

Bifurcation PCI ; *Does It Matter Technique or Concept ?*

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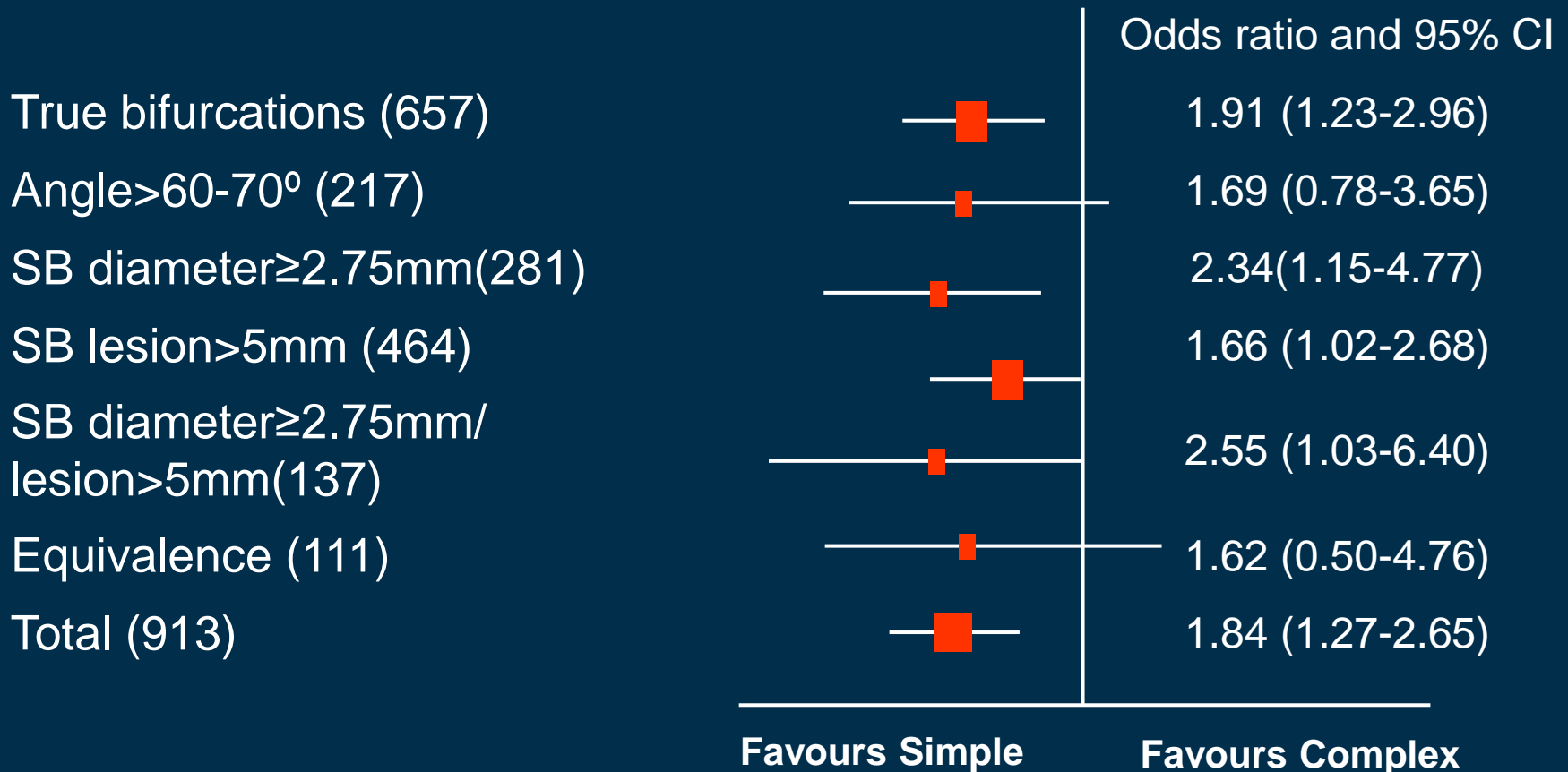
Non-LM Bifurcation PCI

How To Do ?

1. Provisional stenting of the side branch
2. Planned two stent technique

BBC ONE NORDIC Meta-analysis

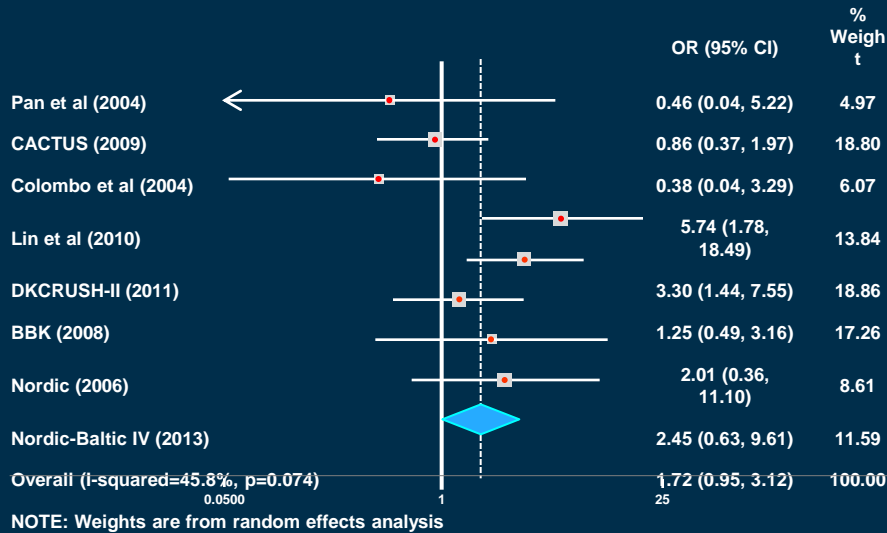
Provisional Stenting is Standard !



Recent Meta-Analysis

2 Stent Techniques Are Also Good !

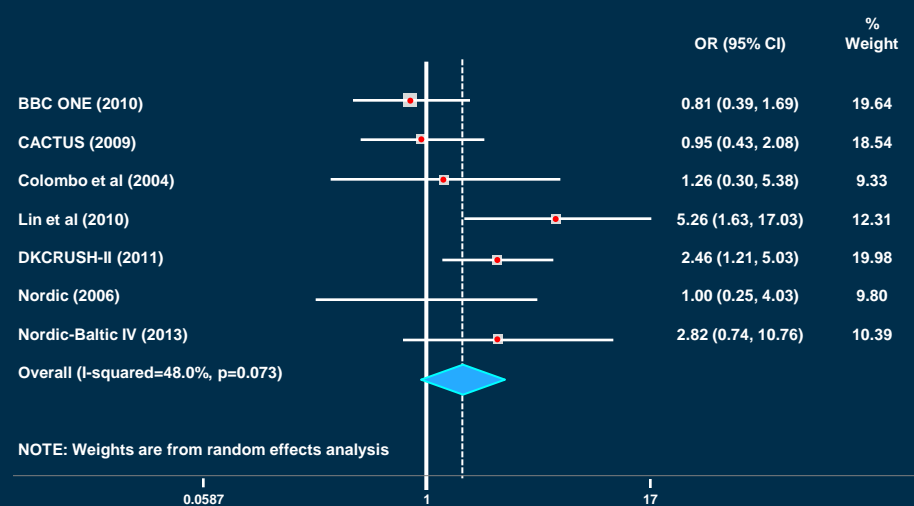
Target Lesion Revascularization



Favours
simple strategy

Favours
complex strategy

Target Vessel Revascularization



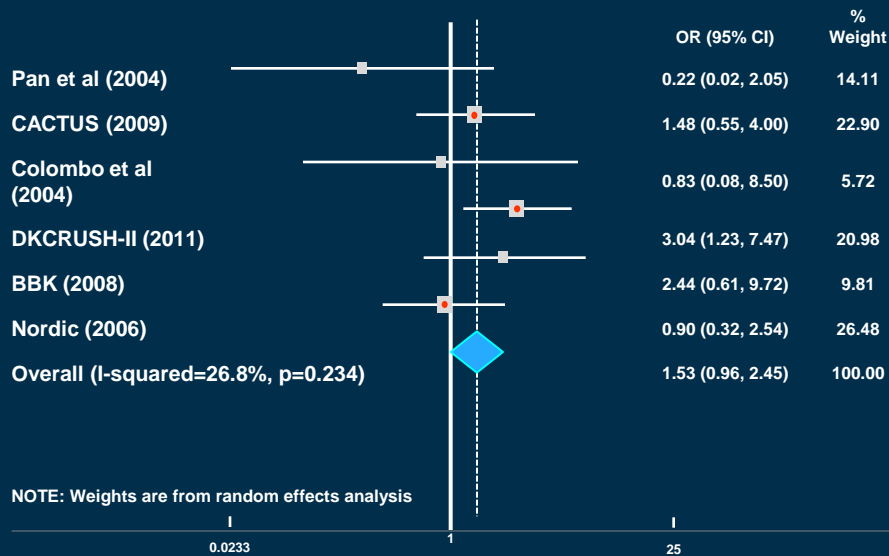
Favours
simple strategy

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complex strategy

Recent Meta-Analysis

2 Stent Techniques Are Also Good !

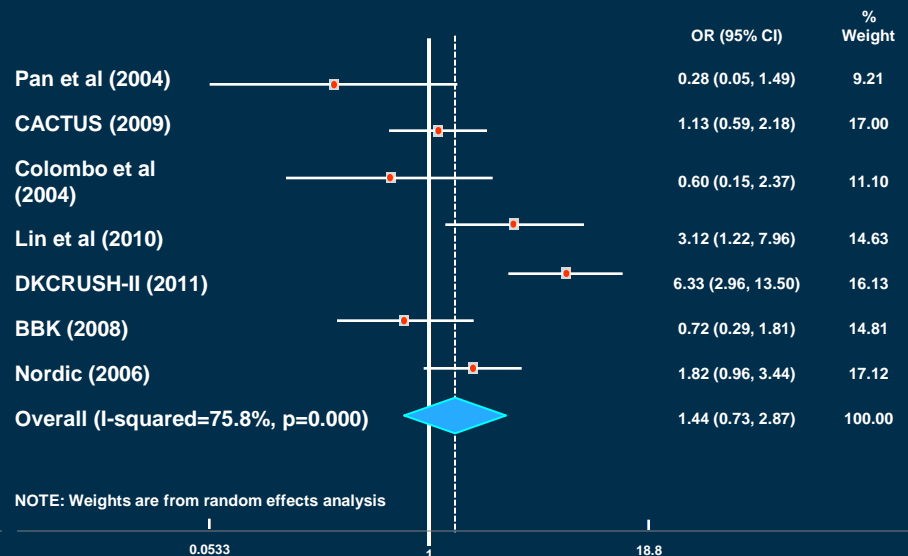
Main Vessel Restenosis



Favours simple strategy

Favours complex strategy

Side Branch Restenosis

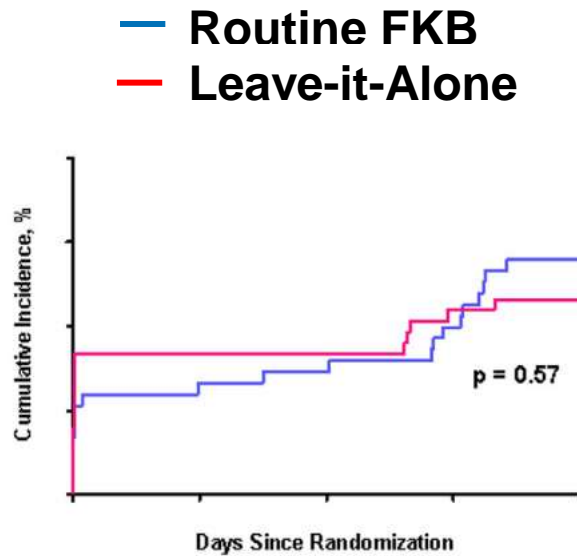


Favours simple strategy

Favours complex strategy

Recent Randomized Study

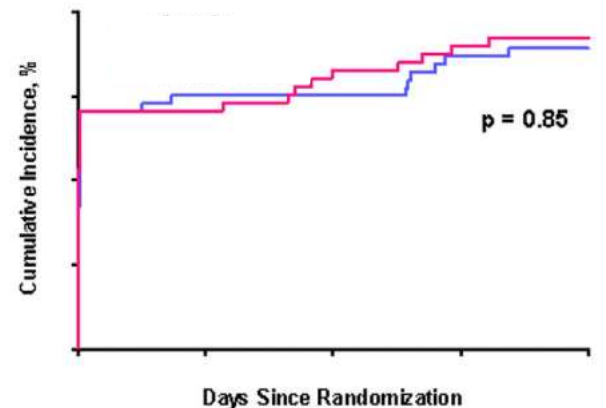
1 or 2 Stent Technique Are Both Good !



No. at risk
Routine-
FKB

151	141	140	136	129
155	149	149	139	137

No. at risk
Crush
technique
Single-
stent



213	182	182	177	175
206	177	172	169	167

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 ?

1. Provisional stenting of the side branch
2. Planned two stent technique

Both Methods Are Good !

2 Stent Technique

When ?

**Provisional
Stenting
(>70%)**

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

***2 Stent
Technique***

***Big (≥ 2.5 mm),
Diffusely Diseased Side Branch
(Medina 1.1.1., 1.0.1)***

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

Randomized Study for Complex Bifurcation Lesion Dedicated Stent vs. Culotte ; *COBRA trial (n=40)*

Table 4. Quantitative coronary angiography at 9-month follow-up.

		After PCI			At 9-month follow-up			Late luminal loss		
		Axxess + BioMatrix (n=18)	Culotte XIENCE (n=18)	p-value	Axxess + BioMatrix (n=18)	Culotte XIENCE (n=18)	p-value	Axxess + BioMatrix (n=18)	Culotte XIENCE (n=18)	p-value
Reference vessel diameter (mm)										
PMV		3.50±0.46	3.29±0.49	0.16	3.43±0.44	3.04±0.47	0.01	NA	NA	NA
DMV		2.60±0.40	2.36±0.40	0.06	2.47±0.44	2.27±0.48	0.17	NA	NA	NA
SB		2.25±0.35	2.16±0.35	0.26	2.06±0.34	1.97±0.27	0.39	NA	NA	NA
Minimal lumen diameter (mm)										
Proximal main vessel	Edge	3.10±0.58	2.74±0.49	0.06	2.93±0.68	2.39±0.67	0.04	0.18±0.35	0.35±0.54	0.33
	Stent *	3.30±0.54	2.99±0.35	0.10	3.18±0.59	2.65±0.47	0.01	0.11±0.35	0.34±0.30	0.08
	Bif core	3.56±0.57	3.27±0.34	0.08	3.52±0.64	2.88±0.32	0.003	0.04±0.28	0.39±0.25	0.002
	Stent †	3.21±0.52	2.95±0.34	0.16	3.10±0.50	2.60±0.42	0.01	0.11±0.30	0.35±0.31	0.05
	Segment	3.01±0.52	2.67±0.43	0.04	2.82±0.64	2.33±0.63	0.07	0.19±0.32	0.34±0.54	0.57
Distal main vessel	Ostium	2.48±0.48	2.55±0.37	0.90	2.36±0.39	2.17±0.44	0.07	0.12±0.34	0.39±0.27	0.02
	Stent	2.32±0.45	2.37±0.43	0.97	2.17±0.41	2.05±0.42	0.30	0.15±0.26	0.31±0.30	0.09
	Edge	2.25±0.46	1.97±0.52	0.03	2.10±0.42	1.81±0.51	0.02	0.15±0.29	0.15±0.25	0.94
	Segment	2.09±0.40	1.94±0.43	0.24	1.98±0.43	1.78±0.44	0.13	0.11±0.17	0.16±0.24	0.62
Side branch	Ostium	2.11±0.50	2.24±0.22	0.64	1.82±0.62	1.78±0.35	0.58	0.29±0.46	0.45±0.35	0.21
	Stent	2.03±0.36	2.12±0.23	0.60	1.75±0.54	1.6 ±0.34	0.24	0.29±0.43	0.46±0.31	0.10
	Edge	1.84±0.44	1.76±0.38	0.42	1.76±0.46	1.60±0.17	0.15	0.09±0.16	0.16±0.31	0.45
	Segment	1.77±0.42	1.75±0.35	0.73	1.60±0.53	1.52±0.23	0.27	0.17±0.31	0.23±0.34	0.51

Values are mean±SD. * refers to the stent segment not including the bifurcation core. † refers to the stent segment including the bifurcation core. Bif: bifurcation

Randomized Study for Complex Bifurcation Lesion Dedicated Stent vs. Culotte ; *COBRA trial (n=40)*

No Different Outcomes !

Table 6. Clinical outcomes up to one year after treatment.

	30-day outcome n (%)			8-month outcome n (%)			1-year outcome n (%)		
	Axxess+ BioMatrix n=20	Culotte XIENCE n=20	p-value	Axxess+ BioMatrix n=20	Culotte XIENCE n=20	p-value	Axxess+ BioMatrix n=20	Culotte XIENCE n=20	p-value
All-cause death	0	0	–	1 (5)	0	0.32	1 (5)	0	0.32
Cardiac death	0	0	–	0	0	–	0	0	–
Non-cardiac death	0	0	–	1 (5)	0	0.32	1 (5)	0	0.32
Myocardial infarction (Tn)	9 (45)	9 (45)	1.00	9 (45)	10 (50)	0.76	9 (45)	10 (50)	0.76
Myocardial infarction (CK-MB)	2 (10)	0	0.49	2 (10)	1 (5)	0.54	2 (10)	1 (5)	0.54
TLR	0	0	–	0	0	–	0	1 (5)	0.32
TVR	0	0	–	0	0	–	1 (5)	1 (5)	0.99
Non-TVR	0	0	–	0	0	–	1 (5)	2 (10)	0.55
Stent thrombosis	0	0	–	0	0	–	0	0	–
MACE	2 (10)	0	0.49	2 (10)	1 (5)	0.97	2 (10)	2 (10)	0.97

Values are n (%). MACE: major adverse cardiac events; TLR: target lesion revascularisation; TVR: target vessel revascularisation

2 Stent Techniques

Any Different Outcomes ?

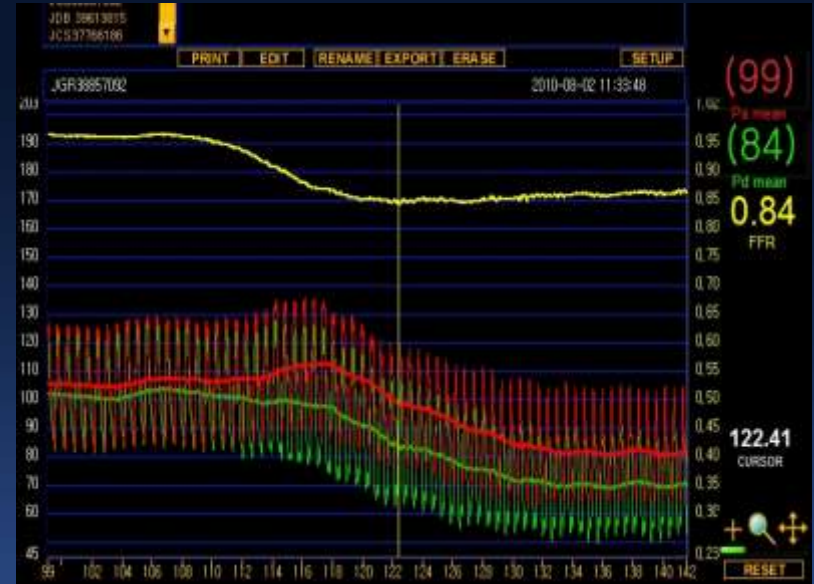
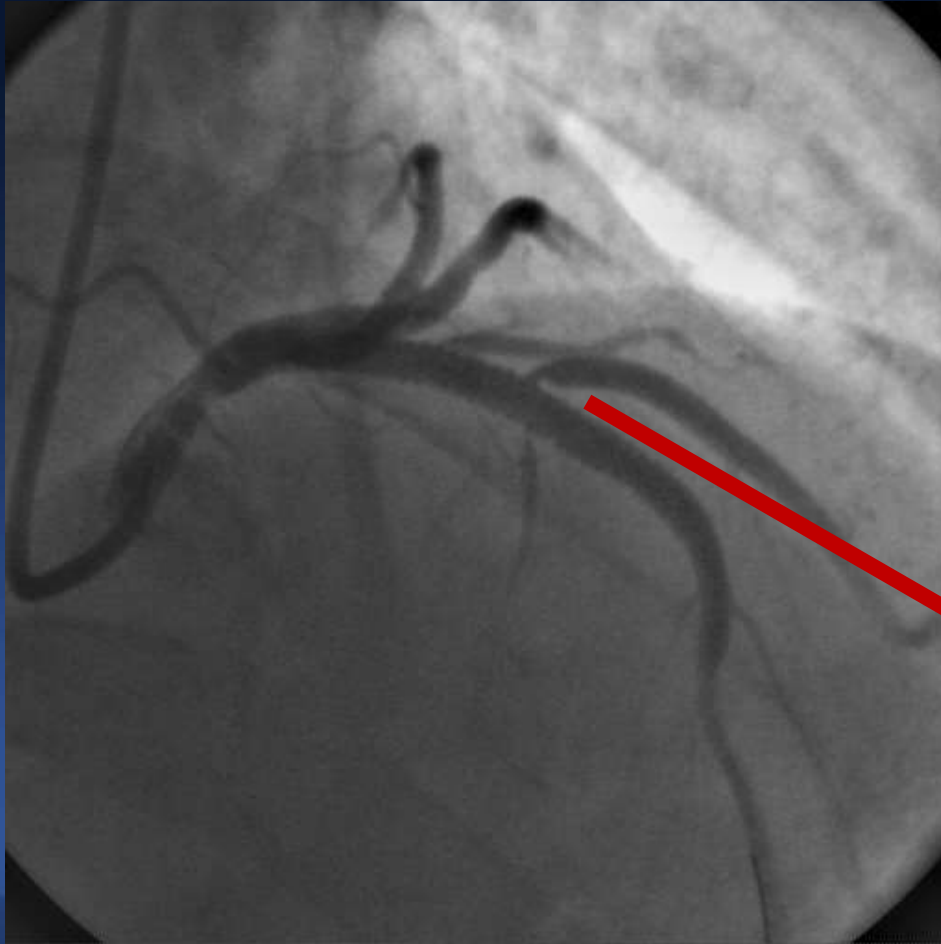
- Different Indications, But
- Very Limited Data,
- Maybe, Small Difference in Soft End Point (Late Loss, TLR, Branch Restenosis).

Why They *Can Not Make An Any Difference ?*

Side Branch Treatment is Not a Big Deal
for Impact of Clinical Outcome.

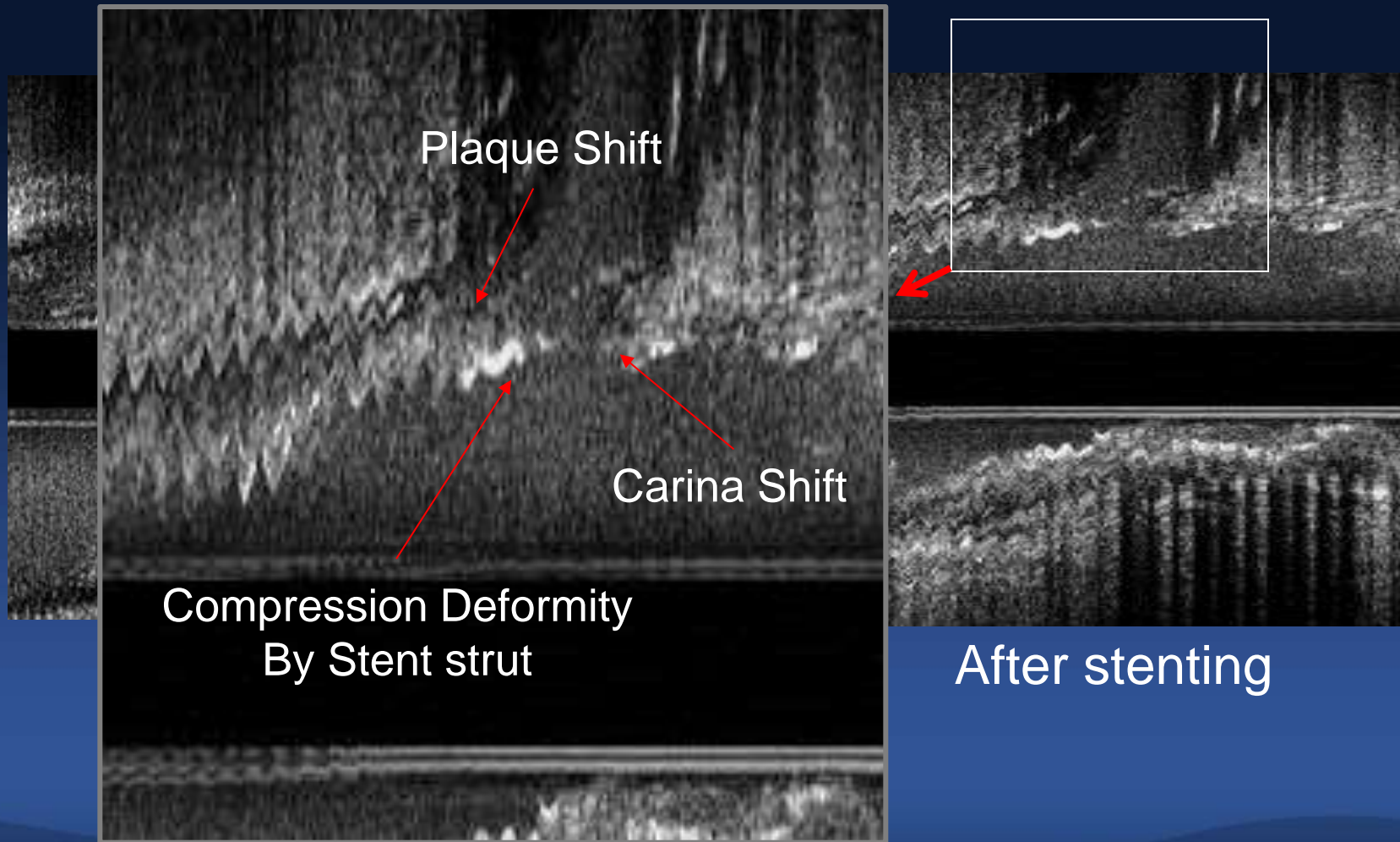
*The Reasons Why Jeopardy Myocardium of
Side Branch is Usually Small, Which Can Not
Make Hard Endpoint Difference (Death and MI).*

Jailing Side Branch After Main Vessel Stenting



FFR 0.84

Mechanism of Jailing Side Branch Morphology

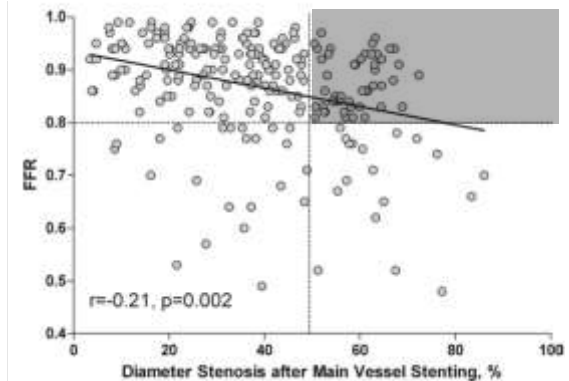
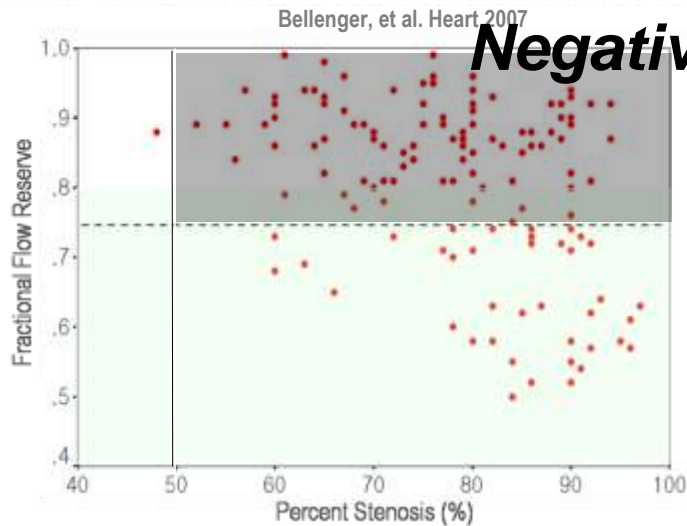
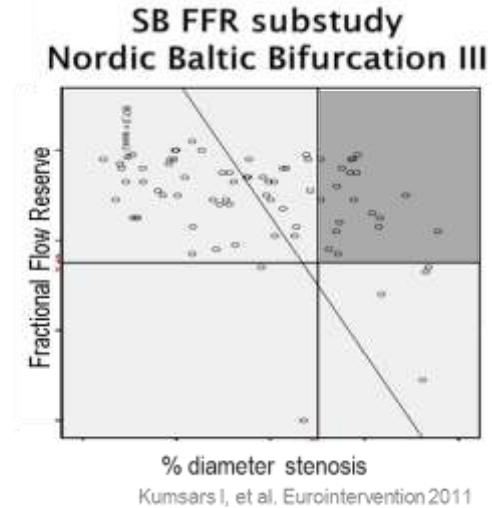
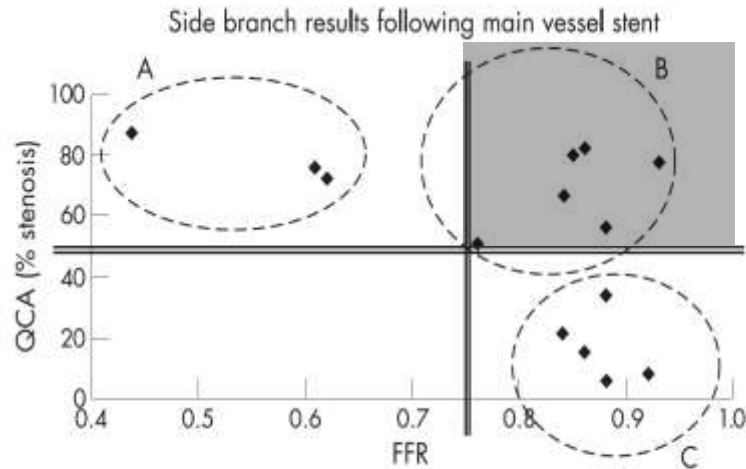


Compression Deformity
By Stent strut

After stenting

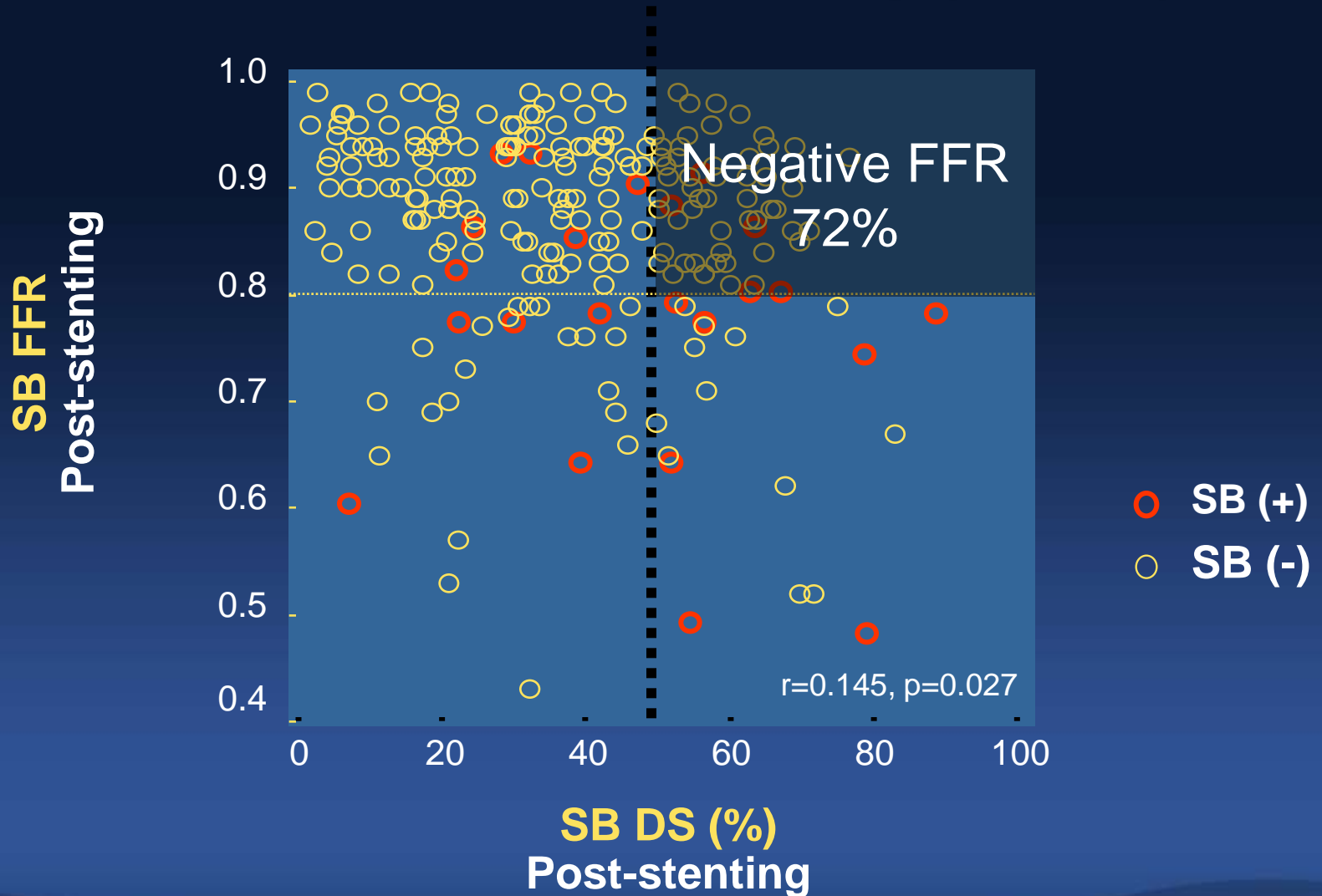
Jailing Side Branch

FFR Is Usually Normal (>0.80) !

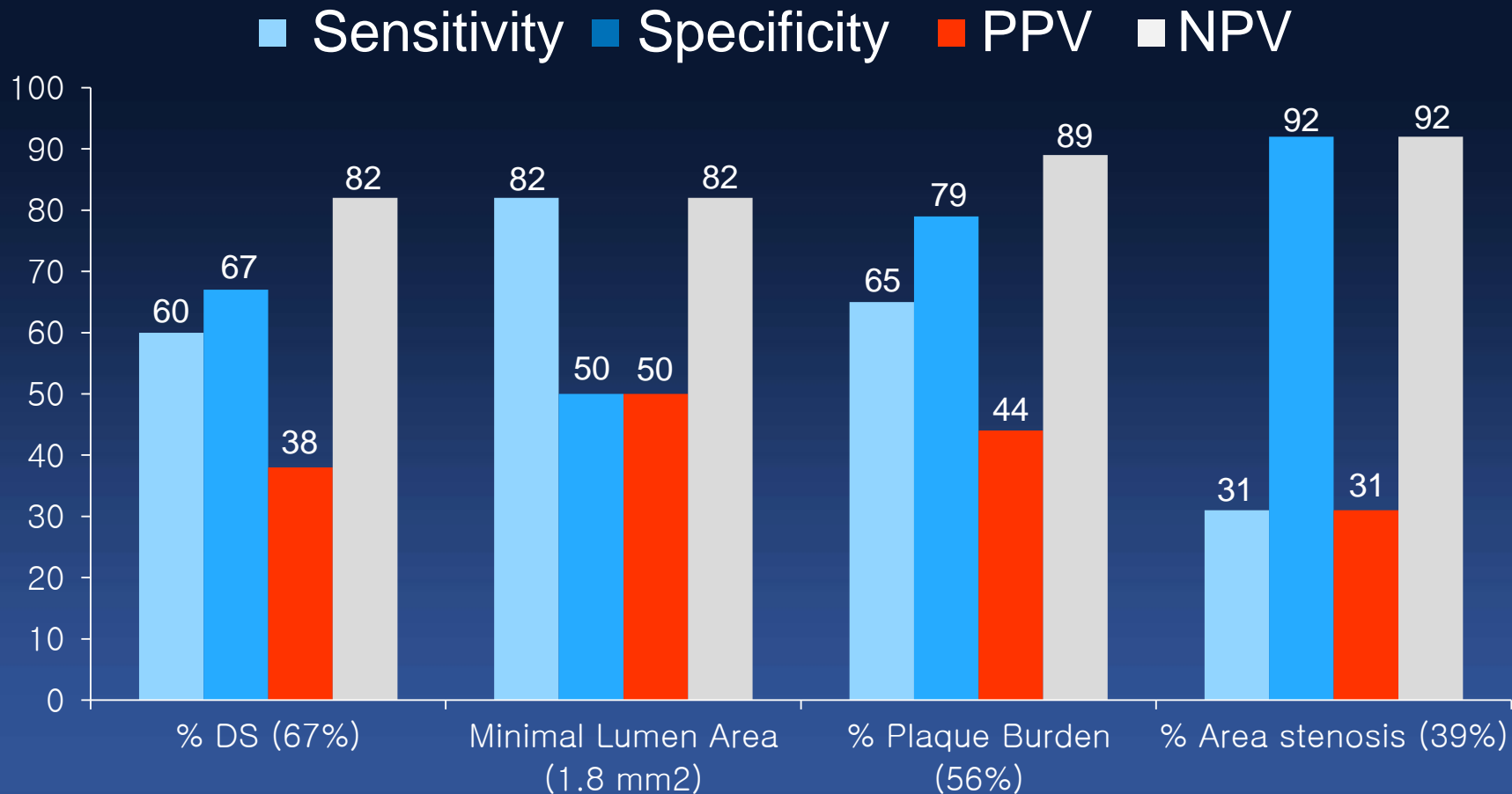


Side Branch FFR

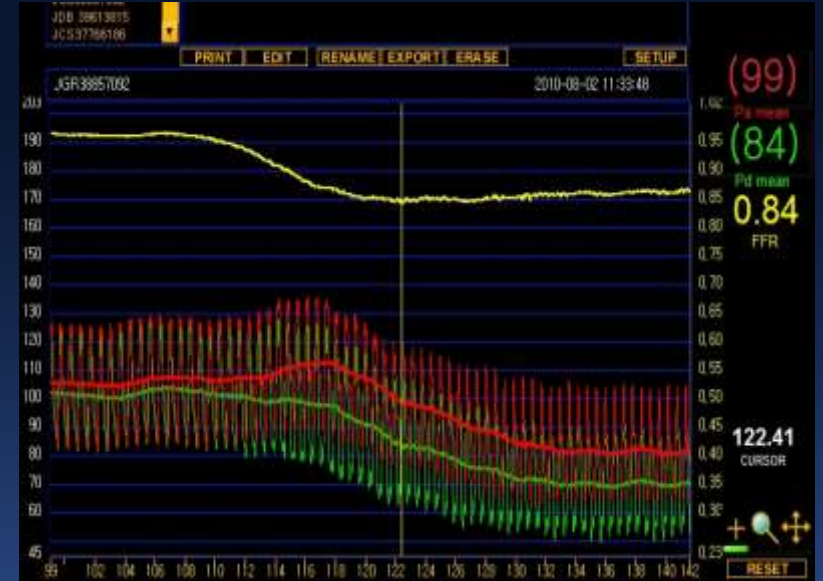
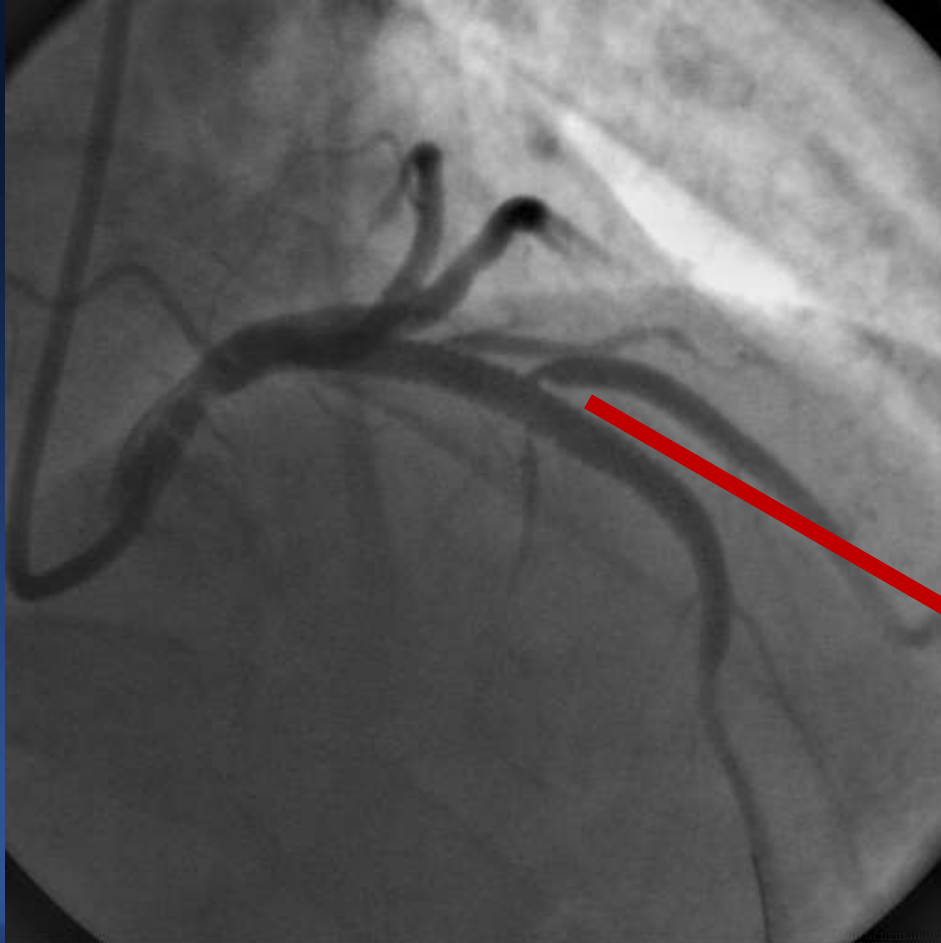
After Main Vessel Stenting (n=232)



Diagnostic Accuracy of %DS *Matched with FFR*



Jailing Side Branch After Main Vessel Stenting



FFR 0.84

To Treat,

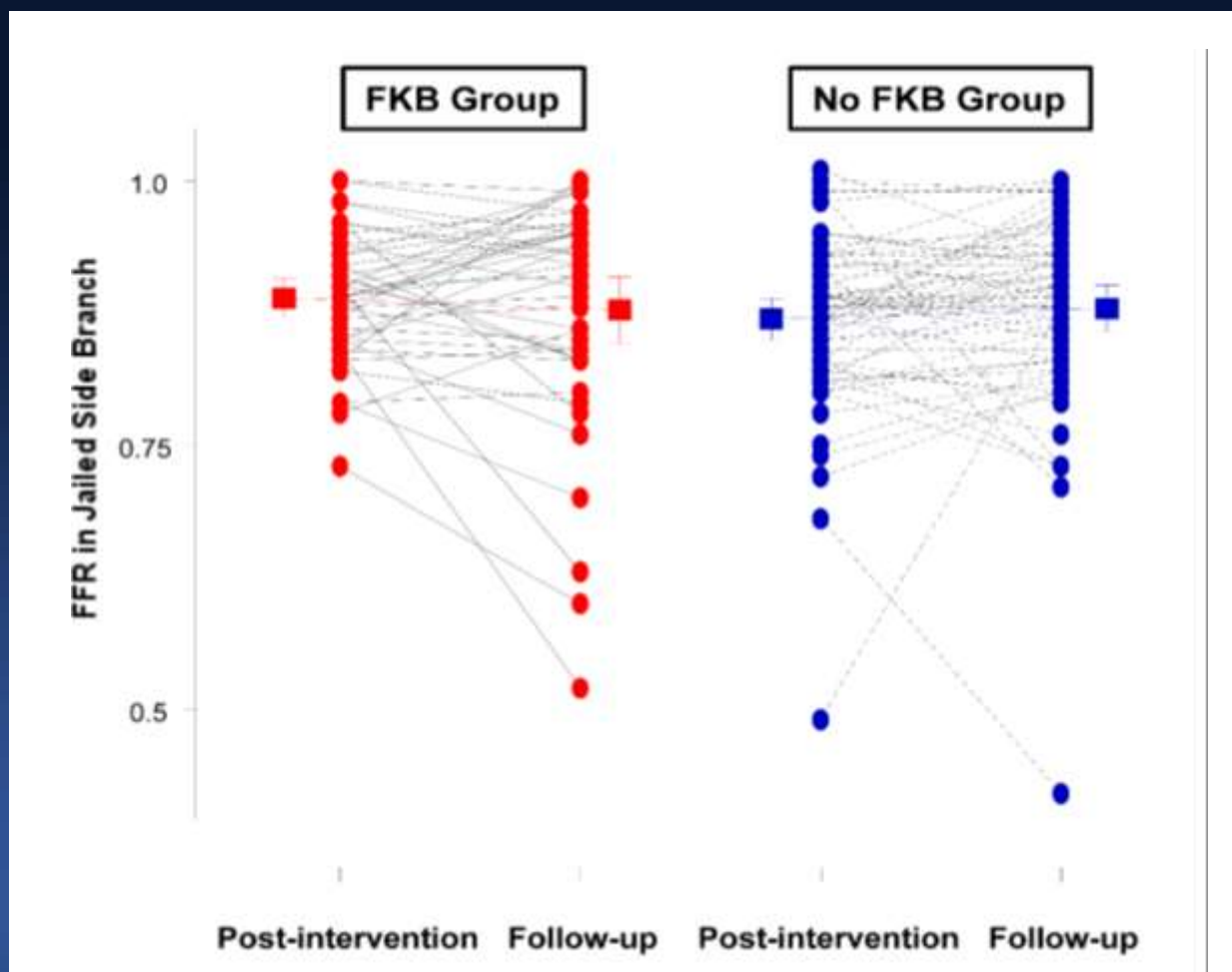
1. FFR Non-believer,
Still Visually Tight Stenosis ?
2. Big Vessel, Large Jeopardy Myocardium ?
But, No Ischemia.
3. Subjective Symptoms ?
Negative FFR is Usually Asymptomatic.

Not to Treat,

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

Serial Side Branch FFR

Kissing Balloon Inflation Can Not Make An Any Difference!



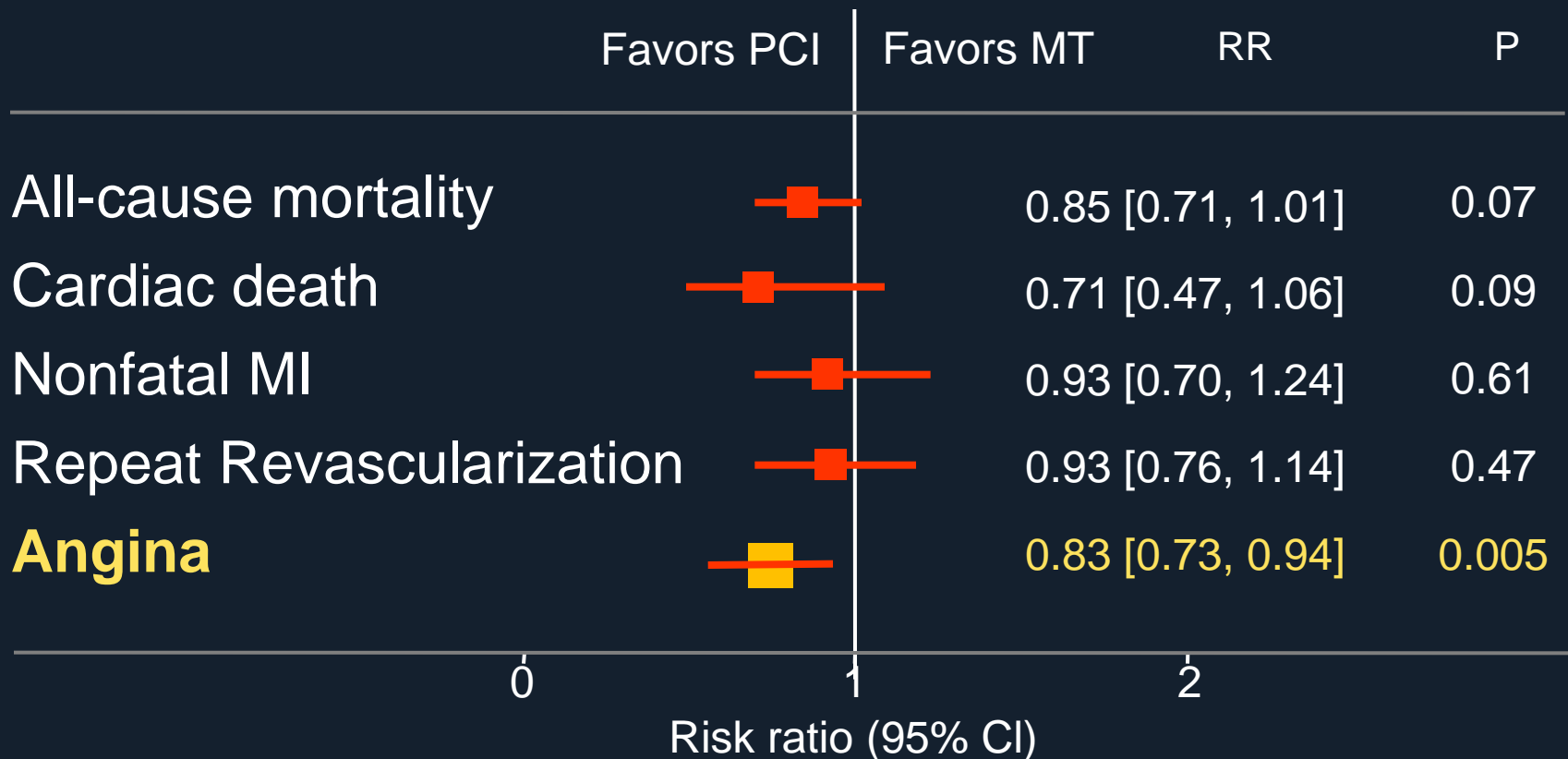
SNUH registry and Nordic-Baltic bifurcation study
Lee JM, Koo BK, et al. Eurointervention 2015

What Really Matters in Jailing Side Branch ?

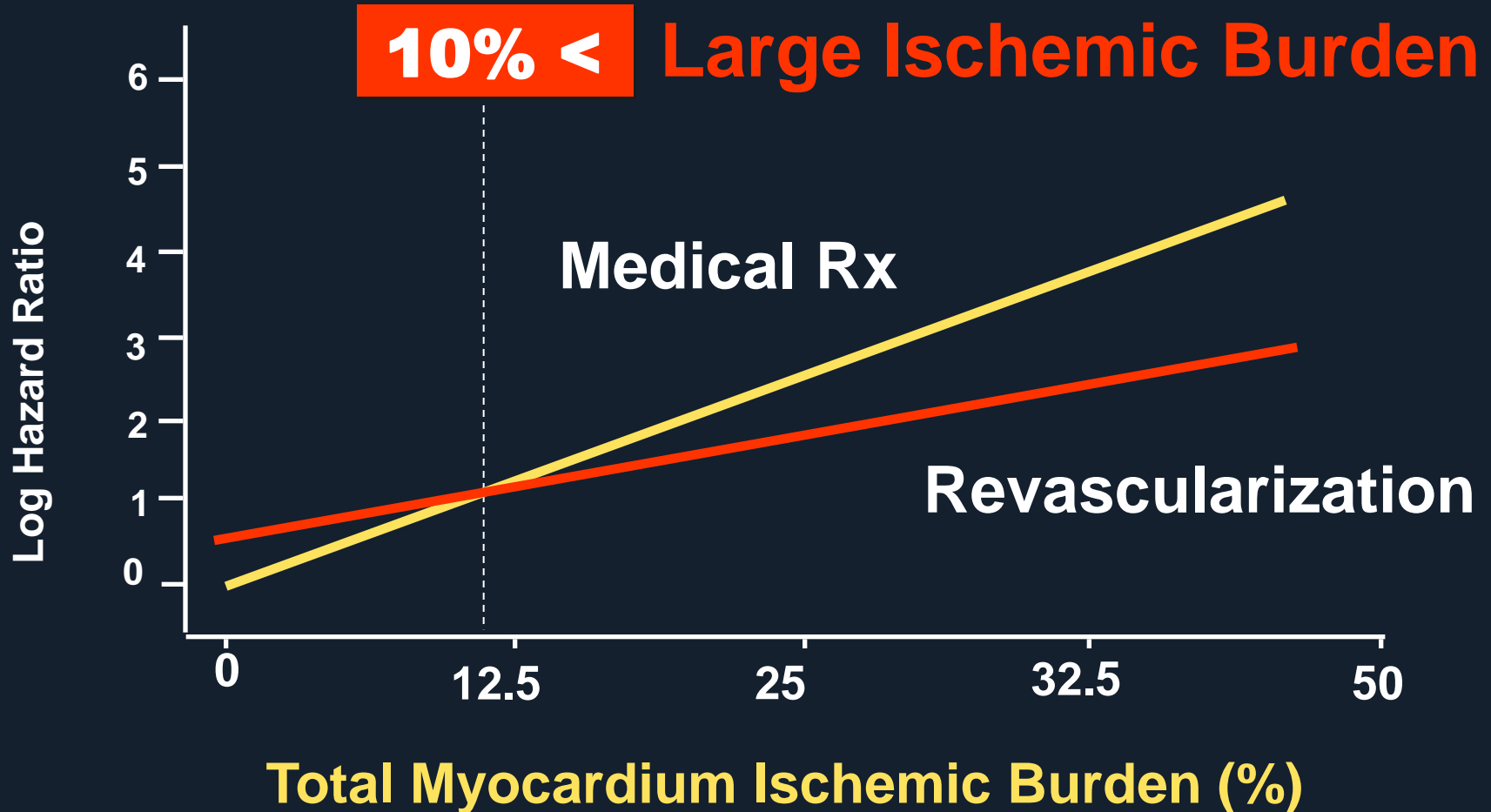
- *Small Myocardium*
- *Mainly Non-ischemic (>70%)*
- *Asymptomatic*
- *Medical Treatment Is Usually Good Enough !*

No Survival Benefit of PCI Over Medication

Meta-Analysis of 12 RCTs, 7182 participants

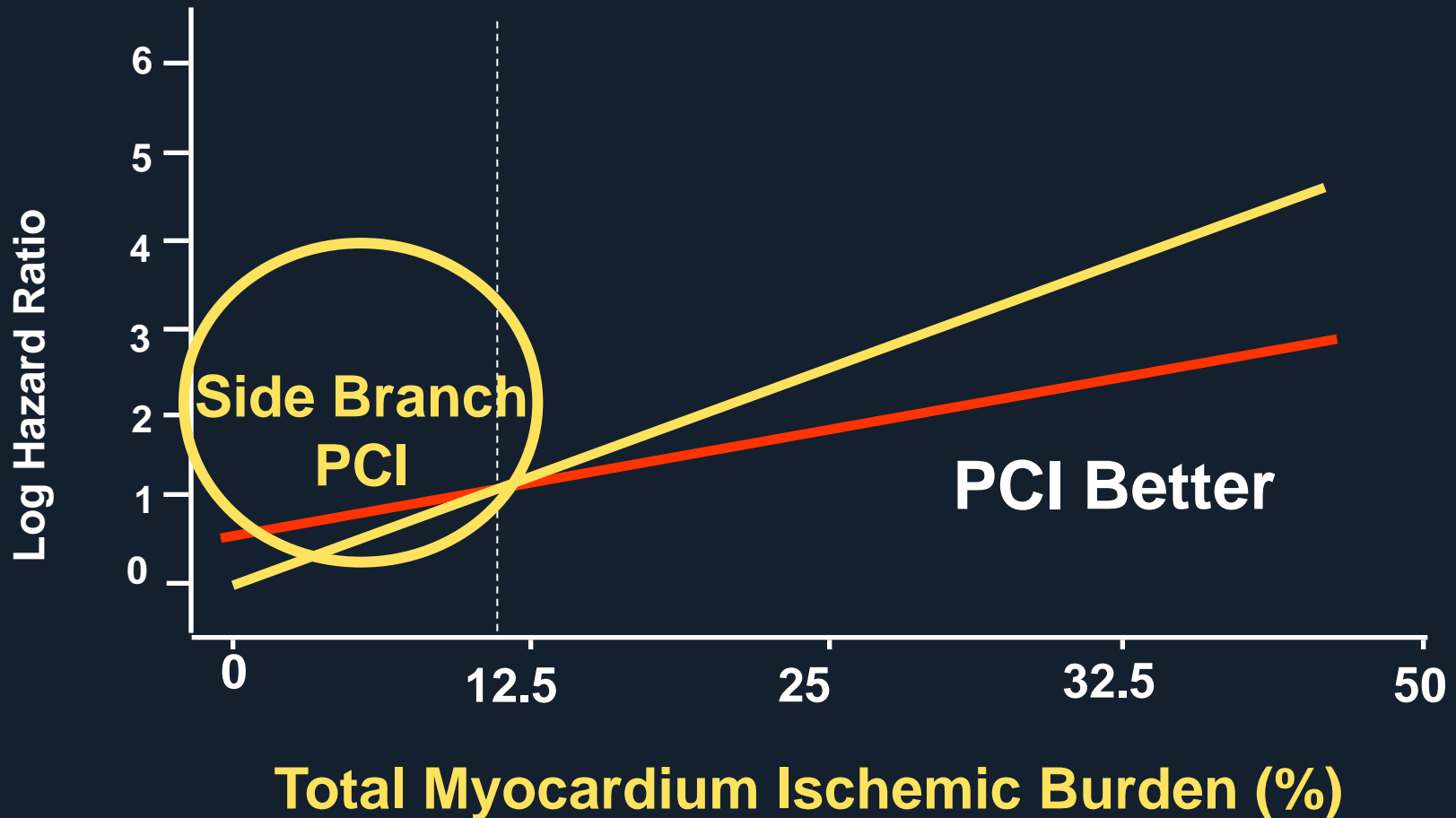


Survival Benefit of Revascularization



No Survival Benefit

Side Branch PCI for Small Myocardium



PCI Classification

Non-Viable,
Asymptomatic,
Small
Ischemic Myocardium,
FFR >0.80

*For Angina
Relieve*

Large Ischemic
Burden, LM and
3 VD

***Cosmetic
Angioplasty***

Inappropriate

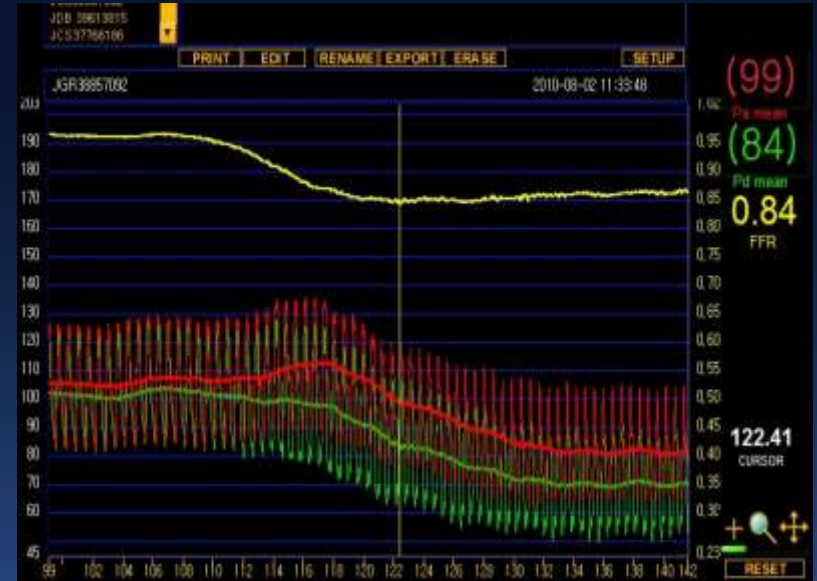
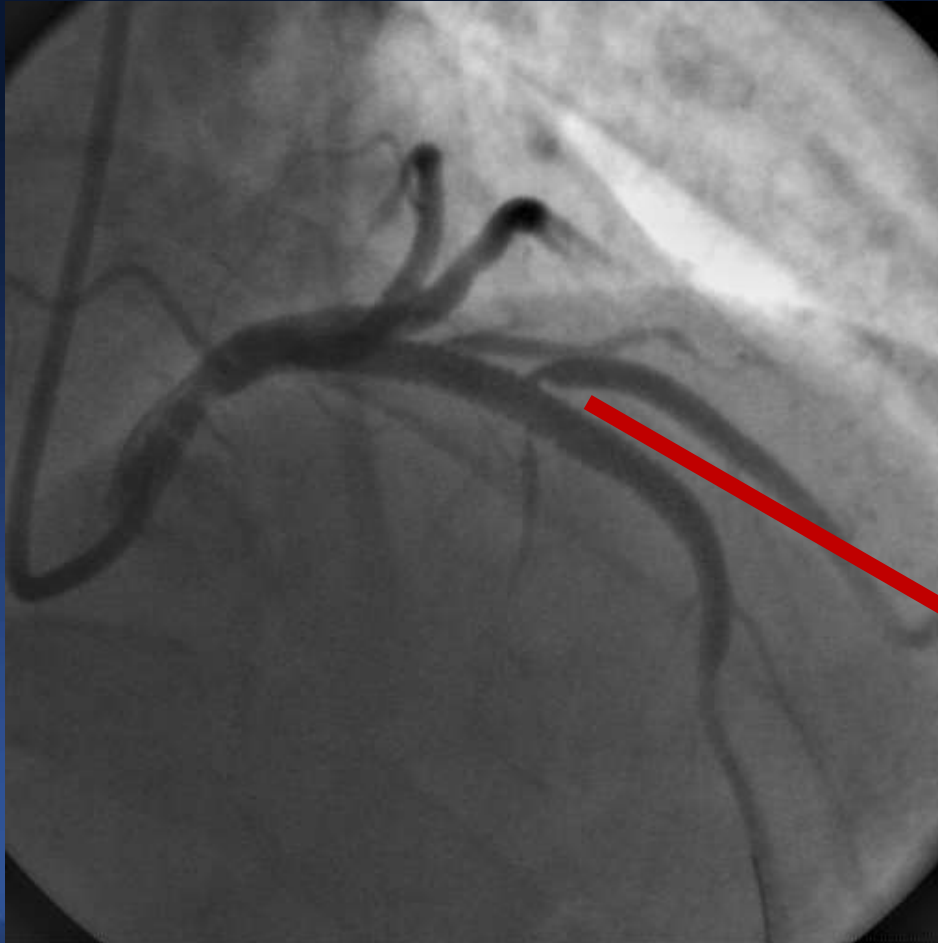
Angioplasty (50%)

JAMA 2011;306(1):53-61

***Symptomatic
Angioplasty***

***Survival
Angioplasty***

If You Want To Treat This, *Cosmetic Angioplasty*



**No Ischemia,
No Symptoms**

Non-LM Bifurcation PCI

**Provisional Stenting
Is Always Enough**

Any 2 Stent Technique

- Jailing Side Branch ?
- How to Treat ?

It Would Be OK !

Sequential High Pressure Inflation on Both Branches,
and Finally Kissing Balloon Inflation !

LM Bifurcation PCI

How To Do ?

1. Single stent cross over
2. Planned two stent technique

2 Stent Technique

When ?

Provisional Stenting (>70%)	<i>Normal LCX (Medina 1.1.0., 1.0.0)</i> Normal or Diminutive LCX Small LCX with < 2.5 mm in diameter Focal disease in distal LCX
<i>2 Stent Technique</i>	<i>Diseased LCX (Medina 1.1.1., 1.0.1)</i> Large LCX with ≥ 2.5 mm in diameter Diseased left dominant coronary system Concomitant diffuse disease in distal LCX

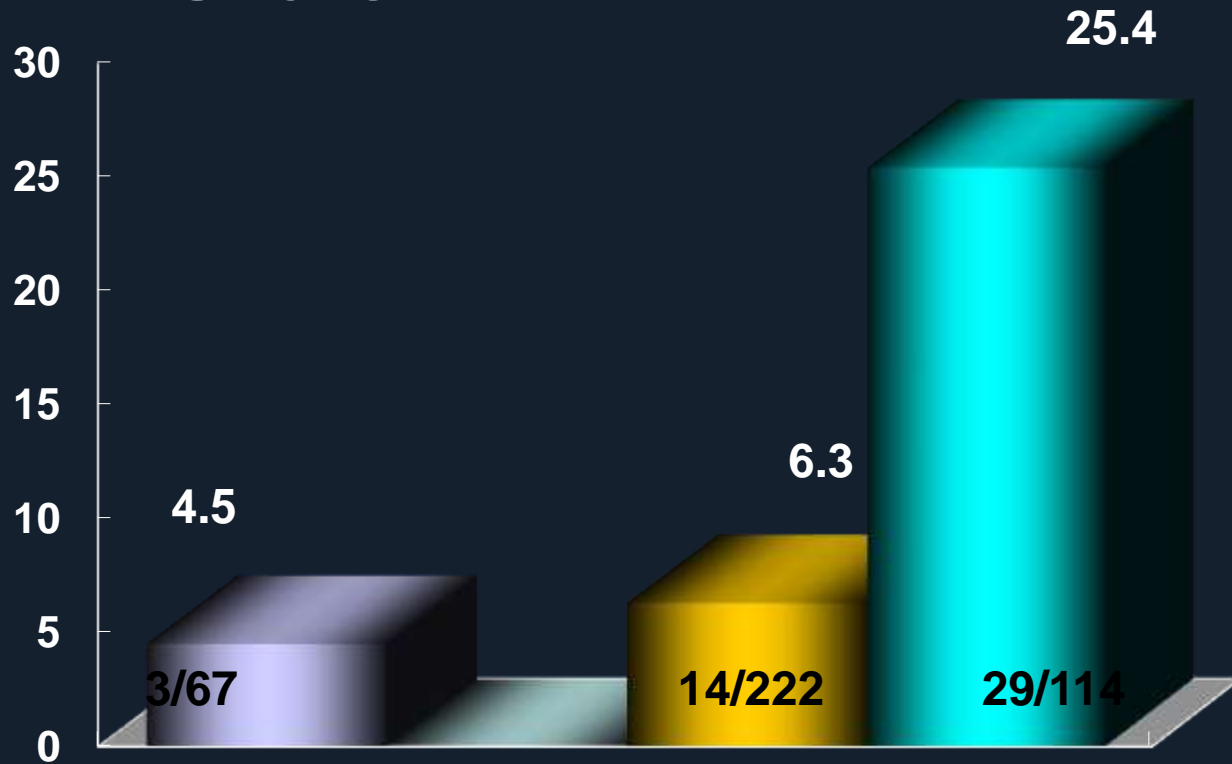
Restenosis at 2 year

LM PCI Using SES (n=423)

Ostial and Shaft

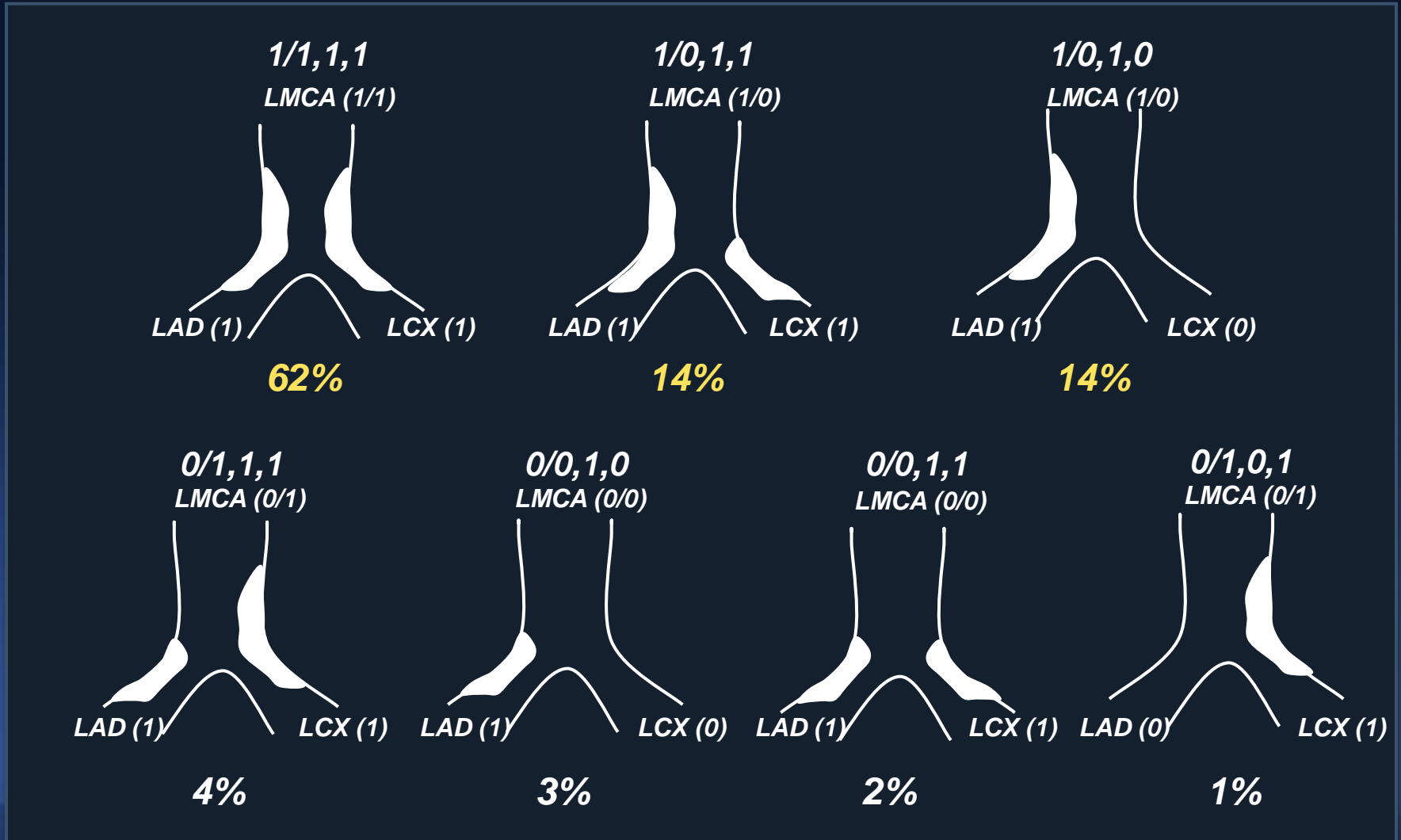
Bifurcation PCI

%

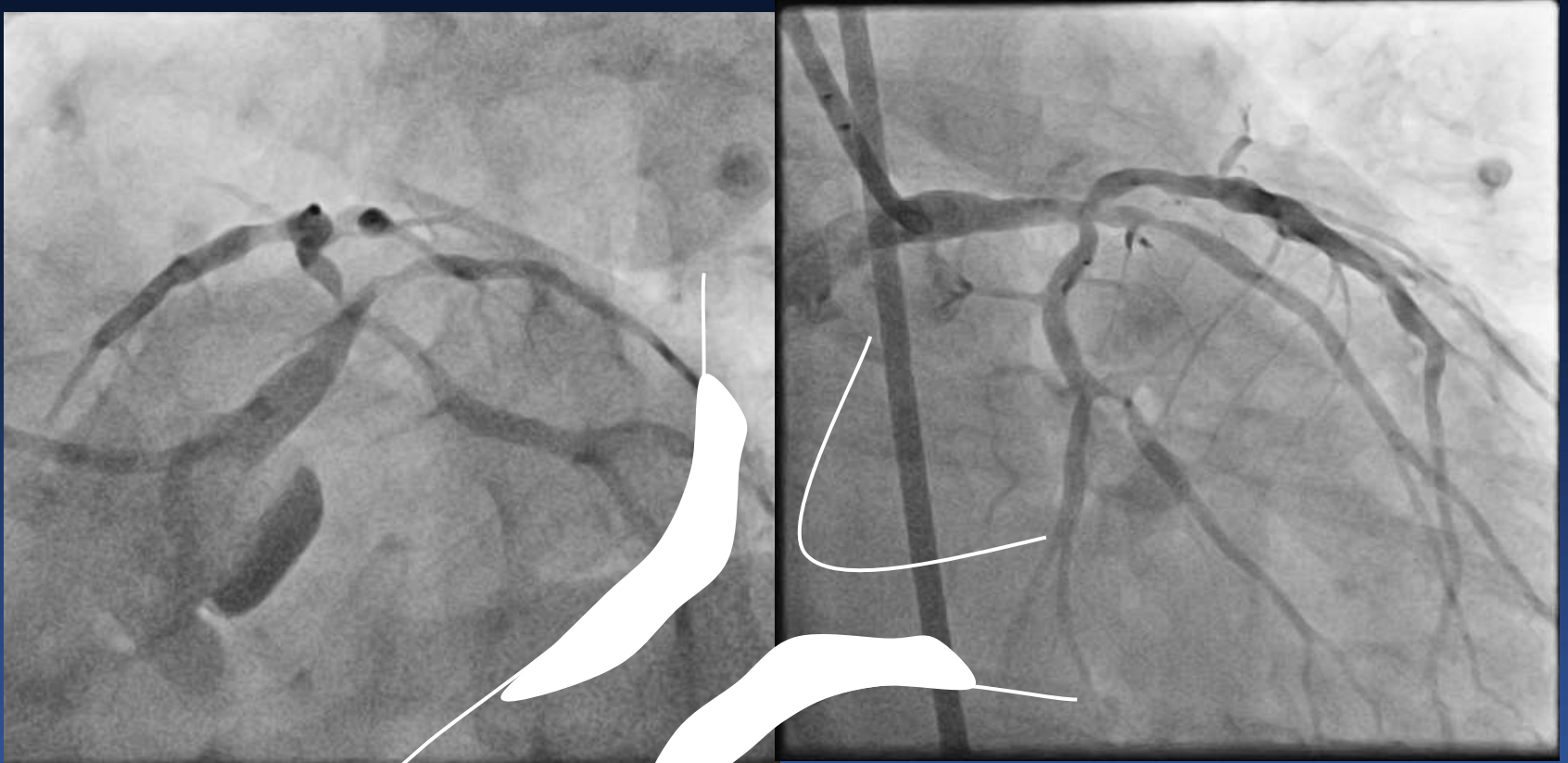


Single Two stent

90% of Plaque, Extends from LM to LAD In LM Bifurcation Disease

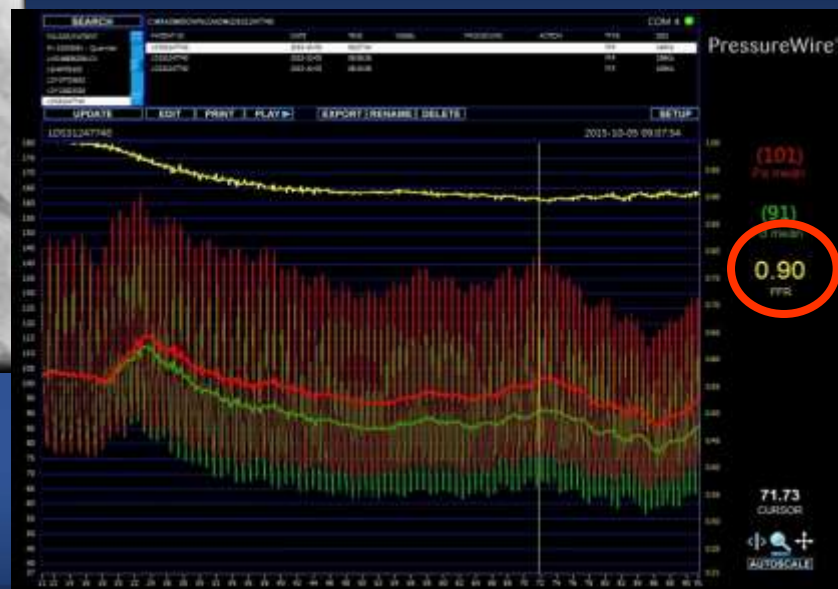
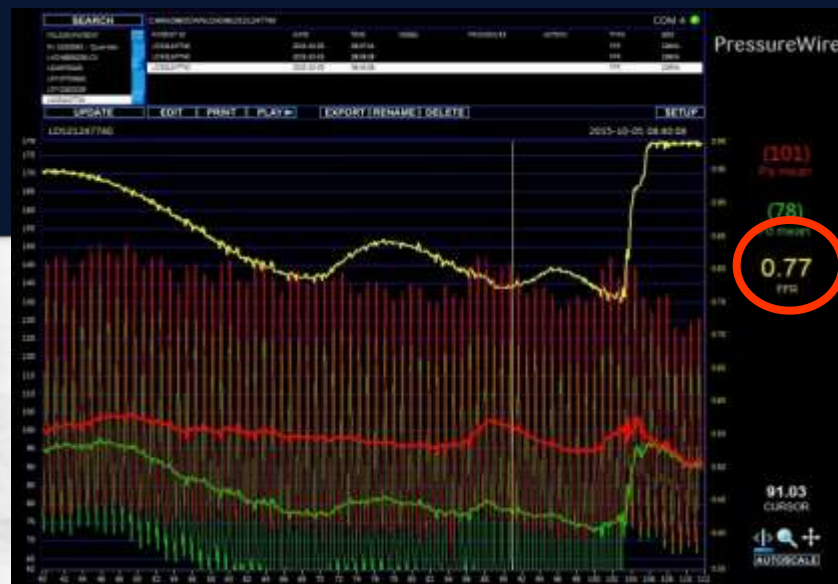
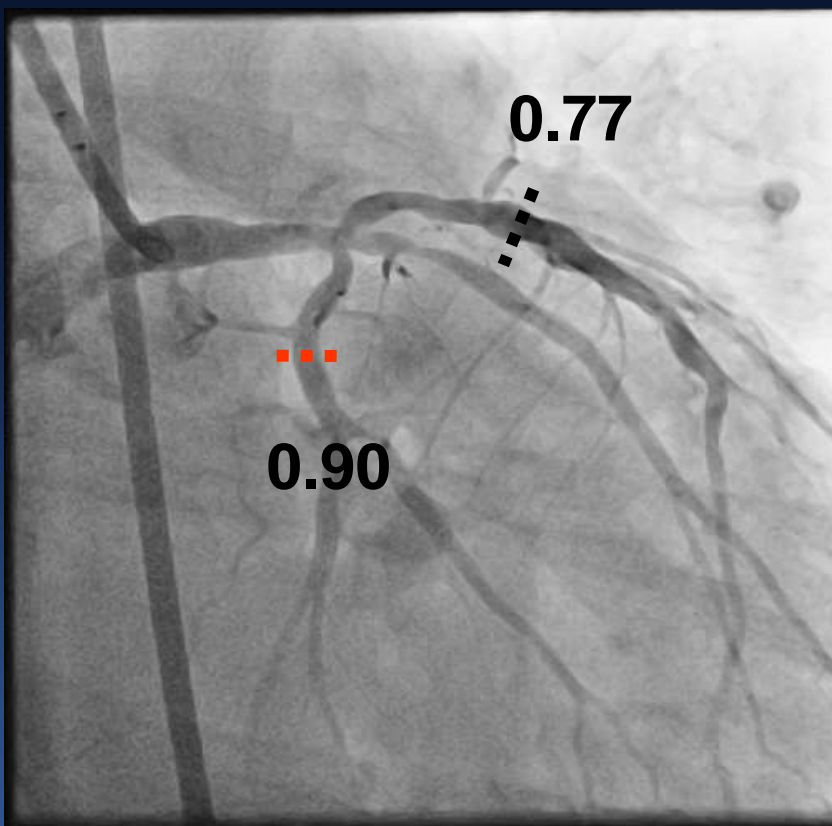


Case 1, 55/M, Effort Chest Pain



FFR

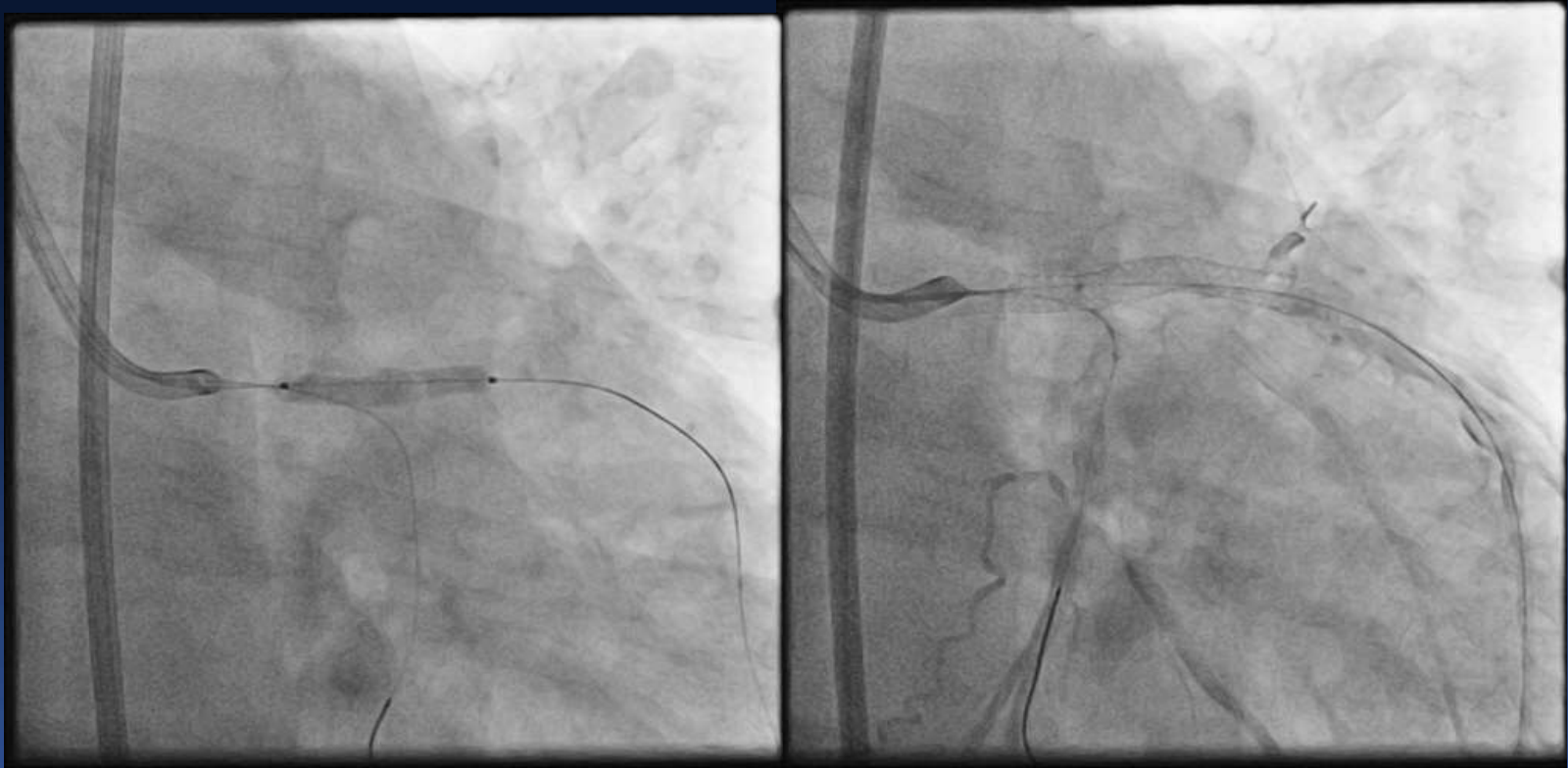
in Both LAD and LCX,



***For Decision Making,
To Treat or Not To Treat***

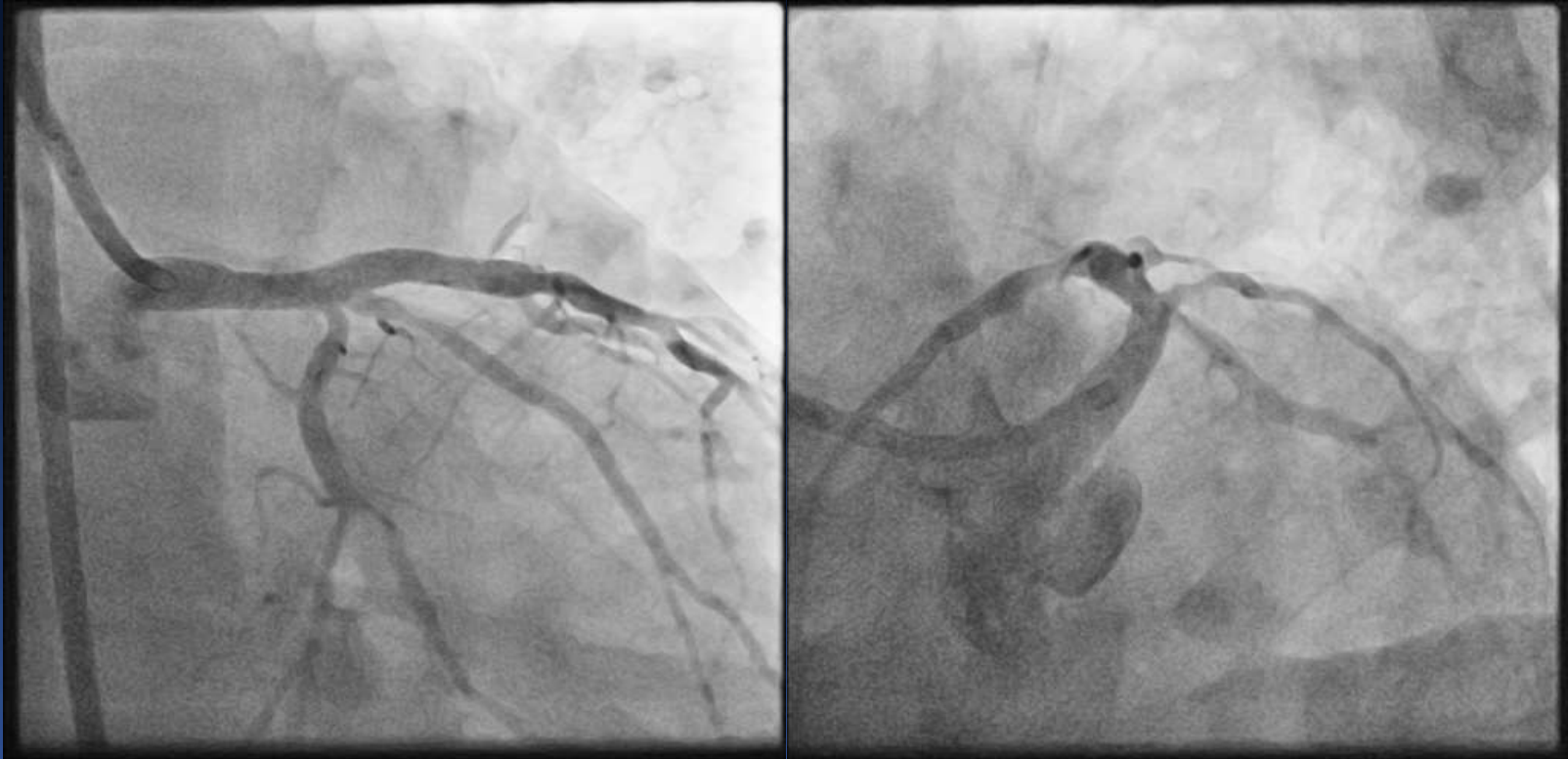
FFR Is Helpful !

Single Stent Crossover



XIENCE Alpine
4.0mm x 30mm

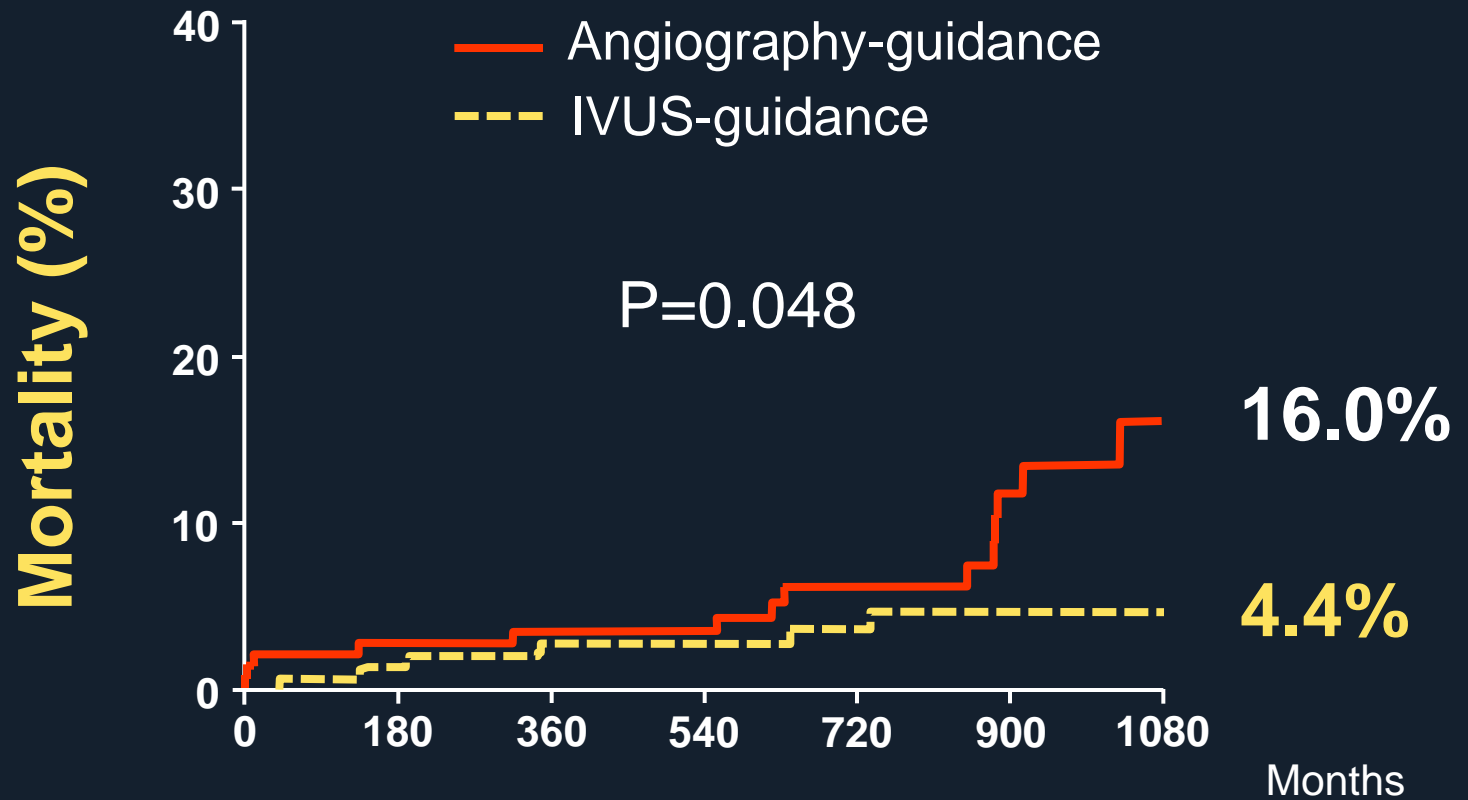
Final Angiogram



Why IVUS for LM PCI ?

Saves Lives !

Angio-Guided vs. IVUS Guided for LM PCI



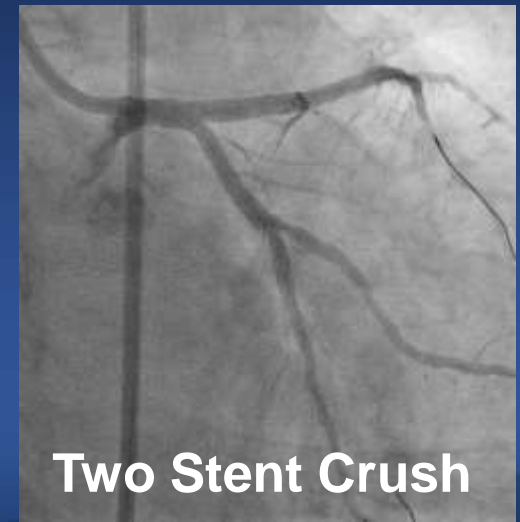
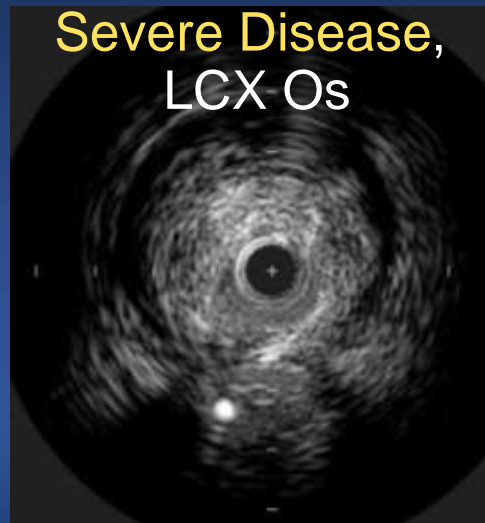
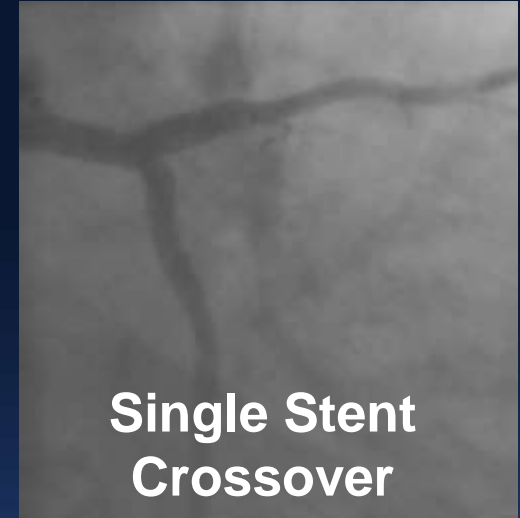
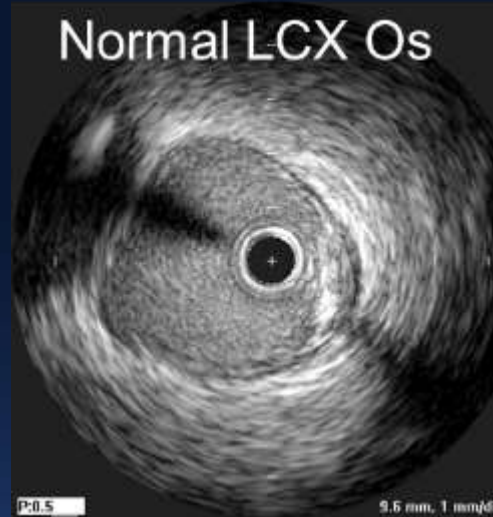
Patients after risk

IVUS-guidance	145	140	98	37
Angiography-guidance	145	137	88	29

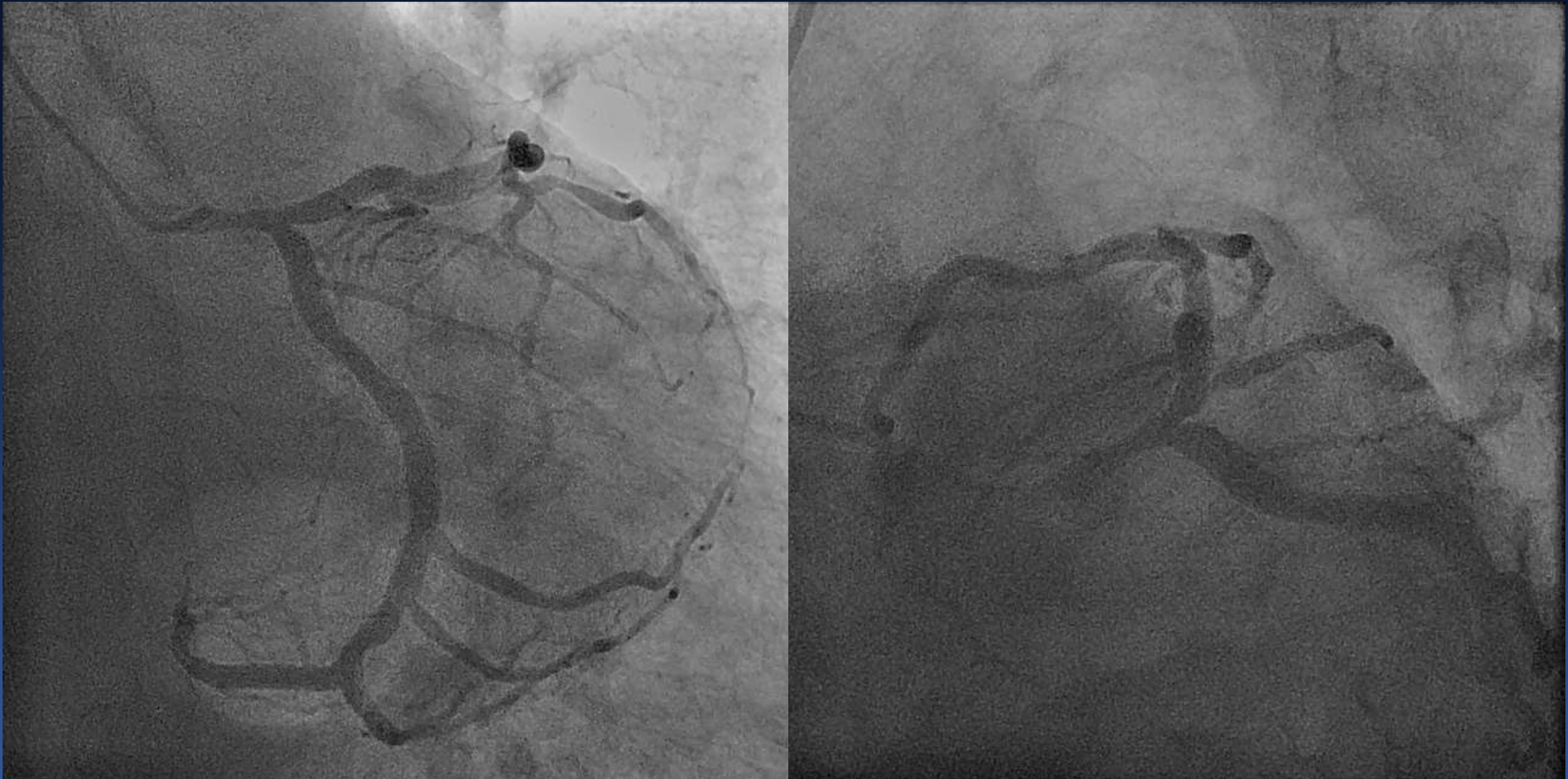
Impact Of IVUS

① *Decision Making ;
1 Stent or 2 Stents ?*

Depending On Whether or LCX Disease by IVUS



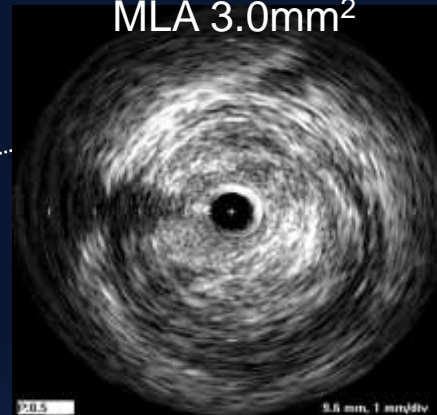
Case 2, 64/M, Effort Chest Pain



IVUS in Both LAD and LCX,

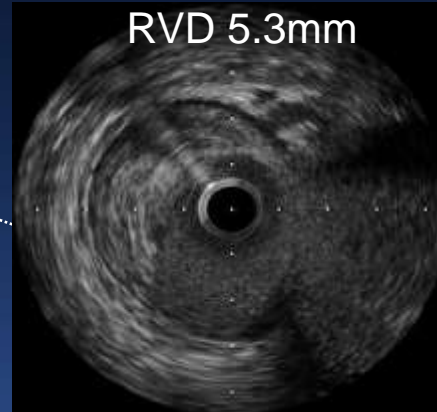
Distal
LM

RVD 6.2mm
MLA 3.0mm²



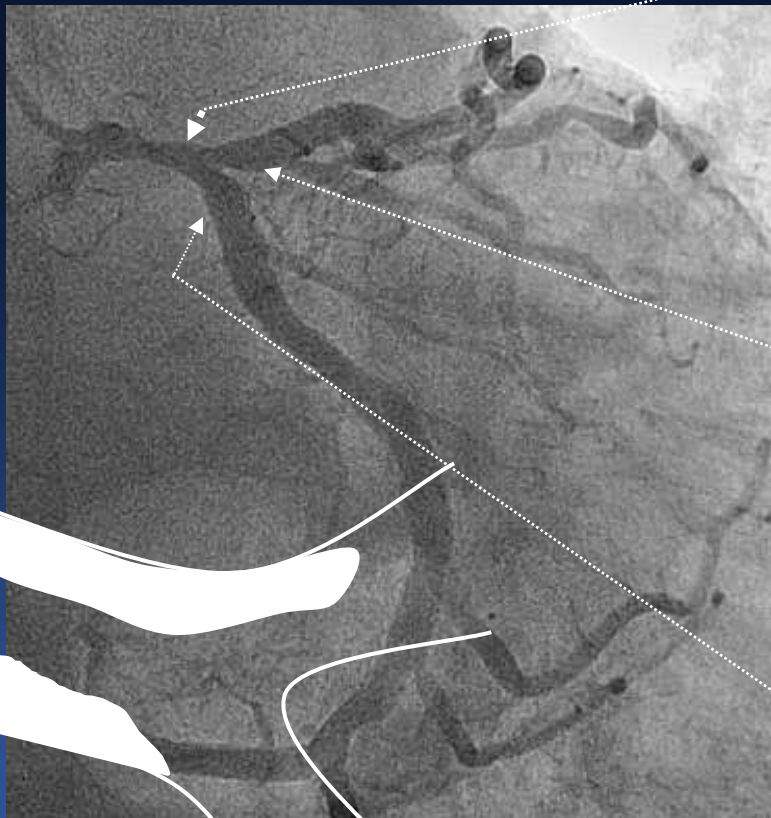
LAD

RVD 5.3mm

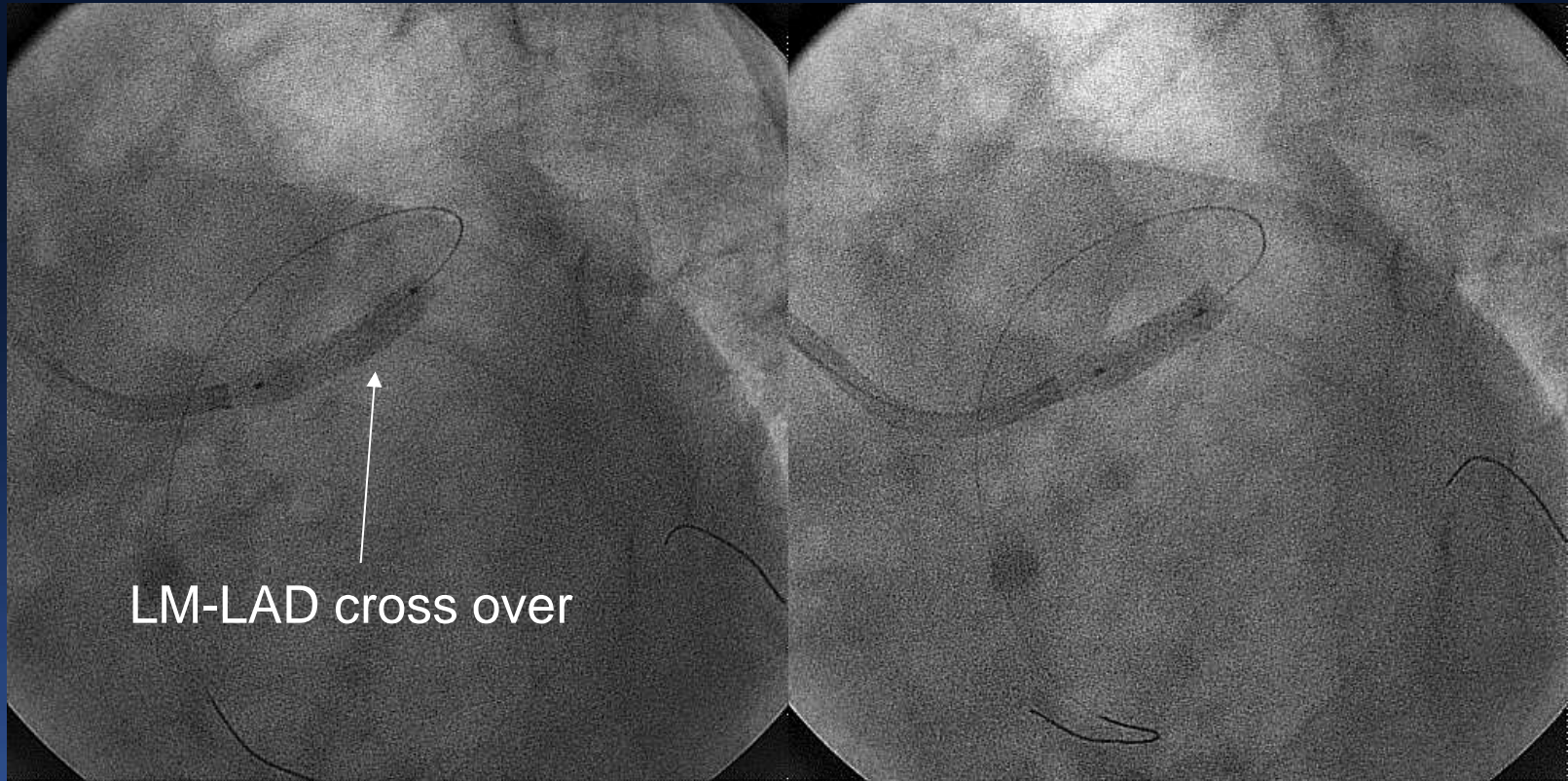


LCX

Disease Free



Stent Cross-Over

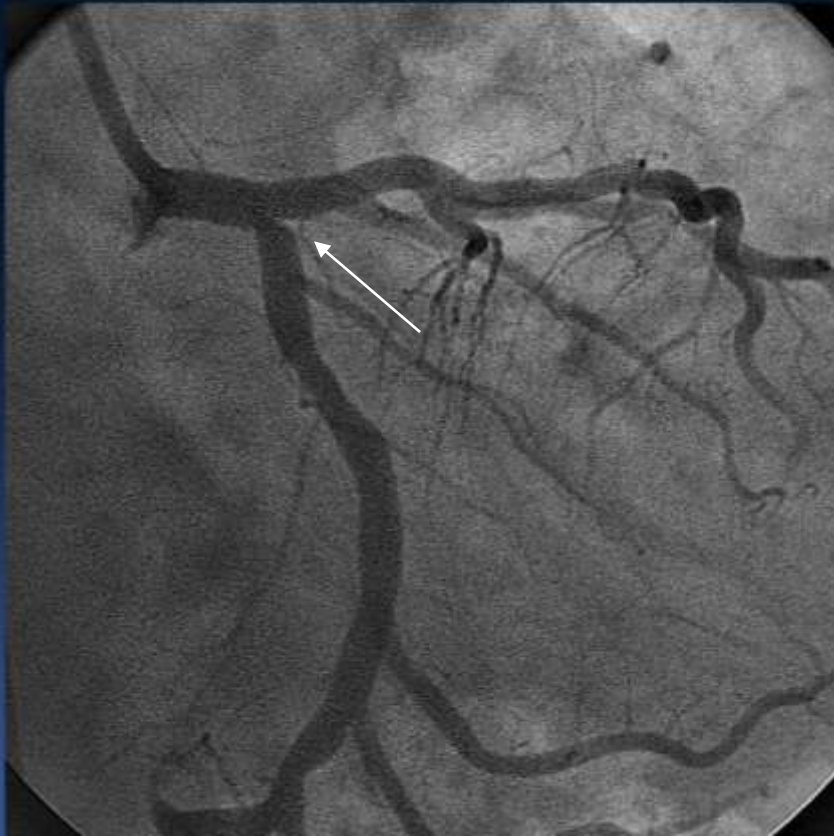


LM-LAD cross over

DES 4.0x20 mm

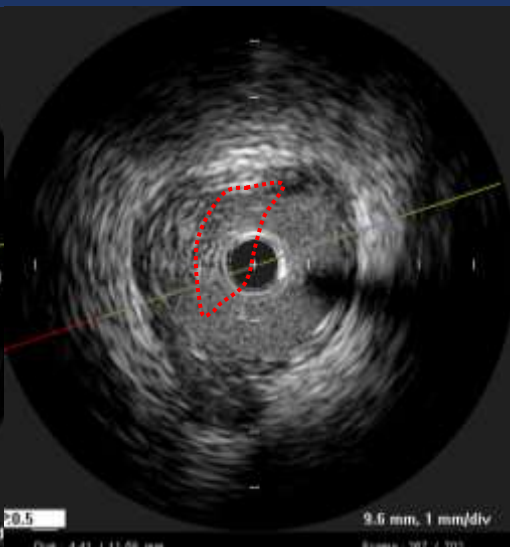
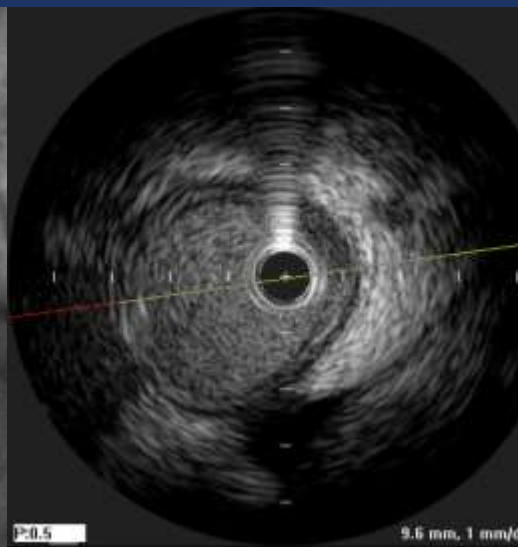
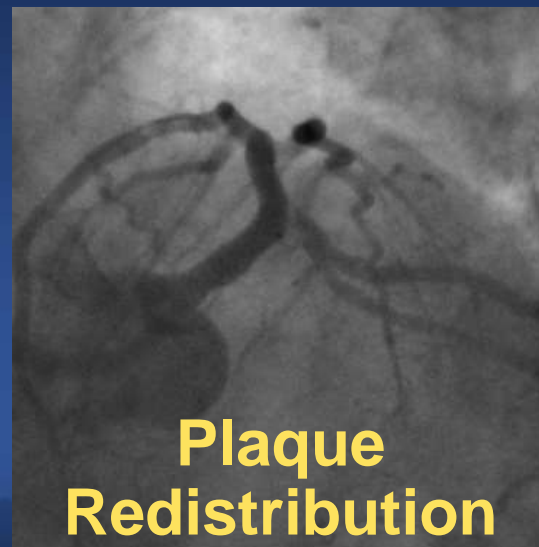
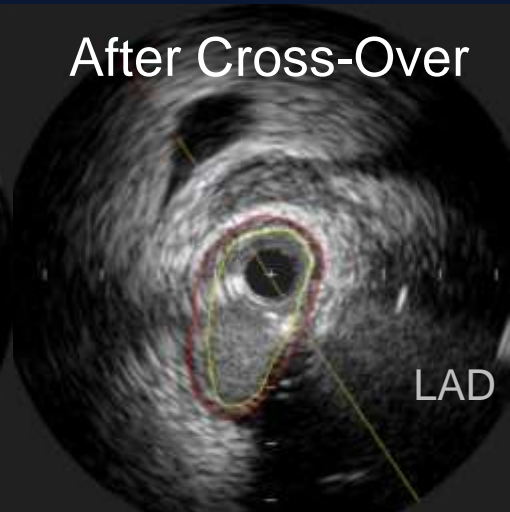
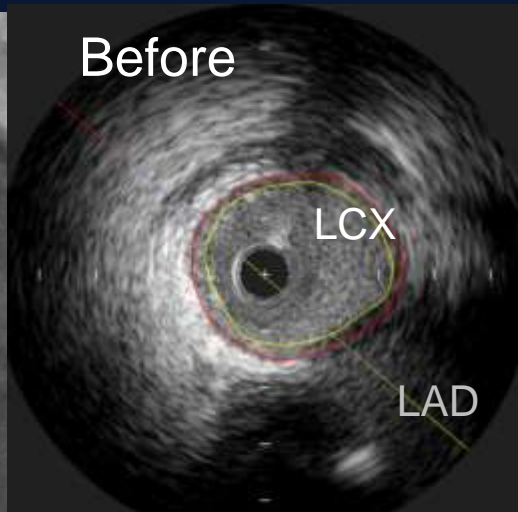
Additional high pressure
Inflation with 4.0 mm
non-compliant balloon

Final Result



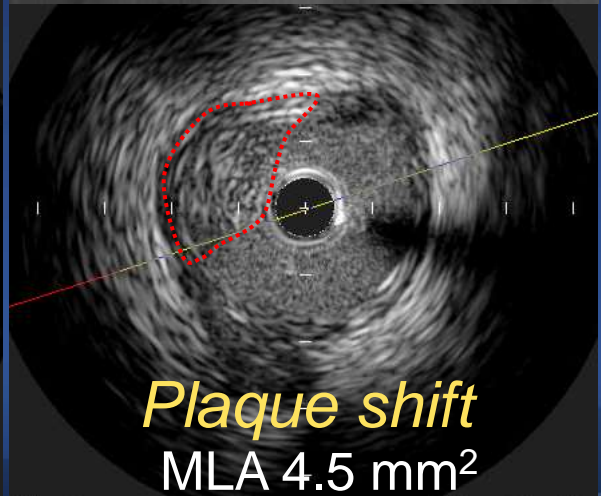
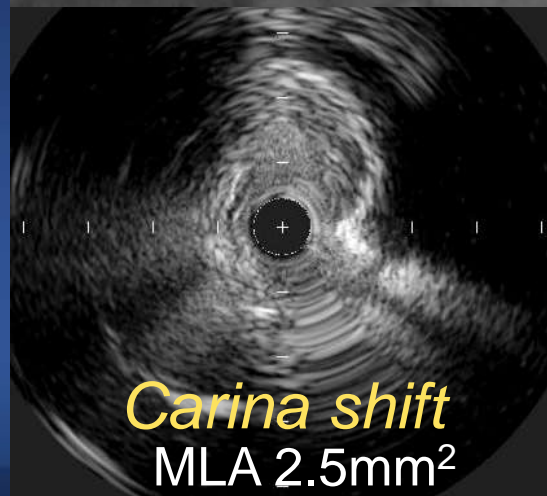
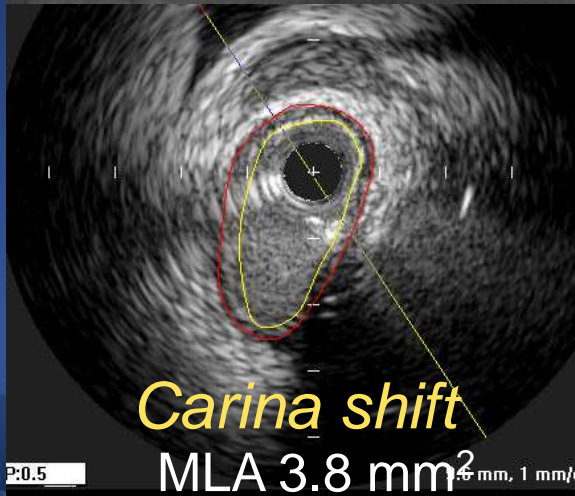
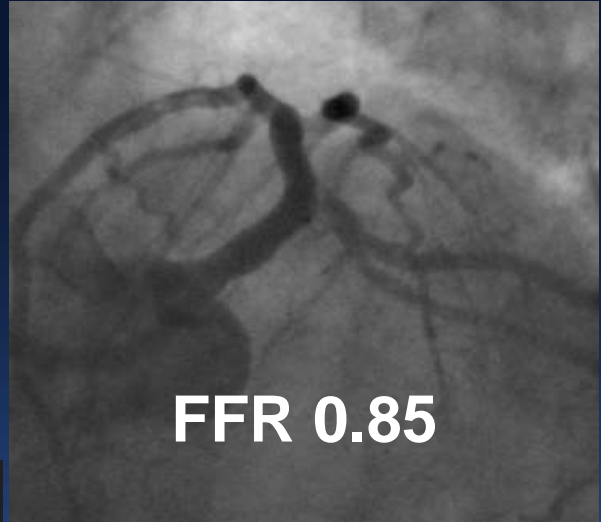
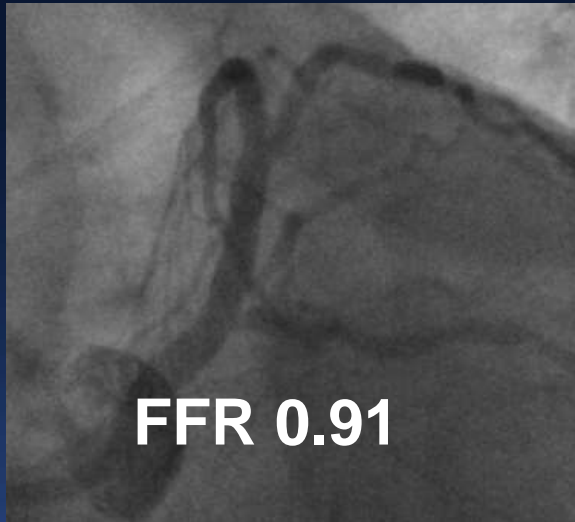
Jailing LCX Os?

Mechanism of LCX Jailing After Stent Cross-Over

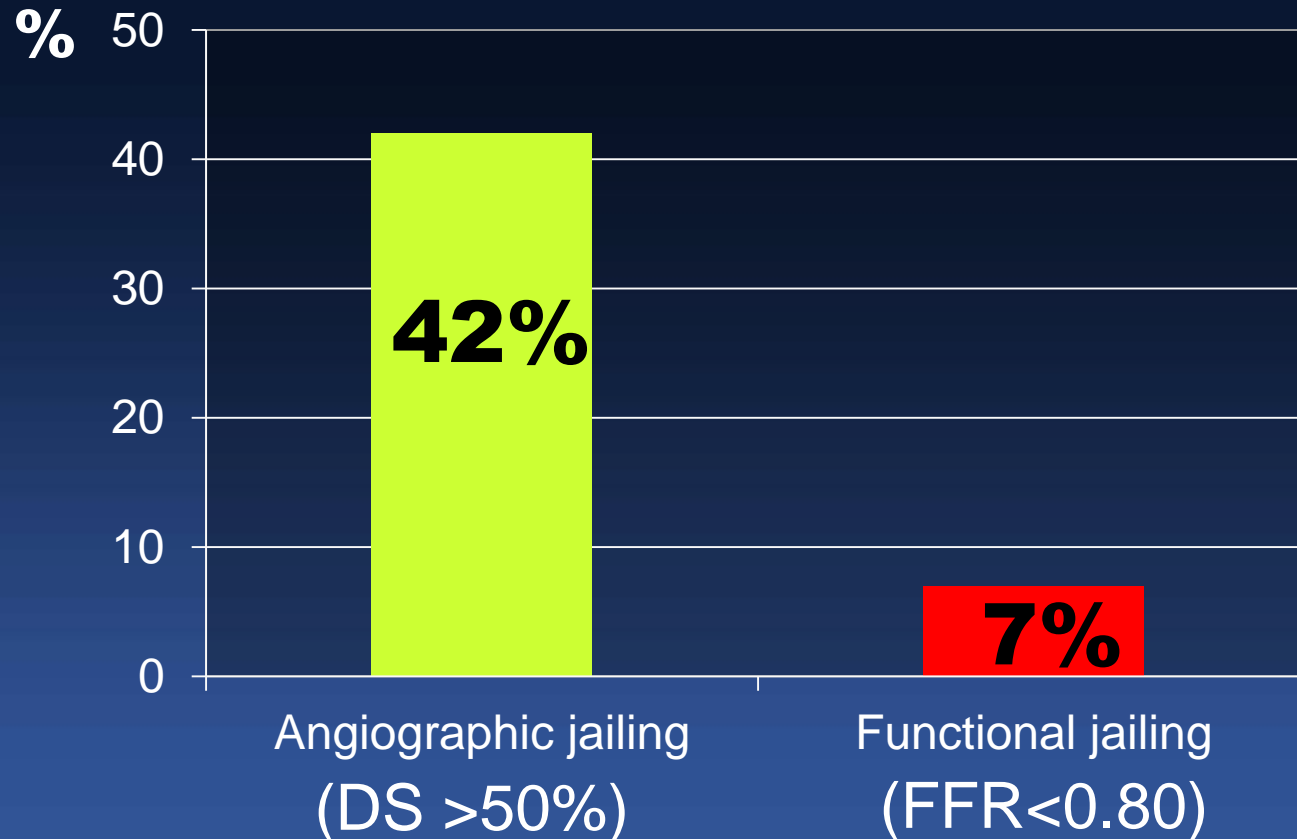


Any Jailing Morphology Cannot Predict Functional Significance of Jailed LCX

LCX Jailing After Stent Cross-Over



Functionally Significant LCX Jailing After Stent Crossover

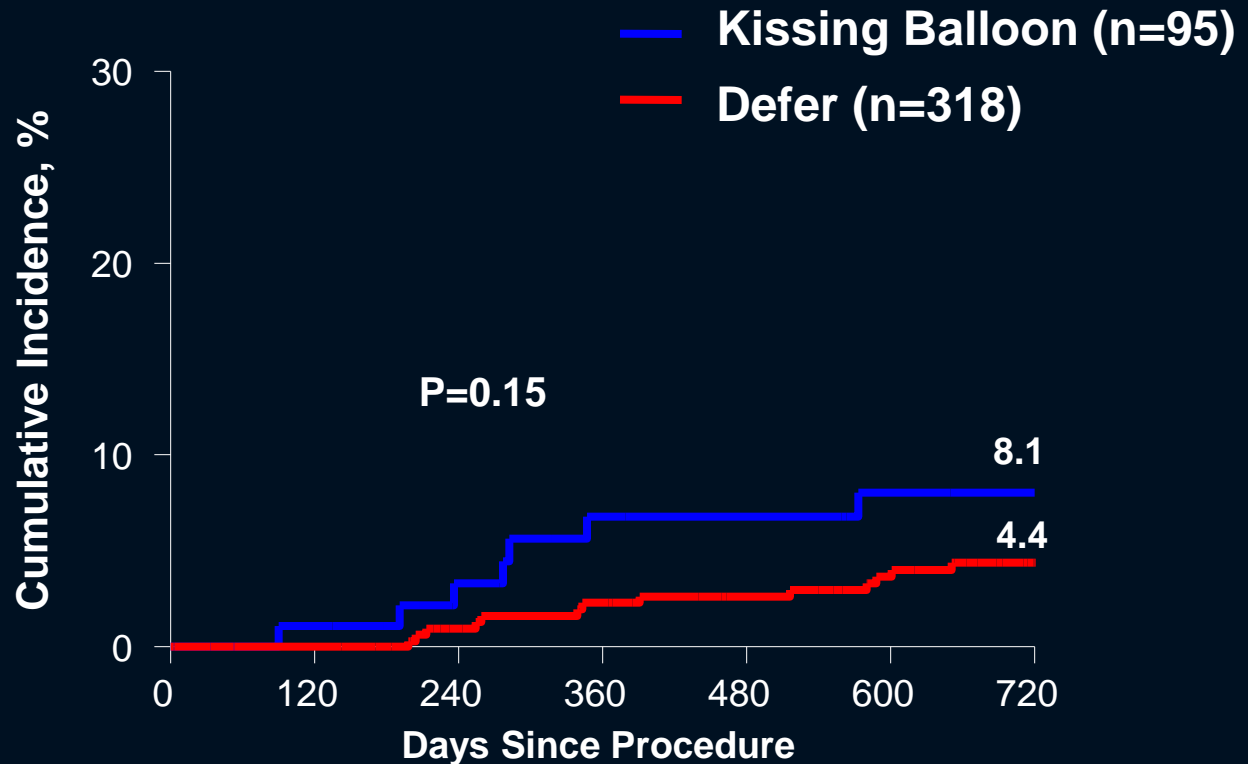


FFR of LCX is 0.92



Leave It !

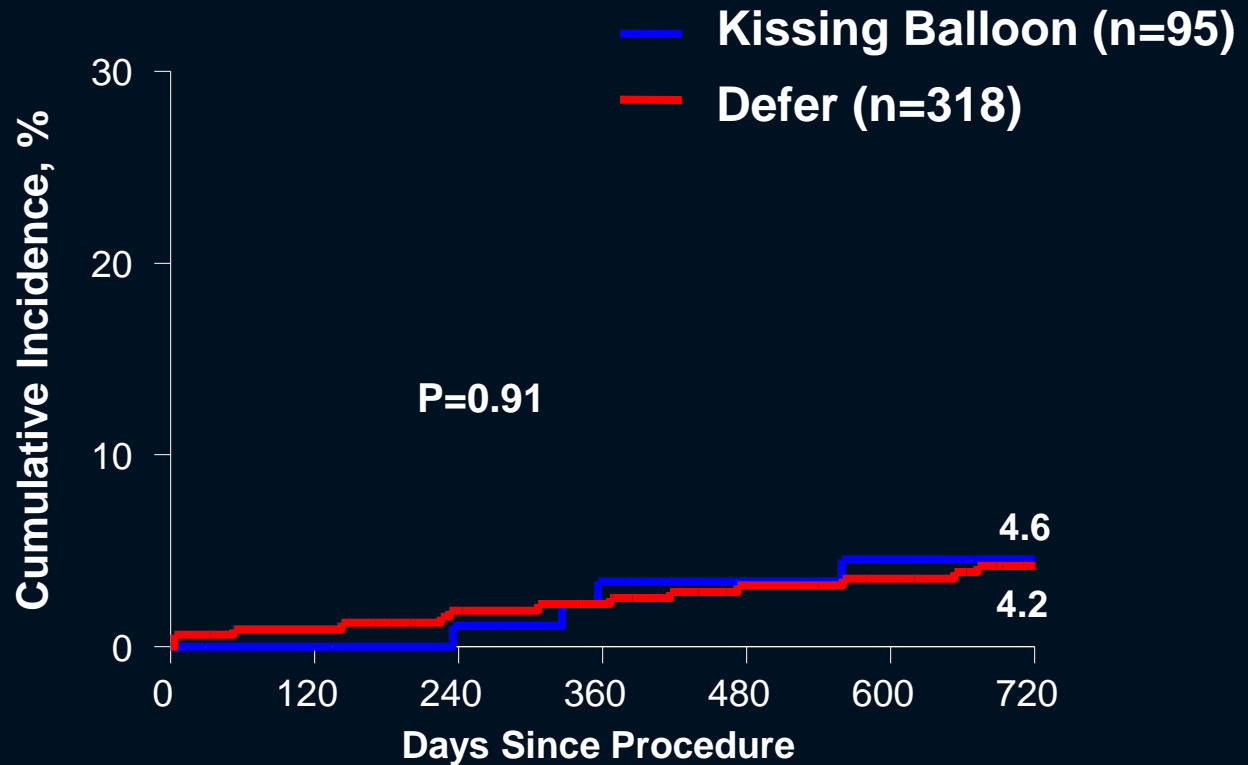
Left Main-TLR at 2 Years



No. at Risk

FKB	95	79	74
No-FKB	318	293	265

Death or MI at 2 Years



No. at Risk

FKB	95	85	80
No-FKB	318	300	278

Impact Of IVUS

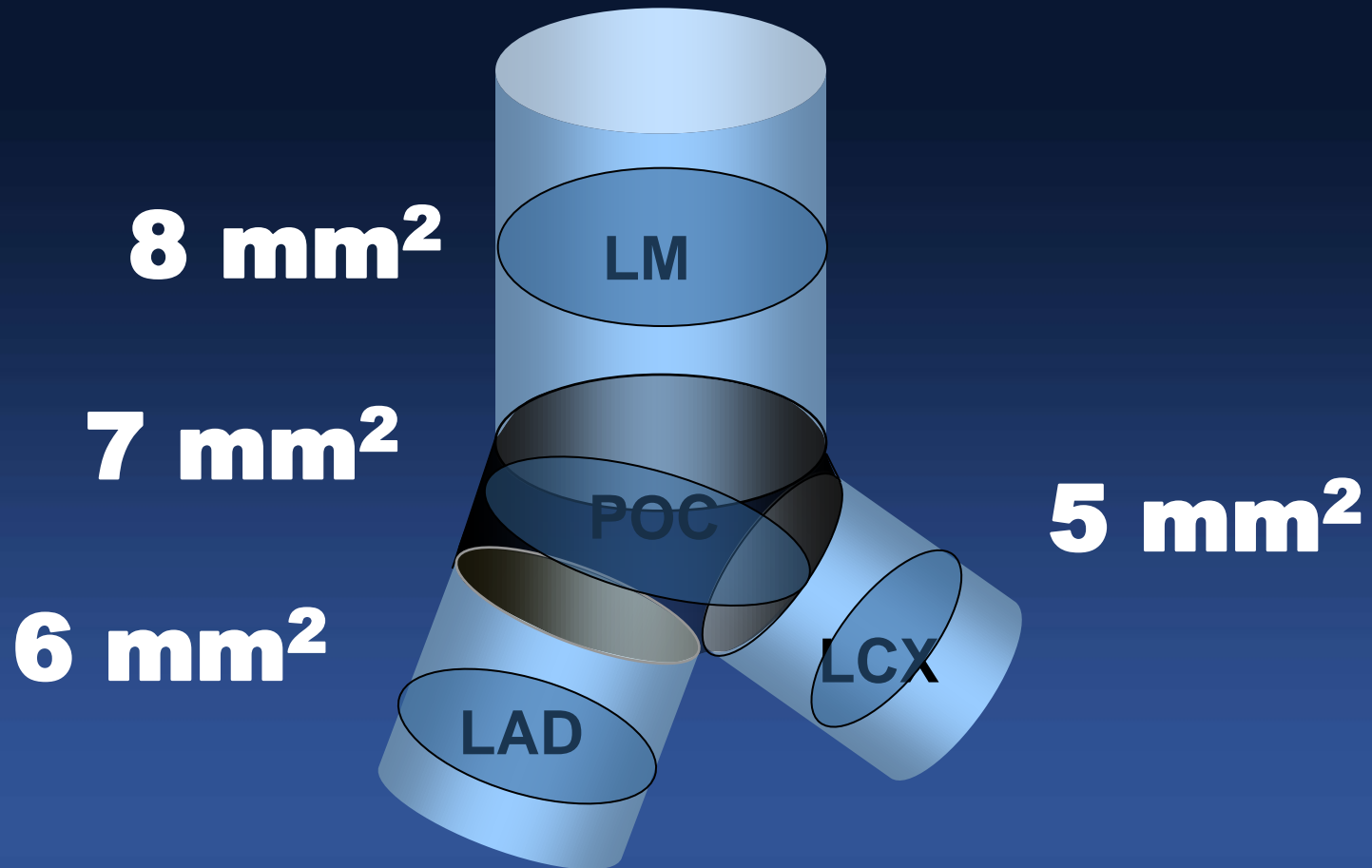
② *Stent Optimization ; After 2 DES Stents*

2 Stent Techniques

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

Effective Stent Area (Rule of 5,6,7,8 mm²)

Restenosis Rate < 5% and TLR < 2%



LM Bifurcation PCI

How To Do ?

1. Provisional stenting of the side branch
2. Planned two stent technique

Both Methods Are Good !

***Integrated Use of FFR and IVUS Can
Make a Good Clinical Outcomes.***

What Really Matters in Any Bifurcation PCI ?

It's a Matter of Concept !



Thank You !!

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