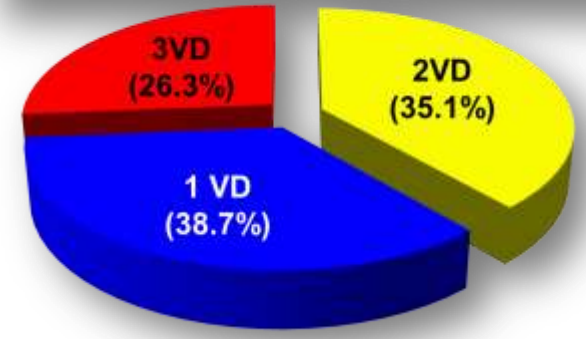# Functional Lesion Assessment in Multivessel CAD and FAME 3

NAM, Chang-Wook MD PhD

Keimyung University Dongsan Hospital, Daegu, Korea

More than 6000 patients from 2003 to 2010 In my Cath lab

3VD (26.3%)

2VD (35.1%)

1 VD (38.7%)

SYNTAX score

Anatomic assessment of the degree and complexity of MVD

(a) Right dominance

Left dominance

Weighting Factor

+6
+5
+3.5
+2.5
+1.5
+1
+0.5

(b) SYNTAX Score

Diseased Segment #

Total Occlusion

Dominance

Trifurcation

Diffuse Small

Bifurcation

Thrombus

Aorta Ostial

Heavy Calcification

Length

Severe Tortuosity

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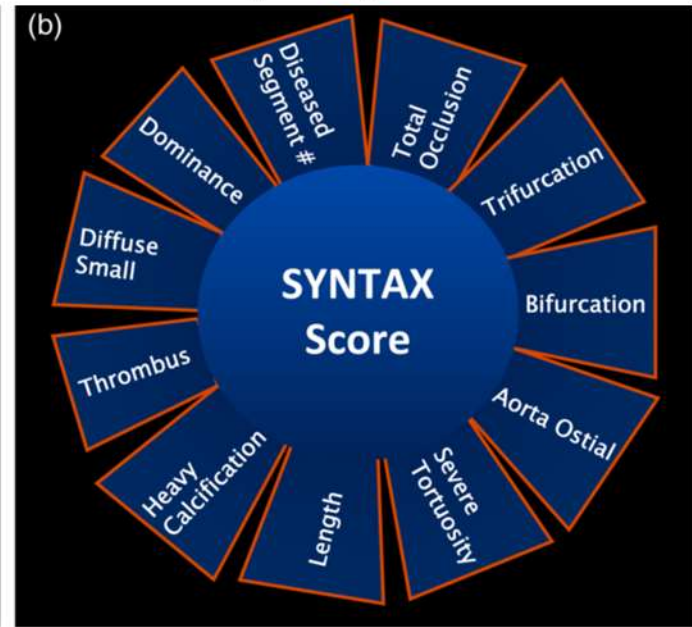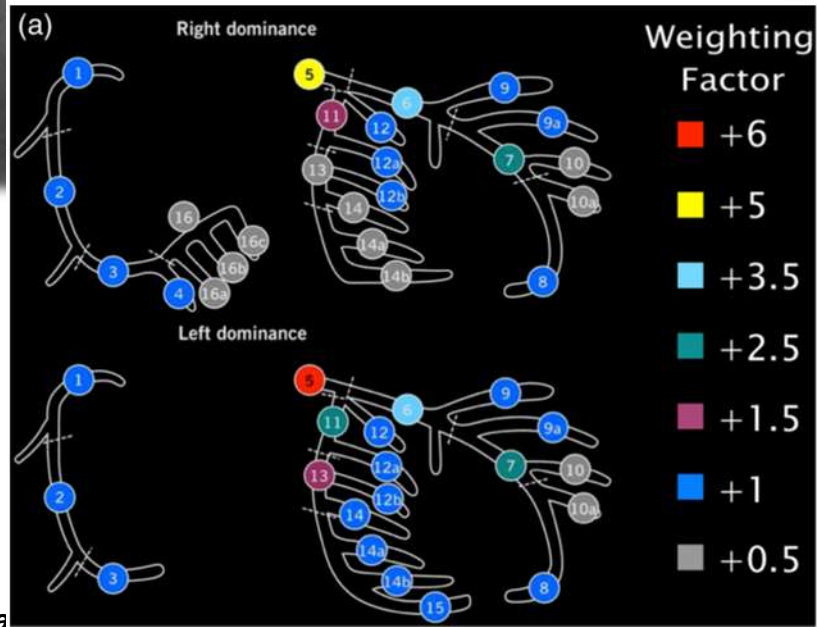
5-year outcomes of 3 vessel disease in SYNTAX trial

SYNTAX score

Baseline SYNTAX score 0–22 — p=0·21 — 33·3% / 26·8%

Baseline SYNTAX score 23–32 — p=0·0008 — 37·9% / 22·6%

Baseline SYNTAX score ≥33 — p=0·0005 — 41·9% / 24·1%

Months since allocation	0	12	24	36	48	60
	171	137	135	133	123	98
	181	154	147	139	130	100
	208	176	174	164	153	121
	207	166	166	157	143	114
	166	142	141	133	125	99
	155	121	119	111	104	79

Residual SYNTAX score

Low Baseline SYNTAX Score (0–22) — Log-rank p value 0.022

Residual SYNTAX Score: 0, >0–4, >4–8, >8

23.8% / 13.8% / 7.7% / 6.7%

Intermediate Baseline SYNTAX Score (23–32) — Log-rank p-value <0.001

34.1% / 12.9% / 10.1% / 8.2%

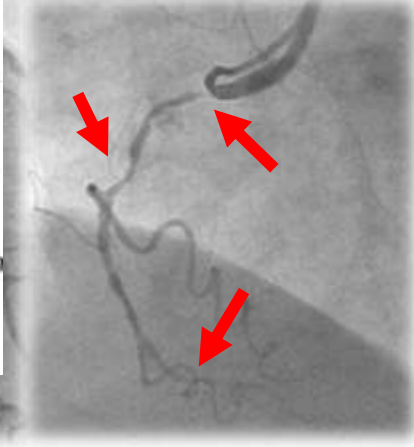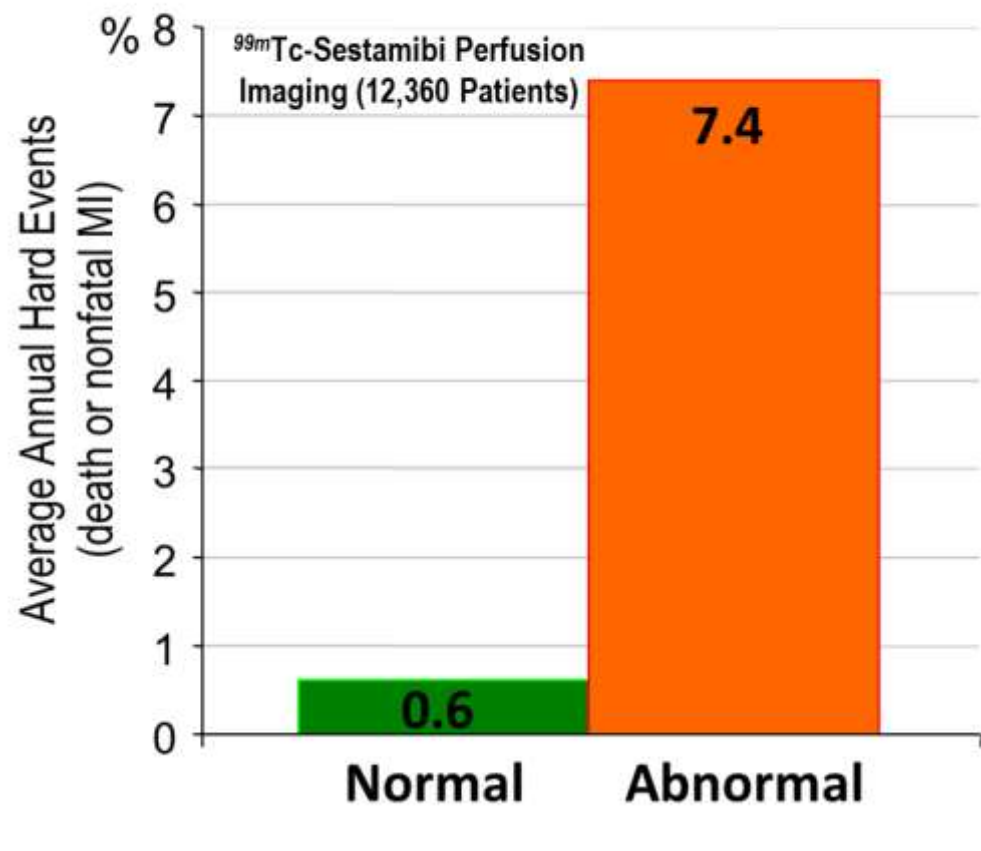High Baseline SYNTAX Score (≥33) — Log-rank p-value <0.001

39.1% / 11.5% / 10.2% / 9.3%

Quantitative **anatomic assessment** of the **degree and complexity of MVD before and after PCI** is associated with **long-term mortality**
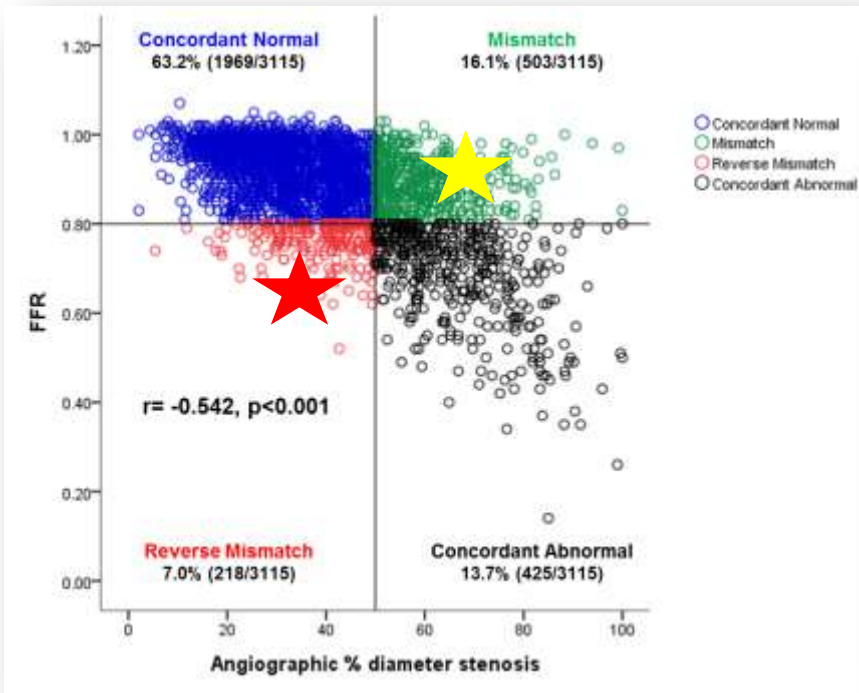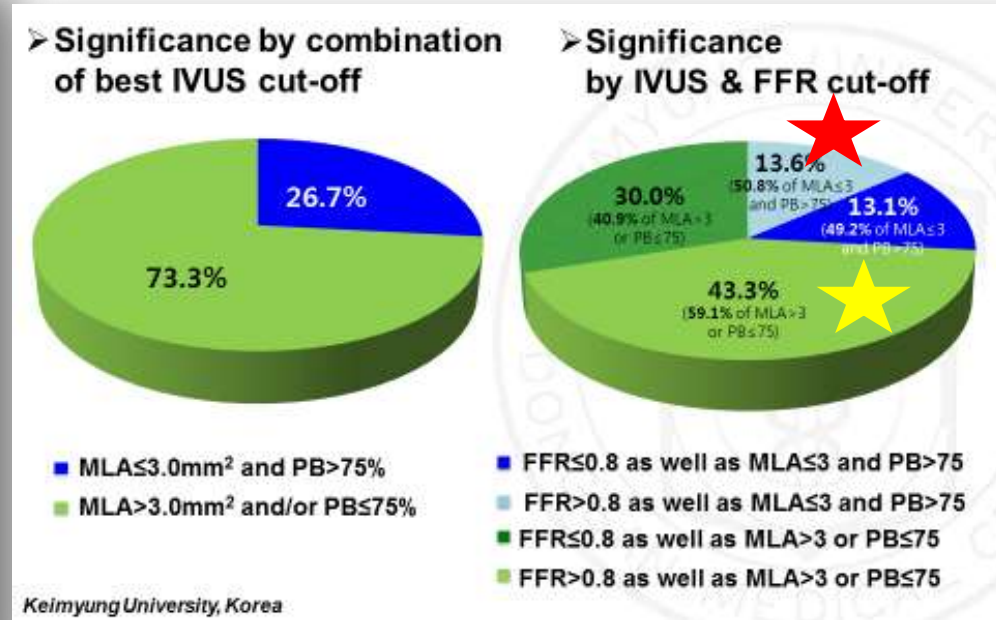
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Existence of ischemia

99mTc-Sestamibi Perfusion Imaging (12,360 Patients)

Average Annual Hard Events (death or nonfatal MI) %

Normal: 0.6
Abnormal: 7.4
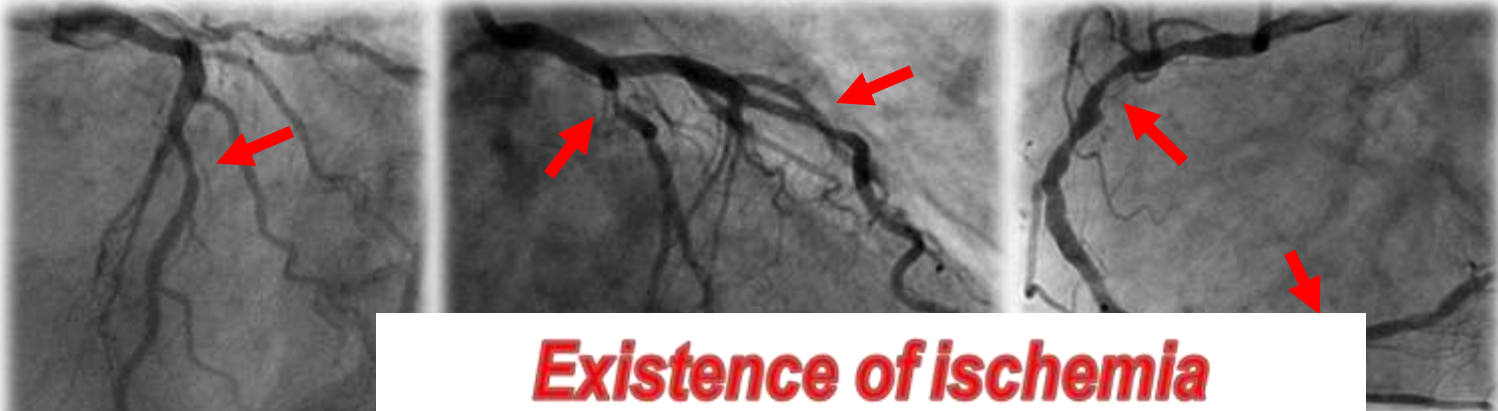
Gap between Anatomy and Physiology

CAG vs. FFR

IVUS vs. FFR

*Sometimes, **what you see** is **not always what it is!***
*These **differences** can **change our decision** in daily practice!*
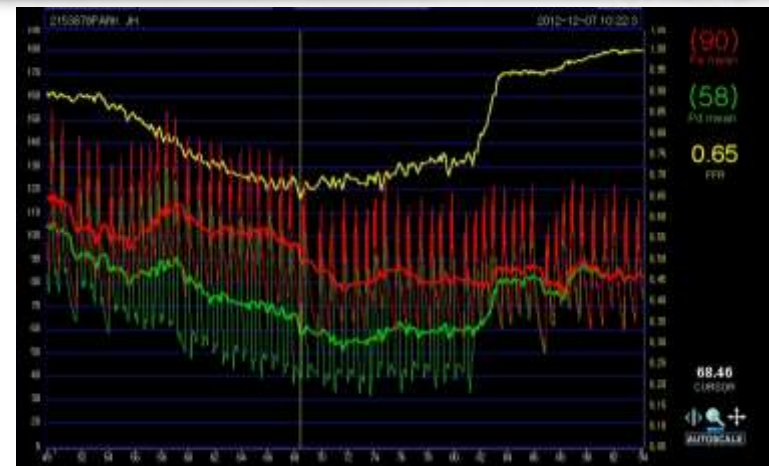
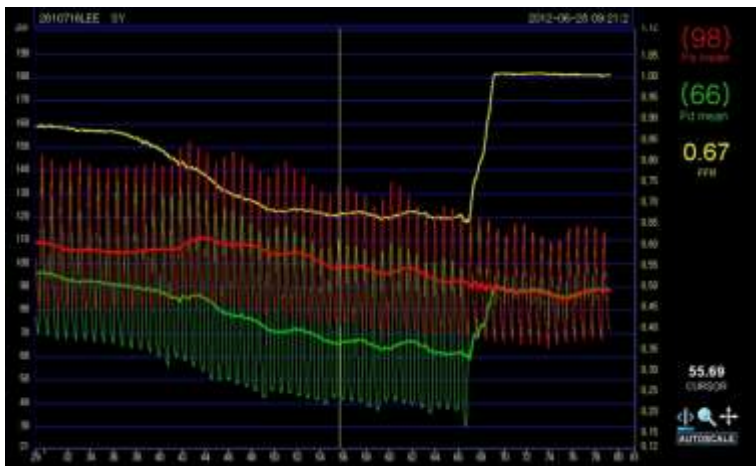# Functional lesion assessment in MVD

❖ Angiographic MVD is not always functional significant MVD. **FFR** can help to reveal the **real status of MVD**.

Only FFR is not enough...

Anatomic view: similar significance

Physiologic view: similar significance

Patient view: different significance

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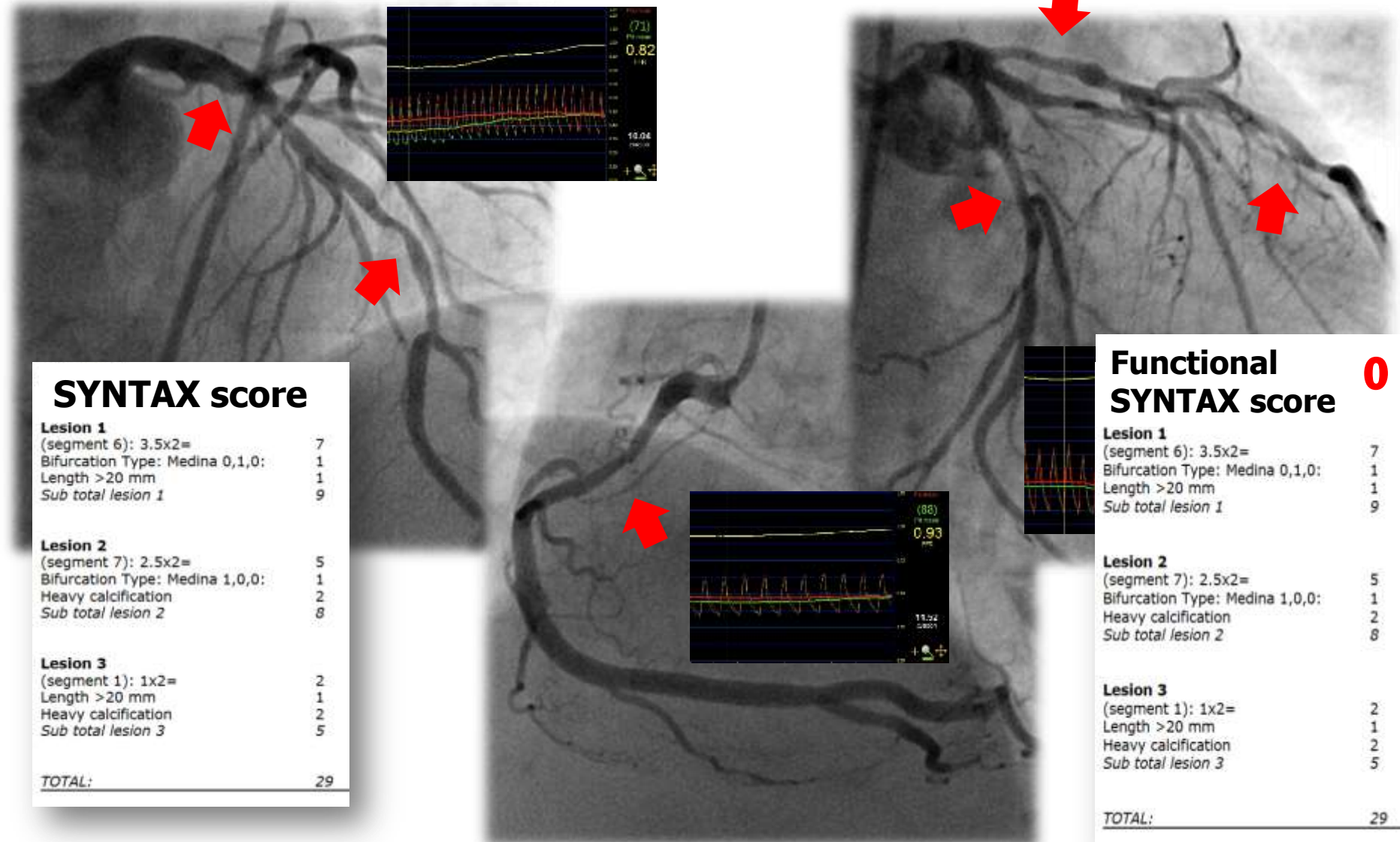
Revisit FAME
Functional SYNTAX score

- ✓ FFR-guided **"Functional SYNTAX score (FSS)"** recalculates SYNTAX score (SS) in the functional significant coronary lesions.

- ✓ FFR-guided FSS would predict clinical outcome better than the SS in patients with multi-vessel CAD undergoing percutaneous coronary intervention

Functional SYNTAX score

52YO/♂ VSA with ECG change, MVD in CCTA

SYNTAX score

Lesion 1
(segment 6): 3.5x2=	7
Bifurcation Type: Medina 0,1,0:	1
Length >20 mm	1
Sub total lesion 1	9

Lesion 2
(segment 7): 2.5x2=	5
Bifurcation Type: Medina 1,0,0:	1
Heavy calcification	2
Sub total lesion 2	8

Lesion 3
(segment 1): 1x2=	2
Length >20 mm	1
Heavy calcification	2
Sub total lesion 3	5

TOTAL:	29

Functional SYNTAX score   **0**

Lesion 1
(segment 6): 3.5x2=	7
Bifurcation Type: Medina 0,1,0:	1
Length >20 mm	1
Sub total lesion 1	9

Lesion 2
(segment 7): 2.5x2=	5
Bifurcation Type: Medina 1,0,0:	1
Heavy calcification	2
Sub total lesion 2	8

Lesion 3
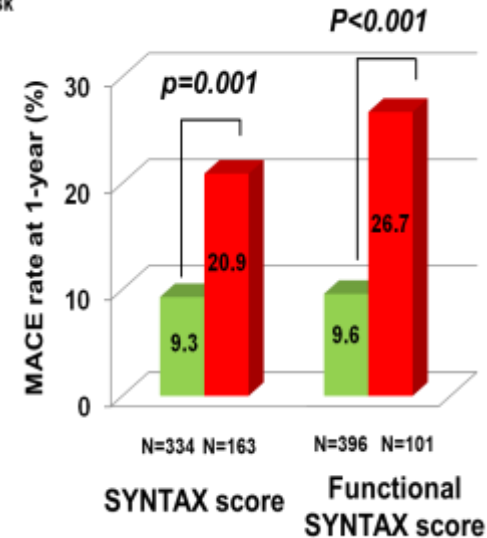|	
(segment 1): 1x2=	2
Length >20 mm	1
Heavy calcification	2
Sub total lesion 3	5

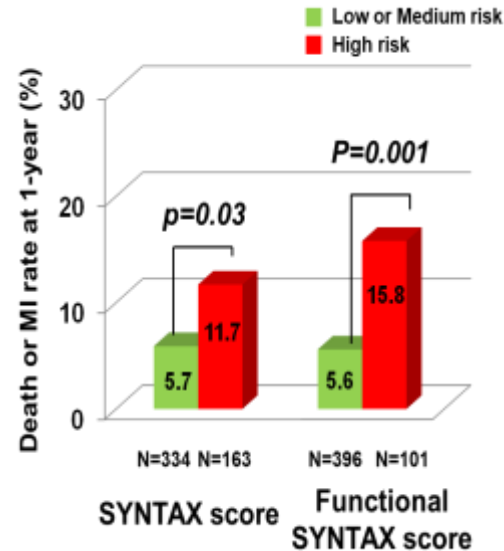| TOTAL:	29

Keimyung University, Korea

Benefits of Functional SYNTAX score

Reclassifying
risk group

Better discrimination
clinical outcomes

SYNTAX score

- 163 (32%)
- 167 (34%)
- 167 (34%)

FSS

- 101 (20%)
- 106 (21%)
- 290 (59%)

Low or Medium risk
High risk

Death or MI rate at 1-year (%)

p=0.03
5.7 / 11.7 — N=334 N=163 — SYNTAX score

P=0.001
5.6 / 15.8 — N=396 N=101 — Functional SYNTAX score

MACE rate at 1-year (%)

p=0.001
9.3 / 20.9 — N=334 N=163 — SYNTAX score

P<0.001
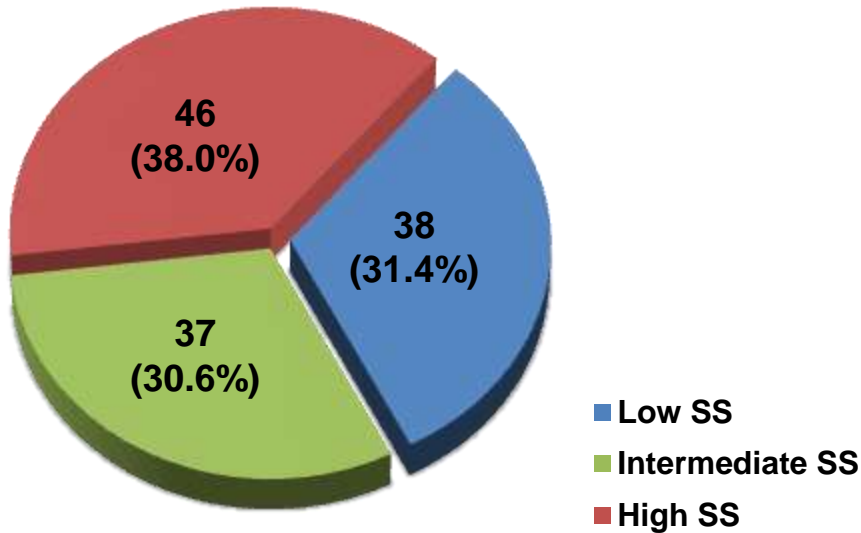9.6 / 26.7 — N=396 N=101 — Functional SYNTAX score
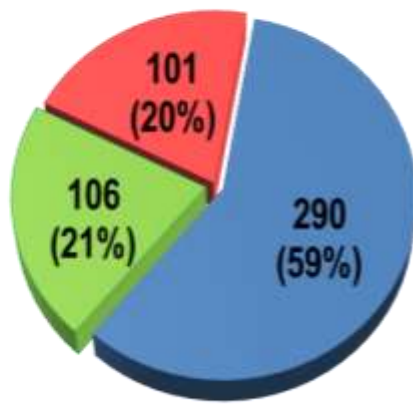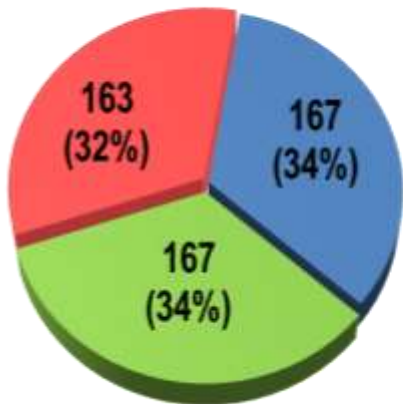
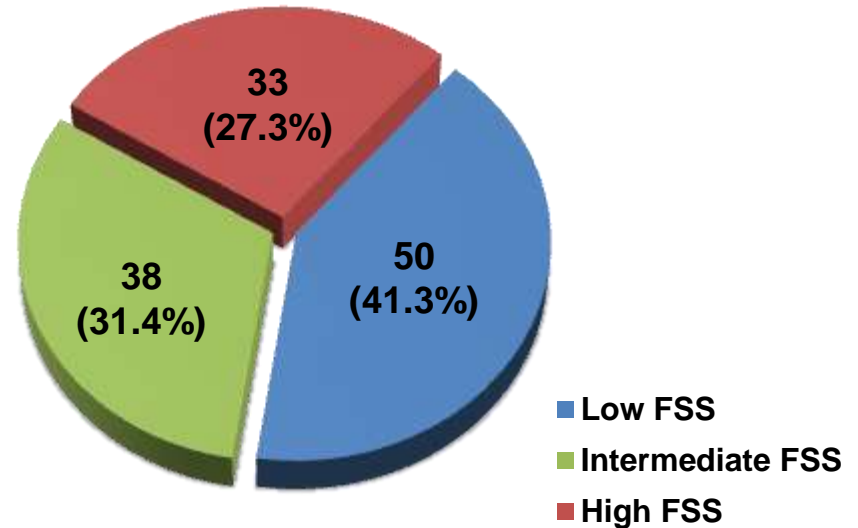## Evidences for longer term outcomes by FSS?

Functional SYNTAX score on 5-year outcome in MVD

- **121 patients were divided into tertiles of risk based on classic SS.**
- **5-year MACE was compared.**

SYNTAX score

46
(38.0%)

38
(31.4%)

37
(30.6%)

- Low SS
- Intermediate SS
- High SS

Functional SYNTAX score

33
(27.3%)

50
(41.3%)

38
(31.4%)

- Low FSS
- Intermediate FSS
- High FSS

*After determining the FSS, **19.0% moved to a lower-risk** group*

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Functional SYNTAX score on 5-year outcome in MVD

- **121 patients were divided into tertiles of risk based on classic SS.**
- **5-year MACE was compared.**

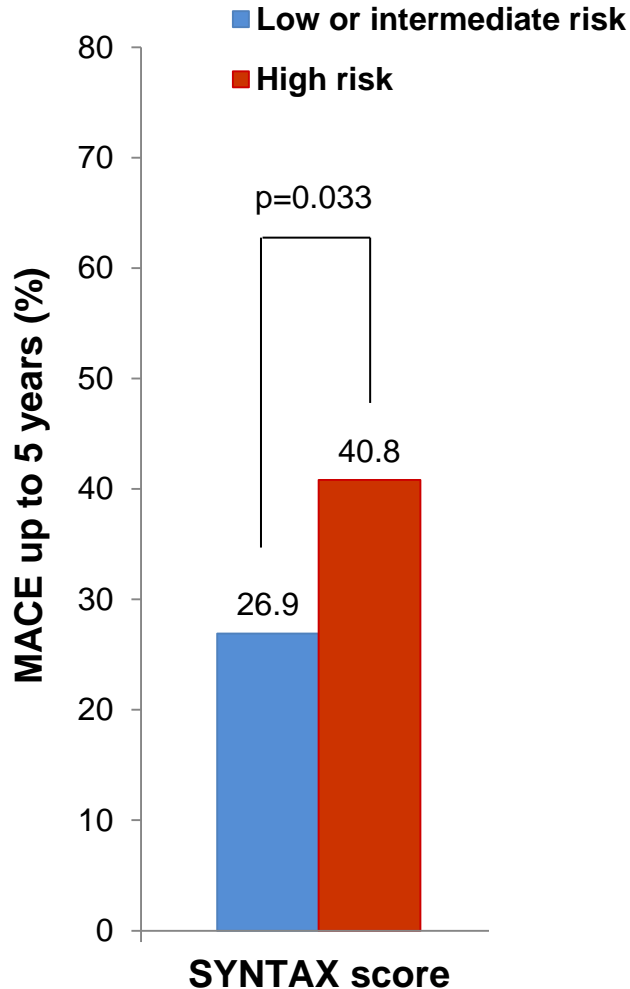Legend:
- ■ Low or intermediate risk
- ■ High risk

Chart (MACE up to 5 years (%) vs SYNTAX score):
- p=0.033
- Low or intermediate risk: 26.9
- High risk: 40.8

*Regression analysis revealed that the **independent predictor of 5-year MACE** was the **FSS (HR 3.025**, 95% CI 1.408-6.502, p=0.005)*

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The Concept of FAME 3

Early generation DES
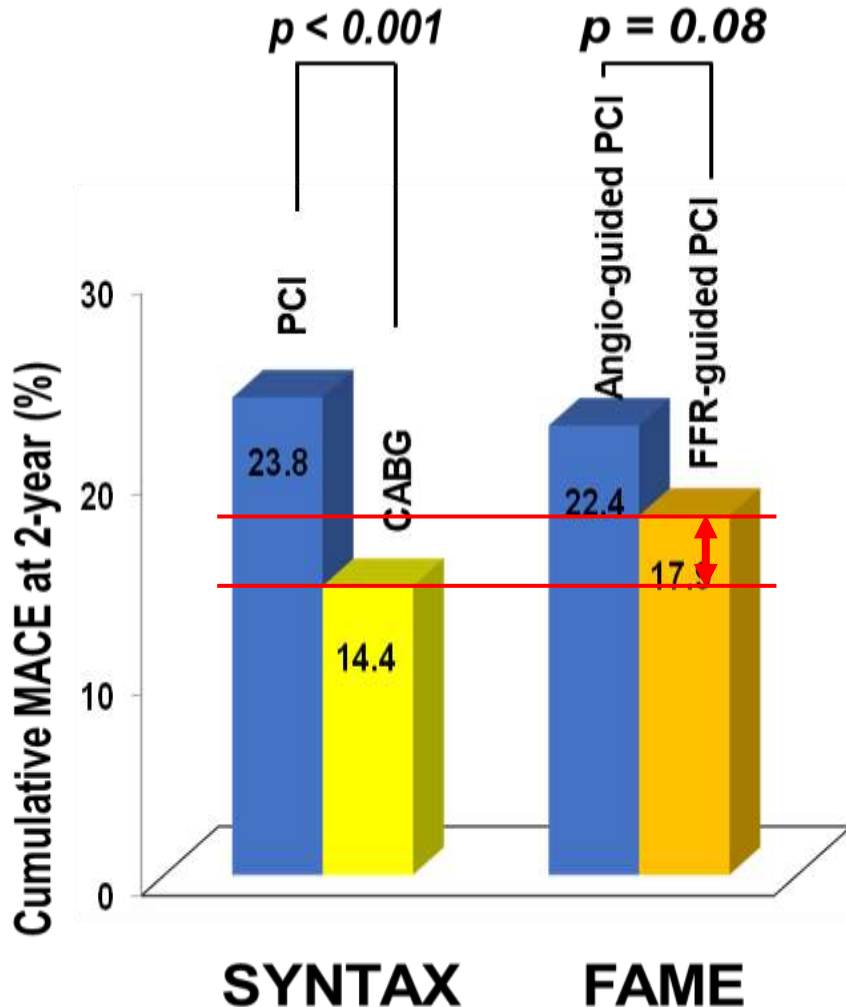
- **With the results of FAME 1 & 2: the benefit of FFR guided decision making**
- **Better performance of 2nd generation DES**

FFR guided PCI with 2nd generation DES in patients with 3 VD can be comparable to CABG.

FAME 3 Trial: Purpose and Flow chart

Purpose: **FFR-guided PCI with the 2nd generation DES** is non-inferior to **CABG** in patients with multivessel CAD

All Comers with 3 V CAD (not involving LM)

↓

Heart team identifies lesions for PCI/CABG and then patient is randomized

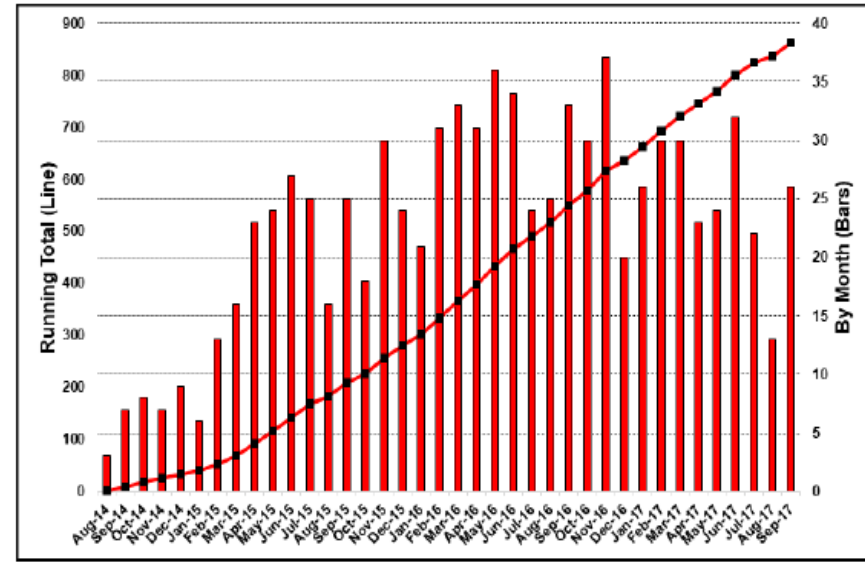FFR-Guided PCI with Resolute DES Stent all lesions with FFR ≤ 0.80 (n=750)

Perform CABG based on coronary angiogram (n=750)

Primary: One Year follow-up for Death, MI, CVA, Revascularization
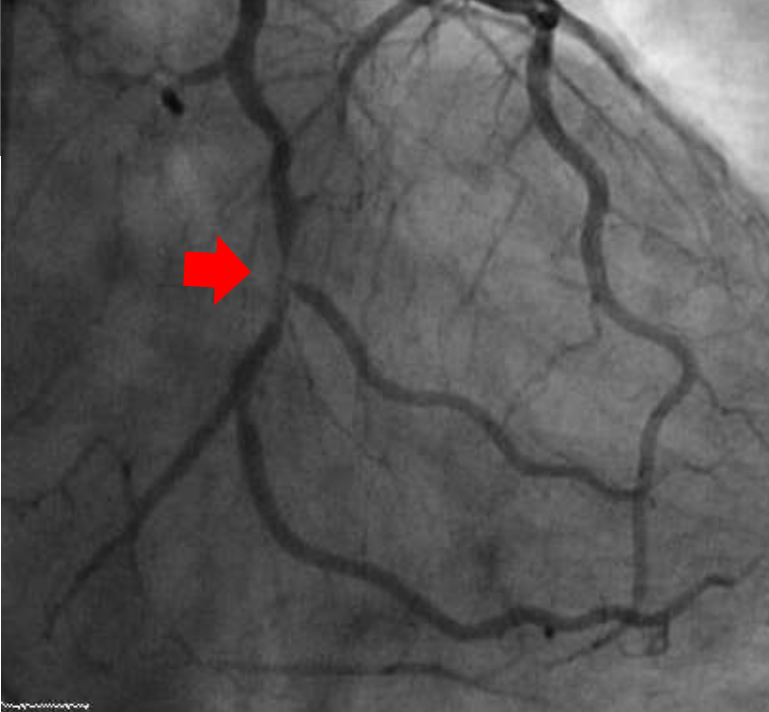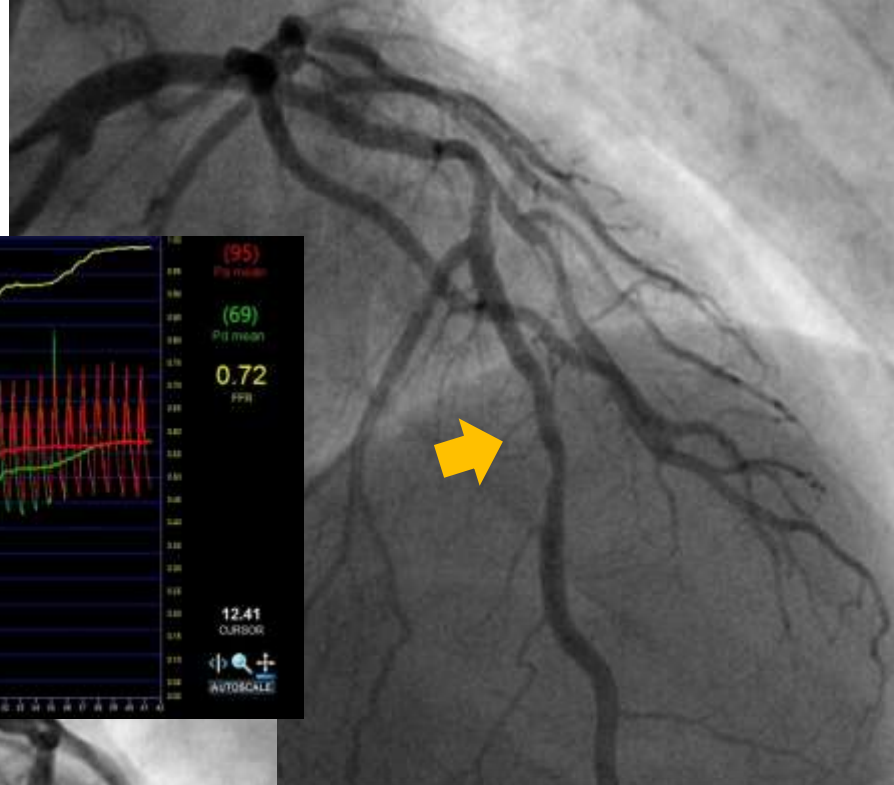Key Secondary: Three Year follow-up for Death/MI/CVA
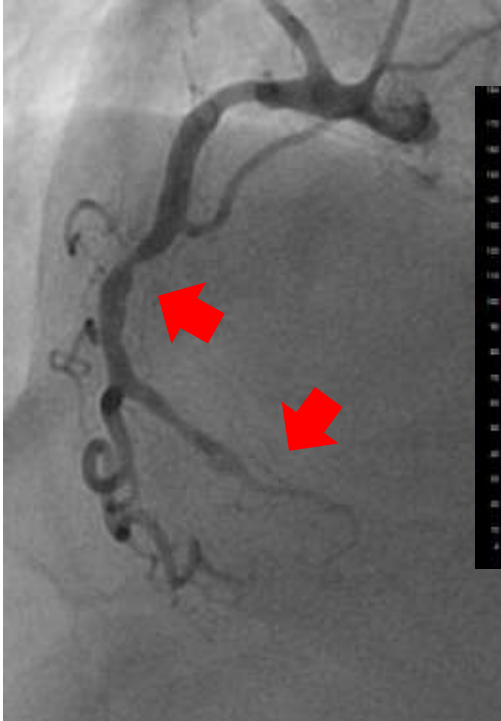
Non-inferior Design

As of October, 2017, approximately 900 patients enrolled

Functional lesion assessment in MVD

❖ Angiographic MVD is not always functional significant MVD. FFR can help to reveal the real status of MVD.

❖ FFR-guided recalculated "**Functional SYNTAX score (FSS)**" is a **combined anatomical and physiological scoring system** to assess the risk of patients with **MVD before and after PCI.**

❖ The **selection of target lesions**, the **method** for **revascularization**, and the **determination of prognosis** in patients with MVD can be **guided by FFR** in daily practice.
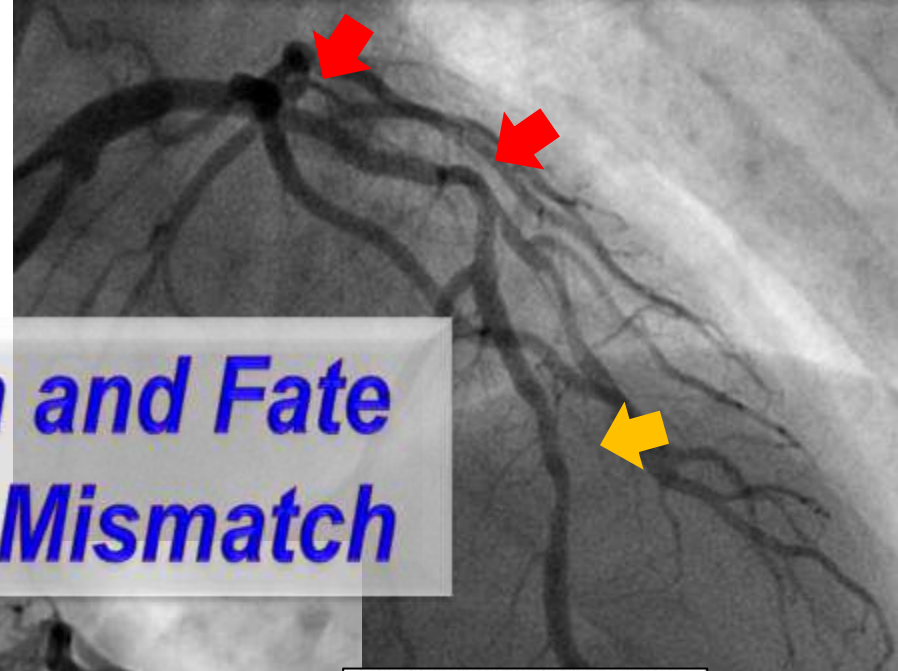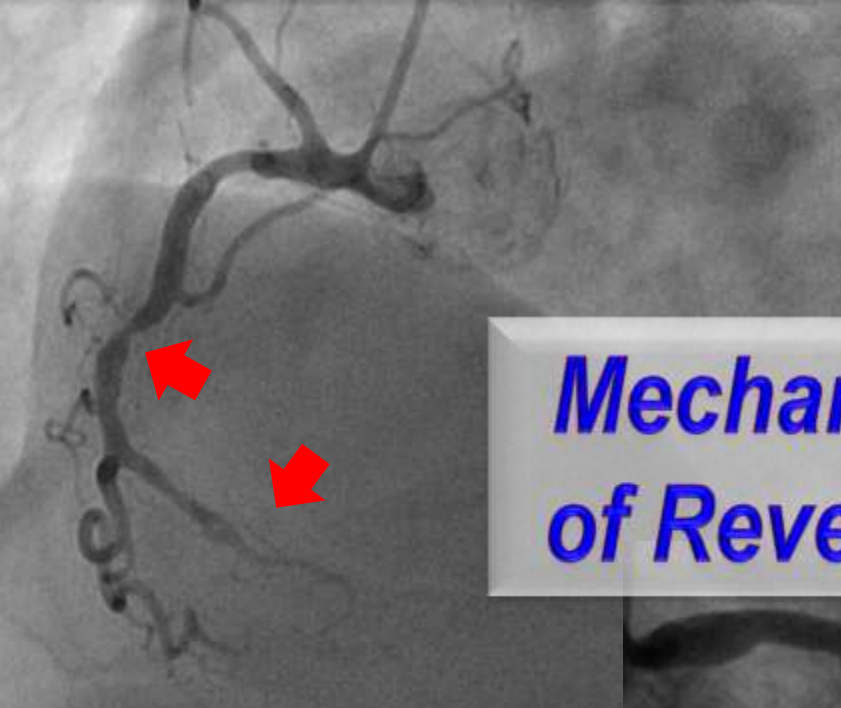
57YO/♂, Effort angina, TTE(+)

SYNTAX Score I

Lesion 1
(segment 2): 1x2= 2
Sub total lesion 1 2

Lesion 2
segment number(s)
(segment 3): 1x5= 5
Age T.O. is unknown 1
the first segment beyond the T.O. visualized by contrast: 16 0
+ sidebranch: Yes, all sidebranches <1.5mm 1
Sub total lesion 2 7

Lesion 3
(segment 12b): 1x2= 2
(segment 13): 0.5x2= 1
Bifurcation Type: Medina 1,1,1: 2
Sub total lesion 3 5

Lesion 4
(segment 8): 1x2= 2
Sub total lesion 4 2

TOTAL: 16

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Mechanism and Fate of Reverse Mismatch

SYNTAX Score I

Lesion 1
(segment 2): 1x2=   2
Sub total lesion 1   2

Lesion 2
segment number(s)
(segment 3): 1x5=   5
Age T.O. is unknown   1
the first segment beyond the T.O. visualized by contrast: 16   0
+ sidebranch: Yes, all sidebranches <1.5mm   1
Sub total lesion 2   7

Lesion 3
(segment 12b): 1x2=   2
(segment 13): 0.5x2=   1
Bifurcation Type: Medina 1,1,1:   2
Sub total lesion 3   5

Lesion 4
(segment 8): 1x2=   2
Sub total lesion 4   2

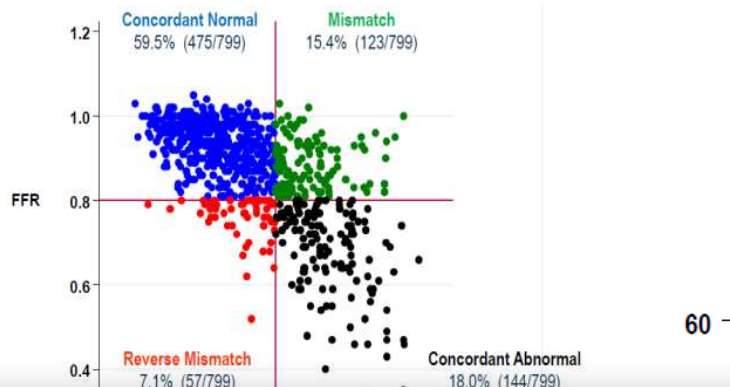**TOTAL:**   16

Functional SYNTAX score

Lesion 1
(segment 2): 1x2=   2
Sub total lesion 1   2

Lesion 2
segment number(s)
(segment 3): 1x5=   5
Age T.O. is unknown   1
the first segment beyond the T.O. visualized by contrast: 16   0
+ sidebranch: Yes, all sidebranches <1.5mm   1
Sub total lesion 2   7

Lesion 3
(segment 12b): 1x2=   2
(segment 13): 0.5x2=   1
Bifurcation Type: Medina 1,1,1:   2
Sub total lesion 3   5

Lesion 4
(segment 8): 1x2=   2
Sub total lesion 4   2

Lesion 5
(segment 6): 3.5x2=   7
(segment 7): 2.5x2=   5
Bifurcation Type: Medina 1,1,1:   2
Severe Tortuosity   2
Length >20 mm   1
Heavy calcification   2
Sub total lesion 5   19

TOTAL: 35

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Mechanism and Fate of Low FFR in Lesions without Angiographic Significant Stenosis
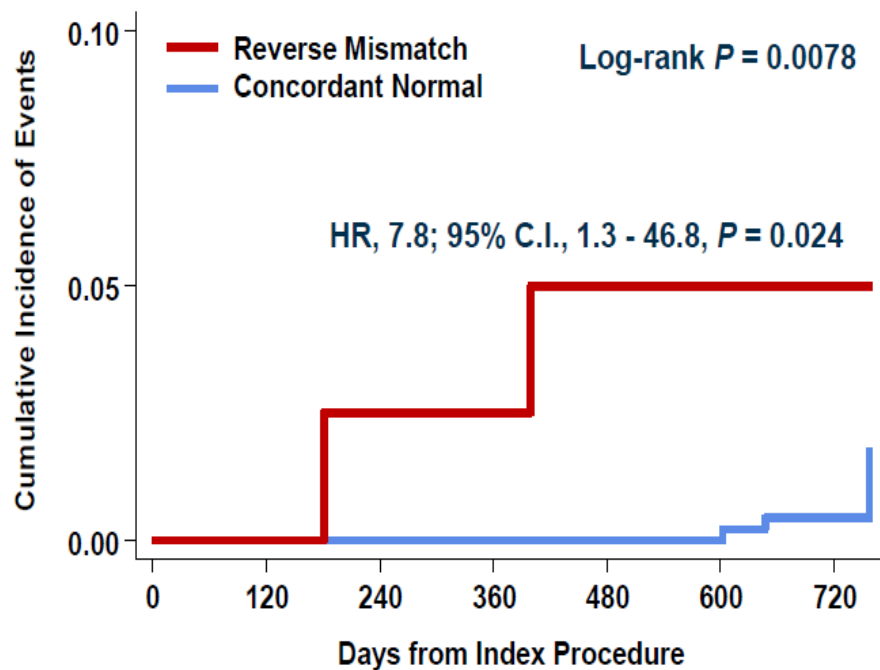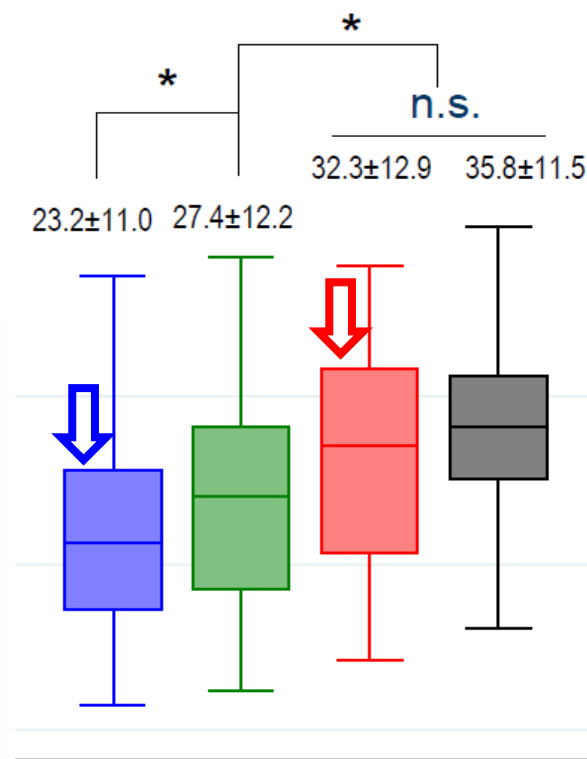
- **299 patients with 799 lesions from 3V FFR-FRIENDS study (1136 pts)**
- **CCTA< 90 days before CAG.**
- **2-year MACE was compared.**

Modified from presentation slides at TCT 2017, from Dr Park JH & Koo BK
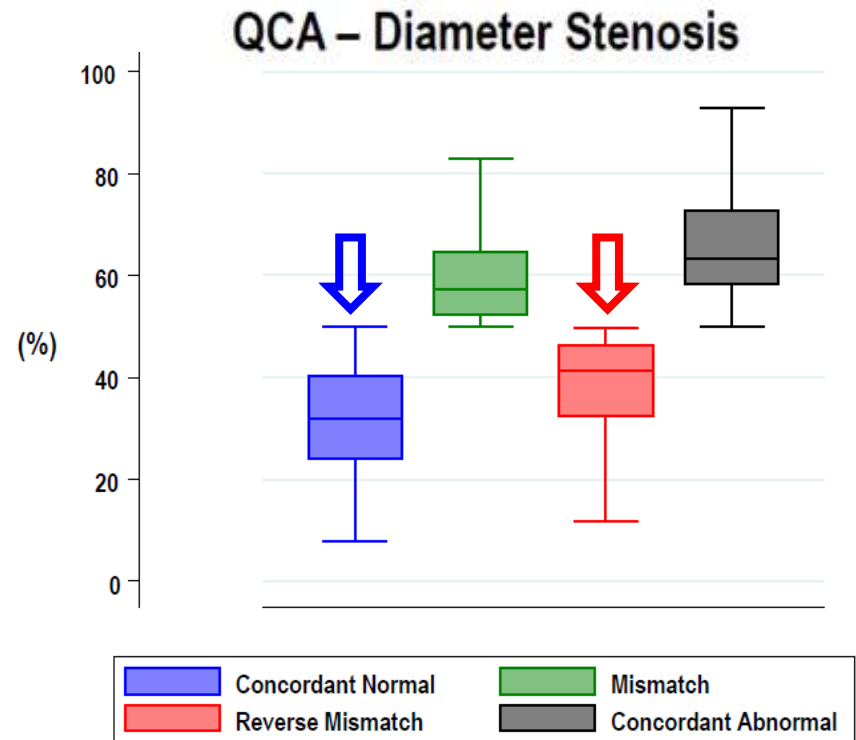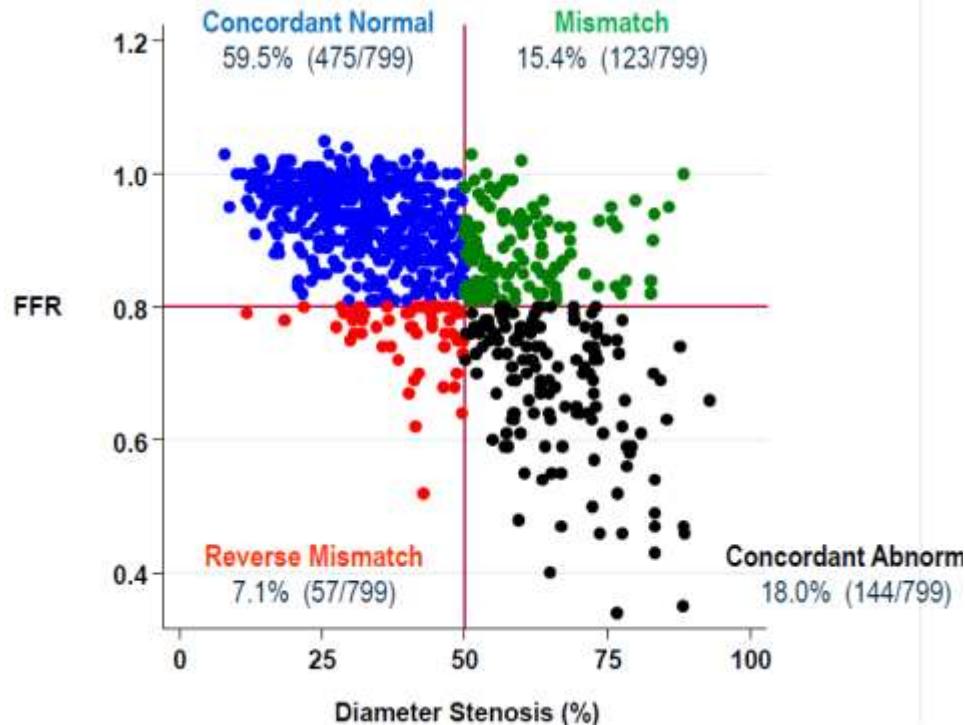
Mechanism and Fate of Low FFR in Lesions without Angiographic Significant Stenosis

PlaqueBurden$_{avg}$ (%)

Keimyung University, Korea

Modified from presentation slides at TCT 2017, from Dr Park JH & Koo BK

Functional lesion assessment in MVD

❖ Angiographic MVD is not always functional significant MVD. **FFR** can help to reveal the **real status of MVD**.

❖ FFR-guided recalculated "**Functional SYNTAX score (FSS)**" is a **combined anatomical and physiological scoring system** to assess the risk of patients with MVD before and after PCI.

❖ The **selection of target lesions**, the **method for revascularization**, and the **determination of prognosis** in patients with MVD can be guided by FFR in daily practice.

❖ **The reverse mismatched lesions** confirmed by **FFR** would be very important in **determining the treatment strategy or prognosis** of the patient with MVD.

Functional lesion assessment in MVD...

Physiology can increase the

depth of our **understanding**

and **decision making** about **MVD**

before, during, and **after PCI**

Functional Lesion Assessment in Multivessel CAD and FAME 3

NAM, Chang-Wook MD PhD

Keimyung University Dongsan Hospital, Daegu, Korea