

Pre- and Post-Stenting IVUS Assessment of Left Main Disease

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Disclosure

I have nothing to disclose

Pre- and Post-PCI Assessment Left Main Bifurcation

- Pre-PCI "LM Stenosis Severity"
Anatomical vs. Functional Severity
- How to Assess SB Ostium Pre-PCI?
- Assessment of SB Compromise

- Treatment strategy (deferral vs. revascularization) should be based on “**Functional significance**”

Author	Comparison	Results	p
Lindstaedt ¹	CABG (FFR<0.75) vs. Medical (≥0.80)	4-year Survival 81% vs. 100% MACE-free 66% vs. 69%	NS
Jasti ²	CABG (FFR<0.75) vs. Medical (≥0.75)	38-month Survival 100% vs. 100% MACE-free 100% vs. 90%	NS
Courtis ³	Revasc (FFR<0.75) vs. Medical (≥0.80)	14-month MACE 7% vs. 13%	NS
Bech ⁴	Revasc (FFR<0.75) vs. Medical (≥0.75)	29-month Survival 100% vs. 97% MACE-free 83% vs. 76%	NS
Hamilos ⁵	CABG (FFR<0.80) vs. Medical (≥0.80)	5-year Survival 85% vs. 90% MACE-free 74% vs. 82%	NS

¹Am Heart J 2006;152:156, ²Circulation 2004;110:2831-6, ³Am J Cardiol 2009;103:943-9

⁴Heart 2001;86:547-52, ⁵Circulation 2009;120:1505-12

IVUS Criteria

To identify Functionally Significant LM Stenosis

MLA < 6.0mm² Predicts LM FFR<0.75

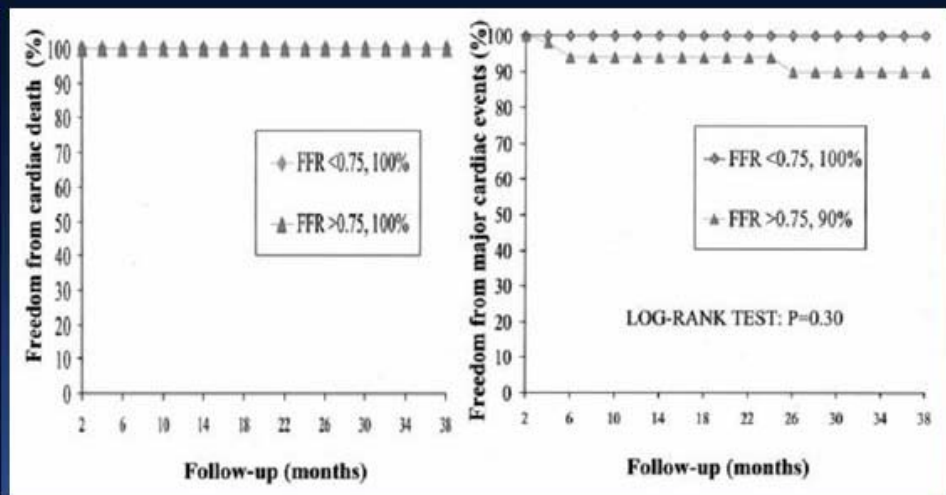
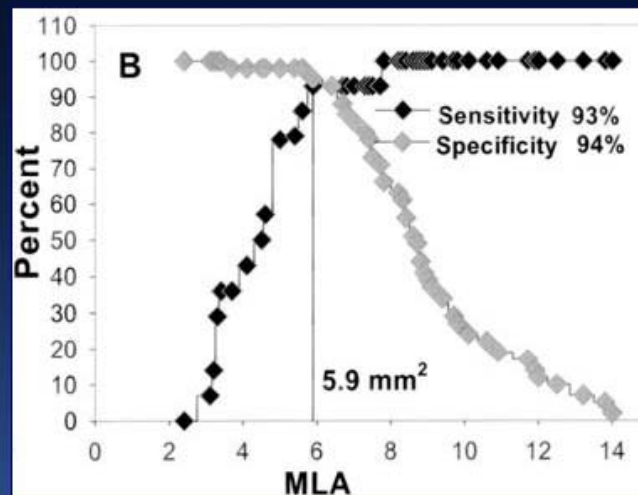
- Sum of lumen areas of two daughter vessels (Each of LAD and LCX should be 4.0mm²)= 150% of the parent LM
- Murray's Law ($LM\ r^3 = LAD\ r^3 + LCX\ r^3$)

Jasti¹

Fassa²

Fassa²

Abizaid³



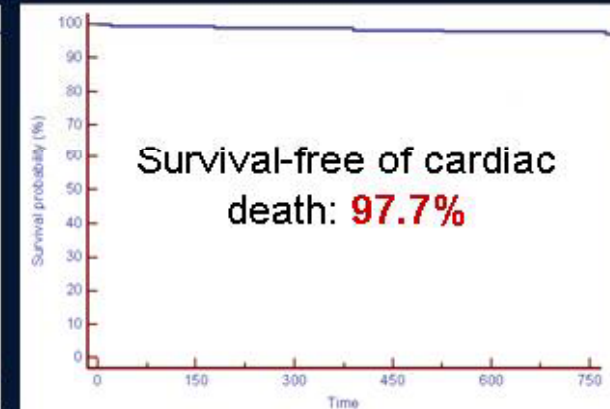
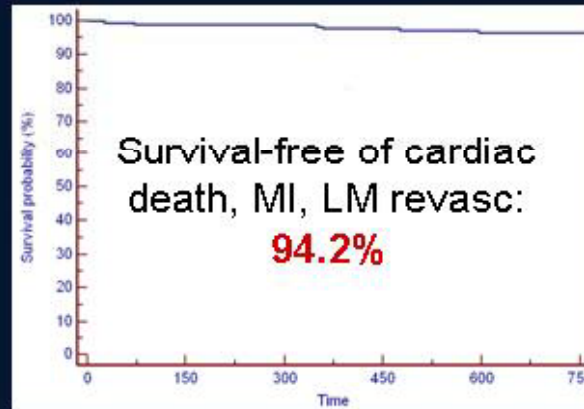
Jasti et al. Circulation 2004;110:2831-6

¹Circu

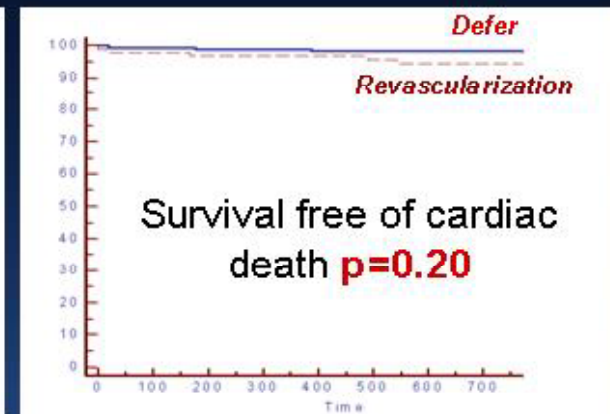
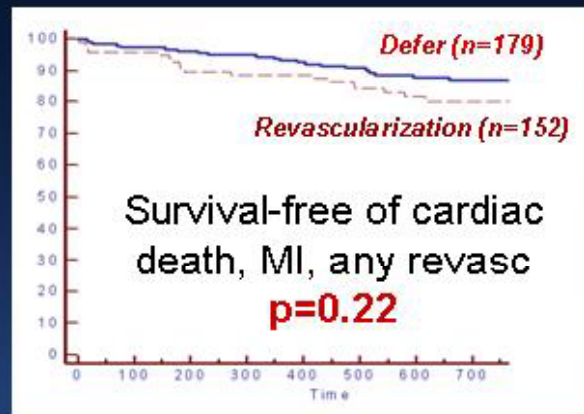
LITRO Study

Prospective application of predefined IVUS criteria for revascularization of intermediate LM lesions:

2-Year Outcome of Deferred Lesions with $MLA > 6mm^2$



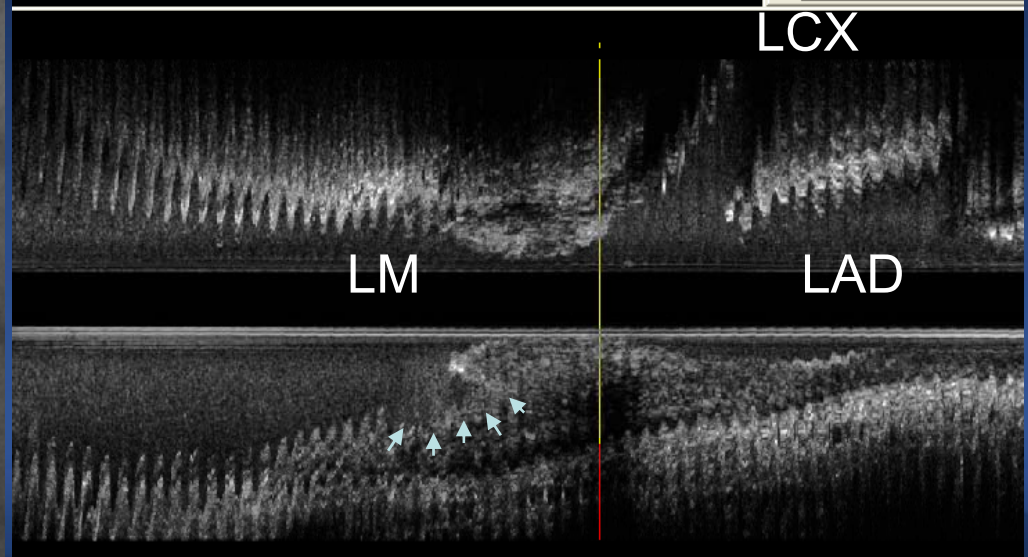
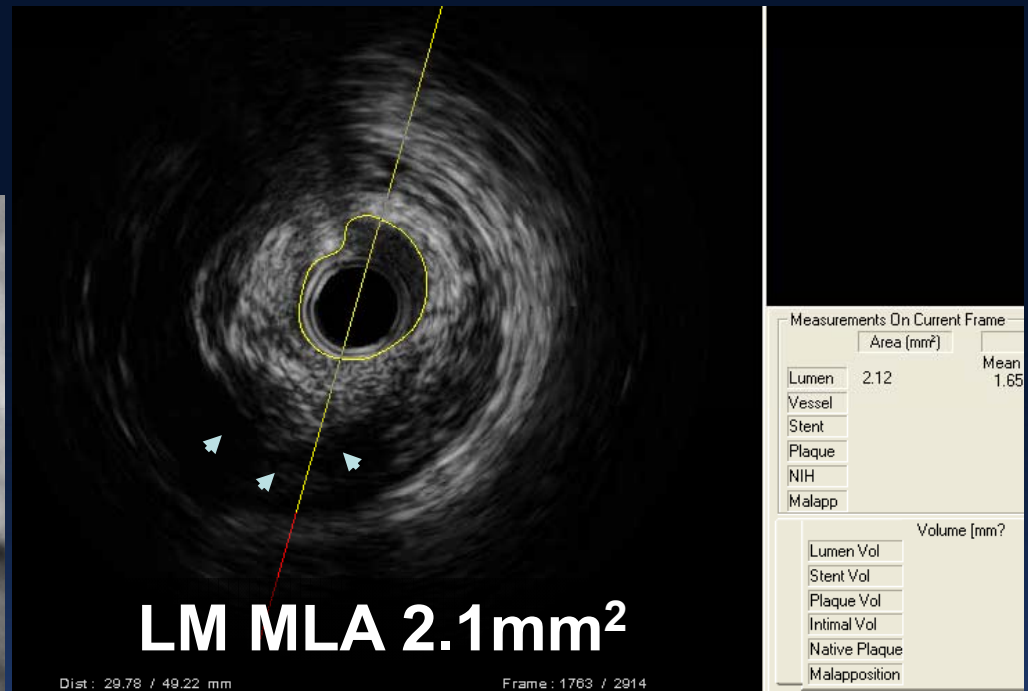
2-Year Outcome of Deferred vs. Revasc



An $MLA \geq 6mm^2$ is a safe value for deferral

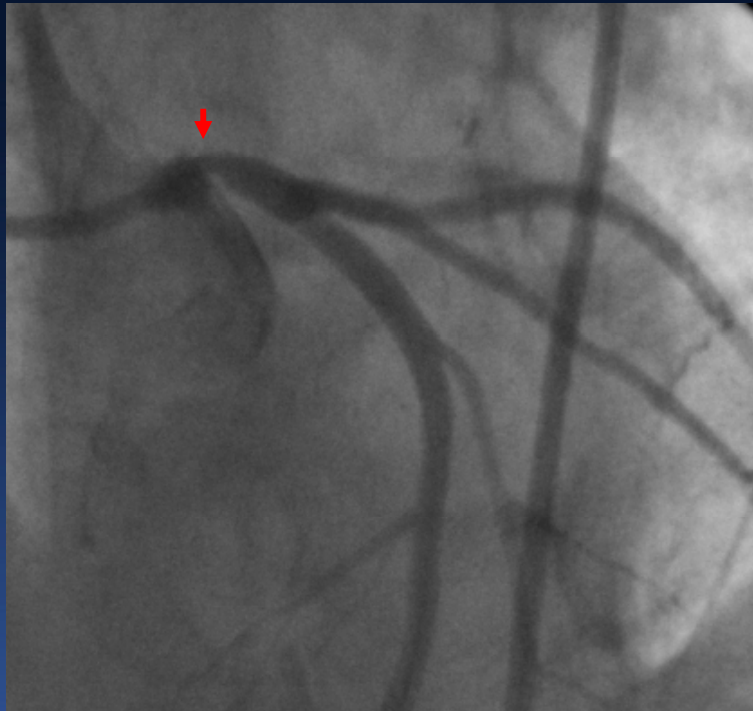
QCA \neq IVUS = FFR

55 Year-Old Male
Unstable Angina

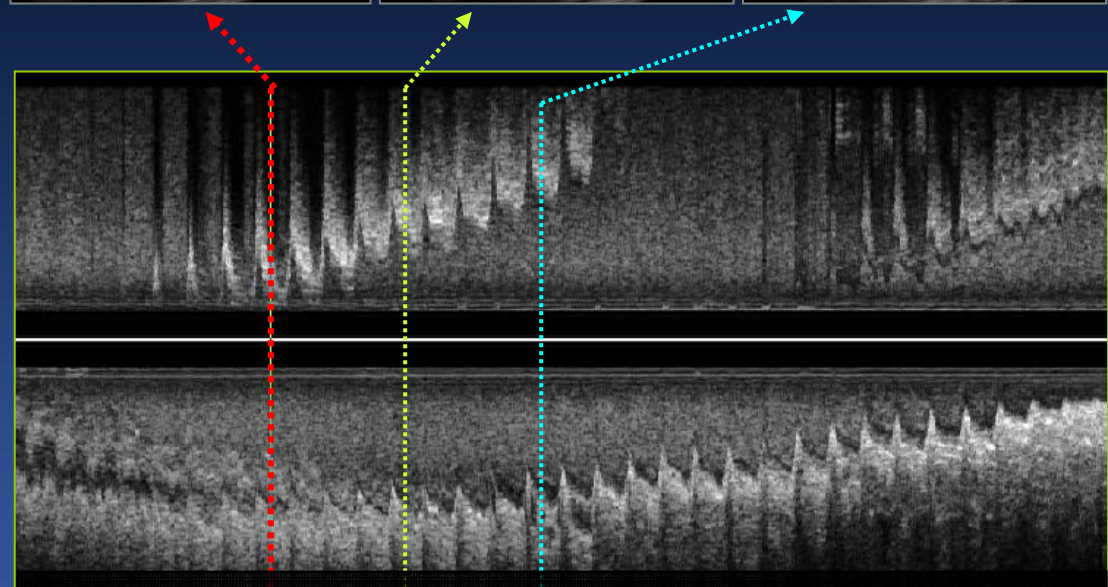
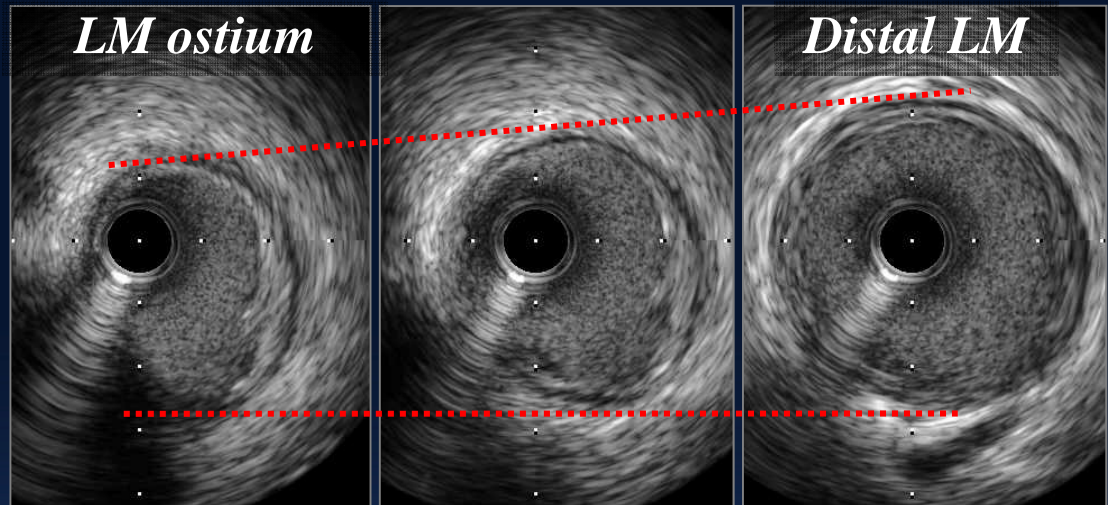


QCA \neq IVUS = FFR

61 / Male
Stable angina



LM FFR=0.80
Thallium – Normal

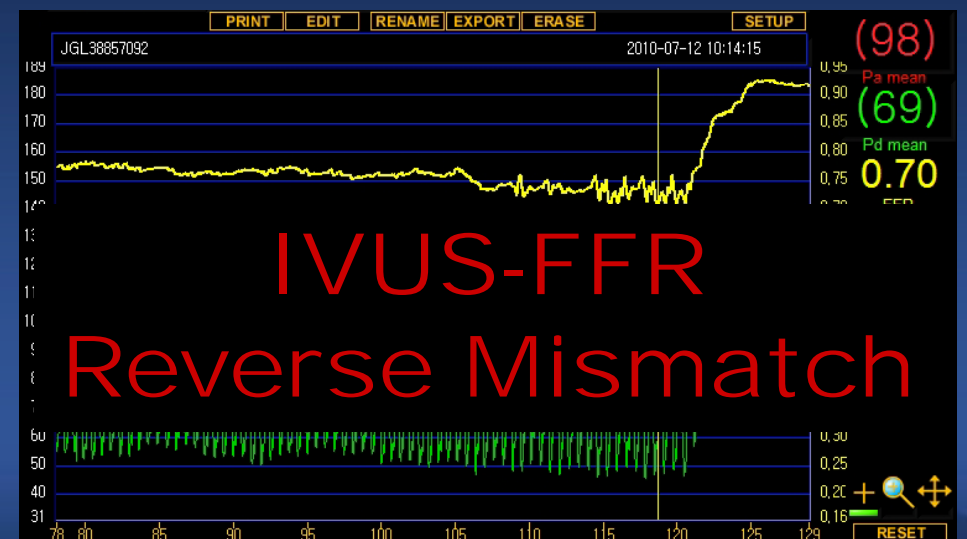
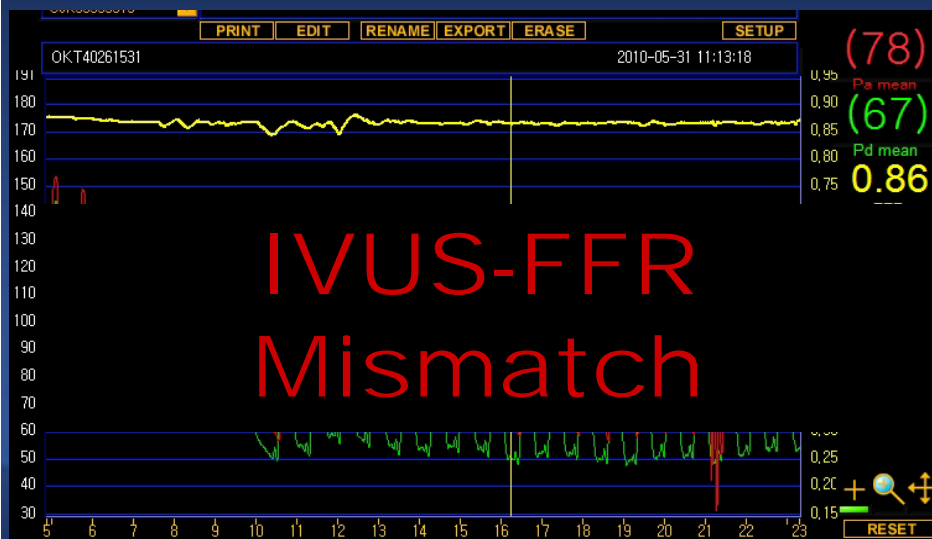
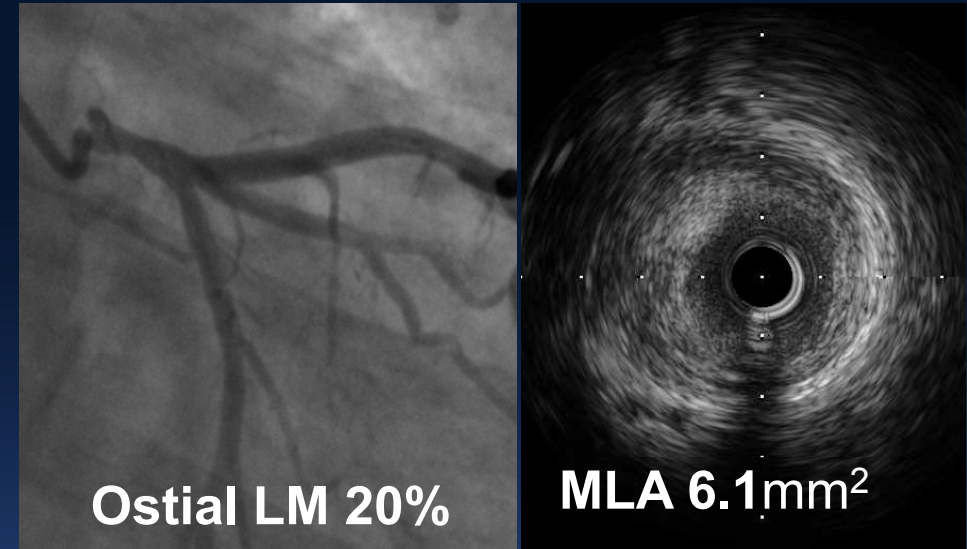
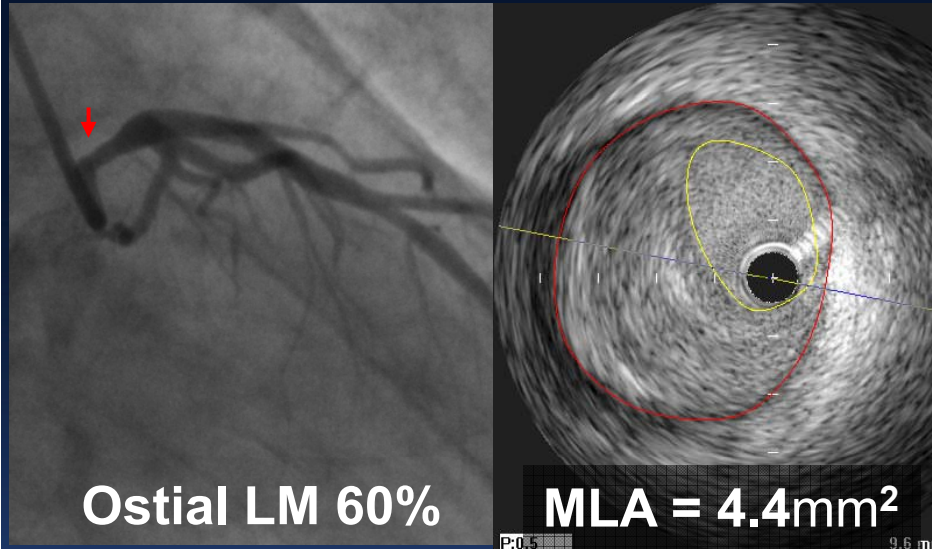


Negative remodeling at LM ostium
MLA= 6.5 mm²

QCA = IVUS \neq FFR

47/M Stable angina

50/M Stable angina



Pitfalls of LM FFR

- Combined LAD/LCX stenosis is so common, which may increase the LM FFR
- The influence of SB lesion on LM FFR will depend on severity of distal stenosis, even more, on the vascular territory supplied by the distal lesion

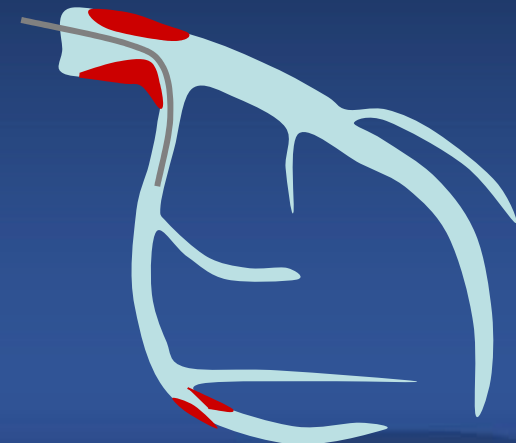
True LM FFR



LM FFR ↑↑



LM FFR ↑

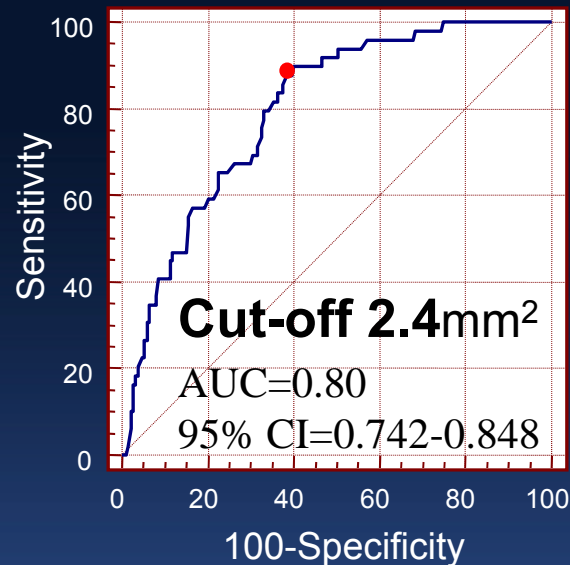


Bruyne et al. Heart 2008;94:949-59

IVUS-MLA Predicting LM FFR < 0.80

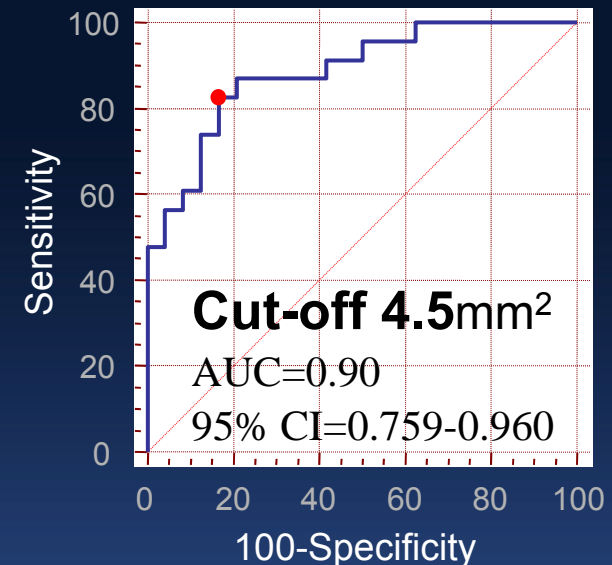
Pure LM lesion of DS 30-80%, exclude distal stream disease

Non-LM



Sensitivity=90%
Specificity=60%
PPV=37%

Pure LM Disease

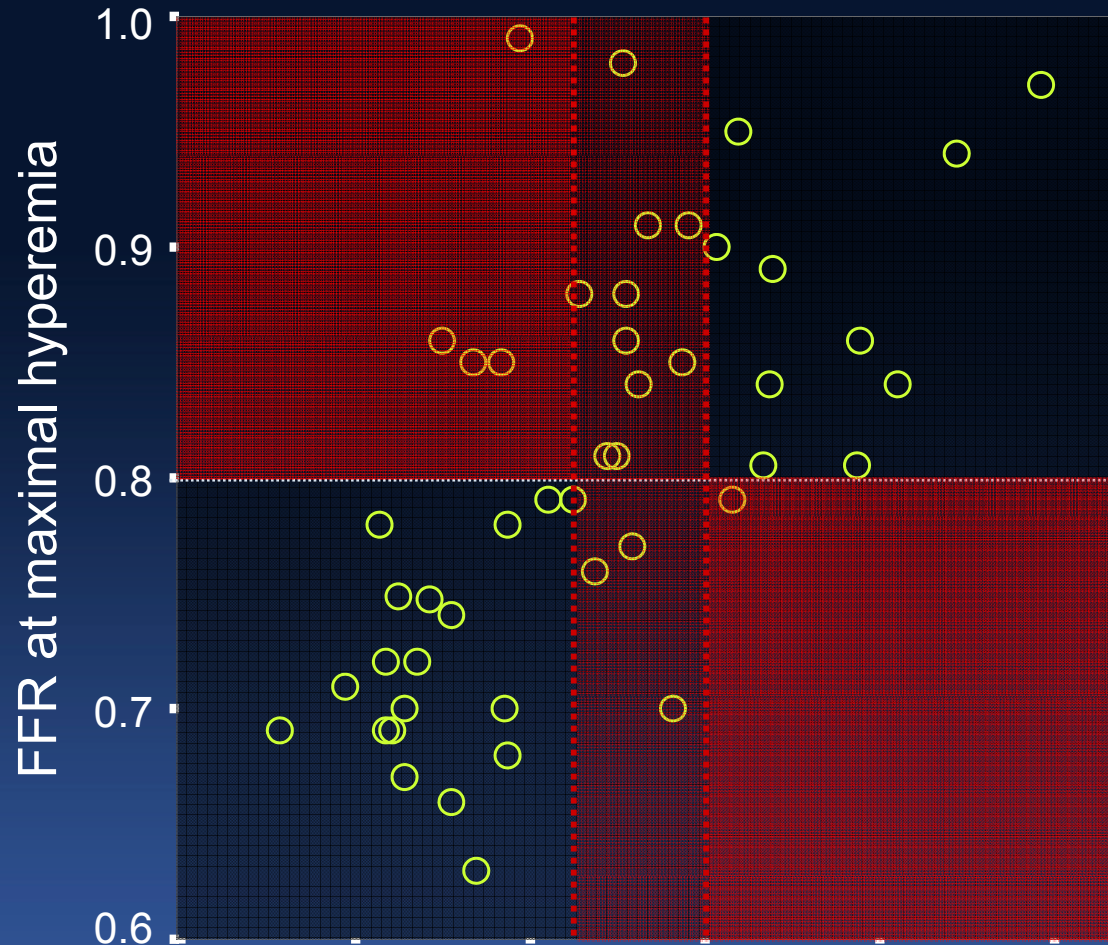


Sensitivity 83%
Specificity 83%
PPV 83%

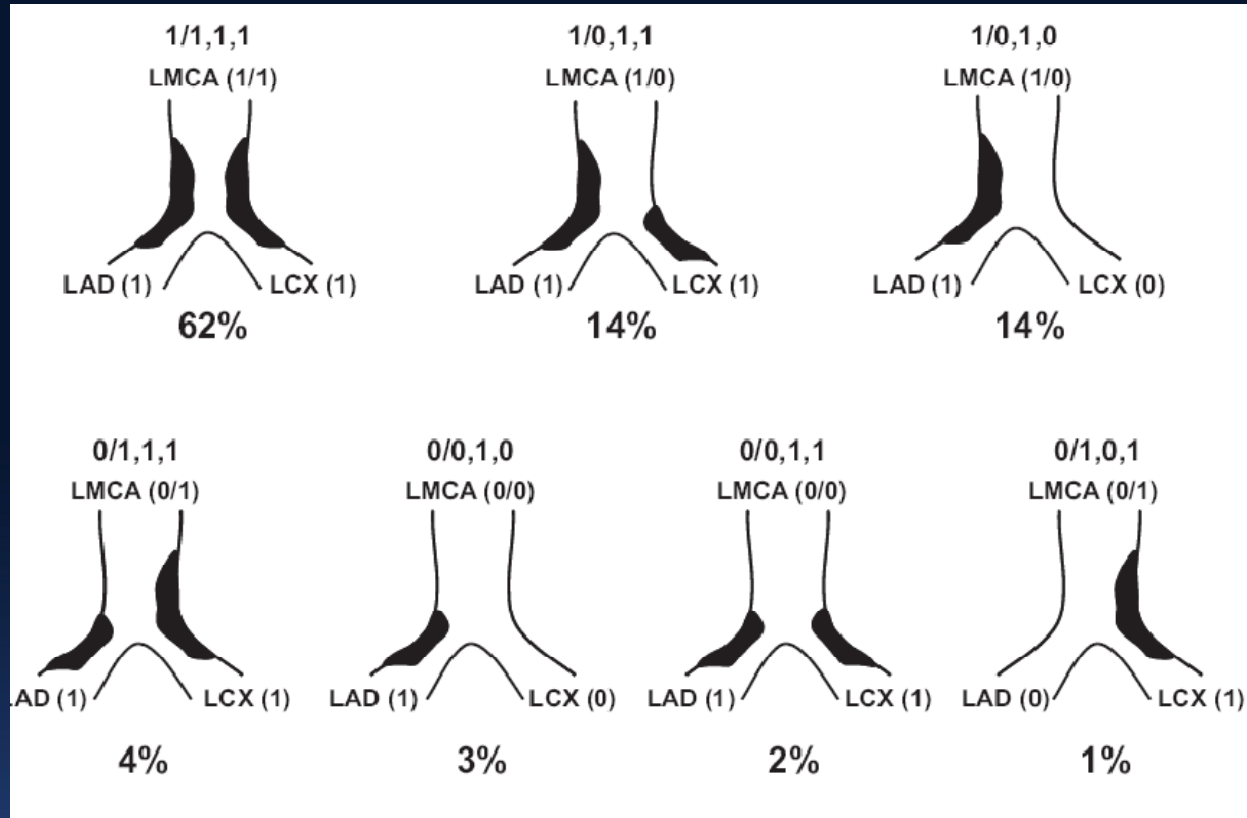
Morphologic Simplicity of Pure LM Lesion

uniformly large vessel, short lesion length, lack of sidebranch

MLA-FFR Mismatch in 32%



With a lower specificity, 60% of patients may undergo unnecessary revascularization procedure

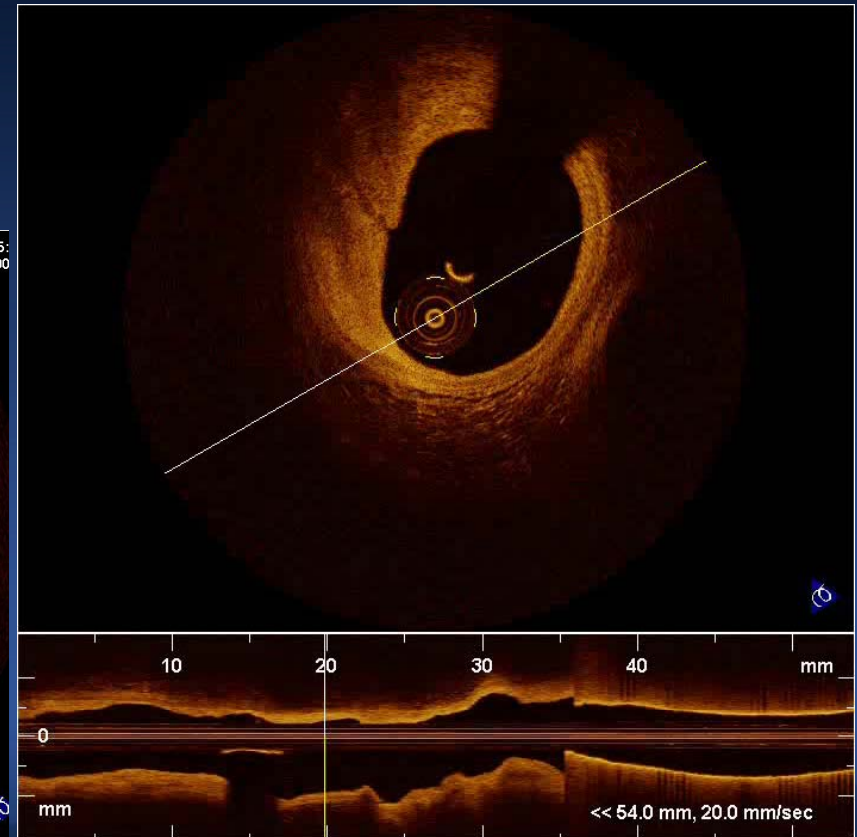
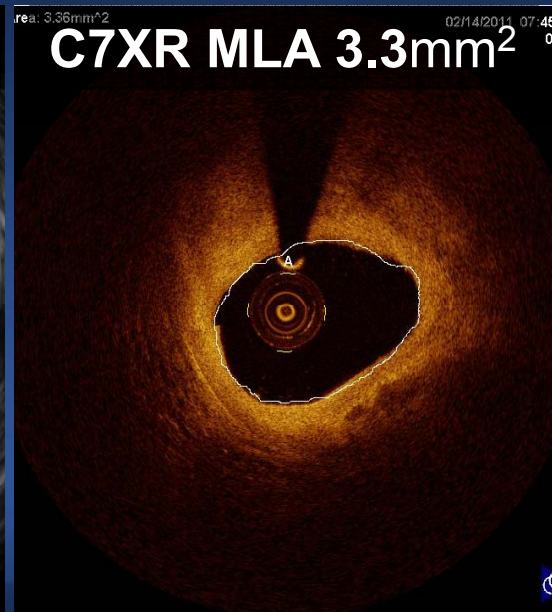
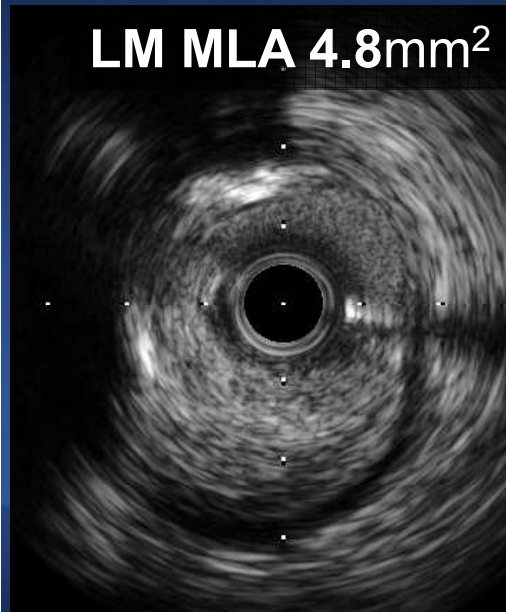
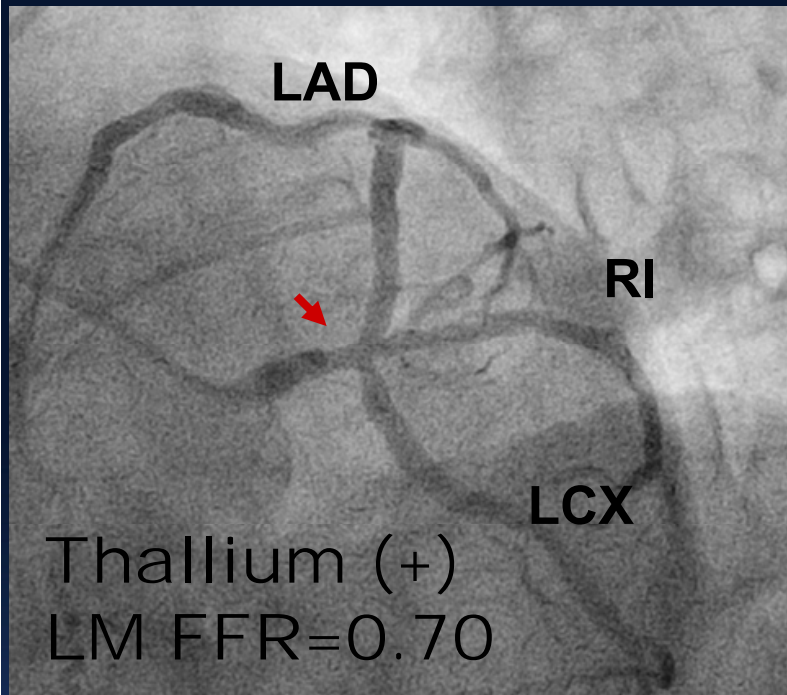


Oviedo et al. Circ Cardiovasc Interv 2010;3:105-12

MLA criteria in isolated LM disease cannot be applied to all LM bifurcations. It suggests functional impact of **LM MLA**, were it not for the distal stream disease or if the distal stenosis were fixed

2nd Generation OCT in Distal LM Disease

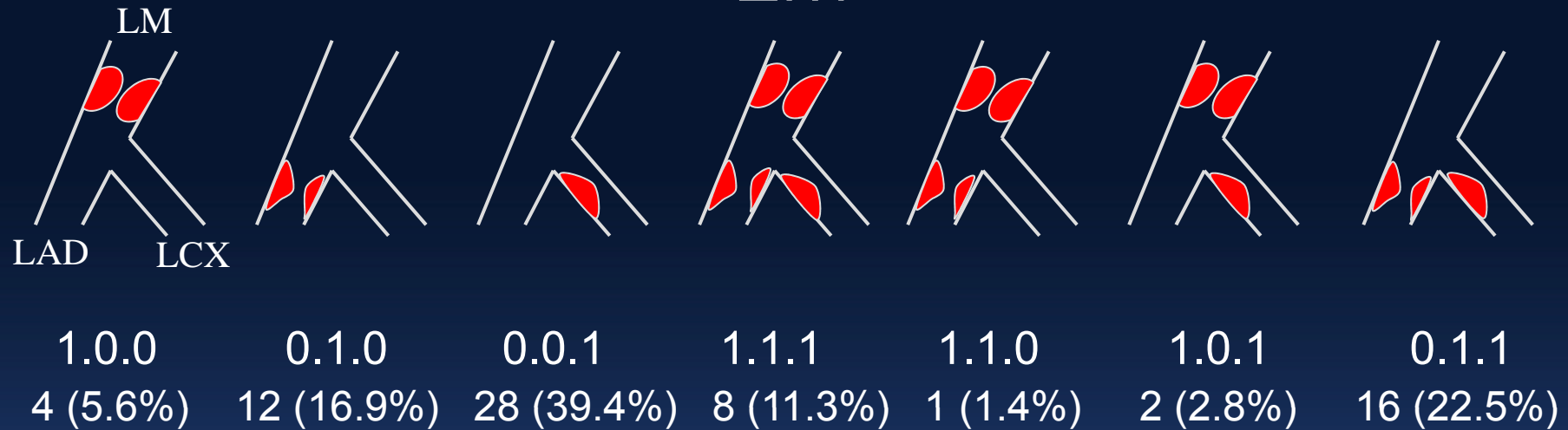
Better Resolution
More Meticulous



Pre- and Post-PCI Assessment Left Main Bifurcation

- Pre-PCI “LM Stenosis Severity”
Anatomical vs. Functional Severity
- **How to Assess SB Ostium Pre-PCI?**
- Assessment of SB Compromise

Common Site of Restenosis in Distal LM

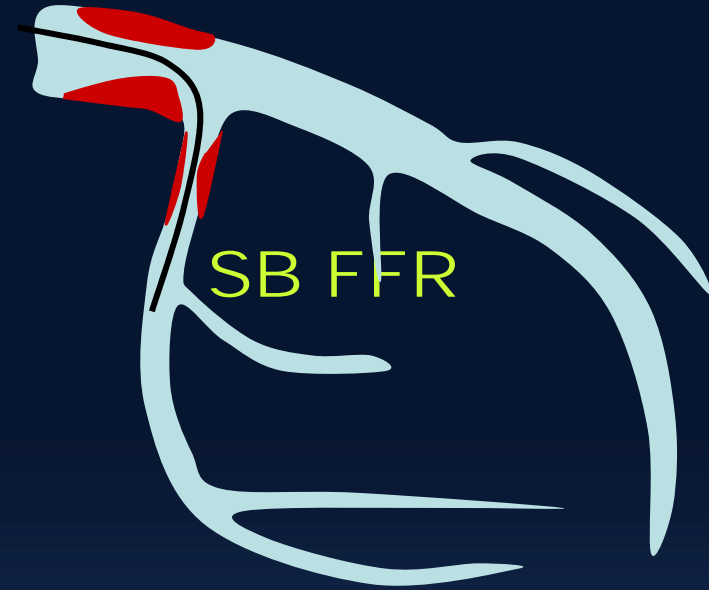


LM (main vessel)	15 (21%)
LAD Ostium	37 (52%)
LCX Ostium	54 (76%)

Treatment strategy of LM bifurcation depends on disease severity of side branch ostium

Park et al. TCT 2010

Use of Pre-PCI SB IVUS vs. SB FFR in LM Bifurcation



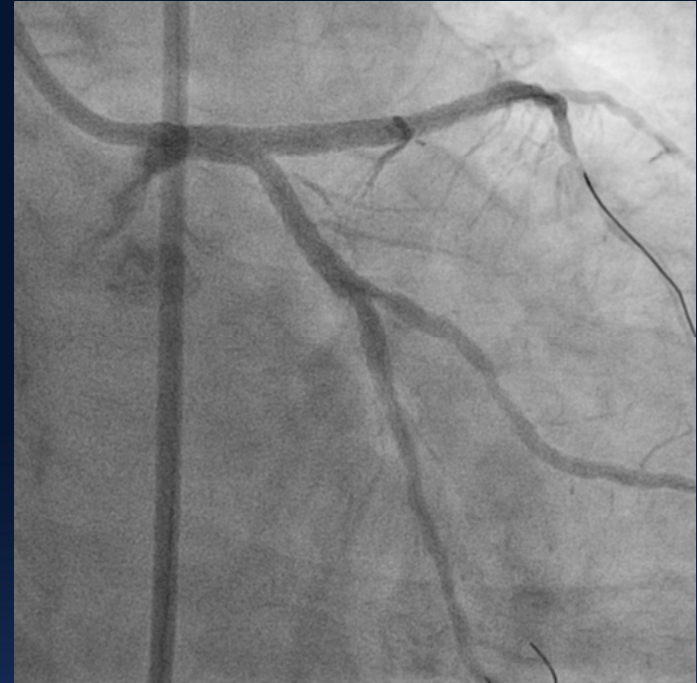
	SB-IVUS	SB FFR
Advantage	<ul style="list-style-type: none"> useful to assess the anatomical severity MLA, PB, remodeling 	<ul style="list-style-type: none"> functional significance in isolated SB stenosis, not in true bifurcation lesions
Pitfalls	<ul style="list-style-type: none"> MLA-FFR mismatch No MLA criteria of SB Low feasibility 	<ul style="list-style-type: none"> Affected by proximal or distal stenosis After MB stenting, SB geometry usually changed



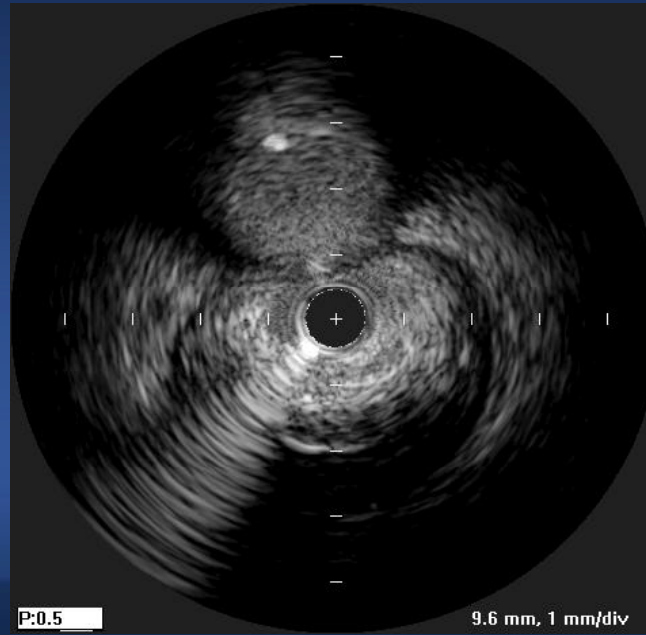
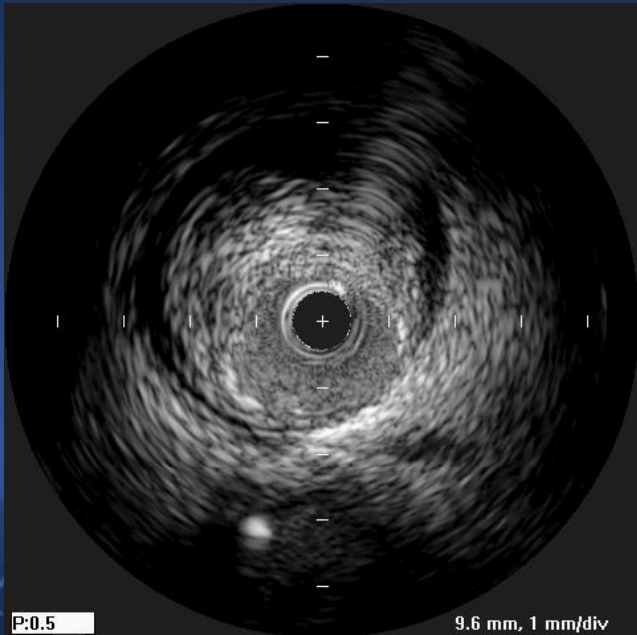
LCX pullback



**Two Xience
Mini-Crush**



LAD pullback





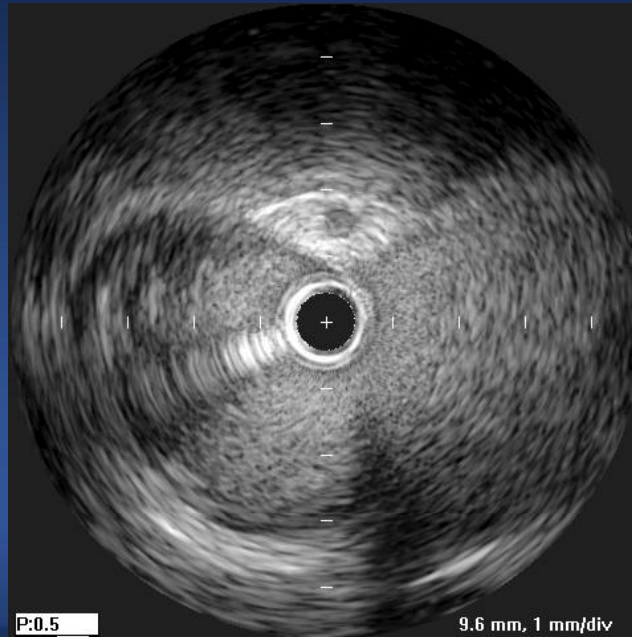
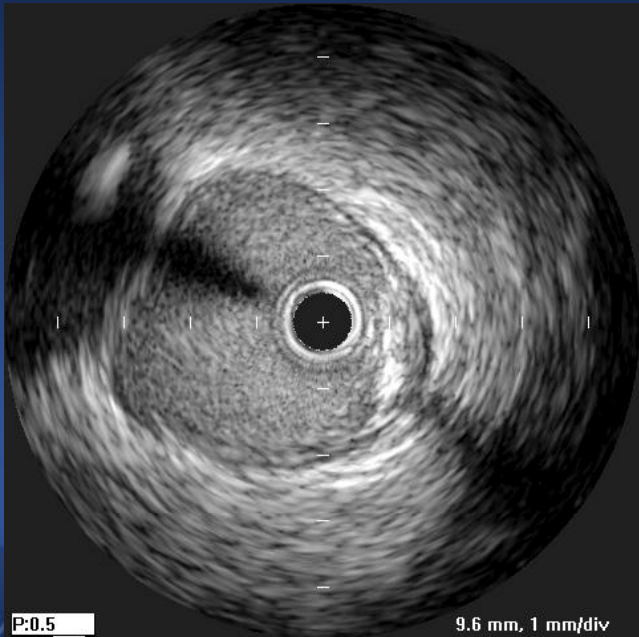
LCX pullback



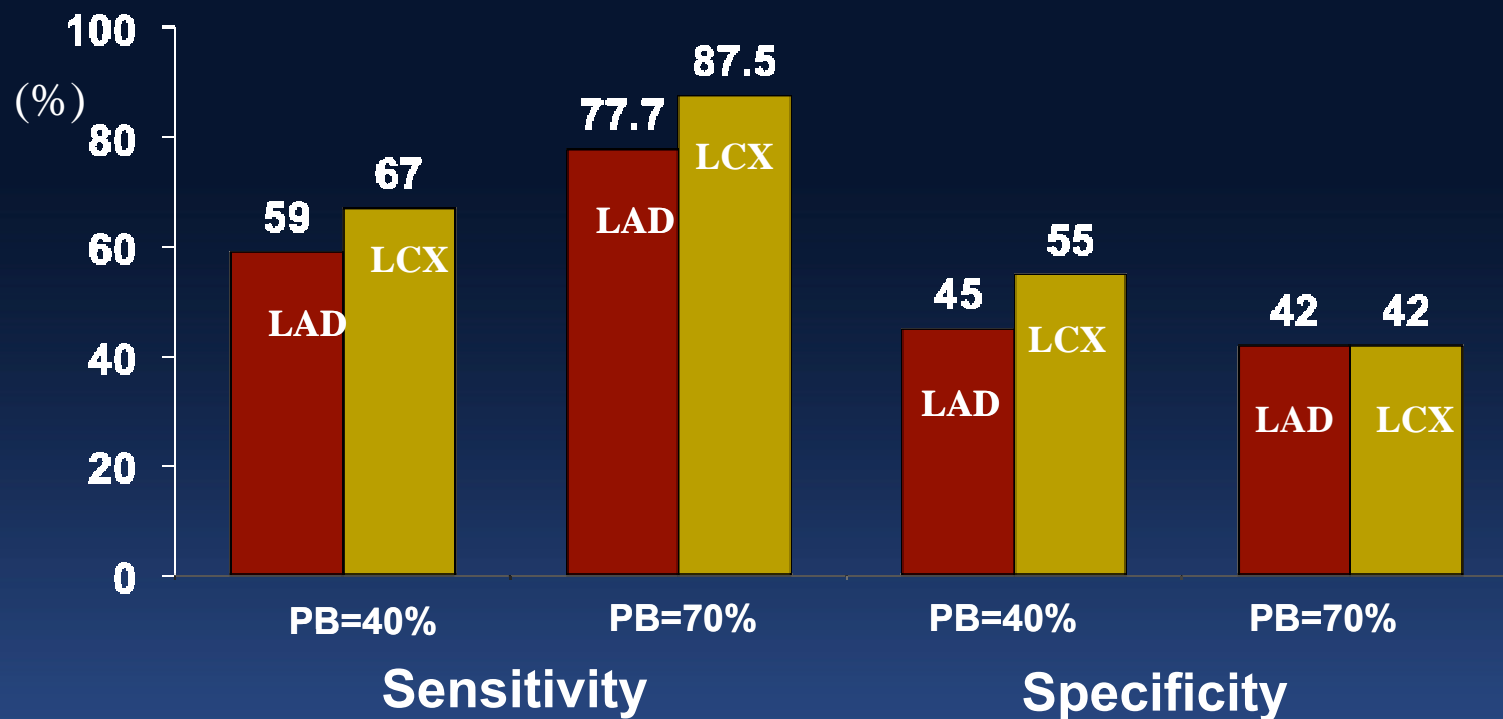
**Single stent
Cross-over**



LAD pullback



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



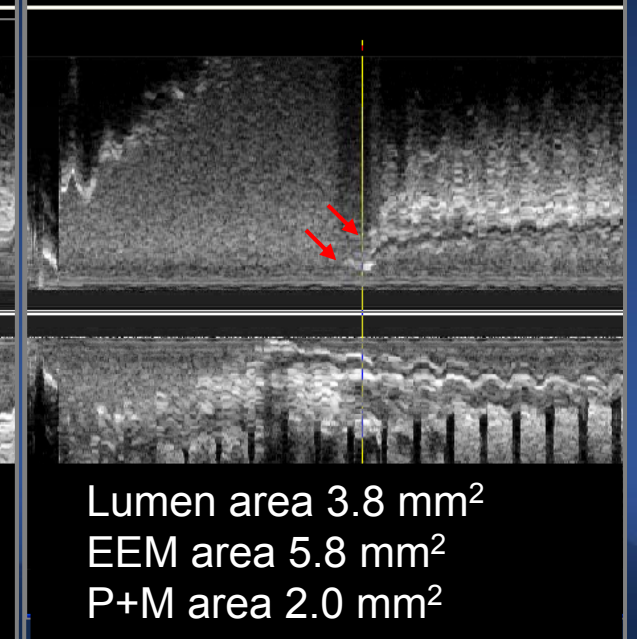
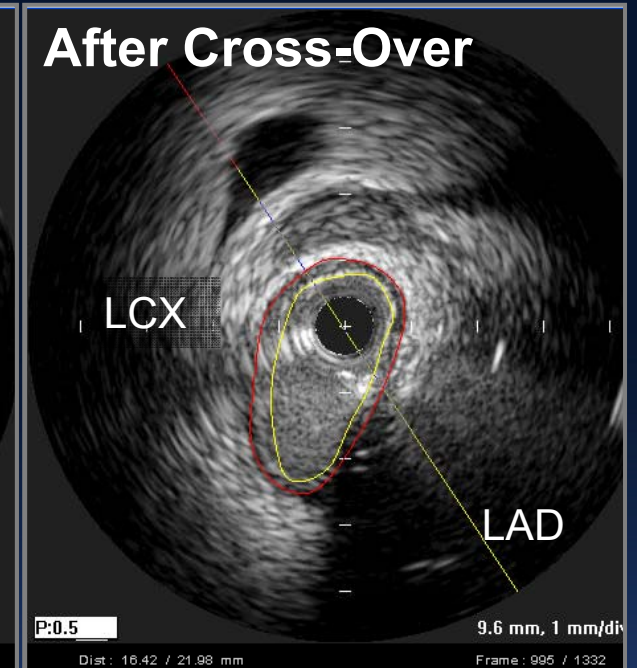
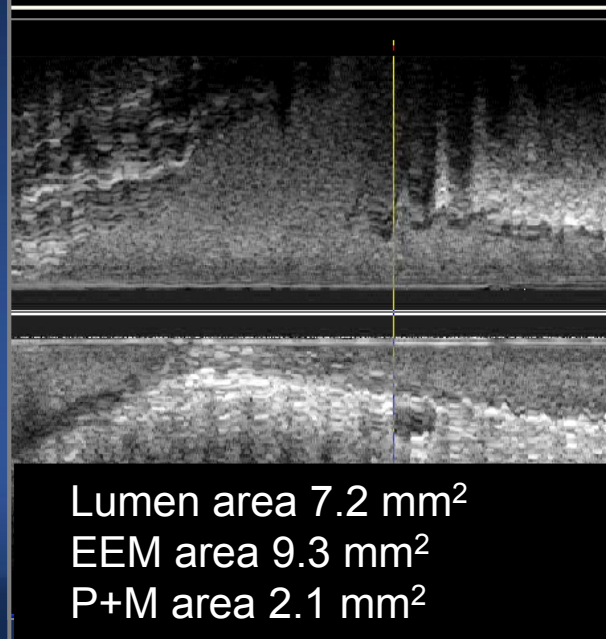
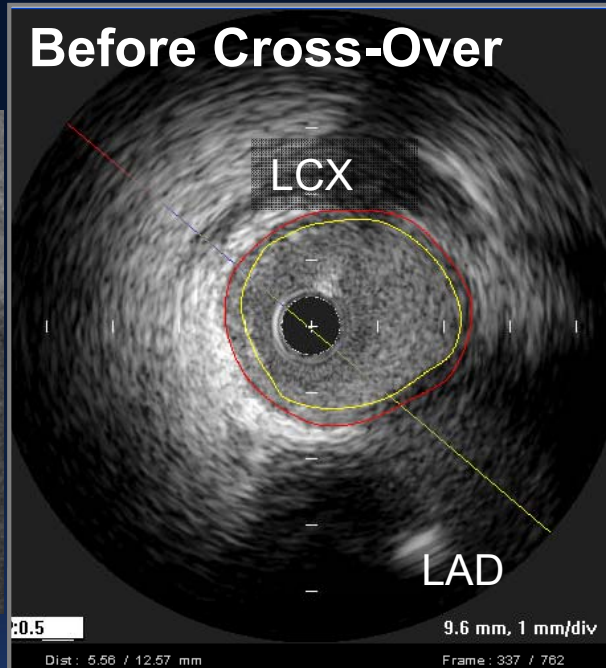
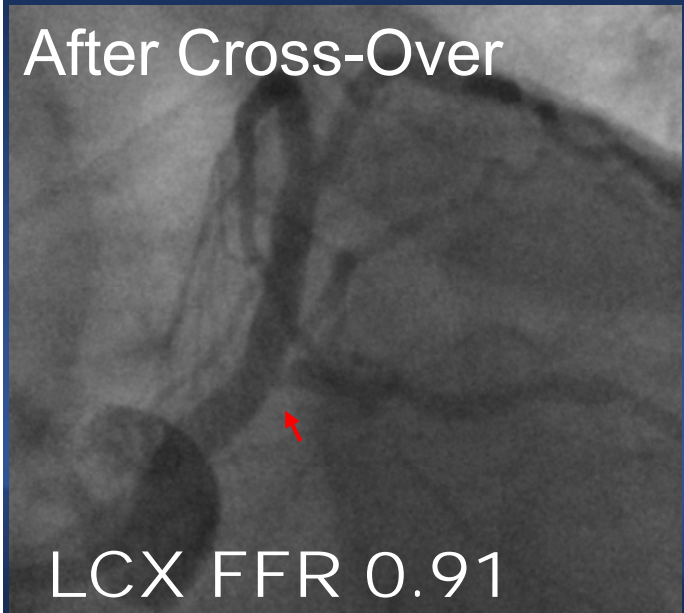
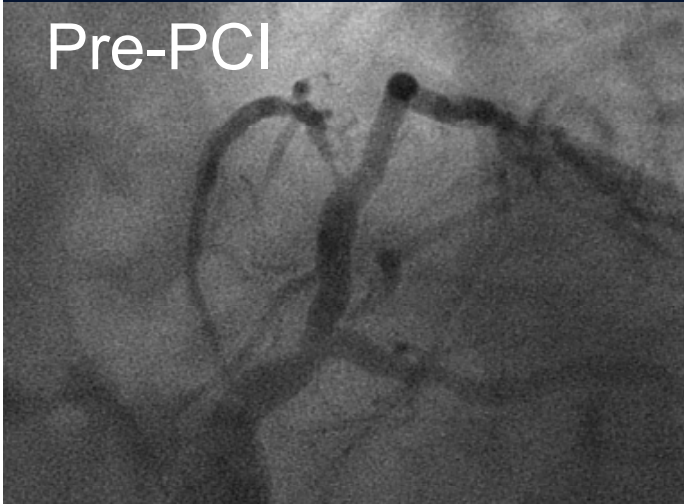
LCX-pullback were available only in 50% pre-stenting and 40% post-stenting due to technical difficulty, which may be realistic in clinical practice

Pre- and Post-PCI Assessment Left Main Bifurcation

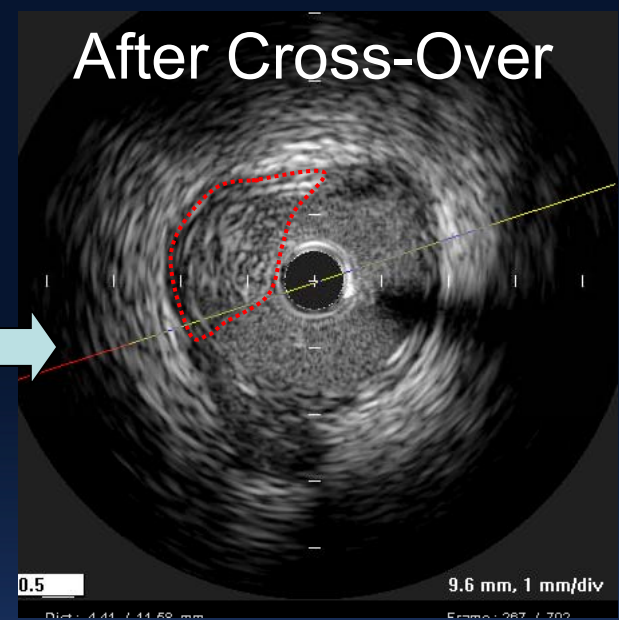
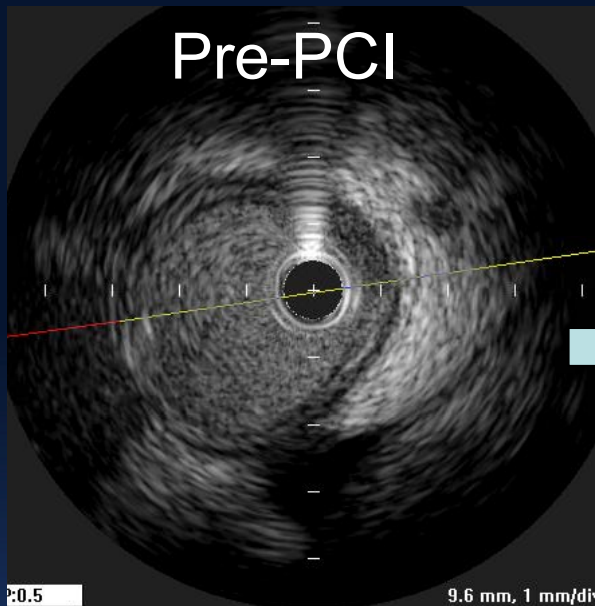
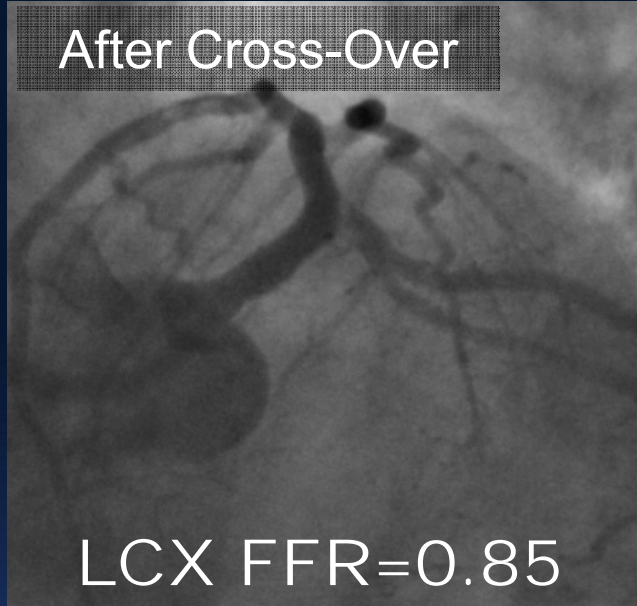
- Pre-PCI “LM Stenosis Severity”
Anatomical vs. Functional Severity
- How to Assess SB Ostium Pre-PCI?
- **Assessment of SB Compromise**

Mechanism of Angiographic Jailing of SB

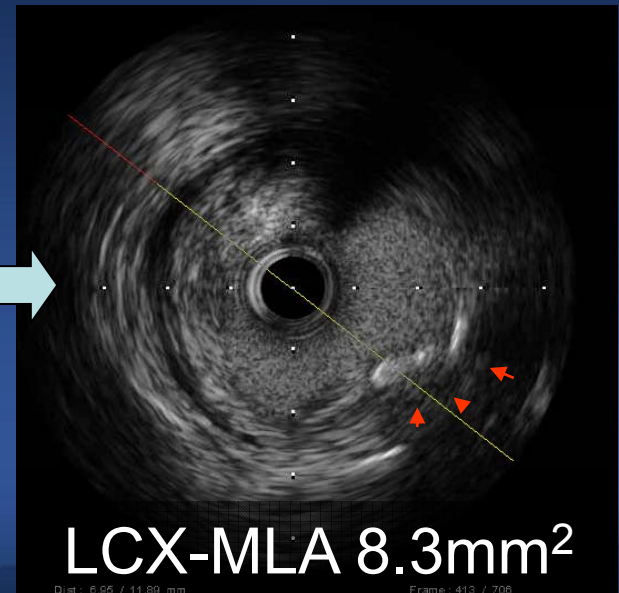
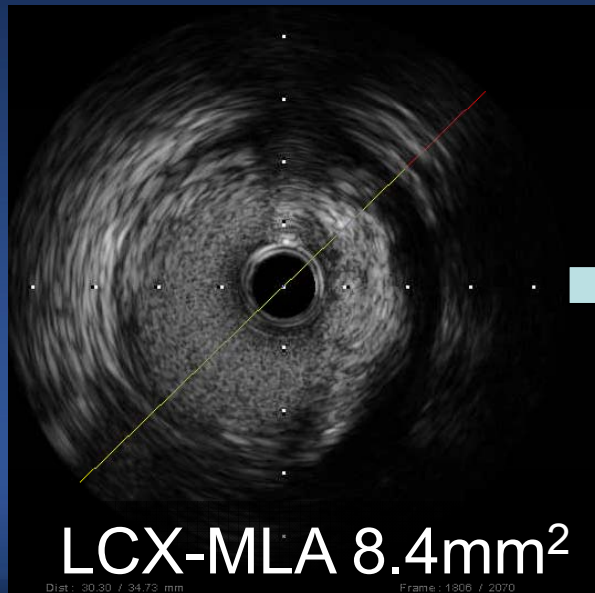
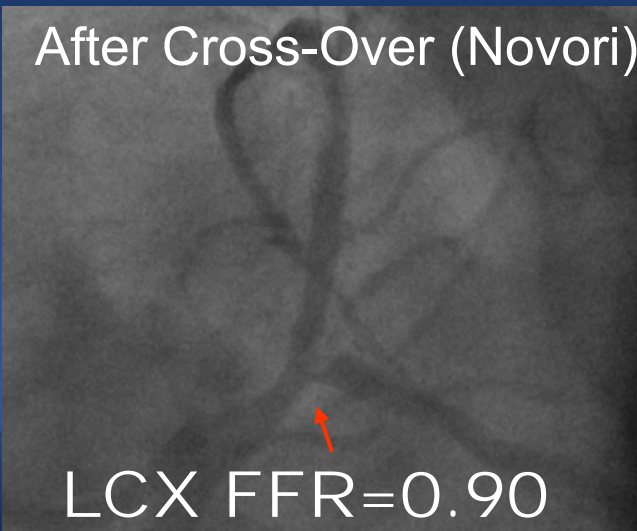
Carina Shift



Plaque Redistribution



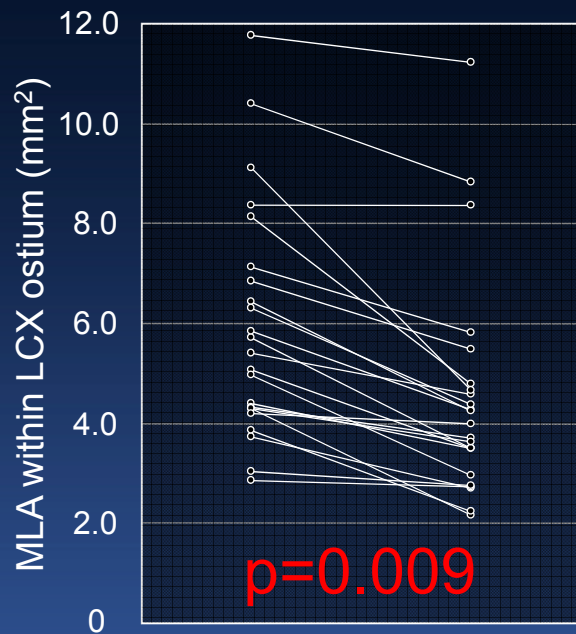
Strut Artifact



Changes in LCX Ostial Geometry After a Single Stent Cross-over

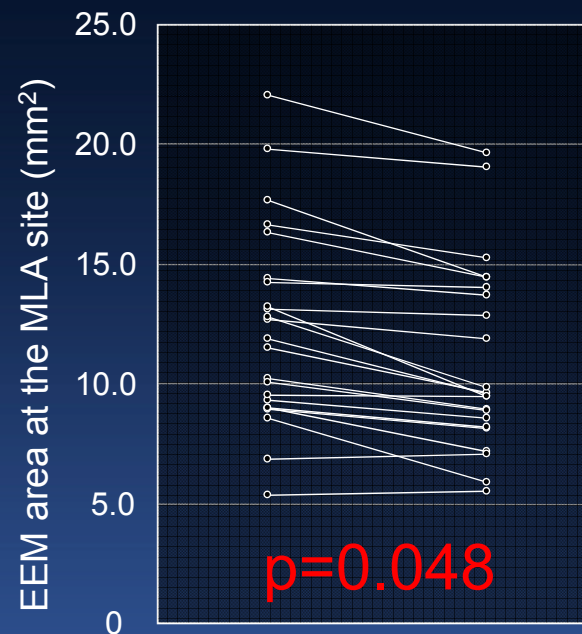
MLA within LCX ostium

5.4mm²→4.0mm²



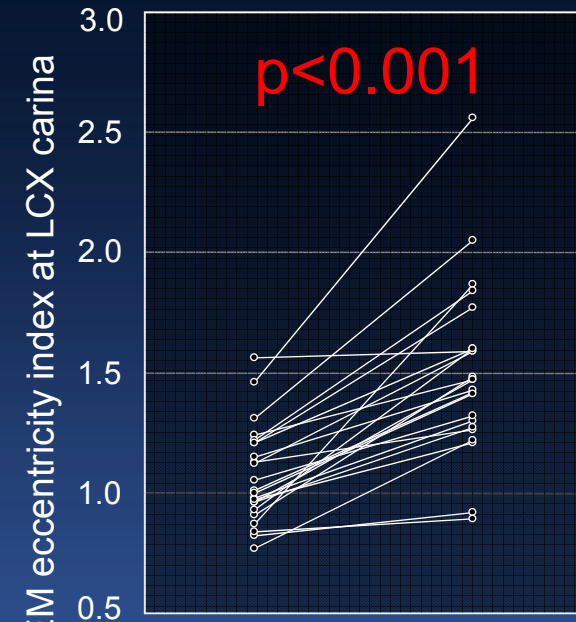
EEM area at MLA

11.8mm²→9.6mm²



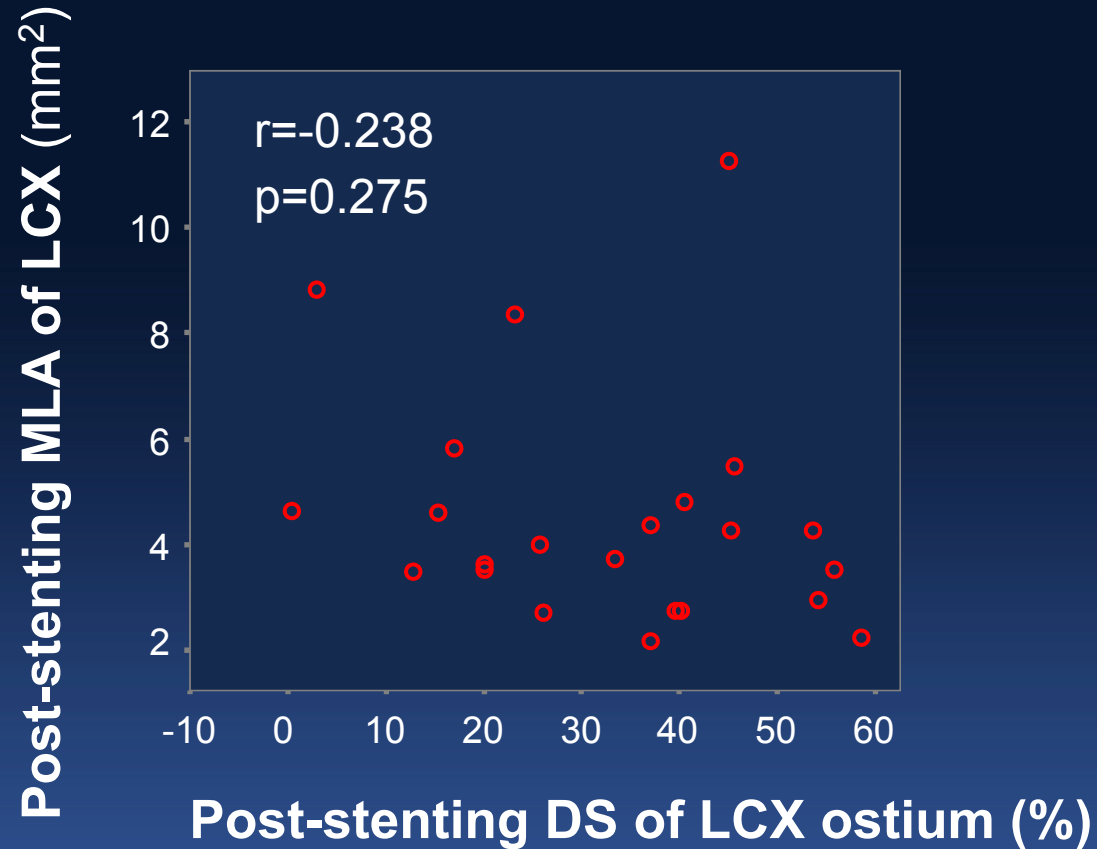
EEM eccentricity

1.22→1.47



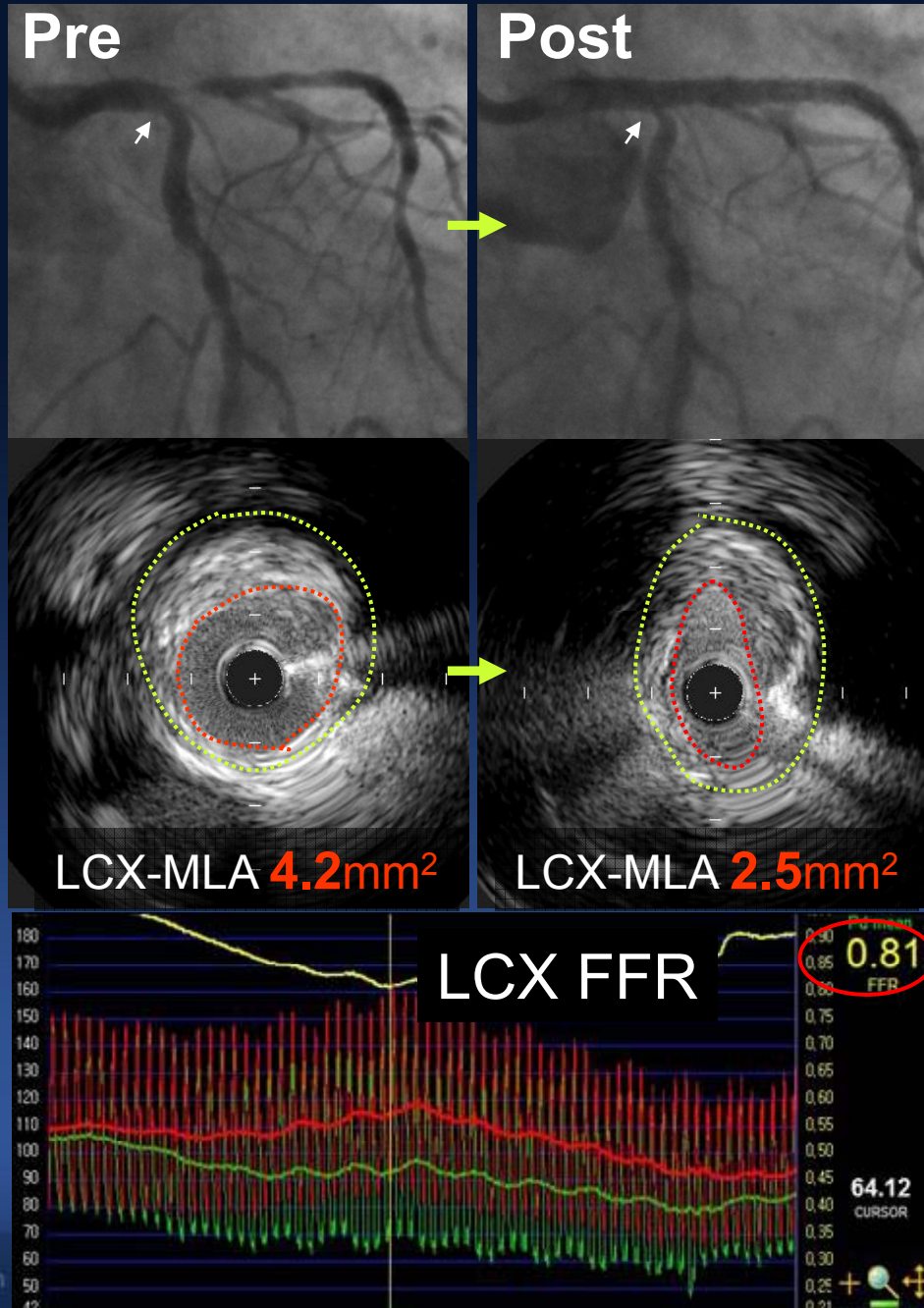
In a minority, plaque redistribution may be superimposed on carina shift to contribute to the further lumen loss at the ostial LCX

QCA-DS vs. IVUS-MLA after LM Cross-over



Kang et al. Circ Cardiovasc Interv 2011 Accepted

QCA = IVUS \neq FFR



Use of IVUS vs. FFR After LM Cross-over

	SB-pullback IVUS	SB FFR
Advantage	<ul style="list-style-type: none">■ Confirm the anatomical compromise and MLA loss■ Mechanism of SB jailing	<ul style="list-style-type: none">■ Confirm the functional SB compromise
Pitfalls	<ul style="list-style-type: none">■ MLA-FFR mismatch■ No MLA criteria■ Low feasibility	<ul style="list-style-type: none">■ Minority - not feasible

Summary

- MLA is an anatomical factor reflecting functional significance of stenosis, but cannot replace LM FFR
- IVUS provides precise mechanism of SB compromise
- *Anatomical* compromise may “*not always*” reflect *functional* compromise. Thus, functional significance should be evaluated by SB FFR post-stenting
- IVUS-FFR play a complementary role in making a decision for initial treatment strategy and optimize PCI