

How to Utilize Invasive Imaging in Left Main PCI

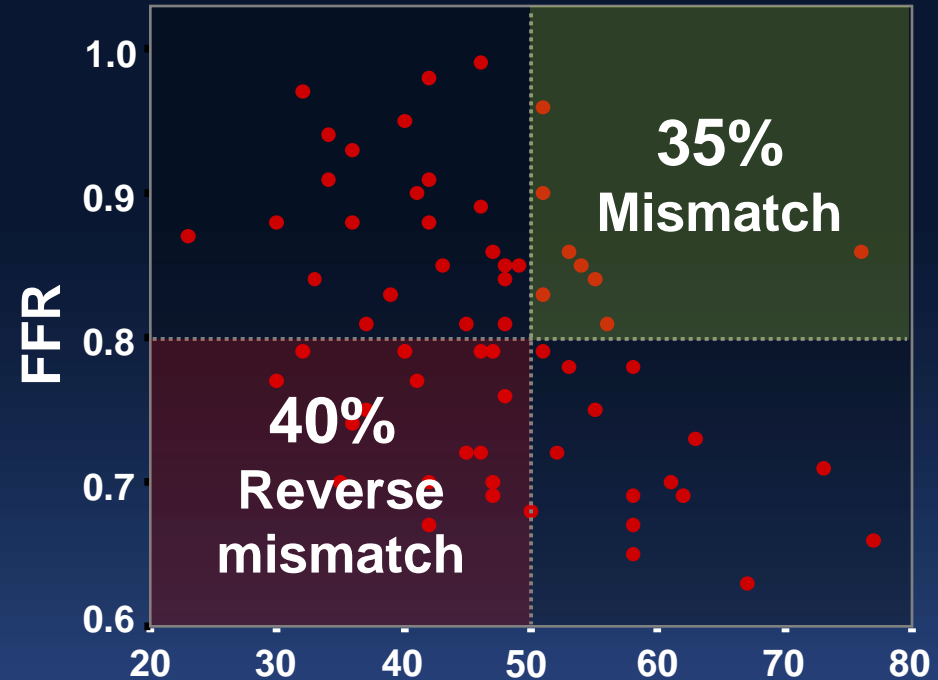
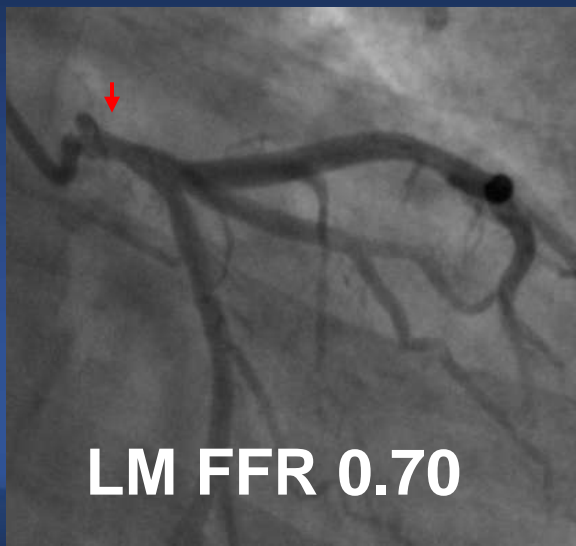
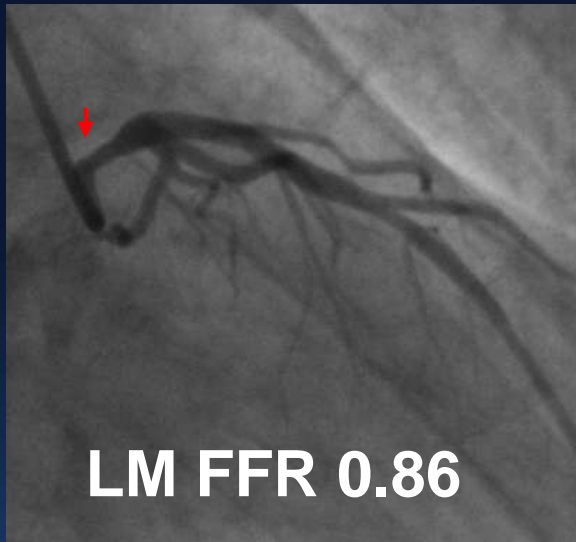
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Disclosure Statement of Financial Interest

I, Soo-Jin Kang DO NOT have a financial interest /arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation

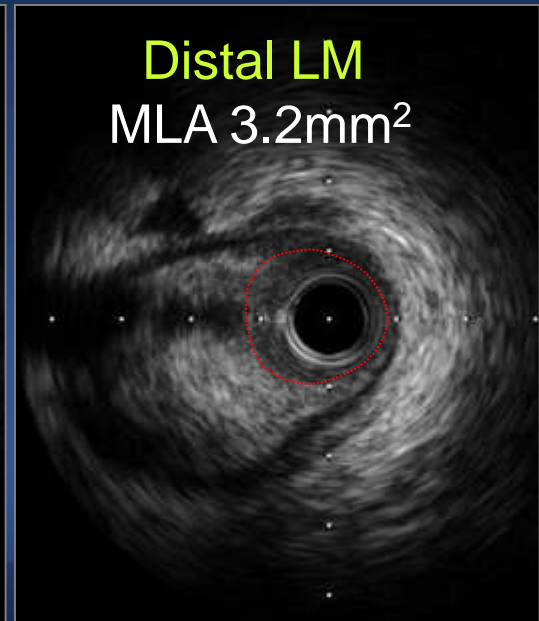
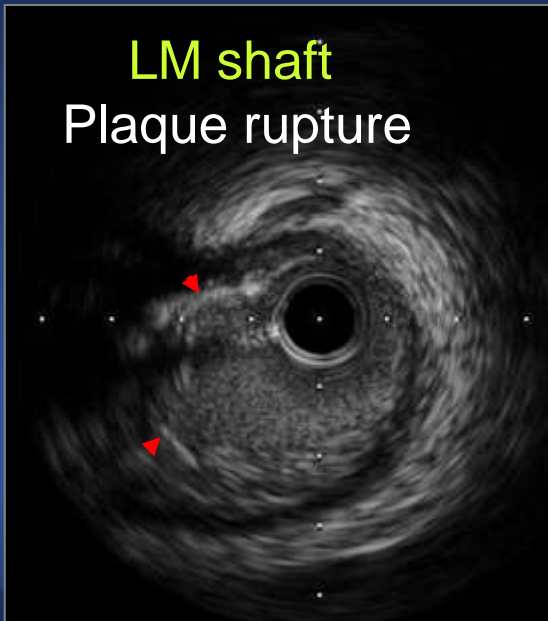
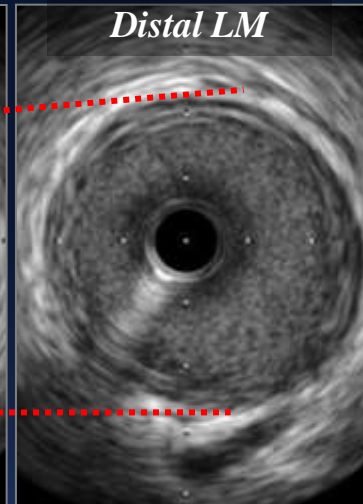
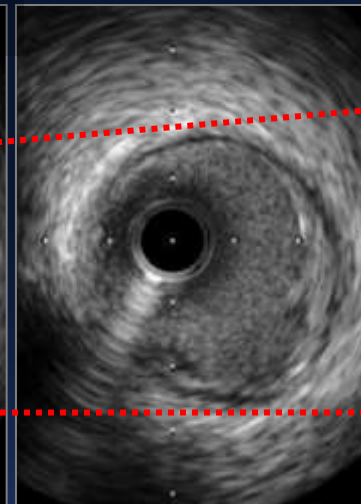
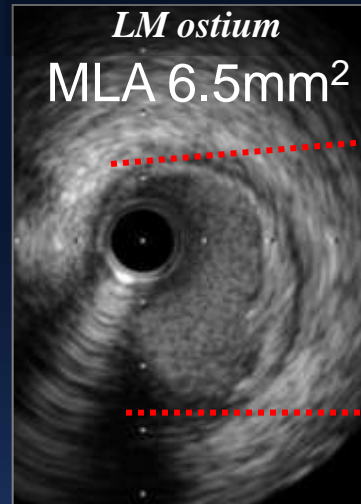
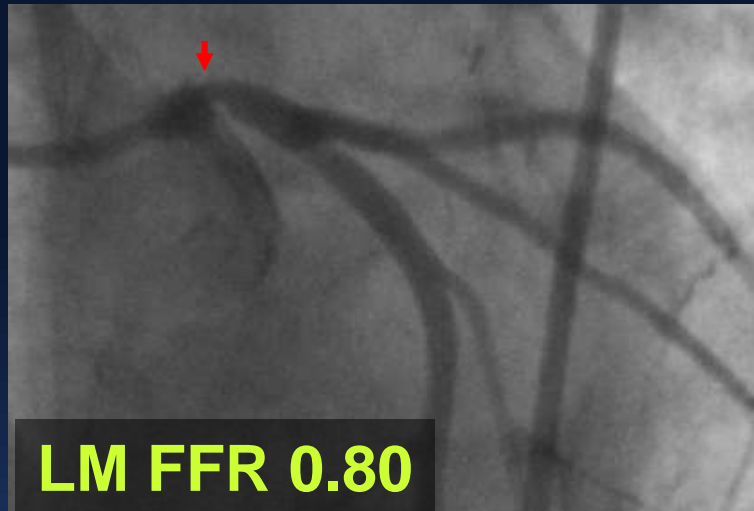
Treat or Not?



DS 48%

Sensitivity 51%
Specificity 75%
Accuracy 65%

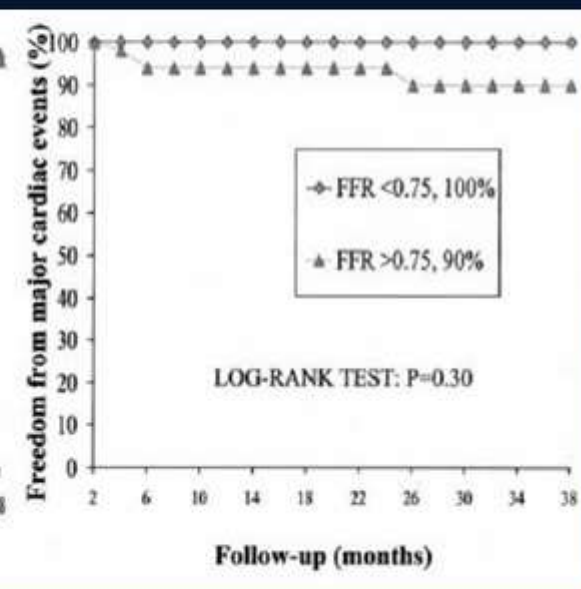
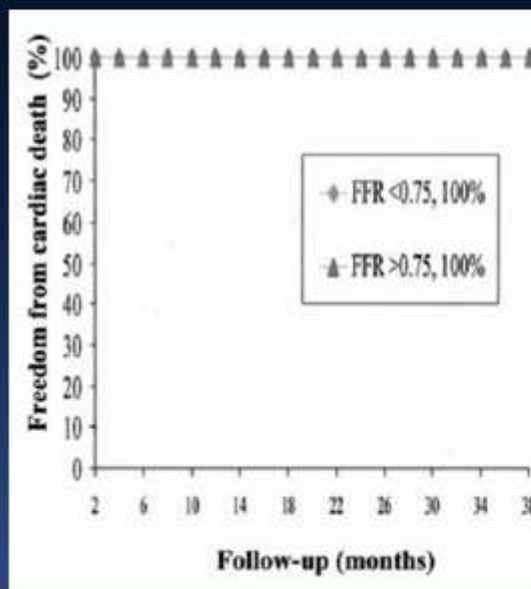
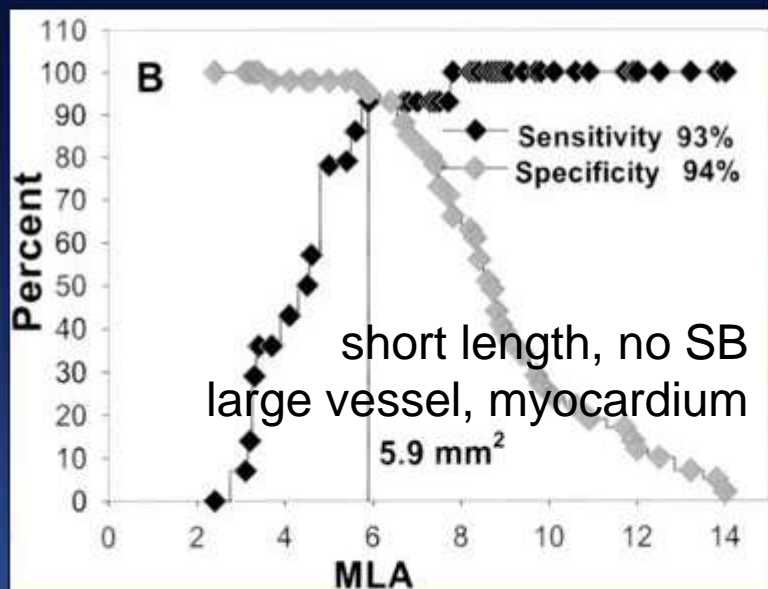
IVUS More Accurately Detects Ischemia-inducing LMCA



Cut-off for Predicting LM FFR<0.75

LM MLA 6.0mm²

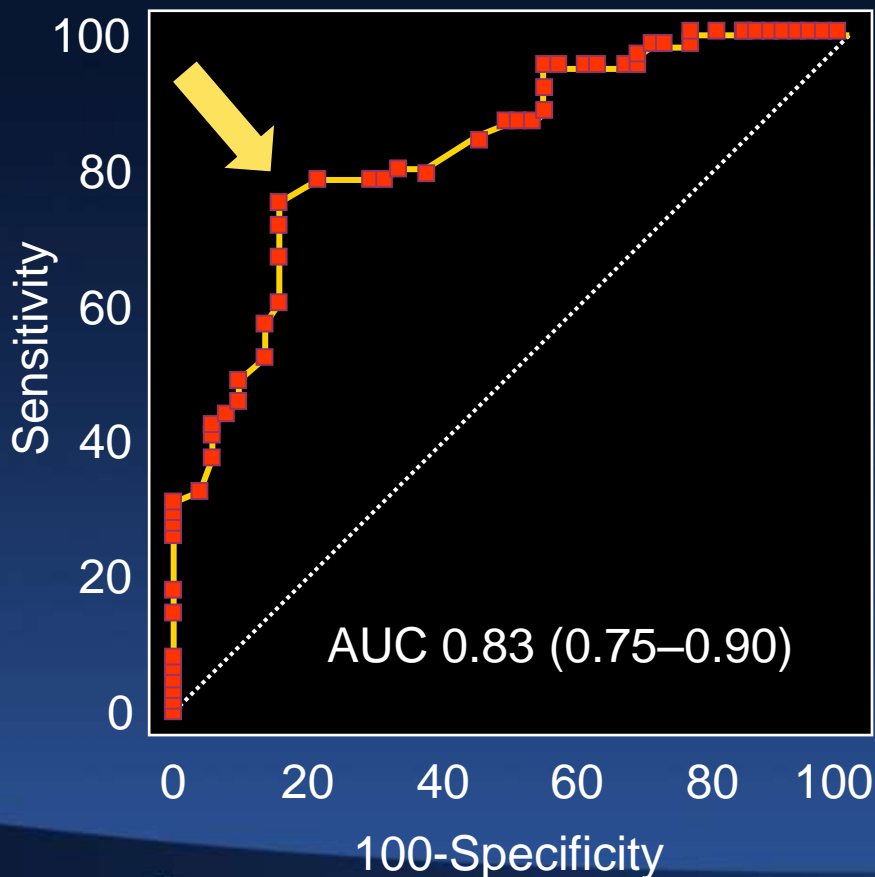
- Sum of lumen areas of two daughter vessels (Each of LAD and LCX should be 4.0mm²)= 150% of the parent LM
- Murray's Law ($LM r^3 = LAD r^3 + LCX r^3$)



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

New LM MLA 4.5mm²

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



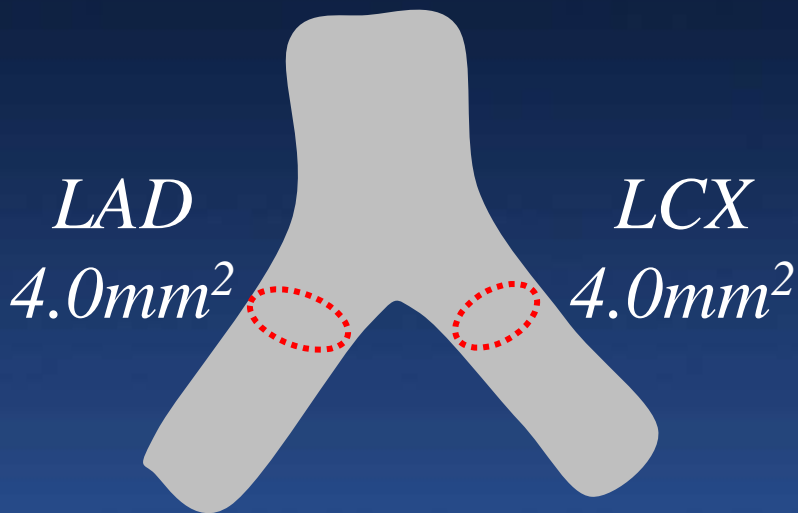
Sensitivity	79%
Specificity	80%
PPV	83%
NPV	76%

Park SJ, Ahn JM et al. JACC Interv (in press)

Geometric Abstraction

Old MLA cut-off 6.0mm^2 was obtained from *Murray's law* considering an **MLA 4.0mm^2** as ischemic threshold of both branches

LM 6.0mm^2



LAD	LCX	LM (Murray's)	LM (Finet's)
4.0	4.0	6.35	7.35
4.0	3.9	6.27	7.26
4.0	3.8	6.19	7.17
4.0	3.7	6.11	7.08
4.0	3.6	6.04	6.98
4.0	3.5	5.96	6.89

De La Torre Hernandez et al. JACC 2011;58:351-8

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

Subgroup-specific MLA

544 intermediate lesions assessed in 516 pts from 24 centers
FFR ≤ 0.80 in 169/544 lesions (31.1%) and 167/516 pts (32.4%)

	N	MLA cutoff	C-statistic	Accuracy
All lesions	544	2.9 mm ²	0.66	66.0%
LAD	296	2.9 mm ²	0.64	63.5%
LCX	110	2.4 mm ²	0.72	77.3%
RCA	138	2.8 mm ²	0.75	77.5%
Proximal	259	3.0 mm ²	0.76	74.9%
Mid	195	2.6 mm ²	0.63	65.6%
Distal	90	3.0 mm ²	0.63	51.1%
RVD <3.0 mm	322	2.6 mm ²	0.65	66.1%
RVD ≥ 3.0 mm	219	3.0 mm ²	0.71	72.6%
Length ≤ 12.3 mm	272	3.0 mm ²	0.67	64.7%
Length >12.3 mm	269	2.8 mm ²	0.69	68.8%

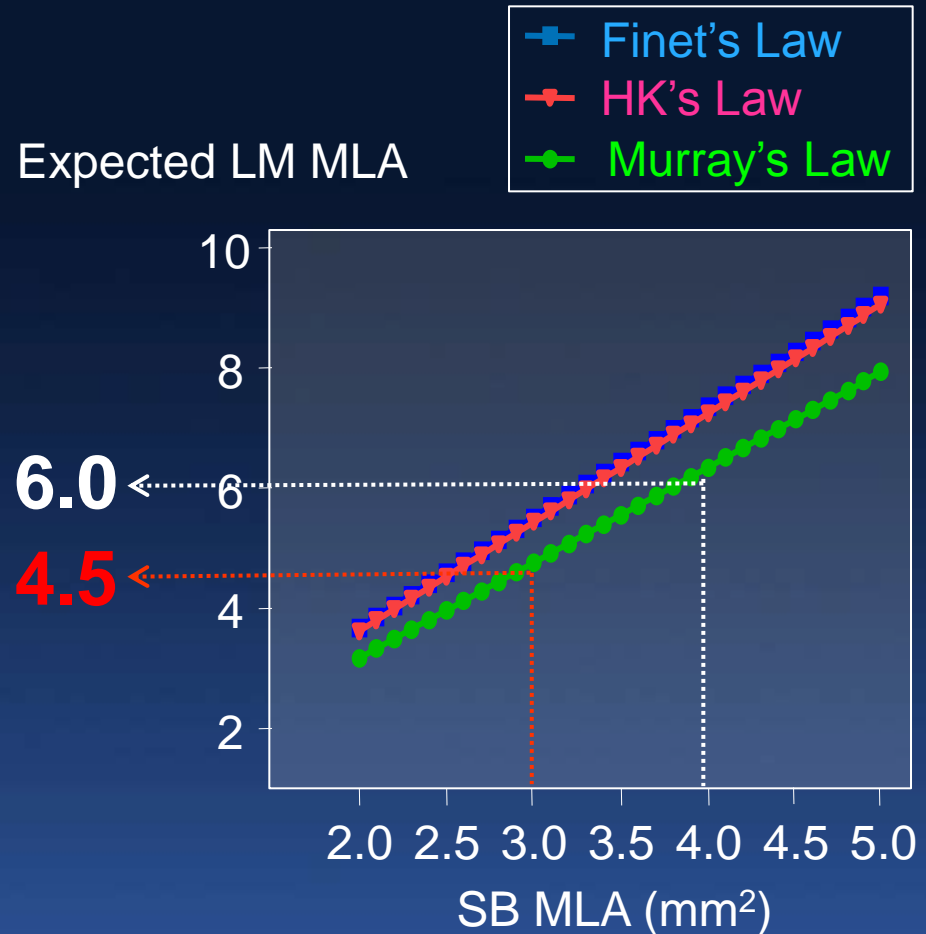
False Assumption...

The used cut-off 4.0mm² is too Big!

New Data

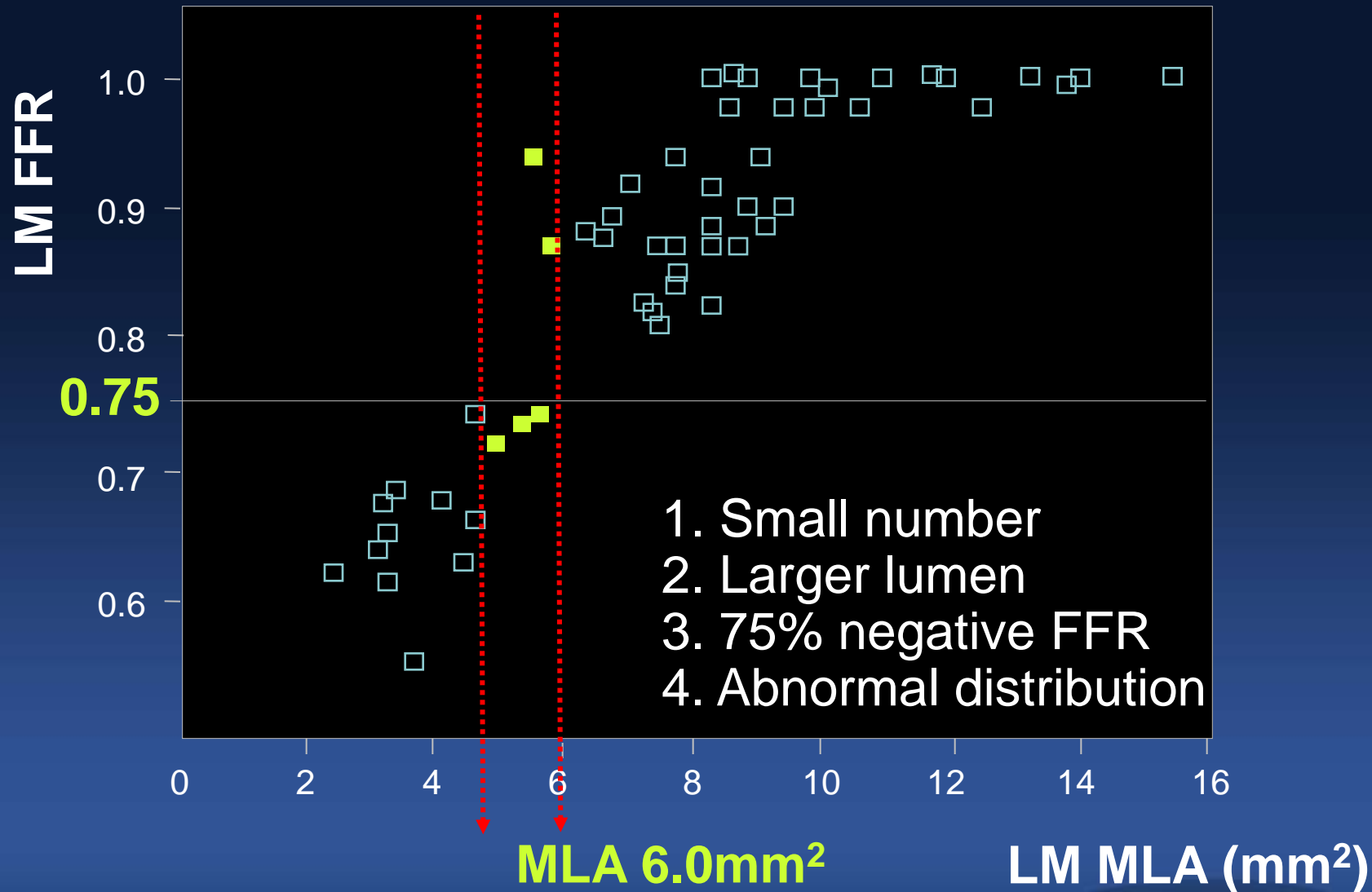
LAD	LCX	LM (Murray's)	LM (Finet's)
3.0	3.0	4.76	5.52
3.0	2.9	4.68	5.42
3.0	2.8	4.60	5.33
3.0	2.7	4.53	5.24
3.0	2.6	4.45	5.14
3.0	2.5	4.37	5.05

Expected LM MLA



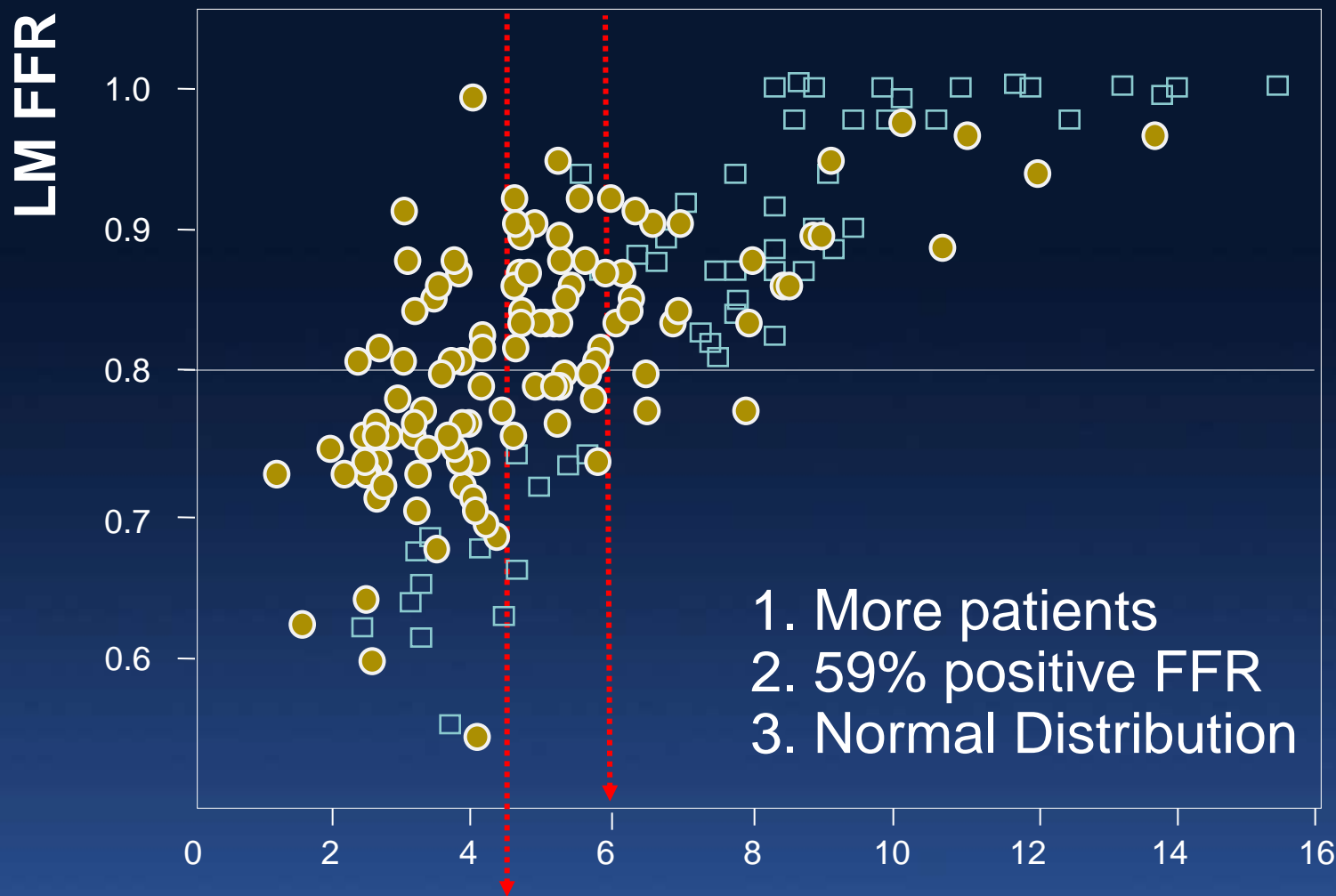
In-vivo Validation

Jasti's data (n=55)



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

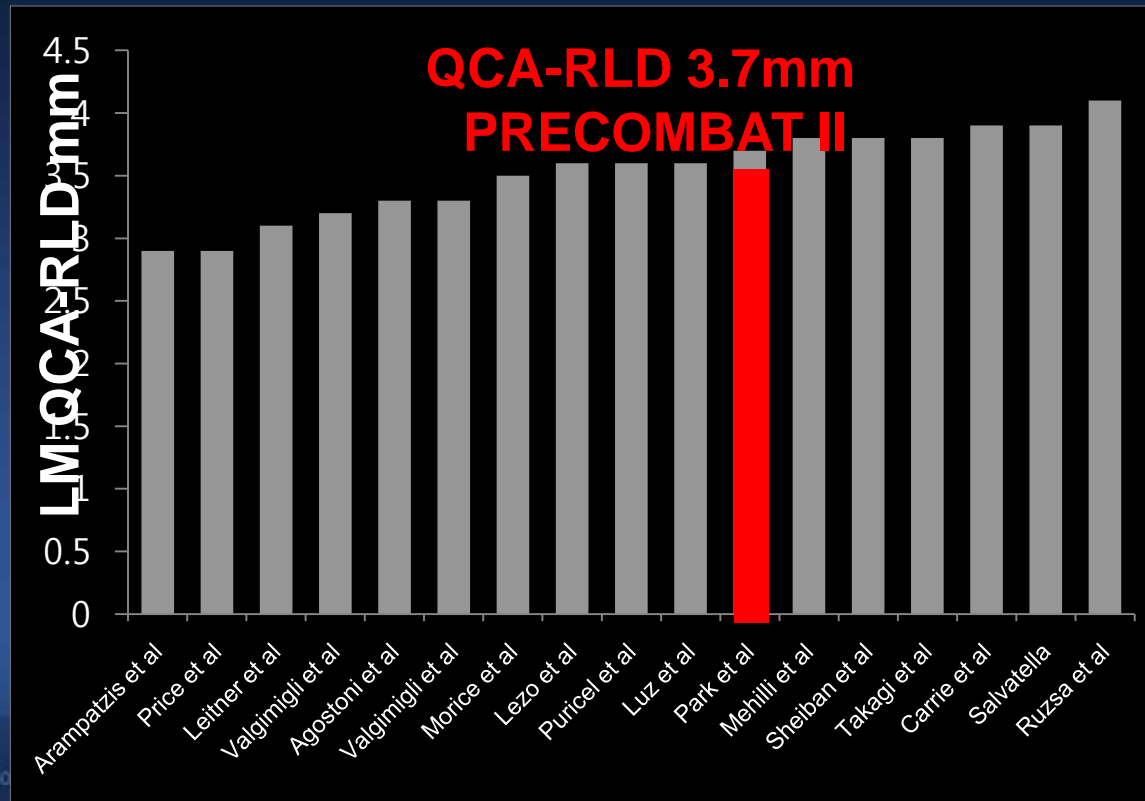
AMC New Data (n=112) Jasti's data (n=55)



Ethnic Difference in LM Size

	Jasti	Abizaid	Kang
IVUS criteria	MLA 5.9mm ²	MLD 3.0mm	MLA 4.8mm ²
Proximal RLD, mm	4.2±1.0	3.9±0.8	3.9±0.6

Jasti et al. Circulation. 2004;110:2831-6, Abizaid et al. J Am Coll Cardiol 1999;34:707-15
Kang et al. JACC Interv 2011;4:1168-74



Why Mismatch

Nov 2009-Jun 2011, 1000 consecutive patients (1129 lesions with DS >30%) who underwent pre-PCI IVUS and FFR
(*ClinicalTrials.gov NCT01366404*)

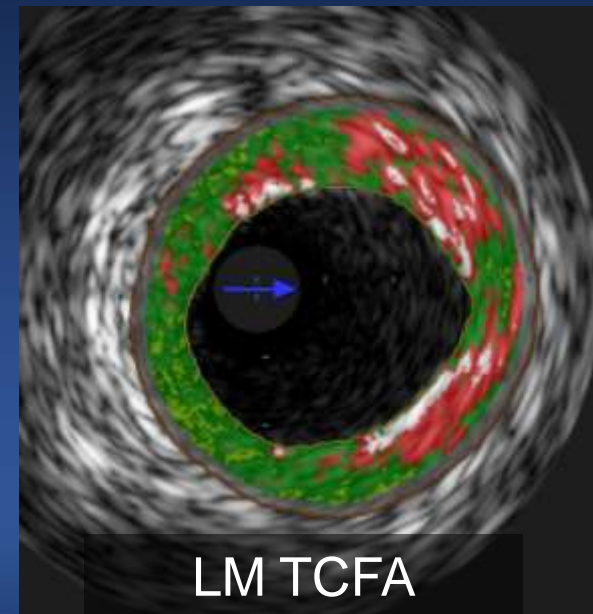
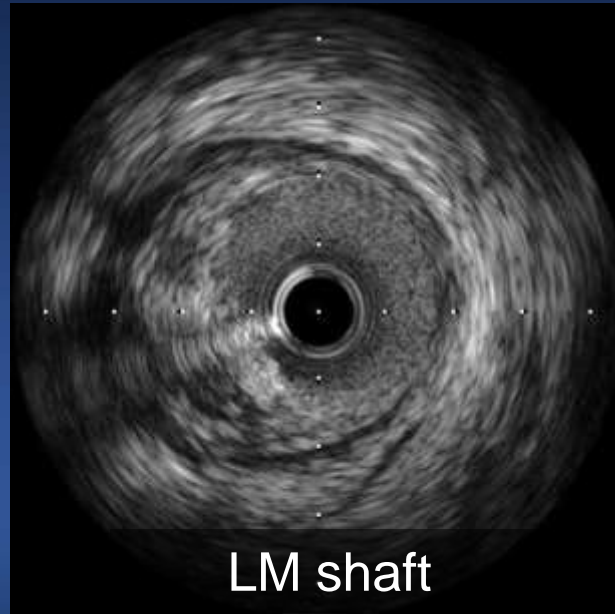
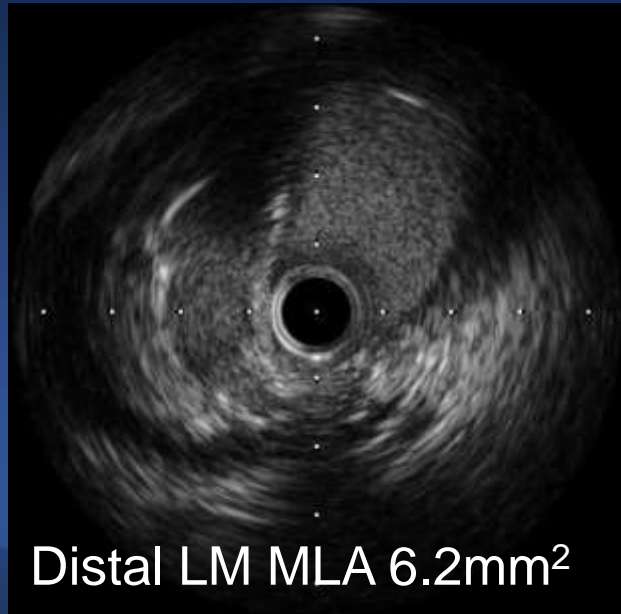
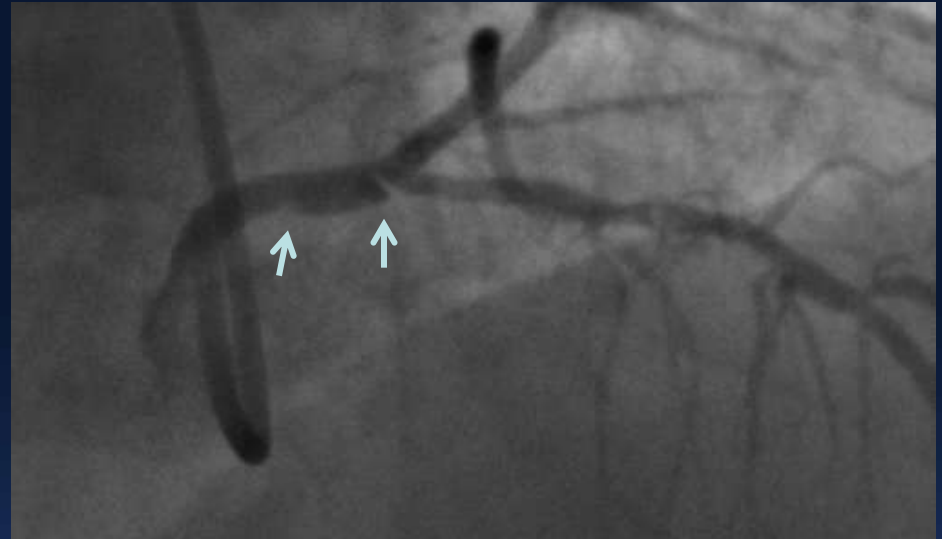
Factors Affecting FFR

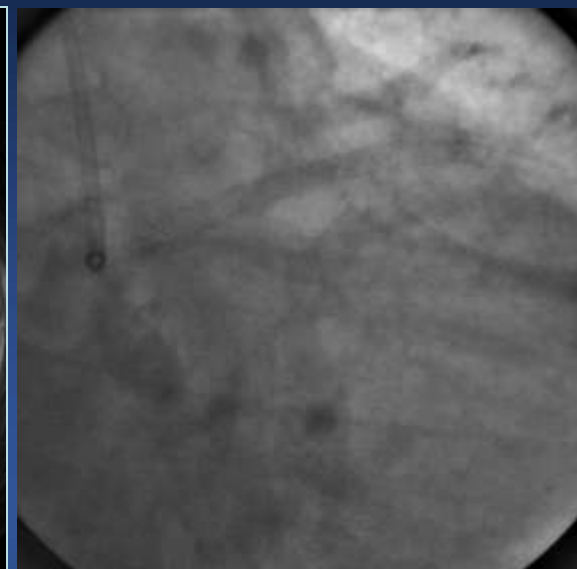
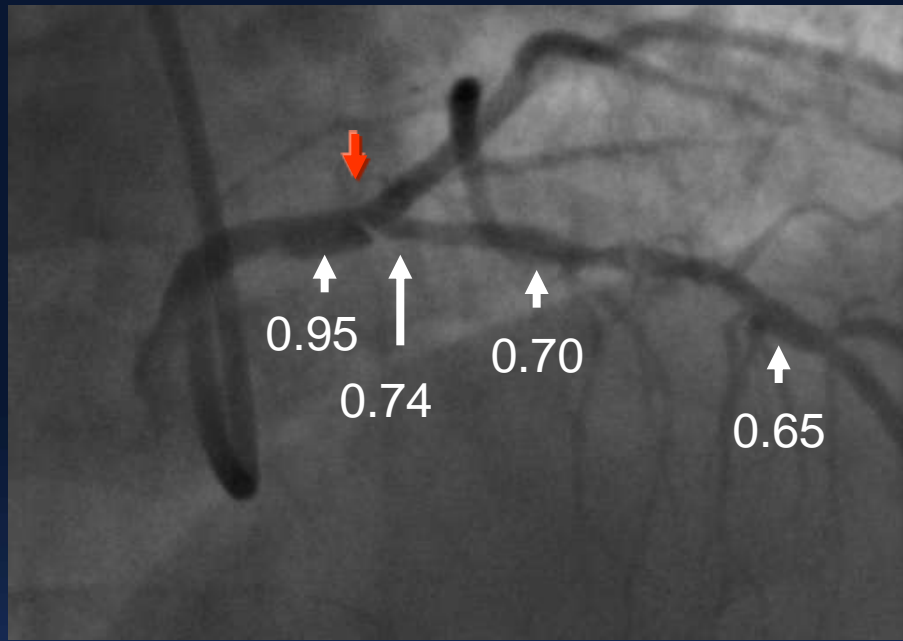
	Beta	p-value	95% CI
Age	0.008	<0.001	0.004 - 0.011
LAD location	-0.386	<0.001	-0.462 - 0.311
Lesion length	-0.006	<0.001	-0.009 - 0.003
Minimal lumen area	0.185	<0.001	0.149 - 0.222
Plaque burden	-0.006	<0.004	-0.009 - 0.003
Plaque rupture	-0.165	0.020	-0.302 - 0.027

AMC data

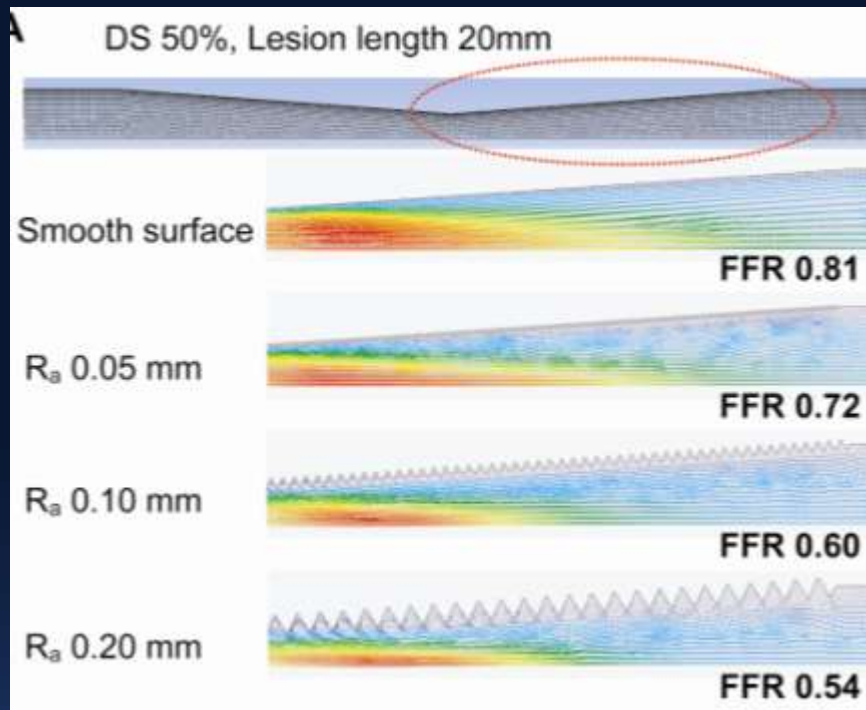
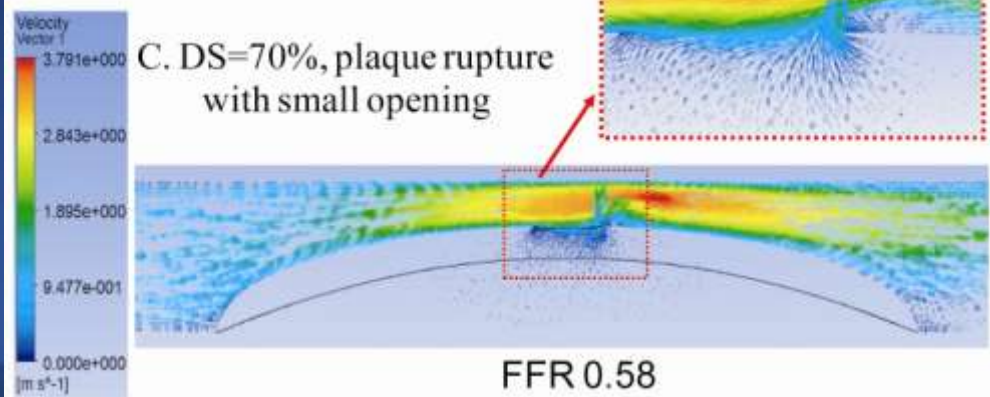
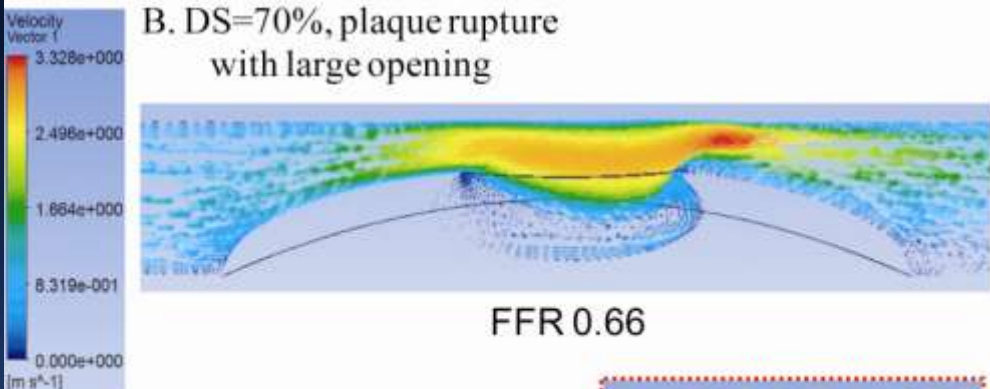
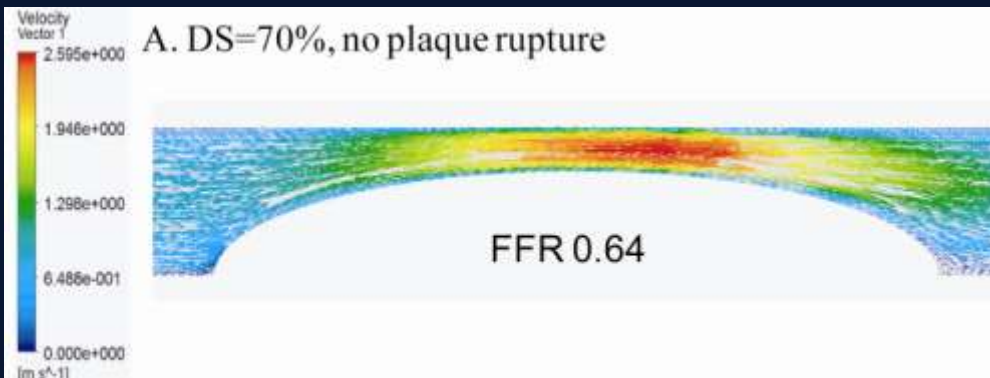
80-Year Old Male

- Resting chest pain
- Normal EKG
- Normal CK-MB, TnI





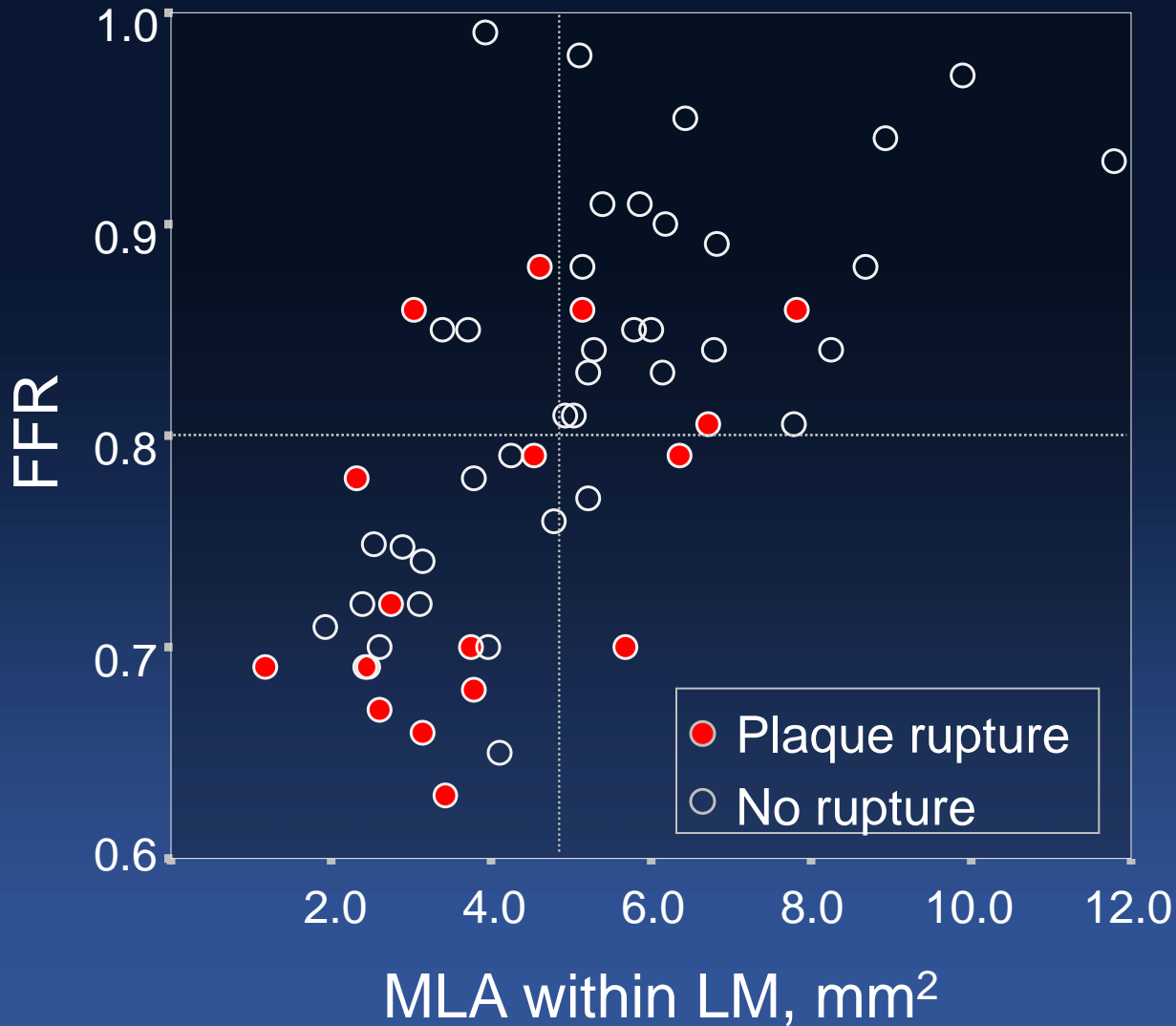
0.65 0.70 0.74 0.95



Complex or irregular lumen produces greater flow resistance and energy loss of fluid, thus resulting in pressure drop and FFR↓

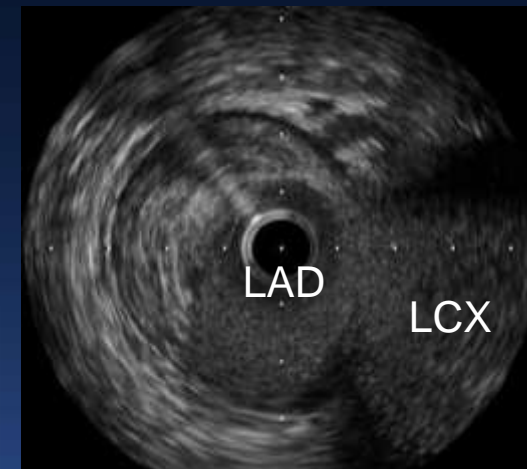
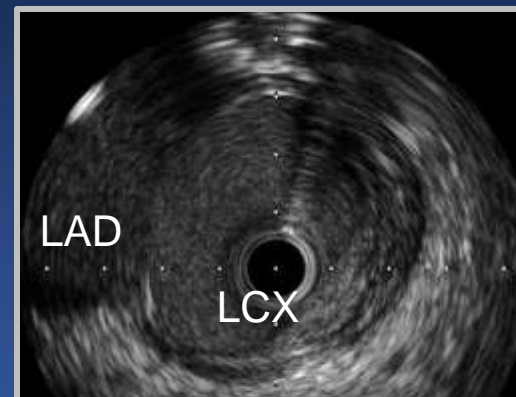
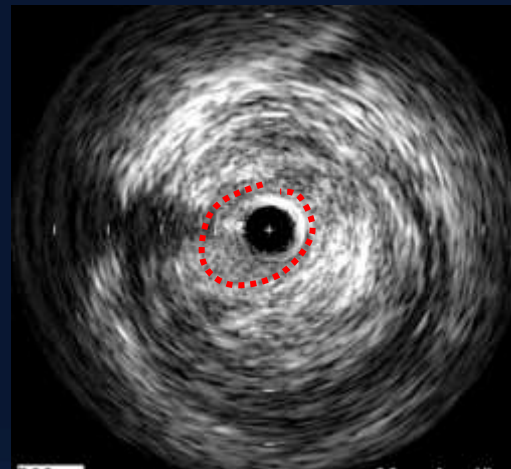
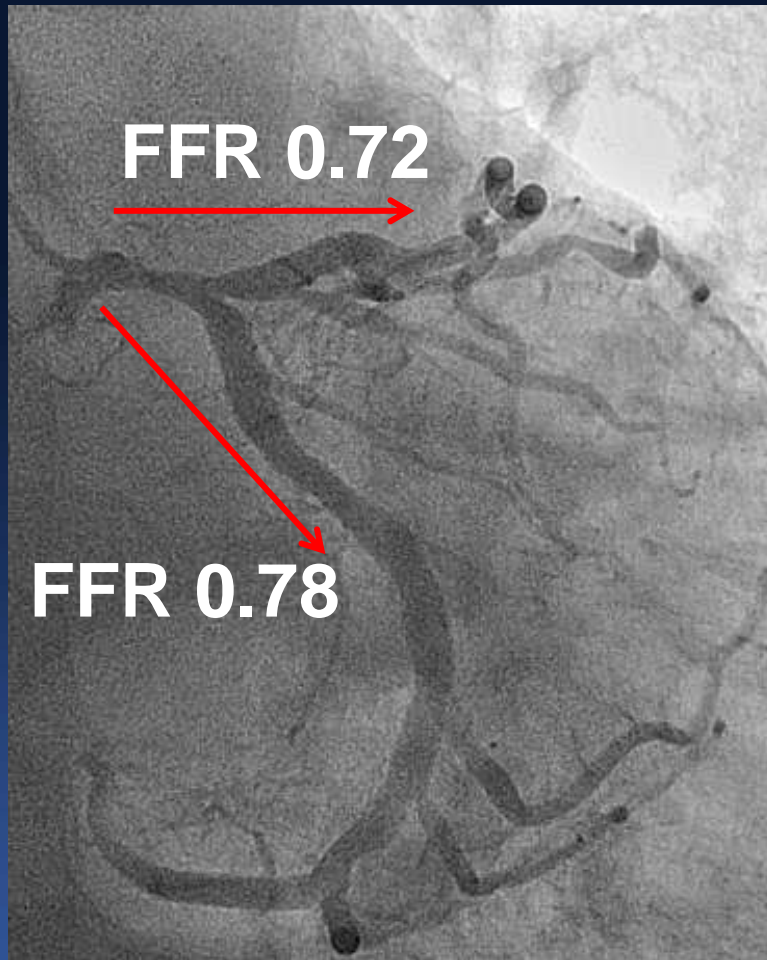
Park et al. JACC interv 2012;5:1029-36

Impact of Plaque Rupture on Ischemia



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

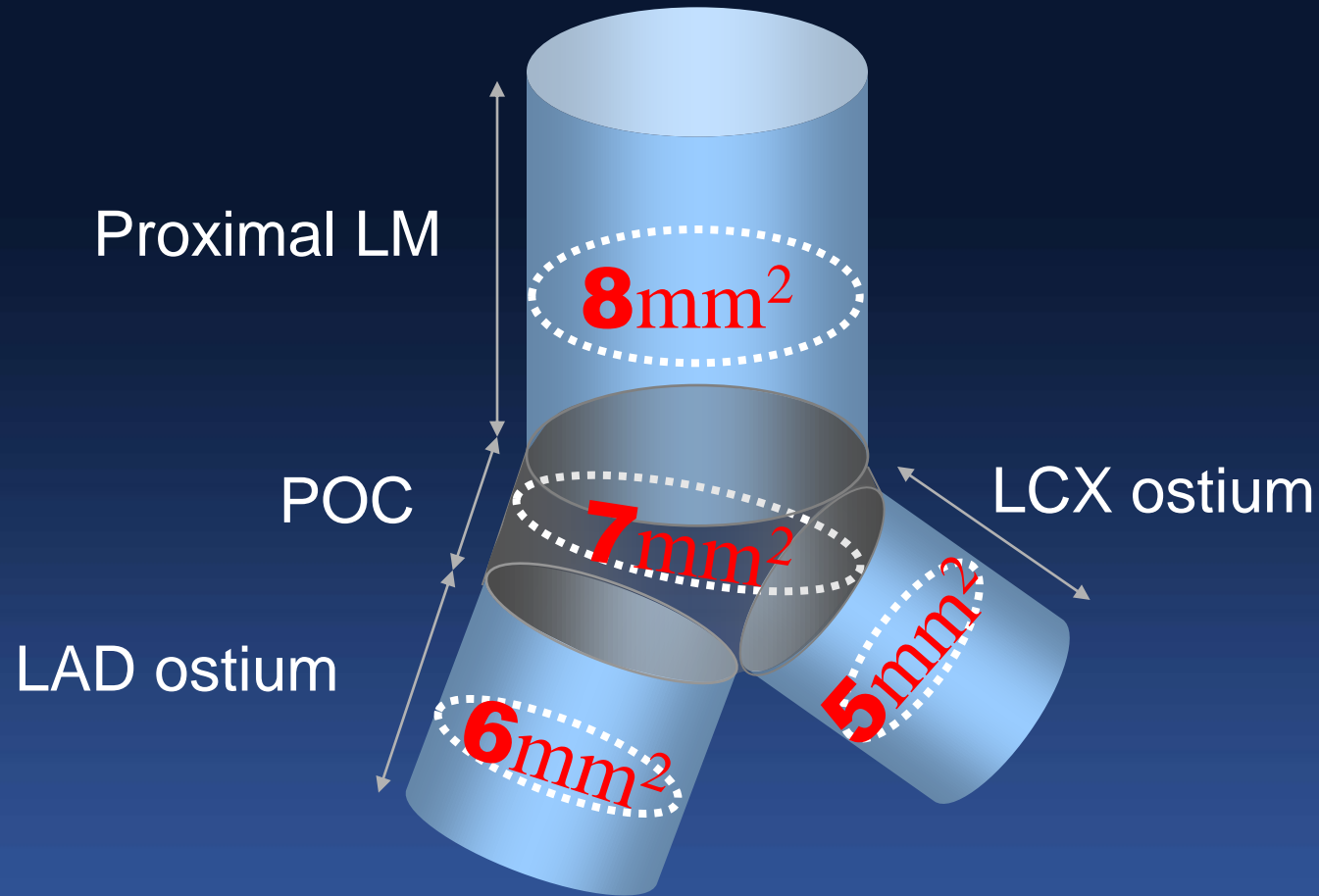
Stent Strategy



How big?
How severe?

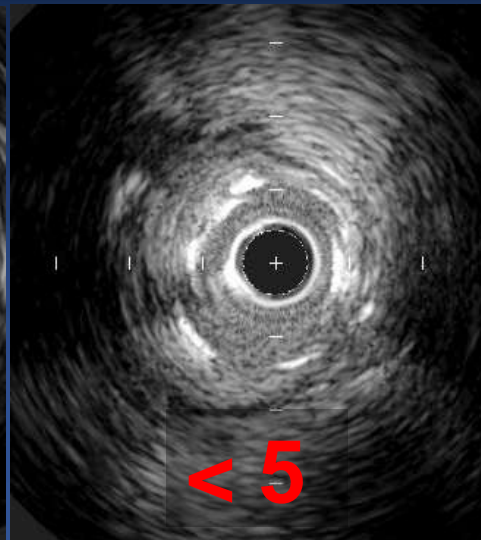
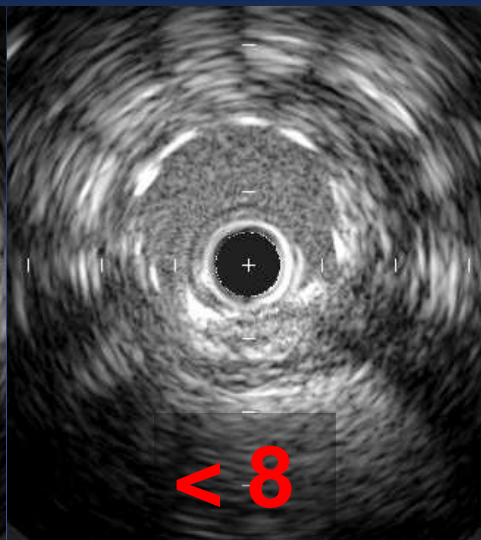
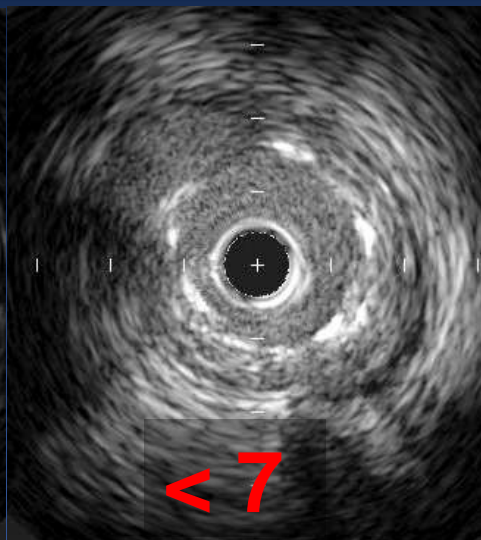
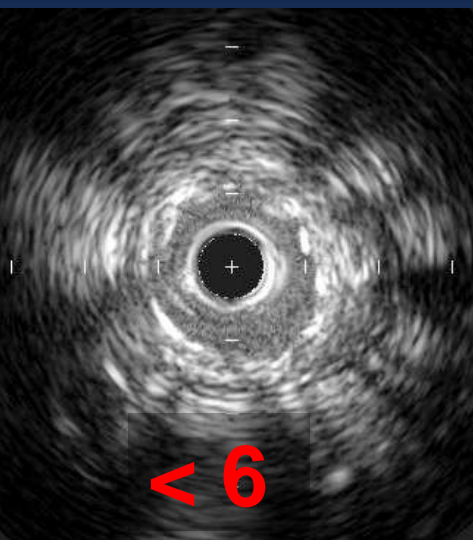
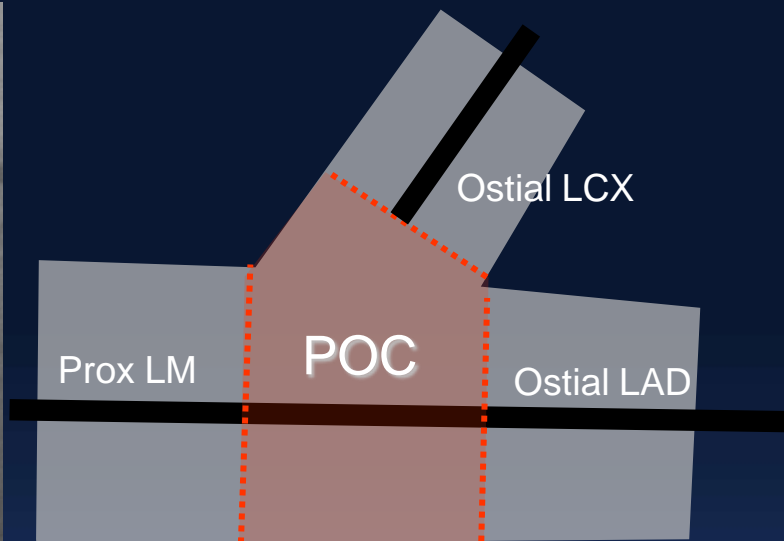


Stent Optimization



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

Angiography Poorly Predicts Underexpansion



LAD 5.0mm²

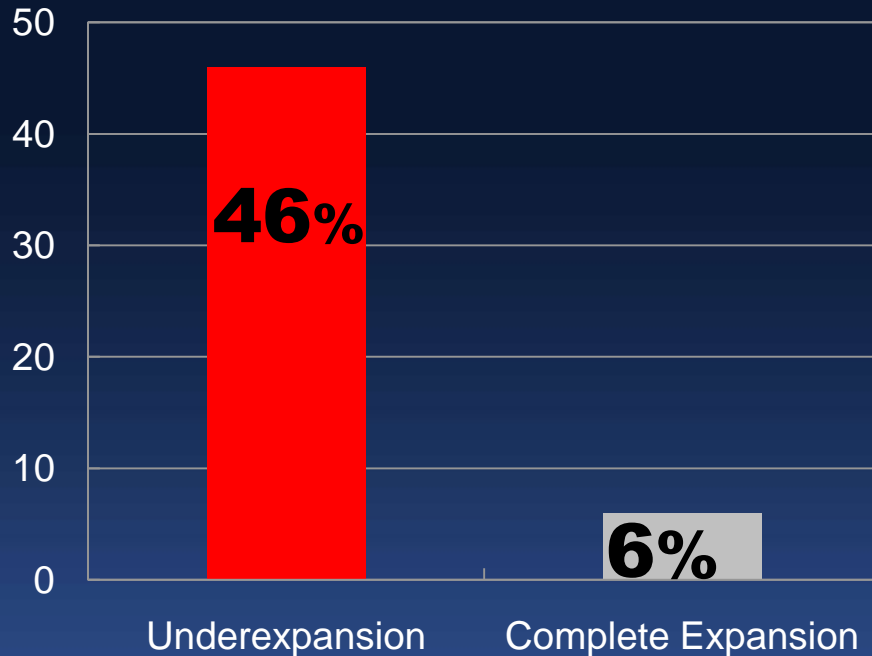
POC 6.3mm²

Prox LM 6.8mm²

LCX 4.0mm²

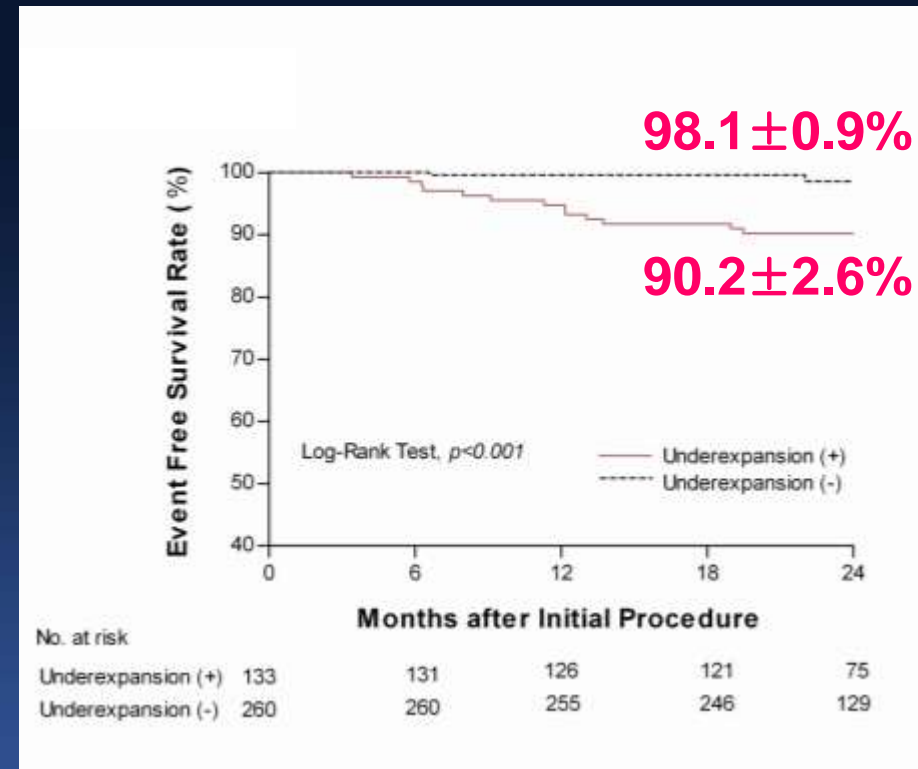
Two-Stent in LMCA Bifurcation

9-month ISR



- Any underexpansion
- No expansion

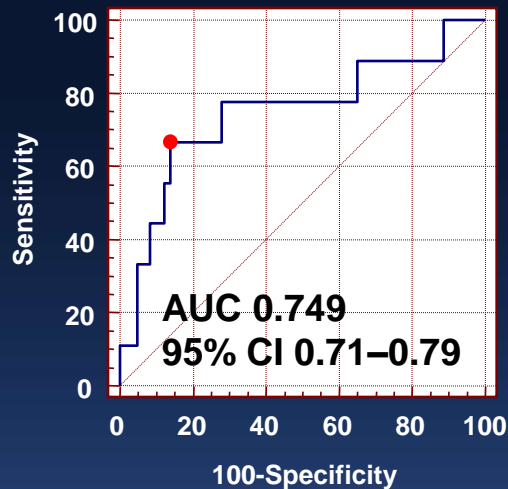
2-yr MACE-free Survival



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

Intravascular Ultrasound Predictors for Edge Restenosis After Newer Generation Drug-Eluting Stent Implantation

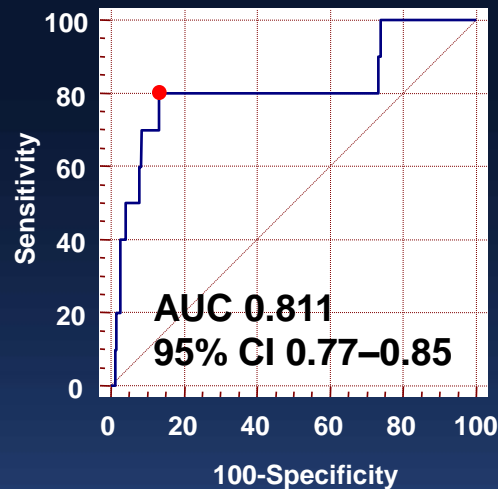
433 E-ZES



PB 56.3%

Sensitivity 67%
Specificity 86%

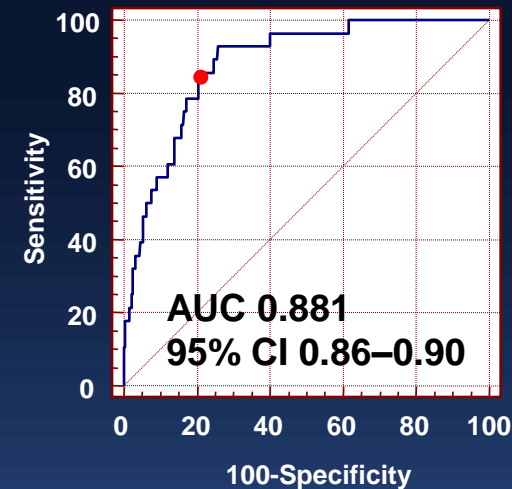
422 R-ZES



PB 57.3%

Sensitivity 80%
Specificity 87%

813 EES



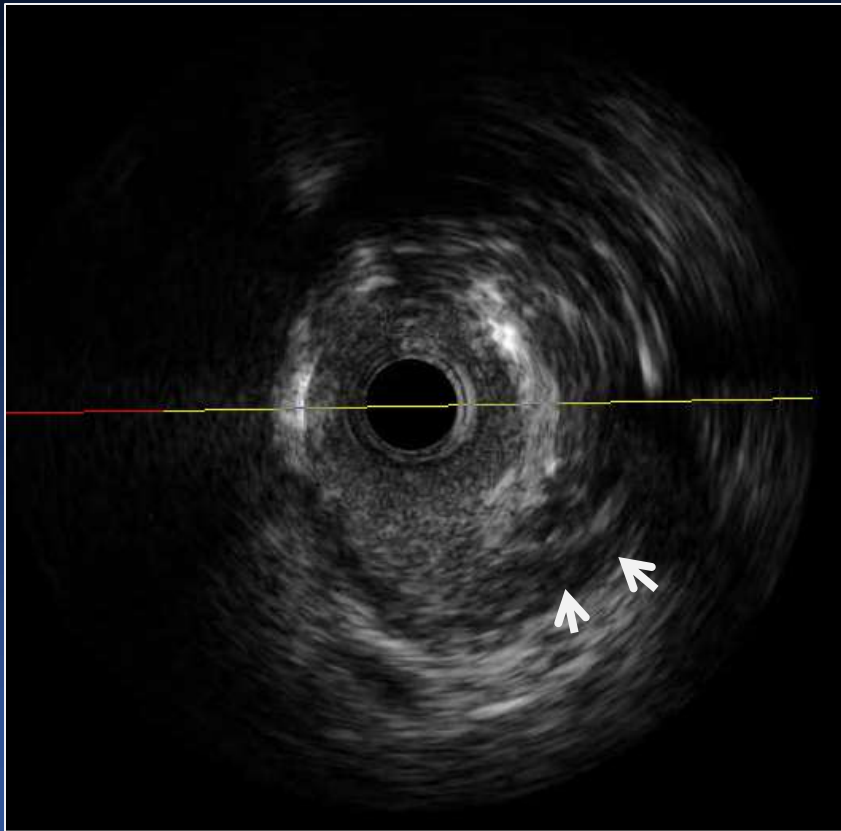
PB 54.2%

Sensitivity 86%
Specificity 80%

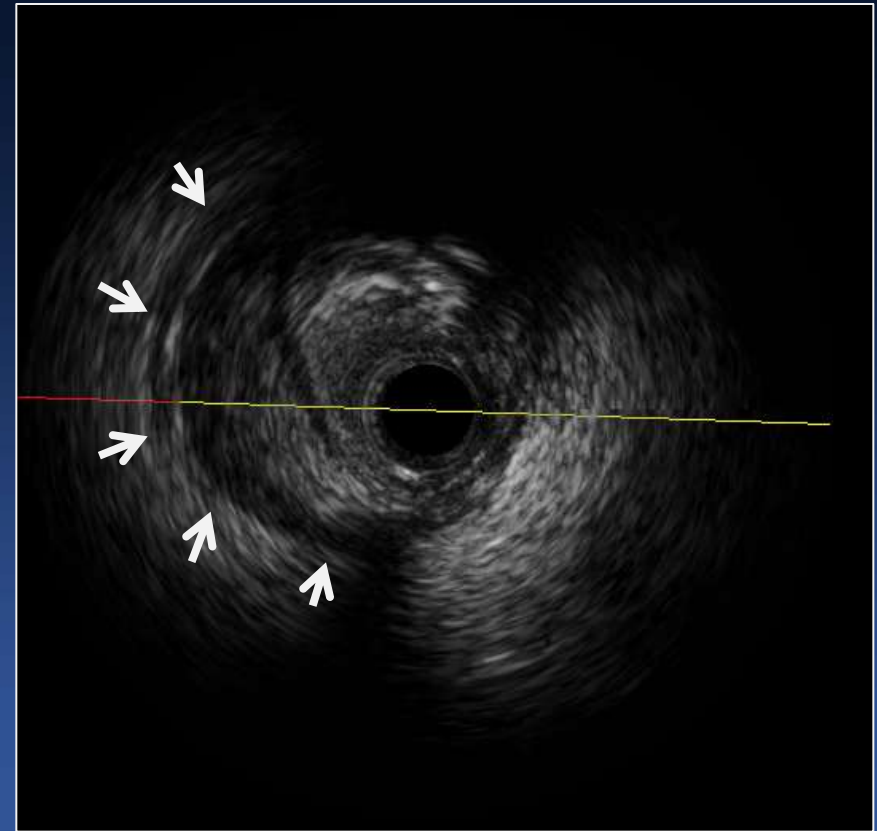
Reference segment residual PB < 55% was useful to determine the optimal landing site

LMCA PCI Complications

**Dissection
at proximal stent edge**

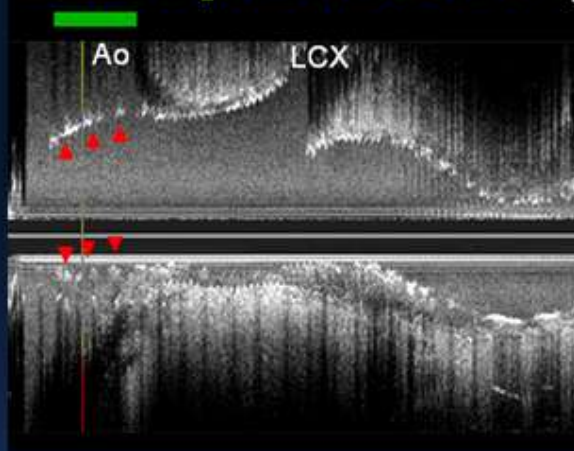


**Hematoma
at distal stent edge**



Don't Worry Too Much! LMCA Ostial Stenting

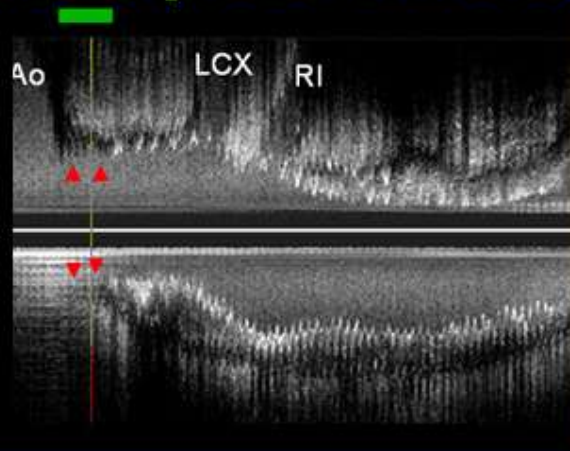
Strut protrusion



LMCA 68%

Length 3.4 ± 1.7 mm

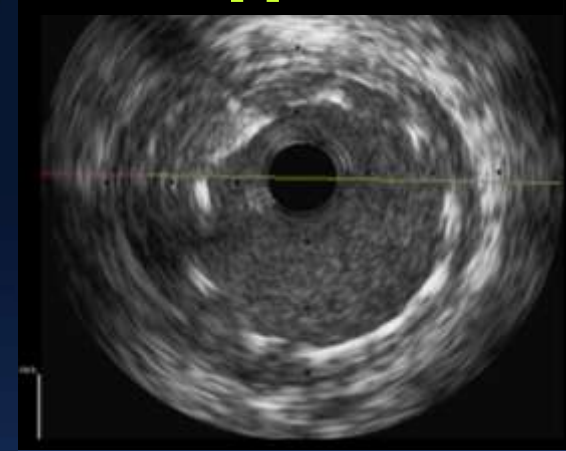
Incomplete coverage



LMCA 23%

Residual PB 42 ± 11 %

Malapposition

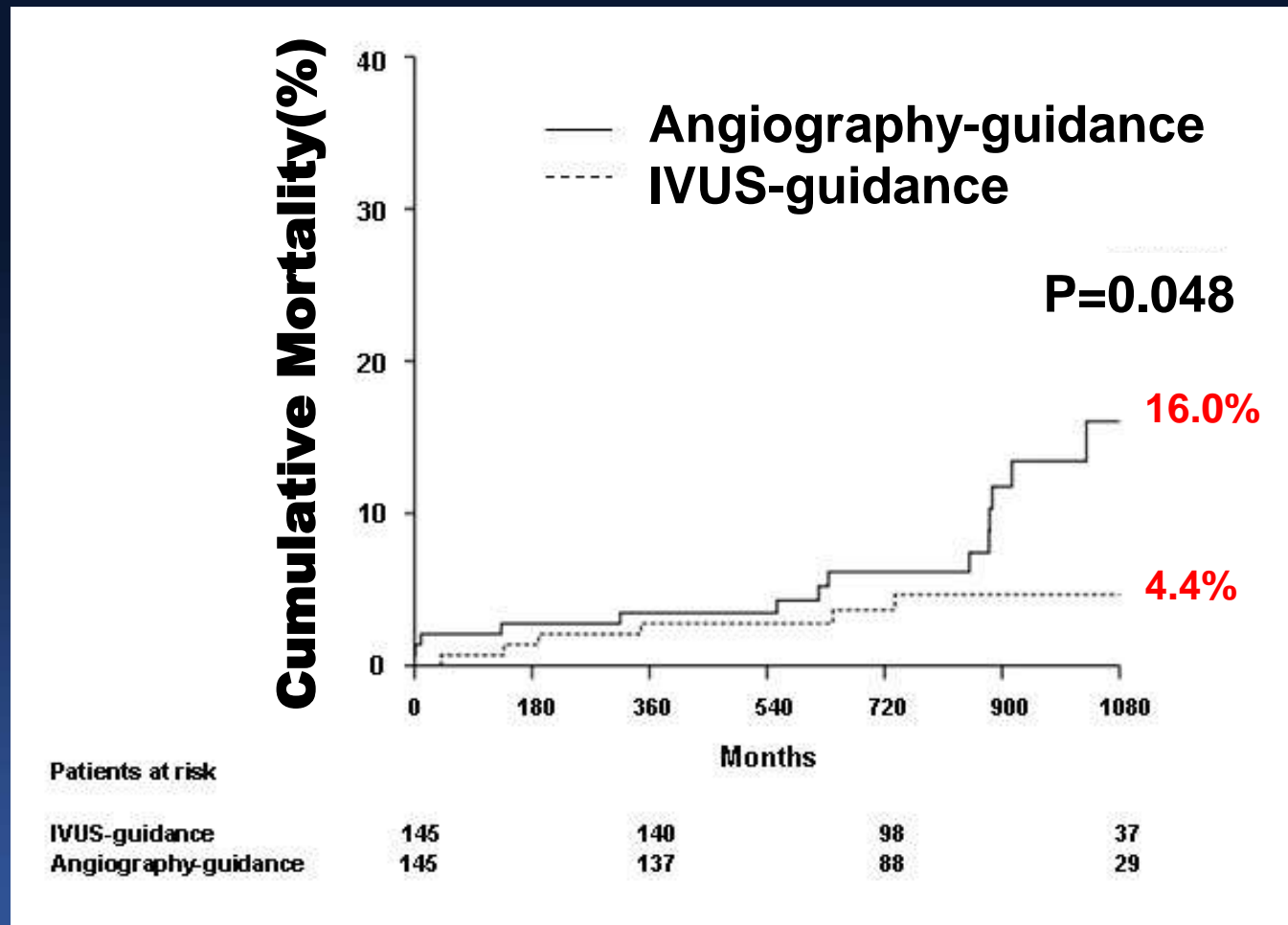


LMCA 18.8%

No relationship with ostial restenosis

Kang et al. Am J Cardiol 2013;111:1401-7

IVUS-Guided LM PCI Saves Lives



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

Conclusions

- Although FFR is a gold standard, IVUS-MLA can be alternatively used to assess ischemia in pure LM
- In LM bifurcation, IVUS is helpful to confirm the real SB ostial disease and to decide stent strategy
- IVUS plays a unique role in device sizing and optimization. IVUS improves PCI outcomes