Quality Improvement in the Prehospital Setting

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Disclosures

- Cherie Adams – none
- Mark Pinchalk - none
Presentation Objectives

Translate the impact of continuous quality improvement initiatives on stroke patient care in the prehospital setting.

- EMS in PA
- Prehospital Care
- Prehospital Scales
- Prehospital notification
- Stroke Destination
- Stroke Feedback
- On the Horizon

Stroke Care at Presbyterian

- Advanced Certification for Comprehensive Stroke Centers by the Joint Commission
- American Heart Association and American Stroke Association’s Get With The Guidelines® - Stroke Gold Plus award
- Nurse practitioner as Clinical Supervisor of The Stroke Institute
- Full time Quality Nurse Coordinator II and full time Stroke Coordinator
- All nurses on neuro units are certified in the National Institute of Health Stroke Scale.
- Community programs including stroke screenings, support groups, and education programs for EMS personnel.
Stroke Institute 2015 Highlights

**Stoke Volume All Populations CY 2015**

Number of Patients

- AIS: 1081
- ICH: 316
- SAH: 127
- TIA: 126
- Total Stroke Volume: 1650

Data Source: PUH Thrombolytic Database

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**Endovascular Procedures**

- OSH tPA ONLY: 145
- PUH IA ONLY: 110
- OSH tPA + PUH IA: 37
- PUH IV tPA ONLY: 37
- PUH Stent ONLY: 23
- PUH IV tPA + IA: 21
- OSH tPA + PUH Stent: 1

Data Source: PUH Thrombolytic Database

192 Endovascular Procedures
Treatment Log – Medic 1
Dispatched for a 53 year old female “stroke”

11:13: On scene
11:16: CPSS + last known well time approximately 10:00
11:19: Blood Glucose = 101mg/dl, P=70, R=18, BP=160/110, SpO2=97%, EKG=NSR
11:22: Stroke Alert Initiated
11:25: IV NSS Lock Sx1 L AC
11:31: Transport initiated to UPMC Shadyside (scene time = 18 minutes)
11:41: Arrived UPMC Shadyside ED (field time = 28 minutes)
**Patient Scenario and Outcome**

A 53-year-old woman with acute onset of left hemiplegia, left gaze deviation, dysarthria—presented 3 hours prior to groin puncture. Her NIHSS was 10 in the ED. T-PA was contraindicated due to unclear time of onset. The patient underwent cerebral arteriography and endovascular revascularization of an occluded R M1 MCA segment. At the conclusion of the procedure the right middle cerebral artery is patent with TIMI 2/3/2b flow noted at the end of the procedure. The patient tolerated the procedure well. Her NIHSS was 2 immediately post-procedure. She suffered no complications and was discharged to home on 5/18/15. Her final NIHSS upon discharge was 1 for mild facial droop.

**Impression:**
Non-contrast head CT demonstrating subtle findings of an early right MCA distribution infarction with areas of low attenuation/infarct involving the right lentiform nucleus and corona radiata.

Hyperdense right MCA. No evidence of acute parenchymal hemorrhage at this time.

CT perfusion demonstrates a large right MCA perfusion deficit as evidenced by decreased cerebral blood flow and elevated mean transit time.

**Right Internal Carotid Artery Post-Embolectomy:** The previously occluded right middle cerebral artery and its branches fill well with no filling defects noted. These results are consistent with TIMI 3, TICI 2b flow.

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**Stroke Systems of Care**
“If you’ve seen one EMS agency…..you’ve seen one EMS agency”

- EMS in the United States -
  - 15,000 EMS systems
    - Fire or third-service, 911 or transport or both, volunteers or paid or both, air services, mobile stroke unit, etc.
  - 800,000 EMS personnel
    - EMT-Basic, Advanced EMT, paramedics, PHRN
    - Scope of practice usually established through state regulation
    - Protocols developed by state, regional or local organizations or agency medical director
  - 16 million transport calls annually
    - Not all communities have 911 emergency medical dispatch
    - Trauma, cardiac arrest, STEMI, altered mental status, stroke, respiratory, psychiatric, etc.
    - Response configuration – 2 paramedics, 1 paramedic and 1 EMT-Basics, 2 EMT-Basics, etc.
  - Stroke training, continuing education, data and quality is highly variable

Prehospital Stroke Mortality

- Approximately 60% of stroke patients are treated and transported by EMS (Ekundayo, 2013)
- 2014 Centers for Disease Control and Prevention stroke mortality -
  - 133,103 total stroke deaths
  - 79,825 deaths prior to inpatient admission (outpatient, ED, DOE, decedent’s home, hospice, nursing home/LTC)

2014 Cerebrovascular diseases (ICD 160-169)
35+ Age Adjusted Mortality Rate per 100,000
Prehospital Stroke Mortality

Prehospital Stroke Guideline

Activation of the 911 system by patents or other members of the public is strongly recommended. 911 dispatchers should make stroke a priority dispatch, and transport times should be minimized.
Dispatching Challenges

- This first link in the stroke chain of survival needs strengthening in order to provide prompt and timely emergency care for these patients.
- People who contact the EMS about non-stroke conditions rarely say stroke, limb weakness, speech problems or facial weakness.
- Medical Priority Dispatch System (MPDS, Priority Dispatch Corporation) is the most widely used dispatcher guide in the United States
  - Sensitivity 41%, Specificity 96%
  - Positive Predictive Value 42%-45% (Ramanujam, 2008, Buck, 2009)
- UK Study - less than one quarter received the highest priority of ambulance response. (Deakin, 2009)


When a question of stroke is raised, dispatchers are instructed to ask the caller the following key questions in the following sequence:

1) Is s/he completely awake (alert)?
2) Is s/he breathing normally?
3) Is s/he able to talk normally?
4) Tell me why you think it’s a STROKE?
   Movement problems
   Speech problems
   Numbness or tingling
5) When did this start (happen)?
6) Has s/he ever had a STROKE before?

Prehospital Stroke Guideline

Prehospital care providers should use prehospital stroke assessment tools, such as LAMS, CPSS, or RACE
Prehospital Stroke Scales

Stroke Identification Scales

- Stroke Scales Cincinnati Prehospital Stroke Scale (CPSS)
- Face Arm Speech Test (FAST)
- Los Angeles Prehospital Stroke Screen (LAPSS)
- Medic Prehospital Assessment for Code Stroke (Med PACS)
- Melbourne Ambulance Stroke Screen (MASS)
- Ontario Prehospital Stroke Screening Tool (OPSS)
- Recognition of Stroke in the Emergency Room Score (ROSIER)

Stroke Severity Scales

- Severity Scales Rapid Arterial Occlusion Evaluation Scale (RACE)
- Los Ángeles Motor Scale (LAMS)
- Cincinnati Prehospital Stroke Severity Scale (CPSSS)
- Kurashiki Prehospital Stroke Scale (KPSS)
- National Institutes of Health Stroke Scale (NIHSS)
  - sNIHSS-8
  - sNIHSS-5

Prehospital Identification Scales

- Prehospital stroke scales varied in their accuracy and missed up to 30% of acute strokes in the field. (Brandler, 2014)

- Inconsistencies in performance may be due to sample size disparity, variability in stroke scale training, and divergent provider educational standards.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Operating characteristics of prehospital stroke scales</th>
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</thead>
<tbody>
<tr>
<td>Stroke scale</td>
<td>Brand</td>
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<tr>
<td>CPSS</td>
<td>Broch et al. (2000)</td>
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</tr>
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Abbreviations: CPSS = Cincinnati Prehospital Stroke Scale; FAST = Face Arm Speech Test; LAPSS = Los Angeles Prehospital Stroke Screen; LA = Los Angeles Prehospital Stroke Screen; Med PACS = Medic Prehospital Assessment for Code Stroke; OPSS = Ontario Prehospital Stroke Screening Tool; ROSE = Recognition of Stroke in the Emergency Room. 95% confidence interval is parentheses.
Prehospital Severity Scales

- **Stroke Severity Scale**
  - Designed based on elements of the NIHSS
  - Thought to be simpler to assess by field providers than a full NIHSS
  - LAMS (Nazliel, 2008)
    - Score ≥4 Sens 81% Spec: 89% for LVO
  - RACE (Herrerra, 2014)
    - Score ≥5 Sens: 85% Spec: 65% for LVO
  - CPSSS (McMullen, 2015)
    - Score ≥2 Sens: 83% Spec: 40% for LVO

Patients should be transported rapidly to the closest available certified primary stroke center or comprehensive stroke center or, if no such centers exist, the most appropriate institution that provides emergency stroke care as described in the 2013 guidelines. In some instances, this may involve air medical transport and hospital bypass.
Stoke Routing and Destination

- Primary Stroke Centers in Pennsylvania
  - Established under Act 54 (signed by Gov. Corbett, May 2012):
    Commonwealth must keep a list of accredited primary stroke centers

- DOH must establish protocols for treatment and transport of stroke patients to the closest primary stroke center
  - Using Cincinnati Prehospital Stroke Scale
  - **Stroke Destination.** A ground ambulance may transport a patient with suspected acute stroke to the closest primary stroke center. It is reasonable to bypass a closer facility and transport directly to a DOH recognized primary stroke center if the ground transport time is < 45 minutes. Consider air transport if ground transport to the closest certified stroke center is >45 minutes.
Principals of Field Triage for Stroke

- **Patient with abnormal vital functions in need of acute resuscitation**
  - Transport to nearest hospital for stabilization of vital signs
  - Once vital functions stabilized, transfer to nearest CSC (or PSC if long distances)

- **Patient with acute onset of stroke symptoms within 6-8 hours**
  - Transport patient to closest PSC or CSC if <15-20 minutes transport time
  - If PSC and/or CSC > 15-20 minutes away, go to closest ASRH

- **Patient with acute stroke and seen initially at ASRH**
  - ASRH might use telemedicine to help evaluate the patient and make transfer recommendations
  - Transfer to nearest PSC or CSC based on stroke type, patient medical condition, treatment options

There should be no more than a 15 minute delay caused by taking a patient to the next highest level of stroke care

Drive Time

Stroke Center Designation
Comprehensive and Primary Stroke Center Drive Time

[Map showing drive times for stroke centers]
EMS personnel should provide prehospital notification to the receiving hospital that a potential stroke patient is en route so that the appropriate hospital resources may be mobilized prior to patient arrival.
Stroke Pre-notification

- EMS transportation at highest priority and hospital prenotification were associated with faster in-hospital stroke response and represent logical targets for EMS quality improvement efforts.
  - Compliance was highest for prehospital documentation of a glucose level (86.0%) and stroke screen (78.5%) and lowest for on-scene time less than or equal to 15 minutes (46.8%), hospital prenotification (56.5%), and transportation at highest priority (55.4%).

- Increasing EMS interactions with emergency physicians, standardizing handoff processes may serve as potential solutions for the high-risk EMS-ED patient transition (Meisel, 2015)
  - 4 key potential ways to improve the structure and process of the handoff: (1) communicate directly with the ED provider responsible for the patient’s care; (2) increase interdisciplinary feedback, transparency, and shared understanding of scope of practice between out-of-hospital and hospital-based providers; (3) standardize some (but not all) aspects of the handoff; and (4) harness technology to close gaps in information exchange.

Pre-notification in PA 2015

<table>
<thead>
<tr>
<th>Benchmark Group</th>
<th>Time Period</th>
<th>Numerator</th>
<th>Denominator</th>
<th>% of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>All PA Hospitals</td>
<td>Jan 2015</td>
<td>813</td>
<td>1430</td>
<td>56.9%</td>
</tr>
<tr>
<td></td>
<td>Feb 2015</td>
<td>741</td>
<td>1270</td>
<td>58.3%</td>
</tr>
<tr>
<td></td>
<td>Mar 2015</td>
<td>755</td>
<td>1333</td>
<td>56.6%</td>
</tr>
<tr>
<td></td>
<td>Apr 2015</td>
<td>774</td>
<td>1378</td>
<td>56.2%</td>
</tr>
<tr>
<td></td>
<td>May 2015</td>
<td>747</td>
<td>1318</td>
<td>55.7%</td>
</tr>
<tr>
<td></td>
<td>Jun 2015</td>
<td>759</td>
<td>1335</td>
<td>56.9%</td>
</tr>
<tr>
<td></td>
<td>Jul 2015</td>
<td>812</td>
<td>1406</td>
<td>57.8%</td>
</tr>
<tr>
<td></td>
<td>Aug 2015</td>
<td>723</td>
<td>1268</td>
<td>57.0%</td>
</tr>
<tr>
<td></td>
<td>Sep 2015</td>
<td>798</td>
<td>1309</td>
<td>60.2%</td>
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<tr>
<td></td>
<td>Oct 2015</td>
<td>771</td>
<td>1346</td>
<td>57.3%</td>
</tr>
<tr>
<td></td>
<td>Nov 2015</td>
<td>707</td>
<td>1221</td>
<td>57.9%</td>
</tr>
<tr>
<td></td>
<td>Dec 2015</td>
<td>738</td>
<td>1336</td>
<td>55.2%</td>
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</tbody>
</table>
To increase both the number of patients who are treated and the quality of care, educational stroke programs for physicians, hospital personnel, and EMS personnel are recommended.

### Feedback Example

- Communication between EMS and ED is a key ingredient to improving time to treatment, standardizing the message supports consistency in care
  - Successfully increases percentage of patients meeting STEMI guidelines
  - Improves relationships with hospitals
- Lack of educational feedback from hospital staff and physicians and continuing medical education on stroke were reported as major deterrents to enhancing their diagnostic acumen. (Hodell, 2016)
- Create a standardized feedback loop, exchange of important information to refine stroke systems of care,
Feedback Example

Essential to Successful Feedback

- Determine with EMS agencies the most important information to include in feedback -
  - Pre-hospital information
  - In-hospital information
  - System Goals
  - Provider contact information
  - Optional: Imaging to further engage pre-hospital providers

- Quick reporting is essential - 24-48 hour turn around

- Provided for good and bad outcomes

- Case reports and quarterly report cards

- Ideally all stroke centers within a region using a similar form

- Include on stroke team meeting
In-Hospital Care Quality

- Last Known Well Documented by Hospital
  - Yes/No
  - Date/Time:
- Brain Image Completed
  - Yes/No
- Interpretation of First Brain Image (Indication of Hemorrhage?)
- IV-tPA administered?
  - Yes/No
- IF NO-WHY:

System Goals

<table>
<thead>
<tr>
<th>Time</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Door to Stroke Team (Physician)</td>
<td>&lt; 15 minutes</td>
</tr>
<tr>
<td>2. Door to CT/MRI</td>
<td>&lt; 25 minutes</td>
</tr>
<tr>
<td>3. Door to IV-tPA</td>
<td>&lt; 60 minutes</td>
</tr>
</tbody>
</table>

Parties Involved & Contact Information

- Emergency Physician:
- Neurologist:
- Outcome/Discharge Disposition:

Source: NorthEast Cerebrovascular Consortium

UPMC Presbyterian Hospital
Acute Stroke Case Follow-Up

Date: 03/12/2016

- Last Known Normal: 12:10
- First Medical Contact (EMS): 12:49, 18 mm (Time to Hospital Notification)
- Arrive to ED: 12:50, 60 mm (Time to ED)
- CT of the Head: 13:21, 1 min (Time to CT)
- IV-tPA: 13:15, 55 mm (Time to IAT)
- Arrive to Intervention Lab: 13:25, 65 min (Transport Time to Lab)
- Initiation of Endovascular Treatment: 14:45, 85 min (Time to Procedure)

First Medical Contact to Endovascular Intervention Time: 117 minutes
Door to Endovascular Intervention Time: 85 minutes

Before Intervention
After Intervention

Rapid reperfusion is key to the management of patients with acute ischemic stroke. Keys to success are early recognition of potential stroke, Medical Command contact, and transport to an appropriate capable of delivering acute stroke care. For questions about the UPMC continuous quality improvement process for stroke patients, please call 412-XXX-XXXX.

Source: NorthEast Cerebrovascular Consortium

American Heart Association
American Stroke Association

Life is why.
On the horizon with EMS

- Mission: Lifeline Stroke
  - Statewide and regional taskforces
  - EMS recognition
    - Measures in development
- Seamless patient care report
  - Connecting EMS data with Get With The Guideline-Stroke
- Brain imaging using mobile CT
- Integrated Protocols for EMS direct to CT at receiving facilities
- Mobile Integrate Healthcare (aka Community Paramedicine)
  - The provision of healthcare using patient-centered, mobile resources in the out-of-hospital environment including – chronic disease management, preventive care or post-discharge follow-up visits; or transport or referral to a broad spectrum of appropriate care, not limited to hospital emergency departments.
- Performance Reporting and Payment Reform
  - First measures developed – stroke
    - Process and outcome

Questions