Left Main PCI Supported by FFR and IVUS

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Q1,
Why FFR ?

Significant Stenosis

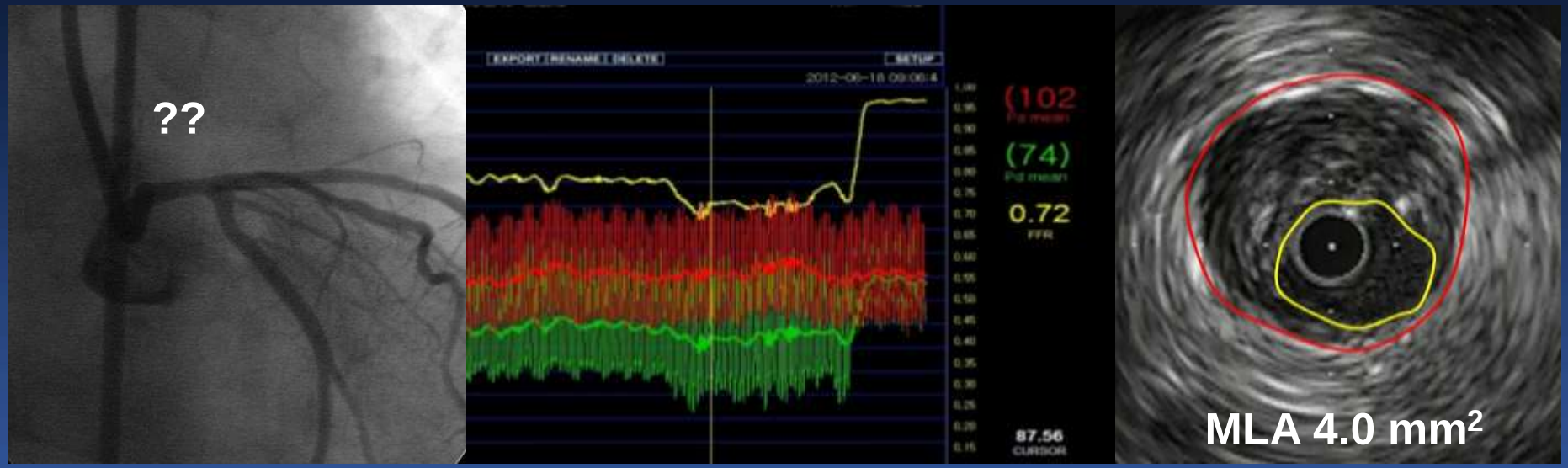
Negative FFR

47/M
Stable Angina

Insignificant Stenosis

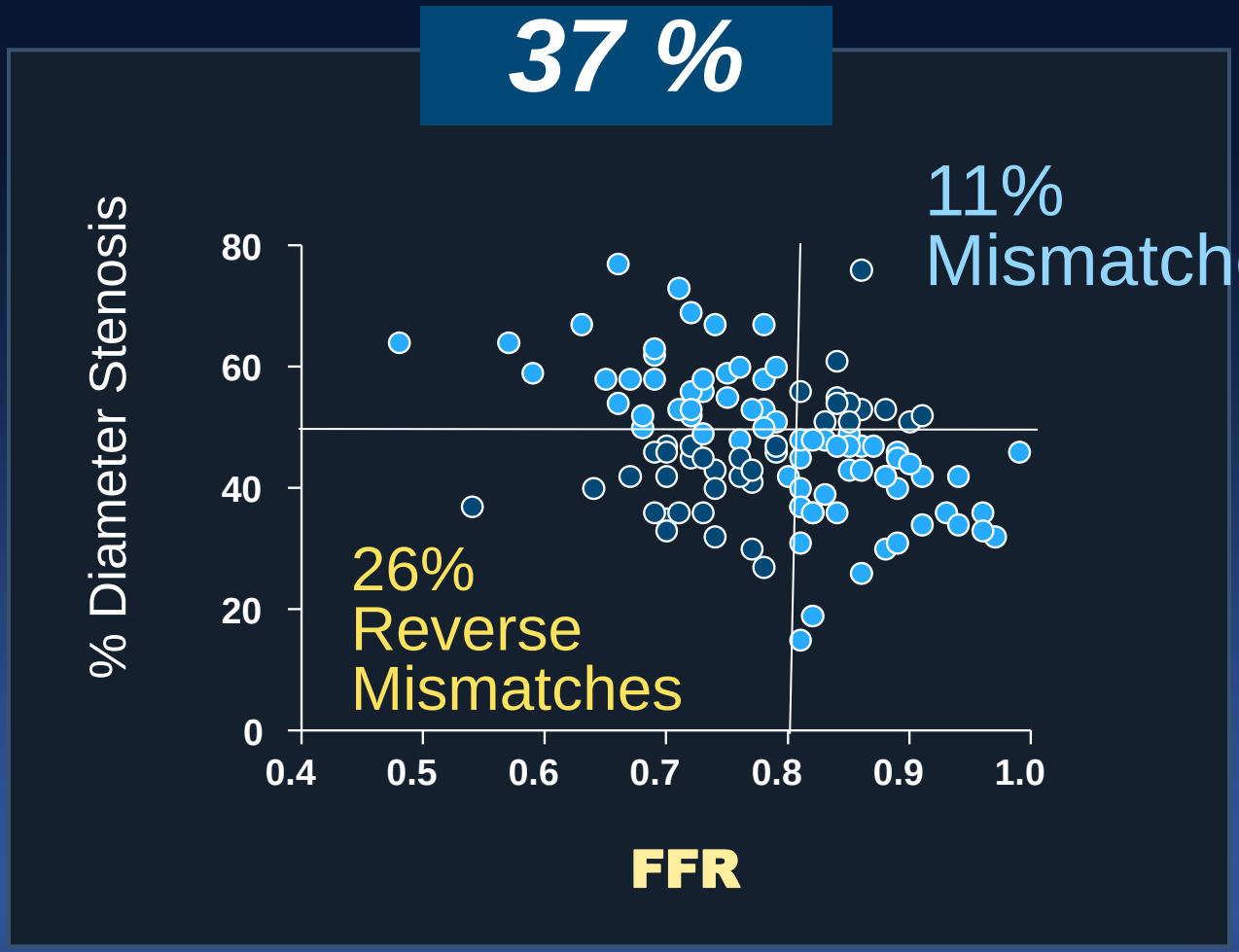
Positive FFR

62/F
Stable Angina



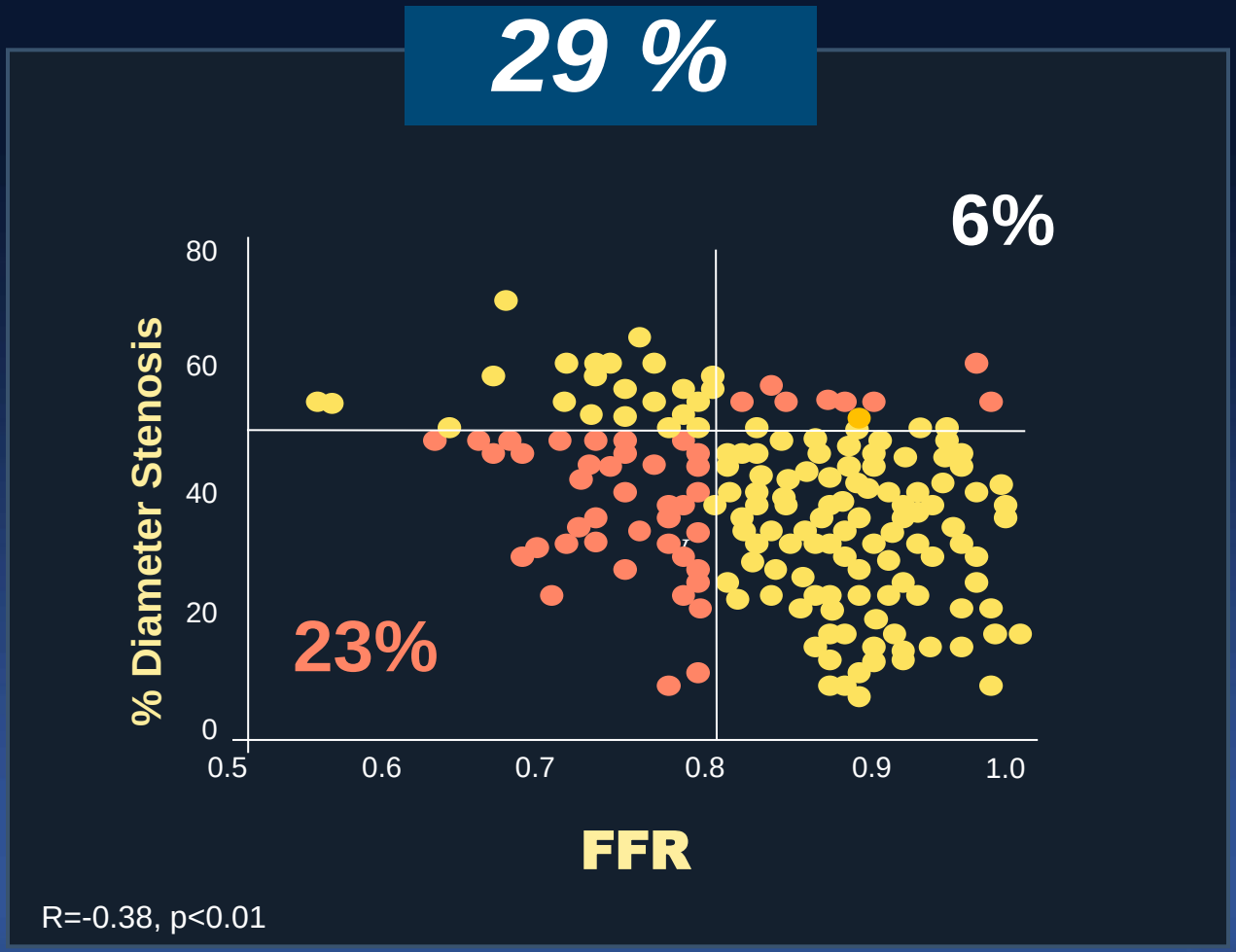
Many Mismatches

Os/Shaft, Intermediate LM Disease



Park SJ et al. *JACC Interv, 2014;7(8):868-874*

Many Mismatches
Ovarall, Intermediate LM Disease



Hamilos M et al. *Circulation 2009;120:1505-1512*

Why Mismatches ?

FFR Is Determined By,

- Size of supplied myocardium
  (reference vessel diameter)
- Degree of diameter stenosis
- Lesion morphology
- Eccentricity
- Lesion length
- Plaque rupture, Plaque burden
- Surface roughness
- Viscous friction, flow separation, turbulence, and eddies

Park SJ et al, JACC Intv 2012;5:1029 –36

Independent Predictors for FFR <0.80,

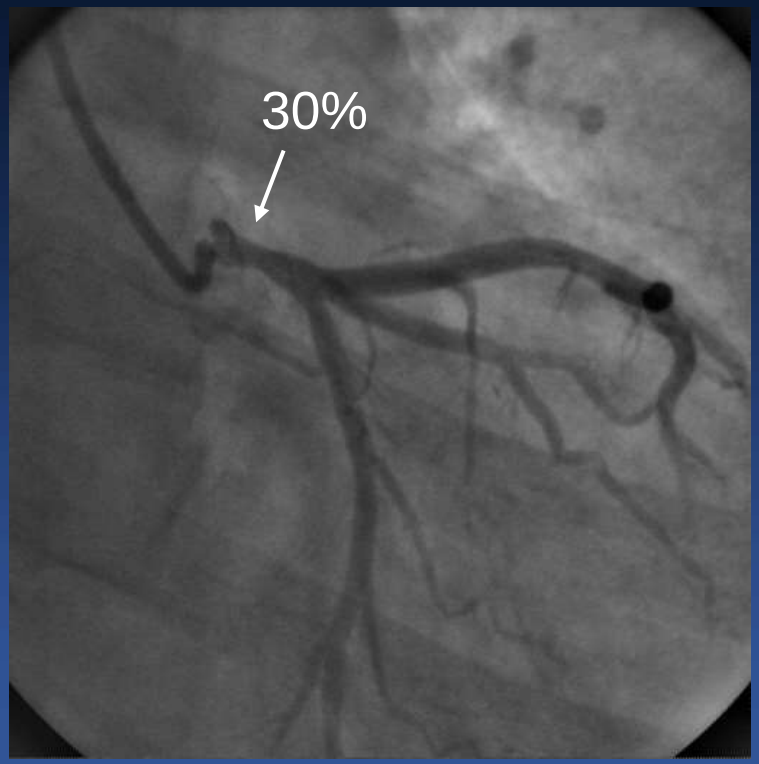
Multivariable Analysis (n=112)

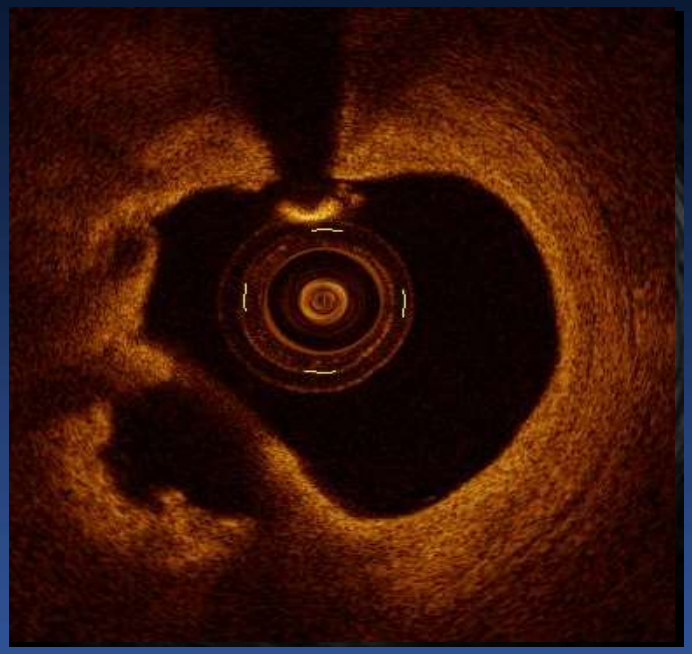
Variables	OR	95%CI	p-value
Model 1			
MLA, mm^2	0.37	0.25-0.56	<0.001
Plaque rupture	4.51	1.36-14.9	0.014
Age, year	0.95	0.90-1.00	0.033
BMI, kg/m^2	1.19	1.00-1.40	0.05
Model 2			
MLA, mm^2	0.34	0.21-0.54	<0.001
Age, year	0.94	0.90-0.99	0.022
LV mass, g	1.01	1.00-1.03	0.03

Model 1 included clinical, QCA, and IVUS variables
Model 2 included Model 1 plus LV mass assessed by Echocardiography

Presence of Plaque Rupture Can Make A Positive FFR

Positive FFR : 0.70



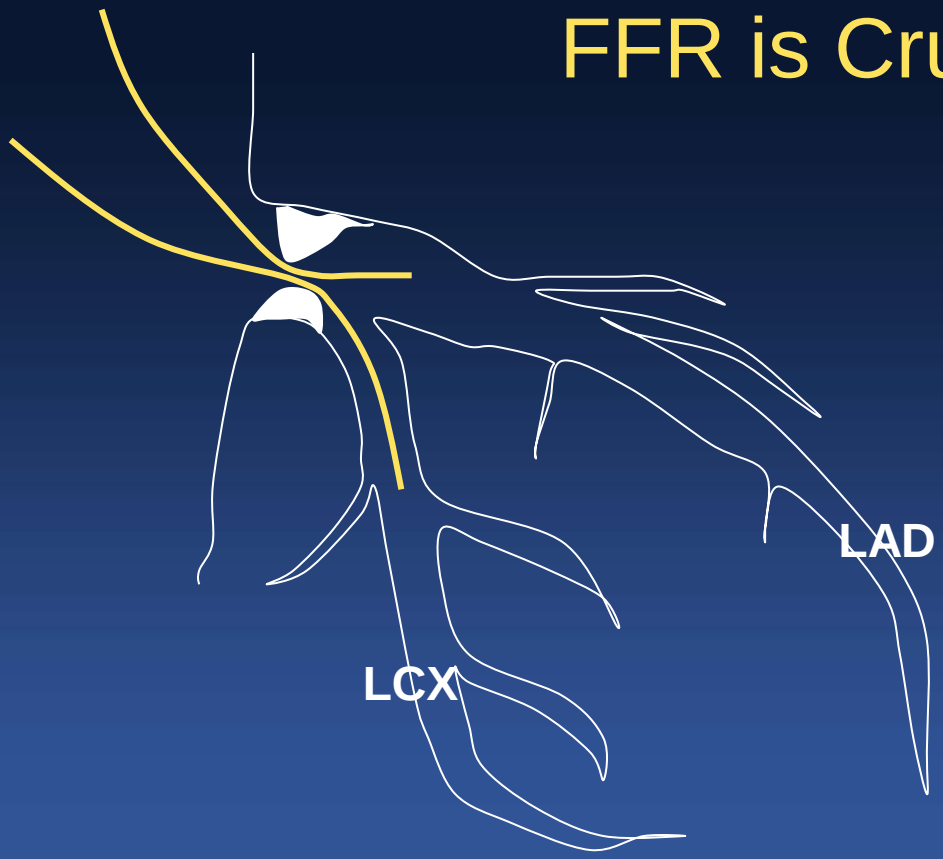


Plaque rupture,
MLA 6.2mm^2

How do I Implement FFR in Real Practice ?

Intermediate LM Ostial and Shaft Disease,

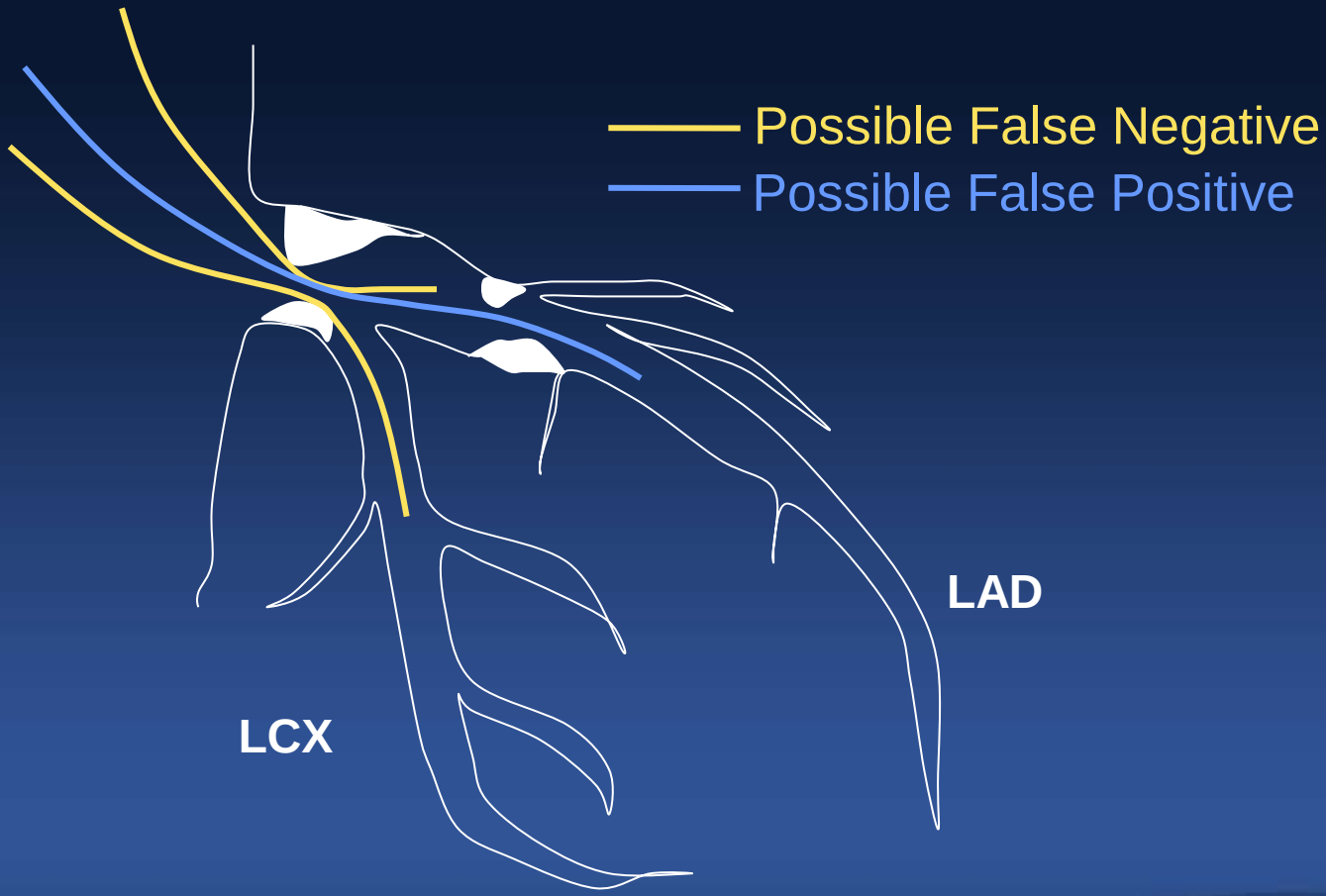
FFR is Crucial



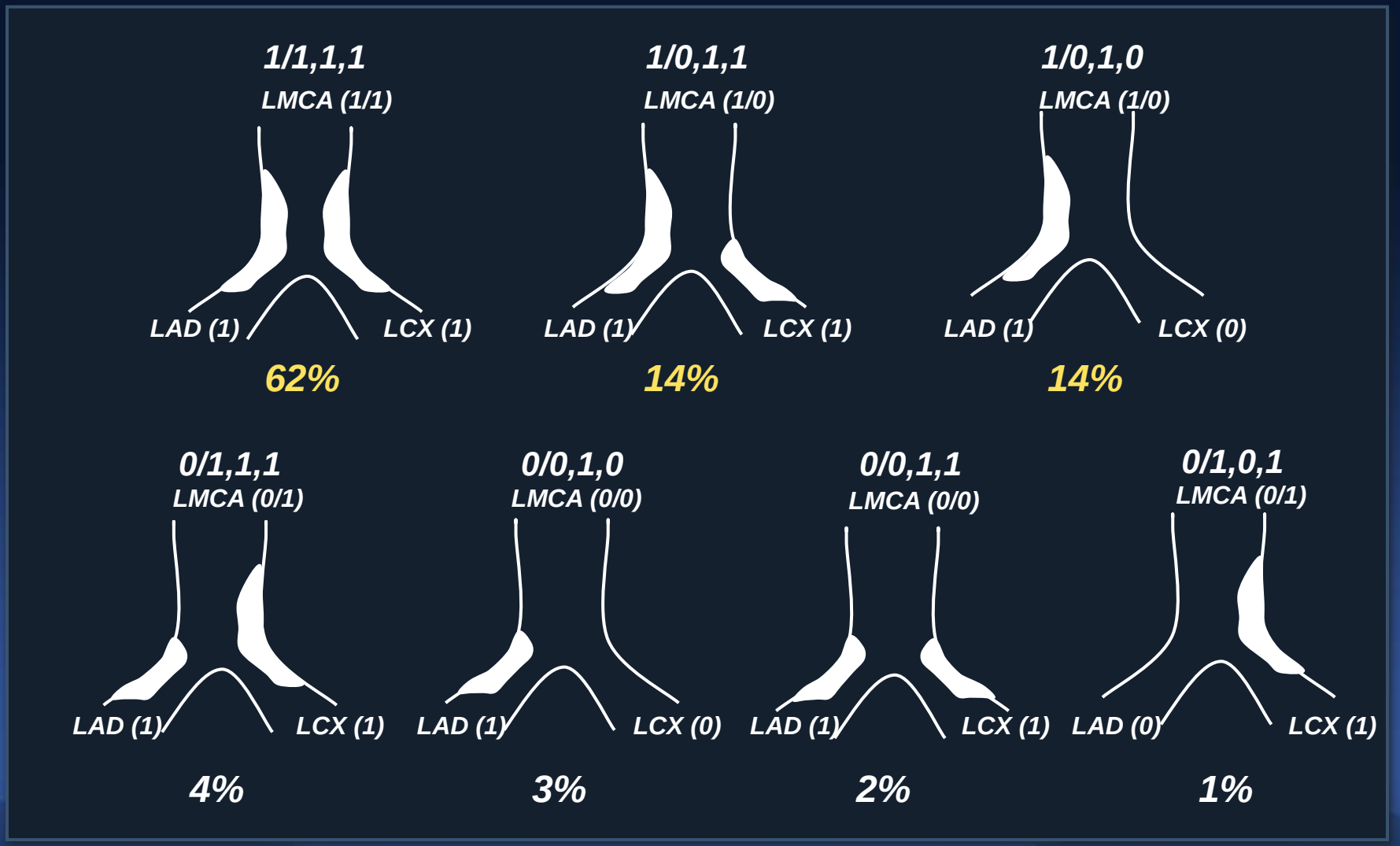
Courtesy of Akiko Maehara, MD

Intermediate LM Bifurcation Disease,

Problem to Measure FFR ?



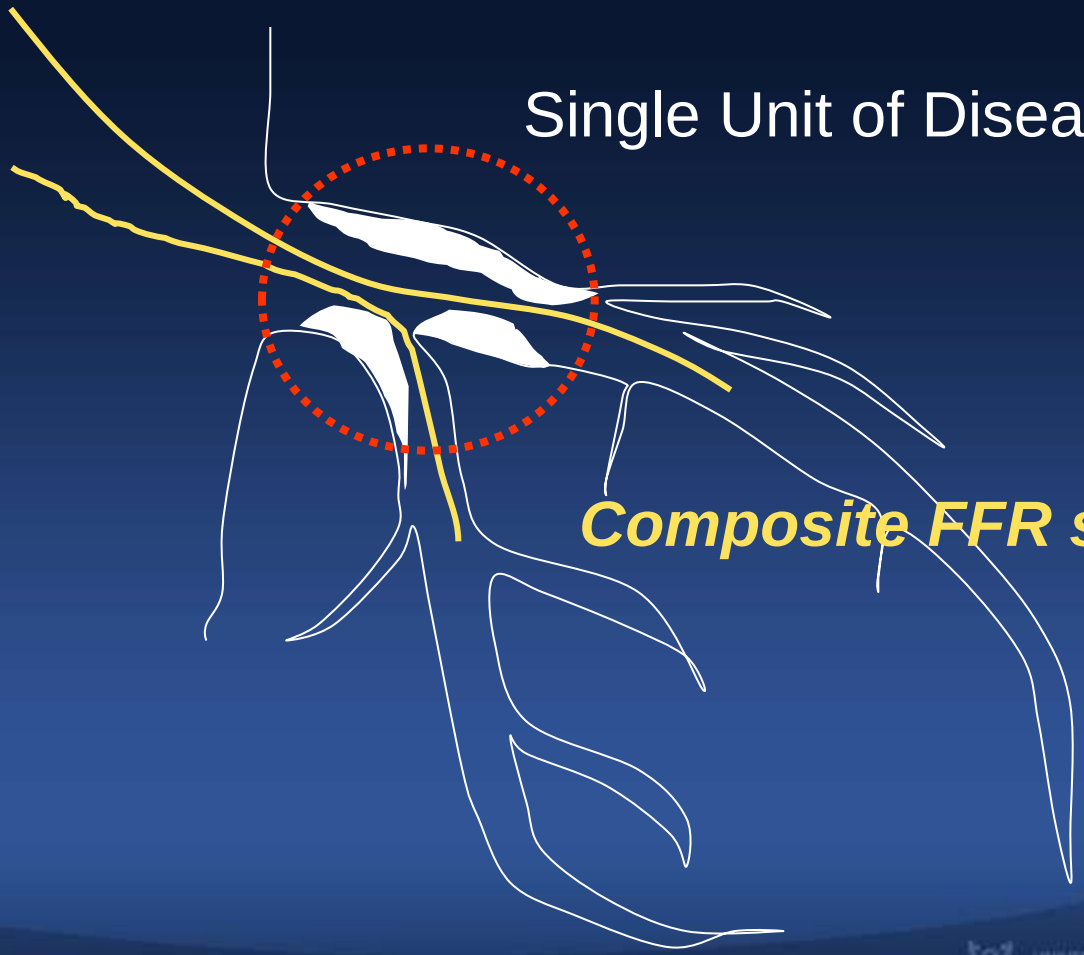
90% of Plaque, Extends from LM to LAD
In LM Bifurcation Disease



Oviedo C et al. Circ Cardiovasc Interv 2010;3:105-12. (IVUS Study, n=140)

Intermediate LM Bifurcation Disease,

If Transducer Placed Beyond Bifurcation
in both LAD and LCX,

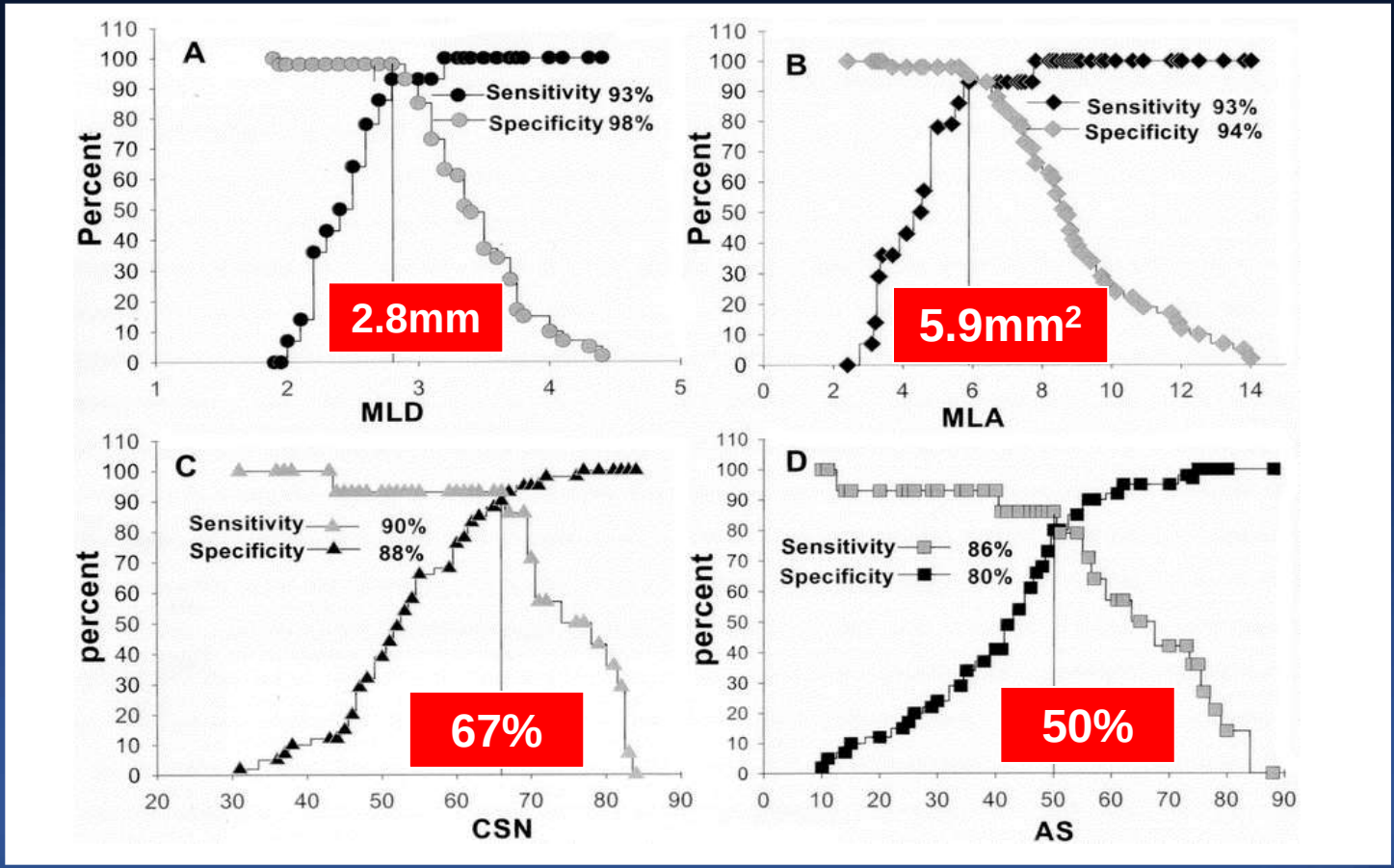


Composite FFR still Works.

What About IVUS MLA ?

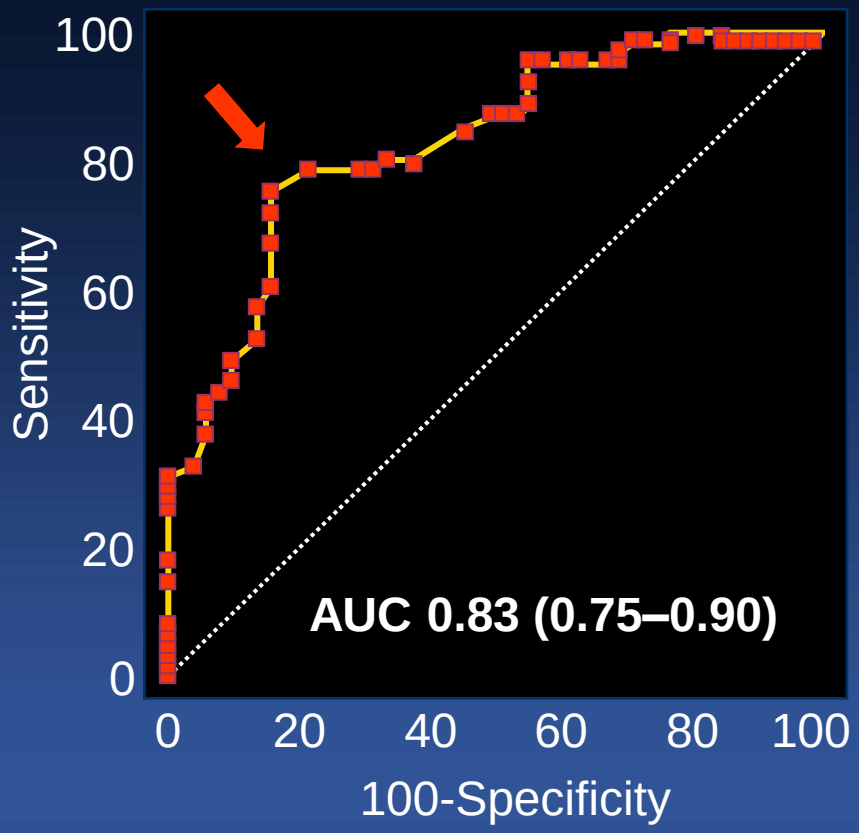
Can IVUS MLA Predict Functional Significance of LM Stenosis too ?

MLA < 6.0 mm² matched FFR <0.75 (n=55, LM disease)



Jasti V et al. Circulation 2004;110:2831-6

MLA < 4.5 mm² matched FFR <0.80 (n=112, Os and Shaft LM disease)



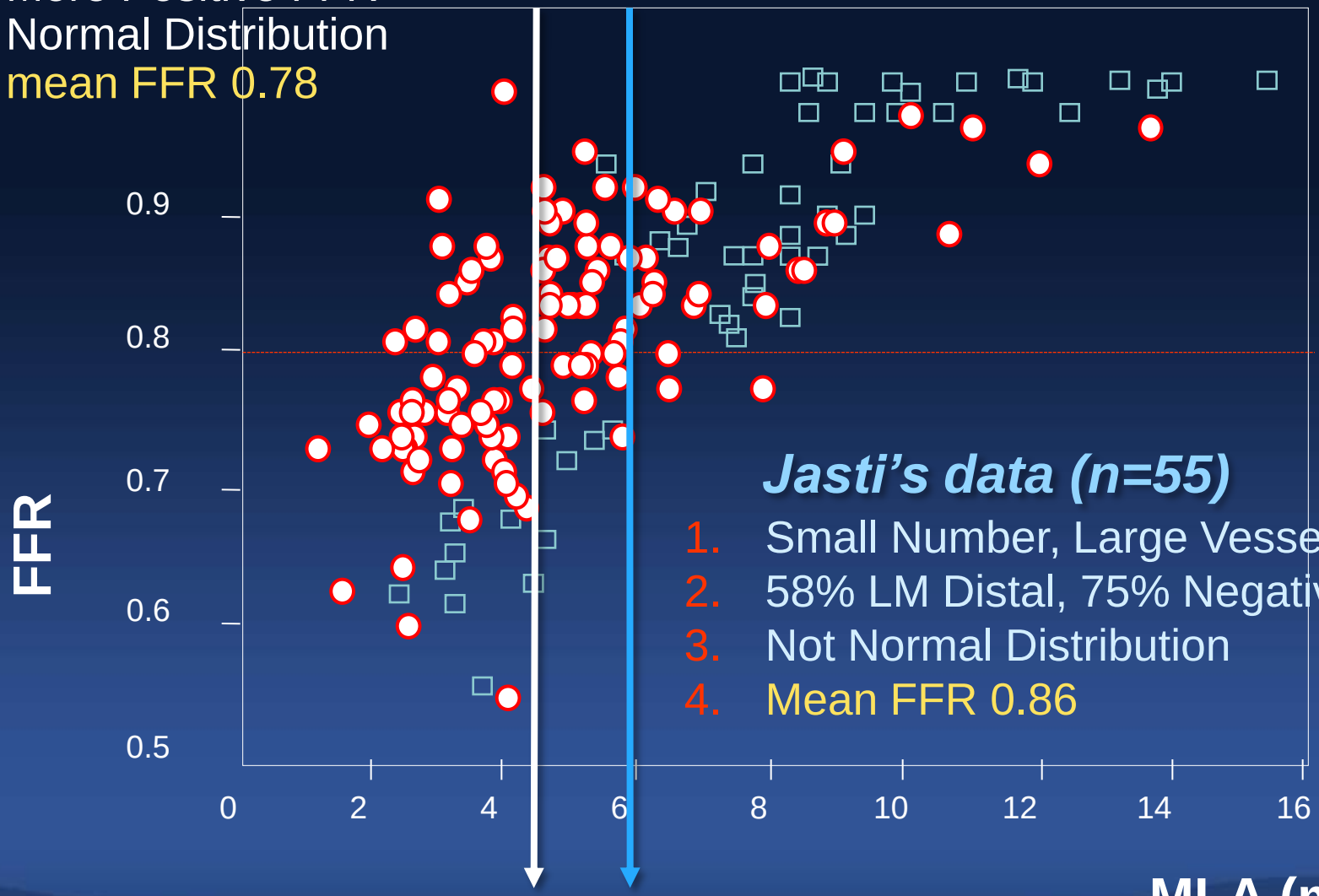
Cut-off = 4.5 mm²

Sensitivity	79%
Specificity	80%
PPV	83%
NPV	76%
Accuracy	80%

What's the Difference ?

Park's Data (n=112)

1. 100%,Ostial/Shaft Lesions
2. More Positive FFR
3. Normal Distribution
4. mean FFR 0.78

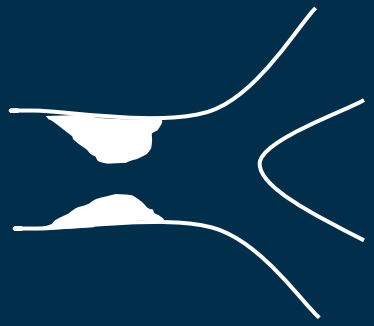


Jasti's data (n=55)

1. Small Number, Large Vessels
2. 58% LM Distal, 75% Negative FFR
3. Not Normal Distribution
4. Mean FFR 0.86

How do I Implement ?

Ostial and Shaft
LM Disease



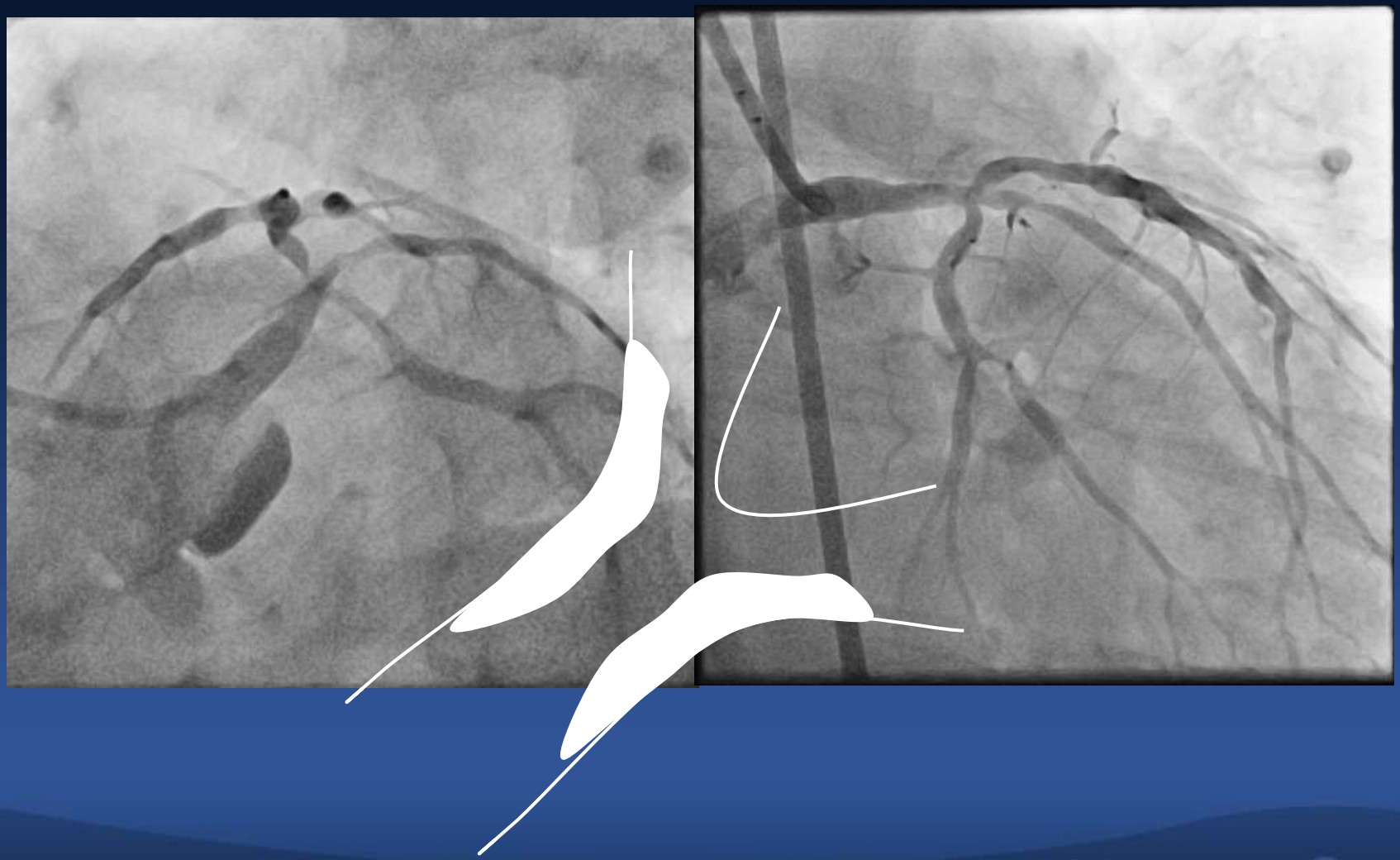
Smaller than 4.5 mm^2
Positive FFR

Bifurcation with
Down Stream Disease

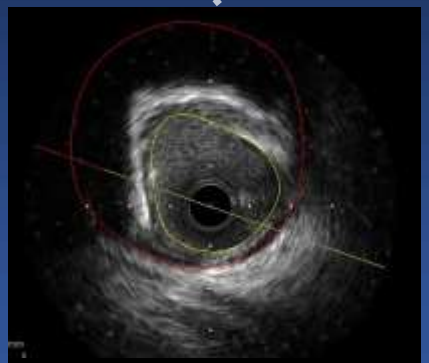
? 4.5~6.0 mm^2
Consider FFR !

Larger than 6.0 mm^2
Negative FFR

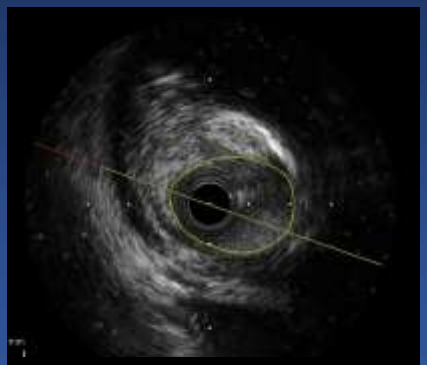
Case 1,
55/M, Effort Chest Pain



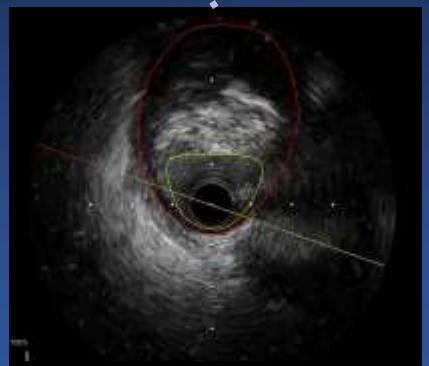
LAD and LM IVUS



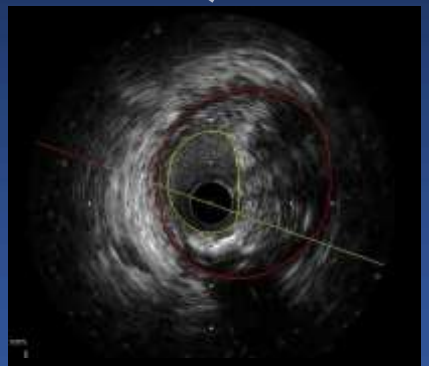
LM
7.6 mm^2



LM Distal
5.3 mm^2

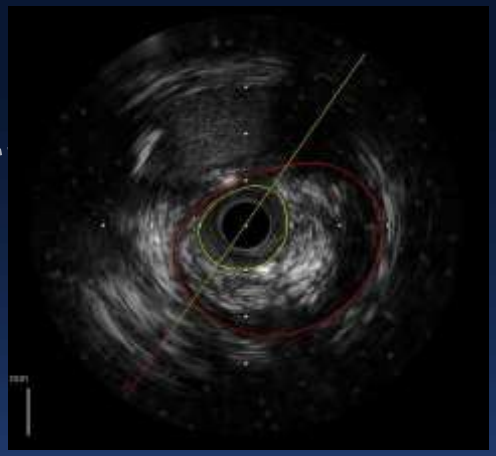


LAD ostium
3.2 mm^2



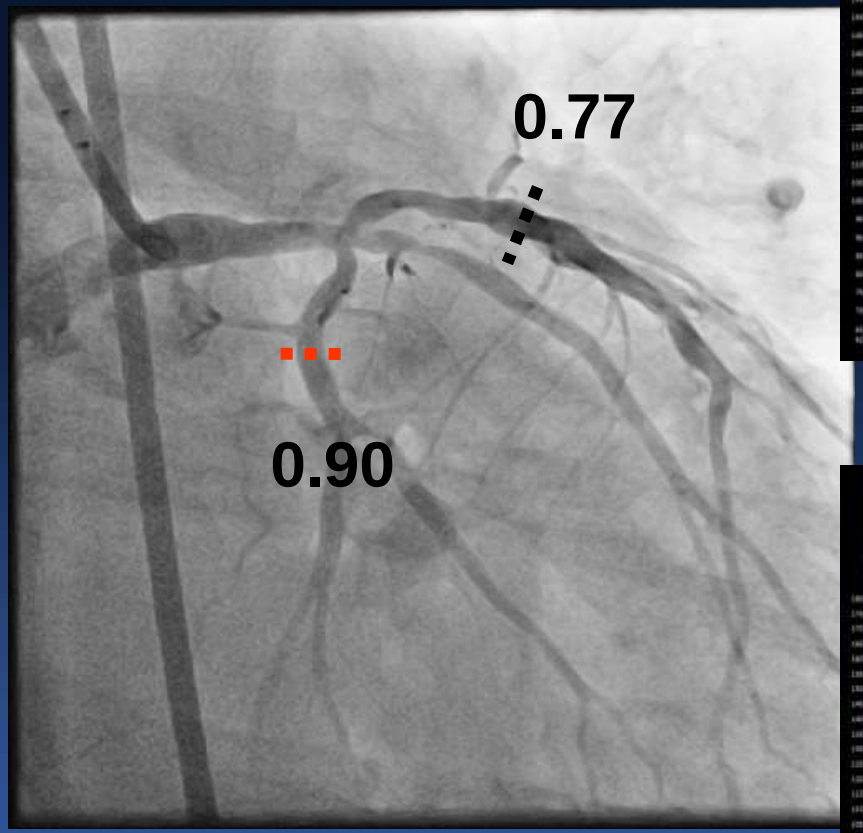
Proximal LAD
3.3 mm^2

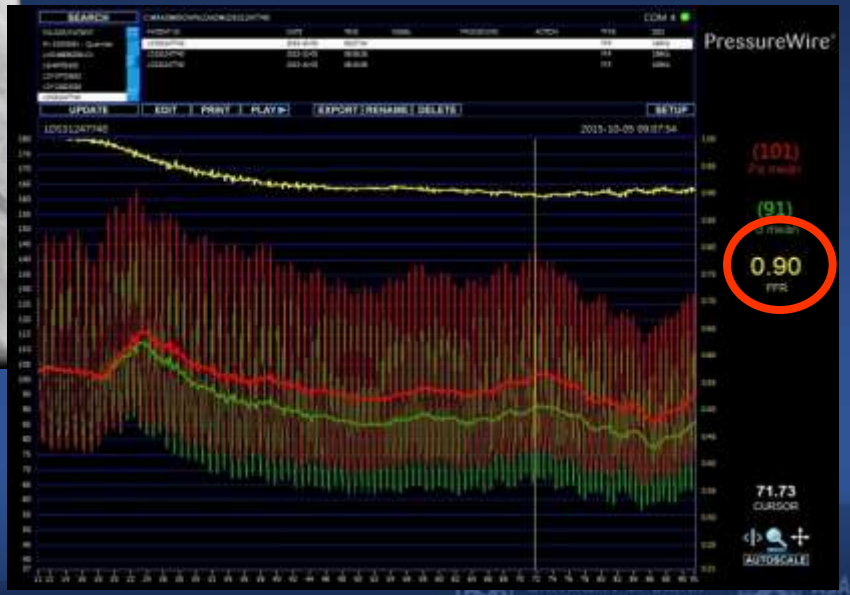
LCX IVUS



40% Narrowing
LCX ostium
MLA : 2.49 mm^2
Plaque burden 79.3%

FFR
in Both LAD and LCX,



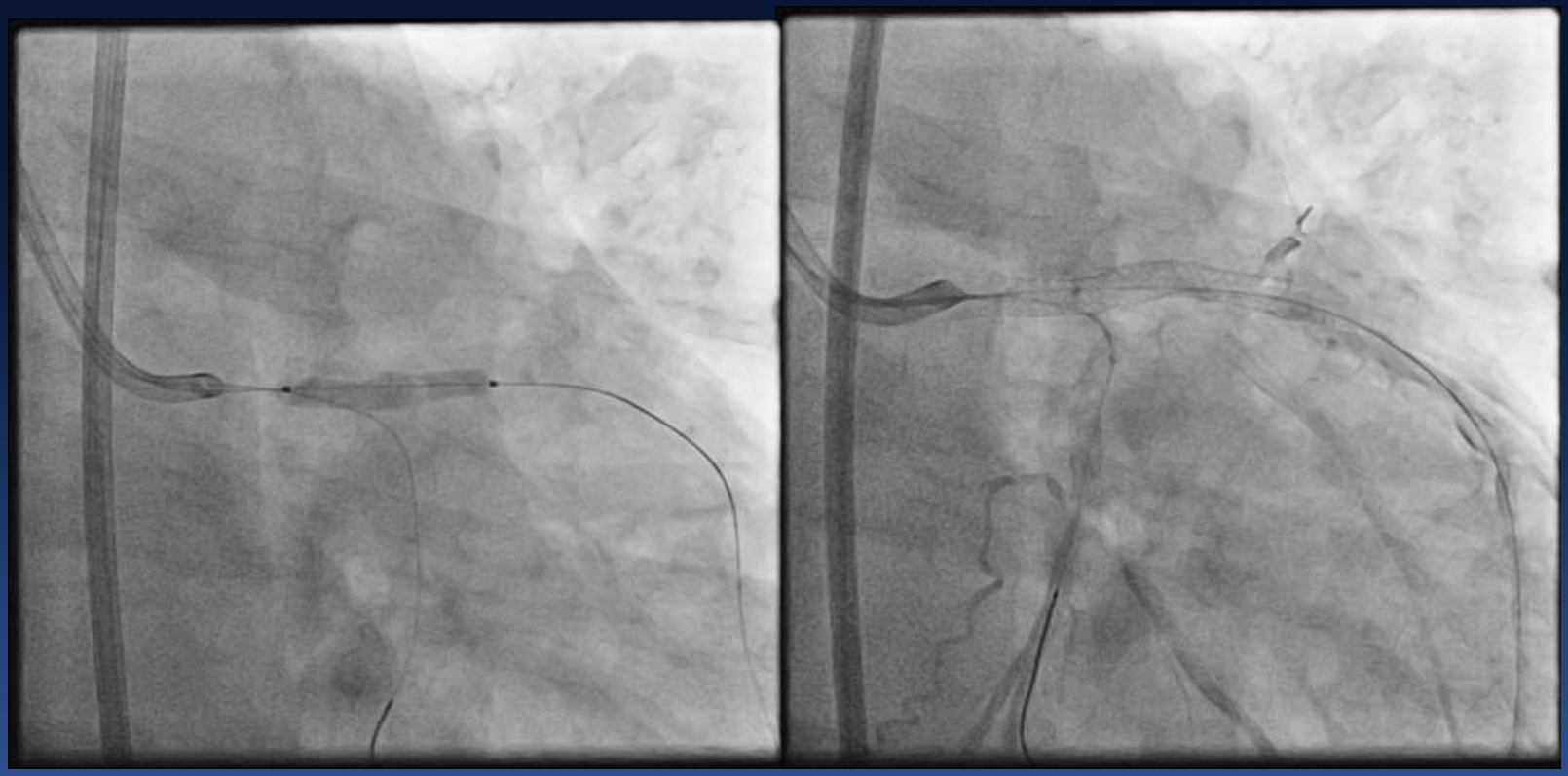


Why FFR ?

Decision Making,

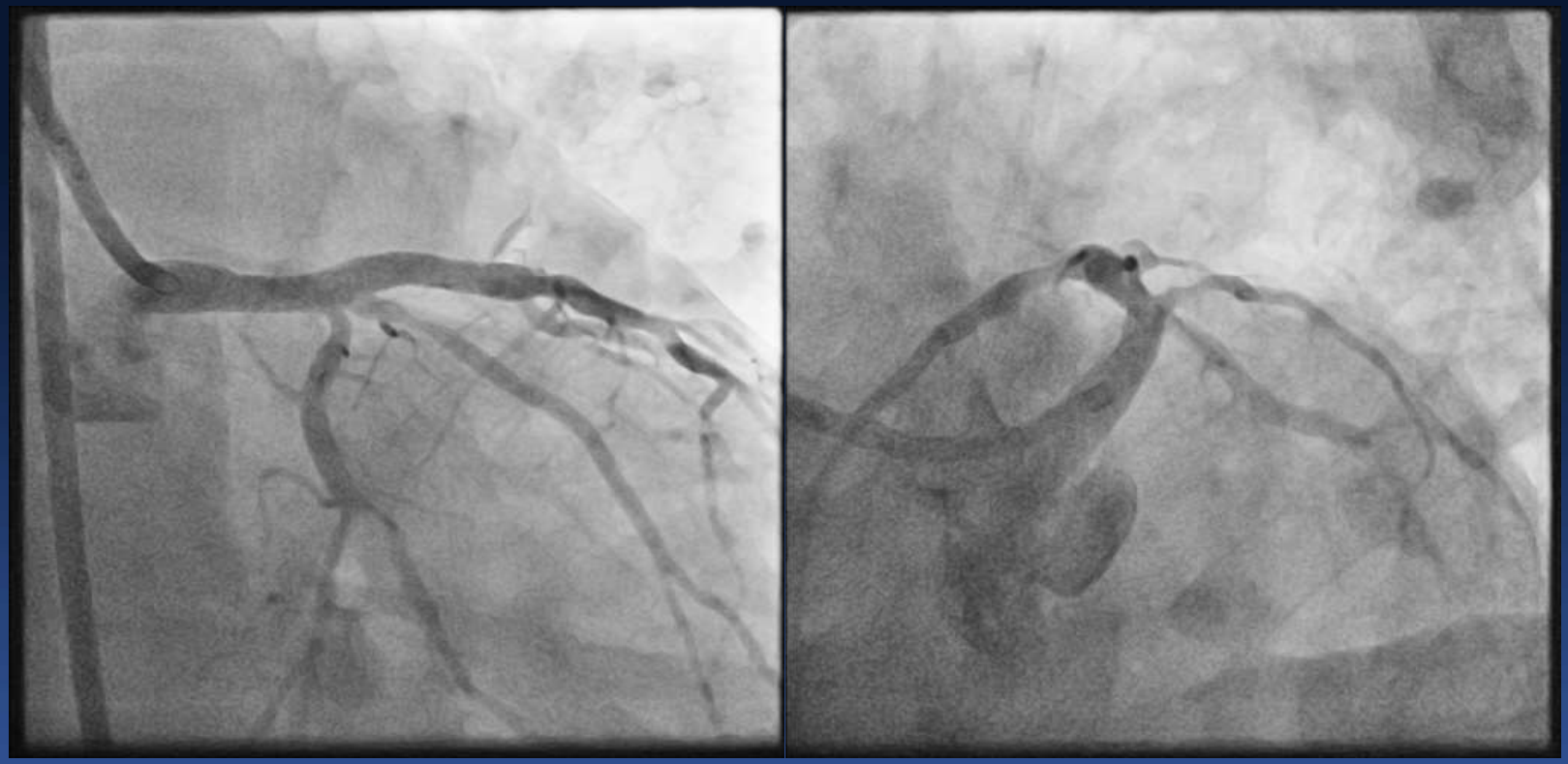
To Treat or Not To Treat !

Single Stent Crossover

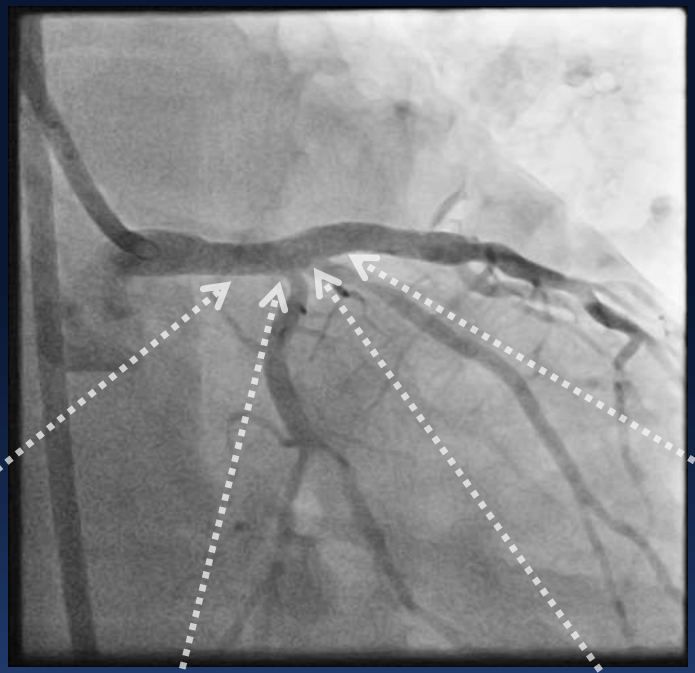


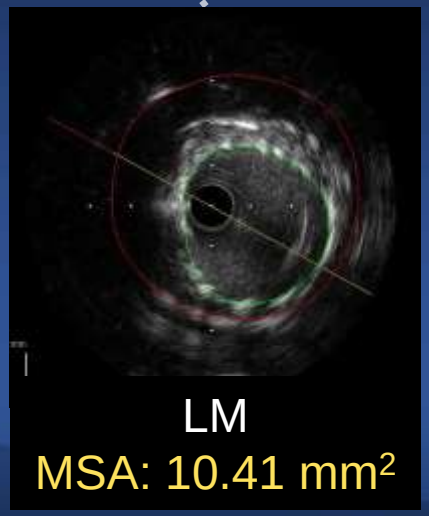
XIENCE Alpine
4.0mm x 30mm

Final Angiogram

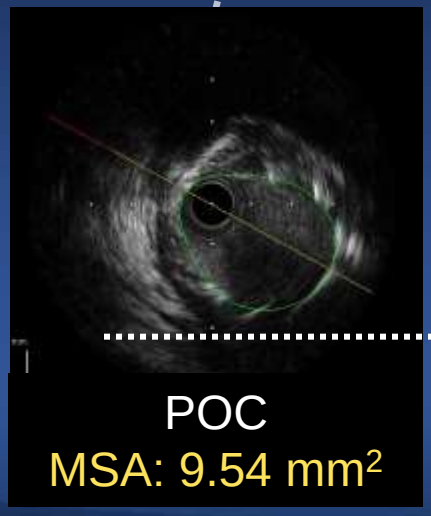


Post-PCI IVUS

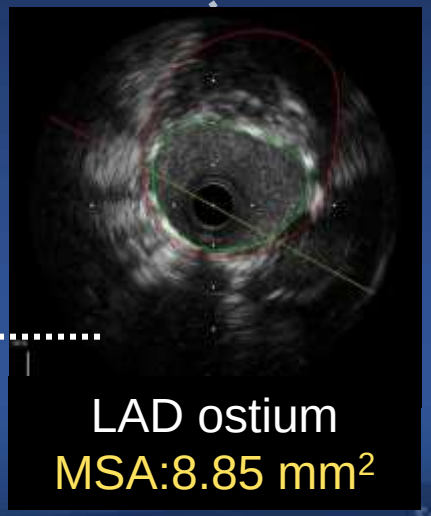




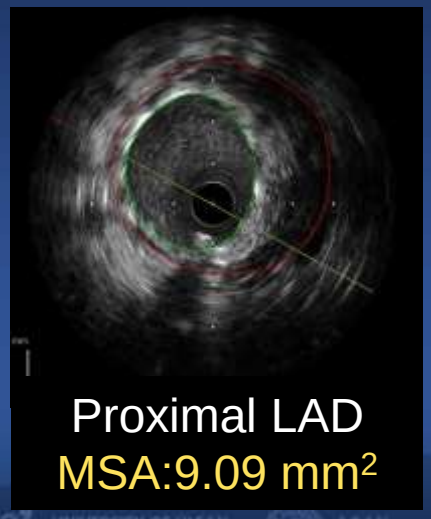
LM
MSA: 10.41 mm^2



POC
MSA: 9.54 mm^2



LAD ostium
MSA:8.85 mm^2

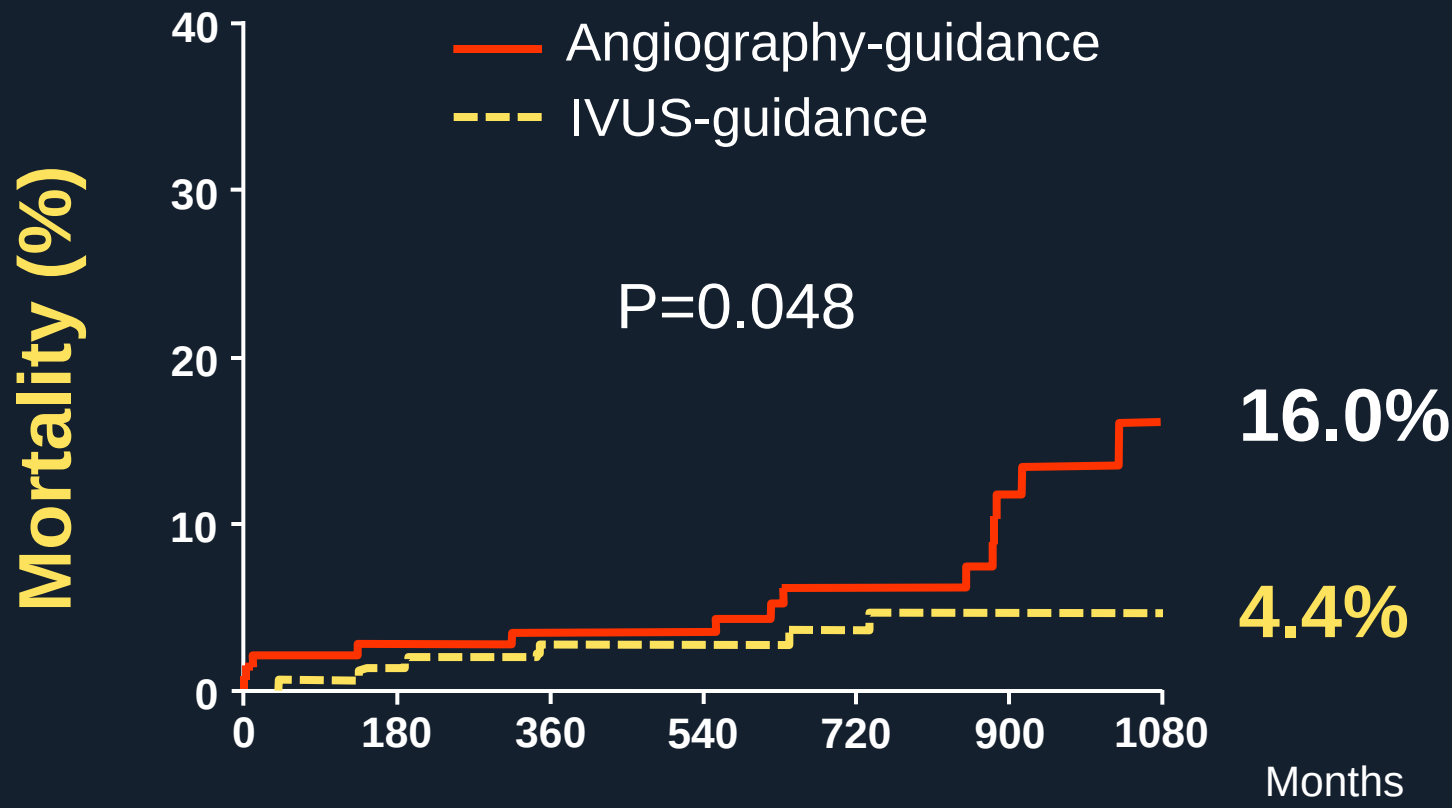


Proximal LAD
MSA:9.09 mm^2

Q2,
Why IVUS too ?

Saves Lives !

Angio-Guided vs. IVUS Guided for LM PCI



Patients after risk				
IVUS-guidance	145	140	98	37
Angiography-guidance	145	137	88	29

Park SJ et al, Circulation. Cardiovasc Interv. 2009;2(3):167-77.

Impact Of IVUS

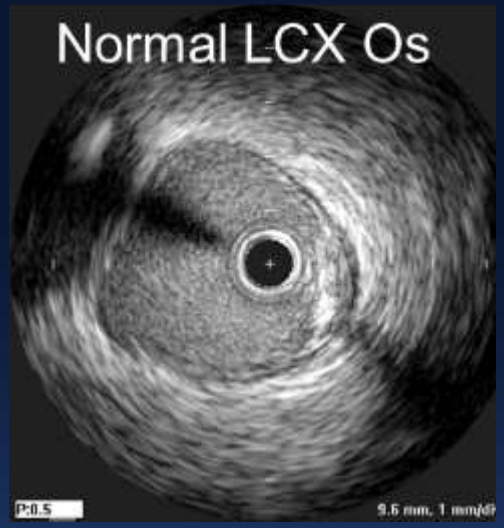
① *Decision Making ;*

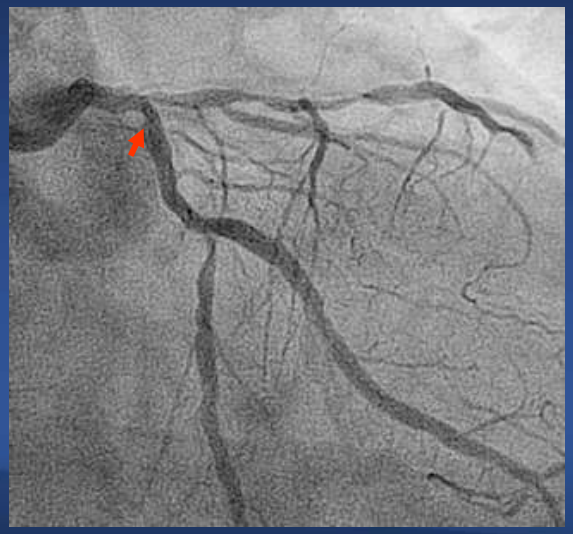
1 Stent or 2 Stents ?

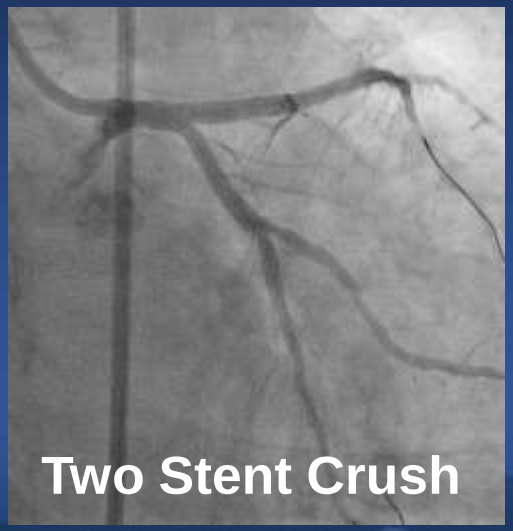
Distal LM Bifurcation PCI

Stent Cross Over	***Normal Ostial LCX (Medina 1.1.0., 1.0.0)*** Normal or Diminutive LCX Small LCX with < 2.5 mm in diameter Focal disease in distal LCX
Two Stent	***Diseased LCX (Medina 1.1.1., 1.0.1)*** Large LCX with ≥ 2.5 mm in diameter Diseased left dominant coronary system Concomitant diffuse disease in distal LCX

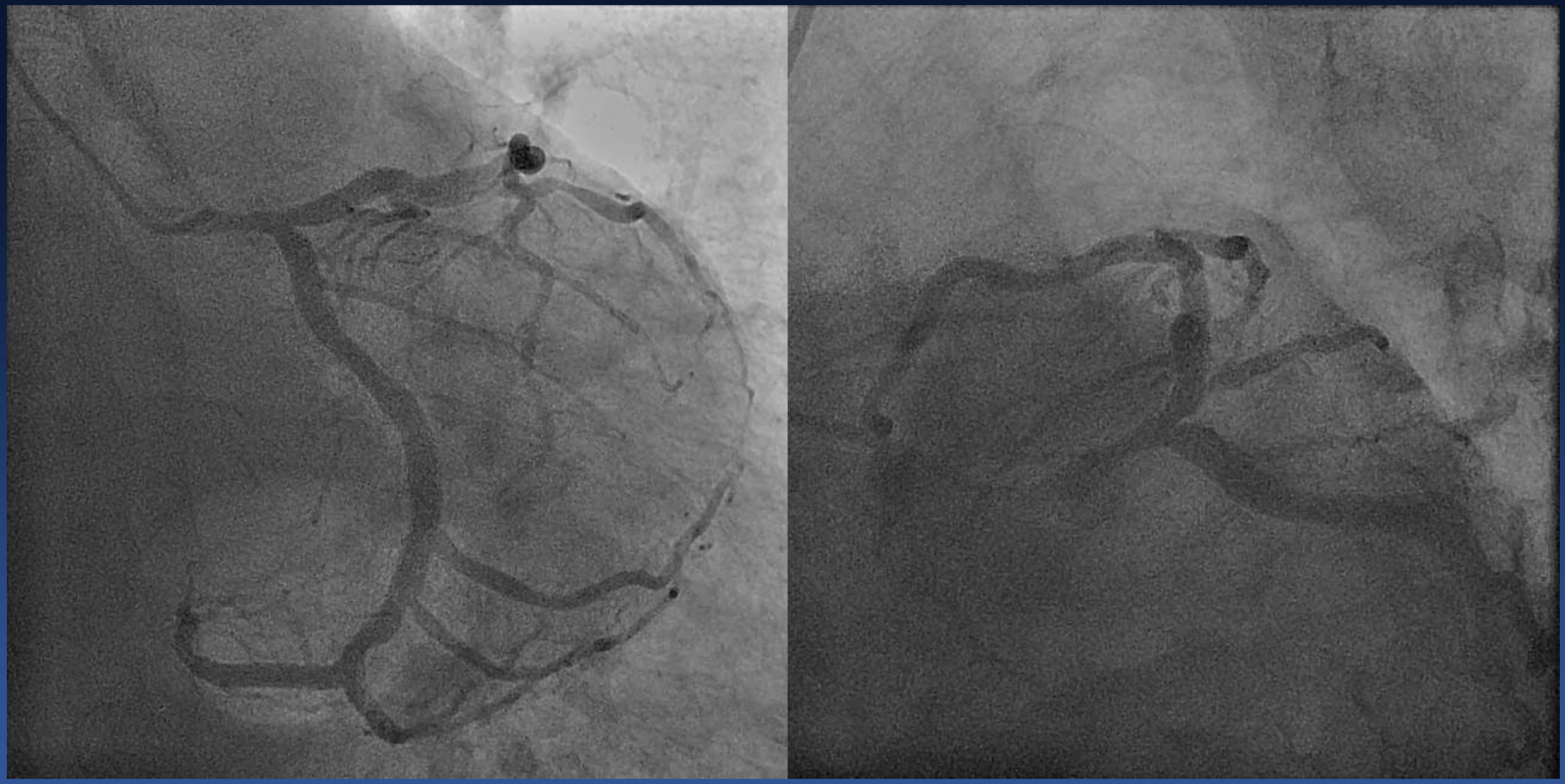
Depending On Whether or LCX Disease by IVUS





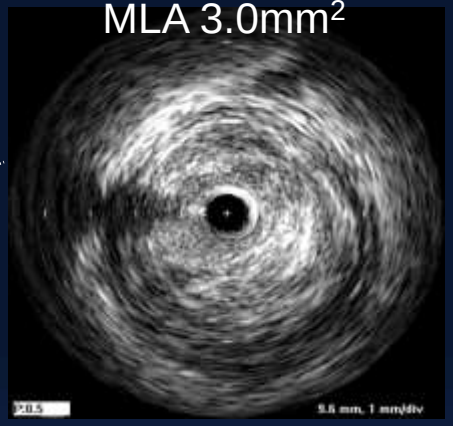


Case 2,
64/M, Effort Chest Pain

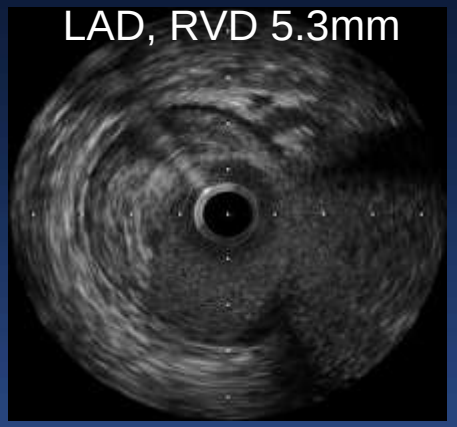


IVUS in Both LAD and LCX,

Distal LM, RVD 6.2mm
MLA 3.0mm^2

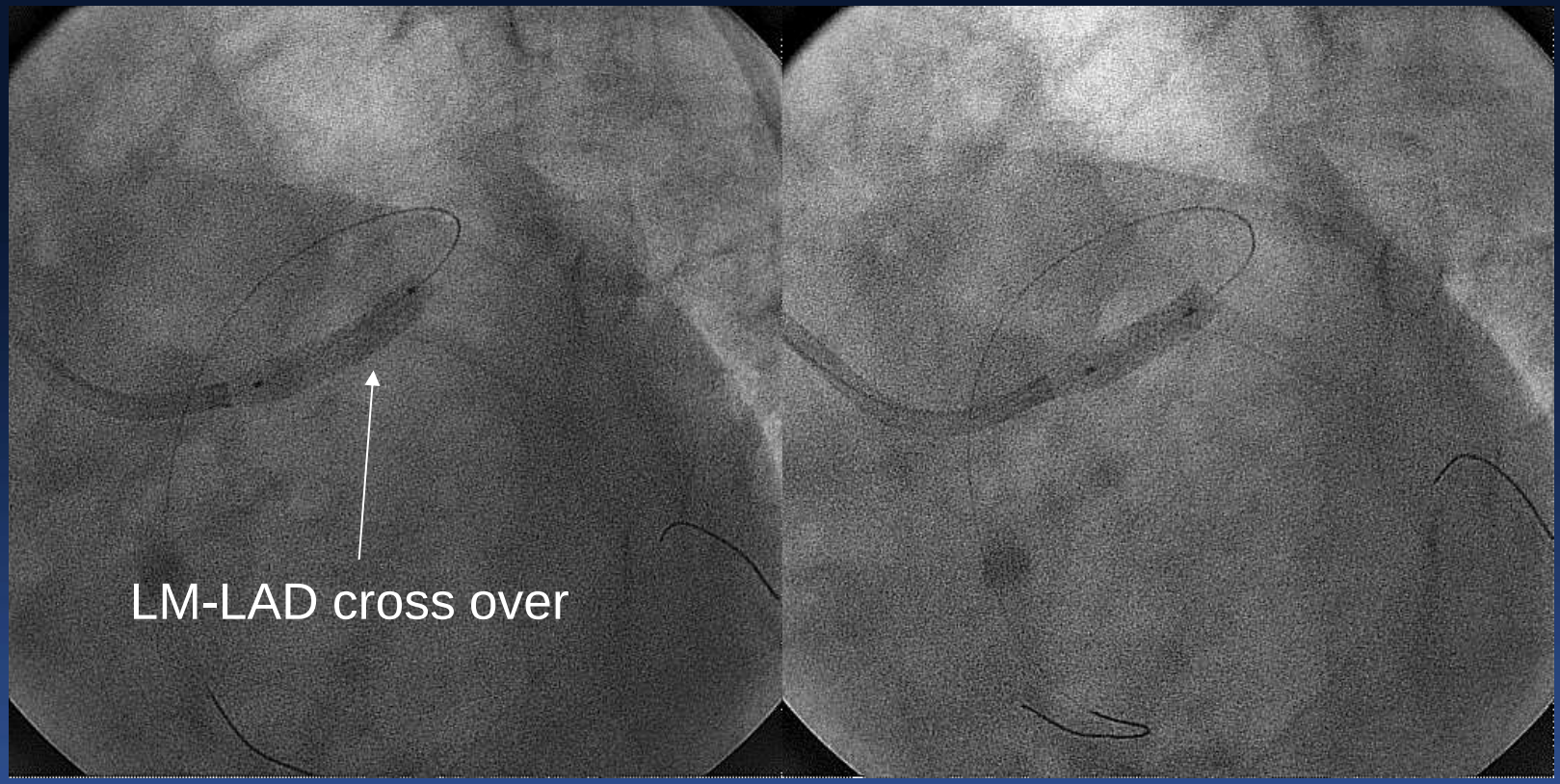


LAD, RVD 5.3mm



LCX, Disease Free

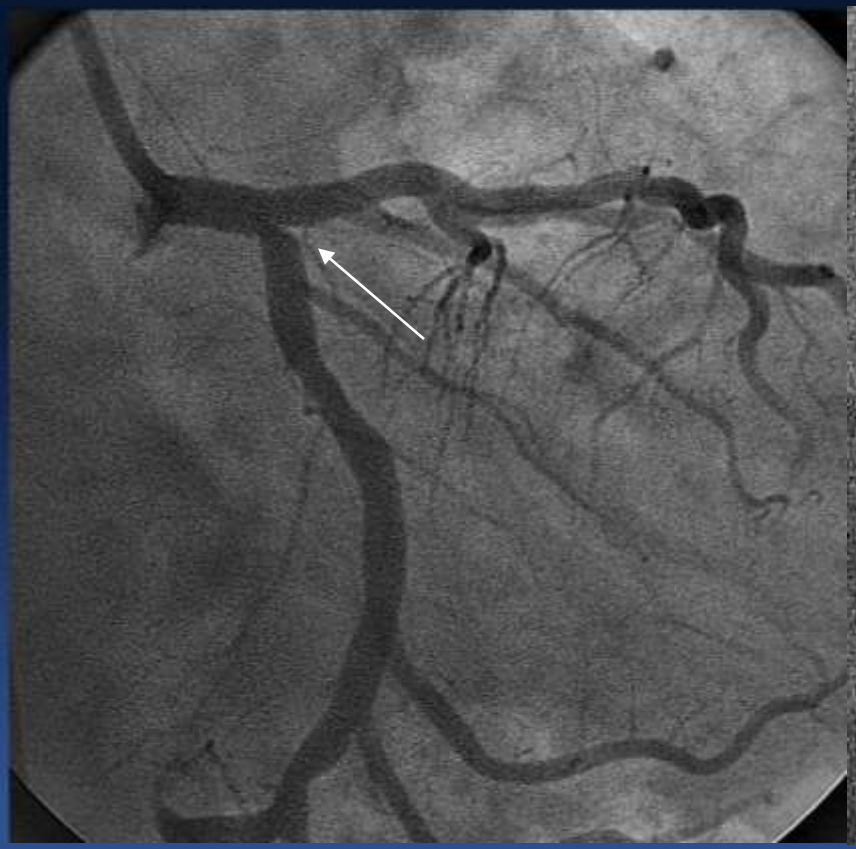
Stent Cross-Over



DES 4.0x20 mm

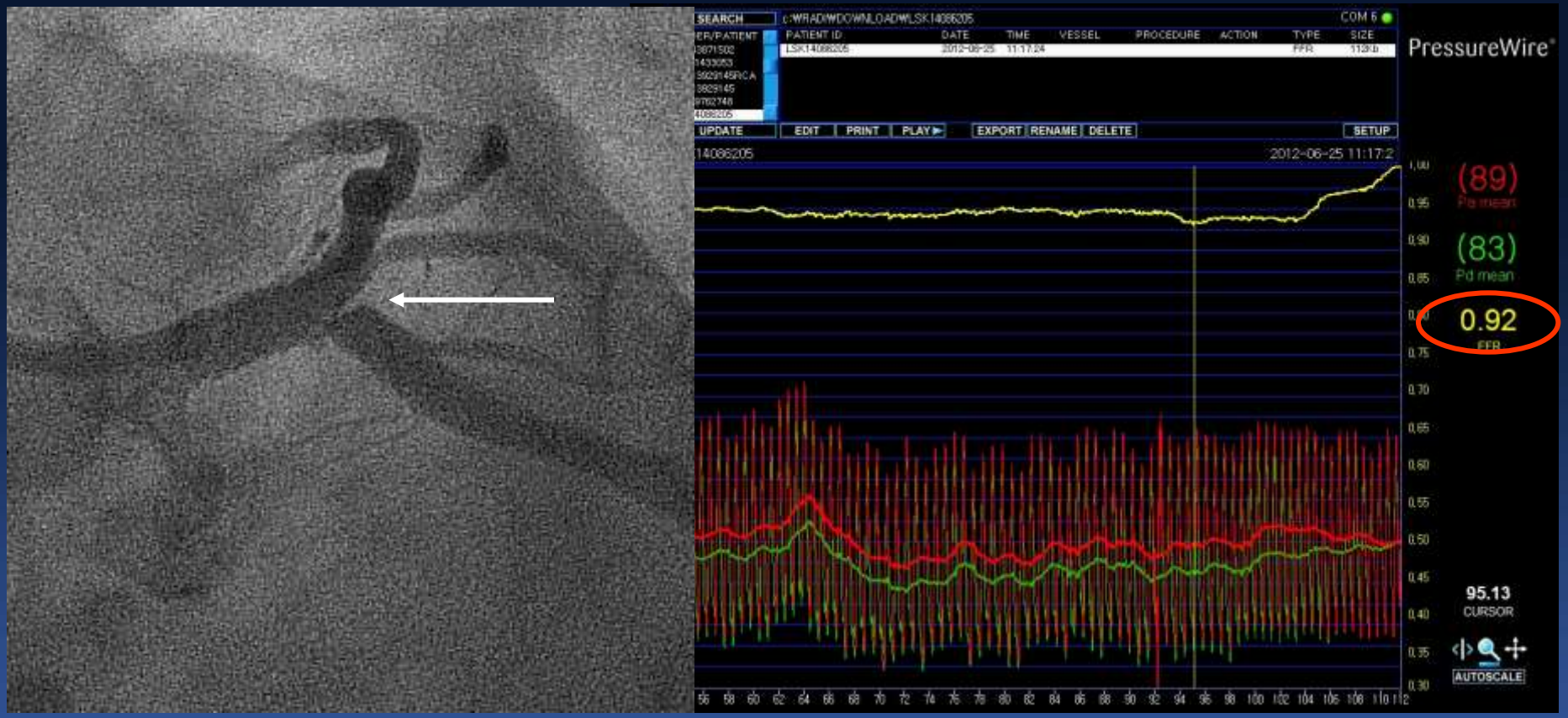
Additional high pressure Inflation with 4.0 mm non-compliant balloon

Final Result



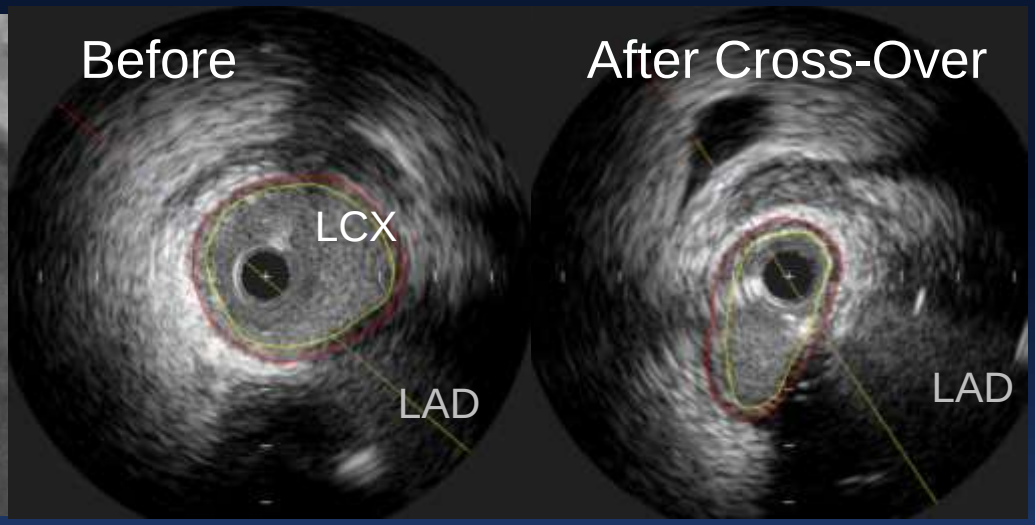
Side branch was compromised ?

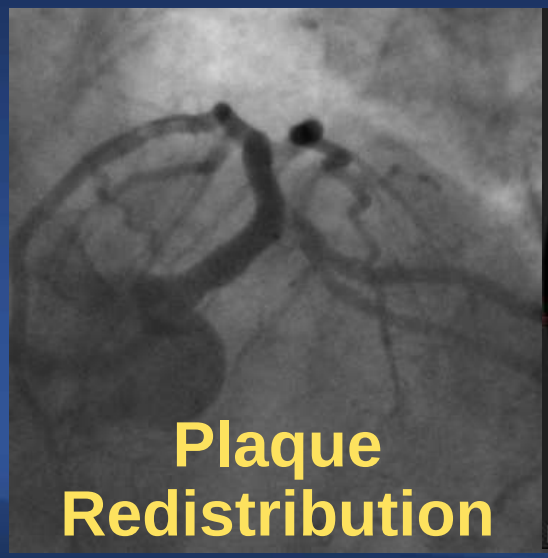
FFR of LCX is 0.92

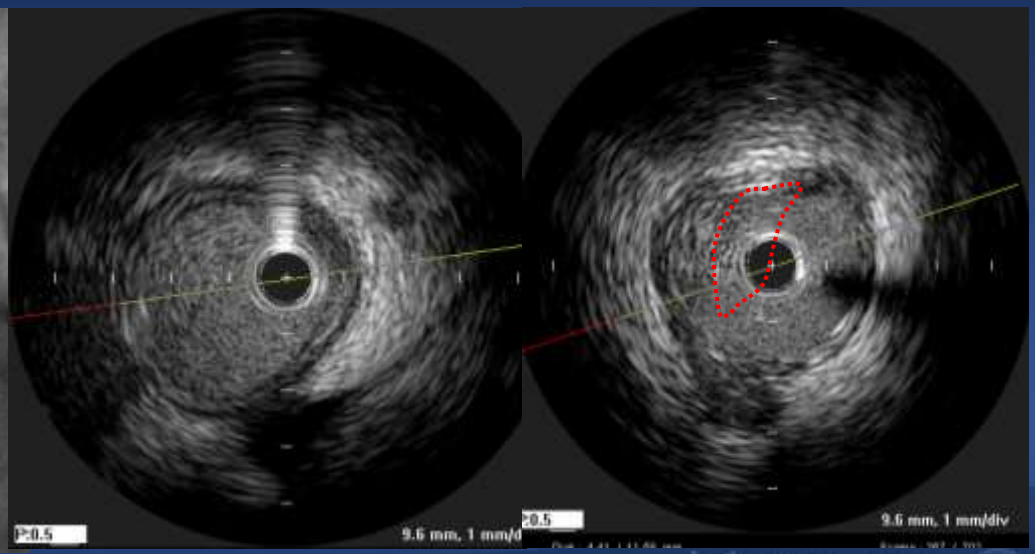


Defer !

Mechanism of LCX Jailing
After Stent Cross-Over



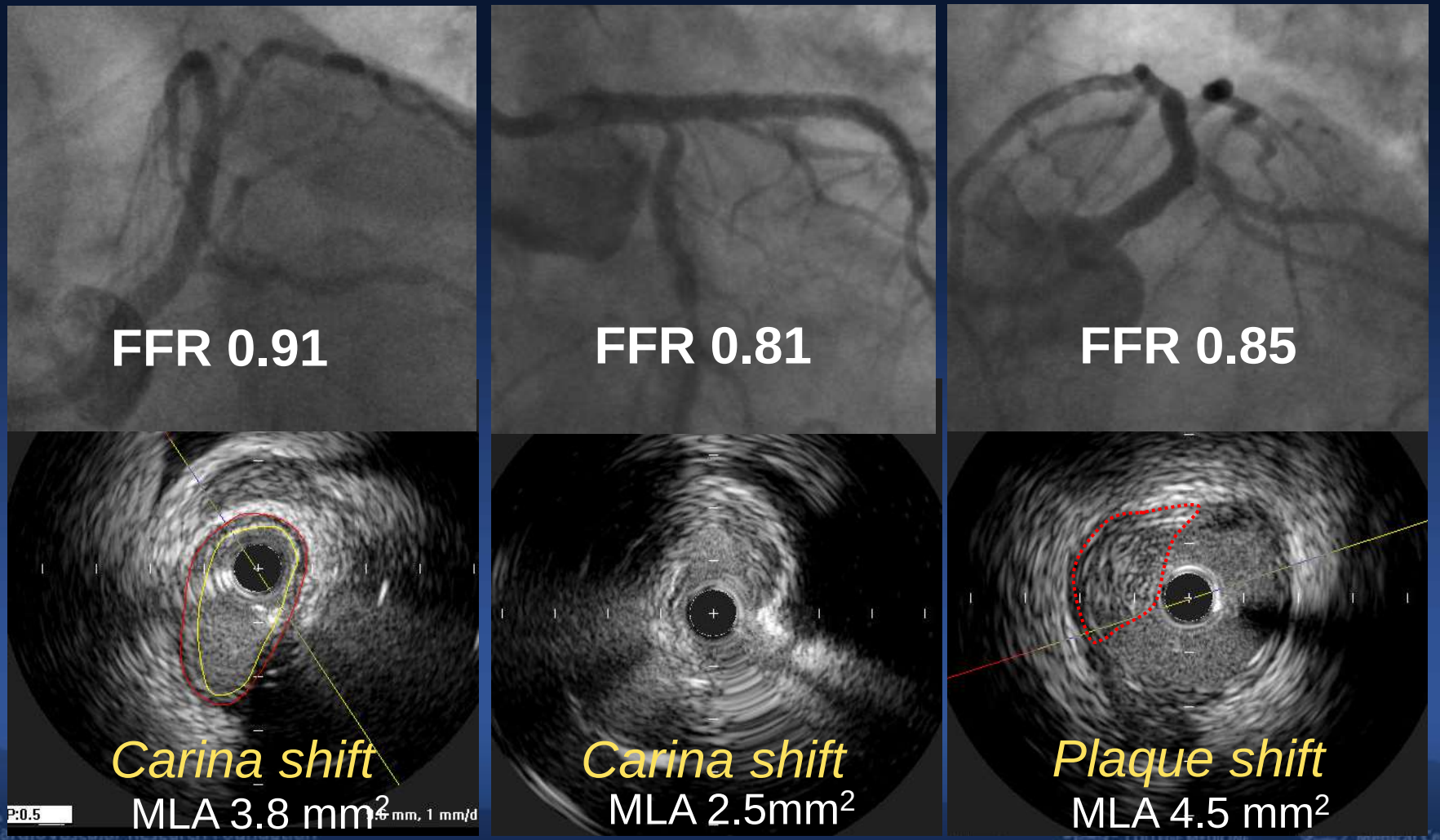




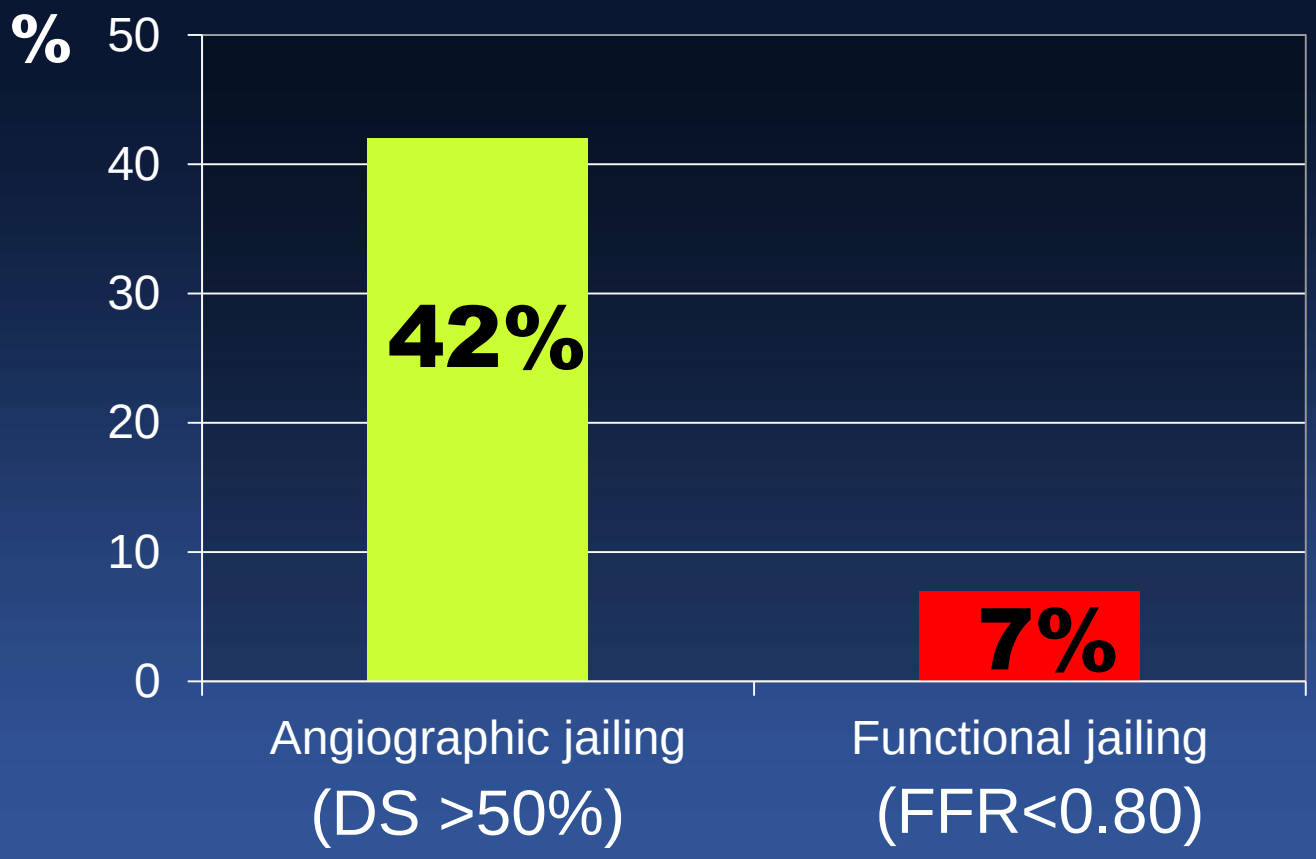
Kang et al. Circ Cardiovasc Interv 2011;4:355-61

Any Jailing Morphology Cannot Predict Functional Significance of Jailed LCX

Jailing LCX After Stent Cross-Over

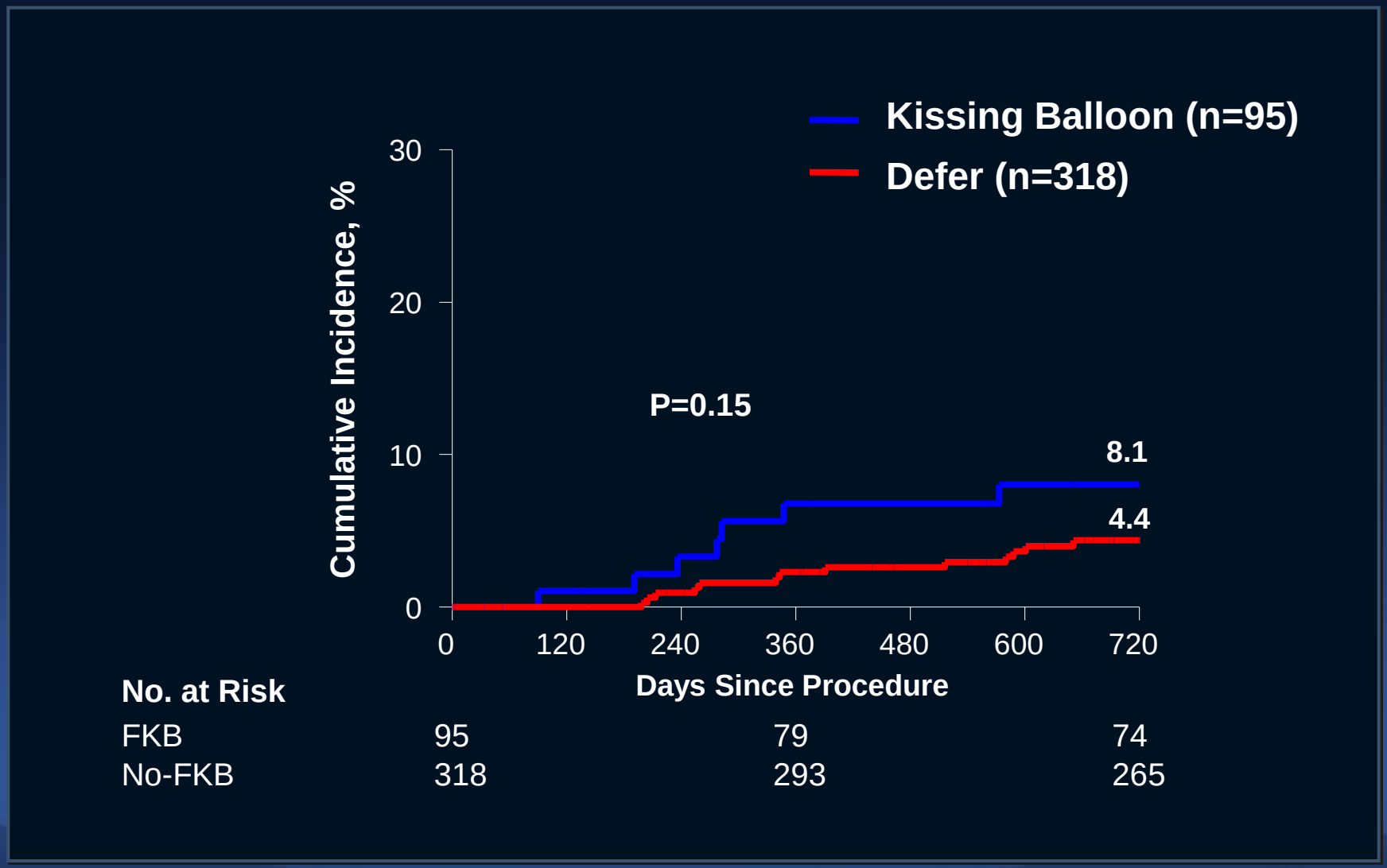


Functionally Significant LCX Jailing
After Stent Crossover



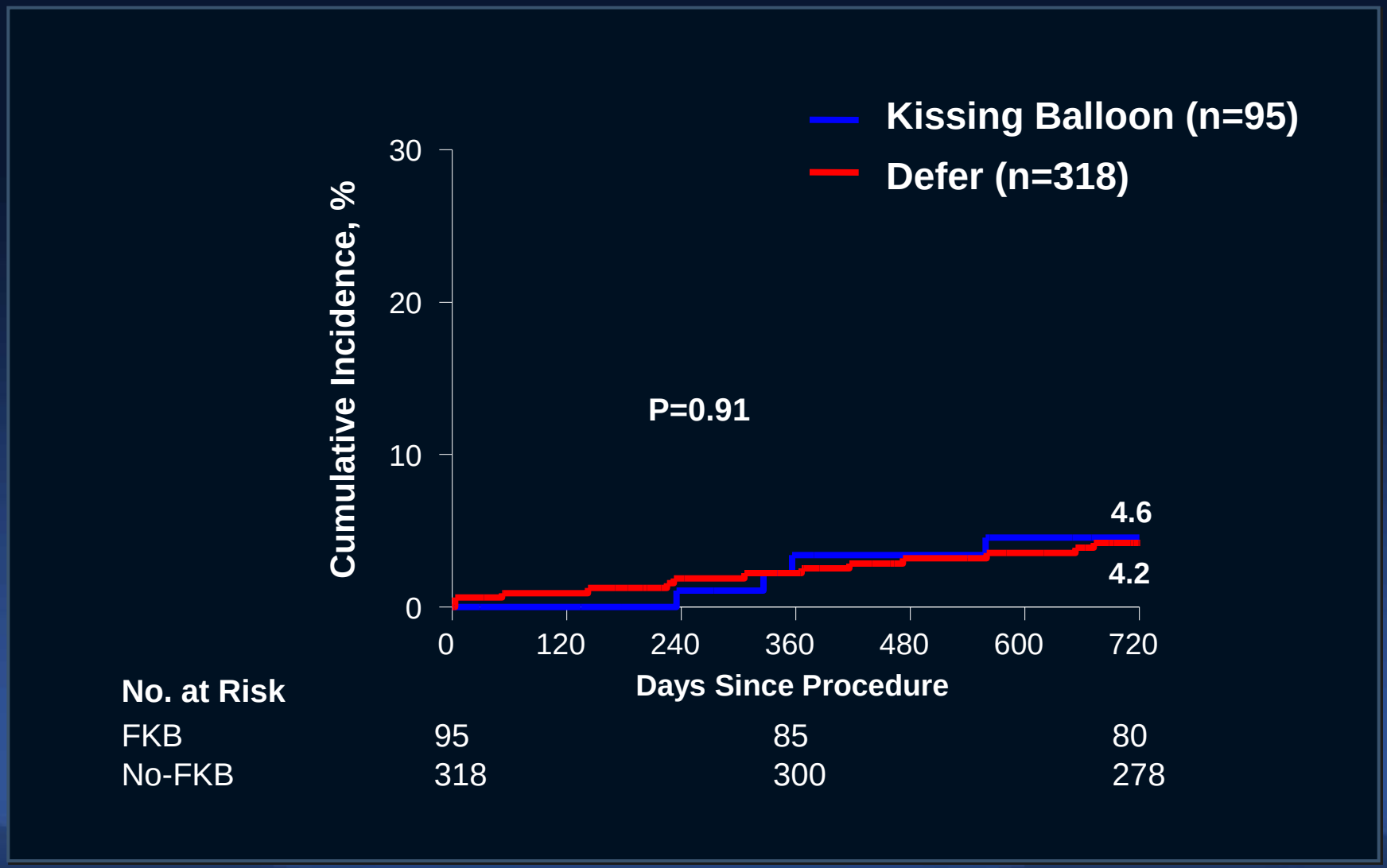
Kang SJ, Catheterization and Cardiovascular Interventions. 2014;83(4):545-52.

Left Main-TLR *at 2 Years*



AMC New Data, 2016

Death or MI *at 2 Years*



AMC New Data, 2016

Impact Of IVUS

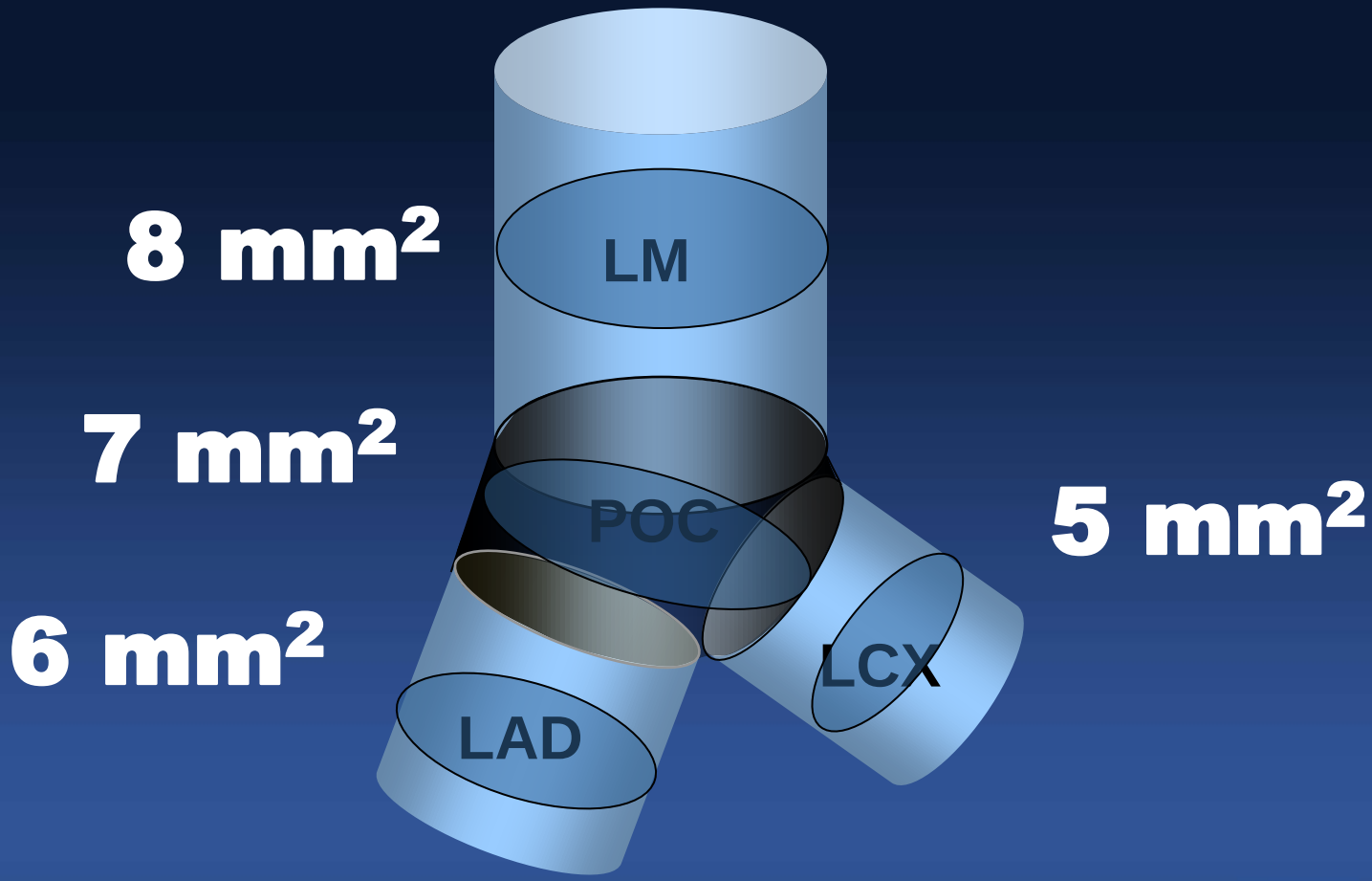
② *Stent Optimization ;*
After 2 DES Stents

2 Stent Techniques

- T-stent, modified T-stent or TAP
- Mini-crush (or step crush)
- Culotte
- V-stent
- Y-stent (SKS-simultaneous kissing stents)

Effective Stent Area (Rule of 5,6,7,8 mm^2)

Restenosis Rate < 5% and TLR < 2%



LM Bifurcation PCI

After
Stent Cross-Over

How to Optimize ?

- Do You Want to Treat the Jailed Side Branch ?
- How to Treat ?

IVUS Minimal Stent CSA Criteria 5-6-7-8 mm^2
May Improve Long-term Clinical Outcomes.

Integrated Use of FFR and IVUS

Less DES,
Less Surgery,
Simplified Procedure, and
Improved Clinical Outcomes !

Thank You !!

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