Establishing a Nationwide STEMI Network (Including Primary PCI Without On-site Surgery)

Mayme Lou Roettig, RN, MSN
Disclosure

- No Disclosures related to this presentation

- For full listing see www.dcri.duke.edu/research/coi.jsp
The Need for Regional Integrated Care for ST-Segment Elevation Myocardial Infarction

John P. Vavalle, MD; Christopher B. Granger, MD

**Case 1 presentation:** A 57-year-old man suffered a sudden cardiac arrest at home, witnessed by his son, who called 911 and began cardiopulmonary resuscitation immediately. Failure, requiring mechanical ventilation, and developed cardiogenic shock. An ECG revealed anterior ST-segment elevation, and laboratory analysis revealed an initial hematocrit of 24%. The presentation involved lack of coordination between EMS, non-PCI, and PCI hospitals. This has led to substantial variations in the treatment of STEMI with...
Why did Mr. Snipe survive?

- Son recognized arrest, called 9-1-1, did CPR
- EMS obtained 12-lead ECG
- EMS activated the Duke cath lab
  - Saves 35 minutes during drive, to achieve 95 min first medical contact to device time
- EMS bypassed a closer non-PCI center
  - 30 min extra drive time, saves 80 minutes compared to 110 min first door to device time
- Primary PCI, hypothermia, care of shock
Expansion of PCI centers including without surgical backup is a good opportunity for areas without coverage
60 minute drive time to PCI lab
2001 – 2006 PCI Capable Hospital Expansion

- PCI-capable hospitals
  1176 to 1695
- Access to PCI
  79.0% to 79.9%

In 2006, 1695 of 4673 US hospitals (36%) had a primary PCI program.

Hospital PCI capability in 2006 was sufficient to provide timely primary PCI (<60 min drive time) to 80% of the population.

From 2001 to 2006, hospital capability to perform PCI grew by 44%, whereas timely access to the procedure grew by only 1%.
STEMI Point of Entry Protocol

Onset of symptom of STEMI
9-1-1 EMS dispatch
EMS on-scene
- Obtain 12-lead ECGs
- Consider prehospital fibrinolytic if capable and EMS-to-needle within 30 min
EMS transport:
- EMS-to-balloon within 90 min
EMS transport: Patient self-transport: Hospital D2B within 90 min

GOALS†
- Patient: 5 min after symptom onset
- Dispatch: 1 min
- EMS on scene: within 8 min
- EMS transport: Prehospital fibrinolysis: EMS-to-needle within 30 min

Total ischemic time: Within 120 min*

* Golden Hour = First 60 minutes

©2011, American Heart Association
EMS bypass of non-PCI centers saves time
Patients who call 9-1-1, have primary PCI, and are picked up more than 10 minutes further from a PCI than a non-PCI center

Compare patients who drive further to a PCI center and those going to closer non-PCI and transferred

1288 patients
- 826 (64%) direct to PCI facility
- 462 (36%) first to non-PCI and transferred

Longer transport times: median 42 vs. 26 minutes

Shorter FMC to device: 93 vs 161 minutes

Mortality 6.3% vs 9.3%; adjusted 13% lower
D2B is optimized in most PCI centers, but transfers are still too SLOW!!
STEMI Door-to-Balloon Times Median Times for Transfer In and Non-Transfer In Patients

ACTION Registry-GWTG DATA: January 01, 2012 - December 31, 2012
For US STEMI patients presenting to primary PCI centers in the US, EMS First Medical Contact to first device deployed within 90 minutes is achieved in only 50% of patients.
Regional Systems of STEMI Care: a Class I Recommendation

All communities should create and maintain a regional system of STEMI care that includes assessment and continuous quality improvement of EMS and hospital-based activities. Performance can be facilitated by participating in programs such as Mission: Lifeline and the D2B Alliance.

Performance of a 12-lead ECG by EMS personnel at the site of FMC is recommended in patients with symptoms consistent with STEMI.
STEMI + Cardiac Resuscitation System Coverage

As of 04/26/2013
(665 STEMI Systems - 65.24% Population Coverage)
(37 Cardiac Resuscitation Systems - 4.76% Population Coverage)

All system data, including coverage area, is self-reported data.

Source: Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed Mortality File 1999-2006. CDC Wonder Online Database. ICD10 I21-I22.

Note: Cardiac Resuscitation Coverage Areas listed are also indicative of a STEMI system in place. Mission: Lifeline does not recognize Cardiac Resuscitation Systems that are not also associated with an active STEMI System.
Time-to-Treatment Goals for Primary PCI

Directly-Admitted Patients
- Call 911 if ischemic symptoms are not relieved within 5 minutes after sublingual nitroglycerin
- EMS arrival expected within 8 minutes after activation
- ECG should be obtained within 10 minutes after first medical contact
- Best clinical outcomes achieved within 120 minutes after symptom onset

Transfer Patients
- First-door-to-balloon \( \leq 120 \) minutes

ECG denotes electrocardiogram, EMS emergency medical services, FMC first medical contact, PCI percutaneous coronary intervention, and STEMI ST-segment-elevation myocardial infarction.
Do regional systems of care focused on eligible patients being treated and faster system times make a difference?
RACE Hospitals by PCI and Reperfusion Designation

- Primary PCI (21)
- Transfer for Primary PCI (52)
- Lytics (31)
- Mixed (15) (primary PCI if transport readily available)
Death by guideline goal

<table>
<thead>
<tr>
<th></th>
<th>Direct Presentation</th>
<th>Transfer In</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Last Qtr</td>
<td>Last 12 mo</td>
</tr>
<tr>
<td><strong>Number of STEMI Patients</strong></td>
<td>810</td>
<td>3,098</td>
</tr>
<tr>
<td><strong>Patient Demographics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (median years)</td>
<td>61.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Female</td>
<td>32%</td>
<td>31%</td>
</tr>
<tr>
<td>Non-White</td>
<td>19%</td>
<td>18%</td>
</tr>
<tr>
<td>Hispanic Ethnicity</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Diagnosis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First ECG obtained Pre-Hospital (EMS Arr.)</td>
<td>89%</td>
<td>91%</td>
</tr>
<tr>
<td>STEMI Noted on first ECG</td>
<td>84%</td>
<td>85%</td>
</tr>
<tr>
<td><strong>Mode of Arrival (to First Facility)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POV</td>
<td>25%</td>
<td>26%</td>
</tr>
<tr>
<td>EMS (Ambulance)</td>
<td>72%</td>
<td>71%</td>
</tr>
<tr>
<td><strong>Reperfusion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contraindicated to reperfusion</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>Eligible for reperfusion</td>
<td>96%</td>
<td>95%</td>
</tr>
<tr>
<td>Treated</td>
<td>89%</td>
<td>89%</td>
</tr>
<tr>
<td>Untreated</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Median Time to Reperfusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary PCI</td>
<td>46.0</td>
<td>46.0</td>
</tr>
<tr>
<td>Fibrinolytic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>38.0</td>
</tr>
<tr>
<td><strong>In-hospital Clinical Events (Exc. Trans-Out)</strong></td>
<td>0.6%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Reinfarction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiogenic shock</td>
<td>5.1%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>2.6%</td>
<td>3.6%</td>
</tr>
<tr>
<td>CVA/Stroke</td>
<td>0.4%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Hemorrhagic stroke (Among CVA pts)</td>
<td>0.0%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Suspected Bleeding Event</td>
<td>3.3%</td>
<td>2.5%</td>
</tr>
<tr>
<td>RBC/Whole Blood Cell Transfusion</td>
<td>3.9%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Any of above events</td>
<td>14.8%</td>
<td>15.1%</td>
</tr>
</tbody>
</table>
STEMI Guideline
Goal 90 min

First Medical Contact to Device Activation
Distribution of Times (minutes)
Direct Presentation, Arriving via EMS
STEMI Guideline Goal: 120 min

Hospital S:
- 75th percentile
- D2B: 58 (~1 hour)
- FMC: EMS: 108 (~2 hours)
- Transfer: 168 (~3 hours)
Time is muscle
Relationship among symptom duration, myocardial salvage, and mortality reduction.


16 minute reduction D2B 2006 - 2009

Outcomes With Different Treatment Strategies
- A to B: No Benefit
- A to C: Benefit
- B to C: Benefit
- D to B: Harm
- D to C: Harm

Hospital S
75th percentile
- D2B: 58 (~1 hour)
- FMC: 108 (~2 hours)
- EMS: 168 (~3 hours)
“Where you live should not determine whether you live”
Pennsylvania PCI Hospitals

STEMI Mortality
- Class 1 (16.2-96.2)
- Class 2 (96.2-127.8)
- Class 3 (127.8-162.5)
- Class 4 (162.5-219.1)
- Class 5 (219.1-725.9)

Stemi Coverage Areas
- PCI Capable Hospital
- Non PCI Capable Hospital
- Mission: Lifeline Recognized Hospital
Local to Regional to National Implementation

Mission: Lifeline 2012

US Healthcare System

250,000 MI’s/yr
250,000 arrests/yr

RACE
North Carolina

40,000 MI’s/yr
2,000 cardiac arrests/yr

Duke
Central NC

5,000 STEMI’s per year

200 MI’s per year

Duke Clinical Research Institute