bolus of tenecteplase 0.4 mg/kg may be considered as an alternative to IV alteplase.
- IV defibrinogenating agents and IV fibrinolytic agents, other than alteplase and tenecteplase, are not recommended.
- The use of sonothrombolysis as adjunctive therapy to IV thrombolysis is not recommended.

Mechanical Thrombectomy

- A patient who is eligible for IV alteplase should receive it even if mechanical thrombectomy is being considered.
- Mechanical thrombectomy should not be delayed for the observation of clinical response in eligible patients who received IV alteplase.
- The guidelines recommend mechanical thrombectomy with a stent retriever (the device of choice) for a patient who meets all of the following criteria:
 - Pre-stroke modified Rankin Scale (mRS) score of 0 to 1, **and**
 - Causative occlusion of the internal carotid artery (ICA) or MCA segment 1 (M1), **and**
 - Age 18 or older, **and**
 - NIHSS score of 6 or higher, **and**
 - ASPECTS of 6 or higher, **and**
 - Treatment can be initiated within 6 hours of symptom onset.
- Mechanical thrombectomy may be a reasonable treatment option for select patients in whom treatment can be initiated within 6 hours from symptom onset and with any of the following:
 - A causative occlusion of MCA segment 2 (M2) or MCA segment 3 (M3) portion of the MCAs
 - A causative occlusion of the anterior cerebral arteries, vertebral arteries, basilar artery, or posterior cerebral arteries
 - A prestroke mRS score higher than 1, ASPECTS higher than 6, or NIHSS score less than 6 and a causative occlusion of the ICA or proximal MCA (M1) (*This area needs additional research.*)

- Mechanical thrombectomy is recommended in select patients who exhibit an AIS within 6 to 16 hours of their last known normal, who have an LVO in the anterior circulation, and who meet other DAWN (clinical trial) or DEFUSE 3 (clinical trial) eligibility.
- Mechanical thrombectomy is reasonable in select patients who exhibit an AIS within 16 to 24 hours of their last known normal, who are determined to have an LVO in the anterior circulation, and who meet other DAWN eligibility.
- Angiography determines the probability of a good functional outcome after a thrombectomy based on a measurement goal of reperfusion to a modified Thrombolysis in Cerebral Infarction (mTICI) 2b/3.
- Better clinical outcomes occur when reperfusion can be established sooner, rather than later.
- Stent retrievers are preferred to the Mechanical Embolus Removal in Cerebral Ischemia (MERCI) device.
- Although stent retrievers are the first choice in mechanical thrombectomy, the use of other devices may be reasonable in certain situations.
- The use of a proximal balloon guide catheter or a large-bore, distal-access catheter along with stent retrievers (rather than a cervical guide catheter alone) may be beneficial.
- IV glycoprotein IIb/IIIa inhibitors used during endovascular therapy (EVT) are without certainty in safety and efficacy.
- Using salvage techniques, such as intra-arterial thrombolysis, may be a reasonable treatment option to achieve an angiographic mTICI 2b/3 result.
- At the time of thrombectomy, an EVT of tandem occlusions (extracranial and intracranial occlusions) may be reasonable.
- The anesthesia choice is determined on an individualized basis.
- The team should maintain the patient's BP at 180/105 mm Hg or less during mechanical thrombectomy and for 24 hours after the procedure.
- The team should maintain the BP below 180/105 mm Hg for a patient who had mechanical thrombectomy with reperfusion.

Other Endovascular Therapies

- Mechanical thrombectomy with a stent retriever is recommended over intra-arterial thrombolysis as first-line treatment.
- In select patients, the team may consider initiating intra-arterial thrombolysis within 6 hours of stroke symptom onset, even if contraindications to IV alteplase exist. However, the consequences are unknown.

Antiplatelet Treatment

- For a patient with AIS, aspirin (ASA) within 24 to 48 hours after symptom onset is recommended. In most cases, ASA is held for the first 24 hours after IV alteplase administration.
- The team must determine the need for ASA within the first 24 hours after IV alteplase administration for a patient with a concomitant condition in which the addition of ASA would be beneficial.
- Dual antiplatelet therapy (aspirin and clopidogrel) started within 24 hours of a minor stroke and continued for 21 days can be beneficial for early secondary stroke prevention for up to 90 days after symptom onset.
- In a patient with a minor stroke, the use of ticagrelor over ASA is not beneficial as an acute treatment, and it is not recommended.

- Aspirin is not recommended as a substitute for acute stroke treatment in a patient who is eligible for IV alteplase administration or mechanical thrombectomy.
- The efficacy of IV tirofiban and eptifibatide in treating AIS is not well established.

Anticoagulants

- For a patient with severe carotid stenosis on the ipsilateral side from the ischemic stroke, the efficacy of urgent anticoagulation is unproven.
- Further studies are needed on the use of argatroban, dabigatran, other thrombin inhibitors, and factor Xa inhibitors to treat AIS.
- For AIS, anticoagulant therapy started emergently offers no benefit in terms of preventing recurrence, diminishing the worsening of symptoms, or improving outcomes. It is not recommended.

Therapies that are not recommended

Volume Expansion, Hemodilution, Vasodilators, and Hemodynamic Augmentation

- The following are not beneficial and not recommended for a patient with AIS:
 - Hemodilution by volume expansion
 - High-dose albumin administration
 - Administration of vasodilatory agents, such as pentoxifylline
- Devices to augment cerebral blood flow in AIS have not been found to be helpful.

Neuroprotective Agents

- Neuroprotective therapy is not beneficial and is not recommended for a patient with AIS.

Emergency Carotid Endarterectomy (CEA) and Carotid Angioplasty and Stenting without Intracranial Clot

- The usefulness of urgent CEA, carotid angioplasty, and stenting in AIS is not well established.

Transcranial Laser Therapy

- Transcranial near-infrared laser therapy is not beneficial and is not recommended to treat AIS.

In-Hospital Management of AIS: General Support

Stroke Units

- Providing specialized comprehensive stroke care with rehabilitation is recommended.
- Standardized stroke care order sets should be used.

Head Positioning

- Positioning a stroke patient's head flat has not been proven beneficial.

Blood Pressure

- For a patient with AIS and a comorbid disease in which hypertension is a threat (such as acute coronary event, acute heart failure, preeclampsia, or eclampsia), lowering the BP by 15% is considered safe.
- For a patient with AIS who has a BP greater than 220/120 mm Hg, who is **not** receiving IV alteplase or EVT, and who has no comorbid hypertensive disease, consider lowering the BP by 15% in the 24 hours after the onset of AIS.
- The following are reasonable medication choices and dosages to lower a patient's BP:

- Labetalol 10 mg IV, followed by a continuous IV infusion of 2 to 8 mg/minute
- NicARDipine 5 mg/hour IV titrated up to the desired effect by 2.5 mg/hour every 5 to 15 minutes (maximum dose of 15 mg/hour)
- Clevidipine 1 to 2 mg/hour IV titrated by doubling the dose every 2 to 5 minutes until the desired BP occurs (maximum dose of 21 mg/hour)
- IV sodium nitroprusside should be considered if the BP is not controlled or the diastolic BP exceeds 140 mm Hg.
- Attempting to prevent death or dependency by initiating or reinitiating antihypertensive treatment in a patient with AIS who has a BP less than or equal to 220/120, who is **not** receiving IV alteplase or EVT, and who has no comorbid hypertensive disease is not beneficial.

Dysphagia Screening

- Patients should be screened for swallowing difficulties to determine aspiration risk prior to providing any oral food, fluids, or medications.
- Use a speech pathologist or other trained health care professional to perform dysphagia screening.
- In patients with suspected aspiration, instrumental evaluation, such as fiberoptic endoscopy or videofluoroscopy, can assist in determining the presence or absence of dysphagia, in identifying the cause of dysphagia, and in guiding the treatment plan.
- No one instrument is suggested or recommended to assess swallowing with sensory loss.
- Initiate an oral hygiene protocol to reduce the risk of pneumonia in patients with AIS.

Nutrition

- After an acute stroke, the patient should start enteral feeding within 7 days of admission.
- A patient with AIS and dysphagia should be fed via nasogastric tube within 7 days of stroke onset. If an inability to safely swallow persists for more than 2 to 3 weeks, a percutaneous gastrostomy tube is suggested.
- If malnourishment is a concern, nutritional supplements are suggested.

Deep Vein Thrombosis Prophylaxis

- In addition to ASA and hydration, intermittent pneumatic compression is recommended for an immobile patient with AIS, unless contraindicated.
- For an immobile patient with AIS, the use of prophylactic-dose subcutaneous heparin (unfractionated or LMWH) has not been established as beneficial.
- Elastic compression stockings should not be used and may harm a patient with AIS.

Depression Screening

- The guidelines recommend using a standardized depression scale to assess for depression after a stroke.
- For a patient with AIS who is diagnosed with depression, the guidelines recommend antidepressants followed by an assessment of efficacy, unless contraindicated.

Rehabilitation

- Early stroke rehabilitation should involve a multidisciplinary team.
- Rehabilitation provided to a stroke survivor should be at an intensity that the patient can tolerate and benefit from.

- Care transition and discharge planning should take place before patient discharge. Planning should include a formal evaluation of the patient's activities of daily living (ADLs), instrumental ADLs, ability to communicate, and functional mobility.
- A rehabilitation specialist should assess a patient with functional deficits.
- Studies have not proven that selective serotonin uptake inhibitors, such as fluoxetine, improve motor activity.
- Very early, high-dose mobilization should not occur within the first 24 hours of stroke onset and may lead to an unfavorable outcome at 3 months.

Other

- Throughout hospitalization and rehabilitation, routine skin assessments should take place using an established skin assessment tool, such as the Braden scale. The patient should receive good skin care and have appropriate surfaces on which to lie and sit to avoid skin friction, pressure, and moisture accumulation. Adequate hydration and nutrition should also be maintained.
- Care decisions should be patient-centered and involve the patient and family. Resources, such as palliative care, should be available as needed.
- Routine prophylactic antibiotics are of no benefit and, therefore, not recommended.
- Routine urinary catheter placement poses a risk for catheter-associated urinary tract infection (CAUTI) and is not recommended.

In-Hospital Management of AIS: Treatment of Acute Complications

Brain Swelling

- General Recommendations
 - Because a patient with a large territorial supratentorial infarction is at high risk for increased intracranial pressure (ICP) and complicating brain edema, the team should discuss care options with the patient (if appropriate), family members, and caregivers. The discussion should include the prognosis and related interventions or limitations in care.
- Medical Management
 - For a patient with clinical deterioration due to cerebral edema associated with a cerebral infarct, osmotic therapy is suggested.
 - For a patient with an acute decrease in neurologic status due to cerebral edema, short-term use of hyperventilation (partial pressure of carbon dioxide [PCO₂] target of 30 to 34 mm Hg) is suggested as a bridge while the team determines the definitive treatment.
 - Hypothermia or barbiturates are not recommended for patients with ischemic cerebral or cerebellar swelling.
 - Corticosteroids are not recommended to treat cerebral edema and increased ICP associated with ischemic stroke.
- Surgical Management of Supratentorial Infarction
 - A decompressive craniectomy with dural expansion is suggested for patients age 60 or younger with a unilateral MCA infarction who, despite medical management, exhibit a worsening neurologic status in the first 48 hours after the event. Treatment for patients over the age of 60 may be considered.
 - Close observation and assessment of neurologic status and treatment are suggested to monitor for cerebral edema in the first few days after a major infarction. A patient with malignant cerebral edema should be transferred to a hospital with neurologic expertise.

- **Surgical Management: Cerebellar Infarction**
 - The recommended treatment for obstructive hydrocephalus after a cerebellar infarct is ventriculostomy. Clinical circumstances may warrant decompressive craniectomy at the same time as or after ventriculostomy.
 - A patient with cerebellar infarction that causes neurologic deterioration from brainstem compression (despite maximal medical therapy) should undergo a decompressive suboccipital craniectomy with dural expansion. If indicated and deemed safe, a ventriculostomy should be concurrently performed for obstructive hydrocephalus.
 - The team may consider a decreased level of consciousness caused by cerebral edema as the sole criteria for decompressive craniectomy.

Seizures

- The treatment and medication choice for seizures associated with stroke should be no different than for any other neurologic condition that causes seizures and should be determined on an individualized basis.
- Prophylactic administration of antiseizure medication is not recommended.

In-Hospital Institution of Secondary Stroke Prevention

Brain Imaging

- Additional information may be obtained with the use of MRI post AIS to determine secondary stroke prevention measures.
- Brain MRI is suggested for select AIS patients as part of a thorough evaluation to determine whether they meet randomized clinical trial (RCT) criteria for mechanical closure of patent foramen ovale (PFO) to prevent recurrent stroke.
- MRI as a routine measure for determining treatment for secondary stroke prevention is unproven.

Vascular Imaging

- A routine noninvasive image of the cervical carotid arteries is recommended within 24 hours of admission on patients who are candidates for CEA or stenting following a nondisabling (mRS 0 to 2) AIS in the carotid territory.
- Additional information may be obtained with the use of intracranial vessel imaging to determine secondary stroke prevention measures.
- Imaging of the intracranial vasculature is suggested for select AIS patients as part of a thorough evaluation to determine whether they meet RCT criteria for mechanical closure of PFO to prevent recurrent stroke.
- Imaging of the intracranial vasculature as a routine measure for determining antithrombotic or EVT for secondary stroke prevention is unproven.

Cardiac Evaluation

- **Electrocardiographic (ECG) Monitoring**
 - Cardiac monitoring for at least the initial 24 hours is recommended to observe for atrial fibrillation or other threatening arrhythmias that may require immediate intervention.
 - Utilizing extended cardiac monitoring has not proven to be of any benefit in determining treatment for secondary stroke prevention.
- **Echocardiography**

- Echocardiography is a diagnostic tool that can be used for select patients to determine treatment for secondary stroke prevention.
- Echocardiography is suggested for select AIS patients as part of a thorough evaluation to determine whether they meet RCT criteria for mechanical closure of PFO to prevent recurrent stroke.
- Echocardiography as a routine measure for determining treatment for secondary stroke prevention is unproven.

Glucose

- Screening for diabetes following AIS is recommended; determining when and which diagnostic tool to use is an individual decision, with the understanding that the illness will increase glucose, and Hgb A1C may be most accurate immediately post event.

Other Tests for Secondary Prevention

- The benefit of screening for thrombophilic states is unproven with AIS patients.
- Routinely screening for obstructive sleep apnea is not recommended for patients with a recent stroke.
- Antiphospholipid antibody routine screening is not recommended for those without indication of antiphospholipid syndrome and for whom the cause of the ischemic event is known.
- There is no indication to routinely screen for hyperhomocysteinemia in AIS patients.

Antithrombotic Treatment

Noncardioembolic Stroke

- Antiplatelet treatment rather than anticoagulants are recommended for secondary stroke prevention and prevention of other future cardiovascular events in patients with noncardioembolic AIS.
- The choice of antiplatelet treatment should be individualized for secondary stroke prevention.
- For patients who have a noncardioembolic AIS while taking aspirin, changing antiplatelet agents or increasing the dosage of aspirin for secondary stroke prevention is unproven.
- Following AIS, if abnormal coagulation studies are found, anticoagulants may be considered on an individual basis.
- Warfarin is not indicated as an alternative for patients with noncardioembolic stroke who were taking antiplatelet agents at the time of the event.
- Triple antiplatelet therapy (aspirin and clopidogrel and dipyridamole) was found to be harmful and should not be given for secondary stroke prevention in noncardioembolic stroke patients.

Atrial Fibrillation

- In most AIS patients with atrial fibrillation, starting anticoagulation between day 4 and 14 post event is recommended.
- For patients with atrial fibrillation, ischemic stroke, and coronary artery disease, the usefulness of antiplatelet treatment combined with anticoagulants for the purpose of secondary prevention of a future cerebral and coronary event is unknown.

Arterial Dissection

- Treating extracranial carotid or vertebral arterial dissections in AIS patients with antiplatelet agents or anticoagulants for 3 to 6 months is suggested.

- For AIS patients with extracranial carotid or vertebral arterial dissections and recurrent events despite medical management, EVT stenting is unproven.

Hemorrhagic Transformation

- Depending on the individual situation and need, starting or continuing antiplatelet or anticoagulation treatments may be considered in AIS patients with hemorrhagic transformation.

Carotid Revascularization

- For those without contraindications, carotid revascularization is recommended, within 48 hours and 7 days of the event for secondary prevention and should not be delayed in patients with nondisabling AIS (mRS 0 to 2).

Treatment of Hyperlipidemia

General Principles

- AIS patients should follow dietary, lifestyle modification, and medication guidelines in accordance with the 2018 ACC/AHA Cholesterol Guidelines.
- Obtaining a plasma lipid profile and baseline low-density lipoprotein cholesterol (LDL-C) is valuable in determining atherosclerotic cardiovascular disease (ASCVD) risk in those over 20 years old who are not on lipid-lowering medication.
- When starting lipid-lowering medication and lifestyle modifications, a fasting lipid profile should be obtained within the first 4 to 12 weeks, and then (whether medication adjustment is needed or not) should be reassessed every 3 to 12 months to determine safety and adherence.

Choice of Lipid-Lowering Drugs for Patients with Clinical Atherosclerotic Cardiovascular Disease (ASCVD)

- High-intensity statin therapy should be started or continued (if already being taken) with the goal of lowering LDL-C by 50% or more in patients who are less than 75 years old with clinical ASCVD.
- Moderate-intensity statin therapy should be started or continued (if already being taken) with the goal of lowering LDL-C by 30% to 49% in patients who have clinical ASCVD but who have had side effects from high-intensity statins or for whom high-intensity statins are contraindicated.
- Use of statins in patients with stable liver disease who have a higher risk of ASCVD is suggested, but must include obtaining baseline measurements and establishing a plan for monitoring.
- Statin therapy at the maximum dose tolerated combined with ezetimibe is recommended for patients who have clinically a very high risk of ASCVD and who are considered for proprotein convertase subtilisin/kexin type 9 (PCSK9) inhibitor therapy.
- In high-risk ASCVD patients on maximum LDL-C lowering medication with LDL-C greater than 70 mg/dl or HDL-C greater than 100, PCSK9 inhibitor therapy is recommended after a discussion with the patient.
- Adding ezetimibe in high-risk ASCVD patients on maximum statin therapy with LDL-C greater than 70 mg/dL is recommended; this includes those patients whose LDL remains greater than 70 mg/dL despite statin therapy.
- A thorough patient assessment to determine risks and benefits of initiating or continuing moderate- to high-intensity statin therapy for the reduction of ASCVD risk is recommended in patients over 75 with clinical ASCVD.

Implementation

- Before the implementation of statin therapy to reduce ASCVD risk, the patient and practitioner should discuss the risks and benefits.
- An assessment of the potential statin side effects related to possible patient predispositions (e.g., new onset diabetes mellitus), is recommended prior to prescribing.
- With the occurrence of non-severe statin side effects, reassessment and dosage adjustment, alternative medication combination, and or treatment to achieve maximum lowering of LDL-C is recommended.
- Alternative non-statin treatment is recommended following the occurrence of severe statin muscle side effects in high-risk ASCVD patients who have attempted dosage adjustment to no avail.

Timing

- Continuing statin therapy in AIS patients previously being treated for hyperlipidemia during hospitalization is recommended.
- Beginning in-hospital statin therapy in AIS patients who meet criteria is recommended.

Special Patient Groups

- A reliable form of contraception should be advised for women of childbearing age who are on statin therapy.
- Women attempting to get pregnant should stop statin therapy 1 to 2 months prior. If pregnancy occurs while on a statin medication, medication should be discontinued immediately upon notification of pregnancy.
- Continuing statin therapy is suggested in renal failure patients on dialysis who are already being treated to lower LDL-C.
- Starting statin therapy in patients with renal failure who are on dialysis is not recommended.

Antihypertensive Medications

- Treating blood pressure greater than 140/90 mm Hg as needed in patients who are neurologically stable during their hospitalization is logical and safe; the goal is to maintain long-term BP control.

Smoking Cessation

- Smoking cessation with high-intensity behavioral initiatives should begin in AIS patients during hospitalization.
- Nicotine replacement therapy is recommended for smokers with AIS.
- AIS patients who have smoked within the last year should be educated on smoking cessation by healthcare providers.
- AIS patients should be instructed to avoid second-hand tobacco smoke.
- Consider starting varenicline in the hospital to encourage smoking cessation in AIS patients.

Stroke Education

- Allow AIS patients to discuss the impact stroke has on their life, and healthcare providers should present stroke education, information, and advice.

Reference

Powers, W. J., et al. (2019). 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. *Stroke*, 50, e344-e418.
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