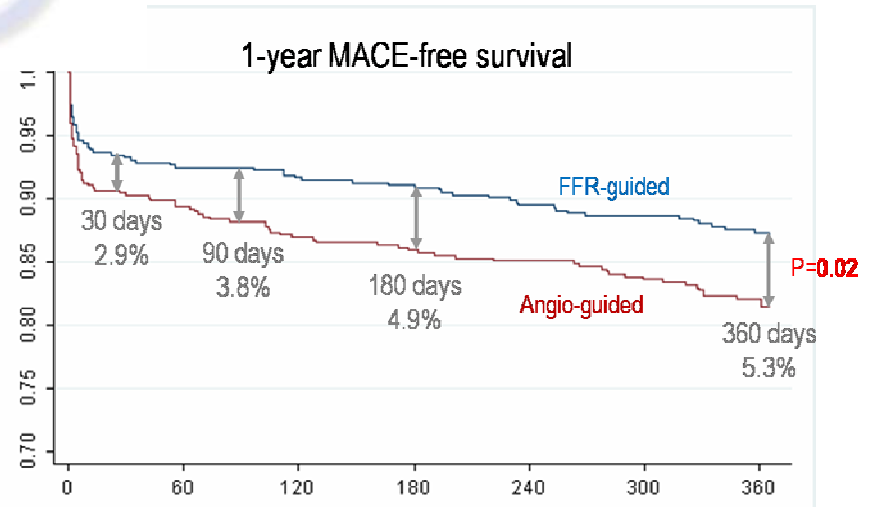
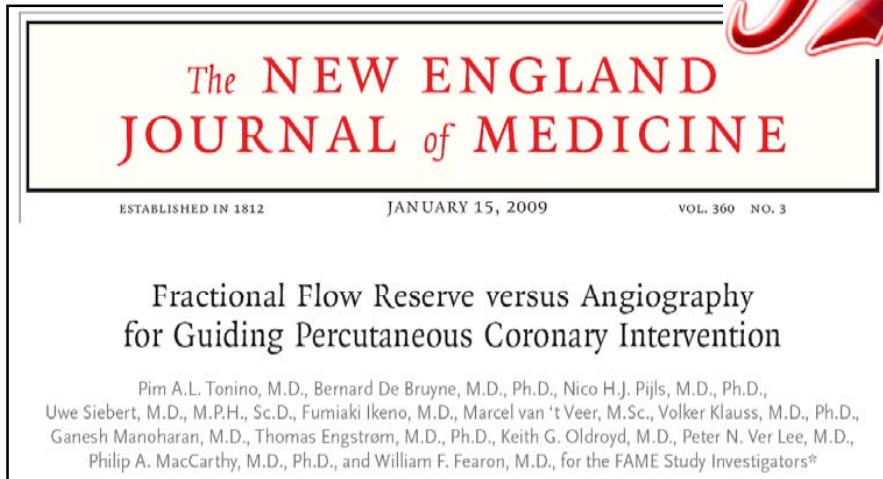


Why “FFR” and Why “Not FFR” in Bifurcation Lesions

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Seoul National University Hospital, Seoul, Korea



European Heart Journal (2010) 31, 2501–2555
doi:10.1093/eurheartj/ehq277

ESC/EACTS GUIDELINES

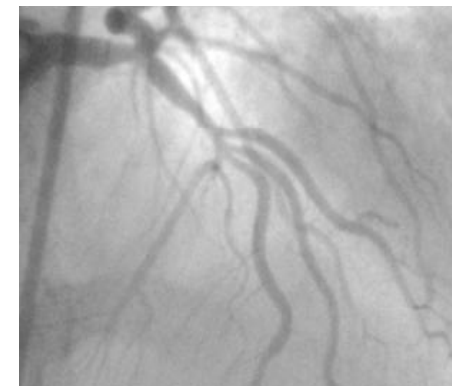
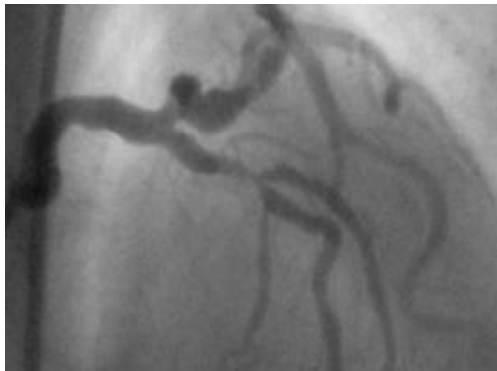
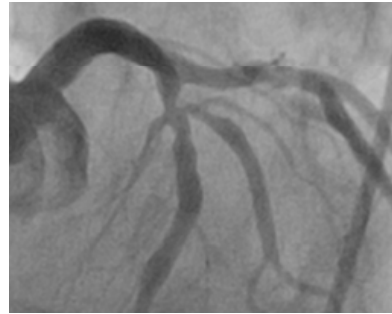


Guidelines on myocardial revascularization

The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

	Class ^a	Level ^b
FFR-guided PCI is recommended for detection of ischaemia-related lesion(s) when objective evidence of vessel-related ischaemia is not available.	I	A
DES ^d are recommended for reduction of restenosis/re-occlusion, if no contraindication to extended DAPT.	I	A
Distal embolic protection is recommended during PCI of SVG disease to avoid distal embolization of debris and prevent MI	I	B

*How can we achieve “FAME”
in complex bifurcation lesions?*



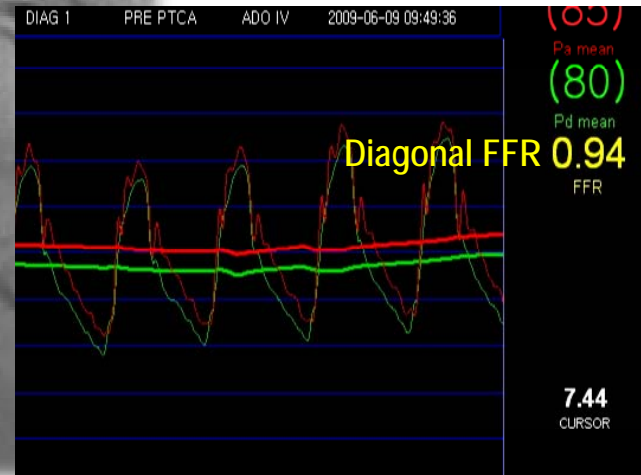
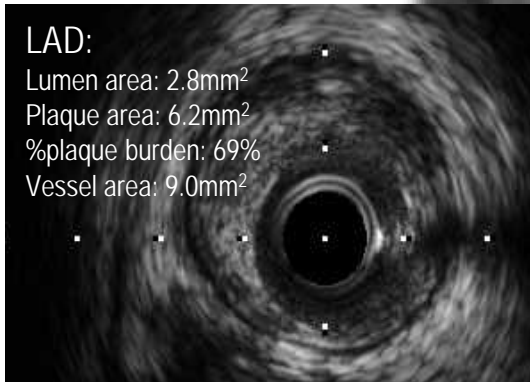
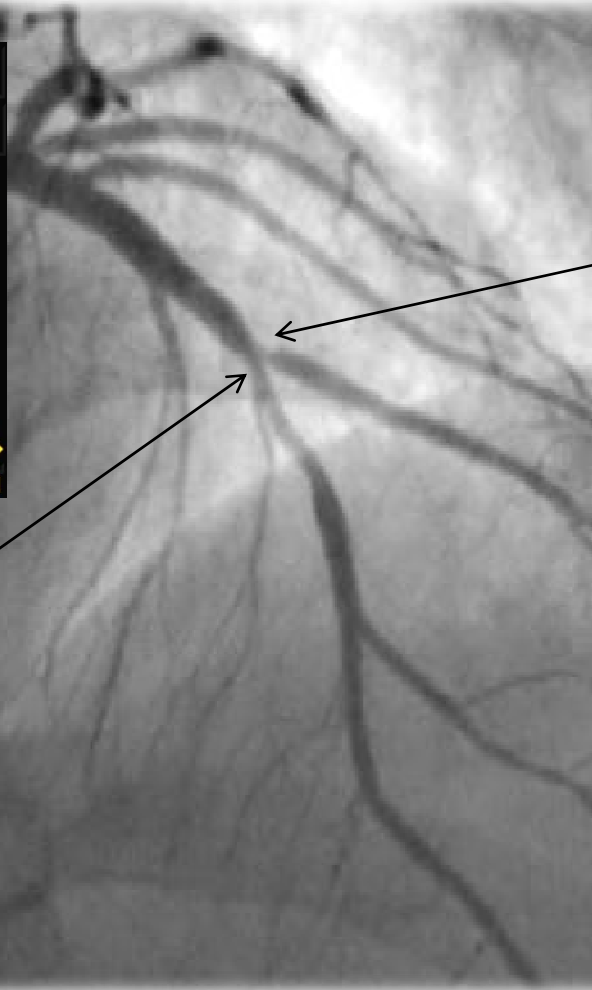
Why FFR? Why “Not FFR”?

FFR at the right time and at the right place

- Pre-intervention
- After main branch stent implantation
- After side branch balloon angioplasty
- After side branch stenting

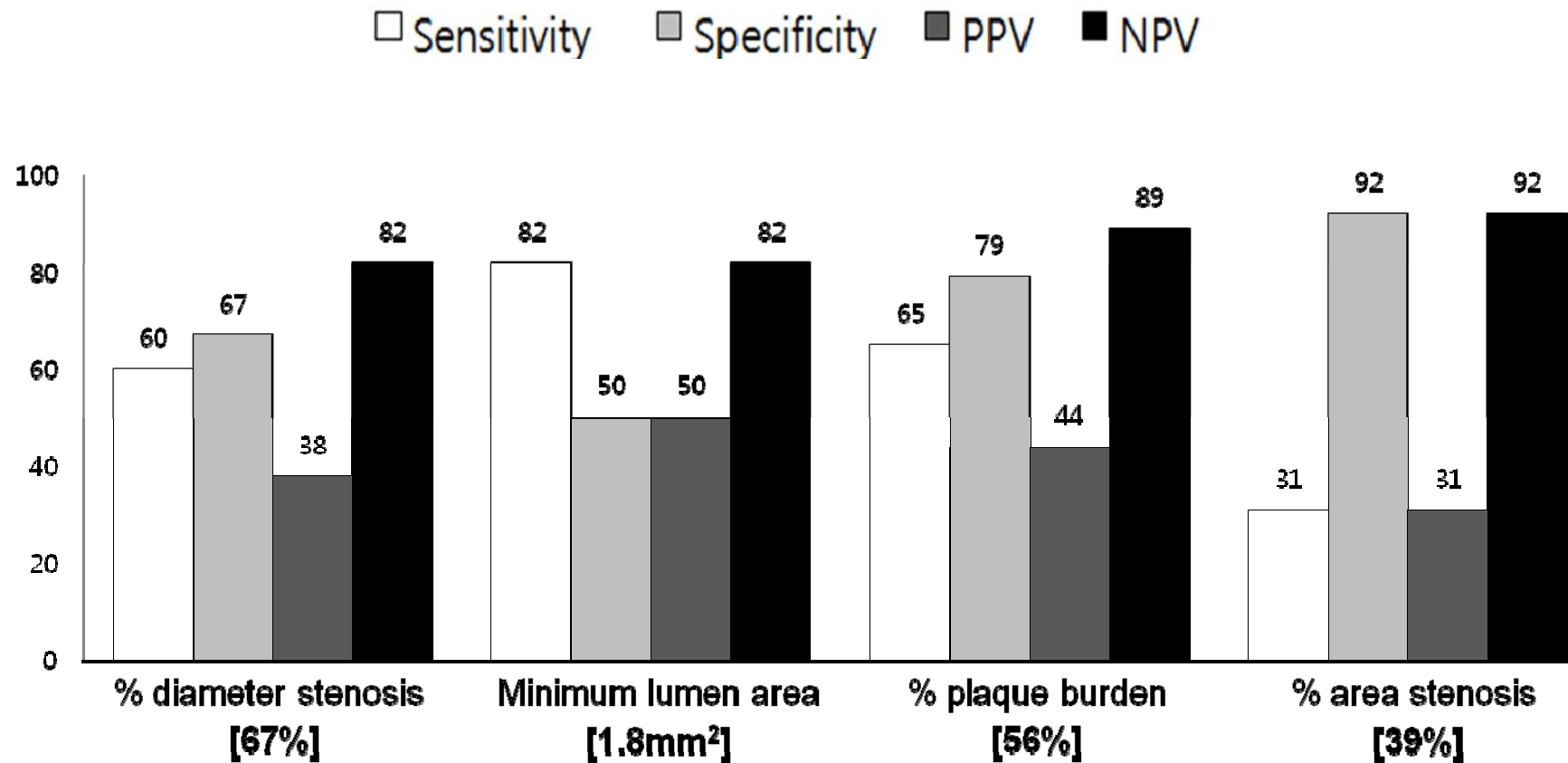


Why FFR?



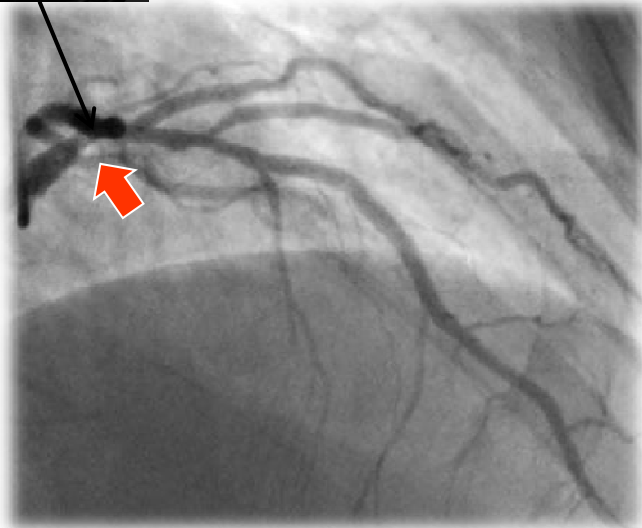
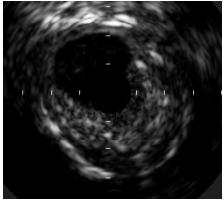
Why FFR?

Diagnostic accuracy of anatomic parameters in pure SB ostial lesions

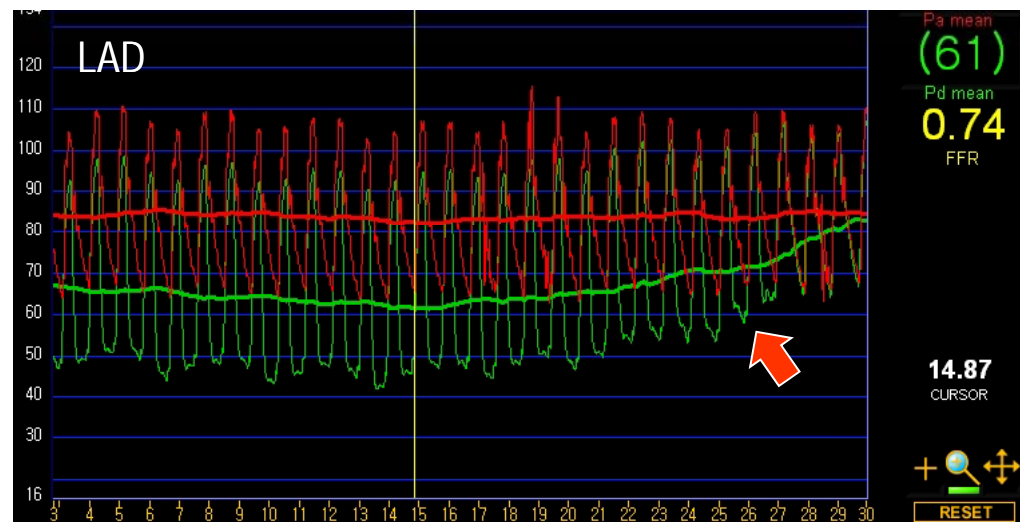
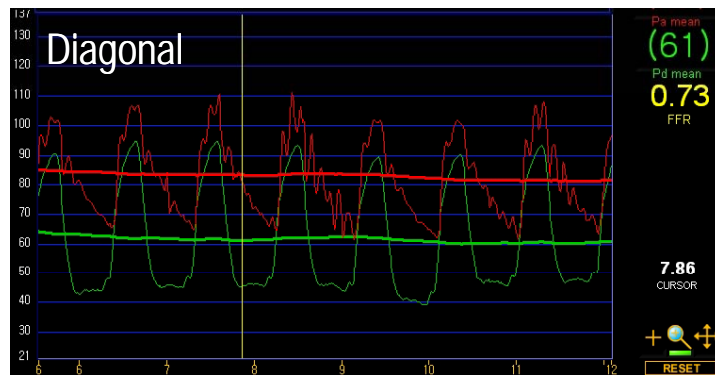
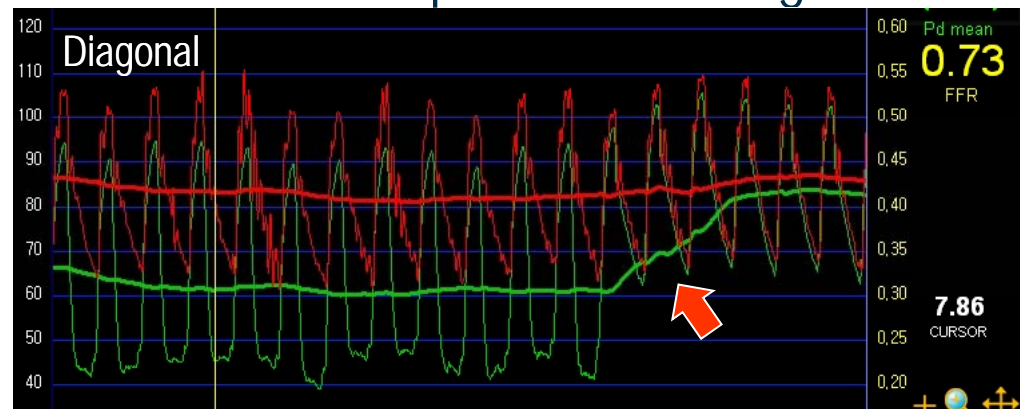


Side branch FFR: Influence of MB stenosis

Anatomical & functional Medina 0,0,1 lesion?



Pullback pressure tracing



Influence of other stenoses in complex lesions



Left main FFR?



Why FFR? Why “Not FFR”?

FFR at the right time and at the right place

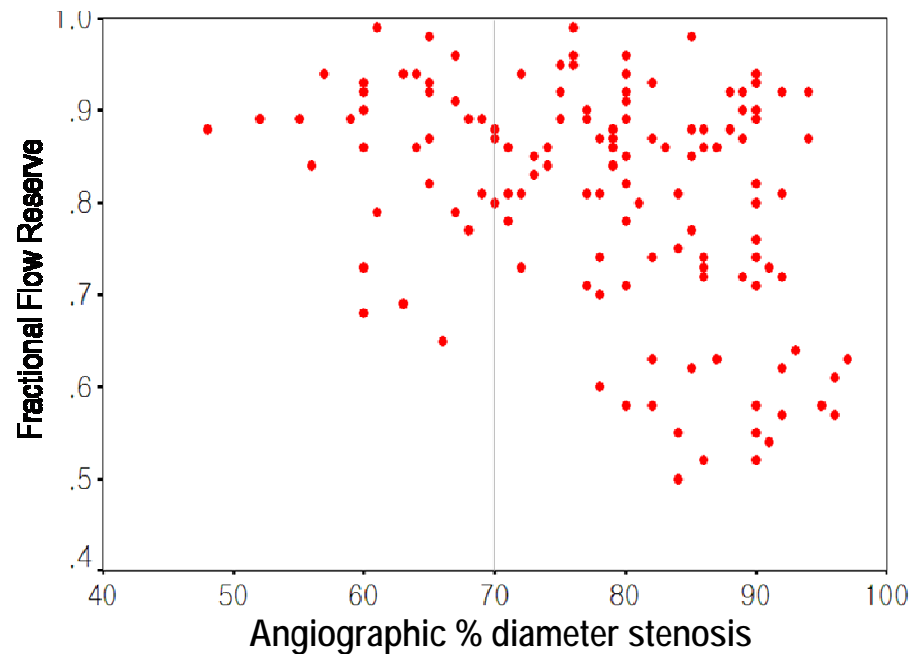
- Pre-intervention
- After main branch stent implantation
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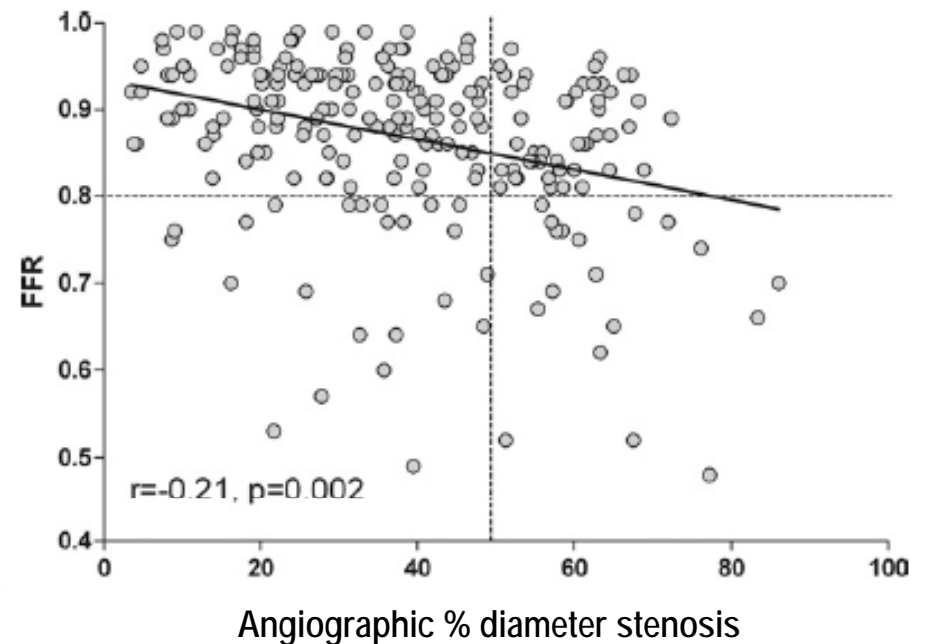
Why FFR?

Angiographic inaccuracy to predict the presence of myocardial ischemia

FFR vs. % diameter stenosis in jailed side branches

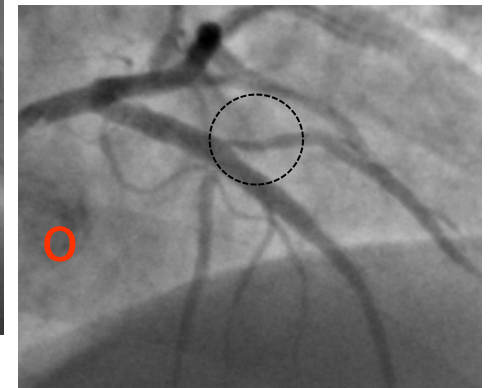
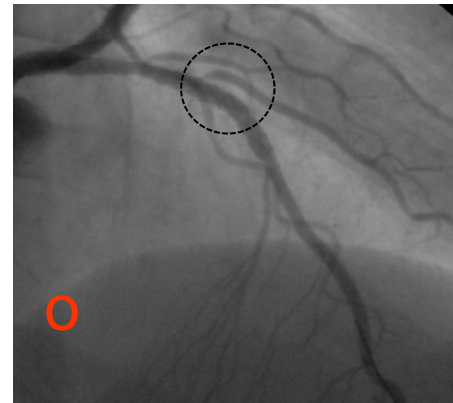
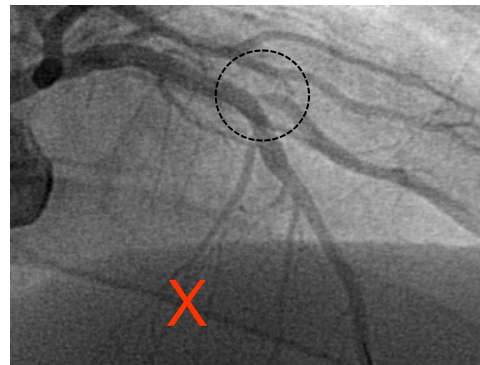
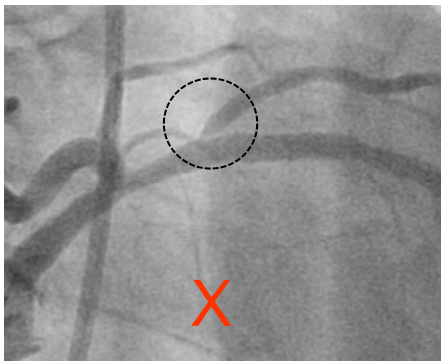
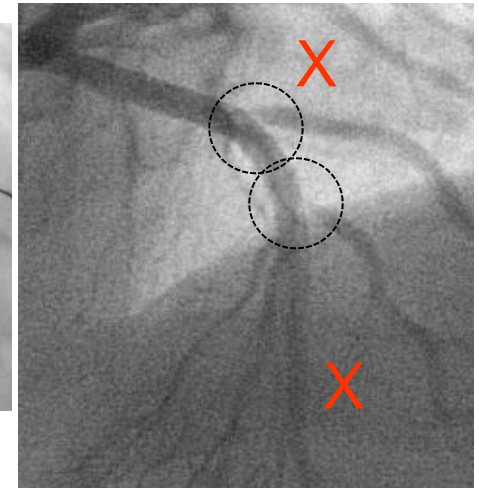
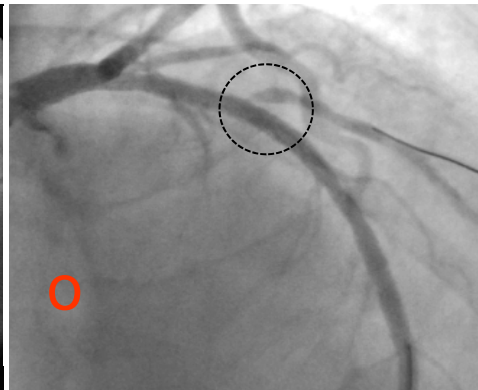
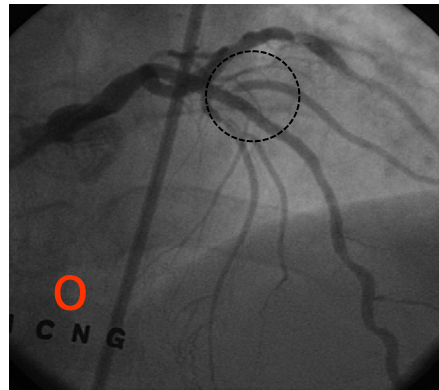
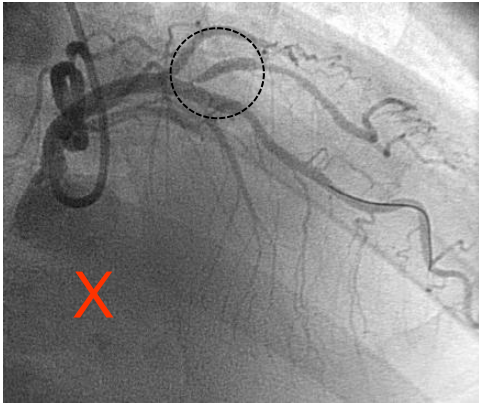


Koo BK, et al JACC 2005, EHJ 2008, Circulation CVI 2010



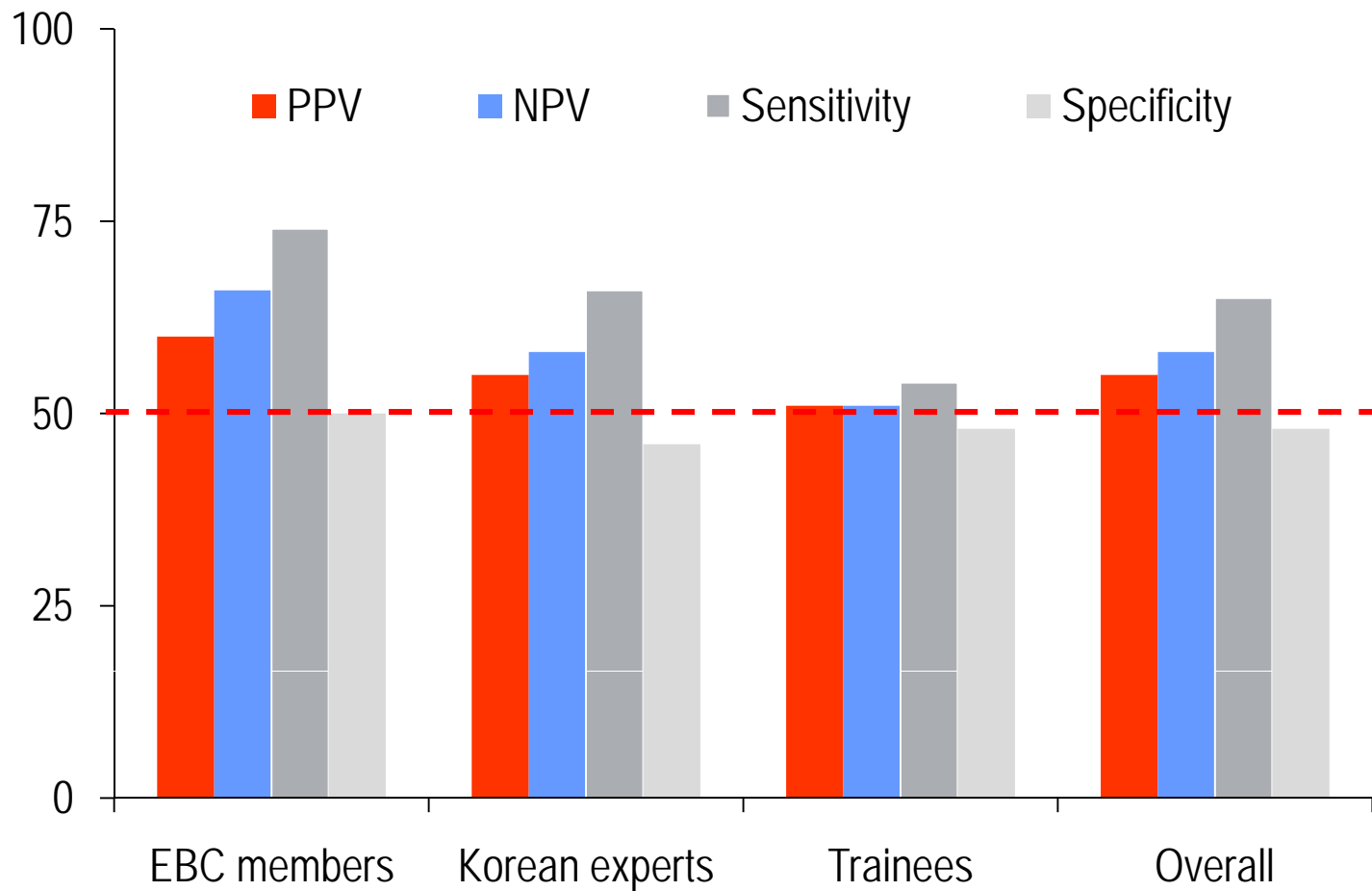
Ahn JM, et al. JACC intv 2012

FFR < 0.75?



How accurate is our assessment?

Estimation of "functional significance" in 20 jailed SB lesions



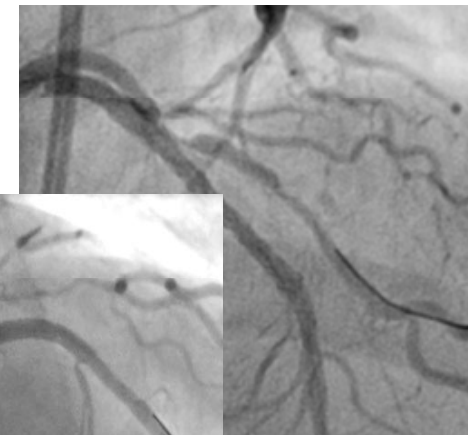
FFR in all jailed side branches?

- Ostial lesions

- Diffuse, multiple lesions

- Highly angulated lesions

- Heavily calcified lesions

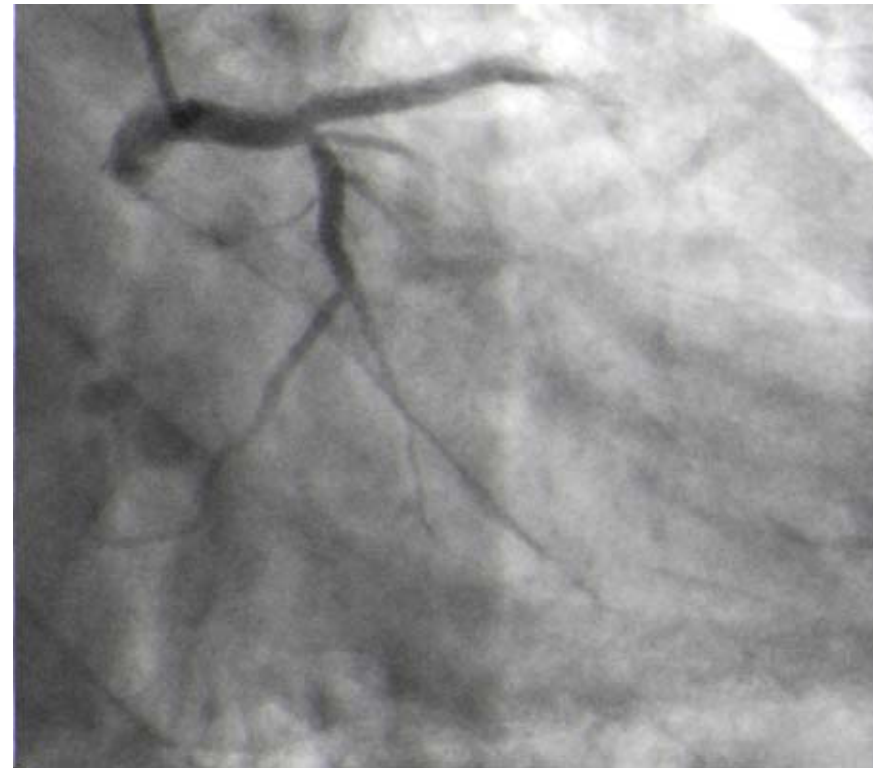


Does side branch FFR matter?

Amount of ischemia is more important than the presence of ischemia

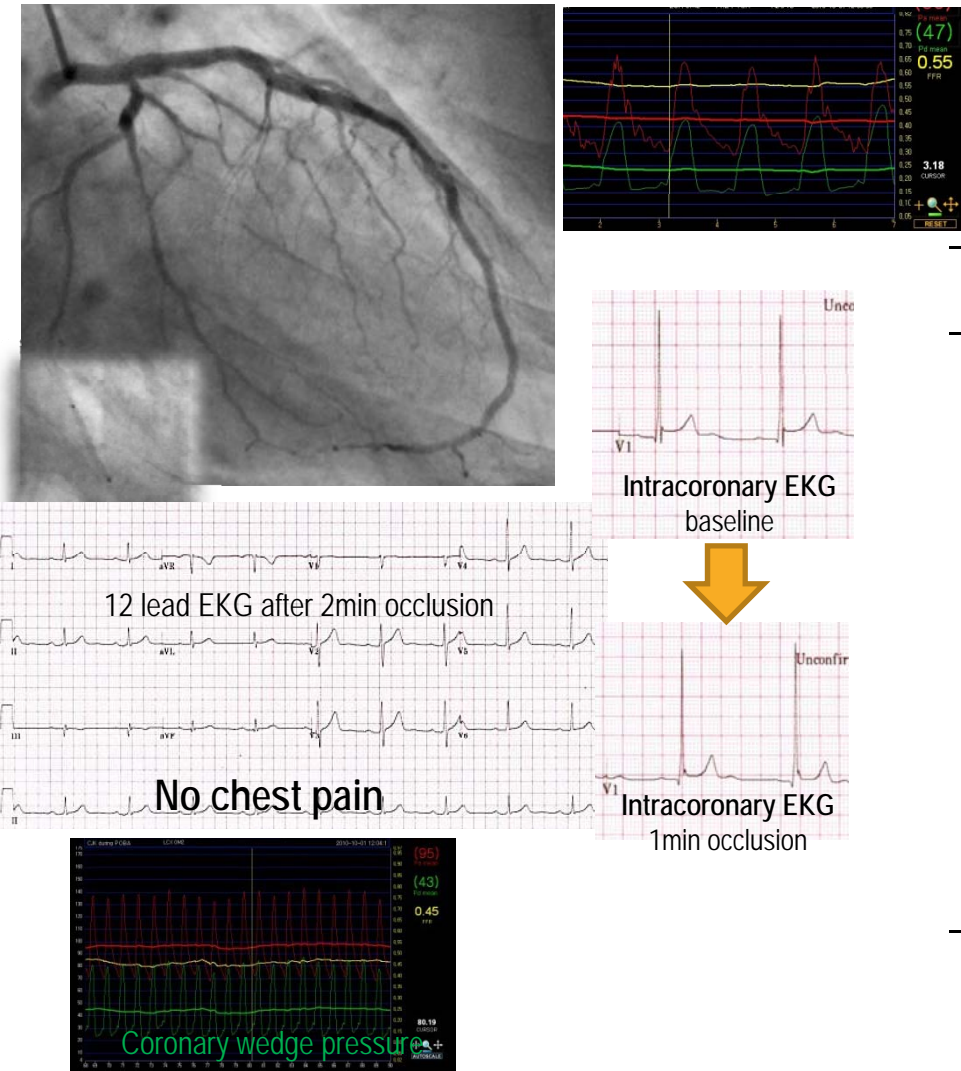
2010 ESC guidelines for revascularization

	Subset of CAD by anatomy	Class ^a	Level ^b
For prognosis	Left main >50% ^d	I	A
	Any proximal LAD >50% ^d	I	A
	2VD or 3VD with impaired LV function ^d	I	B
	Proven large area of ischaemia (>10% LV)	I	B
	Single remaining patent vessel >50% stenosis ^d	I	C
	IVD without proximal LAD and without >10% ischaemia	III	A
For symptoms	Any stenosis >50% with limiting angina or angina equivalent, unresponsive to OMT	I	A
	Dyspnoea/CHF and >10% LV ischaemia/viability supplied by >50% stenotic artery	IIa	B
	No limiting symptoms with OMT	III	C



Does side branch FFR matter?

Amount of ischemia is more important than the presence of ischemia



Comparison of clinical, physiologic and electrocardiographic relevance of LAD/diagonals

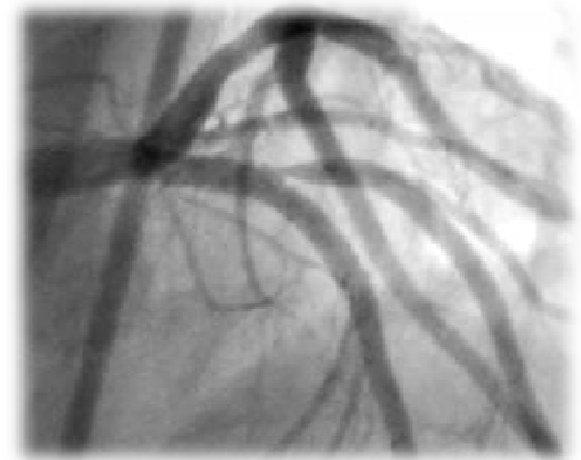
	LAD	Diagonal	P
1min occlusion of flow			
Pain score	4.1±3.5	2.3±2.7	<0.001
ST elevation +	92%	35%	<0.001
QTc segment, msec	454±45	440±36	0.07
QTc dispersion, msec	84±39	71±29	<0.001
Wedge pressure (Pw)	21±7	27±9	<0.001
Pw/Pa	0.22±0.07	0.27±0.08	0.001

Koo BK, et al JACC intv, in revision

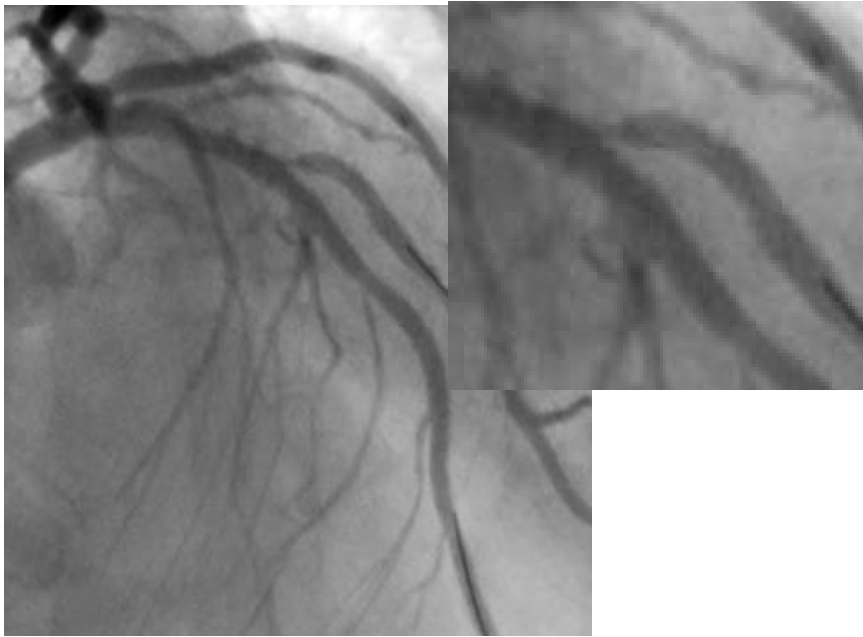
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- After side branch balloon angioplasty
- After side branch stenting



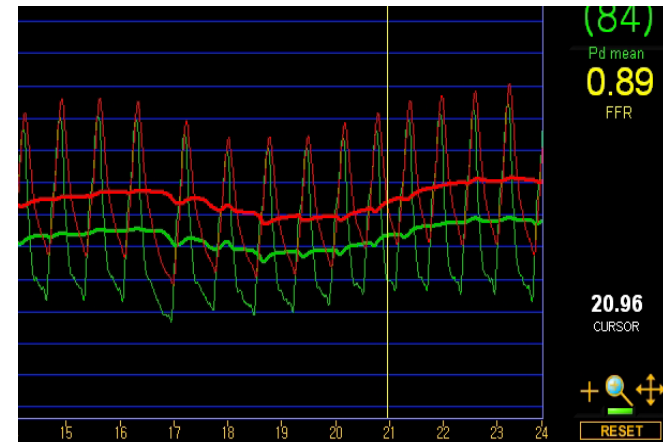
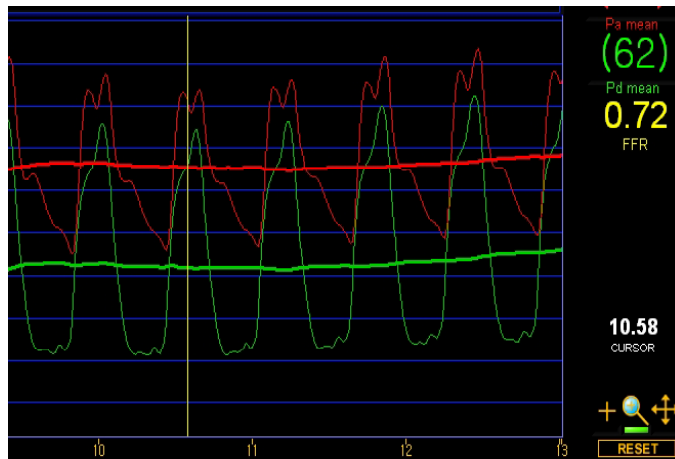
Angiographic vs. FFR after kissing balloon



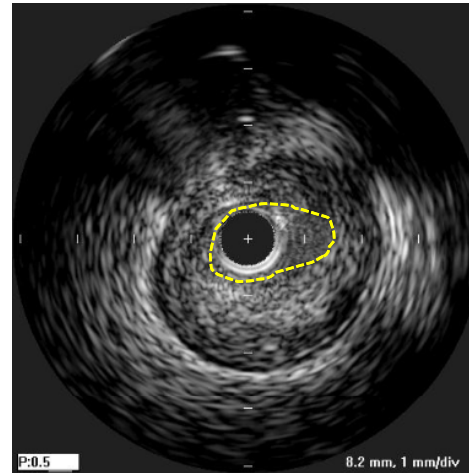
After MB stenting



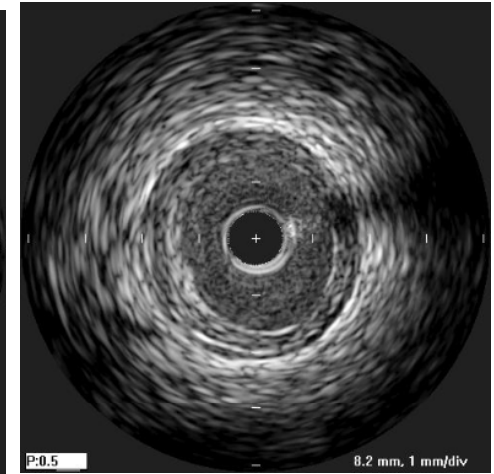
After kissing balloon



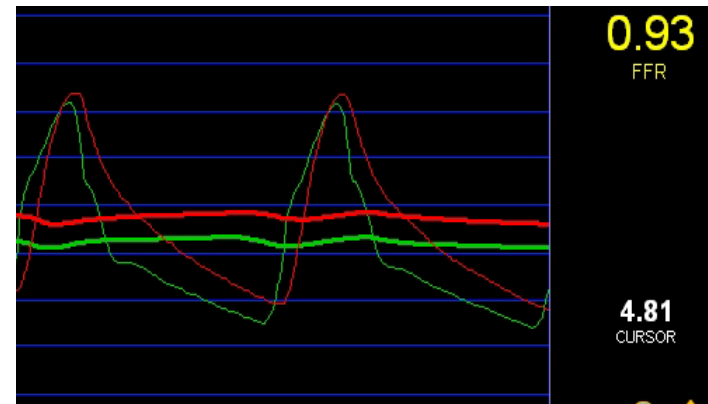
IVUS vs. FFR after kissing balloon



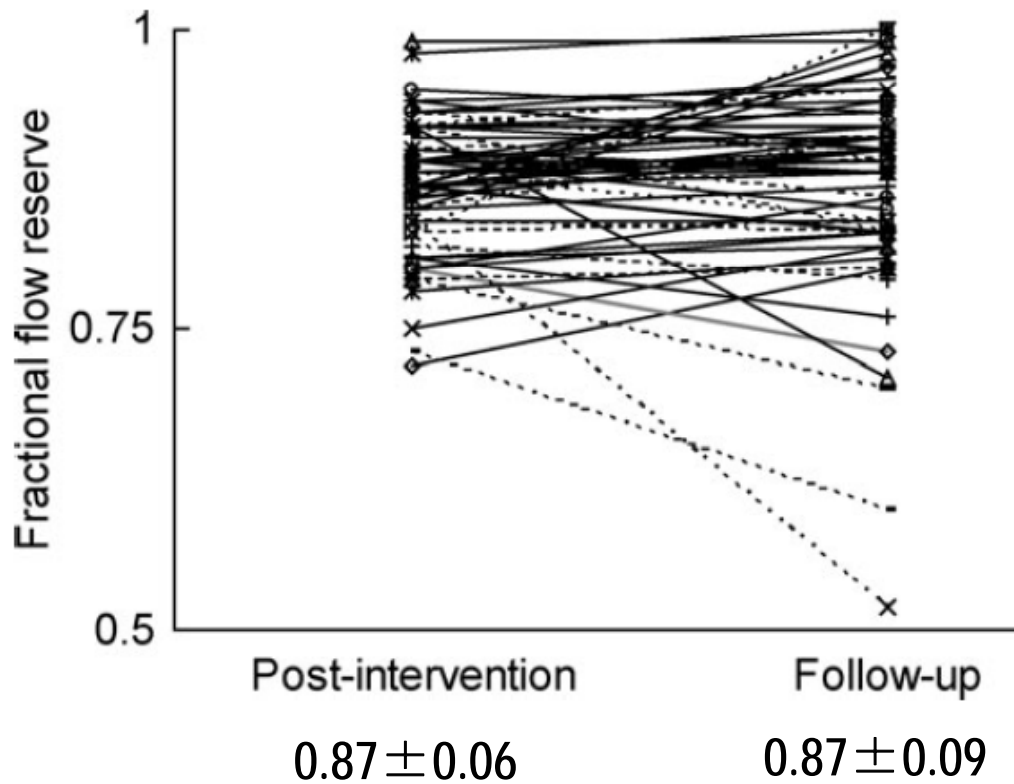
Lumen Area: 2.3mm^2
MLD: 1.2mm



Reference vessel diameter: 3.75mm

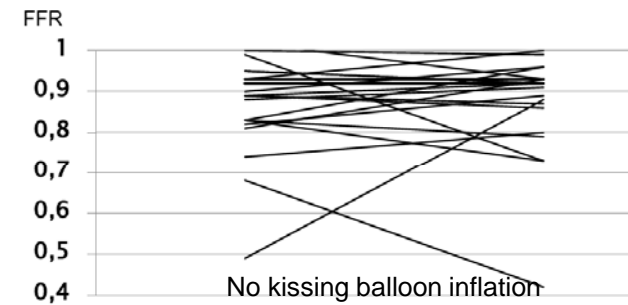


Functional outcome of Jailed side branches

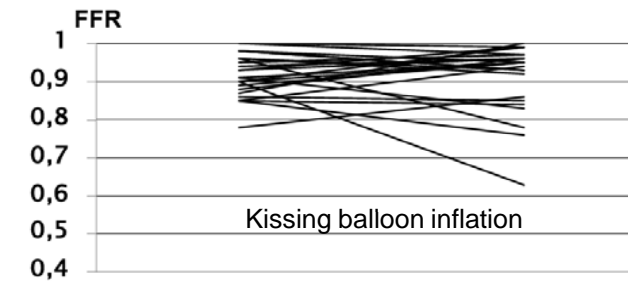


Koo BK. et al, *Eur Heart J* 2008

SB FFR substudy Nordic Baltic Bifurcation III



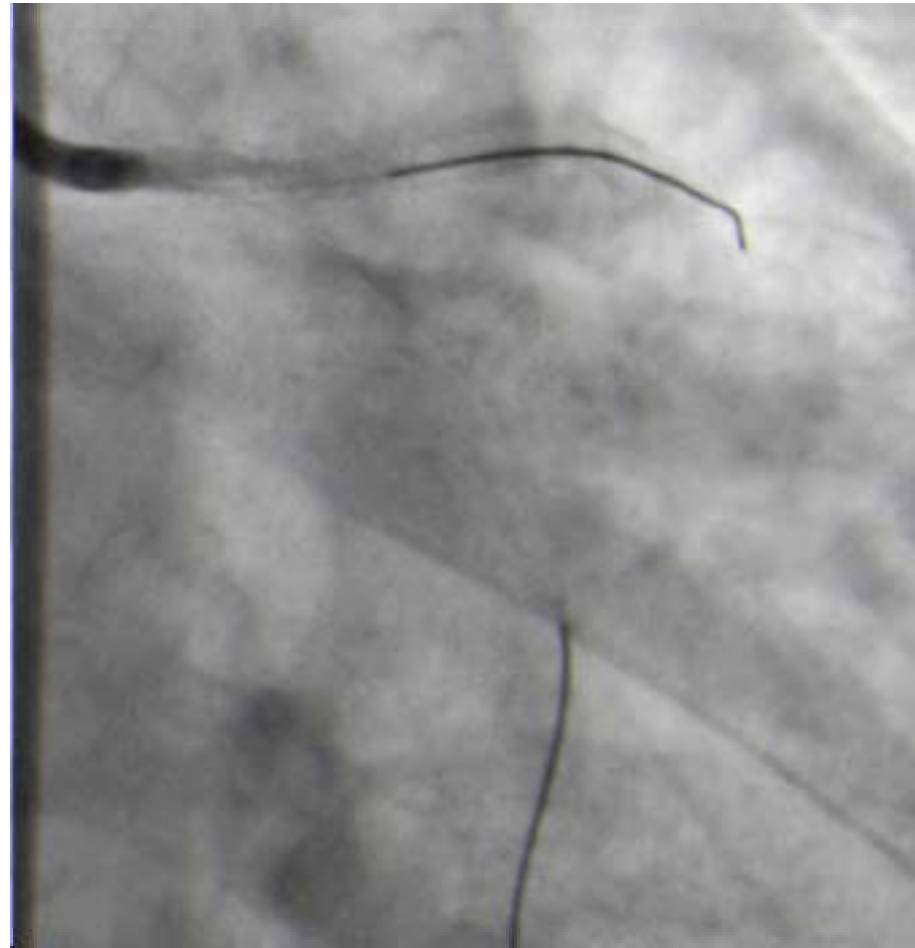
After PCI		Follow-up	
After PCI	n=21	Mean	
		0,87	
Follow-up	n=21	0,87	p=0,911



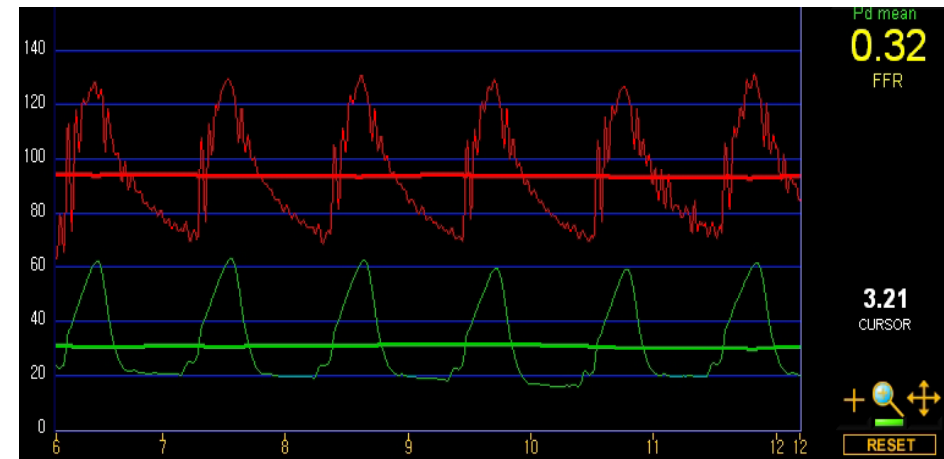
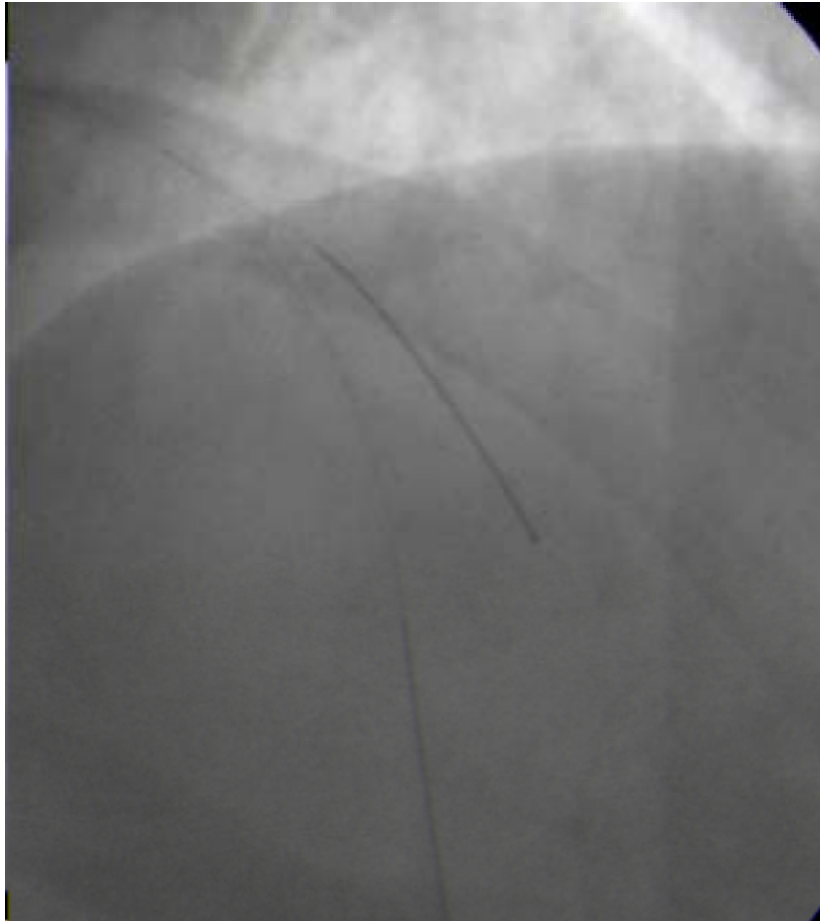
After PCI		Follow-up	
After PCI	n=25	Mean	
		0,92	
Follow-up	n=25	0,91	p=0,804

Kumsars I, et al. *Eurointervention* 2012

Dissection after angioplasty



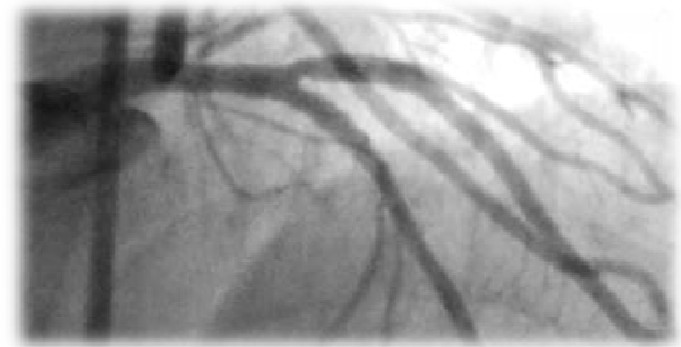
Slow flow



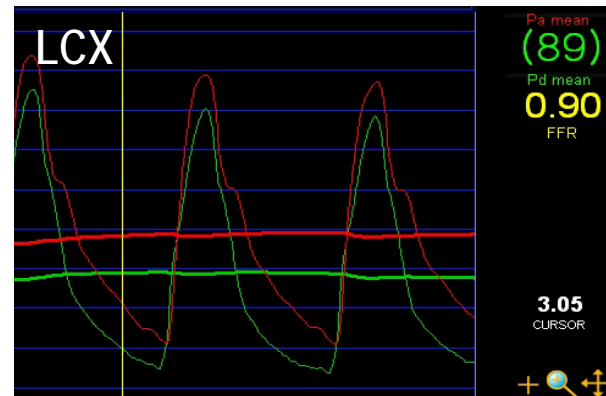
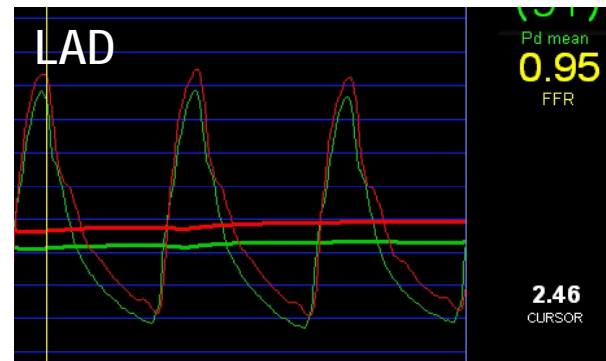
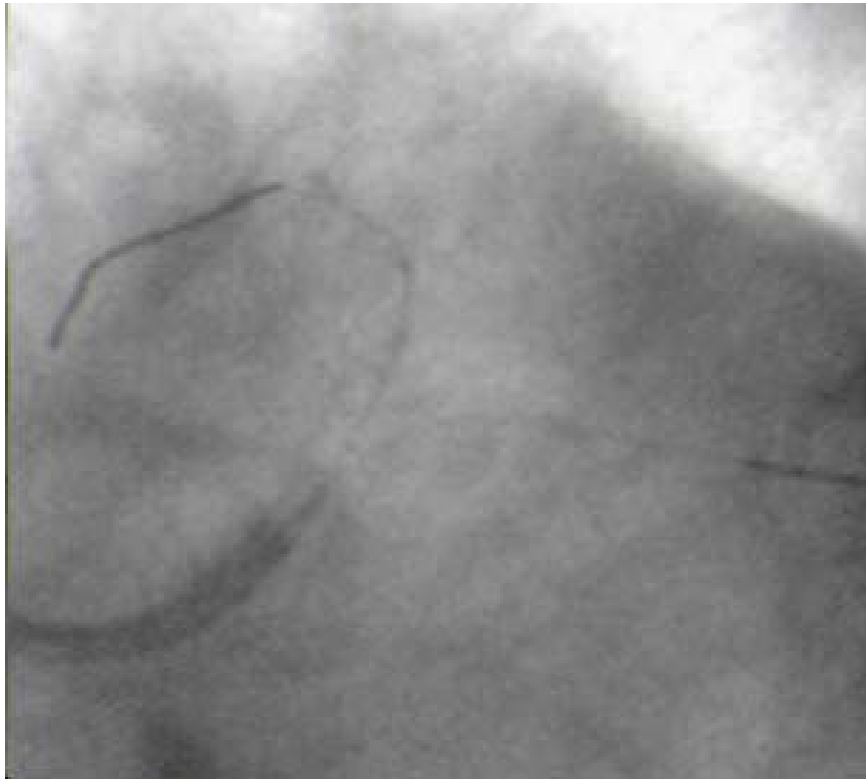
Why FFR? Why “Not FFR”?

FFR at the right time and at the right place

- Pre-intervention
- After main branch stent implantation
- After side branch balloon angioplasty
- After side branch stenting



After left main 2 stenting with TAP technique



FFR after side branch stenting

The Acute Changes of Fractional Flow Reserve in DK (Double Kissing), Crush, and 1-Stent Technique for True Bifurcation Lesions

FEI YE, M.D., JUN-JIE ZHANG, M.D., NAI-LIANG TIAN, M.D., SONG LIN, M.D., ZHI-ZHONG LIU, M.D., JING KAN, M.D., HAI-MEI XU, M.D., ZHONGSHENG ZHU, M.D., and SHAO-LIANG CHEN, M.D., F.S.C.A.I., F.A.C.C.

From the Nanjing First Hospital, Nanjing Medical University, Nanjing, China

FFR before and after PCI (DK crush vs Provisional)

	DK Group	1-Stent Group	P Value
FFR preprocedure			
MB FFR at baseline	0.83 ± 0.15	0.89 ± 0.13	0.109
SB FFR at baseline	0.84 ± 0.15	0.91 ± 0.12	0.100
MB FFR at hyperemia	0.76 ± 0.15	0.83 ± 0.10	0.029
SB FFR at hyperemia	0.76 ± 0.15	0.83 ± 0.16	0.103
FFR postprocedure			
MB FFR at baseline	0.96 ± 0.02	0.95 ± 0.03	0.376
SB FFR at baseline	0.97 ± 0.02	0.96 ± 0.03	0.043
MB FFR at hyperemia	0.92 ± 0.04	0.92 ± 0.05	0.581
SB FFR at hyperemia	0.94 ± 0.03	0.90 ± 0.08	0.028

Efficacy of Fractional Flow Reserve Measurements at Side Branch Vessels Treated With the Crush Stenting Technique in True Coronary Bifurcation Lesions

Byoung Kwon Lee, MD; Hyun Hee Choi, MD; Kyung-Soon Hong, MD; Byoung-Keuk Kim, MD; Jaemin Shim, MD; Jung-Sun Kim, MD; Young-Guk Ko, MD; Donghoon Choi, MD; Yangsoo Jang, Myeong-Ki Hong, MD, PhD

	Pre-KBA MLD, MV/SB (mm)	Post-KBA MLD, MV/SB (mm)	Pre-KBA FFR	Post-KBA FFR
1	2.4/2.5	2.6/2.6	0.90	0.96
2	2.9/2.5	2.9/2.4	0.96	1.00
3	3.0/2.3	3.0/2.5	0.95	0.95
4	2.7/2.3	2.8/2.4	0.96	0.96
5	2.9/2.2	2.9/2.4	0.92	1.00
6	3.1/1.8	3.2/2.0	0.95	0.98
7	3.0/2.2	2.9/2.3	0.94	0.96
8	2.8/1.6	2.7/1.8	1.00	1.00
9	3.0/2.8	2.9/2.8	0.94	0.94
10	3.1/2.9	3.0/3.0	0.88	0.94
11	3.4/2.4	3.3/2.3	0.88	0.94
12	3.2/2.1	3.2/2.3	0.97	1.00

0.94±0.04 0.97±0.03

J Interv Cardiol 2010

Clinical Cardiol 2010

Why FFR and Why “Not FFR” in Bifurcation Lesions?

	Why “FFR”?
Pre-intervention	<ul style="list-style-type: none">• To assess the functional significance of MB
Post-MB stenting	<ul style="list-style-type: none">• To assess the functional significance of jailed SB and to predict their outcomes
Post-SB angioplasty	<ul style="list-style-type: none">• To assess SB procedural success and to predict the outcomes after KBI (non-left main)
Post-SB stenting	