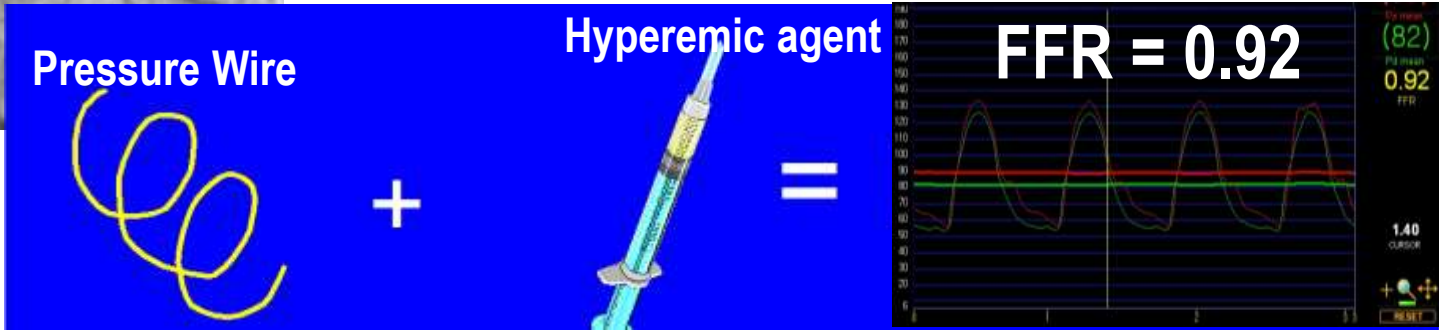
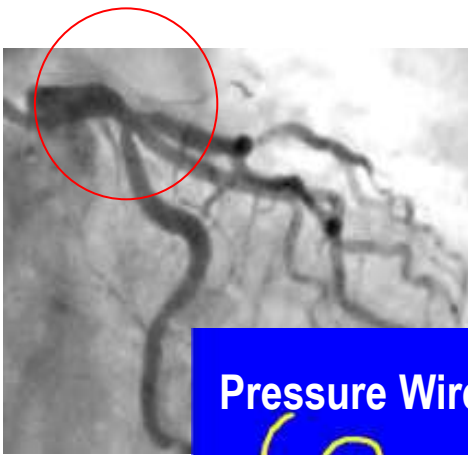


How to Practically Use FFR for Left Main Disease?

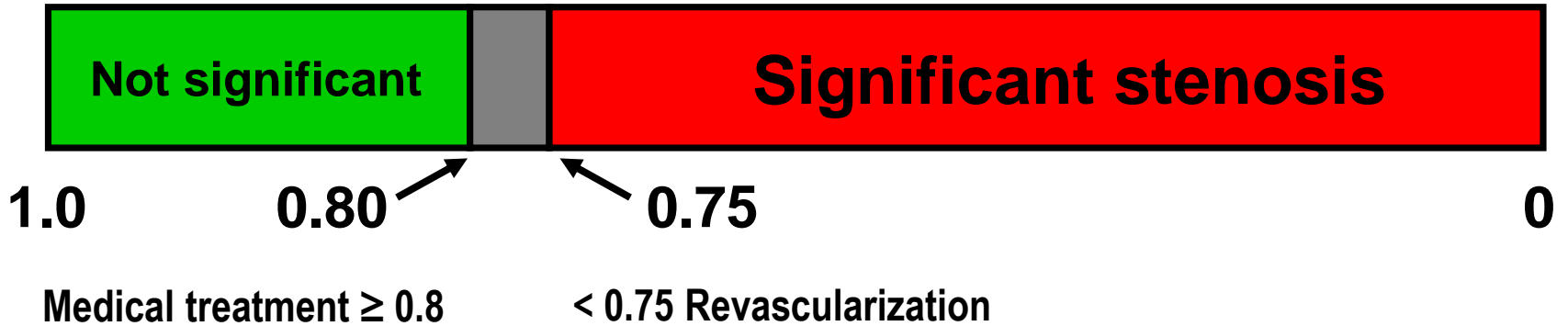
Bon-Kwon Koo, MD, PhD, FACC

Seoul National University Hospital, Seoul, Korea





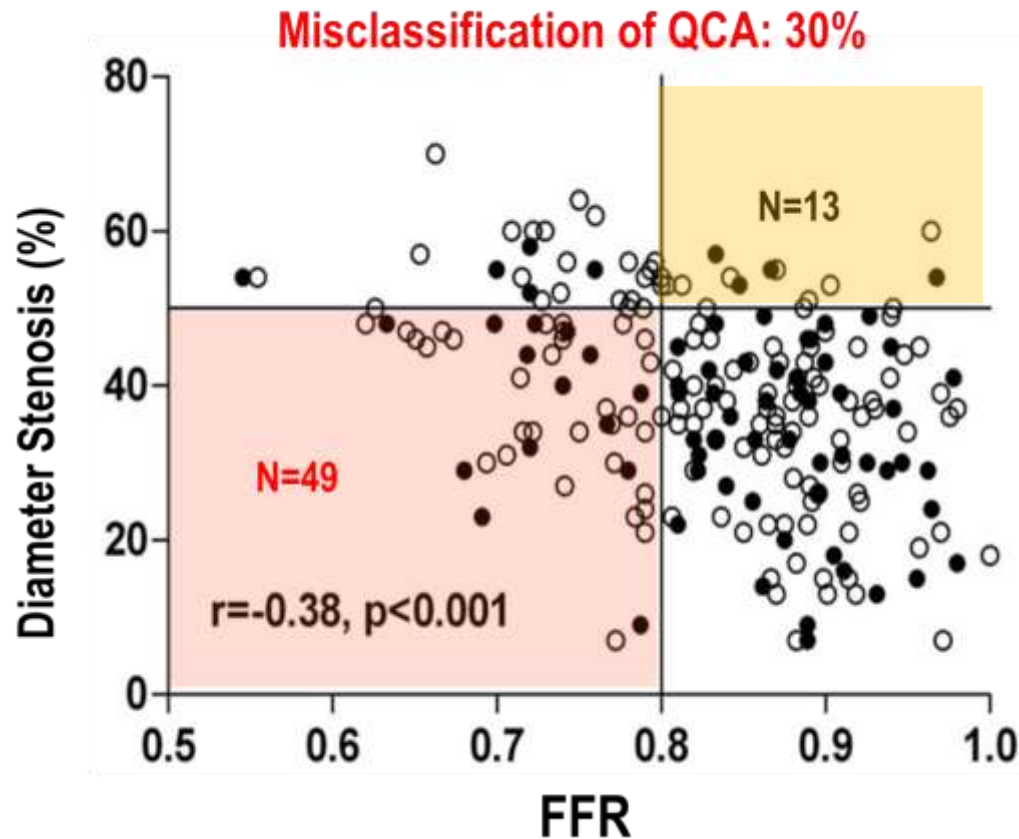
FFR vs. Revascularization



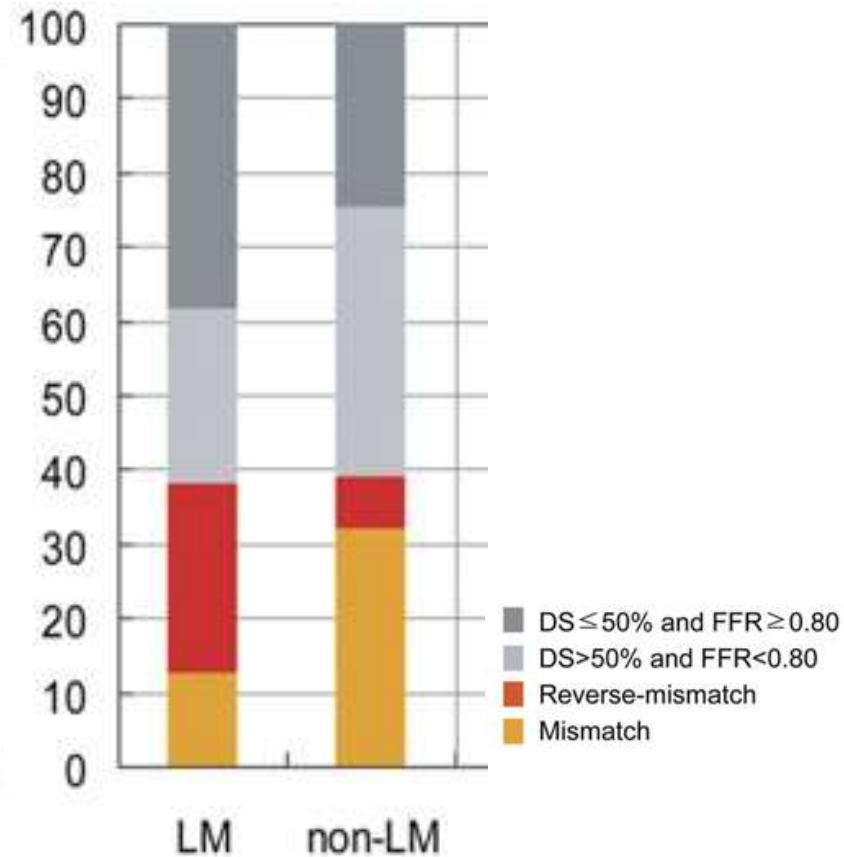
Why FFR is needed in LM lesions?

- The most important coronary stenosis
- Inaccuracy of angiographic assessment
- Complex lesions: ostial, bifurcation, serial stenoses
- Requires complex intervention

Angiography vs. FFR in Left Main disease



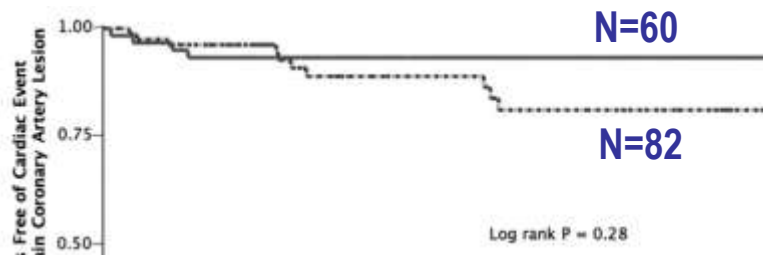
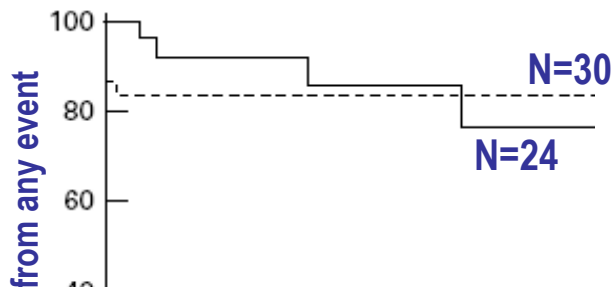
Hamilos et al. Circulation 2009



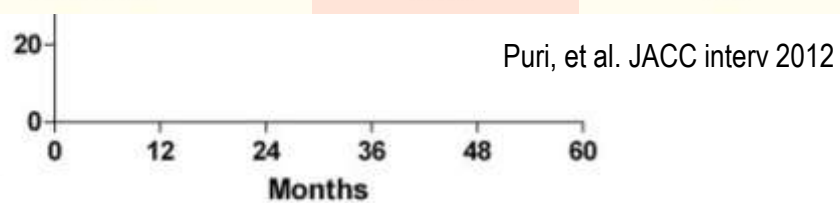
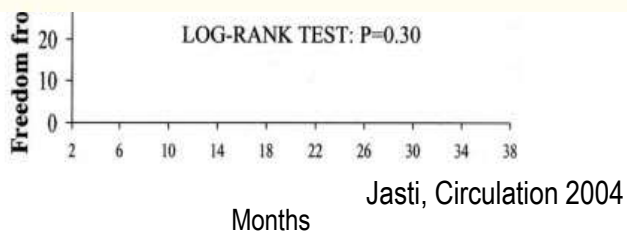
Park SJ, et al. JACC interv 2012

Safety of FFR-guided defer in Left Main stenosis

FFR \geq 0.75 or 0.8 \rightarrow Medical treatment vs. FFR $<$ 0.75 or 0.8 \rightarrow Revascularization



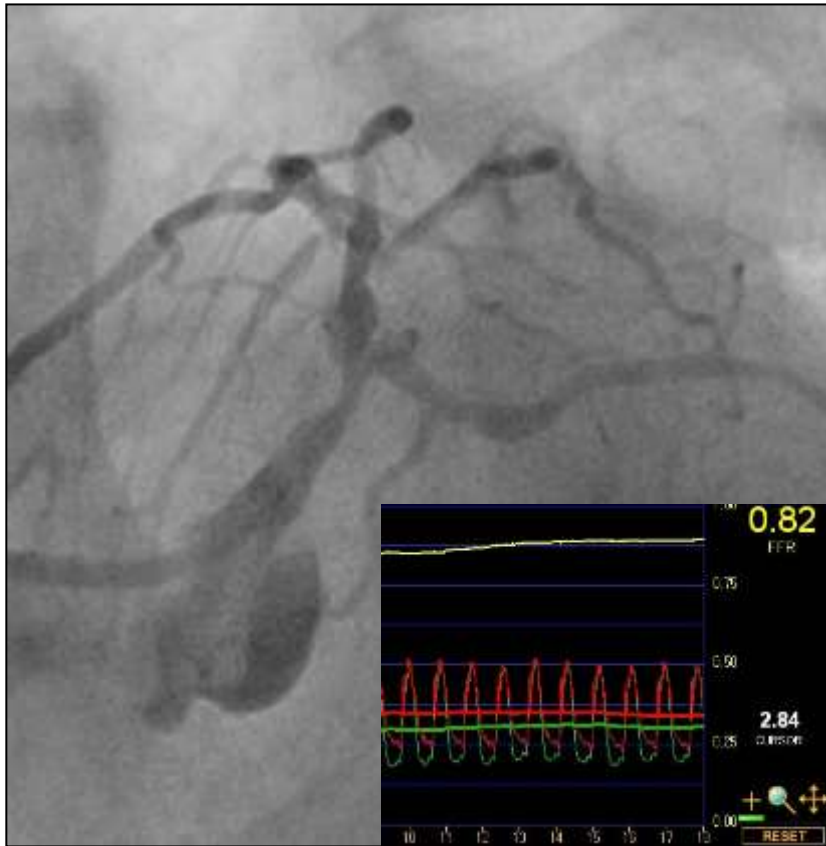
First Author (Ref. #)	N			FU (Months) Mean Duration	Overall Survival	
	Total	Defer Group	Surgical Group		Defer Group (%)	Surgical Group (%)
Bech et al. (23)	54	24	30	29 \pm 15	100	97
Jasti et al. (24)	51	37	14	25 \pm 11	100	100
Jiménez-Navarro et al. (25)	27	20	7	26 \pm 12	100	86
Legutko et al. (26)	38	20	18	24 \pm 12	100	89
Suamaru et al. (27)	15	8	7	33 \pm 10	100	100
Lindstaedt et al. (28)	51	24	27	29 \pm 16	100	81
Hamilos et al. (20)	213	138	75	35 \pm 12	90	85
Total or (mean)	449	271	178	(28 \pm 13)	(95)*	(89)



FFR application: Level of experience

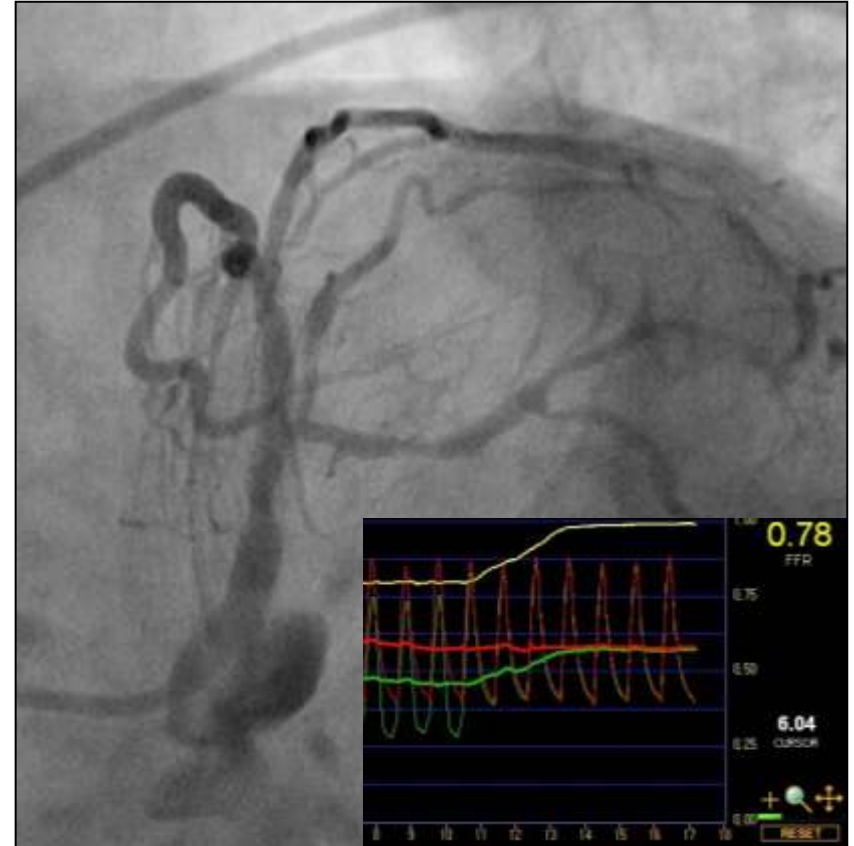
- Level 1: Setting up
- Level 2: Single intermediate stenosis
- Level 3: Serial stenoses, multi-vessel disease
- **Level 4: Left main, bifurcation, jailed side branches**
- Level 5: Dobutamine-stress FFR, IMR/CFR, wedge pressure.....

Which LM lesion is significant?



Mismatch

: Angiographically significant, functionally insignificant



Reverse Mismatch

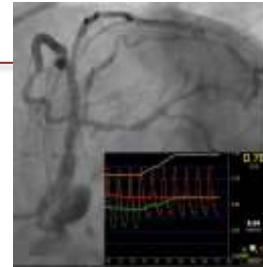
: Angiographically insignificant, functionally significant

Possible causes of mismatch and reverse mismatch



When there is a mismatch..

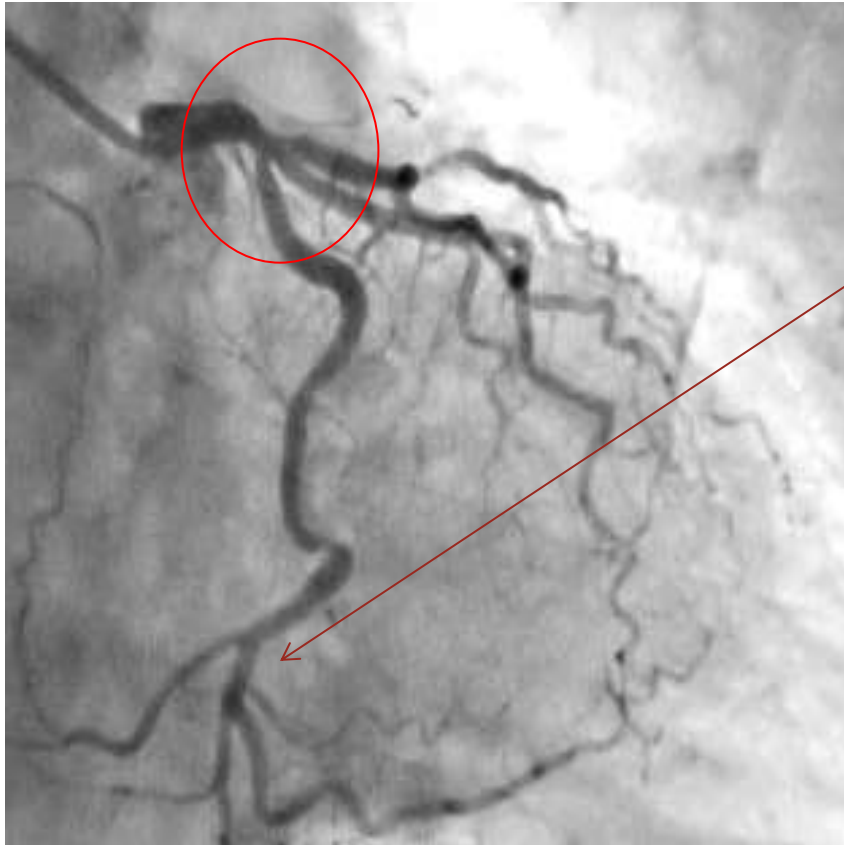
- Pitfalls of FFR measurement
 - Inadequate hyperemia
 - IV adenosine is the ideal hyperemic agent
 - Check the infusion system
 - Use different route, higher dosage, different agent
 - Drift
 - Check with pullback pressure tracing
 - Guiding catheter damping
 - Pull the guide catheter out of the ostium
- Influence of microvascular dysfunction



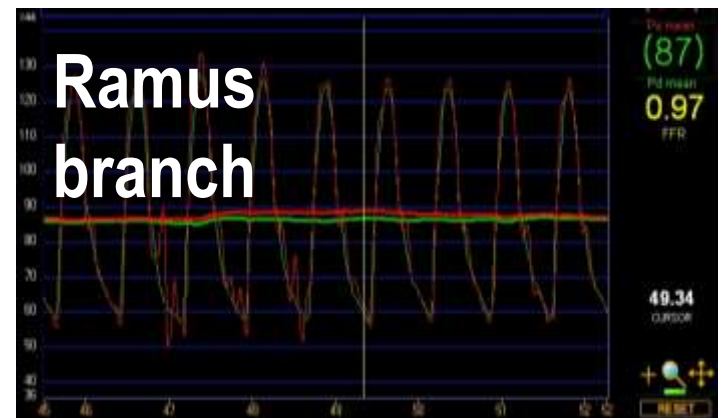
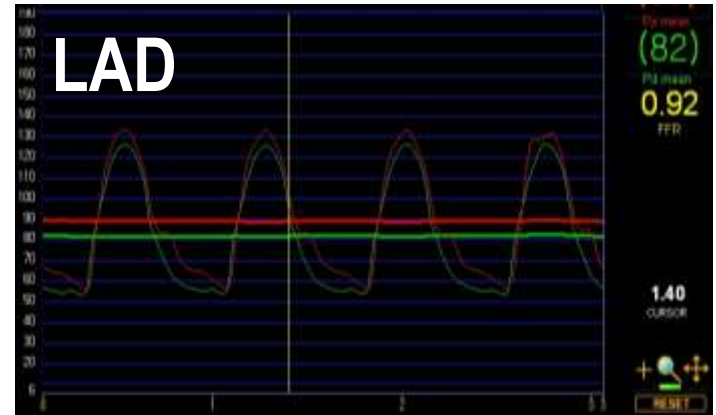
When there is a reverse mismatch...

- Pitfalls of FFR measurement
 - Drift
 - Check with pullback pressure tracing
- Influence of other stenosis
 - Pressure pullback tracing
 - Measure FFR at the other vessel
- Diffuse disease
 - Pressure pullback tracing
- Coronary spasm
- Presence of dissection

Significant Left Main disease?

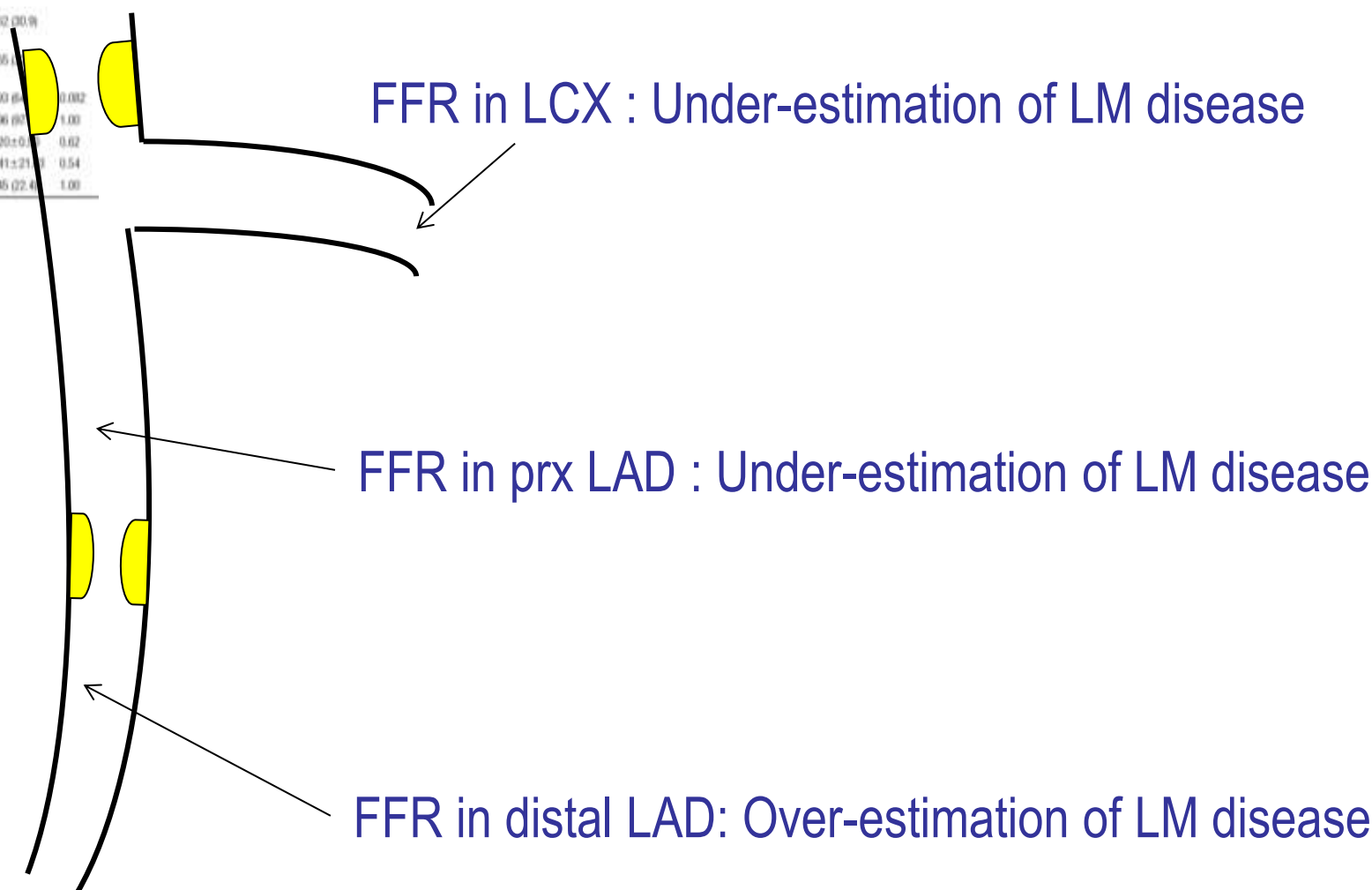


FFR = 0.78

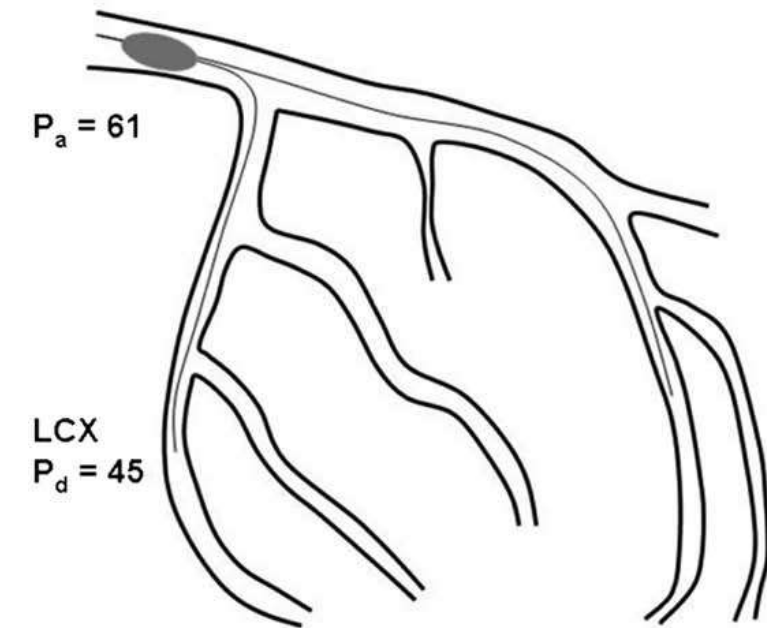


FFR in serial stenoses: complex scenarios...

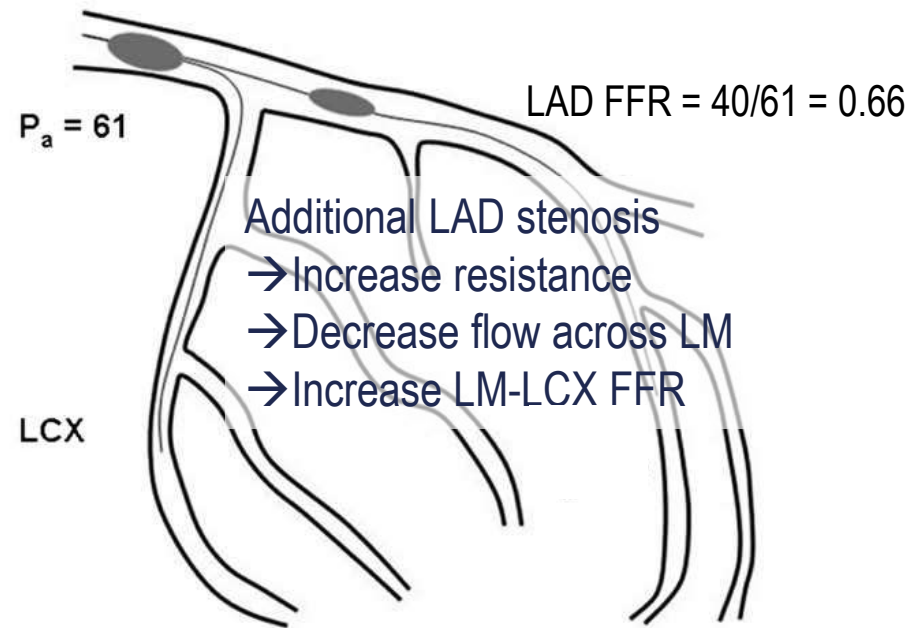
	All		P
	IVUS Guidance	Angiography Guidance	
Patients	201	201	
Age, Y	65.38±10.59	64.31±10.66	0.26
Male gender	146 (72.7)	140 (70)	
Diabetes			
Any type	70 (34.8)	63 (31.3)	0.52
Insulin treated	18 (9.0)	17 (8.5)	1.00
Extent of diseased vessel			
LM only	28 (13.9)	29 (14.4)	0.36
LM plus single-vessel disease	53 (26.4)	45 (22.4)	
LM plus 2-vessel disease	59 (29.4)	62 (30.8)	
LM plus 3-vessel disease	61 (30.4)	65 (32.4)	
RCA disease	76 (37.8)	80 (40)	1.002
De novo lesions	196 (97.5)	196 (97.5)	1.00
No. stents implanted at LM	1.18±0.46	1.20±0.46	0.62
Total stent length of LM	29.09±20.81	30.41±21.1	0.54
Complex stenting	45 (22.4)	45 (22.4)	1.00



FFR of LM stenosis : Influence of LAD stenosis on LCX FFR

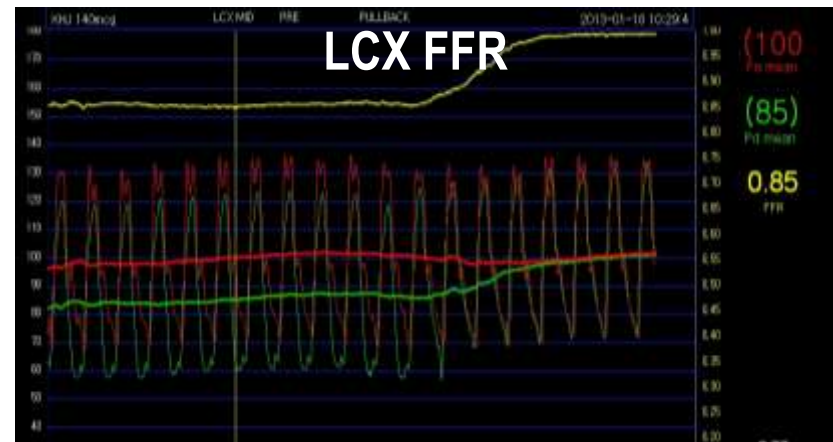
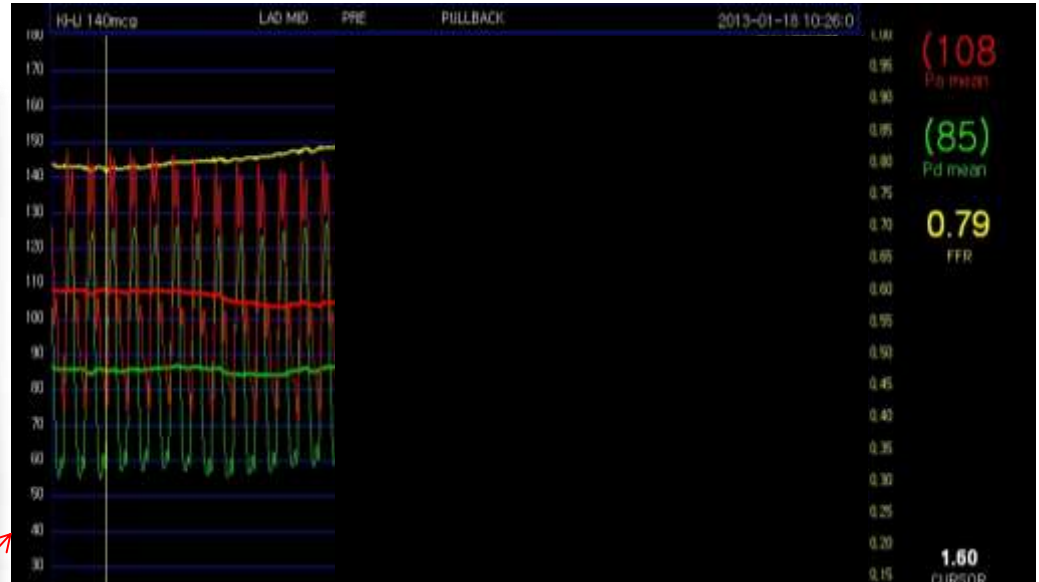
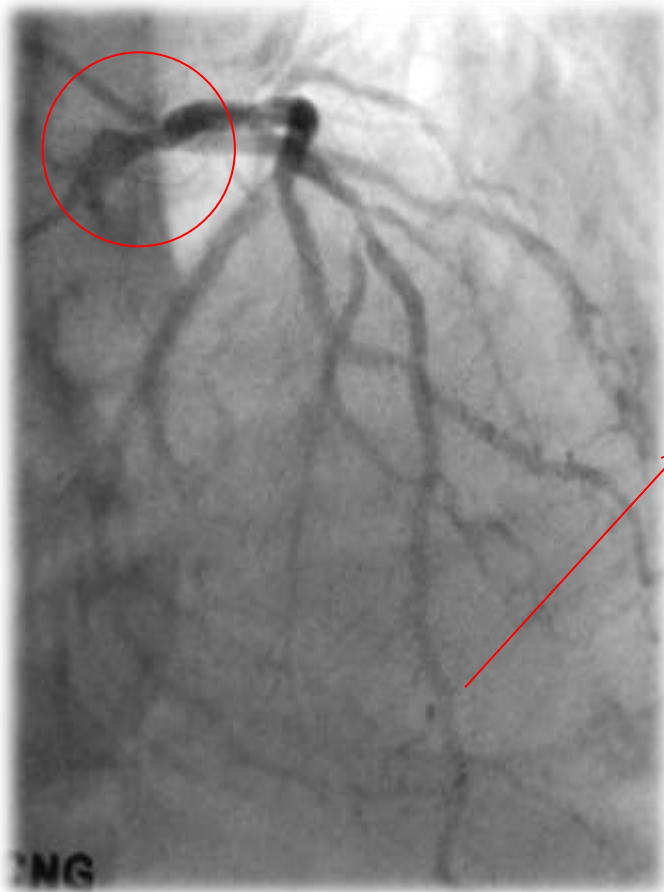


$$\text{LCX FFR} = 45/61 = 0.74$$



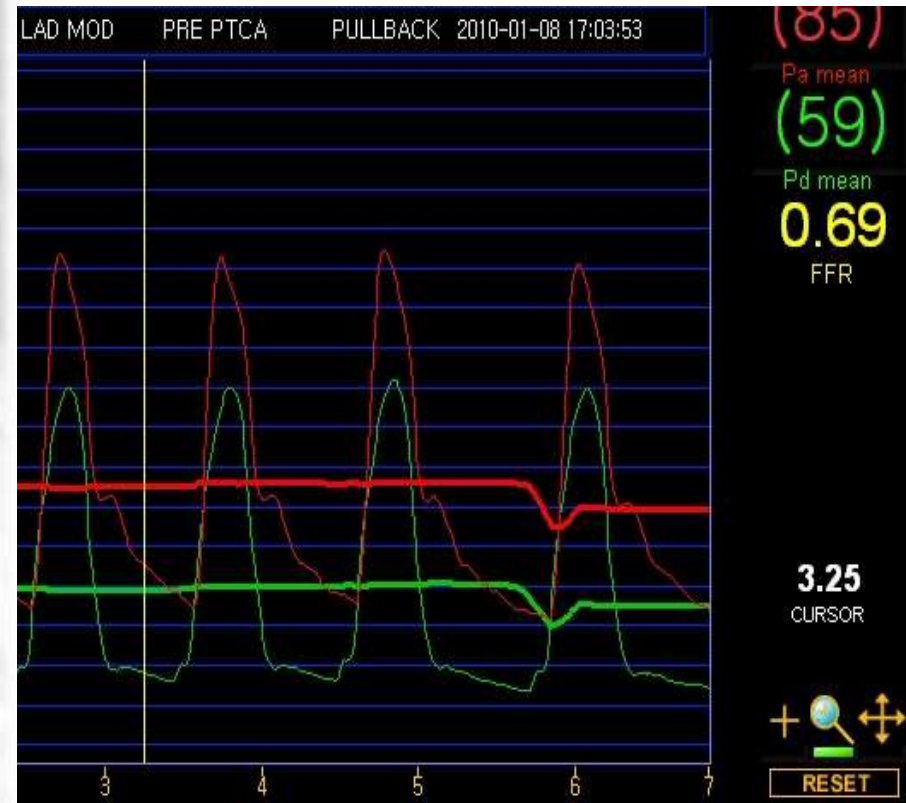
Clinically significant change occurs only when the other vessel stenosis is **proximal and severe.**

Lt main FFR?



$$\text{LM FFR} = 0.79 + [\text{influence of LAD stenosis}] - [\text{influence of LCX stenosis}]$$

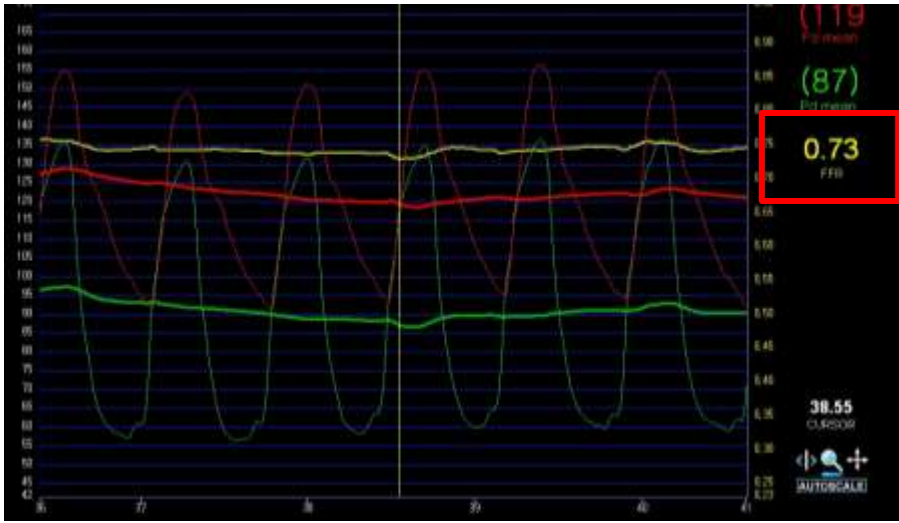
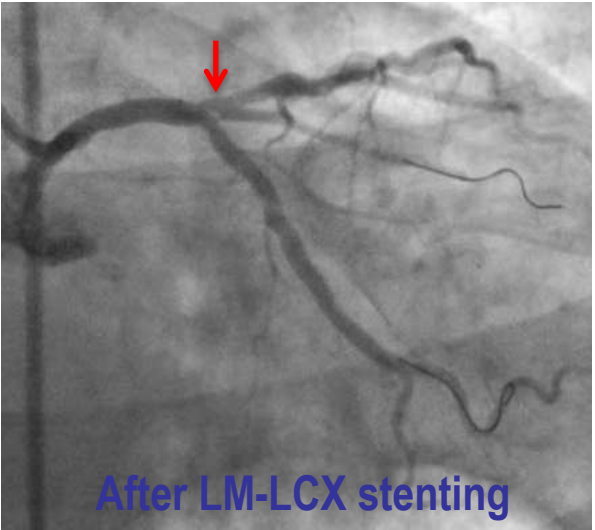
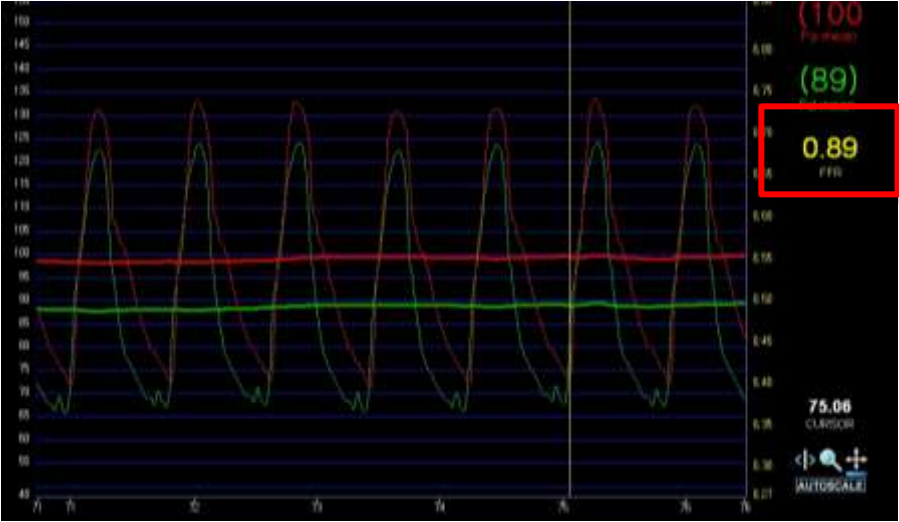
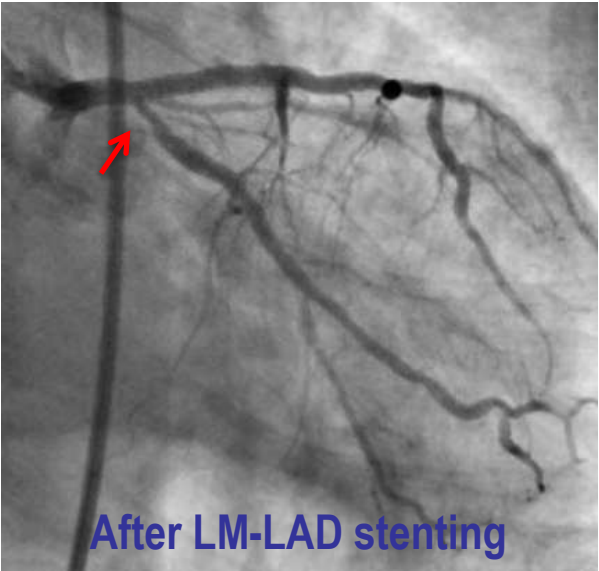
Left main disease?



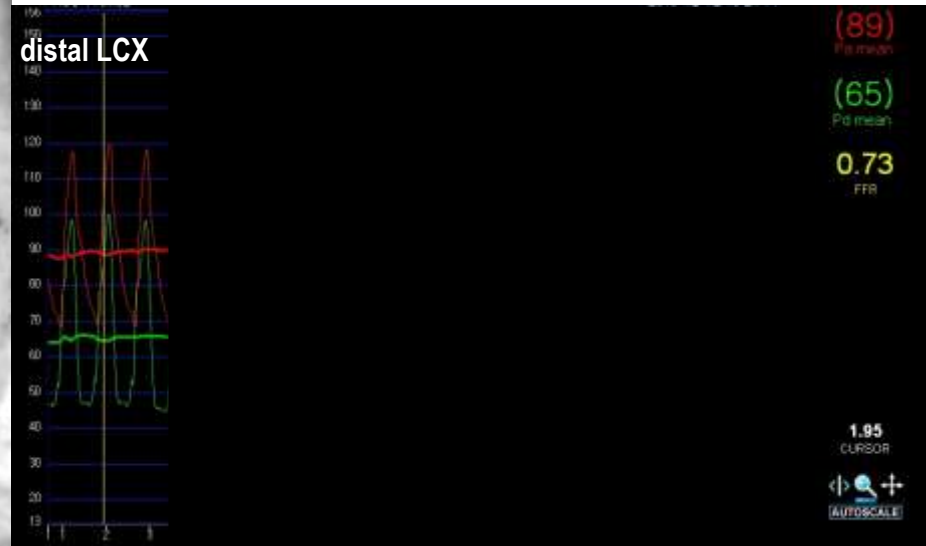
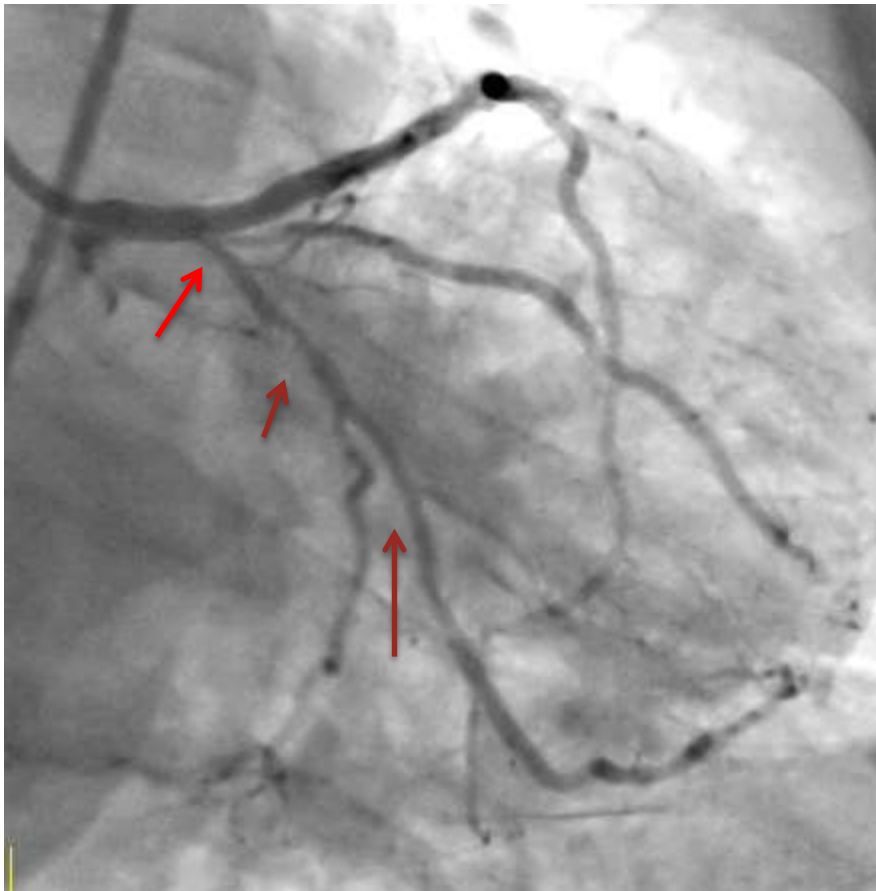
Application of FFR in LM lesions

- **Evaluation of intermediate or ambiguous LM lesions**
- **Decision of treatment strategy**
 - Finding a ischemia-causing lesion to determine the treatment strategy
 - Measurement of functional SYNTAX score
- **Evaluation of jailed LCX or LAD ostial lesion**
- **Evaluation of non-LM stenoses after LM stenting**
- **Assessment of residual ischemia after 2 stenting**

Assessment for jailed branches after LM stenting

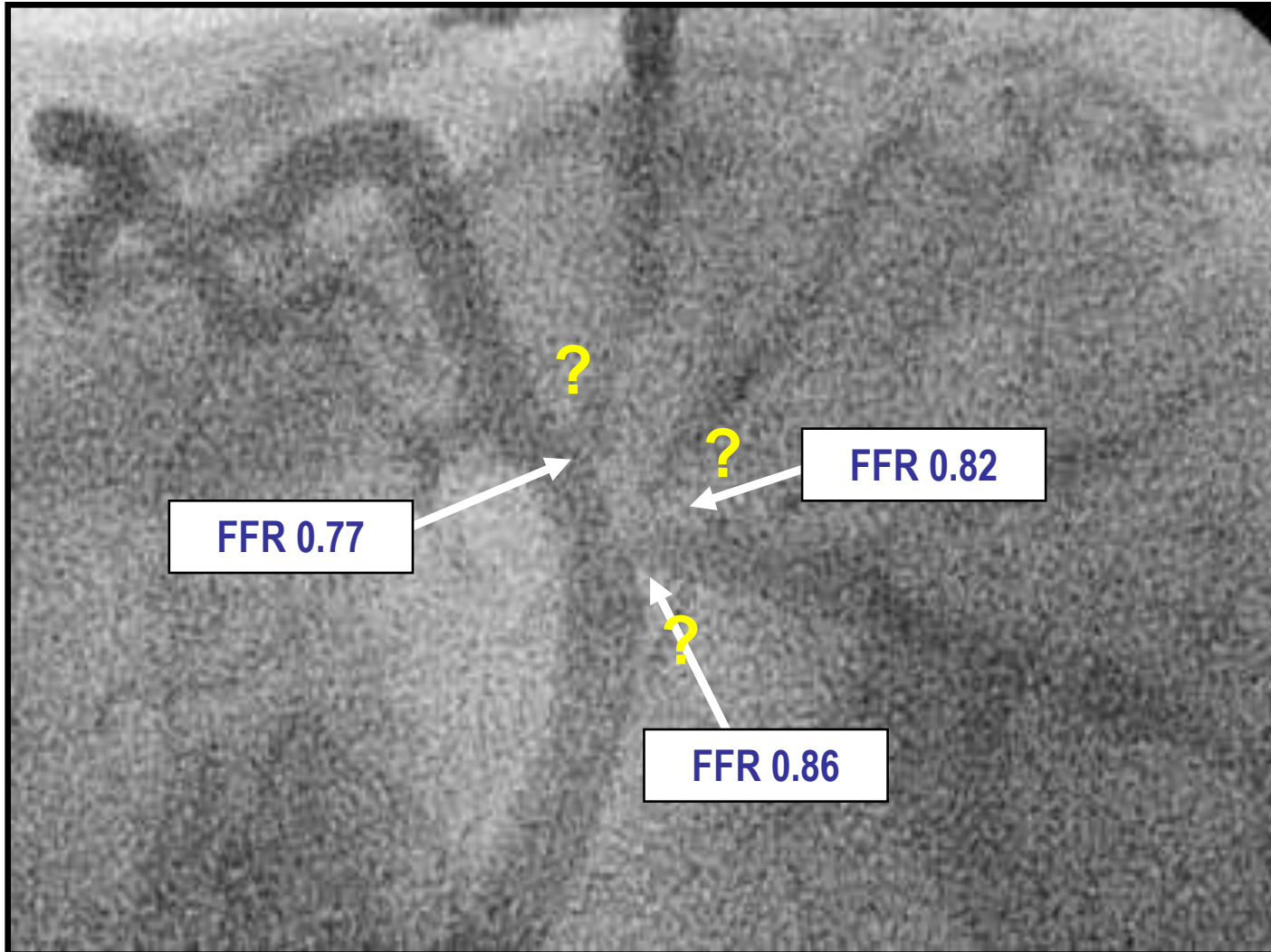


Assessment for residual lesions after LM stenting

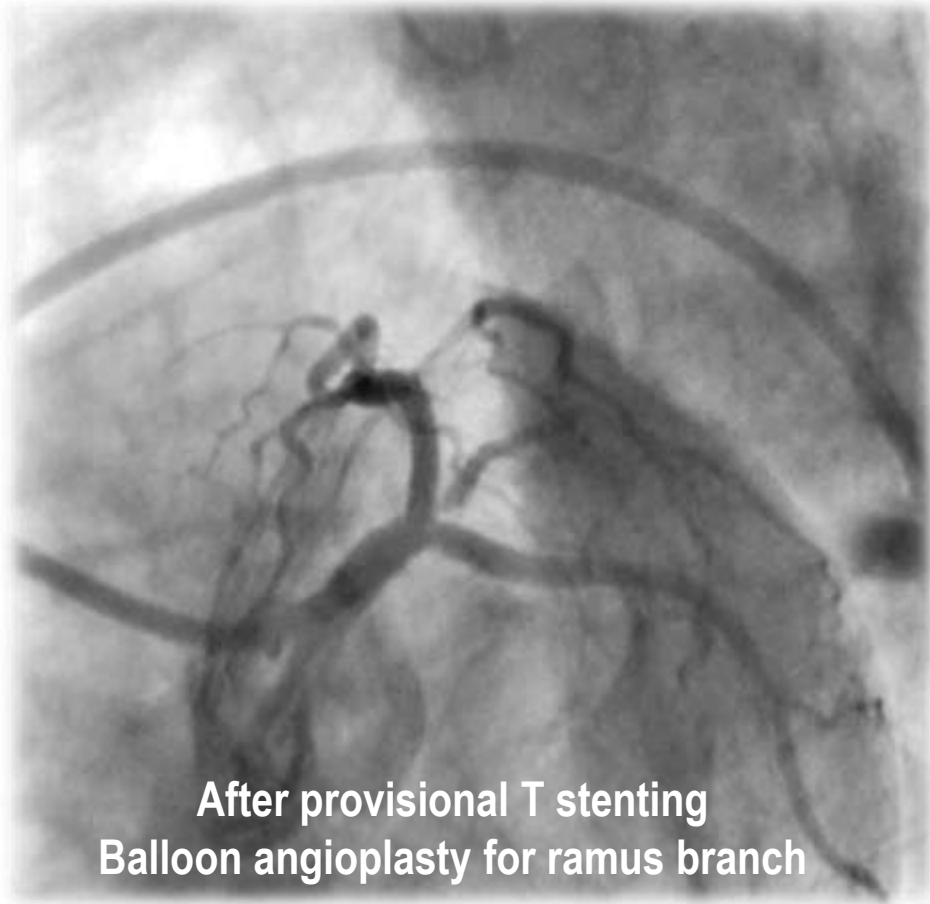


After LM-LAD stenting

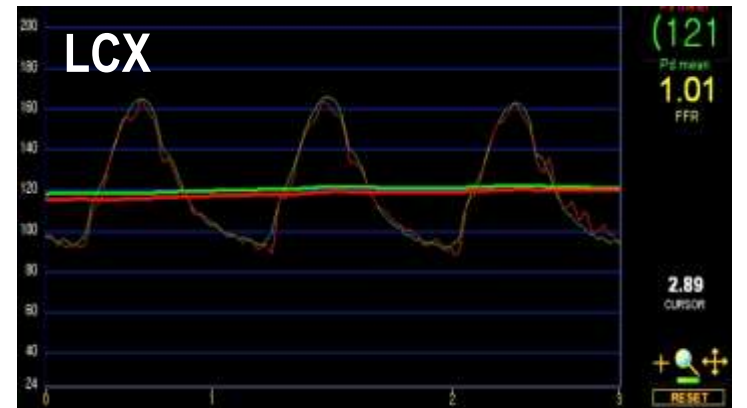
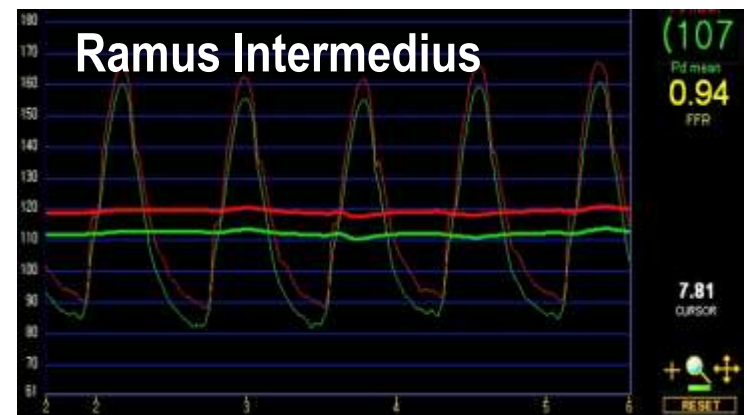
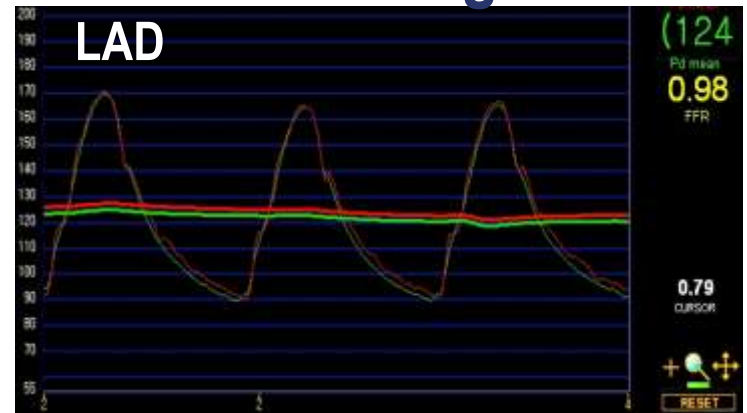
Assessment for ambiguous lesions after LM stenting



Evaluation of procedure after 2 stenting



**Functionally complete
revascularization**



How to practically use FFR for Left main disease?

- Carefully assess the lesion severity in all vessels (non-LM disease, collaterals...)
- Measure FFR at distal of more diseased major vessel
 - If significant, do the pull-back pressure tracing
- Measure FFR at distal of the other major vessel
 - If significant, do the pull-back pressure tracing
 - If insignificant, consider the influence of the other stenoses when the other vessel has severe proximal stenosis
- If both vessel FFRs are significant, double-check the pull-back tracing curves to exclude the influence of the other stenoses on LM FFR.
- When complex intervention is needed use both IVUS and FFR.