Techniques to Reduce the Frequency of Side Branch Stenting

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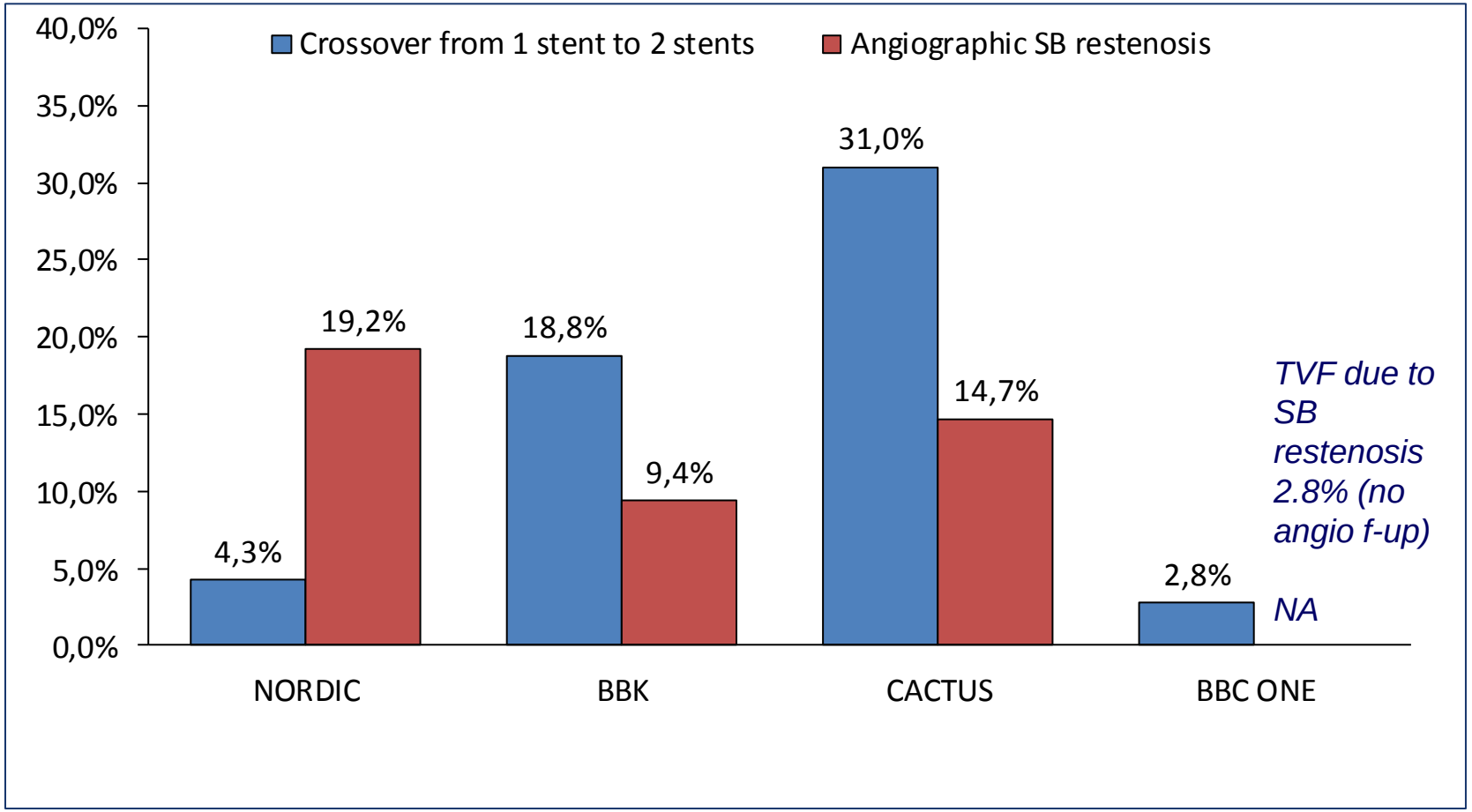
Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

Affiliation/Financial Relationship	Company
• Grant/Research Support • Consulting Fees/Honoraria	• Abbott Vascular, Boston Scientific • Abbot Vascular, Biosensors, Biotronik, Boston Scientific, Cordis J&J, Medtronic
• Major Stock Shareholder/Equity • Royalty Income • Ownership/Founder • Intellectual Property Rights • Other Financial Benefit	

How Often We Need 2nd Stent after MV Stent?

Crossover from 1 Stent to 2 Stents



Steigen TK et al. Circulation. 2006;114:1955-1961 Ferenc M et al. Eur Heart J 2008; 29: 2859–2867 Colombo A et al. Circulation. 2009;119:71–78 Hildick-Smith D et al. Circulation. 2010;121:1235-1243

When We Need 2nd Stent after MV Stenting?

Suboptimal Result in SB after MV Stenting

Nordic Bifurcation Study:
If TIMI<3 → SB dilation; SB stenting if TIMI flow = 0 after dilation

Steigen TK et al. Circulation. 2006;114:1955-1961

CACTUS:
Residual stenosis ≥50%; dissection of type B or worse; TIMI flow ≤2

Colombo A et al. Circulation. 2009;119:71–78

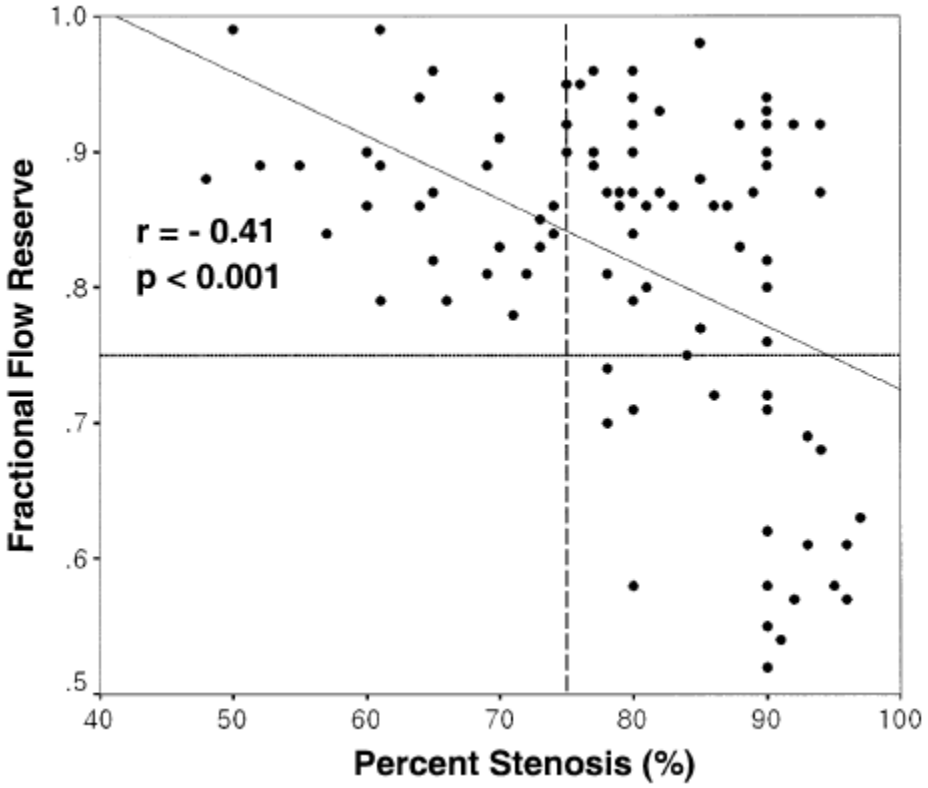
Bifurcations Bad Krozingen:
Flow limiting dissection or residual stenosis of ≥ 75%

Ferenc M et al. Eur Heart J 2008; 29: 2859–2867

BBC ONE:
TIMI flow <3, persistent ostial pinching of SB (<70%), threatened SB closure, or SB dissection > type A

Hildick-Smith D et al. Circulation. 2010;121:1235-1243

Correlation Between FFR and % Stenosis (QCA) in Jailed Side Branches



There was a negative correlation between the percent stenosis and FFR (r=0.41, p<0.001).

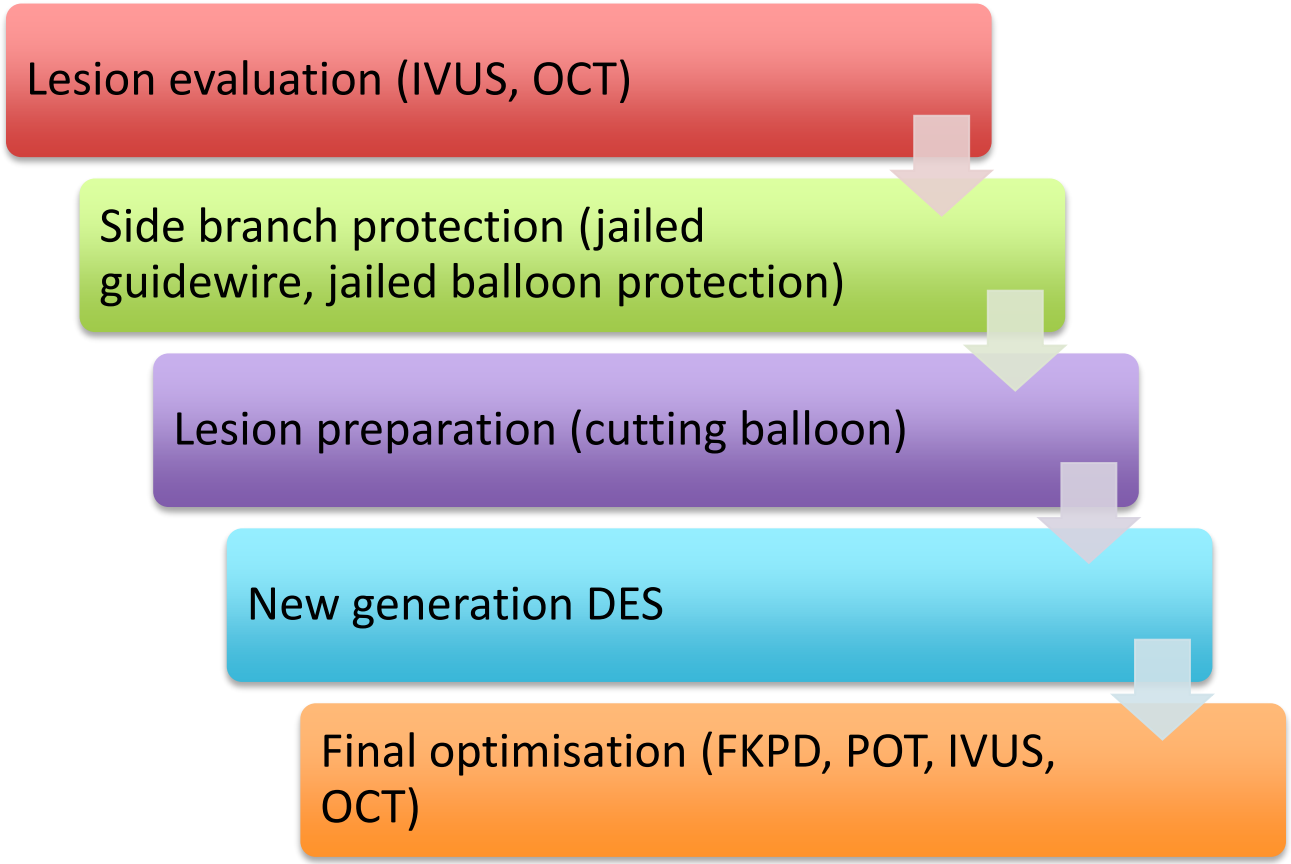
No lesion with <75% stenosis had FFR<0.75.

Among 73 lesions with ≥75% stenosis, only 20 lesions were functionally significant.

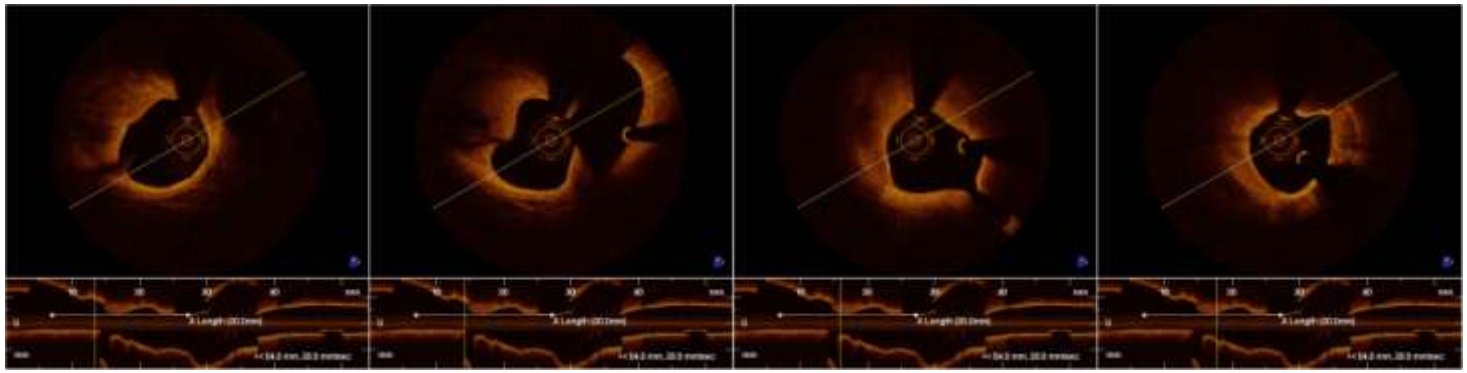
FFR measurements demonstrate that most of stenotic SB do not have functional significance

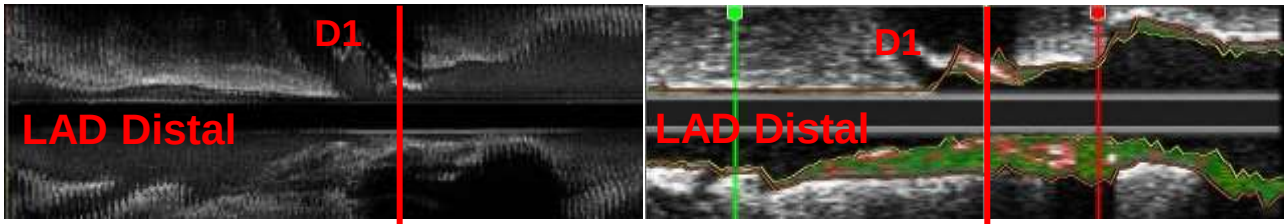
Koo BK et al *J Am Coll Cardiol* 2005;46:633–7)

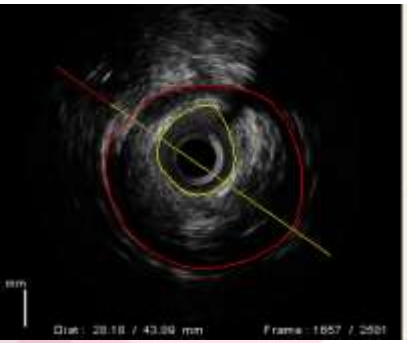
How to avoid side branch stenting in provisional stenting?

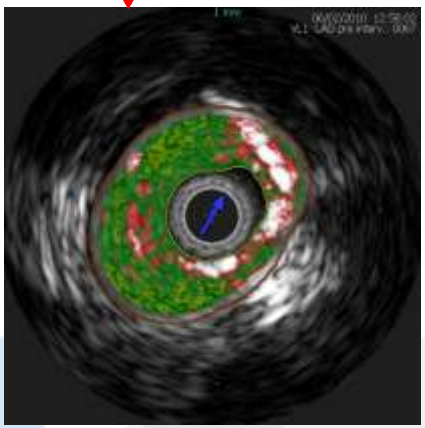


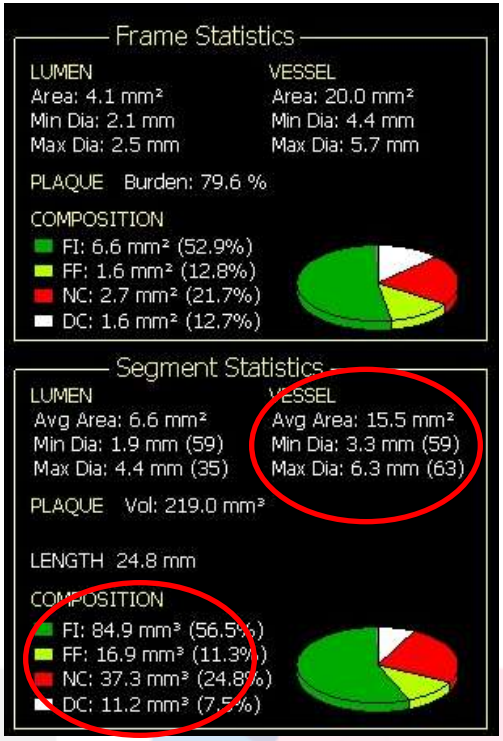
Intravascular imaging for bifurcations











Angiographic and IVUS predictors of SB failure during provisional stenting

56 true bifurcation lesions were randomized for single “provisional” stenting (n=28) vs double stenting (n=28) with everolimus-eluting stents.

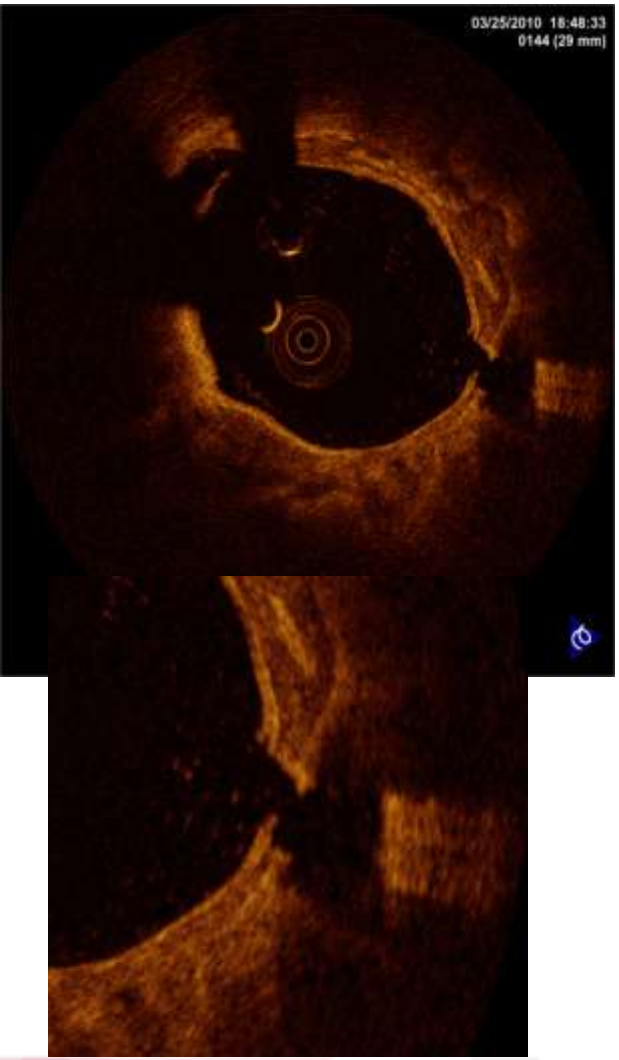
Crossover criteria from single to double stenting was SB with significant residual stenosis (>70%), dissection >type A, and/or impaired flow (TIMI=0 or 1) after performance of “final” kissing-balloon.

By protocol, IVUS imaging was performed in both branches at preprocedure.

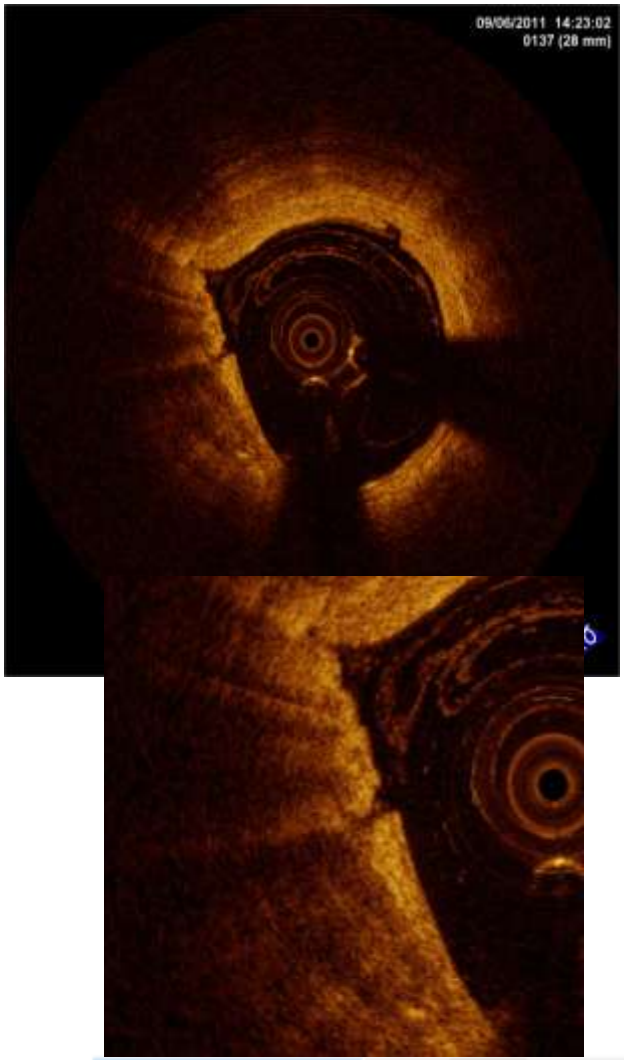
PREPROCEDURE VARIABLES IN THE SB	CROSS-OVER*		P value
	YES, n=6	NO, n=22	
Quantitative Coronary Angiography (QCA)			
Lesion length, mm	13.9	8.87	0.01
Reference diameter	2.47	2.51	0.83
% diameter stenosis	88.6	71.7	0.02
IVUS			
Minimum lumen area (MLA), mm2	1.73	2.33	0.005
Plaque burden	65.5	59.1	0.41
Remodeling index	0.65	0.96	0.03
Calcium (arc >90 degrees), %	83.3	29.3	0.006

Costa RA, et al. ACC 2011
J Am Coll Cardiol. 2011;57(14s1):E1707-E1707

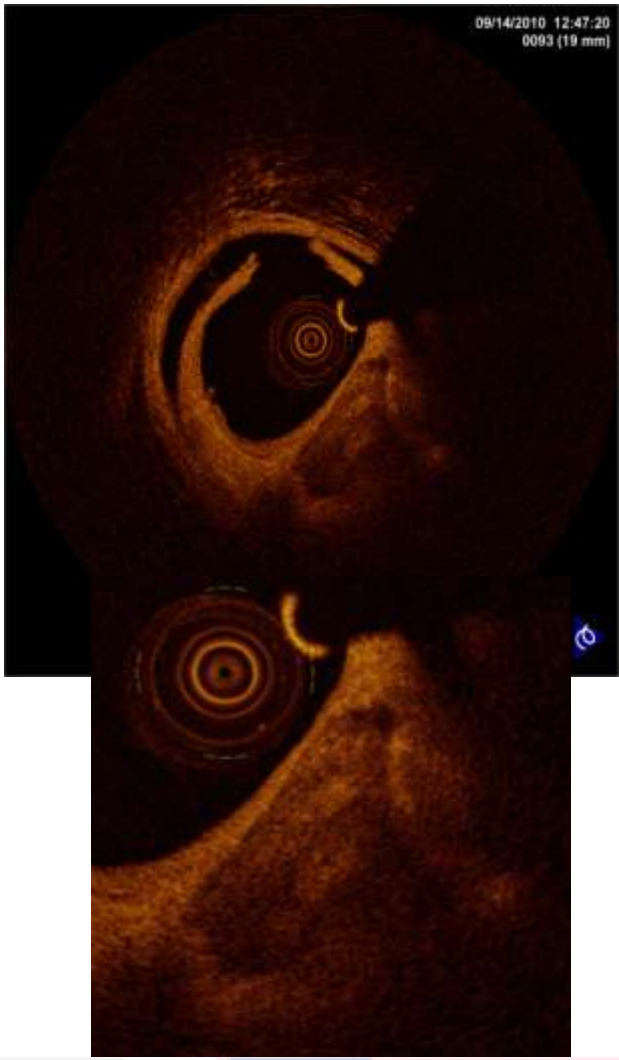
XIENCE-OPTIMAL study: Types of Calcium Modification



Complete Fracture

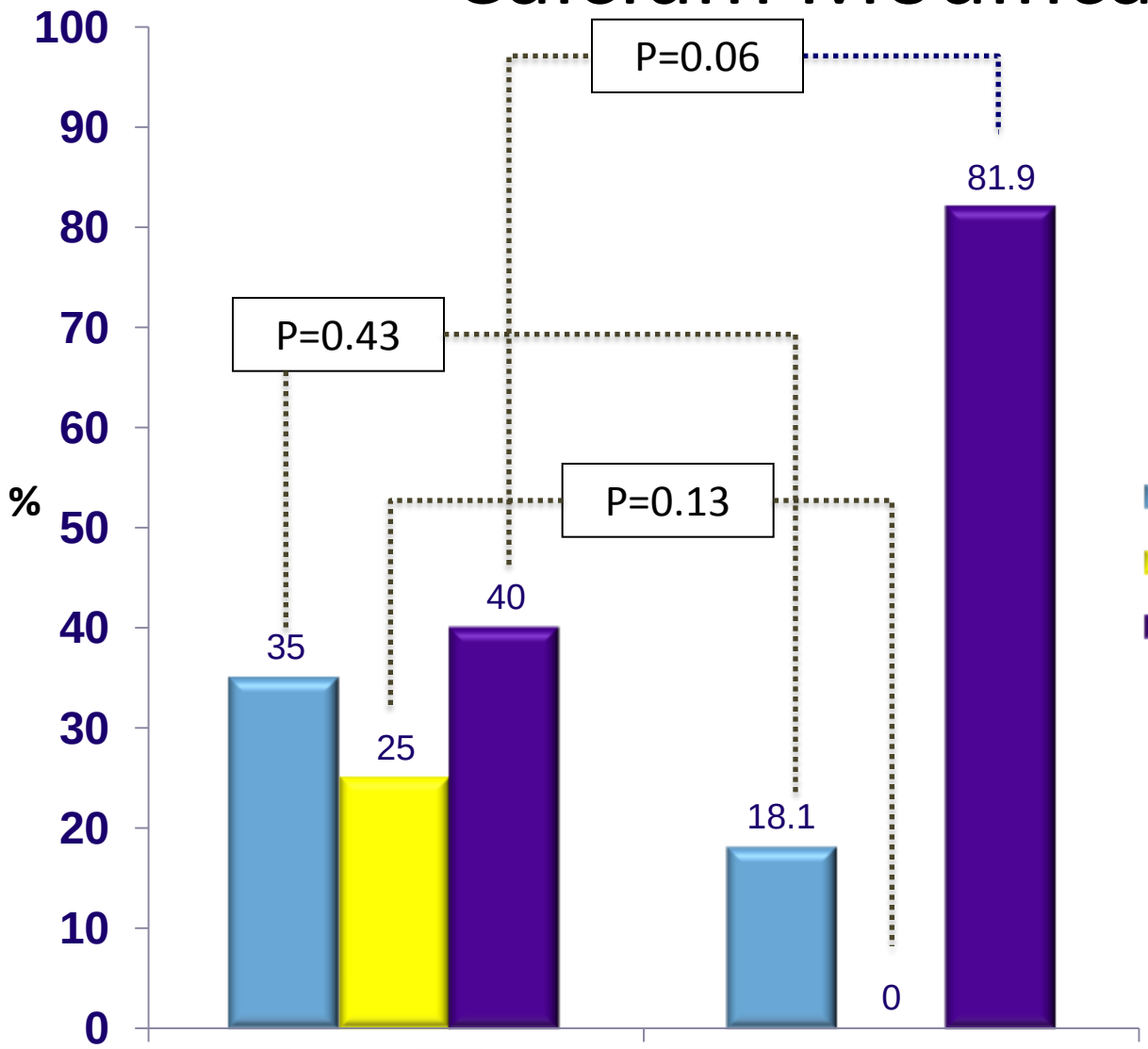


Partial Fracture



No Fracture

Xience-optimal study: Calcium Modification



Patient (pullback) level

Erglis A. EBC 2012

Riga Bifurcation Registry

Single centre substudy (Nordic I, II+ Riga bifurcation registry) to compare the safety and efficacy of plaque modification with cutting ballon (CB) before main vessel stenting and/or side branch treatment in bifurcation lesion

8 Months Outcomes	CB n= 209	Non-CB n= 347	P value
Death, n (%)	7 (3.3)	10 (2.9)	0.802
MI, n (%)	7 (3.3)	9 (2.6)	0.609
Non Q MI, n (%)	6 (12)	4 (8)	0.518
ST, n (%)	5 (2.4)	10 (2.6)	>0.99
TLR, n (%)	11 (5.3)	38 (11.0)	0.021
TVR, n (%)	17 (8.1)	48 (13.8)	0.056

Jailed balloon protection

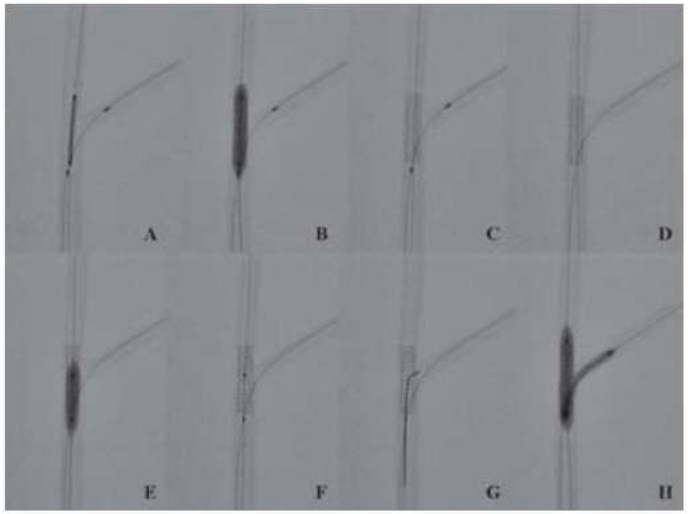


Figure 1. Bench testing of the jailed balloon technique without side-branch balloon inflation. (A) Stent (3.5x18 mm) positioning in the main vessel (MV) with protection balloon (2x20 mm) into the side-branch (SB). The balloon is placed with the proximal marker immediately proximal to the stent. (B) Deployment of MV stent with jailed balloon. (C) MV stent appearance after deployment and before jailed balloon removal. (D) MV stent appearance after uninflated jailed balloon removal. No major stent deformation is detectable. (E) Proximal MV post-dilation with short (4x12 mm) balloon. (F) MV stent appearance after post-dilation of the proximal portion. (G) SB rewiring is performed using a pullback technique from distal to proximal so that MV stent's side-cells are re-crossed in the distal part of the SB ostium. (H) Kissing balloon inflation (3.5x20 mm in the MV and 2.5x20 mm in the SB).

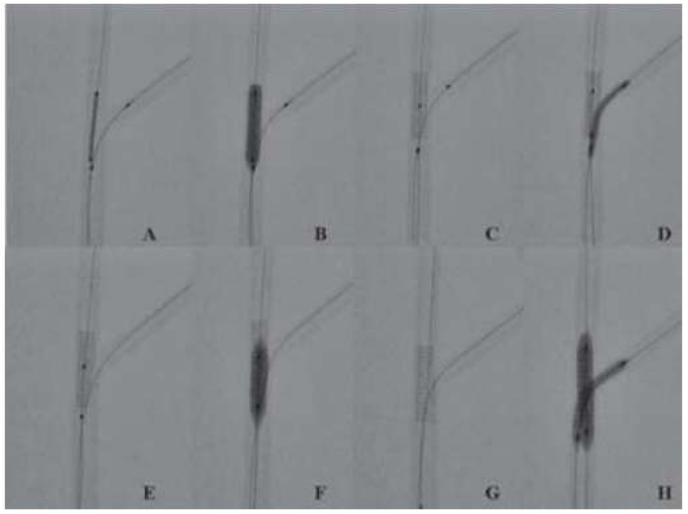
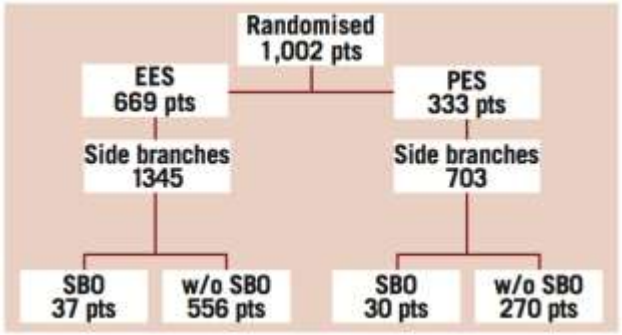


Figure 2. Bench testing of the jailed balloon technique with side-branch balloon inflation. (A) Stent (3.5x18 mm) positioning in the main vessel (MV) with protection balloon (2x20 mm) into the side-branch (SB). The balloon is placed with the proximal marker immediately proximal to the stent. (B) Deployment of MV stent with jailed balloon. (C) Before inflating the SB balloon, the short (4x12 mm) balloon necessary for proximal MV post-dilation is placed in the MV. (D) SB balloon is removed. (E) The stent has a detectable deformation in the proximal part which has been induced by SB balloon dilation. (F) Proximal MV post-dilation with the short (4x12 mm) balloon. (G) MV stent appearance after post-dilation of the proximal portion. The MV stent distortion is completely corrected so that SB rewiring is performed as usual (H) Kissing balloon inflation (3.5x20 mm in the MV and 2.5x20 mm in the SB).

This novel technique has been successfully adopted in 20 patients with complex (55% unprotected LM, 85% Medina 1,1,1) true bifurcated lesions undergoing DES implantation.

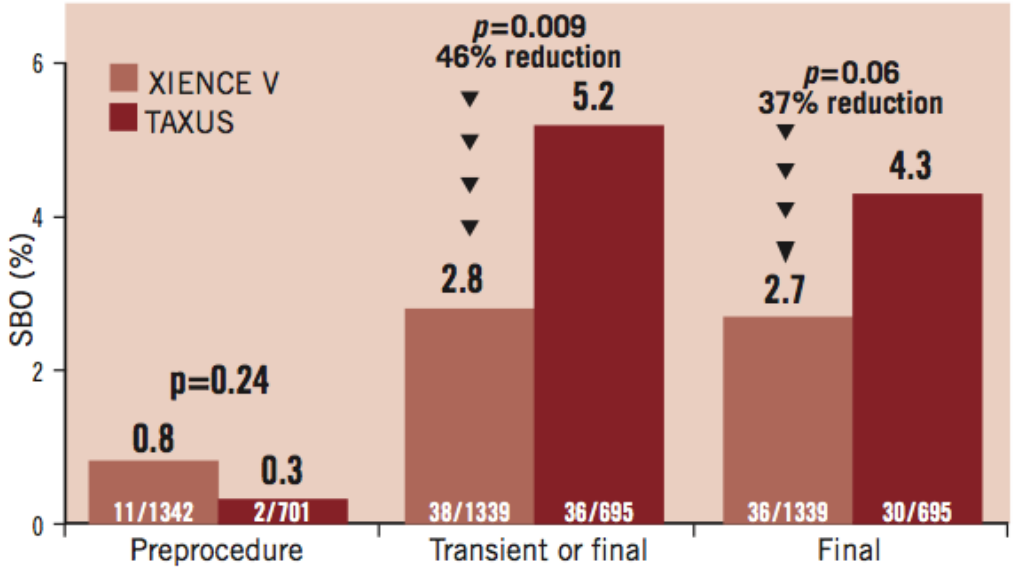
Burzotta F et al. Eurointervention 2010;5:809-813

3-year Results from SPIRIT III: Comparison of Everolimus- and Paclitaxel-Eluting Stent

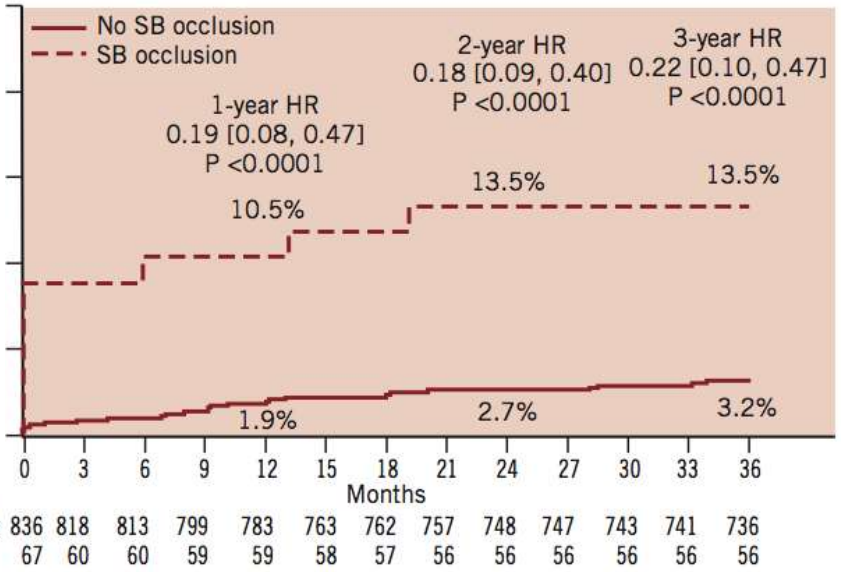


In the EES arm, 90.6% patients had side branches
In PES arm, 91.3% patients had side branches

Side branch occlusion frequency



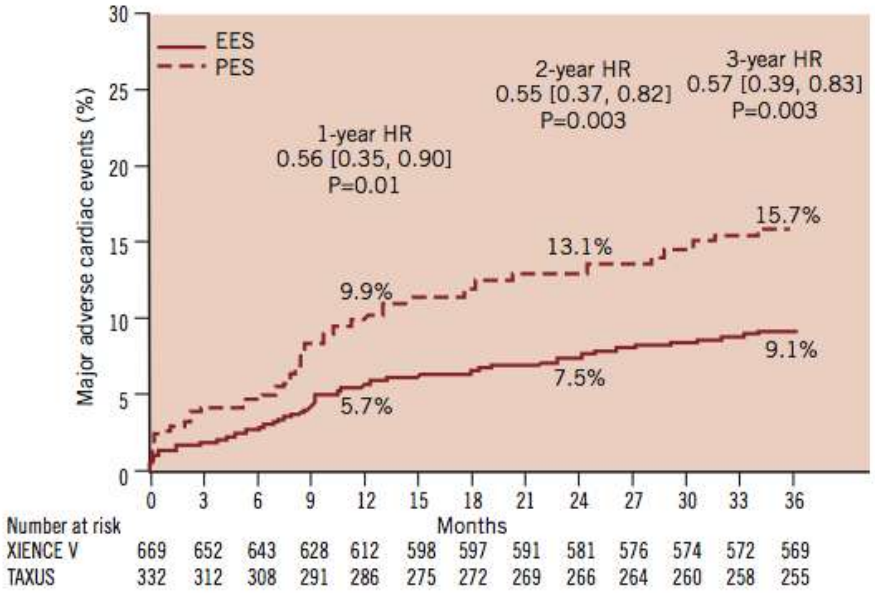
Non-Q-MI in patients with or without SB occlusion



Lansky AJ et al. EuroIntervention 2010; 6 Suppl J:J44-52.

3-year Results from SPIRIT III: Comparison of Everolimus- and Paclitaxel-Eluting Stent

Spirit III: KM curve for MACE through three years

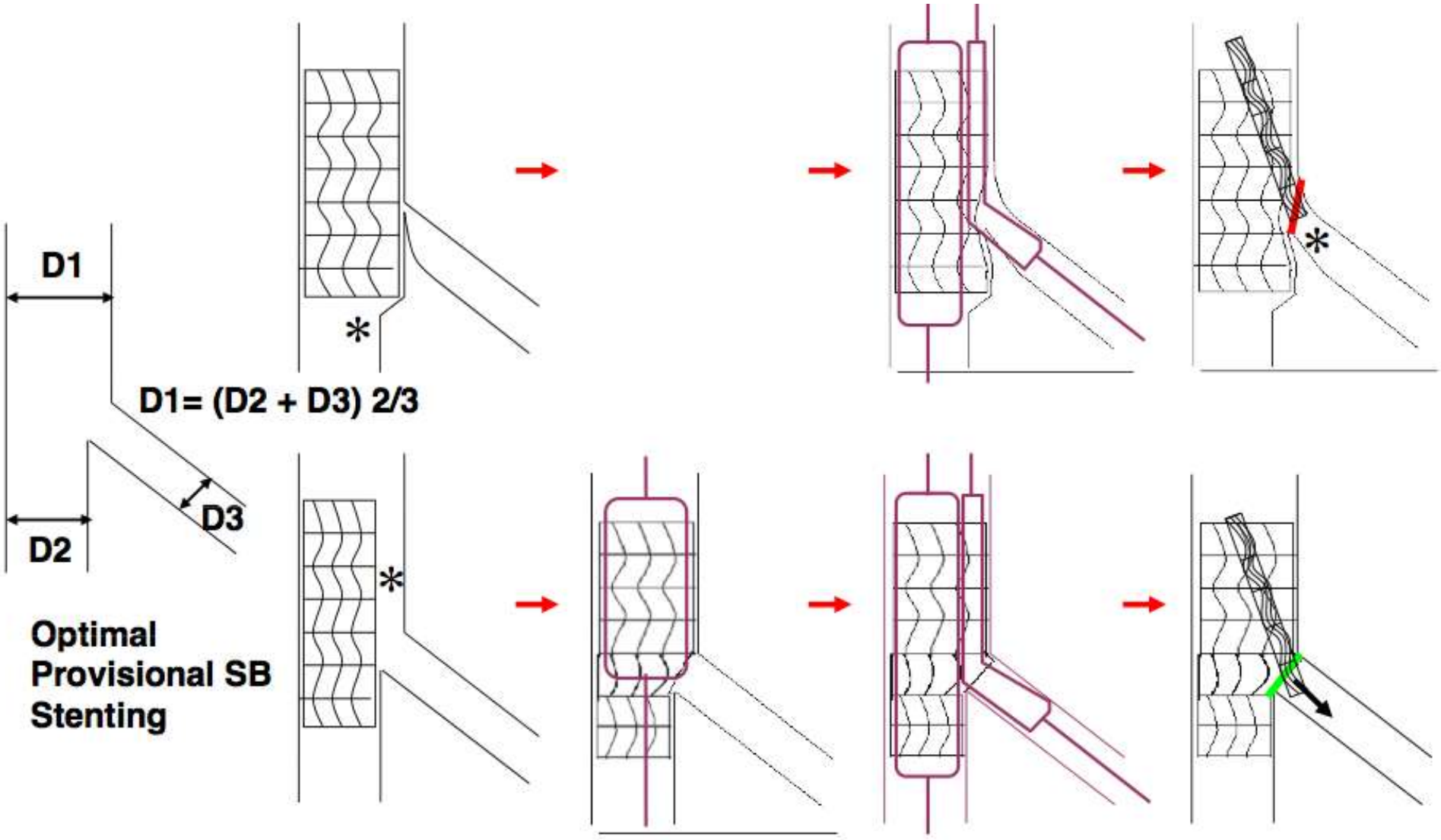


Clinical outcomes for patients with side branches

3 years clinical outcome	EES (n=606)	PES (n=304)	P value
Cardiac death	1.6%	1.8%	0.78
QMI	0.5%	0.7%	0.67
NQMI	3.3%	6.1%	0.07
TLR	5.8%	9.7%	0.05
MACE	9.8%	16.9%	0.005

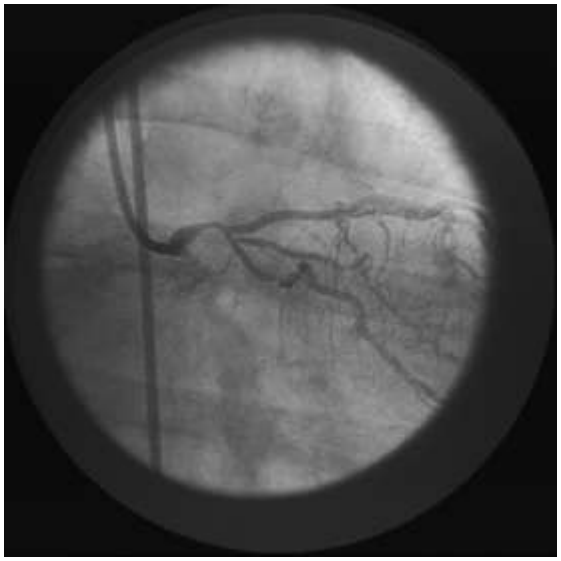
Lansky AJ et al. EuroIntervention 2010; 6 Suppl J:J44-52.

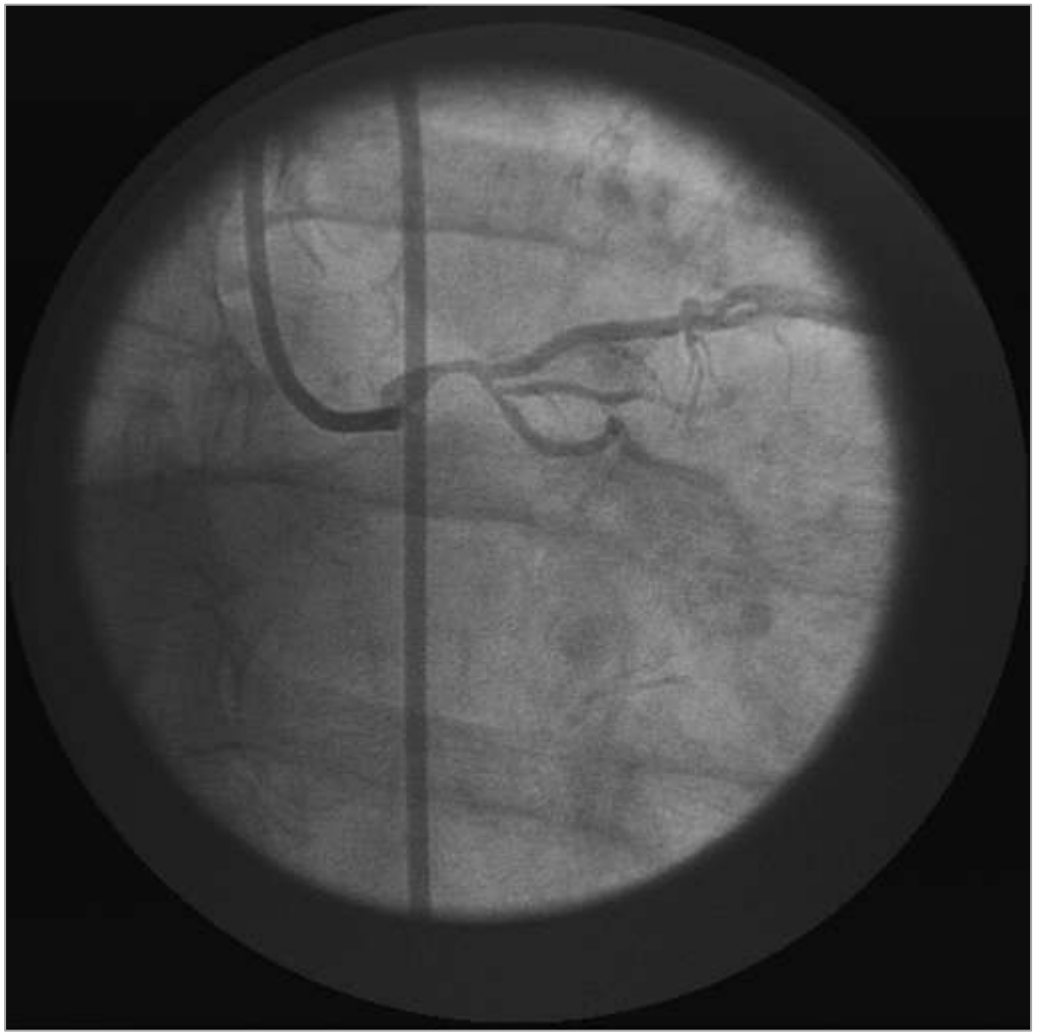
Proximal optimisation technique



Y Louvard, TCTAP 2011

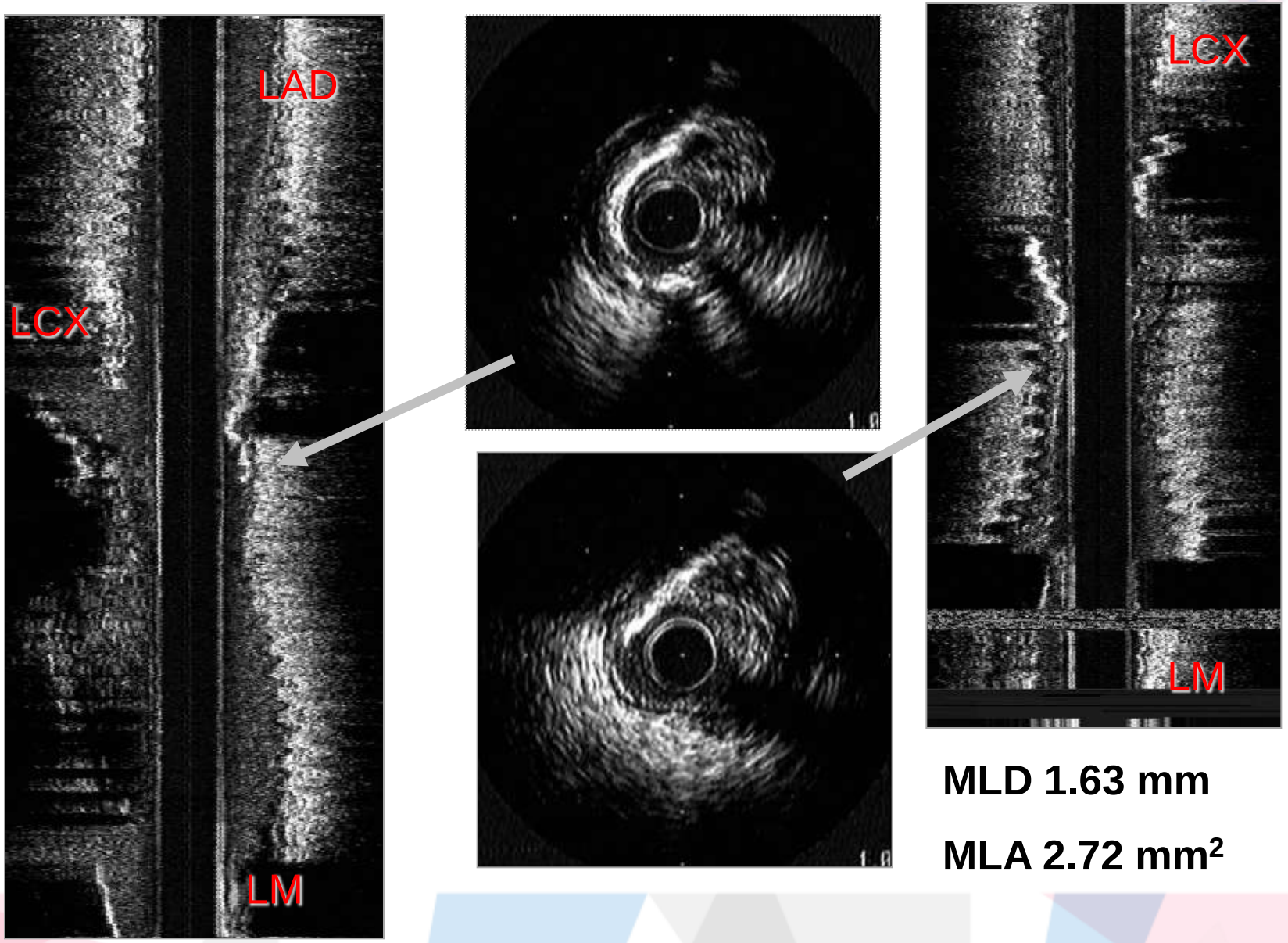
Case Example





- Patient:
  - Female, 64 yo
  - Stable angina, CCS III
  - Risk factors – arterial hypertension, family history
- Materials used:
  - 7F XB 3.5 guiding catheter
  - Choice Floppy and Choice PT guidewires
  - GP IIb/IIIa inhibitor

IVUS Before Intervention



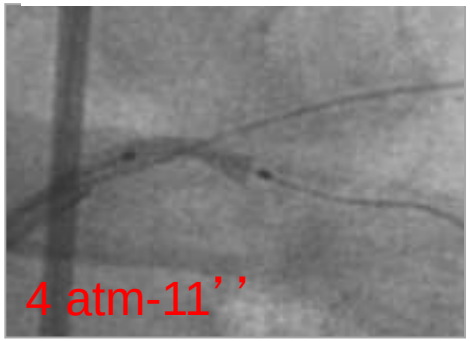
MLD 1.63 mm

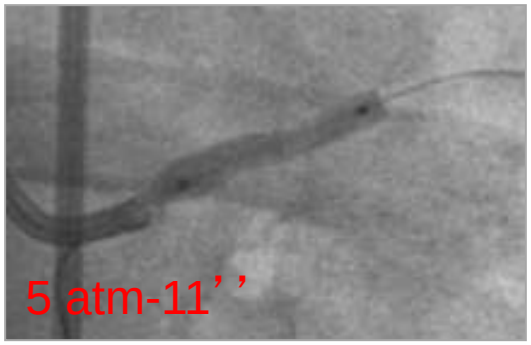
MLA 2.72 mm^2

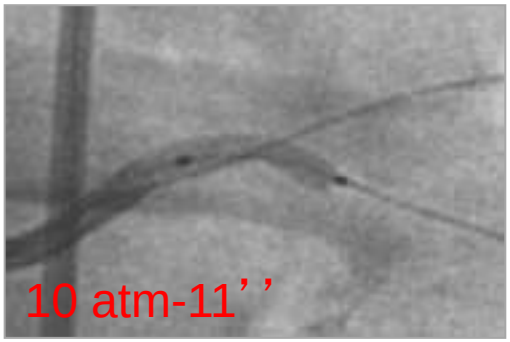
Plaque Preparation with Cutting Balloon

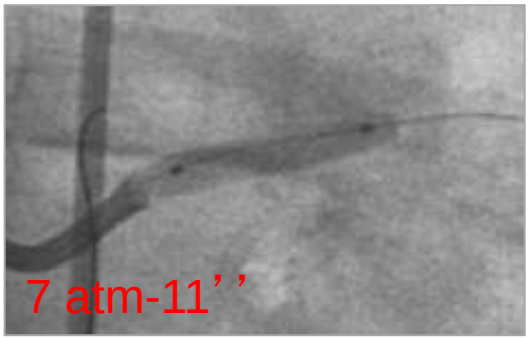
LM-LCX:
Flextome Cutting
Balloon 2.5x10 mm

LM-LAD:
Flextome Cutting
Balloon 3.75x15 mm

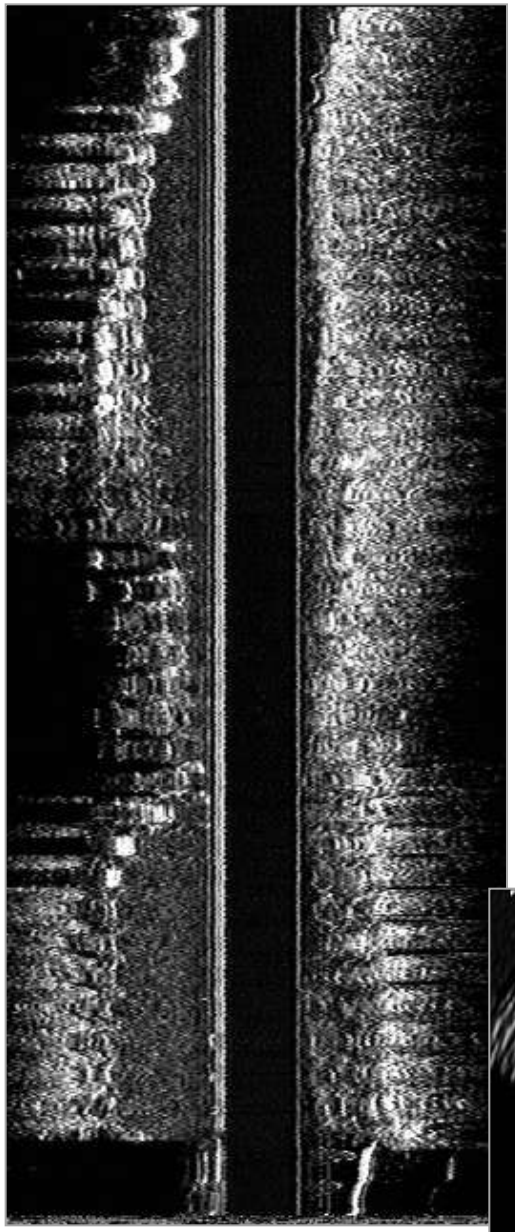






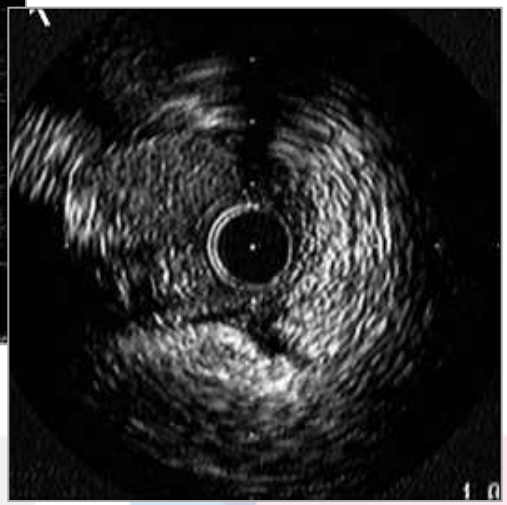


Result after CB intervention

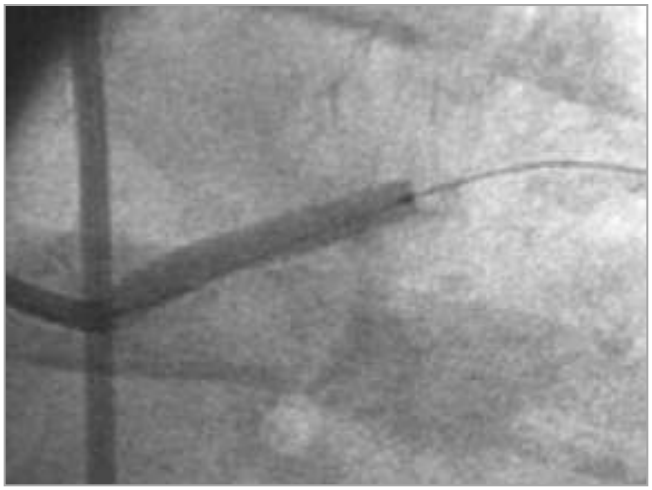


MLD 1.84 mm

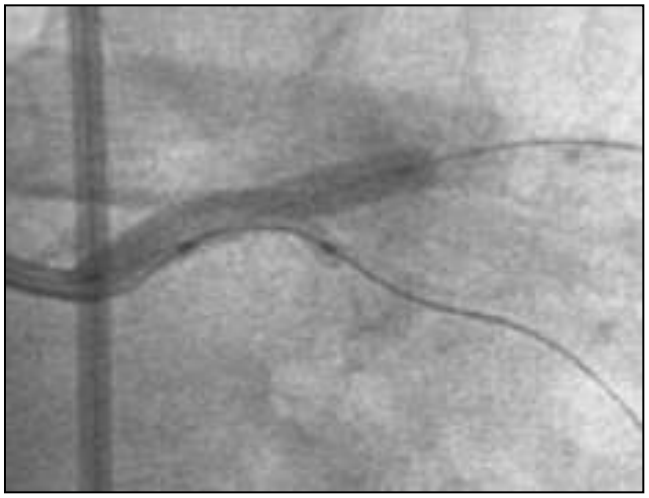
MLA 5.18 mm^2



Stenting and Postdilation



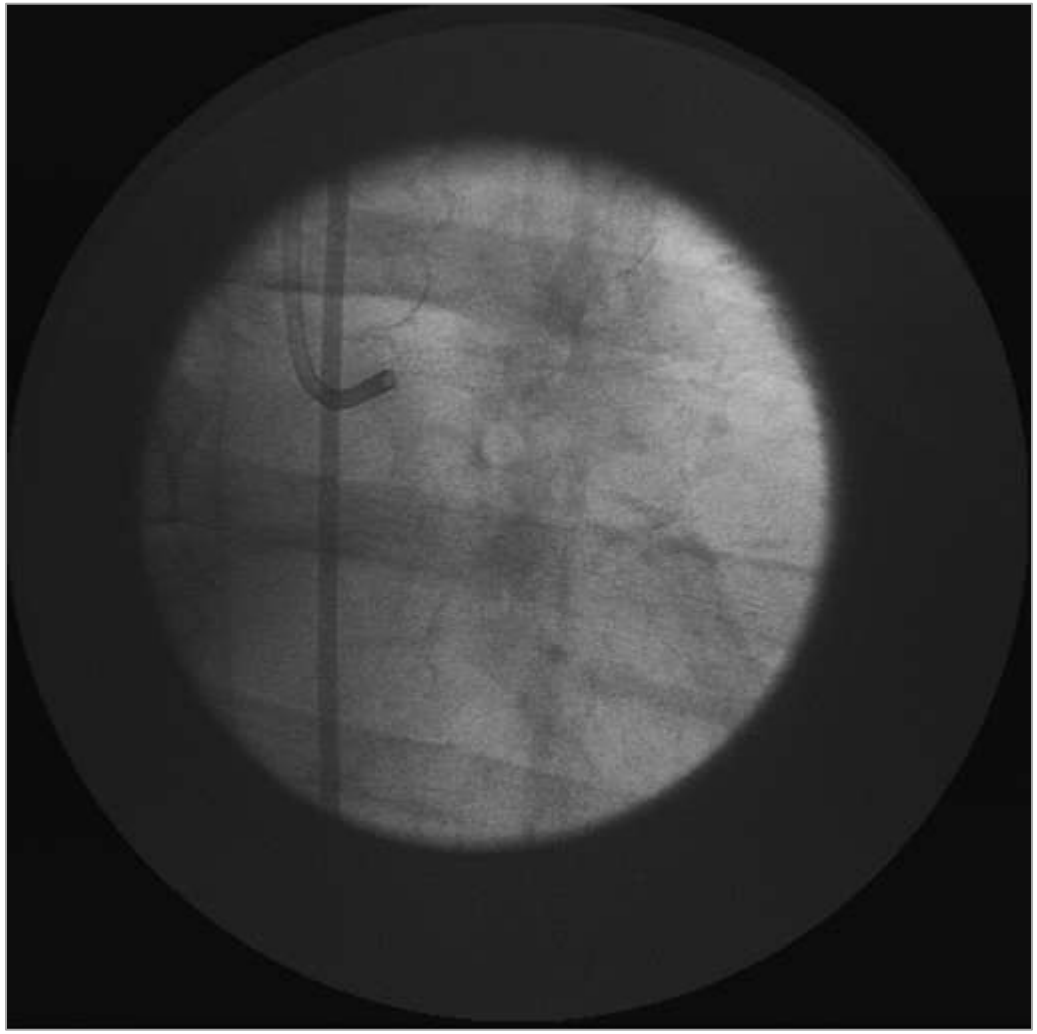
DES 3.5x24 mm
9 atm 21’’

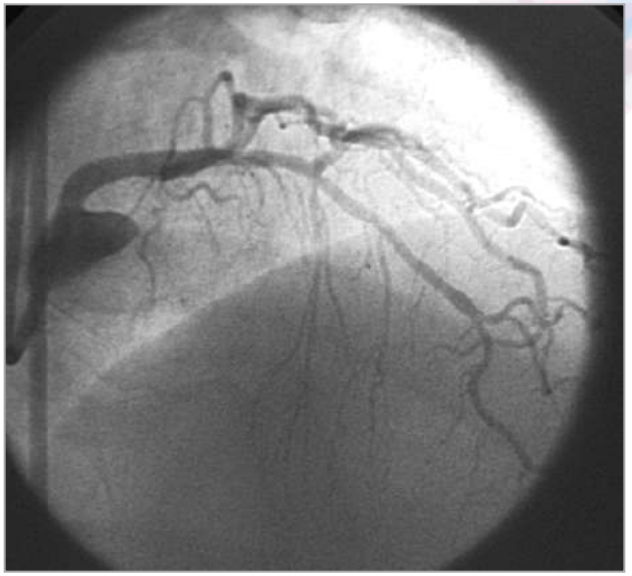


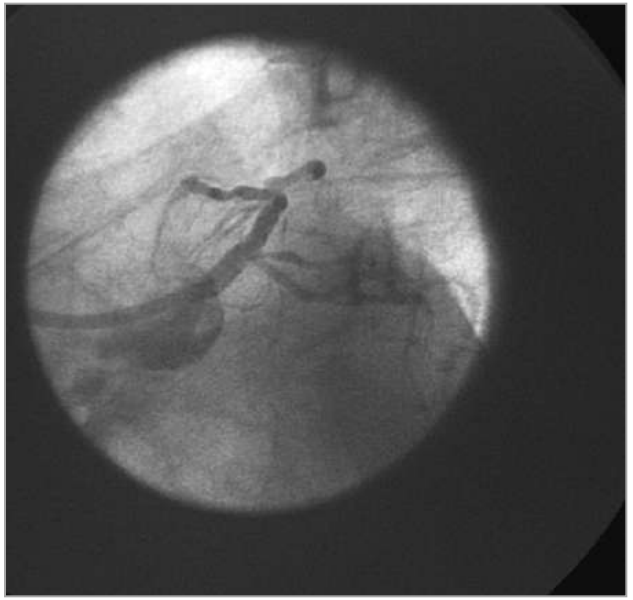
LAD – SC balloon 3.0x24 mm

LCX – NC balloon 2.5x12 mm

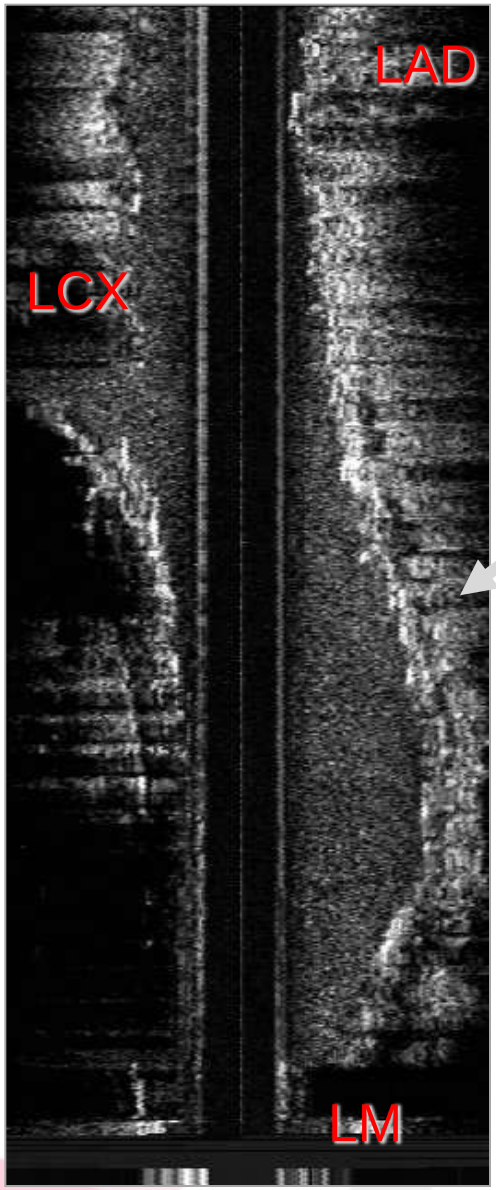
Final result

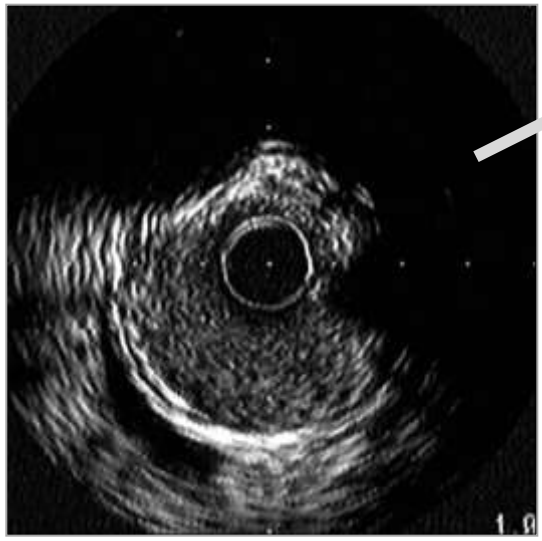


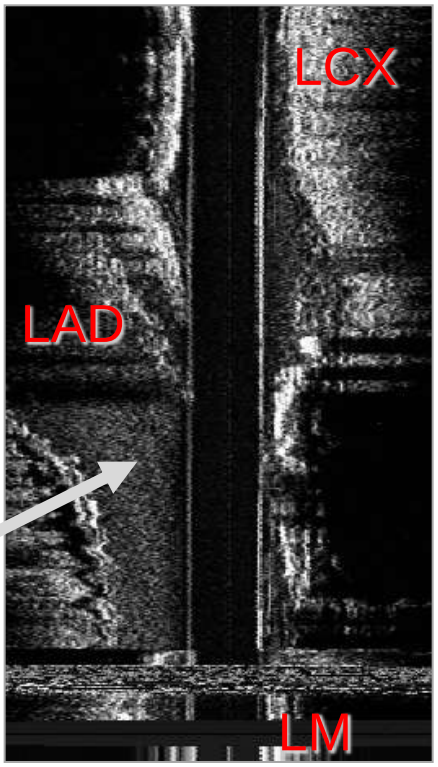




IVUS Post Intervention







MLD 3.00 mm

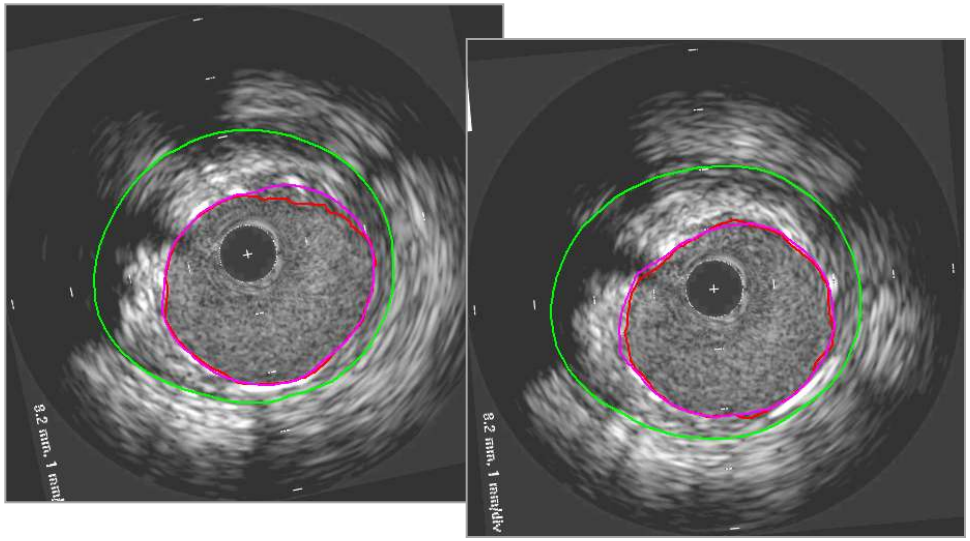
MLA 8.74 mm^2

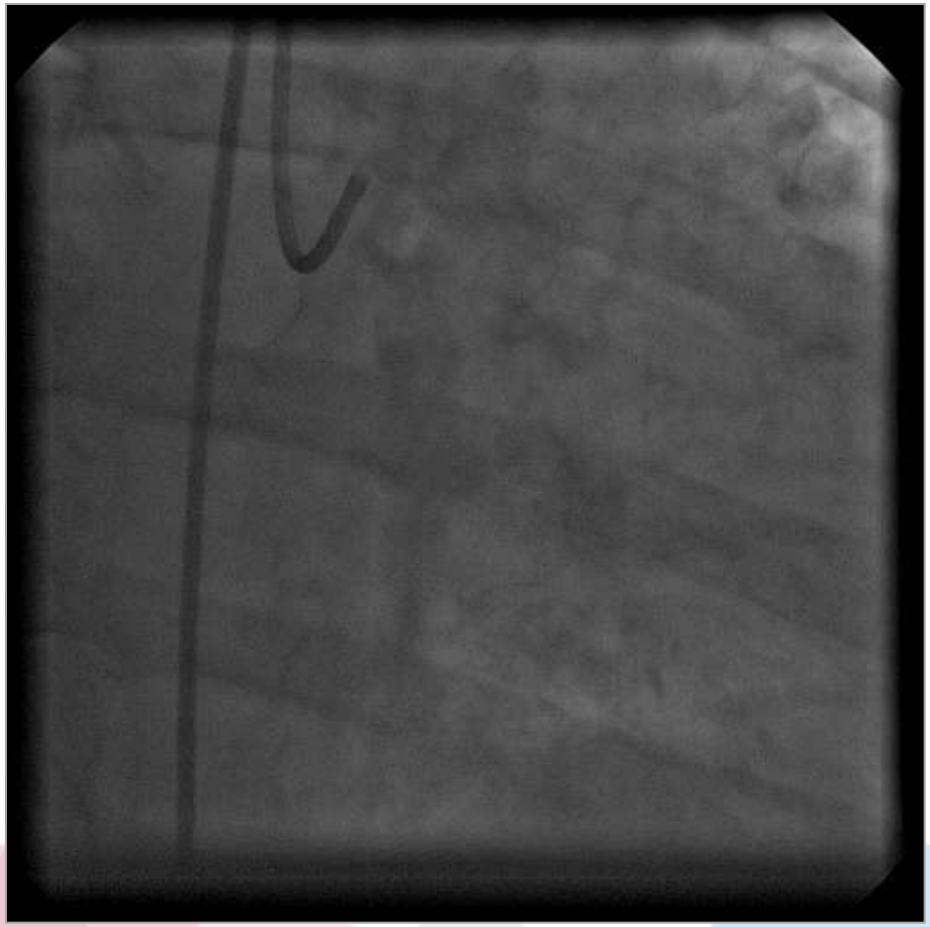
6 Months F-up

Left main:

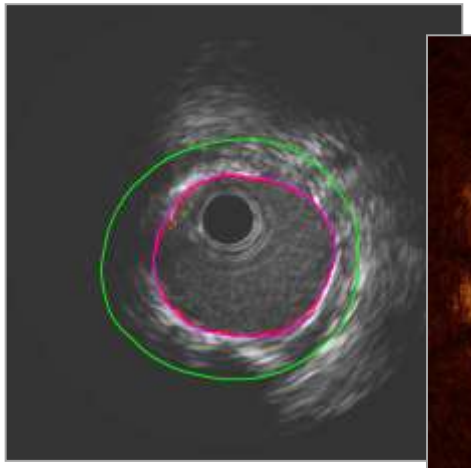
MLD 2.92 mm

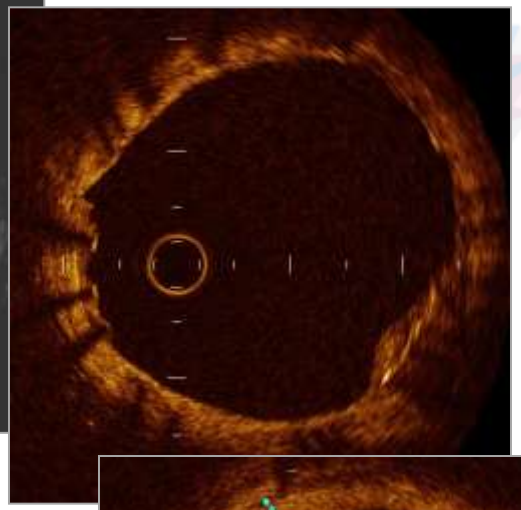
MLA 8.58 mm^2

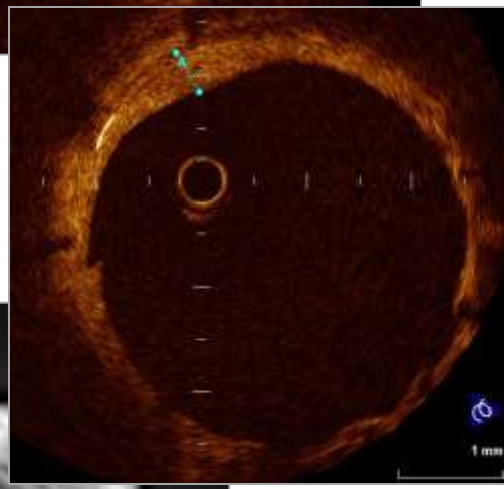


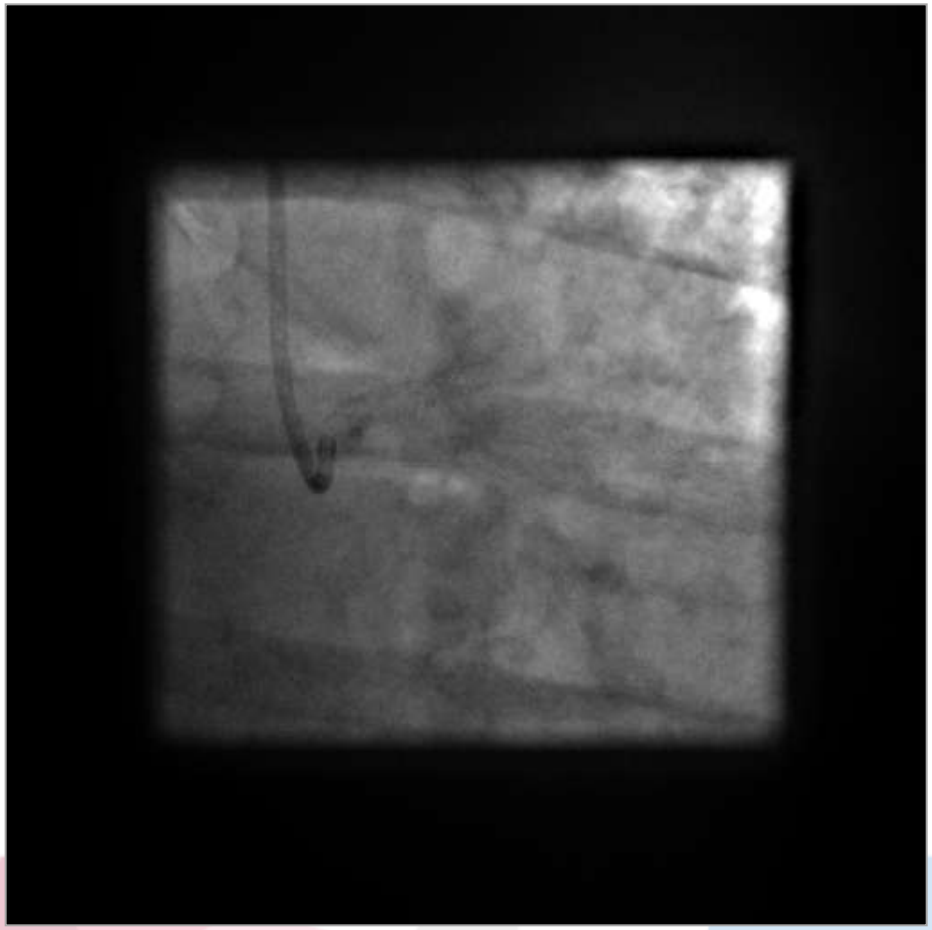


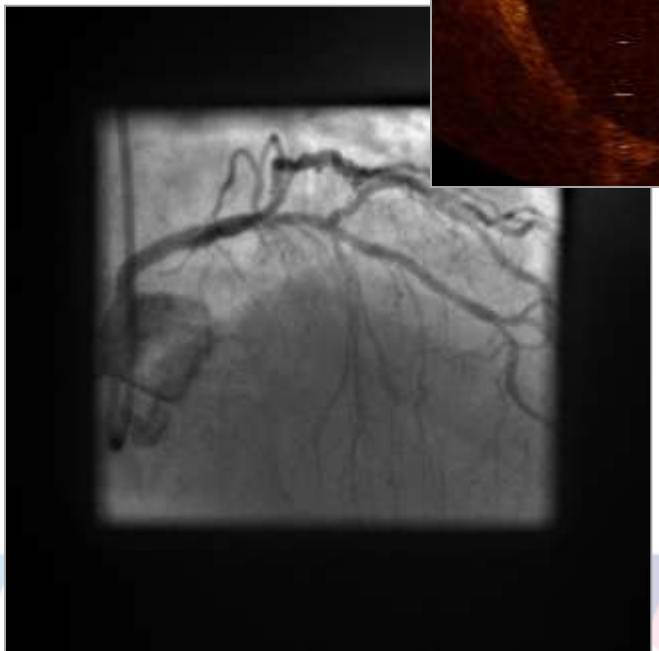
3 Years Follow-up



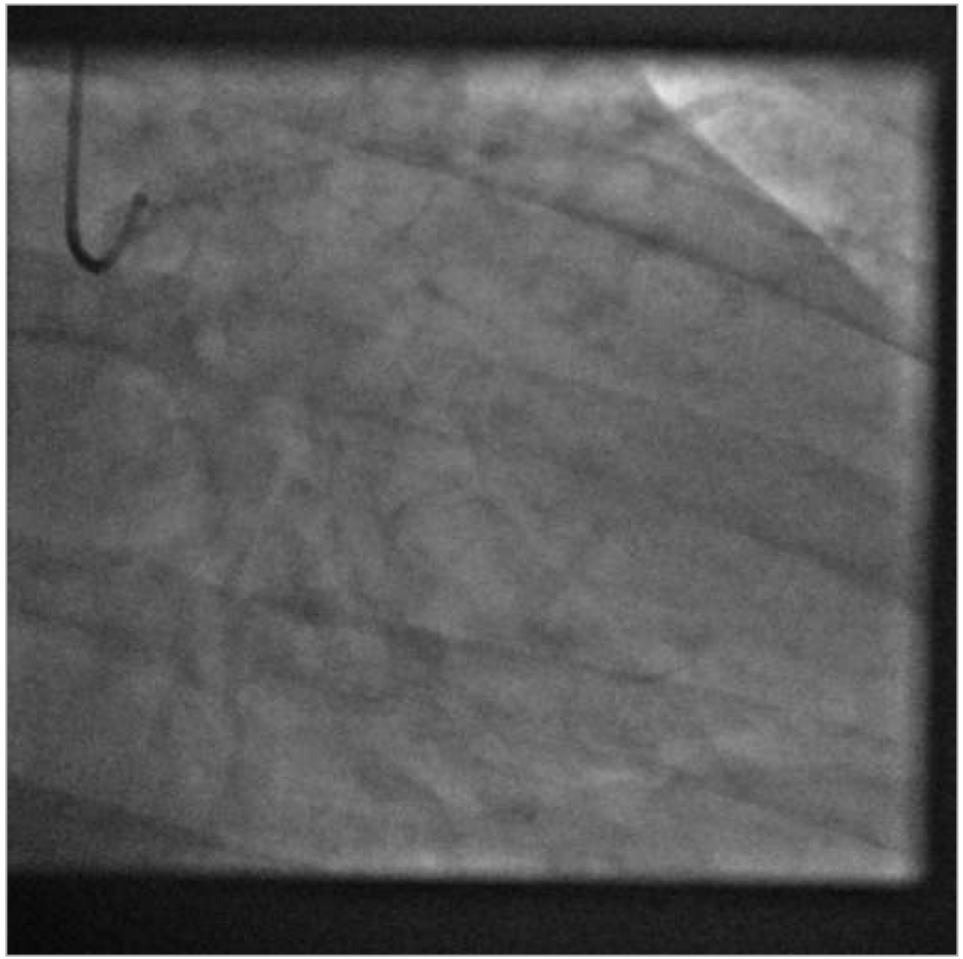


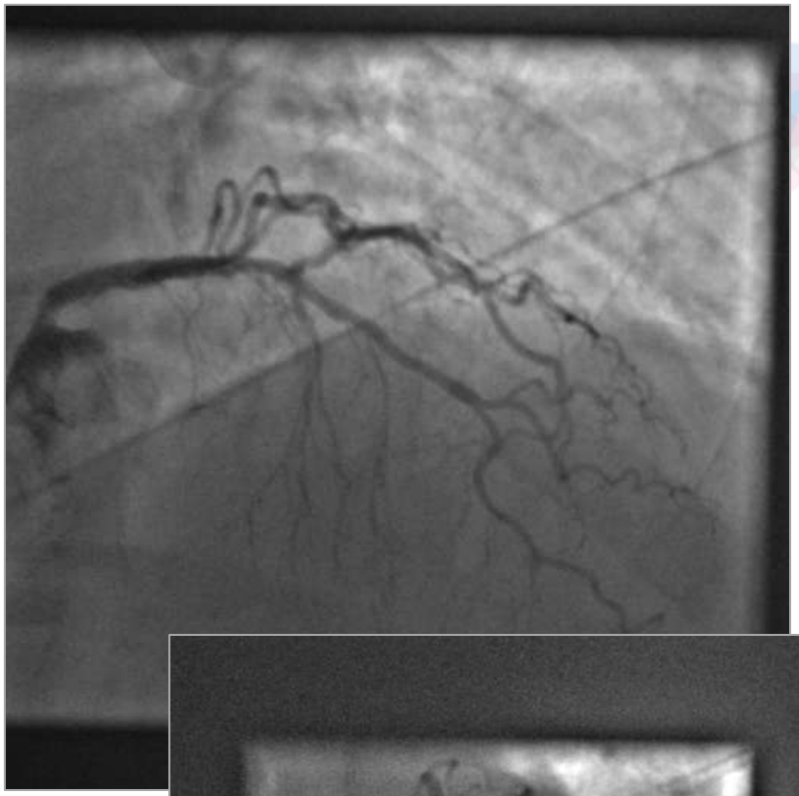


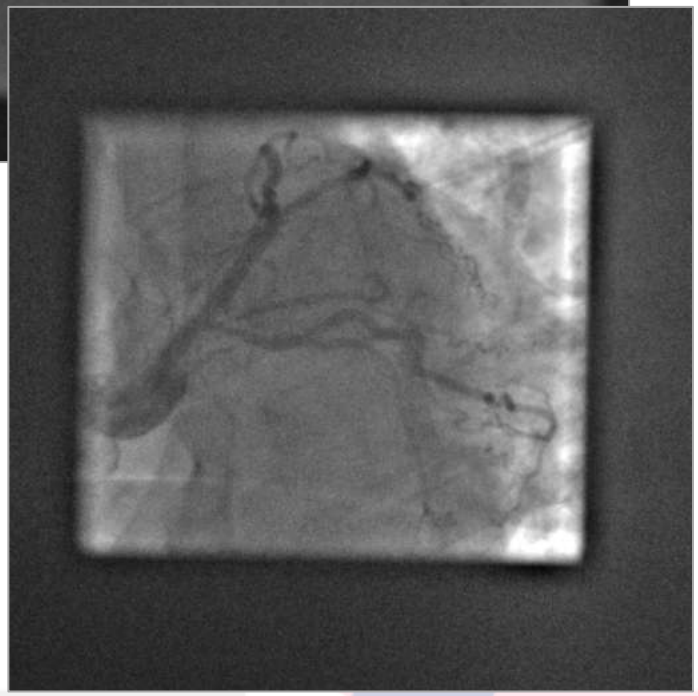




7 Years Follow-up







Conclusion

- Knowledge of anatomy is important, therefore, intravascular imaging is strongly recommended
- Lesion preparation with cutting or scoring ballloons according to intravascular imaging finding
- New generation DES may be preferable to first-generation DES
- POT technique could be recommended to to reproduce the anatomy of bifurcation