Left Main PCI
Dedicated techniques, stents, and operators

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Coronary Catheterization Course – December 16, 2011
LM PCI: Why is it such a big issue?

Because...
- It is prognostic significant (not just symptoms)
- the myocardial jeopardy is extensive and does not leave much room for fault consequences.
- it can be technically challenging.
- it demands proper planning and substantial expertise.
- it operates within the ‘dark gray zone’ of current revascularization guidelines.
Anatomic variations

- Ostial stenosis
- Mid shaft stenosis
- Distal stenosis
Impact on prognosis

- Co-Morbidity
  - Elderly patient
  - LV Function
  - Associated valvular pathology
  - Emergent presentation
  - Shock
  - Diabetes mellitus
  - Renal dysfunction
  - EuroScore, STS Score
  - SYNTAX Score
Left main complexities

- Calcified: >50% of cases
- Distal LM location: ~70% of cases
- Concomitant MVD >70% (↑SYNTAX Score)
Left Main assessment: Imaging Modalities
Left Main
3D Angio

Dvir D, ...Kornowski R, Cardiovasc Revasc Med (in press)
Relation between FFR values and the 2 reviewers’ visual estimations (lesions were classified as significant, nonsignificant, and unsure).

Hamilos M et al. Circulation 2009;120:1505-1512
Kaplan–Meier mortality curves showing percent survival (A) and major adverse cardiac events (MACE; B) in the 2 study groups.

Hamilos M et al. Circulation 2009;120:1505-1512
Diagnosis of Ischemia-Causing Coronary Stenoses by Noninvasive Fractional Flow Reserve Computed From Coronary Computed Tomographic Angiograms

Results From the Prospective Multicenter DISCOVER-FLOW (Diagnosis of Ischemia-Causing Stenoses Obtained Via Noninvasive Fractional Flow Reserve) Study

Bon-Kwon Koo, MD, PhD; Andreja Erglis, MD, PhD; Joon-Hyung Doh, MD, PhD; David V. Daniels, MD; Sandra Jegere, MD; Hyo-Soo Kim, MD, PhD; Allison Dunning, MD; Tony DeFrance, MD; Alexandra Lansky, MD; Jonathan Leipsic, BSc; MD; James K. Min, MD

Seoul and Goyang, South Korea; Riga, Latvia; Palo Alto, San Francisco, and Los Angeles, California; New York, New York; New Haven, Connecticut; and Vancouver, British Columbia, Canada

Objectives

The aim of this study was to determine the diagnostic performance of a new method for quantifying fractional flow reserve (FFR) with computational fluid dynamics (CFD) applied to coronary computed tomography angiography (CCTA) data in patients with suspected or known coronary artery disease (CAD).

Background

Measurement of FFR during invasive coronary angiography is the gold standard for identifying coronary artery lesions that cause ischemia and improves clinical decision-making for revascularization. Computation of FFR from CCTA data (FFR_CCTA) provides a noninvasive method for identifying ischemia-causing stenoses; however, the diagnostic performance of this new method is unknown.

Methods

Computation of FFR from CCTA data was performed on 159 vessels in 103 patients undergoing CCTA, invasive coronary angiography, and FFR. Independent core laboratories determined FFR_CCTA and CAD stenoses severity by CCTA. Ischemia was defined by an FFR_CCTA and FFR < 0.80, and anatomically obstructive CAD was defined as a CCTA stenosis > 50%. Diagnostic performance of FFR_CCTA and CCTA stenosis was assessed with invasive FFR as the reference standard.

Results

Fifty-six percent of patients had ≥1 vessel with FFR < 0.80. On a per-vessel basis, the accuracy, sensitivity, specificity, positive predictive value, and negative predictive value were 84.3%, 87.9%, 92.2%, 73.9%, 92.2%, respectively, for FFR_CCTA and 58.6%, 91.4%, 39.6%, 46.5%, 88.9%, respectively, for CCTA stenoses. The area under the receiver-operator characteristics curve was 0.90 for FFR_CCTA and 0.75 for CCTA (p = 0.001). The FFR_CCTA and FFR were well correlated (r = 0.717, p < 0.001) with a slight underestimation by FFR_CCTA (0.022 = 0.116, p = 0.016).

Conclusions

Noninvasive FFR derived from CCTA is a novel method with high diagnostic performance for the detection and exclusion of coronary lesions that cause ischemia. (The Diagnosis of Ischemia-Causing Stenoses Obtained Via Noninvasive Fractional Flow Reserve; NCT01189331) (J Am Coll Cardiol 2011;68:1989-97) © 2011 by the American College of Cardiology Foundation
HeartFlow™ Imaging: Combining Cardiac CTA + FFR

Images courtesy of Bon Kwon Koo, MD
Fundamental issues

- CABG vs. PCI
- Procedural safety and effectiveness
- PCI planning is mandatory
- Long-term consequences
Favorable vs. Unfavorable LMD for PCI

**Favorable for PCI**
- Ostial LMD
- Mid shaft LMD
- Isolated LMD
- LM diameter $\geq$ 3.5mm
- Patent RCA
- No/mildly calcified
- Good LV function

**Problematic for PCI**
- Distal LM
- Ostial LAD/LCX involvement
- Sharp LAD/LCX angles
- Heavy calcification
- LM diameter $<$ 3.5 mm
- Associated MVD
- Occluded RCA
- Poor LV function
- Associated valve pathology
PCI Strategies
**PCI Considerations in Left Main PCI**

- **Strategies in PCI**
  - Direct vs. Non-direct stenting
  - Need for lesion debulking (+/−)
  - Bifurcation techniques

- **Adjunctive technologies**
  - Intravascular ultrasound
  - Directional or Rotational atherectomy
  - DES vs. BMS

- **Late outcome**
  - Long-term Clopidogrel or Prasugrel or Ticagrelor administration
  - Repeat angiography or cardiac CTA
Ostial LM Stenting

- Debunking or cutting?
- Calcification
- Stent positioning
- DES vs. BMS?
- Optimal expansion
  - IVUS Guidance

1\textsuperscript{st} Stenting

Post stent
Ostial and mid LM Stenting

Cutting balloon

Post stent
Diffuse-calcified LM stenosis
Challenges in distal LM stenting

- Major determinants of procedural success:
  - Vessels diameters (LM and LAD/LCX)
  - Angle between LM to LAD/LCX
  - Presence of an intermediate branch
  - Plaque distribution
  - Plaque composition and amount of calcification
  - Potential for plaque shifting
  - Need for lesion “preparation”
Y/Culottes
Ramus ballooning
Baseline LM Bifurcation Stenting Techniques Requiring Re-treatment

LM Distal PCI (n=20 lesions)

- 5/20 (25%) lesions originally treated with 1 stent
- 15/20 (75%) originally treated with 2 or 3 stents

Bar graphs represent percent of baseline treated lesions.
Distal LM stenting during STEMI

Ulcerated dist. LM plaque

Direct stenting of the LM
Distal LM stenting @trifurcation
Distal LM Stenosis

Pre-dilatation & Stenting into LAD
Complex Distal LM stenting
LM Equivalent disease
LM Equivalent disease treated using the ‘mini-crush’ technique
Ostial LAD involving distal LM (IVUS)
Stenting the LM into the ostial LAD
Long-term considerations

- Plavix vs. Prasugrel vs. Ticagrelor and for how long?
- Platelets inhibition tests?
- How to follow?
  - Symptoms driven?
  - Functional tests? SPECT? Stress echo?
  - Repeat angiography? When?
  - Cardiac CTA? When?
“In a cohort of patients with unprotected LMCA disease, we found no significant differences in rates of death or of the composite endpoint of death, Q-wave MI or stroke between patients receiving stents and those undergoing CABG. However, stenting even with DES was associated with higher rates of TVR that was CABG.”

Seung et al, NEJM 2008
MAIN Compare: Mortality
(Overall PCI and CABG matched cohort: 542 pairs)

No. at Risk

<table>
<thead>
<tr>
<th></th>
<th>Stenting</th>
<th>CABG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>542</td>
<td>542</td>
</tr>
<tr>
<td>180</td>
<td>516</td>
<td>512</td>
</tr>
<tr>
<td>360</td>
<td>372</td>
<td>420</td>
</tr>
<tr>
<td>540</td>
<td>220</td>
<td>317</td>
</tr>
</tbody>
</table>

P = 0.45

Seung et al, NEJM 2008
MAIN Compare: Death, Q-MI, or Stroke
(Overall PCI and CABG matched cohort: 542 pairs)

Seung et al, NEJM 2008
MAIN Compare: Target-vessel Revasc. (Overall PCI and CABG matched cohort: 542 pairs)

Seung et al, NEJM 2008
Revascularisation for Unprotected Left Main
5-Year Results From the MAIN-COMPARE registry

Clinical Results of Unprotected Left Main Coronary Stenting

Itzik Ben-Dor MD, Hana Vaknin-Assa MD, Eli Lev MD, David Brosh MD, Shmuel Fuchs MD, Abd Assali MD and Ran Kornowski MD

Cardiac Catheterization Laboratories, Department of Cardiology, Rabin Medical Center (Beilinson Campus), Petah Tikva, and Sackler Faculty of Medicine, Tel Aviv University, Ramat Aviv, Israel

Table 3. Clinical outcome at 1 and 6 months after PCI

<table>
<thead>
<tr>
<th>Outcome</th>
<th>1 month</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death (overall)</td>
<td>8 (11.3%)</td>
<td>13 (18.3%)</td>
<td>14 (19.7%)</td>
</tr>
<tr>
<td>Death (planned procedure)</td>
<td>1 (2.3%)</td>
<td>2 (4.6%)</td>
<td>3 (6.9%)</td>
</tr>
<tr>
<td>Death (emergent procedure)</td>
<td>7 (25%)</td>
<td>11 (39%)</td>
<td>11 (39%)</td>
</tr>
<tr>
<td>Re-myocardial infarction</td>
<td>0%</td>
<td>5 (7%)</td>
<td>5 (7%)</td>
</tr>
<tr>
<td>TVR</td>
<td>1 (1.4%)</td>
<td>6 (8.5%)</td>
<td>6 (8.5%)</td>
</tr>
<tr>
<td>CABG</td>
<td>1 (1.4%)</td>
<td>4 (5.6%)</td>
<td>4 (5.6%)</td>
</tr>
<tr>
<td>Stent thrombosis</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MACE (overall)</td>
<td>9 (12.7%)</td>
<td>18 (25.3%)</td>
<td>19 (26.8%)</td>
</tr>
<tr>
<td>MACE (planned procedure)</td>
<td>2 (4.6%)</td>
<td>6 (14%)</td>
<td>7 (16.3%)</td>
</tr>
<tr>
<td>MACE (emergent procedure)</td>
<td>7 (25%)</td>
<td>12 (43%)</td>
<td>12 (43%)</td>
</tr>
</tbody>
</table>

TVR = target vessel revascularization, CABG = coronary artery bypass grafting, MACE = major adverse cardiac events.

Figure 1. Outcomes at 1, 6 and 12 months for PCI with DES vs. BMS

6 months outcome DES vs. BMS

- TLR: DES 2.8, BMS 14, P < 0.01
- MACE: DES 8.3, BMS 43

12 months outcome DES vs. BMS

- TLR: DES 2.8, BMS 14, P < 0.01
- MACE: DES 11.1, BMS 43

P = 0.05
102 pts with UPLM stenting @RMC between 2006–2009
- age 74±12 yrs
- 64% male
- 34% diabetics
- 72% ACS
- 45% distal LM disease
- EuroScore=7.2%
- 65% rate of DES use
- 100% angio success

Assali A, Kornowski R et al. Israeli Heart Meeting 4.2010
SYNTAX Trial: PCI vs. CABG results
Kaplan-Meier estimates of A, total MACCE; B, all-cause death; C, MI; D, CVA; E, repeat revascularization; and F, death/CVA/MI for PCI versus CABG in patients with LM disease.

Morice M et al. Circulation 2010;121:2645-2653
SYNTAX Trial: PCI vs. CABG results

Kaplan-Meier estimates of 1-year MACCE by baseline SYNTAX score tercile.

A
Mean baseline
SYNTAX Score
CABG 15.5 ± 4.3
PCI 15.7 ± 4.4

B
Mean baseline
SYNTAX Score
CABG 27.2 ± 3.0
PCI 27.0 ± 2.7

C
Mean baseline
SYNTAX Score
CABG 42.1 ± 7.6
PCI 43.8 ± 9.1

Moric M et al. Circulation 2010;121:2645-2653
SYNTAX Trial: **PCI vs. CABG results**

One-year incidence of A, all-cause death; B, MI; C, CVA; D, death/CVA/MI; and E, repeat revascularizations in patients with low (0 to 22), intermediate (23 to 32), or high (≥33) baseline unadjusted SYNTAX score.

### A Death (all-cause)

<table>
<thead>
<tr>
<th>Group</th>
<th>CABG</th>
<th>PCI</th>
<th>Mean difference (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-22</td>
<td>3.0%</td>
<td>0.9%</td>
<td>-2.2 [-5.8 to 1.4]</td>
<td>0.33</td>
</tr>
<tr>
<td>23-32</td>
<td>6.7%</td>
<td>1.0%</td>
<td>-5.8 [-8.8 to -2.8]</td>
<td>0.051</td>
</tr>
<tr>
<td>≥33</td>
<td>4.1%</td>
<td>9.7%</td>
<td>5.6 [-0.2 to 11.4]</td>
<td>0.06</td>
</tr>
</tbody>
</table>

### B MI

<table>
<thead>
<tr>
<th>Group</th>
<th>CABG</th>
<th>PCI</th>
<th>Mean difference (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-22</td>
<td>2.0%</td>
<td>1.7%</td>
<td>-0.3 [-1.5 to 0.9]</td>
<td>1.00</td>
</tr>
<tr>
<td>23-32</td>
<td>3.4%</td>
<td>2.9%</td>
<td>-0.5 [-1.9 to 0.9]</td>
<td>1.00</td>
</tr>
<tr>
<td>≥33</td>
<td>6.1%</td>
<td>7.5%</td>
<td>1.3 [-0.3 to 2.9]</td>
<td>0.65</td>
</tr>
</tbody>
</table>

### C CVA

<table>
<thead>
<tr>
<th>Group</th>
<th>CABG</th>
<th>PCI</th>
<th>Mean difference (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-22</td>
<td>2.0%</td>
<td>0%</td>
<td>-2.0 [-2.9 to 0.9]</td>
<td>0.21</td>
</tr>
<tr>
<td>23-32</td>
<td>2.2%</td>
<td>0%</td>
<td>-2.2 [-3.0 to 0.8]</td>
<td>0.21</td>
</tr>
<tr>
<td>≥33</td>
<td>3.4%</td>
<td>0.7%</td>
<td>-2.7 [-3.6 to 0.3]</td>
<td>0.22</td>
</tr>
</tbody>
</table>

### D Death/CVA/MI

<table>
<thead>
<tr>
<th>Group</th>
<th>CABG</th>
<th>PCI</th>
<th>Mean difference (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-22</td>
<td>6.1%</td>
<td>1.7%</td>
<td>-4.4 [-6.4 to -2.5]</td>
<td>0.15</td>
</tr>
<tr>
<td>23-32</td>
<td>10.1%</td>
<td>3.0%</td>
<td>-7.2 [-9.2 to -5.2]</td>
<td>0.09</td>
</tr>
<tr>
<td>≥33</td>
<td>10.9%</td>
<td>14.2%</td>
<td>-3.3 [-5.3 to -1.3]</td>
<td>0.40</td>
</tr>
</tbody>
</table>

### E Repeat Revascularization

<table>
<thead>
<tr>
<th>Group</th>
<th>CABG</th>
<th>PCI</th>
<th>Mean difference (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-22</td>
<td>8.1%</td>
<td>7.7%</td>
<td>-0.4 [-1.8 to 0.9]</td>
<td>0.92</td>
</tr>
<tr>
<td>23-32</td>
<td>7.9%</td>
<td>9.7%</td>
<td>-1.8 [-3.2 to -0.3]</td>
<td>0.65</td>
</tr>
<tr>
<td>≥33</td>
<td>4.8%</td>
<td>17.2%</td>
<td>12.4 [-0.4 to 25.2]</td>
<td>0.003</td>
</tr>
</tbody>
</table>

*Morice M et al. Circulation 2010;121:2645-2653*
SYNTAX Trial: 2 Yrs MACCE (LM cohort)

- CABG (348)
- TAXUS™ Stent (357)

<table>
<thead>
<tr>
<th>Event</th>
<th>CABG</th>
<th>TAXUS™ Stent</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>6.2%</td>
<td>5.6%</td>
<td>0.77</td>
</tr>
<tr>
<td>MI</td>
<td>4.1%</td>
<td>5.5%</td>
<td>0.45</td>
</tr>
<tr>
<td>CVA</td>
<td>3.7%</td>
<td>0.9%</td>
<td>0.01</td>
</tr>
<tr>
<td>GO/ST</td>
<td>3.1%</td>
<td>3.2%</td>
<td>0.91</td>
</tr>
<tr>
<td>Revasc.</td>
<td>10.4%</td>
<td>17.3%</td>
<td>0.01</td>
</tr>
<tr>
<td>MACCE</td>
<td>19.3%</td>
<td>22.9%</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Time to event analysis: log-rank P value

- Graft occlusion = GO
- Stent thrombosis = ST
SYNTAX Trial: 2 Yrs MACCE
LM cohort per Syntax Score

MACCE to 2 Years by Syntax Score Tercile

Left Main Syntax Score ≥33

<table>
<thead>
<tr>
<th>Event</th>
<th>CABG (N=149)</th>
<th>PCI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>4.1%</td>
<td>10.4%</td>
<td>0.04</td>
</tr>
<tr>
<td>CVA</td>
<td>4.2%</td>
<td>0.8%</td>
<td>0.08</td>
</tr>
<tr>
<td>MI</td>
<td>6.1%</td>
<td>8.4%</td>
<td>0.48</td>
</tr>
<tr>
<td>Death, CVA or MI</td>
<td>11.5%</td>
<td>15.6%</td>
<td>0.32</td>
</tr>
<tr>
<td>Revasc.</td>
<td>9.2%</td>
<td>21.8%</td>
<td>0.003</td>
</tr>
</tbody>
</table>

MACCE to 2 Years by Syntax Score Tercile
Left Main Syntax Scores 0-32

<table>
<thead>
<tr>
<th>Event</th>
<th>CABG (N=198)</th>
<th>PCI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>7.9%</td>
<td>2.7%</td>
<td>0.02</td>
</tr>
<tr>
<td>CVA</td>
<td>3.3%</td>
<td>0.9%</td>
<td>0.09</td>
</tr>
<tr>
<td>MI</td>
<td>2.6%</td>
<td>3.8%</td>
<td>0.59</td>
</tr>
<tr>
<td>Death, CVA or MI</td>
<td>12.1%</td>
<td>6.9%</td>
<td>0.06</td>
</tr>
<tr>
<td>Revasc.</td>
<td>11.4%</td>
<td>14.3%</td>
<td>0.44</td>
</tr>
</tbody>
</table>
SYNTAX Le Mans: **TAXUS results**

- Angiography for 271 SYNTAX LE MANS pts at 15±1 mos
- Primary Endpoints: Rate of long-term patency of treated LMD by QCA

**Primary Endpoint:**

- Patients (%)

<table>
<thead>
<tr>
<th>Patients (%)</th>
<th>0</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50% stenosis at 15 mo</td>
<td>13</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Patients (%):**

<table>
<thead>
<tr>
<th>LM stem</th>
<th>LM bifurcation</th>
</tr>
</thead>
<tbody>
<tr>
<td>98</td>
<td>90</td>
</tr>
</tbody>
</table>

<50% stenosis at 15 mo

Moric MC et al, EuroIntervention 11.2011
LM PCI vs. CABG: **Meta-Analysis (N=1611)**

**Repeat revascularisation**
- **Study:** Buszman ACC 2008
  - OR (95% CI): 3.89 (1.30, 11.68)
  - Events: PCI 15/52, CABG 5/53
  - %: 9.27
- **Study:** Morice Circulation 2010
  - OR (95% CI): 1.92 (1.12, 3.28)
  - Events: PCI 40/355, CABG 22/336
  - %: 52.43
- **Study:** Boudriot JACC 2011
  - OR (95% CI): 2.55 (0.94, 6.93)
  - Events: PCI 14/100, CABG 6/100
  - %: 13.57
- **Study:** Park NEJM 2011
  - OR (95% CI): 1.85 (0.84, 4.08)
  - Events: PCI 19/300, CABG 10/300
  - %: 24.73
- **Overall (I-squared=0.0%, p=0.672)**
  - OR (95% CI): 2.17 (1.48, 3.17)
  - Events: PCI 89/807, CABG 43/789
  - %: 100.00

**Mortality**
- **Study:** Buszman ACC 2008
  - OR (95% CI): 0.24 (0.03, 2.23)
  - Events: PCI 1/52, CABG 4/53
  - %: 12.38
- **Study:** Morice Circulation 2010
  - OR (95% CI): 0.94 (0.45, 1.96)
  - Events: PCI 15/355, CABG 15/336
  - %: 47.03
- **Study:** Boudriot JACC 2011
  - OR (95% CI): 0.39 (0.07, 2.05)
  - Events: PCI 2/100, CABG 5/100
  - %: 15.61
- **Study:** Park NEJM 2011
  - OR (95% CI): 0.74 (0.26, 2.17)
  - Events: PCI 6/300, CABG 8/300
  - %: 24.98
- **Overall (I-squared=0.0%, p=0.673)**
  - OR (95% CI): 0.72 (0.42, 1.24)
  - Events: PCI 24/807, CABG 32/789
  - %: 100.00

**MACCE**
- **Study:** Buszman ACC 2008
  - OR (95% CI): 1.37 (0.58, 3.23)
  - Events: PCI 16/52, CABG 13/53
  - %: 11.15
- **Study:** Morice Circulation 2010
  - OR (95% CI): 1.18 (0.77, 1.80)
  - Events: PCI 56/355, CABG 48/336
  - %: 49.79
- **Study:** Boudriot JACC 2011
  - OR (95% CI): 1.23 (0.59, 2.55)
  - Events: PCI 19/100, CABG 16/100
  - %: 16.21
- **Study:** Park NEJM 2011
  - OR (95% CI): 1.33 (0.72, 2.44)
  - Events: PCI 26/300, CABG 20/300
  - %: 22.85
- **Overall (I-squared=0.0%, p=0.989)**
  - OR (95% CI): 1.24 (0.93, 1.67)
  - Events: PCI 117/807, CABG 59/789
  - %: 100.00

**Myocardial infarction**
- **Study:** Buszman ACC 2008
  - OR (95% CI): 0.33 (0.03, 3.25)
  - Events: PCI 1/52, CABG 3/53
  - %: 12.92
- **Study:** Morice Circulation 2010
  - OR (95% CI): 1.01 (0.48, 2.14)
  - Events: PCI 15/355, CABG 14/336
  - %: 61.07
- **Study:** Boudriot JACC 2011
  - OR (95% CI): 1.00 (0.20, 5.08)
  - Events: PCI 3/100, CABG 3/100
  - %: 12.92
- **Study:** Park NEJM 2011
  - OR (95% CI): 1.34 (0.30, 6.03)
  - Events: PCI 4/200, CABG 3/200
  - %: 11.12
- **Overall (I-squared=0.0%, p=0.788)**
  - OR (95% CI): 0.97 (0.54, 1.74)
  - Events: PCI 23/807, CABG 23/789
  - %: 100.00

Ferrante G et al, EuroIntervention 11.2011
The Guidelines and Appropriateness Criteria
**Patient Profiling**

Local Heart team (surgeon & interventional cardiologist) assessed each patient with regards to:

- Patient's operative risk (euroSCORE & Parsonnet score)
- Coronary lesion complexity (Newly developed SYNTAX Score)
- Goal: SYNTAX Score to provide guidance on optimal revascularization strategies for patients with high risk lesions

---

**SYNTAX Score**

- Number & location of lesions
- Left Main
- 3 Vessel
- Total Occlusion
- Dominance
- Calcification
- Thrombus
- Bifurcation
- Tortuosity

---

**References**

- Valgimigli et al. Am J Cardiol 2007;99:1072-81

- Coronary tree segments AHA classification and modified for the ARTS study, Circulation 1975; 51:5-40 & Semin Interv Cardiol 1996; 4:209-19
- Modified Lefman score, Circ 1981;63:285-92
- Lesions classification ACC/AHA, Circ 2001;103:3019-41
- Bifurcation classification, CCI 2000;49:274-83
- CTO classification, J Am Coll Cardiol 1997;30:649-53

---

www.syntaxscore.com

Wijns W et al, EHJ 10.2010
**Recommendations for decision making and patient information**

<table>
<thead>
<tr>
<th>It is recommended that patients be adequately informed about the potential benefits and short- and long-term risks of a revascularisation procedure. Enough time should be spared for informed decision making.</th>
<th>I</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>The appropriate revascularisation strategy in patients with MVD should be discussed by the Heart Team.</td>
<td>I</td>
<td>C</td>
</tr>
</tbody>
</table>

Wijns W et al, EHJ 10.2010
### Indications for CABG versus PCI in stable patients with lesions suitable for both procedures and low predicted surgical mortality

<table>
<thead>
<tr>
<th>Subset of CAD by anatomy</th>
<th>Favours CABG</th>
<th>Favours PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1VD or 2VD - non-proximal LAD</td>
<td>IIb C</td>
<td>I C</td>
</tr>
<tr>
<td>1VD or 2VD - proximal LAD</td>
<td>IA</td>
<td>Ila B</td>
</tr>
<tr>
<td>3VD simple lesions, full functional revascularisation achievable with PCI, SYNTAX score ≤ 22</td>
<td>IA</td>
<td>Ila B</td>
</tr>
<tr>
<td>3VD complex lesions, incomplete revascularisation achievable with PCI, SYNTAX score &gt; 22</td>
<td>IA</td>
<td>III A</td>
</tr>
<tr>
<td>Left main (isolated or 1VD, ostium/shaft)</td>
<td>IA</td>
<td>Ila B</td>
</tr>
<tr>
<td>Left main (isolated or 1VD, distal bifurcation)</td>
<td>IA</td>
<td>Ila B</td>
</tr>
<tr>
<td>Left main + 2VD or 3VD, SYNTAX score ≤ 32</td>
<td>IA</td>
<td>IIb B</td>
</tr>
<tr>
<td>Left main + 2VD or 3VD, SYNTAX score ≥ 33</td>
<td>IA</td>
<td>III B</td>
</tr>
</tbody>
</table>
Appropriateness of revascularisation method for advanced coronary artery disease

ACCF / SCAI / STS / AATS / AHA / ASNC 2009 report

<table>
<thead>
<tr>
<th>Two vessel coronary artery disease with proximal LAD stenosis</th>
<th>CABG</th>
<th>PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>No diabetes and normal LVEF</td>
<td>A</td>
<td>U</td>
</tr>
<tr>
<td>Diabetes</td>
<td>A</td>
<td>U</td>
</tr>
<tr>
<td>Depressed LVEF</td>
<td>A</td>
<td>U</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Three vessel coronary artery disease</th>
<th>CABG</th>
<th>PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>No diabetes and normal LVEF</td>
<td>A</td>
<td>I</td>
</tr>
<tr>
<td>Diabetes</td>
<td>A</td>
<td>I</td>
</tr>
<tr>
<td>Depressed LVEF</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Isolated left main stenosis</th>
<th>CABG</th>
<th>PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>No diabetes and normal LVEF</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>Diabetes</td>
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<tr>
<td>Depressed LVEF</td>
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</table>

<table>
<thead>
<tr>
<th>Left main stenosis and additional coronary artery disease</th>
<th>CABG</th>
<th>PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>No diabetes and normal LVEF</td>
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<tr>
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<td>I</td>
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<tr>
<td>Depressed LVEF</td>
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<td>I</td>
</tr>
</tbody>
</table>

### Heart Team Approach to UPLM or Complex CAD

<table>
<thead>
<tr>
<th>Anatomic Setting</th>
<th>COR</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPLM or Complex CAD</td>
<td>I – Heart Team Approach</td>
<td>C</td>
</tr>
<tr>
<td>UPLM or Complex CAD</td>
<td>Ila – Calculation of the STS and SYNTAX scores</td>
<td>B</td>
</tr>
</tbody>
</table>

Levine GN et al, JACC 12.2011
# UPLM Revascularization to Improve Survival

<table>
<thead>
<tr>
<th>Revascular Method</th>
<th>COR</th>
<th>LOE</th>
</tr>
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<tbody>
<tr>
<td>CABG</td>
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<td>B</td>
</tr>
<tr>
<td>PCI</td>
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</tr>
<tr>
<td>IIa—For SIHD when both of the following are present:</td>
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</tr>
<tr>
<td>• Anatomic conditions associated with a low risk of PCI procedural complications and a high likelihood of good long-term outcome (e.g., a low SYNTAX score of ≤22, ostial or trunk left main CAD)</td>
<td></td>
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</tr>
<tr>
<td>• Clinical characteristics that predict a significantly increased risk of adverse surgical outcomes (e.g., STS-predicted risk of operative mortality ≥5%)</td>
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<td></td>
</tr>
<tr>
<td>IIa—For UA/NSTEMI if not a CABG candidate</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>IIa—For STEMI when distal coronary flow is &lt;TIMI grade 3 and PCI can be performed more rapidly and safely than CABG</td>
<td></td>
<td>C</td>
</tr>
<tr>
<td>IIb—For SIHD when both of the following are present:</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>• Anatomic conditions associated with a low to intermediate risk of PCI procedural complications and an intermediate to high likelihood of good long-term outcome (e.g., low-intermediate SYNTAX score of &lt;33, bifurcation left main CAD)</td>
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<td></td>
</tr>
<tr>
<td>• Clinical characteristics that predict an increased risk of adverse surgical outcomes (e.g., moderate-severe COPD, disability from prior stroke, or prior cardiac surgery; STS-predicted operative mortality &gt;2%)</td>
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<tr>
<td>III: Harm—For SIHD in patients (versus performing CABG) with unfavorable anatomy for PCI and who are good candidates for CABG</td>
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# UPLM Revascularization to Improve Survival

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<tr>
<td>PCI</td>
<td>Ila For SIHD when low risk of PCI complications and high likelihood of good long-term outcome (e.g., SYNTAX score of ≤22, ostial or trunk left main CAD), <em>and</em> a significantly increased CABG risk (e.g., STS-predicted risk of operative mortality ≥5%)</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>IIb For SIHD when low to intermediate risk of PCI complications and intermediate to high likelihood of good long-term outcome (e.g., SYNTAX score of &lt;33, bifurcation left main CAD) <em>and</em> increased CABG risk (e.g., moderate-severe COPD, disability from prior stroke, prior cardiac surgery, STS-predicted operative mortality &gt;2%)</td>
<td>B</td>
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Levine GN et al, JACC 12.2011
# UPLM PCI to Improve Survival (ACS)

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<tbody>
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</tr>
<tr>
<td>IIa—For STEMI when distal coronary flow is &lt;TIMI grade 3 and PCI can be performed more rapidly and safely than CABG</td>
<td>C</td>
</tr>
</tbody>
</table>

Levine GN et al, JACC 12.2011
Stent Type (DESs)

- Cypher select+
- Endeavor (Sprint / Resolute)
- Biomatrix Flex
- Promus/Taxus Element
- Xience Prime
Stent Type: DES vs. BMS

Revascularisation for Unprotected Left Main
5-Year Results From the MAIN-COMPARE registry

Bare metal stent

Drug-eluting stent

Clinical Situations Associated With DES or BMS Selection Preference

<table>
<thead>
<tr>
<th>DES Generally Preferred Over BMS (efficacy considerations)</th>
<th>BMS Preferred Over DES (safety considerations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Left main disease</td>
<td>• Patients unable to tolerate or comply with prolonged DAPT</td>
</tr>
<tr>
<td>• Small vessels</td>
<td>• Anticipated surgery requiring discontinuation of DAPT within 12 months</td>
</tr>
<tr>
<td>• In-stent restenosis</td>
<td>• High risk of bleeding</td>
</tr>
<tr>
<td>• Bifurcation lesions</td>
<td></td>
</tr>
<tr>
<td>• Long lesions</td>
<td></td>
</tr>
<tr>
<td>• Multiple lesions</td>
<td></td>
</tr>
<tr>
<td>• Saphenous vein graft lesions</td>
<td></td>
</tr>
<tr>
<td>• Diabetic patients</td>
<td></td>
</tr>
</tbody>
</table>

Levine GN et al, JACC 12.2011
Dedicated LM bifurcation techniques?

- TAXUS petal
- Guidant frontier
- YMed sidekick
- Devax (+ BA9)
- “true” bifurcation designs
- sidebranch designs
- Stentys
- Tryton
Left Main PCI

Dedicated techniques, stents, and operators

- It is always about the operator, his/her ethics, experience, passion, responsibility, skills, dedication and awareness of procedural limitations.

- Always do it for the patient!
Thank You