The Prehospital Approach to Stroke

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Current Prehospital Paradigm

Stroke Screen Positive/Stroke Suspected → Determine Last Known Well → Prenotify Stroke Center and Transport
## Prehospital Stroke Assessment Tools

<table>
<thead>
<tr>
<th>Scale</th>
<th>Components</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPSS</td>
<td>Pronator drift, speech, facial droop</td>
<td>44-95%</td>
<td>23-96%</td>
</tr>
<tr>
<td>LAPSS</td>
<td>Facial grimace, handgrip and arm strength</td>
<td>74-98%</td>
<td>44-97%</td>
</tr>
<tr>
<td>FAST</td>
<td>Facial droop, arm weakness, speech, time</td>
<td>79-85%</td>
<td>68%</td>
</tr>
<tr>
<td>BE-FAST</td>
<td>Balance, eyes (visual symptoms), facial droop, arm weakness, speech, time</td>
<td>~90%</td>
<td>unknown</td>
</tr>
<tr>
<td>MASS</td>
<td>Facial grimace, handgrip and arm strength, speech</td>
<td>83-98%</td>
<td>44-86%</td>
</tr>
<tr>
<td>MedPACS</td>
<td>Facial droop, gaze, arm and leg weakness, speech</td>
<td>44-74%</td>
<td>32-98%</td>
</tr>
<tr>
<td>ROSIER</td>
<td>Facial, arm, or leg weakness; speech; visual fields</td>
<td>80-89%</td>
<td>79-83%</td>
</tr>
</tbody>
</table>
Stroke Recognition

• Stroke Assessment is first priority after correcting any Immediate Life Threats

• When not recognized, stroke often missed (Mosely et al, Stroke 2007)

• 50% of strokes are not dispatched as strokes (Li, unpublished)
  – Being dispatched as stroke is important contributor to stroke assessment (RR: 1.40; 95% CI: 1.25, 1.56)
  – Falls, Unconscious, Sick Person common non-stroke dispatches

• 16% of patients have barriers to stroke assessment
  – 30% related to access, 27% communication, 23% extrication, 20% refusal, and 14% assessment/management (Li, unpublished)
New Prehospital Paradigm

1. Stroke Screen Positive/Stroke Suspected
2. Determine Last Known Well
3. Assess Severity (Stroke Severity Score)
   - Evidence of LVO
   - Prenotify and Transport to Primary Stroke Center
   - Prenotify and Transport to Endovascular Center
# Prehospital Stroke Severity Tools

<table>
<thead>
<tr>
<th>Scale</th>
<th>Components</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-STAT (CPSSS)</td>
<td>Pronator drift, speech, facial droop, conjugate gaze deviation, level of consciousness</td>
<td>56-89%</td>
<td>37-86%</td>
</tr>
<tr>
<td>LAMS</td>
<td>Assign’s numeric score to LAPSS (Facial grimace, handgrip and arm strength)</td>
<td>66-98%</td>
<td>86-97%</td>
</tr>
<tr>
<td>PASS</td>
<td>Level of Consciousness, gaze palsy/deviation, arm weakness</td>
<td>66-97%</td>
<td>10-84%</td>
</tr>
<tr>
<td>FAST</td>
<td>Facial droop, arm motor, speech, time</td>
<td>60-96%</td>
<td>17-89%</td>
</tr>
<tr>
<td>G-FAST</td>
<td>Gaze, facial droop, arm motor, speech, time</td>
<td>56-88%</td>
<td>39-79%</td>
</tr>
<tr>
<td>VAN</td>
<td>Vision, aphasia, neglect</td>
<td>100%</td>
<td>90%</td>
</tr>
<tr>
<td>RACE</td>
<td>Facial palsy, arm motor, leg motor, gaze, aphasia or agnosia</td>
<td>66-85%</td>
<td>46-90%</td>
</tr>
</tbody>
</table>
Take Home: Stroke Recognition

• Perform stroke assessment (CPSS in NY) and make it a routine part of every exam
• Document the assessment and time Last Known Well
• Identify severe strokes and route to endovascular centers using:
  – Clinical indicators of severe stroke
  – Stroke Severity Tool
  – Medical Control/Telestroke
The Importance Of Time

Khatri et al, Lancet Neurology 2014
Time…. 

- Controlling what you can 
  - Chute Time 
  - Scene Time

<table>
<thead>
<tr>
<th>Measure</th>
<th>Goal  (mins)</th>
<th>Median (mins)</th>
<th>IQR (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chute Time</td>
<td>&lt;1</td>
<td>1</td>
<td>0-2</td>
</tr>
<tr>
<td>Response Time</td>
<td>&lt;8</td>
<td>9</td>
<td>7-12</td>
</tr>
<tr>
<td>On Scene Time</td>
<td>&lt;10</td>
<td>15</td>
<td>11-21</td>
</tr>
<tr>
<td>Transport Time</td>
<td></td>
<td>14</td>
<td>10-19</td>
</tr>
<tr>
<td>Total Prehospital Time</td>
<td></td>
<td>39</td>
<td>33-48</td>
</tr>
</tbody>
</table>

(Li, Unpublished Data)
Oxygen

- 63% of patients with hemiparetic stroke develop hypoxia (Sulter et al, J Neuro Sci 2000)

- Single study found those with severe strokes had worse survival (Ronnig and Guldvog, Stroke 1999)

- Beyond 94%, oxyhemoglobin is saturated

- Take Home:
  - Oxygen only for Saturations <94%
IV Access / Fluid Administration

- Stroke patients are generally euvolemic or hypovolemic (Jauch et al, Stroke 2013)

- Hypotension occurs infrequently but leads to poor outcomes (Leonardi-Bee et al, Stroke 2002)

- Peripheral vascular access takes time

- Routine prehospital hypertension management unproven

- Take Home:
  - IV Access ONLY if it does not delay transport
  - IV Fluids (Normal Saline) only for hypotension
Blood Glucose


- Hyperglycemia associated with worse outcomes after stroke

- Take Home:
  - Treat if <45 mg/dl (NYS Protocols <60 mg/dl)
  - D10 instead of D50
12- Lead ECG Acquisition

• ST depression, prolonged QTc, atrial fibrillation, T-wave inversion, conduction defects, PVCs, and LVH in up to 60% with infarct and 44% with TIA (Christensen et al, N Neurol Sci 2005; McDermott et al, Stroke 1994)

• Rarely change management

• Take Home:
  – ECG ONLY if it does not delay transport
  – If STEMI, consider PCI Center
Prehospital Notification

• Early communication of time “last seen normal” (last known well) results in shorter time from:
  – Door to physician assessment
  – Door to imaging
  – Door to needle

• Take Home:
  – EMS: Prenotify all potential stroke patients (NYS Protocols LKW <5 hours)
  – ED’s: Act on information and streamline processes

Mosley et al, Stroke 2007
Bae et al, J Clin Neurol 2010
Oostema et al, J Stroke Cerebrovasc Dis 2014
Patel et al, Stroke 2011
Abdullah, Prehosp Emerg Care 2008
McKinney et al, J Stroke Cerebrovasc Dis 2013
Prabhakaran et al, JAMA Neurol 2013
Prehospital Stroke Care Opportunities

- Enhanced identification of stroke patients at time of 911 call and on scene
- EMS performance measurement to improve stroke care (assessment, LKW, time, interventions)
- Severity decision aids to direct EMS to Interventional Capable facility for LVO treatment
- Decreasing DIDO for patients being transferred
- Expanding paramedic ability to maintain tPA drip
- Feedback loops (Hospital to EMS) critical