Cross-over Technique: When and How to Do & Clinical Outcomes

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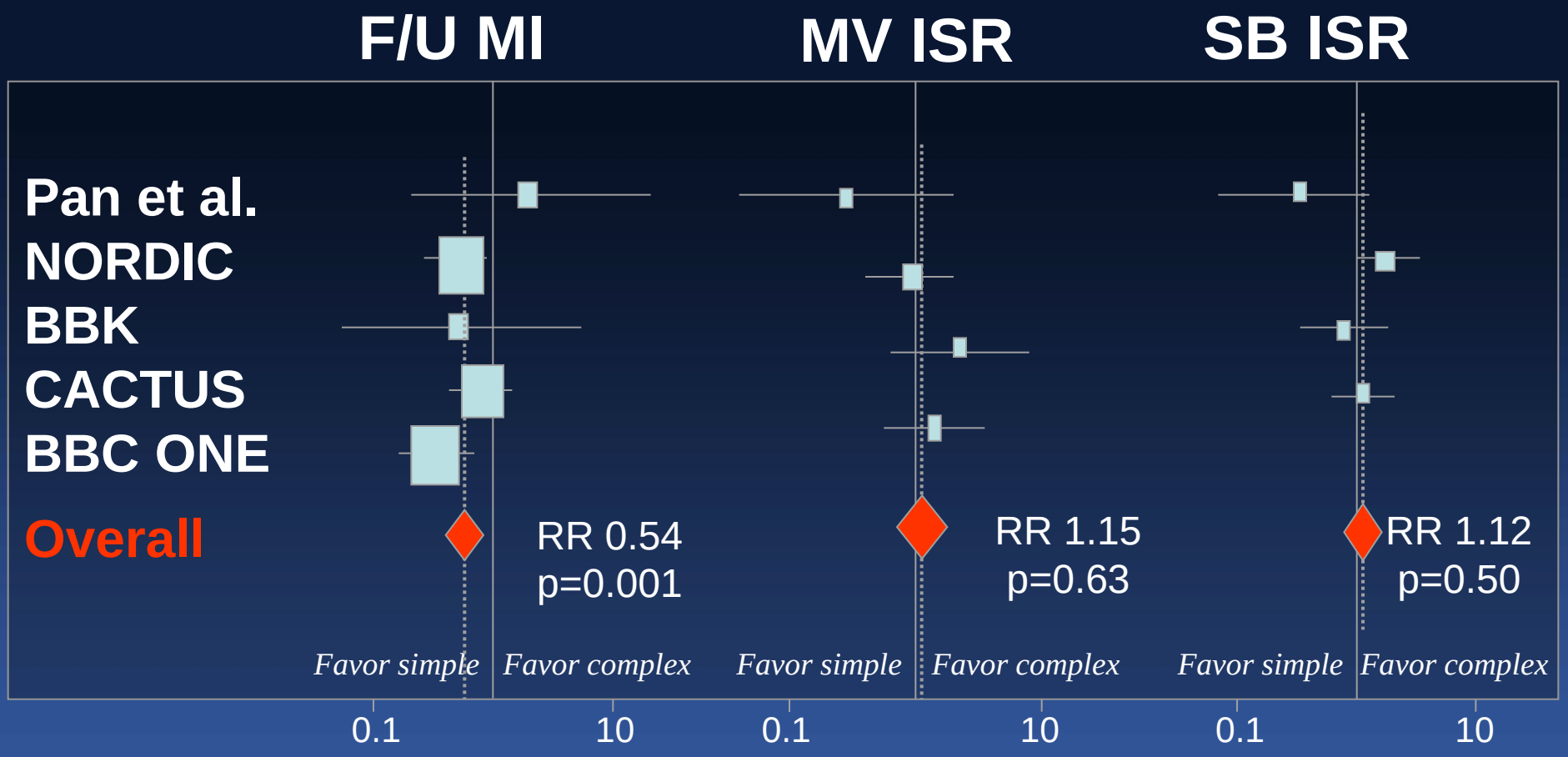
Disclosure Statement of Financial Interest

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

Initial Stent Strategy

Simple vs. Complex

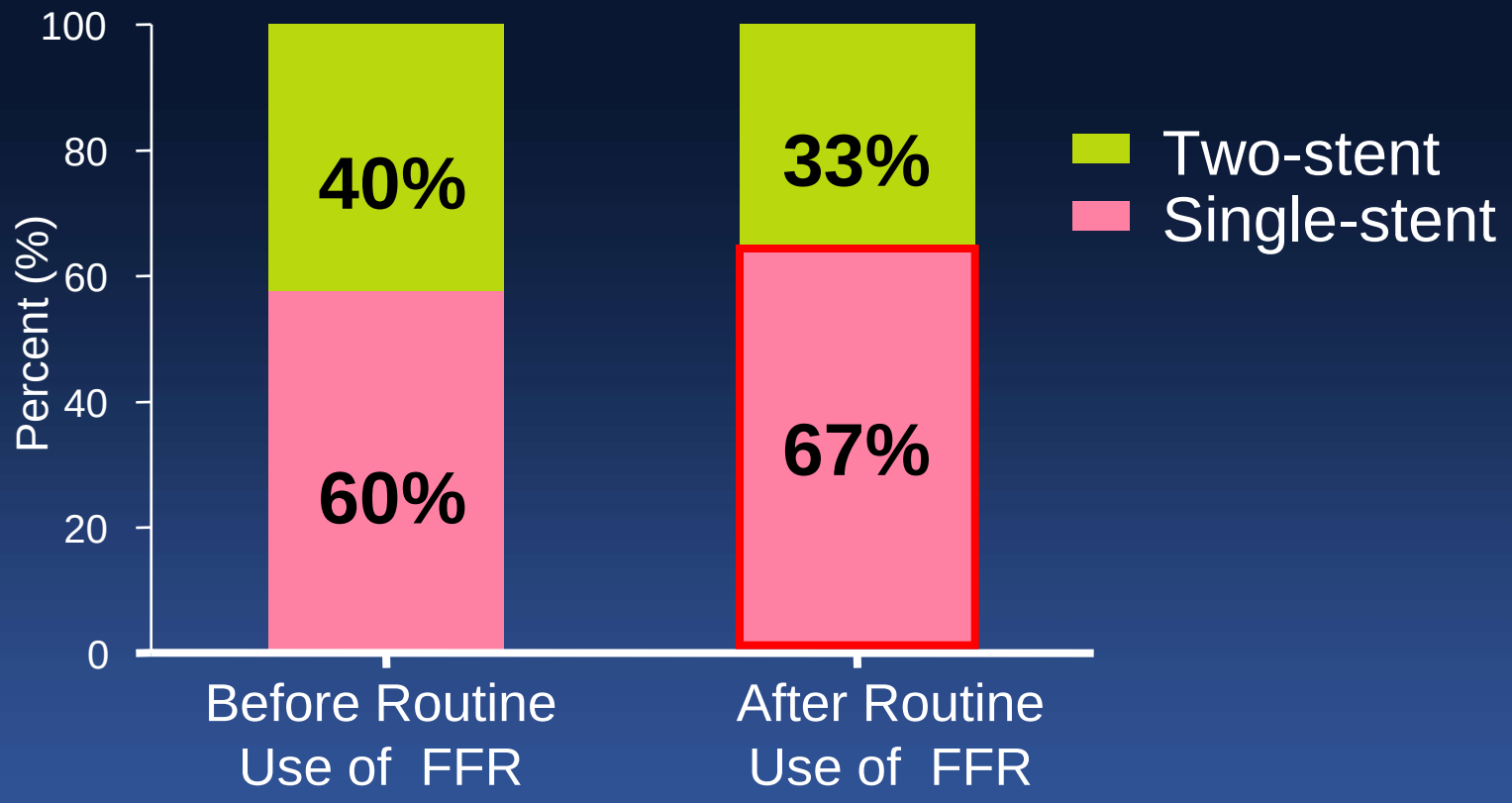


46%↓RR

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

Distal LM Bifurcation in the Real World

Single-stent Cross-over Increased



AMC data

LM bifurcation: Provisional vs. Two-stent

Study	Patients No		FU	Adjusted Hazard ratio (95% CI)			
	Provision	Two	(M)	Death/ MI	Death	MI	TVR
Palmerini[3]	456	317	24	0.38 (0.17-0.85) P=0.018	-	-	-
Toyofuku[6]	261	119	36	-	0.61 (0.34-1.08) P=0.09	-	0.32 (0.18-1.21) P<0.01
Kim[4]	234	158	36	-	0.77 (0.28-2.13) P=0.62	0.38 (0.19-0.78) P=0.008	0.16 (0.05-0.57) P=0.005
Song[5]	509	344	36	0.48 (0.25-0.93) P=0.03	0.30 (0.11-0.81) P=0.02	0.41 (0.18-0.95) P=0.04	0.47 (0.32-0.69) P<0.01

Palmerini et al. Circ Cardiovasc Interv. 2008;1:185-92
Toyofuku et al. Circulation. 2009;120:1866-74
Kim et al. Catheter Cardiovasc Interv. 2011;77:775-82
Song et al. JACC Cardiovasc Interv. 2014;7:255-63

MAIN-COMPARE Registry from AMC

Distal unprotected LMCA lesions treated with DES
at 12 major cardiac centers in Korea

Single-stent
234 (60%)

Two-stent
158 (40%)

3-year	Multivariable*	p	Adjusted with IPTW#	p
Death	0.874 (0.323–2.364)	0.79	0.772 (0.280–2.132)	0.62
MI	0.482 (0.260–0.894)	0.021	0.379 (0.185–0.777)	0.008
TLR	0.254 (0.091–0.713)	0.009	0.163 (0.046–0.573)	0.005
TVR	0.267 (0.129–0.550)	<0.001	0.248 (0.111–0.556)	<0.001
MACE	0.518 (0.323–0.831)	0.006	0.387 (0.224–0.671)	<0.001

* Covariate-Adjusted Cox Proportional Analysis and # Adjusted With Inverse Probability Treatment Weight Methods between Single- vs. Two-Stent

Kim et al. Catheter Cardiovasc Interv. 2011;77:775-82

1528 Consecutive Pts. with LM PCI

from a single center (Fu Wai Hospital)

LM PCI
N=1528

Exclusion: Medina (100), (010), (001)

Medina 011/ 101/ 110/ 111
N=1528

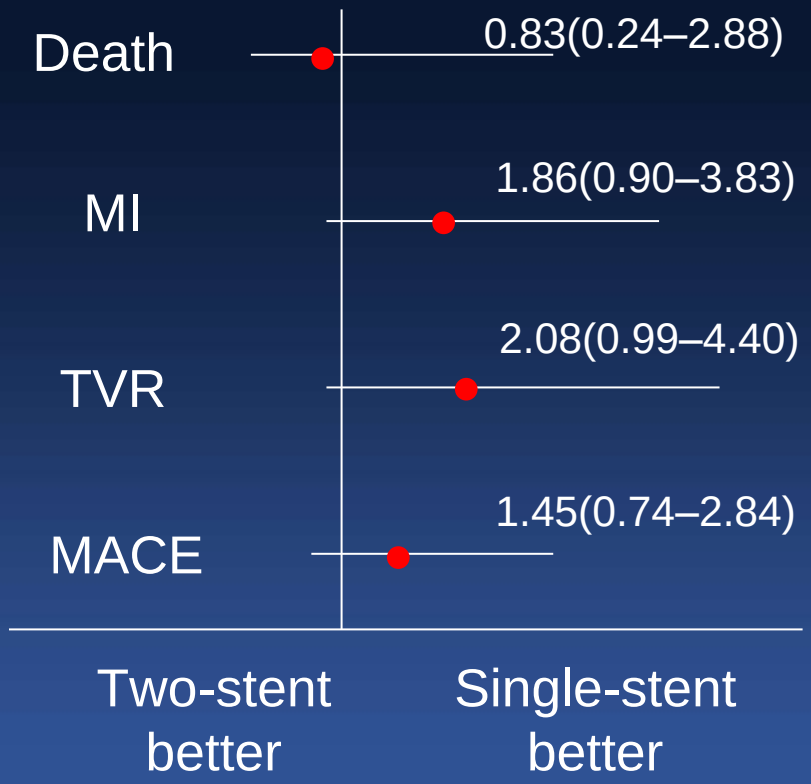
Exclusion: AMI within 24hrs, shock, BMS implantation, PTCA

Final analysis
N=1033

One-stent 661 (64%)

Two-stent 372 (36%)

3-year Clinical Outcomes



Gao et al. Catheter Cardiovasc Interv 2015

Stent Strategy for LM Bifurcation

Favor Provisional Approach

- Normal LCX ostium (Medina 1.1.0., 1.0.0)
- Small LCX (<2.5mm in diameter)
- Focal disease in LCX without concomitant disease
- Wide bifurcation angle

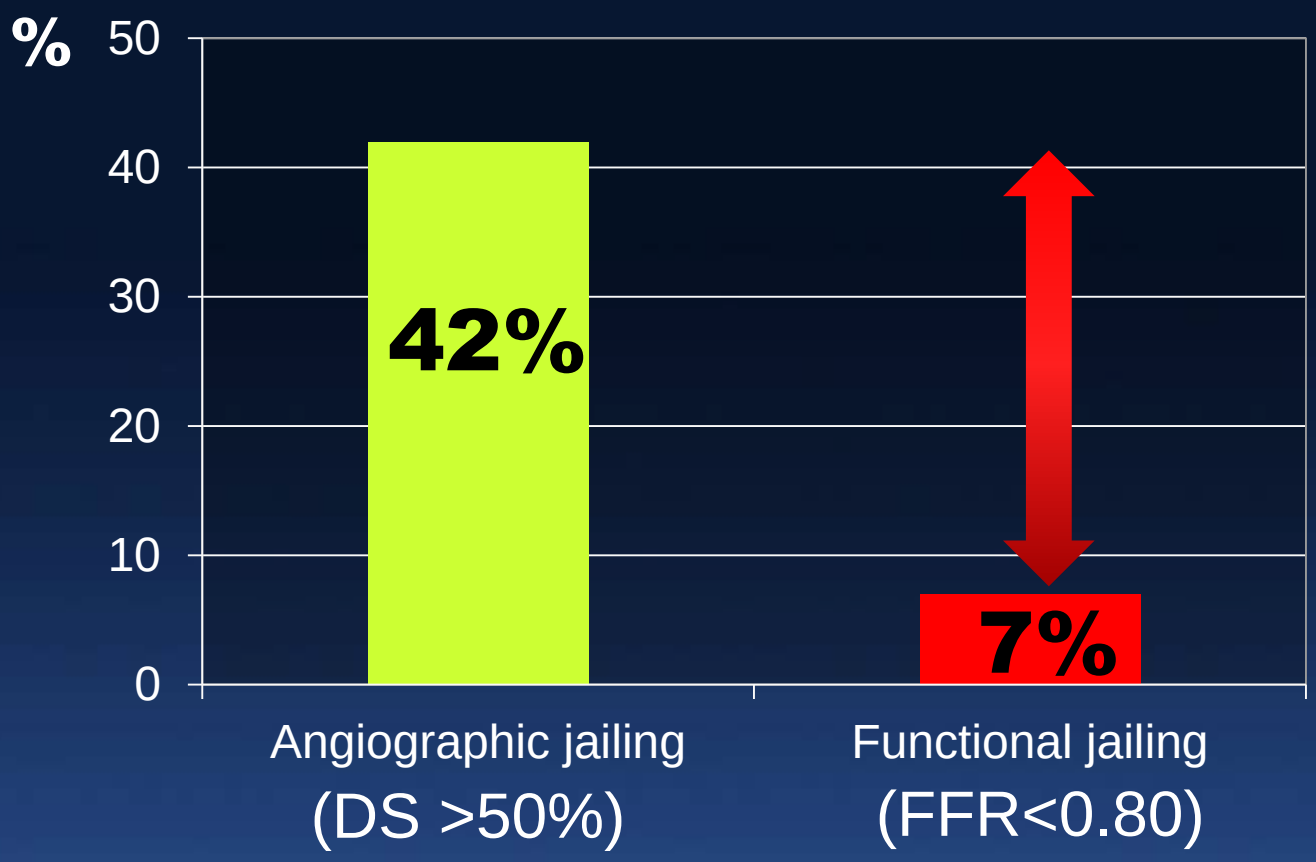
Favor Two-stent Approach

- Significant stenosis at LCX ostium (Medina 1.1.1., 1.0.1)
- Large LCX (≥2.5 mm in diameter)
- Diseased left dominant coronary system
- Diffuse LCX disease
- Narrow bifurcation angle

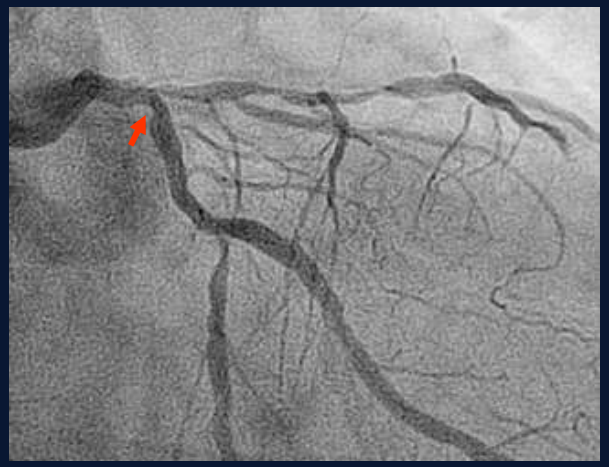
Park SJ, Kim YH. Colombo A, Issam D. Moussa et al.
Textbook of Bifurcation Stenting 2007

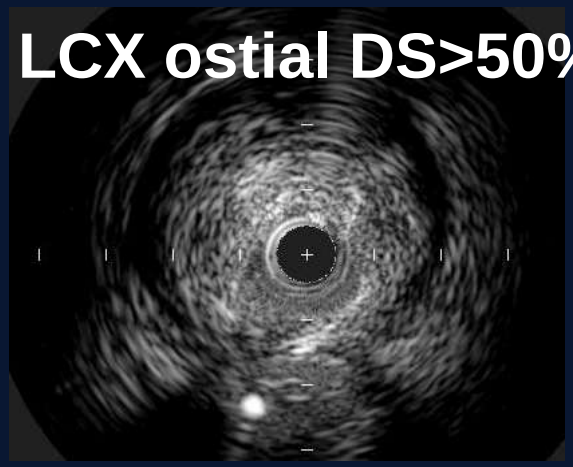
Functional LCX Compromise

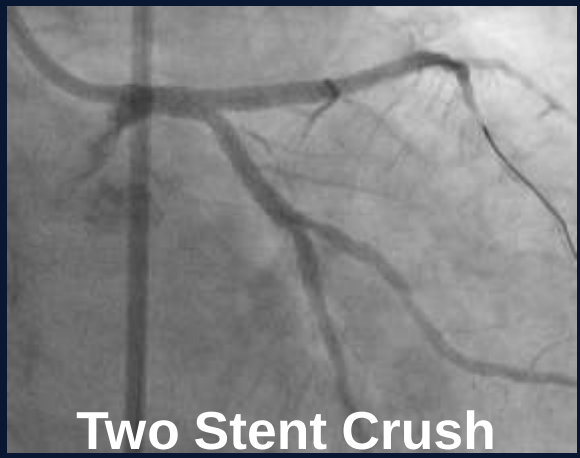
LM Bifurcations with LCX ostial DS<50%

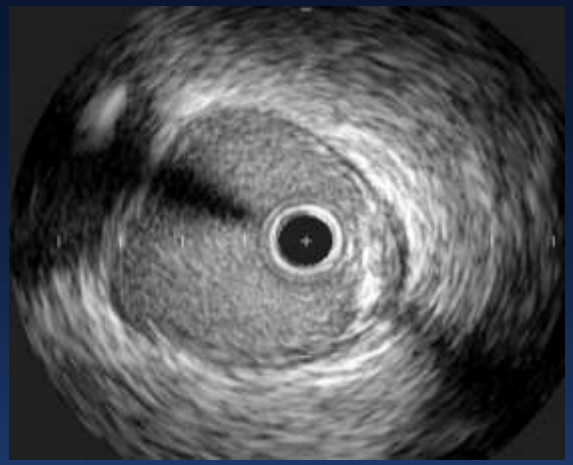


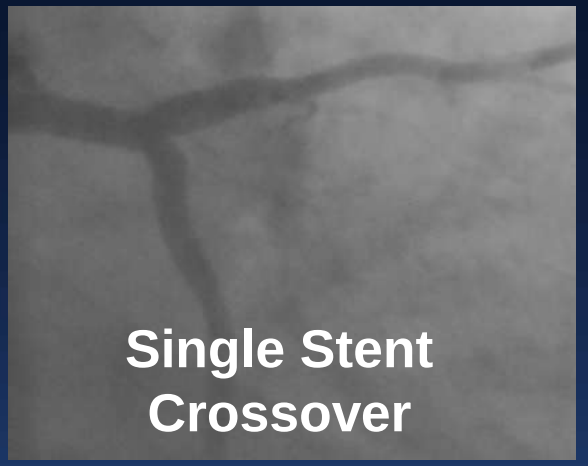
When Pre-PCI LCX Ostial DS<50%, Just Do Single Stent!

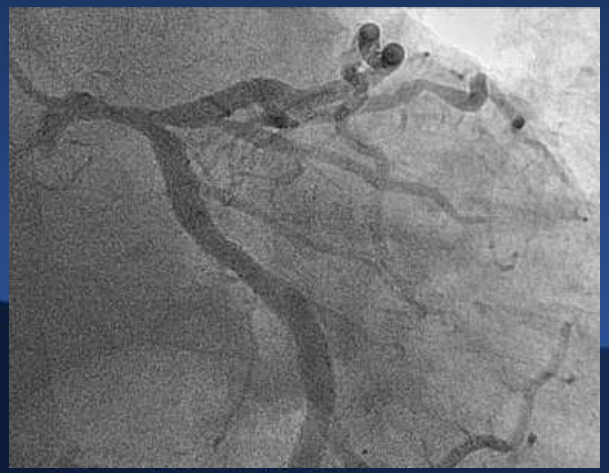


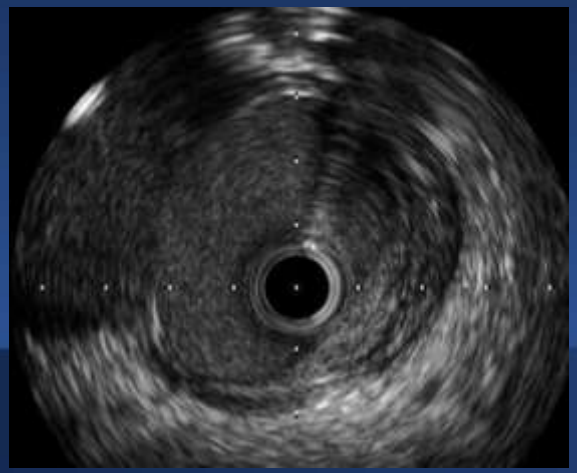

LCX ostial DS>50%

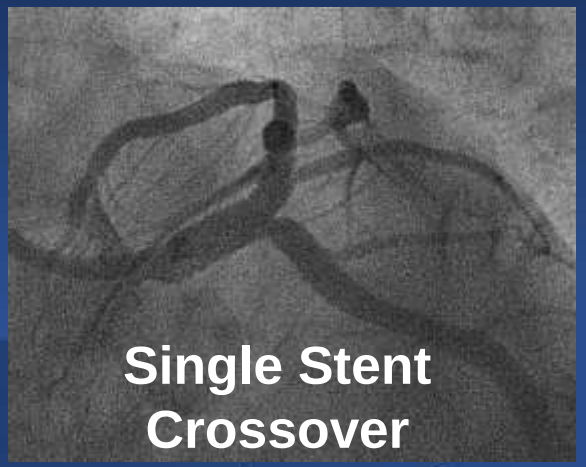

Two Stent Crush




Single Stent
Crossover

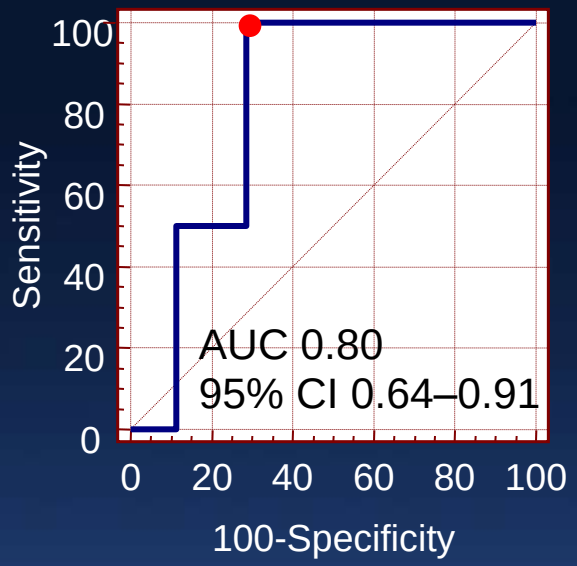





Single Stent
Crossover

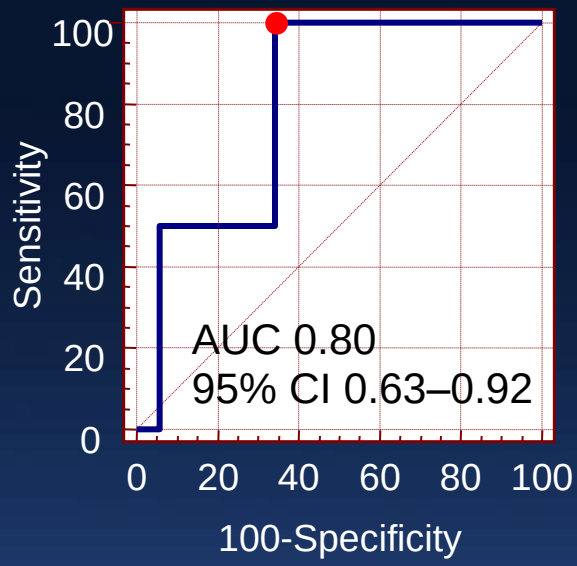
Pre-procedural Predictors for Functional LCX Stenosis (FFR<0.80)

SB MLA <3.7mm²



Sensitivity 100%
Specificity 71%
PPV 16%
NPV 100%

Plaque burden >56%



Sensitivity 100%
Specificity 65%
PPV 14%
NPV 100%

Kang et al. Catheter Cardiovasc Interv 2014;83:542-520

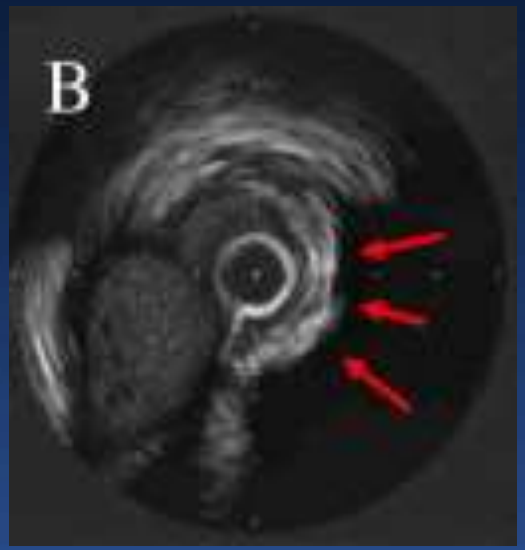
Pre-procedural Predictors for Post-stenting LCX Stenosis

- Plaque at the MB carina side (OR 5.15, p<0.001)

Yoshitaka et al. EuroIntervention. 2012;8:708-16

- MB calcium arc >60˚ (OR 5.12, p=0.03)

Sato et al. Cardiovasc Revasc Med 2014;15:80-5



- Narrow distal carina angle

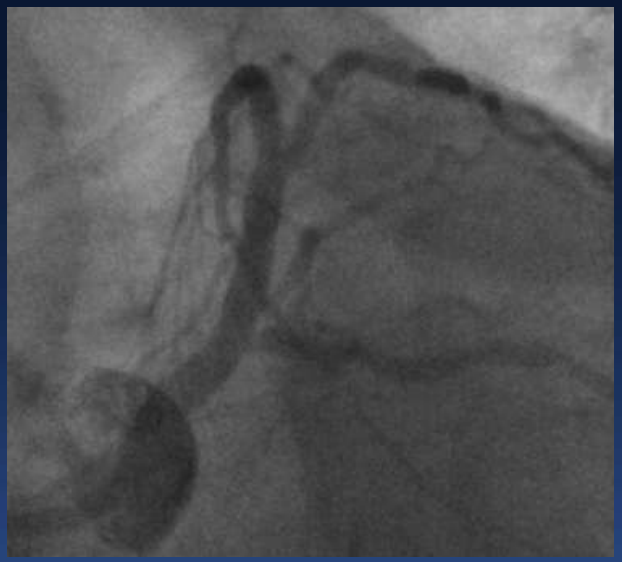
Kang et al. Circ Cardiovasc Interv. 2011;4:355-61

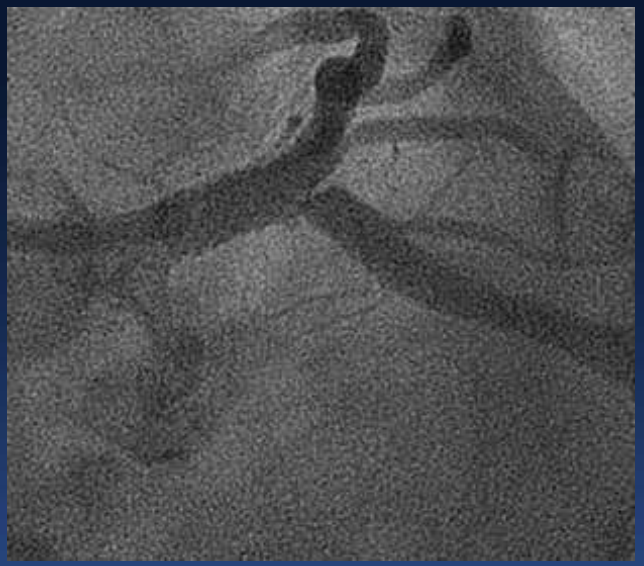
- However, distal carina angle was not an independent predictor of LCX FFR<0.80

Kang et al. Catheter Cardiovasc Interv 2014;83:542-50

How to Treat SB Jailing?

Morphology Cannot Predict LCX FFR

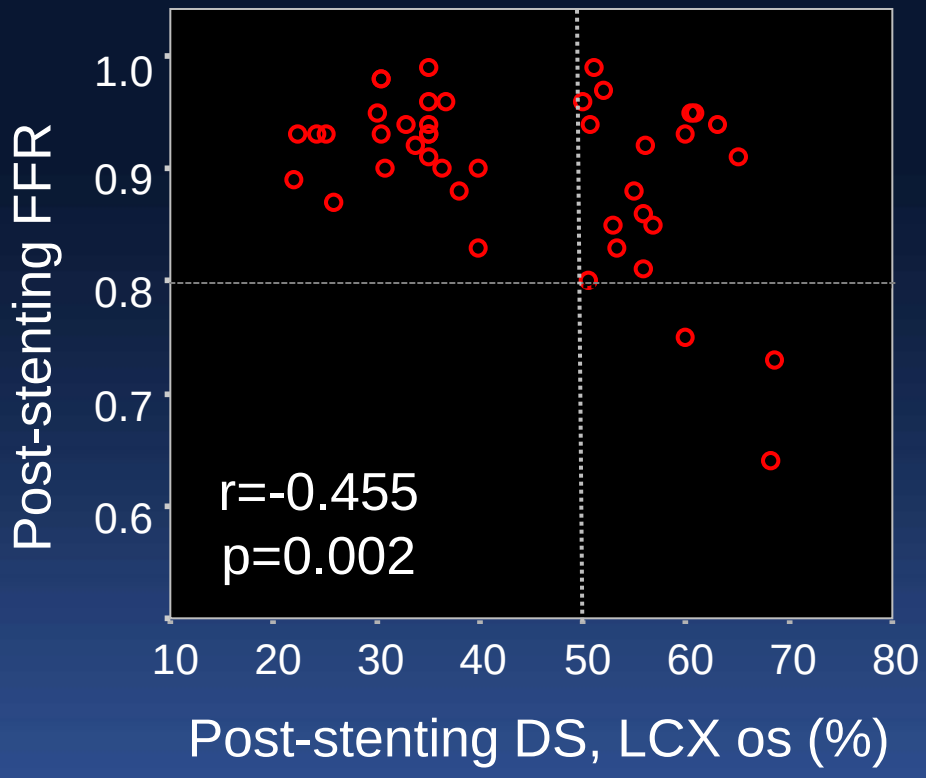


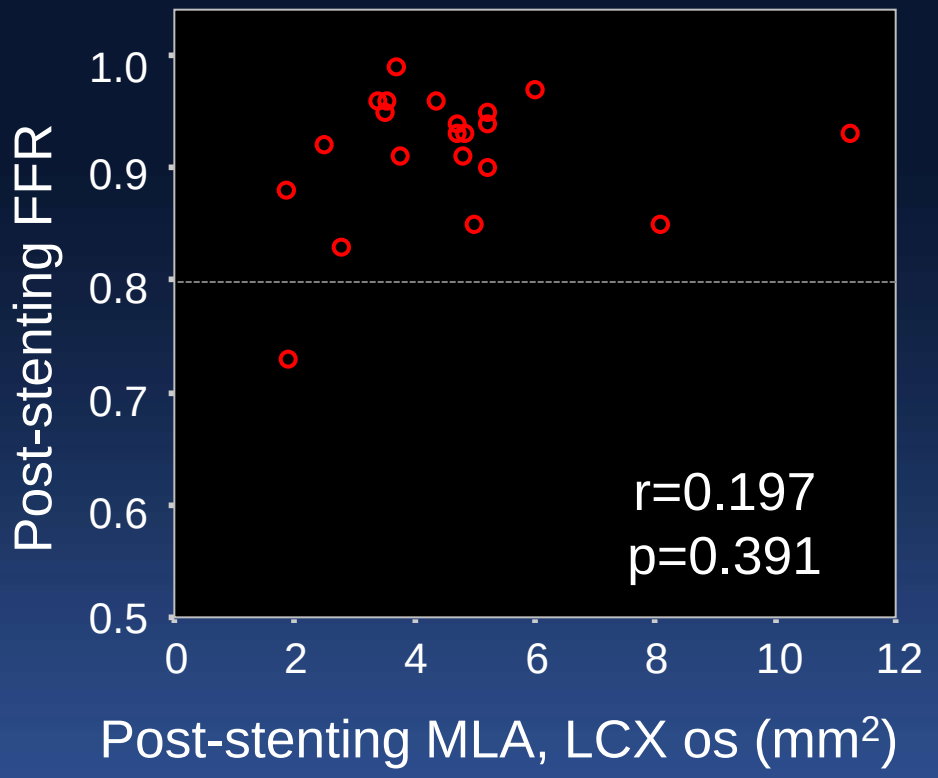


FFR 0.91 **FFR 0.92** **FFR 0.85**

Defer

LMCA Bifurcation
LCX Stenosis after MB Stenting



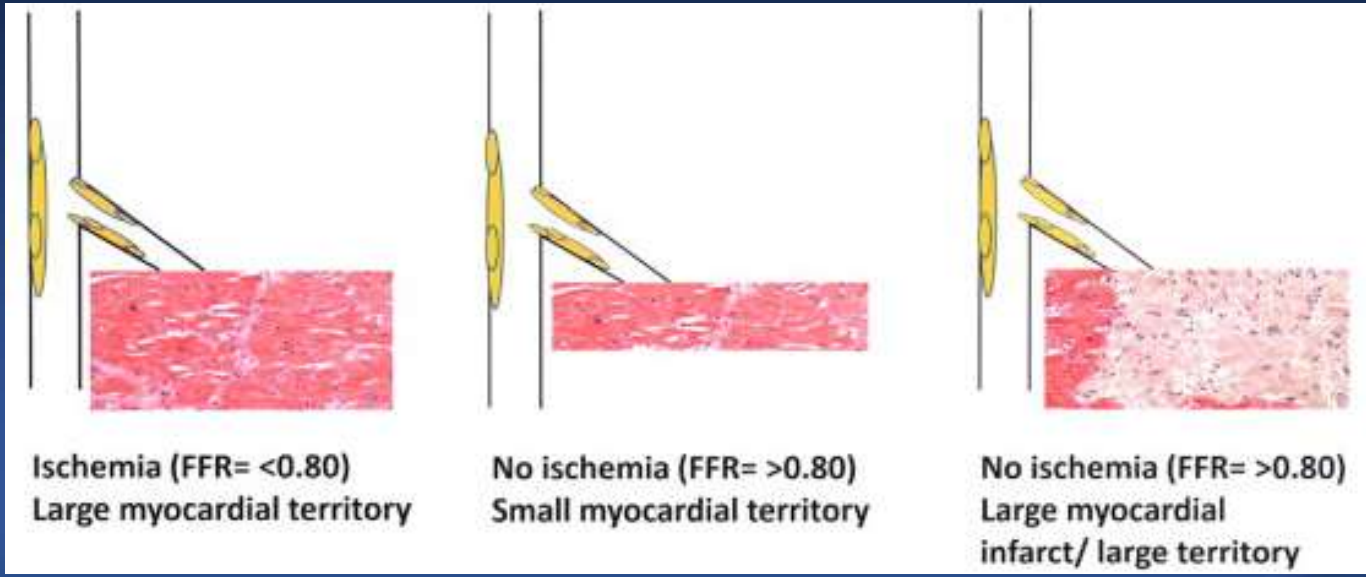


Direct FFR measurement is necessary to make sure whether or not LCX has ischemia

Kang et al. Catheter Cardiovasc Interv 2014;83:542-52

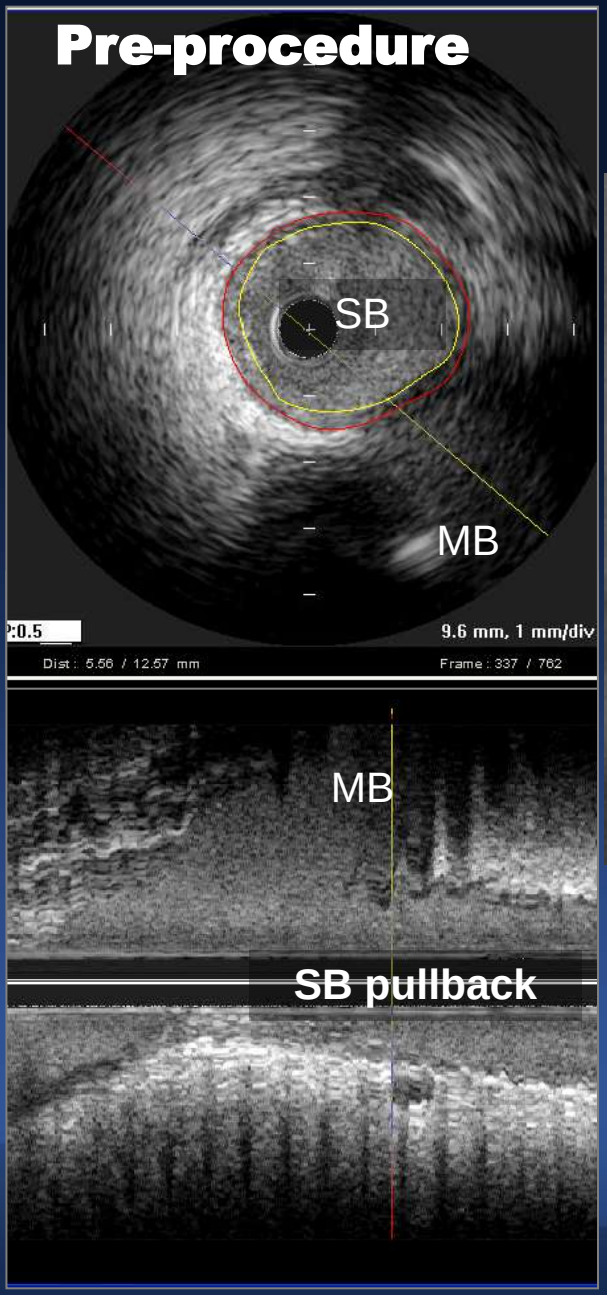
Why Mismatch?

- Lesion eccentricity of SB
- Negative remodeling of ostium
- Various size of myocardium
- Strut artifacts
- Focal carina shift



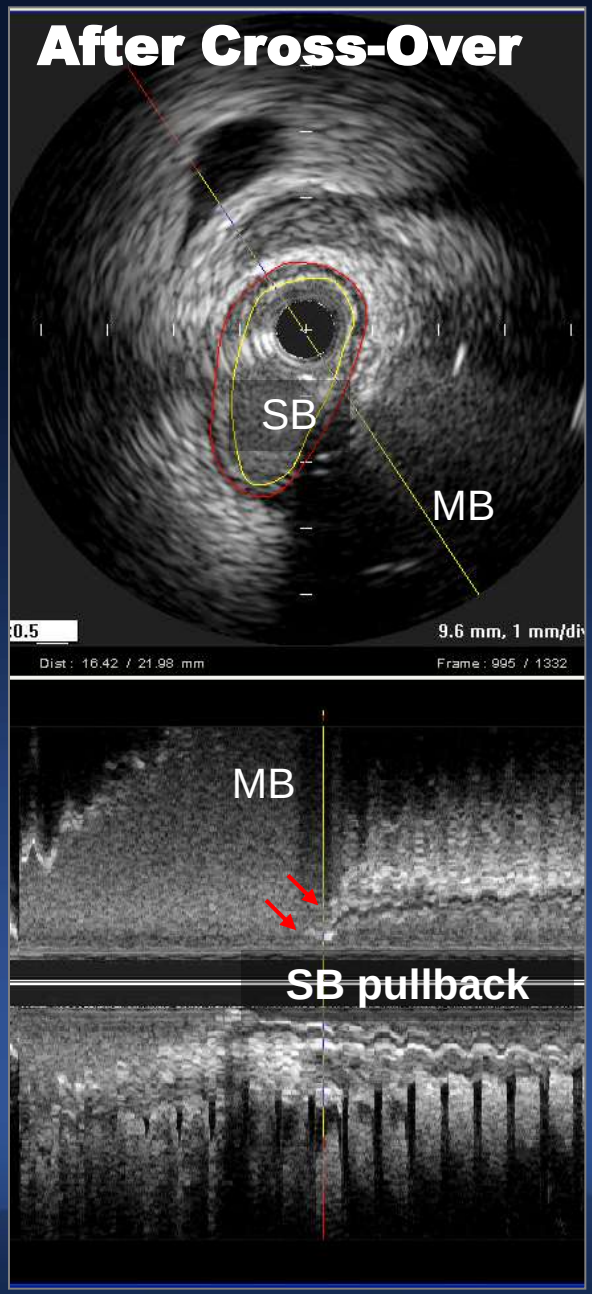
Sachdeva et al. Am J Cardiol 2011;107:1794-5

Mechanism of Angiographic SB Jailing

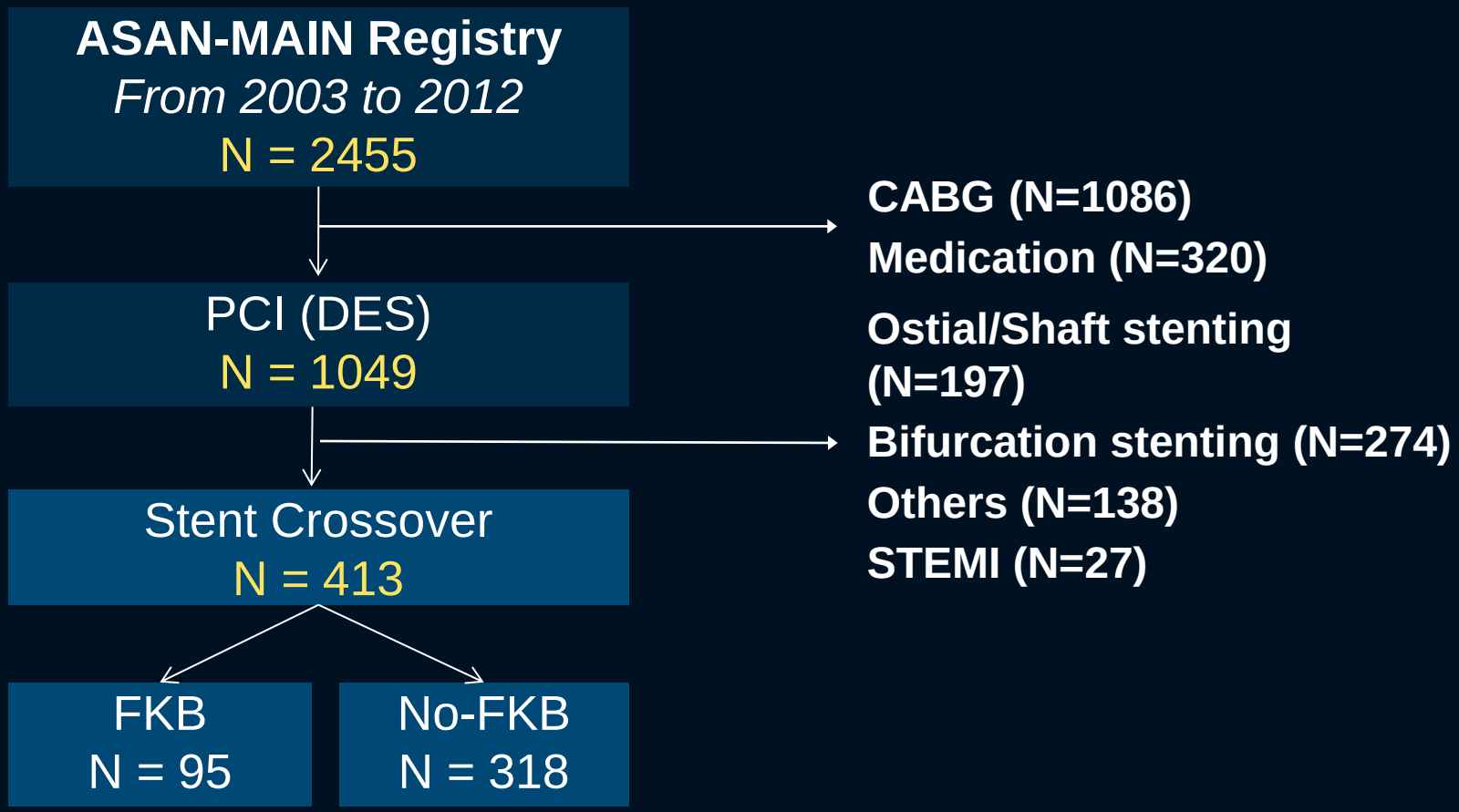


Carina Shift

LCX FFR 0.91



LM Bifurcation PCI With vs. Without Routine Kissing Balloon Inflation (FKB)



AMC New Data, 2014

LM Bifurcation PCI With vs. Without Routine Kissing Balloon Inflation (FKB)

2- year Clinical Outcomes

	FKB (N=95)	Non-FKB (N=318)	Adjusted HR (95% CI)	P value
Death	4 (4.6%)*	12 (3.9%)	1.03 (0.28-3.82)	0.97
Death or MI	4 (4.6%)	13 (4.2%)	0.95 (0.26-3.51)	0.96
TVR	7 (8.1%)	14 (4.8%)	1.12 (0.40-3.11)	0.83
LM-TLR	7 (8.1%)	13 (4.4%)	1.32 (0.46-3.75)	0.60
Definite ST	0	0	NA	NA
MACE#	11 (12.5%)	26 (8.5%)	1.10 (0.49-2.49)	0.82

adjusted for age, DM, clinical presentation, stent No., pre- and post-stenting LCX DS

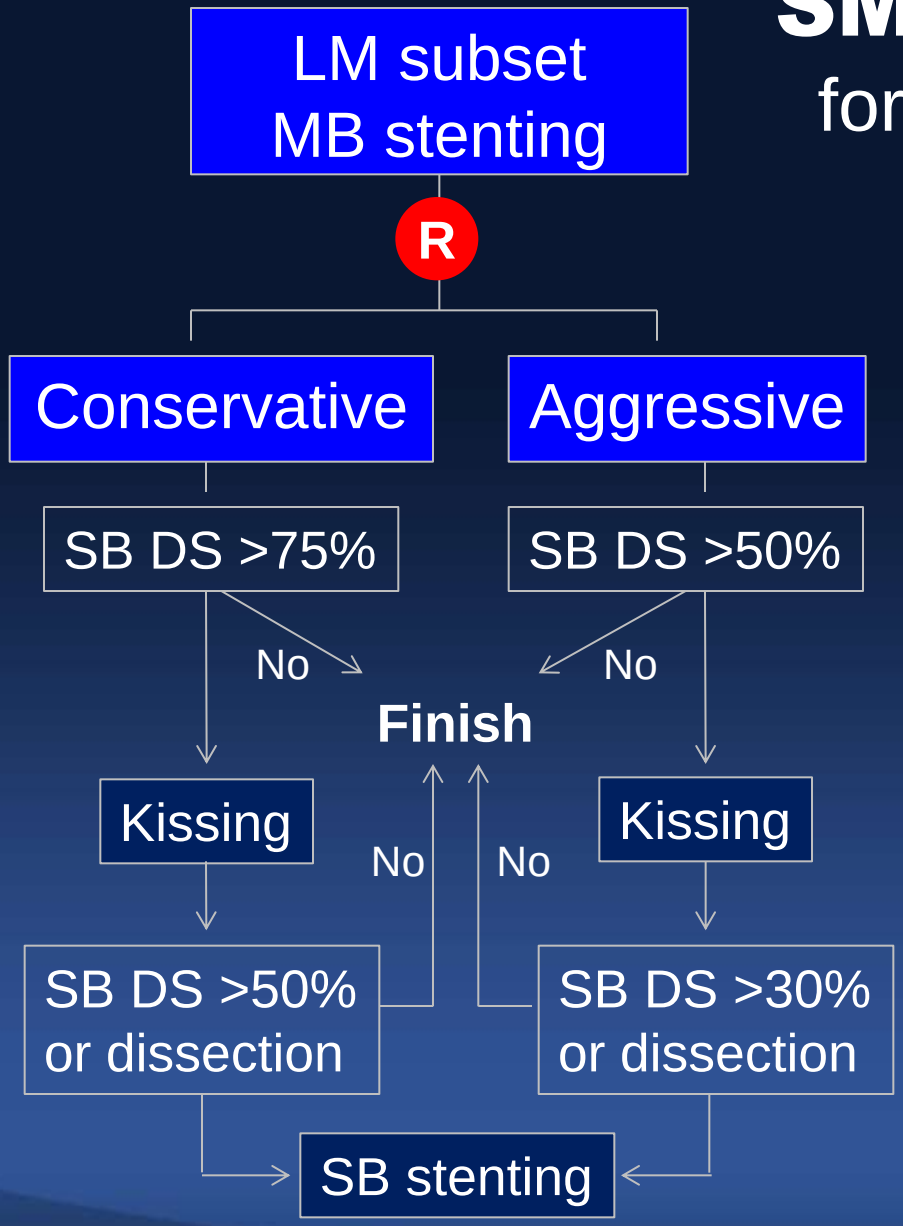
** derived from Kaplan-Meier estimate*

 # composite of death, MI, or LM TLR

AMC New Data, 2014

SMART-STRATEGY RCT

for Provisional SB Intervention



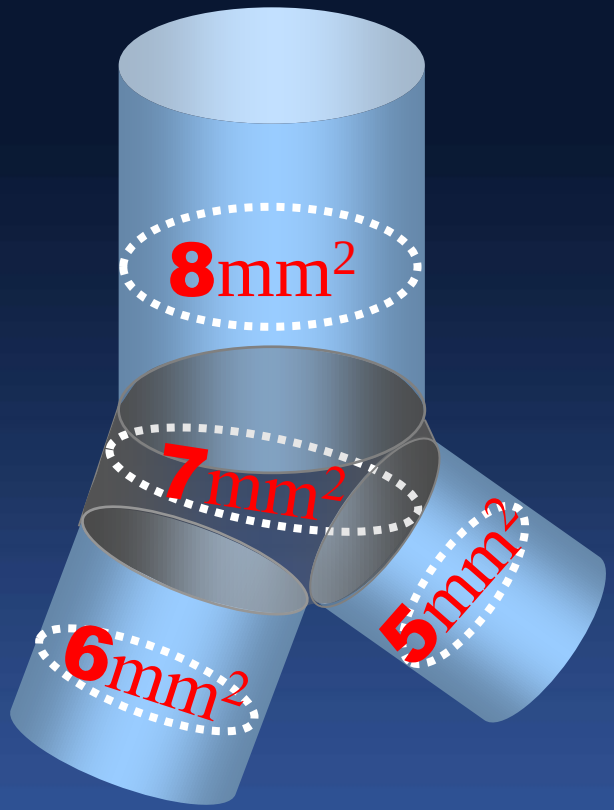
12-month Clinical Outcomes

	CON	AGGR	p
C-death	0	1 (1.8)	> 0.99
ST	0	1 (1.8)	> 0.99
TLR	5 (8.8)	3 (5.3)	0.46
TVR	6 (10.5)	5 (8.8)	0.75
TVF*	6 (10.5)	6 (10.5)	> 0.99

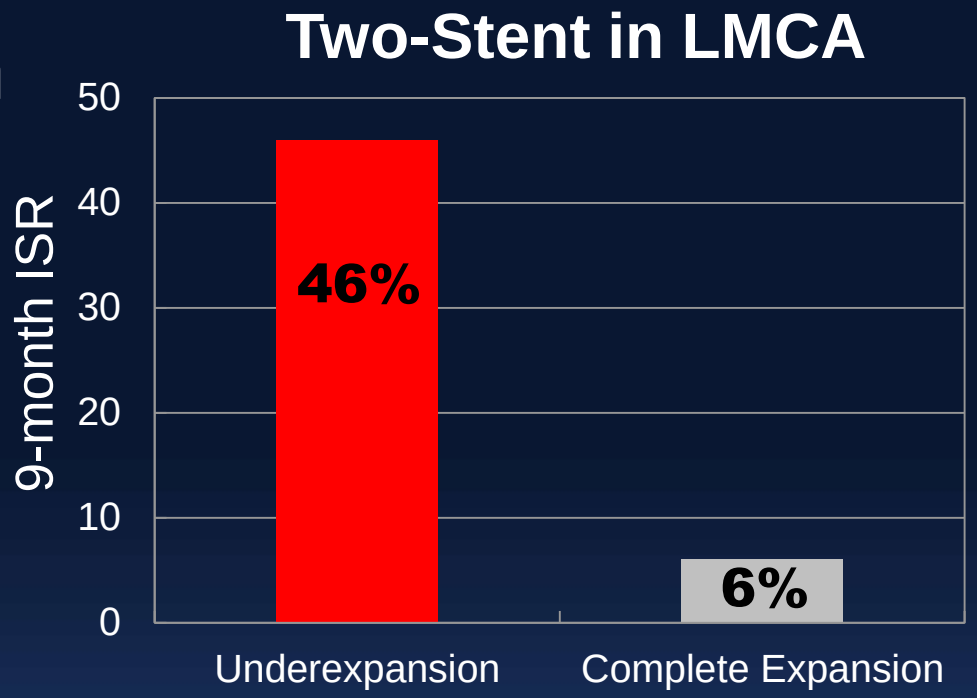
Conservative strategy had similar MACE rates and even lower incidence of PMI

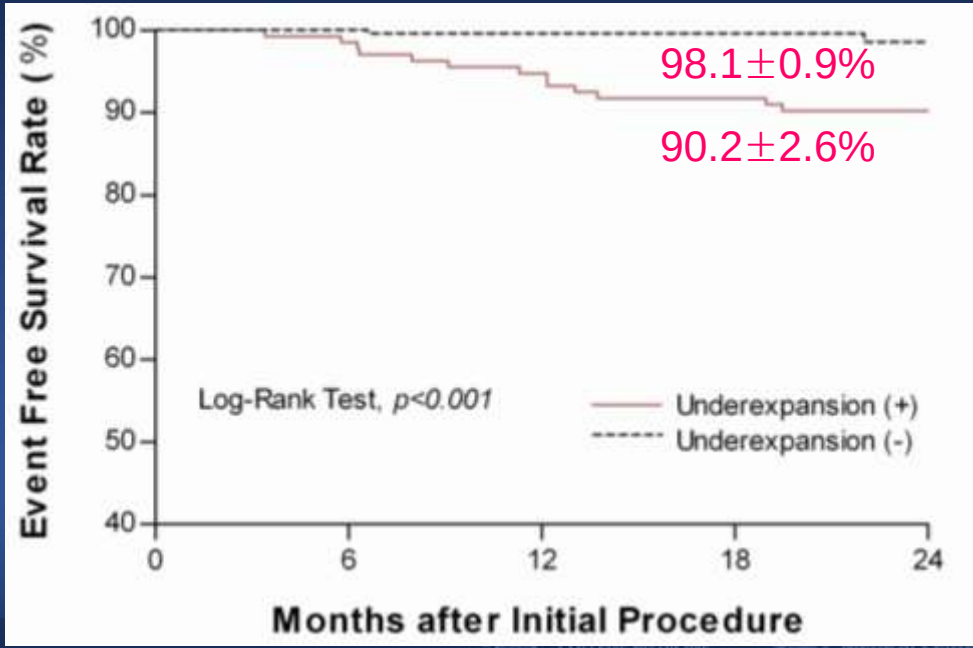
Song YB, Kwon HC et al. JACC Intv 2012;5:1133-40

Stent Optimization
During LM Bifurcation PCI



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





Summary

Distal LM Bifurcation Stenosis

Both Pullback IVUS