How to Utilize IVUS in Bifurcation PCI?

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Disclosure

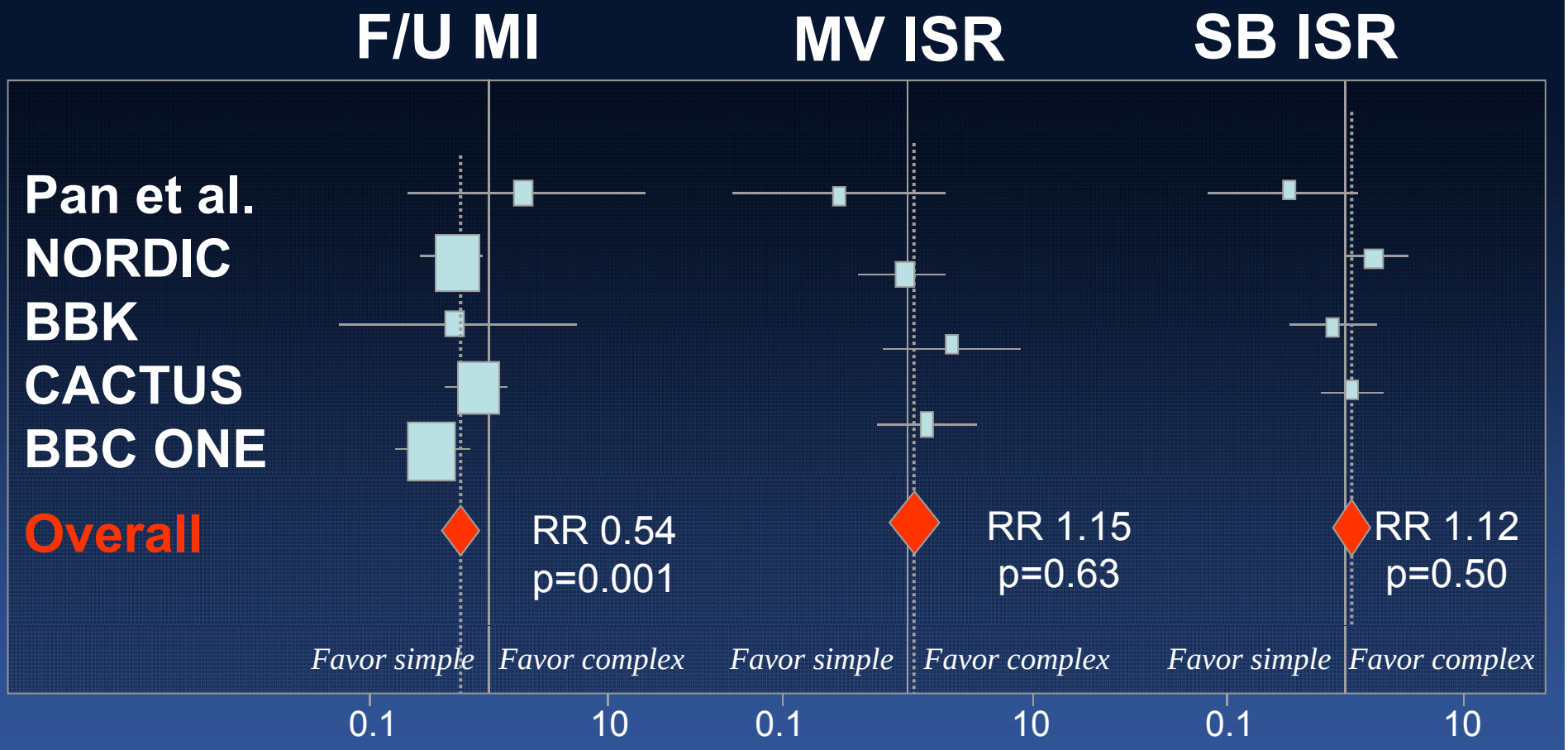
I have nothing to disclose

Utility of IVUS

1. To Determine Stent Strategy
Single vs. Two

Simple vs. Complex

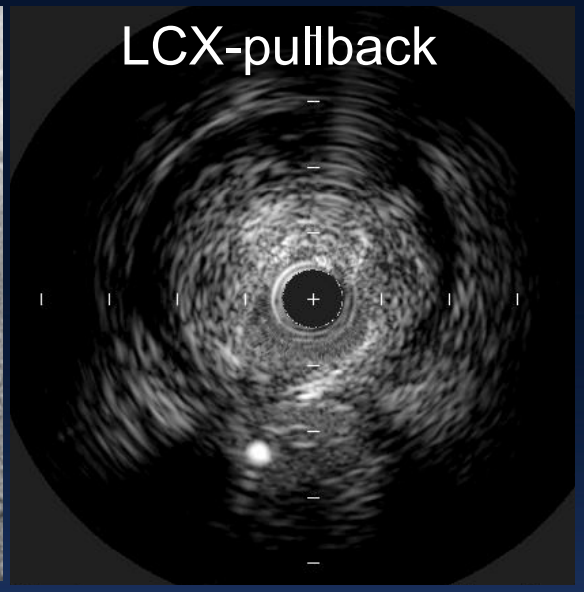
Relative Ratios of Adverse Events

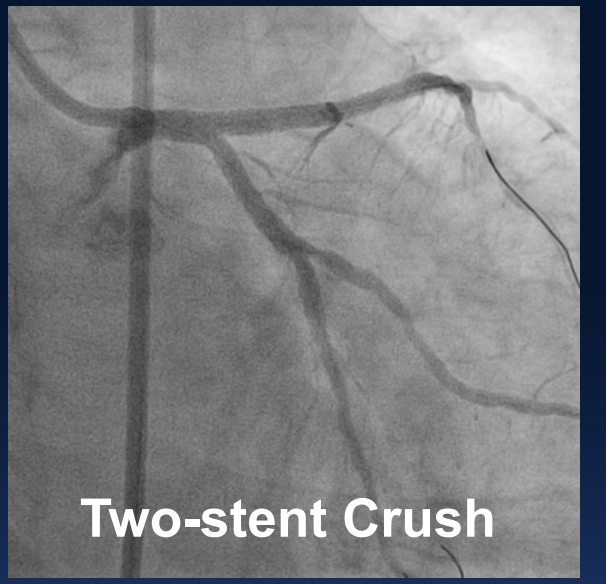


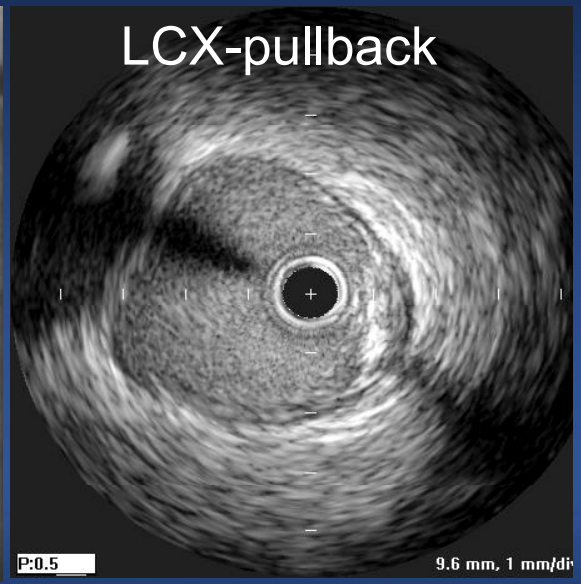
46%↓RR

Zhang et al. Heart 2009;95:1676-81

Disease Involvement of SB Ostium

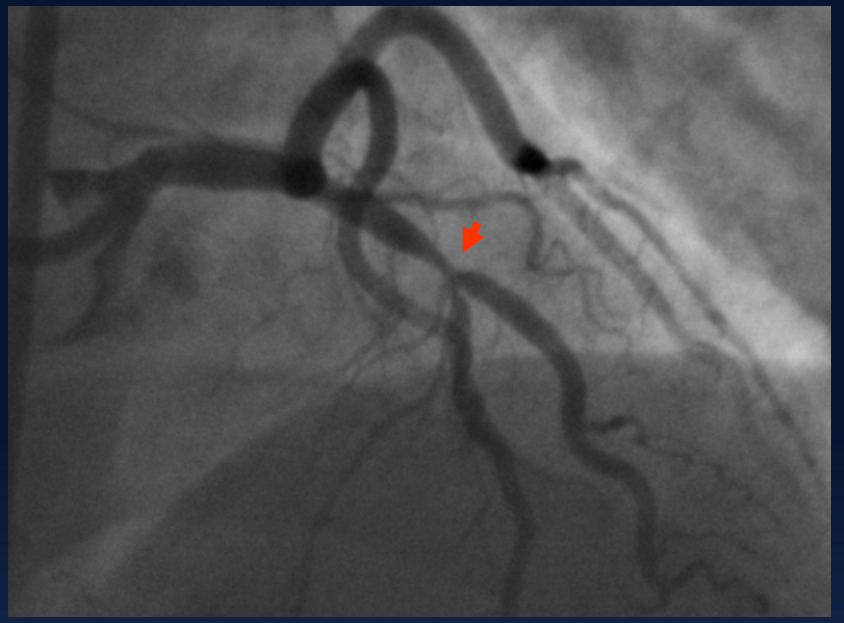




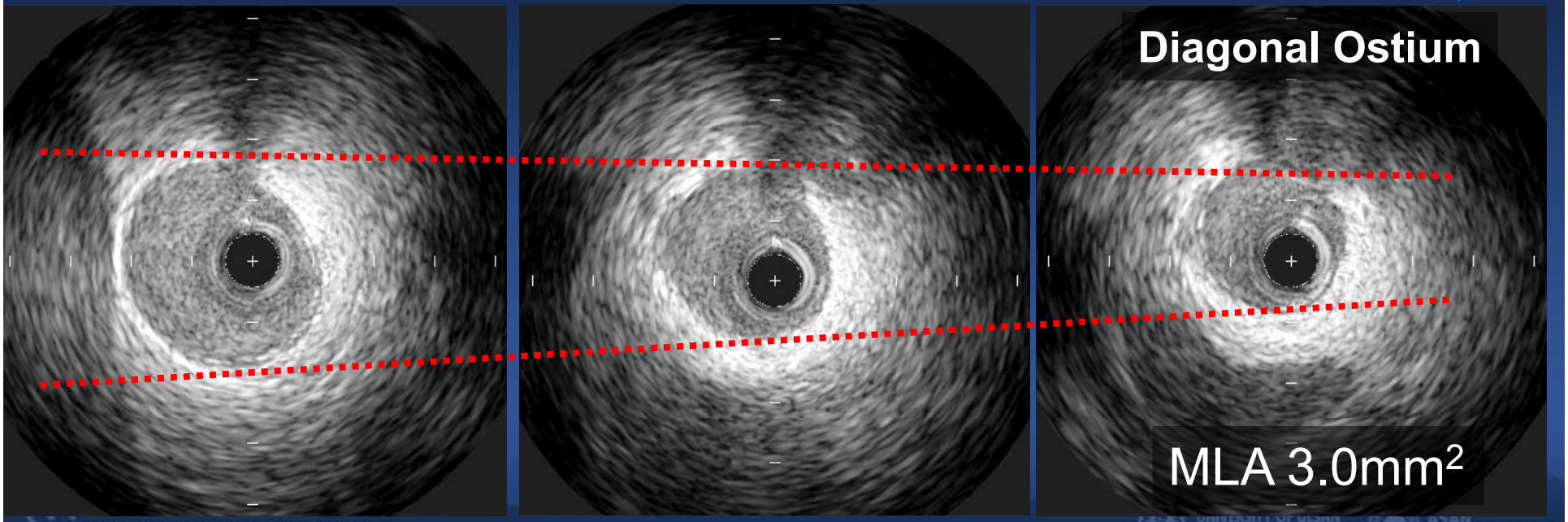


CASE

- **True Bifurcation**
- **SB Involvement?**

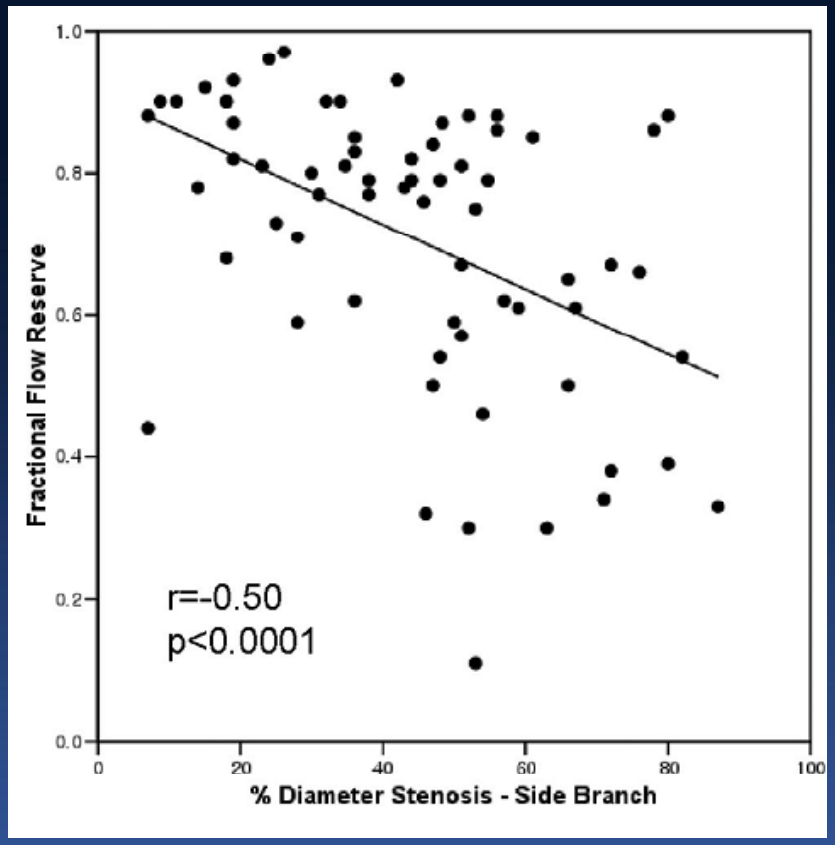


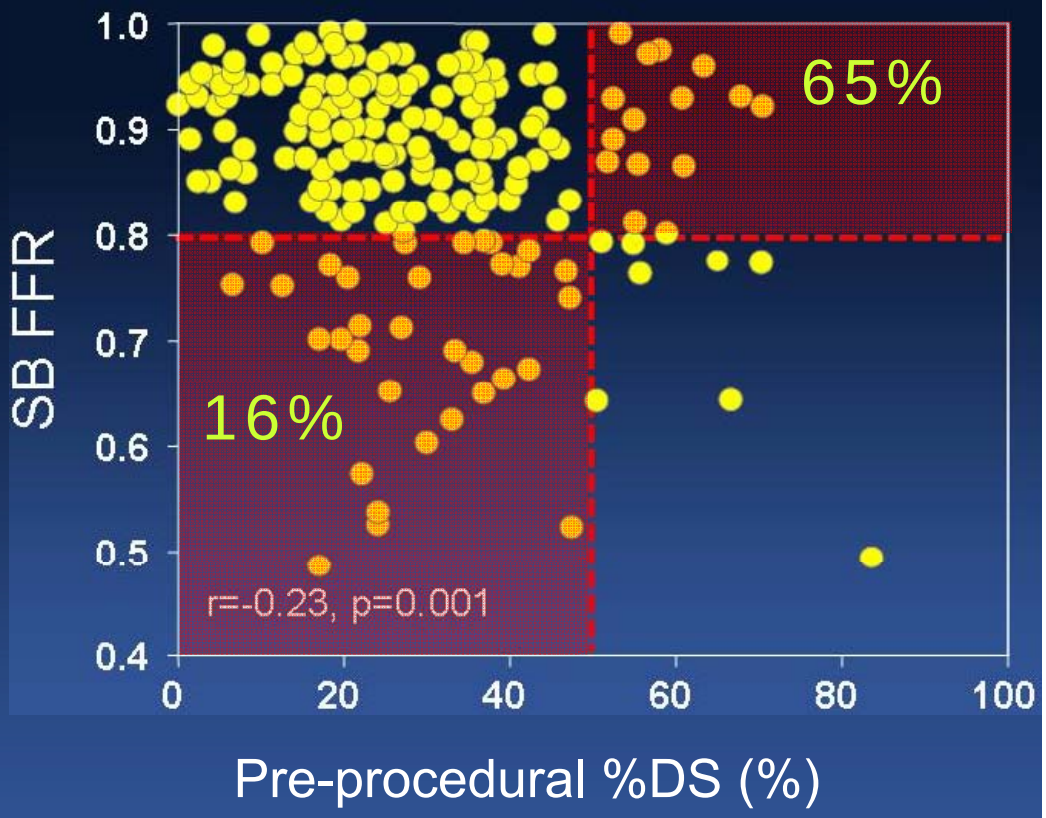
Negative Remodeling without Plaque



Angiographic or IVUS Criteria Suitable for Single Stent Stratery

Angiographic DS is a Poor Predictor for Functional SB Compromise





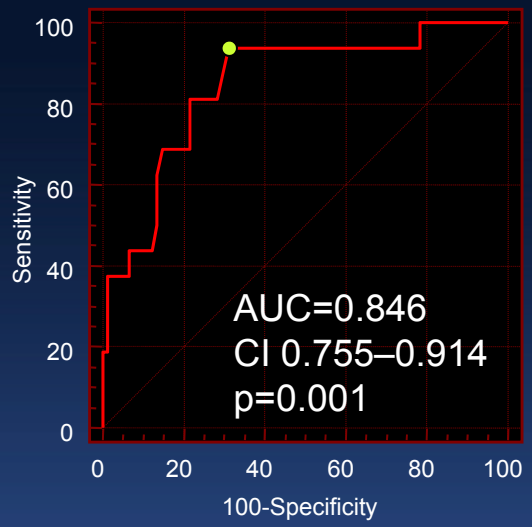
Koo et al. Circ Cardiovasc Interv 2010;3:113-9

Ahn et al. JACC Interv 2011 in Press

Pre-intervention SB-IVUS

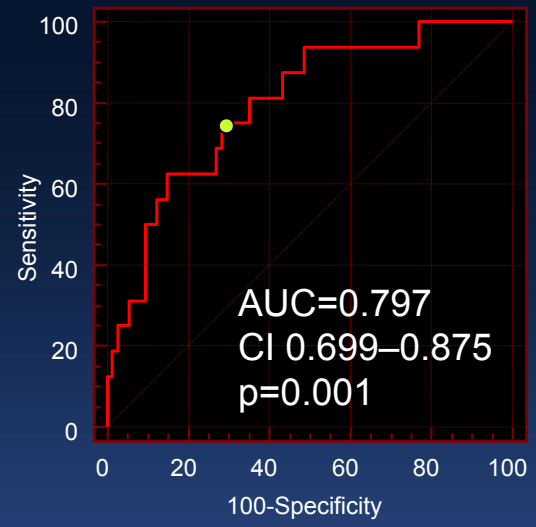
Predicts SB FFR <0.80 after MB stenting

MLA 2.4mm^2



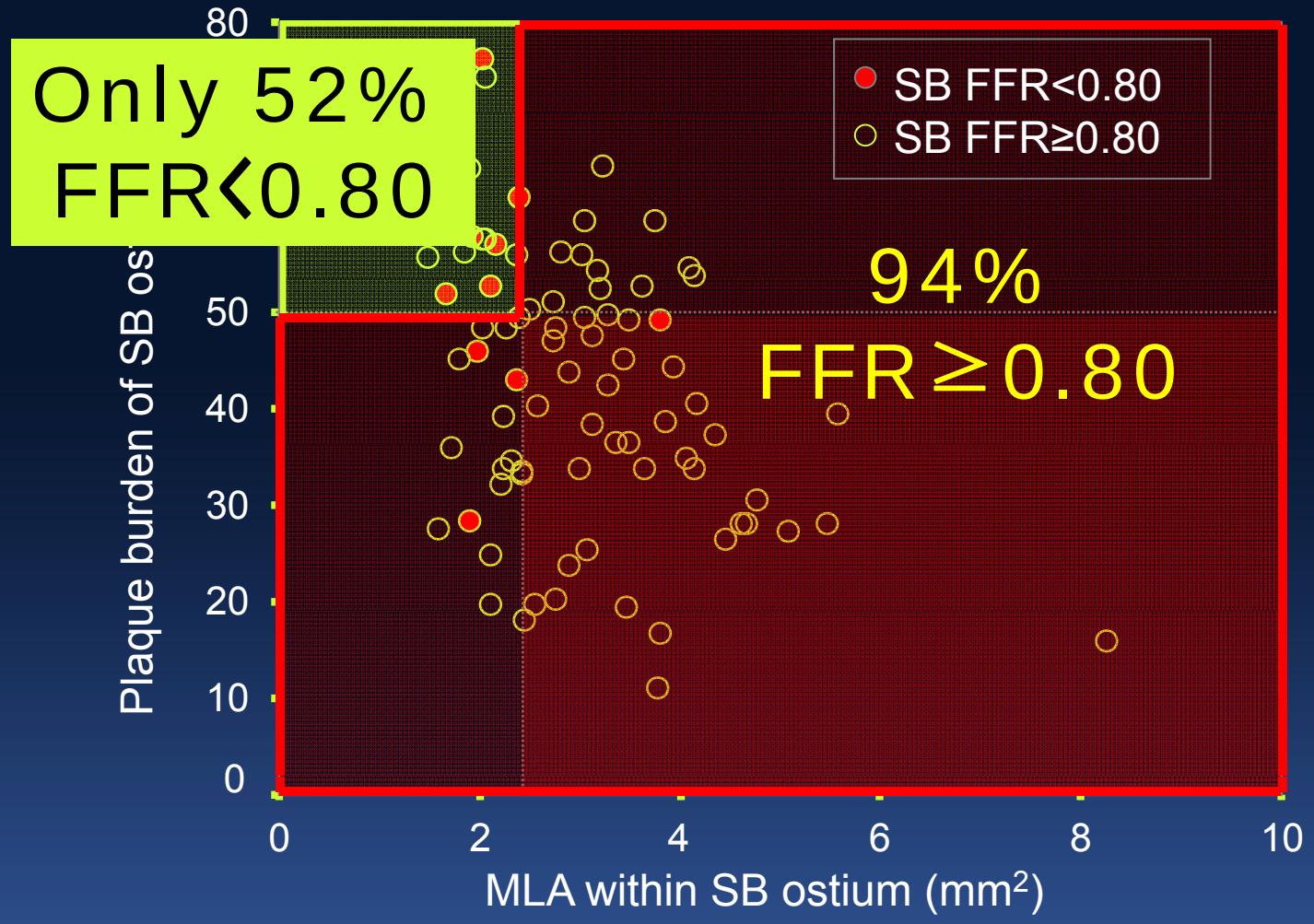
Sensitivity=94%
Specificity=68%
PPV=40%
NPV=98%

Plaque burden 50%



Sensitivity=75%
Specificity=71%
PPV=36%
NPV=93%

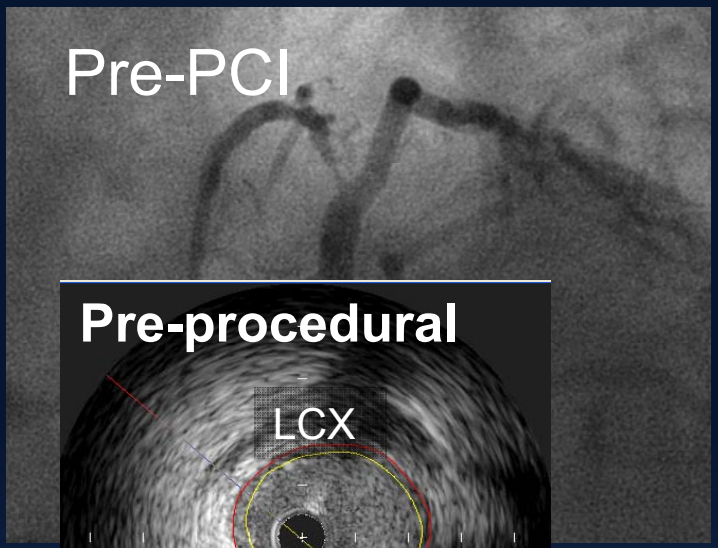
Kang et al. Am J Cardiol 2011;107:1787-93

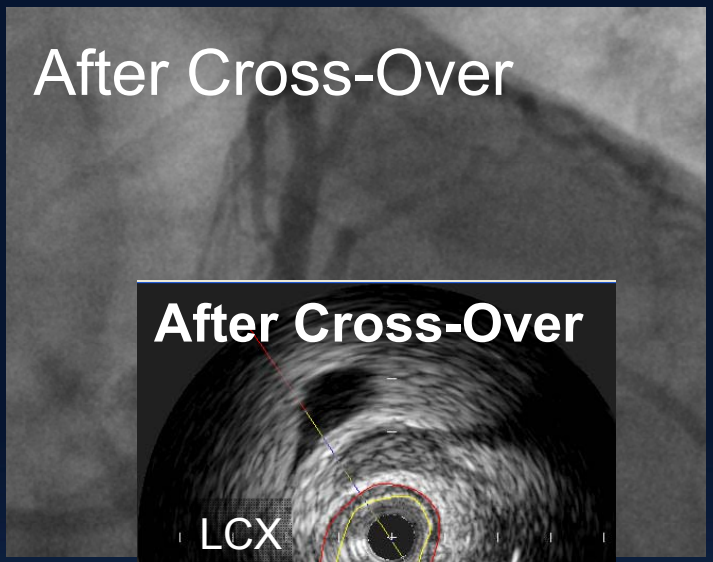


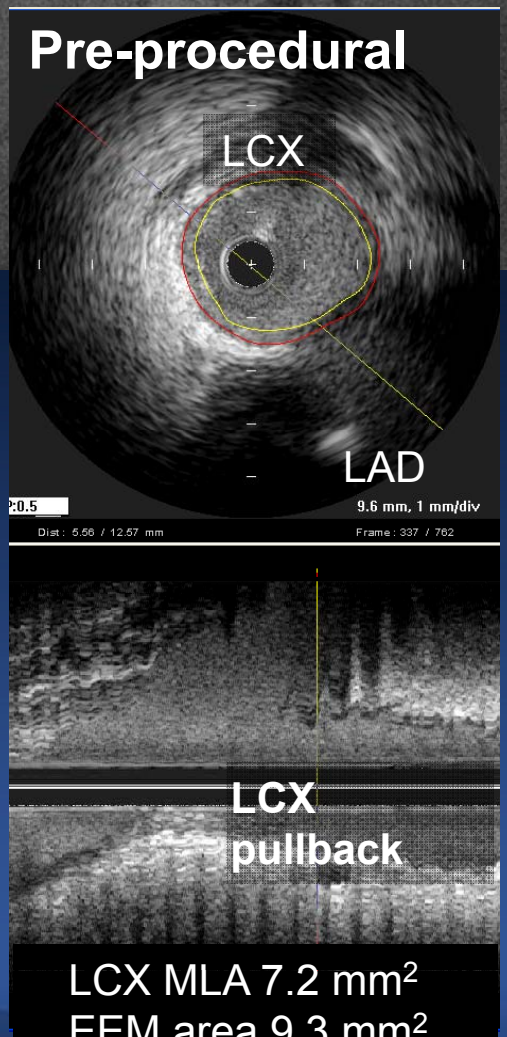
Kang et al. Am J Cardiol 2011;107:1787-93

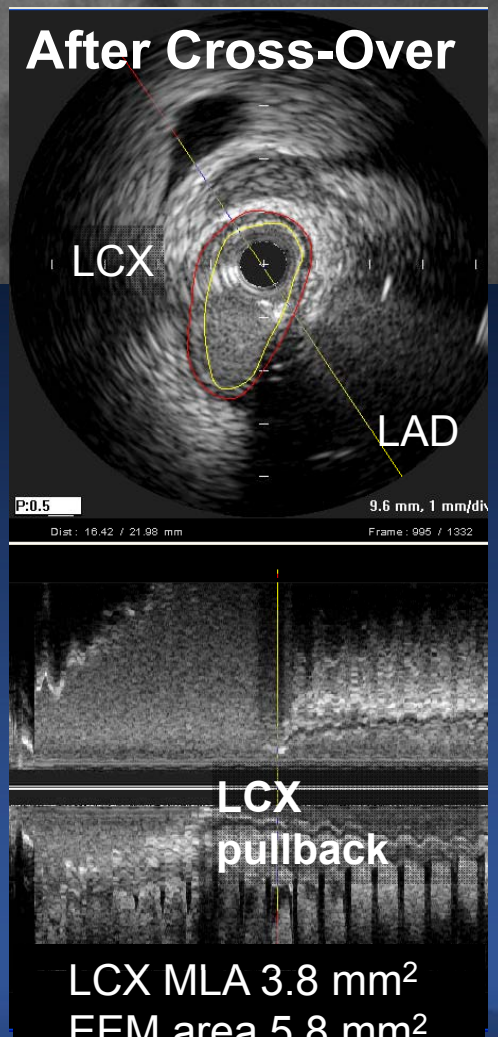
Utility of IVUS

2. Mechanism of SB Jailing









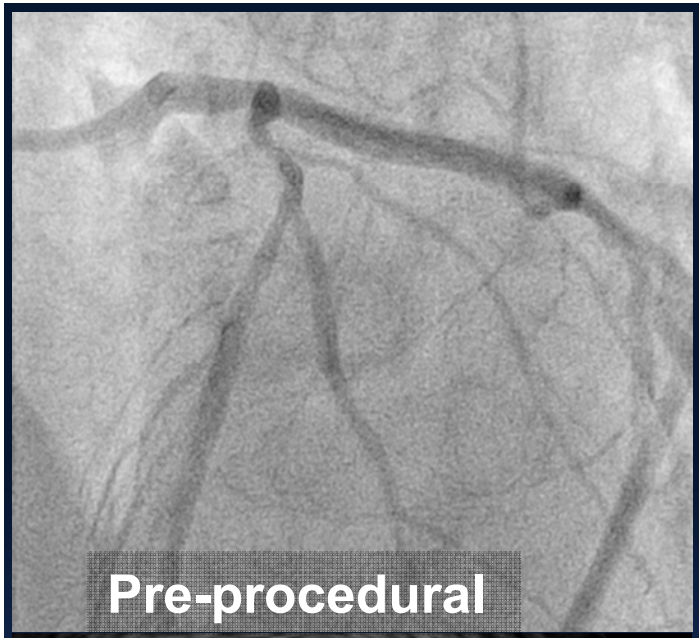
Carina Shift

After cross-over

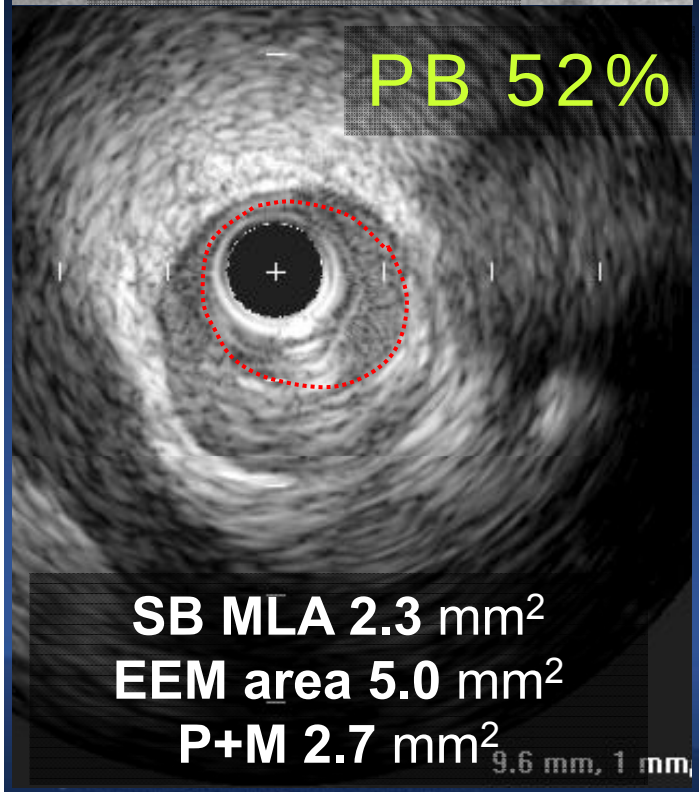
Area Change	
ΔLumen	-3.4 mm^2
ΔVessel	-3.5 mm^2
ΔPlaque	-0.1 mm^2

Plaque Shift

MB Cross-over

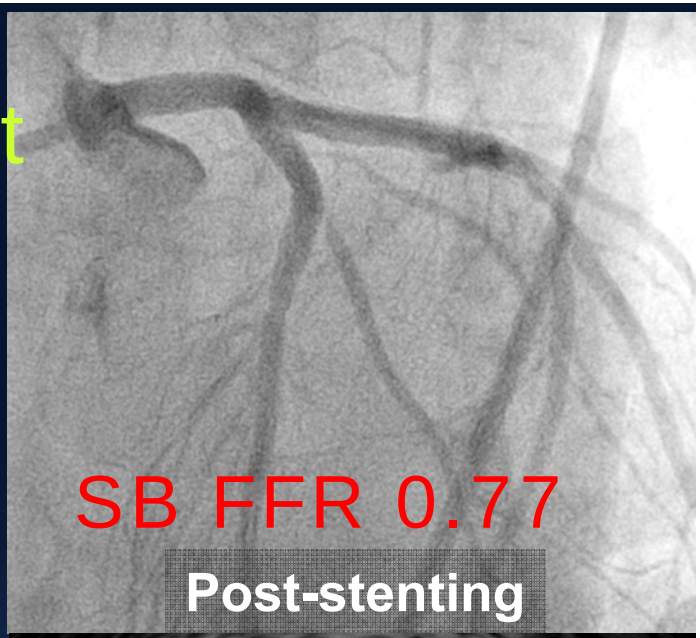


Pre-procedural

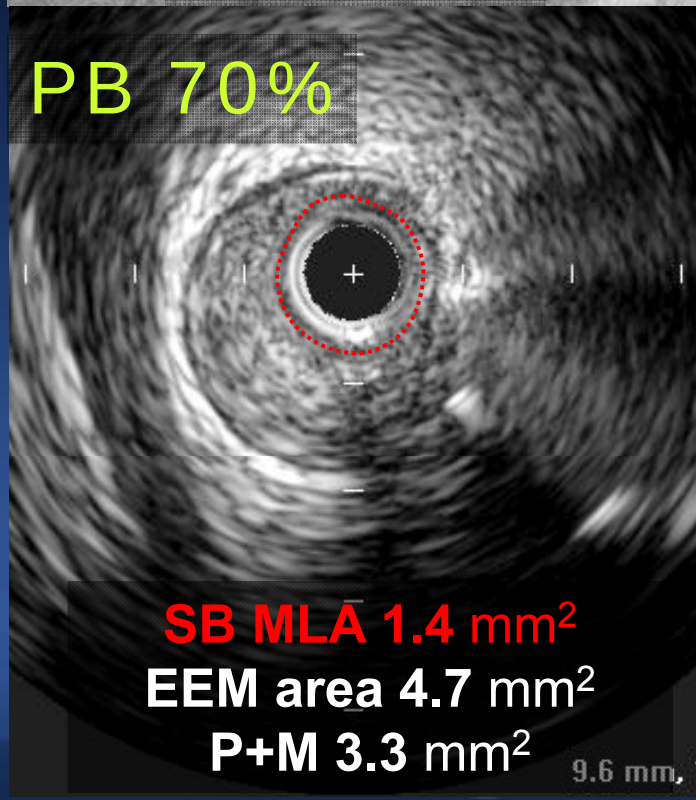


Area Change	
ΔLumen	-1.0mm²
ΔVessel	-0.3mm²
ΔPlaque	+0.7mm²

SB FFR 0.77

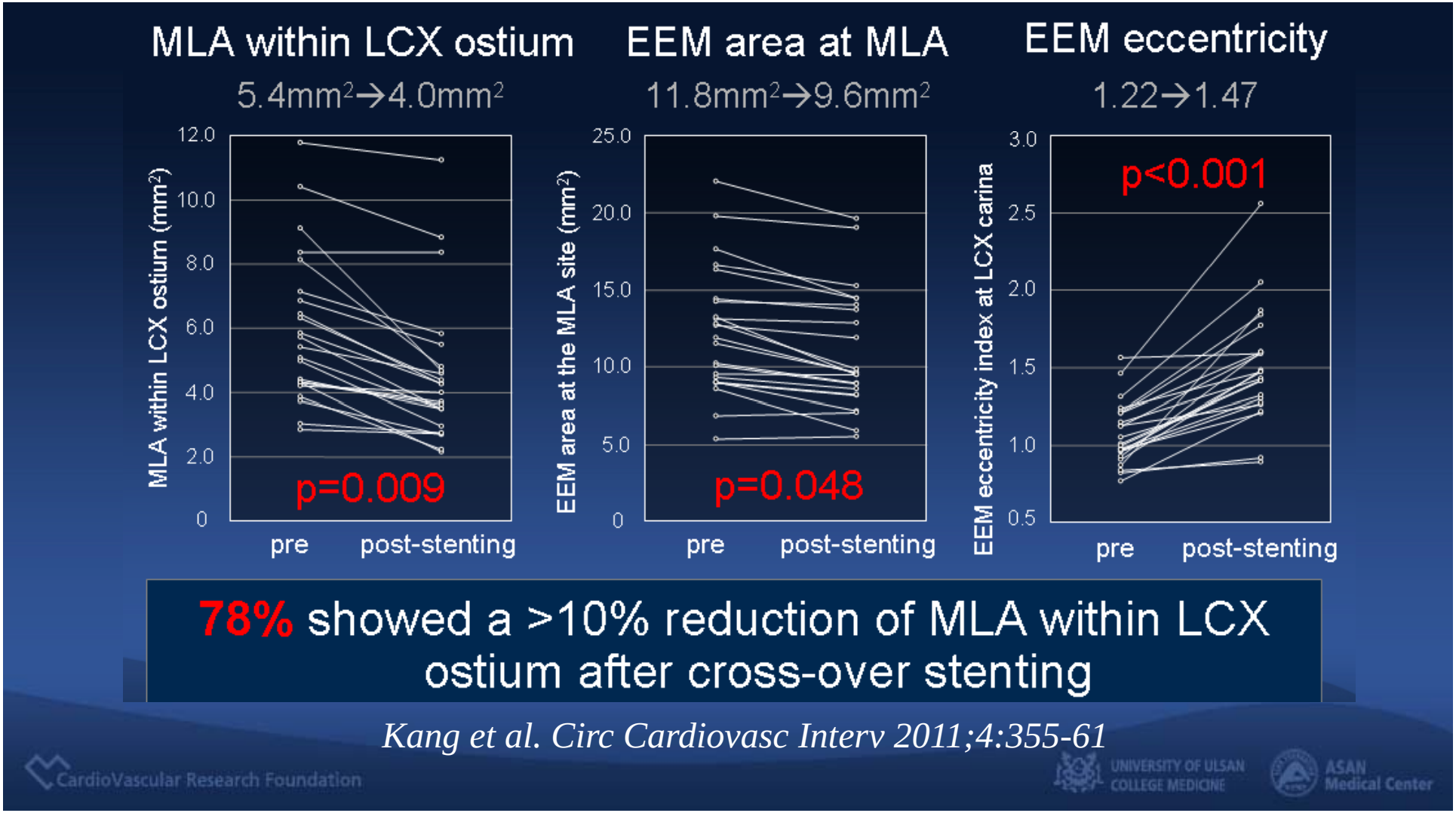


Post-stenting



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)**



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

CardioVascular Research Foundation

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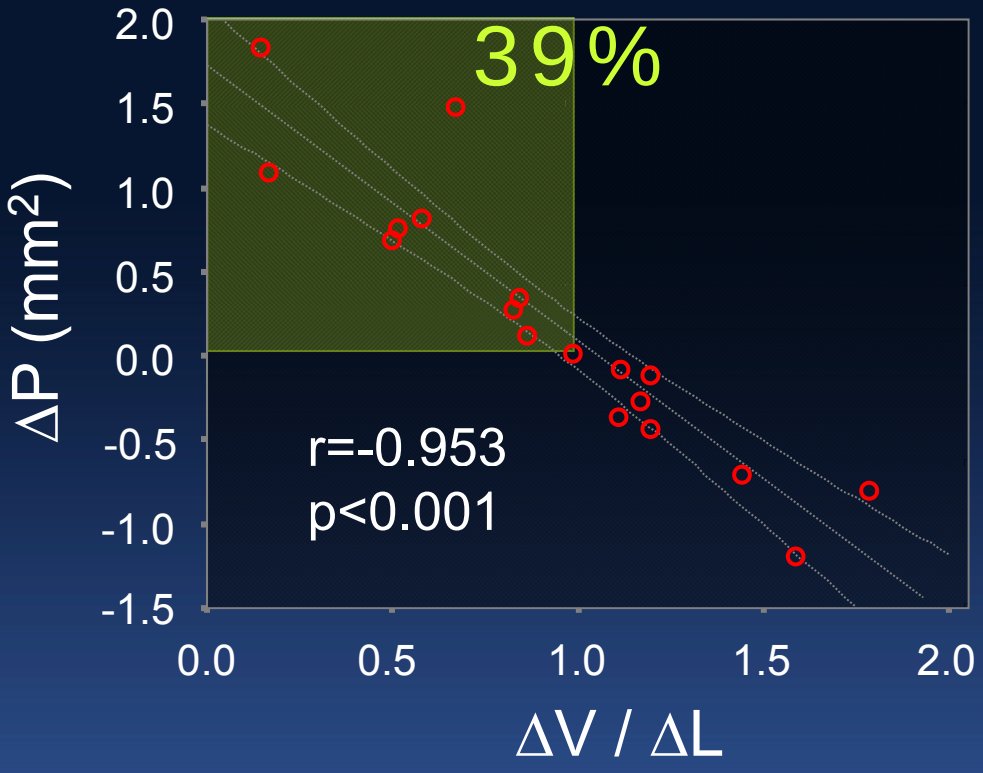
ASAN Medical Center

Plaque Redistribution

Second Mechanism of SB Compromise



In 39%, plaque redistribution may be superimposed on carina shift to contribute to further lumen loss

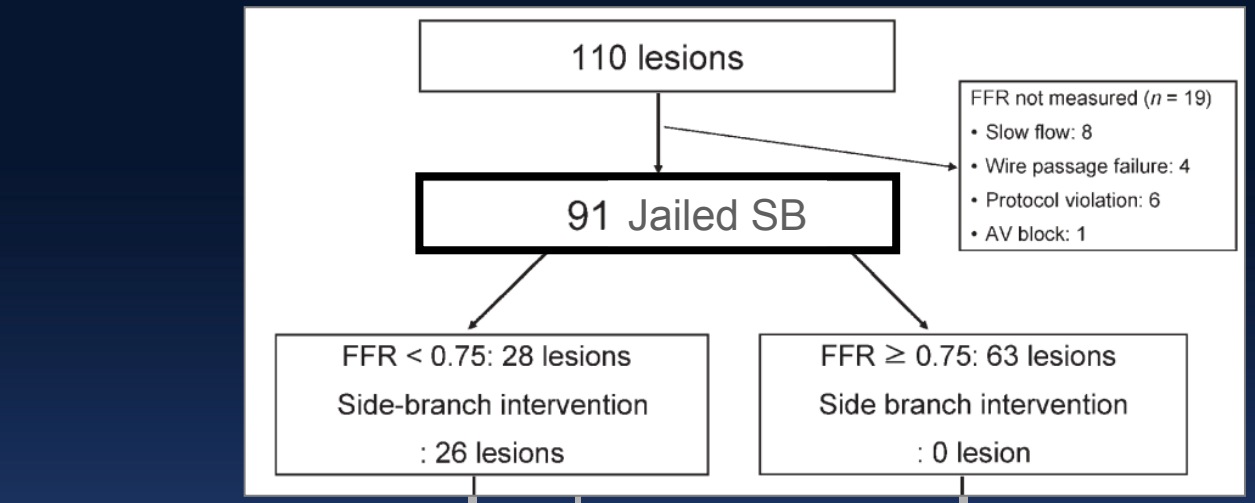
Kang et al. Circ Cariovasc Interv 2011 Accepted

Utility of IVUS

However, treatment of Jailed SB depends on functional significance

Treatment for Angiographically Jailed SB

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



SB intervention
26 lesions

2 lesions

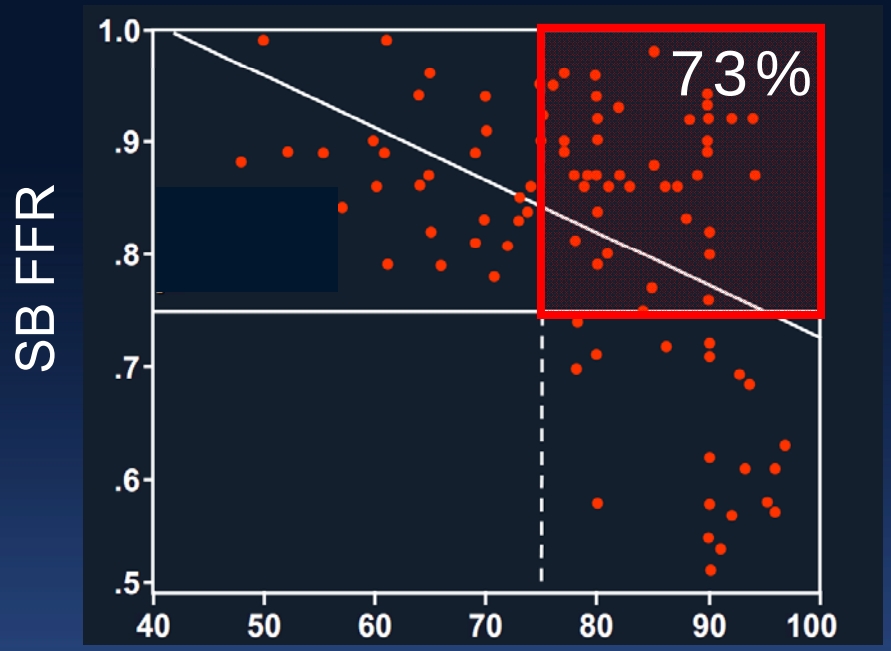
No SB intervention
65 lesions

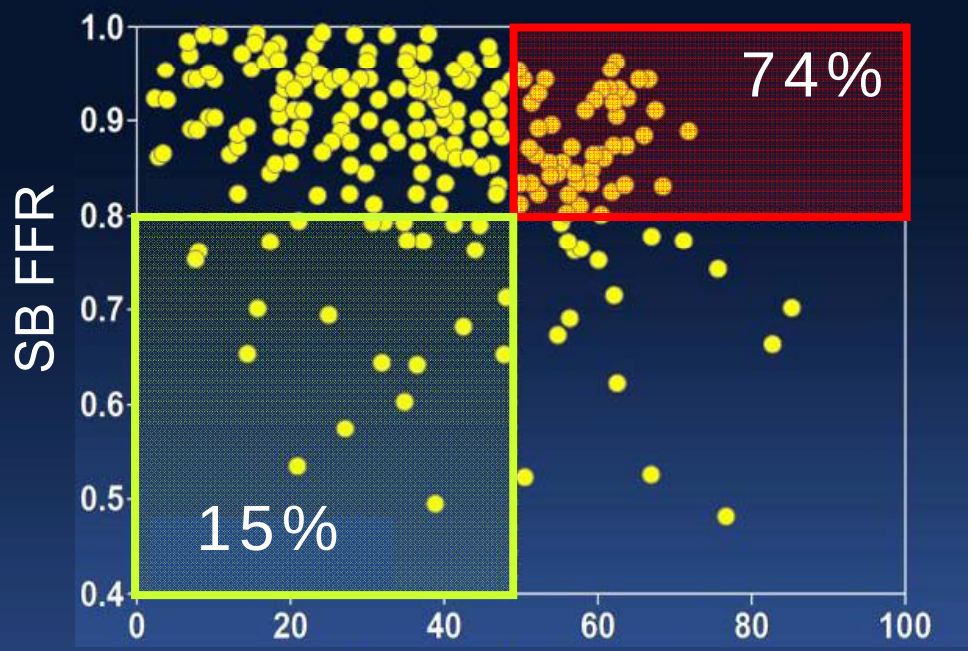
6 Mo f/u

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

Discordance Between
Post-stenting QCA-DS vs. SB FFR





- **73% Mismatch**
- **Cut-off for FFR<0.75: >85%**

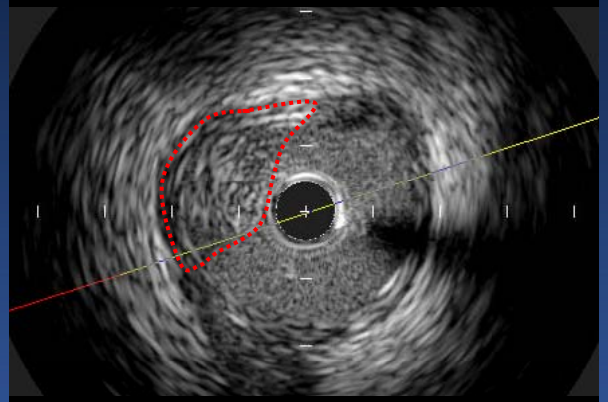
Koo et al. JACC 2005;46:633

- **74% Mismatch**
- **15% Reverse-Mismatch**
- **Cut-off for FFR<0.80: 54%**

Ahn et al. JACC Interv in Press

IVUS Cannot Predict LCX FFR

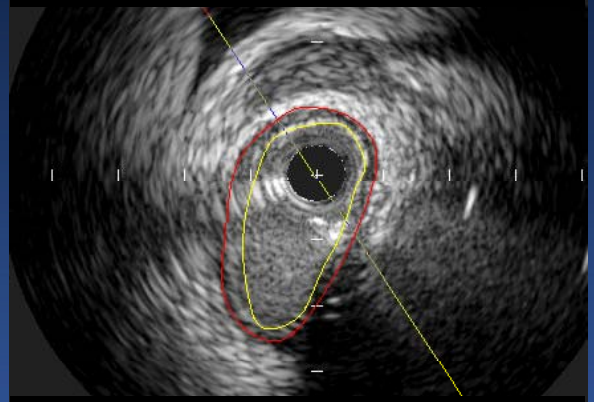
Plaque shift



MLA 4.5 mm²

FFR 0.85

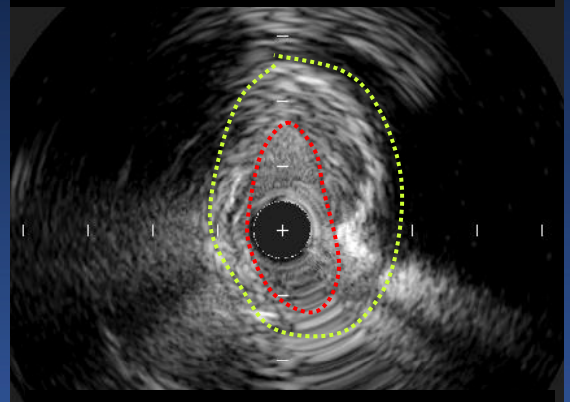
Carina shift



MLA 3.8 mm²

FFR 0.91

Carina shift

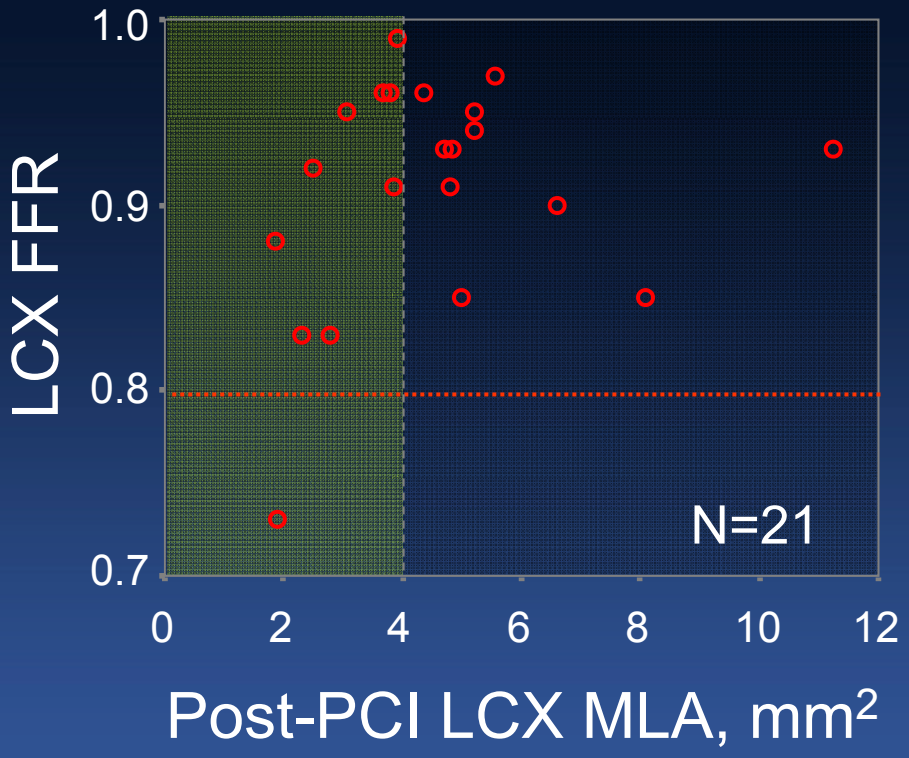


MLA 2.5mm²

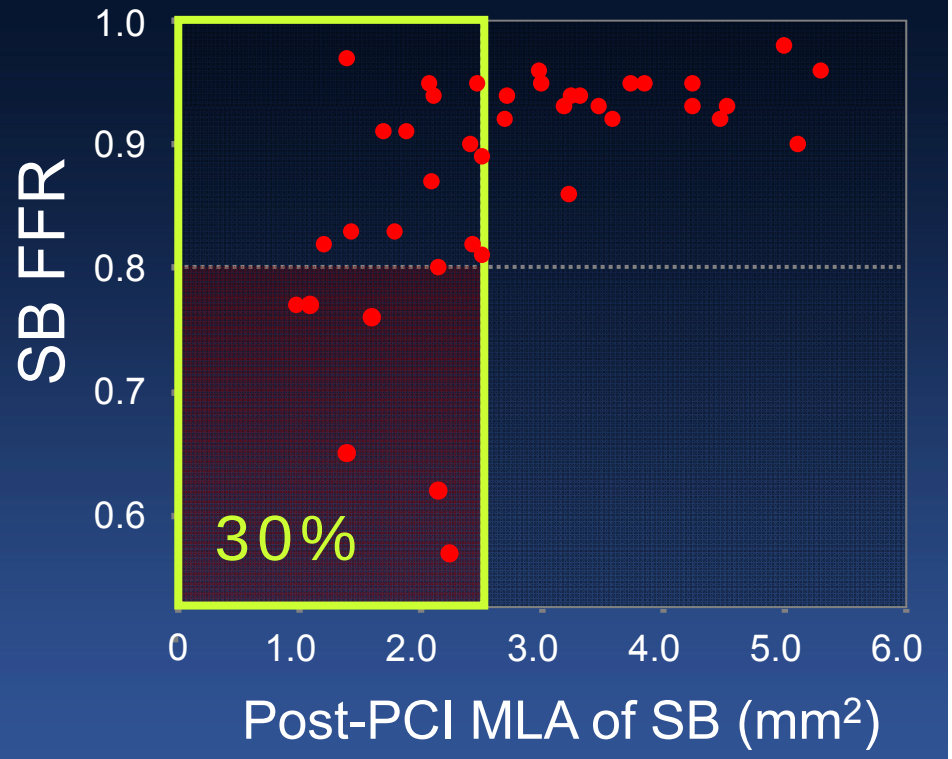
FFR 0.81

Correlation between
IVUS-MLA vs. Post-stenting FFR

LM



Non-LM

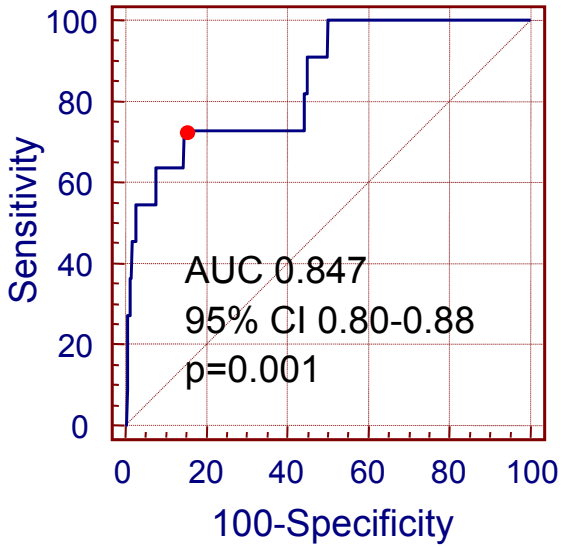


AMC data, preliminary

Utility of IVUS

3. LM Stent Optimization

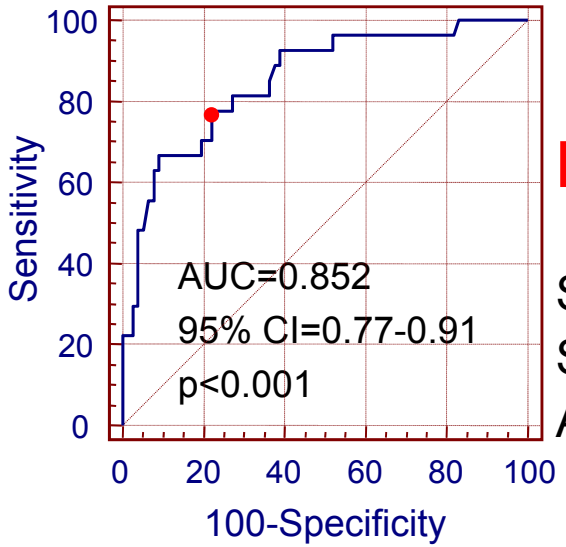
LAD ostium



MSA 6.3mm^2

Sensitivity 73%
Specificity 85%
Accuracy 84%

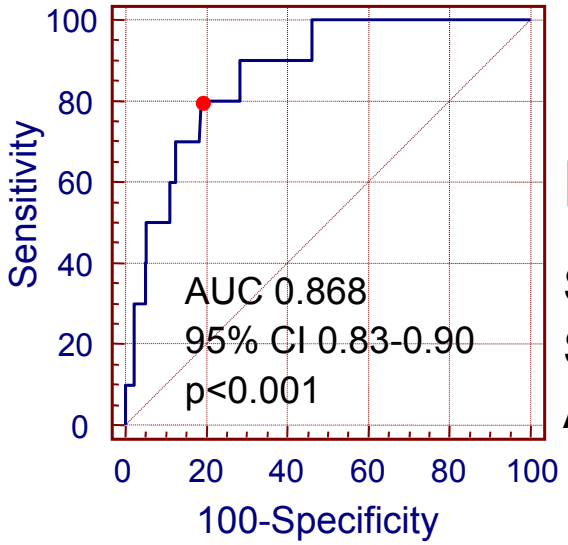
LCX ostium



MSA 5.0mm^2

Sensitivity 78%
Specificity 78%
Accuracy 78%

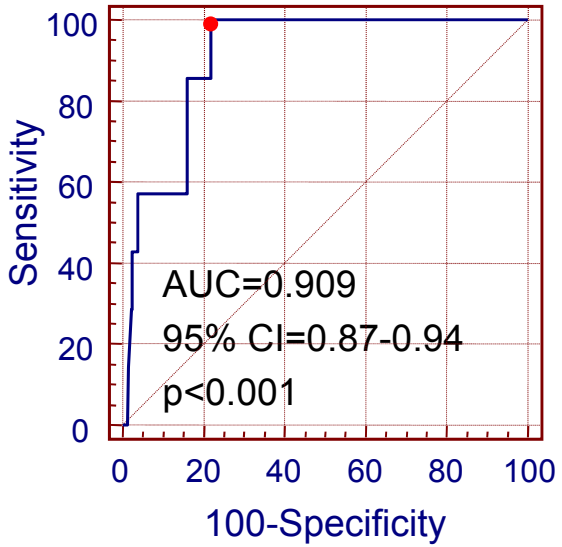
Proximal LM



MSA 8.2mm^2

Sensitivity 80%
Specificity 81%
Accuracy 81%

POC



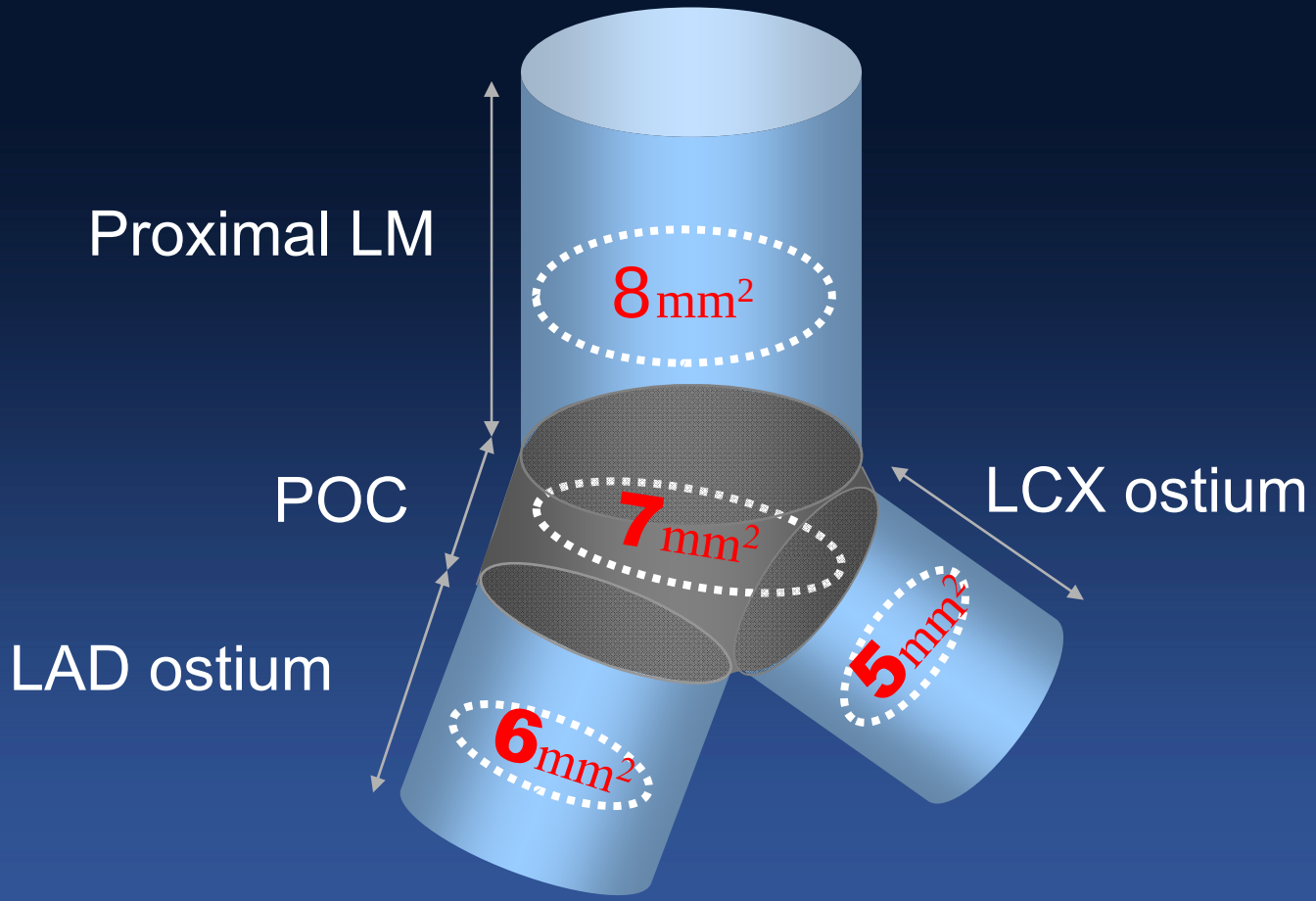
MSA 7.2mm^2

Sensitivity 100%
Specificity 78%
Accuracy 80%

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

Optimal MSA

on a segmental basis

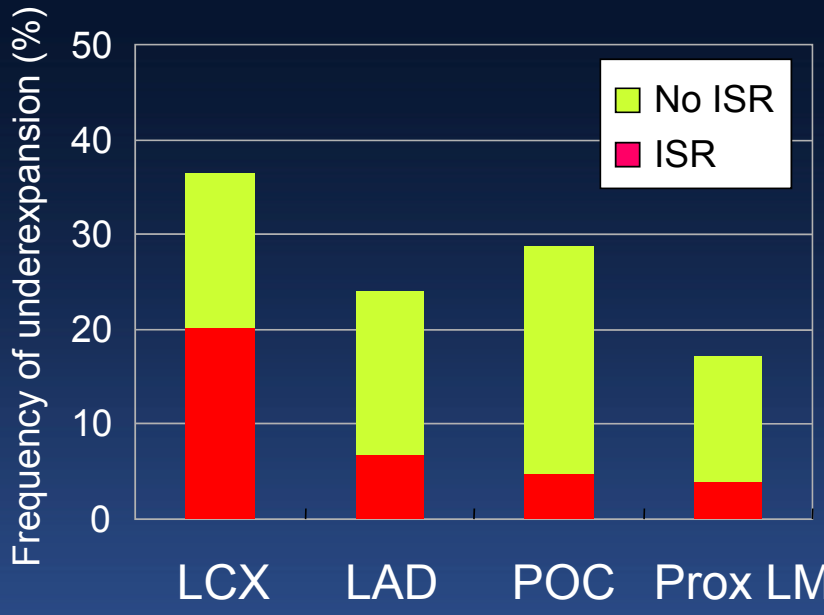


Kang et al. Circ Cardiovasc Interv 2011 2011;4:1168-74

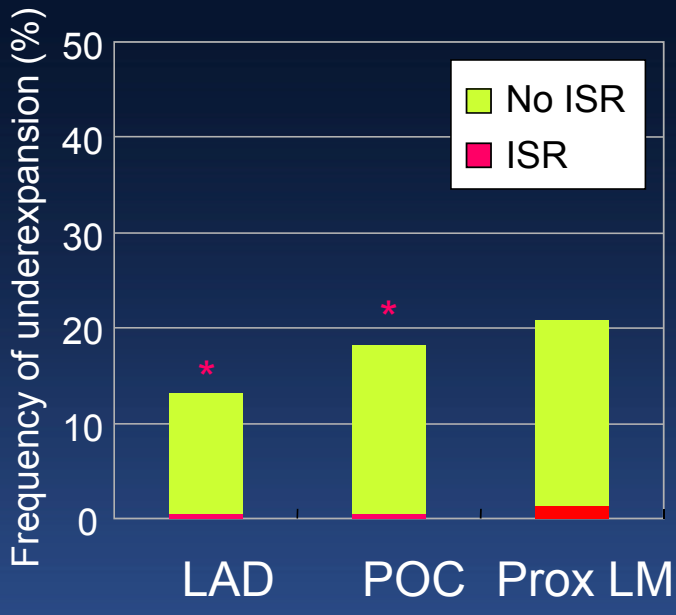
Frequency of Underexpansion and ISR

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

Two-stent



Single-stent

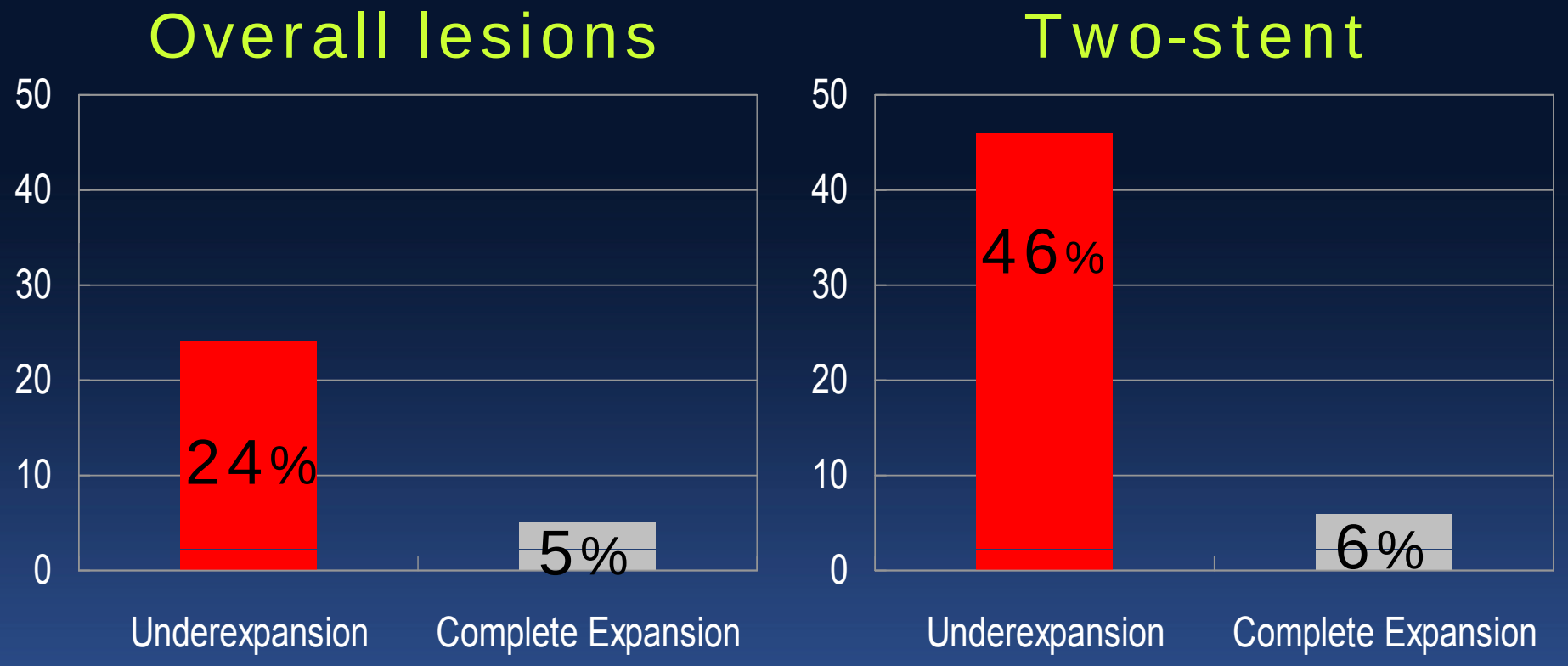


* *single-stent vs. two-stent, p<0.05*

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

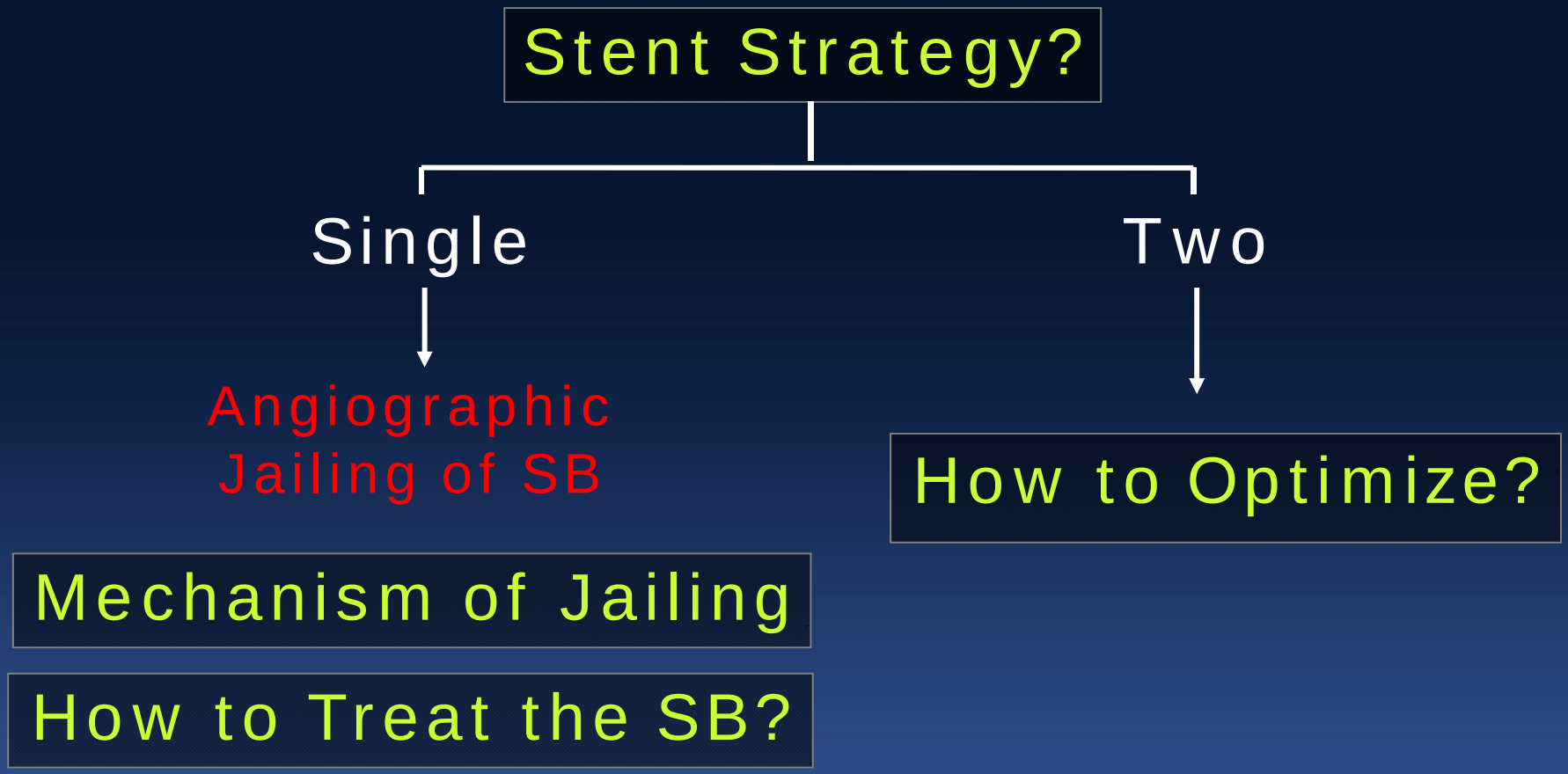
Bifurcations with Crush-stenting

- SB ostium was most frequent site of MSA in 68%
- Within MB, MSA was found in crush area in 56%

	MV	SB	P
MSA, mm^2	6.5±1.7	3.9±1.0	<0.001
MSA <4 mm^2	10%	55%	0.007
MSA <5 mm^2	20%	90%	<0.001

Costa et al. J Am Coll Cardiol 2005;46:599-605

Issues of Bifurcation PCI



IVUS optimization with MSA criteria 5-6-7-8 mm^2 for LM bifurcation may improve long-term clinical outcomes