Integrated Use of FFR and IVUS

Left Main PCI

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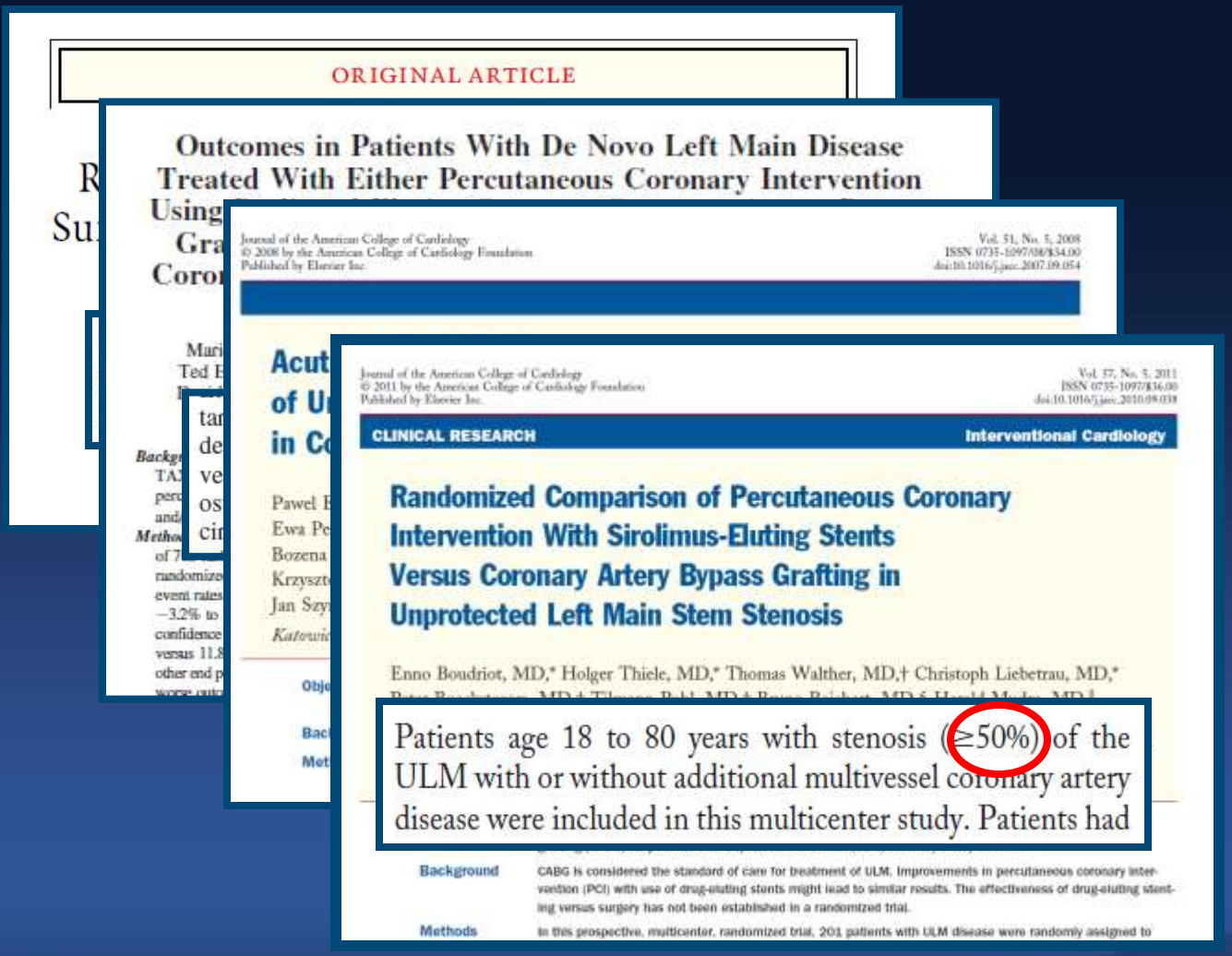
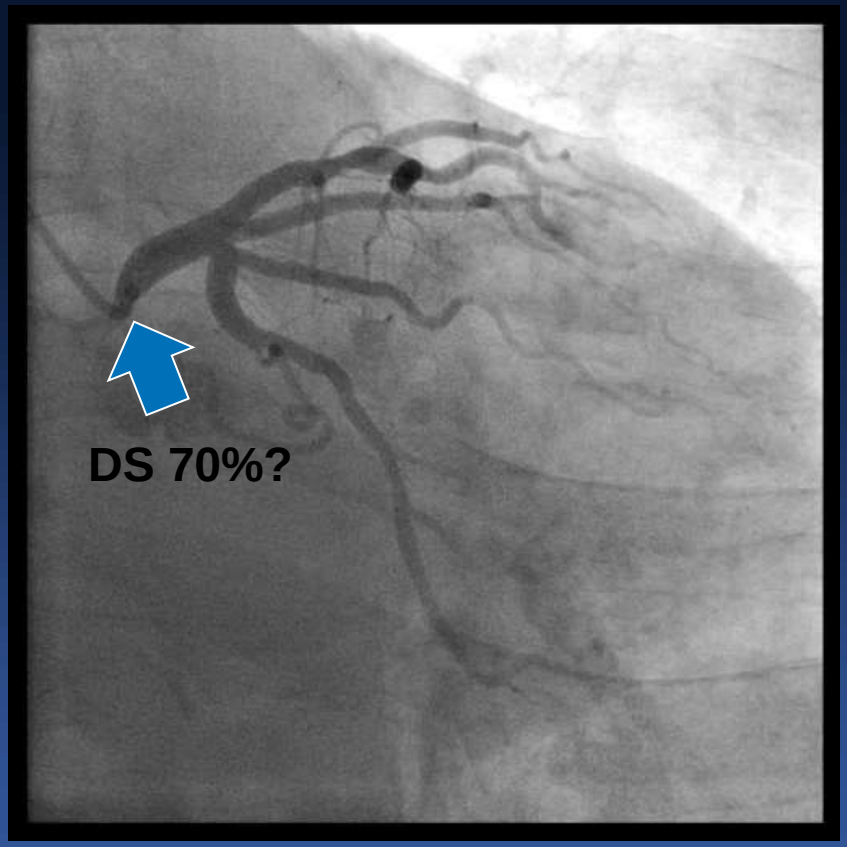
Why We Need FFR in LM Disease?

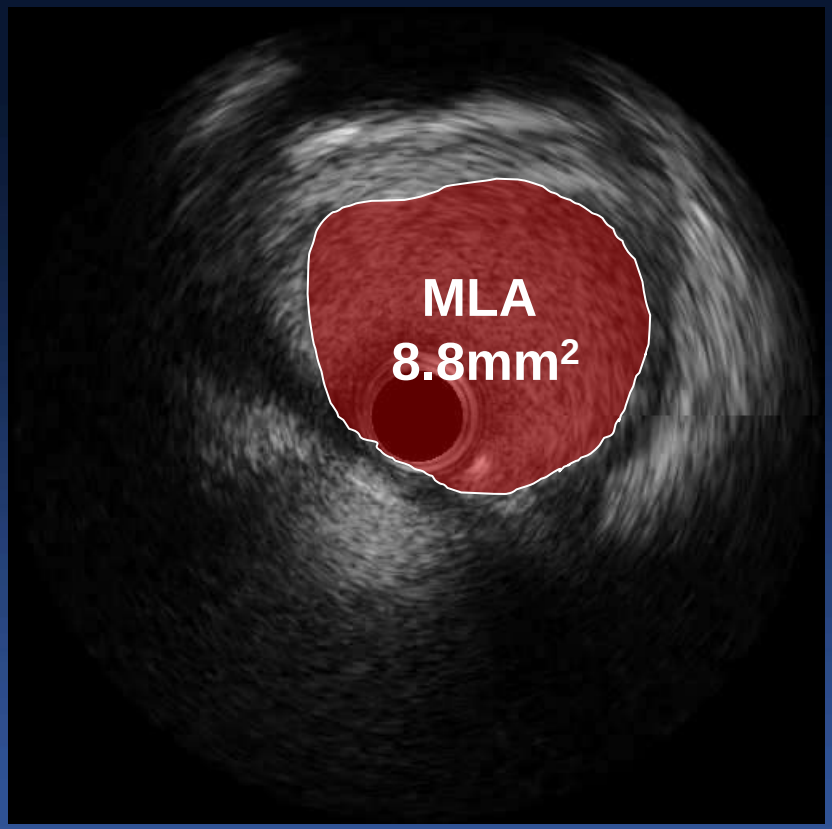
- Inaccuracy of CAG
- Insufficiency of Thallium or TMT
- Supporting Data for FFR Guided Decision

Major Randomized Studies in LM



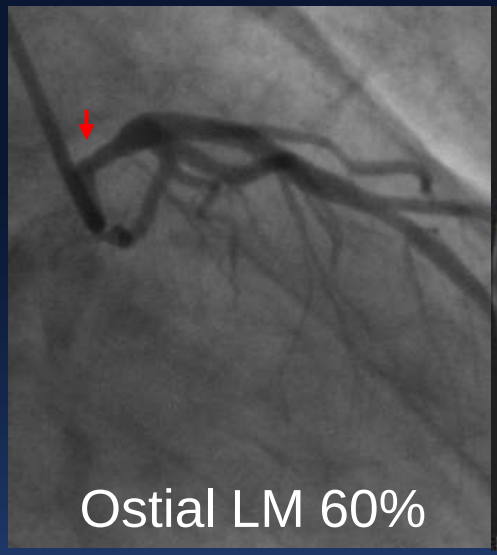
Why We Need FFR?



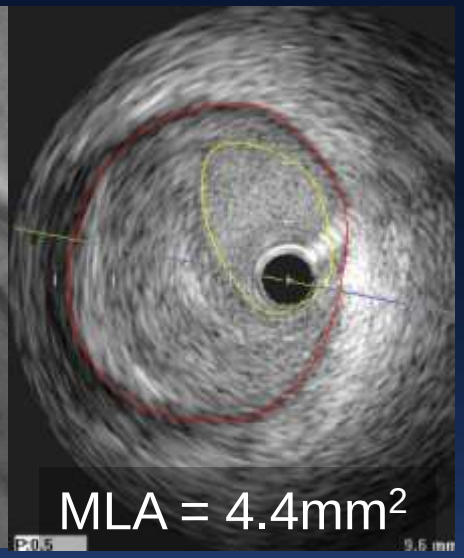


Why We Need FFR in LM?

47/M Stable angina



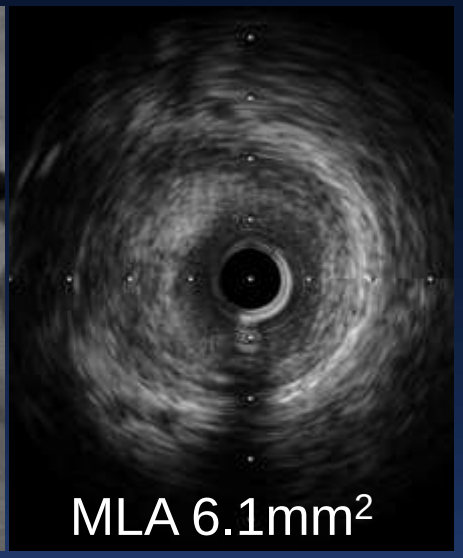
Ostial LM 60%



MLA = 4.4mm^2

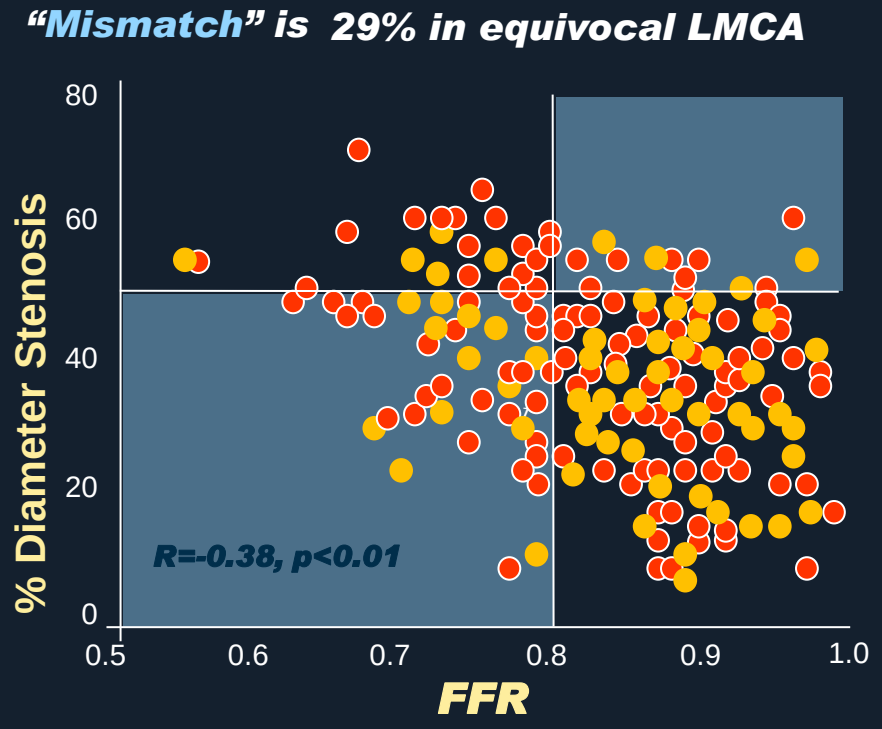
50/M Stable angina

Ostial LM 20%

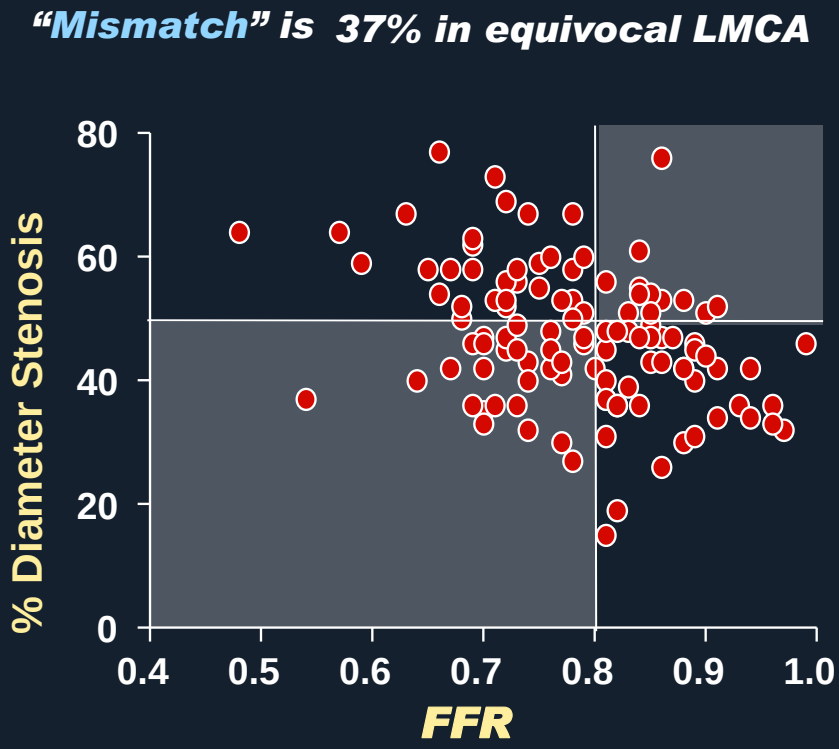


MLA 6.1mm^2

FFR and %DS in Equivocal LMCA



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



Park SJ, Ahn JM et al JACC CI. 2014;7(8):868-74

● **Isolated LMCA disease**

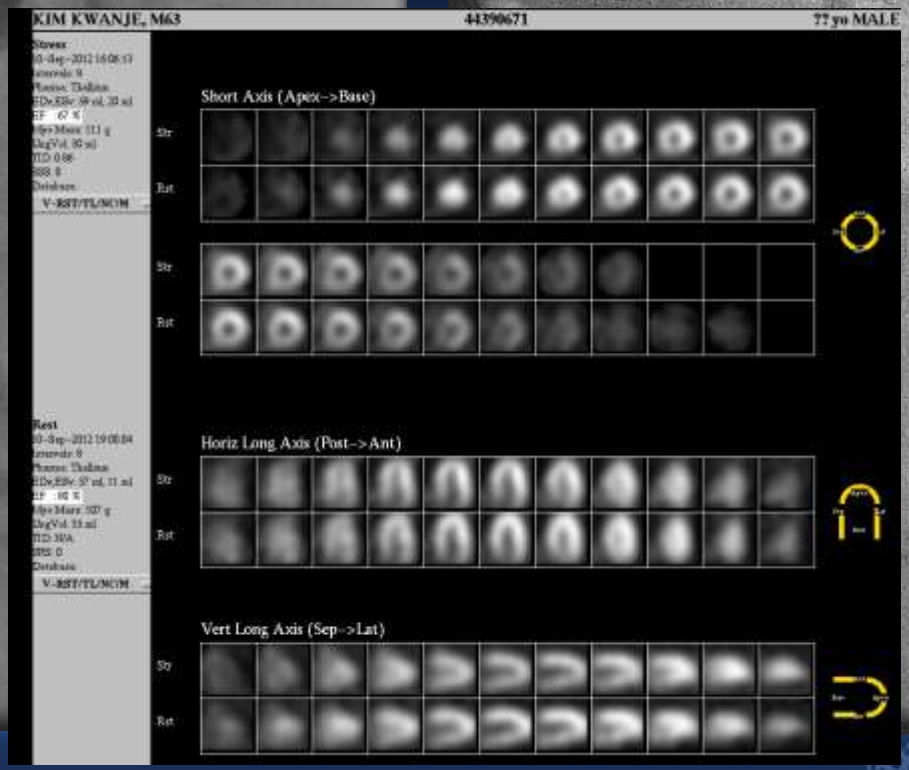
LM with 3VD

65yrs/M, eCP

RCA

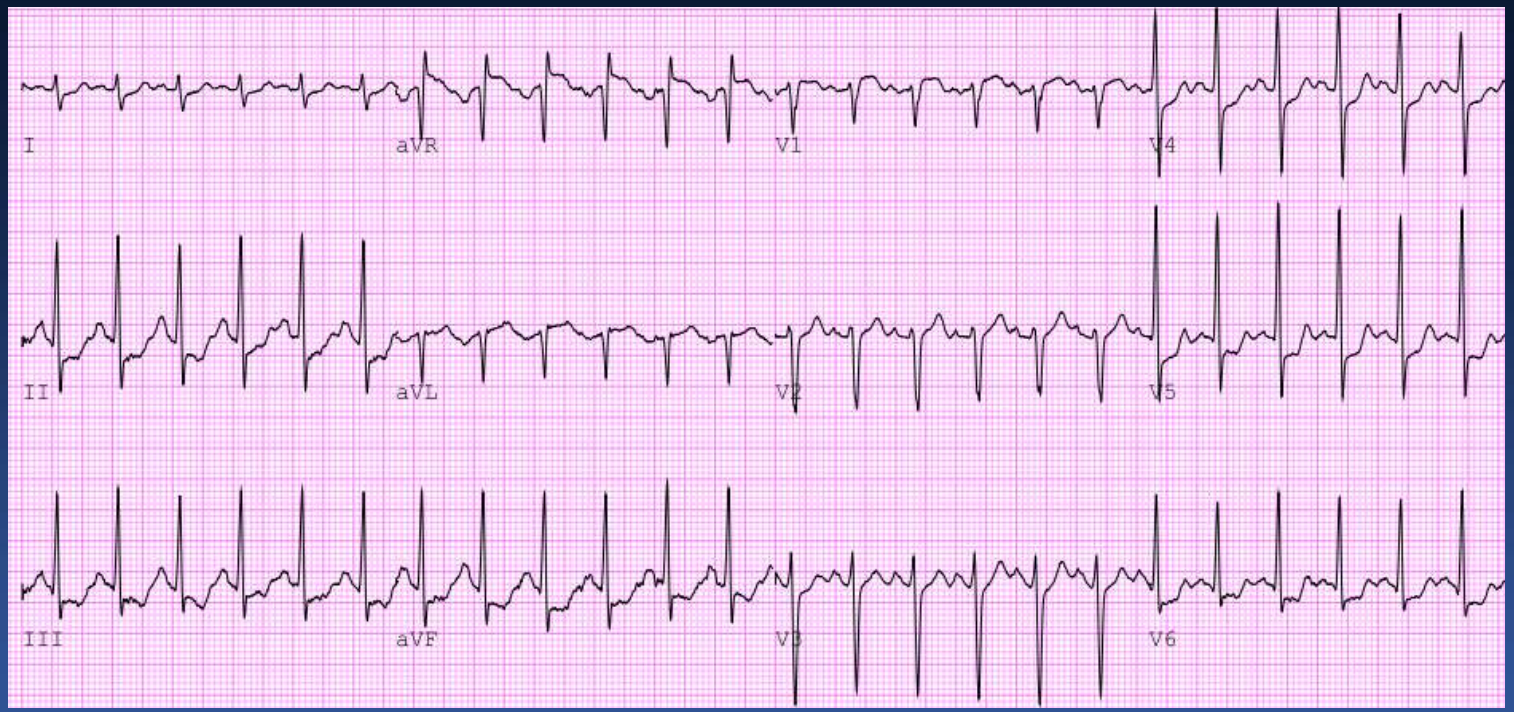
LCA

Normal Perfusion in Thallium SPECT



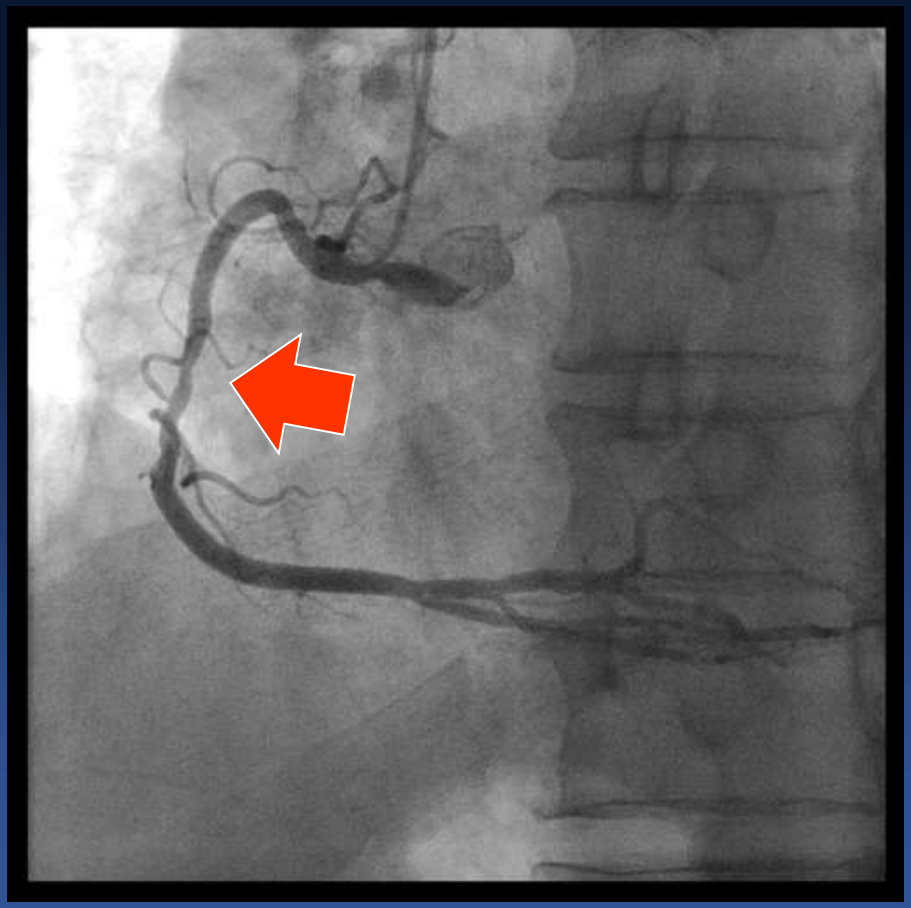
M/76, eCP

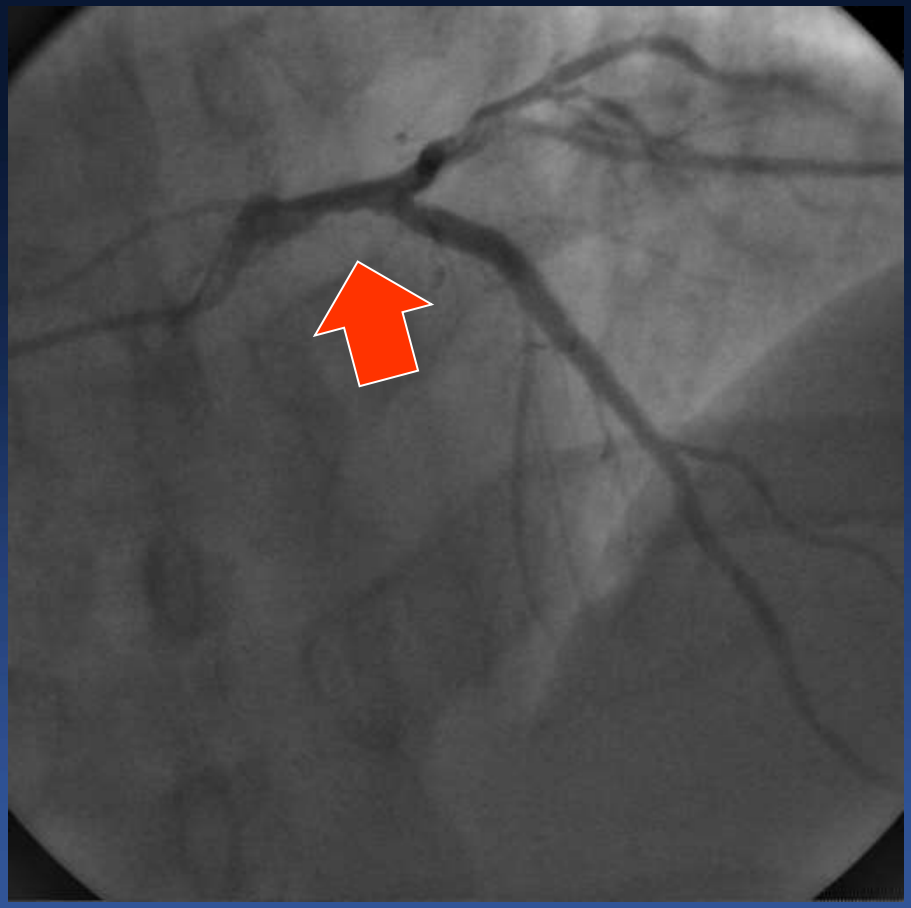
Treadmill Test



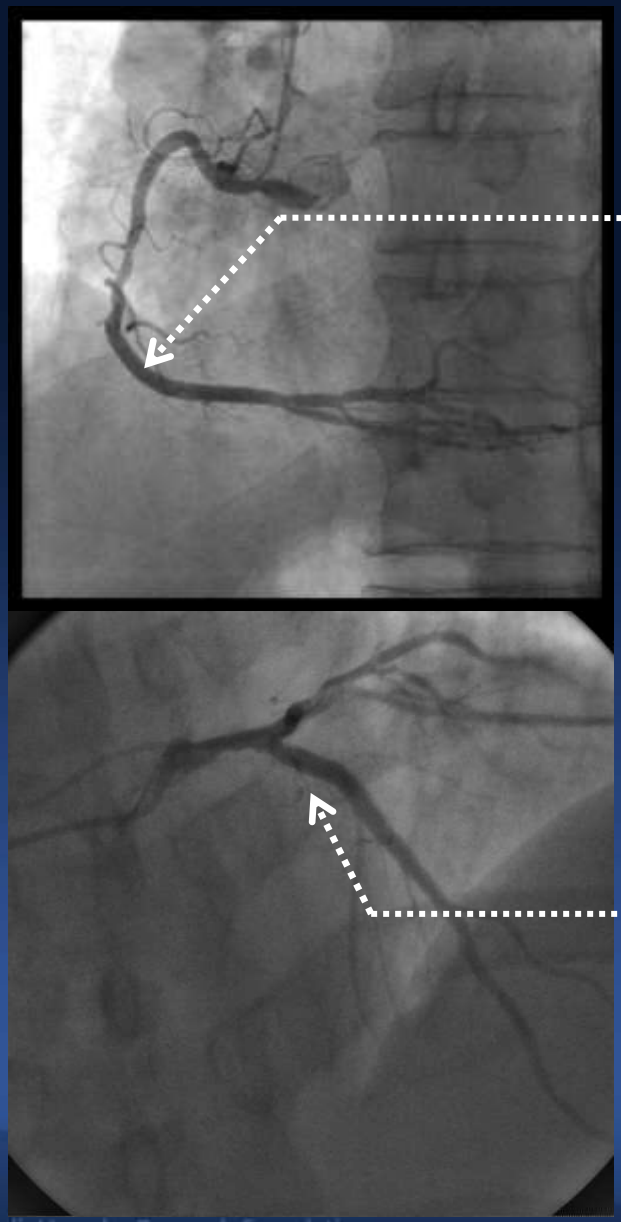
Positive at Stage 4

Coronary Angiography

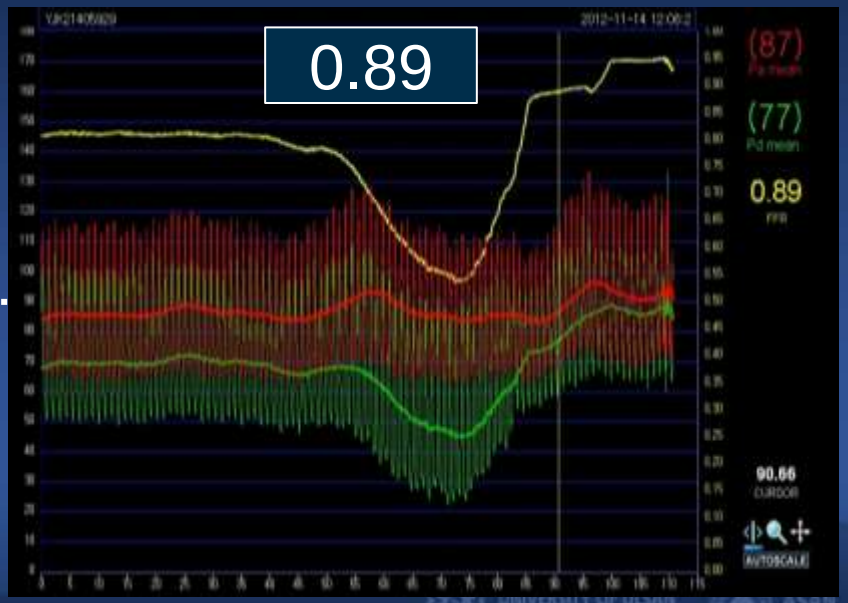




FFR

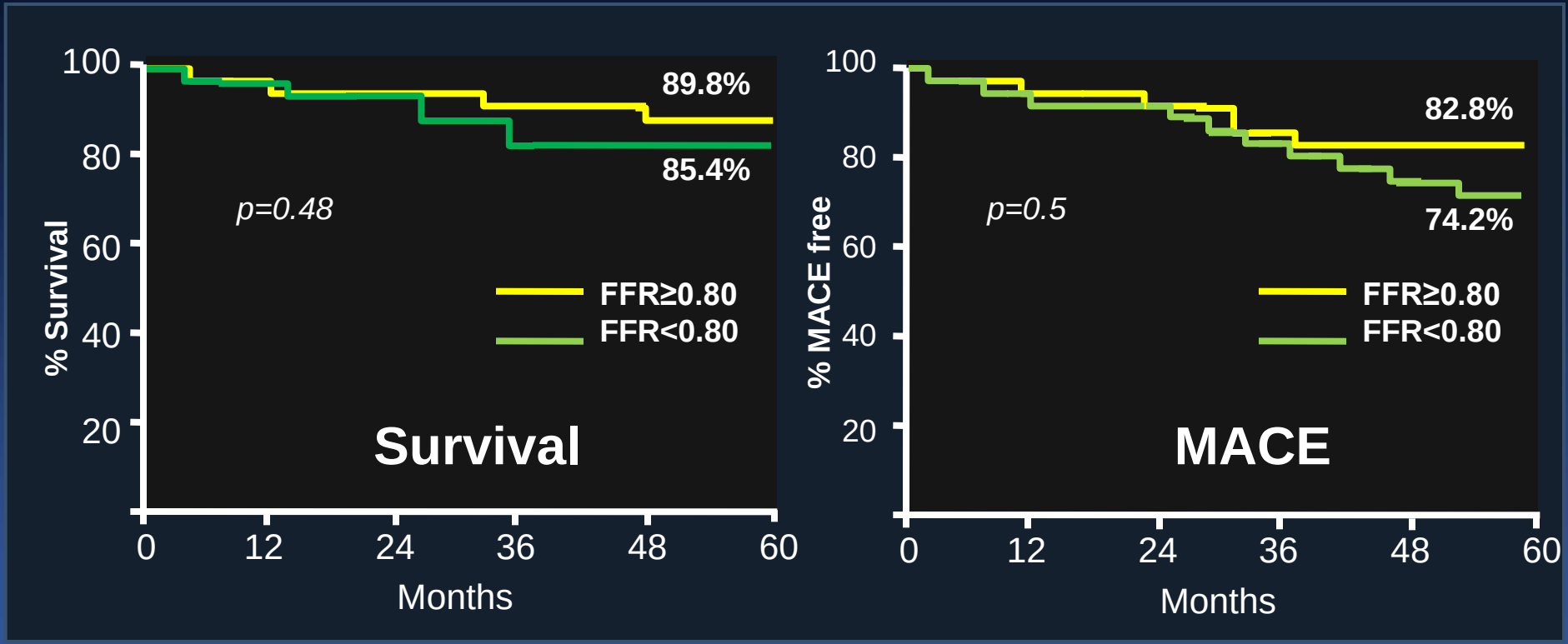



0.72
PressureWire
(77)
(56)
0.72
14.90
AUTOSCALE


0.89
(87)
(77)
0.89
90.66
AUTOSCALE

FFR Guided PCI in Equivocal LMCA

- In 213 patients with an equivocal LMCA stenosis
- FFR ≥0.80: Medication (n=138) vs. FFR<0.80: CABG (n=75)



An FFR-guided strategy showed the favorable outcome.

Circulation. 2009;120:1505-1512

FFR Guided Decision Making in LM Disease

	Hamilos et al [1]		Bech et al [2]		Courtis et al [3]		Lindstaedt et al [4]		Jasti et al [5]	
Age, y	64 ± 9	68 ± 11	63 ± 9	60 ± 9	61 ± 10	63 ± 10	61 ± 10	64 ± 9	**62 ± 11**	
Mean follow up, mo.	35 ± 25		29 ± 15		13 ± 10	14 ± 12	29 ± 18	29 ± 14	**38**	
No. of patients	75	138	30	24	60	82	27	24	14	**37**
FFR cut off value	<0.80	≥0.80	<0.75	≥0.75	<0.75	>0.80	<0.75	>0.80	<0.75	**≥0.75**
Clinical outcomes										
Death, n (%)	7 (9.6)	9 (6.5)	1	0	3 (5)	3 (4)	4 (14.8)	0	0	**3**
MI, n (%)	0	1	1	0	1 (2)	4 (5)	1 (3.7)	0	0	**0**
RR, n (%)	**4 (5.5)**	**17 (12.3)**	**2**	**5**	**0**	**9 (11)**	**1 (3.7)**	**6 (25)**	**0**	**4**

[1]Circulation 2009;120:1505-1512;[2]Heart 2001;86:547-552;[3]Am J Cardiol 2009;103:943-949;
[4]Am Heart J 2006;152:156.e151-156;[5]Circulation 2004;110:2831-2836

Clinical Outcomes After Deferral of LM Disease

(6 studies, 296 patients)

Outcomes	Incidence (%/year)
All Death	2.6 (1.3-5.2)
Cardiac Death	2.6 (1.3-5.2)
Myocardial Infarction	2.0 (0.7-5.1)
TVR	5.5 (3.3-8.8)
MACE	8.2 (5.5-12.1)

Hamilos M, Circulation. 2009;120:1505-1512
Bech GJ, Heart. 2001;86:547-552
Courtis J, Am J Cardiol. 2009;103:943-949
Lindstaedt M, Am Heart J. 2006;152:151-159
Jasti V, Circulation. 2004;110:2831-2836
Sueman, Heart Vessels. 2005;20:271-7

Clinical Outcomes After Deferral of LM Disease

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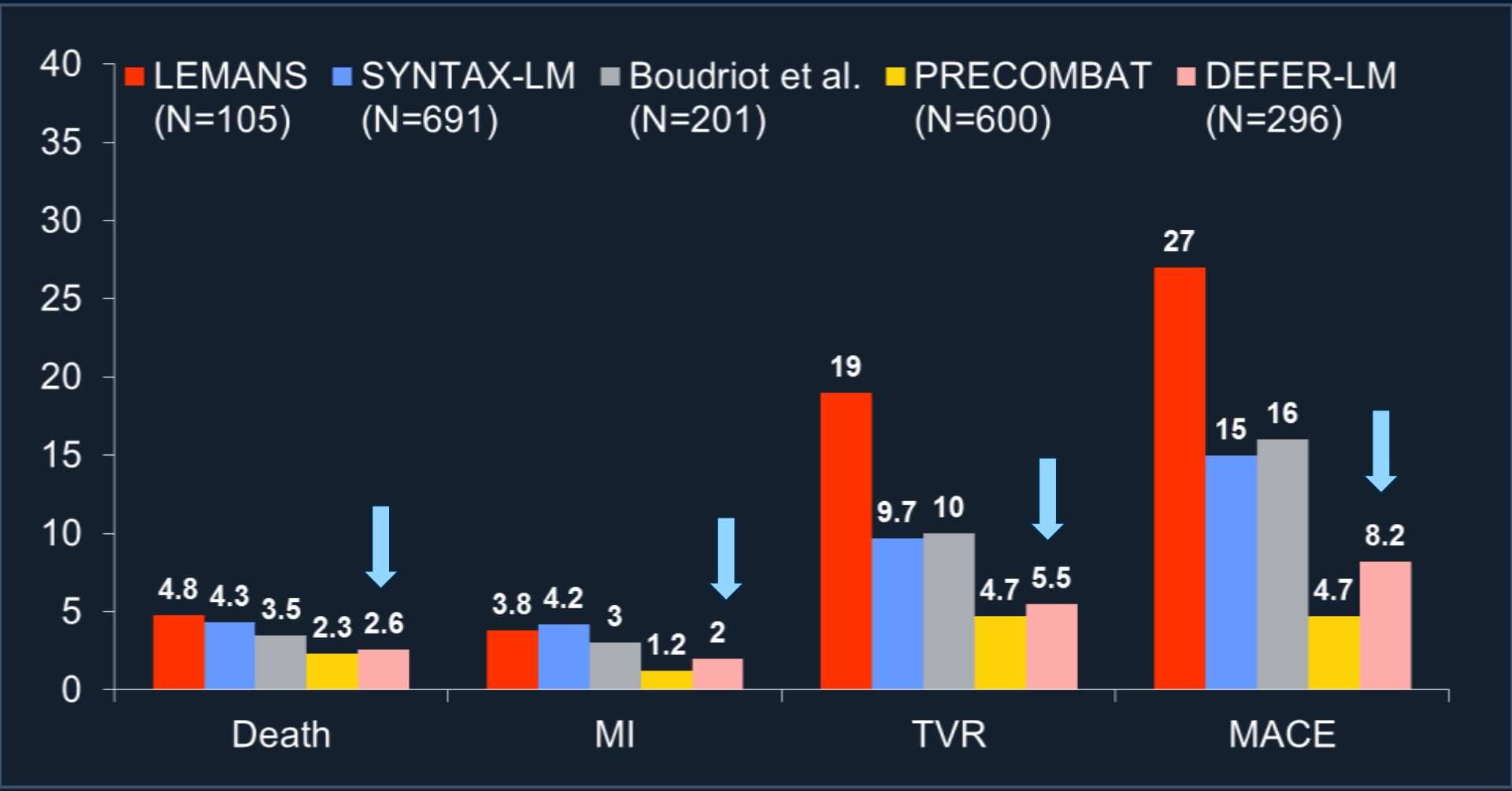


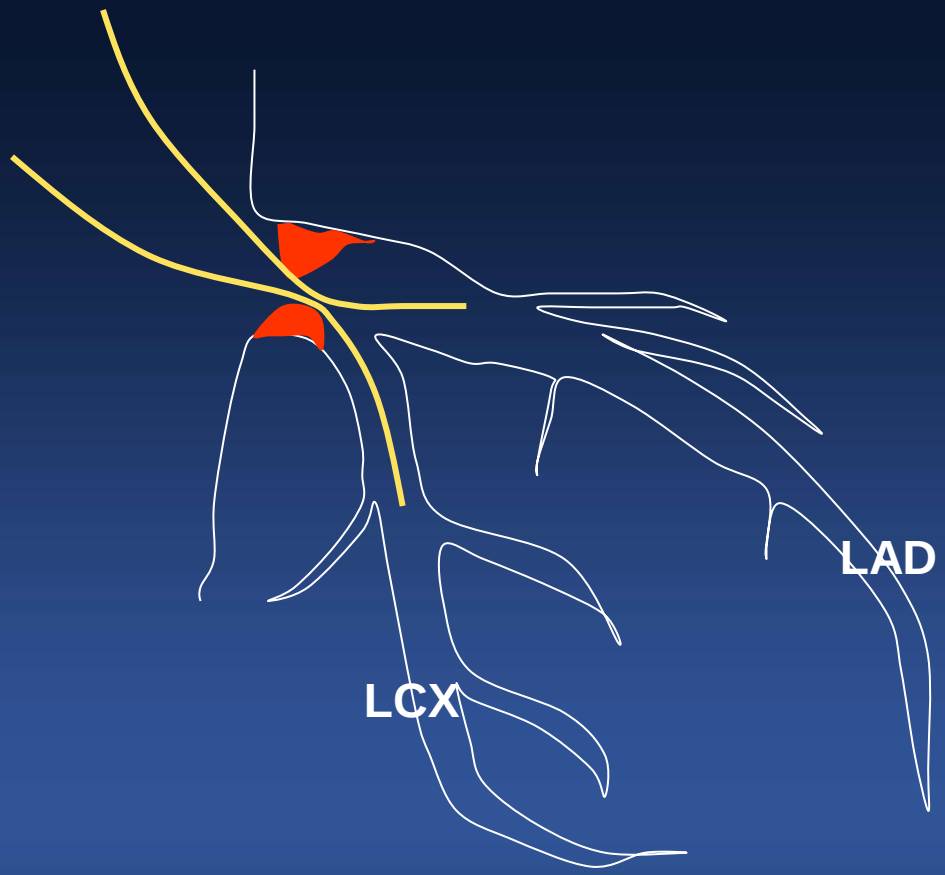
Why We Need FFR in LM Disease?

- Inaccuracy of CAG
- Insufficiency of Thallium or TMT
- Supporting Data for FFR Guided Decision

How Can We Implement FFR in Real Practice ?

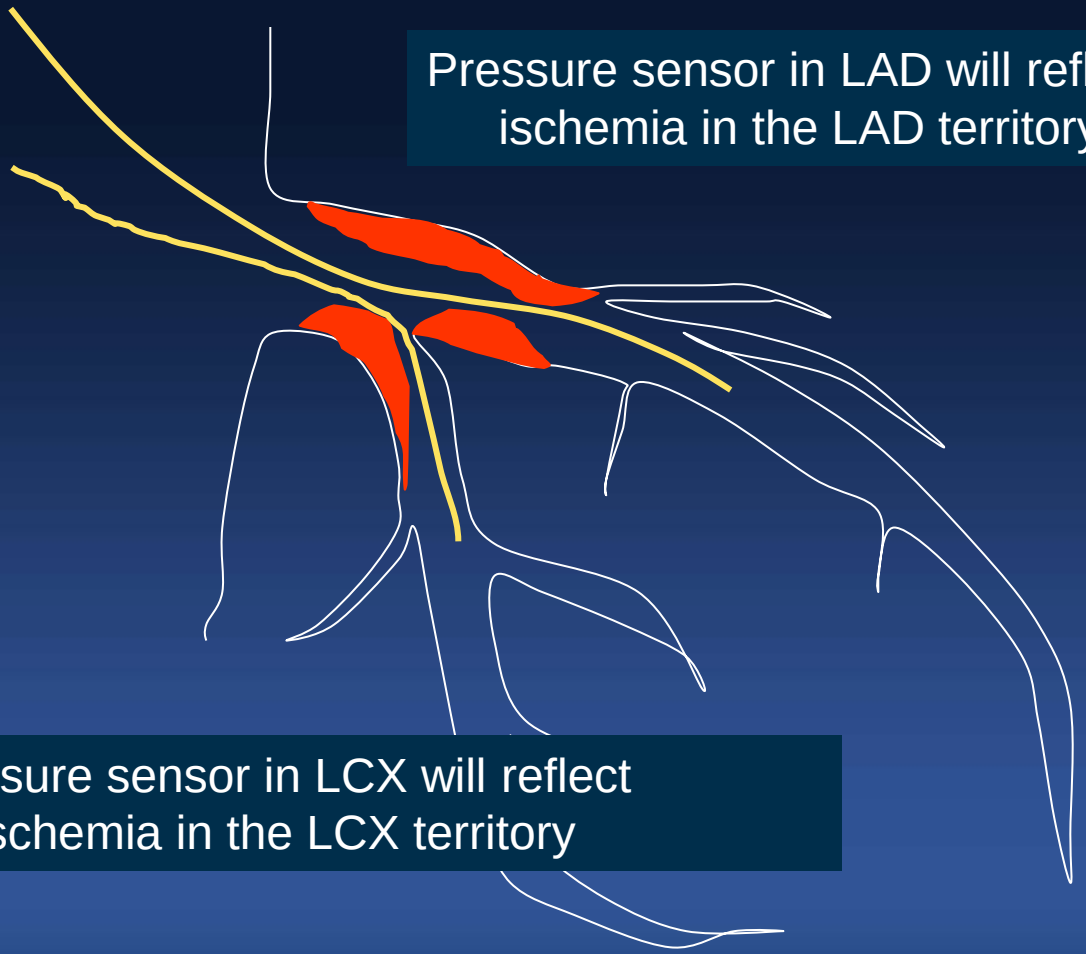
For the Undetermined, Intermediate Ostial and Shaft LM Lesion,

Theoretically, LAD FFR = LCX FFR



For the Intermediate LM Bifurcation Lesion,

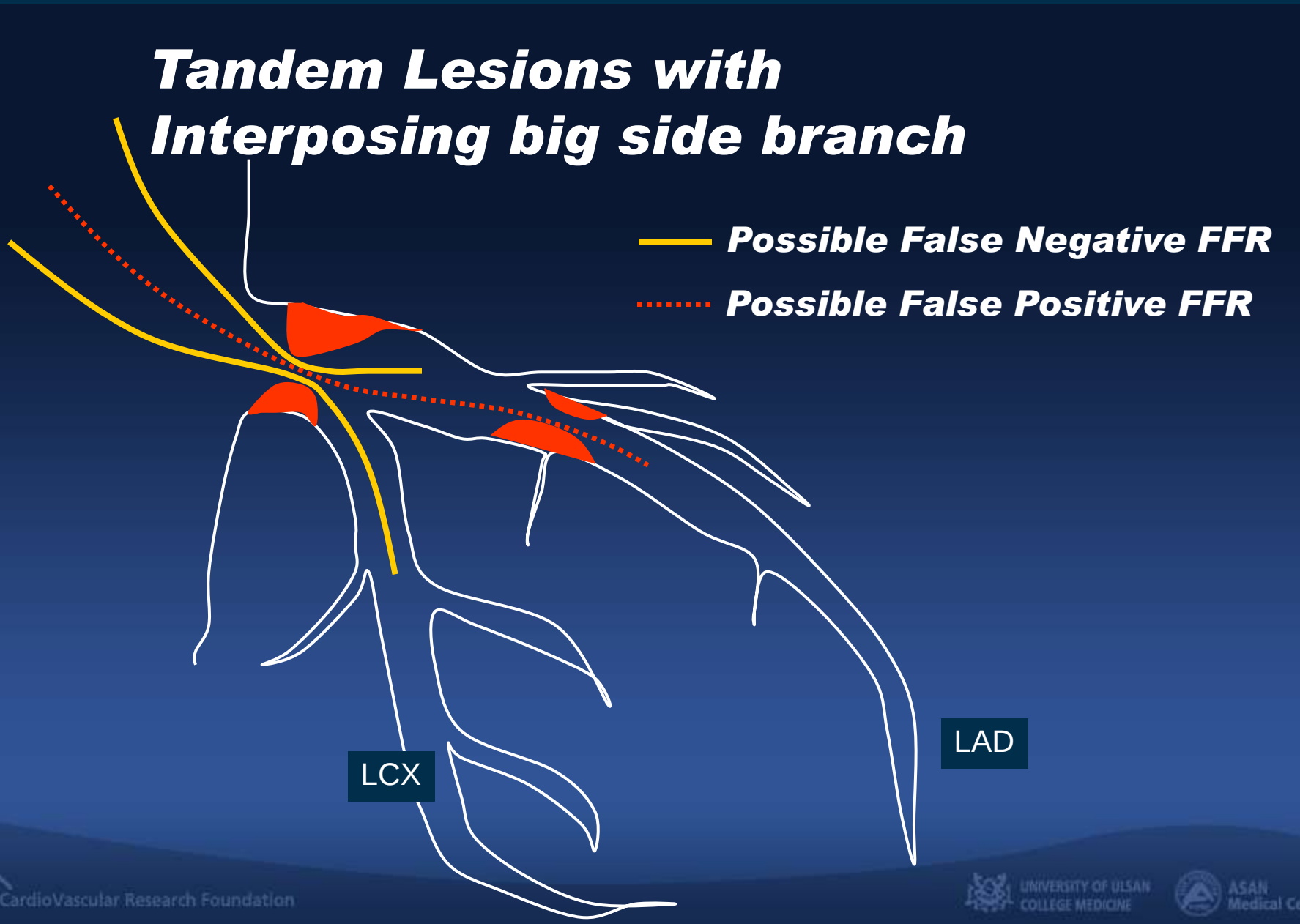
LAD FFR = or ≠ LCX FFR



For the Intermediate LM Bifurcation Lesion,
Main Concern is to Determine
Single Stent Cross Over or 2 Stents Technique.

We Can Not Treat Separately

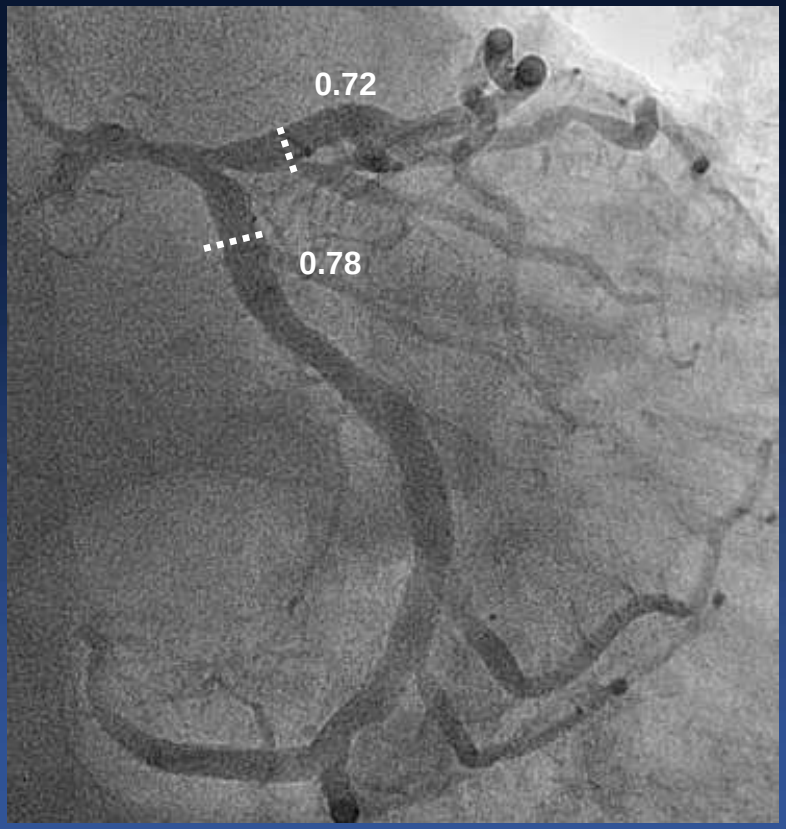
For LMCA stenosis with distal LAD/LCX stenosis



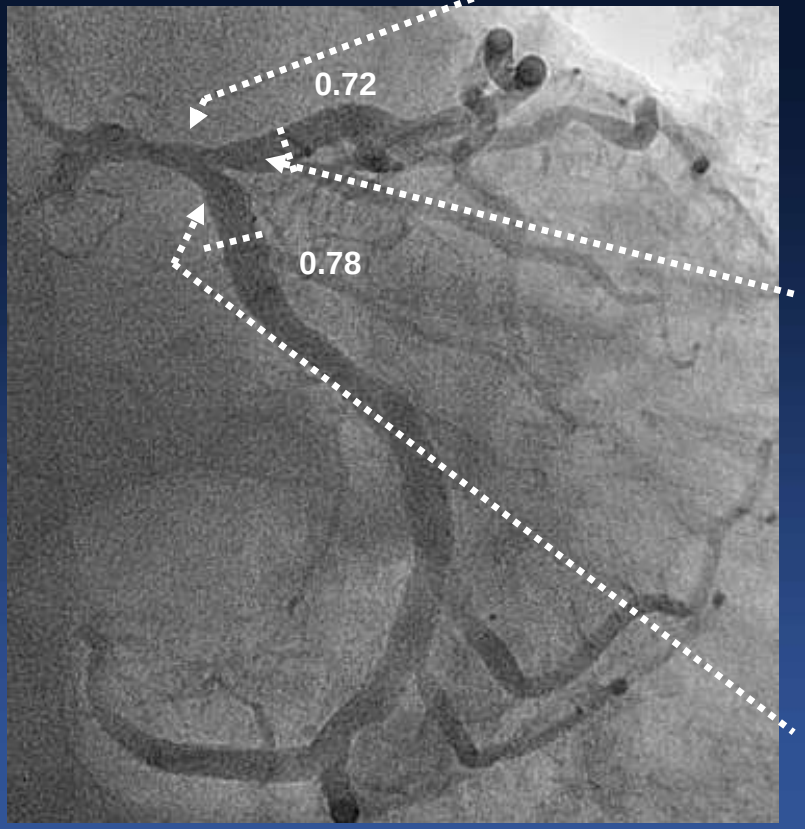
LM Bifurcation Lesion (Medina 1,0,0) with Minimal LCX Disease

55/M, Stable angina,

FFR in Both LAD and LCX,

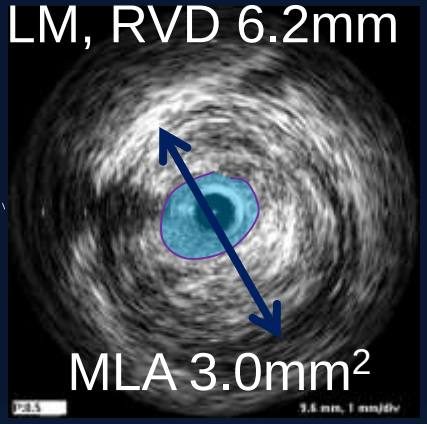


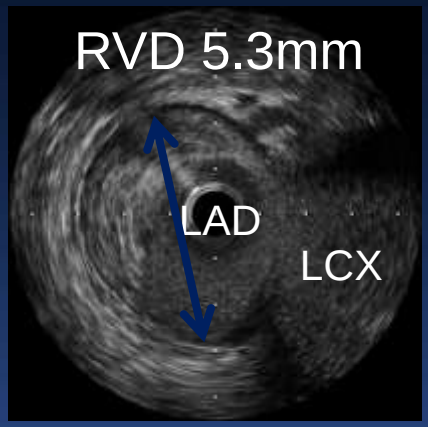
IVUS in Both LAD and LCX,

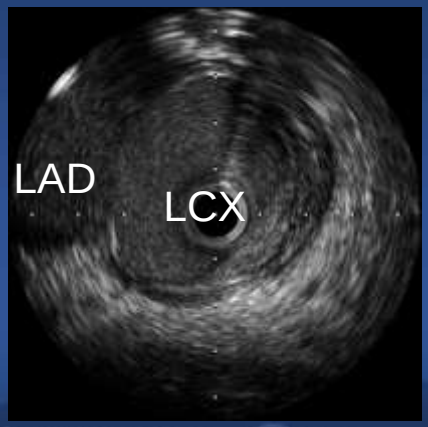


Minimal disease at LCX ostium

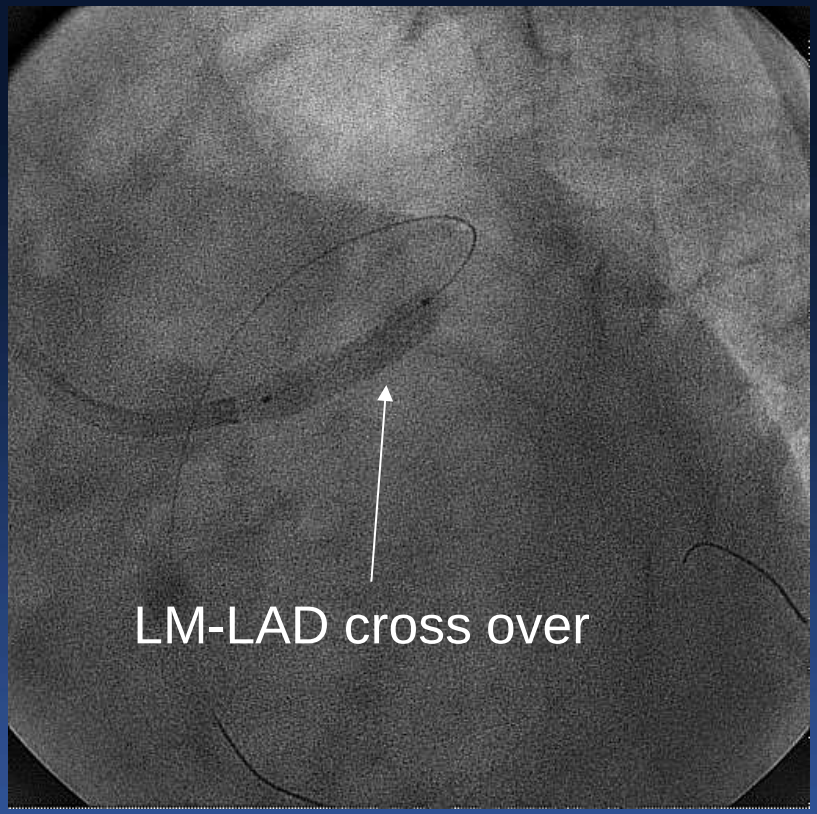
Distal LM, RVD 6.2mm



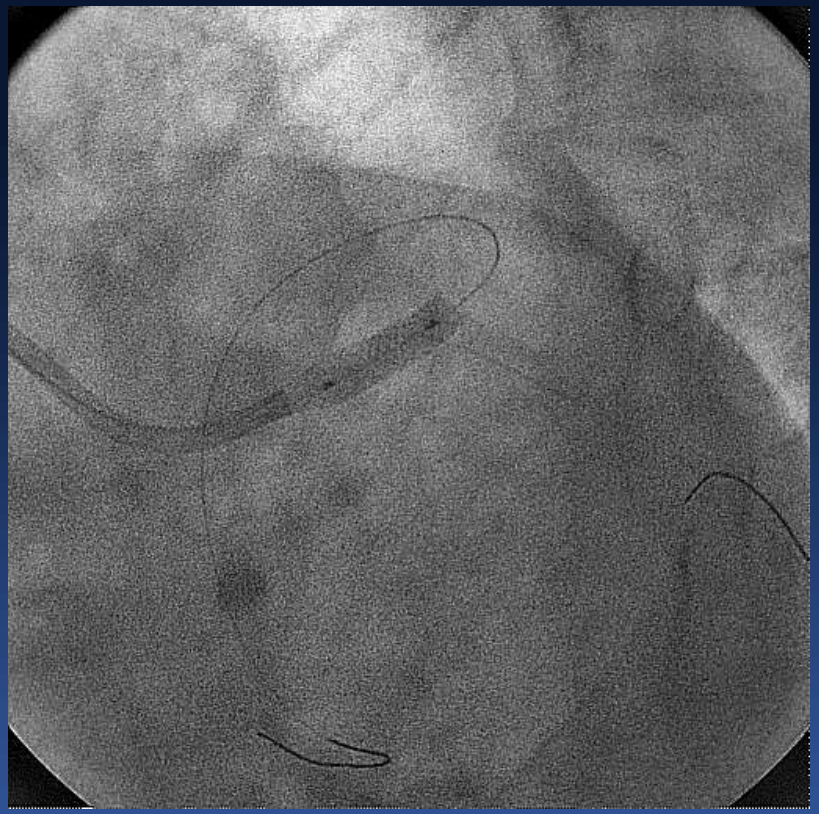




Single Stent Cross-Over
with minimal-disease at LCX OS

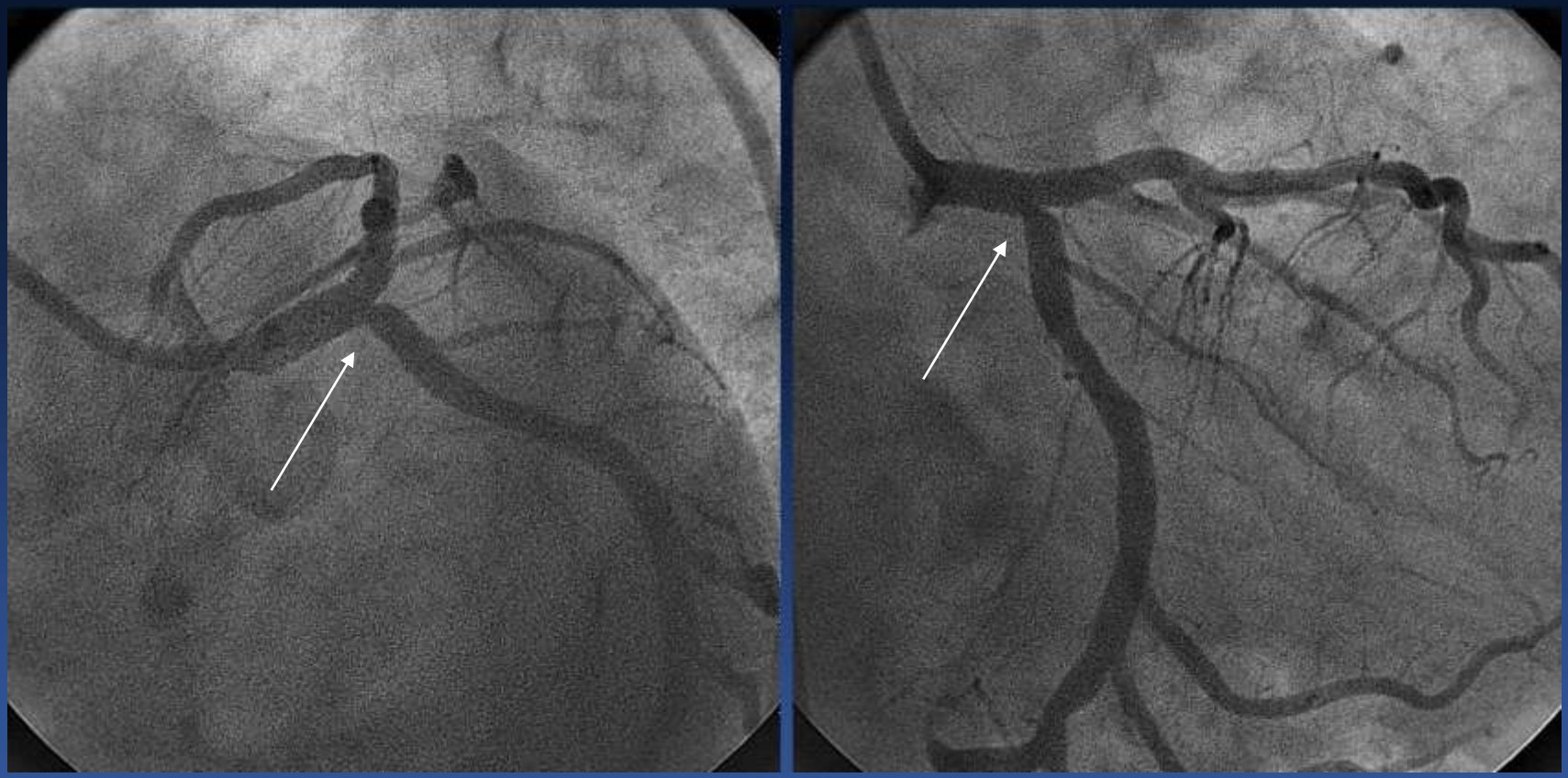


Promus Element
4.0x20



Additional high pressure
Inflation with 4.0 mm
non-compliant balloon

After Single Stent Cross-Over,
Angiographic Compromise of LCX Ostium.

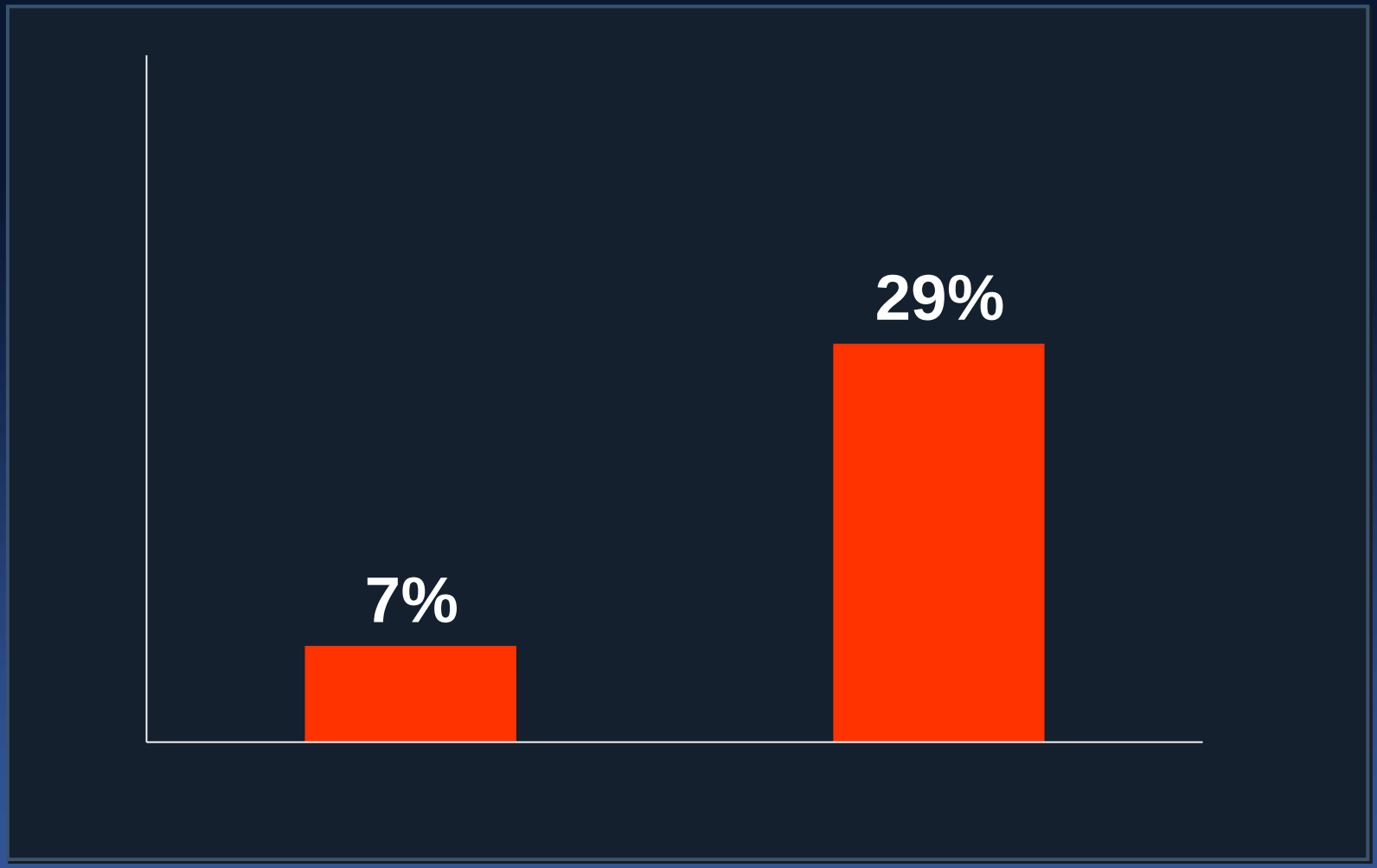


What Would You Do ?
To Treat or Not To Treat

Consider FFR, First !

FFR is 0.92

LCX FFR after Cross-Over Stenting



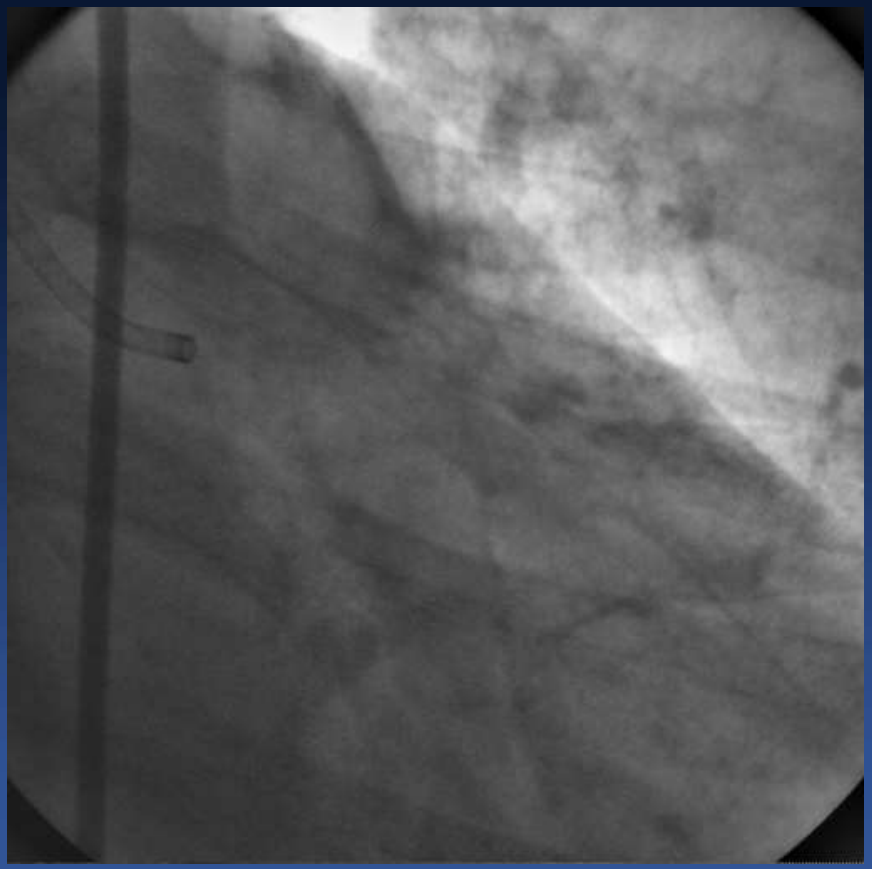
Kang et al. Catheter Cardiovasc Interv. 2014:83(4):545-52

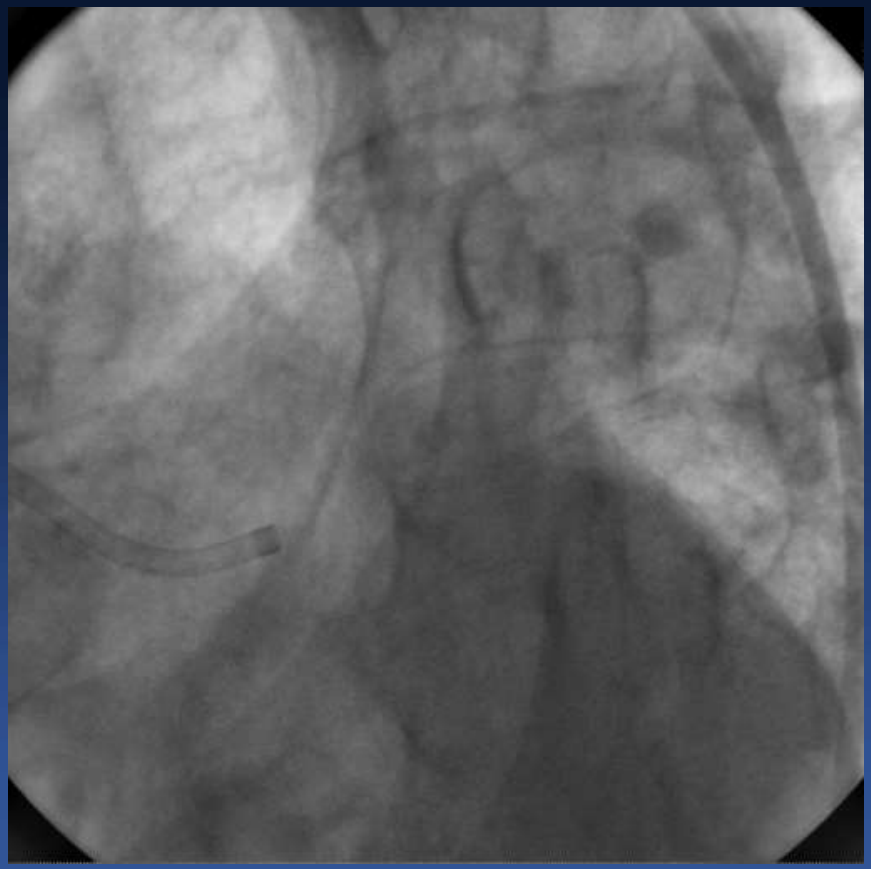
Nam et al, Korean Circ J 2011:41(6):304-7

Why We Need IVUS in LM Disease?

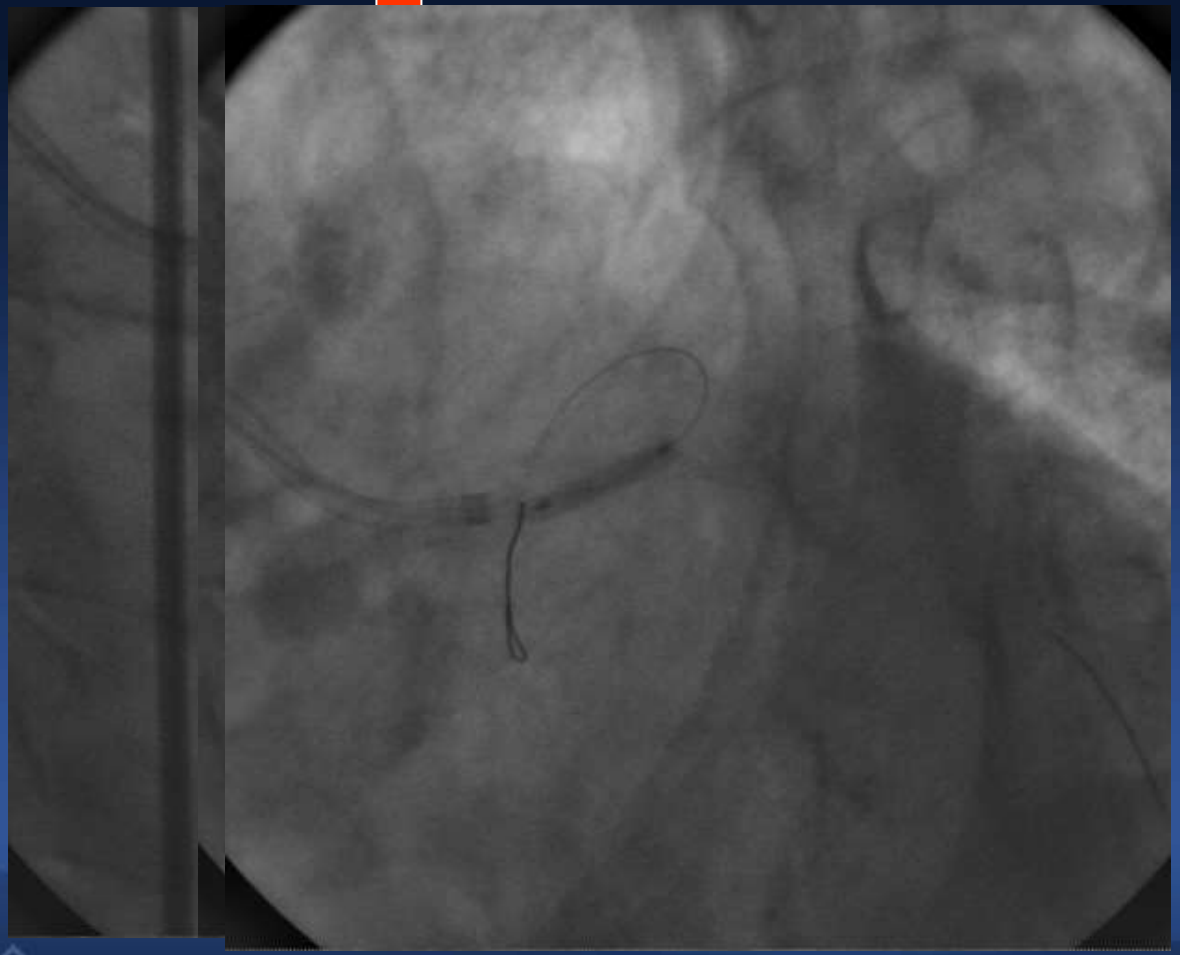
- Decision in Treatment Strategy
- Detection of Procedure Complication: Safety
- Long-Term Outcome: Efficacy
- Prediction of Functional Severity

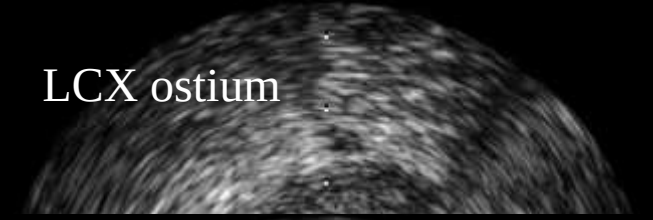
LM shaft stenosis with minimal disease of LCX

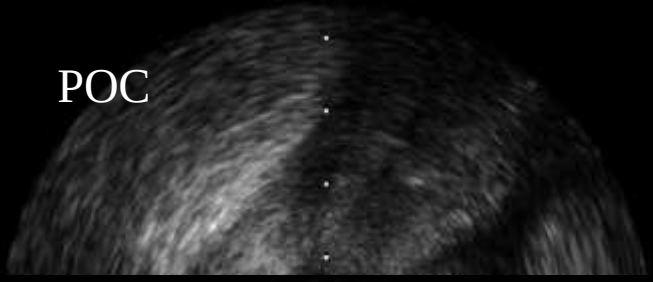


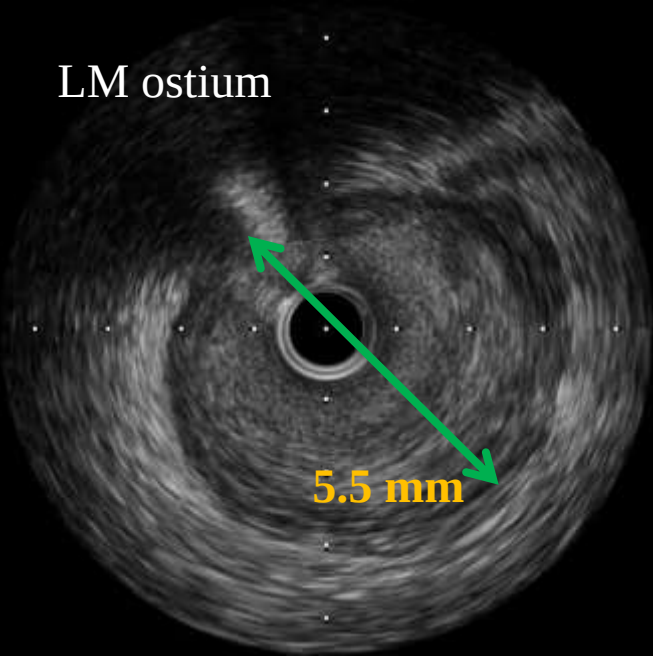


LCX Ostium is OK: Simple Cross-Over



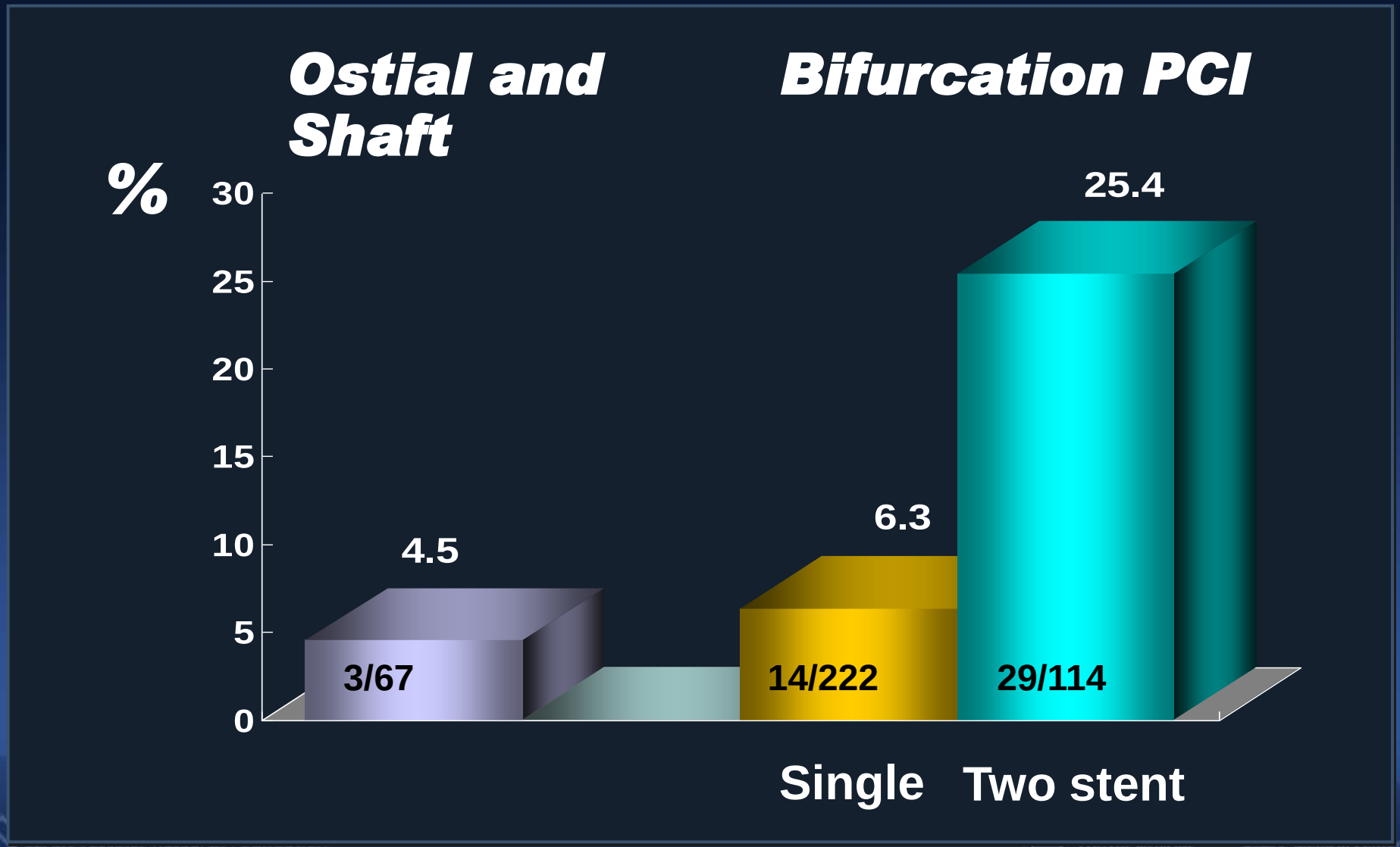




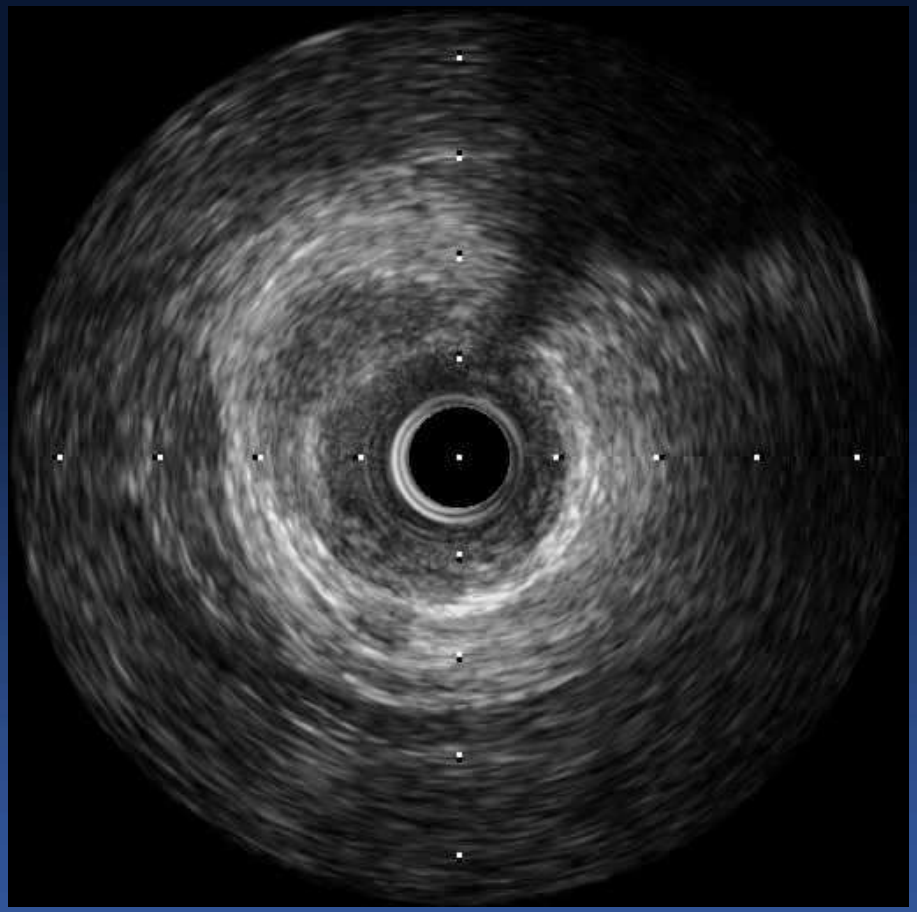


Restenosis at 2 year

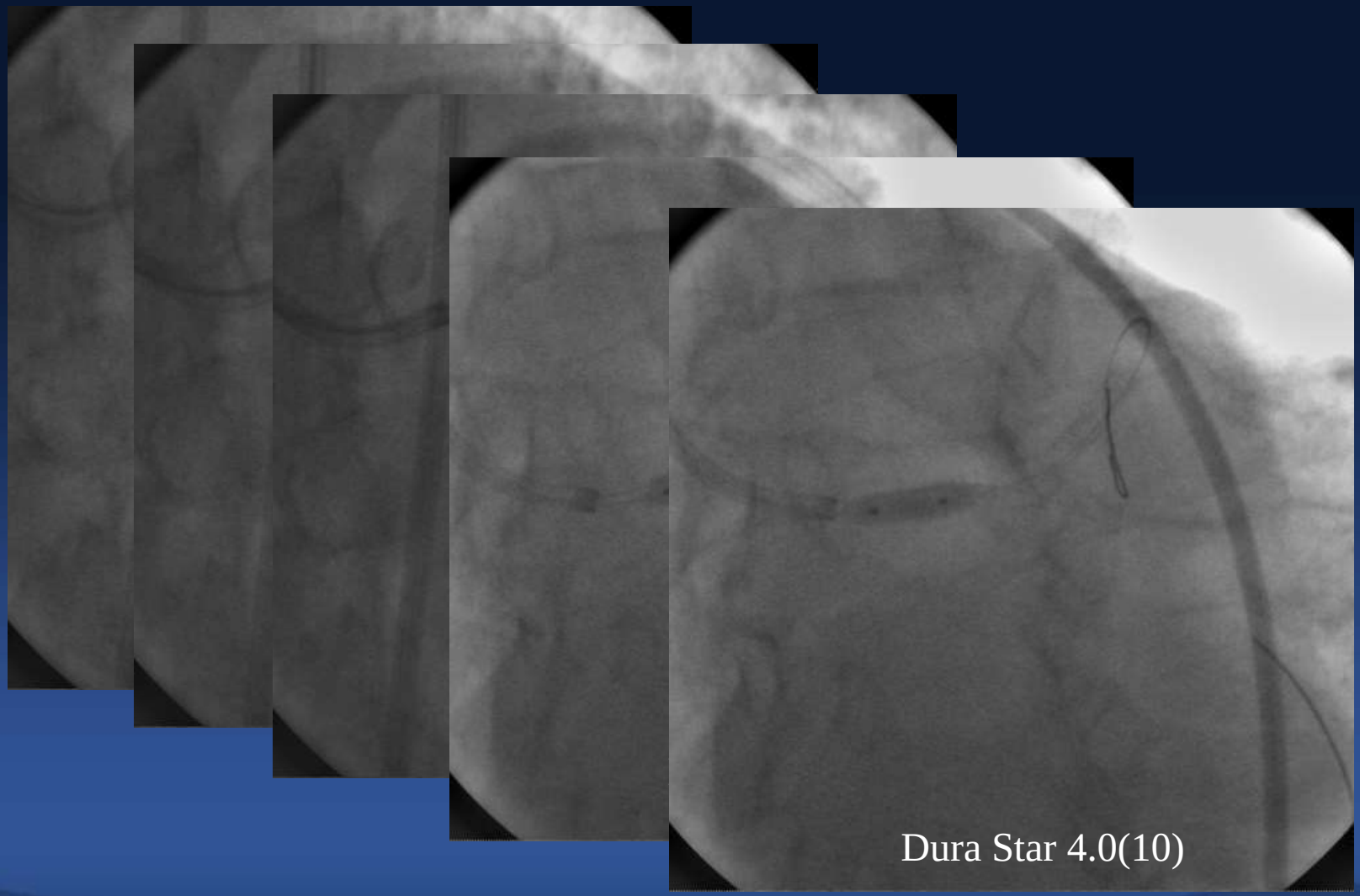
Pooled Analysis in 403 Patients with LM PCI Using SES



Post Stenting



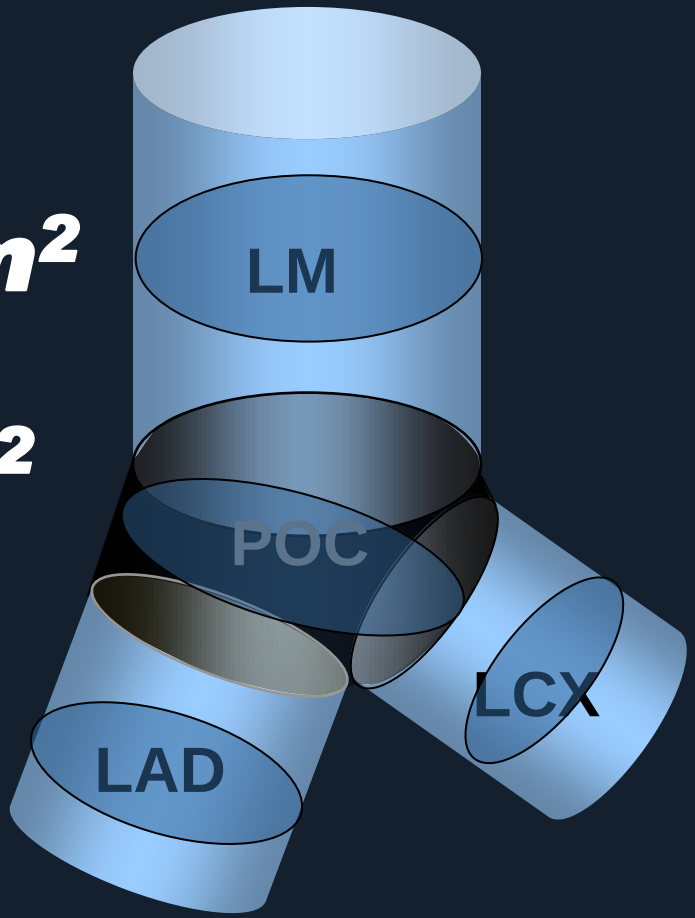
Xience Prime 3.0(12)



Final Angiography

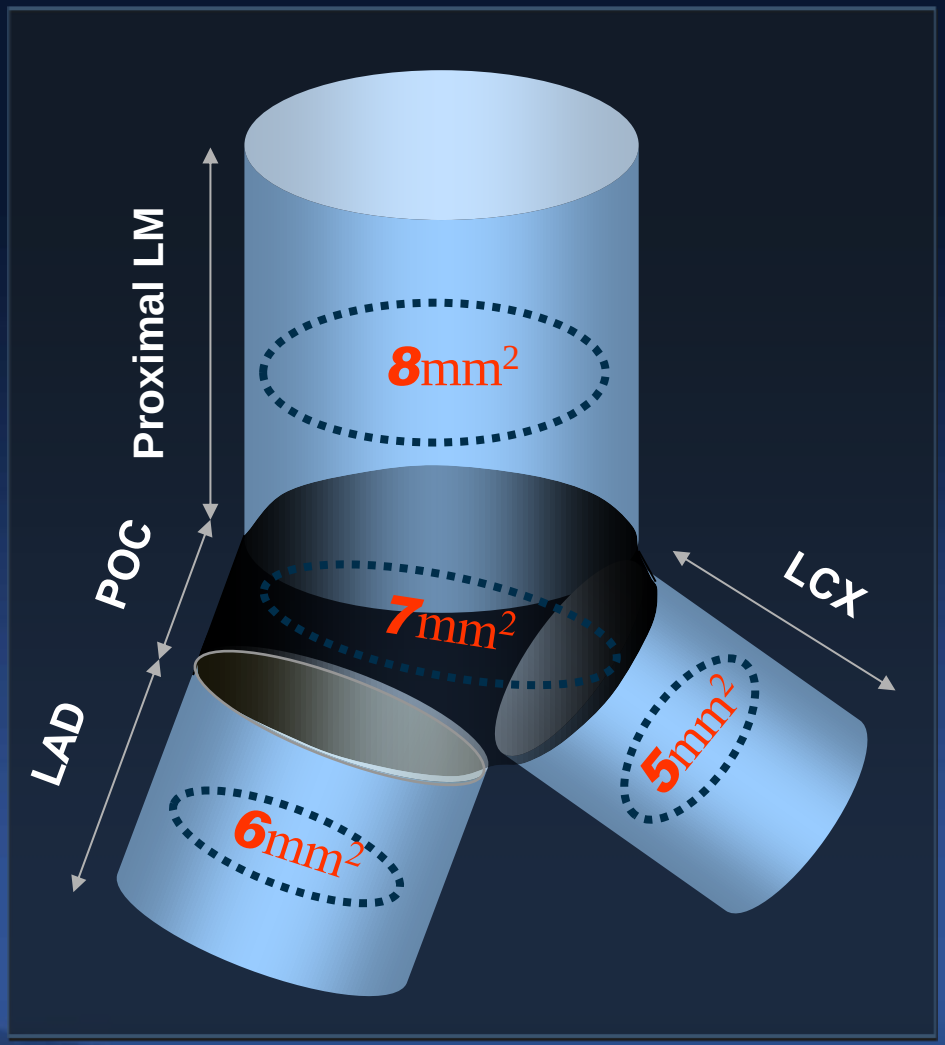
IVUS Stent Area to Reduce Restenosis
(Rule of 5,6,7,8)

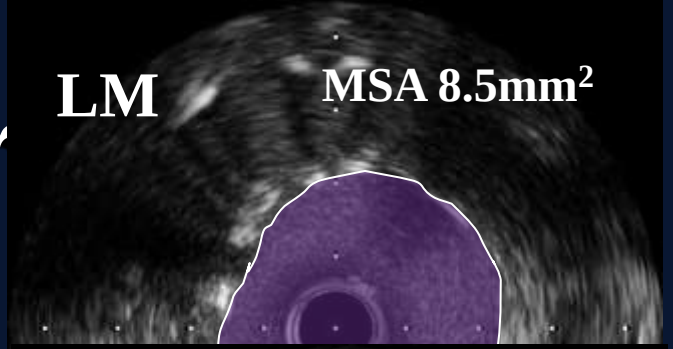
TLR at 2 Years < 2%

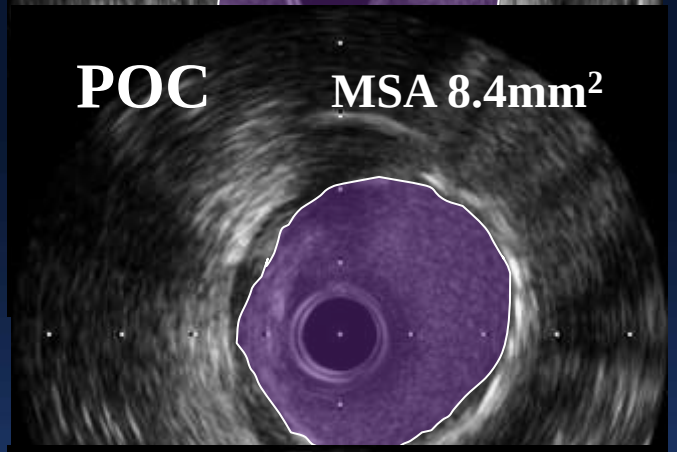


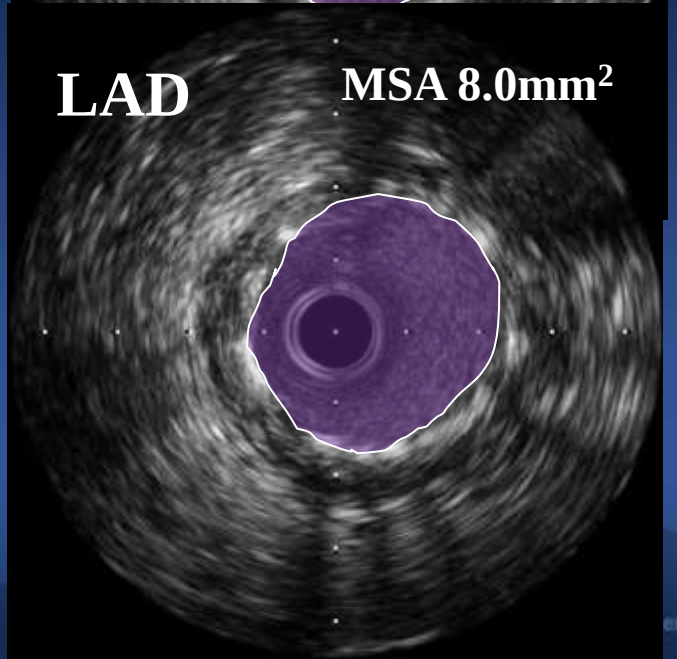
Kang et al. Circ Cardiovasc Interv 2011;4:1168-74

IVUS Criter



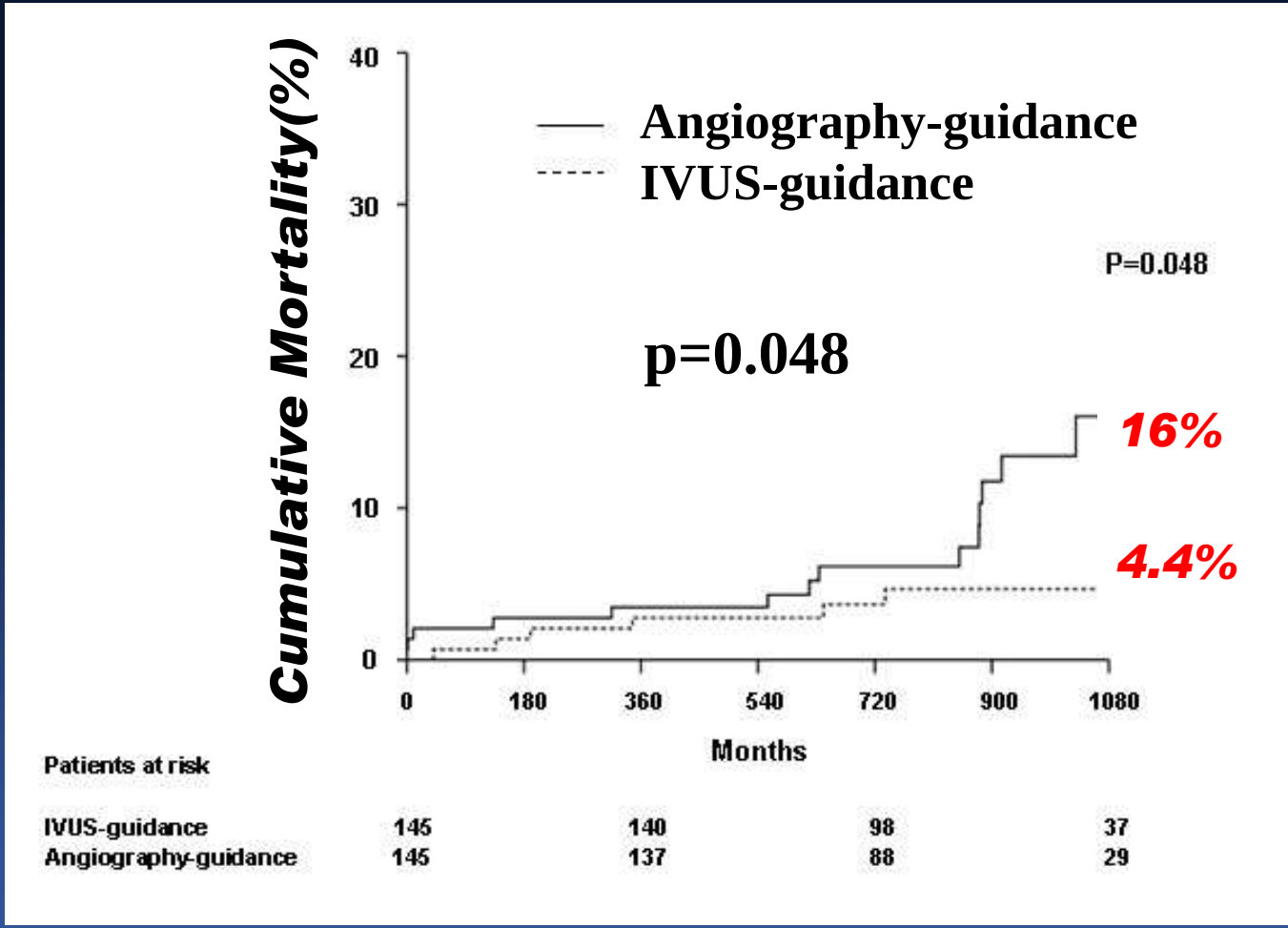






Park SJ et al. JACC Cardiovasc Interv 2011;4:1168-1174.

IVUS-Guidance Saves Lives in LM PCI



Park SJ et al Circ Cardiovasc Interv 2009;2:167-77

Why We Need IVUS in LM Disease?

IVUS-Guidance Saves Lives in LM PCI

- **Decision in Treatment Strategy**

  Based on LCX IVUS finding: One vs Two stent

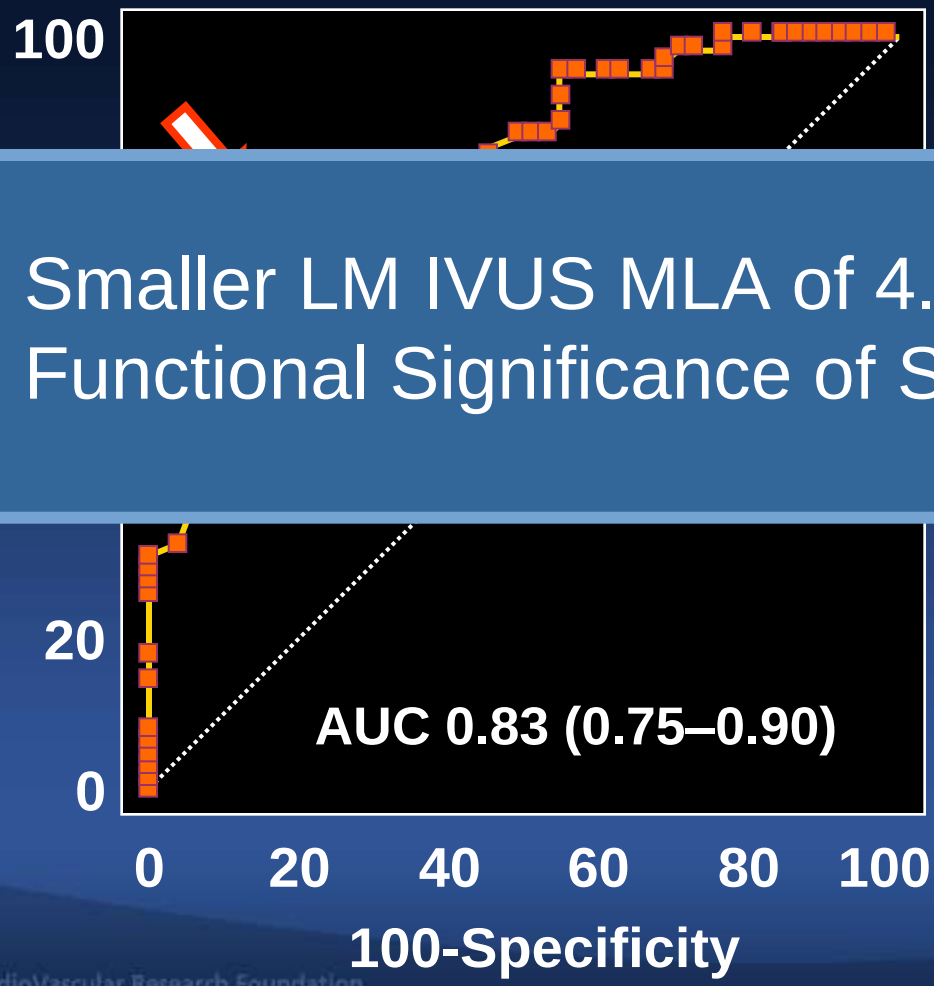
- **Detection of Procedure Complication: Safety**

- **Long-Term Outcome: Efficacy**

  According to the IVUS MLA criteria: 5,6,7,8

New LM IVUS MLA

Matched with FFR <0.80,
Ostial and Shaft LM Disease (N=112)



Cut-off = 4.5 mm²

PPV	83%
NPV	76%
Accuracy	80%

Smaller LM IVUS MLA of 4.5 mm^2 Can Predict Functional Significance of Stenosis (PPV 83%).

Summary

1. LM Disease has the greatest angiographic variability. Angiographic assessment is Not Always Enough. Direct FFR should be measured when the ischemic potential was not defined.
2. FFR Guided Decision Making Can Avoid Unnecessary PCI (Unnecessary LCX Treatment).
3. IVUS Guided Sent Optimization Can Maximize Clinical Outcomes and Minimize Adverse Complications.
4. FFR and IVUS are Very Complementary for the Good Clinical Outcomes.