Evolution of Mission: Lifeline Stroke
The Stroke of the Severity-Based Stroke Triage Algorithm

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<th>Disclosures</th>
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<td><strong>Salary:</strong></td>
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<td><strong>Speaker’s Bureau:</strong></td>
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<td><strong>Consultant:</strong></td>
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<td><strong>Advisory Board:</strong></td>
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A Little History

History and Background of Mission: Lifeline Stroke and the Severity-based Stroke Triage Algorithm for EMS
* 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
25% of AIS Patients May be Eligible for thrombolysis
10% of AIS Patients May be Eligible for Endovascular Thrombectomy (EVT)

Why Doesn’t EMS Just Triage the Right Patient to the Right Hospital?
Last Two Decades

We’ve been focused on identifying suspected strokes within the time window who should be routed to a stroke center capable of delivering IV tPA (e.g., PSC or ASRH type hospitals)
In the Beginning... 2014
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

Metropolitan Version

Rural Version
Arrival of Comprehensive Stroke Centers and soon “Thrombectomy-Capable” Stroke Centers
Pre-Hospital Triage

Factors:

- Distance
- Run Times
- Designation Tiers
- Availability Services
- Diversion Status
- Medical Control
- ABC stable
- Dispatch Criteria
- Public/Private EMS
- Patient Preference
- Symptom onset

++ Thrombectomy-Capable Stroke Centers
And Now We Ask For More

It is a Struggle for Paramedics to clinically identify an AIS patient who is likely to have a large vessel occlusion (LVO) in either the anterior or posterior (good luck!) circulation.
Challenges (2015 & beyond)

- Still must identify suspected stroke in the field
- Transporting an LVO stroke patient to an ASRH/PSC hospital may cause Harm by introducing long delays
- But bypassing ASRH/PSC could place a patient Outside IV tPA Window upon arrival at CSC/TCS
- No single stroke severity tool predicts LVO perfectly
- Must Avoid Missing EVT-eligible patients, But must Avoid Over Diagnosing Pts who are not EVT-eligible
- Finally, the TRUTH and DATA still evolving (e.g. ISC ‘18)
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)
Access to Endovascular Therapy Disparities Still Exist

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

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

<table>
<thead>
<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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<tr>
<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>
<td>1.8</td>
</tr>
<tr>
<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>
<td>8.0</td>
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* Number Needed to Treat (NNT) for One Good Outcome
Challenges/Opportunities

- Access to New Therapies for ALL Patients
- Thrombectomy-Capable Hospitals Are Clustered
- Inter-Hospital Transfers Are Slow (DIDO)
- Knowledge Gaps Remain (EM, EMS, Neurology)
- Existing Stroke Systems of Care Variable
- How to Triage Patients Appropriately and Avoid Needless Diversion from ASRH/PSCs
- > 80% are Appropriate for admission at a PSC
Goals:

- Focus on Systems of Care in improving stroke care
- **Develop EMS Stroke Specific 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, Transition of care, Rehab etc.)
- Initiate White Papers to support M:L and it’s initiatives
M:LS Committee Members

Peter Panagos and Lee Schwamm (Co-Chairs)

- 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)
- Rosamond, Wayne
- Rudnick, Eric
- Saver, Jeffrey
- Summers, Debbie
- Tremwel, Margret F.
- Wages, Robert Keith
- Wolfe, Stacey
- Jollis, James
- George, Mary
- Williams, Joe (AHA)
Process

- 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
Overview of the Severity-based Stroke Triage Algorithm for EMS
Unidimensional EMS Triage for Acute Stroke to tPA-Capable Hospitals

Having a Stroke? No worries, we’ll help. We have tPA!

Slide Courtesy of Lee Schwamm, MD
To Bypass or Not To Bypass for Intervention: That is the Question

Cape Horn, Tip of South America
Stroke is high-impact low frequency prehospital or ED event

Stroke is <5% of EMS transports, ED visits, hospital admissions

Because of its low incidence, it is challenging to develop screening tools with acceptable levels of “overtriage” or false positives

For a hypothetical near-perfect prehospital stroke screen with 99% sensitivity and 95% specificity, given the true 5% prevalence of all strokes (not just LVO), the PPV of such a stroke screen applied to all EMS patients is at best 51%
Life Is Full Of Difficult Decisions

DECISIONS ARE BEING MADE RIGHT NOW. THE QUESTION IS: ARE YOU MAKING THEM FOR YOURSELF OR ARE YOU LETTING OTHERS MAKE THEM FOR YOU?
Severity-Based Stroke Triage Algorithm for EMS

* What It Is:  
Evidenced-based best-practice, multi-specialty review of currently available data for time-dependent benefits of IV tPA and EVT, stroke scale predictive power and EMS Stroke Triage capabilities

* What It Is Not:  
Prescriptive template for every EMS region. Requires customization to local resources and geography.
Severity-Based Stroke Triage Algorithm for EMS

Since the release of the cardiogenic trials in early 2015 demonstrating the efficacy of endovascular thrombectomy (EVT), many healthcare providers and health systems have requested guidance on developing an updated pre-hospital pre-test algorithm for patients with suspected large vessel embolic occlusion (LVO) within current stroke or acute ischemic stroke. In June 2016, the American Heart Association (AHA) and the American Stroke Association (ASA) asked for their Mission: Lifeline Stroke Triage Committee to draft a consensus algorithm that was subsequently reviewed by numerous stakeholder committees within the organization. This guideline seeks to balance the benefits of rapid, early access to EVT for patients with suspected LVO with the potential harm of delayed initiation of IV tPA. Since most patients with stroke will not be candidates for EVT, and because a robust Primary Stroke Center (PSC) network remains an integral part of an effective stroke system of care, the algorithm may be tailored to the needs of the community that implements it, the population and hospital capacity, and the available healthcare resources. In addition, over- triaging is a challenge at every current urban CSCs, and the cost/benefit ratio is often higher at CSCs compared to PSCs. Furthermore, the USC addresses many aspects of hemorrhagic 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 or a Transatlantic-capable Stroke Center (TASC) to be a preferred destination among all PSCs if no CSC is available nearby.

A thorough review of current guidelines and a study was conducted to help develop the algorithm. All evidence was made to keep each step on current available evidence. Where clear scientific evidence was not available, consensus expert opinion and current practice were used. As with any algorithm, it should augment but not replace clinical judgment. The following section clarifies key terms used in this algorithm:

- **Time Frame:** The time from the 1st stroke symptom to the initial medical evaluation.
- **Time of Symptom Onset:** The time at which the symptom was first noticed. These two terms are often used interchangeably, but in practice, time of symptom onset is more appropriate for triage and does not explicitly capture the symptom duration. Among patients with a witnessed stroke onset, these two times will be the same.

- **Time Shako Scoring Tool:** A simple scoring method, usually less than 4 steps, that generates a time-risk competitive priori patient severity or a relative stroke risk. Many patients with a higher score for neurologic disability (e.g., weakness) may take a pro-choice score. Many EMS agencies mandate a point-of-care-based stroke tool as part of stroke screening and this should be included except when prohibited by regulation.

- **Time Shako Score:** A numerical scale used to determine the severity of the neurologic deficit on a scale of 0 to 4 (0, none; 1, mild; 2, moderate; 3, severe; 4, profound). The threshold for initiating EVT at USC is 4.

Stoke Screening Tools

<table>
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<tr>
<th>CINDICATOR</th>
<th>PRE-HOSPITAL STROKE SCALE (PSS)</th>
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<tr>
<td>YES</td>
<td>NO</td>
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<tr>
<td>NO</td>
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<tr>
<td>NO</td>
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</tbody>
</table>

Stoke Severity Tools

<table>
<thead>
<tr>
<th>COMMON SENSE</th>
<th>Triage vollume 1 (CST1)</th>
<th>Field assessment tools</th>
<th>Stroke screening tools</th>
<th>Rapid Arterial Occlusion</th>
<th>120% motor scale (LAMS)</th>
<th>120% transactional scale (LAMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<tr>
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ON SCREEN

- **Initial Screen:**
  - Patient's age
  - Can the patient walk?
  - Is the patient fully conscious?
  - Can the patient swallow?

- **Stroke Suspected:**
  - Yes: Call 911
  - No: Continue with other screening tools.

- **Time Lapse:**
  - 1 hour or less: Call 911
  - 1 hour or more: Continue with other screening tools.

- **Transport to Stroke Unit:**
  - Yes: Call 911
  - No: Continue with other screening tools.

- **Transport to Stroke Unit:**
  - Yes: Call 911
  - No: Continue with other screening tools.

Heart.org/MissionLifelineStroke

This document is a simplified version of the full algorithm and should not be used in place of the full algorithm. For more information, visit Heart.org/MissionLifelineStroke.
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.
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 on time.
Utilizing Time + Best Available Severity Tools to Help Determine Patient Subset with LVO

Perform and document results from severity tool used to assess potential LVO (LAMS, RACE, CSTAT, FAST-ED, etc.)

Identify and document Time Last Known Well & Time of symptom discovery
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, TSC, 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 RIGHT 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 IV 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.
Key Assumptions

- Balance access to EVT in suspected LVO patients with potential harm of delay in IV tPA
- Minimal disruption in clinical work-flow to get EMS on board
- More PSCs (N=1182) than CSCs (N=118) and ASRH (N=24), TSC (N=?)
- Avoid overcrowding at CSC and reducing expertise at PSC
- No single Severity Tool is superior
- Hemorrhagic stroke triage guided by symptom severity
- Acceptable delay for re-routing still unclear. RCTs underway
- Every 15 minute delay increases mortality and sICH
- In rural settings, longer times (20-30 min?) may be reasonable
- Update algorithm when better evidence exists
What are the next steps?
Next Steps
Stroke Systems of Care Overhaul

- EMS Severity Routing Algorithm = High Level Framework
- Assess Your Local Resources
Next Steps
Collaborate across the whole Stroke Care Continuum

Identify and engage your regions Stroke Stake Holders:

- Physician Stroke Champion
- DPH or rule making EMS authority
- EMS Agencies- transport and non-transport
- Hospitals- All levels of stroke care
- Physician Groups
- Any Healthcare Agency Interested in Stroke Care

Success of the algorithm will require strong collaboration between all stroke stake holders
Next Steps
Identify Current Status

- **Identify and assess** your regions stroke resources.
- How are your resources currently utilized?
- What is the **current practice** for pre-hospital stroke care?
- What is current transport pattern for your area for stroke?
- Are you utilizing a Stroke Severity assessment tool? If so, are all EMS agencies and hospitals using the same tool?
- Are there gaps in the stroke care continuum?
- What works well and what needs improvement?
Next Steps
Implementation

* Develop a regional plan and regular dialogue between stroke stakeholders
* Tailor the Algorithm to meet your region’s specific needs and resources
* Implement your plan after education of all is complete
* Initiate regular rapid cycle QI plans to monitor implementation with stroke patient outcomes available to all
* Continually Assess and Adapt to the Evolving Data
* Base Changes on Best Practice with the Patient in Mind
Next Steps: Track Impact

- Identify key metrics specific to your area
- Collect the data
- Assess impact of the algorithm
- Are there areas we can improve the algorithm?
- Share the data with EMS/HOSPITALS
- Share your findings with AHA/ASA Mission: Lifeline Stroke
Potential Research Questions

- Which Pre-hospital LVO tool(s) is the BEST?
- What is the Impact of using these scores?
- Which LVO patients respond to EVT?
- Are all hospitals equal? What is Good Care?
- Trials: Compare drip-and-ship vs. direct to CSC
- Others? Use your imagination.
NEXT STEPS
Mission: Lifeline Stroke

- Update the Algorithm as Experience Improves*
- Discuss role, opportunities and disruptions of TSC
- Creation of an EMS Toolkit for Stroke
- Transition membership and leadership
- Draft and publish ‘White Paper’ for Algorithm

* Already updated for TSC and Severity Scales
www.Heart.org/MissionLifelineStroke

Download your copy of the Algorithm and One-pager from the Mission: Lifeline Stroke Webpage
Thank You

* Lee Schwamm, MD – Co-Chair, Mission: Lifeline Stroke
* Mission: Lifeline Stroke Membership
* AHA Staff
  * James Lugtu and Mic Gunderson
* Matt Siket-Thanks for the defense this AM!
* Andrew Asimos-Thanks for your critical mind!
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