



Physiology Guided MVD PCI

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Multivessel Disease Definition

- **Luminal stenosis of at least 70% in at least two major coronary arteries or in one coronary artery in addition to a 50% or greater stenosis of the left main trunk.**
- **Multivessel coronary artery disease is defined by the presence of ≥ 50 % diameter stenosis of two or more epicardial coronary arteries**

Brief case summary

- **Male / 76**
- **C/C: Dyspnea**
- **PHx : DM/ESRD – maintenance HD**
- **Current smoker(+)**
- **Troponin-T: 2210 pg/ml** **CK-MB: 3.21 ng/ml**

CASE



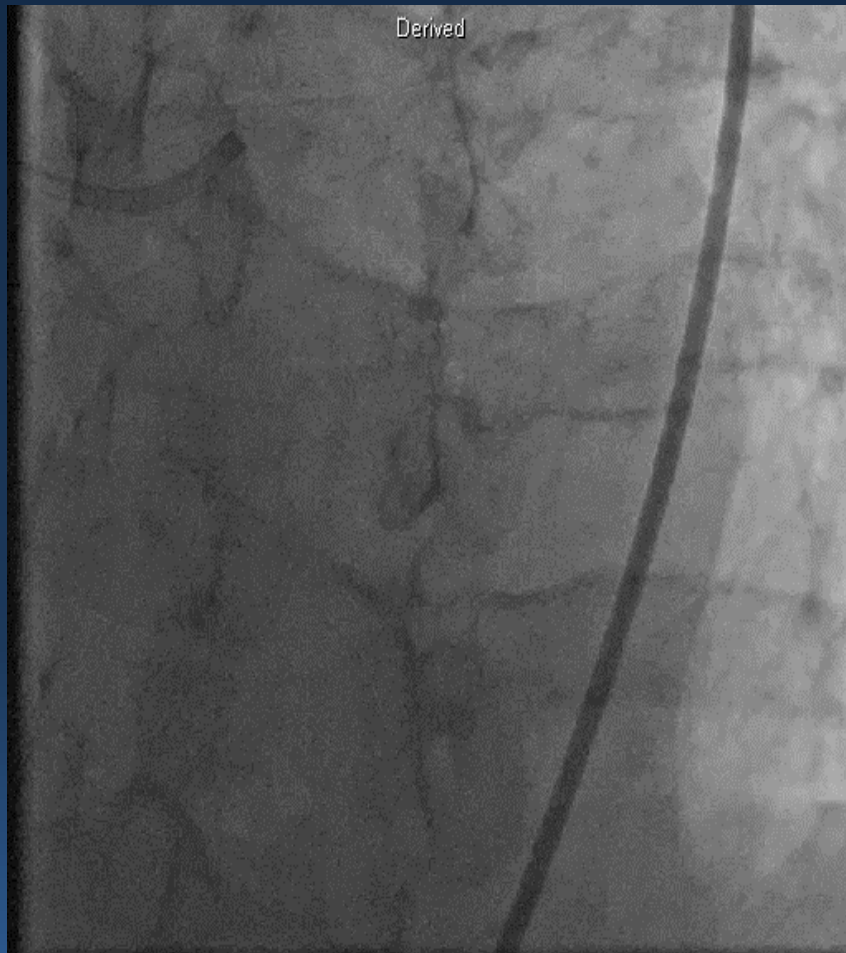
RCA near total occlusion



Ultimaster 3.0/28+2.75/28

CASE

Intermediate lesion on mLAD, D1, pLCX



Multivessel Disease Treatment..

Complete
Revascularization?

V S

Culprit Only?

Complete vs Culprit Only?

2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation

Non-IRA strategy

Routine revascularization of non-IRA lesions should be considered in STEMI patients with multivessel disease before hospital discharge.^{167–173}

IIa

A

Complete vs Culprit Only?



ESC

European Society
of Cardiology

European Heart Journal (2020) 00, 1–79
doi:10.1093/eurheartj/ehaa575

ESC GUIDELINES

2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation

Complete revascularization should be considered in NSTEMI-ACS patients without CS and with multi-vessel CAD.

IIa

C

Complete Revascularization vs Culprit Only?

Complete Revascularization



MVD Revascularization Strategy

➤ Angiography

- % diameter stenosis

➤ Physiology study

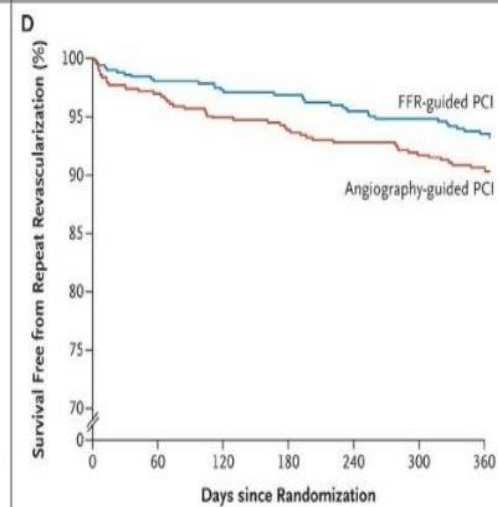
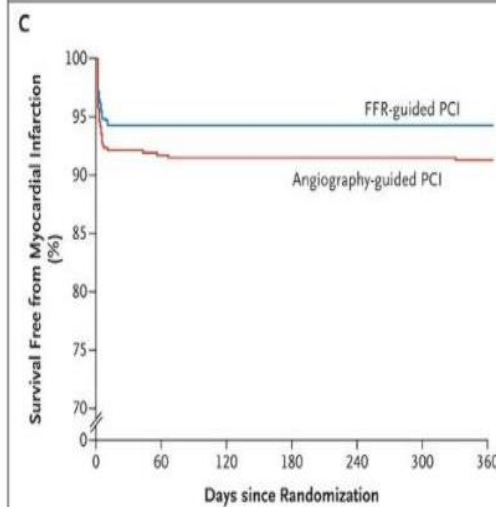
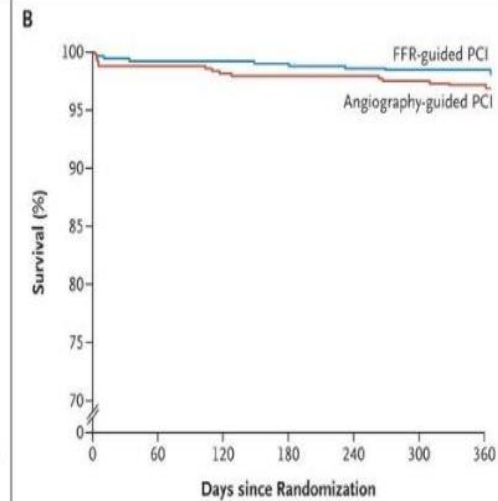
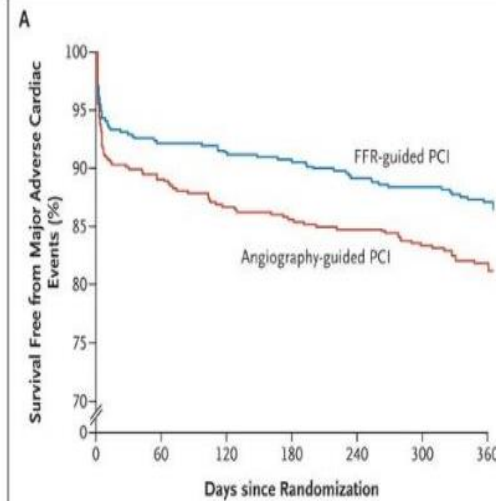
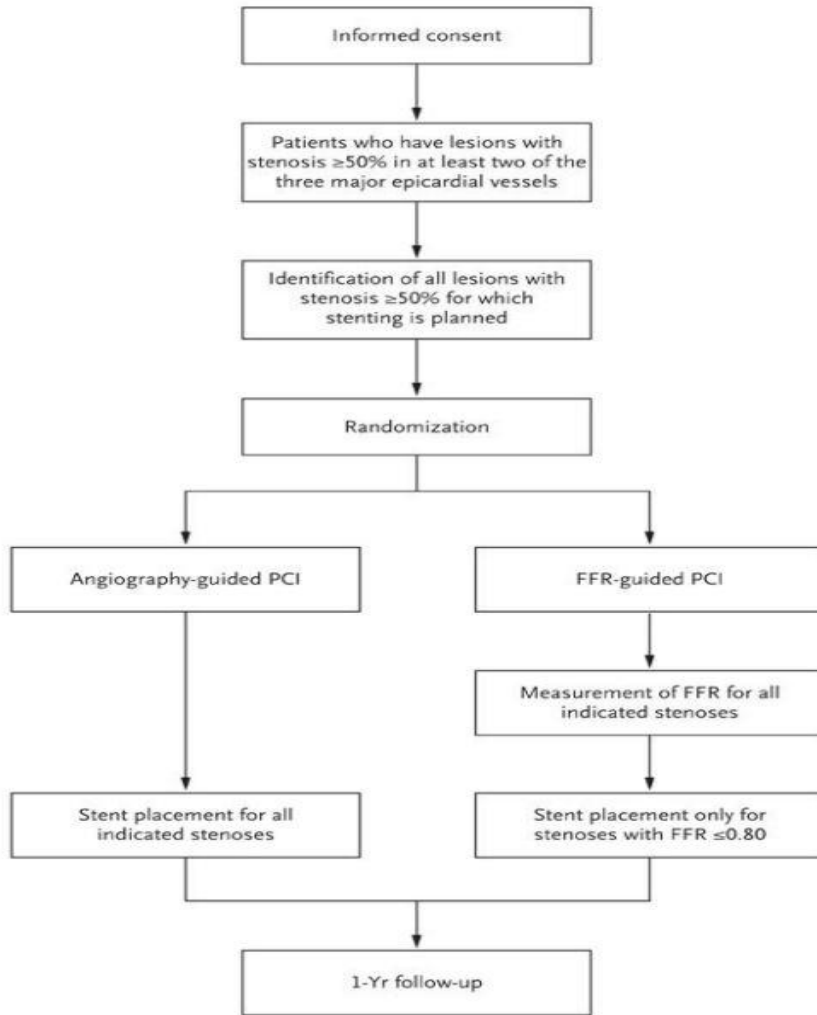
- Functional severity

➤ Imaging study

- Vulnerability

Benefit of physiology guided PCI for MVD

➤ FAME trial (FFR vs. Angiography)



Benefit of physiology guided PCI for MVD

➤ FFR vs. IVUS

Outcomes of Percutaneous Coronary Intervention in Intermediate Coronary Artery Disease

Fractional Flow Reserve-Guided Versus Intravascular Ultrasound-Guided

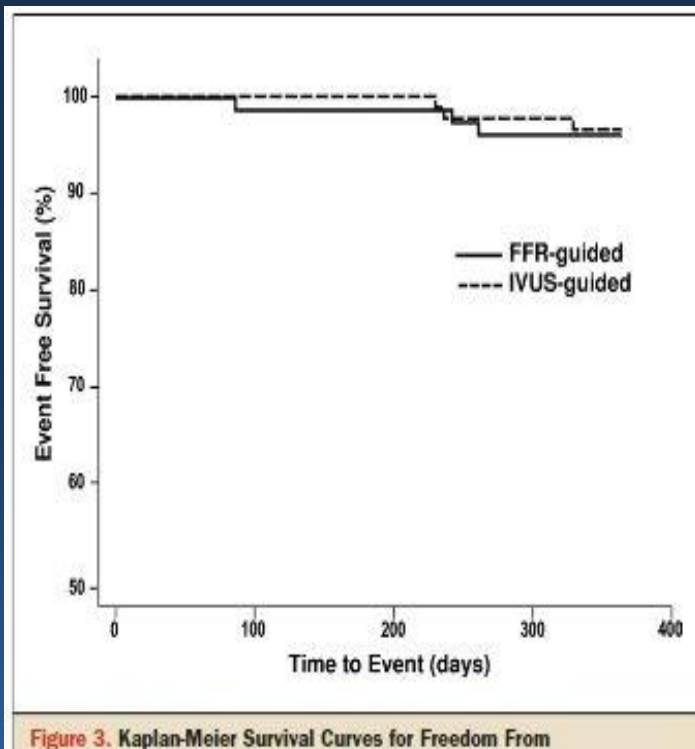


Figure 3. Kaplan-Meier Survival Curves for Freedom From

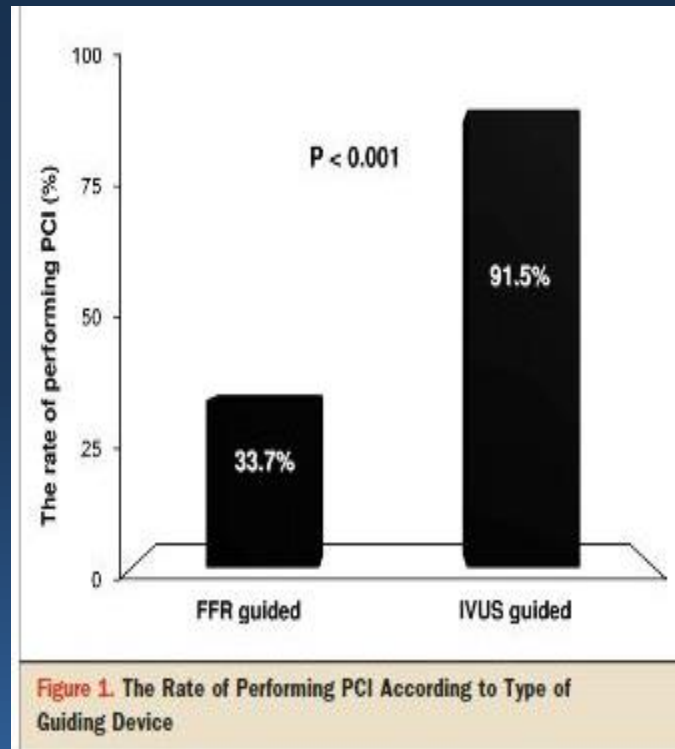


Figure 1. The Rate of Performing PCI According to Type of Guiding Device

Benefit of physiology guided PCI for MVD

➤ 3V FFR-FRIENDS study

3V FFR-FRIENDS study (2011.12~2014.03)

1157 Patients with >30% stenosis in all 3-vessel

Patients excluded (N=21)

- No FFR measurement in any vessel (N=13)
- Planned bypass surgery (N=1)
- Patient withdrawal (N=1)
- Failure to achieve reliable FFR tracing (N=6)

Vessels excluded

- No FFR measurement due to small vessel (N=112)

1136 Patients with 3298 Vessels
(Including 572 vessels with Post-stent FFR)

Stratified by Median Value of Total Sum of 3V-FFR
(Median value: 2.72)

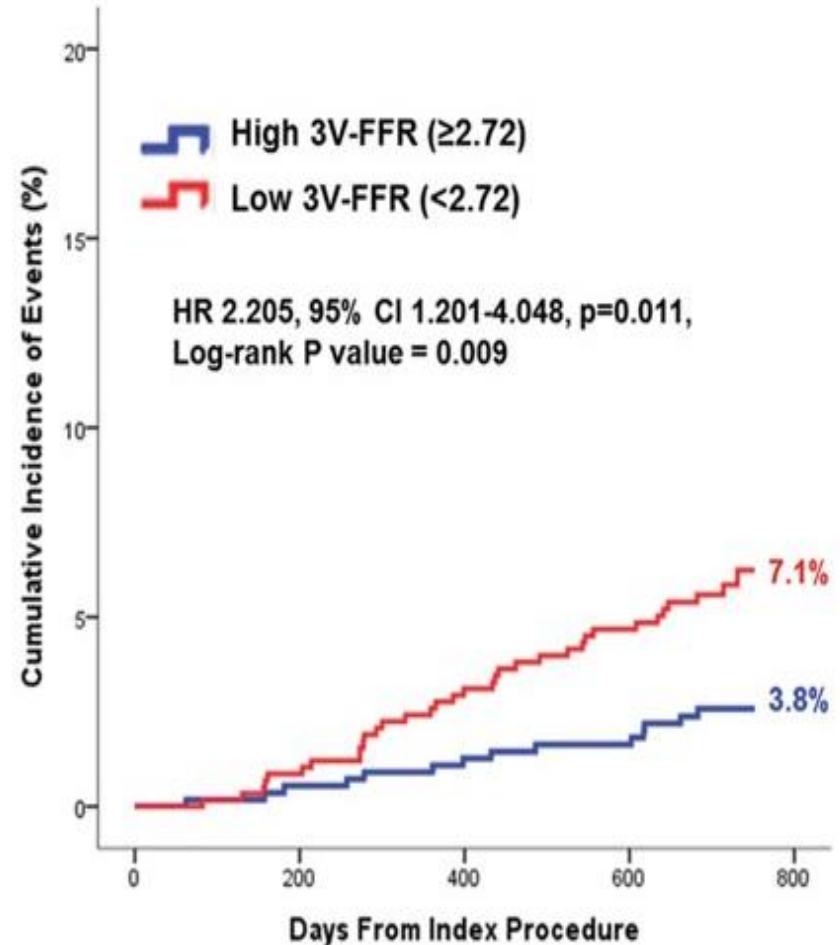
High 3V-FFR group
555 Patients

Low 3V-FFR group
581 Patients

2 Years Follow-Up

Primary Endpoint : Major Adverse Cardiac Events

(Composite of Cardiac death, Non-fatal MI, Ischemia-driven revascularization)



Benefit of physiology guided PCI for MVD

2018 ESC guideline for myocardial revascularization

Recommendations on functional testing and intravascular imaging for lesion assessment

Recommendations	Class ^a	Level ^b
When evidence of ischaemia is not available, FFR or iwFR are recommended to assess the haemodynamic relevance of intermediate-grade stenosis. ^{15,17,18,39}	I	A
FFR-guided PCI should be considered in patients with multivessel disease undergoing PCI. ^{29,31}	IIa	B
IVUS should be considered to assess the severity of unprotected left main lesions. ^{35–37}	IIa	B

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FFR = fractional flow reserve; iwFR = instantaneous wave-free ratio; IVUS = intravascular ultrasound; PCI = percutaneous coronary intervention.

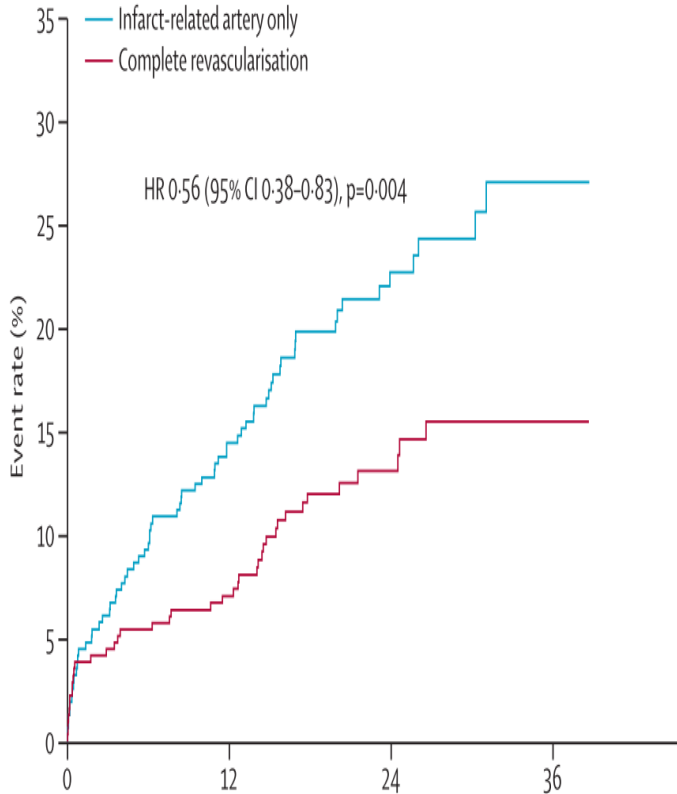
^aClass of recommendation.

^bLevel of evidence.

➤ Most evidence “Stable Angina”

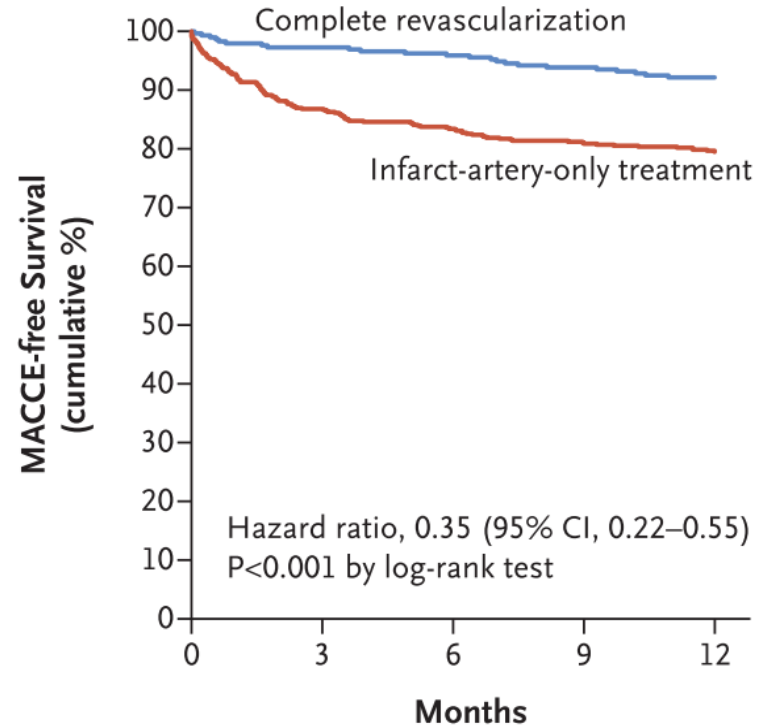
Benefit of physiology guided PCI for MVD

DANAMI3-PRIMULTI trial



Number at risk		Follow-up (months)			
		0	12	24	36
Infarct-related artery only	313	271	142	53	
Complete revascularisation	314	291	159	55	

COMPARE-ACUTE trial



No. at Risk	0	3	6	9	12
Complete revascularization	295	286	281	264	215
Infarct artery	590	512	492	457	371

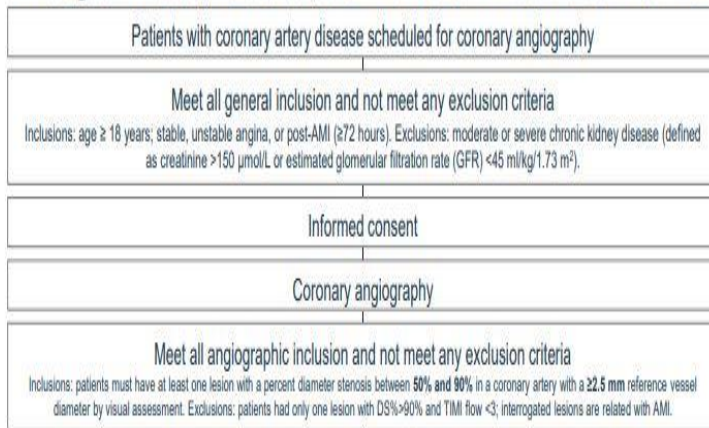


Benefit of physiology guided PCI for MVD

FAVOR III China(QFR vs. Angiography)

Study Design

Investigator-Initiated, Multicenter, Sham-Controlled Blinded Randomized Trial



Randomization Stratifications

- Diabetes Mellitus
- Multivessel Disease
- Presence of any vessel with DS% $>$ 90% and TIMI flow $<$ 3
- Center

Identify target vessels intended to be treated with standard angiography guidance

N=3830 (1:1 randomization)

QFR-guided strategy
N=1915

Angiography-guided strategy
N=1915

Independent Organizations

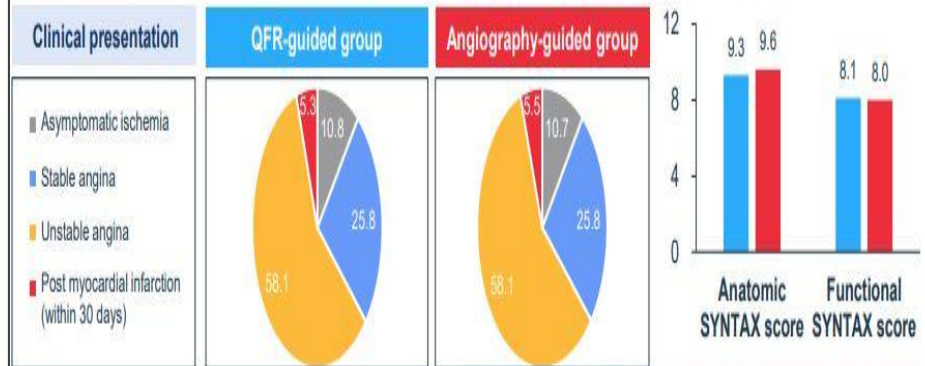
- Core Lab
- CEC
- DSMB
- Data Management
- Statistical Analysis

QFR was measured in all coronary arteries containing any lesion with visually-assessed DS% \geq 50% and \leq 90% and RVD \geq 2.5 mm

- QFR \leq 0.80: PCI
- QFR $>$ 0.80: deferral
- All measured vessel QFR $>$ 0.80: OMT alone

PCI was performed based on visual angiographic assessment per local standard of practice

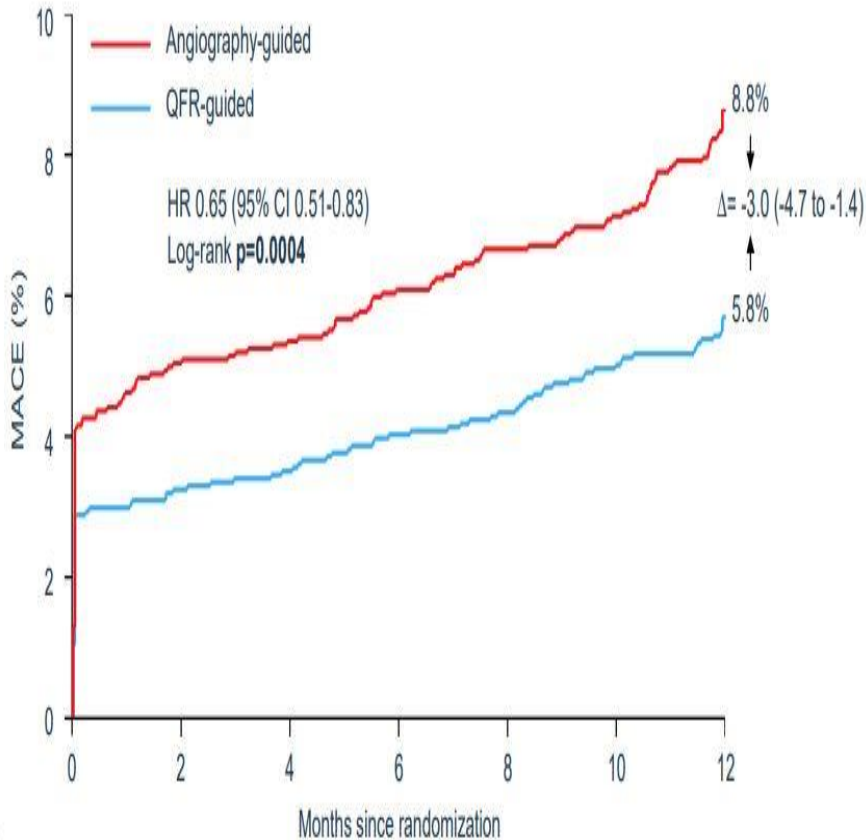
Baseline Characteristics (ii)



	QFR-guided group (N=1913)	Angiography-guided group (N=1912)
Estimated glomerular filtration rate, ml/min/1.73m ²	70.3 (58.4, 83.4)	70.0 (58.0, 83.9)
Left ventricular ejection fraction, %	63.0 (61.0, 66.0)	63.0 (60.0, 66.0)
Multivessel disease	53.5%	54.6%
Any vessel with one or more lesions with diameter stenosis $>$ 90% and TIMI flow $<$ 3	8.9%	9.5%

Benefit of physiology guided PCI for MVD

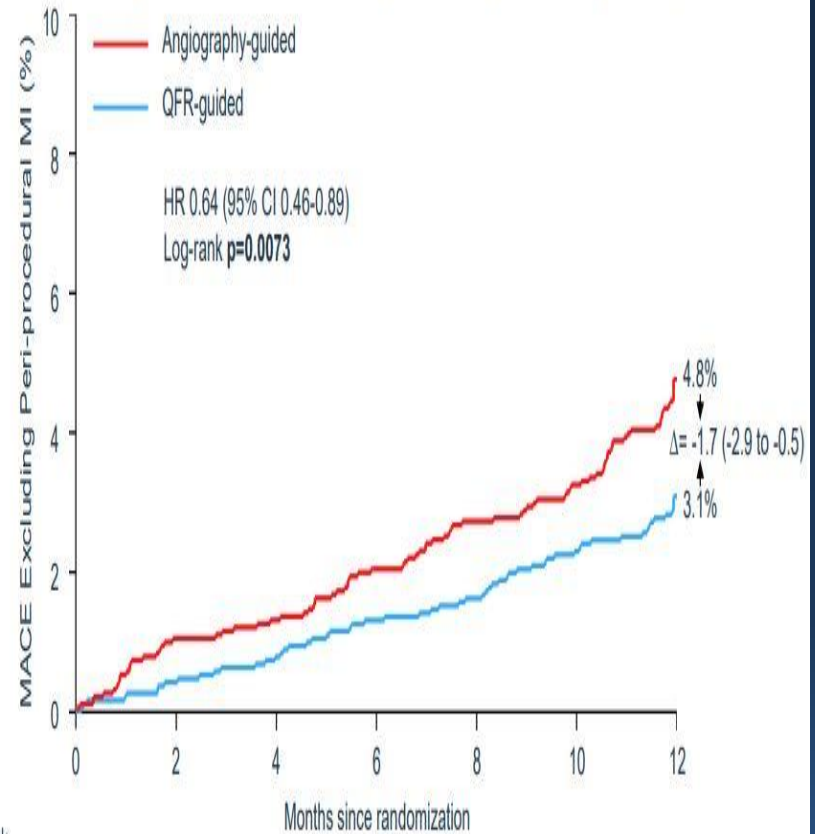
Primary Endpoint



No. at risk

	0	2	4	6	8	10	12
QFR-guided	1913	1845	1840	1828	1821	1809	1795
Angiography-guided	1912	1804	1798	1783	1770	1762	1732

Major Secondary Endpoint



No. at risk

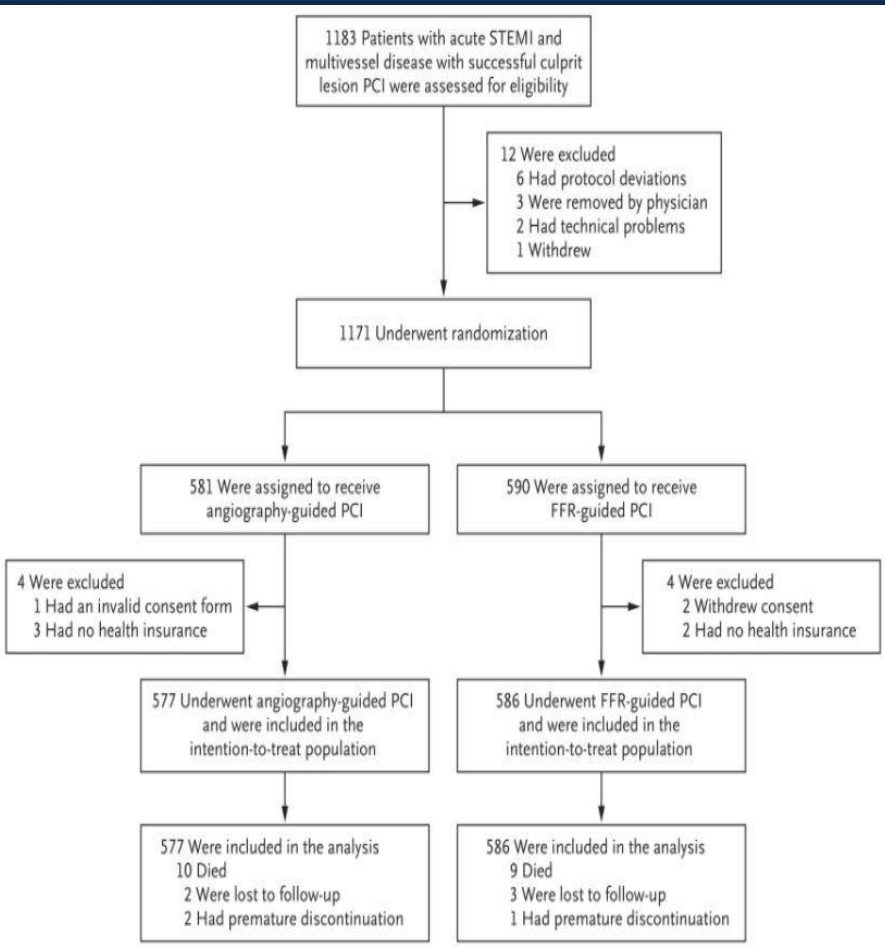
	0	2	4	6	8	10	12
QFR-guided	1913	1900	1894	1881	1874	1862	1846
Angiography-guided	1912	1883	1877	1862	1847	1839	1808

Benefit of physiology guided PCI for MVD

Physiology guided PCI for MVD



Flower-MI trial



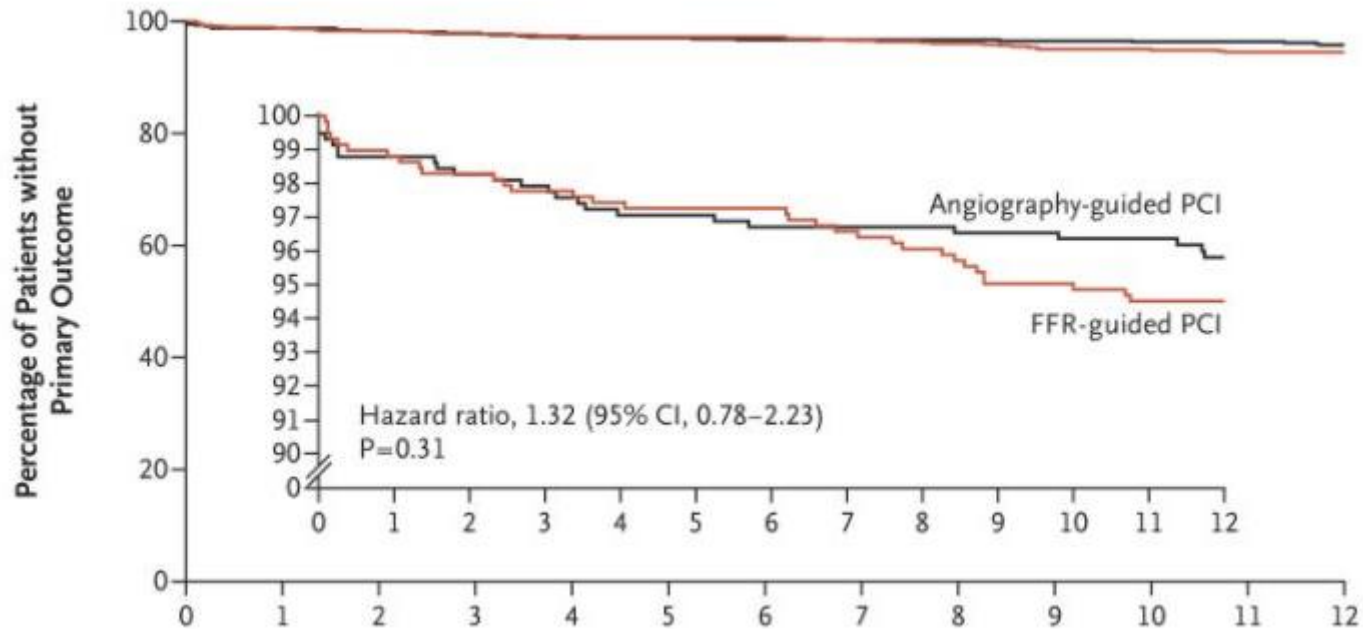
FFR-Guided Revascularization
- Measured FFR in all lesion with stenosis >50% on visual estimation.

Angiography Guided Revascularization
- >50% stenosis by visual estimation

Both Group
- CR during the index procedure was encouraged

primary outcome was a composite of death from any cause, nonfatal myocardial infarction, or unplanned hospitalization leading to urgent revascularization at 1 year.

Flower-MI trial



CONCLUSIONS

In patients with STEMI undergoing complete revascularization, an FFR-guided strategy did not have a significant benefit over an angiography-guided strategy with respect to the risk of death, myocardial infarction, or urgent revascularization at 1 year. However, given the wide confidence intervals for the estimate of effect, the findings do not allow for a conclusive interpretation. (Funded by the French Ministry of Health and Abbott; FLOWER-MI ClinicalTrials.gov number, NCT02943954.)

Discussion

– Lower rate of PCI

(FFR vs. Angiography, 66.2% vs. 97.1%)

But, High peri-procedural MI(1.2% vs. 0.3%)

– Non-IRA TIMI 3 flow

Post-procedure TIMI flow (0-3) – no. (%)	FFR	Angiography
0	5/980 (0.5)	0/891 (0)
1	3/980 (0.3)	4/891 (0.5)
2	7/980 (0.7)	3/891 (0.3)
3	686/980 (70.0)	827/891 (92.8)
Missing	279/980 (28.5)	57/891 (6.4)

Discussion

Result

	FFR	Angiography
	Patients with PCI (≥ 1)	Patients without PCI
	(n=388)	(n=198)
• MACE	16/388 (4.1)	16/198 (8.1)
• All-cause mortality	6/388 (1.6)	3/188 (1.5)
• Myocardial infarction	7/388 (1.8)	11/198 (5.6)
• Urgent revascularization	7/388 (1.8)	8/198 (4.0)

Cardiac death 0.3% vs. 1.2%

• FFR-guided PCI:

Center	Days*	Age	Sex	Cause of death
29	5	61.5	Male	Sudden death at home
30	6	73.7	Male	Cardiogenic shock (stent thrombosis)
34	83	75.8	Female	Post trauma hemorrhage
37	95	77.3	Male	Cancer
39	179	84.8	Male	End-stage renal disease
46	220	90.2	Female	Acute pancreatitis
11	251	53.4	Male	Cancer
18	257	60.3	Male	Cancer
51	347	88.1	Female	Ischemic stroke

• Angio-guided PCI group:

Center	Days*	Age	Sex	Cause of death
11	3	52.9	Male	Sudden death at home
1	12	80.4	Female	Sudden death
1	34	57.5	Male	Acute respiratory distress syndrome (infectious)
29	47	58.5	Male	Sudden death at home
29	56	79.9	Male	Sudden death at home
1	106	70.9	Male	Sudden death
34	162	68.2	Male	Mesenteric ischemia
50	240	86.6	Male	Sudden death
27	265	71.7	Male	Cardiogenic shock
41	300	71.5	Male	Infection post non-cardiovascular surgery

Benefit of physiology guided PCI for MVD

Physiology guided PCI for MVD



Benefit of physiology guided PCI for MVD


Physiology guided PCI for MVD



Angiography guided PCI for MVD

Ongoing trial


FFR Versus Angiography-Guided Strategy for Management of AMI With Multivessel Disease (FRAME-AMI)


The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it  has been evaluated by the U.S. Federal Government. [Know the risks and potential benefits](#) of clinical studies and talk to your health care provider before participating. Read our [disclaimer](#) for details.

Sponsor:

Samsung Medical Center

ClinicalTrials.gov Identifier: NCT02715518


[Recruitment Status](#)  : Recruiting

[First Posted](#)  : March 22, 2016

[Last Update Posted](#)  : September 16, 2021

See [Contacts and Locations](#)


Timing of FFR-guided PCI for Non-IRA in STEMI and MVD (OPTION-STEMI)


The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it  has been evaluated by the U.S. Federal Government. [Know the risks and potential benefits](#) of clinical studies and talk to your health care provider before participating. Read our [disclaimer](#) for details.

Sponsor:

Chonnam National University Hospital

ClinicalTrials.gov Identifier: NCT04626882

[Recruitment Status](#)  : Recruiting

[First Posted](#)  : November 13, 2020

[Last Update Posted](#)  : March 9, 2022

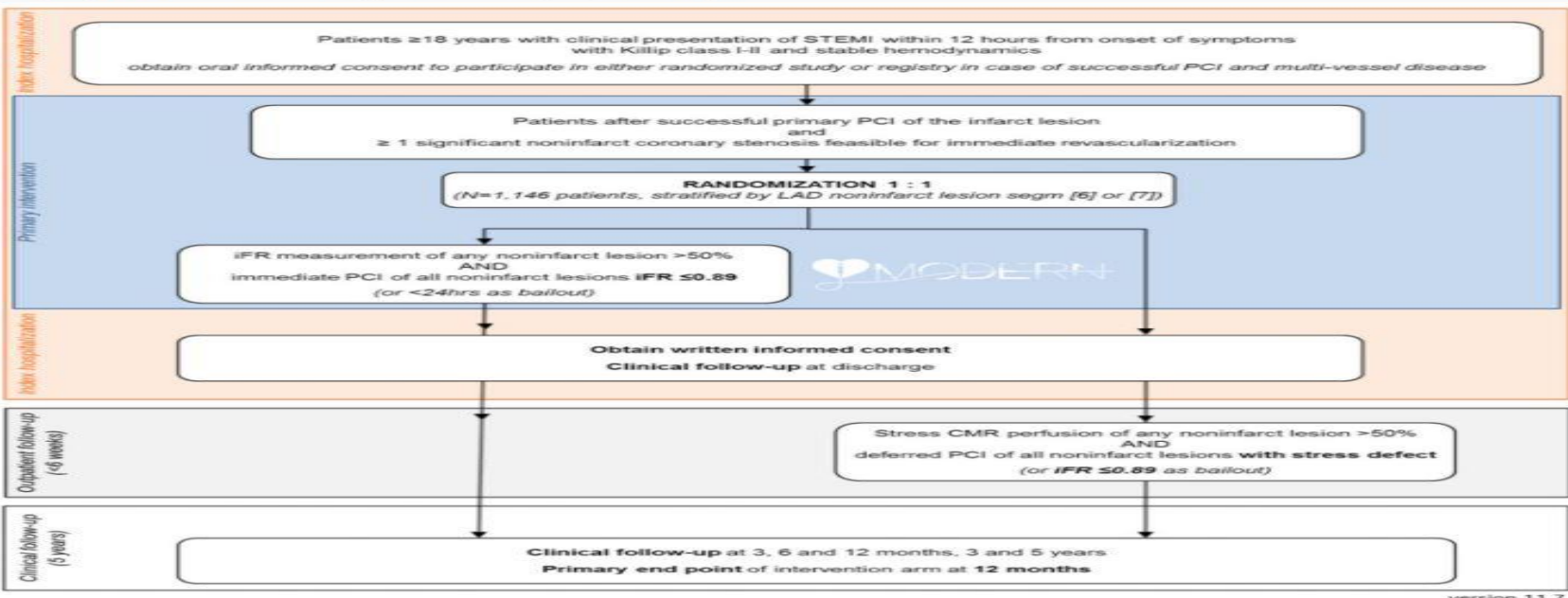
See [Contacts and Locations](#)

Benefit of physiology guided PCI for MVD

iFR Guided multivessel PCI

Instantaneous wave-free ratio guided multivessel revascularisation during percutaneous coronary intervention for acute myocardial infarction: Study protocol of the **randomised controlled iMODERN trial**

Casper W. H. Beijnink, Troels Thim, D. Irk Jan van der Heijden, Igor Klem, Rasha Al-Lamee, Jacqueline L. Vos, Yvonne Koop, Marcel G. W. Dijkgraaf, Marcel A. M. Beijk, Raymond J. Kim, Justin Davies, Luis Raposo, S. rgio B. Baptista, Javier Escaned, Jan J. Piek, Michael Maeng, Niels van Royen, Robin Nijveldt

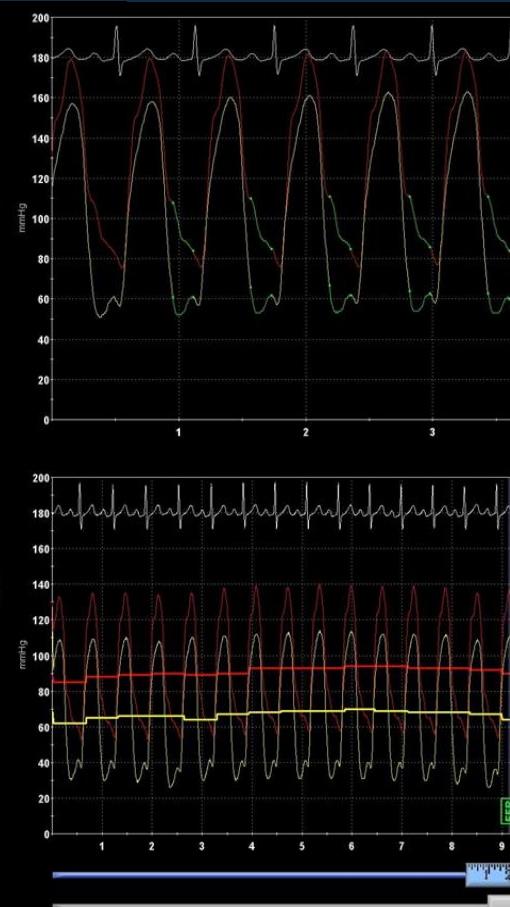
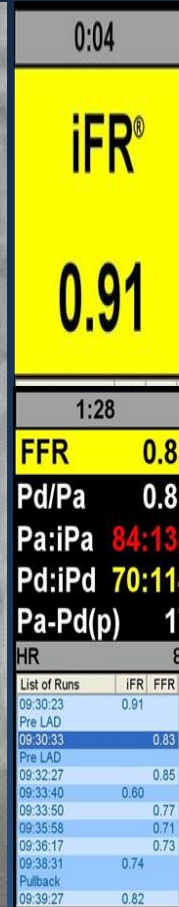


CASE – Physiologic evaluation

➤ mLAD

➤ D1

Derived



CASE – Physiologic evaluation



0:04

iFR[®]
0.92

1:45

FFR 0.90

Pd/Pa 0.90

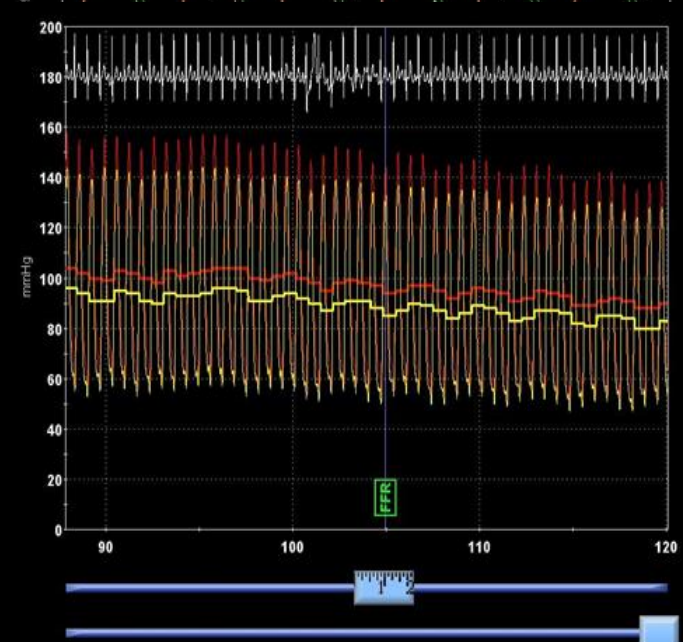
Pa:iPa 94:143

Pd:iPd 85:132

Pa-Pd(p) 12

HR 89

List of Runs	iFR	FFR
Pre Diagonal		
09:36:17		0.73
Pullback Diagonal		
09:38:31	0.74	
Pullback Diagonal		
09:39:27		0.82
Pullback		
09:43:09	0.94	
09:43:20	0.92	
Pre LCX		
09:43:31	0.90	
Pre LCX		



Benefit of physiology guided PCI for MVD

➤ Final CAG after PCI on D1



Angiography : 2VD with 3 target lesion for PCI



FFR: 1VD with 1 target lesion for PCI

iFR : 1VD with 1 target lesion for PCI

If, No significant difference between...

-> Save PCI, Save Cost..

Why not?

THANK YOU FOR YOUR ATTENTION

