Case-Based Learning:

Multi-vessel and Bifurcation

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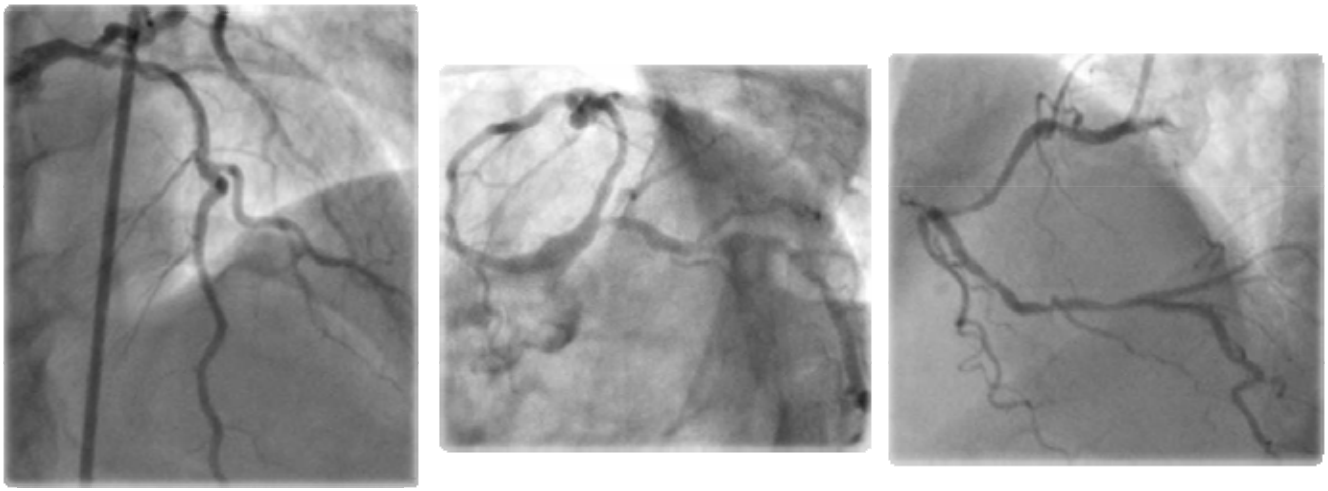
SNUH Seoul National University Hospital
Cardiovascular Center

FFR in multi-vessel, multi-lesion disease

F/52

Stable angina



Physiologic assessment for complex lesions

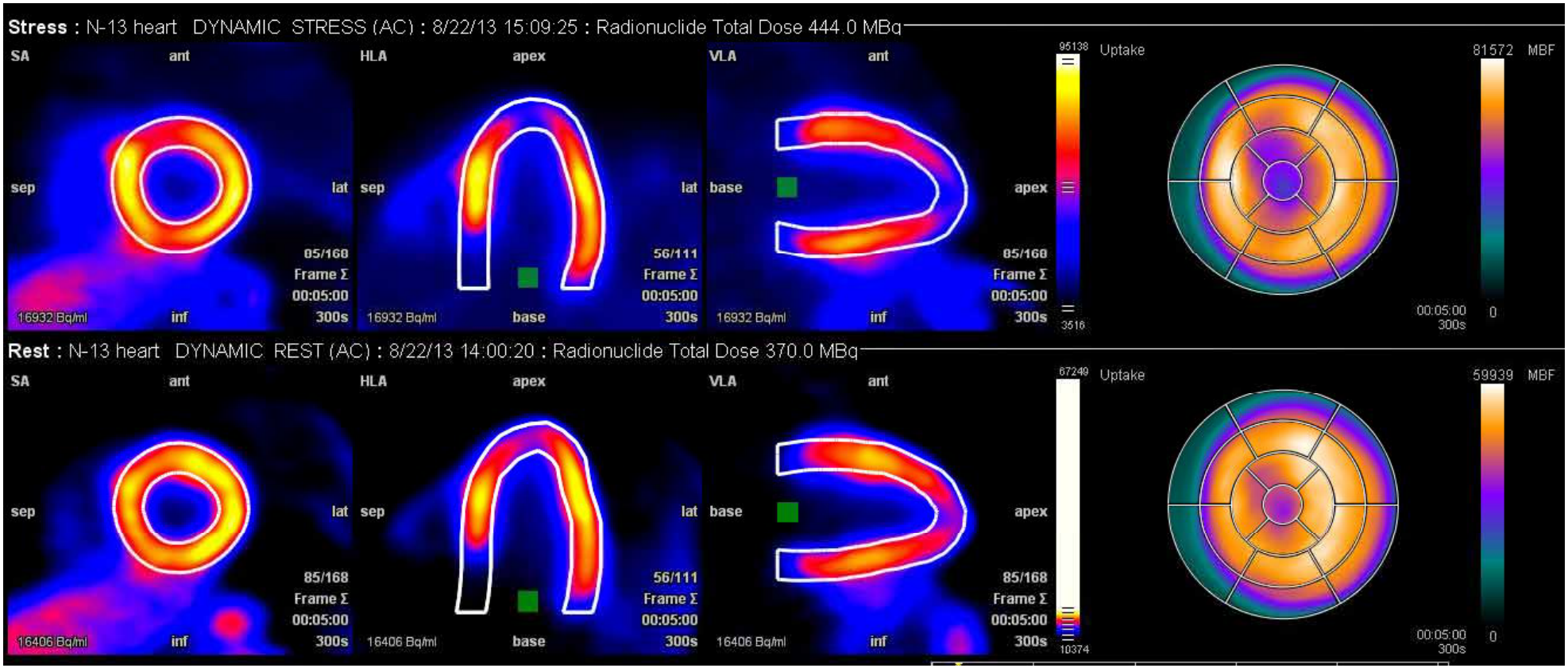
- Safe and more effective than in simple lesions
- Only if, the operator has adequate understanding of coronary physiology, physiologic assessment and some experience.

F/66 Stable angina

Cypher at LAD – 9 years ago

Risk factor: Hypertension, Hypercholesterolemia

N-13 ammonia PET: Reversible defect in apex, apio-mid anterior wall



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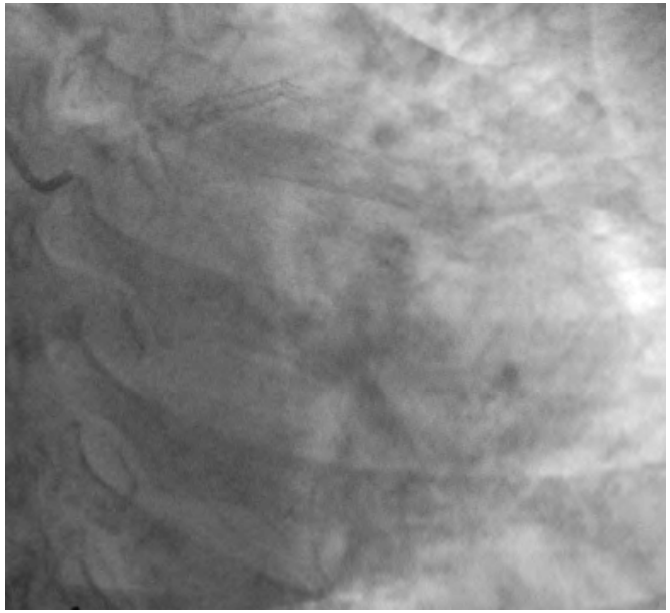

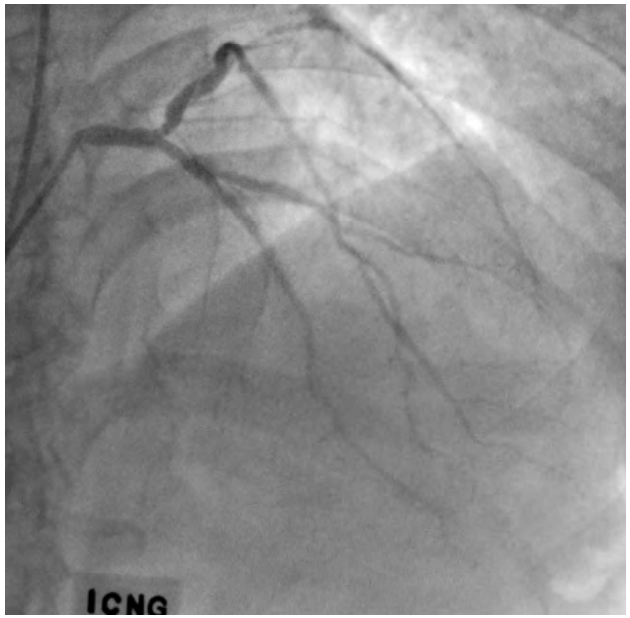

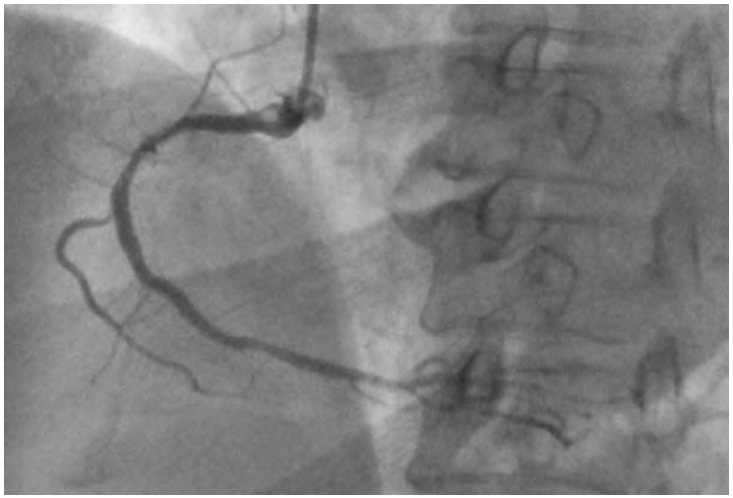

F/66 Stable angina

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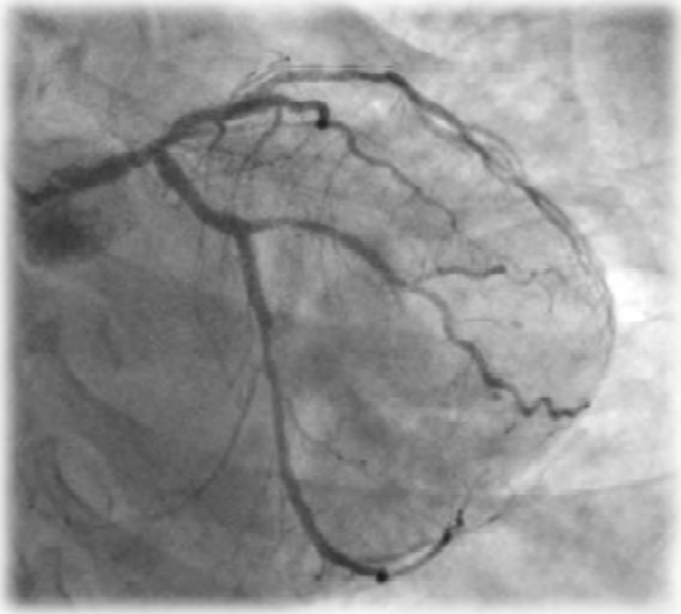

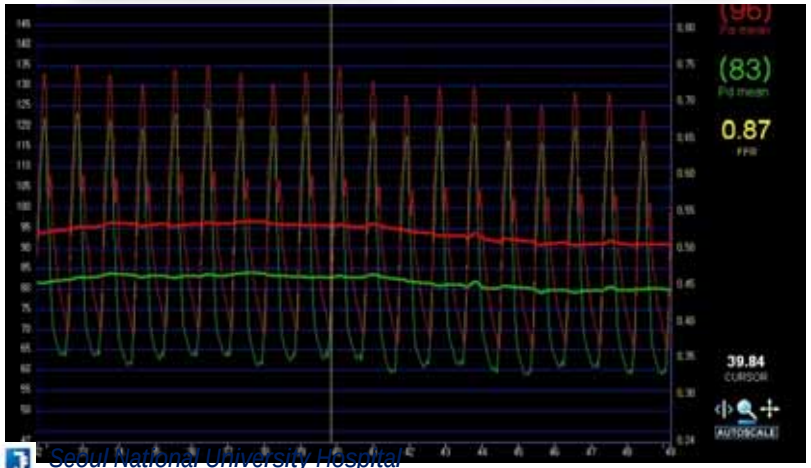

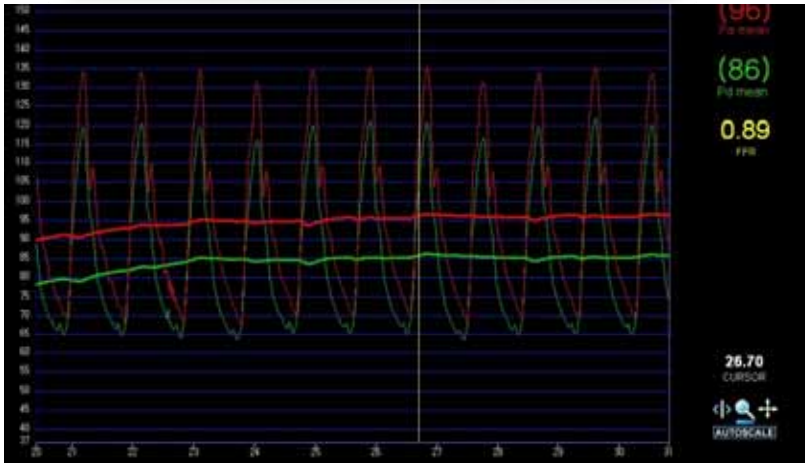

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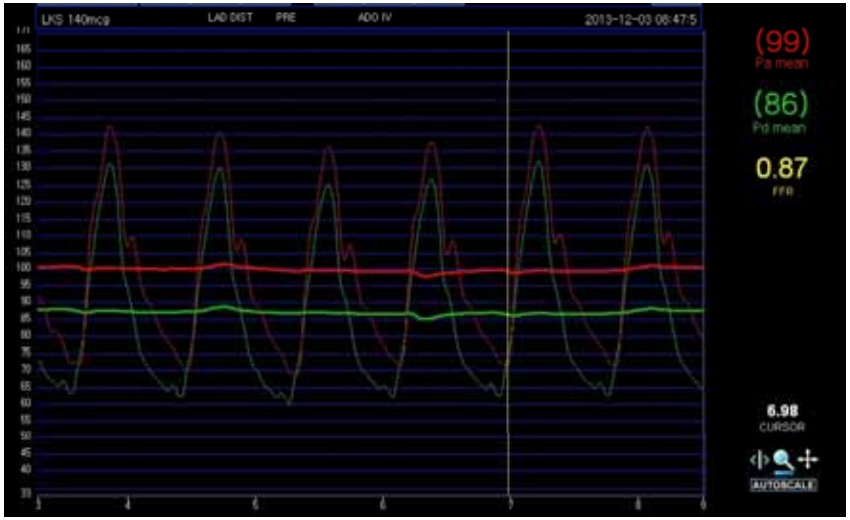
N13-ammonia PET: reversible perfusion defect i

CAG: 2 vessel disease - distal LCX and proximal RCA

FFR: not significant in all 3 vessels

Discrepancy…Who is a liar?

Patient ? PET? FFR?



Coronary Pressure Never Lies

Jacques J. Koolen, MD, PhD and Nico H.J. Pijls,* MD, PhD

Fractional Flow Reserve (FFR), calculated by coronary pressure measurement, is the invasive gold standard to assess the hemodynamic significance of a coronary stenosis. FFR reliably indicates whether a stenosis is responsible for inducible ischemia and if

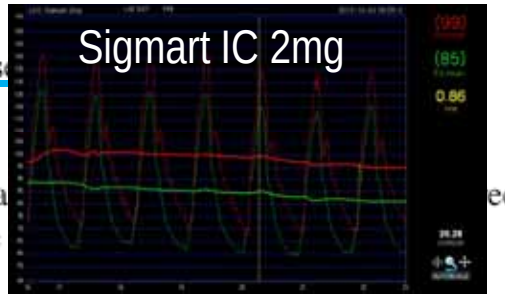
TABLE I. Reasons of Nonischemic FFR Despite an Apparently Tight Stenosis

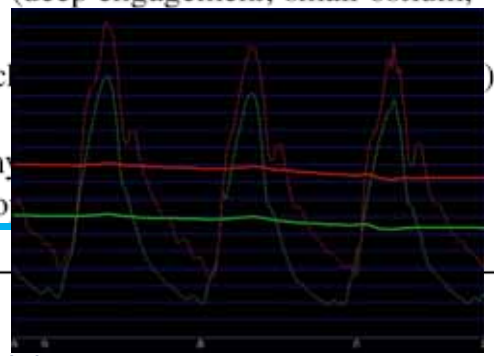
Physiologic explanations
- stenosis hemodynamically nonsignificant despite angiographic appearance
- small perfusion territory, old myocardial infarction, little viable tissue, small vessel
- abundant collaterals
- severe microvascular dis

Interpretable explanations
- other culprit lesion
- diffuse disease rather tha ecording)
- chest pain of noncardiac

Technical explanations
- insufficient hyperemia (check system and solution; or use other stimulus)
- guiding catheter related pitfall (deep engagement, small ostium, sideholes)
- electrical drift (pull sensor bac)

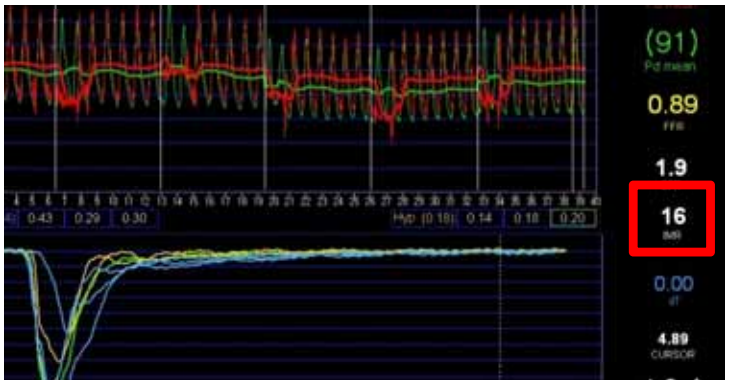
Actual false negative FFR
- acute phase of ST elevation m
- severe left ventricular hypertro
- exercise-induced spasm

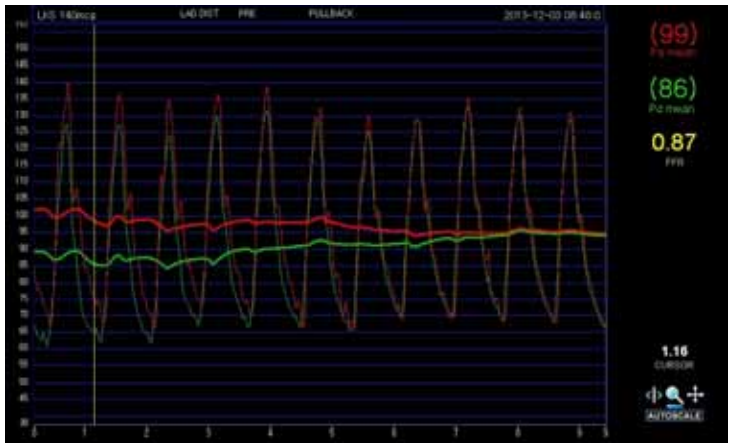




CCI 2008;72:248-56

Echocardiography
1. Normal LV cavity size and systolic function; Calculated EF : 52%
2. No regional wall motion abnormality
3. Normal LV wall thickness
4. Normal valves





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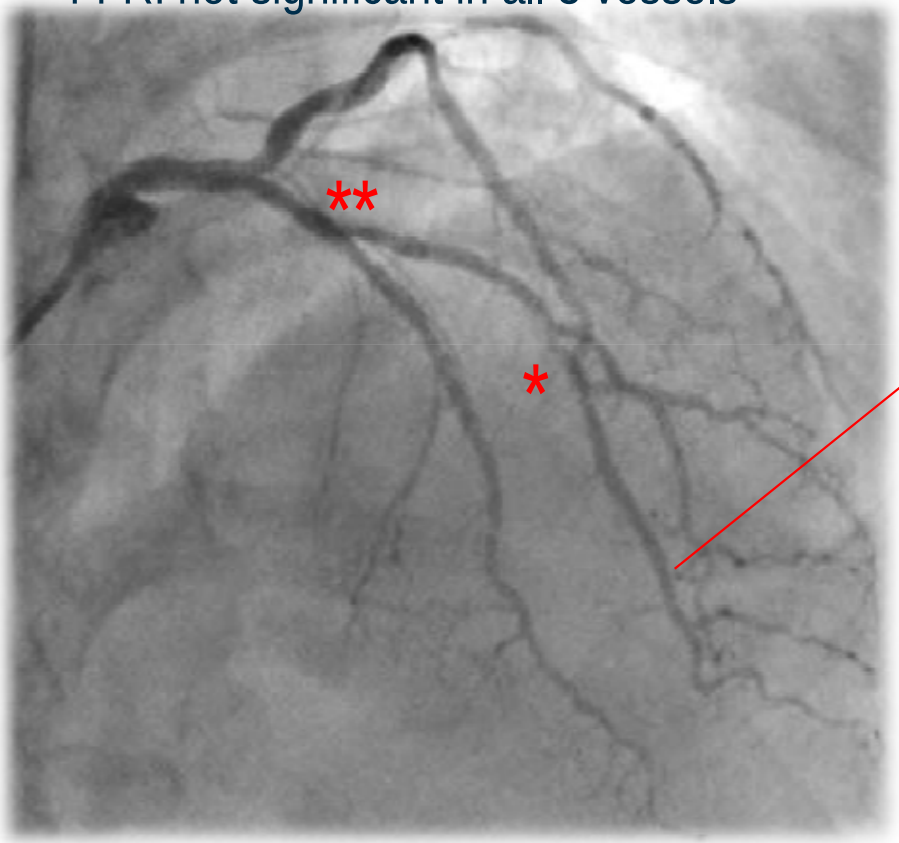

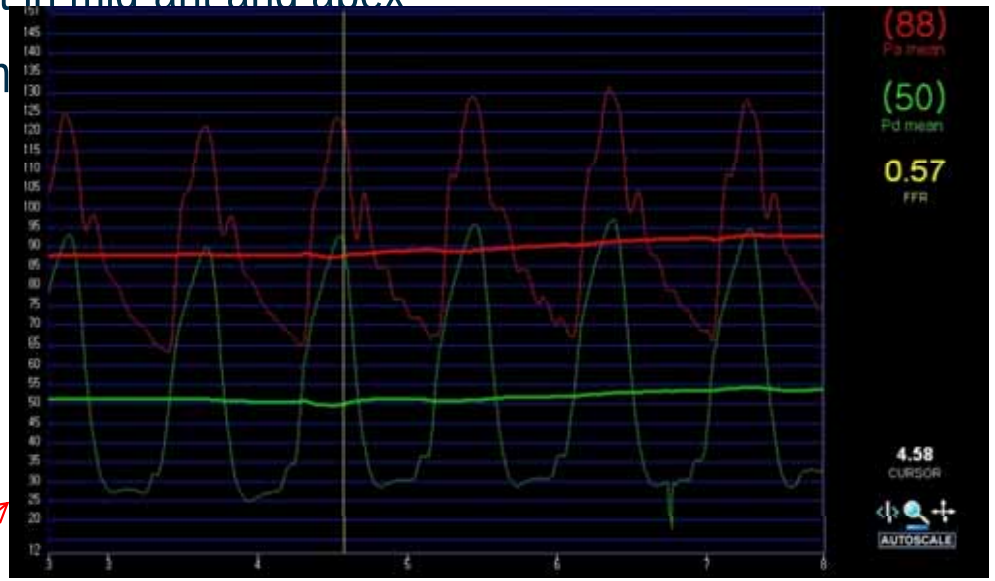

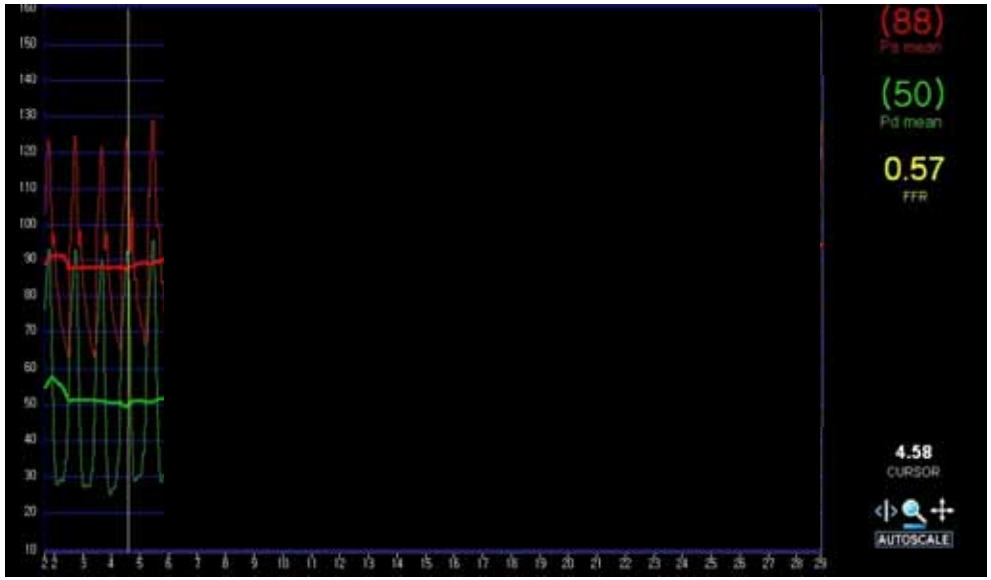

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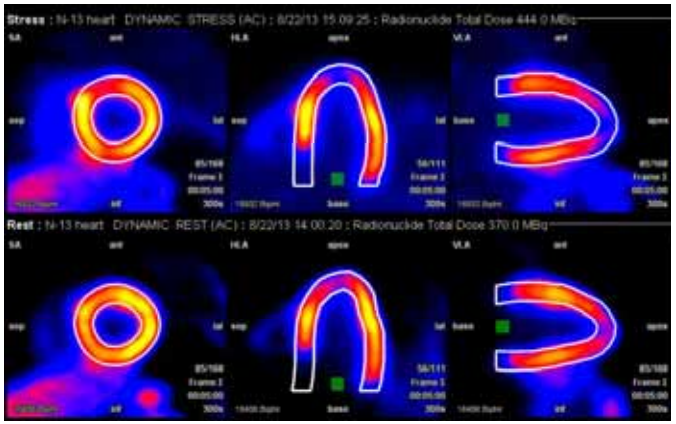

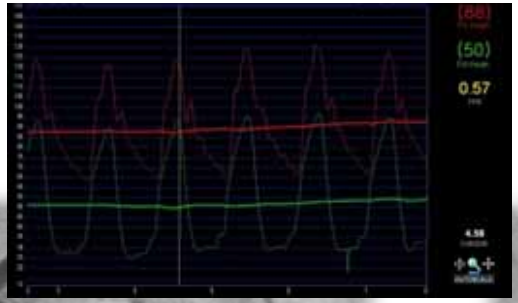

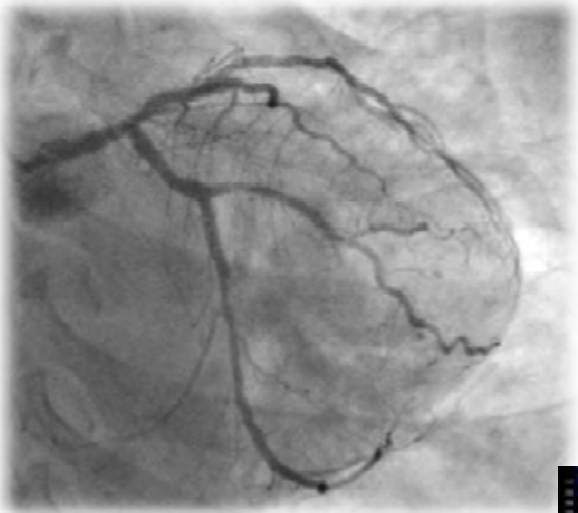

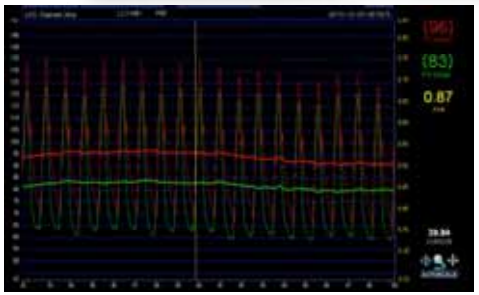

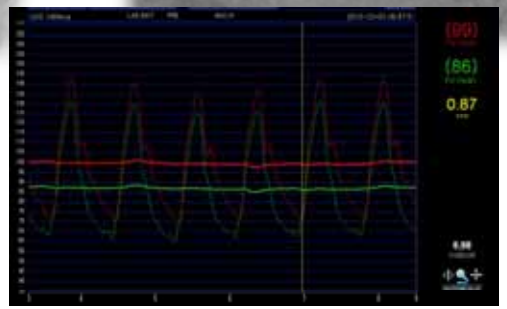

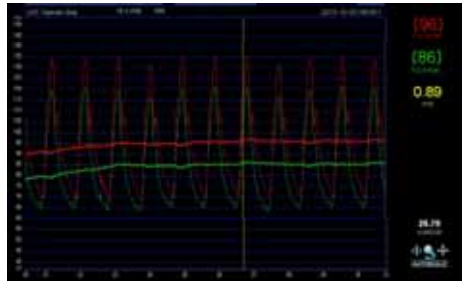

Mismatch between FFR and PET?

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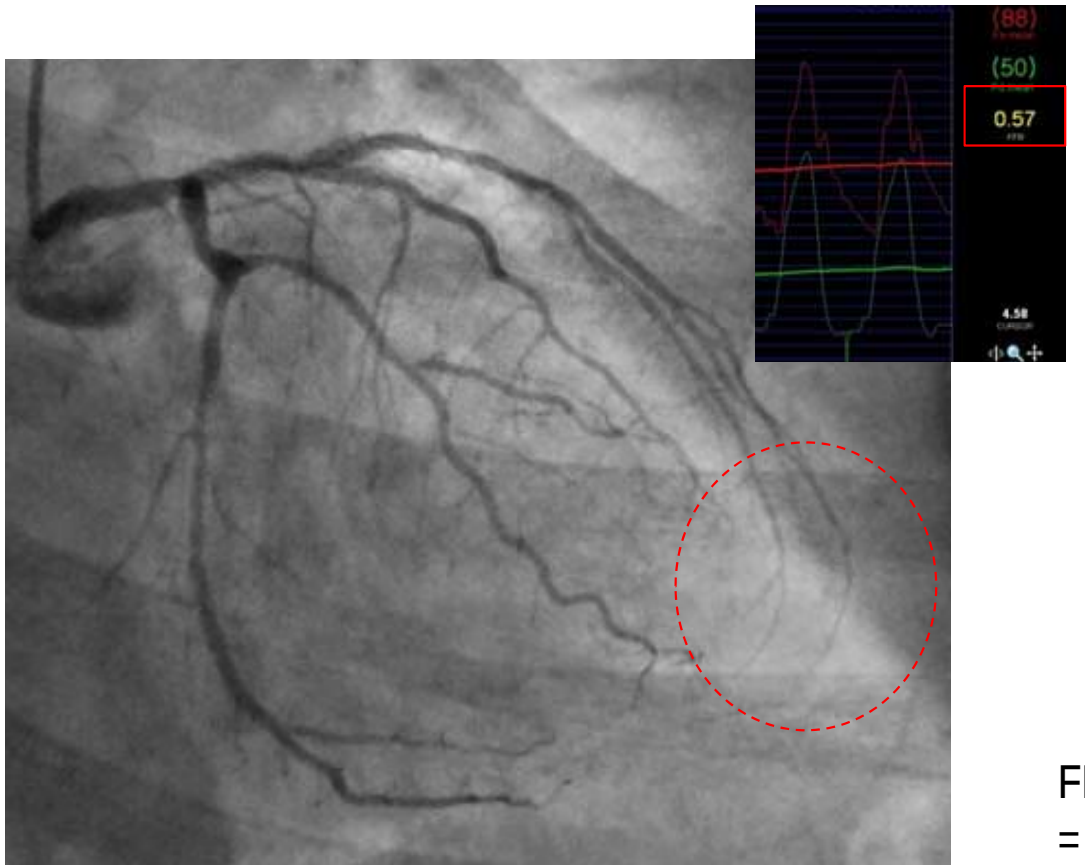
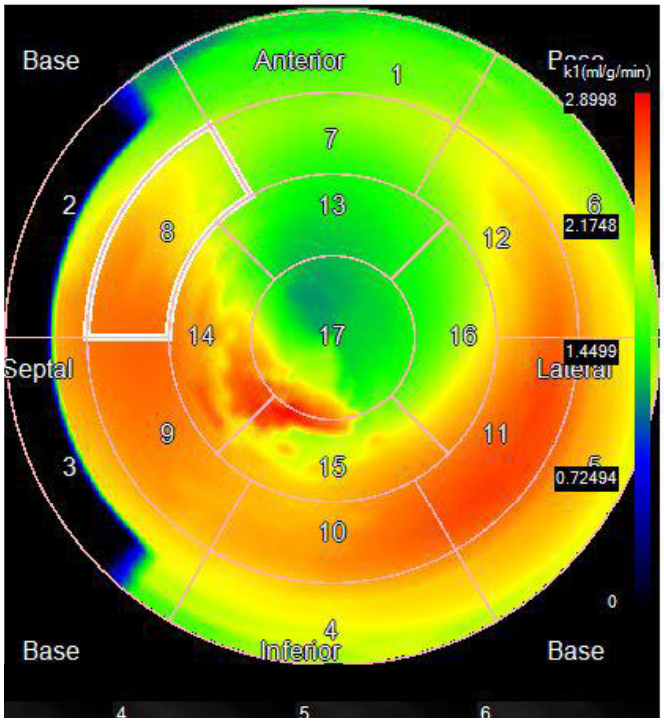




	k1(ml/g/min)
GLOBAL	1.810
LAD	1.574
LCX	2.095
RCA	2.229
Seg1	1.605
Seg2	1.871
Seg3	2.220
Seg4	2.042
Seg5	2.243
Seg6	1.926
Seg7	1.711
Seg8	2.138
Seg9	2.460
Seg10	2.334
Seg11	2.568
Seg12	2.107
Seg13	1.459
Seg14	2.208
Seg15	1.986
Seg16	1.767
Seg17	1.379

FFR by PET flow

= [Hyperemic Blood flow of seg 13 & 17] / Max flow

= [(1.459+1.379)/2] / [(2.568+2.460)/2]

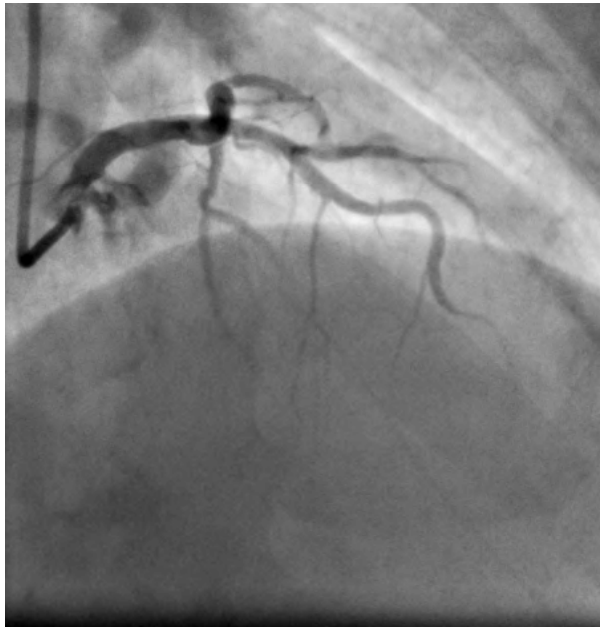
= 0.56

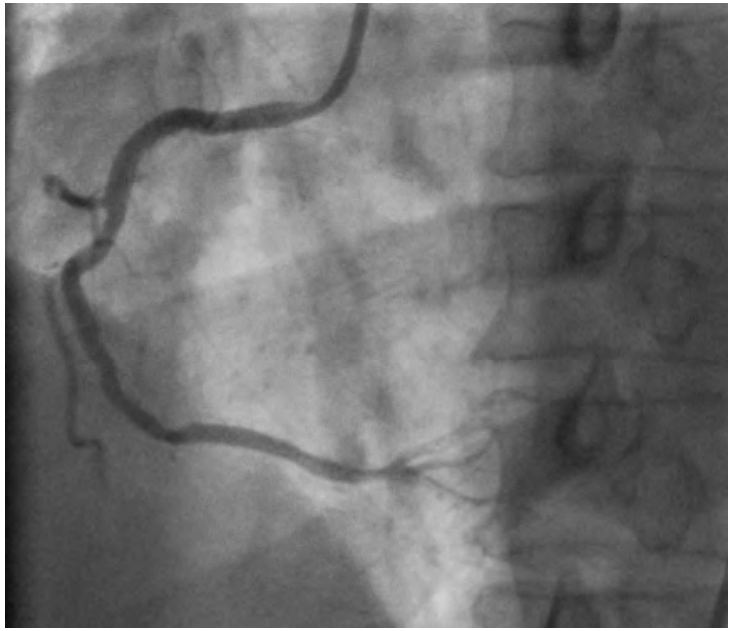
F/52 Stable angina with recent aggravation

Risk factor: DM, Hypertension, Hypercholesterolemia

CT CAG: pLAD 50-60%%, pLCX 70%, RCAos 40-50%

TMT: suggestive of positive



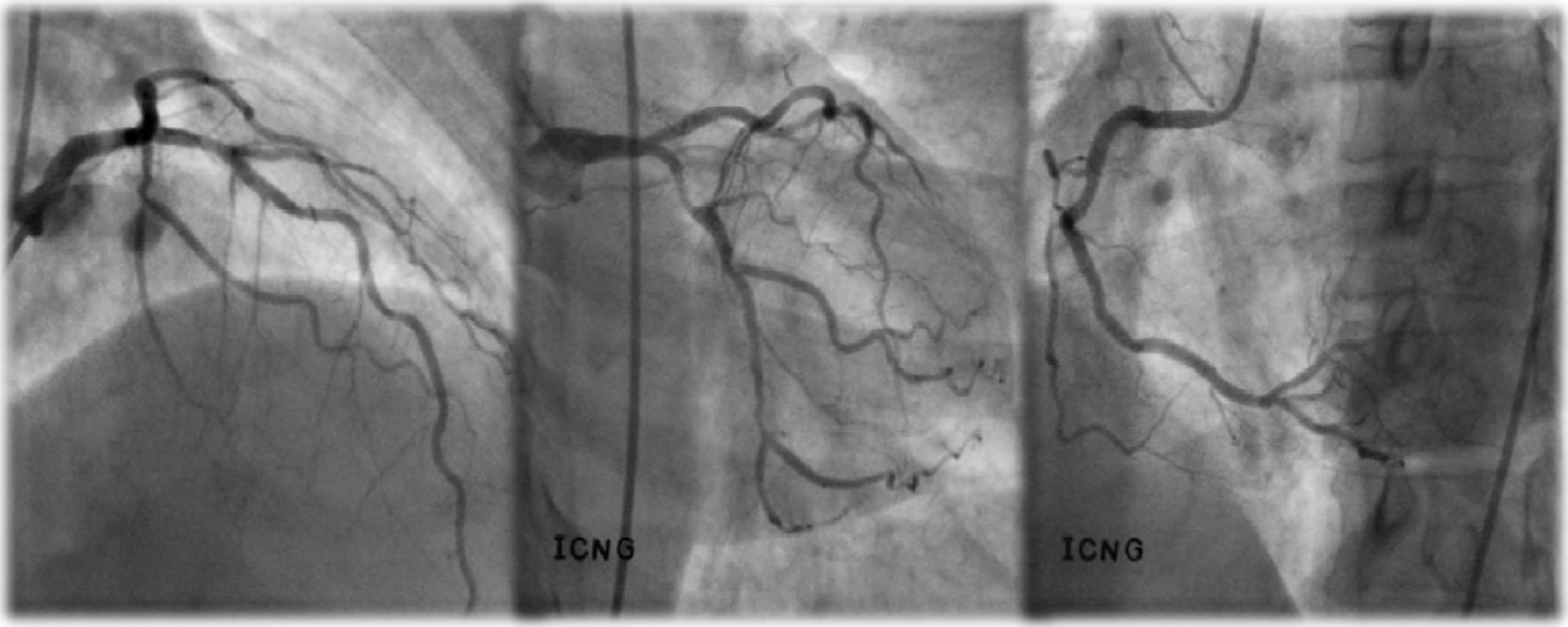


F/52 Stable angina for 4 years

Coronary CT angiography: Proximal LAD 50-60%, prx and dist LCX 70%, RCA os 40-50%

Exercise stress test: suggestive of positive

CAG: 1 vessel disease – proximal and distal LCX



Which one is ischemia-causing stenosis?

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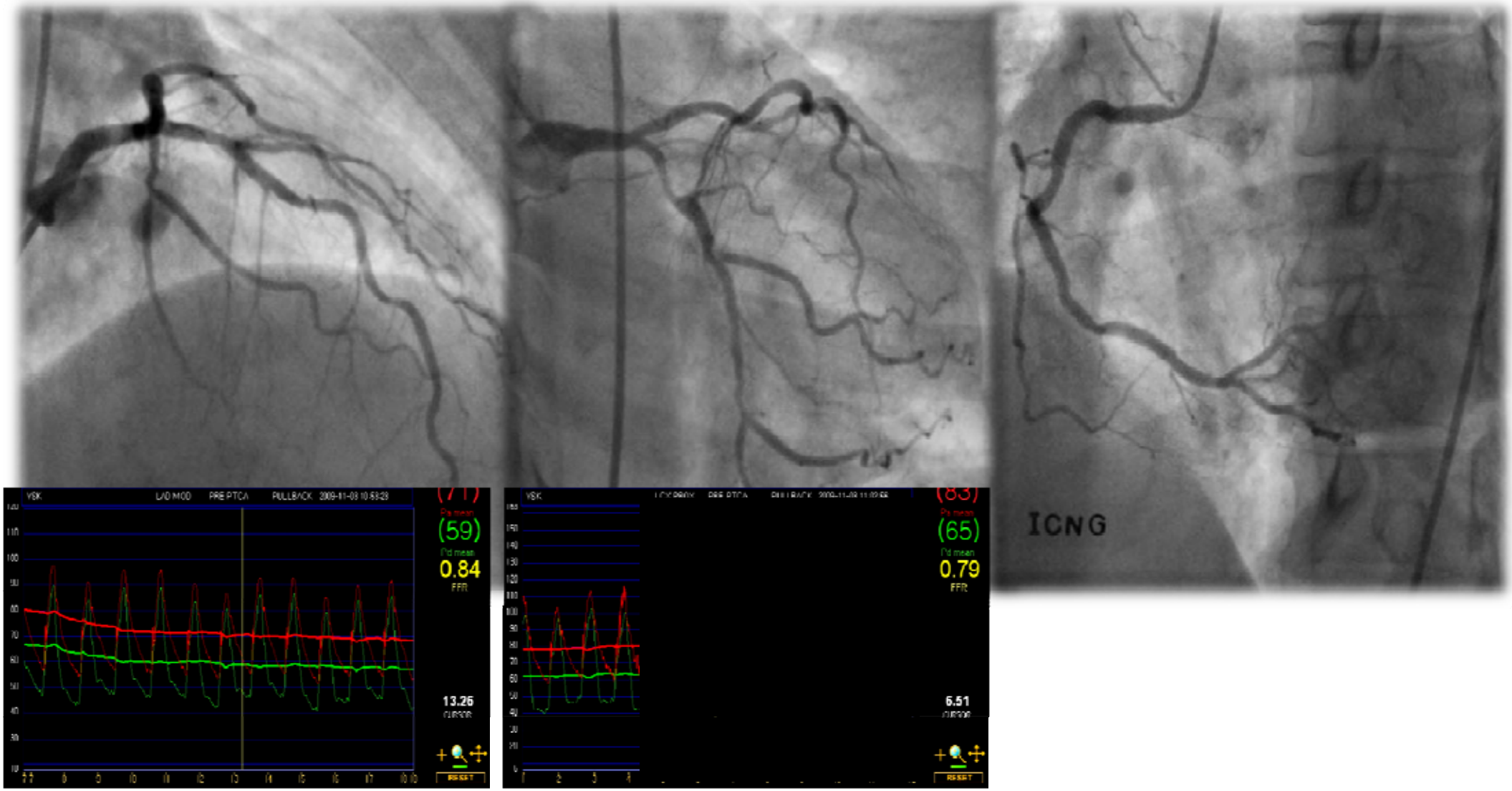

Which one is ischemia-causing stenosis?

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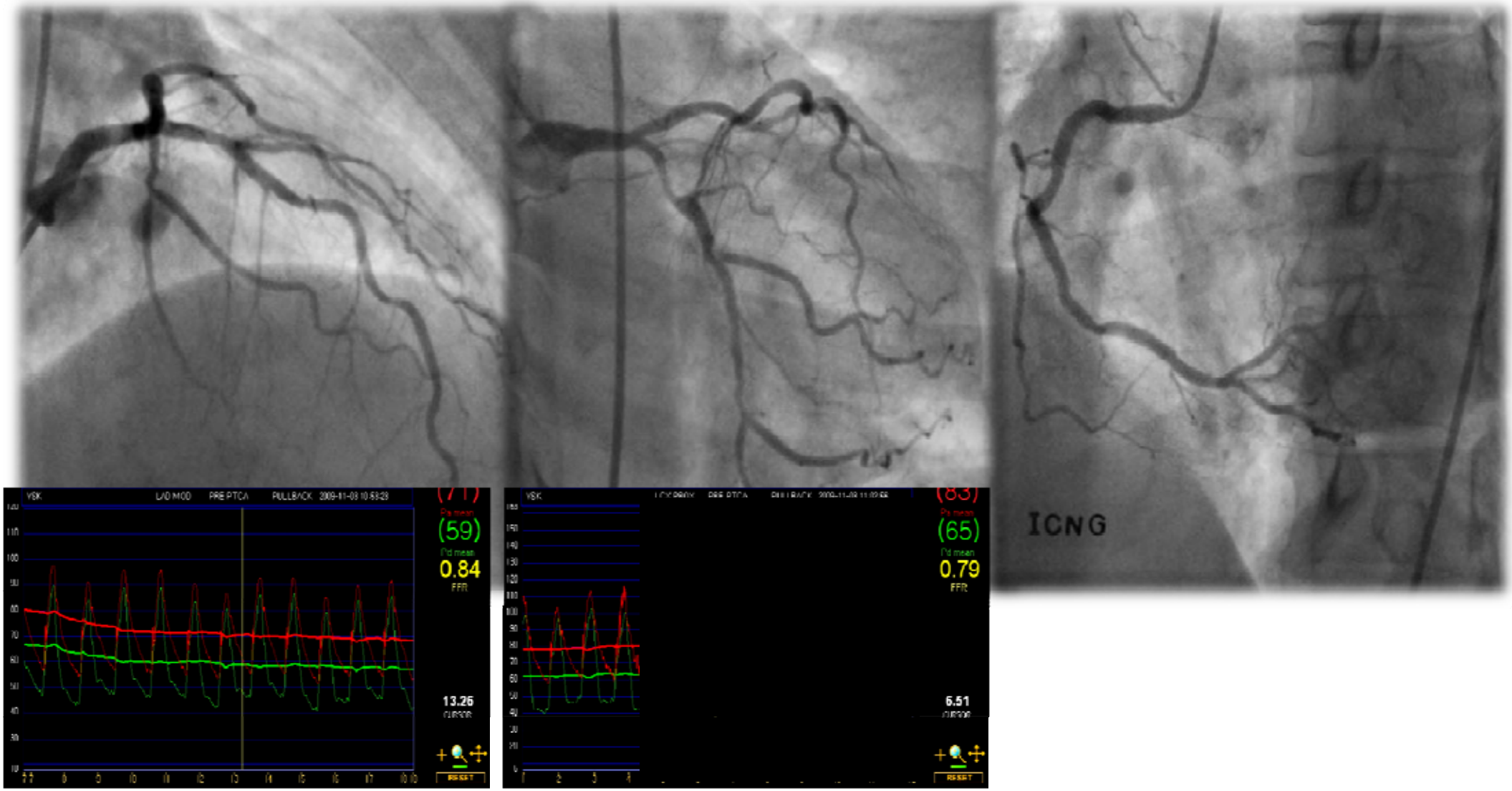

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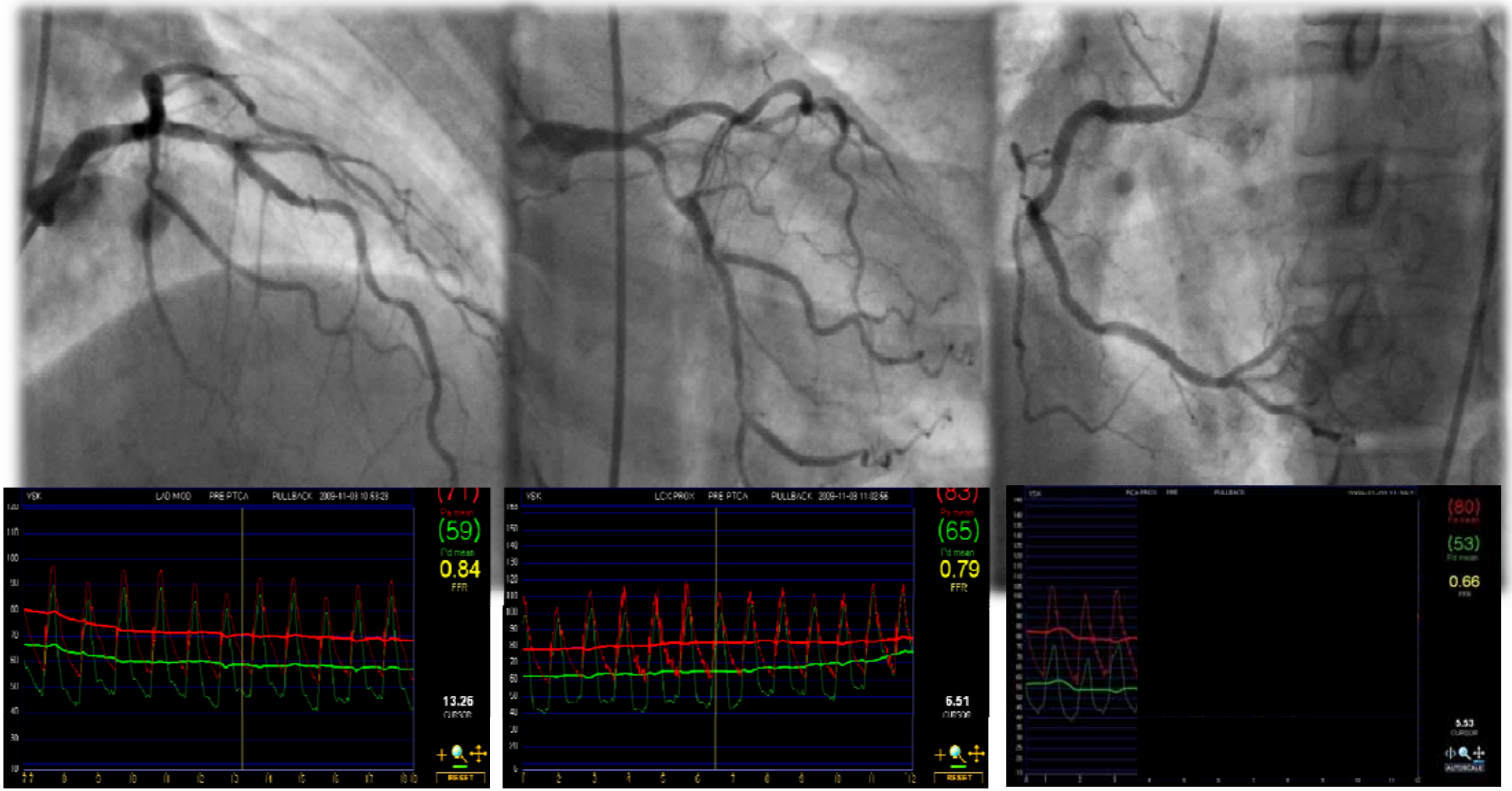


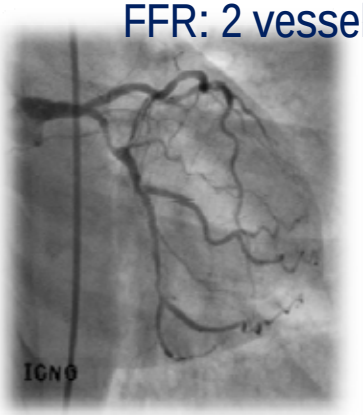
F/52 Stable angina for 4 years

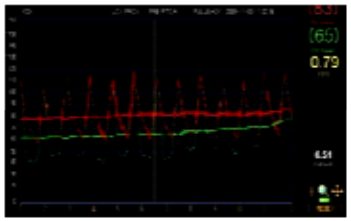
Coronary CT angiography: 2 vessel disease - Proximal LAD, prx and dist LCX 70%

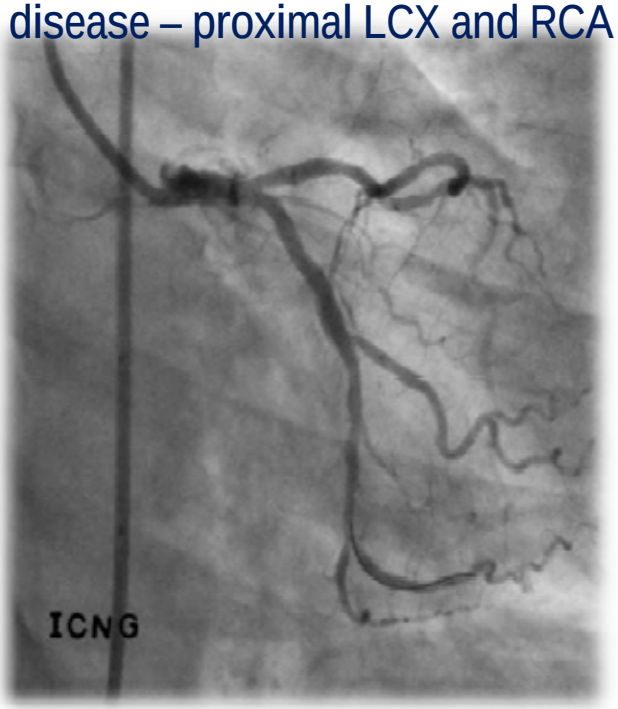
Exercise stress test: suggestive of positive

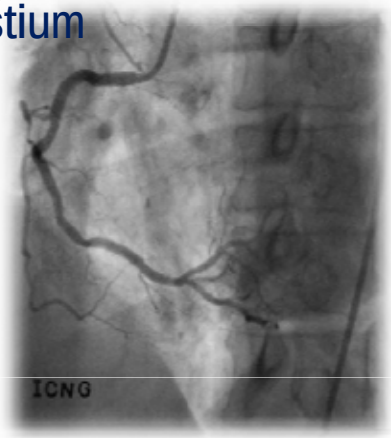
CAG: 1 vessel disease – proximal and distal LCX

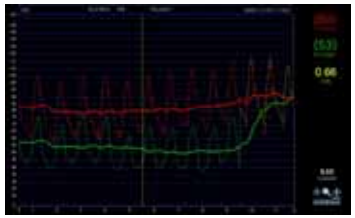
FFR: 2 vessel disease – proximal LCX and RCA ostium

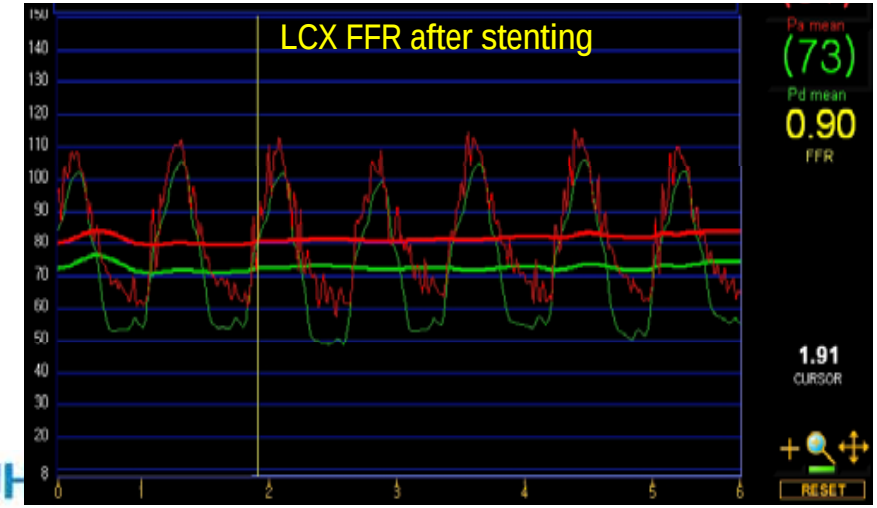


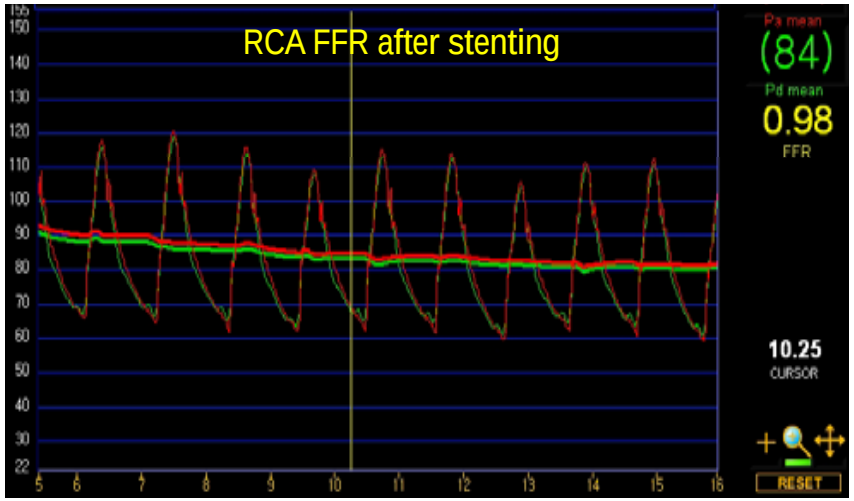




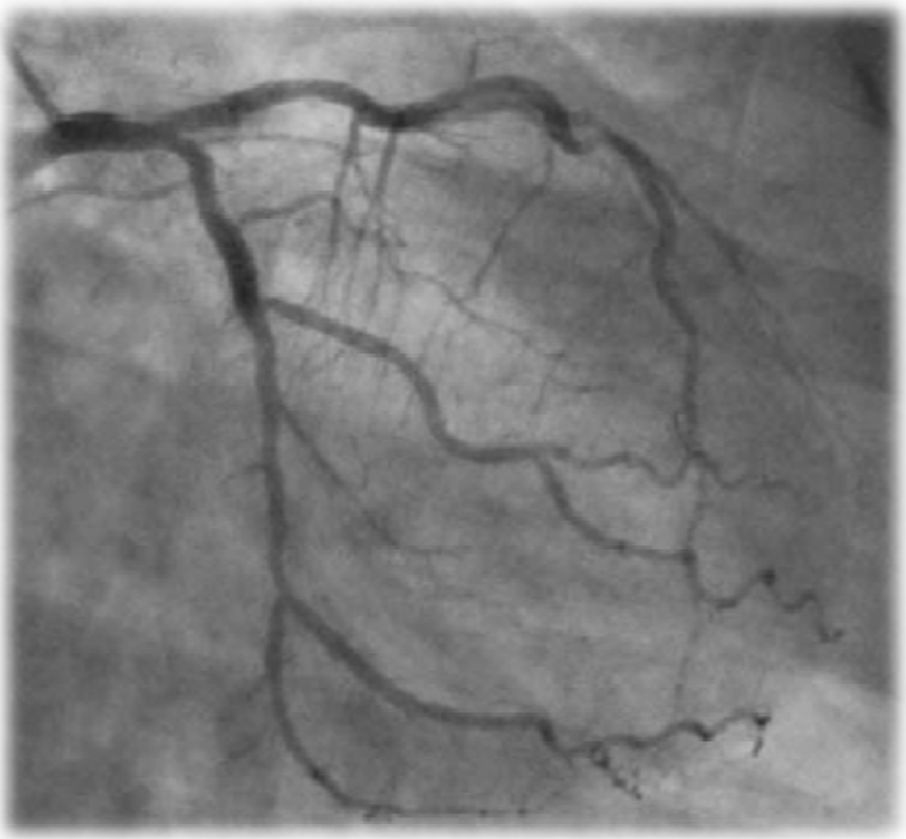


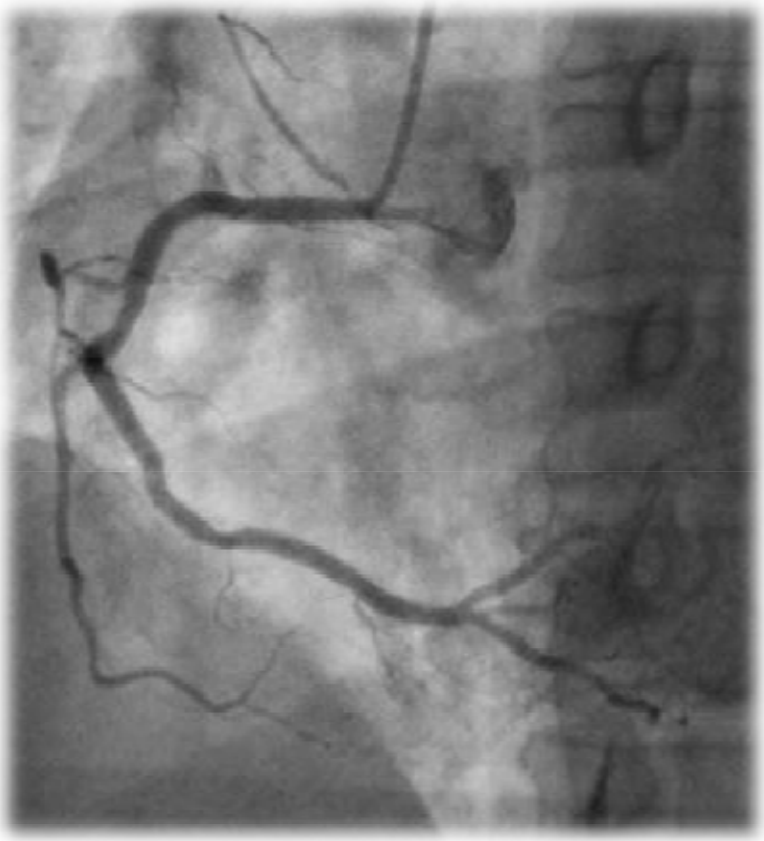






1. 5 year Follow up angiogram

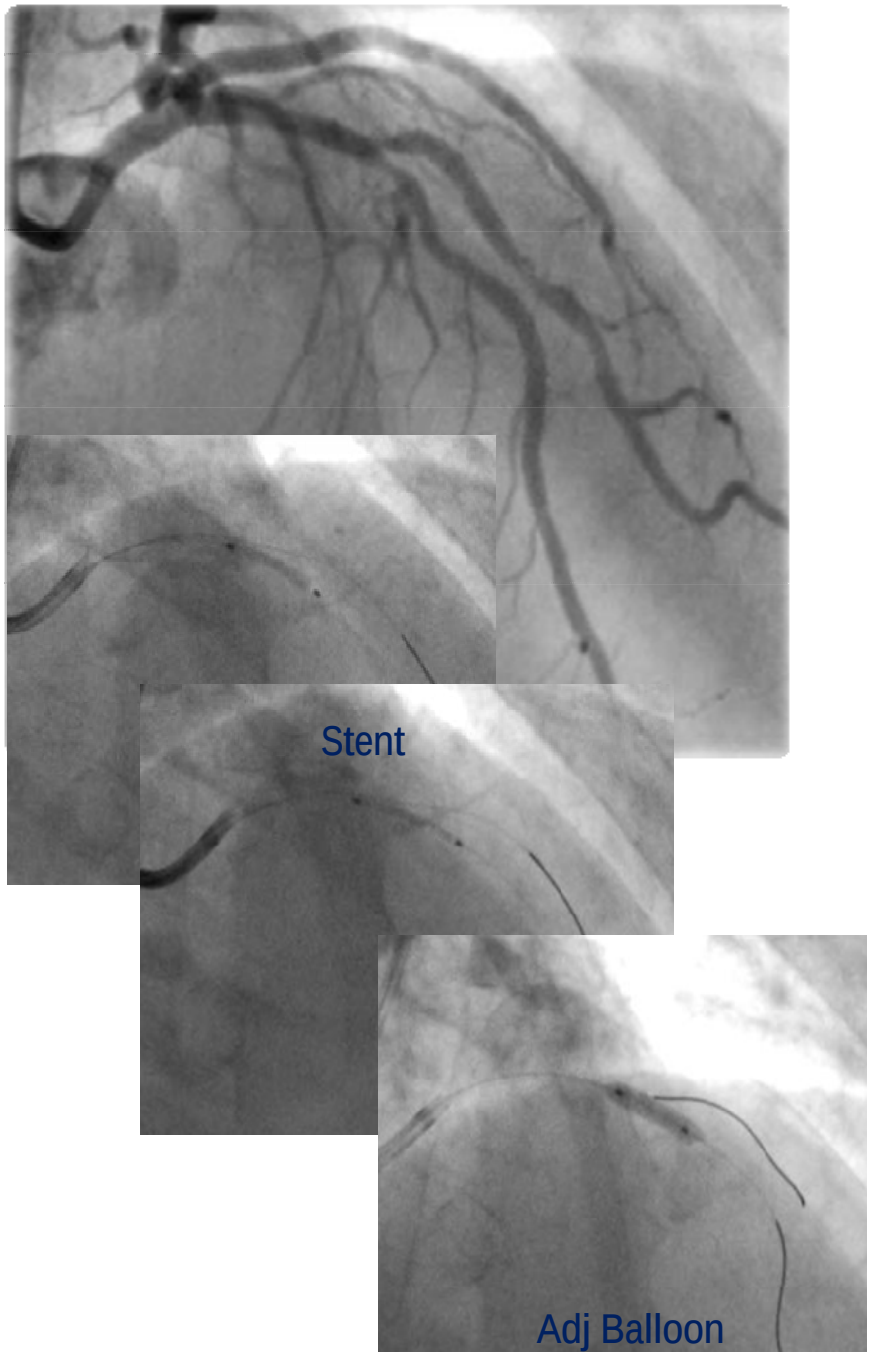


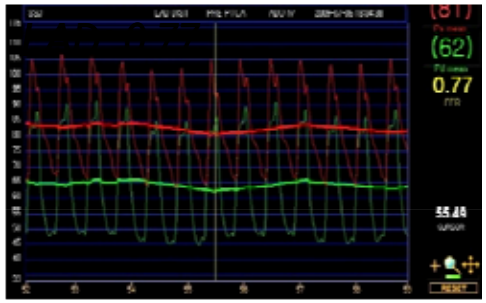


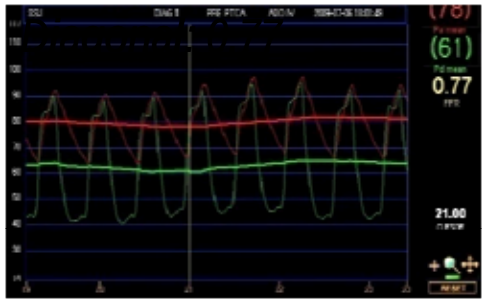
- No symptom, no event for 4 years

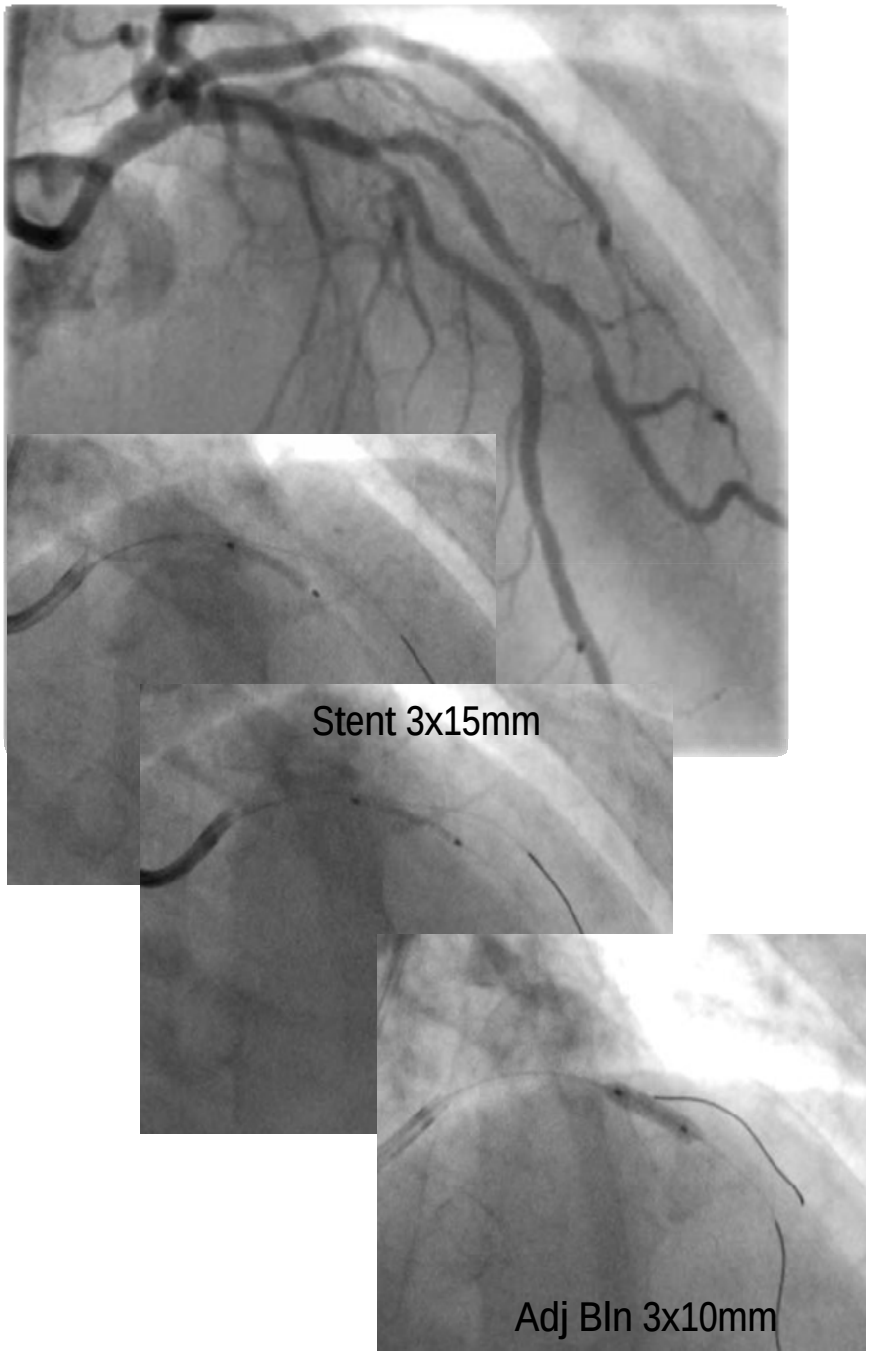
M/50 Claudication

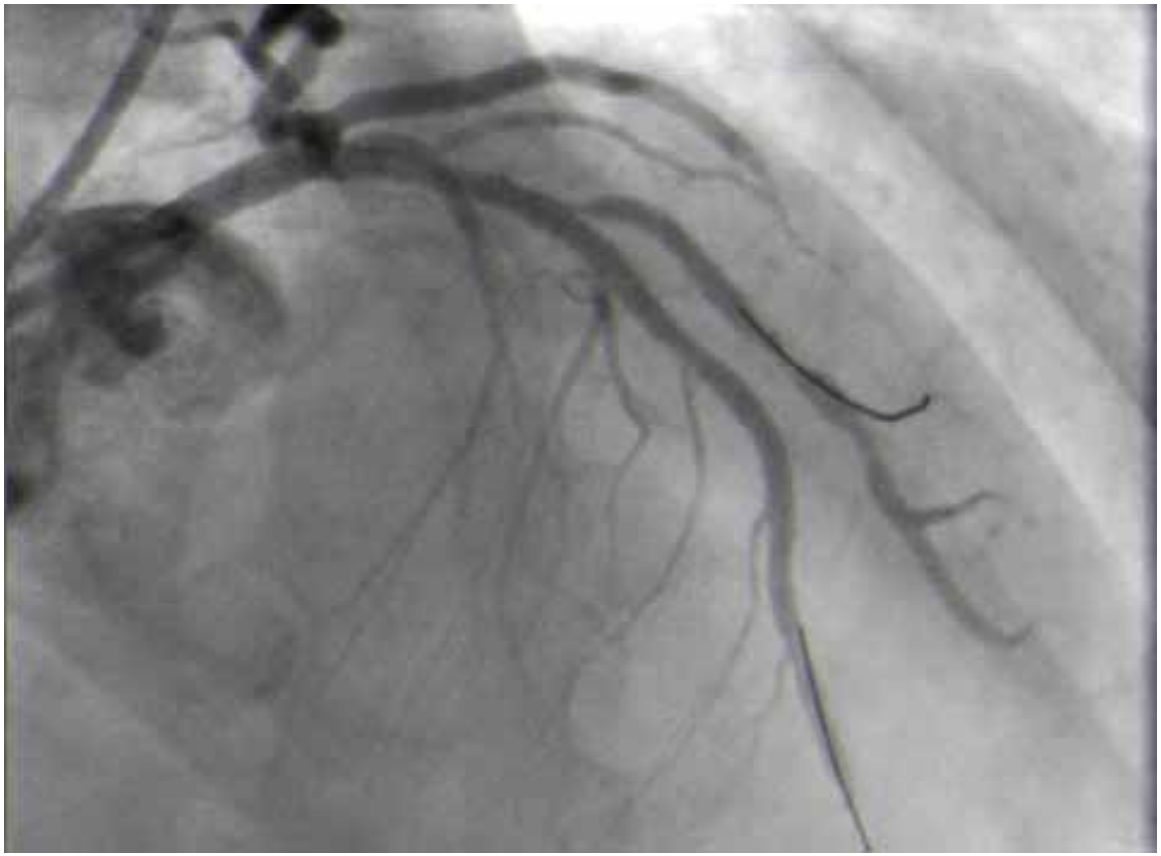
Preoperative angiography before vascular surgery


Stent
Adj Balloon


(62)
0.77
55.46


(61)
0.77
21.00

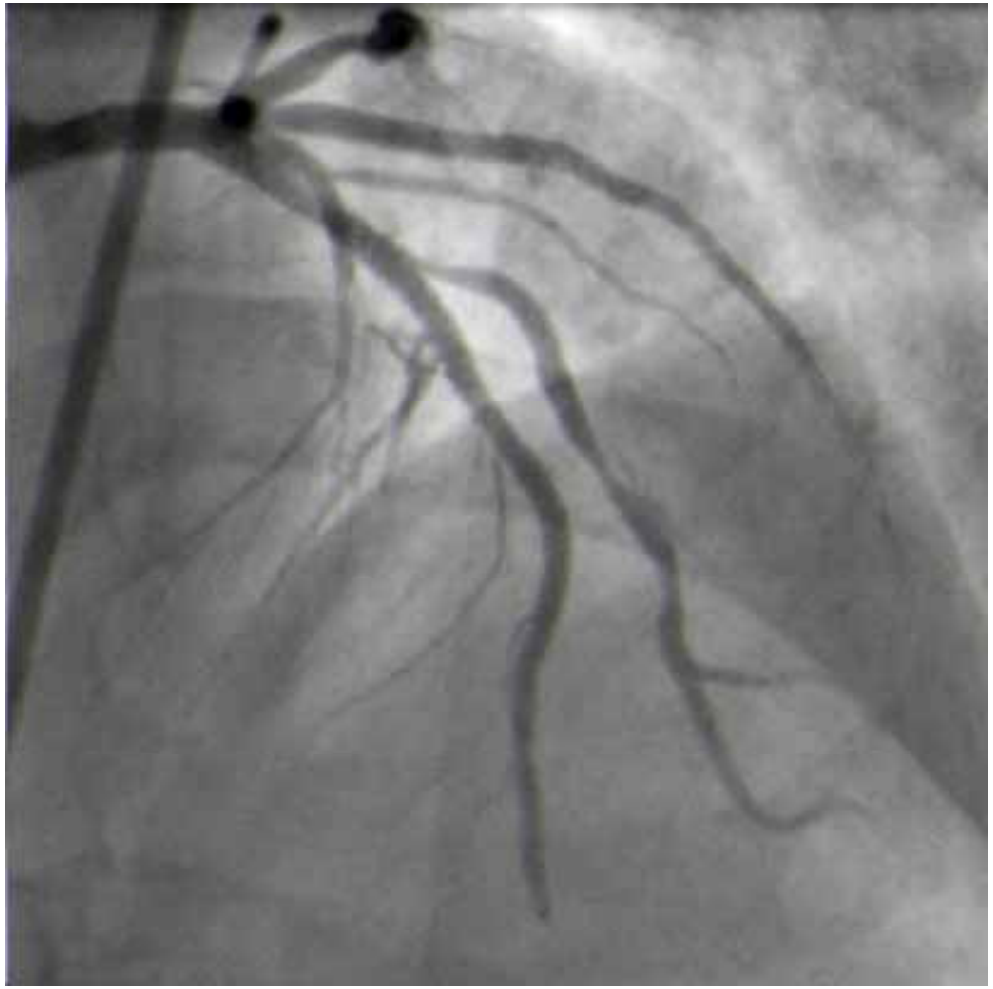




Side branch angioplasty?


(62)
0.72
10.58


{62}
0.72
10.58

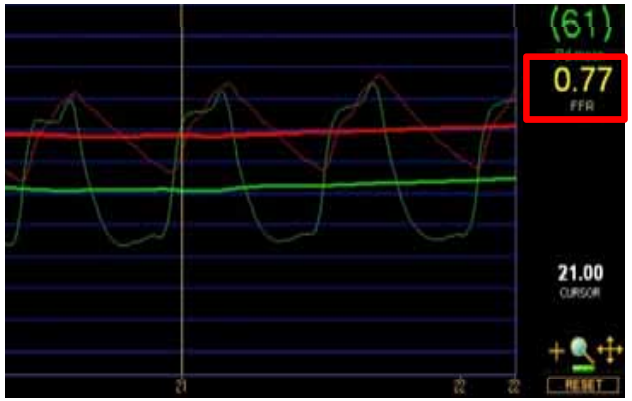


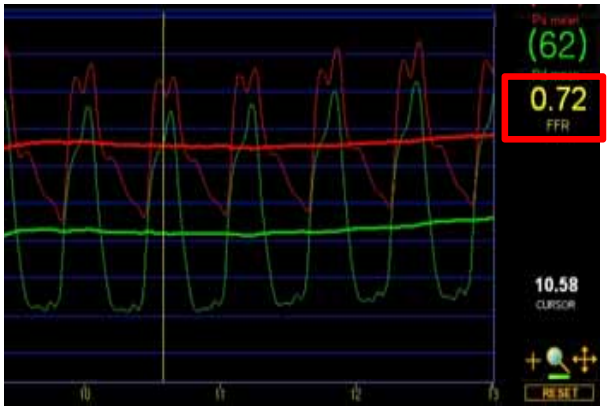
Discrepancy between stenosis and ischemia after SB angioplasty

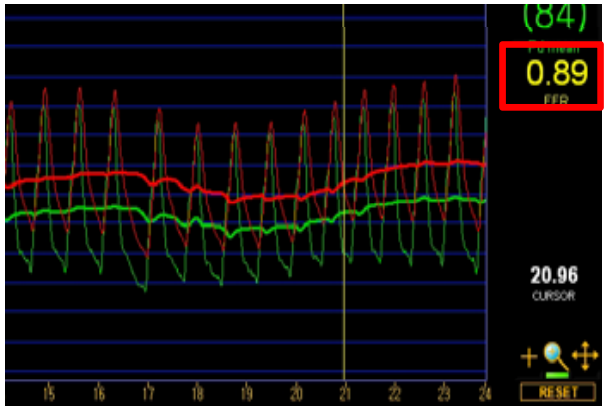
Before PCI

After MB stenting

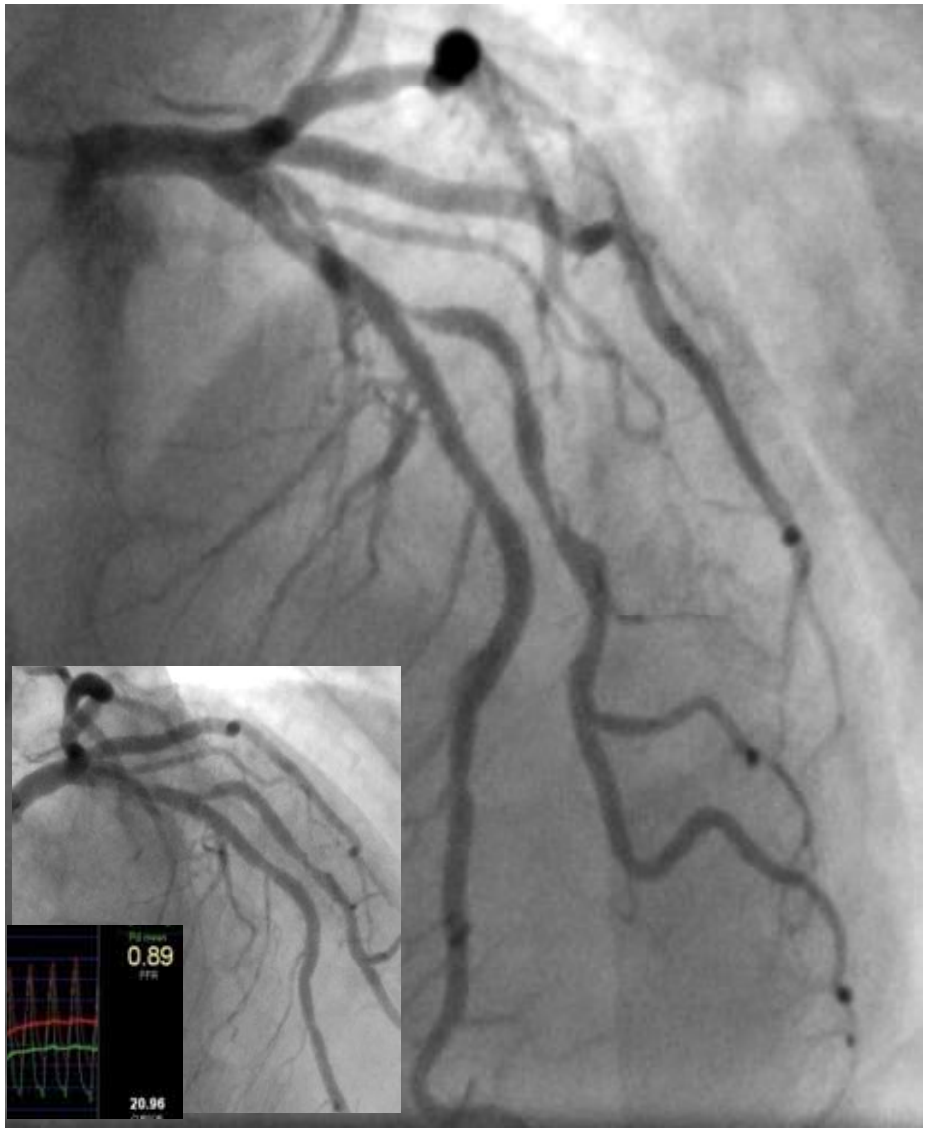
After kissing balloon



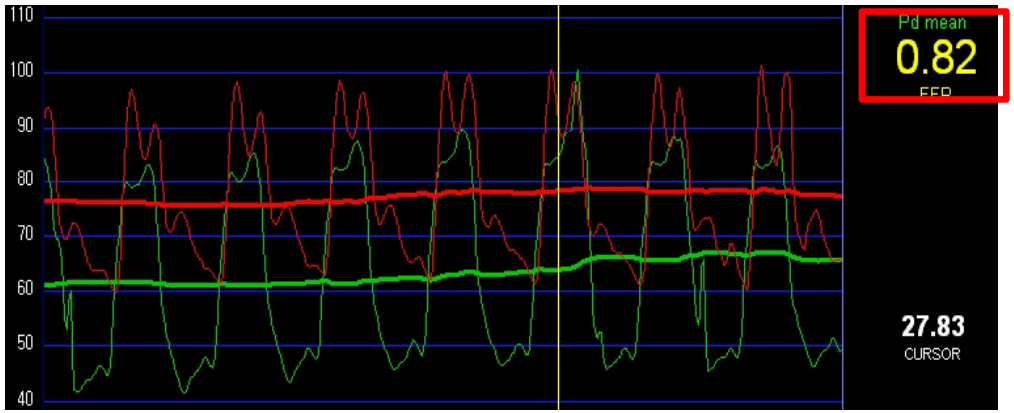




Functional outcome of Jailed side branches



11 month Follow- Up



FFR in Complex lesions

- *FFR is the only mean of gaining a "per segment" functional assessment of the coronary tree.*

- *FFR in complex lesions such as multi-vessel disease or bifurcation lesions can be a very helpful guide to perform the "ischemia-guided functional PCI" and can prevent unnecessary PCIs and their related complications.*

- *However, appropriate knowledge on coronary physiology, physiologic indices and some experience are essential to adequately perform the invasive physiologic studies in complex lesions.*