JCR 2019 Day 3: Deep Dive Into the Post-PCI Coronary Physiology

Influence of Target-Vessel and Relative Increase of FFR on Prognostic Relevance after Coronary Stenting

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Physiologic gain after PCI with DES

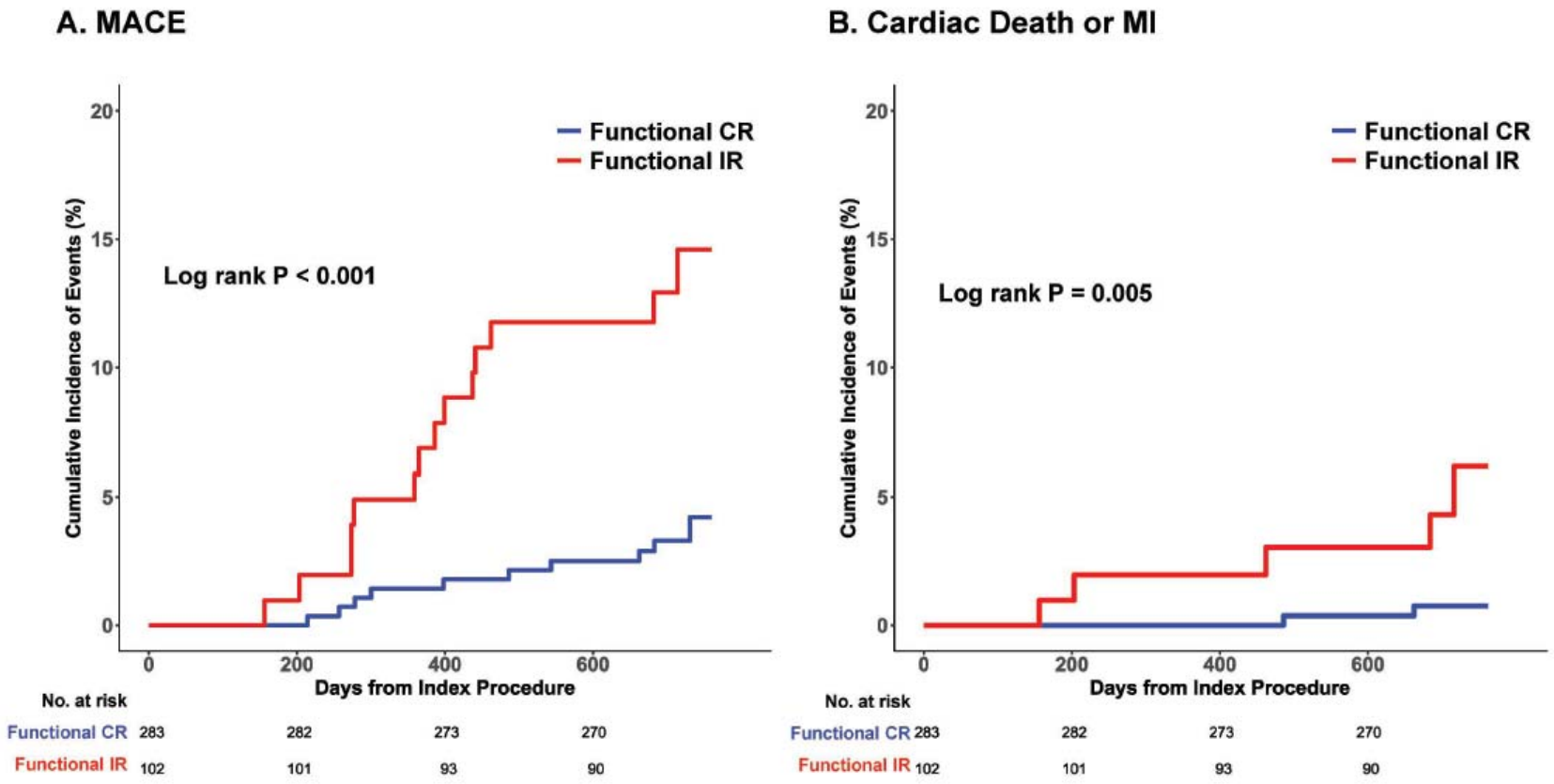
- Reduce pressure gradient across stenotic portion
- Restore blood flow to the myocardium
- Relieve inducible ischemia of the myocardium

Why do we measure physiologic gain after PCI with DES?

- Reduce pressure gradient across stenotic portion
- Restore blood flow to the myocardium
- Relieve inducible ischemia of the myocardium
- Confirm enough physiologic gain and optimization that may be associated with better clinical outcome
- Address residual physiologic burden

Physiologic gain of DES PCI: Impact on clinical outcome

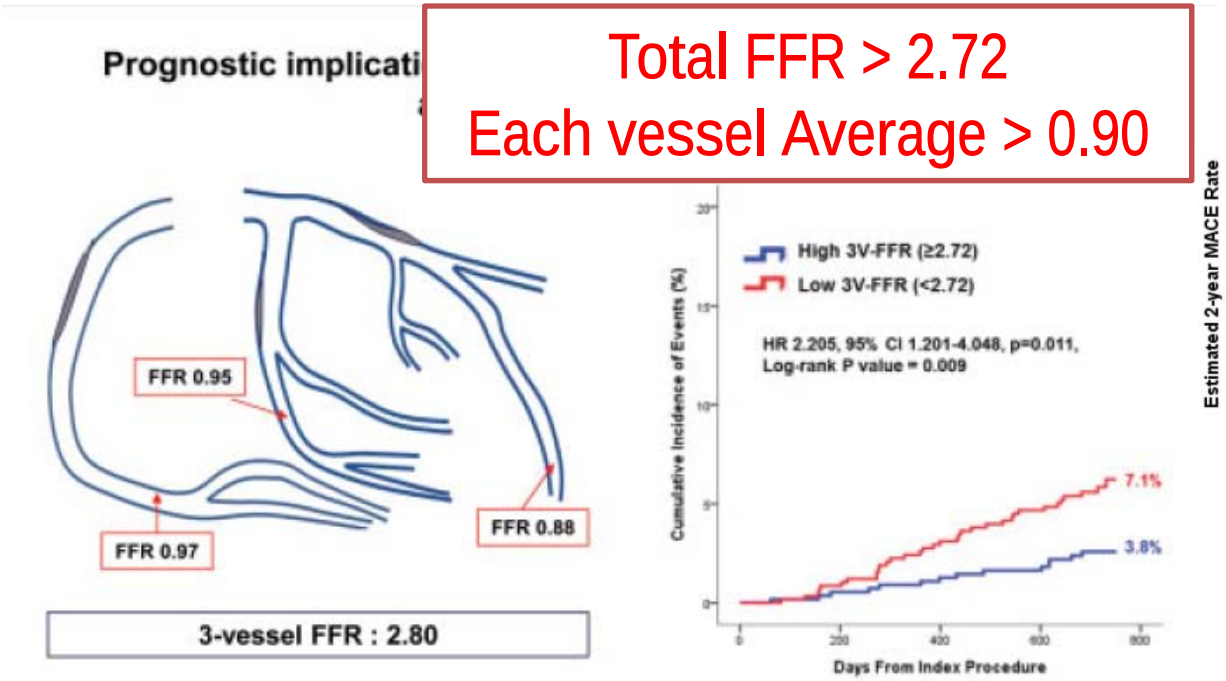
Functional complete revascularization by physiologic FFR confirmation may be associated with better clinical outcome



Choi KH, Lee JM, Koo BK, Nam CW, Shin ES, Doh JH et al, JACC interv 2018

Total residual physiologic burden impact on the clinical outcome: including post-PCI FFR -3V FFR FRIENDS study-

Total FFR > 2.72
Each vessel Average > 0.90



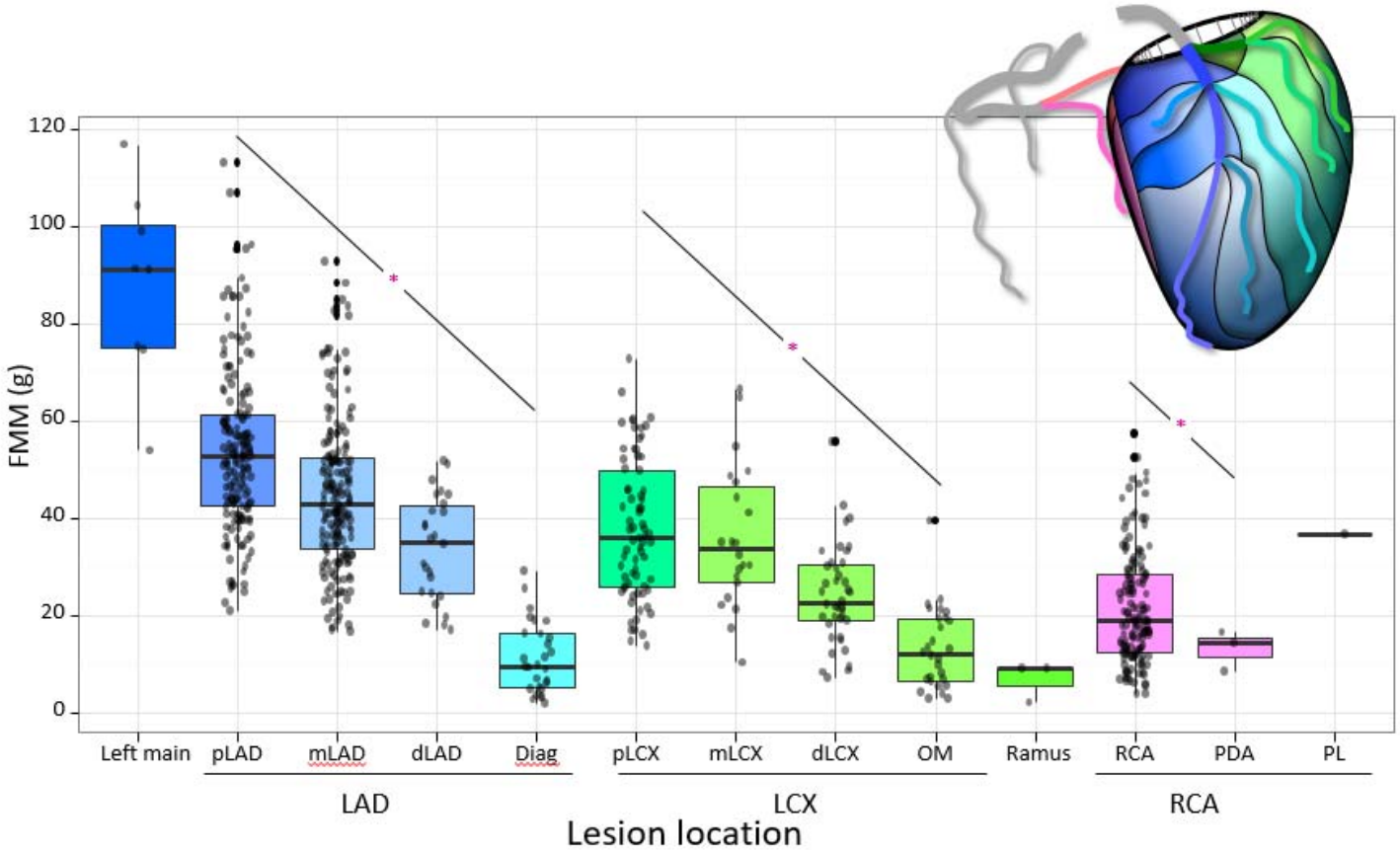
	High 3V-FFR ≥ 2.72 (n = 555)	Low 3V-FFR < 2.72 (n = 581)	HR (95% CI)	P-value
Major adverse cardiac events[a]	15 (3.8%)	34 (7.1%)	2.205 (1.201–4.048)	0.009
Cardiac death	5 (1.3%)	5 (0.9%)	0.967 (0.280–3.341)	0.958
Myocardial infarction	5 (1.3%)	7 (1.8%)	1.371 (0.435–4.319)	0.590
Ischaemia-driven revascularization	11 (2.7%)	29 (6.2%)	2.568 (1.283–5.140)	0.008

Lee JM, Koo BK, Shin ES, Nam CW, Doh JH et al, EHJ 2018

Physiologic gain of DES PCI: Same clinical value upon artery?

Novel CT-derived physiologic parameter: fractional myocardial mass (FMM)

CT derived calculation of amount of subtended myocardial mass demonstrated larger amount of myocardium in LAD territory

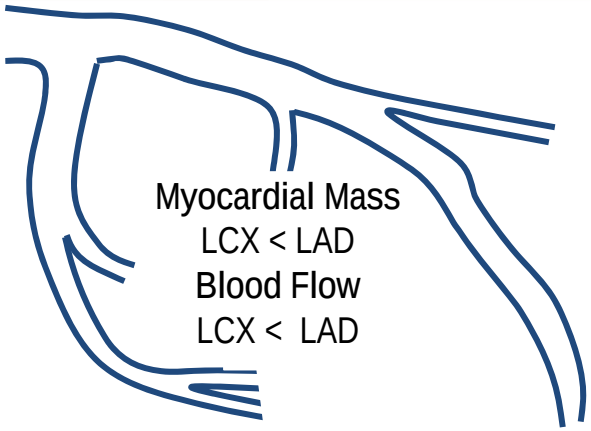


Kim HY, Choi JH, Doh JH, JACC Interv 2016

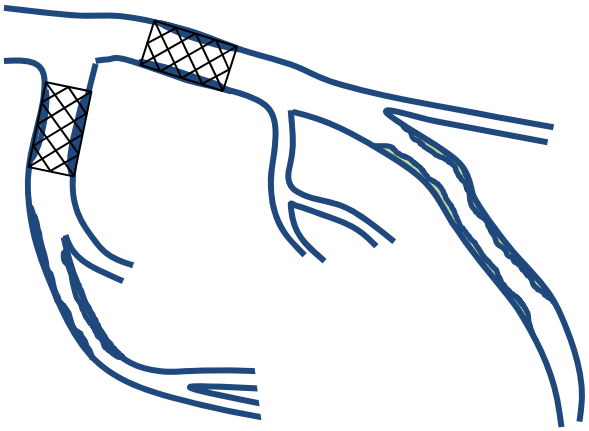
Same lumen gain, different physiologic gain

Normal Coronary Artery

After stent implantation



FFR 1.0 FFR 1.0



FFR 0.92 FFR 0.85

According to the target vessel,

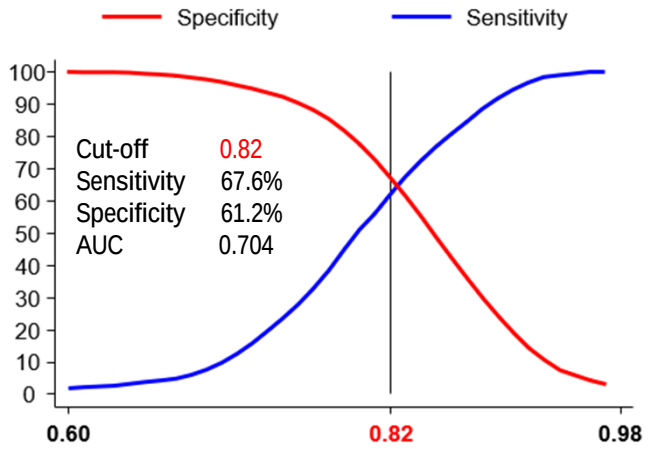
1. Different distribution patterns of post-PCI FFR
2. Different associations between post-PCI FFR and clinical outcomes

LAD territory myocardium may require more blood flow than non-LAD with given size of coronary artery

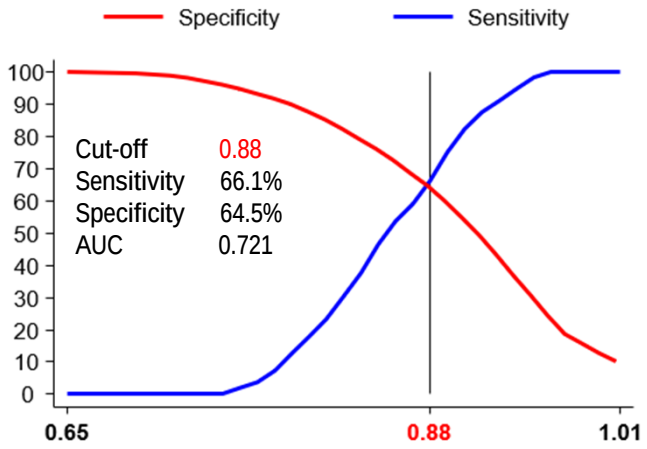
Hwang DW, Lee JM, .., Nam CW, Shin ES, Doh JH, Koo BK. Eurointervention 2018

Post-PCI FFR cut-off and outcome: LAD vs. Non-LAD

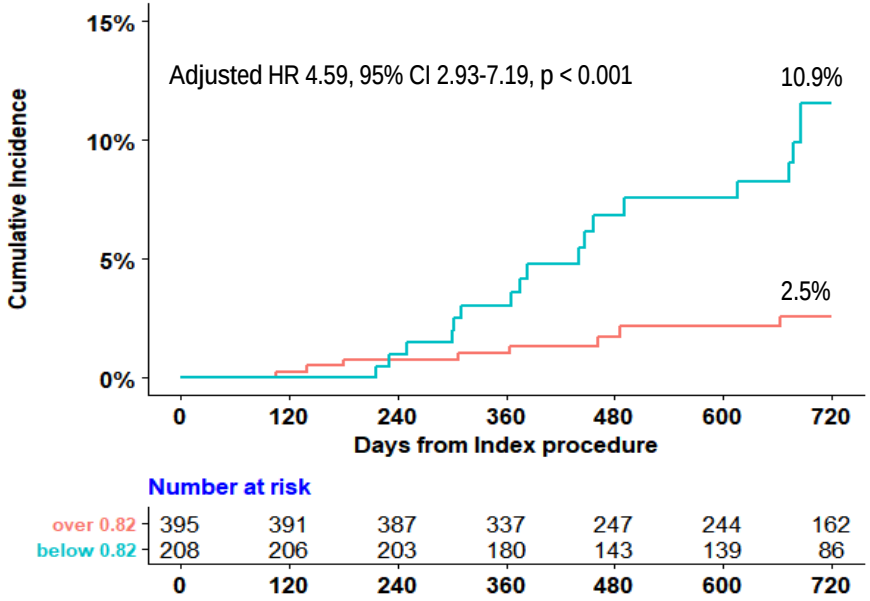
Cut-off value for predicting TVF in LAD



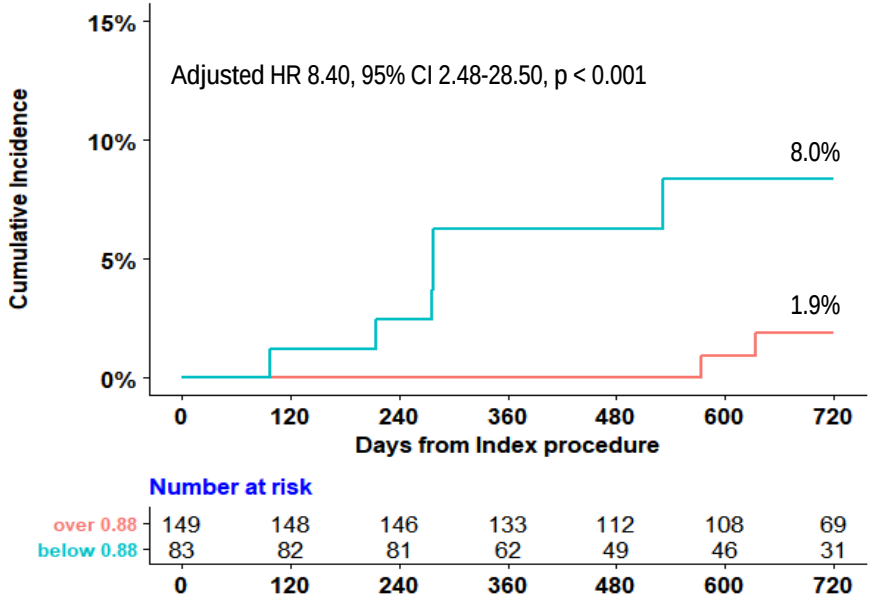
Cut-off value for predicting TVF in non-LAD



Cumulative incidence of TVF in LAD



Cumulative incidence of TVF in non-LAD

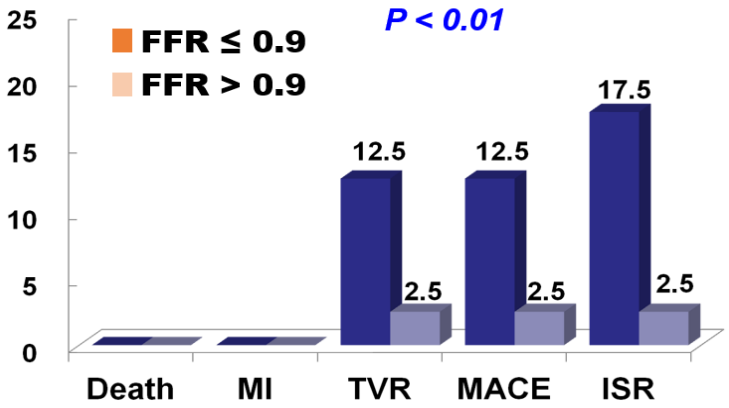


Hwang DW, Lee JM, .., Nam CW, Shin ES, Doh JH, Koo BK. Eurointervention 2018

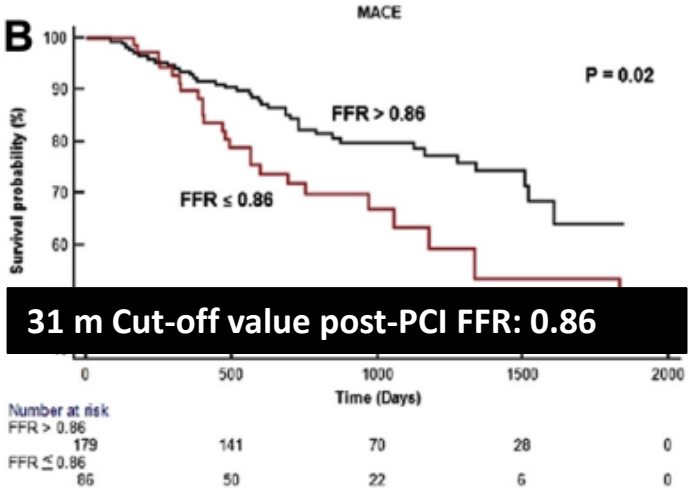
Physiologic gain of DES PCI: Single numeric Cut-off value enough?

High post-DES FFR related with better long term TVF-free survival and reduced TVR

1 year Cut-off value post-PCI FFR: 0.90



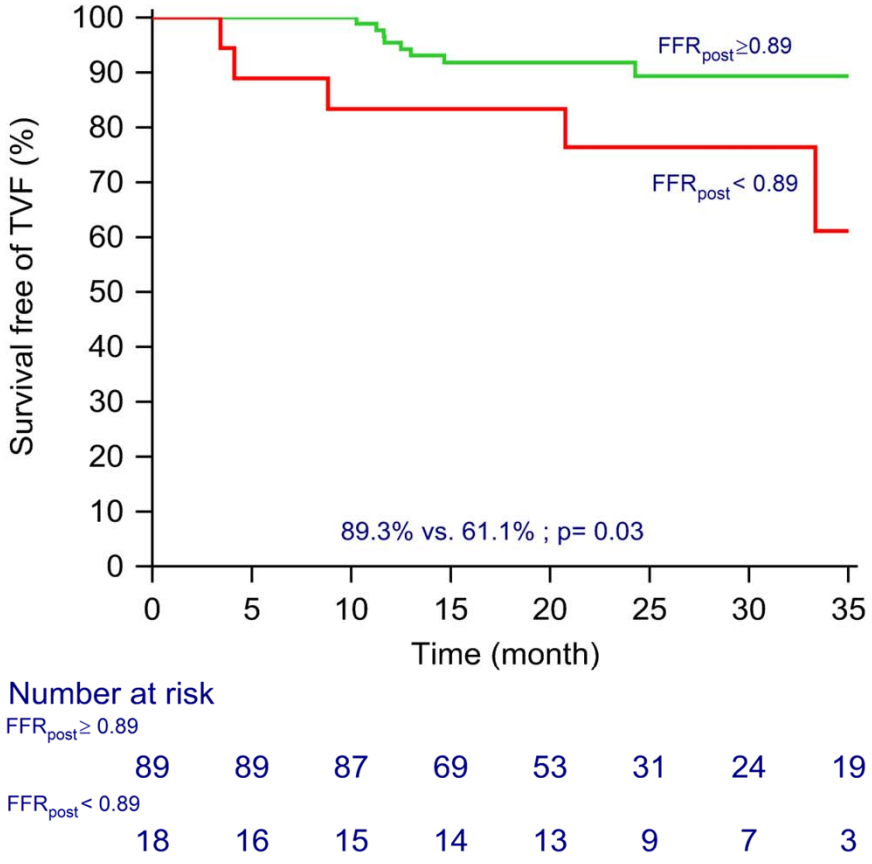
Nam CW et al, AJC 2011:107(12):1783-6



31 m Cut-off value post-PCI FFR: 0.86

Agarwal et al, JACC int 2016:9:1022-31

3 year Cut-off value post-PCI FFR: 0.89



Doh JH, Nam CW, Koo BK et al, J Invasive Cardiol. 2015;27:346-51.

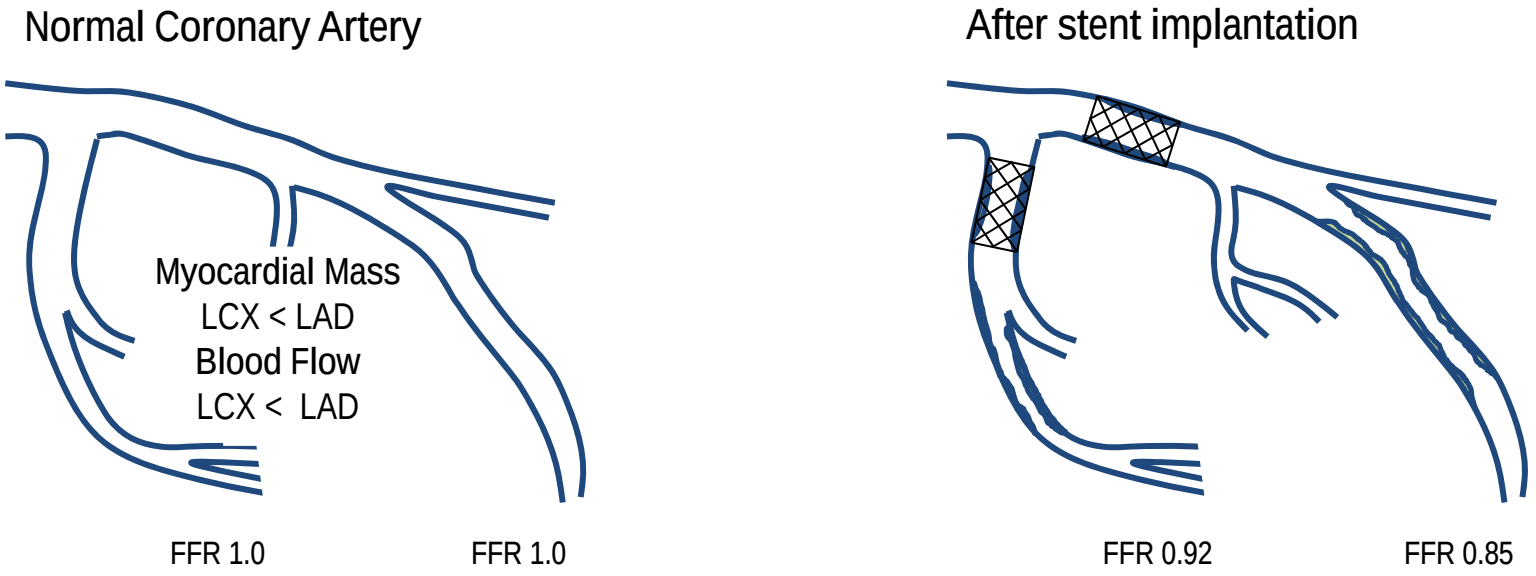
Summary of Previous Individual Studies

	Patient number	Study period	Clinical presentation	Used stent	Primary outcome	Follow-up duration	BCV	Note
Pijls et al.	750	2000-2001	No exclusion criteria	BMS	Any death, AMI, TVR	6 months	0.90	BMS data
Leesar et al.	66	Published in 2011	Excluding ACS	BMS/ DES	MACE	2 years	0.96	BCV was based on previous evidence
Nam et al.	80	Published in 2011	SA, ACS	DES	MACE	1 year	0.90	LAD was independent predictor of low FFR
Matsuo et al.	69	Published in 2013	Excluded AMI	BMS/ DES	TLR	6-8 months	0.79	No predictable value after DES implantation
Doh et al.	115	2007-2012	SA, ACS	DES	TVF	1 year	0.89	IVUS-assisted DES implantation
Agarwal et al.	574	2009-2014	Silent ischemia, SA, UA	BMS/ DES	MACE	31±16 months	0.86	20% of PCI needs further intervention
Kasula et al.	189	2009-2014	NSTEMI, UA	BMS/ DES	MACE	2.4±1.5 years	0.91	ACS population
Piroth et al.	639	2006-2007 2010-2012	Stable disease	DES	VOCE	2 years	0.92	FAME1 and FAME2 Low Predictive value
Li et al.	1,476	2012-2013	Silent ischemia, SA, UA	DES	TVF	3 years	0.88	0.905 cut-off in LAD 2nd generation DES

Post PCI FFR threshold: no single cut-off What and Why?

- Higher post PCI FFR was associated with better clinical outcomes.
- Optimal cut-off value were widely ranged between 0.86 to 0.96.
- The differences corresponded in study population, definition of outcome, type of stent used and included vessels, amount of myocardium supplied from target vessel.

Clinical relevance of post-PCI FFR



According to the target vessel,

1. Different distribution patterns of post-PCI FFR
2. Different associations between post-PCI FFR and clinical outcomes

- Different post PCI FFR cut-offs for LAD and non-LAD lesions can be applied for assessment of prognostic value.
- Clinical relevance of wide range of post-PCI FFR cut-off value in previous studies can be partially explained.

Hwang DW, Lee JM, .., Nam CW, Shin ES, Doh JH, Koo BK. Eurointervention 2018

Additive prognostic impact of % increase of FFR with PCI

Concept of % increase of FFR after PCI

Results from COE-PERSPECTIVE international multicenter post PCI FFR registry

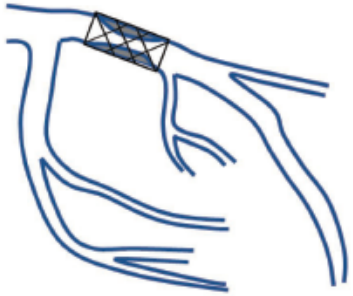
A. Severe Focal Stenosis

- High FFR Gain with PCI (High Percent FFR Increase)
- High Post-PCI FFR
- No Residual Disease Burden

B. Severe Focal Stenosis on Moderate Diffuse Disease

- High FFR Gain with PCI (High Percent FFR Increase)
- Low Post-PCI FFR
- Moderate Residual Disease Burden

C. Moderate Focal Stenosis



- Modest FFR Gain with PCI (Low Percent FFR Increase)
- High Post-PCI FFR
- No Residual Disease Burden

D. Moderate Focal Stenosis on Predominant Diffuse Disease

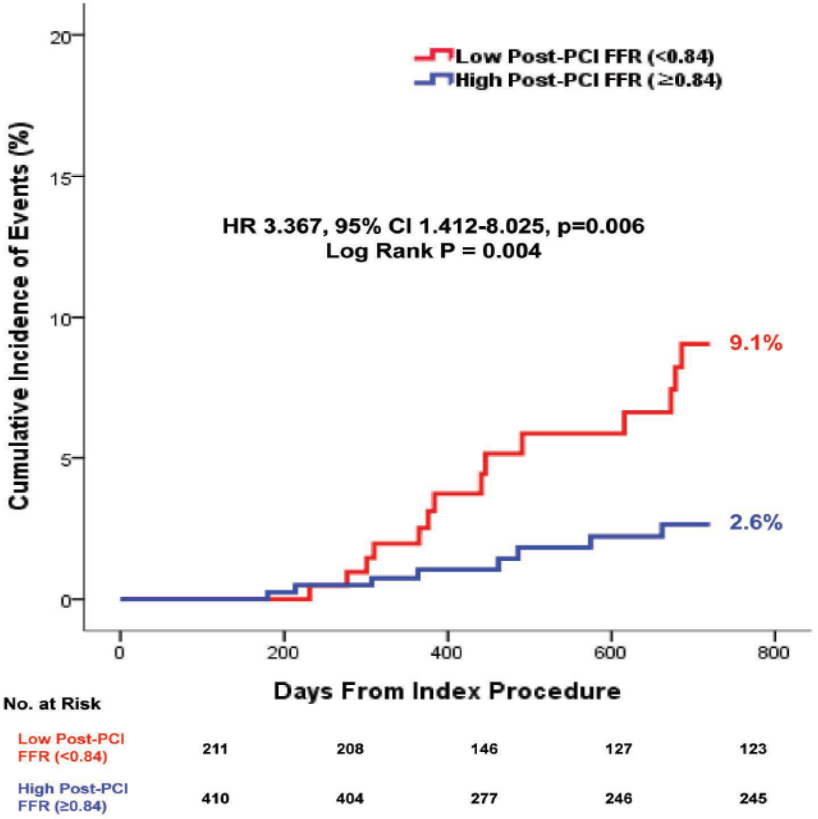
- Low FFR Gain with PCI (Low Percent FFR Increase)
- Low Post-PCI FFR
- High Residual Disease Burden

Lee JM, .., Nam CW, Shin ES, Doh JH, Koo BK. JACC interv 2018

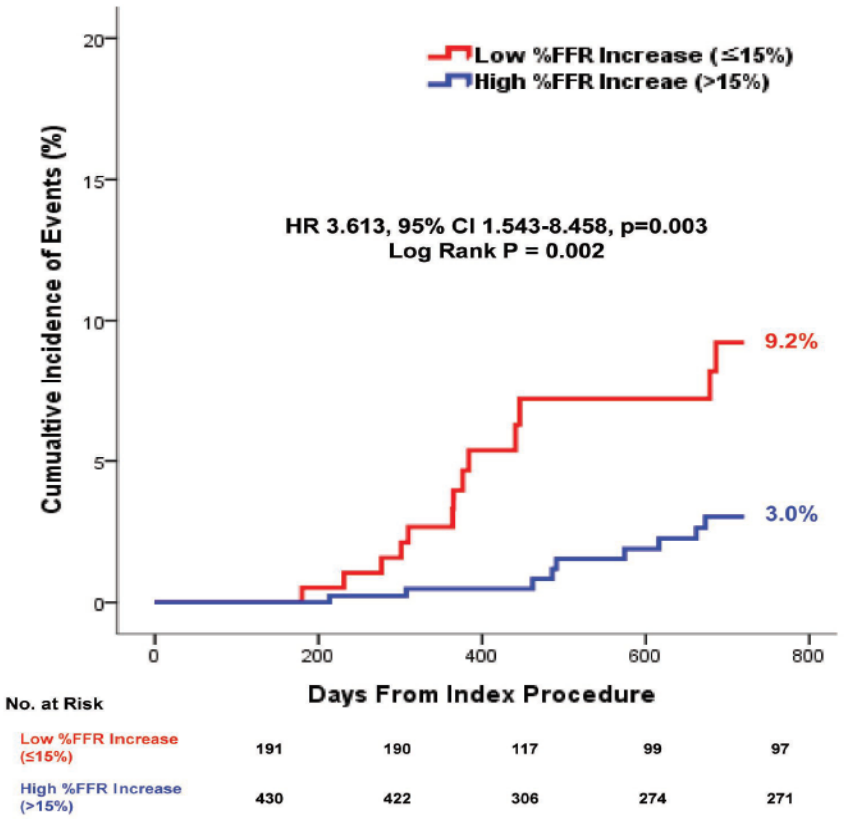
% increase of FFR after PCI could offer additional prognostic value

Results from COE-PERSPECTIVE international multicenter post PCI FFR registry

A. Post-PCI FFR



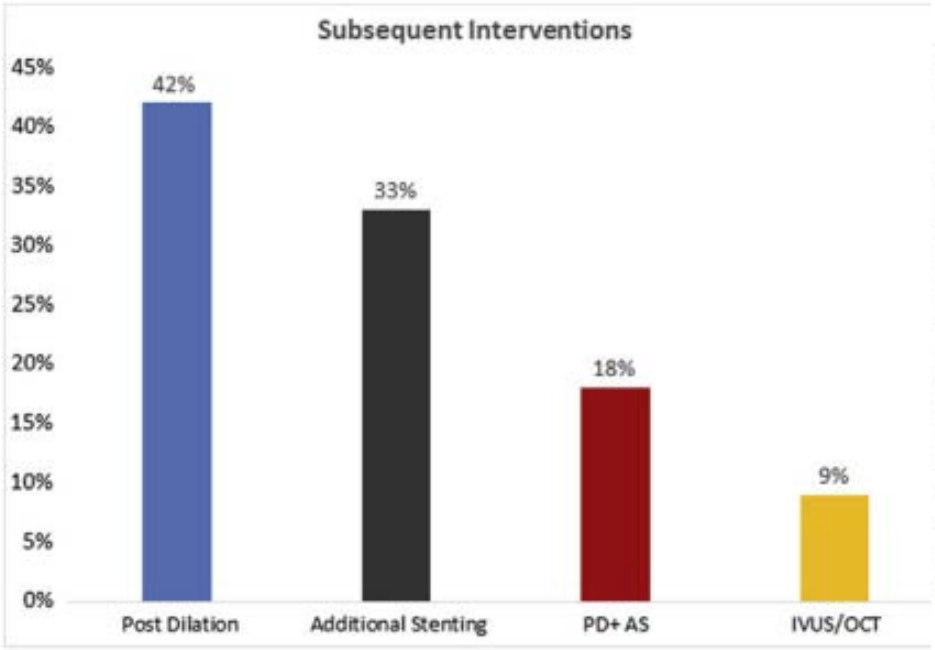
B. Percent FFR increase

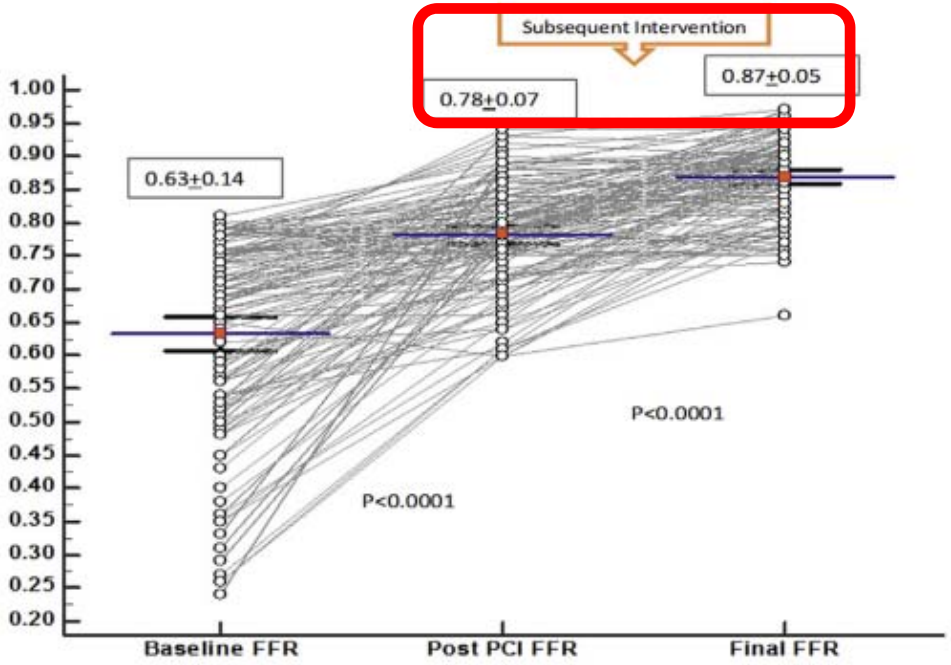


Lee JM, .., Nam CW, Shin ES, Doh JH, Koo BK. JACC interv 2018

Impact of additional intervention on physiologic gain

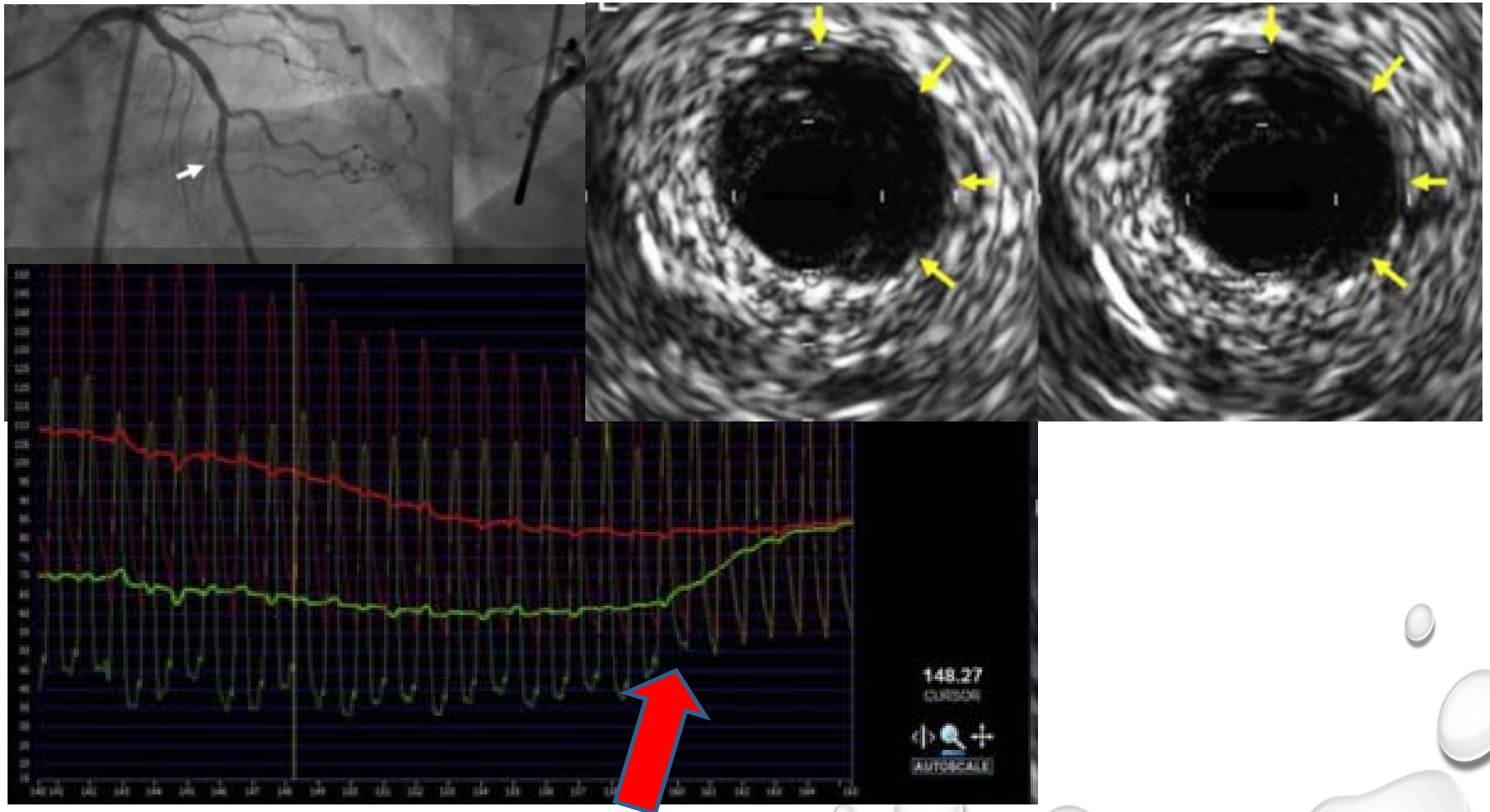
- 664 lesion of 574 patients treated with DES
- 143 lesions (21%) reclassified as ischemic residual lesions by post-stent FFR
- After subsequent interventions, FFR in this subgroup increased from 0.78 ± 0.08 to 0.87 ± 0.06 ($p < 0.0001$).





Agarwal et al, JACC int 2016:9:1022-31

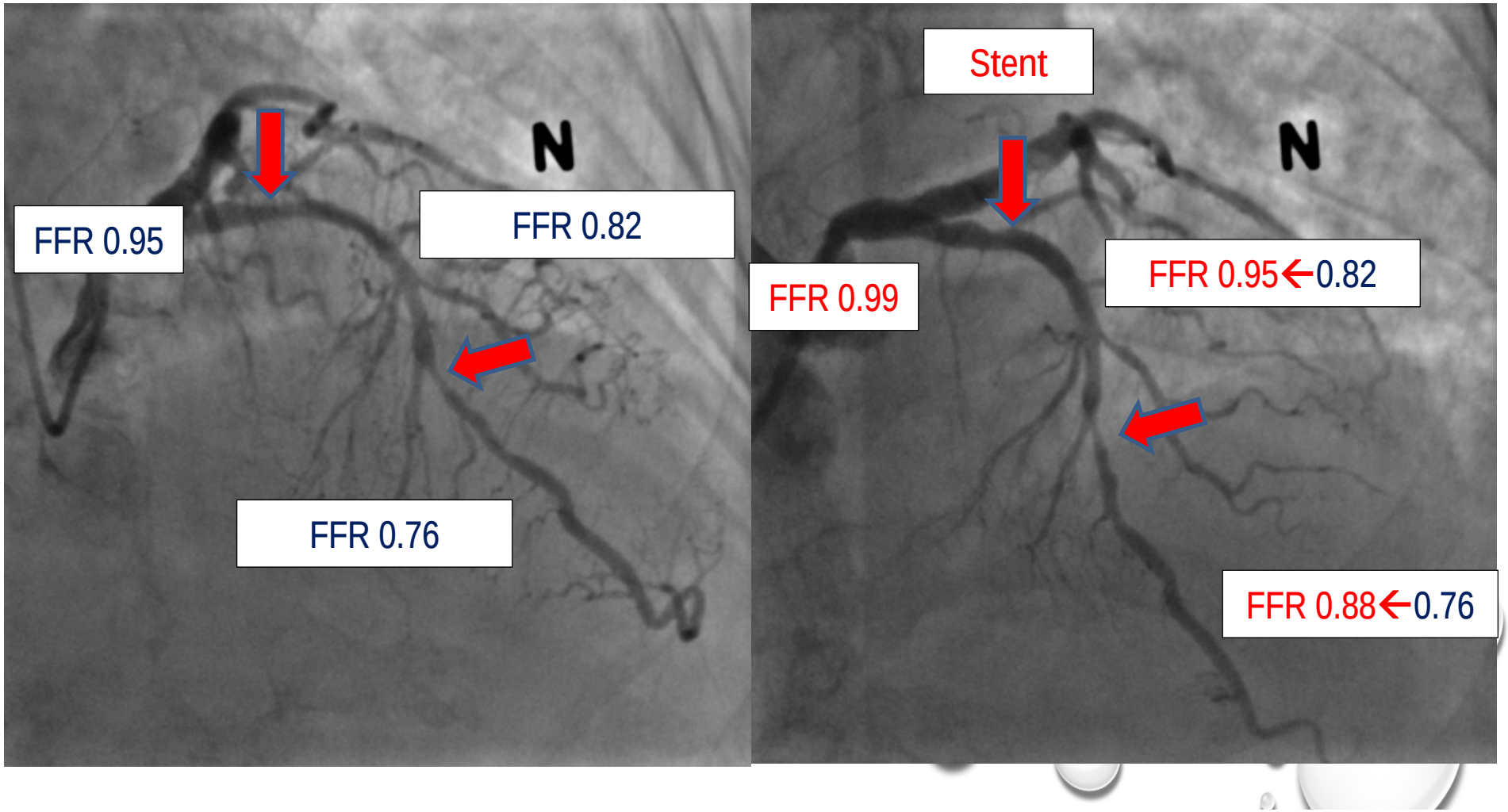
Post-stent pressure pullback FFR measurement can provide useful information about hidden anatomic problem such as dissection or stent underexpansion



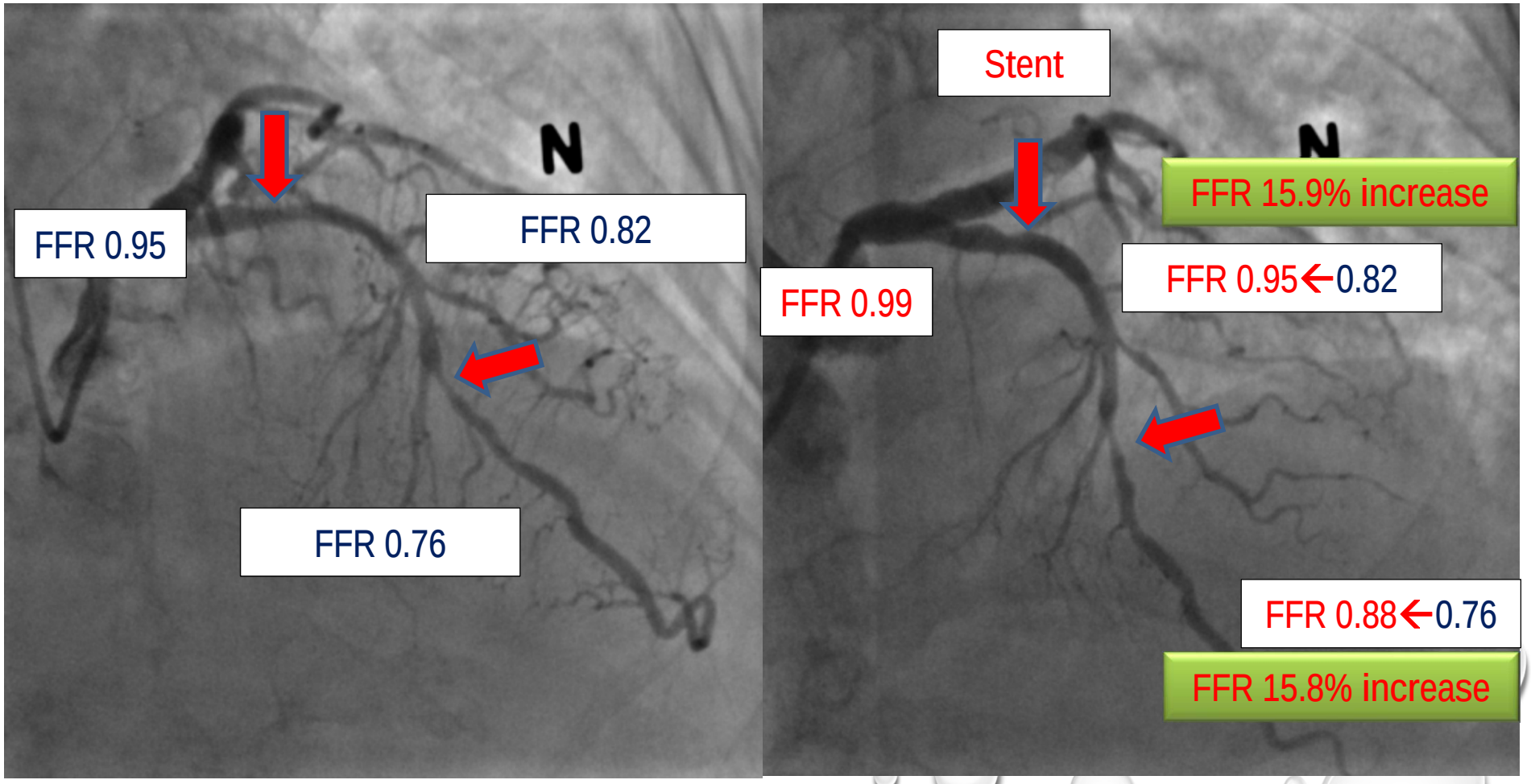
Chung JH, shin ES et al, International Journal of cardiology 185 (2015) 29–33

PCI improves coronary blood flow to myocardium and represents as reduced pressure gradient

Before and After PCI



Before and After PCI



Summary

: Why do we need to measure FFR after DES implantation ?

- Confirm achievement of enough physiologic gain and optimization that may be associated with better clinical outcome
- Address residual physiologic burden may be associated with future DES failure.

Thank you for your attention