

KEY ADVANCES PRACTICE ADVANCE

Acute Stroke Syndrome Evaluation and Management

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Why is this topic important? Over the past decade, studies have demonstrated that select patients with acute ischemic stroke (AIS) due to a large vessel occlusion (LVO) with salvageable brain tissue may have profound benefit from endovascular reperfusion therapy with mechanical thrombectomy (MT) up to 24 hours from their time of being last known well (LKW.) (1-4)

How will this change my clinical practice? Emergency physicians play a critical role in the rapid identification of acute stroke syndromes, where the timely initiation of imaging, consultation, and intervention can dramatically impact outcomes. This includes the rapid assessment of clinical criteria and the ordering of appropriate advanced imaging to facilitate timely MT when indicated. When MT is not available on-site, rapid transportation to a comprehensive stroke center should be prioritized when known to be beneficial. (1)

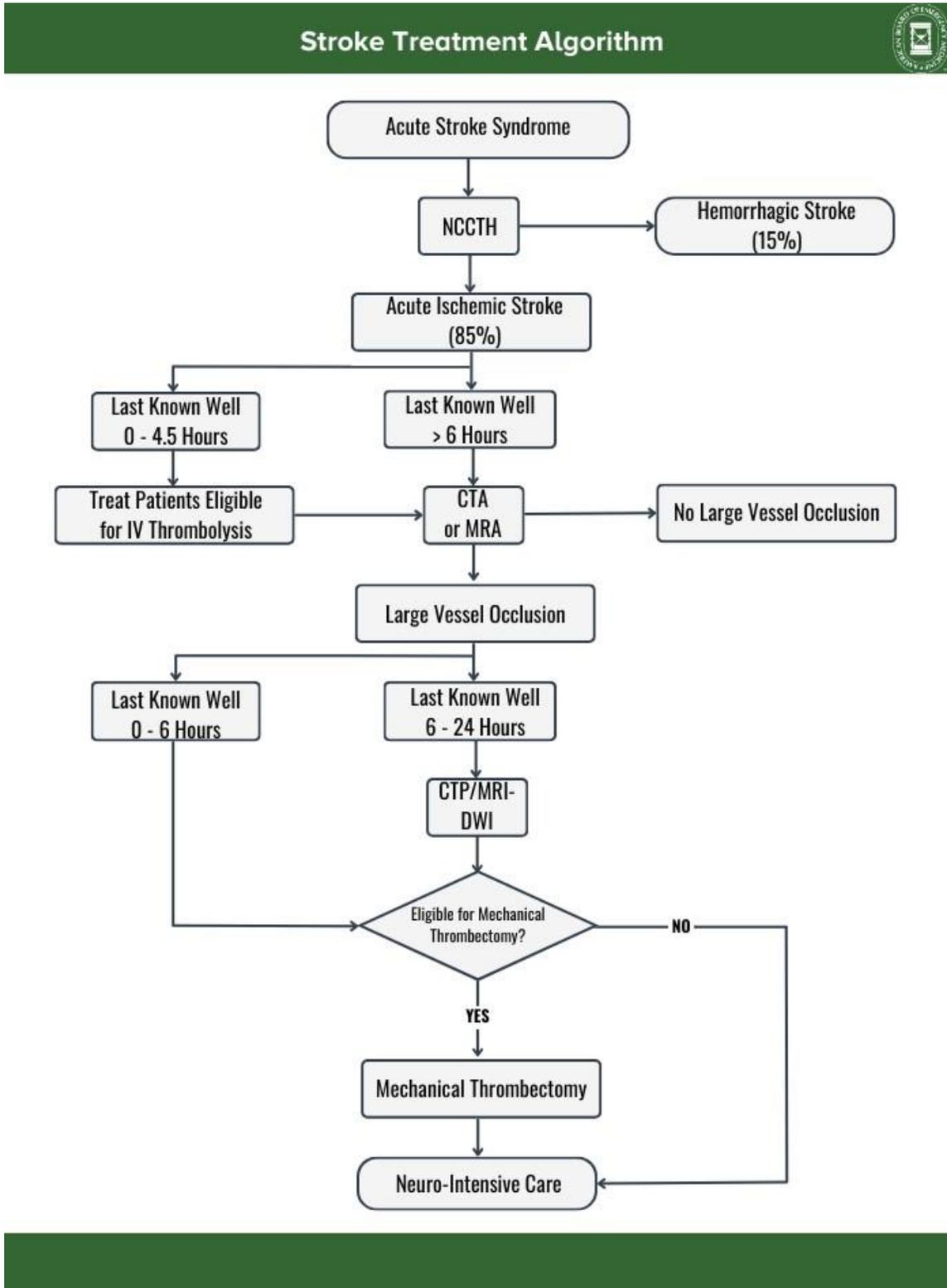
Synopsis Focus Points:

- Emergency physicians should evaluate every patient with an AIS (< 24 hours since last LMK) as a potential candidate for MT.
- Patients most likely to benefit from MT include those with:
 - a National Institutes of Health Stroke Scale (NIHSS) score > 6
 - an anterior circulation LVO with salvageable brain tissue on advanced imaging, and
 - functional independence at baseline (e.g., modified Rankin Scale [mRS] score 0-2).
- Patients eligible for intravenous (IV) thrombolysis therapy should still be considered eligible for MT.
- Patients identified as candidates for MT should be appropriately transferred to a comprehensive stroke center if MT cannot be performed on-site.

Background:

The American Heart Association Stroke Council 2019 update to their AIS guidelines to include strong recommendations (Class I) based on high-quality evidence (Level A) that are directly relevant to the ED selection of patients with suspected AIS that may be candidates for MT.(1) In appropriately selected patients with AIS due to LVO and salvageable brain tissue, MT should be incorporated into a comprehensive stroke evaluation and management algorithms up to 24 hours from their time of being LKW. (See Figure B)

Figure B. Algorithm for Acute Stroke Syndrome Evaluation



Legend: NCCTH, noncontrast computed tomography of the head; IV, intravenous; CTA, computed tomography angiogram; MRA, magnetic resonance angiogram; CTP, computed tomography perfusion; MRI-DWI, magnetic resonance imaging with diffusion-weighted imaging.

Imaging Modalities:

Non-Contrast Computed Tomography (CT) of the Head (NCCTH):

- NCCTH should be obtained as quickly as feasible to exclude hemorrhagic stroke and other potential stroke mimics.
- NCCTH is also used to calculate an Albert Stroke Program Early Computed Tomography Score (ASPECTS) to quantify early ischemic changes on NCCTH and predict the extent of final stroke in patients with emergent LVO. (5)
 - A lower ASPECTS confers a greater likelihood of poor function outcome. An ASPECTS of 0-4 suggests poor functional outcomes, while a score of ≥ 6 has been shown to optimally benefit from MT.

CT Angiography (CTA) or Magnetic Resonance Angiography (MRA):

- CTA/MRA should be obtained as quickly as feasible to identify any vascular abnormalities or a proximal anterior circulation LVO, potentially treatable with MT.
 - Proximal anterior circulation LVO includes occlusion of the internal carotid artery or the M1 and M2 segments of the middle cerebral artery.

CT Perfusion (CTP) or MR Diffusion-Weighted Imaging (MR-DWI):

- CTP/MR-DWI should be obtained as quickly as feasible to identify ongoing core infarct-to-perfusion mismatch after 6 hours from LKW.
 - The “core mismatch” concept is a surrogate marker for the presence of a relevant volume of salvageable brain tissue and refers to a significant lesion volume difference (i.e., mismatch) between the perfusion deficit and the ischemic core. (6,7)

Therapeutic Interventions:

Intravenous (IV) Thrombolysis:

- IV thrombolysis has been shown to have an absolute harm reduction of 5-10% (Number needed to treat [NNT] 10-19) in appropriately selected patients with AIS up to 4.5 hours after symptom onset.
- Both alteplase and tenecteplase have been shown to be beneficial (8)
- Administration of IV thrombolysis should not preclude the ability to use MT as a therapeutic intervention BUT should not delay MT either. (9,10)

Mechanical Thrombectomy (MT):

- MT has been shown to have an absolute harm reduction of 39%, with a NNT of 2.8 when used in appropriately selected patients with AIS patients with anterior circulation LVO. (11)
- Rapid treatment is important, as the benefit from MT falls by 5.3% for every hour of delay. The percentage that can be expected to be independent declines from 50% for thrombectomy within 3 hours to 45% at 4.5 hours, to 40% at 6 hours, and to 33% at 8 hours. (12)
- The decision to pursue MT should be made in conjunction with a neuro-interventionalist or stroke team.
- Patients identified as candidates for MT should be appropriately transferred to a comprehensive stroke center if MT cannot be performed on-site.

- **MT Eligibility Criteria:**
 - For patients within 6 hours of symptom onset or LKW: (1)
 - Pre-symptom mRS ≤ 1
 - NIHSS score of $\geq 6^{**}$
 - Causative LVO of the internal carotid artery or middle cerebral artery segment 1
 - ASPECTS of ≥ 6
 - For patients 6-24 hours out from symptom onset or LKW:
 - DAWN Criteria for 6-24 hours (13)
 - Pre-symptom mRS ≤ 1
 - NIHSS score $\geq 10^{**}$
 - No evidence of intracerebral hemorrhage on CT or MR imaging
 - No evidence of infarct involving $> \frac{1}{3}$ middle cerebral artery territory
 - A core mismatch favorable to MT
 - DEFUSE-3 Criteria for 6-16 hours (14)
 - Pre-symptom mRS ≤ 2
 - NIHSS score $\geq 6^{**}$
 - ASPECTS ≥ 6
 - A core mismatch favorable to MT

Table. Mechanical Thrombectomy Eligibility Criteria

	Criteria		
	American Heart Association ¹	DEFUSE-3 ¹⁴	DAWN ¹³
LKW	< 6 hrs	6 to 16 hrs	6 to 24 hrs
Baseline mRS	≤ 1	≤ 2	≤ 1
NIHSS ^{**}	≥ 6	≥ 6	≥ 10
ASPECTS	≥ 6	≥ 6	N/A
Infarct Characteristics	LVO of Internal Carotid Artery or M1	LVO with a core mismatch favorable to MT	LVO involving $< \frac{1}{3}$ Middle Cerebral Artery territory; No Intracerebral Hemorrhage

^{**} The Society of Neurointerventional Surgery Guidelines state "Thrombectomy may be considered in patients with anterior circulation AIS and NIHSS < 6 when associated with disabling symptoms (class IIa, level B-NR)." ¹⁵

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Resources for Additional Learning:

NIHSS Stroke Scale/Score Calculator: <https://www.mdcalc.com/nih-stroke-scale-score-nihss>

Modified Rankin Scale for Disability Calculator: <https://www.mdcalc.com/modified-rankin-scale-neurologic-disability>

Alberta Stroke Program Early CT Score (ASPECTS): <https://www.mdcalc.com/calc/3164/alberta-stroke-program-early-ct-score-aspects>

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Authors

Stephen Wolf, M.D. (Lead); Michael Brown, M.D.

Editors

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