Updated AHA guidelines for percutaneous coronary intervention

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AHA guidelines

• Updates for percutaneous coronary intervention (PCI) in 2011
• Updates for non-ST elevation myocardial infarction (NSTEMI) and unstable angina in 2011 and 2012
• Updates for ST-elevation myocardial infarction (STEMI) in 2007, 2009 and 2011.
Outlines

• Updates for revascularization strategies to improve survival
• Updates for management of STEMI
• Newer recommendations for PCI-related devices and pharmacology
SYNTAX score and STS score

• Class Ila

• 1. Calculation of the STS (Society of Thoracic Surgeons and SYNTAX (Synergy between Percutaneous Coronary Intervention with TAXUS and Cardiac Surgery) scores is reasonable in patients with unprotected left main and complex CAD.
# On-line STS score calculator

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>80</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>170</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
</tr>
<tr>
<td>Diabetes Control</td>
<td></td>
</tr>
<tr>
<td>Last Creatinine Level Preop (mg/dl)</td>
<td>2</td>
</tr>
<tr>
<td>Dialysis</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
</tr>
<tr>
<td>Infectious Endocarditis</td>
<td></td>
</tr>
<tr>
<td>Chronic Lung Disease</td>
<td></td>
</tr>
<tr>
<td>Immunosuppressive Therapy</td>
<td></td>
</tr>
<tr>
<td>Peripheral Vascular Disease</td>
<td></td>
</tr>
<tr>
<td>Cerebrovascular Disease</td>
<td></td>
</tr>
</tbody>
</table>

## Preoperative Cardiac Status

- **Myocardial Infarction**
  - Yes
  - No
  - Missing

- **Myocardial Infarction - When**
  - <=6 Hrs
  - >6 Hrs but <24 Hrs
  - >1 to 7 Days
  - >8 to 21 Days
  - >21 Days

On-line STS score calculator

Hemodynamics & Cath

- **Number of Diseased Coronary Vessels**
  - None
  - One
  - Two
  - Three
  - Missing

- **Left Main Disease >= 50%**
  - Yes
  - No
  - Missing

- **Ejection Fraction (%)**
  - 35

- **Aortic Stenosis**
  - Yes
  - No
  - Missing

- **Mitral Stenosis**
  - Yes
  - No
  - Missing

- **Aortic Insufficiency**
  - None
  - Trivial
  - Mild
  - Moderate
  - Severe
  - Missing

- **Mitral Insufficiency**
  - None
  - Trivial
  - Mild
  - Moderate
  - Severe
  - Missing

Procedure Name: Isolated CABG

- **Risk of Mortality**: 12.355%
- **Morbidity or Mortality**: 61.422%
- **Long Length of Stay**: 39.416%
- **Short Length of Stay**: 4.513%
- **Permanent Stroke**: 5.184%
- **Prolonged Ventilation**: 63.428%
- **DSW Infection**: 1.057%
- **Renal Failure**: N/A
- **Reoperation**: 22.205%

### Table 2. Lesions adverse characteristic scoring

<table>
<thead>
<tr>
<th>Diameter reduction*</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Total occlusion</td>
<td>x5</td>
</tr>
<tr>
<td>- Significant lesion (50-99%)</td>
<td>x2</td>
</tr>
</tbody>
</table>

**Total occlusion (TO)**

- Age >3months or unknown             | +1  |
- Blunt stump                          | +1  |
- Bridging                             | +1  |
- First segment visible beyond TO      | +1/ per non-visible segment |
- Side branch (SB) - Yes, SB <1.5mm**   | +1  |
  - Yes, both SB < & ≥ 1.5mm            | +1  |

**Trifurcations**

- 1 diseased segment                   | +3  |
- 2 diseased segments                  | +4  |
- 3 diseased segments                  | +5  |
- 4 diseased segments                  | +6  |

**Bifurcations**

- Type A, B, C                         | +1  |
- Type D, E, F, G                      | +2  |
- Angulation <70°                      | +1  |

**Aorto ostial stenosis**              | +1  |

**Severe tortuosity**                  | +2  |

**Length > 20mm**                      | +1  |

**Heavy calcification**                | +2  |

**Thrombus**                           | +1  |

**“Diffuse disease”/small vessels**    | +1/ per segment number |
Syntax score - example

Lesion 1
Segment 5: 5x2
+ Bifurcation Type A
+ Heavy calcification
Lesion 1 score: 13

Lesion 2
Segment 6: 3.5x2
+ Bifurcation Type A
+ Angulation <70°
+ Heavy calcification
Lesion 2 score: 11
SYNTAX trial: synergy between PCI with Taxus vs. CABG in triple vessel disease or LM. Outcome: death, MI, stroke, repeat revascularization: 1800 patients, randomized control trial.

Inferior PCI outcomes for triple vessel or LM in **High** Syntax score group: one year data

SYNTAX trial: 3-year data

dead/stroke/MI: CABG 12.0 vs. PCI 14.1%, P = 0.21
MI rate: CABG 3.6% vs. DES 7.1%, p=0.007
Repeat revascularization: CABG 10.7% vs. DES 19.7%, p<0.001
Unprotected left main

- CABG: class I indication
Unprotected left main

• Ila—For stable ischemic heart disease, PCI when both of the following are present:
  • # Anatomic with a low risk of PCI complications and a good long-term outcome (eg, a low SYNTAX score ≤ 22, ostial or trunk left main CAD)
  • # increased risk of adverse surgical outcomes (eg, STS-predicted operative mortality ≥ 5%)
Unprotected left main

• IIb—For stable ischemic heart disease, PCI when both of the following are present:

• # Anatomy with a low to intermediate risk of PCI complications and an intermediate to high likelihood of good long-term outcome (eg, low-intermediate SYNTAX score < 33, bifurcation left main CAD)

• # increased risk of surgical outcomes (eg, moderate-severe COPD, prior stroke, or prior cardiac surgery; STS-predicted risk of operative mortality > 2%)
Unprotected left main

• IIa—For UA/NSTEMI if not a CABG candidate
• IIa—For STEMI when distal coronary flow is TIMI flow < grade 3 and PCI can be performed more rapidly and safely than CABG
Contrast-Induced Acute Kidney Injury

• Class I

• 1. Patients undergoing cardiac catheterization with contrast media should receive adequate preparatory hydration.

• 3. In patients with CKD (creatinine clearance <60 mL/min), the volume of contrast media should be minimized.
Adequate hydration

- Isotonic saline (normal saline)
- 1 to 1.5 ml/Kg/hour
- 3-12 hours before the procedure,
- and 6-24 hour after the procedure.
Contrast-Induced Acute Kidney Injury

• III: NO BENEFIT
• 1. Administration of N-acetyl-L-cysteine is not useful for the prevention of contrast-induced acute kidney injury.
Vascular Access

• Class IIa

• 1. The use of radial artery access can be useful to decrease access site complications
Revascularization Before Non-cardiac Surgery

• Class III: HARM

• 1. Routine prophylactic coronary revascularization should not be performed in patients with stable CAD before non-cardiac surgery.

• 2. Elective non-cardiac surgery should not be performed in the 4 to 6 weeks after balloon angioplasty or BMS implantation or the 12 months after DES implantation
Outlines

• Updates for revascularization strategies to improve survival
• Updates for management of STEMI
• Newer recommendations for PCI-related devices and pharmacology
Primary PCI of the Infarct Artery

1. Primary PCI should be performed in patients within 12 hours of onset of STEMI.

2. Primary PCI should be performed in patients with STEMI presenting to a hospital with PCI capability within 90 minutes of first medical contact.

3. Primary PCI should be performed in patients with STEMI presenting to a hospital without PCI capability within 120 minutes of first medical contact.
Definition of 1st medical contact

- Onset of symptoms of STEMI
- 9-1-1 EMS Dispatch
- EMS on-scene
  - Encourage 12-lead ECGs
  - Consider prehospital fibrinolytic if capable and EMS-to-needle within 30 min
- EMS transport
  - EMS-to-Balloon within 90 min

Goals:
- 5 min after symptom onset
- 1 min Dispatch
- within 8 min Prehospital fibrinolysis:
  - EMS-to-Needle within 30 min
- Patient self-transport: Hospital Door-to-Balloon within 90 min

Hospital fibrinolysis:
- Door-to-Needle within 30 min
- Not PCI capable
- PCI capable

In-hospital Transfer
Coronary Angiography Strategies in STEMI

• Class I
• Patients who are candidates for primary PCI
• Patients with severe heart failure or cardiogenic shock who are suitable candidates for revascularization, irrespective of time delay
Coronary Angiography Strategies in STEMI

• Class IIa

• 1. A strategy of immediate CAG/PCI is reasonable for patients with STEMI, a moderate to large area of myocardium at risk, and evidence of failed fibrinolysis.

• 2. A strategy of CAG/PCI, 3 to 24 hours after initiating fibrinolytic therapy in STEMI and evidence for successful fibrinolysis is reasonable.
Outlines

• Updates for revascularization strategies to improve survival
• Updates for management of STEMI
• Newer recommendations for PCI-related devices and pharmacology
Rotational atherectomy for fibrotic or heavily calcified lesions that might not be crossed by a balloon catheter or adequately dilated before stent implantation (class IIa).

Boston Scientific website
Cutting balloon angioplasty for avoiding slippage-induced coronary artery trauma during PCI for in-stent restenosis or ostial lesions in side branches (class IIb)

Advantages
- “controlled” dissection
- non-compliant balloon material
Aspiration thrombectomy is reasonable for patients undergoing primary PCI for STEMI (class IIa)
Embolic protection devices should be used during saphenous vein graft PCI (class I)

- **Typical SVG disease process**
  - First month
    - Intimal Hyperplasia
  - 1-7 years
    - build-up of atheroclerosis with superimposed thrombus
  - 7-10 years
    - Occlusion

MJ Davies, Atlas of Coronary Artery Disease. 1998
Glycoprotein IIb/IIIa inhibitors use in STEMI

- Class IIa - start treatment with glycoprotein IIb/IIIa receptor antagonists at the time of primary PCI in selected patients at cath room

- Class III (no benefit) - routine pre-catheterization use (ex. At ER, or ambulance), as an upstream therapy for pts with STEMI planning for primary PCI
Glycoprotein IIb/IIIa inhibitors use in NSTEMI/unstable angina

• Class I: In high-risk pts not adequately pretreated with clopidogrel, it is useful at the time of PCI to administer a GP IIb/IIIa inhibitor (ex. high-bolus dose tirofiban) in addition to heparin

• Class IIa: In high-risk pts, treated with heparin and adequately pretreated with clopidogrel, it is reasonable at the time of PCI to administer a GP IIb/IIIa inhibitor
Choice of 2\textsuperscript{nd} antiplatelet to be added on aspirin in UA/NSTEMI (Class I indication)

- \textit{Invasive approach before PCI}: clopidogrel, or ticagrelor or An IV GP IIb/IIIa inhibitor,
- \textit{Invasive approach during PCI}: during PCI: clopidogrel, or ticagrelor or An IV GP IIb/IIIa inhibitor or prasugrel
- \textit{Conservative approach}: clopidogrel or ticagrelor
ADP P2Y$_{12}$ receptor blockade

## Clopidogrel vs. ticagrelor

<table>
<thead>
<tr>
<th>Type</th>
<th>Clopidogrel</th>
<th>Ticagrelor Cyclopyrimidine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prodrug</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Oral administration</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Loading dose (mg)</td>
<td>300</td>
<td>180</td>
</tr>
<tr>
<td>Maintenance dose (mg)</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Frequency of administration</td>
<td>Once daily</td>
<td>Twice daily</td>
</tr>
<tr>
<td>Onset of action</td>
<td>Delayed</td>
<td>Rapid</td>
</tr>
<tr>
<td>Offset of action</td>
<td>Delayed</td>
<td>Rapid</td>
</tr>
<tr>
<td>Individual variability</td>
<td>Large</td>
<td>Small</td>
</tr>
<tr>
<td>CYP-450 activation</td>
<td>Yes (twice)</td>
<td>No</td>
</tr>
<tr>
<td>Irreversible P2Y12 inhibition</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Relative potency</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Mean platelet inhibition</td>
<td>~50%</td>
<td>~95%</td>
</tr>
<tr>
<td>Time to peak inhibition (h)</td>
<td>~12*</td>
<td>2</td>
</tr>
<tr>
<td>Half-life</td>
<td>Life of platelet</td>
<td>7–12 h</td>
</tr>
<tr>
<td>Days to hold before CABG surgery</td>
<td>&gt;5</td>
<td>&gt;3</td>
</tr>
</tbody>
</table>

Montalescot et al. Int J Cardiol 2012
PLATO study design

UA/NSTEMI (moderate-to-high risk) STEMI (if primary PCI)
All receiving ASA; clopidogrel-treated or-naive; randomized within 24 hours of index event
(N = 18,624)

Clopidogrel
If pretreated, no additional loading dose; if naive, standard 300 mg loading dose, then 75 mg qd maintenance; (additional 300 mg allowed pre PCI)

Ticagrelor
180 mg loading dose, then 90 mg bid maintenance; (additional 90 mg pre-PCI)

6–12-month exposure

Primary endpoint: CV death + MI + Stroke
Key secondary: CV death + MI + Stroke in patients intended for invasive management
Total mortality + MI + Stroke
CV death + MI + Stroke + recurrent ischemia + TIA + arterial thrombotic events
MI alone / CV death alone / Stroke alone / Total mortality
Primary safety: Total major bleeding
Ticagrelor vs. Clopidogrel as 2\textsuperscript{nd} dual antiplatelet agents in acute coronary syndrome (PLATO trial): primary end point: vascular death or MI or stroke
ticagrelor 9.8\% vs. clopidogrel 11.7\%, p<0.001

Wallentin L et al.
N Engl J Med
2009;361:1045
Summary

• Updates for revascularization strategies to improve survival - complex CAD and LM
• Updates for management of STEMI
• Newer recommendations for PCI - related devices and pharmacology