LM PCI 2016: Integrated Approach Using IVUS, FFR and New Imaging Modality

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LM PCI 2016

ESC Guidelines 2014
Elective PCI for LM Stenosis

	CABG		PCI	
Recommendation according to extent of CAD	Class	Level	Class	Level
LM disease a SYNTAX score ≤ 22	I	B	I	B
LM disease a SYNTAX score 23 -32	I	B	IIa	B
LM disease a SYNTAX score > 32	I	B	III	B

EXCEL and NOBLE are Coming Soon I!

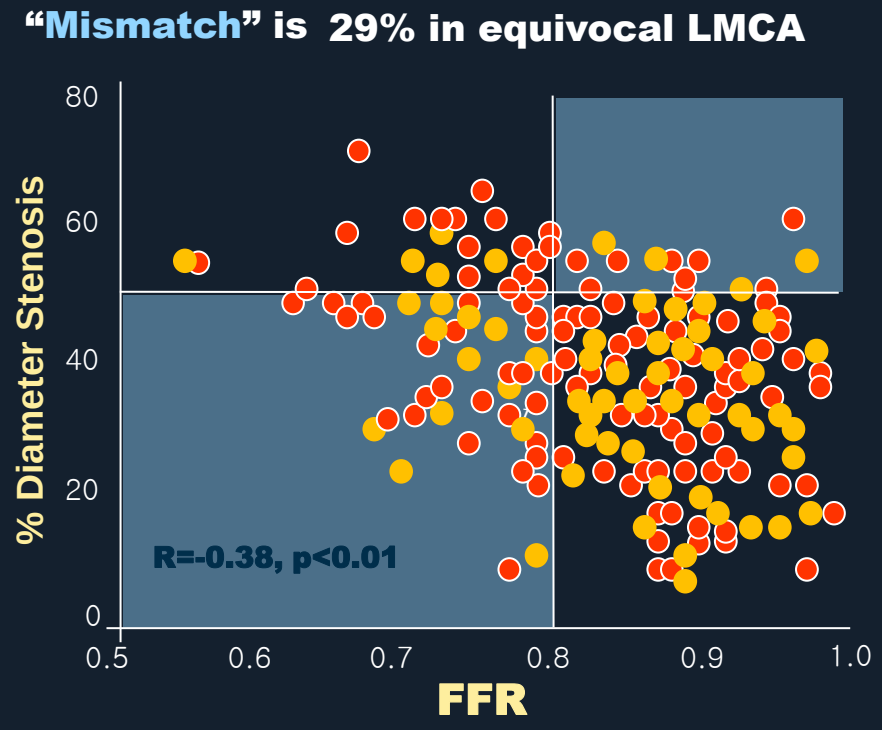
Diagnosis for Significant LM

Which One is Significant LM stenosis?

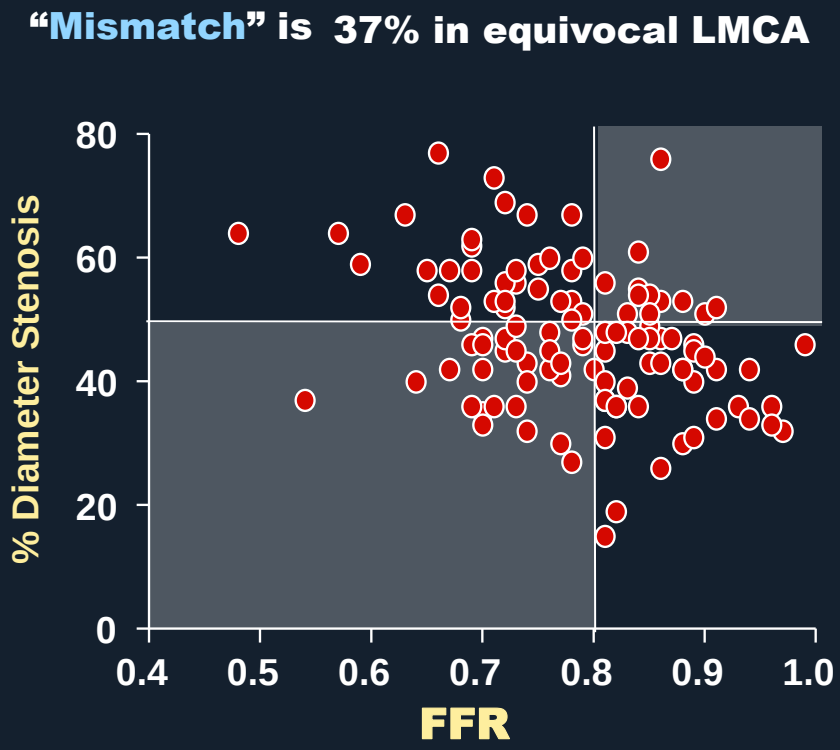
Ostial LM 60%

Ostial LM 20%

Limitation of CAG



Circulation 2009;120:1505-1512



JACC Cardiovasc Interv. 2014 ;7(8):868-74)

Isolated LMCA disease

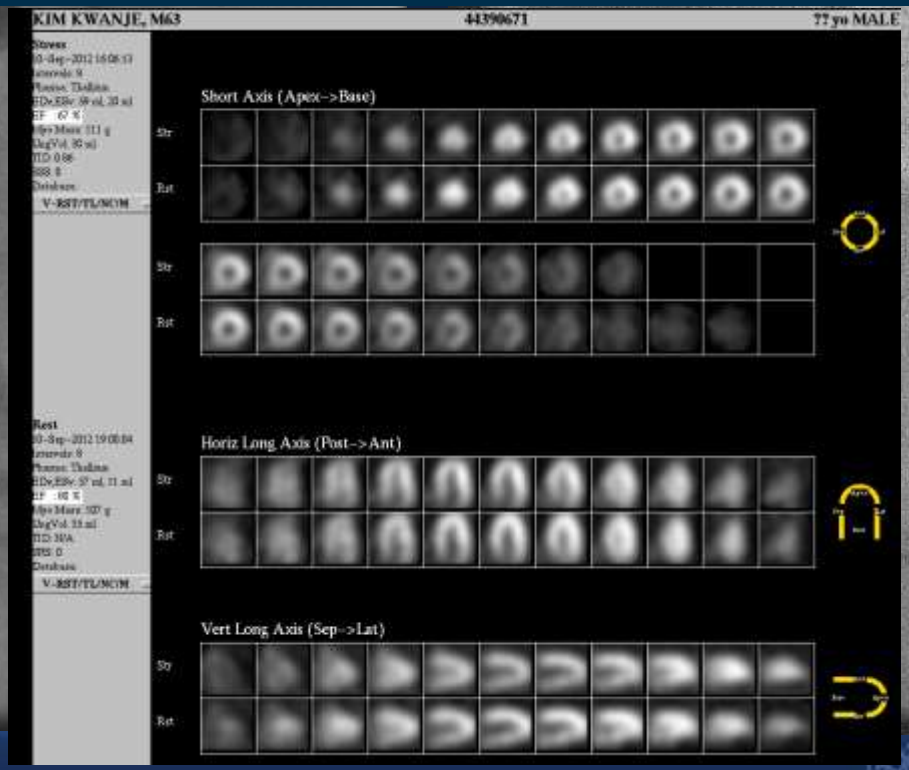
LM Stenosis with RCA disease

65yrs/M, eCP

RCA

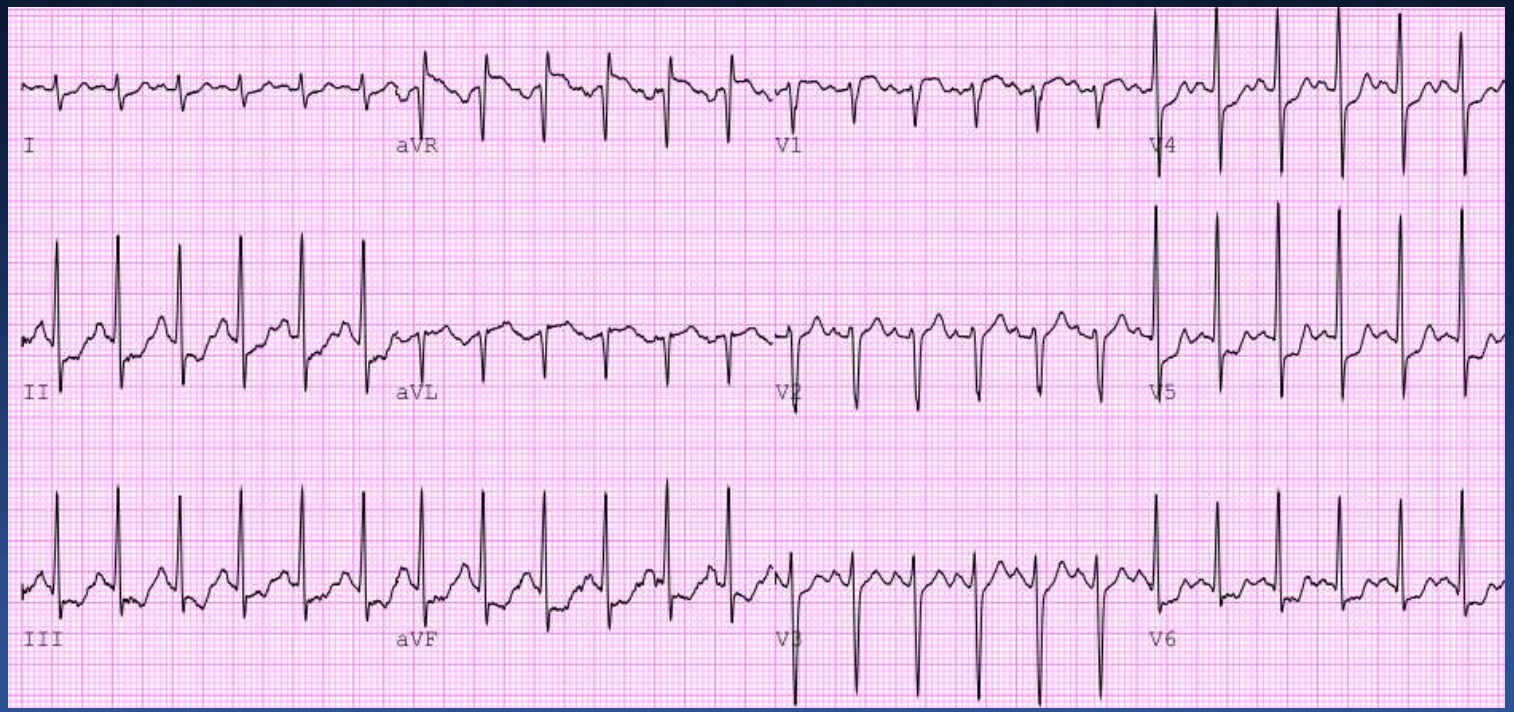
LCA

Normal Perfusion in Thallium SPECT
Balanced Ischemia



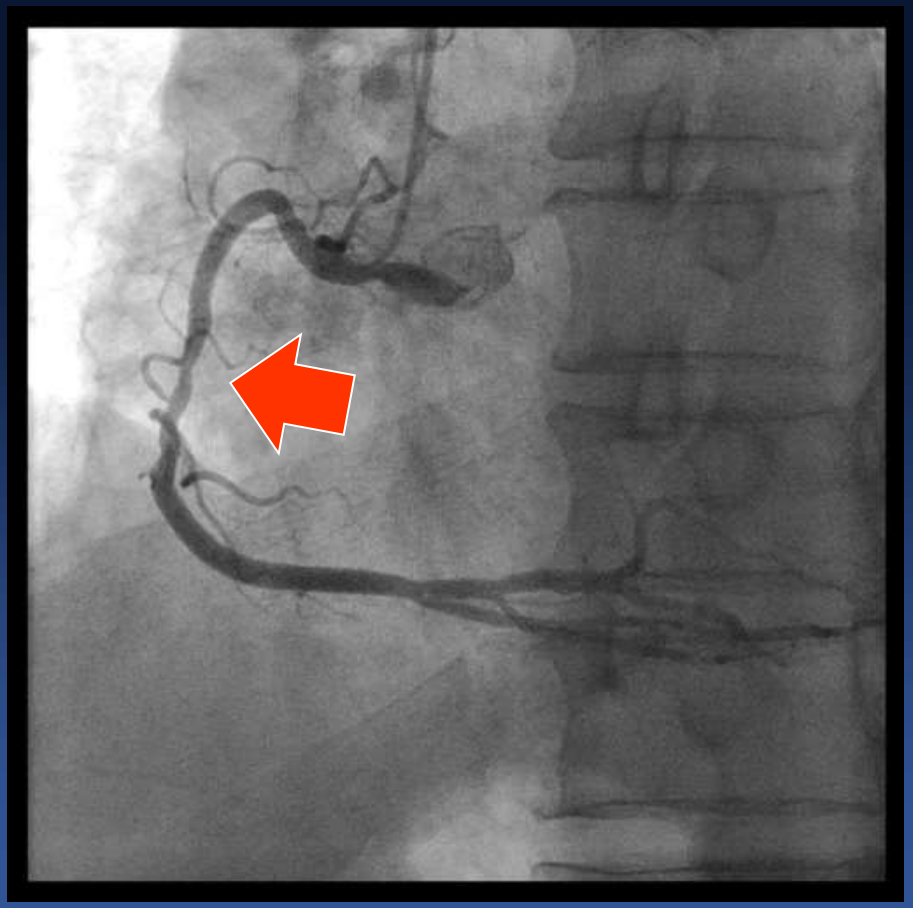
M/76, eCP

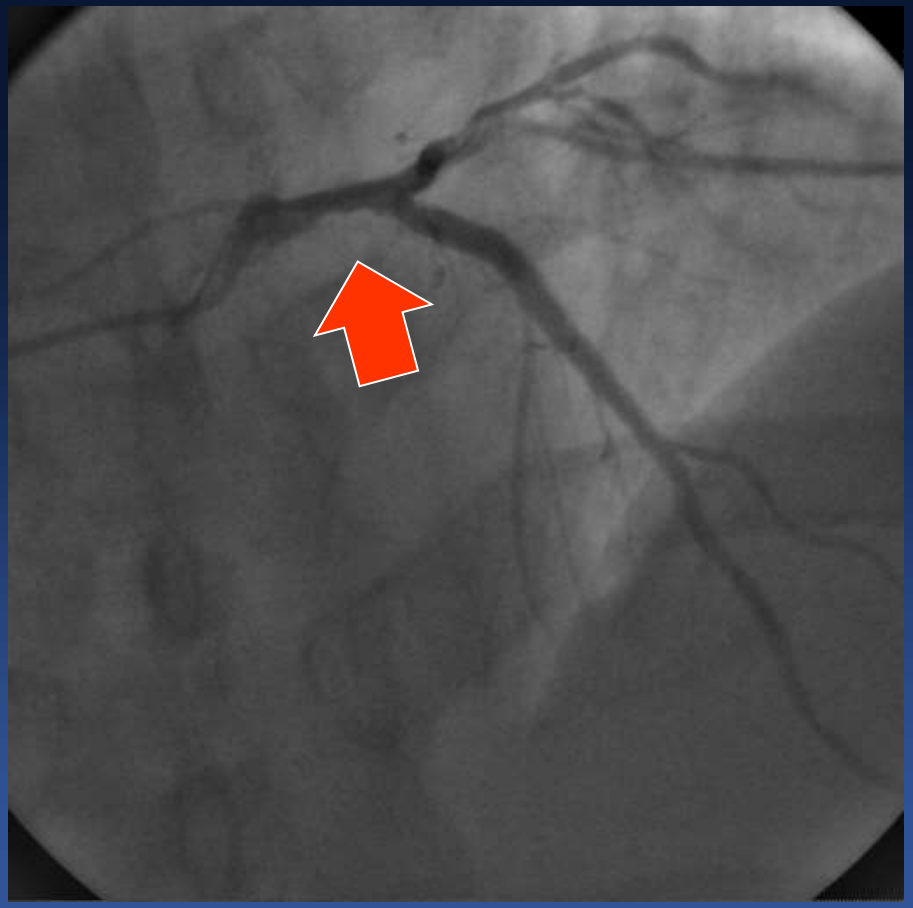
Treadmill Test



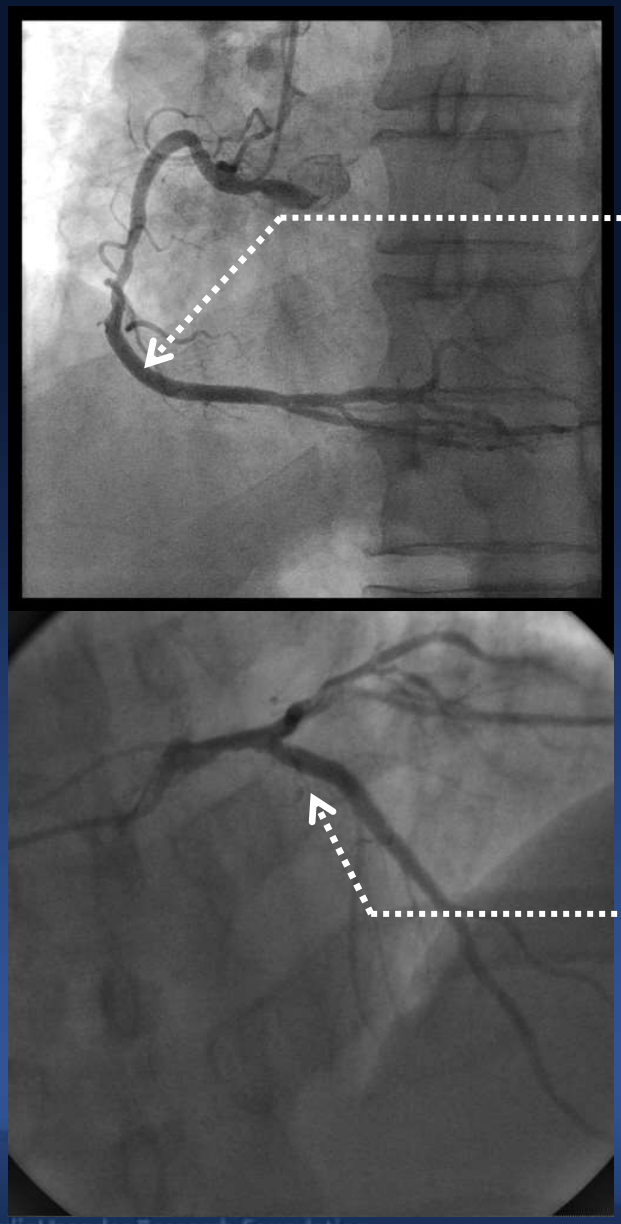
Positive at Stage 4

Coronary Angiography

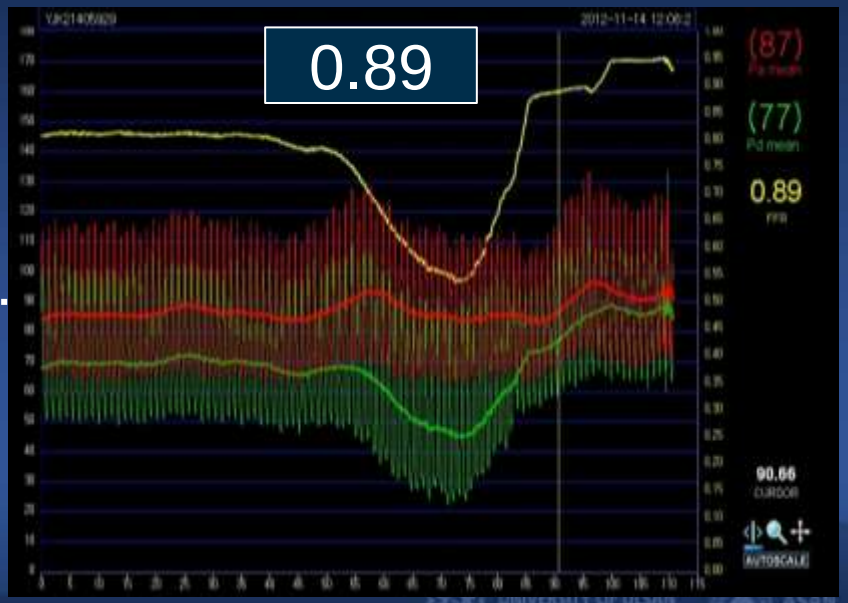




FFR



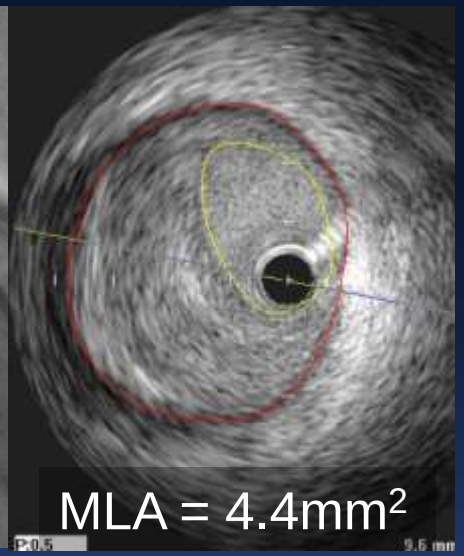

0.72
PressureWire
(77)
(56)
0.72
14.90
AUTOSCALE


0.89
(87)
(77)
0.89
90.66
AUTOSCALE

Which one is Significant LM stenosis?

47/M Stable angina

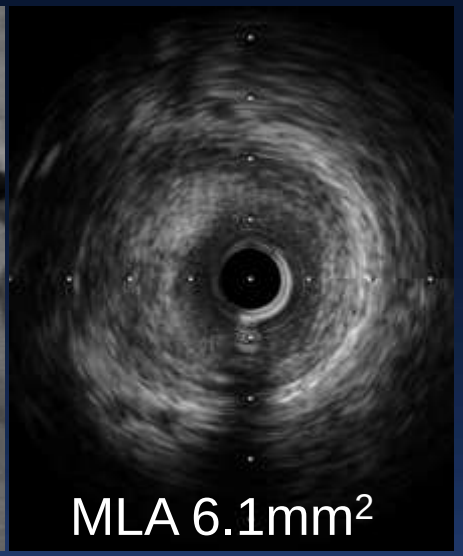
Ostial LM 60%



MLA = 4.4mm^2

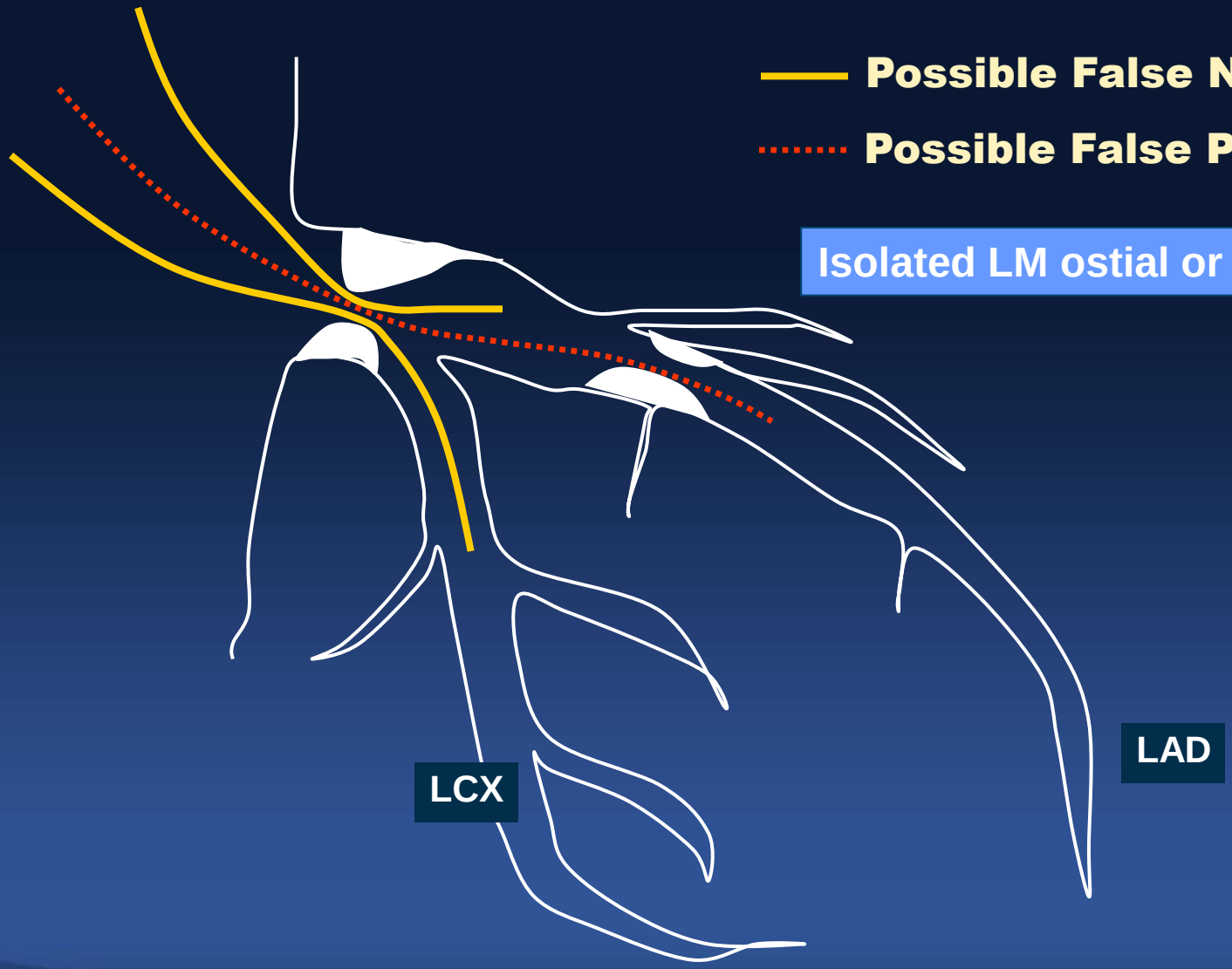
50/M Stable angina

Ostial LM 20%



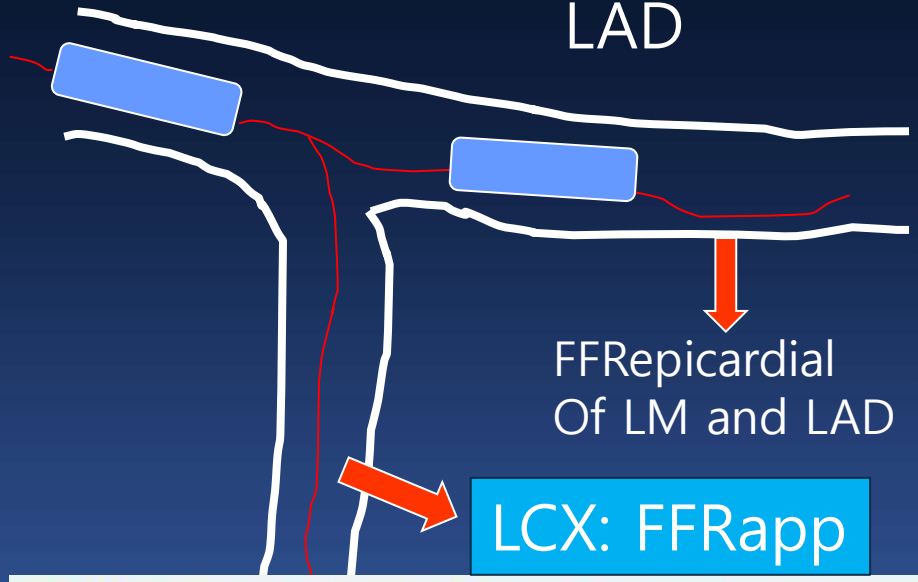
MLA 6.1mm^2

Conceptual Limitations of FFR for LM Disease

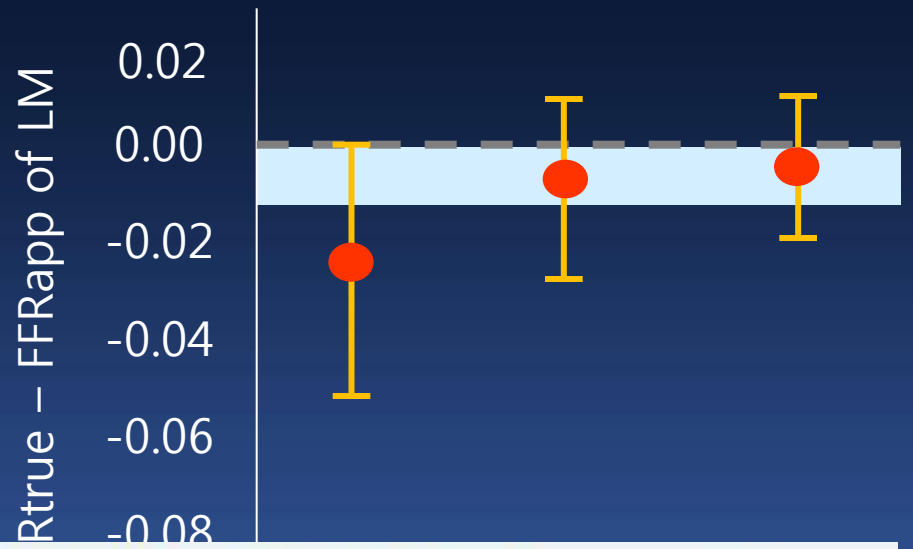


LM and Downstream Disease

Define Absolute Number of LM FFR



Human Validation

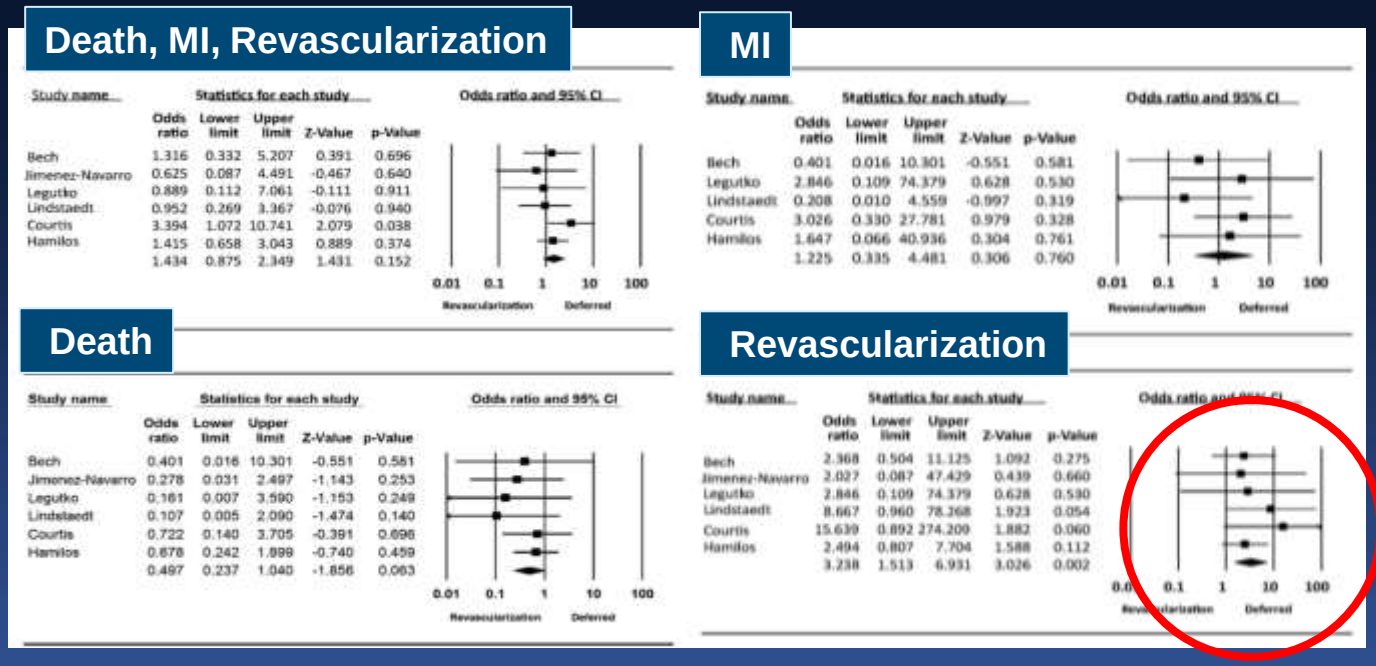


RESULTS In 25 patients, 91 pairs of measurements were made, 71 with LAD stenosis and 20 with LCx stenosis. FFR_{true} of the LMCA was significantly lower than FFR_{app} (0.81 ± 0.08 vs. 0.83 ± 0.08, $p < 0.001$), although the numerical difference was small. This difference correlated with the severity of the downstream disease ($r = 0.35$, $p < 0.001$). In all cases in which FFR_{app} was >0.85, FFR_{true} was >0.80.

Fearon WF, et al JACC Cardiovasc Interv. 2015 Mar;8(3):398-403

Meta-analysis
FFR Guided Treatment of LM:

6 prospective cohort studies involving 525 patients met the inclusion criteria

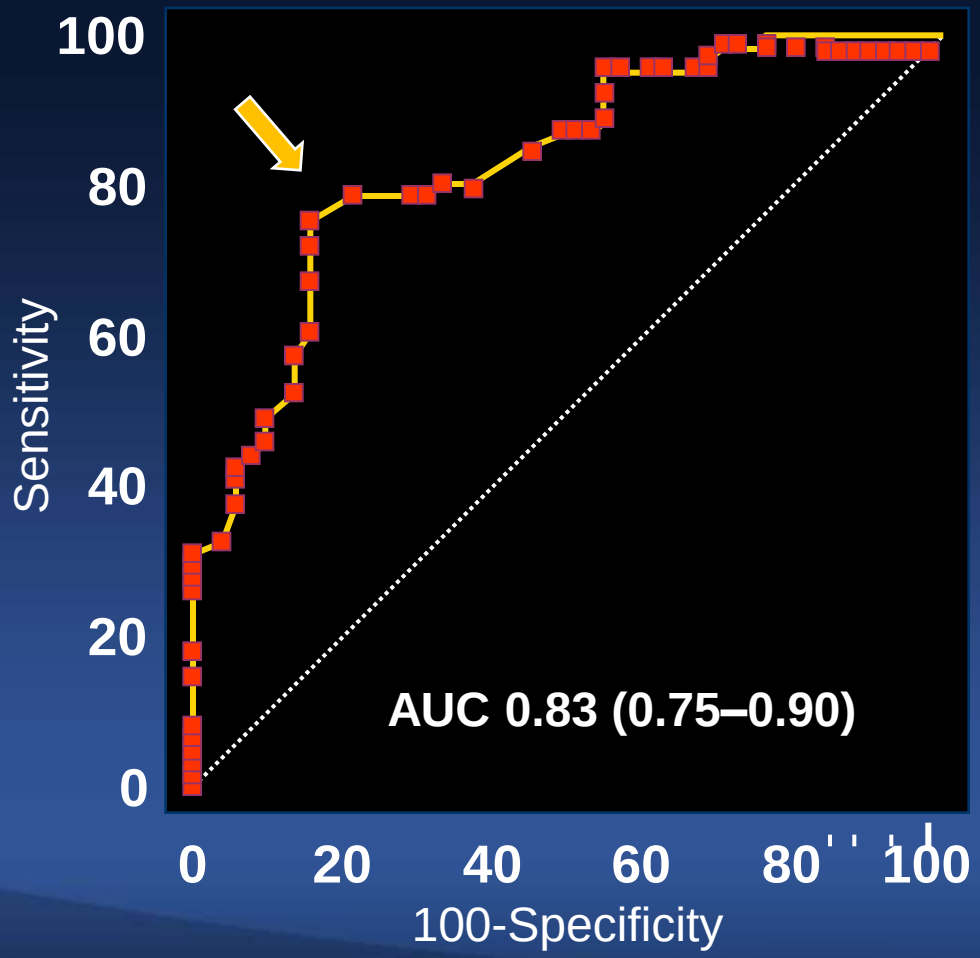


The long term clinical outcomes in patients with ambiguous LMCA stenosis for whom revascularization is deferred based on FFR are favorable and similar to the revascularized group in terms of overall mortality and MI

Catheterization and Cardiovascular Interventions 86:12–18 (2015)

IVUS MLA

Matched with FFR <0.80 (N=112)



Cut-off = 4.5 mm²

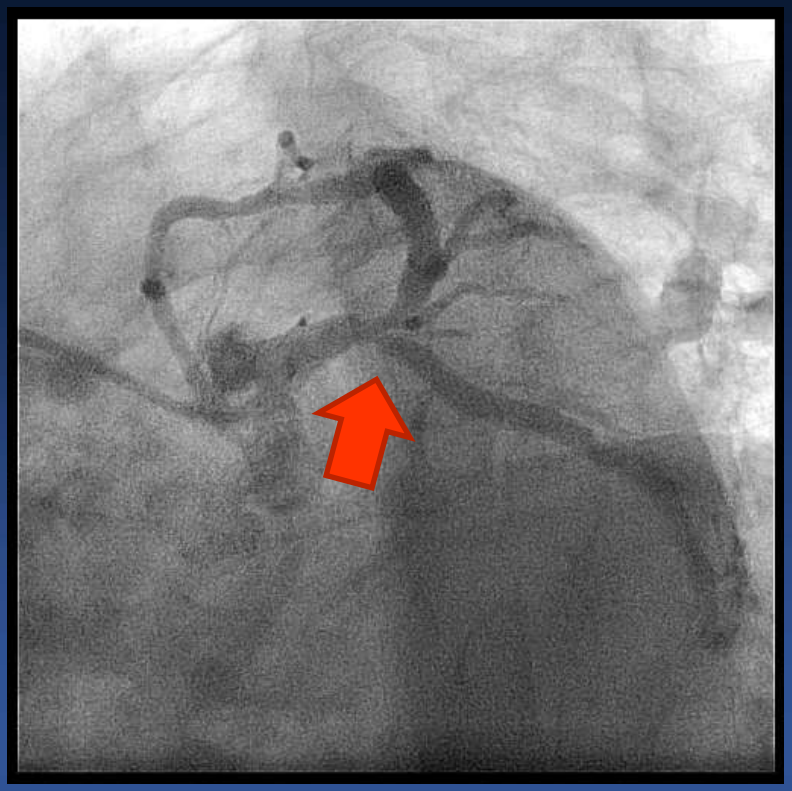
Sensitivity	79%
Specificity	80%
PPV	83%
NPV	76%
Accuracy	80%

Park SJ et al. *JACC Interv, 2014;7(8):868-874*

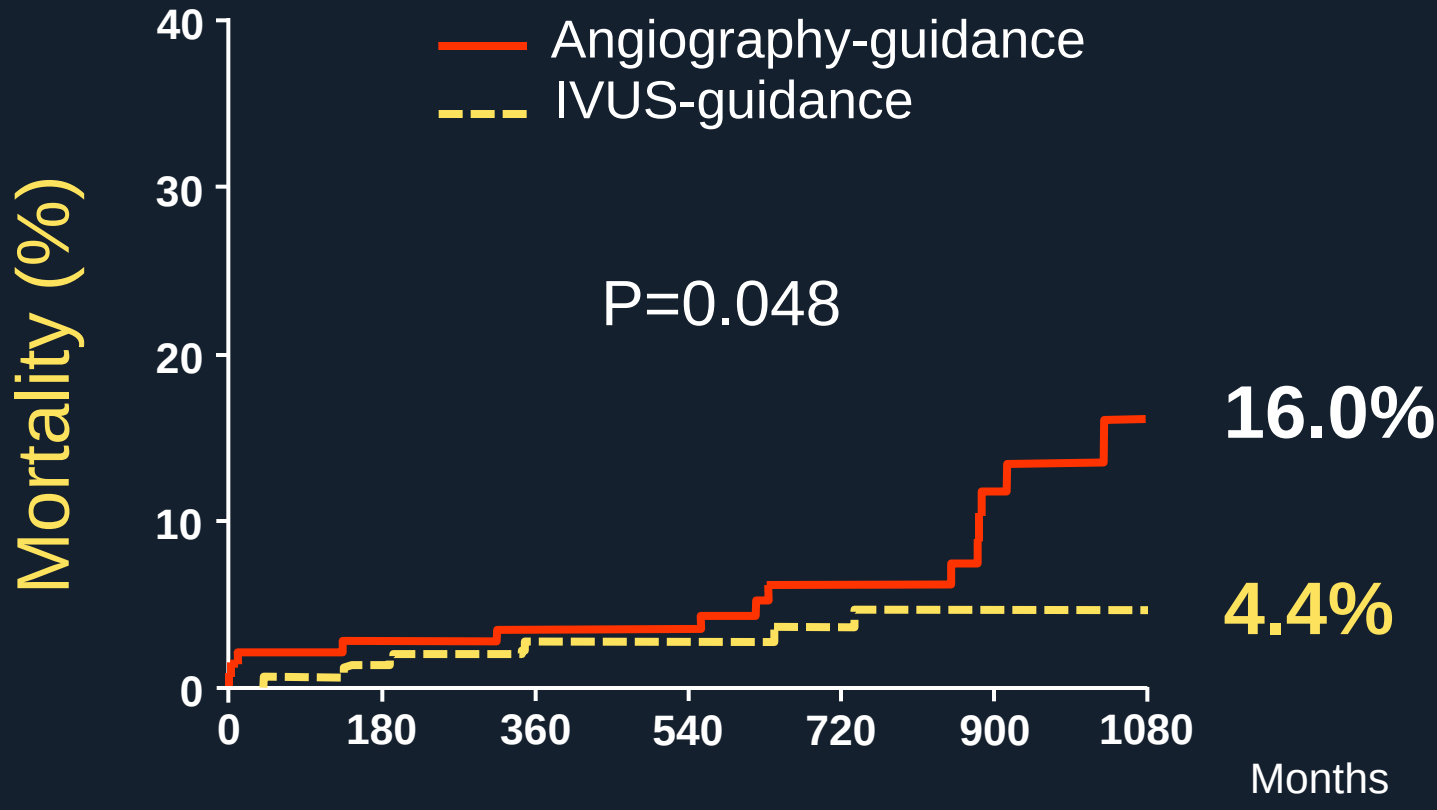
How to Treat: PCI Strategy

Ostial and Shaft Disease

Bifurcation Disease



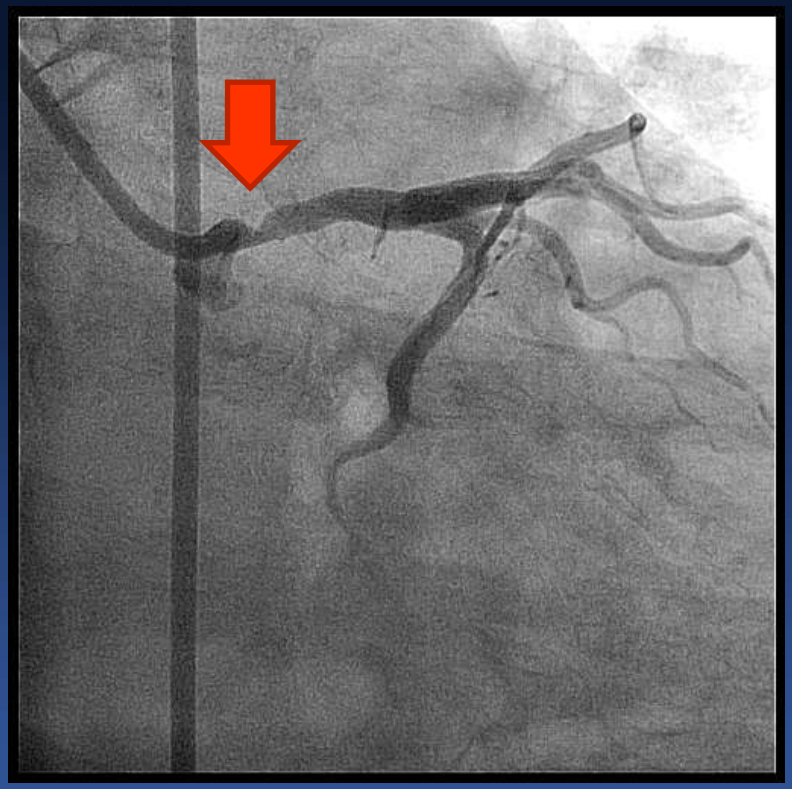
IVUS Guidance Saved Lives !



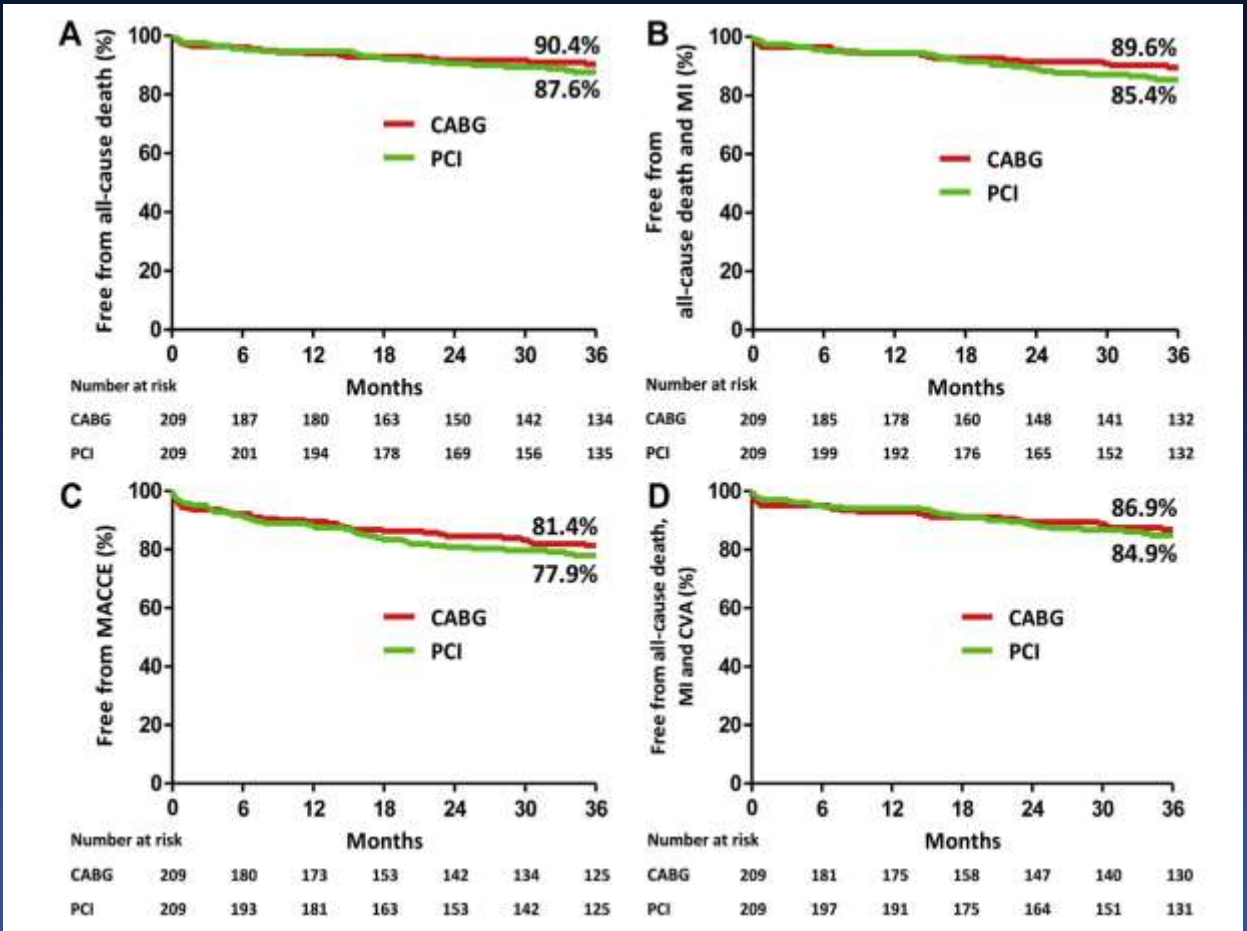
Patients after risk				
IVUS-guidance	145	140	98	37
Angiography-guidance	145	137	88	29

Park SJ et al, Circulation. Cardiovasc Interv. 2009;2(3):167-77.

Left Main Ostial or Shaft Disease



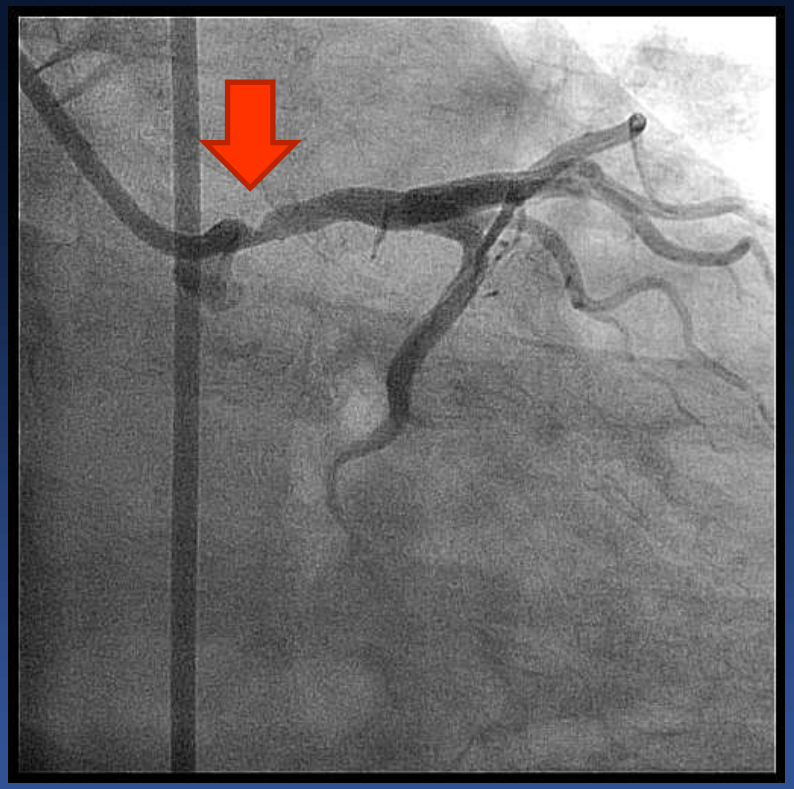
Left Main Ostial or Shaft Disease



DELTA Registry J Am Coll Cardiol Intv 2014;7:354–61

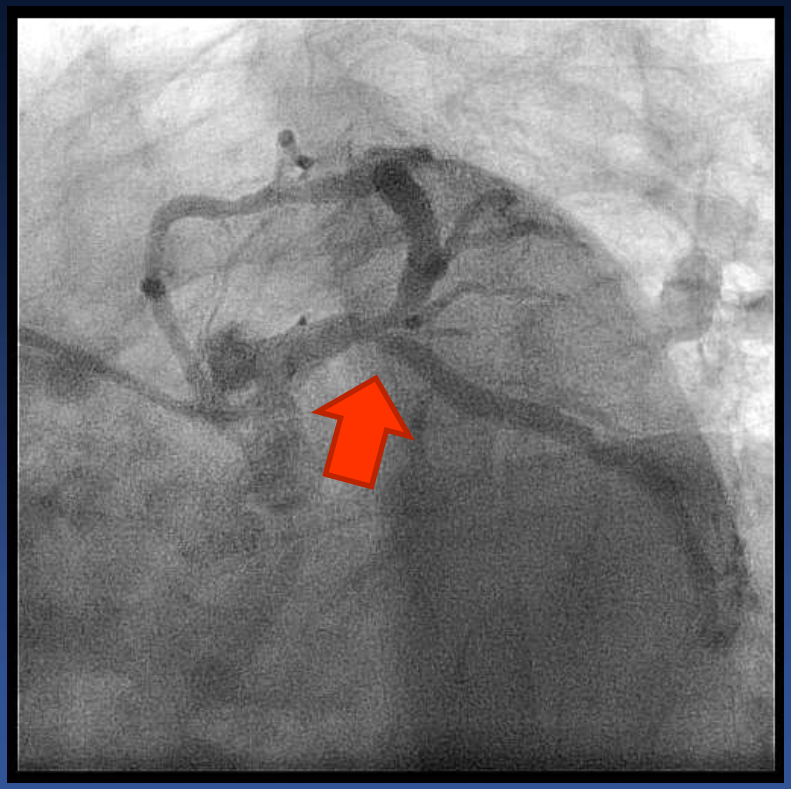
Left Main Ostial or Shaft Disease

Just Stent it



How to Treat: PCI Strategy

Bifurcation Disease



One Stent Better Than Two Stent For LM Bifurcation

	Patients number		FU	Hazard Ratio				
	1 Stent	2 Stent	(M)	MACE	Death or MI	Death	MI	TVR
Palmerini[1]	456	317	24	**0.48 P=0.001**	**0.38 P=0.018**	-	-	-
Toyofuku[2]	261	119	36	-	-	0.61 P=0.09	-	**0.32 P<0.01**
Kim[3]	234	158	36	**0.89 P<0.001**	-	0.77 P=0.62	**0.38 P<0.01**	**0.16 P=0.005**
Song[4]	509	344	36	**0.42 P<0.001**	**0.48 P=0.03**	**0.30 P=0.02**	**0.41 P=0.04**	**0.47 P<0.01**

[1]Circ Cardiovasc Interv. 2008;1:185-92

[2]JACC Cardiovasc Interv. 2014;7:255-63

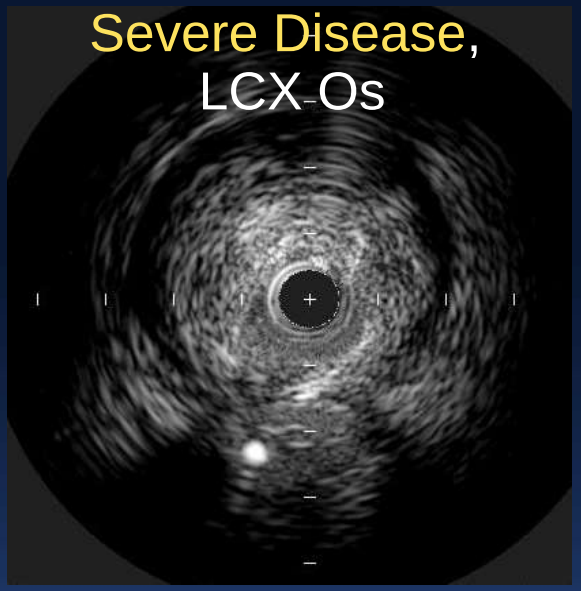
[3]Catheter Cardiovasc Interv. 2011;77:775-82

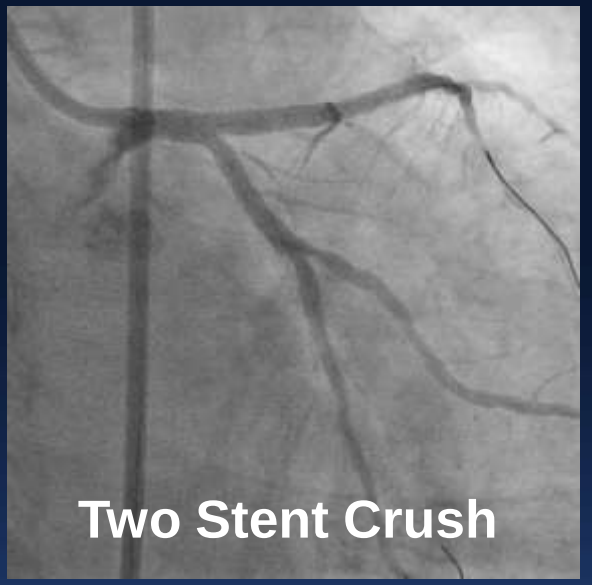
[4]Circulation. 2009;120:1866-74

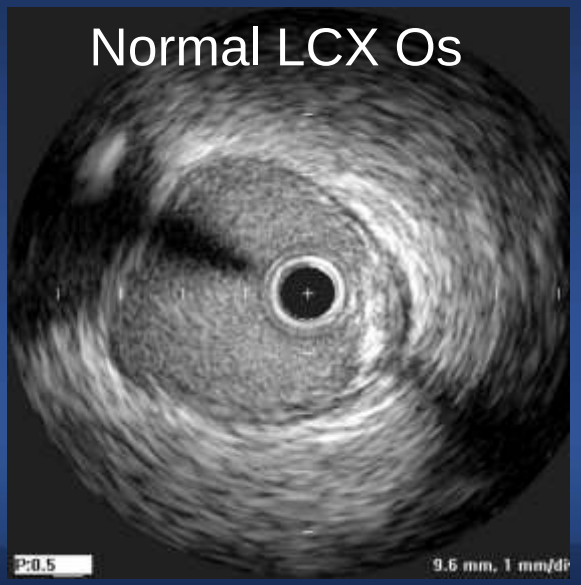
LM Bifurcation

Stent Cross Over	***Normal Ostial LCX (Medina 1.1.0., 1.0.0)*** Normal or Diminutive LCX Small LCX with < 2.5 mm in diameter Focal disease in distal LCX
Two Stent	***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

Direct LCX pullback IVUS
LAD pullback overestimates LCX ostial MLA







Direct LCX pullback IVUS
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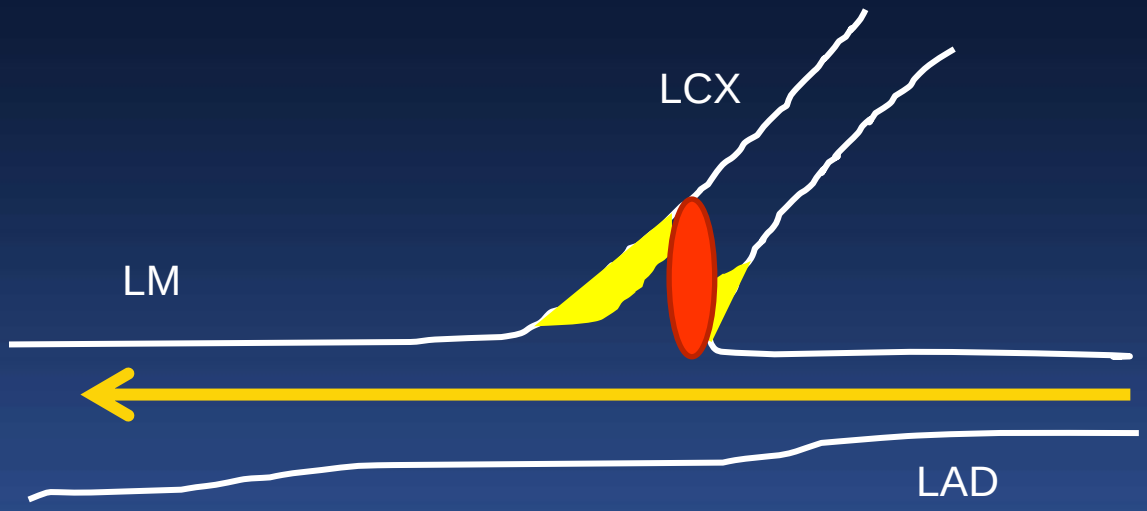

Direct LCX pullback IVUS
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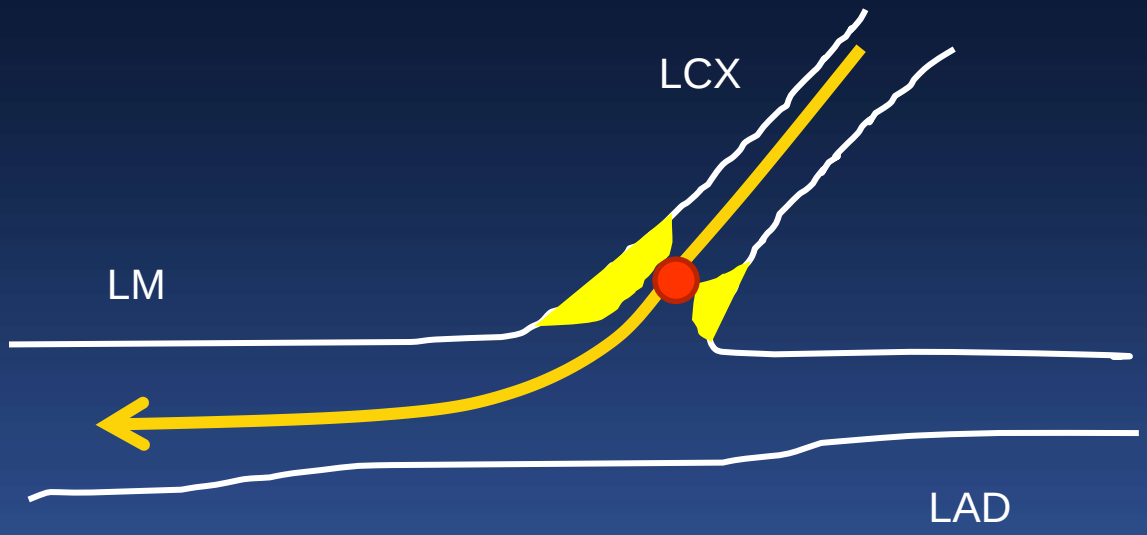
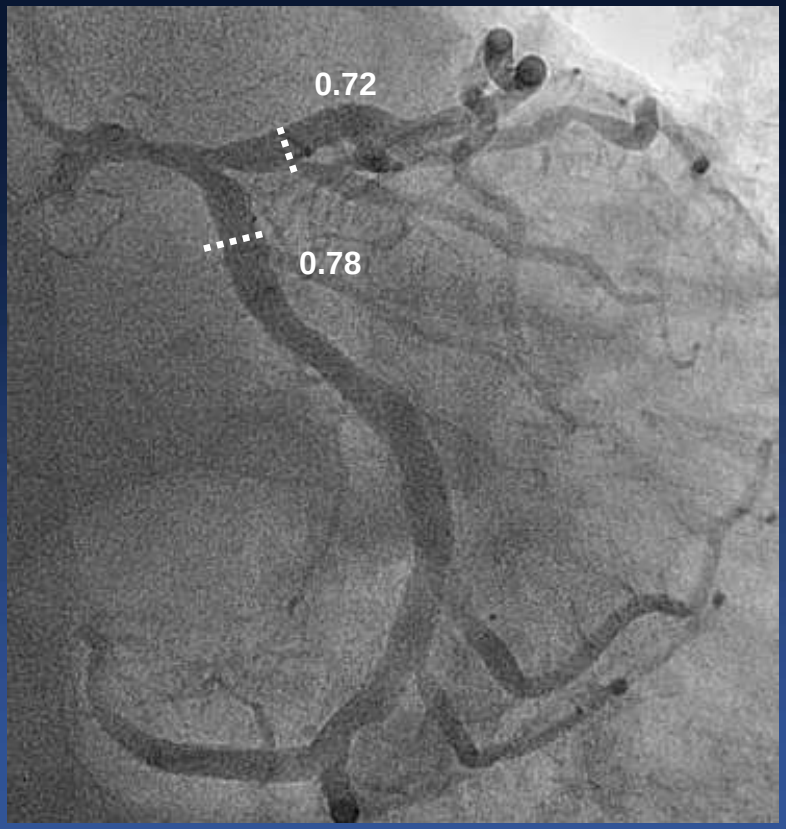


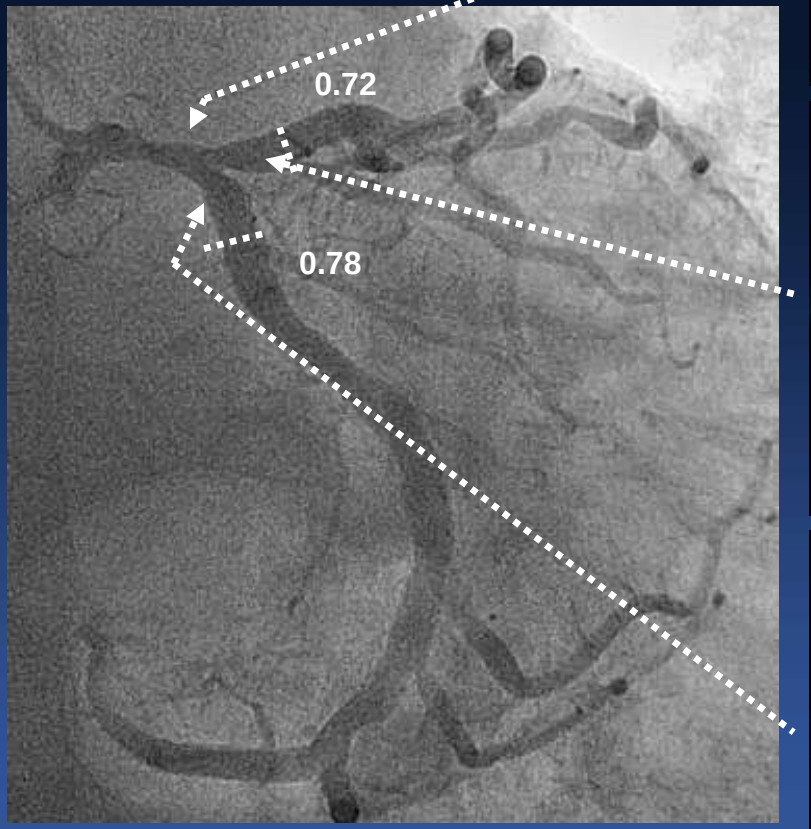
LM Bifurcation Lesion (Medina 1,0,0) with Minimal LCX Disease

55/M, Stable angina,

FFR in Both LAD and LCX,

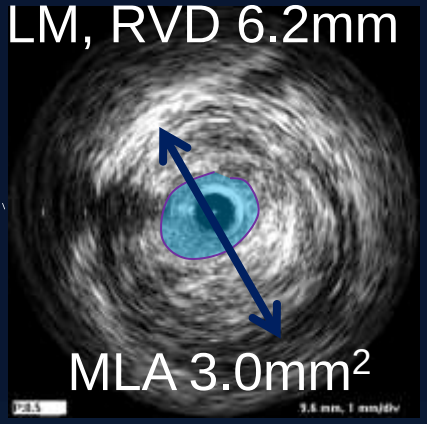


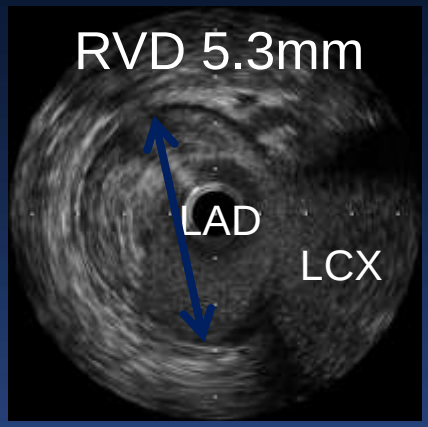
IVUS in Both LAD and LCX,

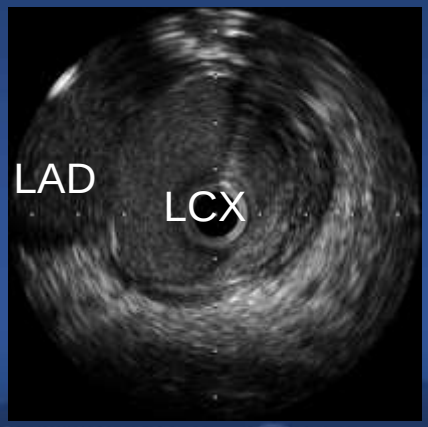


Minimal disease at LCX ostium

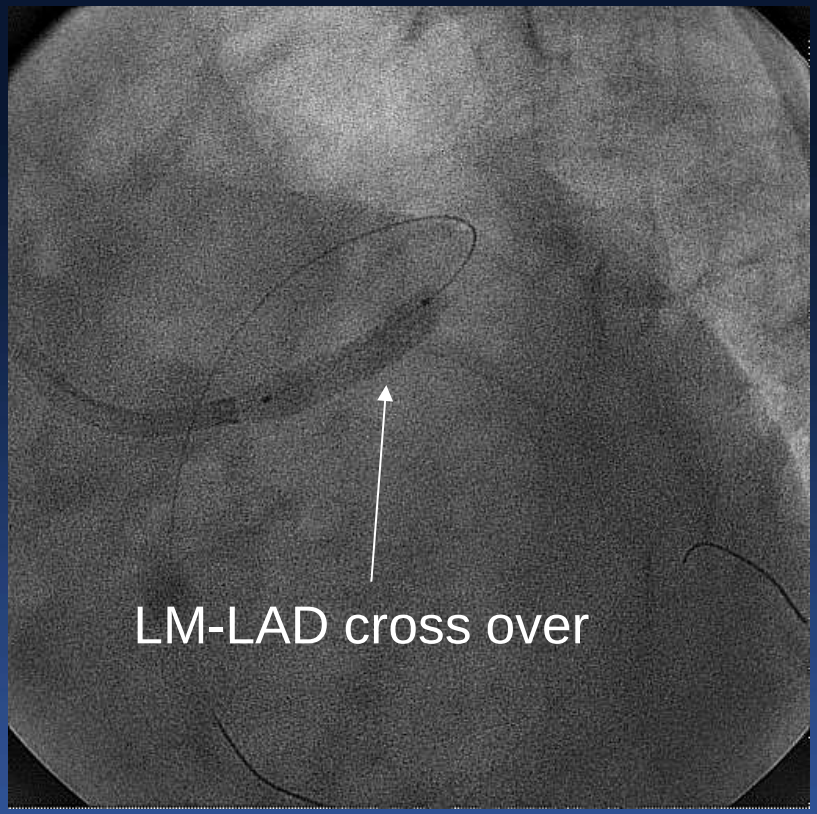
Distal LM, RVD 6.2mm



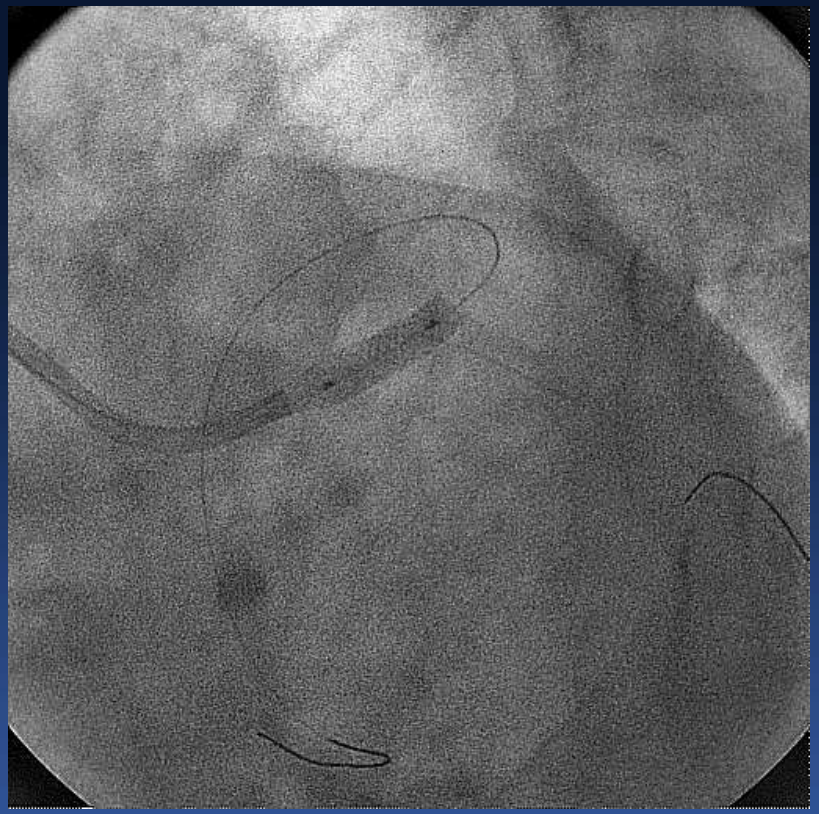




Single Stent Cross-Over
with minimal-disease at LCX OS

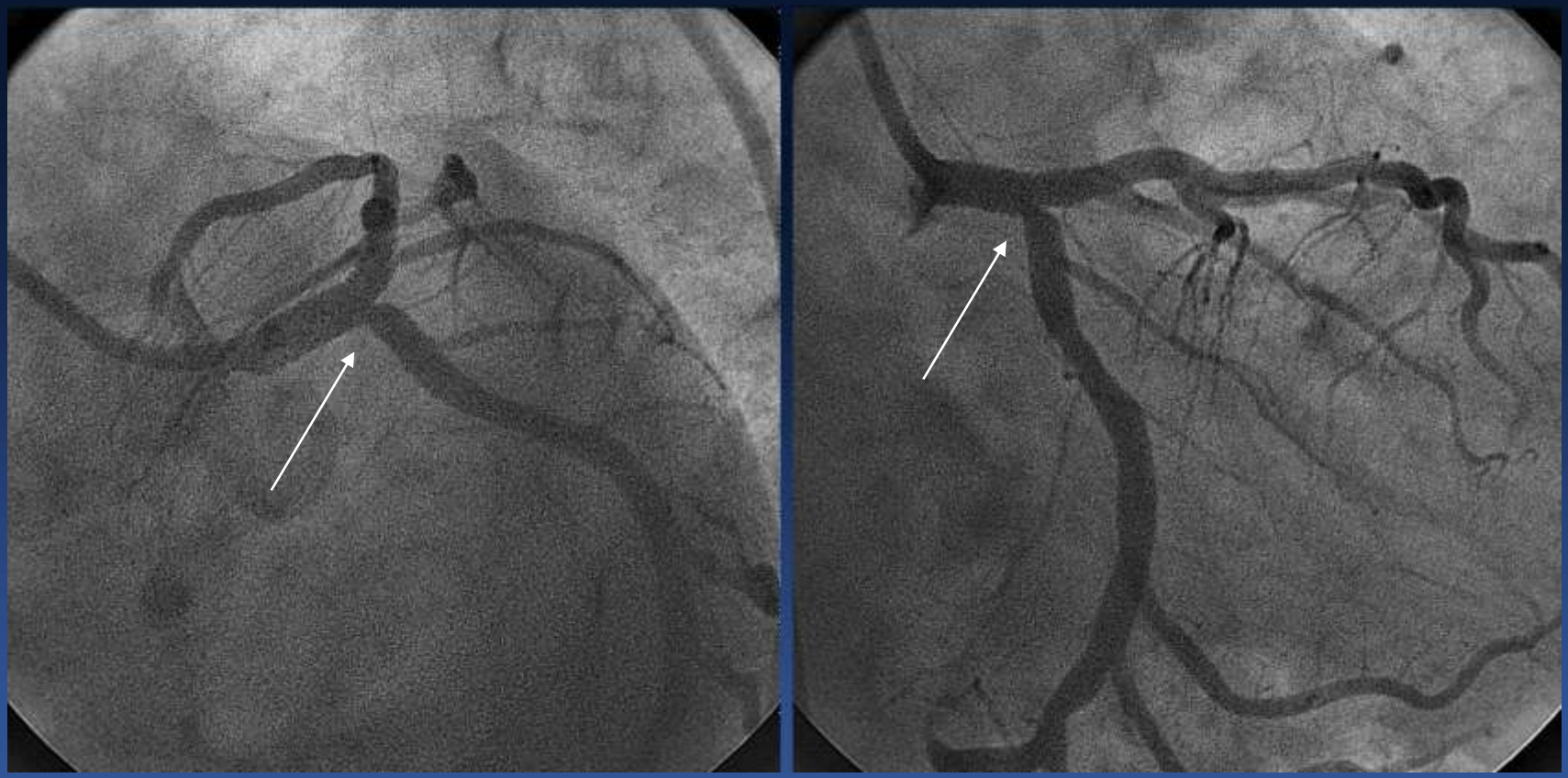


Promus Element
4.0x20

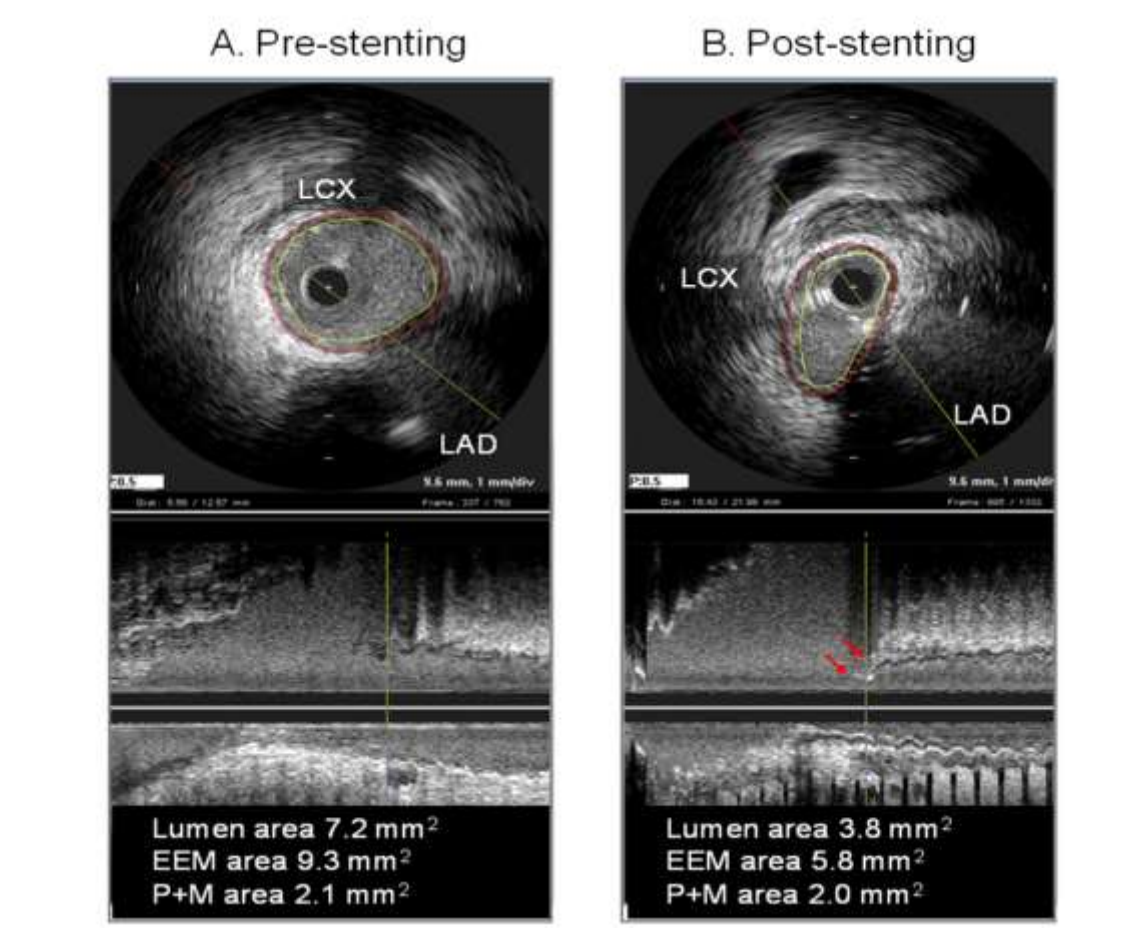


Additional high pressure
Inflation with 4.0 mm
non-compliant balloon

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



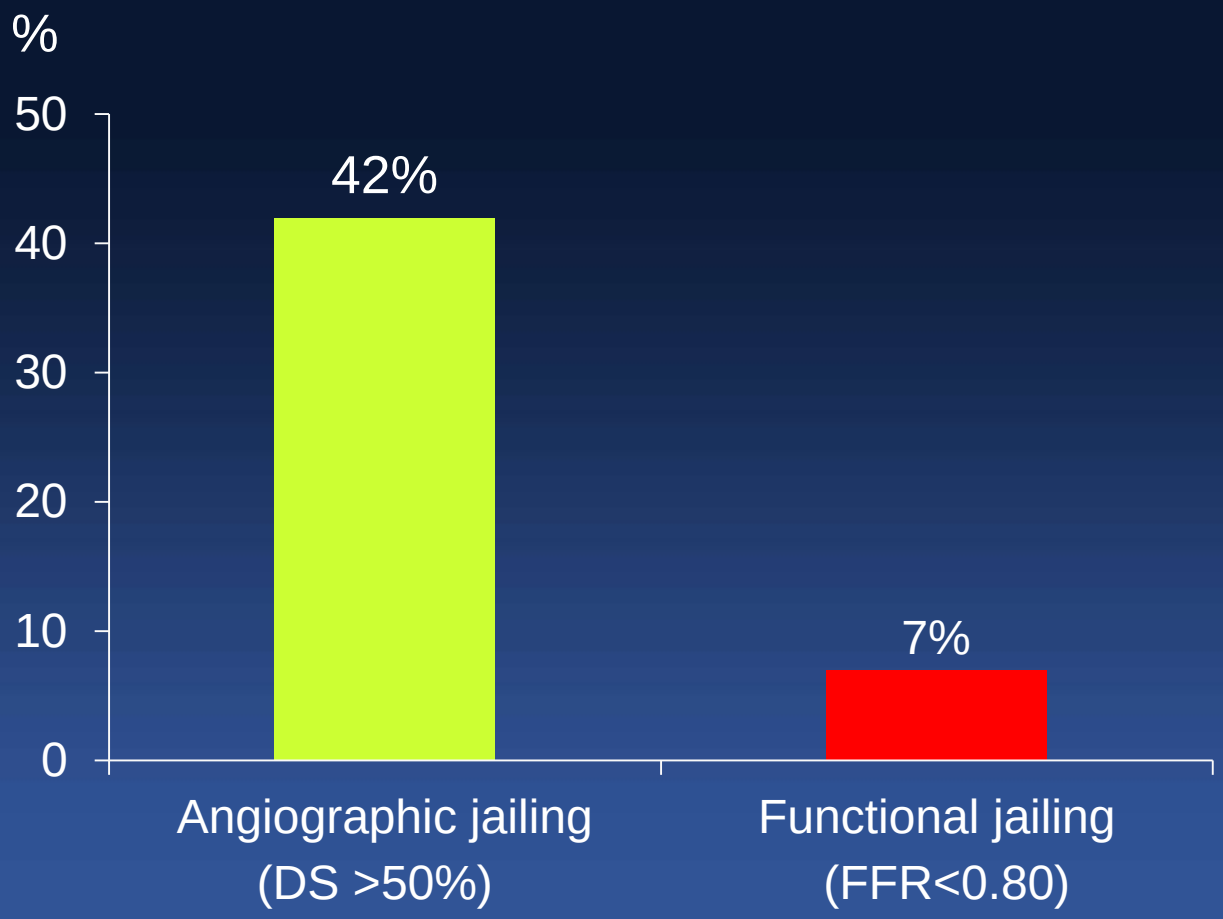
Geometric Change in LCX ostium after Stent Cross Over



1) Carina shift, 2) reduction of MLA, and 3) increased eccentricity of the external elastic membrane and carina angle between the LAD and the LCX

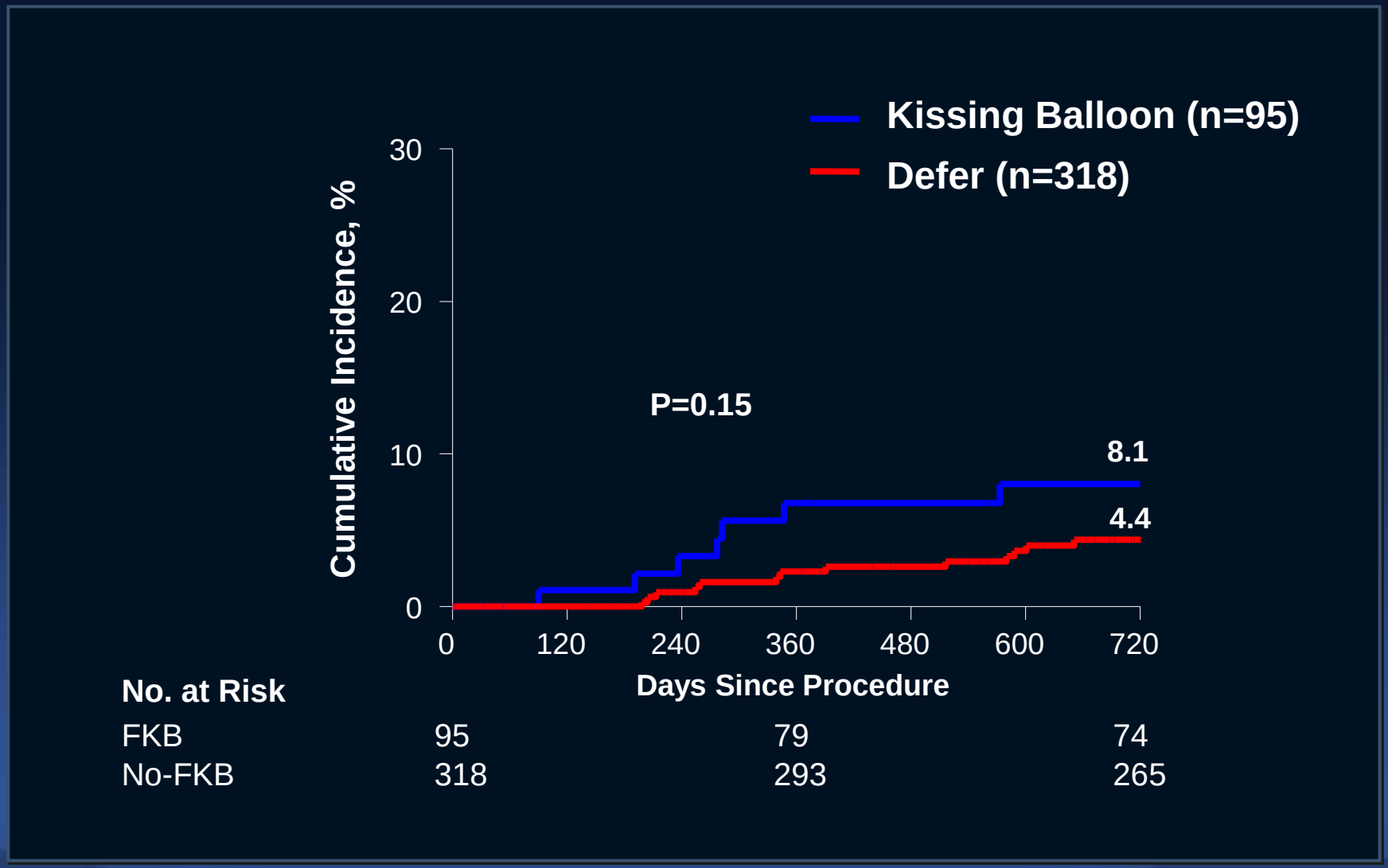
Kang SJ et al. Circ Cardiovasc Interv. 2011;4:355-361.

Functionally Significant LCX Jailing
After Stent Crossover (LCX ostial DS<50%)



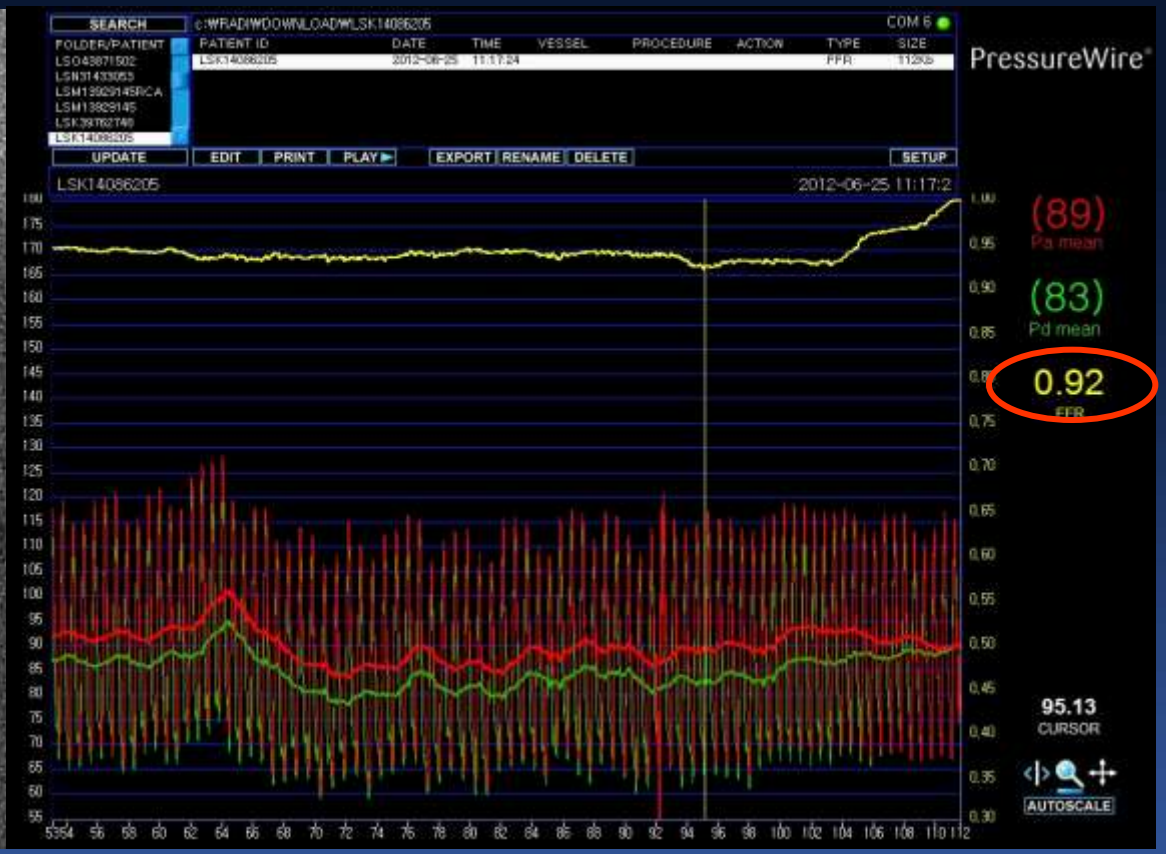
Kang SJ, Catheterization and Cardiovascular Interventions. 2014;83(4):545-52.

Left Main-TLR *at 2 Years*



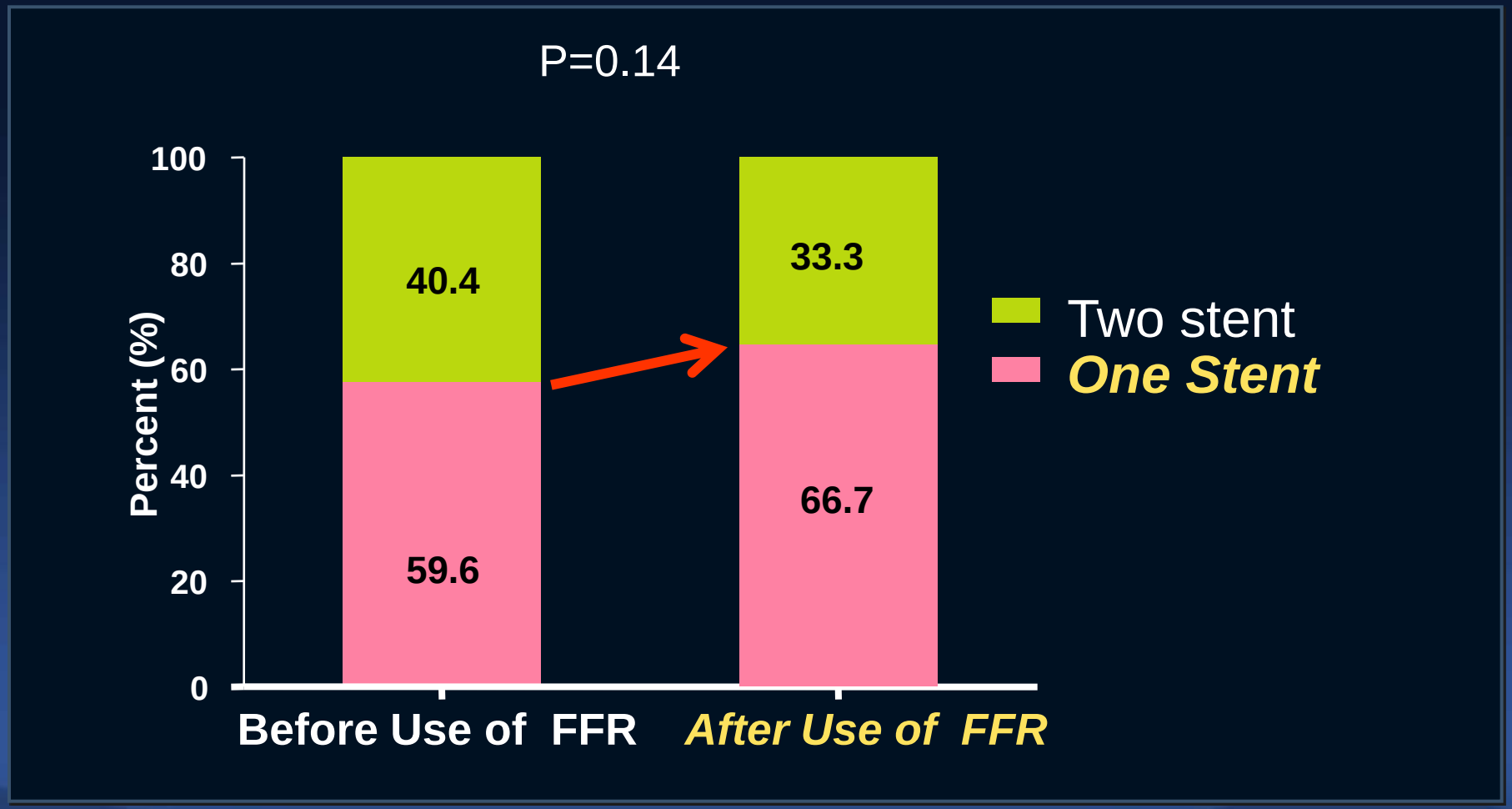
Do You Want to Treat It ?

Consider FFR, First !



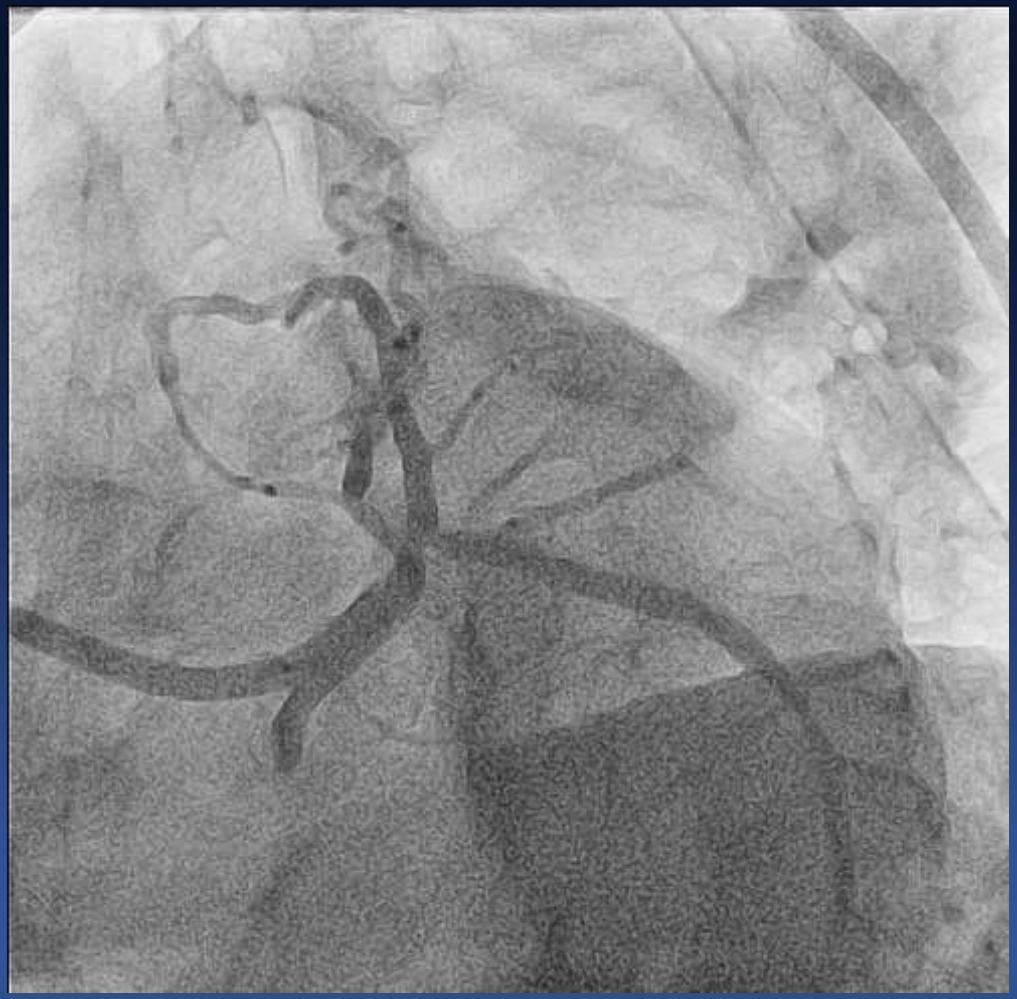
Just Defer !

Distal LM Stent Technique
More One-Stent Technique



Ahn JM et al. Am J Cardiol. 2015 Oct 15;116(8):1163-71.

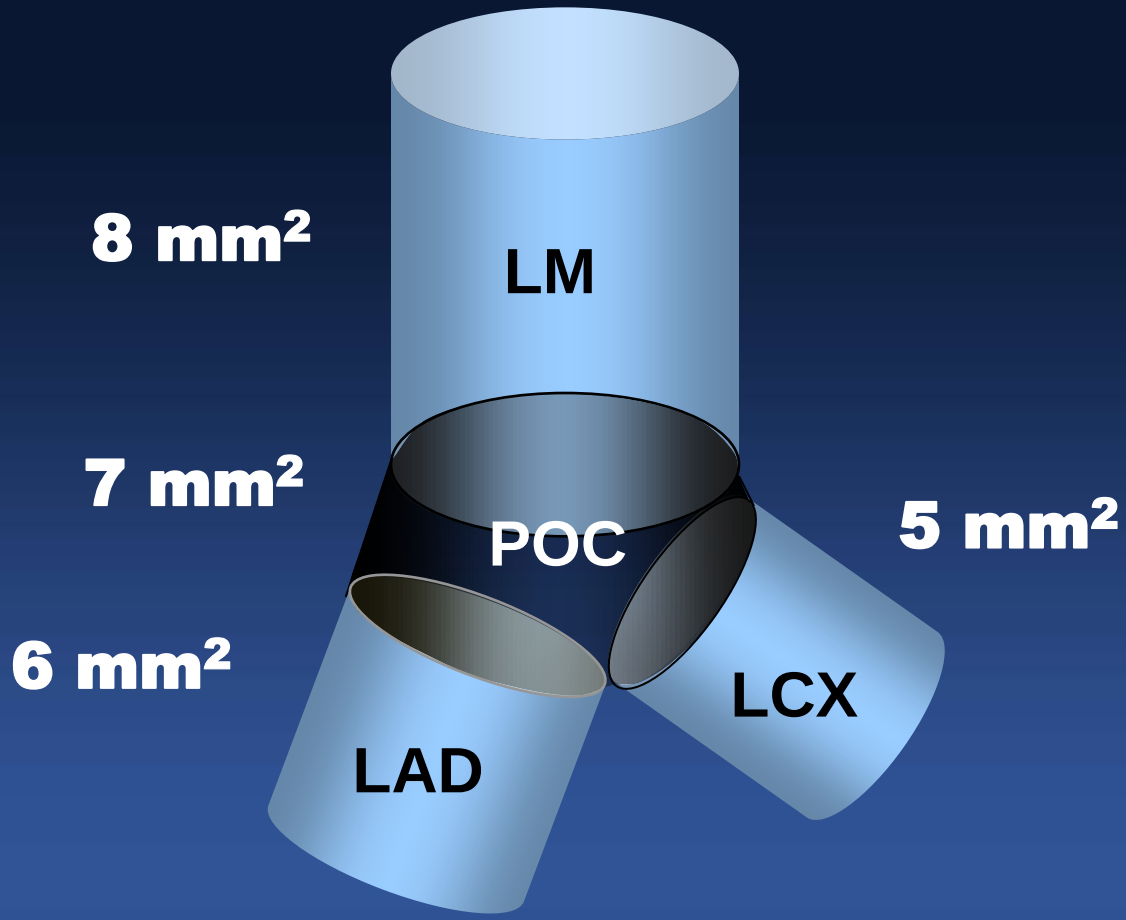
True Bifurcation



Two Stent Technique

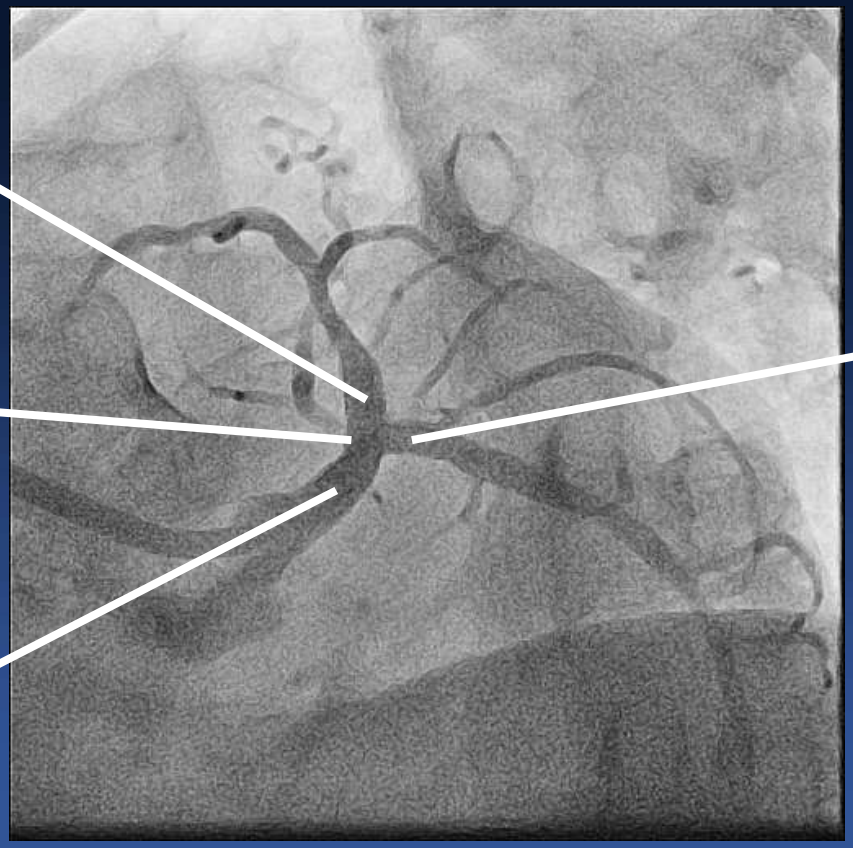
- Crush Technique
- Mini-Crush Technique
- T stent Technique
- Kissing Stent Technique
- Culotte Technique
- Double-Kiss Crush Technique

Effective IVUS Stent Area (Rule of 5,6,7,8) Can Reduce Restenosis Rate

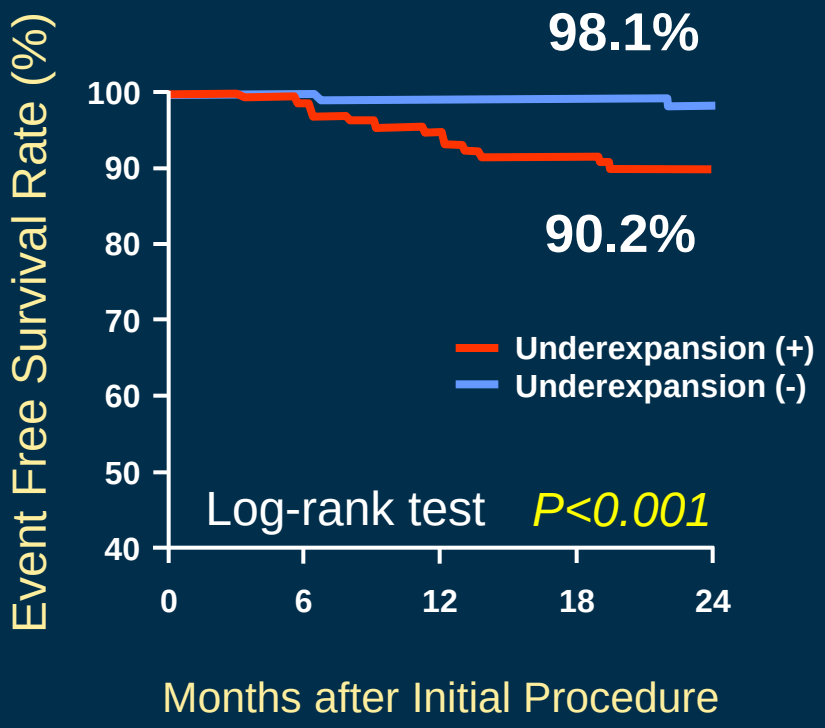


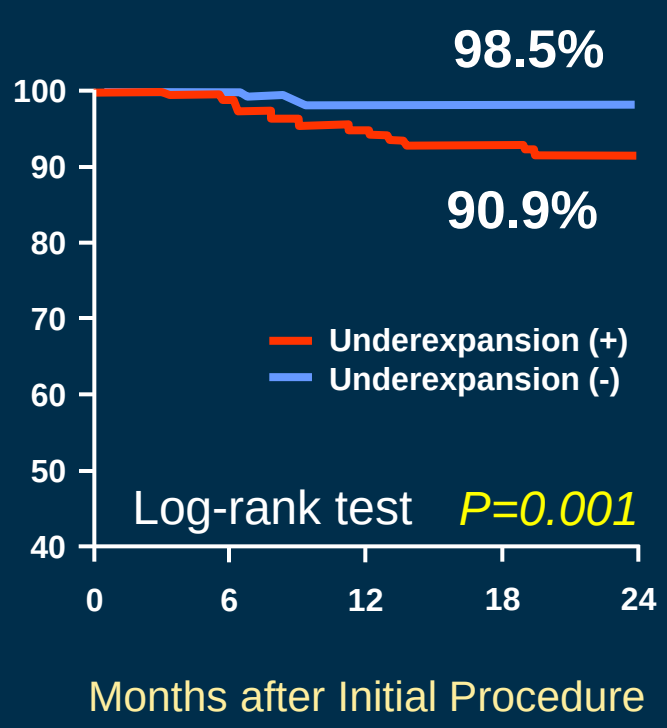
Kang et al. Circ Cardiovasc Interv 2011;4:1168-74

Post Stent IVUS Surveillance For Further High Pressure Ballooning

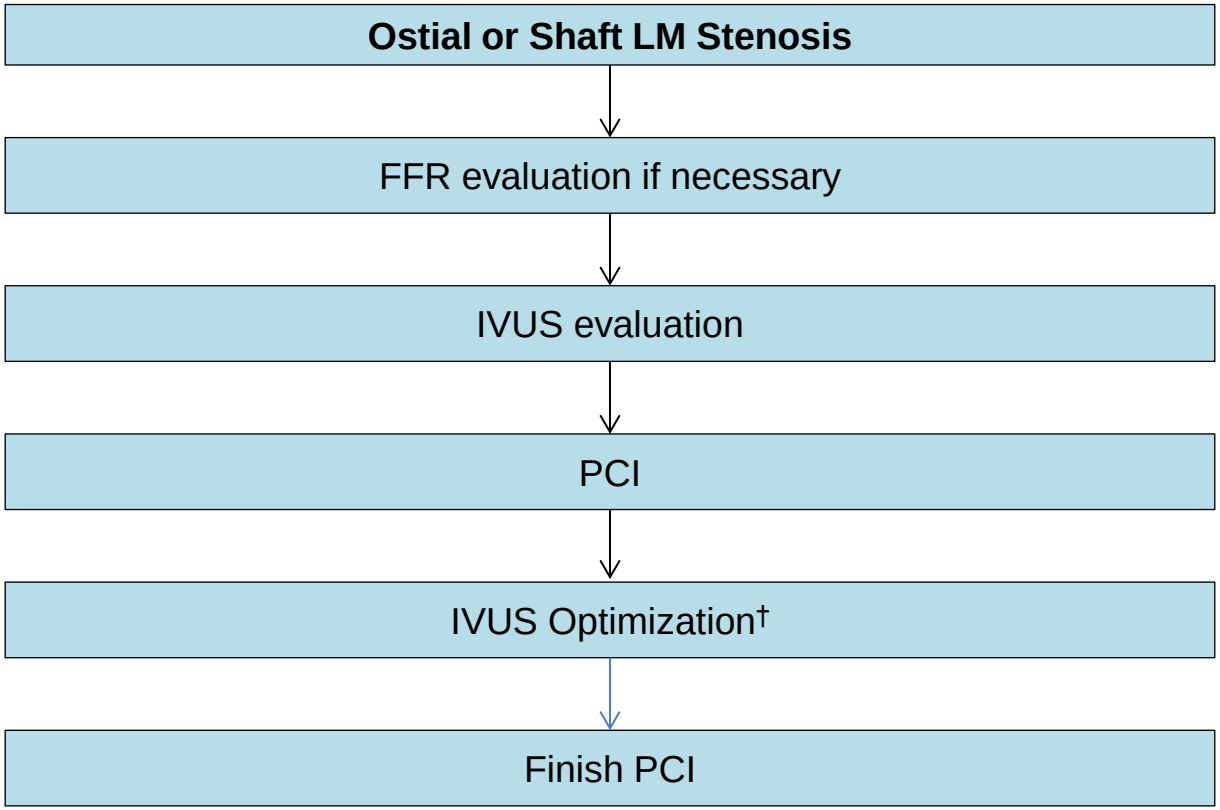


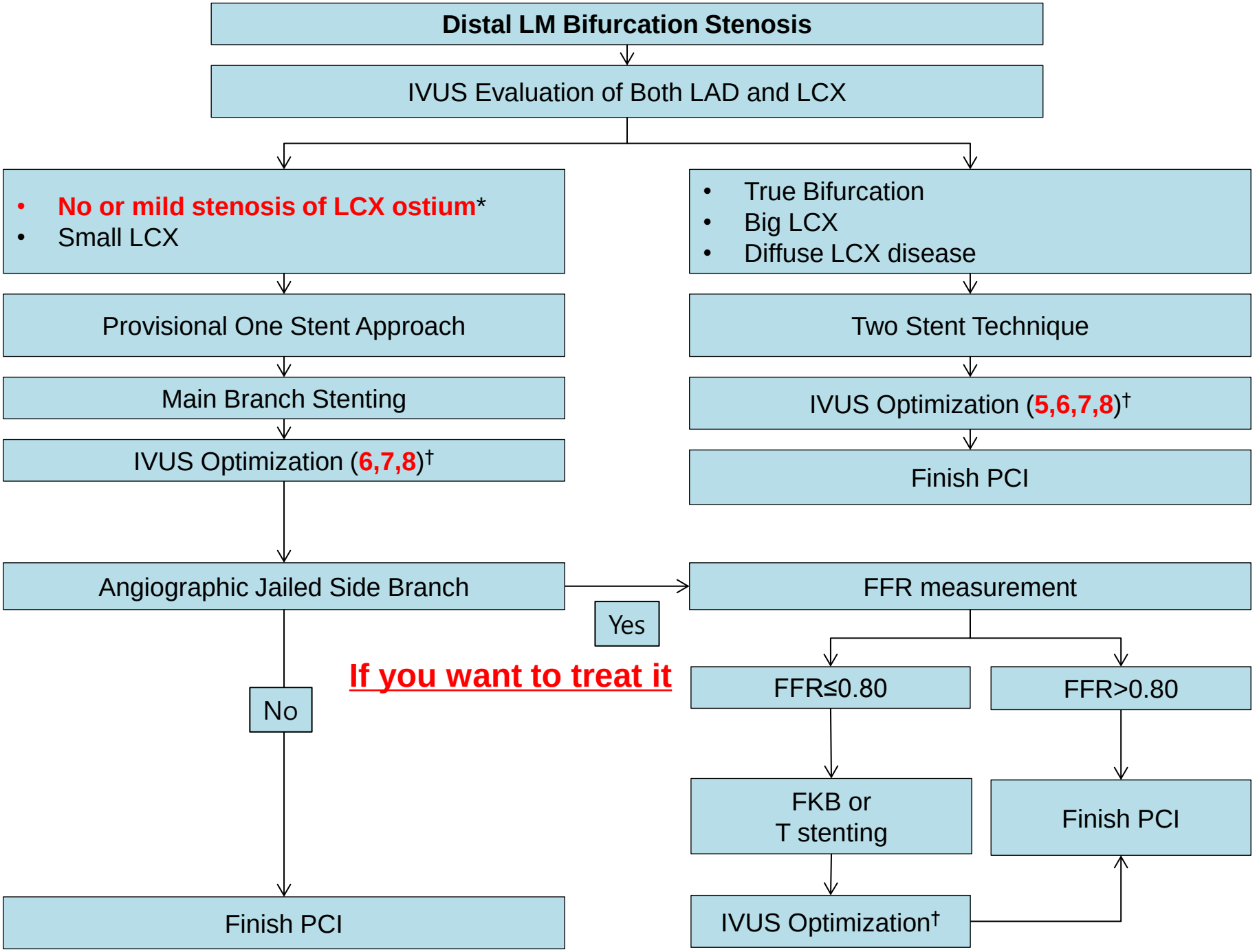
MACE-free and TLR-free Survival





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


Ostial or Shaft LM Stenosis
FFR evaluation if necessary
IVUS evaluation
PCI
IVUS Optimization†
Finish PCI


Distal LM Bifurcation Stenosis
IVUS Evaluation of Both LAD and LCX
• No or mild stenosis of LCX ostium*
• Small LCX
• True Bifurcation
• Big LCX
• Diffuse LCX disease
Provisional One Stent Approach
Two Stent Technique
Main Branch Stenting
IVUS Optimization (6,7,8)†
IVUS Optimization (5,6,7,8)†
Finish PCI
Angiographic Jailed Side Branch
FFR measurement
Yes
If you want to treat it
No
FFR≤0.80
FFR>0.80
FKB or
T stenting
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Finish PCI
IVUS Optimization†