Treatment of ST-elevation myocardial infarction in China: Where are we?

Associate Professor, Yihong Sun, MD
Peking University People’s Hospital
Beijing, China
Disclosure

conflict of Interest
Executive Summary: Heart Disease and Stroke Statistics—2012 Update: A Report From the American Heart Association


- From 1998 to 2008, the rate of death attributable to CVD declined 30.6%. Mortality data for 2008 show that CVD (I00–I99; Q20–Q28) accounted for 32.8% (811 940) of all 2 471 984 deaths in 2008, or 1 of every 3 deaths in the United States.
The Challenges of Coronary Artery Disease in China

Predicted annual total CHD deaths (CHD Policy Model-China)

Hospitalized STEMI Treatment in Europe
Data from National Registries or Surveys (2007-2008)

In-hospital Mortality: 4.2-13.5%
Rapid increase in Percutaneous Coronary Interventions in China

Over 300,000 PCI in 2011!

Heart 2010;96:415-418
Numbers of patients receiving PCI in China in 2010

Reperfusion Therapy of STEMI in China

Trend in patients with D to B <90mins in US
<table>
<thead>
<tr>
<th>Delay</th>
<th>Target</th>
<th>Preferred for FMC to primary PCI</th>
<th>Preferred for FMC to primary PCI</th>
<th>Preferred for FMC to fibrinolysis (FMC to needle)</th>
<th>Preferred for FMC to primary PCI (door to balloon) in primary PCI hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤120 min</td>
<td>≤60 min</td>
<td>if early presentation with large area at risk</td>
<td>≤90 min</td>
<td>≤60 min</td>
<td>≤30 min</td>
</tr>
<tr>
<td>≤24 h</td>
<td>≤10 min</td>
<td>if early presentation with large area at risk</td>
<td>≤60 min</td>
<td>≤30 min</td>
<td>≤10 min</td>
</tr>
</tbody>
</table>

Note: FMC = first medical contact; PCI = percutaneous coronary intervention.
The Registry of Reperfusion Therapy in Patients with STEMI in Beijing

- 18 million residents
- 19 hospitals with capability of primary PCI
  - 16 centers in urban
  - 3 centers in rural area
- From Nov 2005 to Dec 2006

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total N=809</th>
<th>PPCI n=521</th>
<th>TT n=133</th>
<th>No n=155</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>60.9 ± 12.7</td>
<td>60.1 ± 12.4</td>
<td>58.5 ± 11.3</td>
<td>65.3 ± 13.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age &gt;75</td>
<td>135(16.9)</td>
<td>74(14.2)</td>
<td>9(7.2)</td>
<td>52(33.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female</td>
<td>178(22.3)</td>
<td>105(20.2)</td>
<td>26(20.8)</td>
<td>47(30.5)</td>
<td>0.02</td>
</tr>
<tr>
<td>Smoking</td>
<td>446(56.5)</td>
<td>304(59.5)</td>
<td>81(65.9)</td>
<td>61(39.45)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diabetes</td>
<td>158(19.9)</td>
<td>92(17.9)</td>
<td>25(20.2)</td>
<td>41(26.5)</td>
<td>0.18</td>
</tr>
<tr>
<td>Hypertension</td>
<td>414(51.9)</td>
<td>226(51.3)</td>
<td>60(48.0)</td>
<td>88(57.1)</td>
<td>0.04</td>
</tr>
<tr>
<td>hypercholestoremia</td>
<td>162(20.4)</td>
<td>102(19.8)</td>
<td>26(20.8)</td>
<td>34(22.4)</td>
<td>0.63</td>
</tr>
<tr>
<td>Prior MI</td>
<td>74(9.3)</td>
<td>31(6.0)</td>
<td>19(15.2)</td>
<td>24(15.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CKD</td>
<td>14(1.8)</td>
<td>8(1.5)</td>
<td>0(0)</td>
<td>6(3.9)</td>
<td>0.006</td>
</tr>
<tr>
<td>Prior stroke</td>
<td>81(10.2)</td>
<td>50(9.7)</td>
<td>9 (7.3)</td>
<td>22 (14.2)</td>
<td>0.10</td>
</tr>
<tr>
<td>Prior HF</td>
<td>10(1.3)</td>
<td>4(0.8)</td>
<td>2(1.6)</td>
<td>4(2.6)</td>
<td>0.09</td>
</tr>
</tbody>
</table>
## Patient Characteristics by Reperfusion Strategy

Data of Beijing Registry 2006

<table>
<thead>
<tr>
<th></th>
<th>Total N=809</th>
<th>PPCI n=521</th>
<th>TT n=133</th>
<th>No n=155</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-hour presentation</td>
<td>520(64.9)</td>
<td>333(63.9)</td>
<td>86(68.8)</td>
<td>101(65.2)</td>
<td>0.59</td>
</tr>
<tr>
<td>Pre-hospital ECG</td>
<td>291(35.9)</td>
<td>205(41.5)</td>
<td>42(34.4)</td>
<td>44(30.3)</td>
<td>0.03</td>
</tr>
<tr>
<td>EMS transport</td>
<td>310(38.7)</td>
<td>221(42.4)</td>
<td>43 (34.4)</td>
<td>46(29.7)</td>
<td>0.01</td>
</tr>
<tr>
<td>Pre-hospital delay &gt;3h</td>
<td>351(44.2)</td>
<td>223(43.1)</td>
<td>41(33.3)</td>
<td>87(56.1)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

## Evidence Based Medication in Hospital

### Data of Beijing Registry 2006

<table>
<thead>
<tr>
<th>Medication</th>
<th>Total N=809</th>
<th>PPCI n=521</th>
<th>TT n=133</th>
<th>No n=155</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin</td>
<td>774(98.1)</td>
<td>503(97.7)</td>
<td>121(99.2)</td>
<td>150(98.7)</td>
<td>0.46</td>
</tr>
<tr>
<td>Clopidogrel</td>
<td>701(90.0)</td>
<td>496(96.9)</td>
<td>96(81.4)</td>
<td>109(73.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>UFH</td>
<td>211(27.5)</td>
<td>127(25.4)</td>
<td>63(52.9)</td>
<td>21(14.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>LMWH</td>
<td>717(91.8)</td>
<td>481(94.5)</td>
<td>103(85.1)</td>
<td>133(88.1)</td>
<td>0.001</td>
</tr>
<tr>
<td>B-blocker</td>
<td>593(76.1)</td>
<td>397(77.7)</td>
<td>85(71.4)</td>
<td>111(74.5)</td>
<td>0.31</td>
</tr>
<tr>
<td>ACEI</td>
<td>559(72.5)</td>
<td>368(73.3)</td>
<td>88(72.2)</td>
<td>103(69.6)</td>
<td>0.67</td>
</tr>
<tr>
<td>Statin</td>
<td>716(91.6)</td>
<td>484(94.7)</td>
<td>102(85.0)</td>
<td>130(86.1)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

# In Hospital Outcomes by Reperfusion Strategy

Data of Beijing Registry 2006

<table>
<thead>
<tr>
<th></th>
<th>Total N=809</th>
<th>PPCI n=521</th>
<th>TT n=133</th>
<th>No n=155</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>37(4.6)</td>
<td>16(3.1)</td>
<td>7(5.6)</td>
<td>14(9.0)</td>
<td>0.001</td>
</tr>
<tr>
<td>Re-infarction</td>
<td>13(1.7)</td>
<td>8(1.6)</td>
<td>3(2.7)</td>
<td>2(1.4)</td>
<td>0.71</td>
</tr>
<tr>
<td>Stroke</td>
<td>3(0.4)</td>
<td>1(0.2)</td>
<td>1(0.9)</td>
<td>1(0.7)</td>
<td>0.47</td>
</tr>
<tr>
<td>New Heart failure</td>
<td>114(15.0)</td>
<td>68(13.5)</td>
<td>22(19.3)</td>
<td>24(16.9)</td>
<td>0.22</td>
</tr>
<tr>
<td>Severe Bleeding</td>
<td>17(2.3)</td>
<td>12(2.4)</td>
<td>2(1.8)</td>
<td>3(2.2)</td>
<td>0.91</td>
</tr>
</tbody>
</table>
Time from onset of symptoms to Treatment

Data of Beijing Registry 2006

- **In hospital fibrinolysis**
  - Onset of symptom: 130 min
  - In hospital treatment: D to N 87.5 min

- **Primary PCI**
  - Onset of symptom: 137 min
  - In hospital treatment: D to B 137 min

Pre-hospital Delay (symptom onset to hospital arrival)

Data of Beijing Registry 2006

- >6 hours
- 2-6 hours
- <2 hours

## The social-economic factors associated with Pre-hospital Delay

Data of Beijing Registry 2006

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-hospital delay ≤2h</th>
<th>Pre-hospital delay &gt;2h</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=364</td>
<td>N=445</td>
<td></td>
</tr>
<tr>
<td>Age (mean, y)</td>
<td>59.40 ± 12.51</td>
<td>62.35 ± 12.48</td>
<td>0.001</td>
</tr>
<tr>
<td>Age ≥65 y</td>
<td>128 (35.16)</td>
<td>189 (42.47)</td>
<td>0.034</td>
</tr>
<tr>
<td>Female</td>
<td>74 (20.73)</td>
<td>108 (25.35)</td>
<td>0.127</td>
</tr>
<tr>
<td>Health insurance</td>
<td>224(61.5)</td>
<td>294(66.1)</td>
<td>0.039</td>
</tr>
<tr>
<td>Education</td>
<td>167(45.9)</td>
<td>245(55.1)</td>
<td>0.403</td>
</tr>
<tr>
<td>Income &gt;2000RMB/M</td>
<td>73(20.1)</td>
<td>123(27.6)</td>
<td>0.447</td>
</tr>
</tbody>
</table>

The risk factors associated with Pre-hospital Delay

Data of Beijing Registry 2006

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrate on symptom onset</td>
<td>8.666</td>
<td>2.312, 32.476</td>
<td>0.0071</td>
</tr>
<tr>
<td>No severe symptom</td>
<td>2.132</td>
<td>1.264, 3.597</td>
<td>0.0045</td>
</tr>
<tr>
<td>Symptom persist &lt;30mins</td>
<td>25.0</td>
<td>1.786, 595.2</td>
<td>0.0281</td>
</tr>
<tr>
<td>Self transport</td>
<td>2.62</td>
<td>1.57, 4.37</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

The Delay of Door to reperfusion Time

Data of Beijing Registry 2006

D to B

D to N

### The Delay of Door to reperfusion Time

#### Data of Beijing Registry 2006

<table>
<thead>
<tr>
<th>Factor</th>
<th>D to B &gt;90 mins</th>
<th>p value</th>
<th>D to n &gt;30 mins</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low volume PCI center</td>
<td></td>
<td>0.0153</td>
<td></td>
<td>0.0418</td>
</tr>
<tr>
<td>Off hour presentation</td>
<td></td>
<td>0.0412</td>
<td></td>
<td>0.041</td>
</tr>
<tr>
<td>Referral</td>
<td></td>
<td>0.0304</td>
<td></td>
<td>0.0105</td>
</tr>
<tr>
<td>Age &gt;65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF(kiliip 4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prehospital delay &gt;2 h</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In-hospital Pathway of Thrombolysis

Data of Beijing Registry 2006

Arrival at the local hospital → ECG → Decision making
Risk of thrombolysis, Biomarker Informed consent → ED(64%)
PCI(18%) → CCU(36%)

EM (71min) 6 mins 40 mins 15 mins
CCU (112min) 7 mins 50 mins 20 mins
Total (83min) 6 mins 43 mins 17 mins

The Chinese Consensus on Reperfusion Therapy for STEMI
Triage of Reperfusion strategy in hospital (Chinese Consensus)

Suspected STEMI
- Time and risk
- Time of onset
- Risk of STEMI
- Risk of thrombolysis
- Delay of PCI

PCI capable

Non-PCI-capable

In hospital fibrinolysis

3-12 hours
Transfer within 90 min

< 3 hours

Primary PCI

Yes

No

Rescue PCI

failed

Successful

angiography
Ongoing registry of ACS in China

- Web based registry
- Initiated in 2011
- 21 Centers
- STEMI and NSTEMI ACS
- 1500 patients before 7th Agu, 2012
- 567 STEMI analysed
Reperfusion Treatment by Gender

Preliminary analysis of Beijing ACS Registry 2012

- 2006 (n=809)
  - No reperfusion: 19.6%
  - Thrombolysis: 16.4%
  - PPCI: 64.4%

- 2011 (n=567)
  - No reperfusion: 36.1%
  - Thrombolysis: 5.1%
  - PPCI: 70.2%

Percentage of STMI (%)

2006 (n=809) vs. 2011 (n=567)
Pre-hospital Delay (symptom onset to hospital arrival)

Preliminary analysis of Beijing ACS Registry 2012

- <2 hours: 42,4
- 2-6 hours: 28,6
- >6 hours: 42,4

Data not published
Delay of D to B in PPCI

Preliminary analysis of Beijing ACS Registry 2012

Data not published
Trends of time delay in PPCI and Thrombolysis

Data not published
The rate of Pre-hospital ECG and EMS transport

Preliminary analysis of Beijing ACS Registry 2012

Pre-hospital ECG

EMS transport

Percentage of STMI (%)

PPCI
Thrombolysis
No reperfusion

2006 2012 2006 2012
Reperfusion Treatment by Gender

Preliminary analysis of Beijing ACS Registry 2012

Percentage of STMI (%)

Male (n=412)  Female (n=155)

- No reperfusion
- Thrombolysis
- PPCI
Door-to-reperfusion Time: Key Steps In Process Improvement

- Patients education
- Pre-hospital ECG
- “STEMI Alert” activated by ED physician
- Physician and Nurse Champions in the ED and Cath Lab
- Prompt and detailed data feedback report
Improvement in door-to-balloon times in patients with ST-elevation myocardial infarction at a large urban teaching hospital in China

Li Song, Hongbing Yan, Hanjun Zhao, Jian Wang, Yunpeng Chi, Zheng Wu, Bin Zheng, Shaoping Wang, Hongyu Peng, Chen Liu, Peng Zhou

a Cardiovascular Institute and Fu-Wai Hospital, PUMC and CAMS, Beijing, China
b Beijing Anzhen Hospital, Capital Medical University, Beijing, China

After participating in the Beijing Register of Acute ST-elevation Myocardial Infarction (BRAMI) [5] between 2006 and 2007, we identified that, at our institution, two major sources of D2B time delay occurred between electrocardiogram (ECG) acquisition and activation of catheterization team and between activation of the catheterization team and procedure start. We then implemented some strategies to shorten D2B time since July 2008, including enhancing close integration of ambulance networks and hospital such as pre-hospital ECG and advance notification by ambulance crews; activation of catheterization team by emergency department attending physicians; activating catheterization team immediately after acquiring informed consent of PPCI; and all members of the intervention team use cell phones and arrive within 20 min of activation during off-hours. These strategies were mainly based on the identification by Bradley et al. [6].
Improvement of D to B in single PCI center in Beijing

![Graph showing percentage of patients by time in 2006 and 2011](image)

- **2006**
  - >120 min: 53%
  - 90-120 min: 25.7%
  - <90 min: 21.3%

- **2011**
  - >120 min: 16.2%
  - 90-120 min: 56.6%
  - <90 min: 27.3%

Transfer for primary percutaneous coronary intervention in STEMI in Single PCI center in Shanghai

![Graph showing door-to-balloon time for physician and patient transfers with statistics.](image)

![Graph showing MACE-free survival rate with interventionist-transfer and patient-transfer groups and statistical comparison.](image)
Summary

- The use of reperfusion therapy for STEMI varied across the country.
- Prehospital delay is still a big challenge.
- Primary PCI is the preferred treatment for STEMI in China. However, PPCI were not performed within the recommended time (90mins).
- Fibrinolytic therapy is still the choice of reperfusion and the in-hospital delay of fibrinolytic therapy needs to be improved.
- National network and regional programs is warranted to improve the optimal treatment and should be evaluated in the future.
THANK YOU!
The 23rd GWICC
11-14 Oct, 2012  Beijing

WELCOME!