

# What Really Matters in Bifurcation PCI; *Technique or Concept ?*

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# *Bifurcation PCI*

## *How To Do ?*

1. Lots of bench tests and simulation studies generated lots of hypothesis and concerns.
2. Lots of different device and different technical Issues.
3. Why not more functional concept ?

# ***Non-LM Bifurcation PCI***

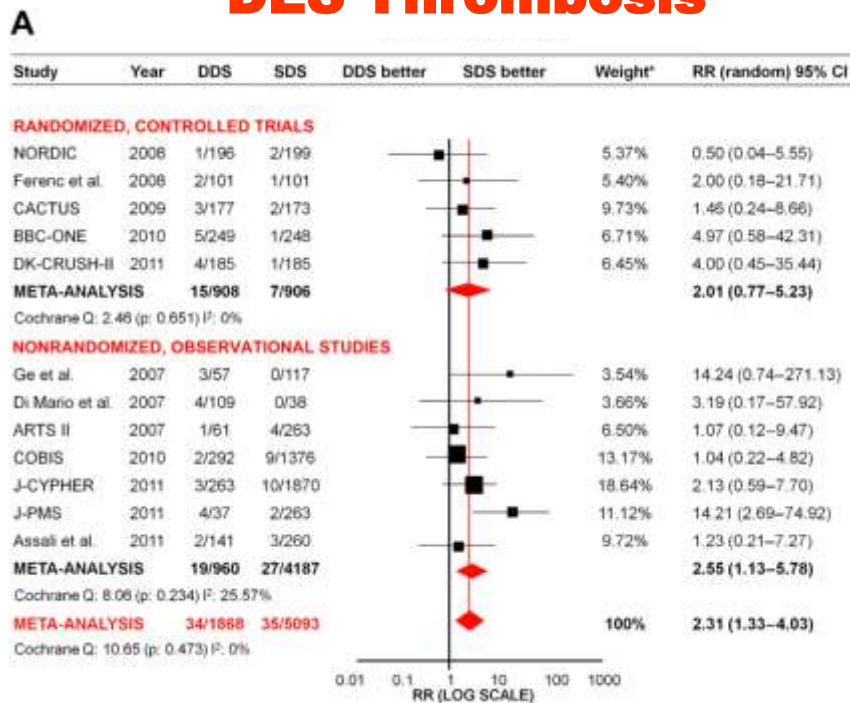
## ***How To Do ?***

1. 1 stent with provisional stenting
2. 2 stent strategy

# Meta-Analysis of 12 Major Studies, 6961 Pts

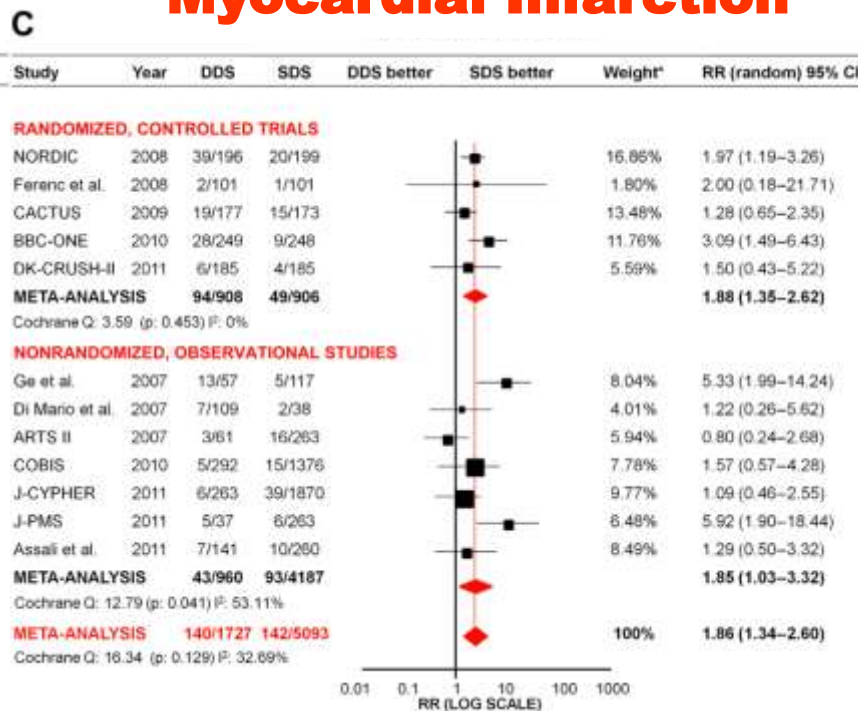
## 1 stent with provisional stenting is Better!

### A DES Thrombosis



Single-stent      Two-stent

### C Myocardial Infarction

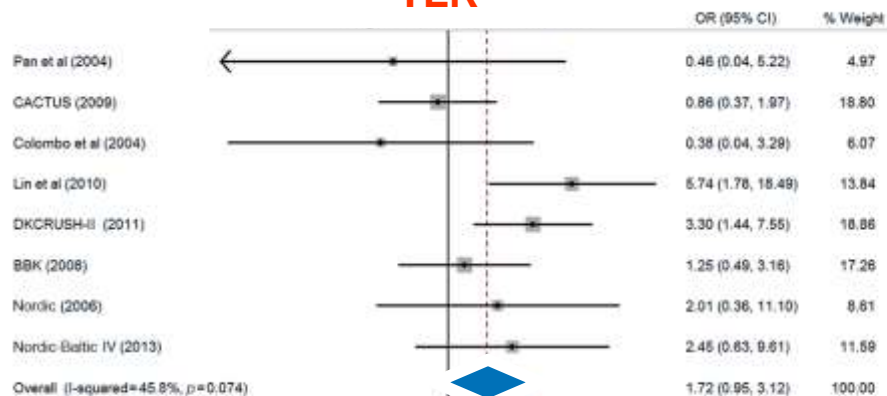


Single-stent      Two-stent

# Recent Meta-Analysis of 9 RCTs, 2569 Pts

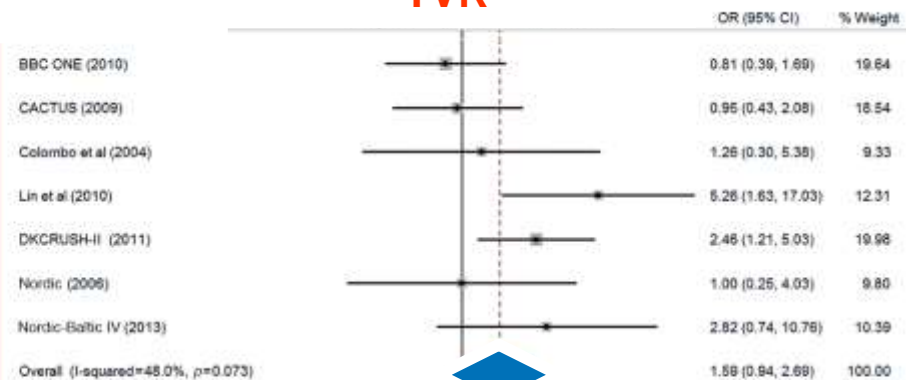
## 2 Stent Techniques Are Also Good !

### TLR



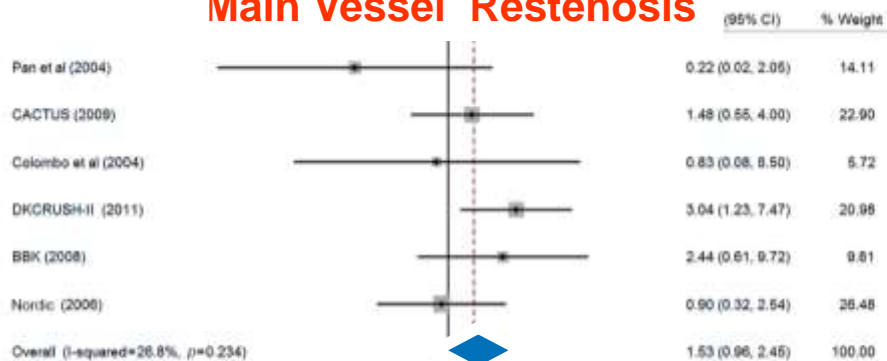
NOTE: Weights are from random effects analysis

### TVR



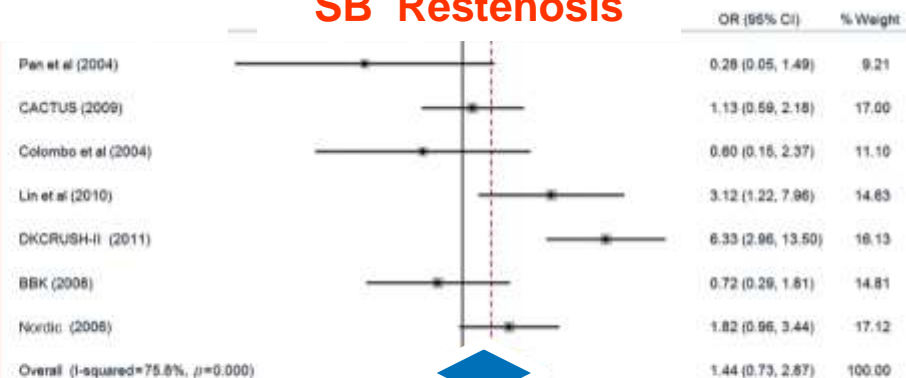
NOTE: Weights are from random effects analysis

### Main Vessel Restenosis



Single-stent      Two-stent

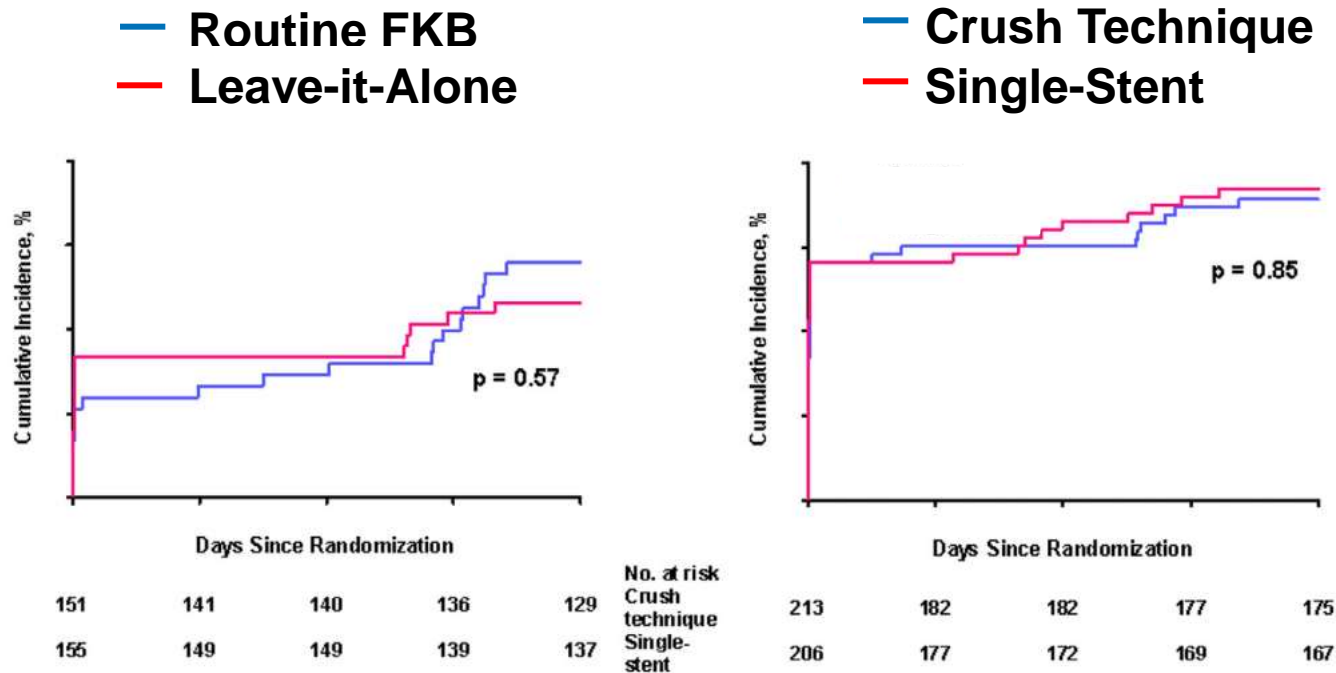
### SB Restenosis



NOTE: Weights are from random effects analysis

Single-stent      Two-stent

# Recent Randomized Study CROSS and PERFECT (n=920) *1 or 2 Stent Technique Are Both Good !*



CROSS and PERFECT Studies (n=920)

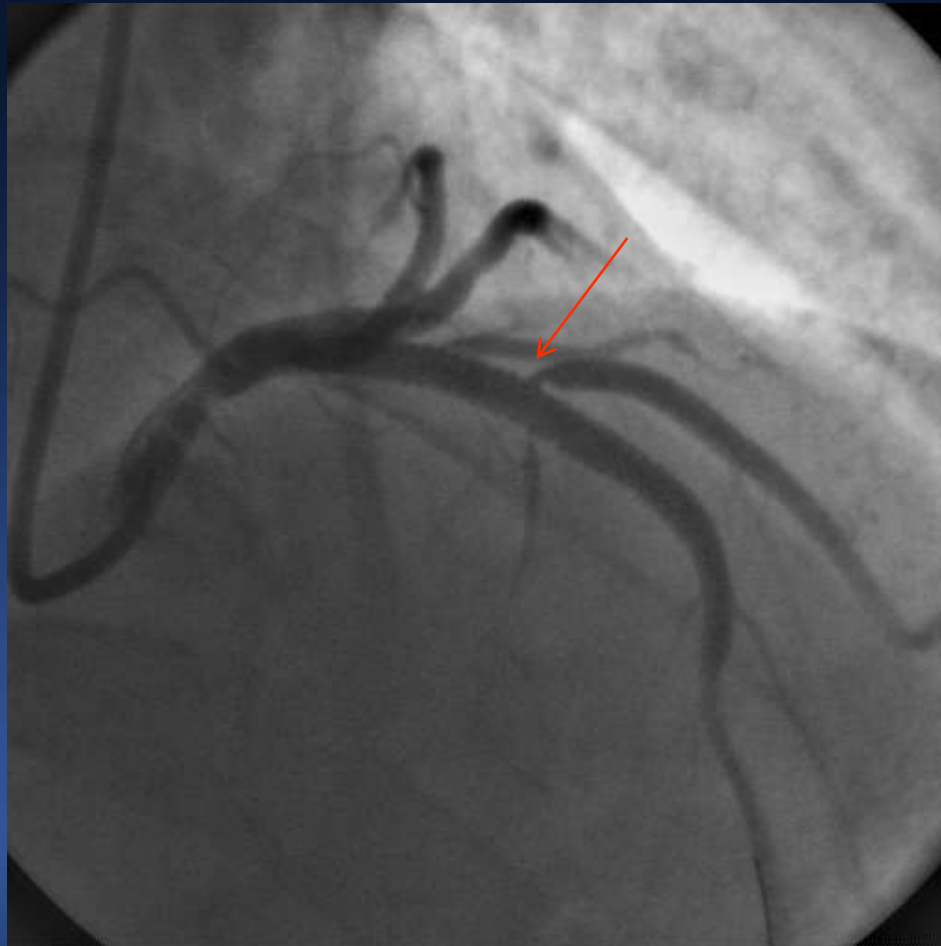
Kim YH, Park SJ, et al. JACC Interv. 2015 April 20;8(4):550-60

# Non-LM Bifurcation PCI

## *How To Do ?*

- Both strategy, (1 or any 2 stent techniques) would be good in clinical outcomes in the era of 2<sup>nd</sup> DES.
- *But, Less is More ! Less invasive (one stent) strategy would be preferred.*

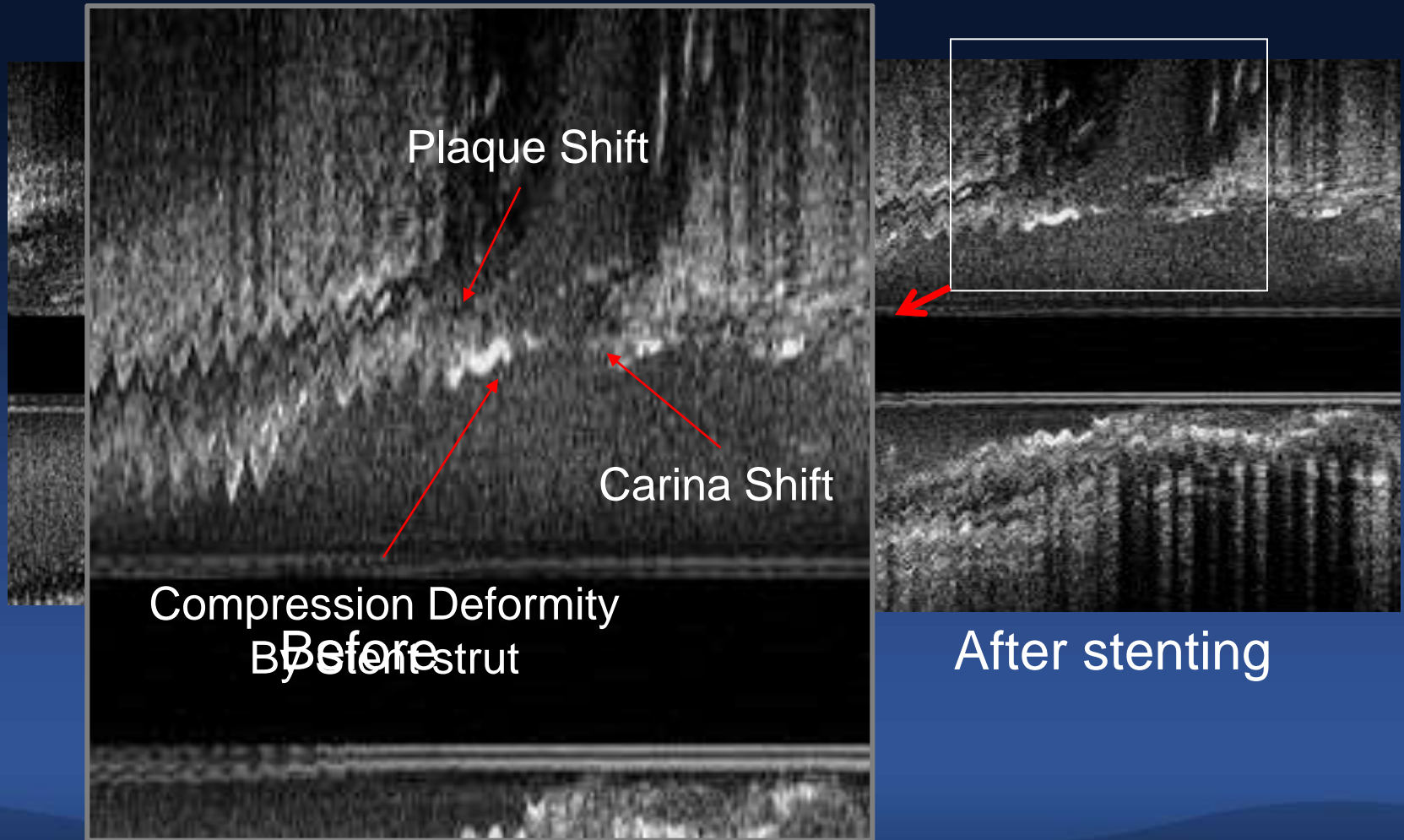
*Side Branch Jailing  
After Main Branch Stenting  
Do you want to treat ?*



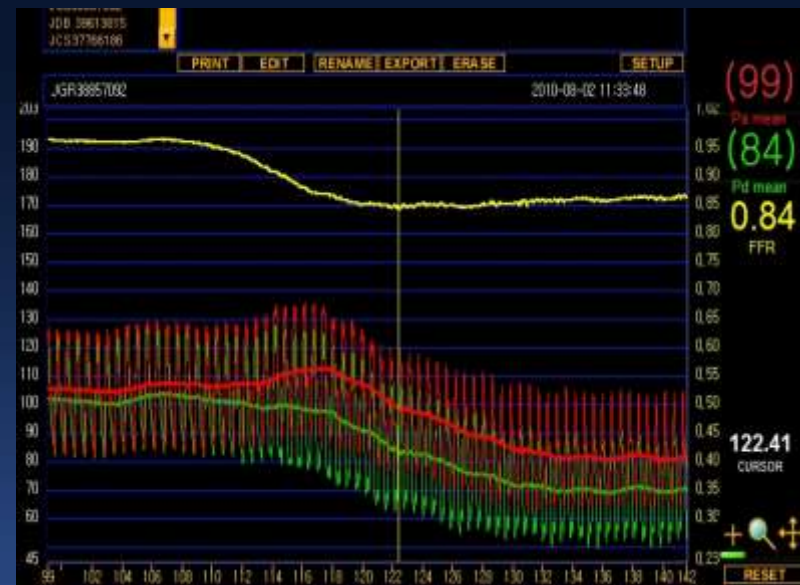
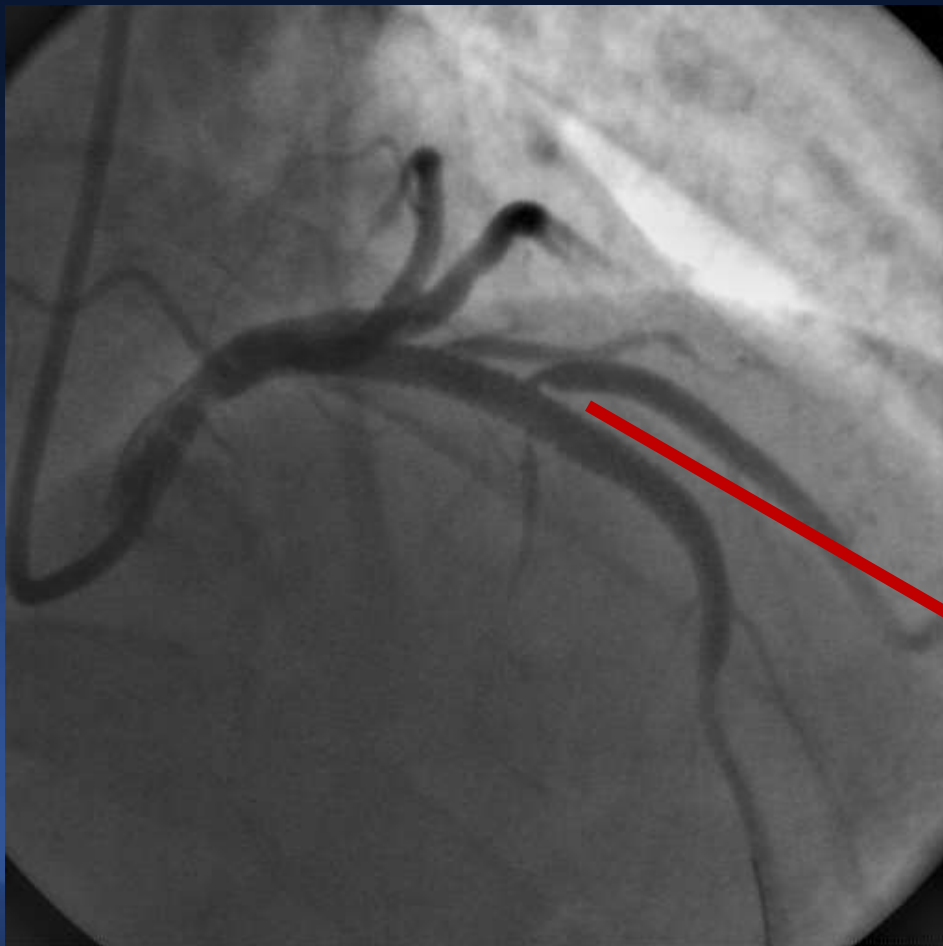


# Mechanism of Jailing Side Branch

*Discrete, Focal !*



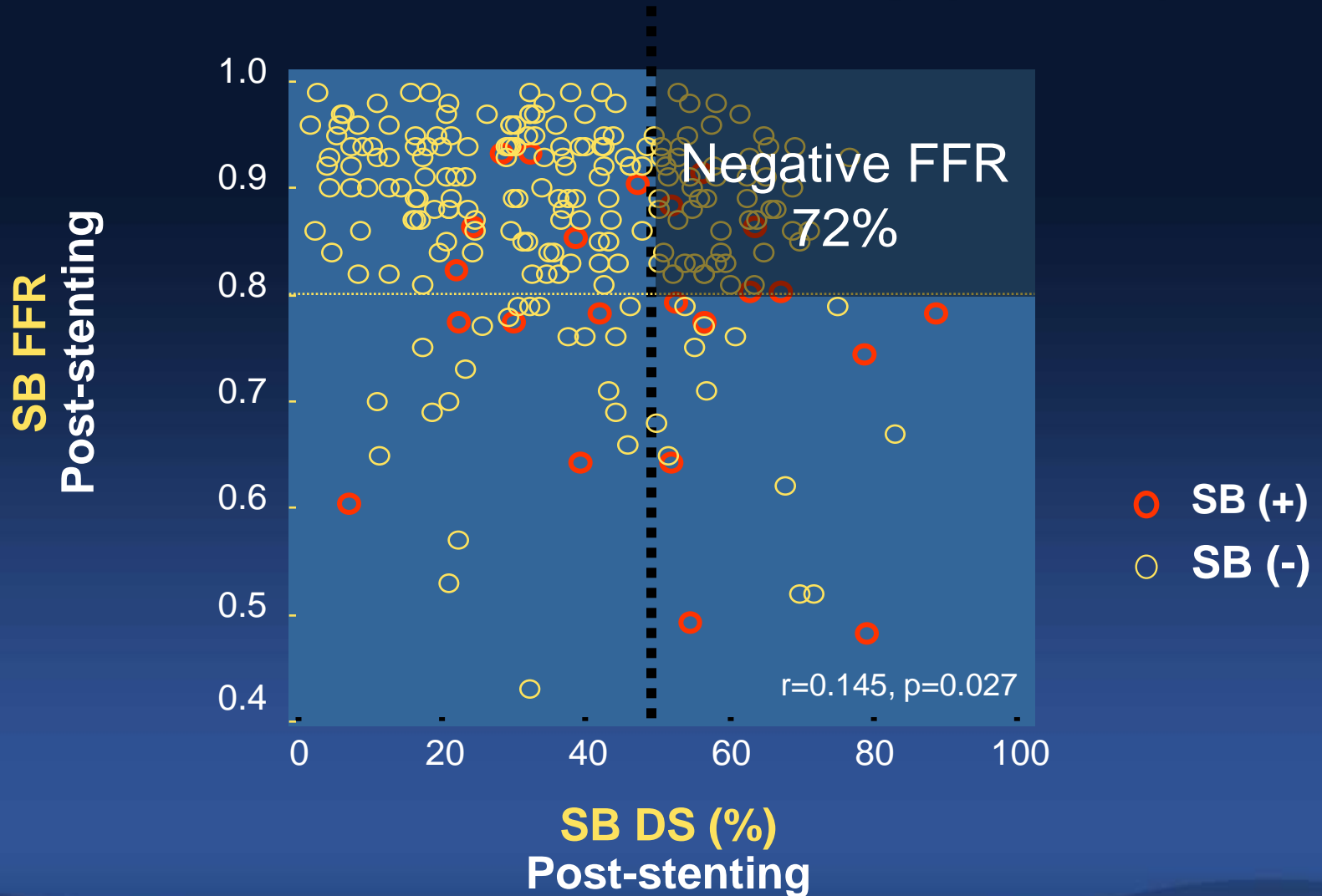
# Side Branch Jailing After Main Branch Stenting Do you want to treat ?



**FFR 0.84**

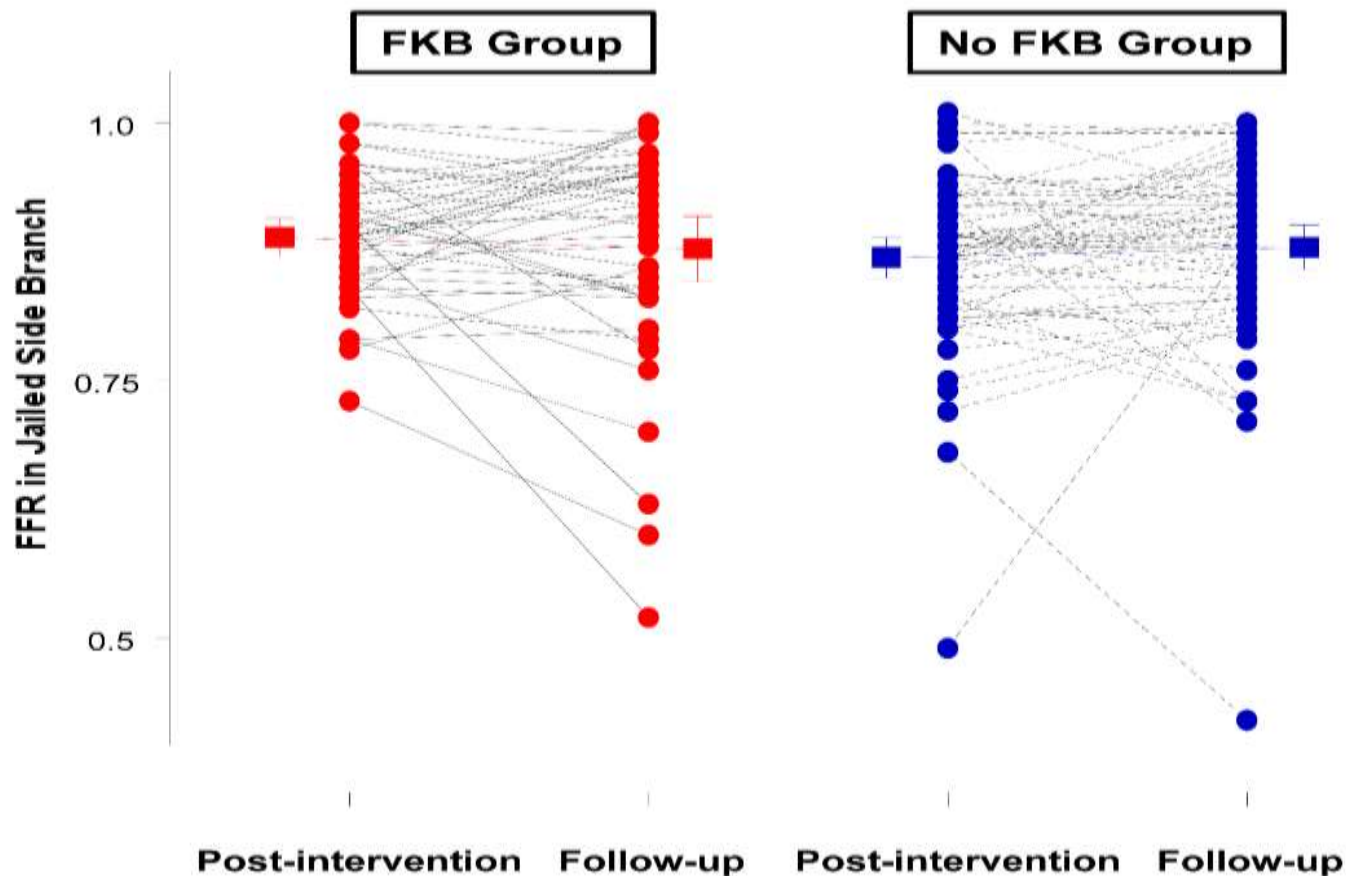
# Side Branch FFR

*After Main Vessel Stenting (n=232)*



# Serial SB FFR

***Routine Kissing Balloon Inflation  
Can Not Make An Any Difference!***



# *Leave It Alone;* *Why Is It OK ?*

1. Negative FFR means *Excellent Prognosis (0.6%/year, Cardiac Death and MI)*, even in the presence of any angiographically proven disease.
2. Routine Kissing Balloon Inflation Is Not Always Good.

# ***When ?***

## **2 Stents Are Needed**

***1 Stent***  
**Provisional**  
**(>70%)**

Normal Side Branch, Whatever Size Is,  
(Medina 1.1.0., 1.0.0), or  
Focal Diseased Side Branch

***2 Stent***  
**Technique**

***Large SB ( $\geq 2.5$  mm) → Large amount  
of myocardium***  
***Diffusely Diseased Side Branch***  
***(Medina 1.1.1., 1.0.1)***

# *Many Factors* Influencing 2 Stent Techniques

- MB and SB size
- Bifurcation angle
- Plaque distribution and location
- Operator experience and expertise  
(most comfortable techniques)

# *Many Different* 2 Stent Techniques

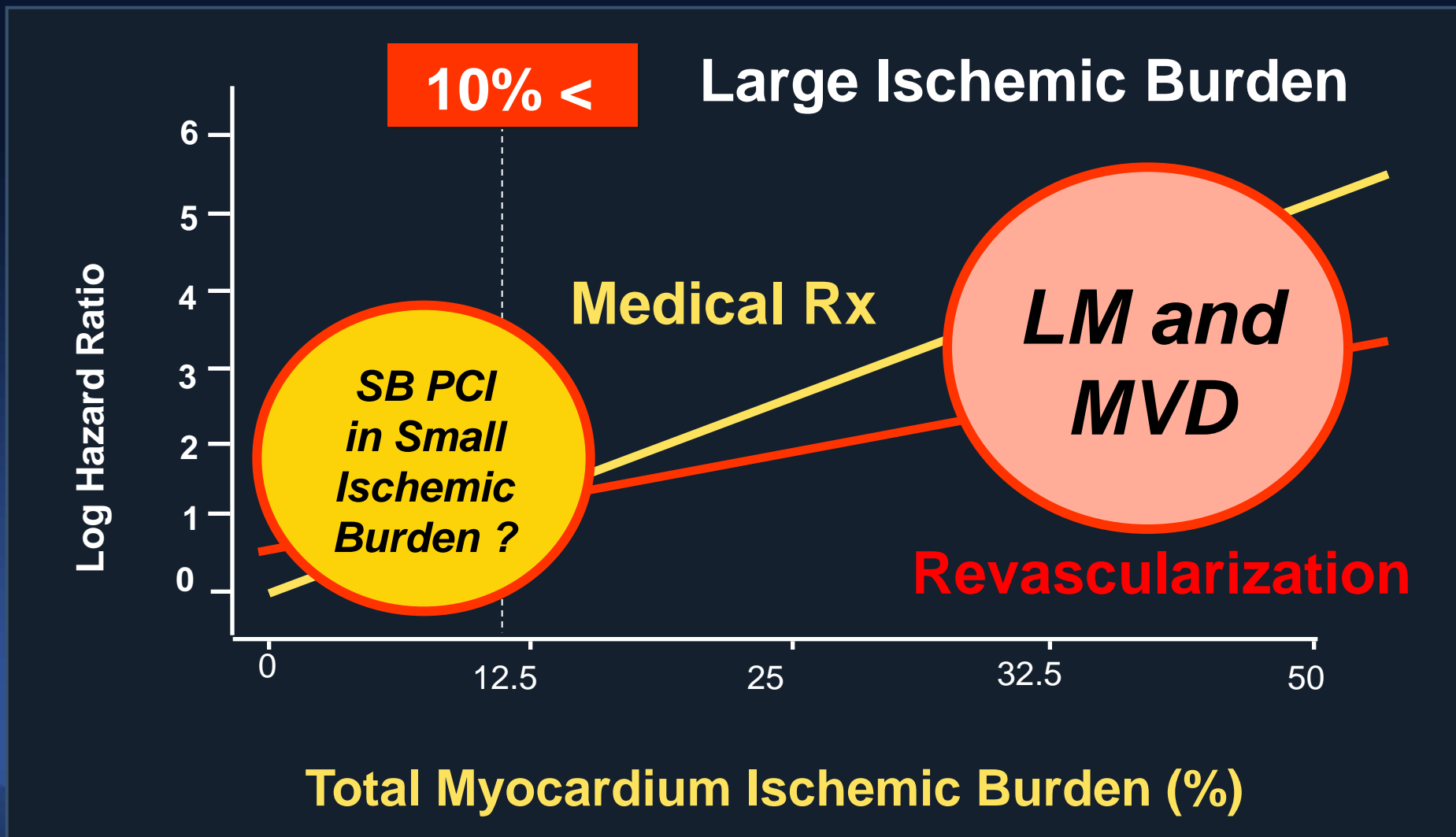
- T-stent, modified T-stent or TAP
- Mini-crush (or step crush), DKCRUSH
- Culotte
- V-stent
- Y-stent (SKS-simultaneous kissing stents)
- Dedicated Bifurcation Stent



# *Why Not, Any Different Outcomes ?* with Different 2 Stent Techniques

- Different Indications,
- Very Limited Data,
- *Small Ischemic Myocardium of SB* Can Not Make an Any Hard Endpoint Difference (Death and MI). Only Difference would be in *Soft End Point* (TLR).

# Survival Benefit of Revascularization, Side Branch PCI



***What Really Matters  
in Non-LM Bifurcation PCI ?  
Conceptual Key Message***

***FFR Guided or FFR-Trained  
Concept Is Crucial for Bifurcation PCI !***

*by the Status of MB rather than Angiographic  
Appearance of the SB.*

# *LM Bifurcation PCI*

## *How To Do ?*

1. 1 stent with provisional stenting
2. 2 stent strategy

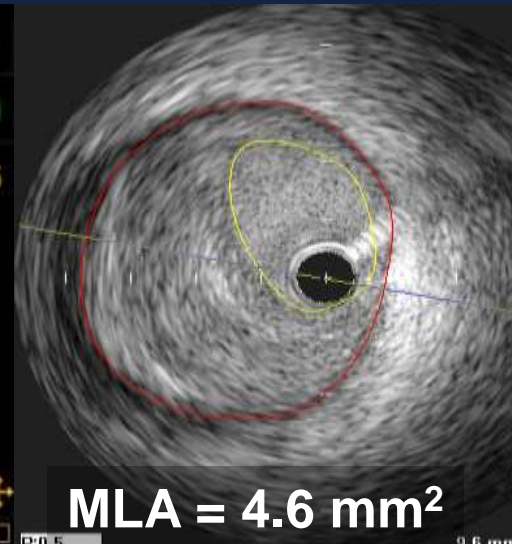
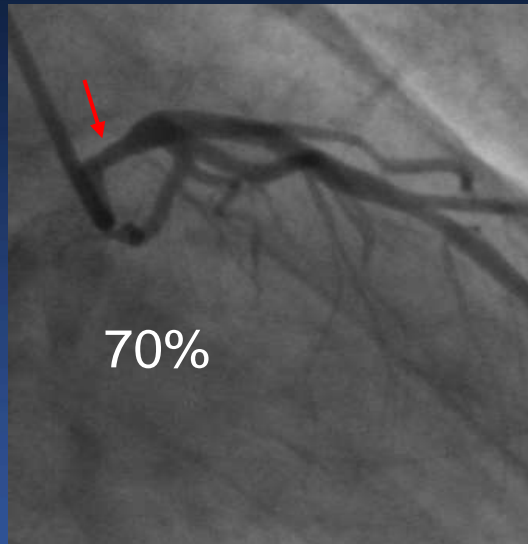
***LM PCI***  
***Many Issues,***

***Why FFR ?***  
***Why IVUS ?***  
***Which One ?***

# Significant Stenosis

## *Negative FFR*

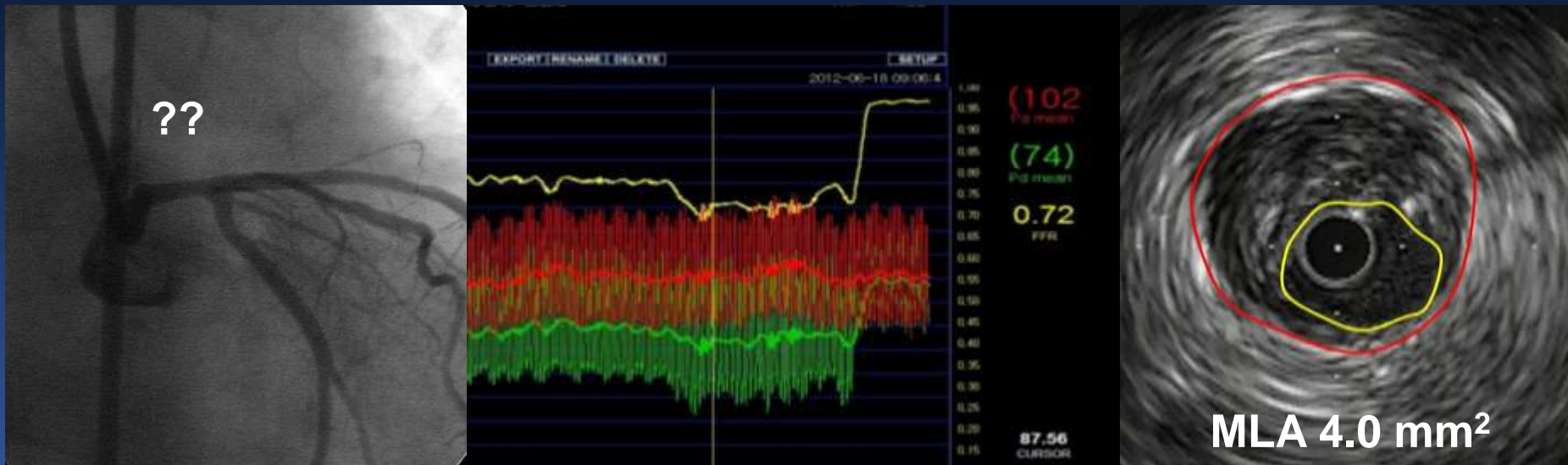
47/M  
Stable Angina



# Insignificant Stenosis

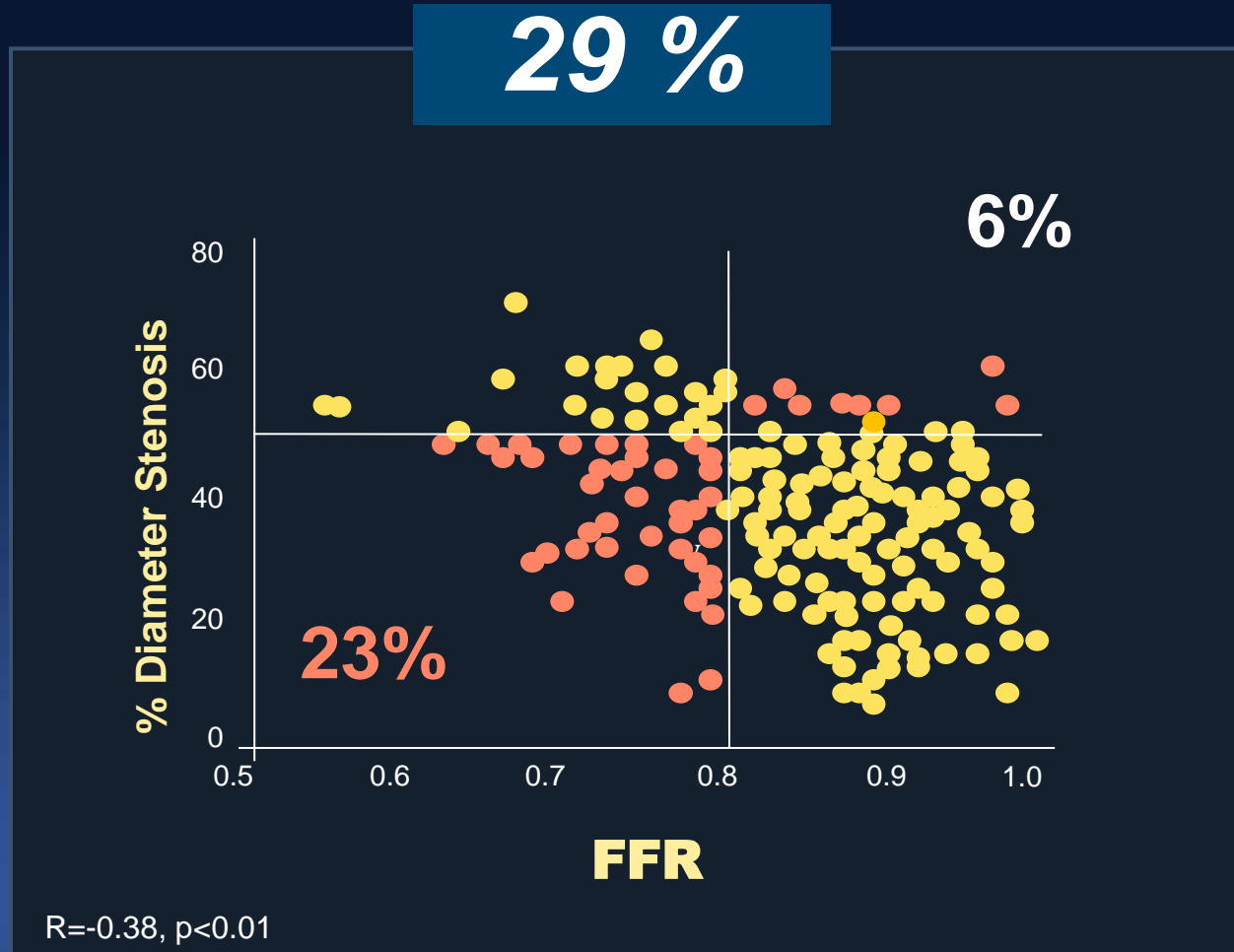
*Positive FFR*

62/F  
Stable Angina



# Many Mismatches

## Overall, Intermediate LM Disease





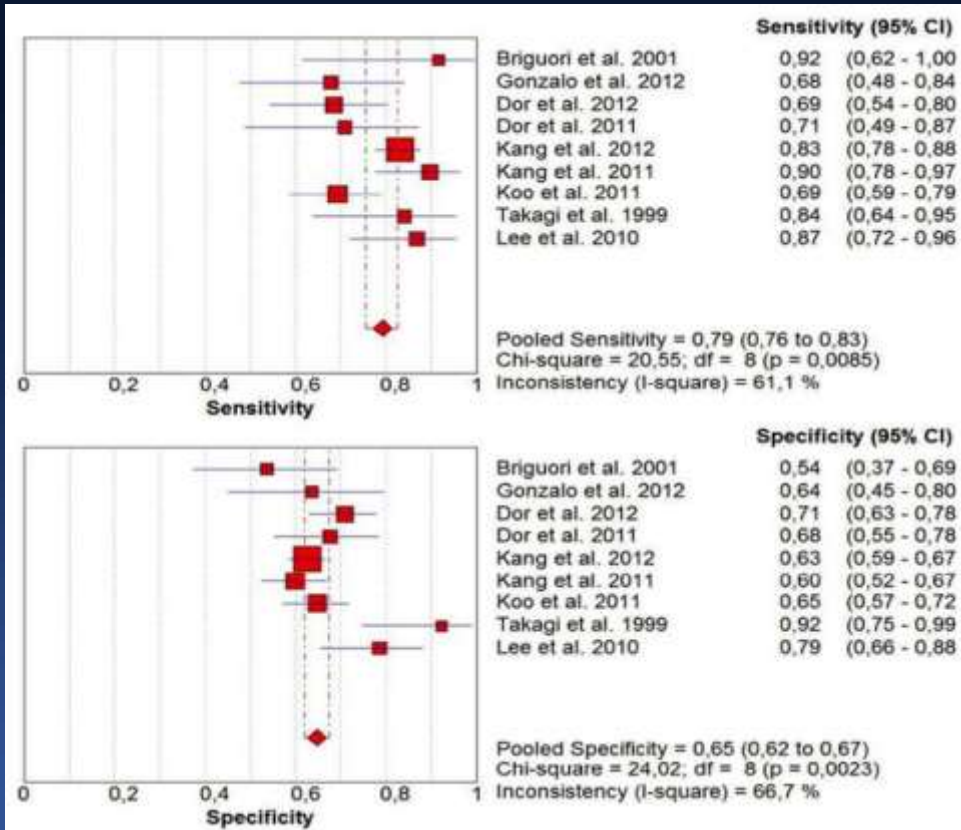
FFR is Crucial,

*For the Decision Making to Treat  
or Not To Treat.*

# ***FFR vs. IVUS MLA***

*Can LM IVUS MLA,  
Predict Functional Significance of Stenosis ?*

# Non-LM, **IVUS MLA** Matched with FFR Meta-analysis, 11 Clinical Trials 1759 pts

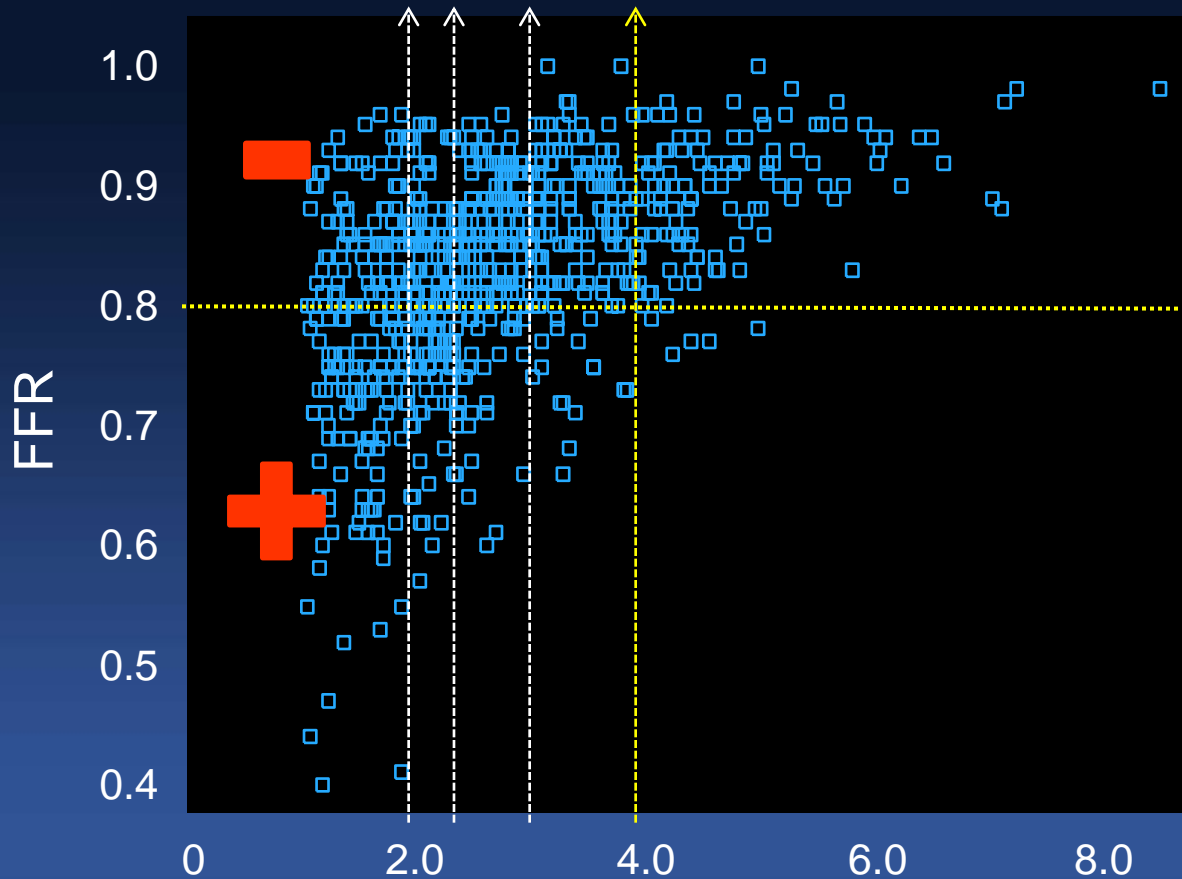


Ischemic Threshold  
**IVUS MLA 2.61mm<sup>2</sup>**

Pooled Sensitivity 79%  
Pooled Specificity 65%

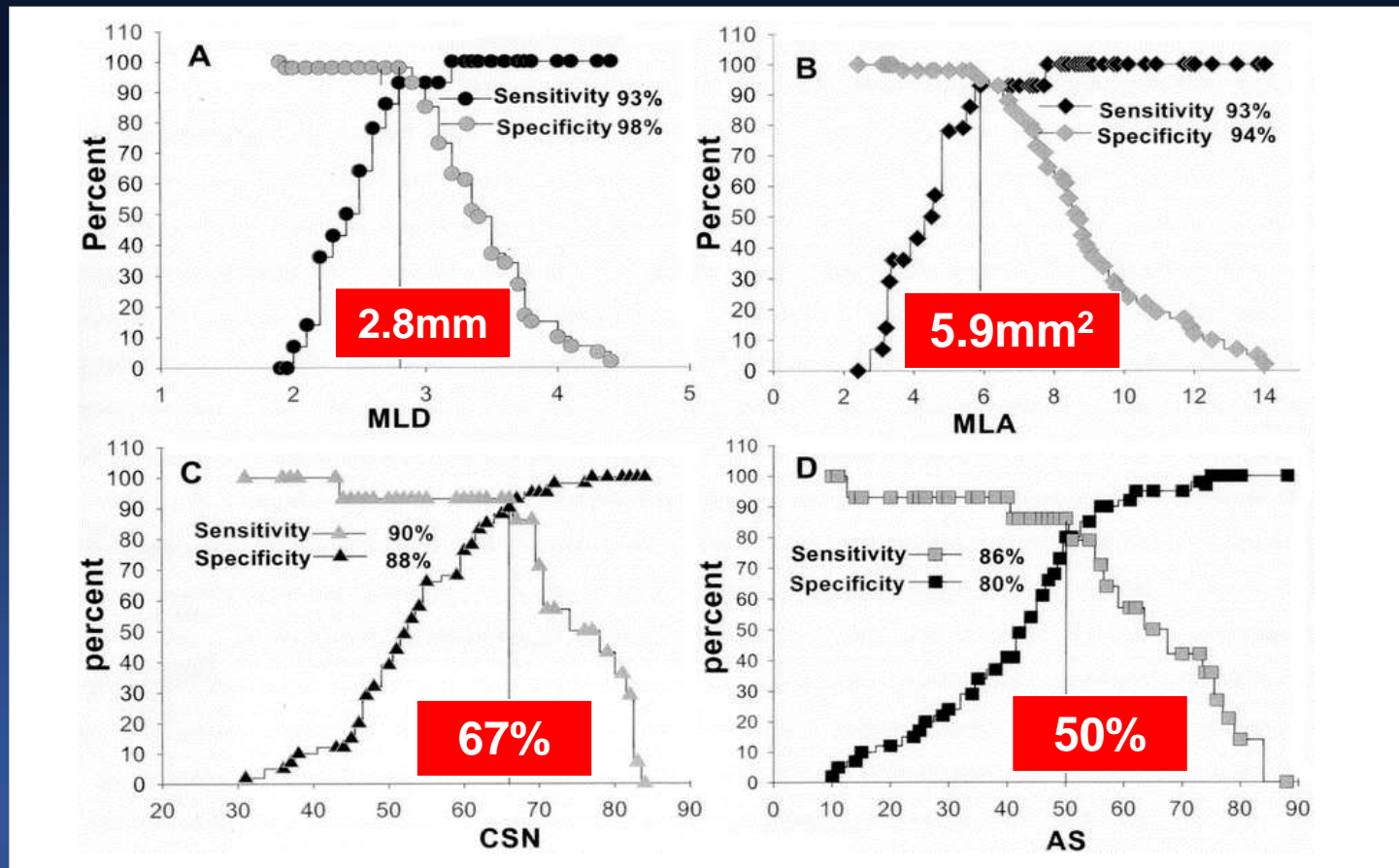
# Can IVUS MLA Predict Functional Significance of Non-LM Stenosis ?

**No !**

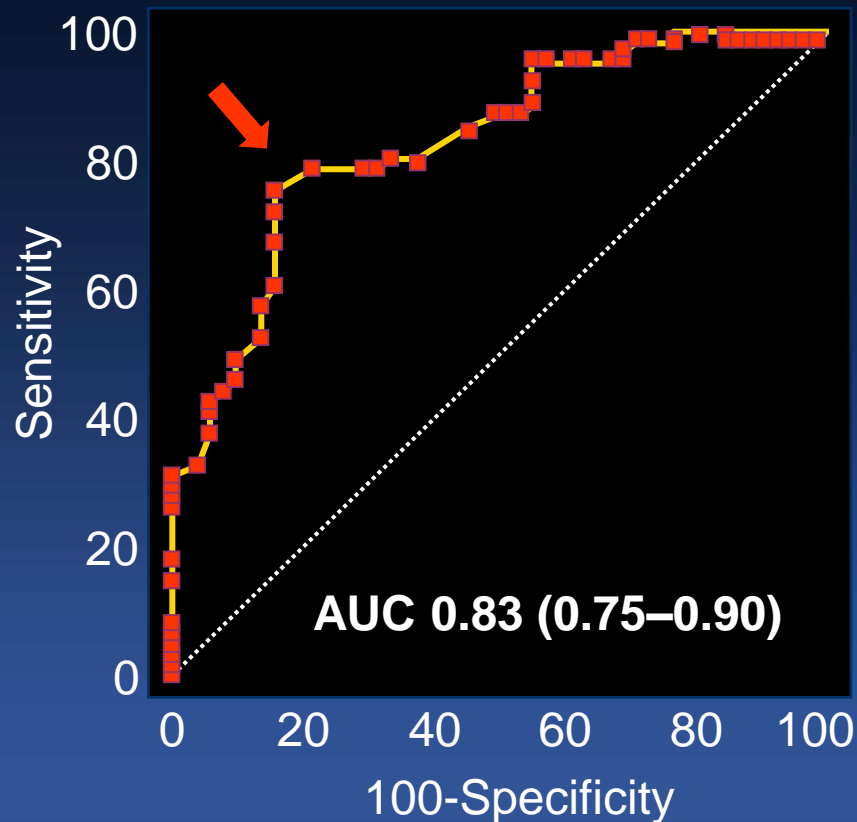


Sensitivity 84%  
Specificity 63%  
PPV 48%  
NPV 90%  
Accuracy 69%

# MLA < 6.0 mm<sup>2</sup> matched FFR < 0.75 (n=55, LM disease)



# MLA < 4.5 mm<sup>2</sup> matched FFR < 0.80 (n=112, Os and Shaft LM disease)

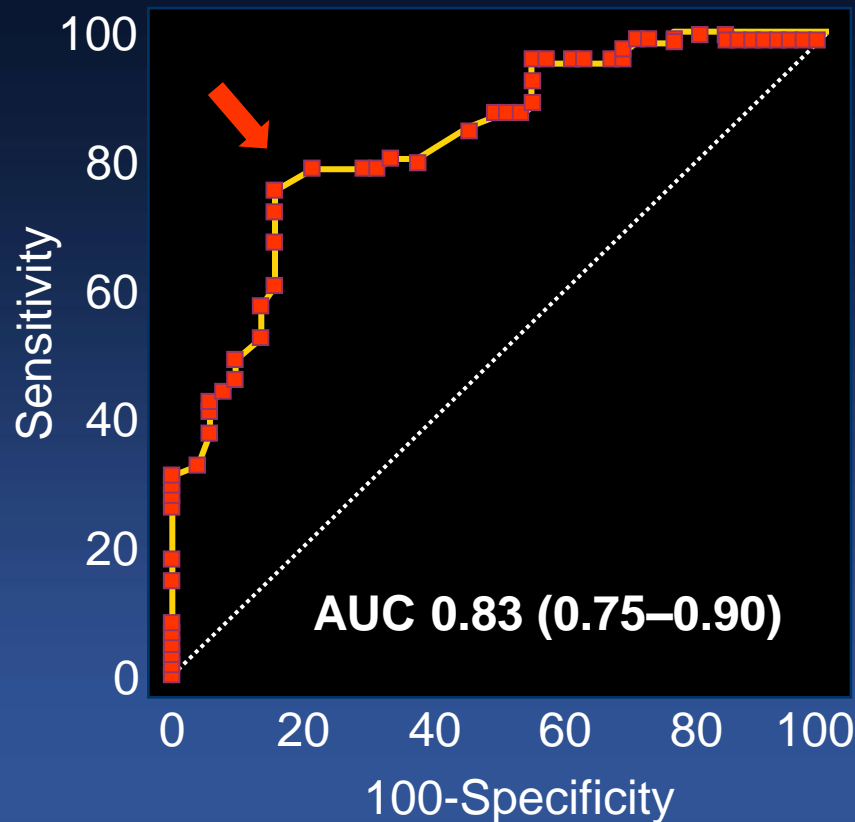


**Cut-off = 4.5 mm<sup>2</sup>**

Sensitivity	79%
Specificity	80%
<b>PPV</b>	<b>83%</b>
NPV	76%
Accuracy	80%

# Can IVUS MLA ( $4.5 \text{ mm}^2$ ) Predict Functional Significance of LM Stenosis ?

## Yes !

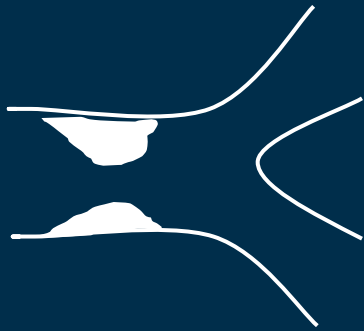


**Cut-off =  $4.5 \text{ mm}^2$**

Sensitivity	79%
Specificity	80%
<b>PPV</b>	<b>83%</b>
NPV	76%
Accuracy	80%

# How do I Implement ?

## Ostial and Shaft LM Disease



**< 4.5 mm<sup>2</sup>**  
**Positive FFR**

## Bifurcation with Down Stream Disease

**4.5~6.0 mm<sup>2</sup>**  
**Consider FFR !**

**> 6.0 mm<sup>2</sup>**  
**Negative FFR**

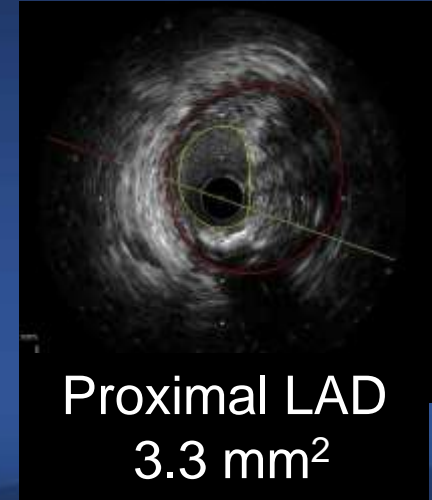
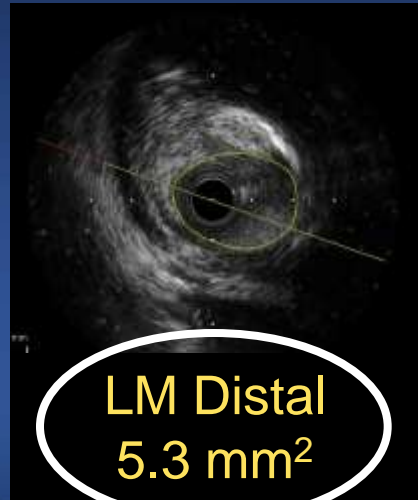
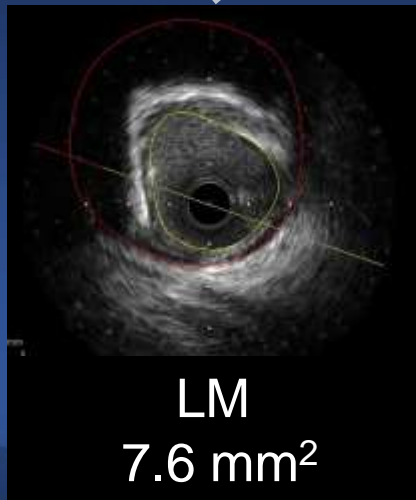
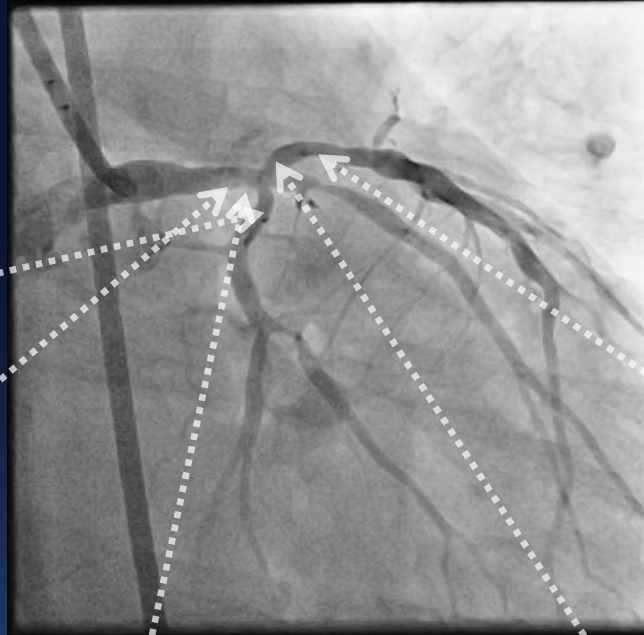


## Case 1, 55/M Effort Chest Pain



Is the Lesion Functionally Significant ?  
How to Treat ?

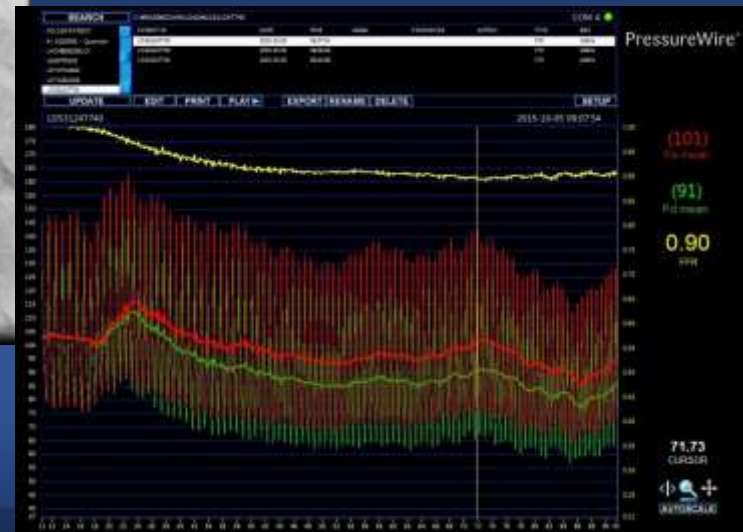
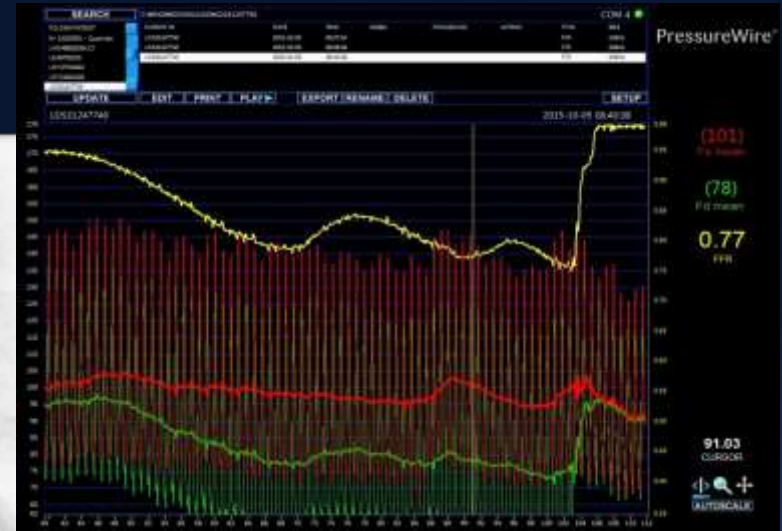
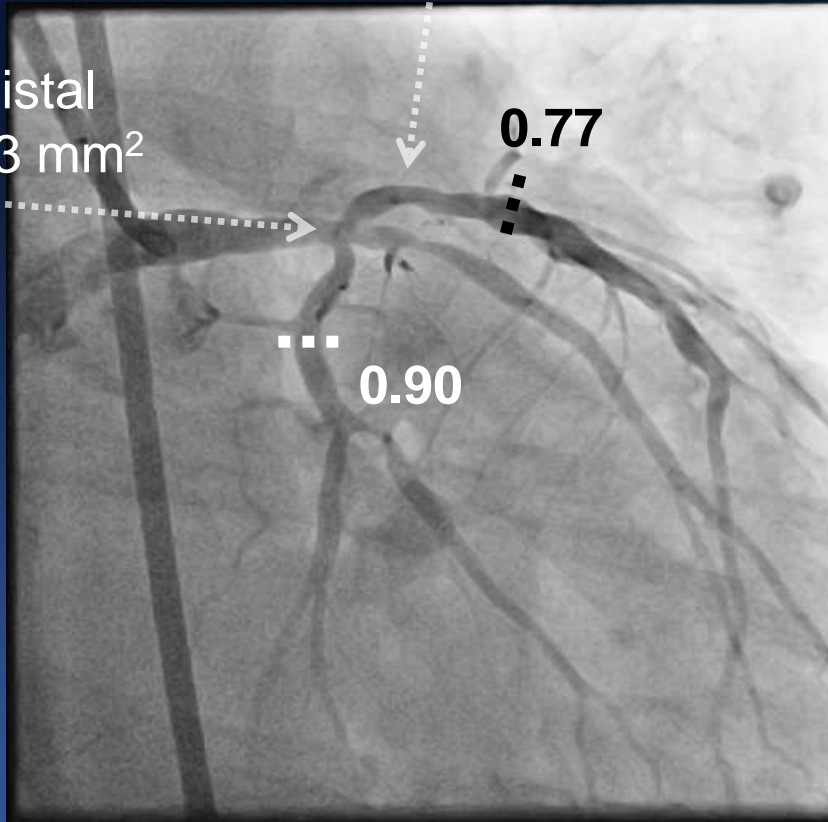
# IVUS



# IVUS vs. FFR

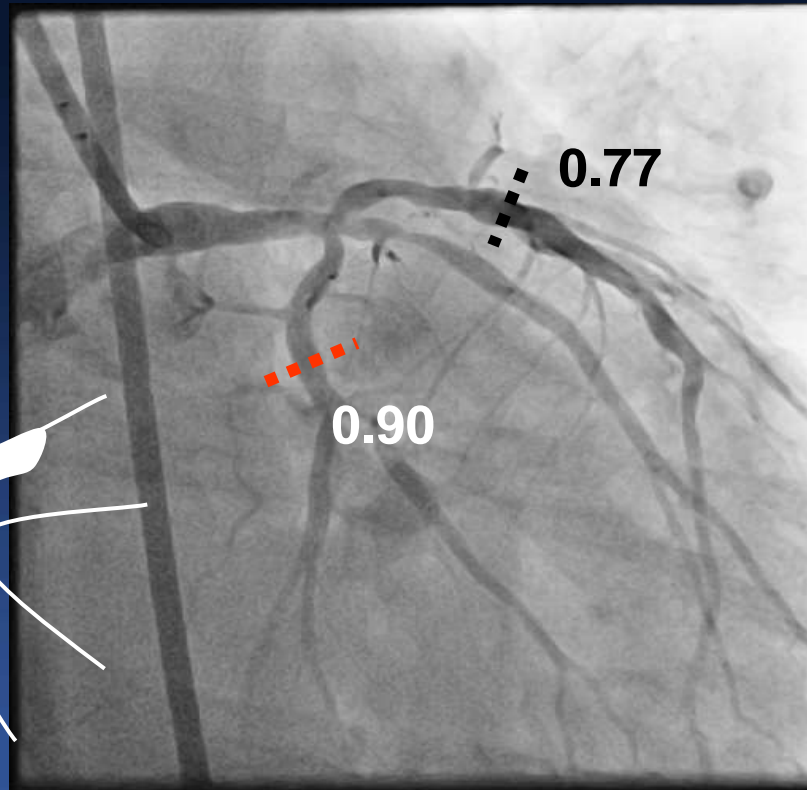
LAD Os  
MLA 3.2 mm<sup>2</sup>

LM Distal  
MLA 5.3 mm<sup>2</sup>



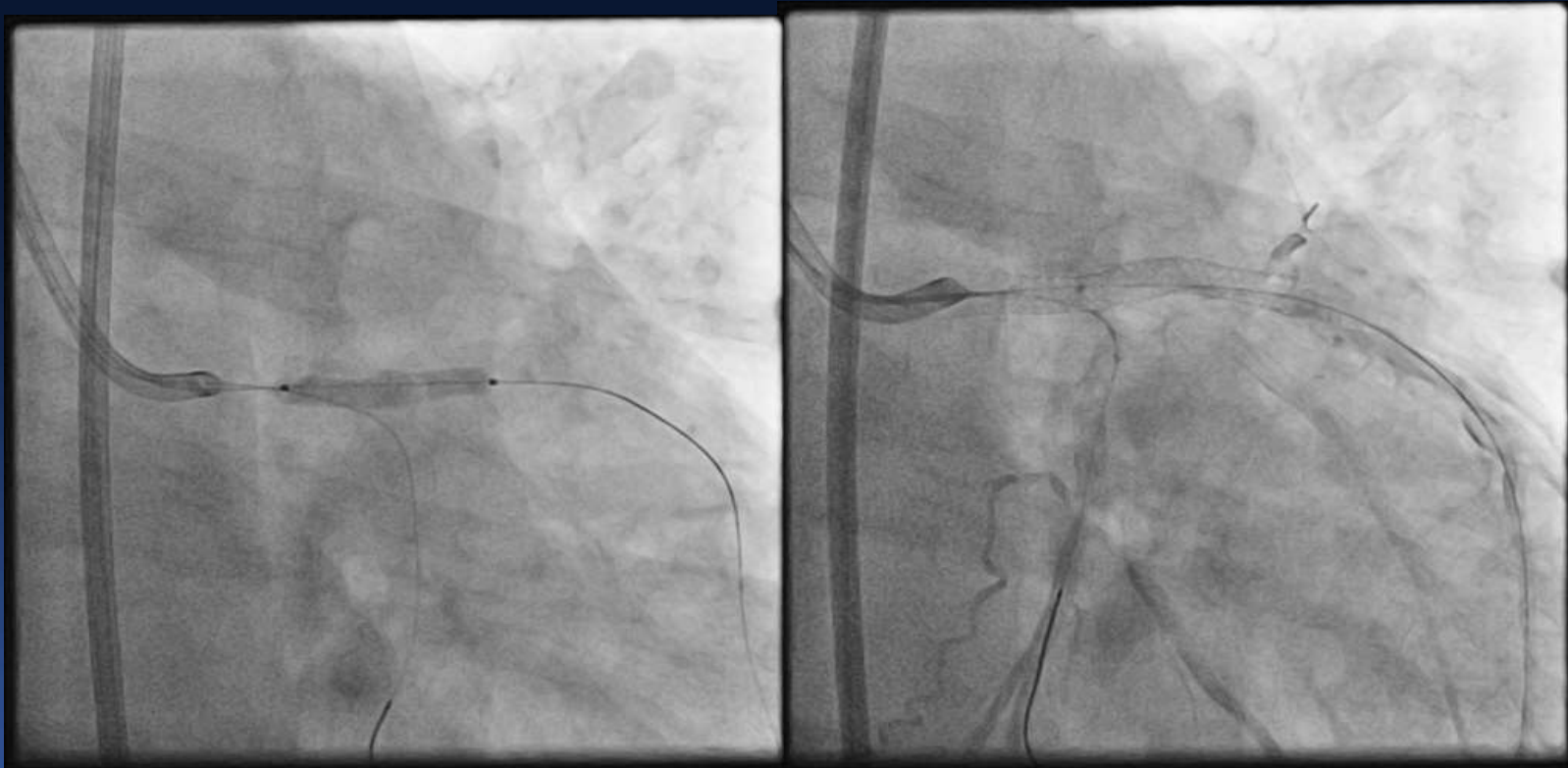
# *How To Treat ?*

## **1 or 2 Stent ?**



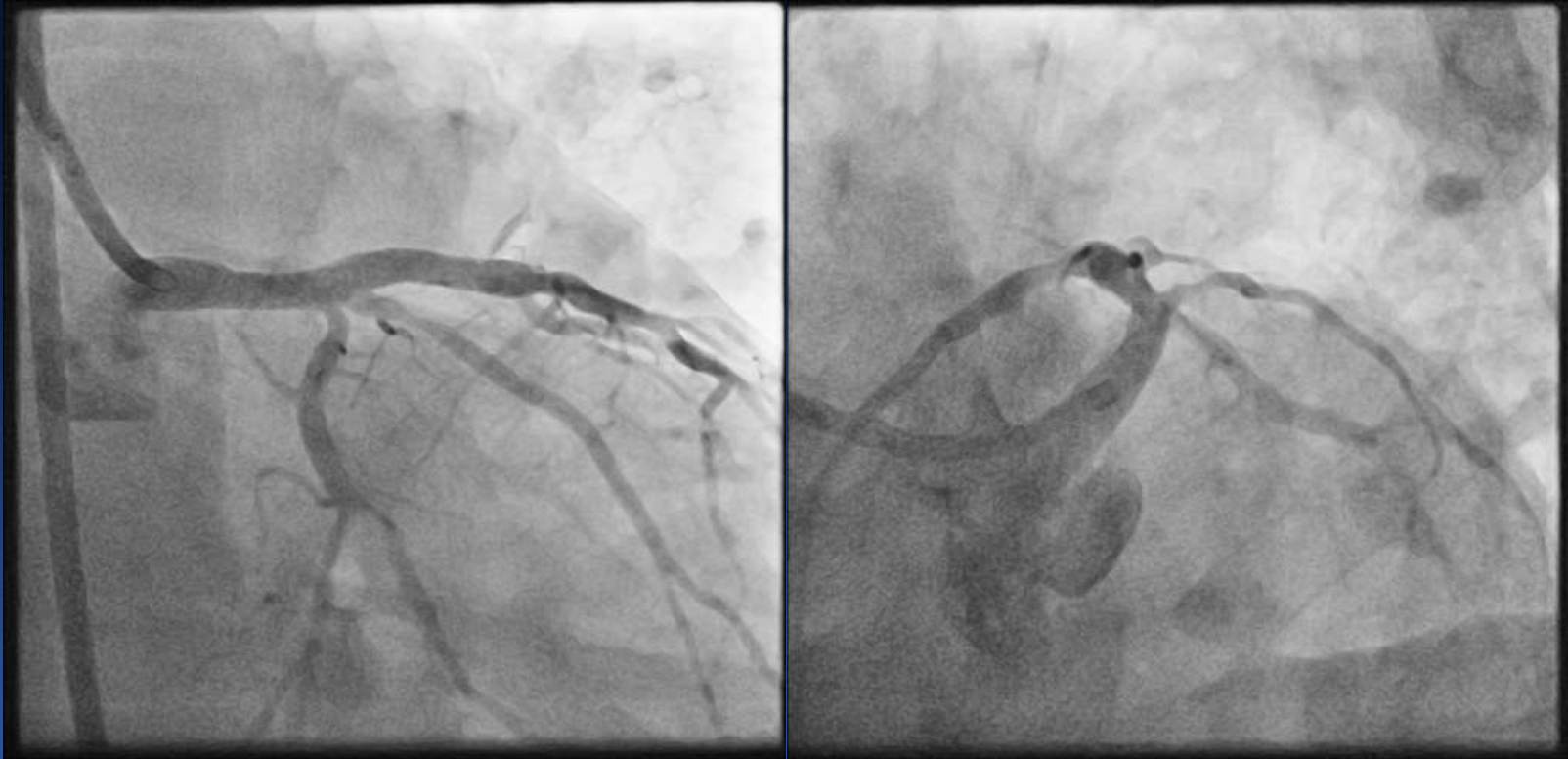


# Single Stent Crossover



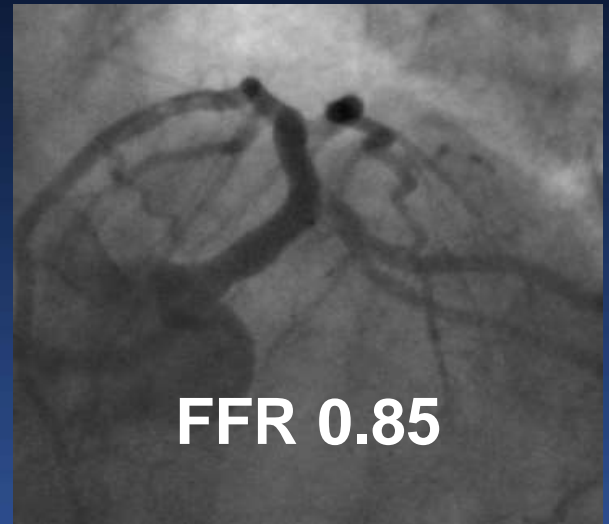
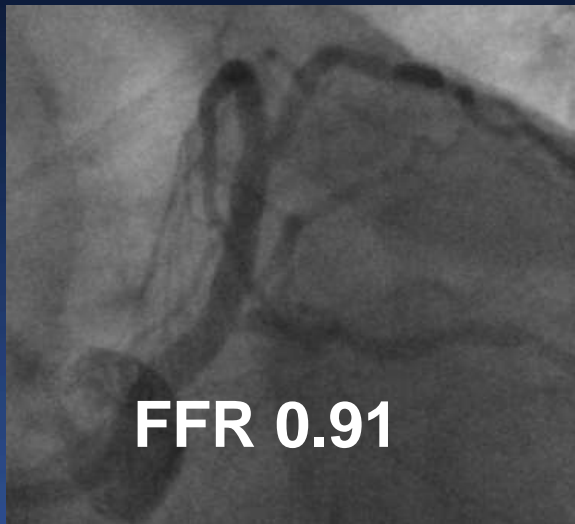
XIENCE Alpine  
4.0mm x 30mm

# Final Angiogram



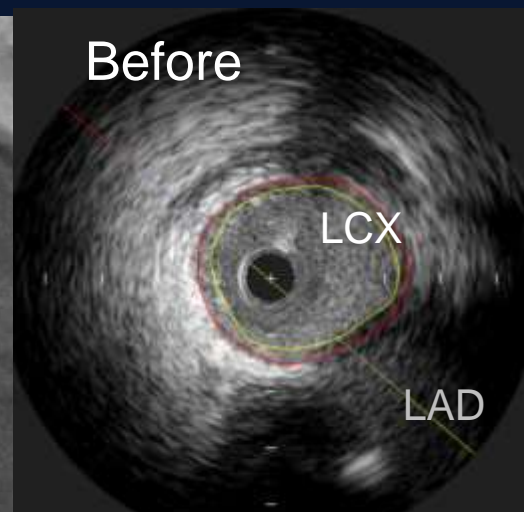
# ***Any Jailing Morphology Cannot Predict Functional Significance of Jailed LCX***

## Jailing LCX After Stent Cross-Over



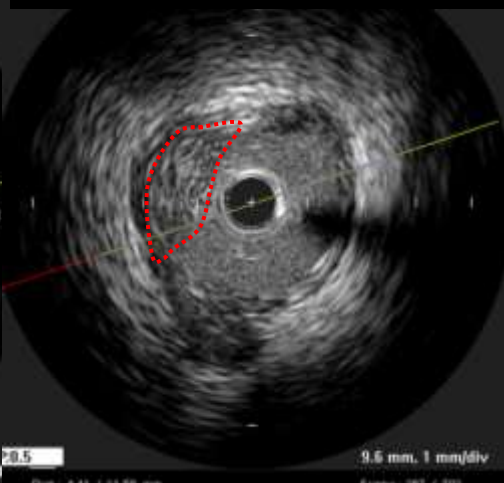
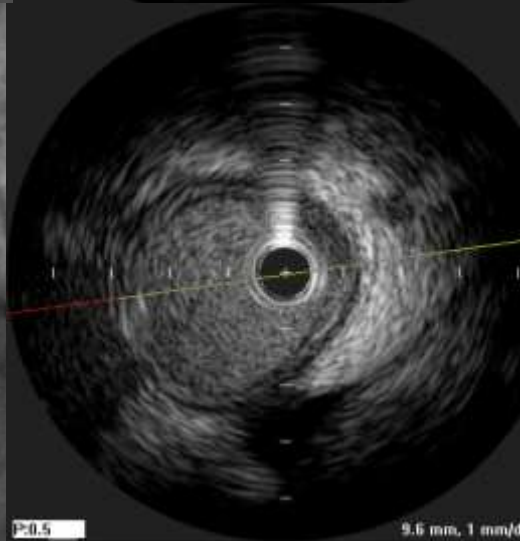
# Mechanism of LCX Jailing After Stent Cross-Over

Mainly,  
Carina Shift



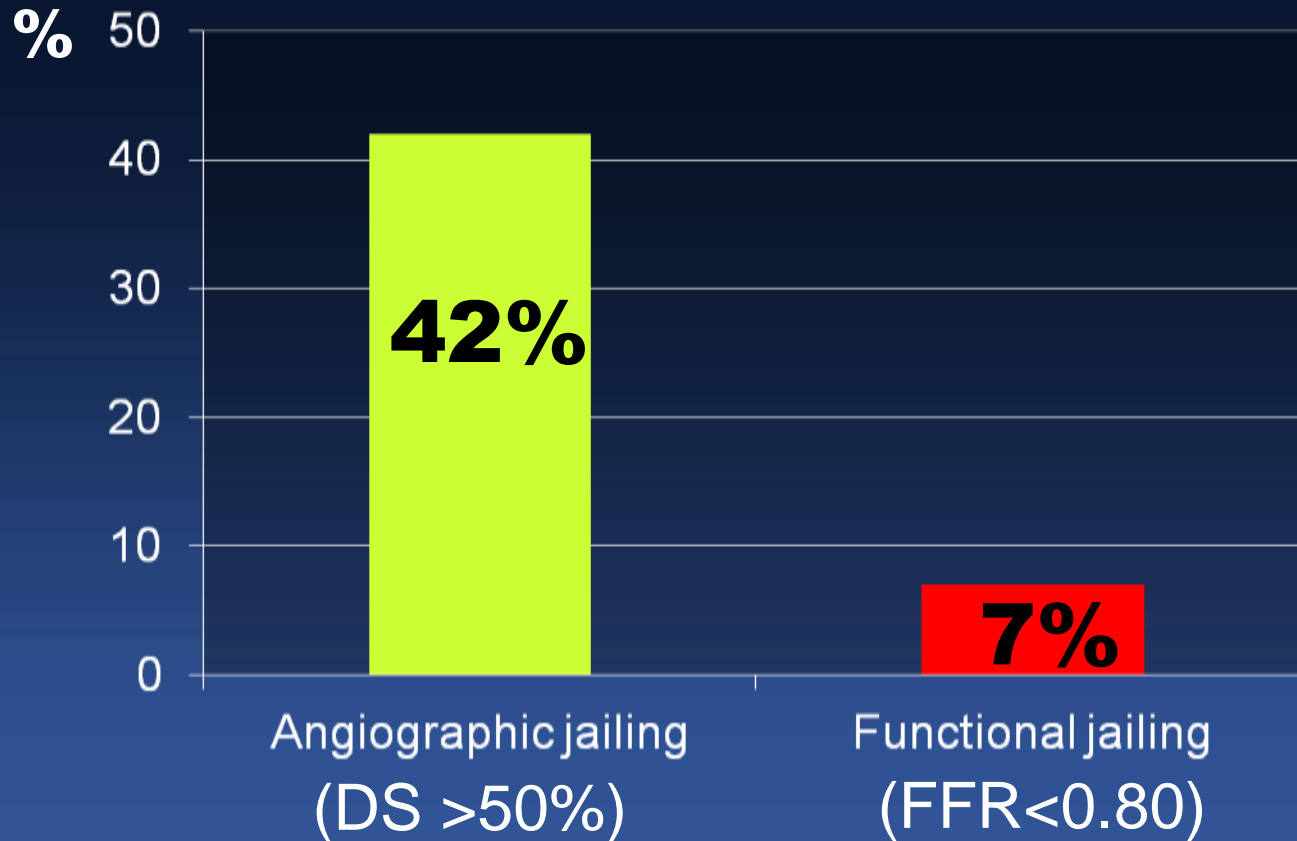
Compressive Vessel Deformation

Plaque  
Redistribution



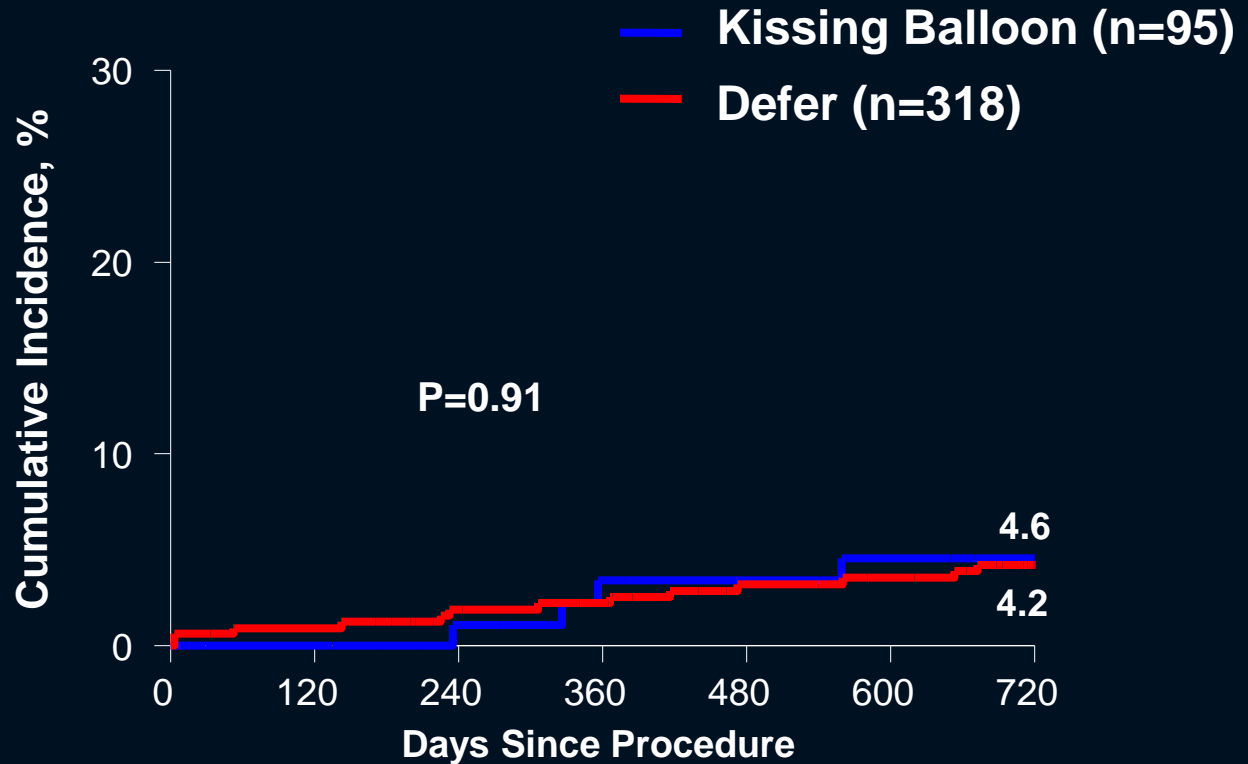


# *Functionally Significant LCX Jailing* After Stent Crossover for LM Bifurcation



# Death or MI at 2 Years

## Jailing LCX Defer Is Safe and Good !



### No. at Risk

FKB	95	85	80
No-FKB	318	300	278

# *1 or 2 Stents ?*

# 2 Stent Techniques

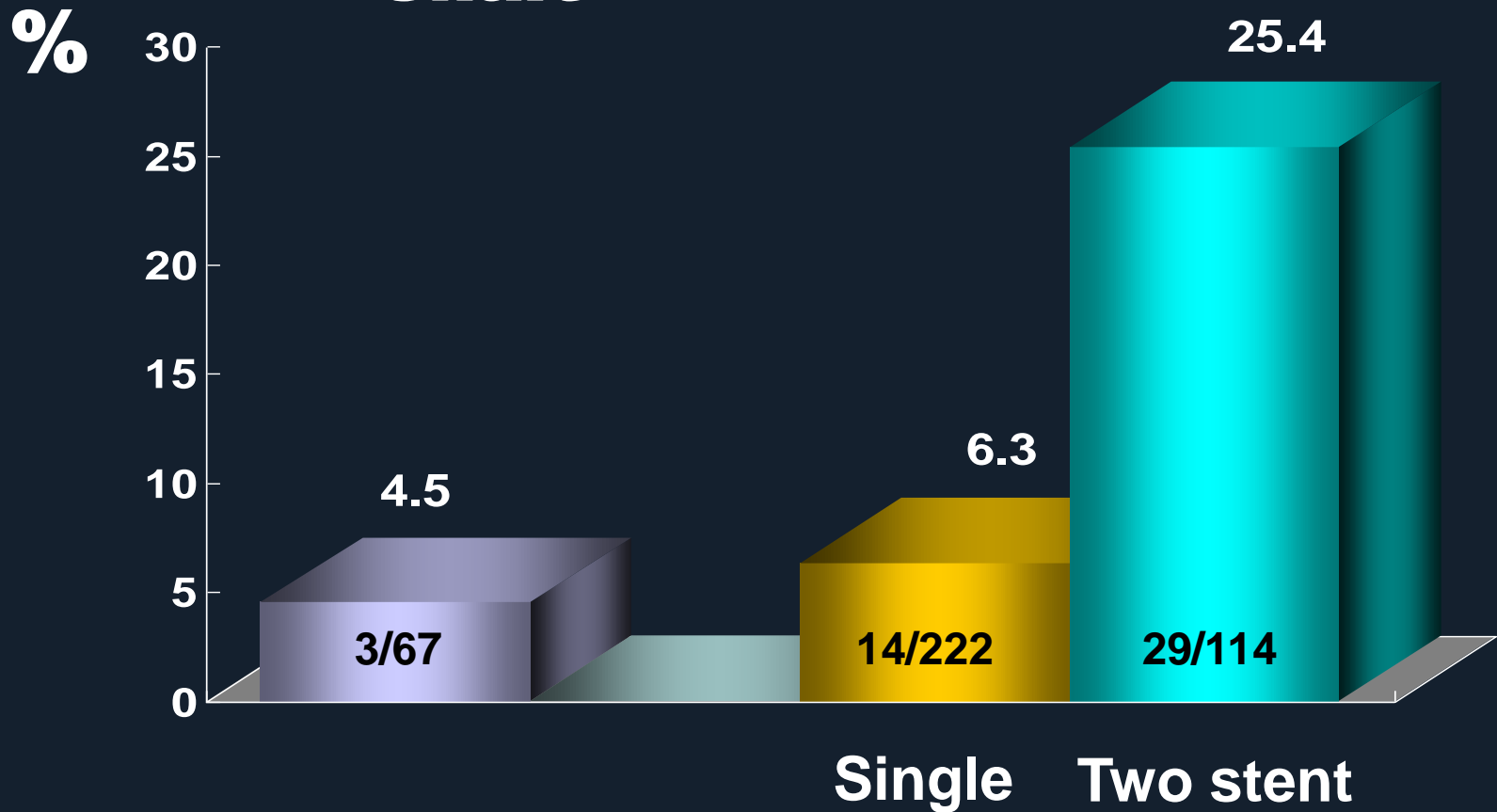
- T-stent, modified T-stent or TAP
- Mini-crush (or step crush)
- Culotte
- V-stent
- Y-stent (SKS-simultaneous kissing stents)

# Restenosis at 2 year

LM PCI Using SES (n=423)

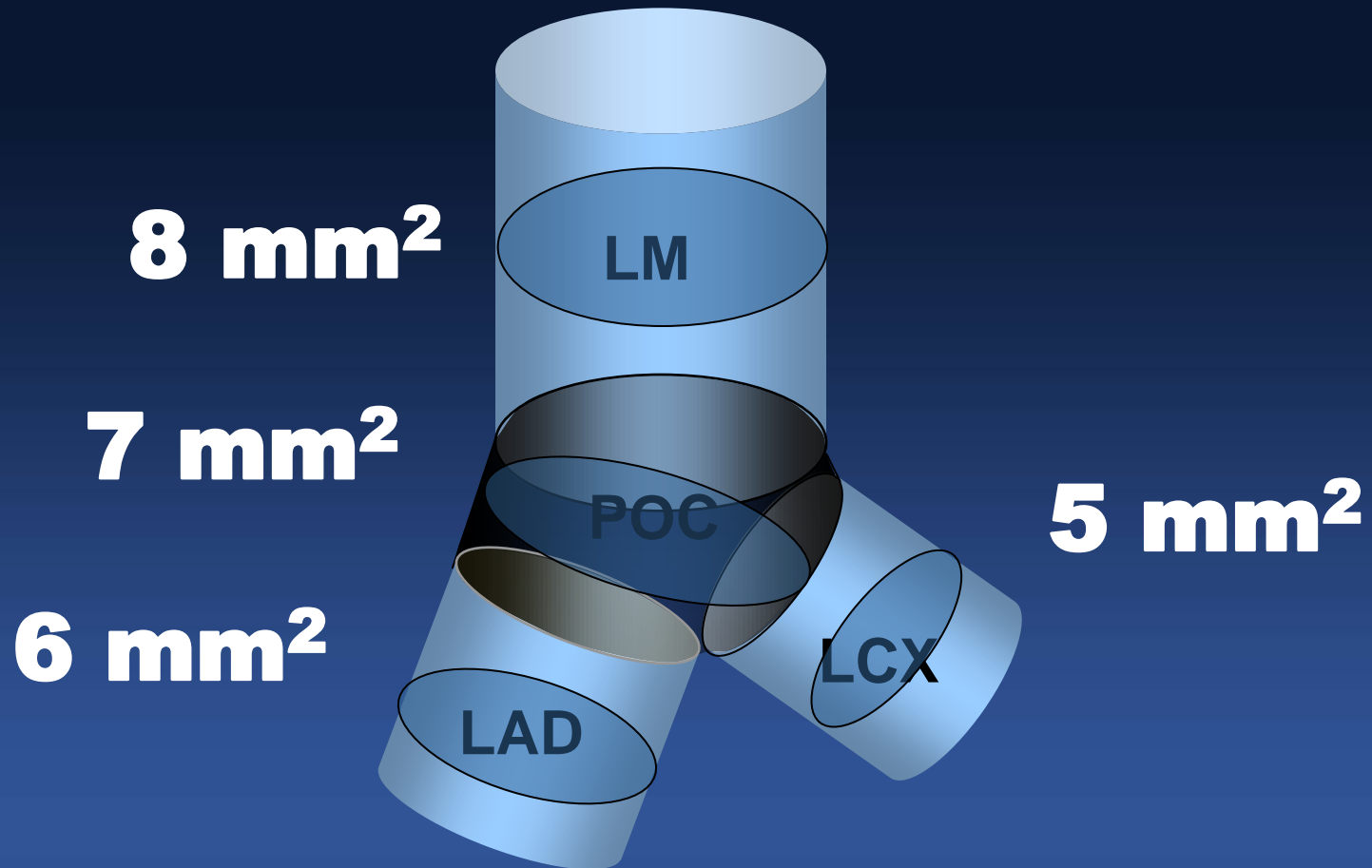
**Ostial and Shaft**

**Bifurcation PCI**



# Effective Stent Area (Rule of 5,6,7,8 mm<sup>2</sup>)

*Restenosis Rate < 5% and TLR < 2%*



# ***LM Bifurcation PCI***

## ***How To Do ?***

- Both strategy (1 or any 2 stent techniques) would be OK in the era of 2<sup>nd</sup> DES. Side branch treatment with FFR guided or FFR trained concept can make a good clinical outcomes.
- *Whatever you used 2 stent technique, IVUS optimization (effective stent area, 5.6.7.8 mm<sup>2</sup>) can make a good clinical outcomes.*

# What Really Matters in Bifurcation PCI ?

***It's a Matter of Concept  
rather than Technique !***