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Together to End Stroke®

STROKE TRAINING FOR EMS PROFESSIONALS

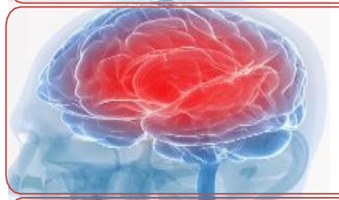
May 2022



Course Objectives



About Stroke



Stroke Policy Recommendations



Stroke Protocols & Hospital Care



Stroke Assessment & Severity Tools



Pre-Notification



Stroke Treatment

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ABOUT STROKE



Why Should We Care?

- Despite new treatment and prevention advances, stroke is *not* going away
- Stroke treatments are available and are effective *if:*
  - *Available at the receiving hospital*
  - *Administered quickly*
- EMS personnel play a critical role in helping ensure stroke patients have access to these therapies



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Stroke Facts

- A stroke is a medical emergency! Stroke occurs when blood flow is either cut off or is reduced, depriving the brain of blood and oxygen.[1]
- About 795,000 strokes occur in the U.S. each year – roughly the same as number of heart attacks (805,000) that occur each year.[1]
- Stroke is the fifth leading cause of death in the U.S.[1]
- Stroke is a leading cause of adult disability.[1]
- On average, every 40 seconds, someone in the United States has a stroke.[1]
- About 1.9 million brain cells die on average for each minute that a large vessel stroke goes untreated.[2]
- About 7.6 million stroke survivors living in the U.S.[1]
- The indirect and direct cost of stroke is $52.8 billion annually (2017-18).[1]
- Stroke crosses all ages, racial/ethnic and socioeconomic groups.[1]

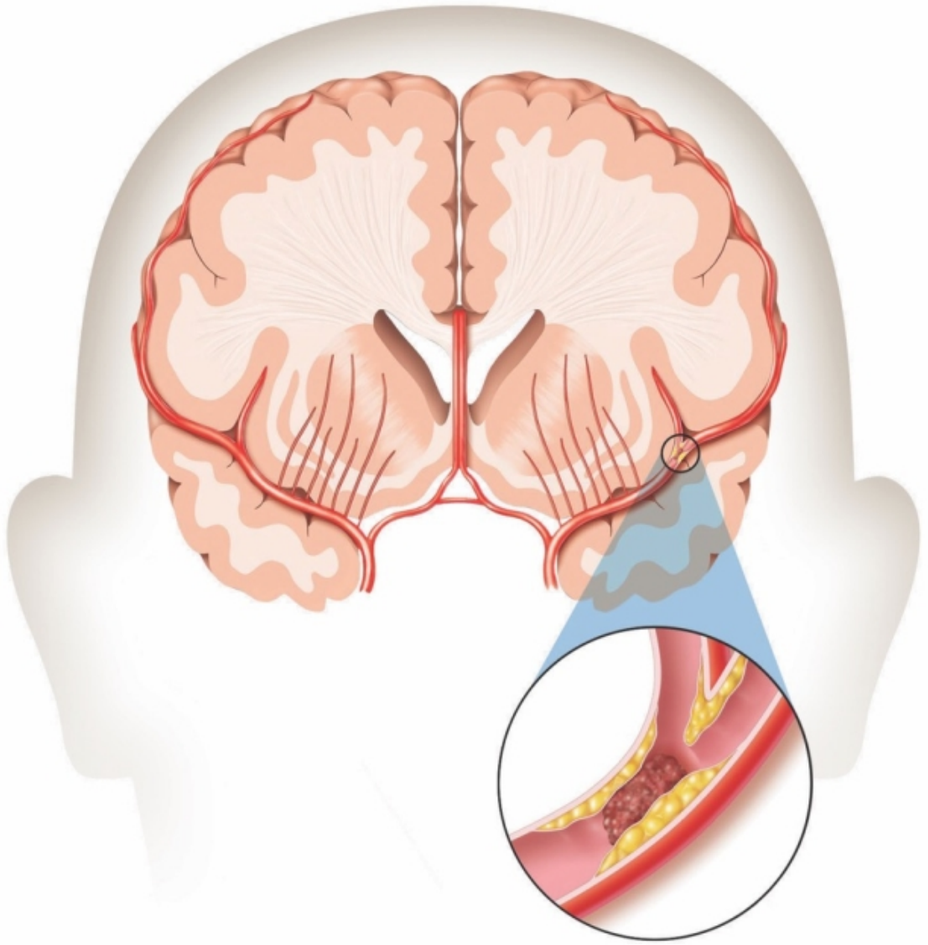
1. Tsao CW, et al. Heart Disease and Stroke Statistics. (2022) *Circulation.*
2. Saver JL. Time Is Brain—Quantified. (2006) *Stroke*.

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Different Types of Stroke

Ischemic Stroke

- It's caused by a blockage in an artery stopping normal blood and the brain
- About 87% of strokes are ischemic
- There are two types of ischemic strokes:
  - **Embolism:** Blood clot or plaque fragment from elsewhere in the body gets lodged in the brain
  - **Thrombosis:** Blood clot is formed in an artery that provides blood to the brain
- A stroke caused by a large vessel occlusion (LVO) is a severe type of ischemic stroke that may need more advanced care.



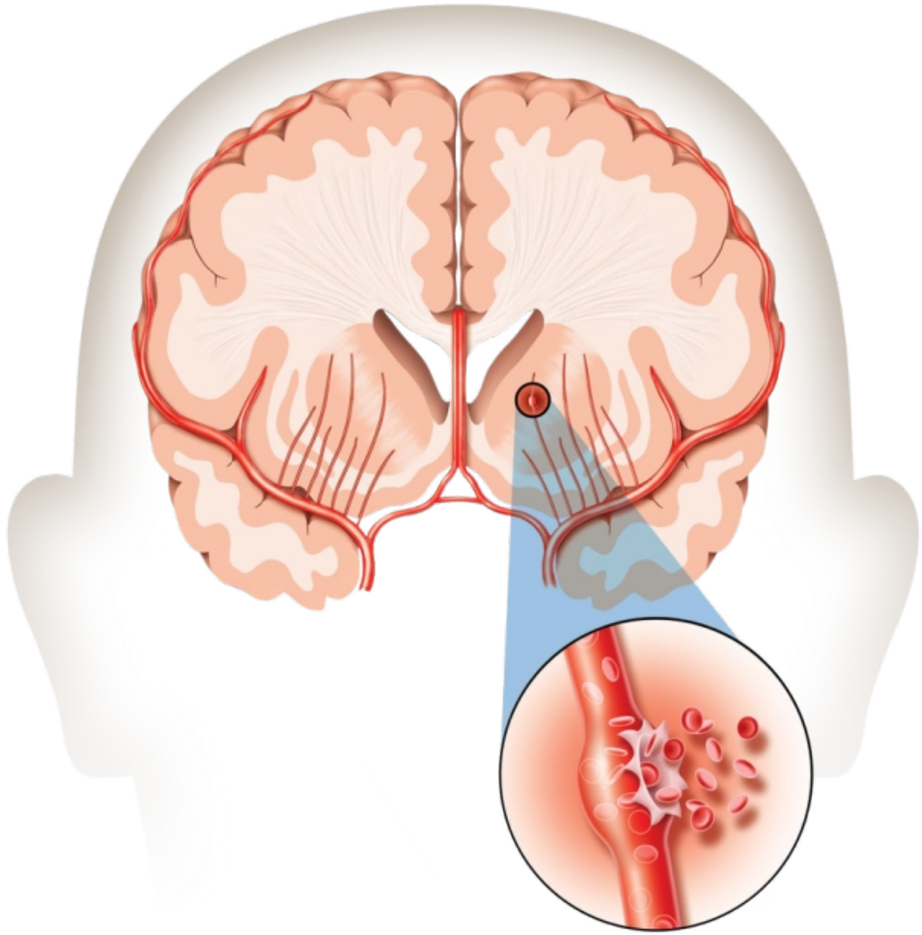
Tsao CW, et al. Heart Disease and Stroke Statistics. (2022) *Circulation.*

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Different Types of Stroke

Hemorrhagic Stroke

- About 13% of strokes are caused by a hemorrhage
  - Caused by a breakage in a blood vessel within the brain
- Can be the result of a ruptured aneurysm
- Two types of hemorrhagic stroke:
  - **Intracerebral Hemorrhage** (within the brain tissue, sometimes referred to as intraparenchymal): A blood vessel bursts leaking blood into the brain tissue
  - **Subarachnoid Hemorrhage**: Occurs when a blood vessel bursts near the surface of the brain and blood pours into the area outside of the brain, between the brain and the skull



Tsao CW, et al. Heart Disease and Stroke Statistics. (2022) *Circulation.*

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Different Types of Stroke

Transient Ischemic Attack (TIA)

- A TIA or **Transient Ischemic Attack** produces stroke-like symptoms
- TIA is caused by a blockage, but unlike a stroke, the blockage is temporary and usually causes no permanent damage to the brain
- About 7% of TIA patients have a stroke within 90 days. Even though these patients may not receive thrombolysis (clot-busting medications), it's important for them to be evaluated quickly in the emergency department. **TIA is a medical emergency!**

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Common Stroke Symptoms*

Right-Sided (Hemisphere) Stroke

- Slurred speech - dysarthria
- Weakness or numbness of the left side of face, arm or leg
- Left-sided neglect
- Right gaze preference

Left-Sided (Hemisphere) Stroke

- Speech problems – what is being said or inability to get words out
- Problems with comprehension
- Weakness or numbness of the right side of face, arm, or leg
- Left gaze preference

Brainstem Stroke

- Nausea, vomiting or vertigo
- Speech problems
- Swallowing problems
- Abnormal eye movements
- Decreased consciousness
- Crossed findings (both sides of the body)

* Symptoms may occur alone or in combination with each other.

Tsao CW, et al. Heart Disease and Stroke Statistics. (2022) *Circulation.*

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Common Stroke Symptoms

Hemorrhagic Stroke

Intracerebral Hemorrhage

- Nausea and vomiting
- Headache
- One-sided weakness
- Decreased consciousness

Subarachnoid Hemorrhage

- Worst headache of life
- Intolerance to light
- Neck stiffness or pain



Tsao CW, et al. Heart Disease and Stroke Statistics. (2022) *Circulation.*

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Common Stroke Mimics

STROKE MIMICS
Alcohol Intoxication
Cerebral Infections
Drug Overdose/Toxicity
Epidural Hematoma
Hypoglycemia
Metabolic Disorders
Migraines
Neuropathies (Bell’s Palsy)
Seizure and Post Seizure (Todd’s Paralysis)
Brain Tumors
Hypertensive Encephalopathy

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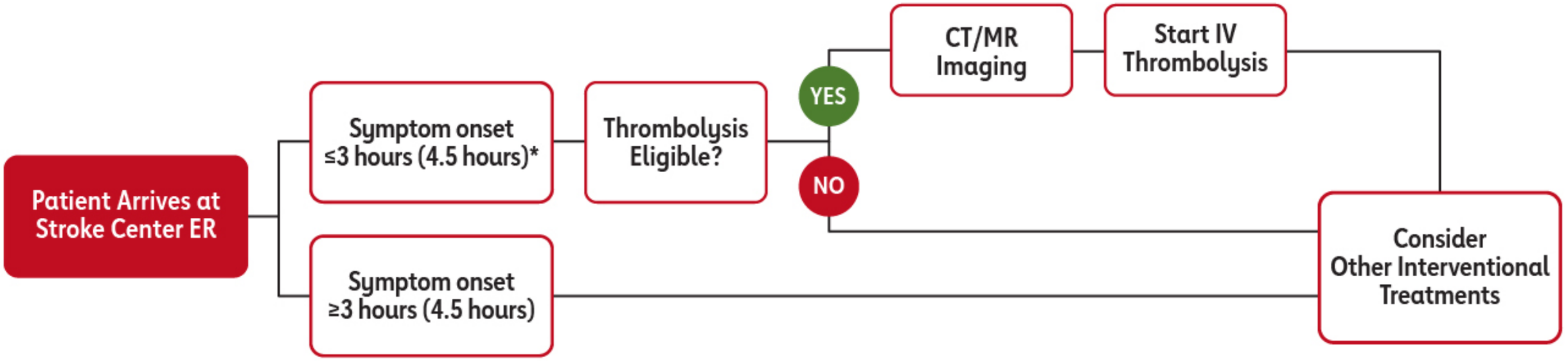
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STROKE TREATMENT



Ischemic Stroke Treatment Protocols





* Thrombolysis with IV Alteplase (tPA) is also recommended for selected patients who can be treated within 3 to 4.5 hours of symptom onset or last known well time.

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Ischemic Stroke Treatment Protocols

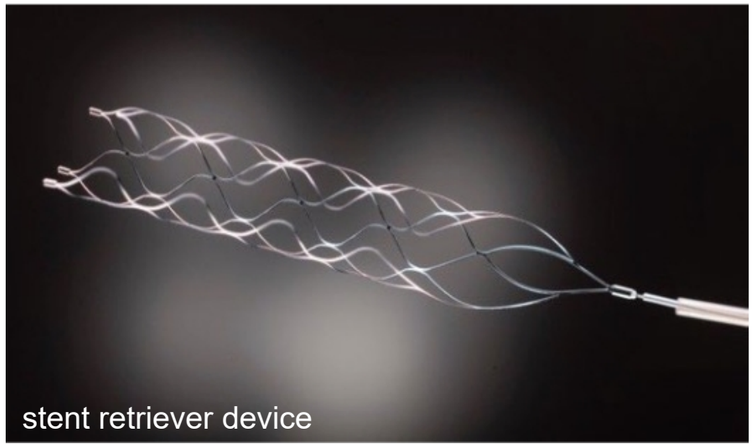
Medical Management

- IV thrombolysis (a.k.a. tPA or Alteplase) is the clot busting drug used with stroke patients.
- Patients must be within the time window of 0–3 hours (or 3–4.5-hour window in certain eligible patients) from symptom onset.
- There are other contraindications associated with the use of the drug.


clot busting drug

Mechanical Thrombectomy

- Mechanical thrombectomy (MT) is an endovascular therapy that uses a stent retriever device to remove the clot in patients with LVO stroke.
- The time window for MT is up to 24 hours from symptom onset.
- Quicker treatment results in better outcomes, so the up to 24-hour time window facilitates MT for more patients but shouldn't be seen as allowing more time for decision-making or transport delays.
- If the patient is eligible for IV thrombolysis, that should be administered first.


stent retriever device

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Patient Outcomes in Research Trials

Thrombolytics[1]

- Ischemic stroke patients who receive thrombolysis are at least 30 percent more likely to have minimal or no disability at three months, compared to patients who do not receive this therapy.

Mechanical Thrombectomy[2]

- In a meta-analysis of major MT trials, 40% of patients treated had reduced disability as a result of thrombectomy, including 23% of patients achieving an independent outcome.

1. NINDS rt-PA Study Group Investigators. Tissue Plasminogen Activator for Acute Ischemic Stroke. *The New England Journal of Medicine*, 333:24, 1995.
2. Campbell BC et al. Safety and Efficacy of Solitaire Stent Thrombectomy: Individual Patient Data Meta-Analysis of Randomized Trials. *Stroke*. 2016.

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Contraindications to Thrombolysis

- Severe recent or acute head trauma
- Recent intracranial/intraspinal surgery
- History of intracranial hemorrhage
- Recent GI malignancy or bleeding
- Blood clotting impairment
- Recent treatment with heparin
- Taking anticoagulant
- Known or suspected aortic arch dissection
- To see a list of more contraindications to thrombolysis, please see the AHA/ASA 2019 Acute Ischemic Stroke Guidelines

EMS identification of current medications, especially anticoagulants, & obtaining patient history including co-morbid conditions (e.g. recent surgery, procedures or stroke) & family contact information is critical because it may impact treatment decisions.

Powers WJ, et al. 2019 Update to 2018 Guidelines for Early Management of Acute Ischemic Stroke. (2019) *Stroke*.

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STROKE PROTOCOLS & HOSPITAL CARE



Stroke Care

The goal of stroke care is to minimize brain injury and maximize the patient's recovery

The **Stroke Chain of Survival** links actions to be taken by patients, family members, and healthcare professionals to maximize stroke recovery. The links include:

- Family member, friend or bystander recognizes stroke warning signs and rapidly calls 9-1-1
- EMS rapidly arrives at scene and performs stroke assessment
- EMS rapidly notifies receiving hospital that patient will be arriving and EMS transports patient to the receiving hospital
- Hospital rapidly diagnoses and treats patient



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Hospital Levels of Care

Acute Stroke Ready Hospital (ASRH)

- Stabilize the patient & provide IV thrombolysis if appropriate
- Transfer most patients to a CSC, TSC or PSC
- Frequently rely on telestroke for neurology expertise

Primary Stroke Center (PSC)

- Stabilize patient and provide IV thrombolysis if appropriate
- Either admit or transfer to a CSC
- Most common type of stroke center

ASRH	Acute Stroke Ready Hospital
PSC	Primary Stroke Center
CSC	Comprehensive Stroke Center
TSC	Thrombectomy-Capable Stroke Center

To find certified stroke centers in your area, check out the American Heart Association map here: heart.org/en/professional/quality-improvement/hospital-maps

1. ASA Mission:Lifeline Stroke Committee. Emergency Medical Services Acute Stroke Triage and Routing. (2020)
2. Jauch EC, et al. Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities. (2021) *Stroke*

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Hospital Levels of Care

Thrombectomy-capable Stroke Center (TSC)

- Meet all criteria of a PSC, including administering IV thrombolysis if appropriate
- Also provide mechanical thrombectomy (MT) for stroke patients with large vessel occlusion (LVO)

Comprehensive Stroke Center (CSC)

- Have the capability to support all needed levels of care to all types of stroke patients, including hemorrhagic stroke:
  - Provide IV thrombolysis and/or MT for ischemic stroke patients when appropriate
  - Full complement of stroke neurology, critical care, & neurosurgical personnel & infrastructure
  - Special interventions
  - Highly technical procedures

ASRH	Acute Stroke Ready Hospital
PSC	Primary Stroke Center
CSC	Comprehensive Stroke Center
TSC	Thrombectomy-Capable Stroke Center

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Levels & Capabilities of Hospital Stroke Certifications

Characteristics	ASRH	PSC	TSC	CSC
Location	Typically rural	Often urban / suburban	Often urban / suburban	Typically urban
Stroke team accessible/available 24/7	Yes	Yes	Yes	Yes
Non-contrast CT available 24/7	Yes	Yes	Yes	Yes
Advanced imaging available 24/7 (e.g., CTA/CTP/MRI/MRA/MRP)	Typically No	Possibly	Yes	Yes
Intravenous thrombolysis capable 24/7	Yes	Yes	Yes	Yes
Thrombectomy capable 24/7	No	Typically No	Yes	Yes
Diagnose stroke etiology and manage post-stroke complications	Unlikely	Yes, Routine	Yes, Complex	Yes, Complex
Admit hemorrhagic stroke	No	Possibly	Possibly	Yes
Clip/coil ruptured intracranial aneurysms	No	Unlikely	Possibly	Yes
Dedicated stroke unit	No	Yes	Yes	Yes
Neurocritical care unit and expertise	No	Possibly	Possibly*	Yes
Clinical stroke research performed	Unlikely	Possibly	Possibly	Yes

*Access to neurocritical care expertise required and may be provided by telemedicine.

Modified from Jauch EC, et al. Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities. (2021) *Stroke*

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STROKE POLICY RECOMMENDATIONS



EMS Assessment & Management

- Support ABCs: airway, breathing, circulation. Give oxygen if needed.
- Perform prehospital stroke assessment using a prehospital stroke screening tool.
- Establish time when patient was last normal; interview family members or witnesses, if needed.
- Identify if patient has significant pre-stroke disability.
- Identify current medications, especially anticoagulants, and obtain patient history including co-morbid conditions (e.g. recent surgery, procedures or stroke) that may impact treatment decisions.
- Provide advance notification to receiving hospital as soon as possible of potential stroke patient “CODE STROKE.”
- Check glucose level if possible.

1. Powers WJ, et al. 2019 Update to 2018 Guidelines for Early Management of Acute Ischemic Stroke. (2019) *Stroke.*
2. ASA Mission:Lifeline Stroke Committee. Emergency Medical Services Acute Stroke Triage and Routing. (2020)

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EMS System Recommendations

- EMS leaders, in coordination with local, regional, & state agencies & in consultation with medical authorities & local experts, should develop triage paradigms & protocols to ensure that patients with known or suspected stroke are rapidly identified & assessed by use of a validated, standardized tool for stroke screening.[1,2]



1. Powers WJ, et al. 2019 Update to 2018 Guidelines for Early Management of Acute Ischemic Stroke. (2019) *Stroke*.
2. Adeoye O, et al. Recommendations for the Establishment of Stroke Systems of Care. (2019) *Stroke*.

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EMS System Recommendations

- In prehospital patients who screen positive for suspected stroke, a standard prehospital stroke severity assessment tool should be used to facilitate triage.[1]
- Patients with a positive stroke screen or who are strongly suspected to have a stroke should be transported rapidly to the closest healthcare facility that is able to administer IV thrombolysis.[2]



1. Adeoye O, et al. Recommendations for the Establishment of Stroke Systems of Care. (2019) *Stroke*.
2. Powers WJ, et al. 2019 Update to 2018 Guidelines for Early Management of Acute Ischemic Stroke. (2019) *Stroke*.

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EMS System Recommendations

- Effective prehospital procedures to identify patients who are ineligible for IV thrombolysis and have a strong probability of LVO stroke should be developed to facilitate rapid transport of patients potentially eligible for thrombectomy to the closest healthcare facilities that are able to perform MT.[1]



1. Powers WJ, et al. 2019 Update to 2018 Guidelines for Early Management of Acute Ischemic Stroke. (2019) *Stroke*.

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SPECIAL REPORT

Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities From the Prehospital Stroke System of Care Consensus Conference

A Consensus Statement From the American Academy of Neurology, American Heart Association/American Stroke Association, American Society of Neuroradiology, National Association of EMS Physicians, National Association of State EMS Officials, Society of NeuroInterventional Surgery, and Society of Vascular and Interventional Neurology: Endorsed by the Neurocritical Care Society

Edward C. Jauch, MD; Lee H. Schwamm, MD; Peter D. Panagos, MD; Jolene Barbazzeni, RN; Robert Dickson, MD; Robert Dunne, MD; Jenevra Foley, MSL, RHIA, CCP; Justin F. Fraser, MD; Geoffrey Lassers, PMD, AAS; Christian Martin-Gill, MD; Suzanne O'Brien, MSN, BSN, RN; Mark Pinchalk, MS; Shyam Prabhakaran, MD; Christopher T. Richards, MD; Peter Taillac, MD; Albert W. Tsai, PhD; Anil Yallapragada, MD; on behalf of the Prehospital Stroke System of Care Consensus Conference

Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities From the Prehospital Stroke System of Care Consensus Conference: A Consensus Statement From the American Academy of Neurology, American Heart Association/American Stroke Association, American Society of Neuroradiology, National Association of EMS Physicians, National Association of State EMS Officials, Society of NeuroInterventional Surgery, and Society of Vascular and Interventional Neurology: Endorsed by the Neurocritical Care Society | Stroke (ahajournals.org)

Overarching Principles

Destination Plans

Ideal destination plans are complex, nuanced, & factor in all available data sources including:

- traffic patterns
- site-specific performance data on the frequency of use, and
- timeliness of IV thrombolytics and endovascular therapy, and their associated clinical outcomes

Regional destination plans should consider general eligibility for IV thrombolytics and for those patients with suspected large vessel stroke within 24 hours of last known well time, should prioritize a nearby Comprehensive Stroke Center over other centers of lower capability when available within acceptable transport times.



More information available at: stroke.org/StrokeTransportPlans

Jauch EC et al. Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities From the Prehospital Stroke System of Care Consensus Conference. (2021) *Stroke*.

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Overarching Principles

Rapid Access to Appropriate Level of Care

The regional stroke system of care should ensure rapid access to the appropriate level of care, during both the prehospital and hospital phases of care. In general, when more than one stroke center is within close proximity from the scene, transport to the highest level of care is preferable.

Coordinated Quality Improvement

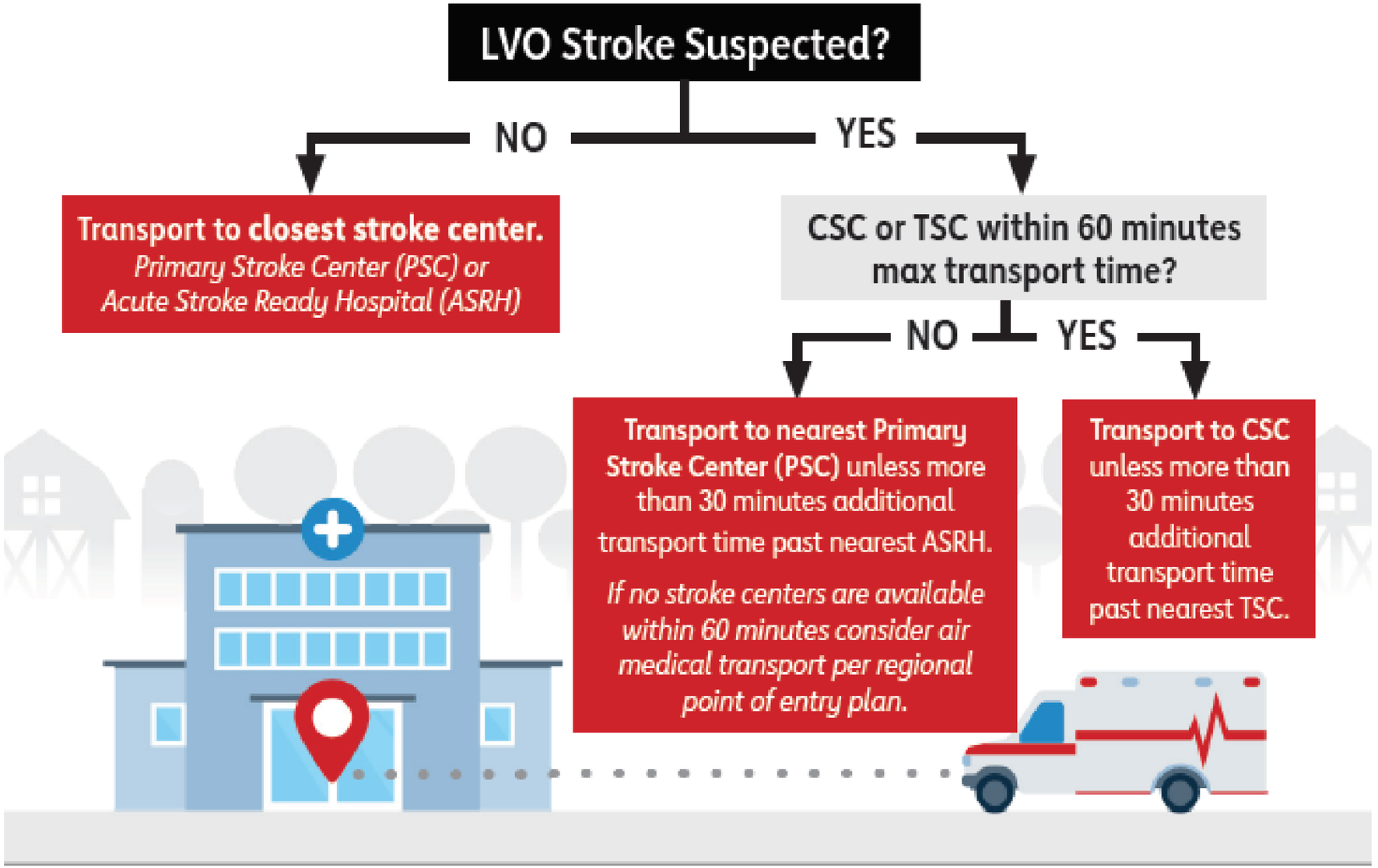
All participating EMS agencies should engage in quality improvement programs coordinated with the stroke system of care as a whole, with emphasis on dispatch, response, field triage, and transitions of care.



More information available at: stroke.org/StrokeTransportPlans

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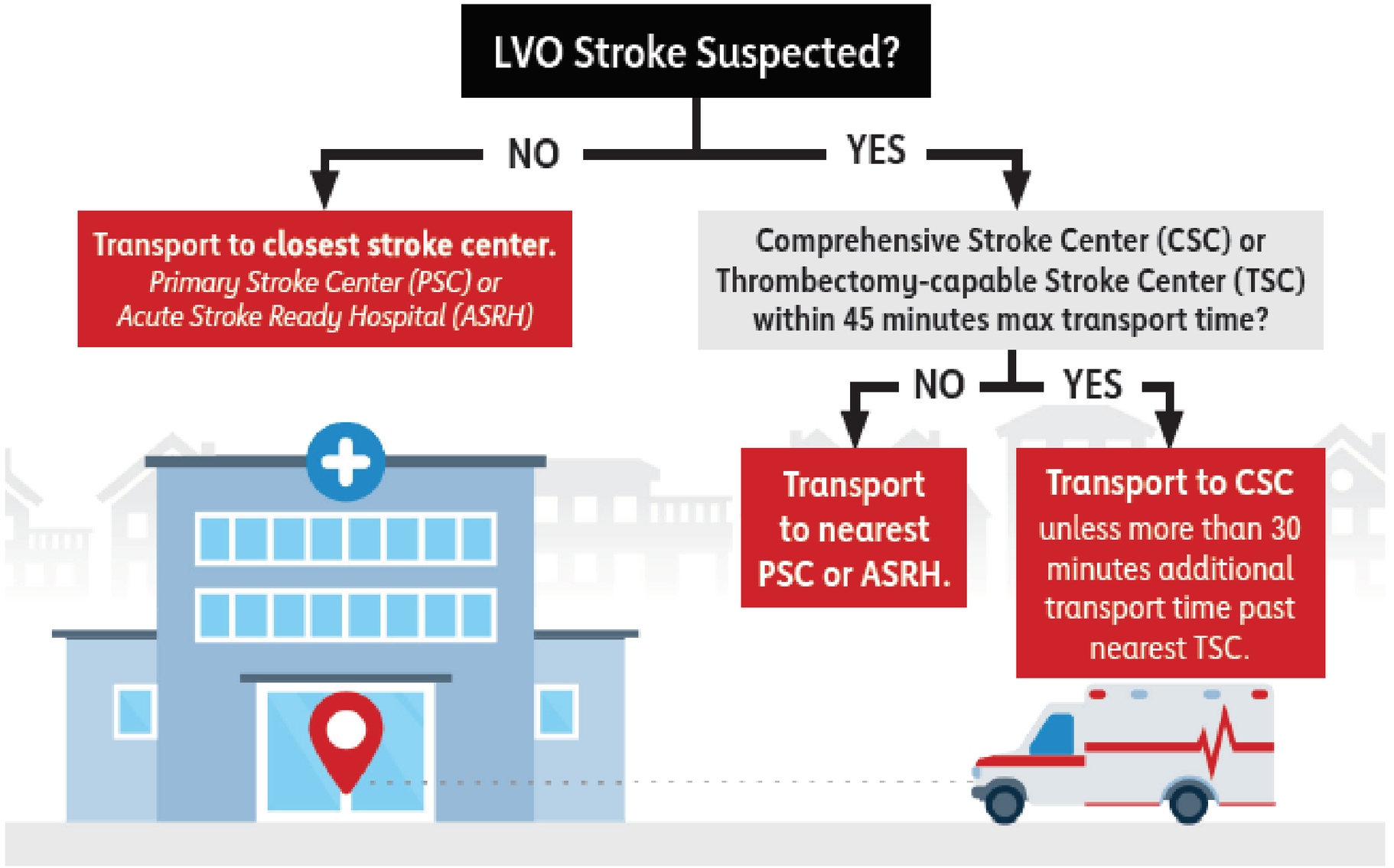
Rural Transport Recommendations



Jauch EC et al. Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities From the Prehospital Stroke System of Care Consensus Conference. (2021) *Stroke*.

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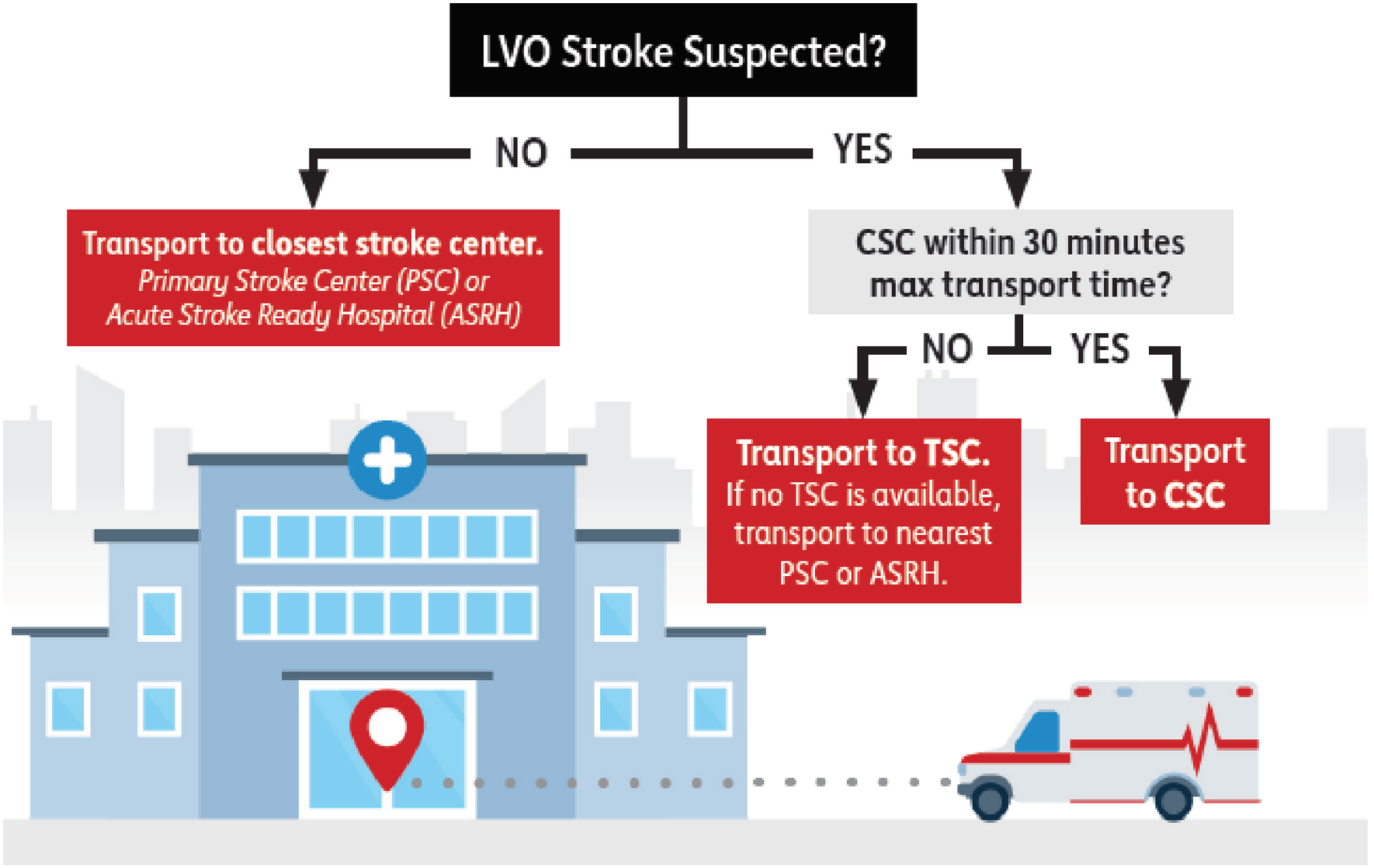
Suburban Transport Recommendations



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Urban Transport Recommendations



Jauch EC et al. Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities From the Prehospital Stroke System of Care Consensus Conference. (2021) *Stroke*.

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STROKE ASSESSMENT & SEVERITY TOOLS



Stroke Assessment & Triage



Screen for stroke using validated screening scale.

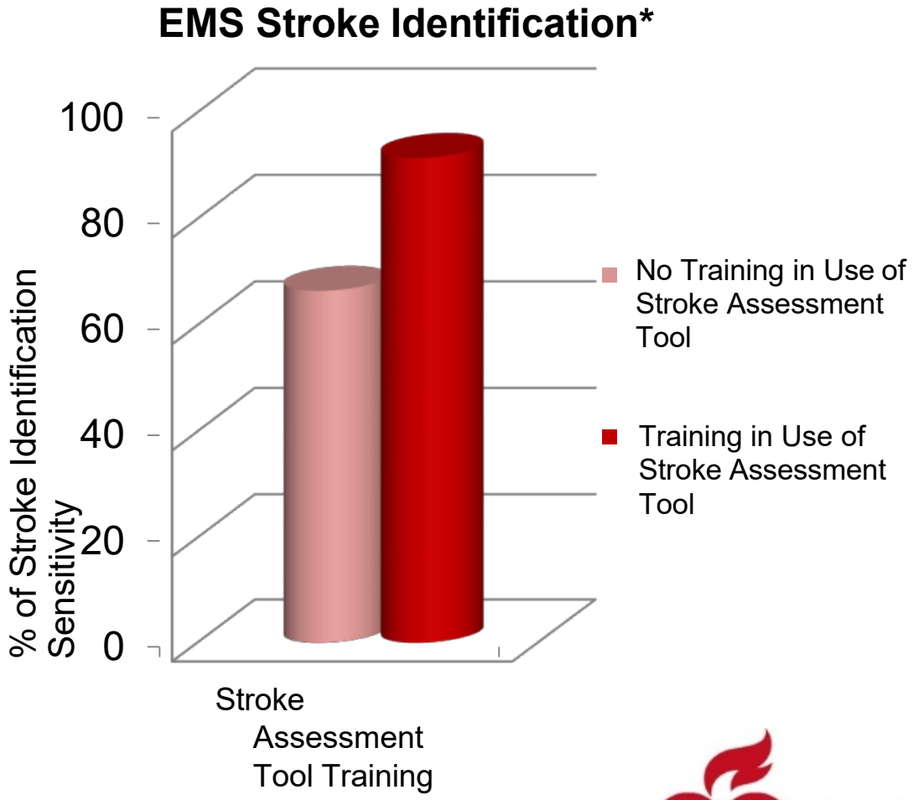
- If positive, check for LVO stroke using stroke severity scale.
  - If LVO stroke is likely or possible, transport per local stroke center destination protocol.
  - If LVO stroke is unlikely, transport to closest stroke center.
- If stroke unlikely, treat per ABCs and local protocol.

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Stroke Assessment Tools



- Stroke assessment tools help EMS identify a stroke quickly and transport the individual to the appropriate center.
- A simple screening that generates a binary result of positive (stroke suspected) or negative (stroke unlikely)[1].
- Prehospital stroke assessment training raises the accuracy of stroke identification[2].
- Paramedics demonstrated a sensitivity of 61-66% without stroke assessment training and **86-97%** with training[2].



1. ASA Mission:Lifeline Stroke Committee. Emergency Medical Services Acute Stroke Triage and Routing. (2020).
2. Maggiore, W. A. (2012). 'Time is Brain' in Prehospital Stroke Treatment . *Journal of Emergency Medical Services* , 1-9. http://www.jems.com/article/patient-care/time-brain-prehospital-stroke-treatment

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Field Assessment of Stroke

Multiple tools are available to screen for stroke.

- Current AHA/ASA guidance does not recommend one tool over another. Jurisdictions should choose a single validated and standardized screening tool for use across the region, if possible.
- Cincinnati Prehospital Stroke Scale is most widely used.
- Other validated stroke screening tools include:
  - Los Angeles Prehospital Stroke Screen (LAPSS)
  - FAST (Face, Arm, Speech, Time)
  - Miami Emergency Neurological Deficit Scale (MENDS)



Adeoye O, et al. Recommendations for the Establishment of Stroke Systems of Care. (2019) *Stroke*.

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Field Assessment of Stroke

Cincinnati Prehospital Stroke Scale	
Have patient look up at you, smile and show their teeth.	**Facial Droop** **Normal:** Left and right side of face move equally **Abnormal:** One side of face does not move at all
Have patient lift arms up and hold them out with eyes closed for 10 seconds.	**Arm Drift** **Normal:** Both left and right arm move together or not at all **Abnormal:** One arm does not move equally with the other
Have patient say a simple sentence, i.e. “You can’t teach an old dog new tricks.”	**Speech** **Normal:** Patient uses correct words with no slurring **Abnormal:** Patient has slurred speech, uses inappropriate words or cannot speak

If any 1 of these 3 signs is abnormal, probability of stroke is 72%.
If all 3 findings are present, probability of acute stroke is >85%.

Adapted from: Kothari RU, Pancioli A, Liu T., Brott T., Broderick J. “Cincinnati Prehospital Stroke Scale: reproducibility and validity.”
Ann Emerg Med. 1999 Apr;33(4):373-8, permission for use.

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Layperson Stroke Recognition

Face Drooping – Ask the person to smile. Does one side of the face droop or is it numb?

Arm Weakness – Ask the person to raise both arms. Is one arm weak or numb? Does one arm drift downward?

Speech Difficulty – Ask the person to repeat a simple sentence, such as “the sky is blue.” Is the sentence repeated correctly? Are they unable to speak, or are they hard to understand?

Time to call 9-1-1 – If the person shows any of these symptoms, even if the symptoms go away, call 911 and get them to the hospital immediately.



stroke.org/WarningSigns

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Stroke Severity Scales

- A scale to quantify neurologic deficits to identify patients with severe symptoms likely due to LVO or hemorrhagic stroke
- At least 6 different scales have been published.
- Each EMS region should choose a single severity scale and monitor adherence to usage as well as accuracy.
- Examples include:
  - Cincinnati Stroke Triage Assessment Tool (C-STAT)
  - Facial palsy, Arm weakness, Speech changes, Time, Eye deviation, Denial / neglect (FAST-ED)
  - Rapid Arterial Occlusion Evaluation Scale (RACE)
  - Los Angeles Motor Scale (LAMS)
  - Vision, Aphasia, Neglect (VAN)

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PRE-NOTIFICATION



Pre-Notification Systems



- EMS professionals should notify hospital staff that a stroke patient is being sent to the hospital prior to their arriving at the hospital.
- Pre-notification systems help improve rapid triage, evaluation, and treatment of patients with acute ischemic stroke.
- The sooner the patient gets medical treatment, the greater potential for a better outcome.

EMS Pre-Notification Systems

The study cited below by Lin, et al. observed shorter symptom onset to hospital arrival when a pre-notification system was used.

There was an increase in the percentage of patients with door-to-imaging times within 25 minutes.

When a pre- notification system was used there were lower onset to door times observed (113 minutes versus 150 minutes).

Overall, pre- notification resulted in more rapid triage, evaluation, & treatment of patients with acute ischemic stroke.

Lin, C. B., Peterson, et al. Emergency Medical Service Hospital Pre-Notification is Associated with Improved Evaluation and Treatment of Acute Ischemic Stroke. (2012). *Journal of the American Heart Association*.

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Conclusions

- Stroke is treatable.
- Time lost is brain lost!
- Use a stroke screening tool & severity scale to determine whether suspected stroke & likelihood of LVO.
- Follow stroke transport protocol for your area to determine destination.
- Give advance notification to receiving hospital.

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Thank You.