Mission: Lifeline Stroke
Release of the EMS Stroke Routing Algorithms
A Long Journey of Collaboration

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Disclosures

* Salary: Washington University
* Speaker’s Bureau: Genentech
* Consultant: AHA/ASA
* Advisory Board: Pulse Therapeutics
Presented on Behalf of Numerous AHA Volunteers, Staff and Committees
Faster Stroke Treatment is Better Treatment

* Patients treated within 60 minutes experience improved outcomes, including lower in-hospital mortality and reduced long-term disability

GC Fonarow et al.  JAMA. 2014;311(16):1632-1640
Saver et al.  JAMA. 2013;309(23):2480-8
Why Doesn’t EMS Just Triage the Right Patient to the Right Hospital?
Triage Issues at the Time:

- Coordination of CSC (New) and PSC centers (Existing)
- EMS Triage of select patients
- IV thrombolysis (Severity)
- Endovascular eligible (pre-2015)
- Hemorrhage (ICH and SAH)
<table>
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<th>Hospital Name</th>
<th>First, Last Name</th>
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<tr>
<td>Mercy Hospital</td>
<td>Amber Elliot</td>
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<td>Kenneth Reichenbach</td>
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<td>Miami Valley</td>
<td>Julie Neff</td>
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EMS ROUTING TASKFORCE

BACKGROUND/FOCUS AREAS

- Develop framework of best practices for EMS stroke triage
- Guidelines should consider local factors
- Recommendations MUST be routed in medical evidence
- Conduct surveys of CS/PSC membership
- Create an algorithm to serve as EMS best practice triage
- Extend discussion to larger CSC community
Was the Patient LKW within last 3.5 hours?

**YES**

Transport to Nearest/Closest PSC

**No**

Follow Recommendations Below Consider Geographic and Regional Logistical Characteristics

IF Transport to CSC does not introduce unreasonable delay (e.g. > 30 min) and the patient meets any of the following criteria, consider transport to CSC bypassing PSC:

Anticoagulation?  MI < 30 days?  Surgery < 30 days?

GCS < 9  ICH or aneurysm?  Stroke < 30 days?

Wake up Stroke or LKW between 3.5-4.5 hrs with goal treatment < 6 hrs?
Evolution and New Ideas

Triage Based on:
- Time (LKW)
- Severity
- Hemorrhage Suspicion
Then AHA/ASA Said
“Let There Be Light”
A. Patients eligible for IV rtPA should receive IV rtPA even if endovascular Rx is being considered
   (Class I; Level of Evidence A). (Unchanged from the 2013 guideline)
B. Patients should receive endovascular therapy with a stent retriever if they meet all the following criteria:
   (1) acute ischemic stroke receiving IV rtPA within 4.5 hours of onset according to guidelines from professional medical societies,
   (2) causative occlusion of the internal carotid artery or proximal middle cerebral artery (M1 or M2),
   (3) age 18 years and over,
   (4) NIHSS score of 6 or greater,
   (5) Alberta Stroke Program Early Computed Tomography Score (ASPECTS) of 6 or greater, and
   (6) treatment can be initiated (groin puncture) < 6 hrs of symptom onset (Class I; Level of Evidence A). (New Recommendation)

Powers WJ et al. 2015 AHA/ASA Focused Update. Stroke. 2915
Access to Endovascular Therapy

* By Ground or Air
* 56% US population have access to endovascular capable hospital

Adeoye, et al. Stroke 2014
## The “New Normal”

<table>
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<tr>
<th></th>
<th>MR CLEAN</th>
<th>ESCAPE</th>
<th>EXTEND-IA</th>
<th>SWIFT PRIME</th>
<th>REVASCAT</th>
<th>IV tPA</th>
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<td>OR good outcome at 90d (mRS 0-2)</td>
<td>2.16</td>
<td>2.6</td>
<td>3.8</td>
<td>2.75</td>
<td>2.1</td>
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<td>NNT for good outcome*</td>
<td>6.1</td>
<td>4.2</td>
<td>3.2</td>
<td>4.0</td>
<td>6.4</td>
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* Number Needed to Treat (NNT) for One Good Outcome
Evolving Endovascular Data

JAMA | Original Investigation

Time to Treatment With Endovascular Thrombectomy and Outcomes From Ischemic Stroke: A Meta-analysis

Jeffrey L. Saver, MD; Mayank Goyal, MD; Aad van der Lugt, MD; Bijoy K. Menon, MD; Charles B. L. M. Majoe, MD; Diederik W. Dippel, MD; Bruce C. Campbell, MD, PhD; Raul G. Nogueira, MD; Andrew M. Demchuk, MD; Alejandro Tomasello, MD; Pere Cardona, MD; Thomas G. Devlin, MD; Donald F. Frei, MD; Richard du Mesnil de Rochemont, MD; Olver A. Berkhemer, MD; Tudor G. Jovin, MD; Adnan H. Siddiqui, MD, PhD; Wim H. van Zwam, MD; Stephen M. Davis, MD; Carlos Castaño, MD; Biggya L. Sapkota, MD; Puck S. Fransen, MD; Carlos Molina, MD; Robert J. van Oostenbrugge, MD; Ángel Chamorro, MD; Hester Lingsma, PhD; Frank L. Silver, MD; Geoffrey A. Donnan, MD; Ashfaq Shuaib, MD; Scott Brown, PhD; Bruce Stouch, PhD; Peter J. Mitchell, MD; Antoni Davalos, MD; Yvo B. W. E. M. Roos, MD; Michael D. Hill, MD, MS; for the HERMES Collaborators
Evolving Endovascular Data

- 1287 Total Patients
- 634 Endo + IV tPA
- 653 IV tPA Only
- OR better mRS at 90-days
- Early Rx, recanalization led to lower degrees of disability at 3 mos c/w IV tPA
- Benefit non-significant > 7.3 hours

JAMA 2016;316(12):1279-1288
Goals:

∗ Focus on Systems of Care in improving stroke care
∗ Develop EMS Stroke Specific Toolkit Transport/Transfer Algorithm
∗ Pre-hospital Thrombolytic checklist
∗ Translate stroke study results to EMS Practice
∗ Validate/Endorse Pre-hospital LVO Stroke Severity Tool
∗ Pilot Pre-Act Stroke
∗ Lead IHI Collaborative to improve stroke processes
∗ Develop EMS Stroke Education Program
∗ Develop Pre-Hospital Stroke Standard of Care and Practice Guidelines
∗ Reach beyond EMS and focus on the whole system of care (Community education, TOC, Rehab etc.)
∗ Initiate White Papers to support M:L and it’s initiatives
M:LS Committee Members

* Acker, Joe
* Albert, Mark
* Allen, Evan D.
* Frankel, Michael
* Franklin, Christy
* Gatti, Ronald G.
* Hundley, J. Lynn
* Jauch, Ed
* Luciano, Jean
* Nash, Bradford S.
* Lugtu, James (AHA)
* Gunderson, Mic (AHA)
* Travis, David (AHA)

* Panagos, Peter (Co-Chair)
* Rosamond, Wayne
* Rudnick, Eric
* Saver, Jeffrey
* Schwamm, Lee (Co-Chair)
* Summers, Debbie
* Tremwel, Margret F.
* Wages, Robert Keith
* Wolfe, Stacey
* Jollis, James
* George, Mary
* Williams, Joe (AHA)
Assemble Diverse Committee Membership
Listen to Constituents and Customers
Review Existing Plans and Experience
Recognize Evolving Data
Awareness of Limitations and Barriers
National representation and sampling views
Multi-specialty collaboration
Vetted within AHA/ASA Leadership Committees
Severity-Based Stroke Triage Algorithm for EMS

* What It Is:  
Evidenced-based best-practice, multi-specialty review of currently available data for EMS Stroke Triage

* What It Is Not:  
Prescription or EXACT template to be followed word-for-word in every region
ABSTRACT

Severity-Based Stroke Triage Algorithm for EMS

A thorough review of current guidelines and studies was conducted to help develop the algorithm. All steps were made to base each step on current available science. Where clear scientific guidance is not available, consensus expert opinion and current practice were used. With any algorithm, it should augment but not replace clinician judgment. The developers of the algorithm would like to provide further details on the following:

- The term “last known well” refers to the time that the patient or a witness can confirm the patient was at their baseline. The term “Time of Symptom Onset” refers to the time at which the symptoms were first noticed.

The algorithm seeks to balance the benefits of rapid, early access to EVT for patients with suspected large vessel occlusion (LVO) with the potential harms of delayed initiation of EVT. Since most patients with stroke will not be candidates for EVT, and because a robust Primary Stroke Center (PSC) network is a vital part of an effective stroke system of care, the algorithm may require tailoring to the needs of the communities that implement it, the population and hospital density, and the available healthcare resources. In addition, overcrowding is a challenge in many current urban CSCs, and the costs of care are often higher at CSCs compared to PSCs. Furthermore, the CSC criteria address many aspects of hemodynamic stroke care that are beyond the capabilities of even a large PSC, and in some regions it may make sense for a PSC with EVT capability to be a preferred destination among all PSCs.

The screening tools are the most popular tools available:

- **STROKE SCREENING TOOLS**
  - Cincinnati Pre-Hospital Stroke Scale (CPSS)
  - Los Angeles Pre-Hospital Stroke Scale (LAPSS)

- **STROKE SEVERITY TOOLS**
  - Cincinnati Cerebral Triage Assessment Tool (CCTAT)
  - Fields Assessment Stroke Triage for Emergency Activation (FAST-20)
  - Los Angeles Motor Scale (LAMS)
  - Rapid Arterial Occlusion Evaluation Scale (RAOES)

STROKE SCREENING TOOLS

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Mission: Lifeline Stroke has developed this algorithm to help ensure the RIGHT patient is brought to the RIGHT stroke center RIGHT on time.
Initial Stroke Care:

No Significant Changes

EMS Dispatch notifies responding EMS Unit of possible stroke call. EMS crew dispatched per regional stroke protocol or on scene suspicion of acute stroke by EMS providers.

Upon arrival—Provide any needed ABC interventions, request dispatch of higher level of provider if necessary for unstable patients and interview patient, family and other witnesses.

Perform and document results of pre-hospital stroke identification screen (CPSS, LAPSS, etc.) and POC blood glucose.

STROKE SCREEN POSITIVE? STROKE SUSPECTED?

NO

Stroke not suspected

Treat and transport as indicated per patient presentation
Mission: Lifeline Stroke has developed this algorithm to help ensure the RIGHT patient is brought to the RIGHT stroke center RIGHT on time.
Utilizing Time + Best Available Severity Tools to Help Determine Patient Subset with LVO
Mission: Lifeline Stroke has developed this algorithm to help ensure the RIGHT patient is brought to the RIGHT stroke center RIGHT on time.
If LVO NOT suspected, then transport per regional plan.

Anticipated that this would be 80% of all transports.

Call stroke alert, pre-notify receiving facility and transport to the closest appropriate stroke center (ASRH, PSC, CSC) per your regional stroke systems of care policy.
Mission: Lifeline Stroke has developed this algorithm to help ensure the RIGHT patient is brought to the RIGHT stroke center on time.
Go Directly to CSC IF:

Severity Screen (++)
+
LKW < 6 Hours
+
Transport to CSC Adds < 15 min
+
Transport to CSC Does Not Place Patient Outside Thrombolysis Window

Any ‘NO’ then Go to Nearest/Closest Appropriate Facility Per Regional Plan

Call Stroke Alert, pre-notify receiving facility and transport directly to an appropriately certified CSC that is within the acceptable transport time, if no CSC meets the criteria then transport to the nearest designated EVT-capable center, or closest appropriate stroke center (ASRH,PSC) per your regional stroke system of care plan.
On Scene Recommendations

**ON SCENE**

- Interview patient, family members and other witnesses to determine Last Known Well (LKW) time and time of Symptom Discovery.
- Attempt to identify possible stroke mimics (e.g., seizure, migraine, intoxication) and determine if patient has pre-existing substantial disability (need for nursing homecare or inability to walk without help from others).
- Encourage family to go directly to Emergency Department if not transported with patient and obtain mobile number of next of kin and witnesses.
- If Mobile Stroke Unit available—follow Mobile Stroke Unit Protocol.
- Each EMS agency should utilize a published and validated stroke screen to assess patients with non-traumatic onset of focal neurologic deficits and validated tool to assess possible Large Vessel Occlusion (LVO).
- Patients who are eligible for IV Alteplase if transported to nearest Acute Stroke Ready Hospital (ASRH) or PSC should not be rerouted to a CSC or EVT-capable Center if doing so would result in a delay that would make them ineligible for IV Alteplase.
- Collect a list of current medications (especially anticoagulants) and obtain patient history including co-morbid conditions (e.g., serious kidney or liver disease, recent surgery, procedures or stroke) that may impact treatment decisions.
Balance early access EVT in LVO with the potential harms of delayed IV initiation *(TIME IS BRAIN)*

More PSCs (N=1182) than CSCs (N=118) and ASRH (N=24)

Avoid overcrowding CSC

No current Severity Tool is superior

Does not directly address hemorrhagic stroke

Acceptable delay for re-routing still unclear??

Why 15 minutes delay chosen?

Some data to suggest each 15 minute delay harmful

Minimal disruption in clinical work-flow

In rural settings, 20-30 minutes may be reasonable

Update algorithm when better evidence exists
What Does This Mean For You?
Next Steps

- EMS Severity Routing Algorithm = High Level Framework
- Assess Your Local Resources
- Develop a regional plan
- Continually Assess and Adapt to the Evolving Data (Research)
- Base Changes on Best Practice with the Patient in Mind
References

* Kidwell CS et al. Stroke. 2000;31:71-76
* Katz BS et al. Stroke 2015;46:1508-12
* Smith EE et al. Stroke. 2015;46:1462-67
* Saver JL et al. JAMA. 2013;309(23):2480-2488
* Saver JL et al. JAMA 2016;316(12):1279-1288