EMERGENCY MEDICINE REPORTS

Practical, Evidence-Based Reviews in Emergency Care

DECEMBER 1, 2021 VOL. 42, NO. 23

AUTHORS

Adria Simon, MD, Assistant Professor, Clinical Emergency Medicine, Assistant Program Director, Emergency Medicine Residency, NewYork-Presbyterian, New York City, NY

Michael DeFilippo, DO, EMT-P, Emergency Medicine Residency, NewYork-Presbyterian, New York City, NY

PEER REVIEWER

Steven M. Winograd, MD, FACEP, Attending Emergency Physician, Keller Army Community Hospital, West Point, NY

STATEMENT OF FINANCIAL DISCLOSURE

None of the authors or planners for this educational activity have relevant financial relationships to disclose with ineligible companies whose primary business is producing, marketing, selling, reselling, or distributing healthcare products used by or on patients

Relias Media
From Relias

Mechanical Thrombectomy for Acute Ischemic Stroke

We all know the drill; emergency medical services calls in with a patient having weakness and trouble speaking — possible stroke. Stroke protocol activated, computed tomography scanner held open, patient taken directly for scan, no hemorrhage seen, then evaluated for thrombolytic therapy. Now, we add mechanical thrombectomy to the mix. How we screen for potential candidates and determine eligibility is the subject of this issue.

—Joseph Stephan Stapczynski, MD, Editor

Introduction and Overview of Ischemic Stroke

Stroke is defined as a disease process that results in decreased blood flow to the brain. Annually in the United States, approximately 795,000 people experience strokes (ischemic and hemorrhagic); approximately 76% of these are first-time events.[1]

Acute ischemic stroke (AIS) accounts for 87% of all strokes and is subdivided further into three major categories: thrombotic, embolic, or hypoperfusion related.[1,2] Thrombotic AIS refers to local obstruction of an artery due to disease of the arterial wall, such as dysplasia, arteriosclerosis, or dissection. Embolic AIS is secondary to debris from elsewhere in the body that then travels through the circulation and occludes arteries in the brain. AIS secondary to hypoperfusion manifests as neurological deficits secondary to inadequate cerebral blood flow in the setting of systemic illness associated with circulatory compromise, such as septic shock. AIS secondary to thrombotic or embolic processes presenting with permanently debilitating symptoms or symptoms that may diminish a patient's quality of life requires prompt recognition and treatment with reperfusion strategies.[2]

Overview of Reperfusion Strategies

After stabilization in the emergency department, the gold standard for reperfusion treatment of AIS in the United States has been intravenous (IV) thrombolytic therapy.[3] After the U.S. Food and Drug Administration approved alteplase in 1996 following National Institutes of Health (NIH)/National Institute of Neurological Disorders and Stroke (NINDS) data showed decreased functional disability in AIS patients treated with IV alteplase, IV thrombolytics have become widely available for patients presenting to stroke centers with symptoms concerning for AIS.[3,4] As the landscape of stroke treatment changes with advancements in technology and imaging, mechanical thrombectomy is an evolving treatment for patients presenting with stroke.

Mechanical thrombectomy is indicated for patients who are experiencing AIS due to large vessel occlusion (LVO).[2] While many centers limit

EXECUTIVE SUMMARY

- Large vessel occlusions account for 24% to 46% of acute ischemic strokes.
- The most sensitive clinical screening tools for large vessel occlusion in acute ischemic stroke involve the detection of both motor deficits (face or limb weakness) and cortical deficits (neglect, aphasia, gaze deviation, and hemianopia).
- The three clinical scoring tools with the best sensitivity to detect large vessel occlusion in acute ischemic stroke are the National Institutes of Health Stroke Scale (NIHSS), the Field Assessment Stroke Triage for Emergency Destination (FAST-ED) and the Rapid Arterial Occlusion Evaluation (RACE).
- The imaging protocol for acute stroke should include an initial noncontrast computed tomography (CT) (to detect hemorrhage), and if no hemorrhage is found, followed by CT or magnetic resonance (MR) angiography (to locate the arterial occlusion).
- Mechanical thrombectomy can be done safely after intravenous thrombolytic therapy.
- Mechanical thrombectomy has proven benefit in patients with strokes that involve the large vessels of the anterior circulation (internal carotid artery or proximal middle cerebral artery) performed within six hours.

their eligibility criteria for mechanical thrombectomy only to LVO involving the anterior circulation, some centers will perform thrombectomy on patients involving both anterior and posterior circulation. Anterior circulation strokes include the anterior cerebral artery (ACA), middle cerebral artery (MCA), and the internal carotid artery (ICA); posterior circulation strokes include the posterior cerebral artery (PCA), the basilar artery, and the vertebral artery. Mechanical thrombectomy is appropriate for selected patients presenting with stroke due to LVO within 24 hours of the time last known to be well (at their neurological baseline) and can be performed regardless of IV thrombolytic administration.[2]

Currently, only select stroke centers have sufficient resources to perform mechanical thrombectomy, creating a best practice gap in emergency stroke treatment. As per a Joint Commission survey, 60% of hospitals certified as stroke centers perform endovascular therapy, such as mechanical thrombectomy.[5] The remaining hospitals perform a "drip and ship" approach to patients meeting requirements for mechanical thrombectomy, wherein patients are started on IV thrombolytic and transferred by emergency medical services (EMS) to a receiving center with thrombectomy capabilities. With the American Heart Association (AHA)/American Stroke Association (ASA) recommending all eligible AIS patients receive consideration for adjunctive endovascular therapy, rapid recognition of candidates who would benefit from additional interventional therapy, such as mechanical thrombectomy, must be recognized promptly.[5,6]

Identifying Potential Candidates for Thrombectomy

Screening tools differ between both hospital and prehospital providers. Because of the time-sensitive nature of reperfusion therapy, a reliable system for recognition of LVO is required for both hospital and prehospital providers. LVO typically is associated with motor and cortical deficits; therefore, screening tools that evaluate both of these areas would be expected to be most sensitive. The predominant acute assessment stroke scale used within hospital systems in the United States is the National Institutes of Health Stroke Scale (NIHSS) because of its reliable and reproducible assessment in patients for LVO.[7,8] Referred to as the gold standard stroke scale by the AHA/ASA, the NIHSS assesses for neurological impairment on an 11-item scale, with a sensitivity for LVO ranging from 53% to 99% depending on score.[7,9,10] Using a threshold value of 10 or greater, the NIHSS score has a sensitivity of 96% and a specificity of 63% for LVO.[11] (*See Table 1.*) The major limitation to the NIHSS is its inability to recognize posterior circulation strokes because of its lack of assessment for unsteady gait, dizziness, or diplopia.[9]

Emergency medical technicians and paramedics use several different tools in their evaluation of prehospital patients presenting with stroke-like symptoms. The Cincinnati Prehospital Stroke Scale (CPSS), the Los Angeles Prehospital Stroke Screen (LAPSS), and the Melbourne Ambulance Stroke Screen (MASS) are the three most common screening tools used by EMS personnel in the United States.[2, 12-14] (*See Tables 2–4.*) A multicenter study revealed only three prehospital stroke scales to have a diagnostic accuracy > 95% for AIS: CPSS, Face Arm Speech Time (FAST), and Medical Prehospital Assessment for Code Stroke (Med PACS).[15] Expanding CPSS with a detailed-severity index (d-CPSS scale) significantly improved detection of AIS secondary to LVO within the prehospital environment while maintaining the ease of use of the stroke scale itself.[16] (*See Table 5.*) As the landscape of LVO treatment rapidly evolves and EMS crews may divert to endovascular-capable facilities to provide standard of care, a stroke scale optimized for detecting LVO-specific diagnostic features will need to be developed and used in conjunction with general stroke assessment tools.[17] (*See Table 6.*)

In a literature review of the 20 most common stroke assessment tools among both prehospital and hospital clinicians, the most sensitive indicators among the reviewed diagnostic tools for LVO are a combination of motor deficit and cortical signs (gaze deviation, aphasia, and neglect).[9] The three tools that demonstrated the highest diagnostic accuracy for LVO were the NIHSS, Field Assessment Stroke Triage for Emergency Destination (FAST-ED), and Rapid Arterial oCclusion Evaluation (RACE).[9,18,19] (*See Tables 1, 7, and 8.*) In addition to RACE, the prehospital-specific stroke scales Gaze,

Table 1. National Institutes of Health Stroke Scale (0-42 Points Total)		
1 – Level of consciousness	A – Responsiveness	0 = Alert and responsive 1 = Not alert, but arousable with minimal stimulation 2 = Not alert, requiring repeat stimulation 3 = Unresponsive or responds only with reflexes
	B – Questions - What is your age? - What is the month?	0 = Answers two questions correctly 1 = Answers one question correctly 2 = Answers neither question correctly
	C – Commands - Open and close your eyes - Grip and release your hand	0 = Performs both tasks correctly 1 = Performs one task correctly 2 = Performs neither task correctly
2 – Best gaze		0 = Normal 1 = Partial gaze palsy 2 = Forced deviation
3 – Visual		0 = No visual field loss 1 = Partial hemianopia 2 = Complete hemianopia 3 = Bilateral hemianopia
4 – Facial palsy		0 = Normal symmetric movements 1 = Minor paralysis 2 = Partial paralysis 3 = Complete paralysis of one or both sides
5 – Motor arms (both arms individually scored)		0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
6 – Motor legs (both legs individually scored)		0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
7 – Limb ataxia		0 = Absent 1 = Present in one limb 2 = Present in both limbs
8 – Sensory		0 = Normal; no loss 1 = Mild-to-moderate sensory loss 2 = Severe-to-total sensory loss
9 – Language		0 = No aphasia; normal 1 = Mild-to-moderate aphasia 2 = Severe aphasia 3 = Mute; global aphasia
10 – Dysarthria		0 = Normal 1 = Mild-to-moderate dysarthria 2 = Severe dysarthria
11 – Extinction and inattention		0 = No abnormality 1 = Visual, tactile, auditory, spatial, or personal inattention 2 = Profound hemi-inattention or extinction
Source: National Institute of Neurological Disorders and Stroke. Stroke Scales and Related Information. Nov. 20, 2019. https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Preventing-Stroke/Stroke-Scales-and-Related-Information		

Table 2. Los Angeles Prehospital Stroke Screen (LAPSS)
• No history of seizure or epilepsy • Age ≥ 45 years • Not wheelchair-bound or bedridden at baseline • Blood glucose level 60-400 mg/dL • Obvious asymmetry or unilateral weakness with any of the following exams: - Smile or grimace - Grip - Arm strength
If all of the above criteria are met (or unobtainable), the LAPSS is **positive** for stroke.
Adapted from: UCLA Health System, Los Angeles Prehospital Stroke Screen (LAPSS)

Table 3. Cincinnnati Prehospital Stroke Screen (CPSS)	
Face exam	**Normal:** Symmetrical face movement **Abnormal:** Asymmetrical face movement
Upper limb	**Normal:** Both arms move equally or not at all **Abnormal:** One arm does not move or one arm drifts down
Speech	**Normal:** Patient repeats phrase said by clinician using correct words with no slurring **Abnormal:** Patient slurs words or uses inappropriate words while repeating phrase, or is mute
If **one** of the three areas have abnormal findings, the CPSS is **positive** for stroke.	

Table 4. Melbourne Ambulance Stroke Screen (MASS)	
History items	• Age > 45 years • No history of seizure or epilepsy • Not wheelchair-bound or bedridden at baseline • Blood glucose level 40-400 mg/dL
Face exam	**Normal:** Symmetrical face movement **Abnormal:** Asymmetrical face movement
Upper limb (arm and grip)	**Normal:** Both arms move equally or not at all **Abnormal:** One arm does not move or one arm drifts down
	Normal: Equal grip strength or both have no grip strength **Abnormal:** Unequal grip strength
Speech	**Normal:** Patient repeats phrase said by clinician using correct words with no slurring **Abnormal:** Patient slurs words or uses inappropriate words while repeating phrase, or is mute
If history criteria met, and if **one** of the three areas have abnormal findings, the MASS is **positive** for stroke.	

Face, Arm, Speech, Time (G-FAST) and Conveniently-Grasped Field Assessment Stroke Triage (CG-FAST) have been shown to have high diagnostic accuracy in LVO detection.[20-22] (*See Tables 9–10.*) Despite multiple different prehospital stroke screening tools with high sensitivity for anterior circulation LVO, they remain significantly less sensitive for detection of more distal occlusions beyond the M2 segment.[23]

Supplementing existing stroke scales with specialist consultation or combined scoring systems has been shown to increase diagnostic accuracy and sensitivity for LVO detection. The addition of a neurologist available for phone consultation in conjunction with an in-person advanced life support EMS crew increased the sensitivity, positive predictive value (PPV), and negative predictive value (NPV) of the FAST-ED stroke scale in LVO detection.[23] Although phone consultation increases on-scene time and subsequently time to definitive care by EMS, instituting a FAST-ED threshold value for neurological phone consultation could eliminate those concerns.[24-25] Combined scales also can increase the diagnostic accuracy for LVO for EMS teams; the use of a positive CPSS, defined as at least one positive screening item to trigger a secondary screen with FAST-ED, resulted in increased detection of LVO in the prehospital environment.[26]

As clinical practice moves toward mechanical thrombectomy as the gold standard for LVO AIS, use of stroke assessment tools with a high efficacy in detecting LVO could affect EMS decisions to divert patients to centers that can perform mechanical thrombectomy in addition to IV thrombolytics and standard stroke care.

Indications for Thrombectomy in Patients with LVO

Once patients have been identified as having persistent disabling neurological deficits, multiple conditions must be fulfilled to qualify for mechanical thrombectomy. The primary qualifications to continue with thrombectomy are neuroimaging, either noncontrast computed tomography (CT) or magnetic resonance imaging (MRI) brain, showing a small infarct core with exclusion of hemorrhage, as well as dedicated vascular imaging (CT or MRI angiography) demonstrating an anterior circulation large arterial occlusion.[2,26-27] The criteria for thrombectomy are broken down further by categorizing patients presenting within six hours and those presenting within six to 24 hours of last known well.[2,28-29]

For patients presenting within six hours, criteria for qualification of thrombectomy are based on the MR CLEAN trial and the ASPECTS

Table 5. Detailed Cincinnati Prehospital Stroke Scale (d-CPSS)

Arm	0 = No drift for 10 seconds 1 = Drift, but does not hit bed 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
Facial palsy	0 = Normal symmetry 1 = Minor paralysis 2 = Partial paralysis 3 = Complete paralysis
Speech	0 = Normal 1 = Mild/moderate aphasia or dysarthria 2 = Severe aphasia or dysarthria 3 = Global aphasia or anarthric or mute
A d-CPSS score ≥ 5 has a 69.9% sensitivity and 75.2% specificity for large vessel occlusion	

Adapted from: Tarkanyi G, Csecsei P, Szegedi I, et al. Detailed severity assessment of Cincinnati Prehospital Stroke Scale to detect large vessel occlusion in acute ischemic stroke. *BMC Emerg Med* 2020;20:64.

Table 6. Optimal Characteristics of a Score to Identify Mechanical Thrombectomy Candidates

- Simple to teach and rapid to perform
- Applicable to populations with suspected acute ischemic stroke
- High interrater reliability
- High accuracy to differentiate large vessel occlusion (LVO) vs. imitators or non-LVO strokes
- Validated both in prehospital setting and externally
- Proven to improve patient outcomes

Adapted from: Michel P. Prehospital scales for large vessel occlusion. *Stroke* 2017;48:247-249.

method.[26,27] The MR CLEAN trial was a prospective, multicenter, clinical trial that evaluated 500 patients with AIS with a proximal arterial occlusion who then were randomized to receive either usual care (IV thrombolytics) or intra-arterial care (delivery of thrombolytic, mechanical thrombectomy, or both) plus usual care. The primary endpoint of the study was modified Rankin Scale (mRS) score at 90 days. (*See Table 11.*) Patients who received intra-arterial therapy in conjunction with usual care had more independence and statistically significant mRS of 0-2, with a number needed to treat (NNT) of 7. The MR CLEAN trial was the first multicenter prospective trial to show that intra-arterial therapy in conjunction with IV thrombolytic therapy is safe and effective for patients with AIS secondary to proximal occlusion of anterior circulation.[26]

The ASPECTS method is a set of neuroimaging criteria that was created to identify patients with MCA infarcts who would be unlikely to recover with medical therapy alone but would benefit from the addition of thrombectomy. The MCA territory is divided into 10 regions of interest, with each assigned a point value: three points for subcortical structures (caudate, lentiform nucleus, and internal capsule) and seven points for the MCA cortex. One point is subtracted for areas that show ischemic changes, such as swelling or hypoattenuation.[27] A normal CT scan has an ASPECTS score of 10 points, whereas a diffusely ischemic MCA on CT presents a score of 0.

Some centers use more selective criteria for mechanical thrombectomy under six hours, following guidance from the AHA/ASA. The AHA/ASA recommend mechanical thrombectomy for patients with no significant prestroke disability characterized by an mRS score of ≤ 1 and an occlusion of the ICA or M1 segment of the MCA.[6] These criteria notably are stricter than the inclusion criteria in MR CLEAN, likely because of the unclear benefit of thrombectomy in patients with greater prestroke mRS scores, NIHSS < 6, or ASPECTS score < 6 (i.e., a larger infarct core). Advocates for stricter thrombectomy criteria also point to the ESCAPE and EXTEND-IA trials, both of which studied intra-arterial therapy but restricted eligibility to patients who had independent function prior to the acute stroke and required CT evidence of collateral circulation (ESCAPE) or salvageable brain tissue (EXTEND-IA).[30,31]

For patients presenting within six to 24 hours, centers use either the DAWN or DEFUSE3 trial criteria to determine eligibility for mechanical thrombectomy. The original data from the MR CLEAN trial showed decreased efficacy of intervention as the time from onset exceeded six hours; however, the DAWN and DEFUSE3 trials were conducted and showed a benefit of thrombectomy for certain patients presenting within six to 24 hours of LVO AIS onset, allowing for criteria for intervention in these patients.[32] (*See Table 12.*)

The DAWN trial was a multicenter, prospective, randomized trial of 206 patients with AIS who had evidence of occluded intracranial ICA or proximal MCA who presented within six to 24 hours of symptom onset with disproportionately severe clinical deficits relative to the infarct volume seen on imaging. Patients were randomized to standard of care vs. standard of care plus thrombectomy. Standard of care for patients presenting greater than six hours from last known well included admission to a specialty stroke unit, antiplatelet therapy, antihypertensive management, venous thromboembolism (VTE) prophylaxis, and stroke rehabilitation. Patients who received thrombectomy had significantly better mRS and functional independence at 90 days.[28]

The DEFUSE3 trial was an open-label, randomized, multicenter trial

Table 7. FAST-ED

Face exam	0 = Normal or minor paralysis 1 = Partial or complete paralysis
Upper limb	0 = No drift 1 = Drift or some effort against gravity 2 = No effort against gravity or no movement
Speech changes	0 = Absent 1 = Mild to moderate 2 = Severe, global aphasia, or mute
Eye deviation	0 = Absent 1 = Partial 2 = Forced deviation
Denial/neglect	0 = Absent 1 = Extinction to bilateral simultaneous stimulation in only one sensory modality 2 = Does not recognize own hand or orients only to one side of the body
Likelihood of large vessel occlusion: score of 0 or 1: < 15%; score of 2 or 3: 30%; score of ≥ 4: > 60%	

Table 8. Rapid Arterial Occlusion Evaluation (RACE) Scale

Condition	RACE Score
Face palsy	0 = absent 1 = mild 2 = moderate to severe
Arm motor impairment	0 = normal to mild 1 = moderate 2 = severe
Leg motor impairment	0 = normal to mild 1 = moderate 2 = severe
Head and gaze deviation	0 = absent 1 = present
If left hemiparesis (agnosia)* • Ask patient "Whose arm is this?" • Ask patient "Can you lift both arms and clap?"	0 = patient recognizes arm and impairment 1 = does not recognize arm or impairment 2 = does not recognize arm nor impairment
If right hemiparesis (aphasia)* • Instruct patient to close eyes • Instruct patient to make a fist	0 = performs both tasks correctly 1 = performs one task correctly 2 = performs neither task

RACE Score ≥ 1 = 100% specificity for large vessel occlusion; RACE score 9 = 99% specificity for large vessel occlusion

* Agnosia and aphasia are associated with respectively listed hemispheric stroke syndromes, and only one can be selected during use of this scale if symptoms are present.

Adapted from: Pérez de la Ossa, Carrera D, Gorchs, M, et al. Design and validation of a prehospital stroke scale to predict large arterial occlusion. The Rapid Arterial Occlusion Evaluation Scale. *Stroke* 2014;45:87-91. doi: https://doi.org/10.1161/STROKEAHA.113.003071

that evaluated 182 patients presenting within six to 16 hours after last known well with evidence of intracranial ICA or MCA occlusion with salvageable ischemic brain tissue. Patients were randomized to medical therapy alone (aspirin) or medical therapy plus thrombectomy; the primary outcome was patient function as determined by mRS at 90 days. There was a statistically significant decrease in mRS at 90 days in the thrombectomy group. Secondary outcomes showed significantly increased functional independence at 90 days.[29]

Patients experiencing posterior circulation stroke may benefit from mechanical thrombectomy. Although a majority of mechanical thrombectomy trials published to date have excluded patients with posterior circulation infarcts, mechanical thrombectomy to the posterior circulation has been performed at centers with appropriate expertise. The BEST trial was a randomized trial that compared standard medical therapy to mechanical thrombectomy in patients with acute vertebrobasilar occlusion. Patients who received mechanical thrombectomy had similar 90-day mortality and similar favorable outcome compared to those who received standard medical treatment (i.e., IV thrombolytics).[33] The BASICS trial evaluated patients with basilar artery occlusion and found no significant difference in outcomes for standard medical therapy vs. mechanical thrombectomy.[34] Both the BEST and BASICS studies did show a non-statistically significant but favorable data trend of benefit to mechanical thrombectomy, demonstrating that more research is needed to determine the safety and efficacy of thrombectomy in posterior circulation stroke secondary to LVO.

Procedure of Mechanical Thrombectomy

Mechanical thrombectomy is performed while patients are under either general anesthesia or procedural sedation. The femoral artery is punctured, followed by insertion of a catheter into the artery, which is guided to the ICA, then past the intracranial site of LVO.[35] After the procedure is performed, patients are monitored in an intensive care unit until deemed clinically stable. There are two general styles of devices used for thrombectomy — stent retrievers and catheter aspiration devices — with utilization depending on provider preference.[36] Stent retrievers coil through, trap, then remove the clot from the vessel.[35] Several commercial stent retrievers have been used, with increased

Table 9. G-FAST	
Gaze	0 = Normal 1 = Abnormal
Face	0 = Normal symmetry 1 = Asymmetry
Arm	0 = Normal 1 = Asymmetric/weak /drift
Speech	0 = Normal 1 = Speech difficulty or abnormality
A G-FAST ≥ 3 has a sensitivity for large vessel occlusion of 88.7%. Adapted from: Duvekot MH, Venema E, Rozeman AD, et al. Comparison of eight prehospital stroke scales to detect intracranial large-vessel occlusion in suspected stroke (PRESTO): A prospective observational study. *Lancet Neurol* 2021;20:213-221.	

Table 10. CG-FAST	
Level of consciousness questions	0 = Normal 1 = One correct or neither correct
Gaze	0 = Normal 1 = Partial or forced deviation
Facial palsy	0 = Normal 1 = Minor, partial, or complete paralysis
Arm weakness	0 = No drift or drift does not hit bed 1 = Some effort against gravity, no effort against gravity, or no movement
Speech problems	0 = Normal 1 = Aphasia or dysarthria
A CG-FAST ≥ 4 has an area under the curve (AUC) of 0.758, sensitivity of 61.7%, and positive predictive value (PPV) of 78.5%. Adapted from: Gong X, Chen Z, Shi F, et al. Conveniently-Grasped Field Assessment Stroke Triage (CG-FAST): A modified scale to detect large vessel occlusion stroke. *Front Neurol* 2019;10:390.	

Table 11. Modified Rankin Scale	
0	No symptoms
1	No significant disability — able to carry out all usual activities despite some symptoms
2	Slight disability — able to look after own affairs without assistance, but unable to carry out all previous activities
3	Moderate disability — requires some help, but able to walk unassisted
4	Moderate severe disability — unable to attend to own bodily needs without assistance and unable to walk without assistance
5	Severe disability — requires constant skilled nursing care and attention, bedridden, incontinent
6	Dead

reperfusion rates and better patient outcomes seen with newer, second-generation stent retrievers, such as the Solitaire and Trevo neurothrombectomy devices.[37,38] Catheter aspiration devices work by aspiration of the obstruction, with stent retrieval used as a backup if the aspiration is unsuccessful.[39]

The multicenter, open-label COMPASS trial assessed catheter aspiration vs. stent retrieval as first-line therapy in 270 patients with LVO presenting within six hours of symptom onset. At 90 days, functional disability as measured by mRS of 0-2 was similar among both groups, demonstrating aspiration as first-line therapy as non-inferior to stent retrieval.[40] Additionally, other studies have shown catheter aspiration to have similar rates of revascularization and functional outcome when compared to second-generation stent retrieval.[39-42]

Benefits and Efficacy of Mechanical Thrombectomy

There have been five major studies that have demonstrated early mechanical thrombectomy (within six hours of last known well) for large artery occlusion in the proximal anterior circulation is safe, effective, and has a significant benefit on mRS as a measure of functional independence and decreased functional disability as compared to standard stroke care alone. Based on the data of these trials, the AHA/ASA announced in 2015 a Class IA recommendation that patients receive mechanical thrombectomy if they meet certain criteria.[43] (*See Table 13.*) The NNT for functional independence regarding mechanical thrombectomy ranges from 3 to 7.5 depending on the randomized controlled trial referenced.[26,30,31,44-46] A meta-analysis of multicenter, randomized controlled mechanical thrombectomy trials evaluated 1,287 patients and found that patients had higher rates of functional independence (as measured on a mRS of 0-2 after 90 days), significantly reduced disability measured by improvement of ≥ 1 on mRS at 90 days, and showed benefit across several subgroups, including those presenting with high stroke severity and age ≥ 80 years.[47] The data for mechanical thrombectomy occurring after six hours have only shown proven effect in those with AIS due to occlusion of intracranial ICA or proximal MCA within six to 24 hours, defined as functional

Table 12. DAWN and DEFUSE-3 Inclusion Criteria

	DAWN	DEFUSE-3
Time window from last known well	6 to 24 hours	6 to 16 hours
Age	≥ 18 years	18 to 90 years
mRS before arterial ischemic stroke symptoms	≤ 1, with life expectancy ≥ 6 months	≤ 2, with life expectancy ≥ 6 months
NIH Stroke Scale (NIHSS) score	≥ 10	≥ 6
Arterial occlusion	Internal carotid artery and/or M1 middle cerebral artery occlusion	Internal carotid artery and/or M1 middle cerebral artery occlusion
Mismatch definition	• Age < 80 years and NIHSS ≥ 10 and infarct core 0-30 mL, OR • Age < 80 years and NIHSS ≥ 20 and infarct core 31-51 mL, OR • Age ≥ 80 years and NIHSS ≥ 10 and infarct core 0-20 mL	• Infarct core volume < 70 mL, and • Mismatch volume > 15 mL, and • Mismatch ratio (penumbra/core) > 1.8

Adapted from: Nogueira RG, Jadhav AP, Haussen DC, et al. Thrombectomy 6 to 24 hours after stroke with a mismatch between deficit and infarct. *N Engl J Med* 2018;378:11-21; and Albers GW, Marks MP, Kemp S, et al. Thrombectomy for stroke at 6 to 16 hours with selection by perfusion imaging. *N Engl J Med* 2018;378:708-718.

Table 13. AHA/ASA Guidelines for Mechanical Thrombectomy

- Prestroke modified Rankin Scale score 0 to 1
- Acute ischemic stroke that received IV thrombolytics (i.e., alteplase) within 4.5 hours of onset
- Occlusion of internal carotid artery (ICA) or proximal middle cerebral artery (MCA) (M1)
- Age ≥ 18 years
- National Institutes of Health Stroke Scale score ≥ 6
- ASPECTS score ≥ 6
- Treatment can be initiated within six hours of symptom onset

All 7 criteria must be met to be indicated.

Adapted from: Powers WJ, Rabinstein AA, Ackerson T, et al. Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2019;50:e344-e418.

independence and reduced disability on the mRS.[28,29] In light of this evidence, the AHA/ASA has recommended application of strict inclusion or exclusion criteria from DAWN or DEFUSE3 to determine eligibility for mechanical thrombectomy after six hours from last known well.[6]

An additional aspect of the benefits of mechanical thrombectomy are within cost effectiveness and quality-adjusted life years (QALY) added after treatment. Data from the United Kingdom have suggested that the net monetary benefit (NMB) to society for mechanical thrombectomy ranges from 95 to 174.9 million U.S. dollars (USD), with the willingness to pay for a QALY ranging from 33,000 USD to 49,500 USD. For comparison, IV thrombolysis alone had an NBM ranging from 72.5 to 135 million USD.[48] A model using pooled outcome data from the ESCAPE, MR CLEAN, EXTEND-IA, REVASCAT, and SWIFT PRIME trials found mechanical thrombectomy in addition to standard care to have led to gained QALY ranging from 0.47 to 2.12, with an incremental cost-effectiveness ratio of 3,110 USD/QALY.[49] The cost effectiveness extends to patients presenting with later last known well times — a model using data from DAWN and DEFUSE3 found late mechanical thrombectomy added to standard medical therapy to be cost-effective in all subgroups evaluated in both studies.[50]

Adverse Effects of Mechanical Thrombectomy

A review of mechanical thrombectomy trials and related literature revealed rates of adverse effects across three broad procedurally related categories: access site complications (4%), new embolization (5%), and vascular complications, which include intracranial hemorrhage, extracranial bleeding, and arterial perforation (6%).[51] The percentile range of complications reported across all studies was wide, given there were no uniform definitions of these complications and in some trials no reported adverse outcomes.

Access site problems include vessel injury, nerve injury, hematoma, and infection. Of the major trials, the definition of hematoma was not consistent, thus, rates ranged from 2% to 10.7%.[51] ESCAPE reported two episodes of hematoma (one neck secondary to failed groin approach, one groin) and EXTEND-IA reported one patient who required transfusion secondary to a groin and retroperitoneal hematoma.[30,31,51]

New embolization occurs during mechanical thrombectomy secondary to

the ability of a dislodged clot to travel to a proximal, unaffected territory or distally within the target artery, resulting in new areas of infarct or occlusion. Occurring in 1% to 12.5% of cases, new embolization was associated with catheter technique and clot mechanics, with higher risk in more proximal clot retrievals.[52] Balloon-guided catheters reported less embolization risk as compared to standard stent retrievers and have demonstrated a higher first-pass success rate and lower mortality rate compared to non-balloon-guided catheters.[53,54]

Intracranial hemorrhage (ICH) occurs more commonly and is associated with more serious adverse events. In literature review, symptomatic ICH ranged from 3.6% to 9.3% from data collected via randomized controlled trial (RCT) and registry analyses; however, a pooled analysis of five trials showed the overall risk of symptomatic ICH to be 4.4% in patients who received both IV thrombolysis and mechanical thrombectomy compared to 4.3% in patients who received IV thrombolysis or standard care alone.[47,51] Mortality related to symptomatic ICH also had no significant difference in mechanical thrombectomy (15%) vs. IV thrombolysis or standard care alone (19%).[47] Stent detachment, although usually asymptomatic, was associated with higher rates of both ICH and arterial perforation, ranging from 0.66% to 3.9%.[51,55,56] Arterial perforation occurred in 0.7% to 4.9% of patients based on factors including type of image quality secondary to angiographic equipment available, patient movement during procedure, and operator experience.[51,57]

To limit adverse events of mechanical thrombectomy procedures, multiple societies recommend that physicians trained specifically in intracranial endovascular procedures perform these techniques. In addition, it is recommended that physicians must undertake these procedures regularly to maintain skills and, thus, reduce procedurally related complications.[58-60]

Summary

Stroke is a debilitating illness affecting millions of individuals across the globe. While effective and life-saving treatment modalities exist at a majority of stroke receiving centers in the form of IV thrombolytics, there is an emerging new standard in AIS with mechanical thrombectomy. A practice gap exists wherein some patients are not recognized as having a salvageable LVO based on older standards, imperfect screening tools, or insufficient resources to recognize and perform thrombectomy in patients who might otherwise benefit from procedural intervention. While mechanical thrombectomy comes with small risk, it has several significant benefits, including return to functional independence, quality of life years gained, and cost-savings for an overtaxed healthcare system.

References

1. Virani SS, Alonso A, Benjamin EJ, et al. Heart disease and stroke statistics – 2020 update: A report from the American Heart Association. *Circulation* 2020;141:e139-e596.
2. Go S. Stroke syndromes. In: Tintinalli JE, Stapczynski JS, Ma OJ, et al, eds. *Tintinalli's Emergency Medicine: A Comprehensive Study Guide*. 9th ed. McGraw-Hill Education; 2019.
3. American Stroke Association. Ischemic stroke treatment. https://www.stroke.org/en/about-stroke/types-of-stroke/ischemic-stroke-clots/ischemic-stroke-treatment
4. National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue plasminogen activator for acute ischemic stroke. *N Engl J Med* 1995;333:1581-1587.
5. Alberts MJ, Range J, Spencer W, et al. Availability of endovascular therapies for cerebrovascular disease at primary stroke centers. *Interv Neuroradiol* 2017;23:64-68.
6. Powers WJ, Rabinstein AA, Ackerson T, et al. Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2019;50:e344-e418.
7. National Institutes of Health. National Institutes of Health Stroke Scale. https://www.nihstrokescale.org/
8. Lyden P, Raman R, Liu L, et al. NIHSS training and certification using a new digital video disk is reliable. *Stroke* 2005;36:2446-2449.
9. Antipova D, Eadie L, Macaden A, Wilson P. Diagnostic accuracy of clinical tools for assessment of acute stroke: A systematic review. *BMC Emerg Med* 2019;19:49.
10. Lyden P. Using the National Institutes of Health Stroke Scale: A cautionary tale. *Stroke* 2017;48:513-519.
11. Martins-Filho RK, Dias FA, Alves FFA, et al. Large vessel occlusion score: A screening tool to detect large vessel occlusion in the acute stroke setting. *J Stroke Cerebrovasc Dis* 2019;28:869.
12. You JS, Chung SP, Chung HS, et al. Predictive value of the Cincinnati Prehospital Stroke Scale for identifying thrombolytic candidates in acute ischemic stroke. *Am J Emerg Med* 2013;31:1699-1702.
13. Kidwell CS, Starkman S, Eckstein M, et al. Identifying stroke in the field. Prospective validation of the Los Angeles prehospital stroke screen (LAPSS). *Stroke* 2000;31:71-76.
14. Bray JE, Coughlan K, Barger B, Bladin C. Paramedic diagnosis of stroke: Examining long-term use of the Melbourne Ambulance Stroke Screen (MASS) in the field. *Stroke* 2010;41:1363-1366.
15. Saberian P, Rafiemanesh H, Heydari F, et al. A multicenter diagnostic accuracy study on prehospital stroke screening scales. *Arch Iran Med* 2021;24:453-460.
16. Tarkanyi G, Csecsei P, Szegedi I, et al. Detailed severity assessment of Cincinnati Prehospital Stroke Scale to detect large vessel occlusion in acute ischemic stroke. *BMC Emerg Med* 2020;20:64.
17. Michel P. Prehospital scales for large vessel occlusion. *Stroke* 2017;48:247-249.
18. Lima FO, Silva GS, Furie KL, et al. The Field Assessment Stroke Triage for Emergency Destination (FAST-ED): A simple and accurate prehospital scale to detect large vessel occlusion strokes. *Stroke* 2016;47:1997-2002.
19. Pérez de la Ossa N, Carrera D, Gorchs M, et al. Design and validation of a prehospital stroke scale to predict large arterial occlusion: The Rapid Arterial Occlusion Evaluation Scale. *Stroke* 2014;45:87-91.
20. Duvekot MH, Venema E, Rozeman AD, et al. Comparison of eight prehospital stroke scales to detect intracranial large-vessel occlusion in suspected stroke (PRESTO): A prospective observational study. *Lancet Neurol* 2021;20:213-221.
21. Scheitz JF, Abdul-Rahim AH, MacIsaac RL, et al. Clinical selection strategies to identify ischemic stroke patients with large anterior vessel occlusion: Results from SITS-ISTR (Safe Implementation of Thrombolysis in Stroke International Stroke Thrombolysis Registry). *Stroke* 2017;48:290-297.

22. Gong X, Chen Z, Shi F, et al. Conveniently-Grasped Field Assessment Stroke Triage (CG-FAST): A modified scale to detect large vessel occlusion stroke. *Front Neurol* 2019;10:390.

23. Duvekot MHC, Venema E, Lingsma HF, et al. Sensitivity of prehospital stroke scales for different intracranial large vessel occlusion locations. *Eur Stroke J* 2021;6: 194-204.

24. Puolakka T, Virtanen P, Kinnunen J, et al. Prehospital identification of large vessel occlusion using the FAST-ED score. *Acta Neurol Scand* 2021;144:400-407.

25. Puolakka T, Kuisma M, Länkimäki S, et al. Cutting the prehospital on-scene time of stroke thrombolysis in Helsinki: A prospective interventional study. *Stroke* 2016;47:3038-3040.

26. Berkhemer OA, Fransen PS, Beumer D, et al. A randomized trial of intraarterial treatment for acute ischemic stroke. *N Engl J Med* 2015;372:11-20.

27. Barber PA, Demchuk AM, Zhang J, Buchan AM. Validity and reliability of a quantitative computed tomography score in predicting outcome of hyperacute stroke before thrombolytic therapy. ASPECTS Study Group. Alberta Stroke Programme Early CT Score. *Lancet* 2000;355: 1670-1674.

28. Nogueira RG, Jadhav AP, Haussen DC, et al. Thrombectomy 6 to 24 hours after stroke with a mismatch between deficit and infarct. *N Engl J Med* 2018;378:11-21.

29. Albers GW, Marks MP, Kemp S, et al. Thrombectomy for stroke at 6 to 16 hours with selection by perfusion imaging. *N Engl J Med* 2018;378:708-718.

30. Campbell BC, Mitchell PJ, Kleinig TJ, et al. Endovascular therapy for ischemic stroke with perfusion-imaging selection. *N Engl J Med* 2015;372:1009-1018.

31. Goyal M, Demchuk AM, Menon BK, et al. Randomized assessment of rapid endovascular treatment of ischemic stroke. *N Engl J Med* 2015;372:1019-1030.

32. Saver JL, Goyal M, van der Lugt A, et al. Time to treatment with endovascular thrombectomy and outcomes from ischemic stroke: A meta-analysis. *JAMA* 2016;316:1279-1288.

33. Liu X, Dai Q, Ye R, et al. Endovascular treatment versus standard medical treatment for vertebrobasilar artery occlusion (BEST): An open-label, randomised controlled trial. *Lancet Neurol* 2020;19: 115-122.

34. Langezaal LCM, van der Hoeven EJRJ, Mont'Alverne FJA, et al. Endovascular therapy for stroke due to basilar-artery occlusion. *N Engl J Med* 2021;384: 1910-1920.

35. Pierre Gobin Y, Starkman S, Duckwiler GR, et al. MERCI 1: A phase 1 study of mechanical embolus removal in cerebral ischemia. *Stroke* 2004;35:2848-2854.

36. Menon BK, Goyal M. Thrombus aspiration or retrieval in acute ischaemic stroke. *Lancet* 2019;393:962-963.

37. Saver JL, Jahan R, Levy EI, et al. Solitaire flow restoration device versus the Merci Retriever in patients with acute ischaemic stroke (SWIFT): A randomised, parallel-group, non-inferiority trial. *Lancet* 2012;380:1241-1249.

38. Nogueira RG, Lutsep HL, Gupta R, et al. Trevo versus Merci retrievers for thrombectomy revascularisation of large vessel occlusions in acute ischaemic stroke (TREVO 2): A randomised trial. *Lancet* 2012;380:1231-1240.

39. Bernsen MLE, Goldhoorn R-JB, Lingsma HF, et al. Importance of occlusion site for thrombectomy technique in stroke: Comparison between aspiration and stent retriever. *Stroke* 2021;52:80-90.

40. Turk AS, Siddiqui A, Fifi JT, et al. Aspiration thrombectomy versus stent retriever thrombectomy as first-line approach for large vessel occlusion (COMPASS): A multicentre, randomised, open label, blinded outcome, non-inferiority trial. *Lancet* 2019;393:998-1008.

41. Mocco J, Zaidat OO, von Kummer R, et al. Aspiration thrombectomy after intravenous alteplase versus intravenous alteplase alone. *Stroke* 2016;47:2331-2338.

42. Lapergue B, Blanc R, Gory B, et al. Effect of endovascular contact aspiration vs stent retriever on revascularization in patients with acute ischemic stroke and large vessel occlusion: The ASTER randomized clinical trial. *JAMA* 2017;318:443-452.

43. Powers WJ, Derdeyn CP, Biller J, et al. 2015 American Heart Association/American Stroke Association focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2015;46:3020-3035.

44. Saver JL, Goyal M, Bonafe A, et al. Stent-retriever thrombectomy after intravenous t-PA vs. t-PA alone in stroke. *N Engl J Med* 2015;372:2285-2295.

45. van den Berg LA, Dijkgraaf MG, Berkhemer OA, et al. Two-year outcome after endovascular treatment for acute ischemic stroke. *N Engl J Med* 2017;376:1341-1349.

46. Dávalos A, Cobo E, Molina CA, et al. Safety and efficacy of thrombectomy in acute ischaemic stroke (REVASCAT): 1-year follow-up of a randomised open-label trial. *Lancet Neurol* 2017;16:369-376.

47. Goyal M, Menon BK, van Zwam WH, et al. Endovascular thrombectomy after large-vessel ischaemic stroke: A meta-analysis of individual patient data from five randomised trials. *Lancet* 2016;387: 1723-1731.

48. Ganesalingam J, Pizzo E, Morris S, et al. Cost-utility analysis of mechanical thrombectomy using stent retrievers in acute ischemic stroke. *Stroke* 2015;46:2591-2598.

49. Kunz WG, Hunink MGM, Sommer WH, et al. Cost-effectiveness of endovascular stroke therapy: A patient subgroup analysis from a US healthcare perspective. *Stroke* 2016;47:2797-2804.

50. Peultier A-C, Pandya A, Sharma R, et al. Cost-effectiveness of mechanical thrombectomy more than 6 hours after symptom onset among patients with acute ischemic stroke. *JAMA Netw Open* 2020;3:e2012476.

51. Balami JS, White PM, McMeekin PJ, et al. Complications of endovascular treatment for acute ischemic stroke: Prevention and management. *Int J Stroke* 2018;13:348-361.

52. Chueh J-Y, Puri AS, Wakhloo AK, Gounis MJ. Risk of distal embolization with stent retriever thrombectomy and ADAPT. *J Neurointerv Surg* 2016;8:197-202.

53. Stampfl S, Pfaff J, Herweh C, et al. Combined proximal balloon occlusion and distal aspiration: A new approach to prevent distal embolization during neurothrombectomy. *J Neurointerv Surg* 2017;9:346-351.

CME/CE INSTRUCTIONS

To earn credit for this activity, please follow these instructions:

1. Read and study the activity, using the references for further research.
2. Log onto ReliasMedia.com and click on My Account. *First-time users must register on the site.*
3. Pass the online test with a score of 100%; you will be allowed to answer the questions as many times as needed to achieve a score of 100%. Tests are taken with each issue.
4. After successfully completing the test, your browser will be automatically directed to the activity evaluation form, which you will submit online.
5. Once the completed evaluation is received, a credit letter will be emailed to you.

54. Blasco J, Puig J, Daunis-I-Estadella P, et al. Balloon guide catheter improvements in thrombectomy outcomes persist despite advances in intracranial aspiration technology. *J Neurointerv Surg* 2021;13:773-778.
55. Castaño C, Dorado L, Remollo S, et al. Unwanted detachment of the Solitaire device during mechanical thrombectomy in acute ischemic stroke. *J Neurointerv Surg* 2016;8:1226-1230.
56. Yub Lee S, Won Youn S, Kyun Kim H, Rok Do Y. Inadvertent detachment of a retrievable intracranial stent: Review of manufacturer and user facility device experience. *Neuroradiol J* 2015;28:172-176.
57. Kang JY, Yi KS, Cha S-H, et al. Gelfoam embolization for distal, medium vessel injury during mechanical thrombectomy in acute stroke: A case report. *World J Clin Cases* 2021;9:5668-5674.
58. Fiehler J, Cognard C, Gallitelli M, et al. European Recommendations on Organisation of Interventional Care in Acute Stroke (EROICAS). *Int J Stroke* 2016;11:701-716.
59. White PM, Bhalla A, Dinsmore J, et al. Standards for providing safe acute ischaemic stroke thrombectomy services (September 2015). *Clin Radiol* 2017;72:175.e1-175.e9.
60. National Institute for Health and Care Excellence. Mechanical clot retrieval for treating acute ischaemic stroke. Published Feb. 24, 2016. https://www.nice.org.uk/guidance/ipg548

CME/CE Questions

1. Which of the following stroke screening tools has the highest sensitivity for detecting acute stroke compared to stroke mimics?
   a. Los Angeles Prehospital Stroke Screen (LAPSS)
   b. Cincinnati Prehospital Stroke Scale (CPSS)
   c. Melbourne Ambulance Stroke Screen (MASS)
   d. Field Assessment Stroke Triage for Emergency Destination (FAST-ED)
2. Which of the following are the most sensitive assessment findings for large vessel occlusion of the anterior circulation?
   a. Combination of motor deficits and cortical signs
   b. Combination of motor deficits and speech deficits
   c. Combination of speech deficits and cortical signs
   d. Combination of speech deficits and hemiparesis
3. Which of the following trials was the first to establish the safety and efficacy for adjunctive endovascular therapy in acute ischemic stroke patients alongside intravenous (IV) thrombolytics?
   a. DAWN
   b. EXTEND-IA
   c. DEFUSE3
   d. MR CLEAN
4. Which of the following trials established the safety and efficacy for endovascular therapy in patients presenting with acute ischemic stroke secondary to anterior large vessel occlusion greater than six hours from last known well?
   a. MR CLEAN
   b. ASPECTS
   c. DAWN
   d. BEST
5. Which of the following is the most common adverse effect of mechanical thrombectomy?
   a. Arterial perforation
   b. New embolization
   c. Access site complications
   d. Subarachnoid hemorrhage
6. Which of the following trials established the position that posterior large vessel occlusion treatment could add adjunctive endovascular therapy as shown by non-significant trends toward benefit?
   a. BEST
   b. DAWN
   c. DEFUSE3
   d. COMPASS
7. Which of the following stroke screening tools uses demographic data, such as age, to determine the likelihood of a stroke?
   a. LAPSS
   b. CPSS
   c. National Institutes of Health Stroke Scale (NIHSS)
   d. FAST-ED
8. A patient presenting with acute ischemic stroke has slight disability but can carry out all of their usual activities without apparent issue. What is the modified Rankin Scale (mRS) score?
   a. 0
   b. 1
   c. 2
   d. 4
9. Of the data given, which of the following patients would meet criteria for mechanical thrombectomy as defined by the American Heart Association/American Stroke Association criteria?
   a. Age 54, last known well 45 minutes, prestroke mRS 0, internal carotid artery occlusion on computed tomography (CT)
   b. Age 17, last known well 2 hours, prestroke mRS 0, middle cerebral artery (MCA) occlusion on CT
   c. Age 82, last known well 45 minutes, prestroke mRS 2, MCA occlusion on CT
   d. Age 64, last known well 3 hours, prestroke mRS 1, vertebrobasilar occlusion on CT
10. Which of the following anatomical locations is the preferred entry site for cannulation during mechanical thrombectomy?
   a. Neck via carotid artery
   b. Wrist via radial artery
   c. Groin via femoral artery
   d. Chest via subclavian artery

EMERGENCY MEDICINE REPORTS™
(ISSN 0746-2506) is published semimonthly by Relias LLC, 1010 Sync St., Ste. 100, Morrisville, NC 27560-5468. Periodicals postage paid at Morrisville, NC, and additional mailing offices. POSTMASTER: Send address changes to *Emergency Medicine Reports*, Relias LLC, 1010 Sync St., Ste. 100, Morrisville, NC 27560-5468.

Executive Editor: Shelly Morrow Mark
Associate Editor: Mike Gates
Editorial Group Manager: Leslie Coplin
Accreditations Director: Amy M. Johnson, MSN, RN, CPN

GST Registration No.: R128870672

Back issues: $30. Missing issues will be fulfilled by customer service free of charge when contacted within one month of the missing issue's date.

SUBSCRIBER INFORMATION

CUSTOMER SERVICE: (800) 688-2421

Customer Service Email Address:
customerservice@reliasmedia.com

Editorial Email Address:
smark@relias.com

Online:
ReliasMedia.com

MULTIPLE COPIES:
Discounts are available for group subscriptions, multiple copies, site-licenses, or electronic distribution. For pricing information, please contact our Group Account Managers at groups@reliasmedia.com or (866) 213-0844.

Relias Media
From **Relias**

ACCREDITATION

JOINTLY ACCREDITED PROVIDER™
INTERPROFESSIONAL CONTINUING EDUCATION

In support of improving patient care, Relias LLC is jointly accredited by the Accreditation Council for Continuing Medical Education (ACCME), the Accreditation Council for Pharmacy Education (ACPE), and the American Nurses Credentialing Center (ANCC), to provide continuing education for the healthcare team.

The Relias LLC designates this enduring material for a maximum of 3 *AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

3 ANCC contact hours will be awarded to participants who meet the criteria for successful completion

Approved by the American College of Emergency Physicians for a maximum of 3 hour(s) of ACEP Category I credit.

This Enduring Material activity, *Emergency Medicine Reports*, has been reviewed and is acceptable for credit by the American Academy of Family Physicians. Term of approval begins 01/01/2020. Term of approval is for one year from this date. Physicians should claim only the credit commensurate with the extent of their participation in the activity. Approved for 3 AAFP Prescribed credits.

The American Osteopathic Association has approved this continuing education activity for up to 2.5 AOA Category 2-B credits.

This is an educational publication designed to present scientific information and opinion to health professionals, to stimulate thought, and further investigation. It does not provide advice regarding medical diagnosis or treatment for any individual case. It is not intended for use by the layman. Opinions expressed are not necessarily those of this publication. Mention of products or services does not constitute endorsement. Clinical, legal, tax, and other comments are offered for general guidance only; professional counsel should be sought for specific situations.

This CME/CE activity is intended for emergency and family physicians and nurses. It is in effect for 36 months from the date of the publication.

EMERGENCY MEDICINE REPORTS

Mechanical Thrombectomy for Acute Ischemic Stroke

National Institutes of Health Stroke Scale (0-42 Points Total)		
1 – Level of consciousness	A – Responsiveness	0 = Alert and responsive 1 = Not alert, but arousable with minimal stimulation 2 = Not alert, requiring repeat stimulation 3 = Unresponsive or responds only with reflexes
	B – Questions - What is your age? - What is the month?	0 = Answers two questions correctly 1 = Answers one question correctly 2 = Answers neither question correctly
	C – Commands - Open and close your eyes - Grip and release your hand	0 = Performs both tasks correctly 1 = Performs one task correctly 2 = Performs neither task correctly
2 – Best gaze		0 = Normal 1 = Partial gaze palsy 2 = Forced deviation
3 – Visual		0 = No visual field loss 1 = Partial hemianopia 2 = Complete hemianopia 3 = Bilateral hemianopia
4 – Facial palsy		0 = Normal symmetric movements 1 = Minor paralysis 2 = Partial paralysis 3 = Complete paralysis of one or both sides
5 – Motor arms (both arms individually scored)		0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
6 – Motor legs (both legs individually scored)		0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
7 – Limb ataxia		0 = Absent 1 = Present in one limb 2 = Present in both limbs
8 – Sensory		0 = Normal; no loss 1 = Mild-to-moderate sensory loss 2 = Severe-to-total sensory loss
9 – Language		0 = No aphasia; normal 1 = Mild-to-moderate aphasia 2 = Severe aphasia 3 = Mute; global aphasia
10 – Dysarthria		0 = Normal 1 = Mild-to-moderate dysarthria 2 = Severe dysarthria
11 – Extinction and inattention		0 = No abnormality 1 = Visual, tactile, auditory, spatial, or personal inattention 2 = Profound hemi-inattention or extinction
Source: National Institute of Neurological Disorders and Stroke. Stroke Scales and Related Information. Nov. 20, 2019. https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Preventing-Stroke/Stroke-Scales-and-Related-Information		

Modified Rankin Scale	
0	No symptoms
1	No significant disability — able to carry out all usual activities despite some symptoms
2	Slight disability — able to look after own affairs without assistance, but unable to carry out all previous activities
3	Moderate disability — requires some help, but able to walk unassisted
4	Moderate severe disability — unable to attend to own bodily needs without assistance and unable to walk without assistance
5	Severe disability — requires constant skilled nursing care and attention, bedridden, incontinent
6	Dead

FAST-ED	
Face exam	0 = Normal or minor paralysis 1 = Partial or complete paralysis
Upper limb	0 = No drift 1 = Drift or some effort against gravity 2 = No effort against gravity or no movement
Speech changes	0 = Absent 1 = Mild to moderate 2 = Severe, global aphasia, or mute
Eye deviation	0 = Absent 1 = Partial 2 = Forced deviation
Denial/neglect	0 = Absent 1 = Extinction to bilateral simultaneous stimulation in only one sensory modality 2 = Does not recognize own hand or orients only to one side of the body
Likelihood of large vessel occlusion: score of 0 or 1: < 15%; score of 2 or 3: 30%; score of ≥ 4: > 60%	

AHA/ASA Guidelines for Mechanical Thrombectomy

- Prestroke modified Rankin Scale score 0 to 1
- Acute ischemic stroke that received IV thrombolytics (i.e., alteplase) within 4.5 hours of onset
- Occlusion of internal carotid artery (ICA) or proximal middle cerebral artery (MCA) (M1)
- Age ≥ 18 years
- National Institutes of Health Stroke Scale score ≥ 6
- ASPECTS score ≥ 6
- Treatment can be initiated within six hours of symptom onset

All 7 criteria must be met to be indicated.

Adapted from: Powers WJ, Rabinstein AA, Ackerson T, et al. Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2019;50:e344-e418.

Cincinnnati Prehospital Stroke Screen (CPSS)	
Face exam	**Normal:** Symmetrical face movement **Abnormal:** Asymmetrical face movement
Upper limb	**Normal:** Both arms move equally or not at all **Abnormal:** One arm does not move or one arm drifts down
Speech	**Normal:** Patient repeats phrase said by clinician using correct words with no slurring **Abnormal:** Patient slurs words or uses inappropriate words while repeating phrase, or is mute
If **one** of the three areas have abnormal findings, the CPSS is **positive** for stroke.	

Melbourne Ambulance Stroke Screen (MASS)	
History items	• Age > 45 years • No history of seizure or epilepsy • Not wheelchair-bound or bedridden at baseline • Blood glucose level 40-400 mg/dL
Face exam	**Normal:** Symmetrical face movement **Abnormal:** Asymmetrical face movement
Upper limb (arm and grip)	**Normal:** Both arms move equally or not at all **Abnormal:** One arm does not move or one arm drifts down
	Normal: Equal grip strength or both have no grip strength **Abnormal:** Unequal grip strength
Speech	**Normal:** Patient repeats phrase said by clinician using correct words with no slurring **Abnormal:** Patient slurs words or uses inappropriate words while repeating phrase, or is mute
If history criteria met, and if **one** of the three areas have abnormal findings, the MASS is **positive** for stroke.	

Supplement to *Emergency Medicine Reports*, December 1, 2021: "Mechanical Thrombectomy for Acute Ischemic Stroke."
Authors: Adria Simon, MD, Assistant Professor, Clinical Emergency Medicine, Assistant Program Director, Emergency Medicine Residency, NewYork-Presbyterian, New York City, NY; Michael DeFilippo, DO, EMT-P, Emergency Medicine Residency, NewYork-Presbyterian, New York City, NY.