Disclosures

- **Interventional cardiologist**
  - Clinical Cardiovascular MRI and Vascular Ultrasound
- **Research Grants:**
  - NHLB, AHRQ, AstraZeneca, Pleuristem, Johnson and Johnson, Maquet / Datascope
- **Advisory Board/Consulting:**
  - Genzyme, Bayer, Baxter Healthcare, Ortho McNeil Jansen, theHeart.org, Medscape, Maquet, CSI technologies
- **Professional Society Roles:**
  - Member ACC/AHA AUC Task Force
  - Chair of Writing Group for ACC/AHA Coronary Revascularization Appropriateness Criteria
  - Chair of AHA Diagnostic and Interventional Cath Committee
Appropriate Time for Revascularization Post- MI….. So many questions

- **Timing on revascularization for patients with**
  - NSTEMI
  - STEMI (as soon as possible)
  - Shock

- **Timing for revascularization of Non-Culprit vessels**
  - Post STEMI – with IRA PCI
  - Post STEMI – with multi-vessel disease

- **Timing for CABG**
  - Post STEMI or NSTEMI
‘When you come to a fork in the road….. take it’
Yogi Berra
Appropriate Time for Revascularization Post- MI….. So many questions

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2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention (and Coronary Revascularization)
### UA/NSTEMI: Choice of Strategy*

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>COR</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>An early invasive strategy** in patients who have refractory angina or hemodynamic or electrical instability (without serious comorbidities or contraindications to such procedures)</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>An early invasive strategy** in initially stabilized patients (without serious comorbidities or contraindications to such procedures) who have an elevated risk for clinical events</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>The selection of PCI or CABG as the means of revascularization in the patient with ACS should generally be based on the same considerations as those without ACS</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>A conservative strategy recommended (over an early invasive strategy) in women with low-risk features</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>An early invasive strategy (within 12 to 24 hours of admission) chosen over a delayed invasive strategy for initially stabilized <em>high-risk</em> patients***</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>An initial conservative (i.e., a selectively invasive) strategy in initially stabilized patients who have an elevated risk for clinical events (including troponin positive patients)***</td>
<td>IIb</td>
<td>C</td>
</tr>
<tr>
<td>An early invasive strategy** in patients with extensive comorbidities in whom the risks of revascularization and comorbid conditions are likely to outweigh the benefits of revascularization, in patients with acute chest pain and a low likelihood of ACS, or in patients who will not consent to revascularization regardless of the findings</td>
<td>III – No Benefit</td>
<td>C</td>
</tr>
</tbody>
</table>

*UA/NSTEMI GL with additional and more comprehensive recommendations

**Early invasive strategy = diagnostic angiography with intent to perform revascularization

***Recs from the 2011 UA/NSTEMI focused update (not in PCI GL)
## Coronary Angiography in STEMI

<table>
<thead>
<tr>
<th>Indications</th>
<th>COR</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Immediate coronary angiography</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Candidate for primary PCI</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Severe heart failure or cardiogenic shock (if suitable revascularization candidate)</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>Moderate to large area of myocardium at risk and evidence of failed fibrinolysis</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td><strong>Coronary angiography 3 to 24 hours after fibrinolysis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemodynamically stable patients with evidence for successful fibrinolysis</td>
<td>IIa</td>
<td>A</td>
</tr>
<tr>
<td><strong>Coronary angiography before hospital discharge</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stable patients</td>
<td>IIb</td>
<td>C</td>
</tr>
<tr>
<td><strong>Coronary angiography at any time</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients in whom the risks of revascularization are likely to outweigh the benefits or the patient or designee does not want invasive care</td>
<td>III: No Benefit</td>
<td>C</td>
</tr>
</tbody>
</table>

GNL 2011
# PCI in STEMI*

## Indications

<table>
<thead>
<tr>
<th>Condition</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary PCI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STEMI symptoms within 12 h</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Severe heart failure or cardiogenic shock</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>Contraindications to fibrinolytic therapy with ischemic symptoms &lt;12 h</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>Clinical and/or ECG evidence of ongoing ischemia between 12 and 24 h</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>symptom onset</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asymptomatic patient presenting between 12 and 24 h after symptom onset</td>
<td>IIb</td>
<td>C</td>
</tr>
<tr>
<td>and higher risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noninfarct artery PCI at the time of primary PCI in patients without</td>
<td>III: Harm</td>
<td>B</td>
</tr>
<tr>
<td>hemodynamic compromise</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Delayed or Elective PCI in Patients with STEMI (i.e. Non-Primary PCI)

<table>
<thead>
<tr>
<th>Condition</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Clinical evidence for fibrinolytic failure or infarct artery reocclusion</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>Patent infarct artery 3 to 24 h after fibrinolytic therapy</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>Ischemia on noninvasive testing</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>Hemodynamically significant stenosis in a patent infarct artery &gt;24 hours</td>
<td>IIb</td>
<td>B</td>
</tr>
<tr>
<td>after STEMI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totally occluded infarct artery &gt;24 h after STEMI in a hemodynamically</td>
<td>III: No Benefit</td>
<td>B</td>
</tr>
<tr>
<td>asymptomatic patient without evidence of severe ischemia</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Systems goal of performing primary PCI within 90 minutes of first medical contact when the patient presents to a hospital with PCI capability (Class I, LOE: B), and within 120 minutes when the patient presents to a hospital without PCI capability (Class I, LOE: B).
Cardiogenic Shock

<table>
<thead>
<tr>
<th>Recommendation</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Immediate coronary angiography in patients with STEMI with severe heart failure or cardiogenic shock who are suitable candidates for revascularization</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>PCI for patients with acute MI who develop cardiogenic shock and are suitable candidates</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>Hemodynamic support device for patients with cardiogenic shock after STEMI who do not quickly stabilize with pharmacological therapy</td>
<td>I</td>
<td>B</td>
</tr>
</tbody>
</table>
Recommendations for Initial Reperfusion Therapy When Cardiogenic Shock Complicates STEMI

Cardiogenic Shock

Early Shock, Diagnosed on Hospital Presentation
- Fibrinolytic therapy if all of the following are present:
  1. >90 minutes to PCI
  2. <3 hours post MI onset?
  3. No contraindications
- Arrange prompt transfer to invasive capable center

Delayed Onset Shock
- Echocardiogram to rule out mechanical defects
- Arrange rapid transfer to invasive capable center

Hemodynamic Support Device

Cardiac Catheterization and Coronary Angiography

1-2 vessel CAD
- PCI IRA

Moderate 3-vessel CAD
- PCI IRA

Severe 3-vessel CAD
- Immediate CABG

Left main CAD

Staged Multivessel PCI
Staged CABG

Dashed lines indicate that the procedure should be performed in patients with specific indications only
Appropriate Time for Revascularization Post- MI..... So many questions

- **Timing on revascularization for patients with**
  - NSTEMI
  - STEMI (as soon as possible)
  - Shock

- **Timing for revascularization of Non-Culprit vessels**
  - Post STEMI – with IRA PCI
  - Post STEMI – with multi-vessel disease

- **Timing for CABG**
  - Post STEMI or NSTEMI
Reperfusion of non-culprit artery--
Existing Evidence For CABG post MI

• We examined our experience retrospectively in 3,942 patients who underwent CABG between 1986 and 1993, including 2,296 patients after acute MI

• The operative mortality associated with increasing time intervals between MI and CABG were 9.1%, 8.3%, 5.2%, 6.5%, and 2.9%, for less than 6 hours, 6 hours to 2 days, 2 to 14 days, 2 to 6 weeks, and more than 6 weeks, respectively. In comparison, the operative mortality was 2.5% for patients with no history of acute MI.

• 2 days if possible had the stable lowest risk

Cresswell Journal Thoracic Surgery - 1997
More observational Surgical Data

• The operative mortality rates associated with increasing time intervals between AMI and CABG were 17.4, 9.1, 4.0, and 5.8 per cent, for less than 6 hours, 6 to 24 hours, 1 to 7 days, and 7 to 21 days, respectively.

2.2.1. CABG in Patients With Acute MI: Recommendations

Class I

1. Emergency CABG is recommended in patients with acute MI in whom
   1) primary PCI has failed or cannot be performed,
   2) coronary anatomy is suitable for CABG, and
   3) persistent ischemia of a significant area of myocardium at rest
      and/or hemodynamic instability refractory to nonsurgical therapy
      is present. (Level of Evidence: B)

2. Emergency CABG is recommended in patients undergoing surgical repair of a postinfarction mechanical complication of MI, such as
   ventricular septal rupture, mitral valve insufficiency because of
   papillary muscle infarction and/or rupture, or free wall rupture. (Level of Evidence: B)
Class I - CABG

Emergency CABG is recommended in patients with cardiogenic shock and who are suitable for CABG irrespective of the time interval from MI to onset of shock and time from MI to CABG. *(Level of Evidence: B)*

Emergency CABG is recommended in patients with life-threatening ventricular arrhythmias (believed to be ischemic in origin) in the presence of left main stenosis greater than or equal to 50% and/or 3-vessel CAD. *(Level of Evidence: C)*
In patients taking a thienopyridine in whom coronary artery bypass surgery (CABG) is planned and can be delayed, it is recommended that the drug be discontinued to allow for dissipation of the antiplatelet effect.

The period of withdrawal should be at least 5 days in patients receiving clopidogrel / ticagrelor and at least 7 days in patients receiving prasugrel, … unless the need for revascularization and/or the net benefit of the thienopyridine outweighs the potential risks of excess bleeding.
Conclusions

• **Timing on revascularization for patients with**
  – NSTEMI – Invasive strategy
  – STEMI (as soon as possible)
  – Shock – PCI or CABG as soon as possible

• **Timing for revascularization of Non-Culprit vessels**
  – Post STEMI – with IRA if shock
  – Post STEMI – with multi-vessel disease – CABG or PCI not acutely unless unstable

• **Timing for CABG – 48 hours to 5 days**