It's the FFR!: Functional Syntax Score vs. Syntax Score

Keimyung University Dongsan medical center, Daegu, Korea
Chang-Wook Nam MD, PhD
80 YO ♀ Angina, HTN Hx

MultivesSEL disease

Multifocal lesion

Diffuse lesion

Bifurcation lesion

Intermediate lesion

CTO
CABG VS. PCI c DES
**Outcome**

3-Year Results in 3 VD subset

**Death/CVA/MI**

- Before 1 year: 6.6% vs 8.0%, *P=0.39*
- 1-2 years: 1.8% vs 3.7%, *P=0.07*
- 2-3 years: 2.5% vs 4.4%, *P=0.10*

Cumulative Event Rate ± 1.5 SE; log-rank *P* value; *Binary rates*

**CVA**

- Before 1 year: 1.9% vs 0.7%, *P=0.09*
- 1-2 years: 0.4% vs 0.8%, *P=0.69*
- 2-3 years: 0.6% vs 0.8%, *P=1.00*

**Repeat revasc.**

- Before 1 year: 5.5% vs 14.6%, *P<0.001*
- 1-2 years: 2.8% vs 3.9%, *P=0.35*
- 2-3 years: 2.5% vs 3.0%, *P=0.63*

Repeat CABG: 1.6% vs 3.8%, *P=0.003*
Repeat PCI: 9.5% vs 16.7%, *P=0.0003*

**MACCE**

- Before 1 year: 11.5% vs 19.2%, *P<0.001*
- 1-2 years: 4.4% vs 7.0%, *P=0.08*
- 2-3 years: 4.6% vs 7.4%, *P=0.06*

Cumulative KM Event Rate ± 1.5 SE; log-rank *P* value; *Binary rates*
The Selection of Patients with Multi-vessel CAD can Improve Outcomes

MACCE to 3 Years by SYNTAX Score Tertile

Low Scores (0-22)

Intermediate Scores (22-33)

High Scores (33≤)

CABG

PCI

TCT 2010
# Multivessel Disease (MVD)

## Current Guidelines for MVD

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Multivessel disease

SYNTAX score
MACCE by SYNTAX Score 33+

Mean baseline SYNTAX Score
CABG 41.5 ± 7.1
TAXUS 41.7 ± 7.8

Cumulative Event Rate (%) vs Months Since Allocation

- CABG (N=315)
- TAXUS (N=290)

**SYNTAX score**

**Summary**

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<td>Sub total lesion 1</td>
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<th>Lesion 2</th>
<th>segment number(s)</th>
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<td>(segment 3): 1x5=</td>
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<tr>
<th>Lesion 3</th>
<th>3.5x2=</th>
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<tr>
<td>Sub total lesion 3</td>
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<tr>
<th>Lesion 4</th>
<th>2.5x2=</th>
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<tr>
<td>Bifurcation Type: Medina 1,0,1;</td>
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<td>Sub total lesion 4</td>
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<th>Lesion 5</th>
<th>2.5x2=</th>
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<td>Length &gt;20 mm</td>
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<td>Sub total lesion 5</td>
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<th>1x2=</th>
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**TOTAL:** 38
**MVD in FAME**

![Graph showing survival from major adverse cardiac events for FFR-guided and Angio-guided PCI](image)

- Survival from major adverse cardiac events over 730 days, with a 4.5% difference in favor of Angio-guided PCI.

**Number of stent**

- Bar chart comparing Angio-guided PCI (2.7) and FFR-guided PCI (1.9) with **P<0.001**

**Angio-guided PCI vs. FFR-guided PCI**

- ![Scatter plot comparing FFR vs. QALY](image)

- **Angio Better** vs. **FFR Better**

- **Less Costly**

**References**

- Tonino PA, NEJM 2009;360:213-24
- Pijl NH, JACC 2010;56:177-84
- Fearon WF, Circ 2010;29
Linear Increase in MACCE by Number of Stents in the SYNTAX Trial

1.5 Stents
“Typical” Real
World Average
1 stent
5.6%

4.6 Stents
SYNTAX Average
17.8%

Avg. in pts with
5-8+ stents
in SYNTAX
19.6%

12m MACCE in TAXUS Arm

Number of Stents Implanted

12m MACCE Probability

12m MACCE Rate

Courtesy to Dr William Wijns
The Selection of Patients with Multi-vessel CAD can Improve Outcomes

**Current Guidelines for MVD**

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If we can add functional information for decision making...
Revisit FAME

Functional SYNTAX Score for Risk Assessment in Multi-vessel Coronary Artery Disease

FFR-guided “Functional SYNTAX score (FSS)” would predict 1-year clinical outcome better than the “classic SYNTAX score (SS)” in patients with multi-vessel coronary artery disease undergoing percutaneous coronary intervention.
Patient with stenoses $\geq 50\%$ in at least 2 of the 3 major epicardial vessels

Indicate all stenoses $\geq 50\%$ considered for stenting

Randomization

Angiography-guided PCI

Stent all indicated stenoses

FFR-guided PCI

Measure FFR in all indicated stenoses

Stent only those stenoses with FFR $\leq 0.80$

1-year follow-up
### Summary

- **Lesion 1**
  - (segment 1): 1×2
  - Severe Tortuosity
  - Sub total lesion 1: 2

- **Lesion 2**
  - Segment number(s)
    - (segment 2): 1×5
  - Age T.O. is unknown
  - + Blunt stump
  - the first segment beyond the T.O. visualized by contrast: 16
  - + sidebranch: Yes, all sidebranches <1.5mm
  - Severe Tortuosity
  - Sub total lesion 2: 12

- **Lesion 3**
  - (segment 7): 2.5×2
  - Severe Tortuosity
  - Heavy calcification
  - Sub total lesion 3: 9

- **Lesion 4**
  - (segment 11): 1.5×2
  - Severe Tortuosity
  - Sub total lesion 4: 3

- **Lesion 5**
  - (segment 11): 1.5×2
  - Severe Tortuosity
  - Sub total lesion 5: 2

**TOTAL:** 33

### SYNTAX score

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#### Summary

**Lesion 1**
- (segment 1): 1x2–
- Severe Tortuosity
- Sub total lesion 1

**Lesion 2**
- segment number(s): (segment 2): 1x5=
- Age T.O. is unknown
- + Blunt stump
- the first segment beyond the T.O. visualized by contrast: 16 + sidebranch: Yes, all sidebranches <1.5mm
- Severe Tortuosity
- Sub total lesion 2

**Lesion 3**
- (segment 7): 2.5x2–
- Severe Tortuosity
- Heavy calcification
- Sub total lesion 3

**Lesion 4**
- (segment 11): 1.5x2–
- Severe Tortuosity
- Sub total lesion 5

**TOTAL:** 33
Comparison of Outcomes

MACE at 1-year (%)

SYNTAX

- PCI
  - CABG: 11.5%
  - FFR-guided PCI: 13.2%

FAME

- High SS
  - 26.7%
- Low to Medium SS
  - 9.6%

Nam CW, Interv Cardiol 2011:3:695–704
Different Fate of Risk Group

Low risk: 101 (62%)
Medium risk: 167 (34%)
High risk: 167 (34%)

SYNTAX score

Functional SYNTAX score:
- Low risk: 37 (23%)
- Medium risk: 98 (59%)
- High risk: 69 (41%)

1-year MACE (%)
- Moved to Lower risk: 11.3%
- Remained in High risk: 26.7%

P < 0.01

Nam CW, JACC 2011;58:1211–8
Nam CW, Interv Cardiol 2011:3:695–704
Comparison of Outcomes

Nam CW, JACC 2011;58:1211–8
Nam CW, Interv Cardiol 2011:3:695–704
Functional SYNTAX score
### Summary

**Lesion 1**
- (segment 1): 1x2=
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**Lesion 2**
- Segment number(s): 1x5=
- Age T.O. is unknown
- the first segment beyond the T.O. visualized by contrast: + sidebranch: Yes, all sidebranches <1.5mm
- Sub total lesion 2

**Lesion 3**
- (segment 7): 2.5x2=
- Sub total lesion 3

**Lesion 4**
- (segment 8): 1x2=
- Length >20 mm
- Sub total lesion 4

**Lesion 5**
- (segment 13): 0.5x2=
- Sub total lesion 5

**TOTAL:**
LCX Evaluation and Treatment

- Bifurcation lesion
- Multifocal lesion
- Diffuse lesion
- Multivessel disease
- Intermediate lesion
- CTO
PCI in intermediate lesion: FFR vs IVUS

Nam CW, et al. JACC interv 2010:3:812
Intermediate lesion

1. VA 12.46mm², LA 4.78mm², Plaque Burden 61.7%

2. VA 11.58mm², LA 2.88mm², Plaque Burden 75.1%

3. VA 7.09mm², LA 2.75mm², Plaque Burden 61.3%

4. VA 5.43mm², LA 2.0 mm², Plaque Burden 63.1%

5. VA 5.95mm², LA 4.37mm², Plaque Burden 26.5%

6. VA 3.74mm², MLA 2.87mm², Plaque Burden 50.0%
Multifocal & Diffuse long lesion
Post interventional evaluation
Post interventional evaluation

0.97
0.89
1.0

0.89
1.0
0.97
FFR-guided 3VD PCI
Conclusion

- If FSS is applicable in the patients with multi-vessel CAD, the number of low- and medium-risk patients who usually are recommended PCI can be dramatically increased.

- CABG could be highly recommendable in the high-risk patients with multi-vessel CAD classified by FSS to hopefully improve outcomes.

- Therefore, the selection of target vessels, the method for revascularization, and the determination of prognosis in patients with multi-vessel CAD are improved by FFR-guided risk in daily practice.