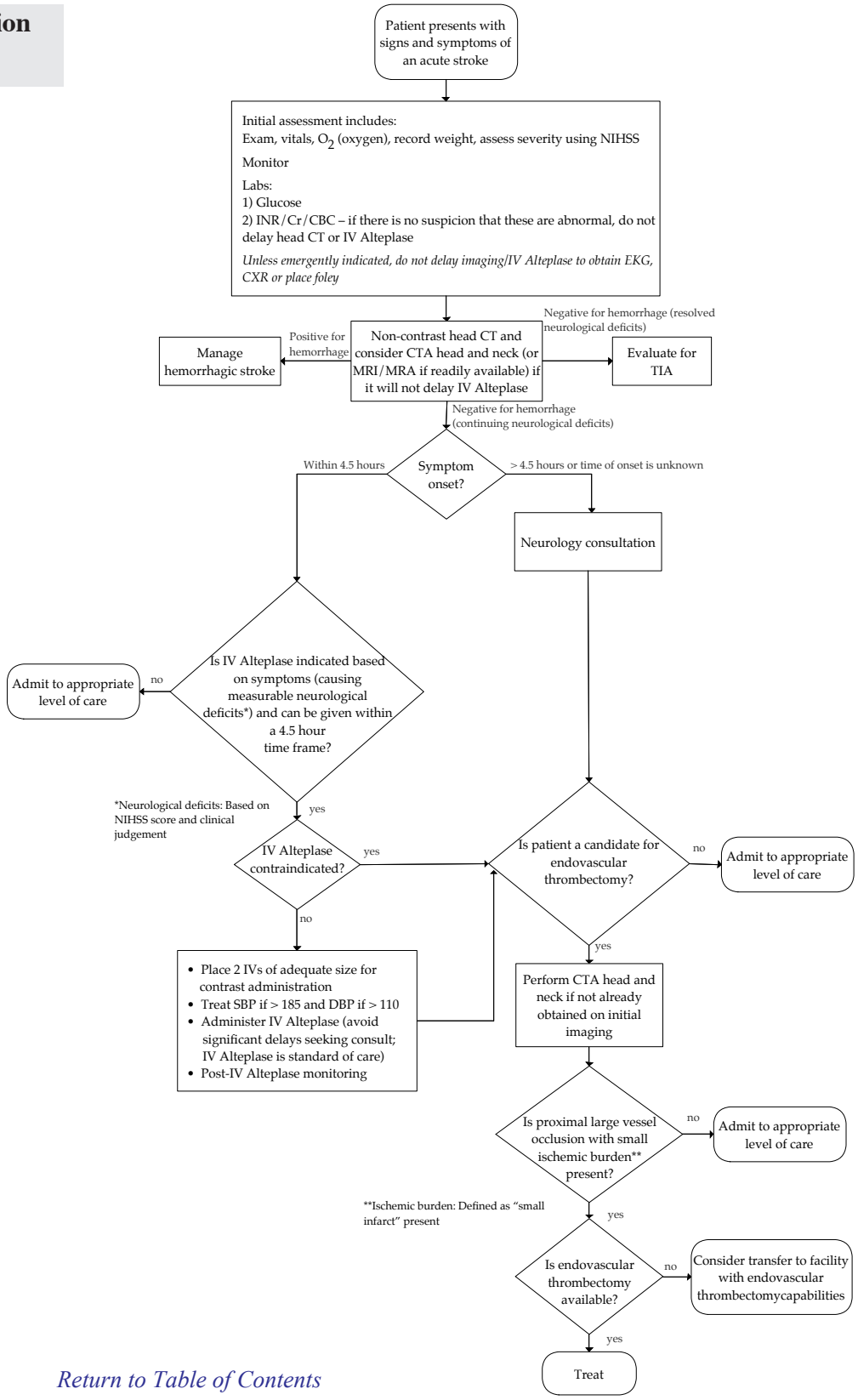
Acute Ischemic Stroke Algorithm

Twelfth Edition
June 2019



Return to Table of Contents

Table of Contents

Work Group Co-Leaders
David Anderson, MD
Neurology, University of Minnesota Physicians
David Larson, MD
Emergency Medicine, Ridgeview Medical Center

Work Group Members
HealthEast Care System
Tess Sierzant, MS, RN
Neurology Nursing
Lakeview Hospital
Bjorn Peterson, MD
Emergency Medicine
Mayo Clinic
James Klaas, MD
Neurology
Minneapolis Clinic of Neurology/Fairview Health Services
Ruth Marie Thomson, DO
Vascular Neurology
Park Nicollet Health Services
Fadoua Kushner, PharmD
Pharmacy
University of Minnesota Physicians
Christopher Streib, MD
Vascular Neurology
ICSI Staff
Senka Hadzic, MPH
Clinical Systems Improvement Facilitator
Jodie Dvorkin, MD, MPH
Project Manager/Health Care Consultant

Evidence Grading

The American Heart Association (AHA)/American Stroke Association (ASA) uses its own system for classifying recommendations and evaluating the levels of evidence. This system is explained in the AHA/ASA stroke document. Since this is an endorsement document, ICSI did not use its own system to evaluate the levels of evidence or classify recommendations. Where new literature was available to support the existing recommendations or qualification statement for an existing recommendation, the new literature was cited. If there was no new literature on the topic, and the recommendation was still valid based on the existing practice and previous literature, no literature was cited.

Return to Table of Contents

Foreword

The American Heart Association/American Stroke Association (AHA/ASA) is not a sponsor of or affiliated with, nor does it endorse ICSI or the ICSI Diagnosis and Initial Treatment of Ischemic Stroke Work Group. AHA/ASA has not reviewed ICSI's process for endorsement of guidelines. The following ICSI endorsement and conclusions are solely the consensus of the ICSI Diagnosis and Initial Treatment of Ischemic Stroke Work Group using the ICSI Endorsement Process.

Introduction

Stroke is the fifth leading cause of death in the United States and a leading cause of serious long-term disability *(Mozzafarian, 2015; Kochanek, 2014)*. Annually, approximately 800,000 people in the United States have a stroke, and 130,000 die *(Centers for Disease Control and Prevention, 2016)*. Of all strokes, 87% are ischemic strokes *(Mozaffarian, 2015)*. In Minnesota, ischemic stroke death rate – regardless of gender and age group – is at 19 per 100,000, compared to the national rate of 20 per 100,000, for years 2011-2013 per the Centers for Disease Control and Prevention's Interactive Atlas of Heart Disease and Stroke.

In the United States, one person dies from stroke every four minutes, on average *(Mozaffarian, 2015)*. Therefore, time is of the essence in getting appropriate early care for persons with an onset of stroke symptoms. The recommendations in this guideline are for early management of stroke due to ischemic brain ischemia/infarction. This guideline does not address stroke prevention, transient ischemic stroke (TIA) or management of hemorrhagic stroke.

To increase access to appropriate early care for stroke, Minnesota passed legislation to authorize the Minnesota Department of Health (MDH) to designate hospitals as Acute Stroke-Ready Hospitals, Primary Stroke Centers and Comprehensive Stroke Centers. In addition to hospital designation, the legislation also included data collection and reporting, and standardization of EMS protocols. MDH provides training, education and other resources to the hospitals that want to become designated as stroke centers. The ICSI Diagnosis and Initial Treatment of Ischemic Stroke guideline work group strongly encourages the hospitals to participate in this process.

Endorsement of American Heart Association (AHA)/American Stroke Association (ASA) 2018 Stroke Guidelines

The ICSI Diagnosis and Initial Treatment of Ischemic Stroke guideline work group has updated its endorsement of the recommendations from the 20th AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke. For detailed context and evidence supporting the recommendations, see the original document: Powers WJ, Rabinstein AA, Ackerson T, et al on behalf of the American Heart Association Stroke Council. 2018 Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2018;49:e46–e99. doi: 10.1161/STR.0000000000000158. AHA/ASA provided writing group and reviewer group conflict-of-interest disclosures. These were reviewed and taken into consideration by the ICSI Diagnosis and Initial Treatment of Ischemic Stroke Work Group. The AHA/ASA document can be accessed at http://www.strokeassociation.org/STROKEORG/.

Return to Table of Contents

The following sections/content and recommendations were not reviewed and endorsed since AHA/ASA has deleted these sections, and they are currently under review:

- Section 1.3 EMS Systems Recommendation 4
- Section 1.4 Hospital Stroke Capabilities Recommendation 1
- Section 1.6 Telemedicine Recommendation 3
- Section 2.2 Brain Imaging Recommendation 11
- Section 3.2 Blood Pressure Recommendation 3
- Section 4.3 Blood Pressure Recommendation 2
- Section 4.6 Dysphagia Recommendation 1
- Section 6.0 All subsections (11)

Return to Table of Contents

Recommendations

Note: In this document, qualification statement signifies substantial qualification/change to the original AHA/ASA recommendation, and recommendations with qualifications statements are labeled as "agree with qualification." Statements that are comments only do not significantly change the original recommendation, and those recommendations are labeled as "agree."

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
1. Prehospital Stroke Management and Systems of Care	
1.1 Prehospital Systems	
1. Public health leaders, along with medical professionals and others, should design and implement public education programs focused on stroke systems and the need to seek emergency care (by calling 9-1-1) in a rapid manner. These programs should be sustained over time and designed to reach racially/ethnically, age, and sex diverse populations. (COR I; LOE B-R) *(Recommendation revised from 2013 Stroke Systems of Care. COR and LOE added.)*	Agree
2. Activation of the 9-1-1 system by patients or other members of the public is strongly recommended. 9-1-1 dispatchers should make stroke a priority dispatch, and transport times should be minimized. (COR I; LOE B-NR) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment Stroke symptoms should prompt dispatchers to upgrade the response to a priority dispatch, despite what local dispatch protocols might recommend. (Ekundayo, 2013)
3. To increase both the number of patients who are treated and the quality of care, educational stroke programs for physicians, hospital personnel, and EMS personnel are recommended. (COR I; LOE B-NR) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
1.2 EMS Assessment and Management	
1. The use of a stroke assessment system by first aid providers, including EMS dispatch personnel, is recommended. (COR I; LOE B-NR) *(Recommendation reworded for clarity from 2015 CPR/ECC. Class and LOE unchanged.)*	Agree
2. EMS personnel should begin the initial management of stroke in the field. Implementation of a stroke protocol to be used by EMS personnel is strongly encouraged. (COR I; LOE B-NR) (*Recommendation revised from 2013 AIS Guidelines.)*	Agree
3. EMS personnel should provide prehospital notification to the receiving hospital that a suspected stroke patient is en route so that the appropriate hospital resources may be mobilized before patient arrival. (COR I; LOE B-NR) (*Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
1.3 EMS Systems	
1. EMS leaders, in coordination with local, regional, and state agencies and in consultation with medical authorities and local experts, should develop triage paradigms and protocols to ensure that patients with a known or suspected stroke are rapidly identified and assessed by use of a validated and standardized instrument for stroke screening, such as the FAST (face, arm, speech test) scale, Los Angeles Prehospital Stroke Screen, or Cincinnati Prehospital Stroke Scale. (COR I; LOE B-NR) *(Recommendation reworded for clarity from 2013 Stroke Systems of Care. Class and LOE added to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. Regional systems of stroke care should be developed. These should consist of the following: (a) Healthcare facilities that provide initial emergency care, including administration of IV alteplase, and, (b) Centers capable of performing endovascular stroke treatment with comprehensive periprocedural care to which rapid transport can be arranged when appropriate. (COR I; LOE A) (*Recommendation reworded for clarity from 2015 Endovascular. Class and LOE unchanged.)*	Agree
3. Patients with a positive stroke screen and/or a strong suspicion of stroke should be transported rapidly to the closest healthcare facilities that can capably administer IV alteplase. (COR I; LOE B-NR) (*Recommendation reworded for clarity from 2013 AIS Guidelines.)*	Agree with qualification There is considerable discussion about identification of large artery occlusion (LVO) type strokes, with implication that disposition may be different for LVO. Such policies vary according to local circumstances and remain controversial. The working group recommends that adoption of such policies should take best care of patients with all stroke mechanisms.
1.5 Hospital Stroke Teams	
1. An organized protocol for the emergency evaluation of patients with suspected stroke is recommended. (COR I; LOE B-NR) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
2. It is recommended that DTN time goals be established. A primary goal of achieving DTN times within 60 minutes in ≥50% of AIS patients treated with IV alteplase should be established. (COR I; LOE B-NR) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree with qualification While a door-to-needle (DTN) goal as set in this recommendation is appropriate, the ICSI stroke work group would encourage organizations to set goals where each patient with acute ischemic stroke who is a candidate for alteplase is treated as fast as possible as long as it's safe for the patient.
3. It may be reasonable to establish a secondary DTN time goal of achieving DTN times within 45 minutes in ≥50% of patients with AIS who were treated with IV alteplase. (COR IIb; LOE C-E0) *(New recommendation)*	Agree with qualification While a door-to-needle (DTN) goal as set in this recommendation is appropriate, the ICSI stroke work group would encourage organizations to set goals where each patient with acute ischemic stroke who is a candidate for alteplase is treated as fast as possible as long as it's safe for the patient.
4. Designation of an acute stroke team that includes physicians, nurses, and laboratory/radiology personnel is recommended. Patients with stroke should have a careful clinical assessment, including neurological examination. (COR I; LOE B-NR) *(Recommendation wording modified from 2013 AIS Guidelines to match Class I stratifications. Class unchanged. LOE added to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
5. Multicomponent quality improvement initiatives, which include ED education and multidisciplinary teams with access to neurological expertise, are recommended to safely increase IV thrombolytic treatment. (COR I; LOE A) *(New recommendation.)*	Agree with comment Add "the percent of ischemic stroke patients receiving" before "IV thrombolytic treatment."
1.6 Telemedicine	
1. For sites without in-house imaging interpretation expertise, teleradiology systems approved by the US Food and Drug Administration are recommended for timely review of brain imaging in patients with suspected acute stroke. (COR I; LOE A) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
2. When implemented within a telestroke network, teleradiology systems approved by the US Food and Drug Administration are useful in supporting rapid imaging interpretation in time for IV alteplase administration decision making. (COR I; LOE A) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE revised.)*	Agree
4. Telestroke/teleradiology evaluations of AIS patients can be effective for correct IV alteplase eligibility decision making. (COR IIa; LOE B-NR) *(New recommendation)*	Agree with comment The ICSI work group suggests replacing "correct" with "appropriate".
5. Administration of IV alteplase guided by telestroke consultation for patients with AIS may be as safe and as beneficial as that of stroke centers. (COR IIb; LOE B-NR) *(New recommendation)*	Agree
6. Providing alteplase decision-making support via telephone consultation to community physicians is feasible and safe and may be considered when a hospital has access to neither an in-person stroke team nor a telestroke system. (COR IIb; LOE C-LD) *(New recommendation)*	Agree
7. Telestroke networks may be reasonable for triaging patients with AIS who may be eligible for interfacility transfer in order to be considered for acute mechanical thrombectomy. (COR IIb; LOE B-NR) *(New recommendation)*	Agree with comment The ICSI work group suggests replacing "may be" with "are."
1.7 Organization and Integration of Components	
1. It may be useful for primary stroke centers and other healthcare facilities that provide initial emergency care, including administration of IV alteplase, to develop the capability of performing emergency noninvasive intracranial vascular imaging to most appropriately select patients for transfer for endovascular intervention and to reduce the time to EVT. (COR IIb; LOE C-LD) *(Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment The ICSI work group suggests replacing the second "to" with "on" and "select" with "selected."
2. Mechanical thrombectomy requires the patient to be at an experienced stroke center with rapid access to cerebral angiography, qualified neurointerventionalists, and a comprehensive periprocedural care team. Systems should be designed, executed, and monitored to emphasize expeditious assessment and treatment. Outcomes for all patients should be tracked. Facilities are encouraged to define criteria that can be used to credential individuals who can perform safe and timely intra-arterial revascularization procedures. (COR I; LOE C-E0) *(Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
3. All hospitals caring for stroke patients within a stroke system of care should develop, adopt, and adhere to care protocols that reflect current care guidelines as established by national and international professional organizations and state and federal agencies and laws. (COR I; LOE C-E0) *(2013 Systems of Care Recommendation)*	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
4. Different services within a hospital that may be transferring patients through a continuum of care, as well as different hospitals that may be transferring patients to other facilities, should establish hand-off and transfer protocols and procedures that ensure safe and efficient patient care within and between facilities. Protocols for interhospital transfer of patients should be established and approved beforehand so that efficient patient transfers can be accomplished at all hours of the day and night. (COR I; LOE C-E0) *(2013 Systems of Care Recommendation)*	Agree
5. It may be beneficial for government agencies and third-party payers to develop and implement reimbursement schedules for patients with acute stroke that reflect the demanding care and expertise that such patients require to achieve an optimal outcome, regardless of whether they receive a specific medication or procedure. (COR IIb; LOE C-E0) *(Revised recommendation from 2013 Systems of Care)*	Agree
1.8 Establishment of Data Repositories	
1. Participation in a stroke data repository is recommended to promote consistent adherence to current treatment guidelines, to allow continuous quality improvement, and to improve patient outcomes. (COR I; LOE B-NR) *(New recommendation)*	Agree
1.9 Stroke System Care Quality Improvement Process	
1. Healthcare institutions should organize a multidisciplinary quality improvement committee to review and monitor stroke care quality benchmarks, indicators, evidence-based practices, and outcomes. The formation of a clinical process improvement team and the establishment of a stroke care data bank are helpful for such quality of care assurances. The data repository can be used to identify the gaps or disparities in quality stroke care. Once the gaps have been identified, specific interventions can be initiated to address these gaps or disparities. (COR I; LOE B-NR) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. Continuous quality improvement processes, implemented by each major element of a stroke system of care and the system as a whole, can be useful in improving patient care or outcomes. (COR IIa; LOE B-NR) *(Revised recommendation from 2013 Stroke Systems of Care.)*	Agree
3. Stroke outcome measures should include adjustments for baseline severity. (COR I; LOE B-NR) *(Revised recommendation from 2013 Stroke Systems of Care.)*	Agree
2. Emergency Evaluation and Treatment	
2.1 Stroke Scales	
1. The use of a stroke severity rating scale, preferably the NIHSS, is recommended. (COR I; LOE B-NR) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015*. (*Recommendation Classification System.)*	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
2.2 Brain Imaging	
1. All patients admitted to hospital with suspected acute stroke should receive brain imaging evaluation on arrival to hospital. In most cases, noncontrast CT (NCCT) will provide the necessary information to make decisions about acute management. (COR I; LOE B-NR *(Recommendation revised from 2013 AIS Guidelines.)*	Agree with comment NCCT=Noncontrast Head CT
2. Systems should be established so that brain imaging studies can be performed within 20 minutes of arrival in the ED in at least 50% of patients who may be candidates for IV alteplase and/or mechanical thrombectomy. (COR I; LOE B-NR) *(New recommendation)*	Agree with qualification While the brain imaging studies goal as set in this recommendation is appropriate, the ICSI stroke work group would encourage organizations to set goals where brain imaging studies in each patient with acute ischemic stroke who are candidates for either alteplase or mechanical thrombectomy are performed as fast as possible consistent with patient safety.
3. There remains insufficient evidence to identify a threshold of acute CT hypoattenuation severity or extent that affects treatment response to IV alteplase. The extent and severity of acute hypoattenuation or early ischemic changes should not be used as a criterion to withhold therapy for such patients who otherwise qualify. (COR III: No Benefit; LOE B-R) *(Recommendation revised from 2016 IV Alteplase.)*	Agree with comment This recommendation does not apply to criteria for mechanical thrombectomy.
4. The CT hyperdense MCA sign should not be used as a criterion to withhold IV alteplase from patients who otherwise qualify. (COR III: No Benefit; LOE B-R) *(New recommendation)*	Agree
5. Routine use of magnetic resonance imaging (MRI) to exclude cerebral microbleeds (CMBs) before administration of IV alteplase is not recommended. (COR III: No Benefit; LOE B-NR) *(New recommendation)*	Agree
6. Use of imaging criteria to select ischemic stroke patients who awoke with stroke or have unclear time of symptom onset for treatment with IV alteplase is not recommended outside a clinical trial. (COR III: No Benefit; LOE B-NR) *(Recommendation unchanged from 2016 IV Alteplase. Class and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
7. Multimodal CT and MRI, including perfusion imaging, should not delay administration of IV alteplase. (COR III: Harm; LOE B-NR) *(New recommendation)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
8. For patients who otherwise meet criteria for EVT, a noninvasive intracranial vascular study is recommended during the initial imaging evaluation of the acute stroke patient, but should not delay IV alteplase if indicated. For patients who qualify for IV alteplase according to guidelines from professional medical societies, initiating IV alteplase before noninvasive vascular imaging is recommended for patients who have not had noninvasive vascular imaging as part of their initial imaging assessment for stroke. Noninvasive intracranial vascular imaging should then be obtained as quickly as possible. (COR I; LOE A) *(Recommendation reworded for clarity from 2015 Endovascular. Class and LOE unchanged.)*	Agree with qualification The ICSI work group recognizes that clinical practice may vary. If an institution's initial imaging evaluation of an acute stroke patient routinely includes rapid, non-invasive vascular imaging that does not delay administration of IV r-tPA, then it would be reasonable to obtain vascular imaging prior to administering IV r-tPA. Conversely, there may be instances where vascular imaging is not necessary prior to initiating endovascular treatment (e.g., presence of a hyperdense vessel sign on non-contrast head CT, or clinical syndrome of large vessel occlusion stroke in the setting of a normal head CT).
9. For patients who otherwise meet criteria for EVT, it is reasonable to proceed with CTA if indicated in patients with suspected intracranial LVO before obtaining a serum creatinine concentration in patients without a history of renal impairment. (COR IIa; LOE B-NR) *(New recommendation)*	Agree
10. In patients who are potential candidates for mechanical thrombectomy, imaging of the extracranial carotid and vertebral arteries, in addition to the intracranial circulation, is reasonable to provide useful information on patient eligibility and endovascular procedural planning. (COR IIa; LOE C-E0) *(New recommendation)*	Agree
12. In selected patients with AIS within 6 to 24 hours of last known normal who have LVO in the anterior circulation, obtaining CTP, DW-MRI, or MRI perfusion is recommended to aid in patient selection for mechanical thrombectomy, but only when imaging and other eligibility criteria from RCTs showing benefit are being strictly applied in selecting patients for mechanical thrombectomy. (COR I; LOE A) *(New recommendation)*	Agree
13. It may be reasonable to incorporate collateral flow status into clinical decision making in some candidates to determine eligibility for mechanical thrombectomy. (COR IIb; LOE C-LD) *(Recommendation revised from 2015 Endovascular.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
2.3 Other Diagnostic Tests	
1. Only the assessment of blood glucose must precede the initiation of IV alteplase in all patients. (COR I; LOE B-R) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. Baseline ECG assessment is recommended in patients presenting with AIS, but should not delay initiation of IV alteplase. (COR I; LOE B-NR) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
3. Baseline troponin assessment is recommended in patients presenting with AIS, but should not delay initiation of IV alteplase. (COR I; LOE B-NR) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE revised.)*	Agree
4. Usefulness of chest radiographs in the hyperacute stroke setting in the absence of evidence of acute pulmonary, cardiac, or pulmonary vascular disease is unclear. If obtained, they should not unnecessarily delay administration of IV alteplase. (COR IIb; LOE B-NR) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment The ICSI work group suggests deleting "unnecessarily."
3. General Supportive Care and Emergency Treatment	
3.1 Airway, Breathing, and Oxygenation	
1. Airway support and ventilatory assistance are recommended for the treatment of patients with acute stroke who have decreased consciousness or who have bulbar dysfunction that causes compromise of the airway. (COR I; LOE C-E0) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. Supplemental oxygen should be provided to maintain oxygen saturation >94%. (COR I; LOE C-LD) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
3. Supplemental oxygen is not recommended in nonhypoxic patients with AIS. (COR III: No Benefit; LOE B-R) *(Recommendation unchanged from 2013 AIS Guidelines. COR and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4. Hyperbaric oxygen (HBO) is not recommended for patients with AIS except when caused by air embolization. (COR III: No Benefit; LOE B-NR) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree
3.2 Blood Pressure	
1. Hypotension and hypovolemia should be corrected to maintain systemic perfusion levels necessary to support organ function. (COR I; LOE C-E0) *(New recommendation)*	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
2. Patients who have elevated BP and are otherwise eligible for treatment with IV alteplase should have their BP carefully lowered so that their systolic BP is <185 mm Hg and their diastolic BP is <110 mm Hg before IV fibrinolytic therapy is initiated. (COR I; LOE B-NR) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with qualification In addition, the ICSI work group recommends checking in with the attending physician on targeting individualized patient goals for blood pressure.
4. The usefulness of drug-induced hypertension in patients with AIS is not well established. (COR IIb; LOE C-LD) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE revised.)*	Agree
3.3 Temperature	
1. Sources of hyperthermia (temperature >38°C) should be identified and treated, and antipyretic medications should be administered to lower temperature in hyperthermic patients with stroke. (COR I; LOE C-E0) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. The benefit of induced hypothermia for treating patients with ischemic stroke is not well established. Hypothermia should be offered only in the context of ongoing clinical trials. (COR IIb; LOE B-R) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree with comment A recent trial of 50 patients showed that addition of moderate hypothermia early after hemicraniectomy did not improve mortality and functional outcome compared with standard care and was harmful in patients with malignant middle cerebral artery stroke. More research is needed. (Neugebauer, 2019)
3.4 Blood Glucose	
1. Evidence indicates that persistent in-hospital hyperglycemia during the first 24 hours after AIS is associated with worse outcomes than normoglycemia and thus, it is reasonable to treat hyperglycemia to achieve blood glucose levels in a range of 140 to 180 mg/dL and to closely monitor to prevent hypoglycemia in patients with AIS. (COR IIa; LOE C-LD) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. Hypoglycemia (blood glucose <60 mg/dL) should be treated in patients with AIS. (COR I; LOE C-LD) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
3.5 IV Alteplase	
1. IV alteplase (0.9 mg/kg, maximum dose 90 mg over 60 minutes with initial 10% of dose given as bolus over 1 minute) is recommended for selected patients who may be treated within 3 hours of ischemic stroke symptom onset or patient last known well or at baseline state. Physicians should review the criteria outlined in Table 6 to determine patient eligibility. (Class I; LOE A) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class and LOE unchanged.)*	Agree
2. IV alteplase (0.9 mg/kg, maximum dose 90 mg over 60 minutes with initial 10% of dose given as bolus over 1 minute) is also recommended for selected patients who can be treated within 3 and 4.5 hours of ischemic stroke symptom onset or patient last known well. Physicians should review the criteria outlined in Table 6 determine patient eligibility. (COR I; LOE B-R) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
3. For otherwise eligible patients with mild stroke presenting in the 3- to 4.5-hour window, treatment with IV alteplase may be reasonable. Treatment risks should be weighed against possible benefits. (COR IIb; LOE B-NR) *(New recommendation)*	Agree with comment Mild stroke includes low NIHSS score (0-5) and clinical judgment of "non-disabling." Low NIHSS score (0-5) itself does not necessarily mean "non-disabling."

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
4. In otherwise eligible patients who have had a previously demonstrated small number (1–10) of CMBs on MRI, administration of IV alteplase is reasonable. (COR IIa; LOE B-NR) *(New recommendation)*	Agree with qualification It is the consensus of the ICSI work group to add the following qualification to the recommendation. The work group also recommends that recommendations 4 and 5 be combined. Data regarding the risk of sICH following alteplase for AIS patients with known cerebral microbleeds are limited by variability in imaging techniques and inclusion of few patients with substantial cerebral microbleed burden. The predominant finding in published analyses has been an association between increased burden of cerebral microbleeds and increased rate of post-alteplase symptomatic ICH. A clear CMB threshold where harm from sICH outweighs the benefits of alteplase, however, has not been established. Clinical judgement should include consideration of the number of cerebral microbleeds in conjunction with the potential benefit of thrombolysis. Alteplase in patients with > 10 CMBs should be used with caution. (Chacon-Portillo, 2018; Nagaraja, 2018; Charidimou, 2017; Zand, 2018; Shoamanesh, 2017)

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
5. In otherwise eligible patients who have had a previously demonstrated high burden of CMBs (>10) on MRI, treatment with IV alteplase may be associated with an increased risk of sICH, and the benefits of treatment are uncertain. Treatment may be reasonable if there is the potential for substantial benefit. (COR IIb; LOE B-NR) *(New recommendation)*	Agree with qualification It is the consensus of the ICSI work group to add the following qualification to the recommendation. The work group also recommends that recommendations 4 and 5 be combined. Data regarding the risk of sICH following alteplase for AIS patients with known cerebral microbleeds are limited by variability in imaging techniques and inclusion of few patients with substantial cerebral microbleed burden. The predominant finding in published analyses has been an association between increased burden of cerebral microbleeds and increased rate of post-alteplase symptomatic ICH. A clear CMB threshold where harm from sICH outweighs the benefits of alteplase, however, has not been established. Clinical judgement should include consideration of the number of cerebral microbleeds in conjunction with the potential benefit of thrombolysis. Alteplase in patients with > 10 CMBs should be used with caution. (Chacon-Portillo, 2018; Nagaraja, 2018; Charidimou, 2017; Zand, 2018; Shoamanesh, 2017)
6. IV alteplase for adults presenting with an AIS with known sickle cell disease can be beneficial. (COR IIa; LOE B-NR) *(New recommendation)*	Agree
7. Abciximab should not be administered concurrently with IV alteplase. (COR III:Harm; LOE B-R) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree
8. IV alteplase should not be administered to patients who have received a treatment dose of low-molecular-weight heparin (LMWH) within the previous 24 hours. (COR III:Harm; LOE B-NR) *(Recommendation reworded for clarity from 2016 IV Alteplase. Class and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment Prophylactic doses of LMWH received in the past 24 hours do not exclude a patient from receiving IV alteplase.

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
9. The potential risks should be discussed during thrombolysis eligibility deliberation and weighed against the anticipated benefits during decision making. (COR I; LOE C-E0) *(Recommendation and Class unchanged from 2016 IV Alteplase. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
10. Given the extremely low risk of unsuspected abnormal platelet counts or coagulation studies in a population, it is reasonable that urgent IV alteplase treatment not be delayed while waiting for hematologic or coagulation testing if there is no reason to suspect an abnormal test. (COR IIa; LOE B-NR) *(Recommendation and Class unchanged from 2015 IV Alteplase. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
11. Treating clinicians should be aware that hypoglycemia and hyperglycemia may mimic acute stroke presentations and determine blood glucose levels before IV alteplase initiation. IV alteplase is not indicated for nonvascular conditions. (COR III: No Benefit; LOE B-NR) *(Recommendation reworded for clarity from 2015 IV Alteplase. Class and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
12. Because time from onset of symptoms to treatment has such a powerful impact on outcomes, treatment with IV alteplase should not be delayed to monitor for further improvement. (COR III: Harm; LOE C-E0) *(Recommendation wording modified from 2015 IV Alteplase to match Class III stratifications and reworded for clarity. Class and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
13. In patients undergoing fibrinolytic therapy, physicians should be prepared to treat potential emergent adverse effects, including bleeding complications and angioedema that may cause partial airway obstruction. (COR I; LOE B-NR) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
14. BP should be maintained <180/105 mm Hg for at least the first 24 hours after IV alteplase treatment. (COR I; LOE B-NR) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
15. The risk of antithrombotic therapy within the first 24 hours after treatment with IV alteplase (with or without EVT) is uncertain. Use might be considered in the presence of concomitant conditions for which such treatment given in the absence of IV alteplase is known to provide substantial benefit or withholding such treatment is known to cause substantial risk. (COR IIb; LOE B-NR) *(New recommendation)*	Agree
16. In patients eligible for IV alteplase, benefit of therapy is time dependent, and treatment should be initiated as quickly as possible. (COR I; LOE A) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class and LOE unchanged.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
Table 6. Eligibility Recommendations for IV Alteplase in Patients With AIS	
Indications (Class I)	
Within 3 h*When uncertain, the time of onset time should be considered the time when the patient was last known to be normal or at baseline neurological condition.	
1. IV alteplase (0.9 mg/kg, maximum dose 90 mg over 60 min with initial 10% of dose given as bolus over 1 min) is recommended for selected patients who may be treated within 3 h of ischemic stroke symptom onset or patient last known well or at baseline state. Physicians should review the criteria outlined in this table to determine patient eligibility. (Class I; LOE A)	Agree
Age	
1. For otherwise medically eligible patients ≥18 y of age, IV alteplase administration within 3 h is equally recommended for patients <80 and >80 y of age. (Class I; LOE A)	Agree
Severity	
1. For severe stroke symptoms, IV alteplase is indicated within 3 h from symptom onset of ischemic stroke. Despite increased risk of hemorrhagic transformation, there is still proven clinical benefit for patients with severe stroke symptoms. (Class I; LOE A)	Agree
2. For patients with mild but disabling stroke symptoms, IV alteplase is indicated within 3 h from symptom onset of ischemic stroke. There should be no exclusion for patients with mild but nonetheless disabling stroke symptoms, in the opinion of the treating physician, from treatment with IV alteplase because there is proven clinical benefit for those patients. (Class I; LOE B-R)	Agree
3–4.5 h*	
1. IV alteplase (0.9 mg/kg, maximum dose 90 mg over 60 min with initial 10% of dose given as bolus over 1 min) is also recommended for selected patients who can be treated within 3 and 4.5 h of ischemic stroke symptom onset or patient last known well. Physicians should review the criteria outlined in this table to determine patient eligibility. (Class I; LOE B-R)	Agree
Age/Diabetes mellitus/Prior stroke/Severity/OACs/ Imaging	
1. IV alteplase treatment in the 3- to 4.5-h time window is recommended for those patients ≤80 y of age, without a history of both diabetes mellitus and prior stroke, NIHSS score ≤25, not taking any OACs, and without imaging evidence of ischemic injury involving more than one third of the MCA territory. (Class I; LOE B-R)	Agree
Urgency	
1. Treatment should be initiated as quickly as possible within the above listed time frames because time to treatment is strongly associated with outcomes. (Class I; LOE A)	Agree
Blood pressure	
1. IV alteplase is recommended in patients whose BP can be lowered safely (to <185/110 mm Hg) with antihypertensive agents, with the physician assessing the stability of the BP before starting IV alteplase. (Class I; LOE B-NR)	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
Blood glucose	
1. IV alteplase is recommended in otherwise eligible patients with initial glucose levels >50 mg/dL. (Class I; LOE A)	Agree
CT	
1. IV alteplase administration is recommended in the setting of early ischemic changes on NCCT of mild to moderate extent (other than frank hypodensity). (Class I; LOE A)	Agree
Prior antiplatelet therapy	
1. IV alteplase is recommended for patients taking antiplatelet drug monotherapy before stroke on the basis of evidence that the benefit of alteplase outweighs a possible small increased risk of sICH. (Class I; LOE A)	Agree
2. IV alteplase is recommended for patients taking antiplatelet drug combination therapy (eg, aspirin and clopidogrel) before stroke on the basis of evidence that the benefit of alteplase outweighs a probable increased risk of sICH. (Class I; LOE B-NR)	Agree
End-stage renal disease	
1. In patients with end-stage renal disease on hemodialysis and normal aPTT, IV alteplase is recommended. (Class I; LOE C-LD) However, those with elevated aPTT may have elevated risk for hemorrhagic complications.	Agree
Contraindications (Class III) **Time of onset**	
1. IV alteplase is not recommended in ischemic stroke patients who have an unclear time and/ or unwitnessed symptom onset and in whom the time last known to be at baseline state is >3 or 4.5 h. (Class III: No Benefit; LOE B-NR)	Agree
2. IV alteplase is not recommended in ischemic stroke patients who awoke with stroke with time last known to be at baseline state >3 or 4.5 h. (Class III: No Benefit; LOE B-NR)	Agree
CT	
1. IV alteplase should not be administered to a patient whose CT reveals an acute intracranial hemorrhage. (Class III: Harm; LOE C-EO)	Agree
2. There remains insufficient evidence to identify a threshold of hypoattenuation severity or extent that affects treatment response to alteplase. However, administering IV alteplase to patients whose CT brain imaging exhibits extensive regions of clear hypoattenuation is not recommended. These patients have a poor prognosis despite IV alteplase, and severe hypoattenuation defined as obvious hypodensity represents irreversible injury. (Class III: No Benefit; LOE A)	Agree
Ischemic stroke within 3 mo	
1. Use of IV alteplase in patients presenting with AIS who have had a prior ischemic stroke within 3 mo may be harmful. (Class III: Harm; LOE B-NR)	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
Severe head trauma within 3 mo	
1. In AIS patients with recent severe head trauma (within 3 mo), IV alteplase is contraindicated. (Class III: Harm; LOE C-EO)	Agree
2. Given the possibility of bleeding complications from the underlying severe head trauma, IV alteplase should not be administered in posttraumatic infarction that occurs during the acute in-hospital phase. (Class III: Harm; LOE C-EO) *(Recommendation wording modified to match Class III stratifications.)*	Agree
Intracranial/intraspinal surgery within 3 mo	
1. For patients with AIS and a history of intracranial/spinal surgery within the prior 3 mo, IV alteplase is potentially harmful. (Class III: Harm; LOE C-EO)	Agree
History of intracranial hemorrhage	
1. IV alteplase administration in patients who have a history of intracranial hemorrhage is potentially harmful. (Class III: Harm; LOE C-EO)	Agree
Subarachnoid hemorrhage	
1. IV alteplase is contraindicated in patients presenting with symptoms and signs most consistent with an SAH. (Class III: Harm; LOE C-EO)	Agree
GI malignancy or GI bleed within 21 d	
1. Patients with a structural GI malignancy or recent bleeding event within 21 d of their stroke event should be considered high risk, and IV alteplase administration is potentially harmful. (Class III: Harm; LOE C-EO)	Agree
Coagulopathy	
1. The safety and efficacy of IV alteplase for acute stroke patients with platelets <100 000/mm3, INR >1.7, aPTT >40 s, or PT >15 s are unknown, and IV alteplase should not be administered. (Class III: Harm; LOE C-EO) (In patients without history of thrombocytopenia, treatment with IV alteplase can be initiated before availability of platelet count but should be discontinued if platelet count is <100 000/mm3. In patients without recent use of OACs or heparin, treatment with IV alteplase can be initiated before availability of coagulation test results but should be discontinued if INR is >1.7 or PT is abnormally elevated by local laboratory standards.) *(Recommendation wording modified to match Class III stratifications.)*	Agree
LMWH	
1. IV alteplase should not be administered to patients who have received a treatment dose of LMWH within the previous 24 h. (Class III: Harm; LOE B-NR) *(Recommendation wording modified to match Class III stratifications.)*	Agree with comment Prophylactic doses of LMWH received in the past 24 hours do not exclude a patient from receiving IV alteplase.

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
Thrombin inhibitors or factor Xa inhibitors	
1. The use of IV alteplase in patients taking direct thrombin inhibitors or direct factor Xa inhibitors has not been firmly established but may be harmful. (Class III: Harm; LOE C-EO) IV alteplase should not be administered to patients taking direct thrombin inhibitors or direct factor Xa inhibitors unless laboratory tests such as aPTT, INR, platelet count, ecarin clotting time, thrombin time, or appropriate direct factor Xa activity assays are normal or the patient has not received a dose of these agents for >48 h (assuming normal renal metabolizing function). (Alteplase could be considered when appropriate laboratory tests such as aPTT, INR, ecarin clotting time, thrombin time, or direct factor Xa activity assays are normal or when the patient has not taken a dose of these ACs for >48 h and renal function is normal.) *(Recommendation wording modified to match Class III stratifications.)*	Agree
Glycoprotein IIb/IIIa receptor inhibitors	
1. Antiplatelet agents that inhibit the glycoprotein IIb/IIIa receptor should not be administered concurrently with IV alteplase outside a clinical trial. (Class III: Harm; LOE B-R) *(Recommendation wording modified to match Class III stratifications.)*	Agree
Infective endocarditis	
1. For patients with AIS and symptoms consistent with infective endocarditis, treatment with IV alteplase should not be administered because of the increased risk of intracranial hemorrhage. (Class III: Harm; LOE C-LD) *(Recommendation wording modified to match Class III stratifications.)*	Agree
Aortic arch dissection	
1. IV alteplase in AIS known or suspected to be associated with aortic arch dissection is potentially harmful and should not be administered. (Class III: Harm; LOE C-EO) *(Recommendation wording modified to match Class III stratifications.)*	Agree
Intra-axial intracranial neoplasm	
1. IV alteplase treatment for patients with AIS who harbor an intra-axial intracranial neoplasm is potentially harmful. (Class III: Harm; LOE C-EO)	Agree
Additional recommendations for treatment with IV alteplase for patients with AIS (Class II)	
Extended 3- to 4.5-h window	
1. For patients >80 y of age presenting in the 3- to 4.5-h window, IV alteplase is safe and can be as effective as in younger patients. (Class IIa; LOE B-NR)	Agree
2. For patients taking warfarin and with an INR ≤1.7 who present in the 3- to 4.5-h window, IV alteplase appears safe and may be beneficial. (Class IIb; LOE B-NR)	Agree
3. In AIS patients with prior stroke and diabetes mellitus presenting in the 3- to 4.5- h window, IV alteplase may be as effective as treatment in the 0- to 3-h window and may be a reasonable option. (Class IIb; LOE B-NR)	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
Severity 0- to 3-h window	
1. Within 3 h from symptom onset, treatment of patients with mild ischemic stroke symptoms that are judged as nondisabling may be considered. Treatment risks should be weighed against possible benefits; however, more study is needed to further define the risk-to-benefit ratio. (Class IIb; LOE C-LD)	Agree
Severity 3- to 4.5-h window	
1. For otherwise eligible patients with mild stroke presenting in the 3- to 4.5-h window, IV alteplase may be as effective as treatment in the 0- to 3-h window and may be a reasonable option. Treatment risks should be weighed against possible benefits. (Class IIb; LOE B-NR)	Agree
2. The benefit of IV alteplase between 3 and 4.5 h from symptom onset for patients with very severe stroke symptoms (NIHSS > 25) is uncertain. (Class IIb; LOE C-LD)	Agree
Preexisting disability	
1. Preexisting disability does not seem to independently increase the risk of sICH after IV alteplase, but it may be associated with less neurological improvement and higher mortality. Thrombolytic therapy with IV alteplase for acute stroke patients with preexisting disability (mRS score ≥2) may be reasonable, but decisions should take into account relevant factors, including quality of life, social support, place of residence, need for a caregiver, patients' and families' preferences, and goals of care. (Class IIb; LOE B-NR)	Agree
2. Patients with preexisting dementia may benefit from IV alteplase. Individual considerations such as life expectancy and premorbid level of function are important to determine whether alteplase may offer a clinically meaningful benefit. (Class IIb; LOE B-NR)	Agree
Early improvement	
1. IV alteplase treatment is reasonable for patients who present with moderate to severe ischemic stroke and demonstrate early improvement but remain moderately impaired and potentially disabled in the judgment of the examiner. (Class IIa; LOE A)	Agree
Seizure at onset	
1. IV alteplase is reasonable in patients with a seizure at the time of onset of acute stroke if evidence suggests that residual impairments are secondary to stroke and not a postictal phenomenon. (Class IIa; LOE C-LD)	Agree
Blood glucose	
1. Treatment with IV alteplase in patients with AIS who present with initial glucose levels <50 or >400 mg/dL that are subsequently normalized and who are otherwise eligible may be reasonable. *(Recommendation modified from 2015 IV Alteplase to conform to text of 2015 IV Alteplase. [Class IIb; LOE C-LD])*	Agree
Coagulopathy	
1. The safety and efficacy of IV alteplase for acute stroke patients with a clinical history of potential bleeding diathesis or coagulopathy are unknown. IV alteplase may be considered on a case-by-case basis. (Class IIb; LOE C-EO)	Agree
2. IV alteplase may be reasonable in patients who have a history of warfarin use and an INR ≤1.7 and/or a PT <15 s. (Class IIb; LOE B-NR)	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
4. Although the benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for carefully selected patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have causative occlusion of the MCA segment 2 (M2) or MCA segment 3 (M3) portion of the MCAs. (COR IIb; LOE B-R) *(Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE revised.)*	Agree with qualification Endovascular treatment of more distal MCA occlusions such as the M3 or M4 division is not well studied. Interventions on very distal occlusions are less likely to result in clinical benefit than more proximal occlusion (Lemmens, 2016). It is consensus of the ICSI work group to not recommend routine endovascular intervention of occlusion more distal than the M2 division of the MCA. The ICSI work group notes that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.
5. Although the benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for carefully selected patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have causative occlusion of the anterior cerebral arteries, vertebral arteries, basilar artery, or posterior cerebral arteries. (COR IIb; LOE C-E0) *(Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment The ICSI work group notes that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.
6. Although its benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have prestroke mRS score >1, ASPECTS <6, or NIHSS score <6, and causative occlusion of the internal carotid artery (ICA) or proximal MCA (M1). Additional randomized trial data are needed. (COR IIb; LOE B-R) *(Recommendation unchanged from 2015 Endovascular.)*	Agree with comment The ICSI work group acknowledges that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.
7. In selected patients with AIS within 6 to 16 hours of last known normal who have LVO in the anterior circulation and meet other DAWN or DEFUSE 3 eligibility criteria, mechanical thrombectomy is recommended. (COR I; LOE A) *(New recommendation.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
Extracranial cervical dissections	
1. IV alteplase in AIS known or suspected to be associated with extracranial cervical arterial dissection is reasonably safe within 4.5 h and probably recommended. (Class IIa; LOE C-LD)	Agree with comment The ICSI work group notes that treatment risks should be weighed against potential benefits of treatment.
Intracranial arterial dissection	
1. IV alteplase usefulness and hemorrhagic risk in AIS known or suspected to be associated with intracranial arterial dissection remain unknown, uncertain, and not well established. (Class IIb; LOE C-LD)	Agree
Unruptured intracranial aneurysm	
1. For patients presenting with AIS who are known to harbor a small or moderate-sized (<10 mm) unruptured and unsecured intracranial aneurysm, administration of IV alteplase is reasonable and probably recommended. (Class IIa; LOE C-LD)	Agree
2. Usefulness and risk of IV alteplase in patients with AIS who harbor a giant unruptured and unsecured intracranial aneurysm are not well established. (Class IIb; LOE C-LD)	Agree
Intracranial vascular malformations	
1. For patients presenting with AIS who are known to harbor an unruptured and untreated intracranial vascular malformation the usefulness and risks of administration of IV alteplase are not well established. (Class IIb; LOE C-LD)	Agree
2. Because of the increased risk of ICH in this population of patients, IV alteplase may be considered in patients with stroke with severe neurological deficits and a high likelihood of morbidity and mortality to outweigh the anticipated risk of ICH secondary to thrombolysis. (Class IIb; LOE C-LD)	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
CMBs	
1. In otherwise eligible patients who have previously had a small number (1–10) of CMBs demonstrated on MRI, administration of IV alteplase is reasonable. (Class IIa; Level B-NR)	Agree with qualification It is the consensus of the ICSI work group to add the following qualification to the recommendation. The work group also recommends that recommendations 4 and 5 be combined. Data regarding the risk of sICH following alteplase for AIS patients with known cerebral microbleeds are limited by variability in imaging techniques and inclusion of few patients with substantial cerebral microbleed burden. The predominant finding in published analyses has been an association between increased burden of cerebral microbleeds and increased rate of post-alteplase symptomatic ICH. A clear CMB threshold where harm from sICH outweighs the benefits of alteplase, however, has not been established. Clinical judgement should include consideration of the number of cerebral microbleeds in conjunction with the potential benefit of thrombolysis. Alteplase in patients with > 10 CMBs should be used with caution. (Chacon-Portillo, 2018; Nagaraja, 2018; Charidimou, 2017; Zand, 2018; Shoamanesh, 2017)

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
2. In otherwise eligible patients who have previously had a high burden of CMBs (>10) demonstrated on MRI, treatment with IV alteplase may be associated with an increased risk of sICH, and the benefits of treatment are uncertain. Treatment may be reasonable if there is the potential for substantial benefit. (Class IIb; Level B-NR)	Agree with qualification It is the consensus of the ICSI work group to add the following qualification to the recommendation. The work group also recommends that recommendations 4 and 5 be combined. Data regarding the risk of sICH following alteplase for AIS patients with known cerebral microbleeds are limited by variability in imaging techniques and inclusion of few patients with substantial cerebral microbleed burden. The predominant finding in published analyses has been an association between increased burden of cerebral microbleeds and increased rate of post-alteplase symptomatic ICH. A clear CMB threshold where harm from sICH outweighs the benefits of alteplase, however, has not been established. Clinical judgement should include consideration of the number of cerebral microbleeds in conjunction with the potential benefit of thrombolysis. Alteplase in patients with > 10 CMBs should be used with caution. (Chacon-Portillo, 2018; Nagaraja, 2018; Charidimou, 2017; Zand, 2018; Shoamanesh, 2017)
Extra-axial intracranial neoplasms	
1. IV alteplase treatment is probably recommended for patients with AIS who harbor an extra-axial intracranial neoplasm. (Class IIa; LOE C-EO)	Agree
Acute MI	
1. For patients presenting with concurrent AIS and acute MI, treatment with IV alteplase at the dose appropriate for cerebral ischemia, followed by percutaneous coronary angioplasty and stenting if indicated, is reasonable. (Class IIa; LOE C-EO)	Agree
Recent MI	
1. For patients presenting with AIS and a history of recent MI in the past 3 mo, treating the ischemic stroke with IV alteplase is reasonable if the recent MI was non-STEMI. (Class IIa; LOE C-LD)	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
2. For patients presenting with AIS and a history of recent MI in the past 3 mo, treating the ischemic stroke with IV alteplase is reasonable if the recent MI was a STEMI involving the right or inferior myocardium. (Class IIa; LOE C-LD)	Agree
3. For patients presenting with AIS and a history of recent MI in the past 3 mo, treating the ischemic stroke with IV alteplase may reasonable if the recent MI was a STEMI involving the left anterior myocardium. (Class IIb; LOE C-LD)	Agree
Other cardiac diseases	
1. For patients with major AIS likely to produce severe disability and acute pericarditis, treatment with IV alteplase may be reasonable. (Class IIb; LOE C-EO); urgent consultation with a cardiologist is recommended in this situation.	Agree with qualification It is the consensus of the ICSI work group to add the following qualification to the recommendation: Any benefits of treatment should be weighed against the potential risks. We support the statement that "urgent consultation with a cardiologist is recommended in this situation."
2. For patients presenting with moderate AIS likely to produce mild disability and acute pericarditis, treatment with IV alteplase is of uncertain net benefit. (Class IIb; LOE C-EO)	Agree with qualification It is the consensus of the ICSI work group to add the following qualification to the recommendation: Any benefits of treatment should be weighed against the potential risks. We recommend that a consultation with a cardiologist be done in this situation.
3. For patients with major AIS likely to produce severe disability and known left atrial or ventricular thrombus, treatment with IV alteplase may be reasonable. (Class IIb; LOE C-LD)	Agree
4. For patients presenting with moderate AIS likely to produce mild disability and known left atrial or ventricular thrombus, treatment with IV alteplase is of uncertain net benefit. (Class IIb; LOE C-LD)	Agree
5. For patients with major AIS likely to produce severe disability and cardiac myxoma, treatment with IV alteplase may be reasonable. (Class IIb; LOE C-LD)	Agree
6. For patients presenting with major AIS likely to produce severe disability and papillary fibroelastoma, treatment with IV alteplase may be reasonable. (Class IIb; LOE C-LD)	Agree
Procedural stroke	
1. IV alteplase is reasonable for the treatment of AIS complications of cardiac or cerebral angiographic procedures, depending on the usual eligibility criteria. (Class IIa; LOE A)	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
Systemic malignancy	
1. The safety and efficacy of alteplase in patients with current malignancy are not well established. (Class IIb; LOE C-LD) Patients with systemic malignancy and reasonable (>6 mo) life expectancy may benefit from IV alteplase if other contraindications such as coagulation abnormalities, recent surgery, or systemic bleeding do not coexist.	Agree
Pregnancy	
1. IV alteplase administration may be considered in pregnancy when the anticipated benefits of treating moderate or severe stroke outweigh the anticipated increased risks of uterine bleeding. (Class IIb; LOE C-LD)	Agree with qualification It is consensus of the ICSI work group to recommend consultation with a high-risk obstetrics gynecology provider in these instances.
2. The safety and efficacy of IV alteplase in the early postpartum period (<14 d after delivery) have not been well established. (Class IIb; LOE C-LD)	Agree
Ophthalmological conditions	
1. Use of IV alteplase in patients presenting with AIS who have a history of diabetic hemorrhagic retinopathy or other hemorrhagic ophthalmic conditions is reasonable to recommend, but the potential increased risk of visual loss should be weighed against the anticipated benefits of reduced stroke-related neurological deficits. (Class IIa; LOE B-NR)	Agree
Sickle cell disease	
1. IV alteplase for adults presenting with an AIS with known sickle cell disease can be beneficial. (Class IIa; LOE B-NR)	Agree with comment New data from AHA/ASA Get With The Guidelines-Stroke registry suggest that coexistent SCD had no significant impact on the safety or outcome of thrombolytic therapy in acute ischemic stroke. However, more research is needed. (Adams, 2017)
Illicit drug use	
1. Treating clinicians should be aware that illicit drug use may be a contributing factor to incident stroke. IV alteplase is reasonable in instances of illicit drug use–associated AIS in patients with no other exclusions. (Class IIa; LOE C-LD)	Agree
Stroke mimics	
1. The risk of symptomatic intracranial hemorrhage in the stroke mimic population is quite low; thus, starting IV alteplase is probably recommended in preference over delaying treatment to pursue additional diagnostic studies. (Class IIa; LOE B-NR)	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
3.6 Other IV Thrombolytics and Sonothrombolysis	
1. The benefit of IV defibrinogenating agents and of IV fibrinolytic agents other than alteplase and tenecteplase is unproven; therefore, their administration is not recommended outside a clinical trial. (COR III: No Benefit; LOE B-R) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree
2. Tenecteplase administered as a 0.4-mg/kg single IV bolus has not been proven to be superior or noninferior to alteplase but might be considered as an alternative to alteplase in patients with minor neurological impairment and no major intracranial occlusion. (COR IIb; LOE B-R) *(New recommendation.)*	Agree
3. The use of sonothrombolysis as adjuvant therapy with IV thrombolysis is not recommended. (COR III: No Benefit; LOE B-R) *(New recommendation.)*	Agree
3.7 Mechanical Thrombectomy	
1. Patients eligible for IV alteplase should receive IV alteplase even if EVTs are being considered. (COR I; LOE A) *(Recommendation reworded for clarity from 2015 Endovascular.)*	Agree
2. In patients under consideration for mechanical thrombectomy, observation after IV alteplase to assess for clinical response should not be performed. (COR III: Harm; LOE B-R) *(Recommendation revised from 2015 Endovascular.)*	Agree
3. Patients should receive mechanical thrombectomy with a stent retriever if they meet all the following criteria: (1) prestroke mRS score of 0 to 1; (2) causative occlusion of the internal carotid artery or MCA segment 1 (M1); (3) age ≥18 years; (4) NIHSS score of ≥6; (5) ASPECTS of ≥6; and (6) treatment can be initiated (groin puncture) within 6 hours of symptom onset. (COR I; LOE A) *(Recommendation revised from 2015 Endovascular.)*	Agree with qualification The ICSI work group would like to affirm that there is NO upper age limit for endovascular stroke treatment in acute ischemic stroke. Elderly patients benefit similarly to their younger counterparts. Age should never be solely used as exclusion criteria for endovascular stroke treatment. The ICSI work group notes that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
4. Although the benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for carefully selected patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have causative occlusion of the MCA segment 2 (M2) or MCA segment 3 (M3) portion of the MCAs. (COR IIb; LOE B-R) *(Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE revised.)*	Agree with qualification Endovascular treatment of more distal MCA occlusions such as the M3 or M4 division is not well studied. Interventions on very distal occlusions are less likely to result in clinical benefit than more proximal occlusion (Lemmens, 2016). It is consensus of the ICSI work group to not recommend routine endovascular intervention of occlusion more distal than the M2 division of the MCA. The ICSI work group notes that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.
5. Although the benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for carefully selected patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have causative occlusion of the anterior cerebral arteries, vertebral arteries, basilar artery, or posterior cerebral arteries. (COR IIb; LOE C-E0) *(Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment The ICSI work group notes that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.
6. Although its benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have prestroke mRS score >1, ASPECTS <6, or NIHSS score <6, and causative occlusion of the internal carotid artery (ICA) or proximal MCA (M1). Additional randomized trial data are needed. (COR IIb; LOE B-R) *(Recommendation unchanged from 2015 Endovascular.)*	Agree with comment The ICSI work group acknowledges that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.
7. In selected patients with AIS within 6 to 16 hours of last known normal who have LVO in the anterior circulation and meet other DAWN or DEFUSE 3 eligibility criteria, mechanical thrombectomy is recommended. (COR I; LOE A) *(New recommendation.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
8. In selected patients with AIS within 6 to 24 hours of last known normal who have LVO in the anterior circulation and meet other DAWN eligibility criteria, mechanical thrombectomy is reasonable. (COR IIa; LOE B-R) *(New recommendation.)*	Agree with qualification While the ICSI work group agrees with the recommendation, it disagrees with COR. The COR should be changed from IIa to I. The findings of DAWN trial (Noguiera, 2018) are equivalent to slightly better than DEFUSE 3 trial, which received COR I. (Albers, 2018); therefore, the COR should be raised to I for DAWN trial as well.
9. The technical goal of the thrombectomy procedure should be reperfusion to a modified Thrombolysis in Cerebral Infarction (mTICI) 2b/3 angiographic result to maximize the probability of a good functional clinical outcome. (COR I; LOE A) *(Recommendation reworded for clarity from 2015 Endovascular.)*	Agree with comment There is increasing evidence that TICI 2b and TICI 3, traditionally combined as a measure of "good reperfusion," are not clinically analogous with TICI 3, resulting in significantly more favorable functional outcomes. (Goyal, 2018; Rizvi, 2019)
10. As with IV alteplase, reduced time from symptom onset to reperfusion with endovascular therapies is highly associated with better clinical outcomes. To ensure benefit, reperfusion to TICI grade 2b/3 should be achieved as early as possible within the therapeutic window. (COR I; LOE B-R) *(Recommendation revised from 2015 Endovascular.)*	Agree
11. Use of stent retrievers is indicated in preference to the Mechanical Embolus Removal in Cerebral Ischemia (MERCI) device. (COR I; LOE A) *(Recommendation unchanged from 2015 Endovascular.)*	Agree with comment While the studies used stent retrievers, the ICSI work group acknowledges that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.
12. The use of mechanical thrombectomy devices other than stent retrievers as first-line devices for mechanical thrombectomy may be reasonable in some circumstances, but stent retrievers remain the first choice. (COR IIb; LOE B-R) *(Recommendation revised from 2015 Endovascular.)*	Agree with comment While the studies used stent retrievers, the ICSI work group acknowledges that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
13. 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. Future studies should examine which systems provide the highest recanalization rates with the lowest risk for nontarget embolization. (COR IIa; LOE C-LD) *(Recommendation and Class unchanged from 2015 Endovascular. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment While the studies used stent retrievers, the ICSI work group acknowledges that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.
14. Use of salvage technical adjuncts including intra-arterial thrombolysis may be reasonable to achieve mTICI 2b/3 angiographic results. (COR IIb; LOE C-LD) *(Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
15. EVT of tandem occlusions (both extracranial and intracranial occlusions) at the time of thrombectomy may be reasonable. (COR IIb; LOE B-R) *(Recommendation revised from 2015 Endovascular.)*	Agree with comment EVT of tandem occlusion (both extracranial and intracranial occlusions) is indicated to restore cerebral perfusion. It remains unclear whether or not the more proximal extracranial lesion should undergo stenting simultaneously, however, the current evidence suggests that this approach is safe and reasonable. (Jadhav, 2018)
16. It is reasonable to select an anesthetic technique during endovascular therapy for AIS on the basis of individualized assessment of patient risk factors, technical performance of the procedure, and other clinical characteristics. Further randomized trial data are needed. (COR IIa; LOE B-R) *(Recommendation revised from 2015 Endovascular.)*	Disagree with comment Data is mixed. Multicenter analyses suggest worse outcomes using general anesthesia. (Gravel, 2019; Eker, 2017; Campbell, 2018; Berkhemer, 2016) Individual centers have published data favorable to general anesthesia, which may be likely a result of their specific practices. (Schönenberger, 2016; Simonsen, 2018) In conclusion, if general anesthesia is necessary, endovascular therapy and general anesthesia are still better than no EVT.
17. In patients who undergo mechanical thrombectomy, it is reasonable to maintain the BP ≤180/105 mm Hg during and for 24 hours after the procedure. (COR IIa; LOE B-NR) *(New recommendation.)*	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
18. In patients who undergo mechanical thrombectomy with successful reperfusion, it might be reasonable to maintain BP at a level <180/105 mm Hg. (COR IIb; LOE B-NR) *(New recommendation.)*	Agree
3.8 Other EVTs	
1. Initial treatment with intra-arterial thrombolysis is beneficial for carefully selected patients with major ischemic strokes of <6 hours' duration caused by occlusions of the MCA. (COR I; LOE B-R) *(Recommendation and Class unchanged from 2015 Endovascular. LOE amended to conform with the ACC/AHA 2015 Recommendation Classification System.)*	Disagree with comment Although PROACT II trial showed positive results of intra-arterial thrombolysis for selected patients with major ischemic strokes of <6 hours' duration caused by occlusions of the MCA (Furlan, 1999), intra-arterial thrombolysis without mechanical thrombectomy is not standard of care and should not be endorsed. Significant technological advances in stroke treatment have occurred over the last 20 years, resulting in better and faster recanalization. A trial directly comparing mechanical thrombectomy with intra-arterial thrombolysis of a proximal large vessel occlusion can no longer happen because it would be unethical to treat stroke patients with intra-arterial thrombolysis alone.
2. Regarding the previous recommendation about intra-arterial thrombolysis, these data are derived from clinical trials that no longer reflect current practice, including the use of fibrinolytic drugs that are not available. A clinically beneficial dose of intra-arterial alteplase is not established, and alteplase does not have US Food and Drug Administration approval for intra-arterial use. As a consequence, mechanical thrombectomy with stent retrievers is recommended over intra-arterial thrombolysis as first-line therapy. (COR I; LOE C-E0) *(Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE amended to conform with the ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment While the studies used stent retrievers, the ICSI work group acknowledges that the technology has advanced beyond the stent retrievers, and interventionists might use other more advanced technologies.
3. Intra-arterial thrombolysis initiated within 6 hours of stroke onset in carefully selected patients who have contraindications to the use of IV alteplase might be considered, but the consequences are unknown. (COR IIb; LOE C-E0) *(Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
3.9 Antiplatelet Treatment	
1. Administration of aspirin is recommended in patients with AIS within 24 to 48 hours after onset. For those treated with IV alteplase, aspirin administration is generally delayed until 24 hours later but might be considered in the presence of concomitant conditions for which such treatment given in the absence of IV alteplase is known to provide substantial benefit or withholding such treatment is known to cause substantial risk. (COR I; LOE A) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree
2. Aspirin is not recommended as a substitute for acute stroke treatment in patients who are otherwise eligible for IV alteplase or mechanical thrombectomy. (COR III: No Benefit; LOE B-R) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree
3. The efficacy of IV tirofiban and eptifibatide is not well established. Further clinical trials are needed. (COR IIb; LOE B-R) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree
4. The administration of other glycoprotein IIb/IIIa receptor antagonists, including abciximab, in the treatment of AIS is potentially harmful and should not be performed. Further research testing the safety and efficacy of these medications in patients with AIS is required. (COR III: Harm; LOE B-R) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree
5. In patients presenting with minor stroke, treatment for 21 days with dual antiplatelet therapy (aspirin and clopidogrel) begun within 24 hours can be beneficial for early secondary stroke prevention for a period of up to 90 days from symptom onset. (COR IIa; LOE B-R) *(New recommendation.)*	Agree with comment The benefit risk is optimal when dual Rx is started early and lasts about 1 month (or 21 days). If dual Rx is continued up to 90 days, hemorrhagic risk eliminates benefit.
6. Ticagrelor is not recommended (over aspirin) in the acute treatment of patients with minor stroke. (COR III: No Benefit; LOE B-R) *(New recommendation.)*	Agree
3.10 Anticoagulants	
1. Urgent anticoagulation, with the goal of preventing early recurrent stroke, halting neurological worsening, or improving outcomes after AIS, is not recommended for treatment of patients with AIS. (COR III: No Benefit: LOE A) *(Recommendation and LOE unchanged from 2013 AIS Guidelines. Class amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. The usefulness of urgent anticoagulation in patients with severe stenosis of an internal carotid artery ipsilateral to an ischemic stroke is not well established. (COR IIb; LOE B-NR) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
3. The safety and usefulness of short-term anticoagulation for nonocclusive, extracranial intraluminal thrombus in the setting of AIS are not well established. (COR IIb; LOE C-LD) *(New recommendation.)*	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
4. At present, the usefulness of argatroban, dabigatran, or other thrombin inhibitors for the treatment of patients with AIS is not well established. Further clinical trials are needed. (COR IIb; LOE B-R) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree
5. The safety and usefulness of factor Xa inhibitors in the treatment of AIS are not well established. Further clinical trials are needed. (COR IIb; LOE C-LD) *(New recommendation.)*	Agree
3.11 Volume Expansion/Hemodilution, Vasodilators, and Hemodynamic Augmentation	
1. Hemodilution by volume expansion is not recommended for treatment of patients with AIS. (COR III: No Benefit; LOE A) *(Recommendation and LOE unchanged from 2013 AIS Guidelines. Class amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. The administration of high-dose albumin is not recommended for the treatment of patients with AIS. (COR III: No Benefit; LOE A) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree
3. The administration of vasodilatory agents, such as pentoxifylline, is not recommended for treatment of patients with AIS. (COR III: No Benefit; LOE A) *(Recommendation and LOE unchanged from 2013 AIS Guidelines. Class amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4. At present, use of devices to augment cerebral blood flow for the treatment of patients with AIS is not well established. These devices should be used only in the setting of clinical trials. (COR IIb; LOE B-R) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
3.12 Neuroprotective Agents	
1. At present, no pharmacological or non-pharmacological treatments with putative neuroprotective actions have demonstrated efficacy in improving outcomes after ischemic stroke, and therefore, other neuroprotective agents are not recommended. (COR III: No Benefit; LOE A) *(Recommendation reworded for clarity from 2013 AIS Guidelines. LOE unchanged. COR amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment No "other" agents have been identified.
3.13 Emergency CEA/Carotid Angioplasty and Stenting Without Intracranial Clot	
1. The usefulness of emergent or urgent CEA when clinical indicators or brain imaging suggests a small infarct core with large territory at risk (eg, penumbra), compromised by inadequate flow from a critical carotid stenosis or occlusion, or in the case of acute neurological deficit after CEA, in which acute thrombosis of the surgical site is suspected, is not well established. (COR IIb; LOE B-NR) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with the ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment CEA=Carotid endarterectomy
2. In patients with unstable neurological status (eg, stroke-in-evolution), the efficacy of emergency or urgent CEA is not well established. (COR IIb; LOE B-NR) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with the ACC/AHA 2015 Recommendation Classification System.)*	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
3.14 Other	
1. Transcranial near-infrared laser therapy is not recommended for the treatment of AIS. (COR III: No Benefit; LOE B-R) *(Recommendation revised from 2013 AIS Guidelines.)*	Agree with comment A literature search on "using transcranial near-infrared laser therapy to treat acute ischemic stroke in humans" did not yield any new results.
4. In-Hospital Management of AIS: General Supportive Care	
4.1 Stroke Units	
1. The use of comprehensive specialized stroke care (stroke units) that incorporates rehabilitation is recommended. (COR I; LOE A) *(Recommendation unchanged from 2013 AIS Guidelines.)*	Agree
2. The use of standardized stroke care order sets is recommended to improve general management. (COR I; LOE B-NR) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4.2 Supplemental Oxygen	
1. Airway support and ventilatory assistance are recommended for the treatment of patients with acute stroke who have decreased consciousness or who have bulbar dysfunction that causes compromise of the airway. (COR I; LOE C-E0) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. Supplemental oxygen should be provided to maintain oxygen saturation >94%. (COR I; LOE C-LD) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
3. Supplemental oxygen is not recommended in nonhypoxic patients hospitalized with AIS. (COR III: No Benefit; LOE B-R) *(Recommendation reworded for clarity from 2013 AIS Guidelines. COR and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4.3 Blood Pressure	
1. In patients with AIS, early treatment of hypertension is indicated when required by comorbid conditions (eg, concomitant acute coronary event, acute heart failure, aortic dissection, postthrombolysis sICH, or preeclampsia/eclampsia). Lowering BP initially by 15% is probably safe. (COR I; LOE C-E0) *(New recommendation.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
1. Prehospital Stroke Management and Systems of Care	
1.1 Prehospital Systems	
1. Public health leaders, along with medical professionals and others, should design and implement public education programs focused on stroke systems and the need to seek emergency care (by calling 9-1-1) in a rapid manner. These programs should be sustained over time and designed to reach racially/ethnically, age, and sex diverse populations. (COR I; LOE B-R) *(Recommendation revised from 2013 Stroke Systems of Care. COR and LOE added.)*	Agree
2. Activation of the 9-1-1 system by patients or other members of the public is strongly recommended. 9-1-1 dispatchers should make stroke a priority dispatch, and transport times should be minimized. (COR I; LOE B-NR) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment Stroke symptoms should prompt dispatchers to upgrade the response to a priority dispatch, despite what local dispatch protocols might recommend. (Ekundayo, 2013)
3. To increase both the number of patients who are treated and the quality of care, educational stroke programs for physicians, hospital personnel, and EMS personnel are recommended. (COR I; LOE B-NR) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
1.2 EMS Assessment and Management	
1. The use of a stroke assessment system by first aid providers, including EMS dispatch personnel, is recommended. (COR I; LOE B-NR) *(Recommendation reworded for clarity from 2015 CPR/ECC. Class and LOE unchanged.)*	Agree
2. EMS personnel should begin the initial management of stroke in the field. Implementation of a stroke protocol to be used by EMS personnel is strongly encouraged. (COR I; LOE B-NR) (*Recommendation revised from 2013 AIS Guidelines.)*	Agree
3. EMS personnel should provide prehospital notification to the receiving hospital that a suspected stroke patient is en route so that the appropriate hospital resources may be mobilized before patient arrival. (COR I; LOE B-NR) (*Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
2. Hypoglycemia (blood glucose <60 mg/dL) should be treated in patients with AIS. (COR I; LOE C-LD) *(Recommendation and Class unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4.6 Dysphagia Screening	
2. It is reasonable for dysphagia screening to be performed by a speech-language pathologist or other trained healthcare provider. (COR IIa; LOE C-LD) *(Recommendation reworded for clarity from 2016 Rehab Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
3. An instrumental evaluation is reasonable for those patients suspected of aspiration to verify the presence/absence of aspiration and to determine the physiological reasons for the dysphagia to guide the treatment plan. (COR IIa; LOE B-NR) *(Recommendation wording modified from 2016 Rehab Guidelines to match Class IIa stratifications. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4. It is not well established which instrument to choose for evaluation of swallowing with sensory testing, but the choice may be based on instrument availability or other considerations (ie, fiberoptic endoscopic evaluation of swallowing, videofluoroscopy, fiberoptic endoscopic evaluation). (COR IIb; LOE C-LD) *(Recommendation reworded for clarity from 2016 Rehab Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment Literature search on "instrument for evaluation of swallowing with sensory testing in patients with acute ischemic stroke" did not yield any new results.
4.7 Nutrition	
1. Enteral diet should be started within 7 days of admission after an acute stroke. (COR I; LOE B-R) *(New recommendation.)*	Agree with qualification It is the consensus of the ICSI work group that nutrition is important and should be started as quickly as possible.
2. For patients with dysphagia, it is reasonable to initially use nasogastric tubes for feeding in the early phase of stroke (starting within the first 7 days) and to place percutaneous gastrostomy tubes in patients with longer anticipated persistent inability to swallow safely (>2–3 weeks). (COR IIa; LOE C-E0) *(New recommendation.)*	Agree with qualification It is the consensus of the ICSI work group that nutrition is important and should be started early. Use clinical judgment to determine if tubes are necessary.
3. Nutritional supplements are reasonable to consider for patients who are malnourished or at risk of malnourishment. (COR IIa; LOE B-R) *(Recommendation and Class unchanged from 2016 Rehab Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4. Implementing oral hygiene protocols to reduce the risk of pneumonia after stroke may be reasonable. (COR IIb; LOE B-NR) *(New recommendation.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
4.8 Deep Vein Thrombosis Prophylaxis	
1. In immobile stroke patients without contraindications, intermittent pneumatic compression (IPC) in addition to routine care (aspirin and hydration) is recommended over routine care to reduce the risk of deep vein thrombosis (DVT). (COR I; LOE B-R) *(Recommendation revised from 2016 Rehab Guidelines.)*	Agree
2. The benefit of prophylactic-dose subcutaneous heparin (unfractionated heparin [UFH] or LMWH) in immobile patients with AIS is not well established. (COR IIb; LOE A) *(New recommendation.)*	Agree with qualification While the ICSI stroke work group agrees that evidence is not well established (see summary below of recent evidence), it is their **expert opinion consensus** that **for practical purposes**, prophylactic-dose of subcutaneous heparin (unfractionated heparin [UFH] or LMWH) is beneficial in immobile patients with acute ischemic stroke. Summary of recent evidence: No trials have specifically singled out immobile patients to study the benefit of prophylactic subcutaneous heparin (UFH or LWMH). Instead, they looked at patients who had suffered ischemic stroke and had associated risk factors (of which immobility is one, per Khan 2017) that would increase the risk of thrombotic event such as DVT or PE. (Kahn, 2017) A 2013 meta-analysis of randomized, controlled trials of 22,655 patients with ischaemic stroke who were randomized to either an anticoagulant regimen (unfractionated heparin, low-molecular-weight heparin, or heparinoid) or to aspirin or placebo from the IST, TOAST, FISS-tris, HAEST, and TAIST studies found no evidence that patients with ischaemic stroke who were at higher risk of thrombotic events or lower risk of haemorrhagic events benefited from heparins. This analysis found that patients with ischaemic stroke who were of advanced age, had increased neurological impairment or had atrial fibrillation had a high risk of both thrombotic and haemorrhagic events after stroke, and patients with CT-visible evidence of recent cerebral ischaemia were at increased risk of thrombotic events. (Whiteley, 2013)

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
3. When prophylactic anticoagulation is used, the benefit of prophylactic-dose LMWH over prophylactic-dose UFH is uncertain. (COR IIb; LOE B-R) *(New recommendation.)*	Agree with qualification The evidence is mixed. PREVAIL study of patients with acute ischaemic stroke who were unable to walk unassisted showed benefit of enoxaparin in reducing the risk of venous thromboembolism but not reduction in PE events compared with unfractionated heparin in patients with acute ischemic stroke irrespective of severity; the rate of major extracranial bleeding was higher with enoxaparin than with unfractionated heparin. (Sherman, 2007; Khan, 2017) Another meta-analysis of patients with recent acute ischemic stroke (with none of the studies reporting reliable information on disability or recovery after stroke) found that compared with UFH, there was no evidence of an effect of LMWH or heparinoids on death from all causes during the treatment period. LMWH or heparinoid were associated with a significant reduction in deep vein thrombosis (DVT) compared with UFH. However, the number of the major clinical events such as pulmonary embolism (PE) and intracranial haemorrhage was too small to provide a reliable estimate of the effects. (Sandercock, 2017)
4. In ischemic stroke, elastic compression stockings should not be used. (COR III: Harm; LOE B-R) *(Recommendation wording modified from 2016 Rehab Guidelines to match Class III stratifications. COR and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4.9 Depression Screening	
1. Administration of a structured depression inventory is recommended to routinely screen for poststroke depression, but the optimal timing of screening is uncertain. (COR I; LOE B-NR) *(Recommendation revised from 2016 Rehab Guidelines.)*	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
2. Patients diagnosed with poststroke depression should be treated with antidepressants in the absence of contraindications and closely monitored to verify effectiveness. (COR I; LOE B-R) *(Recommendation and Class unchanged from 2016 Rehab Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4.10 Other	
1. Routine use of prophylactic antibiotics has not been shown to be beneficial. (COR III: No Benefit; LOE B-R) *(Recommendation unchanged from 2013 AIS Guidelines. COR and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. Routine placement of indwelling bladder catheters should not be performed because of the associated risk of catheter-associated urinary tract infections. (COR III: Harm; LOE C-LD) *(Recommendation wording modified from 2013 AIS Guidelines to match Class III stratifications. COR and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
3. During hospitalization and inpatient rehabilitation, regular skin assessments are recommended with objective scales of risk such as the Braden scale. (COR I; LOE C-LD) *(Recommendation and Class unchanged from 2016 Rehab Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4. It is recommended to minimize or eliminate skin friction, to minimize skin pressure, to provide appropriate support surfaces, to avoid excessive moisture, and to maintain adequate nutrition and hydration to prevent skin breakdown. Regular turning, good skin hygiene, and use of specialized mattresses, wheelchair cushions, and seating are recommended until mobility returns. (COR I; LOE C-LD) *(Recommendation and Class unchanged from 2016 Rehab Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
5. It is reasonable for patients and families with stroke to be directed to palliative care resources as appropriate. Caregivers should ascertain and include patient-centered preferences in decision making, especially during prognosis formation and considering interventions or limitations in care. (COR IIa; LOE C-E0) *(New recommendation.)*	Agree
4.11 Rehabilitation	
1. It is recommended that early rehabilitation for hospitalized stroke patients be provided in environments with organized, interprofessional stroke care. (COR I; LOE A) *(Recommendation unchanged from 2016 Rehab Guidelines.)*	Agree
2. It is recommended that stroke survivors receive rehabilitation at an intensity commensurate with anticipated benefit and tolerance. (COR I; LOE B-NR) *(Recommendation and Class unchanged from 2016 Rehab Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
3. High-dose, very early mobilization within 24 hours of stroke onset should not be performed because it can reduce the odds of a favorable outcome at 3 months. (COR III: Harm; LOE B-R) *(Recommendation wording modified from 2016 Rehab Guidelines to match Class III stratifications. LOE revised. Class amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment A 2015 AVERT randomized, controlled trial of 2083 participants found that very early mobilisation after stroke reduces the probability of a favourable outcome at 3 months. The intervention group that received very early mobilization that focused on out-of-bed activities such as sitting, standing and walking, and included at least three additional out-of-bed sessions to usual care that began within 24 hours of stroke onset had significantly less favorable outcome on disability than the control group. (The AVERT Trial Collaboration Group, 2015)
4. It is recommended that all individuals with stroke be provided a formal assessment of their activities of daily living and instrumental activities of daily living, communication abilities, and functional mobility before discharge from acute care hospitalization and the findings be incorporated into the care transition and the discharge planning process. (COR I; LOE B-NR) *(Recommendation and Class unchanged from 2016 Rehab Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
5. A functional assessment by a clinician with expertise in rehabilitation is recommended for patients with an acute stroke with residual functional deficits. (COR I; LOE C-LD) *(Recommendation and Class unchanged from 2016 Rehab Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
6. The effectiveness of fluoxetine or other selective serotonin reuptake inhibitors to enhance motor recovery is not well established. (COR IIb; LOE C-LD) *(Recommendation and Class unchanged from 2016 Rehab Guidelines. LOE revised from 2016 Rehab Guidelines.)*	Agree with comment Literature search on "the effectiveness of fluoxetine or other selective serotonin reuptake inhibitors to enhance motor recovery in patients with acute ischemic stroke" did not yield any new results on this topic.
5. In-Hospital Management of AIS: Treatment of Acute Complications	
5.1 Cerebellar and Cerebral Edema	
1. Ventriculostomy is recommended in the treatment of obstructive hydrocephalus after a cerebellar infarct. Concomitant or subsequent decompressive craniectomy may or may not be necessary on the basis of factors such as infarct size, neurological condition, degree of brainstem compression, and effectiveness of medical management. (COR I; LOE C-LD) *(Recommendation revised from 2014 Cerebral Edema.)*	Agree

Return to Table of Contents

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	ICSI Work Group Consensus • Agree • Agree with qualification or comment • Disagree with comment
2. Decompressive suboccipital craniectomy with dural expansion should be performed in patients with cerebellar infarction causing neurological deterioration from brainstem compression despite maximal medical therapy. When deemed safe and indicated, obstructive hydrocephalus should be treated concurrently with ventriculostomy. (COR I; LOE B-NR) *(Recommendation revised from 2014 Cerebral Edema.)*	Agree
3. When considering decompressive suboccipital craniectomy for cerebellar infarction, it may be reasonable to inform family members that the outcome after cerebellar infarct can be good after sub-occipital craniectomy. (COR IIb; LOE C-LD) *(Recommendation and Class unchanged from 2014 Cerebral Edema. Wording revised and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
4. Patients with large territorial supratentorial infarctions are at high risk for complicating brain edema and increased intracranial pressure. Discussion of care options and possible outcomes should take place quickly with patients (if possible) and caregivers. Medical professionals and caregivers should ascertain and include patient-centered preferences in shared decision making, especially during prognosis formation and considering interventions or limitations in care. (COR I; LOE C-E0) *(New recommendation.)*	Agree
5. Patients with major infarctions are at high risk for complicating brain edema. Measures to lessen the risk of edema and close monitoring of the patient for signs of neurological worsening during the first days after stroke are recommended. Early transfer of patients at risk for malignant brain edema to an institution with neurosurgical expertise should be considered. (COR I; LOE C-LD) *(Recommendation revised from 2013 AIS Guidelines. LOE revised.)*	Agree
6. In patients ≤60 years of age with unilateral MCA infarctions who deteriorate neurologically within 48 hours despite medical therapy, decompressive craniectomy with dural expansion is reasonable because it reduces mortality by close to 50%, with 55% of the surgical survivors achieving moderate disability (able to walk) or better (mRS score 2 or 3) and 18% achieving independence (mRS score 2) at 12 months. (COR IIa; LOE A) *(Recommendation revised from 2014 Cerebral Edema.)*	Agree
7. In patients >60 years of age with unilateral MCA infarctions who deteriorate neurologically within 48 hours despite medical therapy, decompressive craniectomy with dural expansion may be considered because it reduces mortality by close to 50%, with 11% of the surgical survivors achieving moderate disability (able to walk [mRS score 3]) and none achieving independence (mRS score ≤2) at 12 months. (COR IIb; LOE B-R) *(Recommendation revised from 2014 Cerebral Edema.)*	Agree
8. Although the optimal trigger for decompressive craniectomy is unknown, it is reasonable to use a decrease in level of consciousness attributed to brain swelling as selection criteria. (COR IIa; LOE A) *(Recommendation, Class, and LOE unchanged from 2014 Cerebral Edema.)*	Agree

2018 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke Recommendation	**ICSI Work Group Consensus** • **Agree** • **Agree with qualification or comment** • **Disagree with comment**
9. Use of osmotic therapy for patients with clinical deterioration from cerebral swelling associated with cerebral infarction is reasonable. (COR IIa; LOE C-LD) *(Recommendation reworded for clarity from 2014 Cerebral Edema. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
10. Use of brief moderate hyperventilation (Pco2 target 30–34 mm Hg) is a reasonable treatment for patients with acute severe neurological decline from brain swelling as a bridge to more definitive therapy. (COR IIa; LOE C-E0) *(New recommendation.)*	Agree
11. Hypothermia or barbiturates in the setting of ischemic cerebral or cerebellar swelling are not recommended. (COR III: No Benefit; LOE B-R) *(Recommendation and LOE revised from 2014 Cerebral Edema. COR amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree with comment A recent trial of 50 patients showed that addition of moderate hypothermia early after hemicraniectomy did not improve mortality and functional outcome compared with standard care and was harmful in patients with malignant middle cerebral artery stroke. More research is needed. (Neugebauer, 2019)
12. Because of a lack of evidence of efficacy and the potential to increase the risk of infectious complications, corticosteroids (in conventional or large doses) should not be administered for the treatment of cerebral edema and increased intracranial pressure complicating ischemic stroke. (COR III: Harm; LOE A) *(Recommendation wording modified from 2013 AIS Guidelines to match Class III stratifications. LOE unchanged. Class amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
5.2 Seizures	
1. Recurrent seizures after stroke should be treated in a manner similar to when they occur with other acute neurological conditions, and anti-seizure drugs should be selected based upon specific patient characteristics. (COR I; LOE C-LD) *(Recommendation reworded for clarity from 2013 AIS Guidelines. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree
2. Prophylactic use of anti-seizure drugs is not recommended. (COR III: No Benefit; LOE B-R) *(Recommendation reworded for clarity from 2013 AIS Guidelines. LOE revised. COR amended to conform with ACC/AHA 2015 Recommendation Classification System.)*	Agree

Return to Table of Contents

During this revision, a search was conducted for NQF-endorsed, CMS and Joint Commission measures to support implementation of the recommendations in this endorsement. None was identified to be appropriate for inclusion.

The ICSI stroke work group did not develop measures for this endorsement.

Return to Table of Contents

The subdivisions of this section are:

- References

Return to Table of Contents

References

AVERT Trial Collaboration group, Bernhardt J, Langhorne P, Lindley, RI, et al. Efficacy and safety of very early mobilisation within 24 h of stroke onset (AVERT): a randomised controlled trial. *Lancet* 2015;386:46-55.

Adams, RJ, Cox, M, Ozark, SD, et al. Coexistent sickle cell disease has no impact on the safety or outcome of lytic therapy in acute ischemic stroke findings from get with the guidelines-stroke. *Stroke* 2017;48:686-91.

Albers, GW, Marks, MP, Kemp, S, et al. for the DEFUSE 3 Investigators. Thrombectomy for stroke at 6 to 16 hours with selection by perfusion imaging. *N Engl J Med* 2018;378:708-18.

Berkhemer, OA, Jansen, IG, Beumer, D, et al. Collateral status on baseline computed tomographic angiography and intra-arterial treatment effect in patients with proximal anterior circulation stroke. *Stroke* 2016 Mar;47(3):768-76.

Campbell, BCV, Mitchell, PJ, Churilov, L, et al. for the EXTEND-IA TNK Investigators. Tenecteplase versus alteplase before thrombectomy for ischemic stroke. *N Engl J Med* 2018;378:1573-82.

Centers for Disease Control and Prevention. Stroke fact sheet. Available at: http://www.cdc.gov/dhdsp/data_statistics/fact_sheets/docs/fs_stroke.pdf. 2016.

Chacon-Portillo MA, Llinas RH, Marsh, EB. Cerebral microbleeds shouldn't dictate treatment of acute stroke: a retrospective cohort study evaluating risk of intracerebralhemorrhage. *BMC Neurology* (2018) 18:33.

Charidimou, A, Turc, G, Oppenheim, C, et al. Microbleeds, cerebral hemorrhage, and functional outcome after stroke thrombolysis. *Stroke* 2017 Aug;48(8):2084-90.

Eker, OF, Panni, P, Dargazanli, C, et al. Anterior circulation acute ischemic stroke associated with atherosclerotic lesions of the cervical ICA: A nosologic entity apart. *Am J Neuroradiol* 2017 Nov;38(11):2138-45.

Ekundayo OJ, Saver JL, Fonarow GC, et al. Patterns of emergency medical services use and its association with timely stroke treatment: findings from get with the guidelines-stroke. *Circ Cardiovasc Qual Outcomes* 2013;6:262-69.

Furlan A, Higashida R, Wechsler, L, et al. Intra-arterial prourokinase for acute ischemic stroke. The PROACT II study: a randomized controlled trial. Prolyse in acute cerebral thromboembolism. *JAMA* 1999;282(21):2003-11.

Goyal, M, Fisher, M. Variance of imaging protocols for patients with suspected acute ischemic stroke because of large-vessel occlusion. *Stroke* 2018;49:1805–08.

Gravel G, Boulouis G, Benhassen W, Rodriguez-Regent, C, et al. Anaesthetic management during intracranial mechanical thrombectomy: systematic review and meta-analysis of current data. *J Neurol Neurosurg Psychiatry* 2019;90:68-74.

Jadhav, AP, Desai, SM, Kenmuir, CL, et al. Eligibility for endovascular trial enrollment in the 6- to 24-hour time window: Analysis of a single comprehensive stroke center. *Stroke* 2018 Apr;49(4):1015-1017.

Khan MT, Ikram A, Saeed O, et al. (December 23, 2017) Deep vein thrombosis in acute stroke – A systemic review of the literature. *Cureus* 9(12): e1982.

Kochanek KD, Murphy SL, Xu J, Arias E. Mortality in the United States, 2013. NCHS Data Brief 2014;(178):1-8.

Lemmens R, Hamilton SA, Liebeskind DS, et al. Effect of endovascular reperfusion in relation to site of arterial occlusion. *Neurology* 2016;86:762-70.

Return to Table of Contents

References

Mozaffarian D, Benjamin EJ, Go AS, et al. Heart disease and stroke statistics – 2015 update: a report from the American heart association. *Circulation* 2015;131:e29-322.

Nagaraja,N, Tasneem, N, Shaban, A, et al. Cerebral microbleeds are an independent predictor of hemorrhagic transformation following intravenous alteplase administration in acute ischemic stroke. *J Stroke Cerebrovasc Dis* 27(5):1403 -11,2018.

Neugebauer, H, Schneider, H, Bösel, J, et al. Outcomes of hypothermia in addition to decompressive hemicraniectomy in treatment of malignant middle cerebral artery stroke a randomized clinical trial. *JAMA Neurol* 2019 Jan 18. doi:10.1001/jamaneurol.2018.4822.

Nogueira, RG, Jadhav, AP, Haussen, DC, Bonafe, A, et al., for the DAWN Trial Investigators.Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct. *N Engl J Med* 2018;378:11-21.

Rizvi A, Seyedsaadat SM, Murad MH, et al. Redefining 'success': a systematic review and meta-analysis comparing outcomes between incomplete and complete revascularization. *J Neurointerv Surg* 11:9–13, 2019.

Sandercock PAG, Leong TS. Low-molecular-weight heparins or heparinoids versus standard unfractionated heparin for acute ischaemic stroke. *Cochrane Database of Sys Rev* Apr 4 2017;4: CD000119. DOI: 10.1002/14651858.CD000119.pub4.

Sherman, DG, Albers, GW, Bladin,C, et al. on behalf of the PREVAIL Investigators* The efficacy and safety of enoxaparin versus unfractionated heparin for the prevention of venous thromboembolism after acute ischaemic stroke (PREVAIL Study): an open-label randomised comparison. *Lancet* 369: 1347–55, 2017.

Shoamanesh, A, Charidimou, A, Sharma, M, Hart, RG. Should patients with ischemic stroke or transient ischemic attack with atrial fibrillation and microbleeds be anticoagulated? *Stroke* 48:3408–12, 2017.

Schönenberger S, Uhlmann L, Hacke W, et al. Effect of conscious sedation vs general anesthesia on early neurological improvement among patients with ischemic stroke undergoing endovascular thrombectomy: a randomized clinical trial. *JAMA* 2016;316:1986-96.

Simonsen, CZ, Yoo, AJ, Sørensen, LH, et al. Effect of general anesthesia and conscious sedation during endovascular therapy on infarct growth and clinical outcomes in acute ischemic stroke: A randomized clinical trial. *JAMA Neurol* Apr 1;75(4):470-77, 2018.

Whiteley, WN, Adams, HP Jr, Bath, PM, et al. Targeted use of heparin, heparinoids, or low-molecular-weight heparin to improve outcome after acute ischaemic stroke: an individual patient data meta-analysis of randomised controlled trials. *Lancet Neurol* 12:539–45, 2013.

Zand, R, Shahjouei, S, Tsivgoulis, G, et al. Cerebral Microbleeds are Associated with Higher Mortality Among Ischemic Stroke Patients. *J Stroke Cerebrovasc Dis* 2018 Nov;27(11):3036-42, 2018.

Return to Table of Contents

ICSI has long had a policy of transparency in declaring potential conflicting and competing interests of all individuals who participate in the development, revision and approval of ICSI guidelines and protocols.

In 2010, the ICSI Conflict of Interest Review Committee was established by the Board of Directors to review all disclosures and make recommendations to the board when steps should be taken to mitigate potential conflicts of interest, including recommendations regarding removal of work group members. This committee has adopted the Institute of Medicine Conflict of Interest standards as outlined in the report, Clinical Practice Guidelines We Can Trust (2011).

Where there are work group members with identified potential conflicts, these are disclosed and discussed at the initial work group meeting. These members are expected to recuse themselves from related discussions or authorship of related recommendations, as directed by the Conflict of Interest committee or requested by the work group.

The complete ICSI policy regarding Conflicts of Interest is available at http://bit.ly/ICSICOI.

Funding Source

The Institute for Clinical Systems Improvement provided the funding for this guideline revision. ICSI is a not-for-profit, quality improvement organization based in Bloomington, Minnesota. ICSI's work is funded by the annual dues of the member medical groups and three sponsoring health plans in Minnesota. Individuals on the work group are not paid by ICSI but are supported by their medical group for this work.

The only exception to this, patient and public members of a work group, are provided with a small stipend to cover meeting attendance.

ICSI facilitates and coordinates the guideline development and revision process. ICSI, member medical groups and sponsoring health plans review and provide feedback but do not have editorial control over the work group. All recommendations are based on the work group's independent evaluation of the evidence.

Return to Table of Contents

Disclosure of Potential Conflicts of Interest

David Anderson, MD (Co-Leader)
Professor, University of Minnesota Department of Neurology; University of Minnesota Physicians
National, Regional, Local Committee Affiliations: DSMB Member; Editor: Continuum Audio; Editor: Neurology Clinical Practices
Guideline-Related Activities: None
Research Grants: None
Financial/Non-Financial Conflicts of Interest: None

James Klaas, MD (Work Group Member)
Assistant Professor, Neurology, Mayo Clinic
National, Regional, Local Committee Affiliations: None
Guideline-Related Activities: None
Research Grants: None
Financial/Non-Financial Conflicts of Interest: None

Fadoua Kushner, PharmD (Work Group Member)
Clinical Staff Pharmacist, Pharmacy; Park Nicollet Health Services – Methodist Hospital
National, Regional, Local Committee Affiliations: None
Guideline-Related Activities: None
Research Grants: None
Financial/Non-Financial Conflicts of Interest: None

David Larson, MD, FACEP (Co-Leader)
Emergency Medicine, Medical Director, Ridgeview Emergency Department; Ridgeview Medical Center
National, Regional, Local Committee Affiliations: Board Member of CALS Program – Comprehensive Advanced Life Support
Guideline-Related Activities: None
Research Grants: None
Financial/Non-Financial Conflicts of Interest: None

Bjorn Peterson, MD (Work Group Member)
Emergency Medicine, Emergency Department Medical Director; HealthPartners Medical Group and Regions Hospital
National, Regional, Local Committee Affiliations: None
Guideline-Related Activities: None
Research Grants: None
Financial/Non-Financial Conflicts of Interest: None

Tess Sierzant, MS, RN, ACNS-BC (Work Group Member)
Neuroscience Clinical Nurse Specialist, Neuroscience Nursing; HealthEast Care System
National, Regional, Local Committee Affiliations: Board Membership and President, Neuroscience Nursing Foundation, Professional Advisory Board, Epilepsy Foundation
Guideline-Related Activities: None
Research Grants: None
Financial/Non-Financial Conflicts of Interest: None

Return to Table of Contents

Christopher Streib, MD (Work Group Member)
Assistant Professor, University of Minnesota Department of Neurology; Vascular Neurology; University of Minnesota Physicians
National, Regional, Local Committee Affiliations: None
Guideline-Related Activities: None
Research Grants: None
Financial/Non-Financial Conflicts of Interest: None

Ruth Marie Thomson, DO (Work Group Member)
Vascular Neurologist, Neurology; with Minneapolis Clinic of Neurology and Fairview HealthServices
National, Regional, Local Committee Affiliations: None
Guideline-Related Activities: None
Research Grants: None
Financial/Non-Financial Conflicts of Interest: None

Return to Table of Contents

ICSI seeks review from members and the public during the revision process.

Member Review

All ICSI documents are available for member review at two points in the ICSI revision process. The ICSI Response Report is sent to members at the beginning of a document revision. The goal of this report is to solicit feedback about the guideline, including but not limited to the algorithm, content, recommendations, and implementation. Members are also welcome to participate in the public comment period (see below).

Member review was not done for this version of the Diagnosis and Initial Treatment of Ischemic Stroke guideline.

Invited Reviews

For some guidelines, ICSI will invite experts in the community to comment on a guideline draft prior to finalization. This is done during the public comment period.

No invited review was done for the Diagnosis and Initial Treatment of Ischemic Stroke guideline.

Return to Table of Contents

Document Drafted Jan – Jun 2000
First Edition Oct 2001
Second Edition Nov 2002
Third Edition Nov 2003
Fourth Edition Feb 2005
Fifth Edition Mar 2006
Sixth Edition Begins March 2007
Seventh Edition Jul 2008
Eighth Edition Jul 2009
Ninth Edition Jul 2010
Tenth Edition Aug 2012
Eleventh Edition Dec 2016
Twelfth Edition Begins June 2019

Original Work Group Members

Ansar Ahmed, MD
Neurology
HealthPartners Medical Group

David Anderson, MD
Neurology
Hennepin County Medical Center

Diane Davies, MD
BHCAG Representative
Pfizer

Spring Davis, RN, BSN
Health Education
HealthPartners Health Plan

Sandra Hanson, MD
Neurology, Work Group Leader
Park Nicollet Health Services

Diane Jacobsen, MPH
Measurement Advisor
ICSI

James Lee, MD, MPH
Family Practice
RiverWay Clinics

Joseph McRaith, MD
Internal Medicine
Aspen Medical Group

Barbara Mullikin, MS
Facilitator
ICSI

Kathleen Neacy, MD
Emergency Medicine
HealthPartners Medical Group

Manuel Ramirez-Lassepas, MD
Neurology
HealthPartners Medical Group

Kathryn Schultz, PharmD
Pharmacy
Allina Medical Clinic

Eelco Wijdicks, MD
Neurology
Mayo Clinic

The next revision will be no later than April 2024.

Document History

- 2012 implemented the GRADE methodology to identify and evaluate recommendations.
- 2016: Original content was discontinued.

Return to Table of Contents

Contact ICSI at:
8009 34th Avenue South, Suite 1200; Bloomington, MN 55425; (952) 814-7060; (952) 858-9675 (fax)
Online at http://www.icsi.org

ICSI Document Development and Revision Process

Overview

Since 1993, the Institute for Clinical Systems Improvement (ICSI) has developed more than 60 evidence-based health care documents that support best practices for the prevention, diagnosis, treatment or management of a given symptom, disease or condition for patients.

Audience and Intended Use

The information contained in this ICSI health care guideline is intended primarily for health professionals and other expert audiences.

This ICSI health care guideline should not be construed as medical advice or medical opinion related to any specific facts or circumstances. Patients and families are urged to consult a health care professional regarding their own situation and any specific medical questions they may have. In addition, they should seek assistance from a health care professional in interpreting this ICSI health care guideline and applying it in their individual case.

This ICSI health care guideline is designed to assist clinicians by providing an analytical framework for the evaluation and treatment of patients, and is not intended either to replace a clinician's judgment or to establish a protocol for all patients with a particular condition.

Document Development and Revision Process

The development process is based on a number of long-proven approaches and is continually being revised based on changing community standards. The ICSI staff, in consultation with the work group and a medical librarian, conduct a literature search to identify systematic reviews, randomized clinical trials, meta-analysis, other guidelines, regulatory statements and other pertinent literature. This literature is evaluated based on the GRADE methodology by work group members. When needed, an outside methodologist is consulted.

The work group uses this information to develop or revise clinical flows and algorithms, write recommendations, and identify gaps in the literature. The work group gives consideration to the importance of many issues as they develop the guideline. These considerations include the systems of care in our community and how resources vary, the balance between benefits and harms of interventions, patient and community values, the autonomy of clinicians and patients and more. All decisions made by the work group are done using a consensus process.

ICSI's medical group members and sponsors review each guideline as part of the revision process. They provide comment on the scientific content, recommendations and implementation strategies. This feedback is used by and responded to by the work group as part of their revision work. Final review and approval of the guideline is done by ICSI's Committee on Evidence-Based Practice. This committee is made up of practicing clinicians and nurses, drawn from ICSI member medical groups.

Implementation Recommendations and Measures

These are provided to assist medical groups and others to implement the recommendations in the guidelines. Where possible, implementation strategies are included that have been formally evaluated and tested. Measures are included that may be used for quality improvement as well as for outcome reporting. When available, regulatory or publicly reported measures are included.

Document Revision Cycle

Scientific documents are revised as indicated by changes in clinical practice and literature. ICSI staff monitors major peer-reviewed journals for any pertinent evidence that would affect a particular guideline and recommendation.

Return to Table of Contents