IVUS Guidance for DES Implantation to Treat LMCA Disease: Optimal Endpoints and Long-term Results

Soo-Jin Kang, MD., PhD.

University of Ulsan College of Medicine
Asan Medical Center, Seoul, Korea

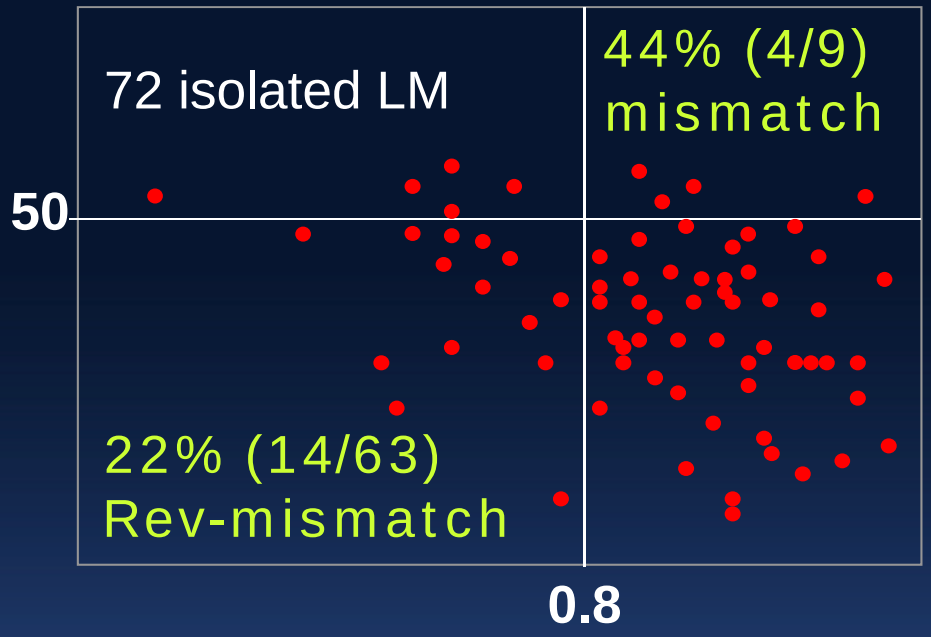
Disclosure

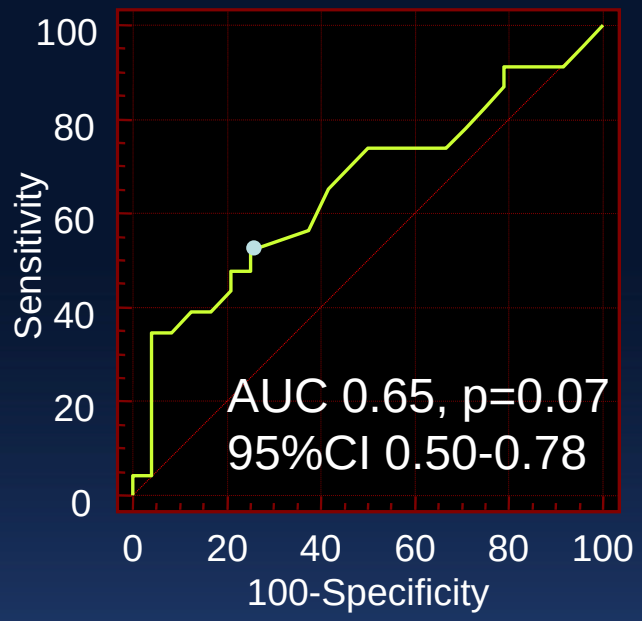
I have nothing to disclose

Issues of LM PCI

To Treat or Not to Treat?

QCA DS Poorly Predicts LM FFR





DS 50%

Sensitivity 26%
Specificity 92%
Accuracy 75%

DS 48%

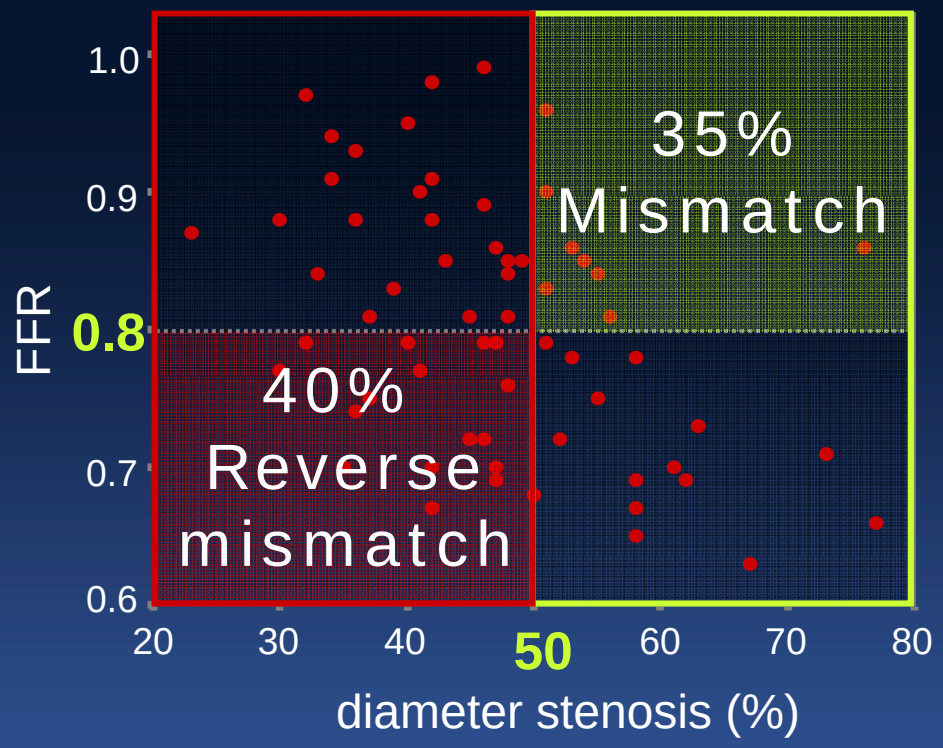
Sensitivity 51%
Specificity 75%
Accuracy 65%

Hamilos et al. Circulation 2009;120:1505-12

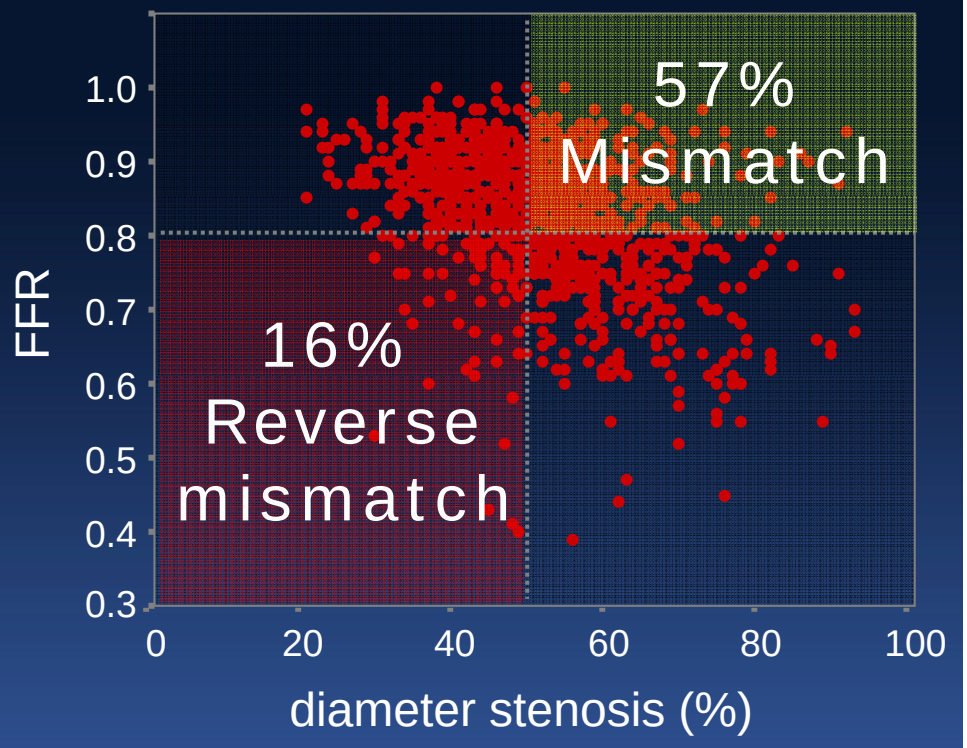
AMC data

QCA-FFR Discordance

63 Isolated LM

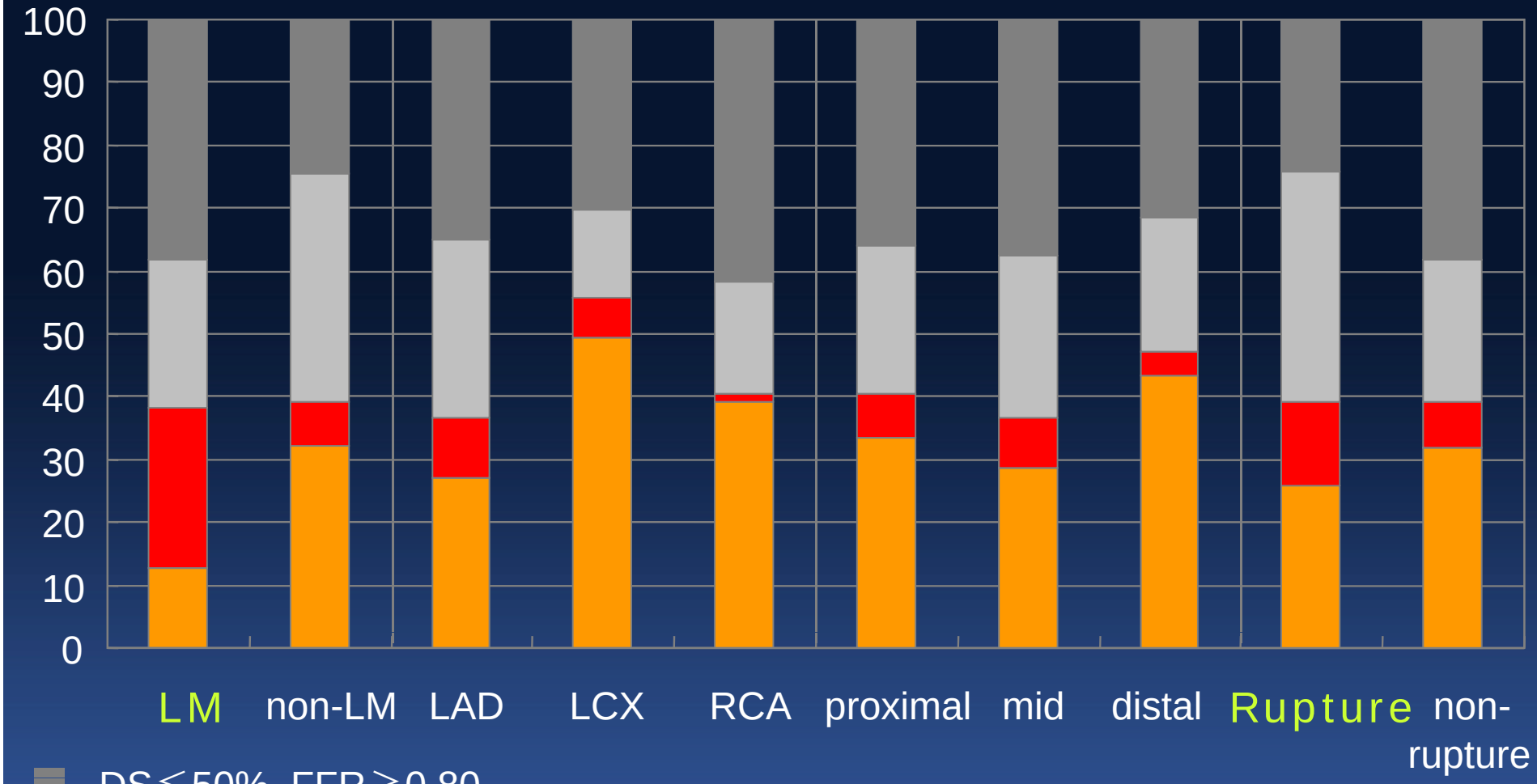


1066 Non-LM



AMC data - ACC 2012

QCA-FFR Discordance in 1129 Lesions



- Relatively large myocardial territory of LM
- Angiographic underestimation of stenosis

AMC data- ACC 2012

Best IVUS Criteria

To identify Functionally Significant LM Stenosis

Jasti[1]

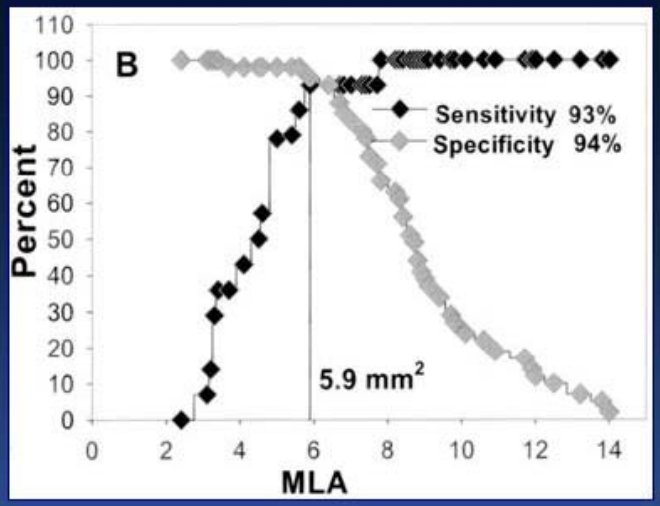
Fassa[2]

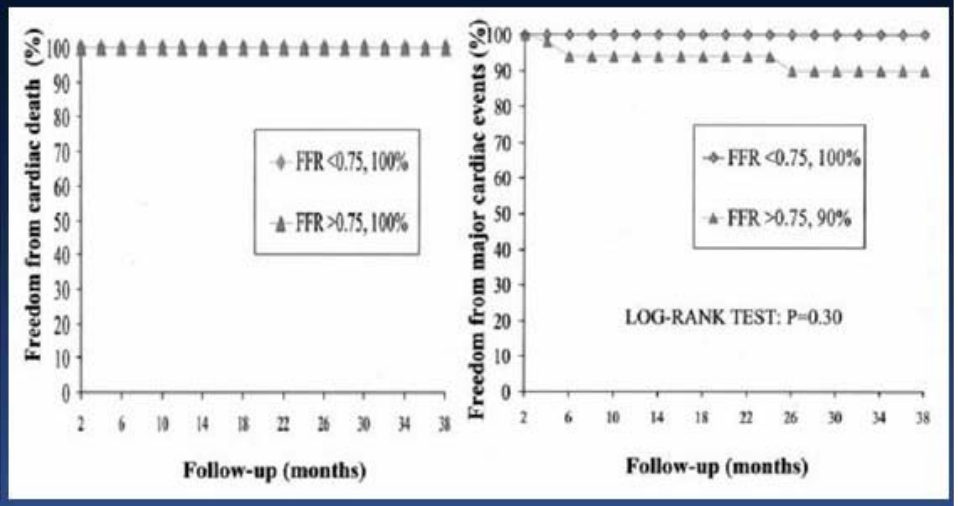
Fassa[2]

Abizaid[3]

MLA< 6.0mm^2 Predicts LM FFR<0.75

- Sum of lumen areas of two daughter vessels (Each of LAD and LCX should be 4.0mm^2)= 150% of the parent LM
- Murray's Law (*LM* r^3 = *LAD* r^3 +*LCX* r^3)



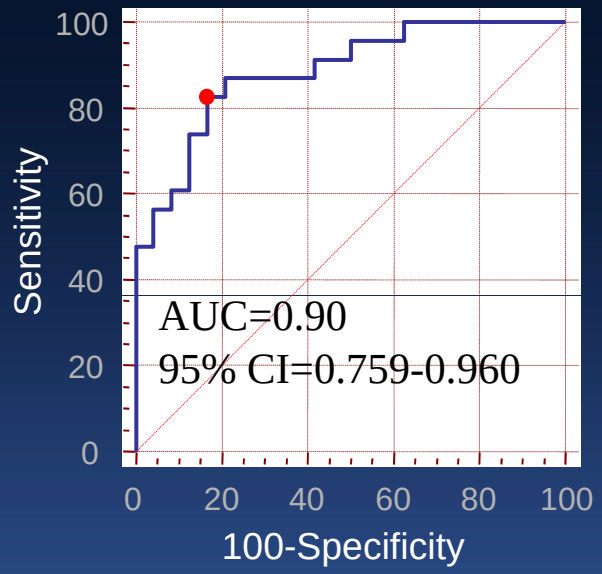


Jasti et al. Circulation 2004;110:2831-6

[1]Circu

IVUS Predicting LM FFR< 0.80

Pure LM lesion of DS 30-80%
Exclude distal stream disease



MLA 4.8mm^2

Sensitivity 89%

Specificity 83%

Accuracy 86%

Morphologic Simplicity

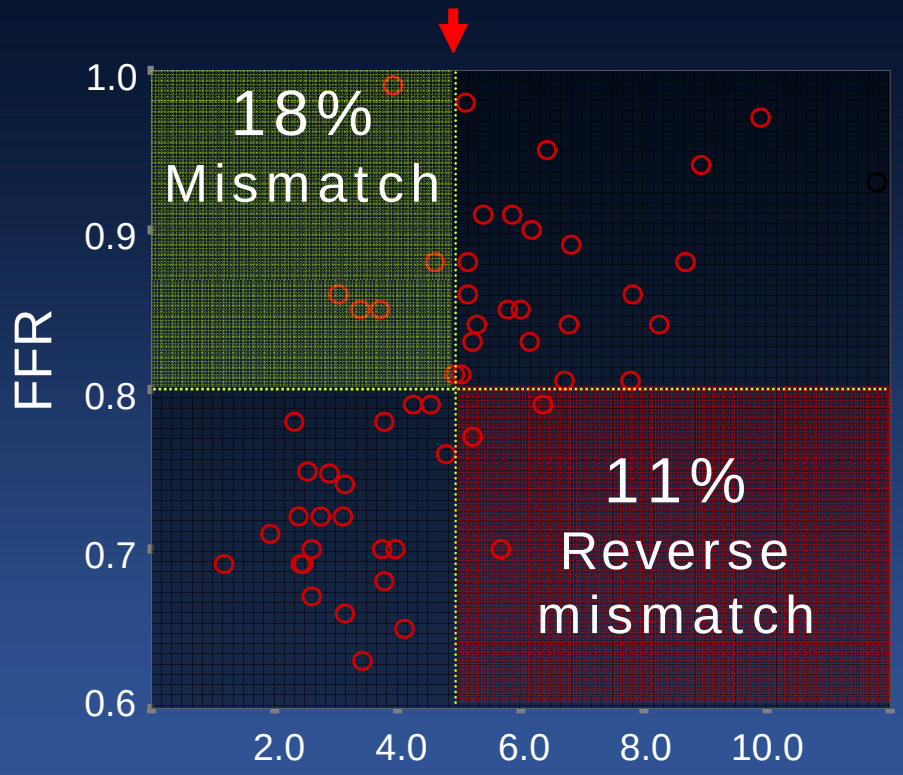
uniformly large vessel, short lesion length, lack of sidebranch

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

Visual-Functional Discordance in LM

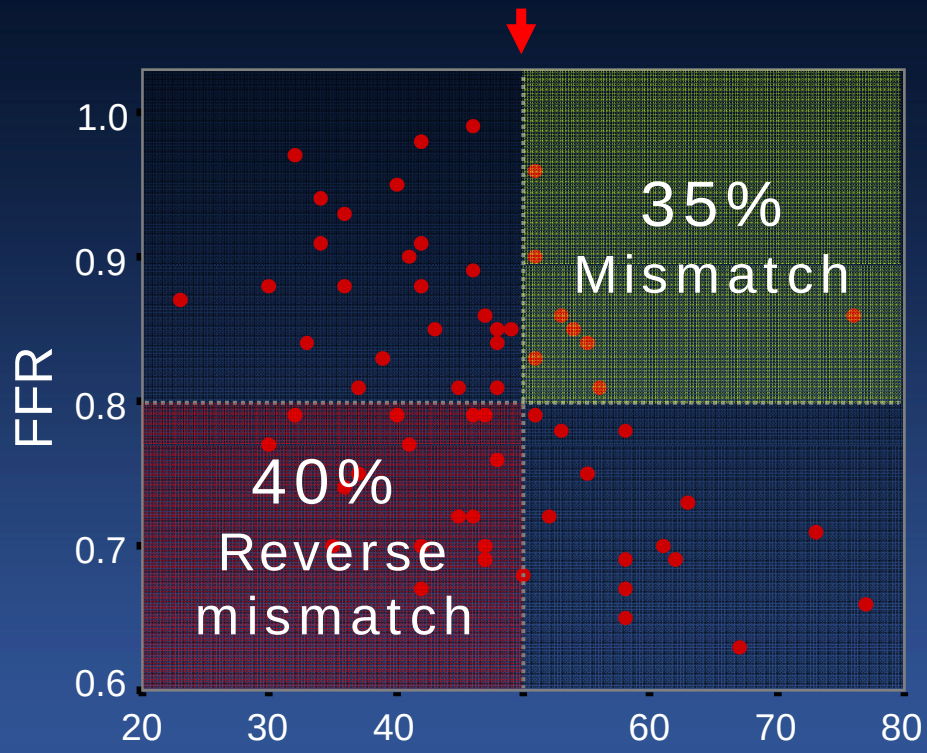
IVUS-MLA 4.8mm^2

Accuracy 86%



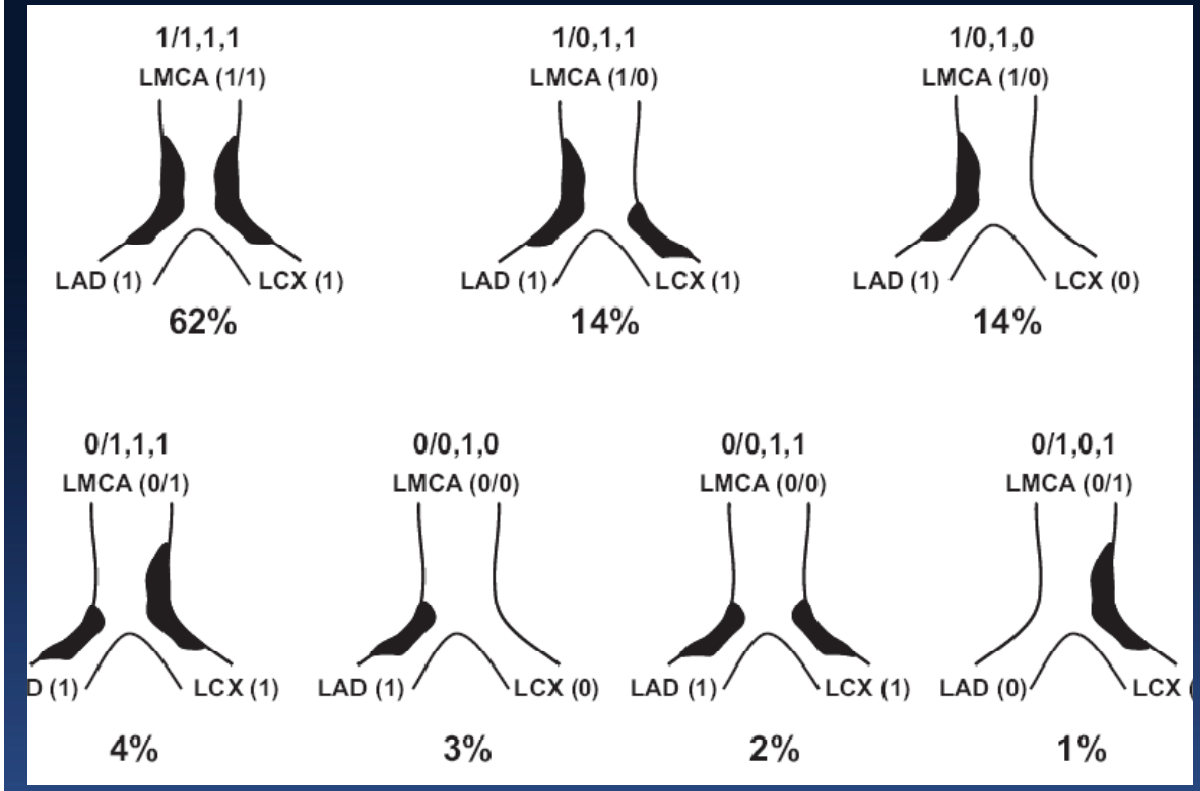
QCA-DS 50%

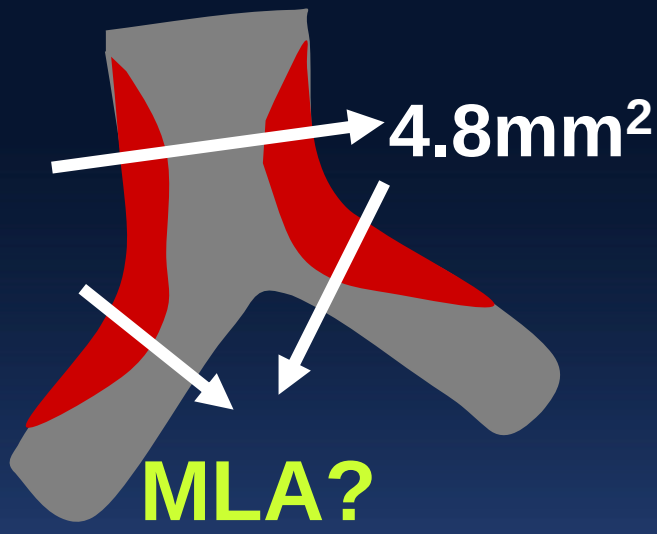
Accuracy 65%



More accurate morphologic information by IVUS

True Bifurcation Lesions in Majority…

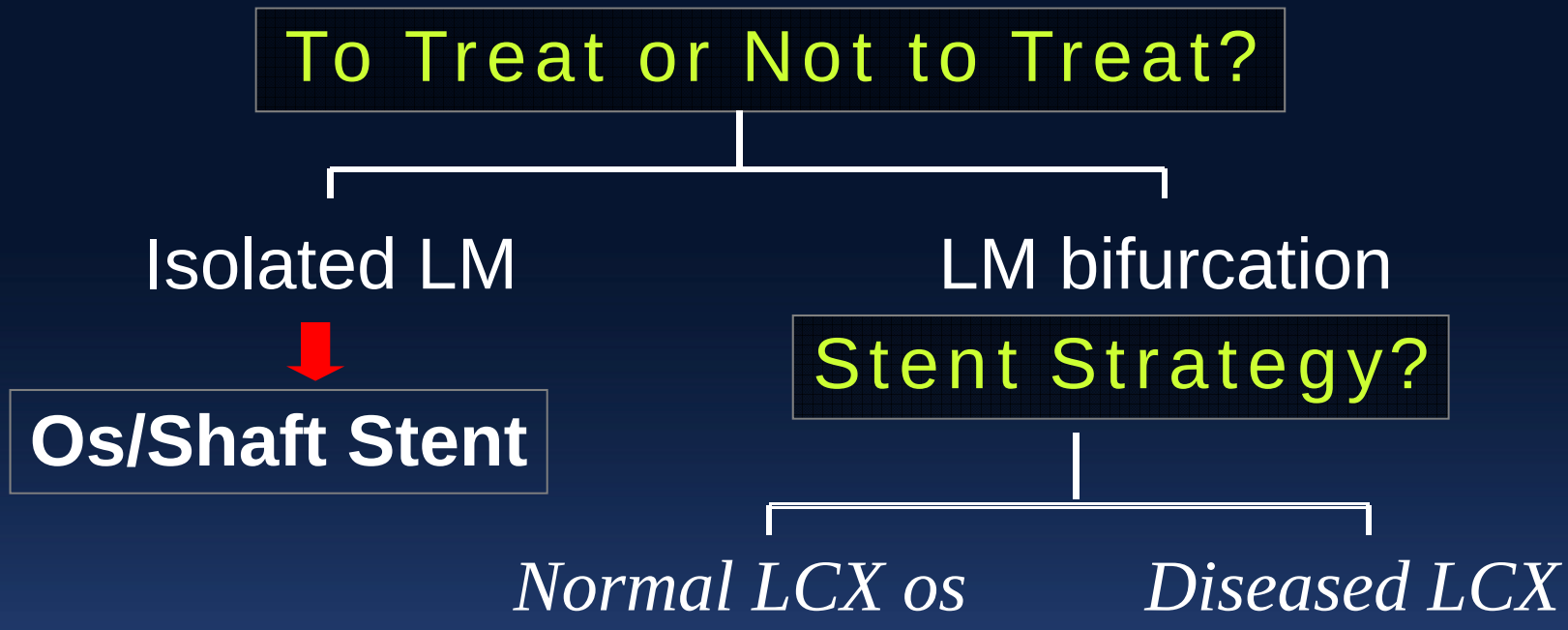




Oviedo et al. Circ Cardiovasc Interv 2010;3:105-12

For LM true bifurcation, FFR measurement is necessary to decide to treat or not to treat

Issues of LM PCI

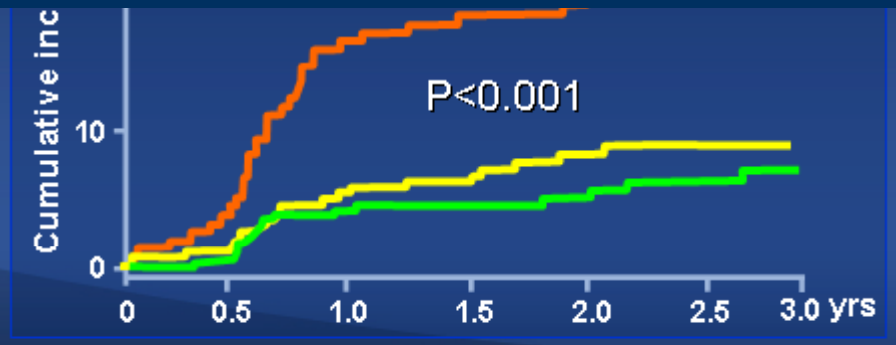


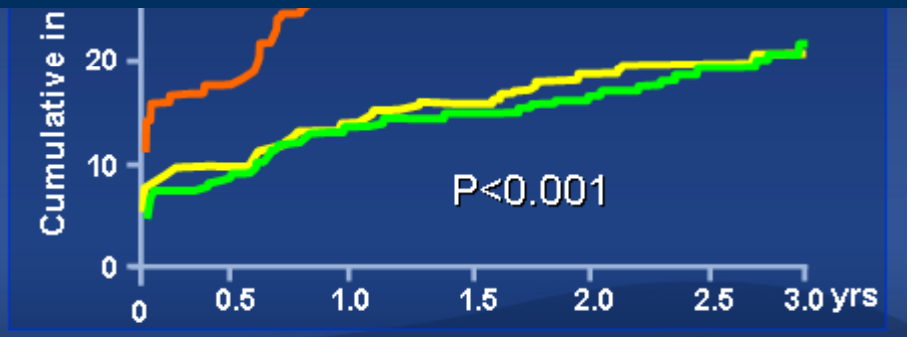
Complex 2 stents

Non-distal (Ostial and Shaft)

Simple (single stent cross over) In LM bifurcation lesions

Single Stent Cross Over is Clearly Better !





CardioVascular Research Foundation

UNIVERSITY OF ULSAN COLLEGE OF MEDICINE

ASAN Medical Center

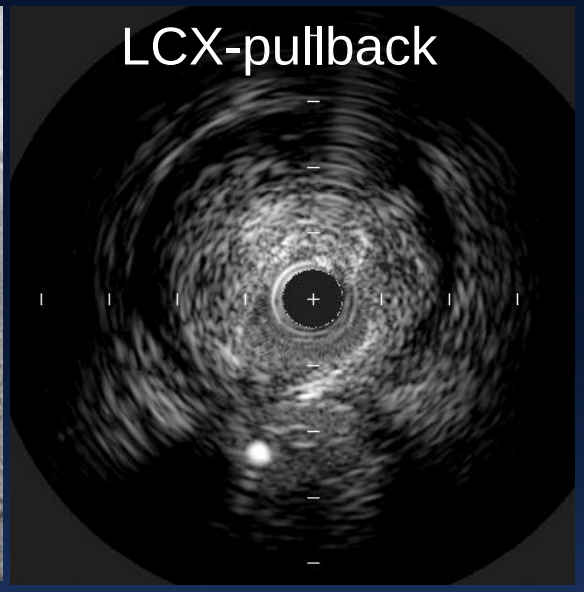
Kim WJ, et al. Catheter Cardiovasc Interv. 2011 May 1;77(6):775-82

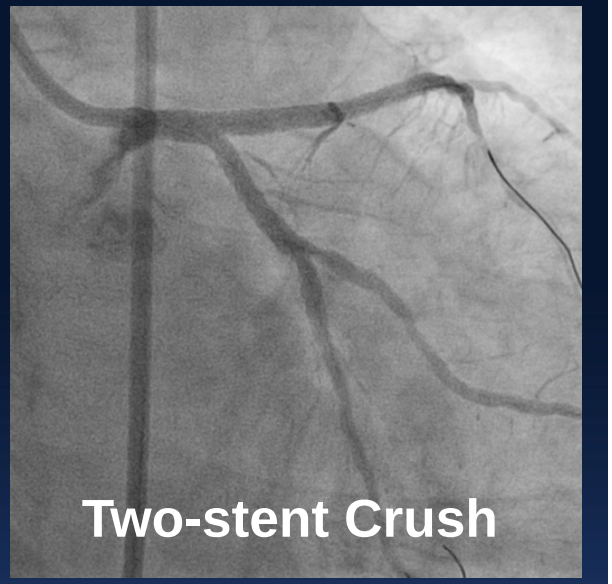
Stent Strategy for LM Bifurcation

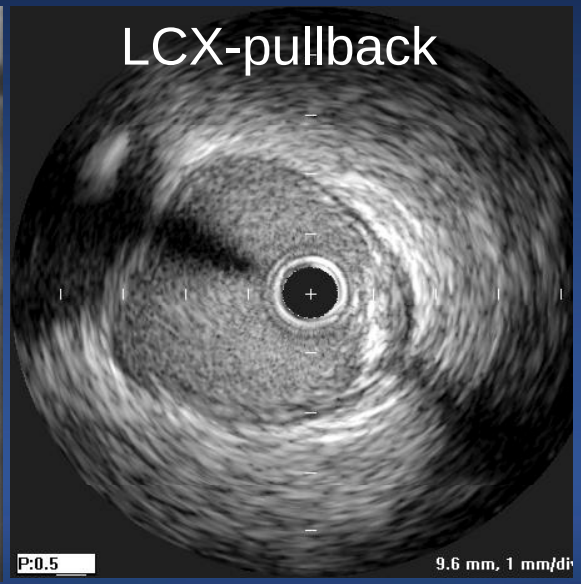
Single	▪ Normal ostial LCX (Medina 1.1.0., 1.0.0…) ▪ Small LCX with < 2.5 mm in diameter ▪ Diminutive LCX ▪ Normal or focal disease in distal LCX
Two	▪ Diseased LCX (Medina 1.1.1., 1.0.1…) ▪ Large LCX with ≥ 2.5 mm in diameter ▪ Diseased left dominant coronary system ▪ Concomitant diffuse disease in distal LCX

Because most have proximal LM disease, pre-PCI LCX-FFR is not reliable to assess LCX ostial disease

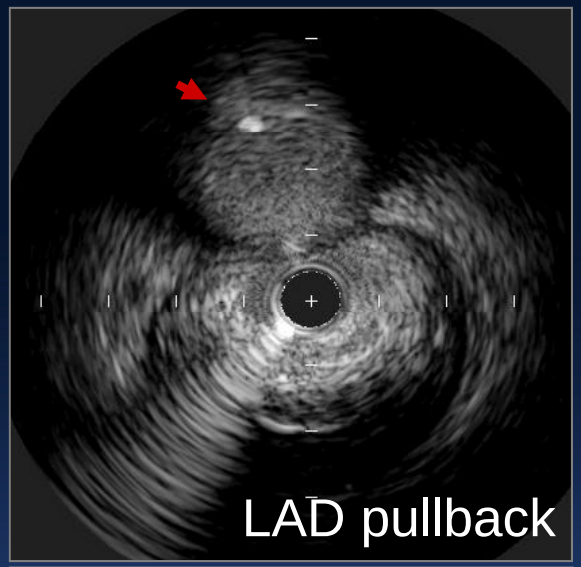
Disease Involvement of LCX Ostium

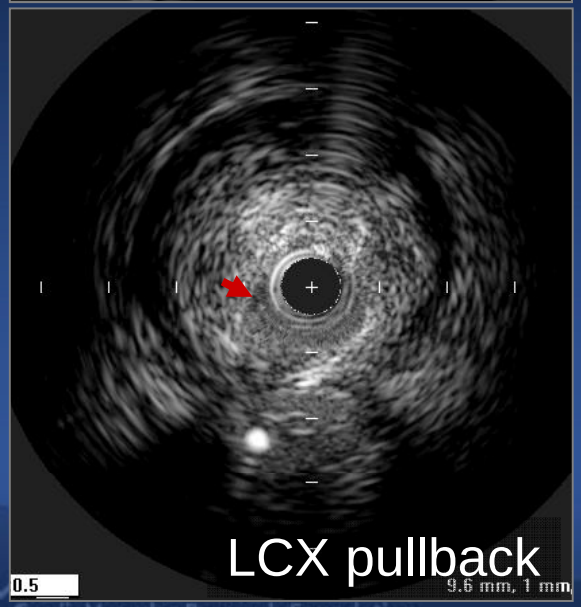


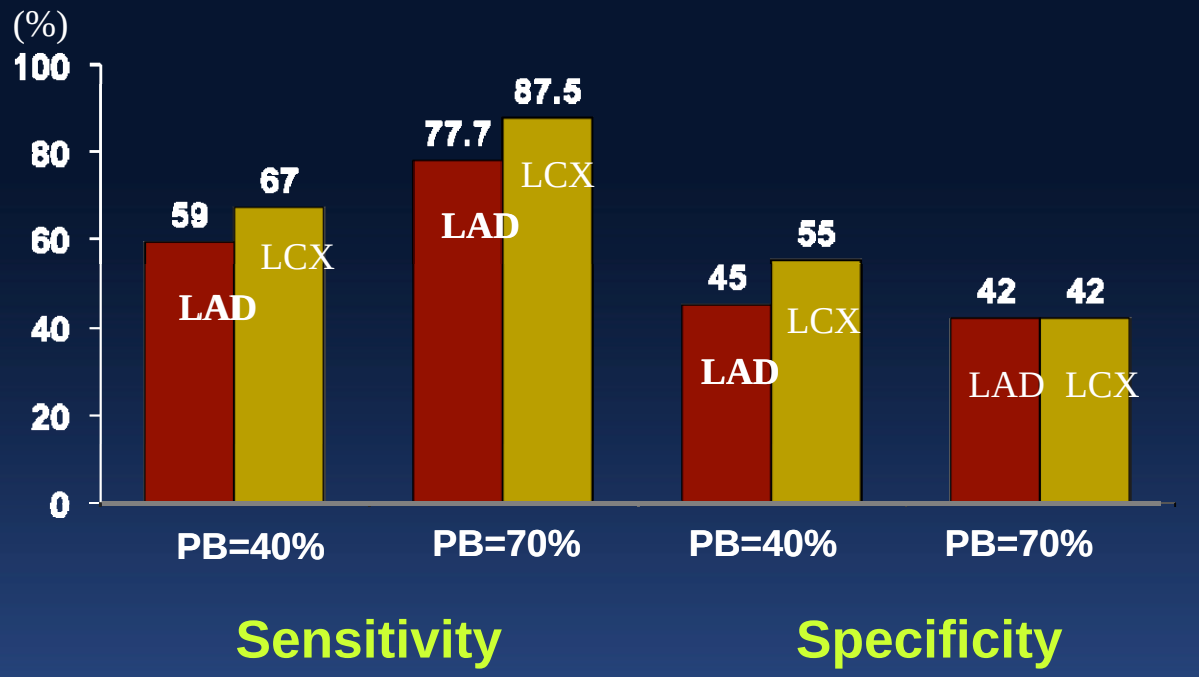




Plaque Burden of SB Ostium Measured by MB-Pullback is Only Moderately Reliable



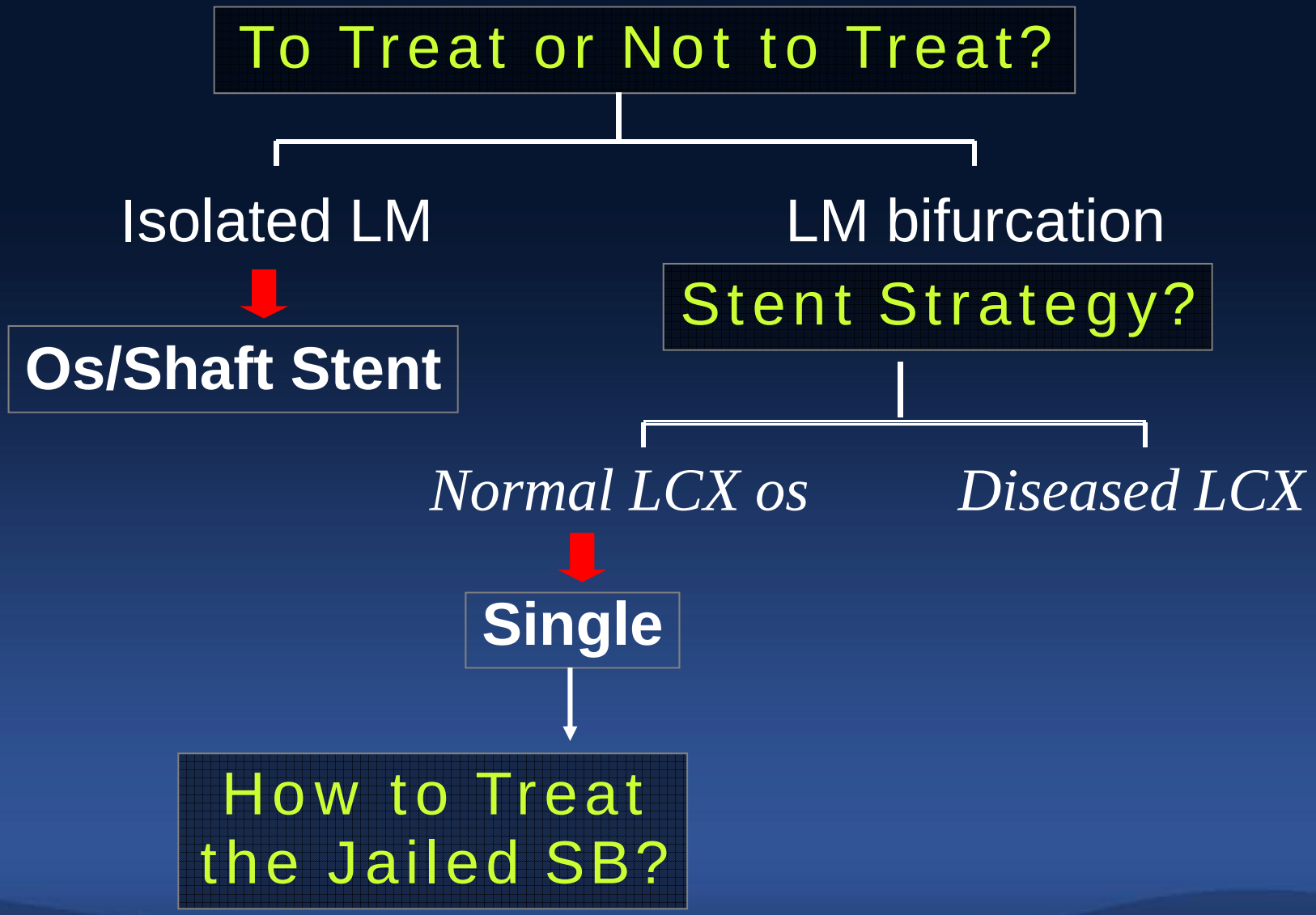




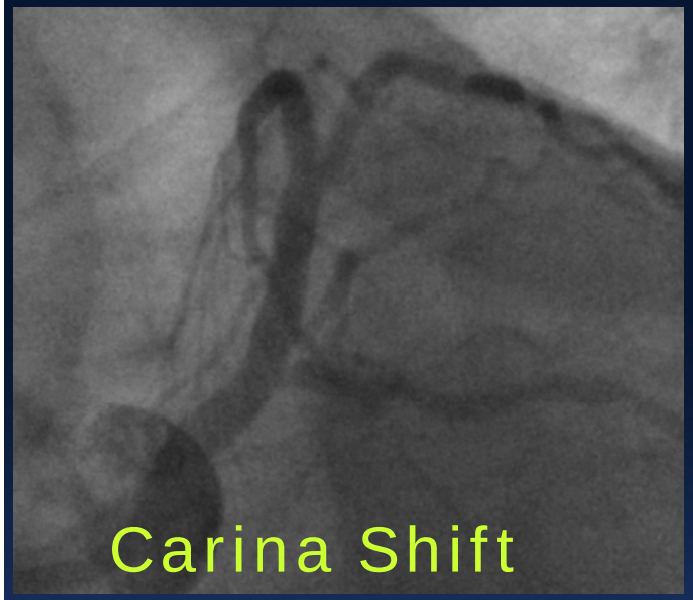
Direct SB pullback is necessary for accurate assessment of LCX ostium

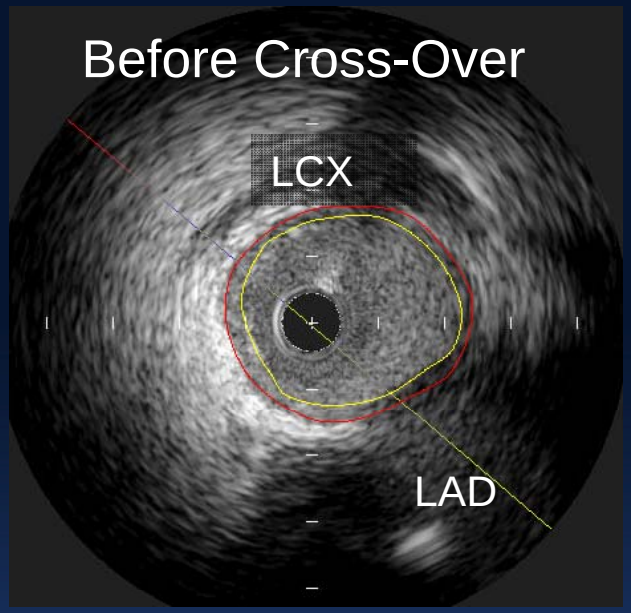
Oviedo et al. Am J Cardiol 2010;105:948-54

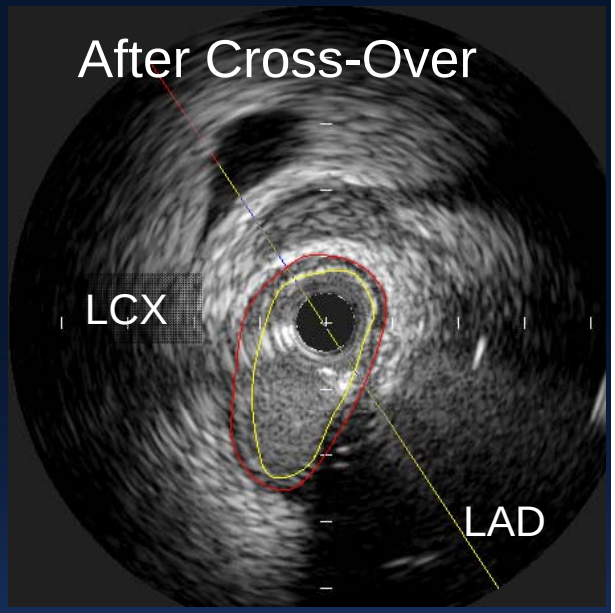
Issues of LM PCI

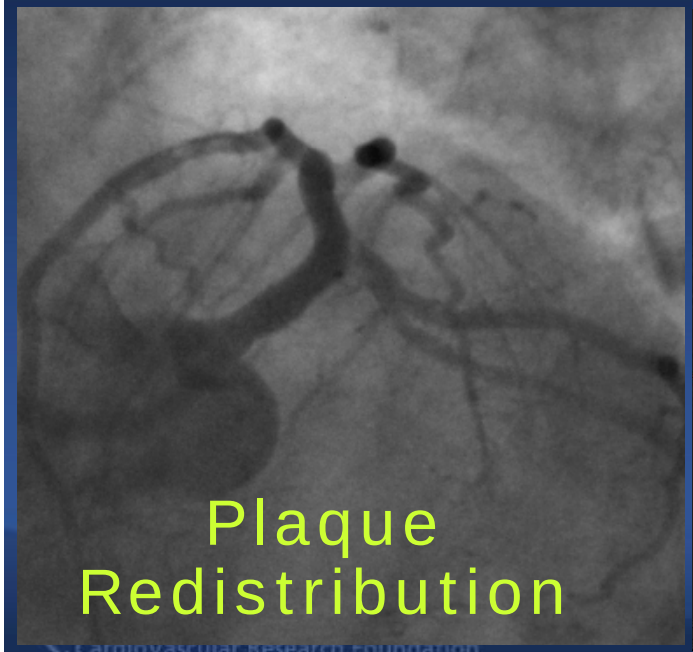


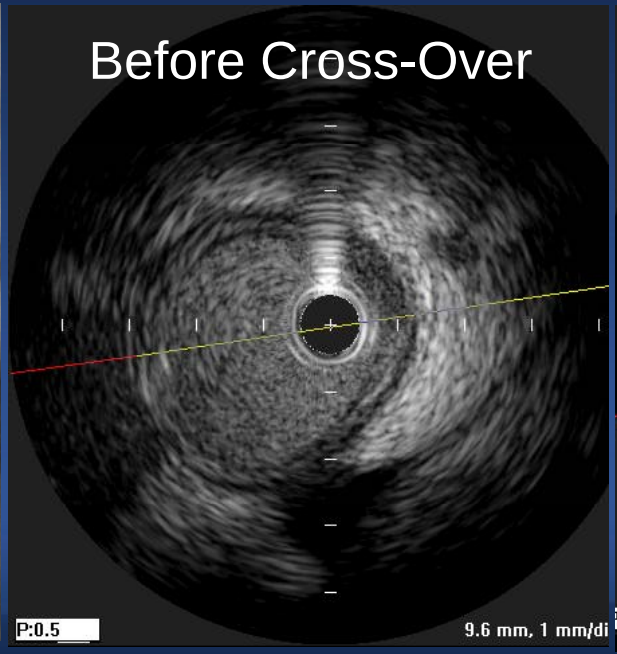
Mechanism of LCX Compromise

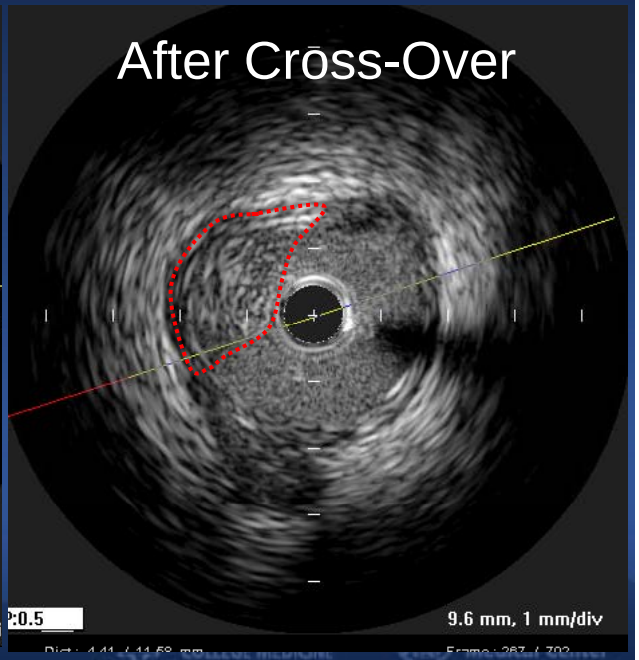






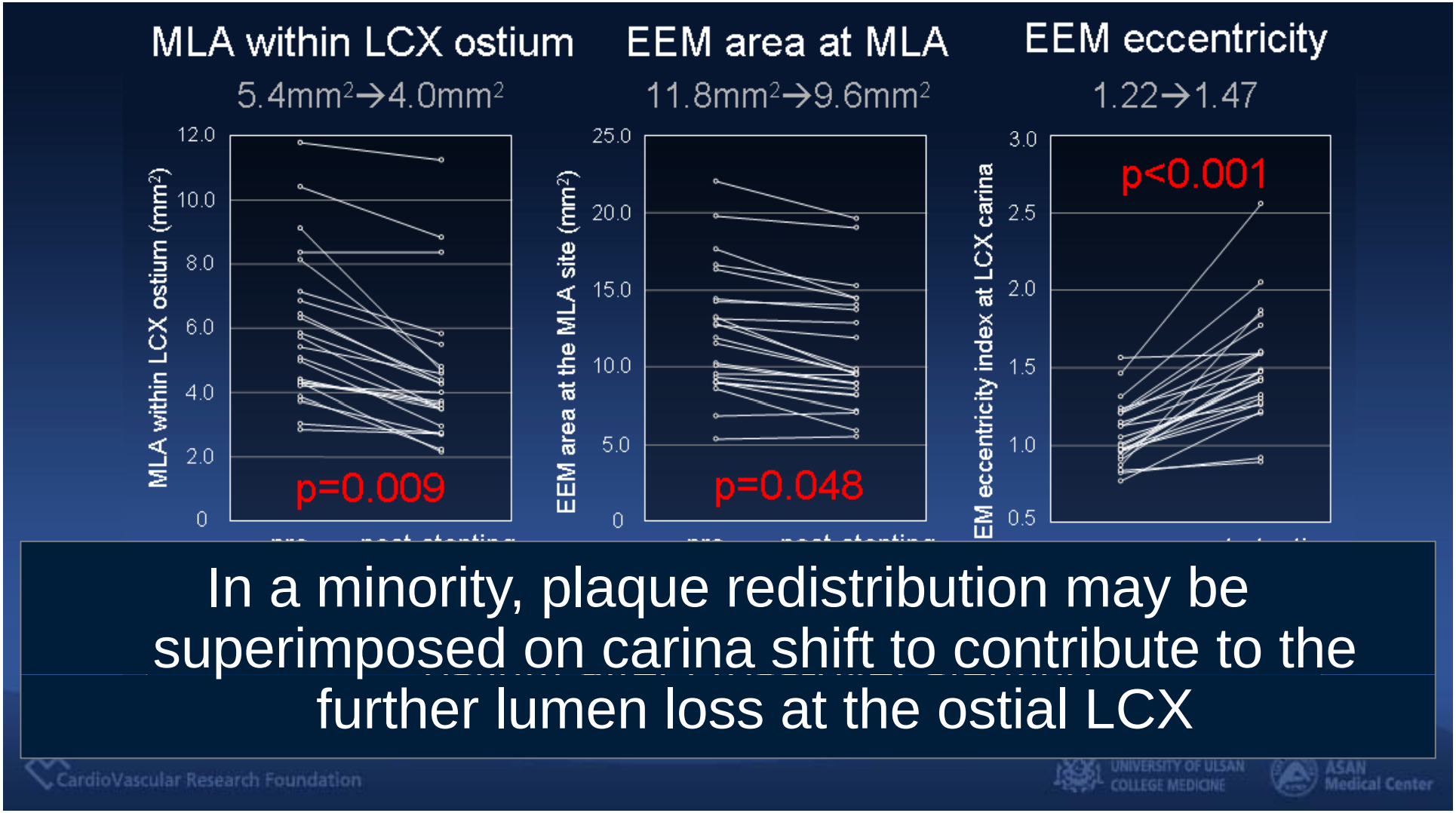






Changes in Left Main Bifurcation Geometry After a Single-Stent Crossover Technique

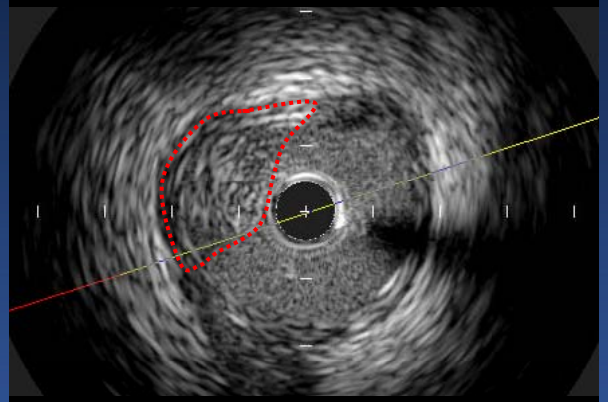
An Intravascular Ultrasound Study Using Direct Imaging of Both the Left Anterior Descending and the Left Circumflex Coronary Arteries Before and After Intervention **(n=23 LM bifurcation lesions)**



In a minority, plaque redistribution may be superimposed on carina shift to contribute to the further lumen loss at the ostial LCX

IVUS Cannot Predict LCX FFR

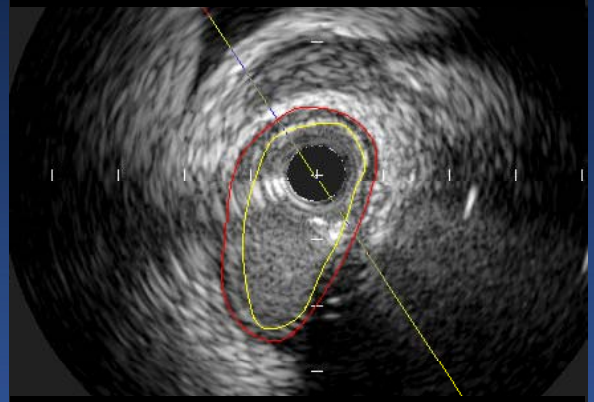
Plaque shift



MLA 4.5 mm²

FFR 0.85

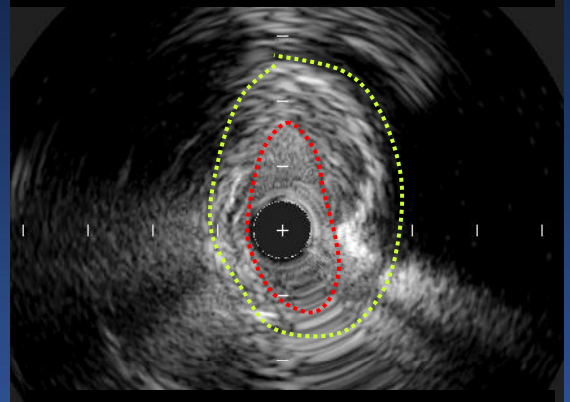
Carina shift



MLA 3.8 mm²

FFR 0.91

Carina shift

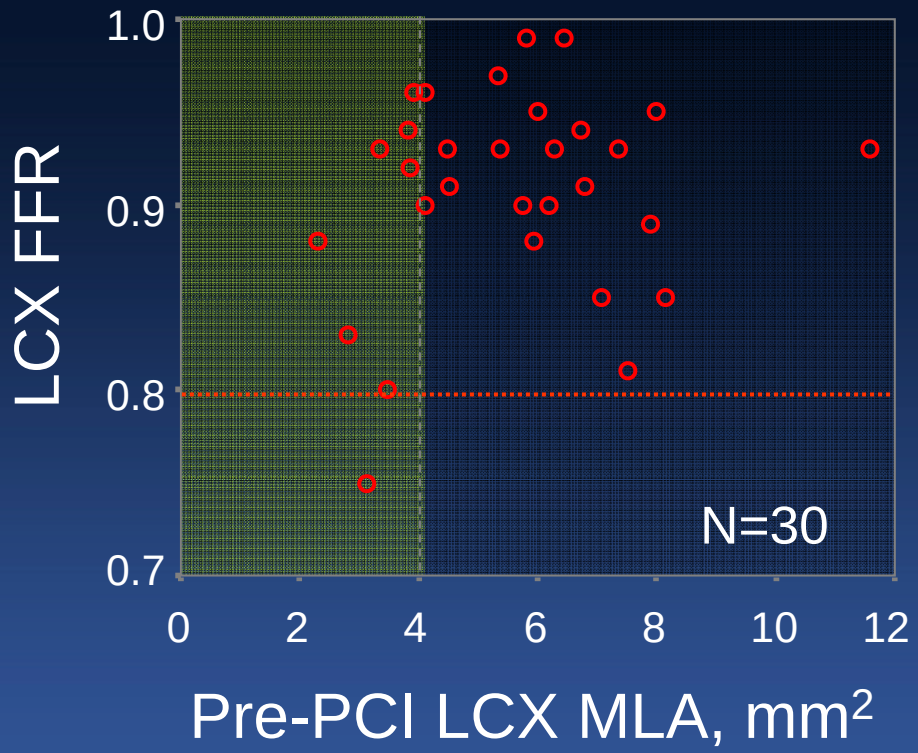


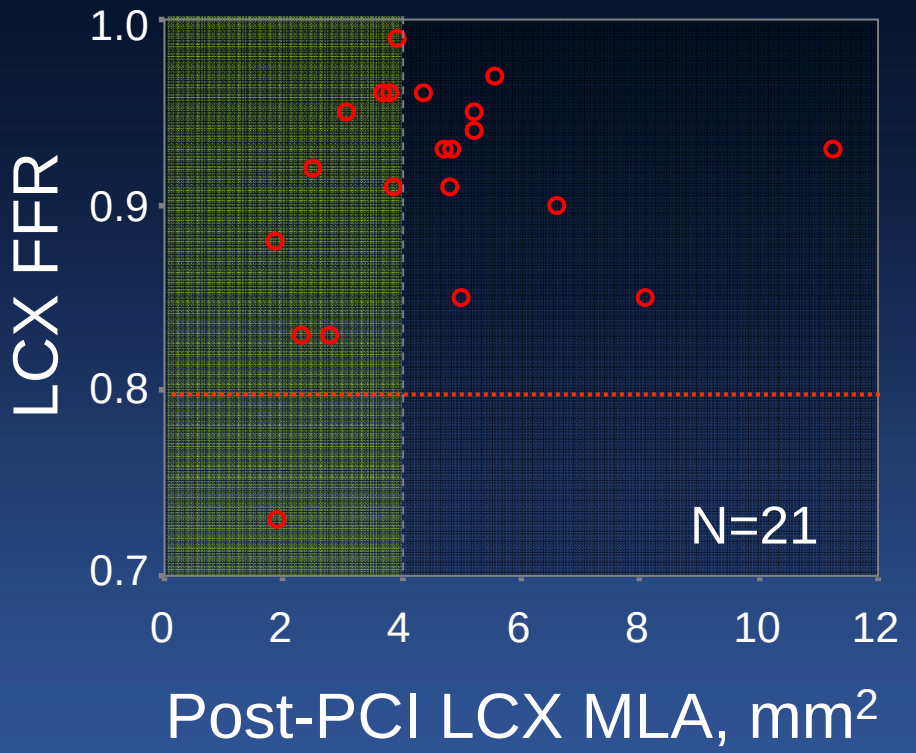
MLA 2.5mm²

FFR 0.81

Correlation between
IVUS-MLA vs. Post-stenting FFR

*LM bifurcation with **LCX ostial DS <50%** pre-procedure*

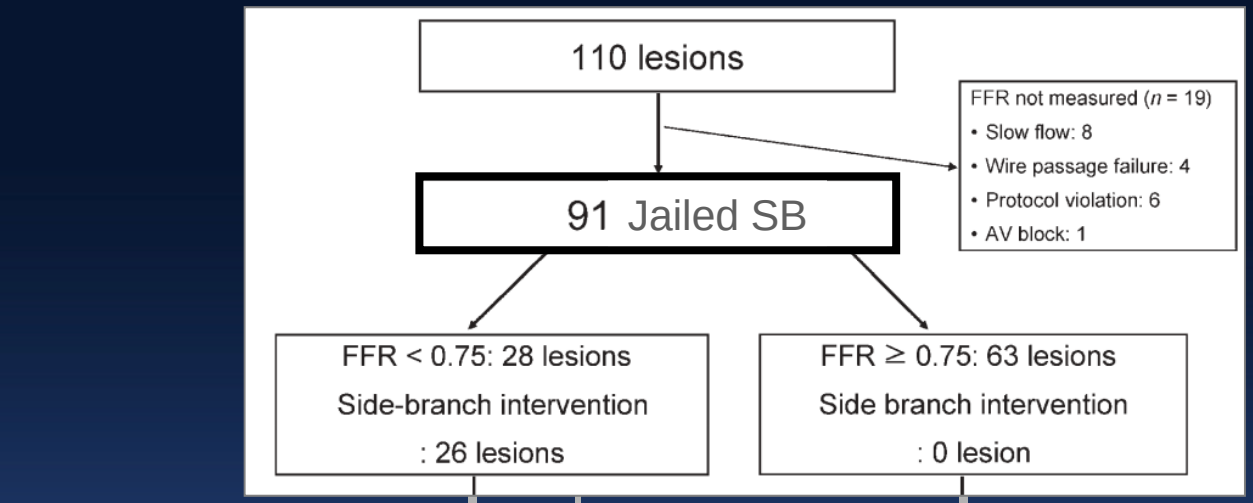




AMC data, preliminary

Treatment for Angiographically Jailed SB

SB FFR >0.75 is safe for deferral in non-LM disease



SB intervention
26 lesions

2 lesions

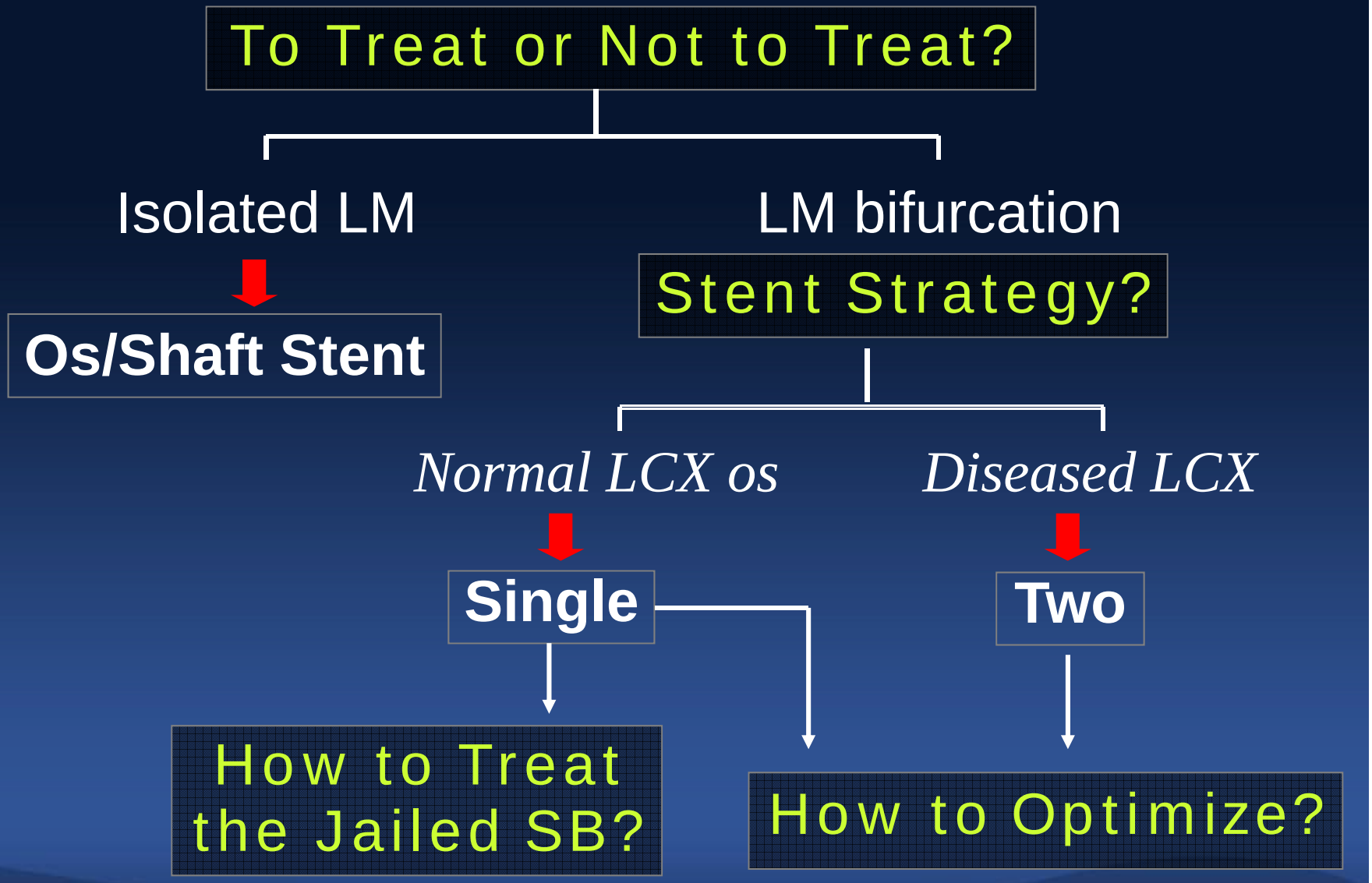
No SB intervention
65 lesions

6 Mo f/u

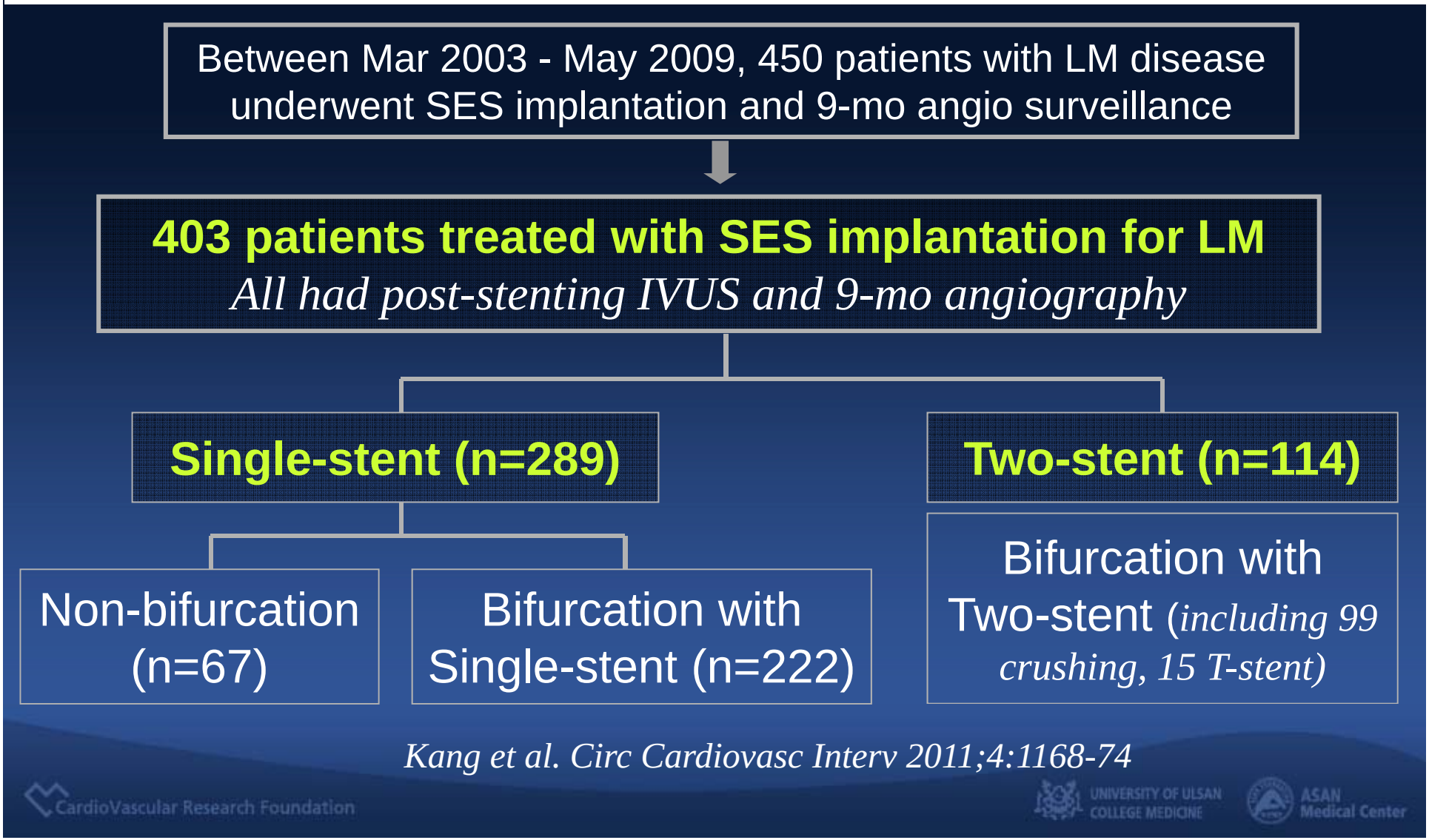
No change in SB FFR (0.87±0.06→0.89±0.07)
Functional restenosis (FFR<0.75) in only 8%

Koo et al. Eur Heart J 2008;29:726–32

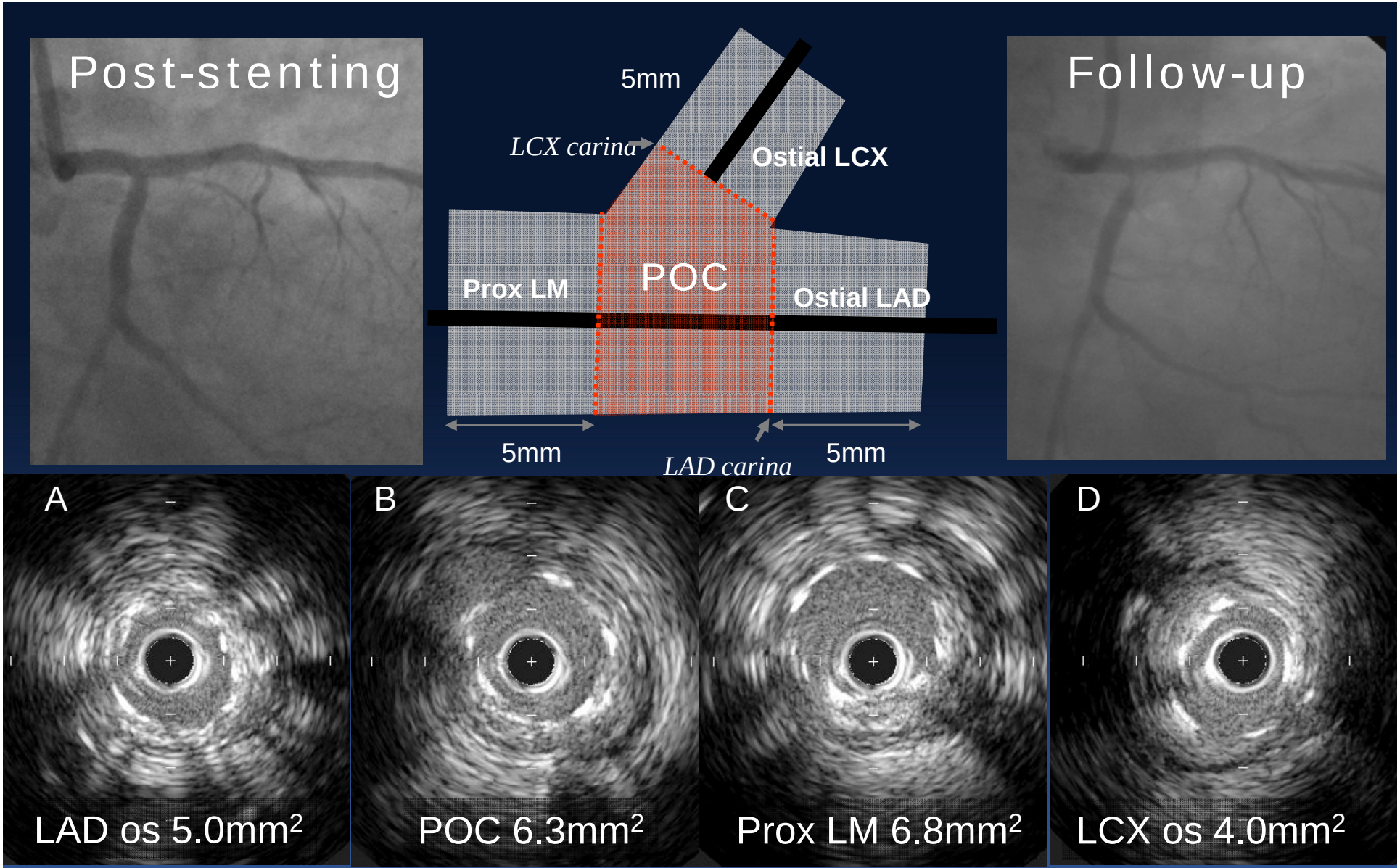
Issues of LM PCI



Comprehensive Intravascular Ultrasound Assessment of Stent Area and Its Impact on Restenosis and Adverse Cardiac Events in 403 Patients With Unprotected Left Main Disease



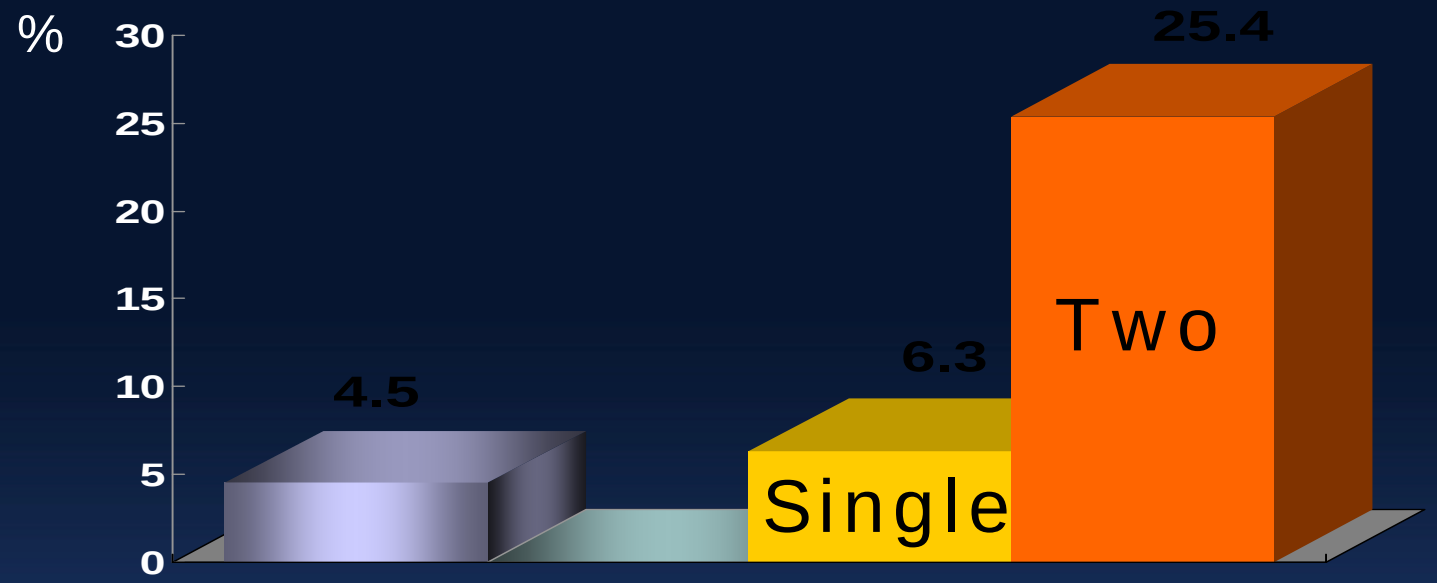
Kang et al. Circ Cardiovasc Interv 2011;4:1168-74



Using both pullback, MSA in 4 segments were measured. The MSA predicting 9-month angiographic ISR at the corresponding segments were assessed

Kang et al. Am J Cardiol 2011;107:367-73

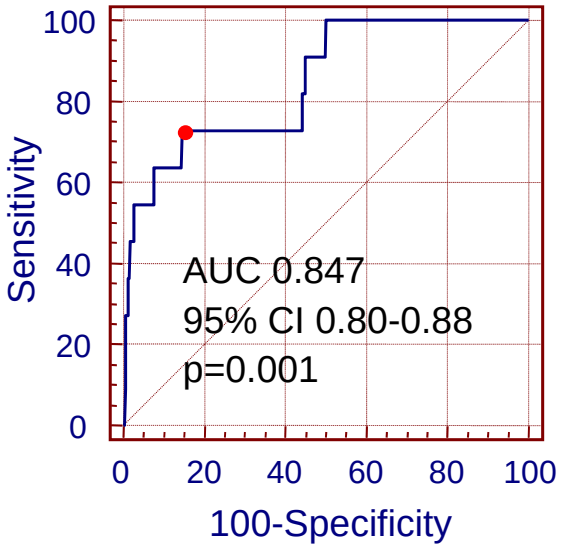
9-Month Angiographic Restenosis



4.5% (3/67)	6.3% (14/222)	25.4% (29/114)
LM ostium: 3 (4.5%)	*LM (above POC): 2 (1.0%)* *POC: 1 (0.5%)* *LAD ostium: 3 (1.4%)* *non-stented LCX os: 9 (4.1%)*	*LM (above POC): 5 (4.4%)* *POC: 6 (5.3%)* *LAD ostium: 8 (7.0%)* *LCX ostium: 27 (23.7%)*

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

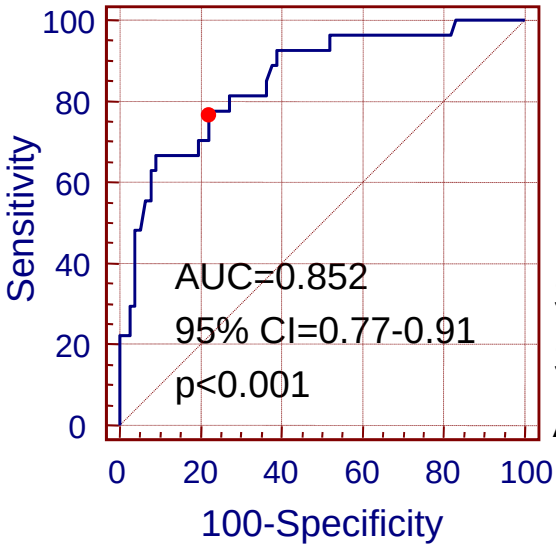
LAD ostium



MSA 6.3mm^2

Sensitivity 73%
Specificity 85%
Accuracy 84%

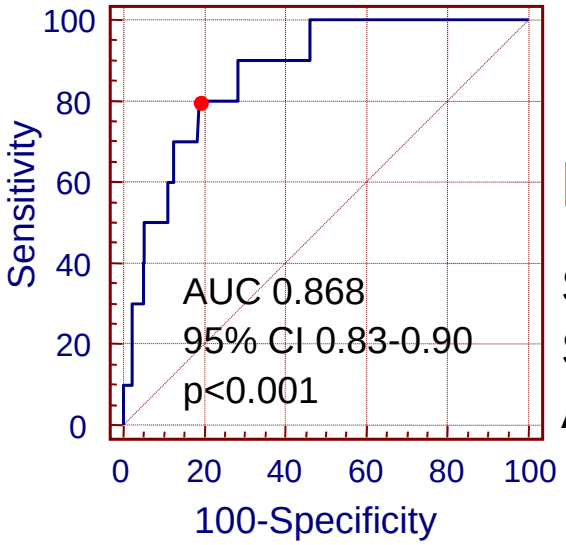
LCX ostium



MSA 5.0mm^2

Sensitivity 78%
Specificity 78%
Accuracy 78%

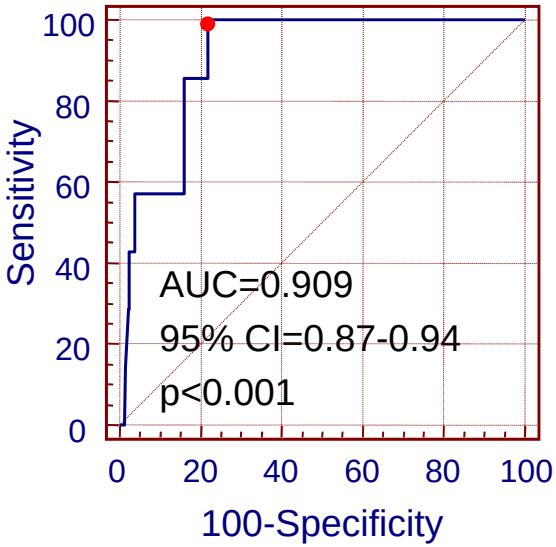
Proximal LM



MSA 8.2mm^2

Sensitivity 80%
Specificity 81%
Accuracy 81%

POC



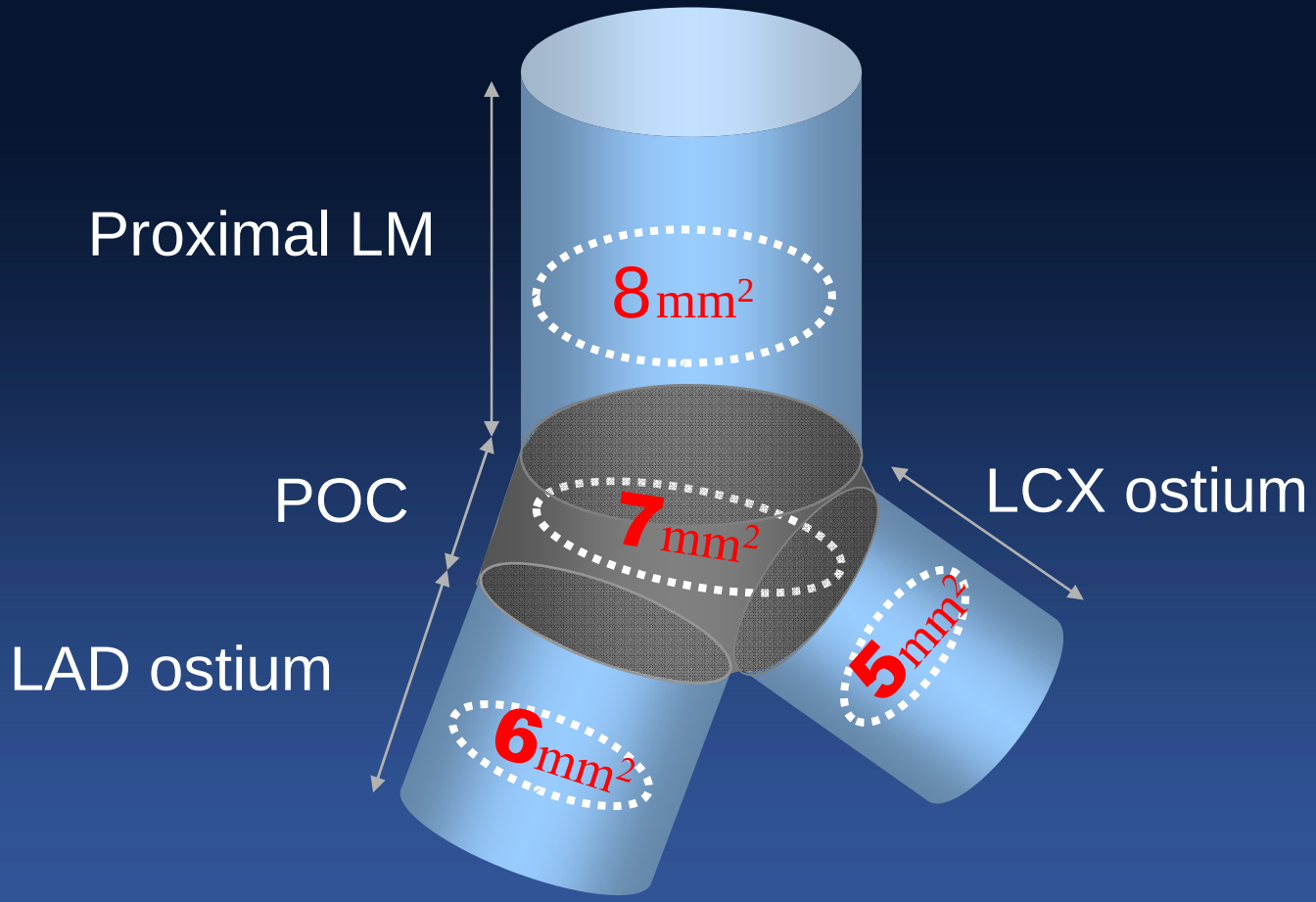
MSA 7.2mm^2

Sensitivity 100%
Specificity 78%
Accuracy 80%

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

Optimal MSA

on a segmental basis

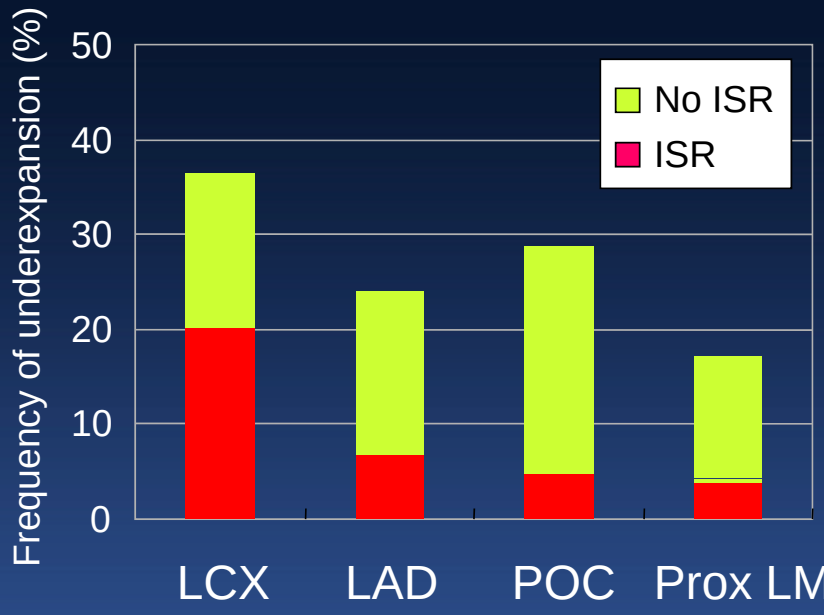


Kang et al. Circ Cardiovasc Interv 2011 2011;4:1168-74

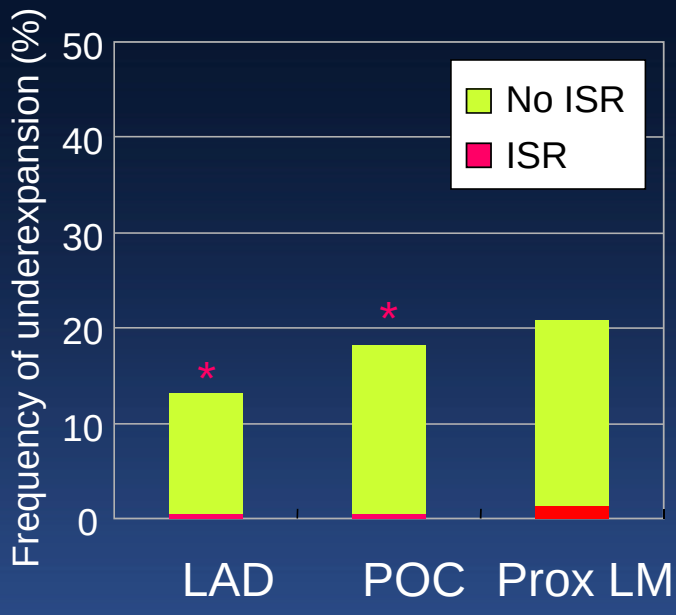
Frequency of Underexpansion and ISR

33.8% *had underexpansion of at least one stented segment*

Two-stent



Single-stent

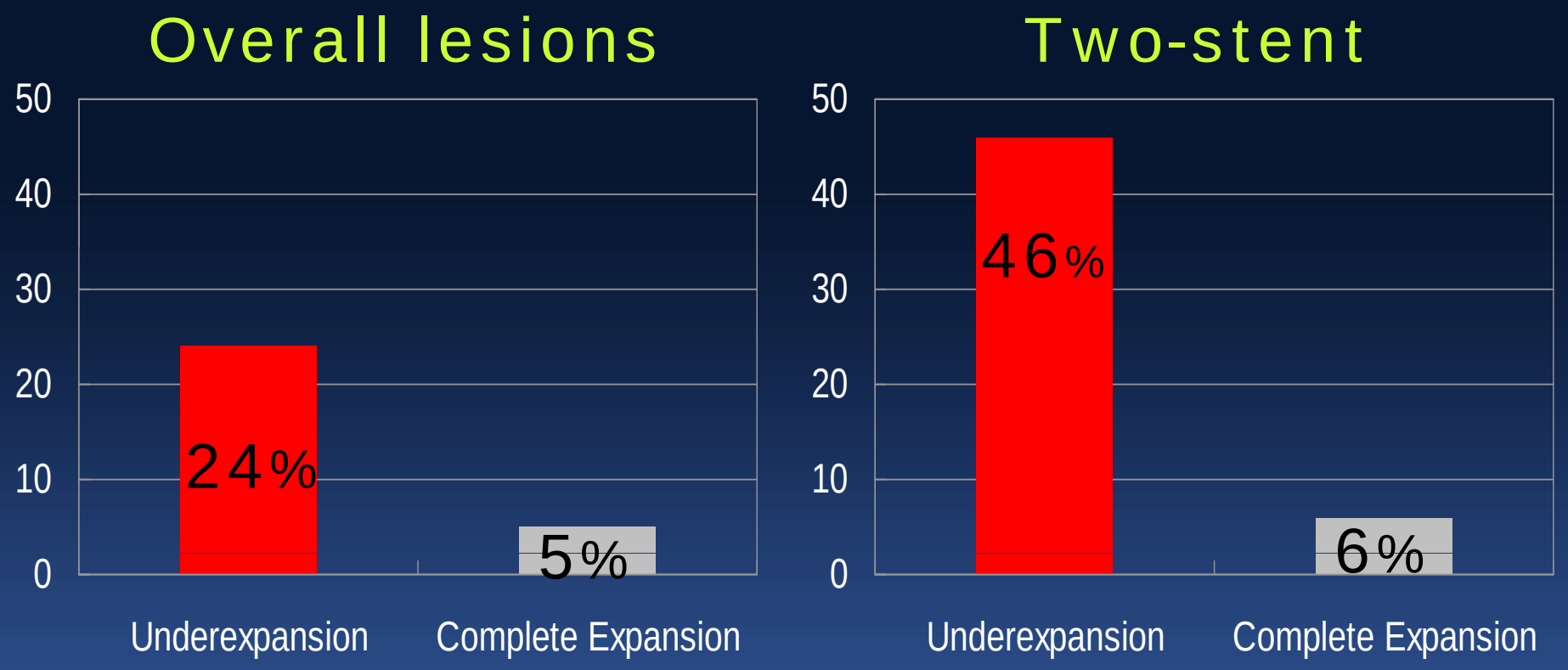


* *single-stent vs. two-stent, p<0.05*

54% had underexpansion in at least one of the 4 stented segments

27% had underexpansion in at least one of the 3 stented segments

Frequency of ISR in LM Lesions
with vs. without Underexpansion



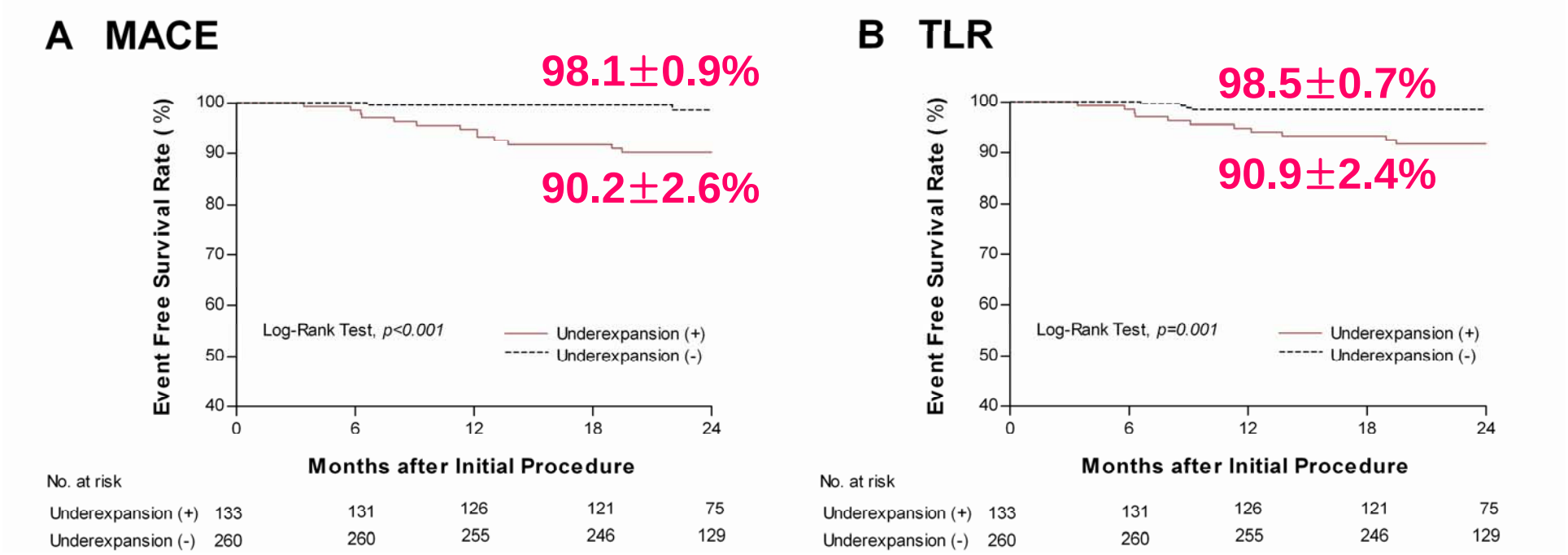
Underexpansion of at least 1 segment

Adequate expansion at all sites

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

Kaplan-Meier for MACE-free Survival

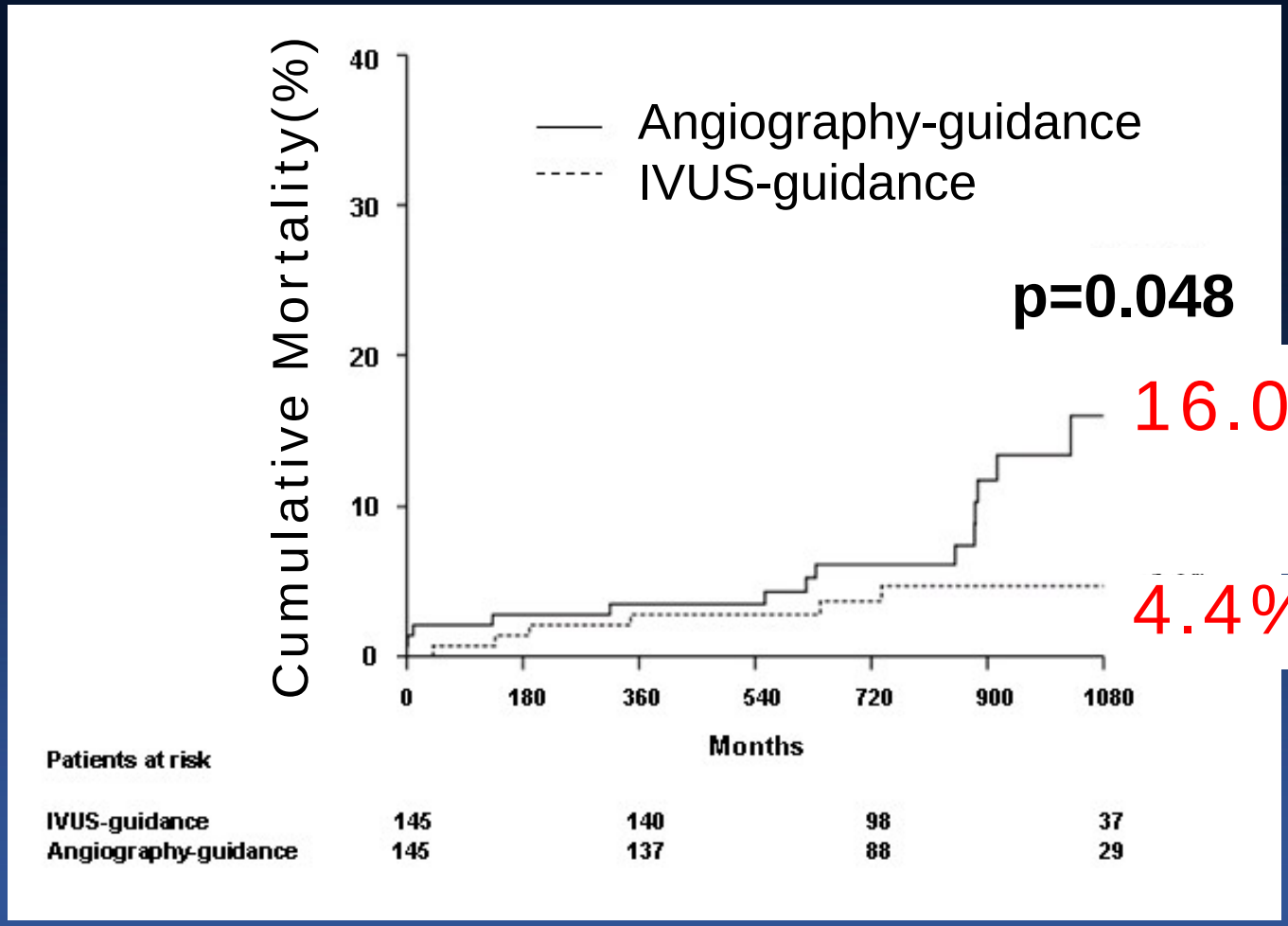
2-year MACE 4.8% at 23.8±3.2 months (median 24 months)



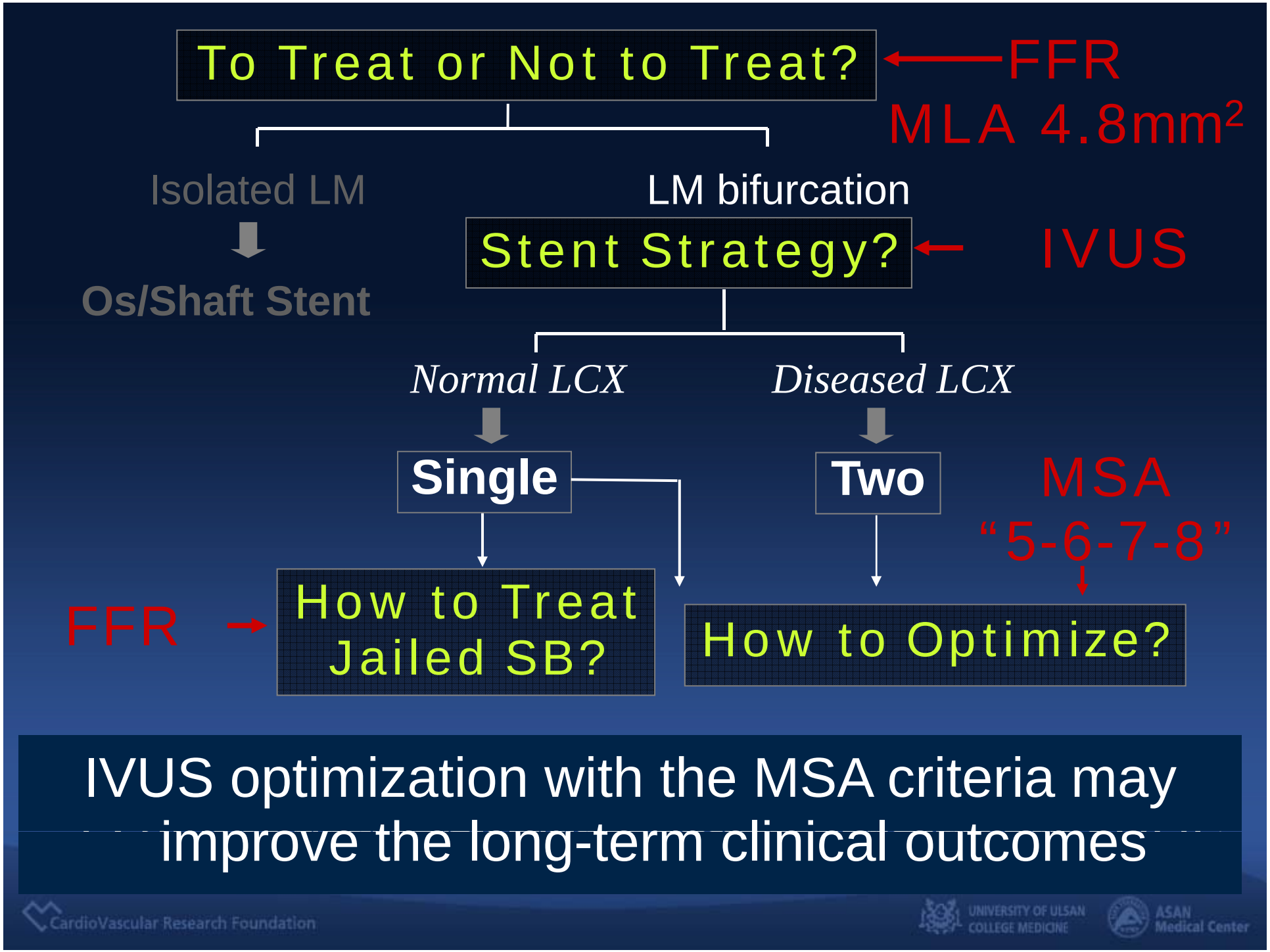
TLR 4.1%, Cardiac death 1%, AMI (VLST) 0.5%

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

IVUS-Guidance Saves Lives in LM PCI



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



IVUS optimization with the MSA criteria may improve the long-term clinical outcomes