Disclosures

• None
Objectives

• Review of ST-elevation MI (STEMI) patient risk assessment
• Zwolle risk score for early STEMI discharge
• Saint Luke’s East Early DC Program (SLEDP) experience
US STEMI Care

- >250,000 US adults annually
- Average $20,000/admission
- High-risk condition, 25%+ mortality before arrival
- Timely primary PCI critical to acutely reduce risk
- Post-PCI care needs can be variable

High-risk STEMI
- Cardiac arrest
- Pulmonary edema
- Ventricular arrhythmia
- Mechanical circulatory support (e.g., ECMO, Impella, IABP)

Intermediate-risk STEMI
- Late presentation
- Multivessel disease
- Acute heart failure
- Hypotension +/- pressors
- Elderly, comorbidities

Low-risk STEMI
- Prompt revascularization
- Single-vessel disease
- Complete revascularization
- Radial access
- No heart failure
- Stable post-PCI vital signs
Doctor, how much damage was done to my heart?

Nurse, when can I go home?
### Median post-procedure length of stay (in days) for PCI patients with STEMI

<table>
<thead>
<tr>
<th></th>
<th>My Hospital</th>
<th>US Hospitals 50th Pctl</th>
<th>US Hospitals 90th Pctl</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.0</td>
<td>1.9</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Your hospital’s median post-procedure length of stay (in days) for PCI patients with STEMI. [Detail Line:2111]
ICU disposition is the convention for STEMI care following primary PCI, but is the ICU a necessity in every case?
Post-PCI STEMI Goals of Care

- Prompt attention to potential post-MI complications
- Frequent vital sign and access site assessment
- Titration of medications (e.g., beta-blockers, antihypertensives)
- Post-MI education
Consequences of Post-STEMI ICU Care

- Increased length of stay
- Exposure to nosocomial infection
- Increased care costs
- Reduced patient satisfaction
- Opportunity cost of occupied ICU bed
Can successful post-STEMI care be achieved in an intermediate-care setting (e.g., CVRU)?
TIMI Risk Score

1) Age 65-74 / ≥ 75 - 2/3 points
2) Systolic Blood Pressure < 100 - 3 points
3) Heart rate > 100 - 2 points
4) Killip II-IV - 2 points
5) Anterior STE or LBBB - 1 point
6) Diabetes, h/o HTN, or h/o angina - 1 point
7) Weight < 67 kg - 1 point
8) Time to treatment > 4 hours - 1 point

Mortality at 30 Days (%)

- 0% at risk: 12%
- 1% at risk: 22%
- 2% at risk: 16%
- 3% at risk: 16%
- 4% at risk: 14%
- 5% at risk: 9%
- 6% at risk: 6%
- 7% at risk: 3%
- 8% at risk: 2%
- >8% at risk: 1%

Early Post-STEMI Discharge (2008-2011)

Predictors of Early DC

• Radial access
• Admission free of:
  – Cardiogenic shock
  – Cardiac arrest
  – Anterior MI
  – Multivessel disease
  – Left main stenosis
  – Vascular disease

Role of Early Discharge: Cost savings

- Early economic models performed on patients receiving thrombolysis (GUSTO-I, 1996)
- Extending the hospital stay for an additional day (beyond 3d) among low-risk STEMI patients provides less value (i.e., $105,629 per year of life saved)
- Care must be individualized (risk assessment, patient education, medication titration, etc)

Guideline recs for post-PPCI STEMI LOS

- Guides pre-hospital and in-lab reperfusion care
- Encourages early risk stratification
- Acknowledges some low-risk patients are amendable to early dc
- No specifics for early discharge risk stratification tool

2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

- More contemporary guidelines
- More guidance offered for low-risk STEMI discharge (day 2 or 3)
- Declares unique challenges of early dc


2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation

- The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC)
Primary Angioplasty in Low Risk Patients with AMI (PAMI II)

- Hypothesis: Hosp dc 3 d after PTCA in low-risk patients is safe, cost-effective
- Low-risk (def): age ≤ 70, EF > 45%, 1-2v CAD, primary PTCA success, no arrhythmia
- Patients randomized to:
  - **Accelerated care**: non-ICU care, full-dose heparin (48hrs) followed by half-dose heparin (12 hrs) and d/c after 3 d without noninvasive testing
  - **Traditional care**: to ICU, heparin (72hrs), non-invasive testing

<table>
<thead>
<tr>
<th></th>
<th>Accelerated Care (n = 237)</th>
<th>Traditional Care (n = 234)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>55 ± 10</td>
<td>56 ± 10</td>
<td>0.21</td>
</tr>
<tr>
<td>Male</td>
<td>77.6%</td>
<td>75.2%</td>
<td>0.54</td>
</tr>
<tr>
<td>Previous MI</td>
<td>11.2%</td>
<td>10.4%</td>
<td>0.79</td>
</tr>
<tr>
<td>Hypertension</td>
<td>37.7%</td>
<td>37.6%</td>
<td>1.0</td>
</tr>
<tr>
<td>Diabetes, insulin-dependent</td>
<td>2.2%</td>
<td>3.9%</td>
<td>0.27</td>
</tr>
<tr>
<td>Thrombolytic eligible</td>
<td>75.7%</td>
<td>80.9%</td>
<td>0.18</td>
</tr>
<tr>
<td>Diseased vessels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>75.6%</td>
<td>74.8%</td>
<td>0.83</td>
</tr>
<tr>
<td>2</td>
<td>23.1%</td>
<td>23.1%</td>
<td></td>
</tr>
<tr>
<td>3*</td>
<td>1.3%</td>
<td>2.1%</td>
<td></td>
</tr>
<tr>
<td>Post-PTCA TIMI flow grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–1*</td>
<td>0.4%</td>
<td>0.4%</td>
<td>0.54</td>
</tr>
<tr>
<td>2</td>
<td>1.3%</td>
<td>1.7%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>98.3%</td>
<td>97.8%</td>
<td></td>
</tr>
<tr>
<td>Post-PTCA % stenosis</td>
<td>20 ± 13</td>
<td>20 ± 12</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Zwolle Risk Score

- Risk scores for early d/c developed in patients with medical therapy, +/- thrombolysis, without considering **procedural variables**
- Prognostic score built according to 30-d mortality rates
- STEMI patients \( n=1791 \), enrolled 1994-2001
  - All patients received asa (500 mg) + heparin (10000 IU) IV pre PTCA/PCI
  - Post-PCI patients (52.2%) received warfarin x 3 mo (pre-1996) or 1-mo DAPT (ticlopidine or clopidogrel, after 1996)

• Low-risk Zwolle score: $\leq 3$
• Low-risk patients
  • 0.2% risk VT/VF at 48hrs
  • 0.5% 30-d mortality
• Can be safely discharged 48-72 hours of admission

Survival by Zwolle Score

Practical Pathways of STEMI Care

- Much of STEMI risk mitigated by prompt revascularization/PCI
- Following primary PCI, validated risk models predict which patients are safe for early discharge
- Appropriate early discharge may benefit patients without adverse effects
- Unique requirements of CVRU staff on education, medication titration, and early arrangements for follow-up care (i.e., cardiac rehab, clinic appts)
SLE Early Discharge Program (SLEDP) for STEMI

- Pilot launched Dec 2018
- Program identifies SLE-based STEMI patients deemed low-risk for complications and appropriate for early discharge
- Patients referred from lab directly to an intermediate-care, CV recovery unit (CVRU)
SLEDP Criteria

• Low-risk Zwolle score ($\leq 3$)
• Radial access with successful patent hemostasis OR femoral hemostasis in lab
• Uncomplicated, single-vessel primary PCI
• Complete coronary revascularization
• TIMI III flow
• Stable VS (SBP > 90 mmHg, HR < 100 bpm, >90% RA, a/ox3)
• No arrhythmia in lab
• LV end-diastolic pressure < 25 mmHg
• Non-use of GPIIb/IIIa, cangrelor, tPA
• MD/IC discretion for enrollment
Zwolle risk score: Safe early (48-72 hr) discharge

- Killip class: *** (1 [0]; 2 [4]; 3-4 [9])
- TIMI grade post PPCI: *** (3 [0]; 2 [1]; 0-1 [2])
- Age score: *** (< 60 years [0]; >= 60 years [2])
- 3-v CAD present: *** (no [0], yes [1])
- Anterior infarction: *** (no [0], yes [1])
- Ischemia time > 4hrs: *** (no [0], yes [1])

Zwolle risk score: *** (low risk: score 0-3; non-low risk: score >3)
CVRU Education & Follow-up Protocol

- CVRU staff competencies: education & action plan clear

- LVEF assessment: completed in hospital, often in lab (LVgram), or arranged for evaluation within 14d post-discharge

- Cardiac rehab: referral order sent; patient education, patient preference for location of CR, reason for patient decline of CR all documented

- Two-midnight rule: estimated LOS documented on admission, documentation of why patient eligible for early discharge prior to 2nd midnight, as needed
CVRU Admission
- LVgram in lab or echo
- Low-risk criteria met
- Plan for CVRU disposition confirmed
- RN reviews meds
- Confirms LVEF done or f/u plan
- Documents Cardiac Rehab eval and/or preference

Pre-Discharge Planning
- RN confirms EF assessment
- Discharging cardiology team confirms EF assessment completed
- Discharging RN/Cardiology staff document plan for cardiac rehab

Successful CVRU discharge
- Medications
- EF assessment
- Cardiac rehab referral
- Follow-up appointment
Methods: SLEDP Outcomes

• Retrospective analysis of prospectively collected data on all STEMI (n=158) & NSTEMI (n=520) from Dec 2018-Sept 2019
• Primary Outcome: Length of stay (LOS) PCI-to-discharge (days)
• Secondary Outcomes:
  – Major bleeding
  – Stroke
  – In-hospital Mortality
Saint Luke’s East: Early Discharge Program (SLEDP)

- **SLE STEMI**
  - N=53
- **SLE STEMI-to-CVRU**
  - N=7
- **SLE STEMI-to-ICU**
  - N=46
- **Non-SLE STEMI-to-ICU**
  - N=105
- **Non-STEMI (all SLHS)**
  - N=520

- Dec 2018-Sept 2019
- SLHS STEMI (n=158)
- NSTEMI (n=520)
Acute MI Length of Stay (LOS) Following PCI

- Average post-PCI LOS reduced by **1.44 d (95% CI 0.43-2.45)**
Major Bleeding (definition)

1. Hemoglobin drop of >=3 g/dL;
2. Transfusion of whole blood or packed red blood cells;
3. Procedural intervention/surgery at the bleeding site to reverse/stop or correct the bleeding
Ischemic Stroke (%)

- SLE STEMI-to-CVRU (n=7): 0.00%
- SLE STEMI-to-ICU: 0.00%
- NON-SLE SLHS STEMI: 0.00%
- SLHS NSTEMI: 0.19%
Next Steps

• Additional enrollments needed for program validation
• Evaluate readmission rates
• Evaluate direct and in-direct economic impact of program
• Prospectively assess patient satisfaction
• Expand program with use of EMR-based Zwolle risk calculator with careful study of patient selection and results
Conclusions

• Zwolle risk scoring successfully identified patients appropriate for SLE Early DC Program (SLEDP)
• SLEDP reduced LOS by 1.44 d without increase in adverse in-hospital events
• Potential to improve patient satisfaction, reduce adverse events, and opportunity for health cost savings