TCTAP 2013 Fellowship Course
Left Main and Bifurcation PCI: Bifurcation PCI

Plaque Shift vs. Carina Shift Prevalence and Implication

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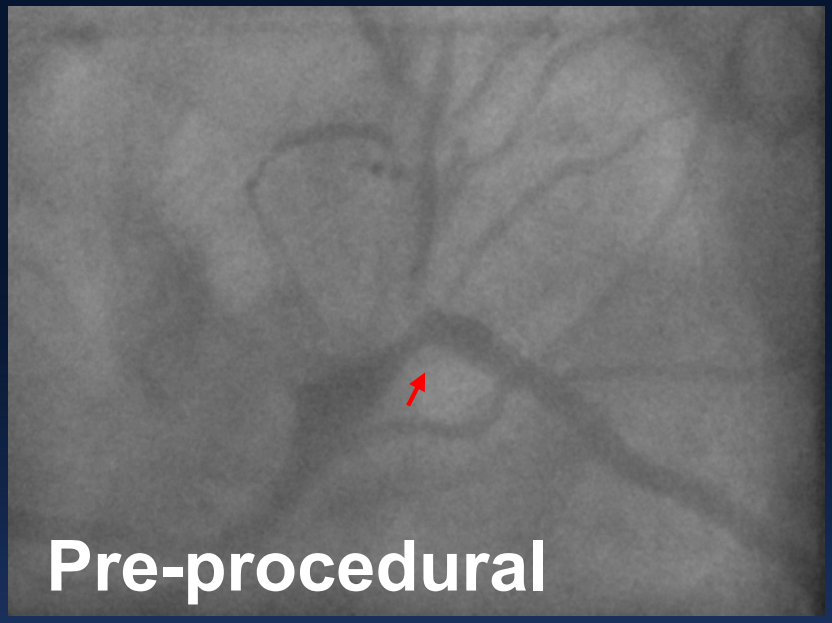
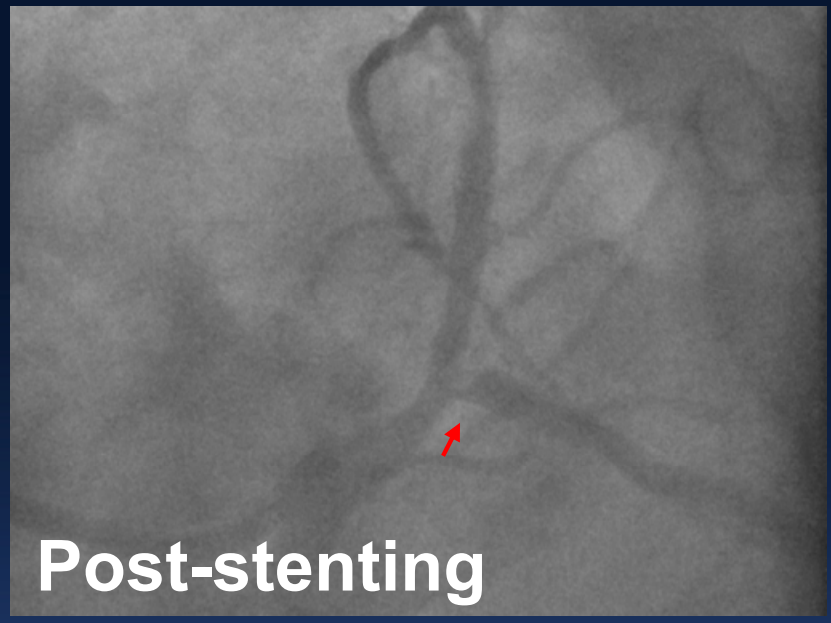
Disclosure

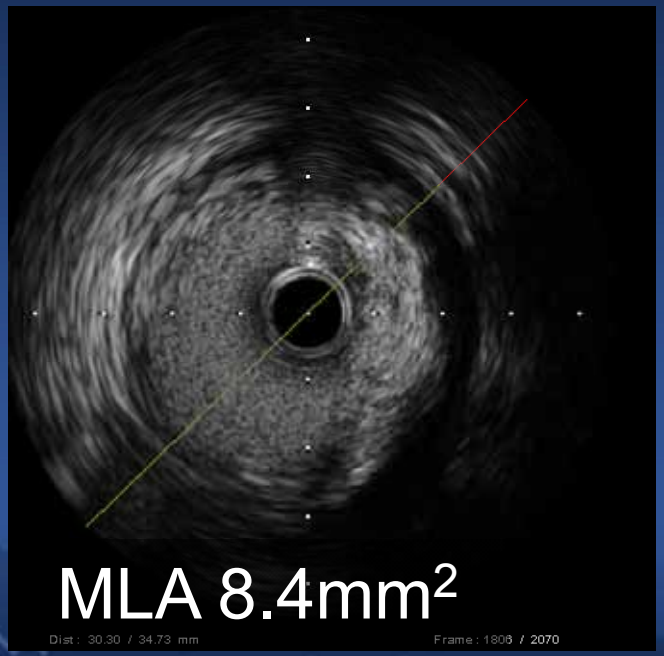
I have nothing to disclose

Mechanisms of Angiographic SB Jailing

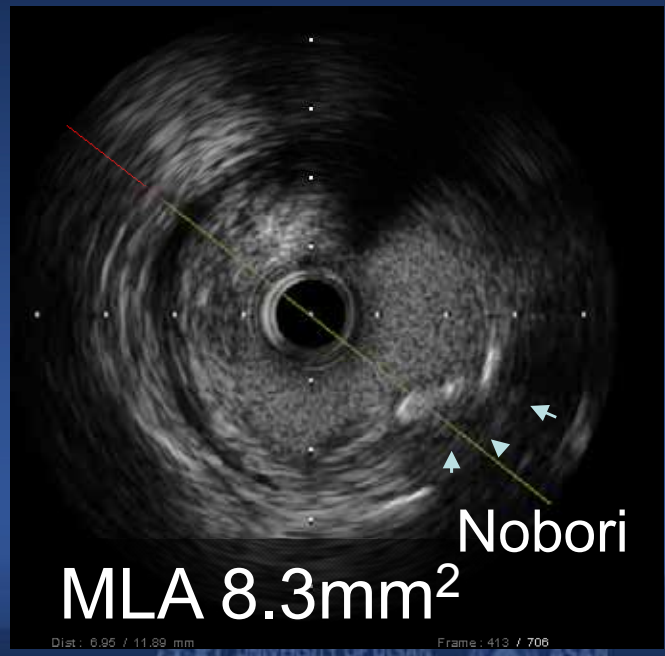
Stent Strut Artifact







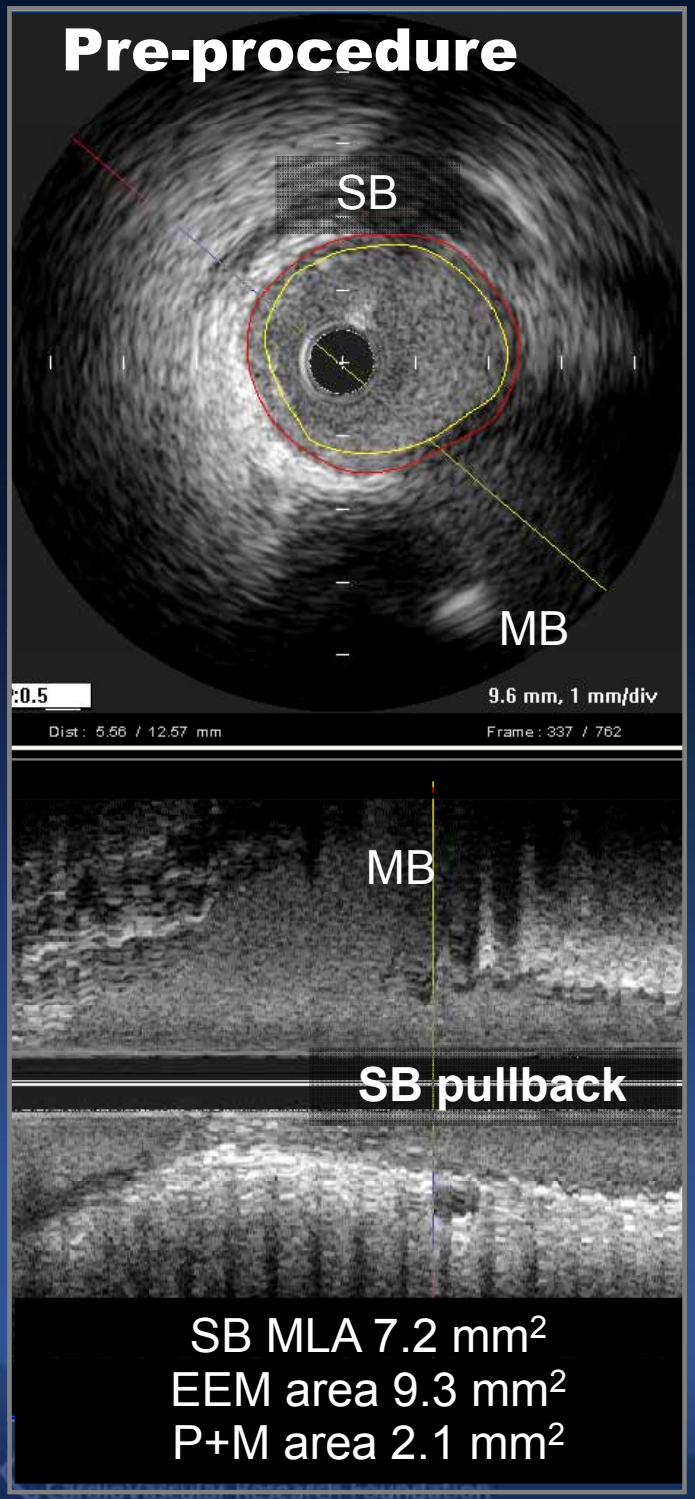
After cross-over



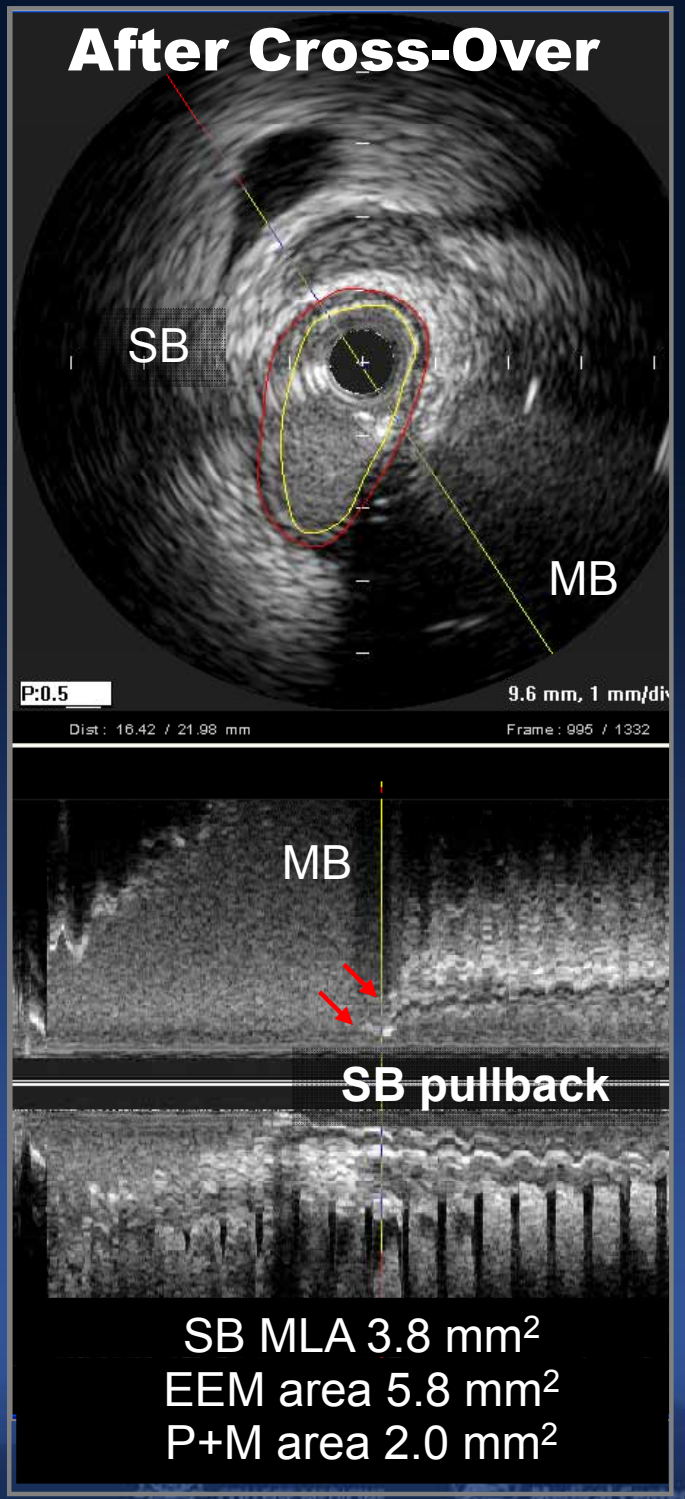
Carina Shift

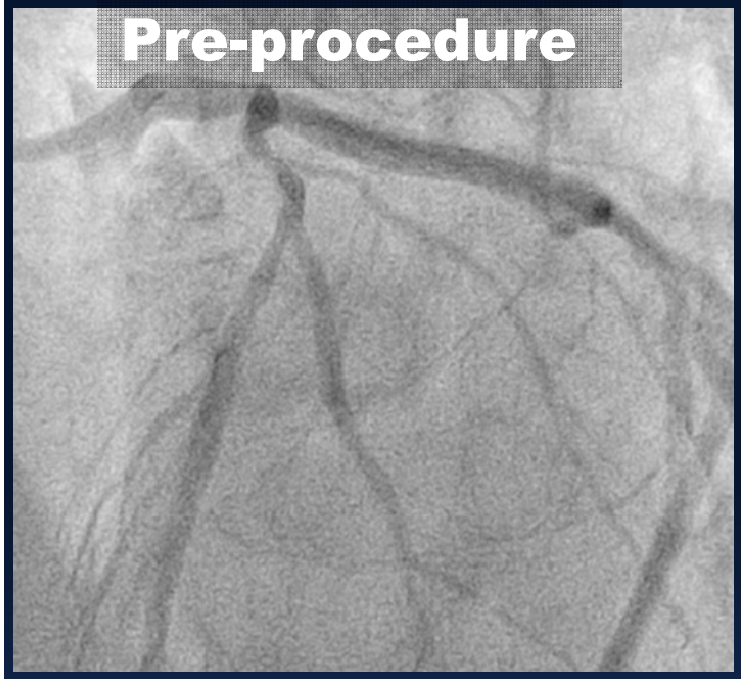
$\Delta V/\Delta L > 1$

$\Delta P < 0$



Area Change	
ΔL	-3.4 mm²
ΔV	-3.5 mm²
ΔP	-0.1 mm²

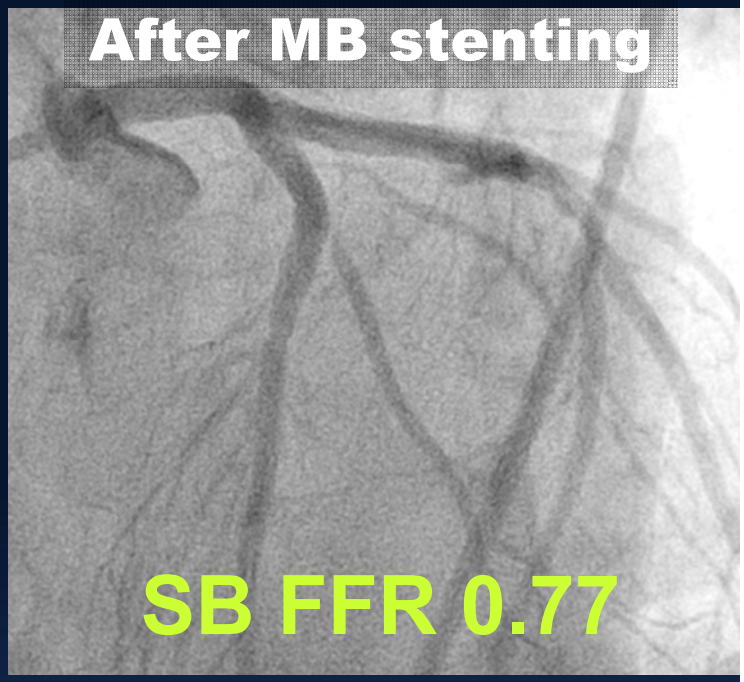


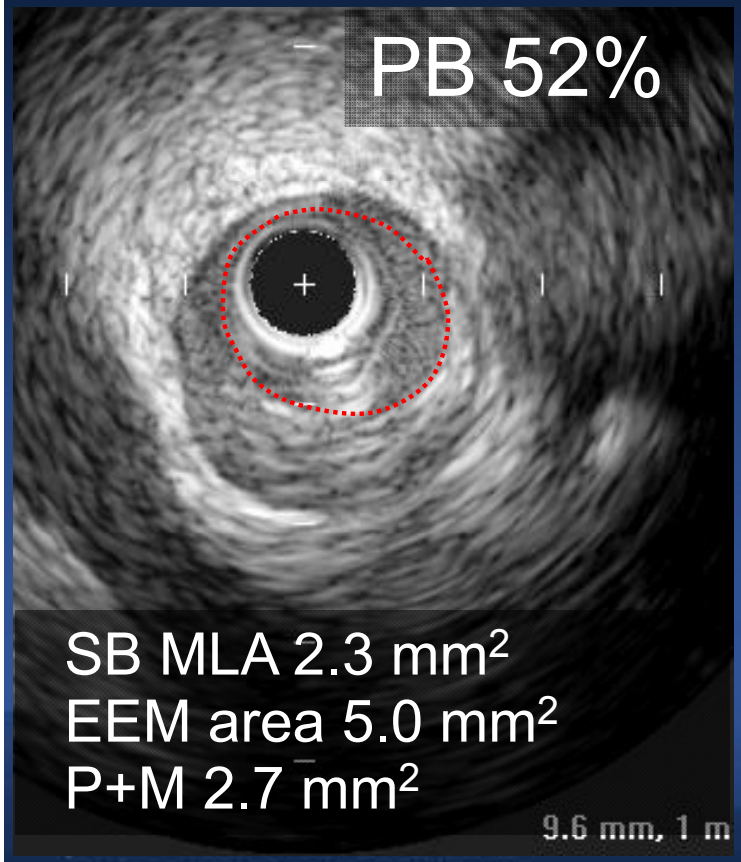


Plaque Shift

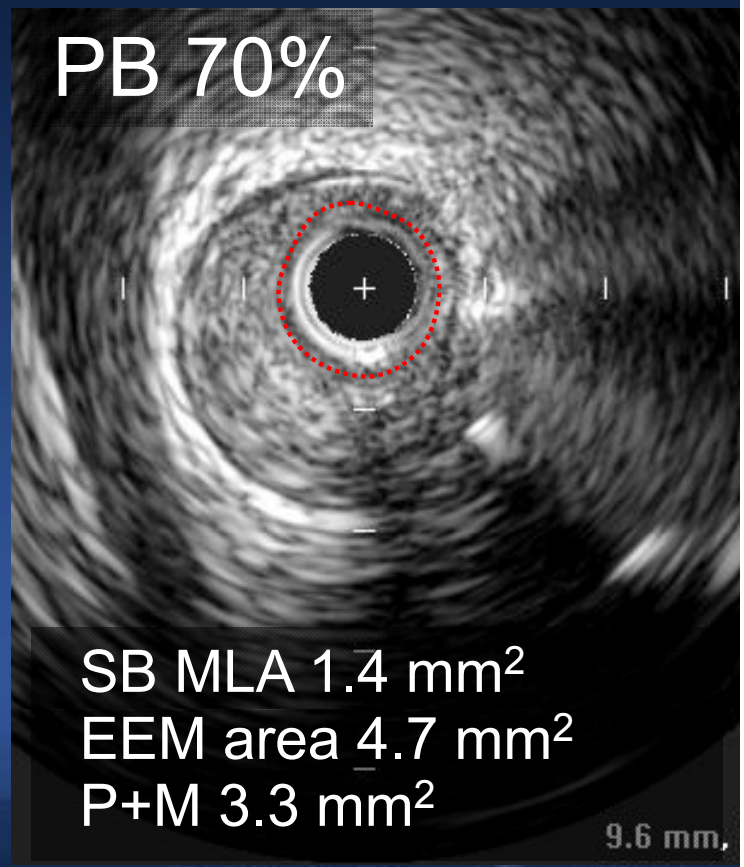
$\Delta V/\Delta L < 1$

$\Delta P > 0$





Area Change	
ΔL	-1.0mm²
ΔV	-0.3mm²
ΔP	**+0.7mm²**



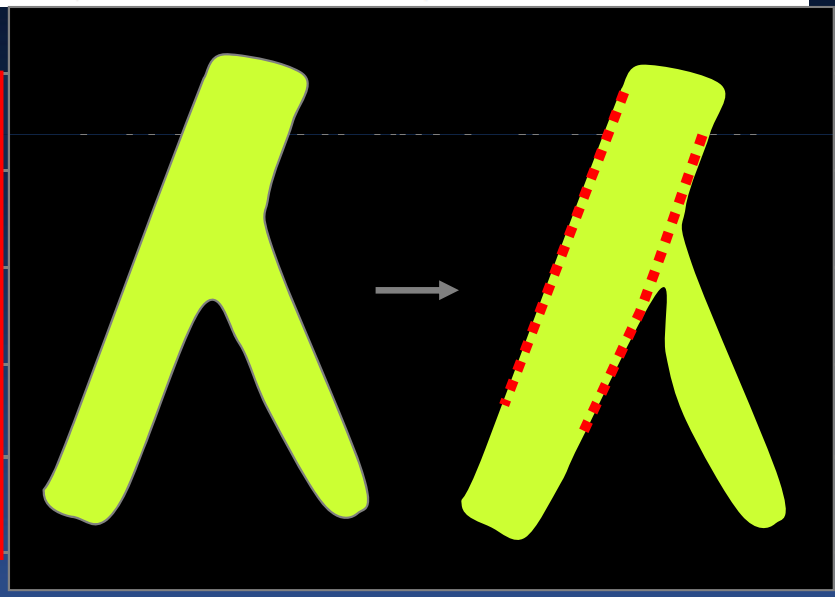
Plaque Shift vs. Carina Shift

- **Prevalence of Carina vs. Plaque Shift**
- **Impact on Functional Significance**

Anatomic and Functional Evaluation of Bifurcation Lesions Undergoing Percutaneous Coronary Intervention

Bon-Kwon Koo, MD, PhD; Katsuhisa Waseda, MD, PhD; Hyun-Jae Kang, MD, PhD; Hyo-Soo Kim, MD, PhD; Chang-Wook Nam, MD, PhD; Seung-Ho Hur, MD, PhD; Jung-Sun Kim, MD, PhD; Donghoon Choi, MD, PhD; Yangsoo Jang, MD, PhD; Joo-Yong Hahn, MD, PhD; Hyeon-Cheol Gwon, MD, PhD; Myeong-Ho Yoon, MD, PhD; Seung-Jea Tahk, MD, PhD; Woo-Young Chung, MD, PhD; Young-Seok Cho, MD, PhD; Dong-Ju Choi, MD, PhD; Takao Hasegawa, MD; Toru Kataoka, MD; Sung Jin Oh, MD; Yasuhiro Honda, MD; Peter J. Fitzgerald, MD, PhD; William F. Fearon, MD

	Distal MB segment		
	Pre	Post	p
Lumen VI	3.5±1.5	6.1±2.1	<0.001
Plaque VI	**5.4±1.8**	**5.3±1.7**	**0.227**
Vessel VI	**9.0±2.5**	**11.3±3.1**	**<0.001**

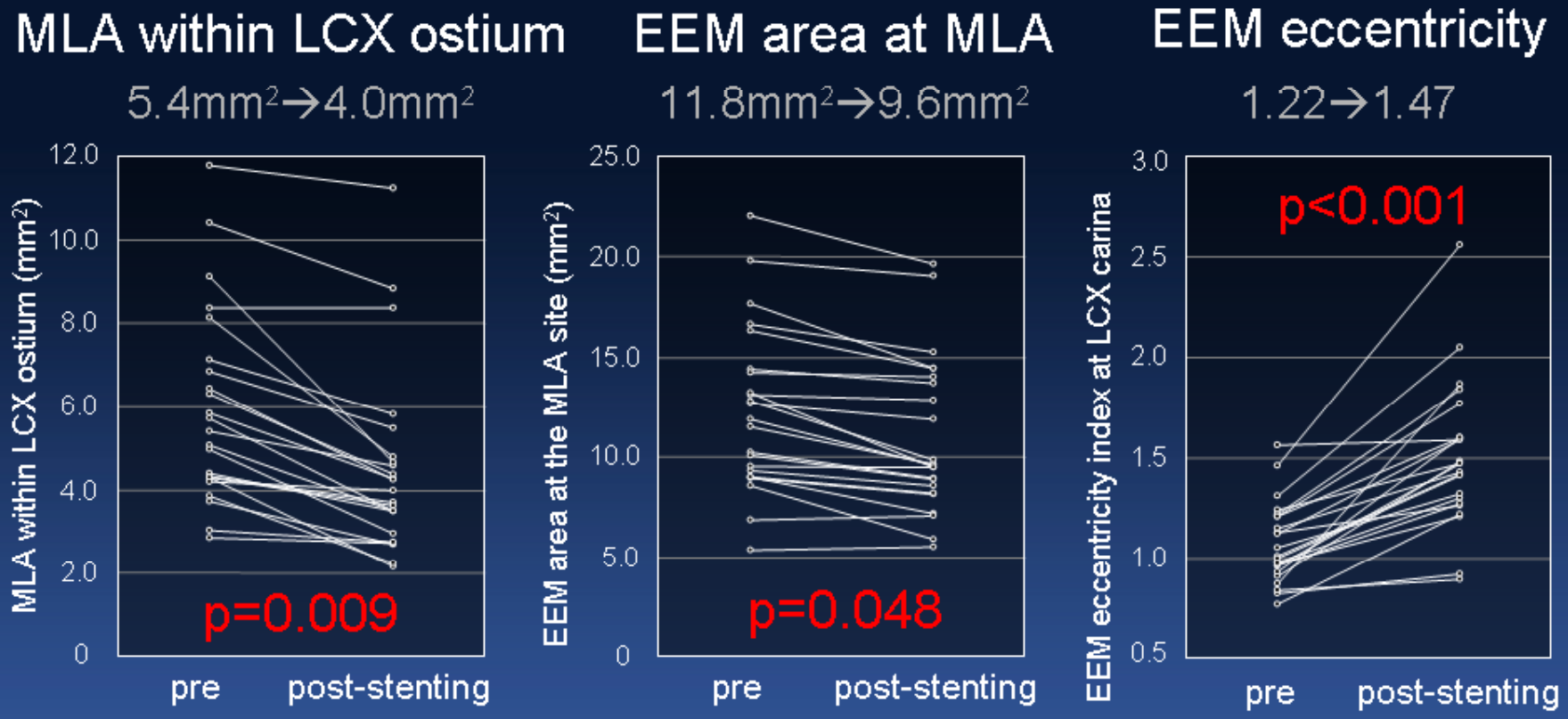


Luminal gain is not caused by plaque shift but by EEM expansion, leading to carina shift and SB compromise

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

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)**

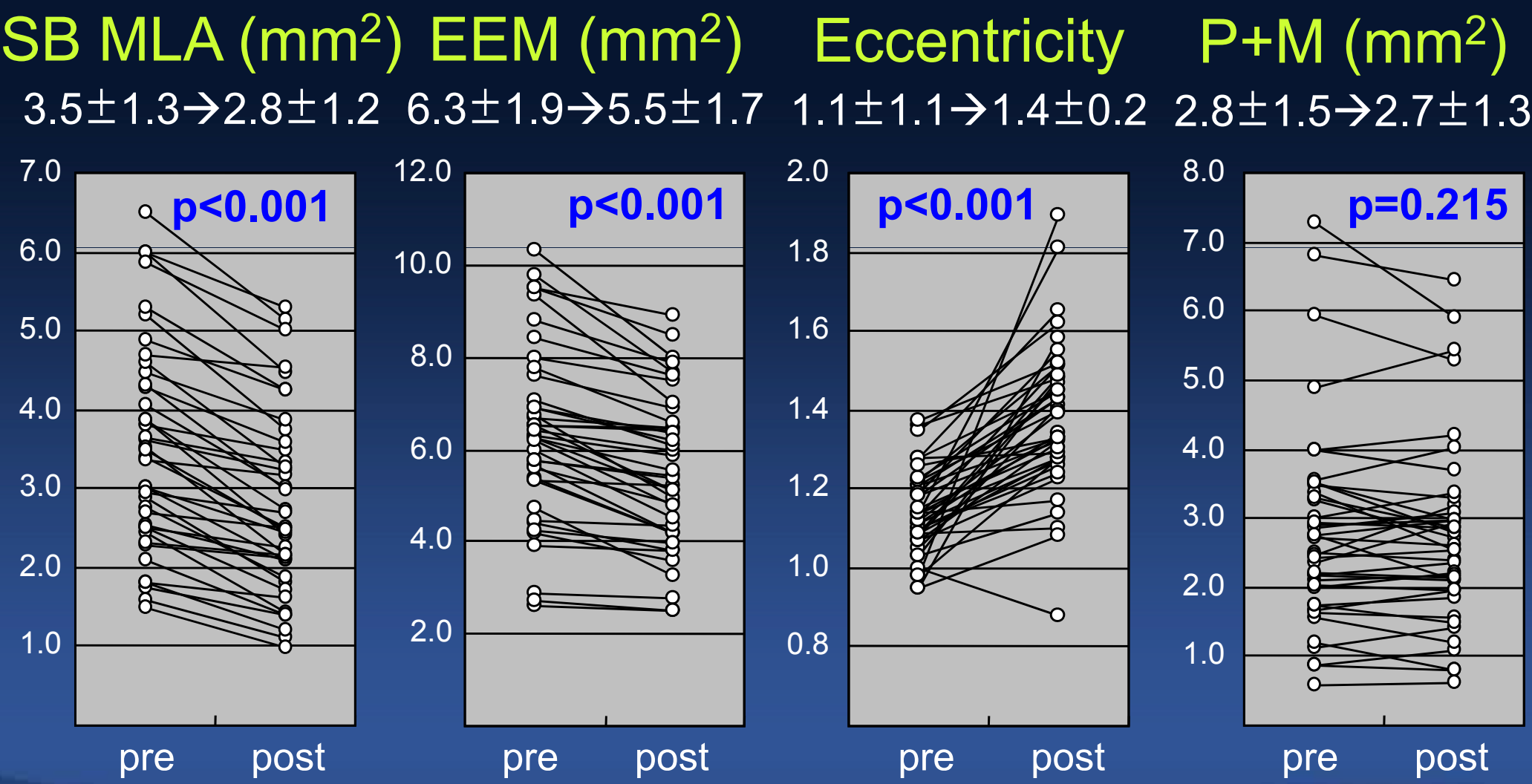


78% showed a >10% reduction of MLA within LCX ostium after cross-over stenting

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

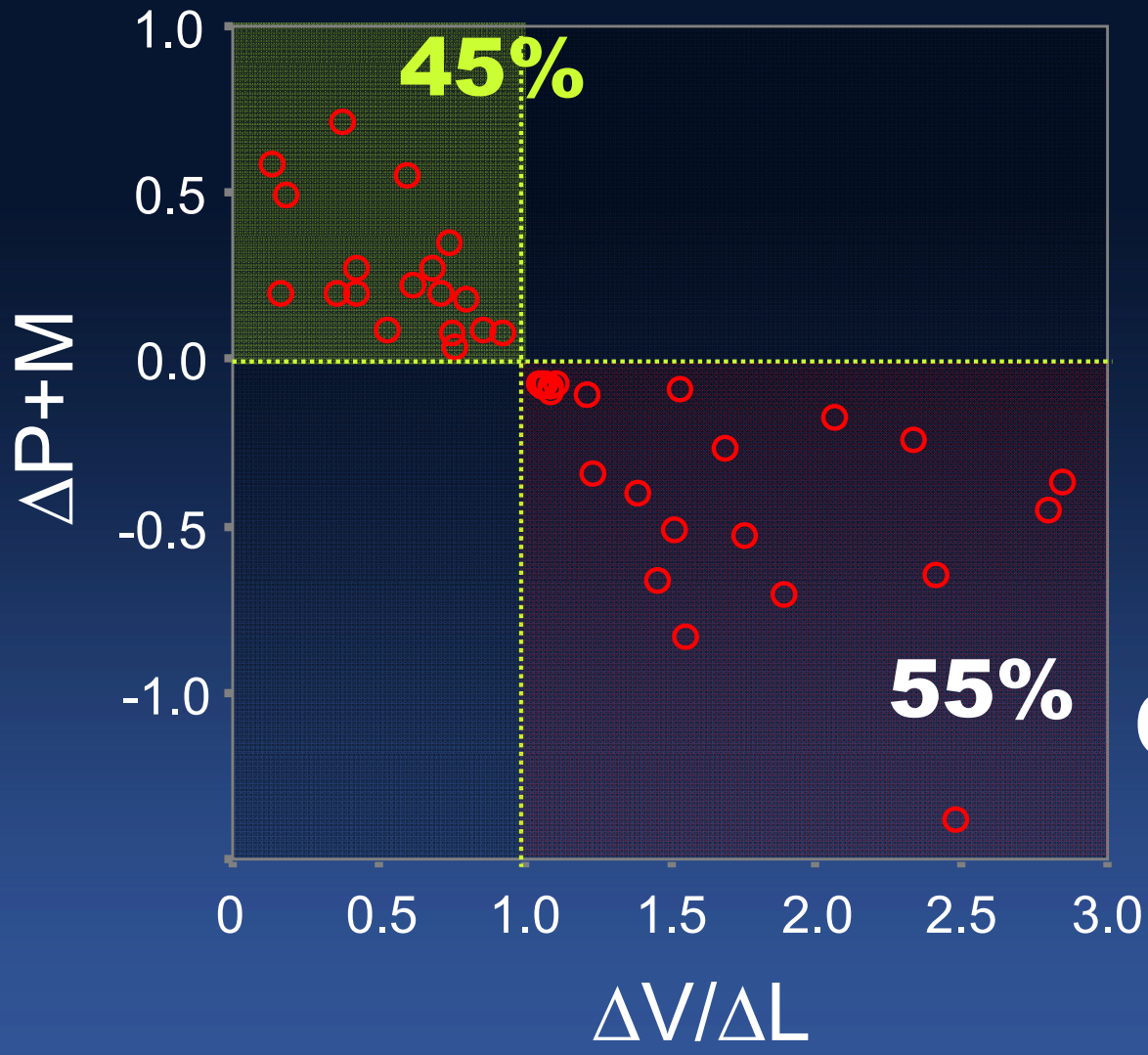
Hemodynamic Impact of Changes in Geometry of Non-LM Bifurcation

Non-LM bifurcation lesions with SB ostial DS<50%



Kang et al. Catheter Cardiovasc Interv 2013 in press

Plaque Shift + Carina Shift



Isolated Carina Shift

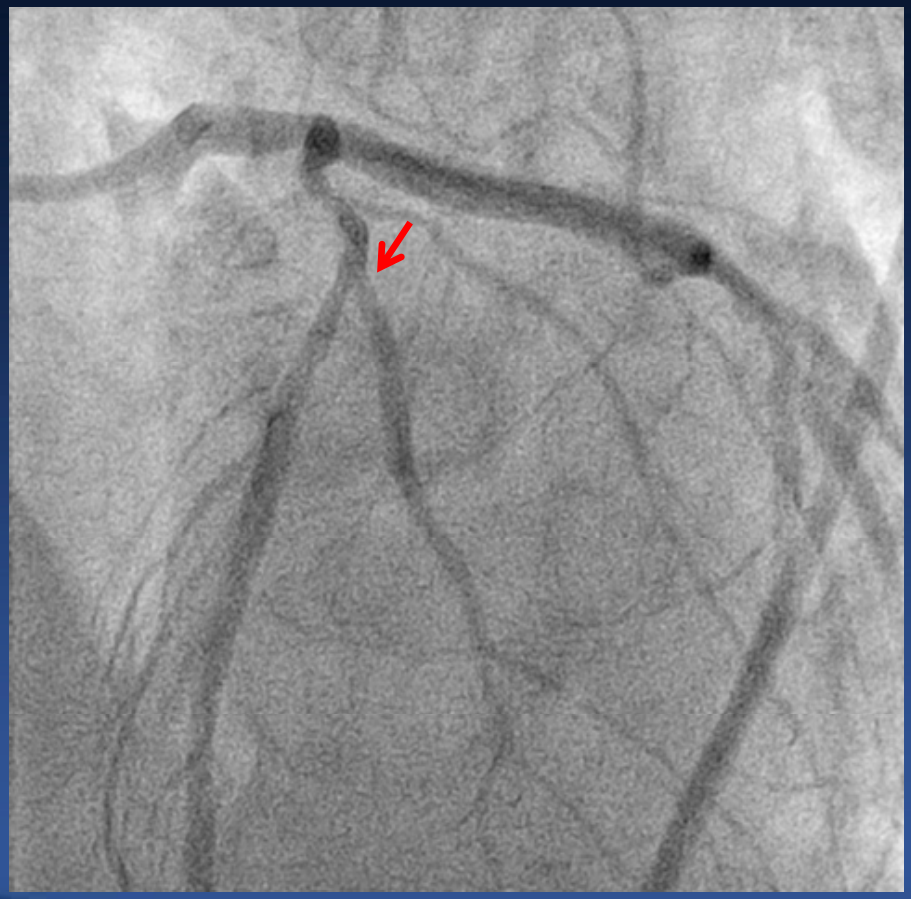
Kang et al. Catheter Cardiovasc Interv 2013 in press

Plaque Shift vs. Carina Shift

- Prevalence of Carina vs. Plaque Shift
- Impact on Functional Significance

SB ostium with pre-procedural DS<50%

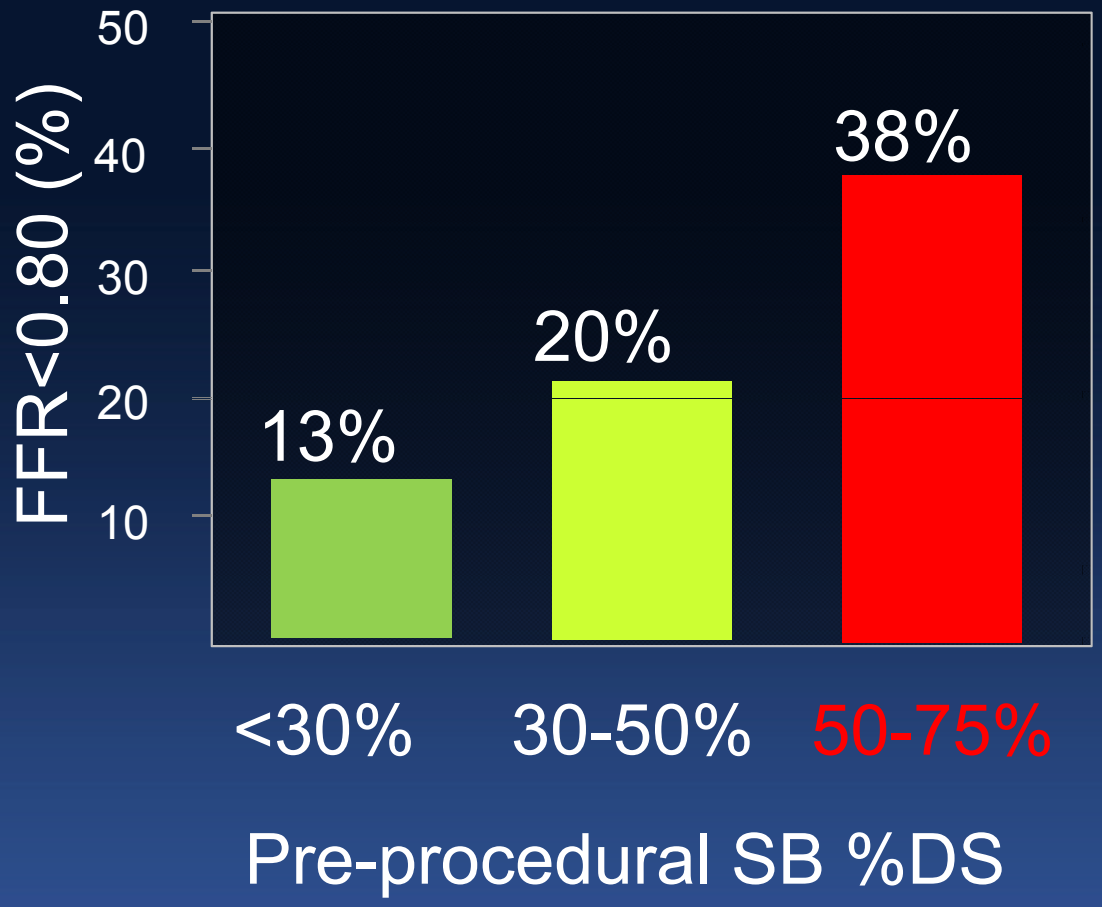
48% were angiographically jailed (DS>50%) after MB stenting, while **15%** had FFR<0.80



After MB stenting

AMC preliminary

How Often Functional SB Compromise?



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

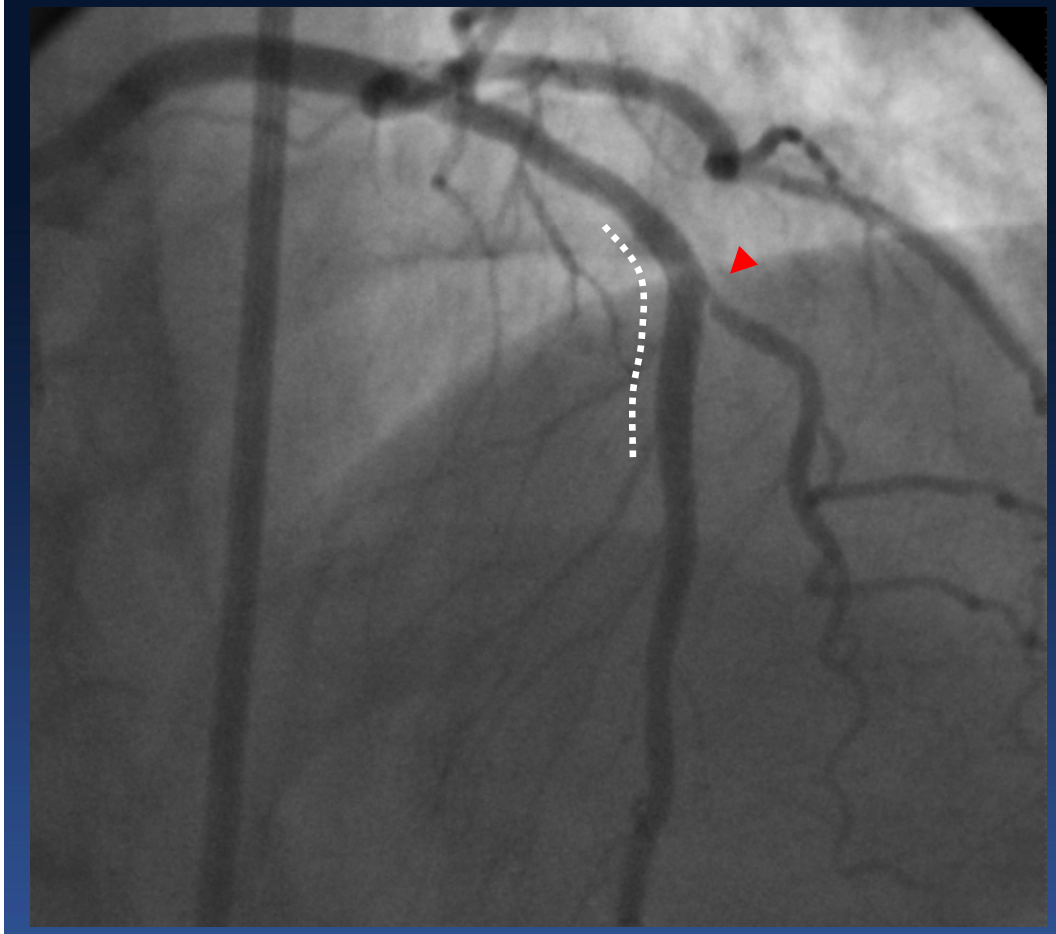
How to Treat Angiographic Jailing of SB?

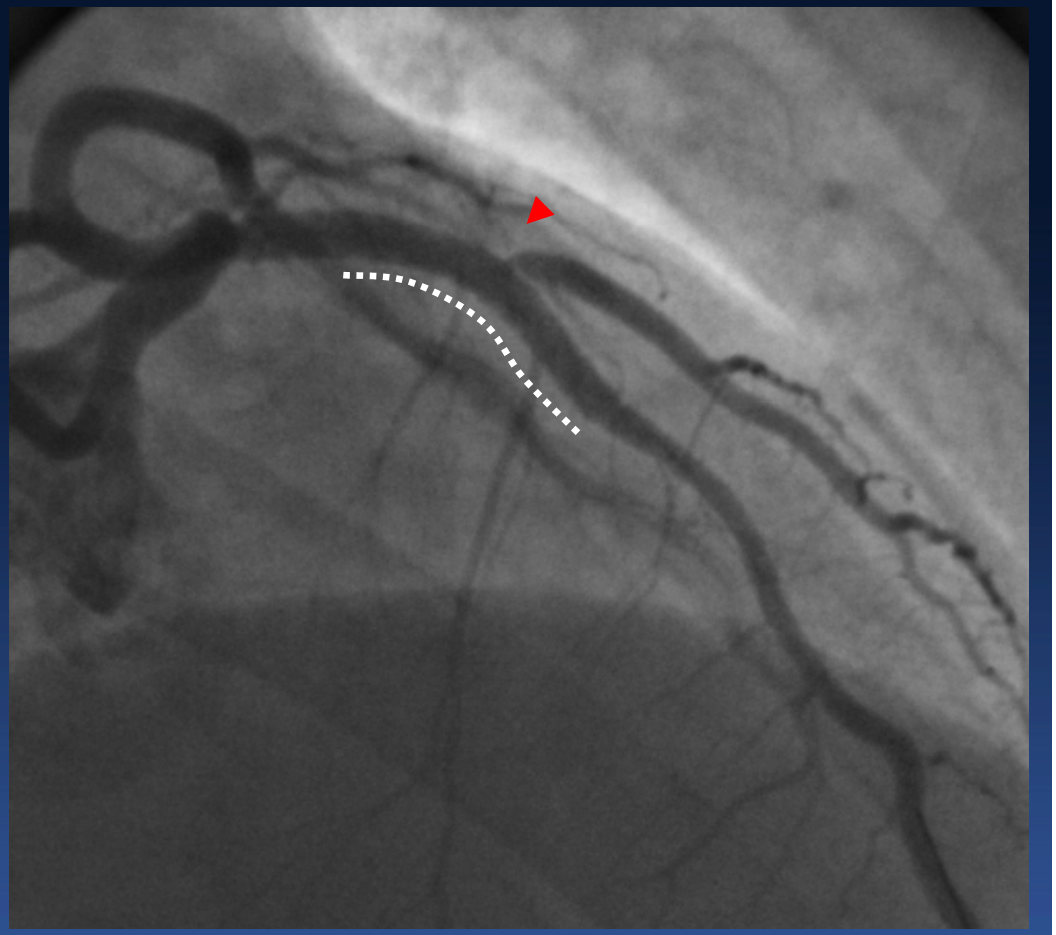
FFR >0.75 is safe for deferral of jailed SB

FFR-guided provisional SB intervention resulted in a low rate of 9-month MACE

Koo et al. Eur Heart J 2008;29:726–32

Mismatch Between QCA vs. FFR

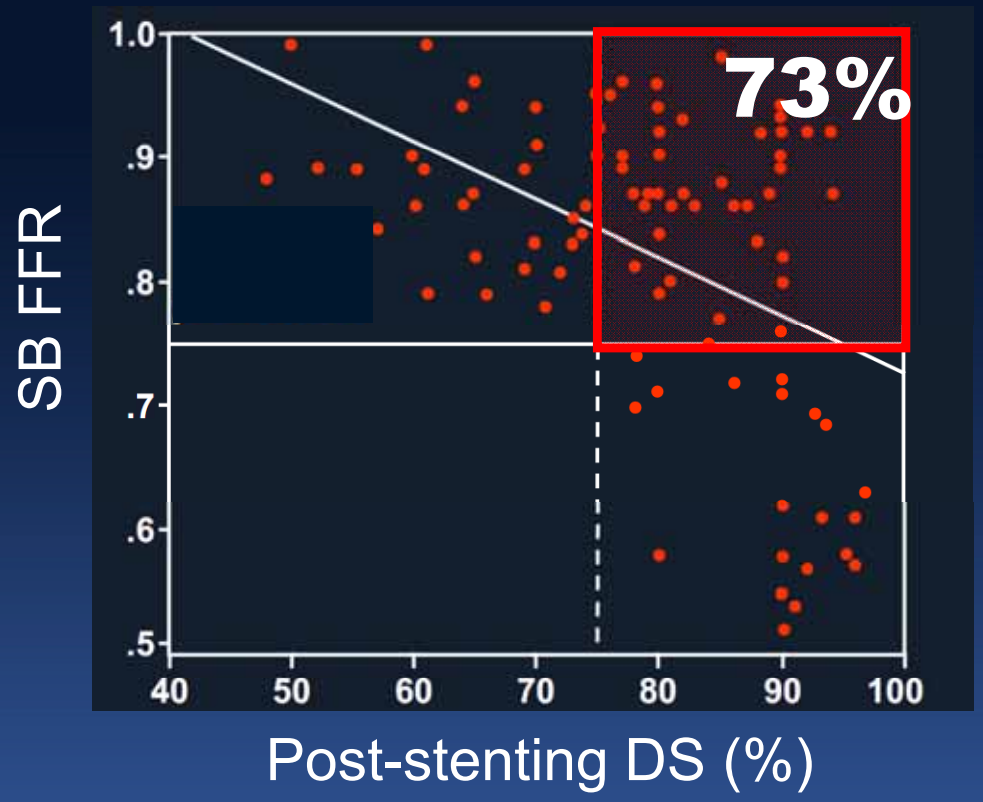


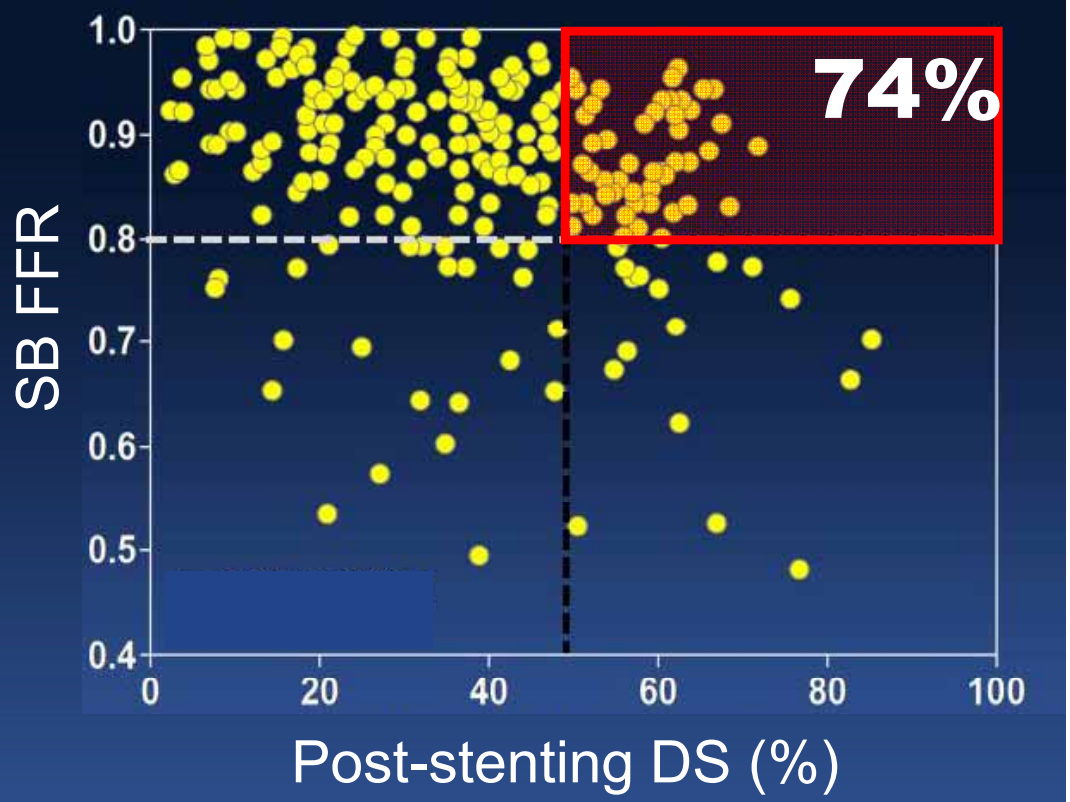


Post-stenting DS 70%
SB FFR 0.83

Post-stenting DS 80%
SB FFR 0.88

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





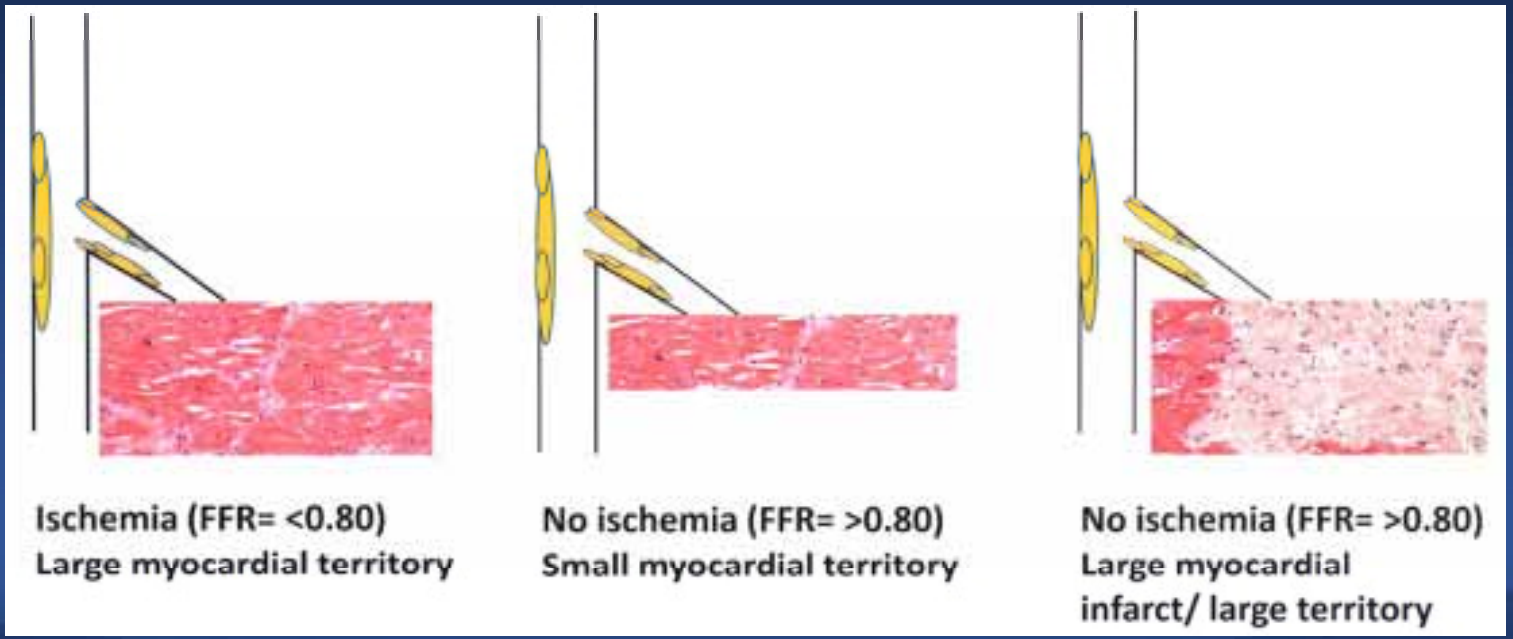
Koo et al. JACC 2005;46:633

Ahn et al. JACC Interv in Press

Why Mismatch?

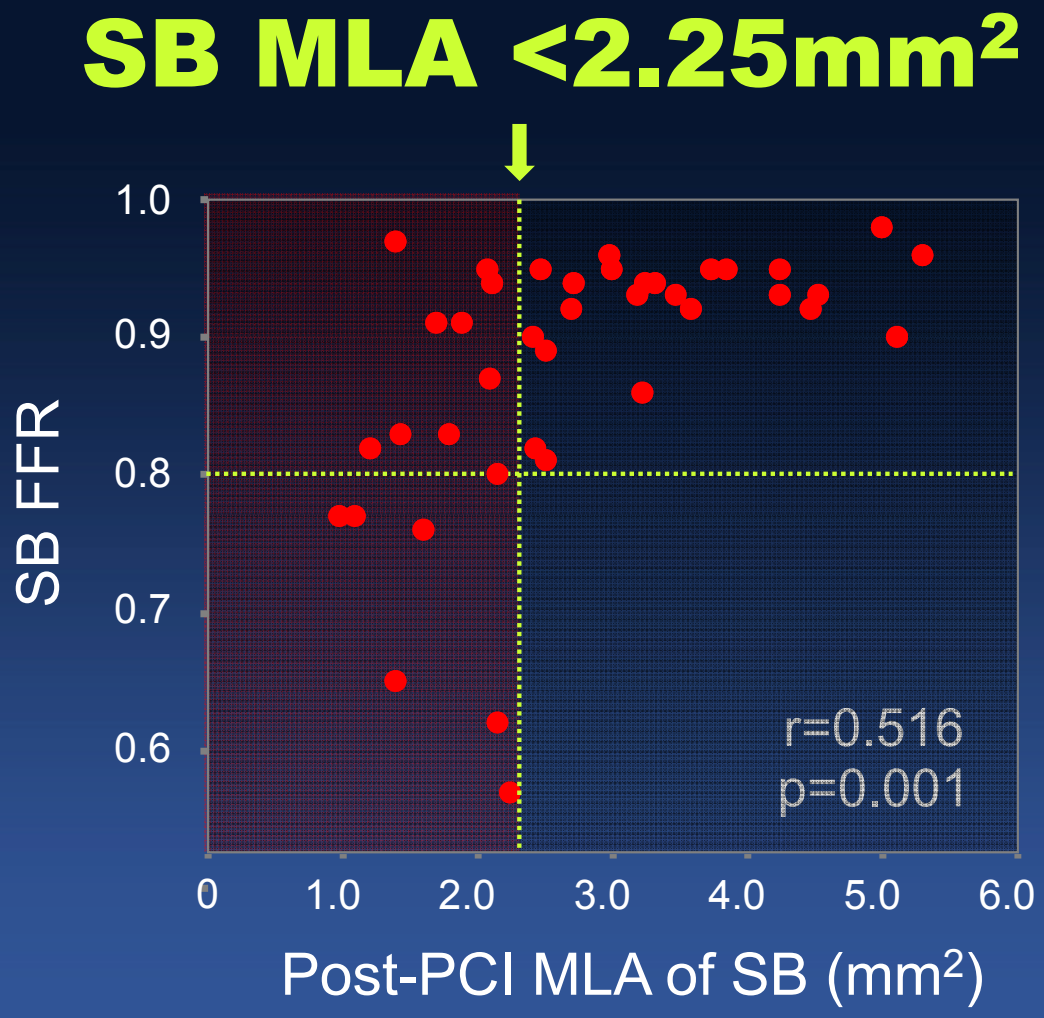
Angiography and SB FFR

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



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

Is Post-stenting SB-IVUS Useful to Assess Jailed SB?



To Predict FFR<0.80

Sensitivity 100%

Specificity 71%

PPV 38%

NPV 100%

Kang et al. Catheter Cardiovasc Interv 2013 in press

Why Mismatch?
IVUS-MLA vs. FFR

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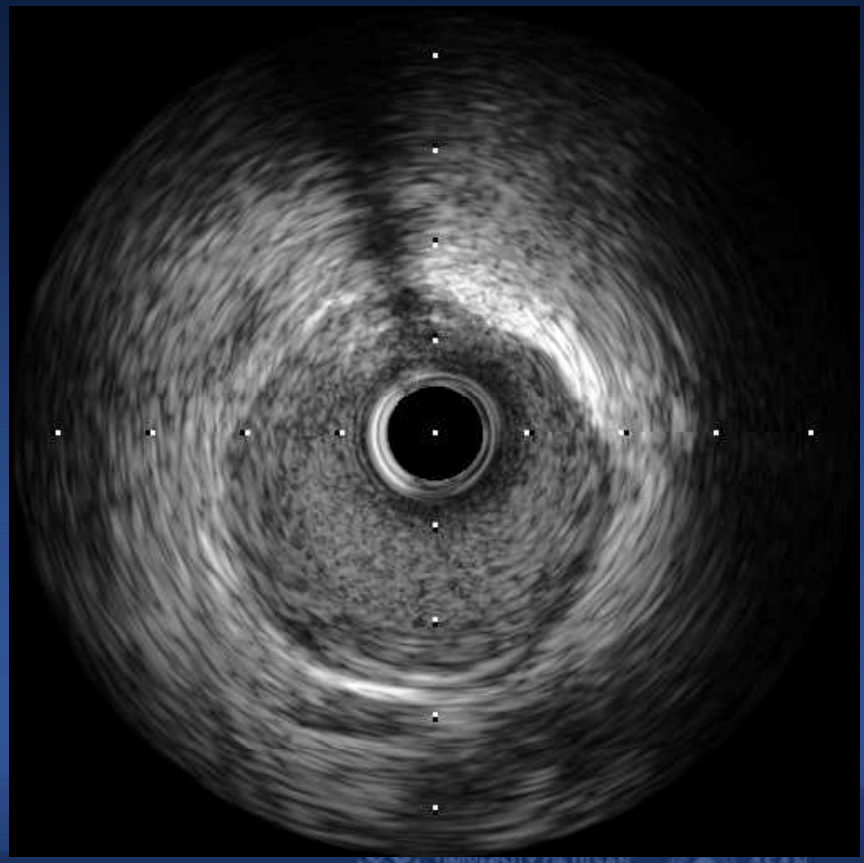
- Small myocardial territory
- The general mechanism of SB jailing is focal carina shift rarely causing functional stenosis

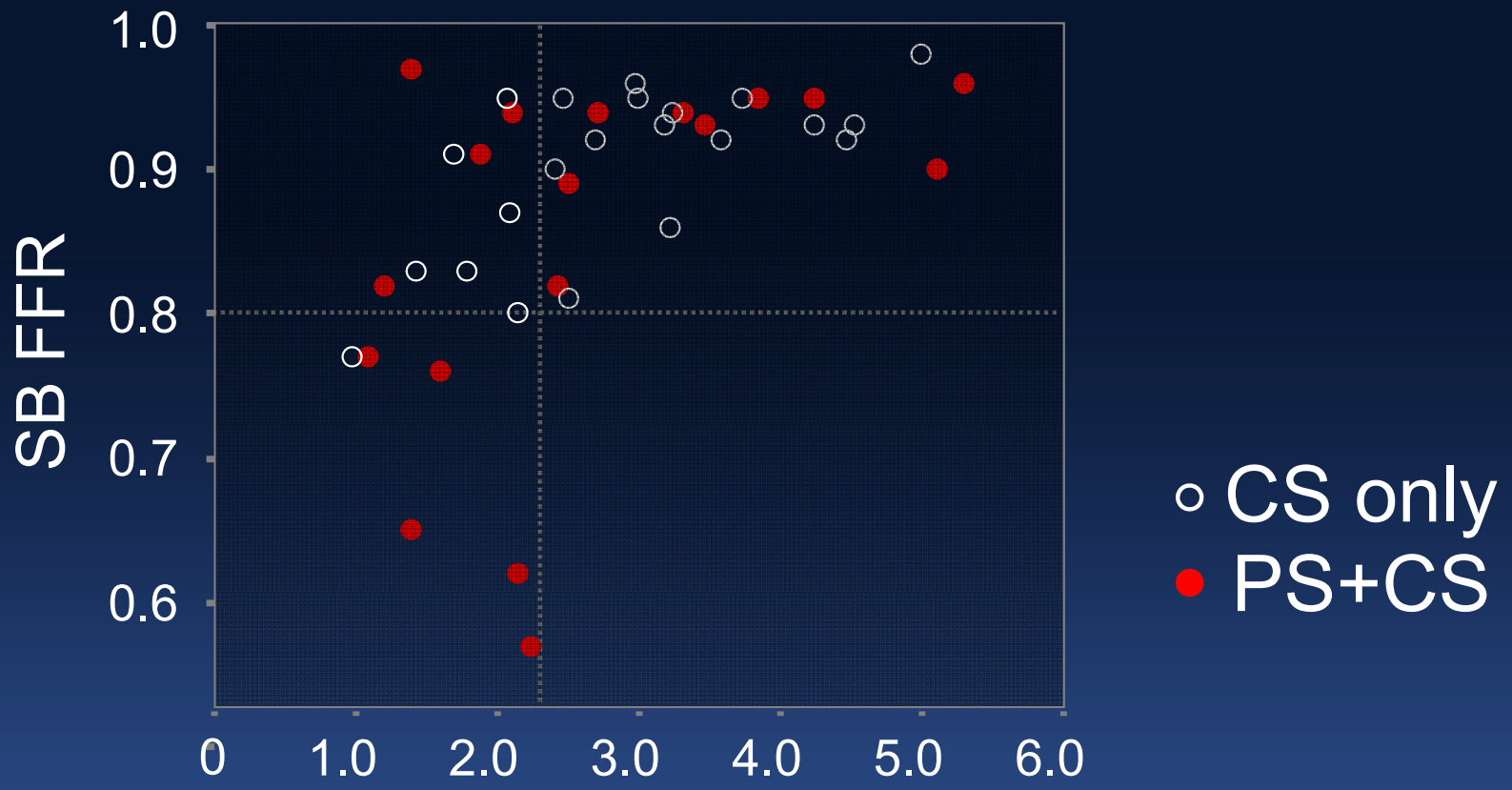
Why Does the Isolated Carina Shift Rarely Reduce FFR?

- Not by plaque gain, but by vessel deformation
- The luminal change is extremely focal



Hemodynamic Impact

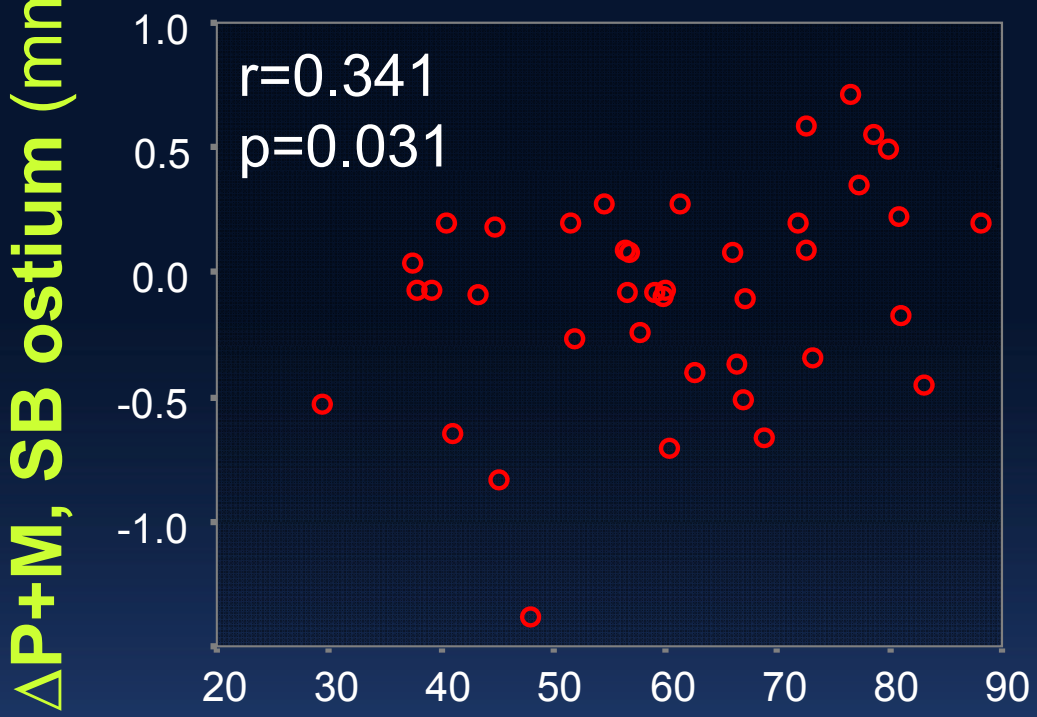
Carina vs. Plaque Shift

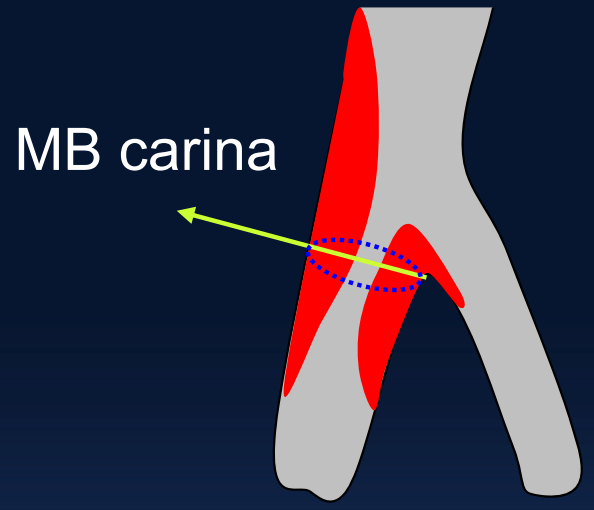


Plaque shift may be a prerequisite to the hemodynamically significant SB stenosis

Kang et al. Catheter Cardiovasc Interv 2013 in press

Predictor for Plaque Shift

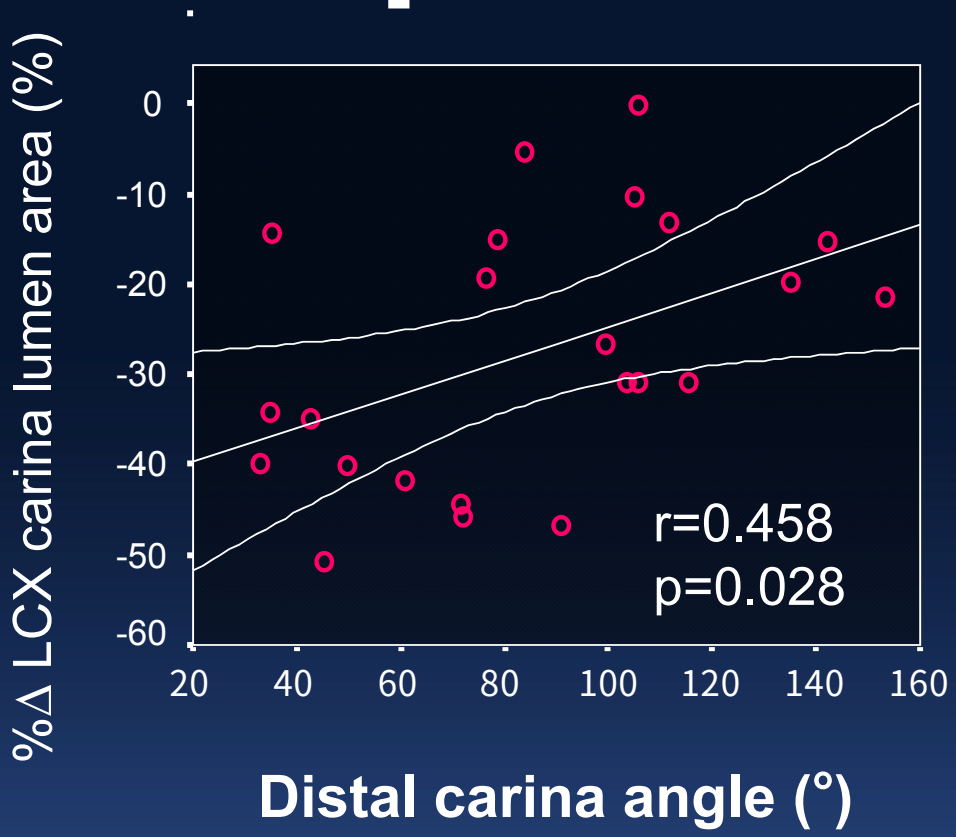


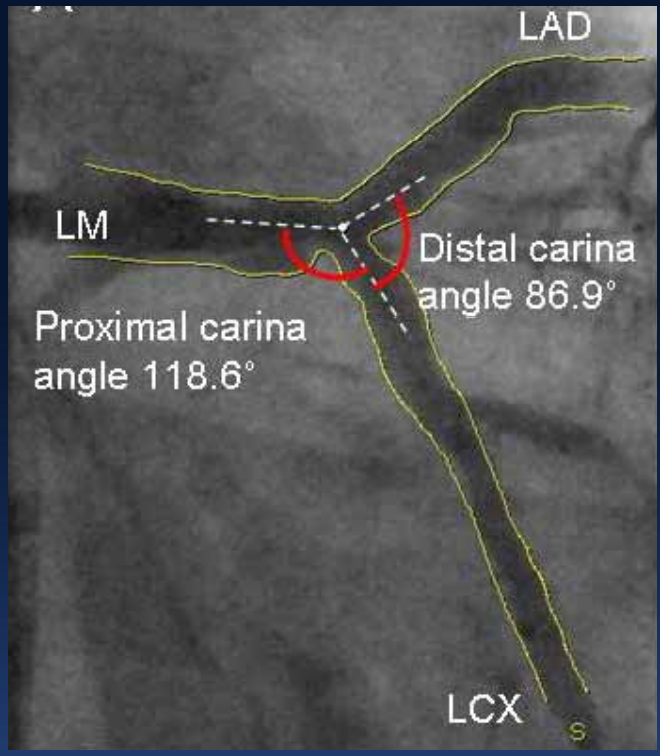


	r	p
Lumen area, MB carina	-0.137	0.399
Plaque burden, MB carina	**0.341**	**0.031**
Plaque burden, distal MB	0.299	0.061
Plaque burden, proximal MB	-0.039	0.813
Plaque burden, SB ostium	-0.218	0.176

Kang et al. Catheter Cardiovasc Interv 2013 in press

Impact of Carina Angle





A narrow distal carina angle predicted a greater reduction in MLA and EEM area at the LCX ostium

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

Summary

- Carina shift is a general mechanism of SB jailing, occurs in almost all lesions
- Plaque shift is less frequent, but more aggressive mechanism of the functional SB compromise
- Considering the frequent visual–functional mismatch, treatment of the jailed SB should be based on post-stenting SB FFR