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Optimizing the LCX Ostium in Left Main Bifurcation PCI: Hidden Tips and Tricks

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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

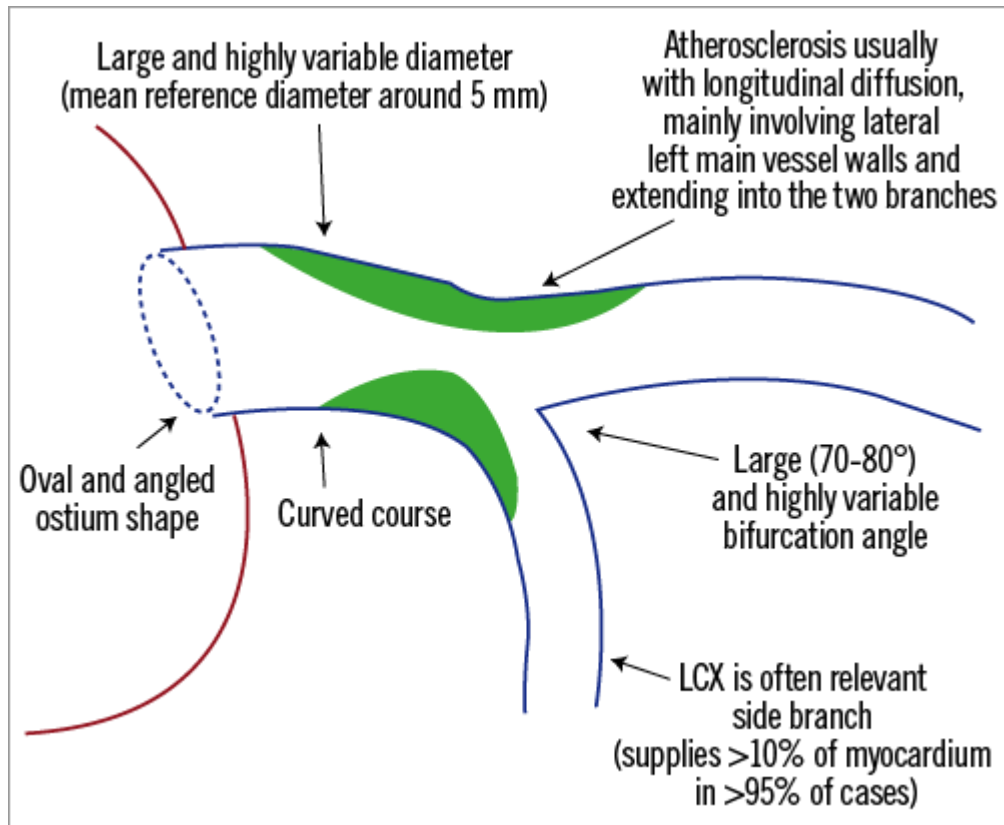
- Grant/Research Support
- Consulting Fees/Honoraria
- Stock shareholder:

Company

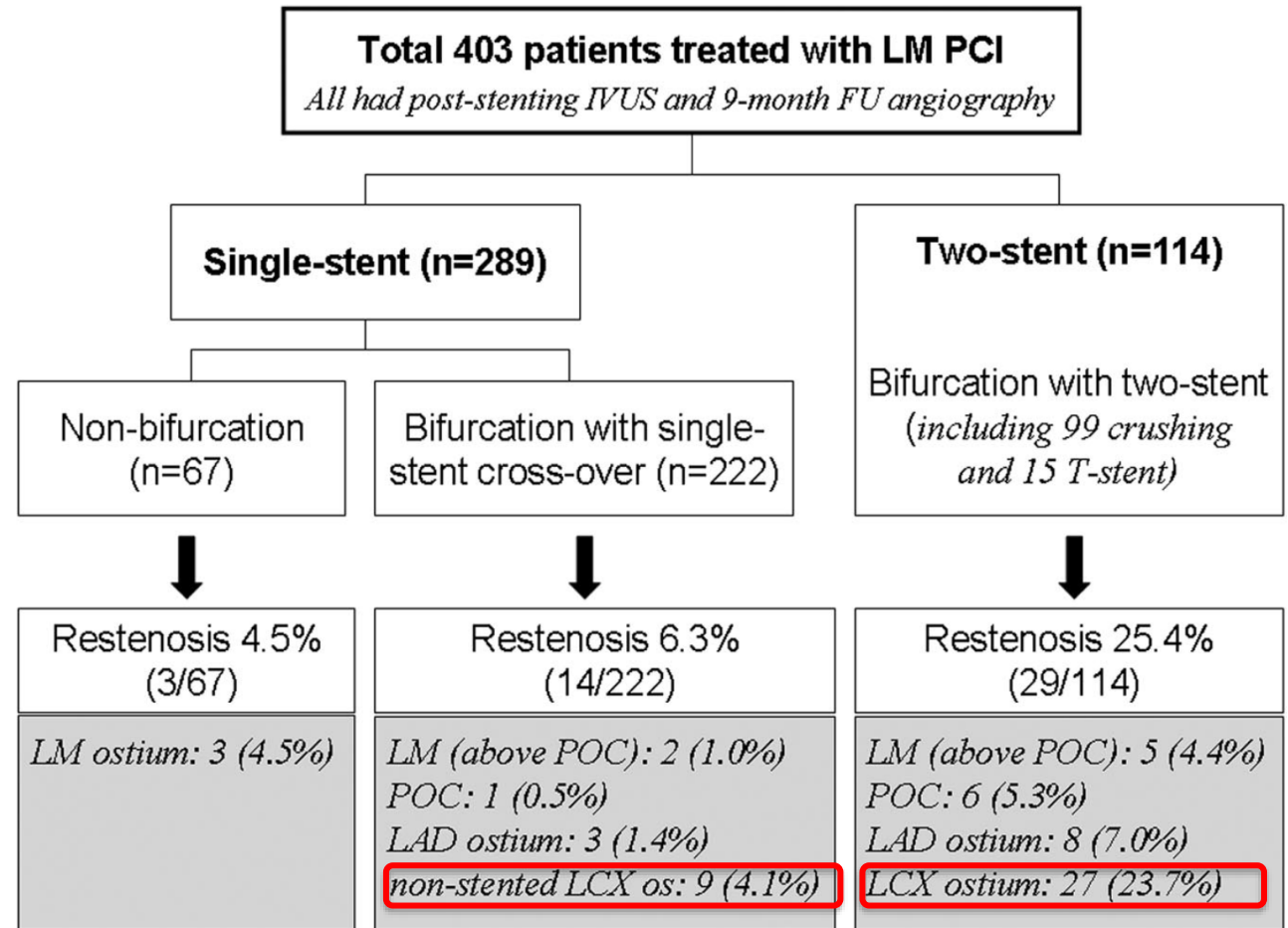
- Abbott Vascular, Boston Scientific, HeartFlow, Inc, MVRx
- Amgen, Abbott Laboratories, Astra-Zeneca, Bayer, Boehringer Ingelheim, GlaxoSmithKline, Berlin Chemie / Menarini, Merck, Pfizer, Roche, Sandoz, Sanofi, Servier Laboratories, Siemens laboratories, Abbott Vascular, Boston Scientific, Biotronik, Biosensors, Cordis,
- CERC

Q: The weakest link in the left main stenting?

A: LCX ostium



Incidence of angiographic restenosis
Data from the Asan Medical Center, Seoul, Korea

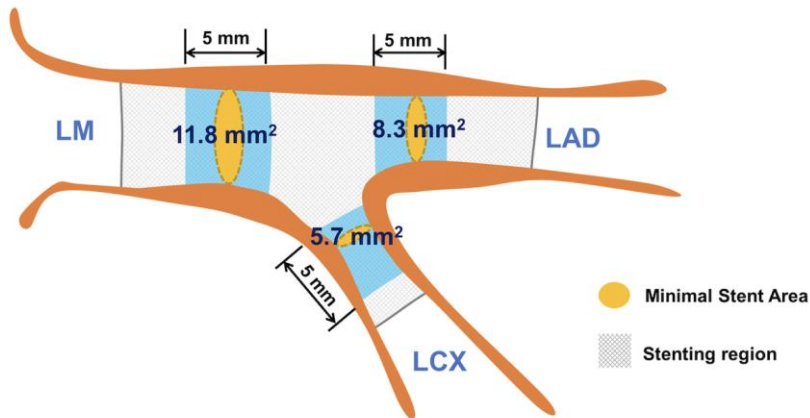


Q: Predictors of MACE in LM PCI (DK-Crush)?

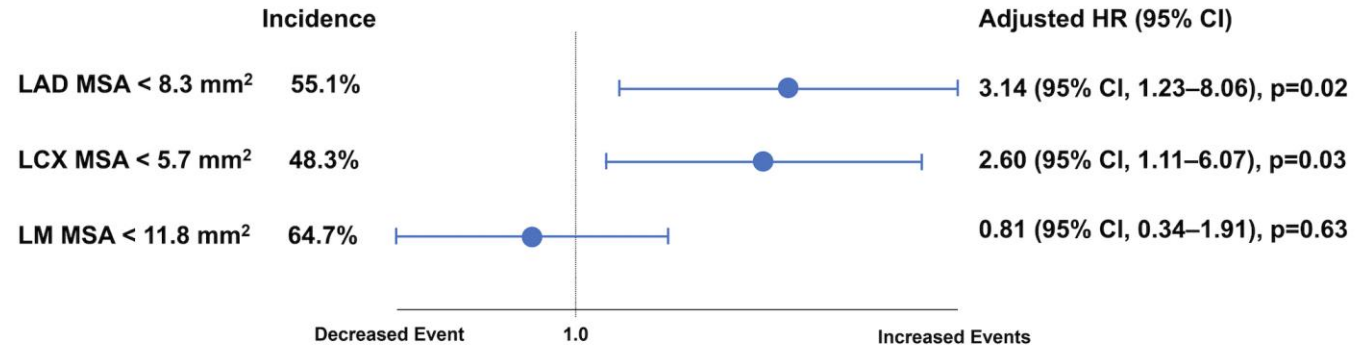
A: Stent underexpansion

292 consecutive patients with LM bifurcation stenosis who were treated using the crush technique. The final minimal stent area was measured in the ostial left anterior descending artery (LAD), ostial left circumflex artery (LCX), and distal LM. The primary outcome was 5-year major adverse cardiac events, including all-cause death, myocardial infarction, and TLR.

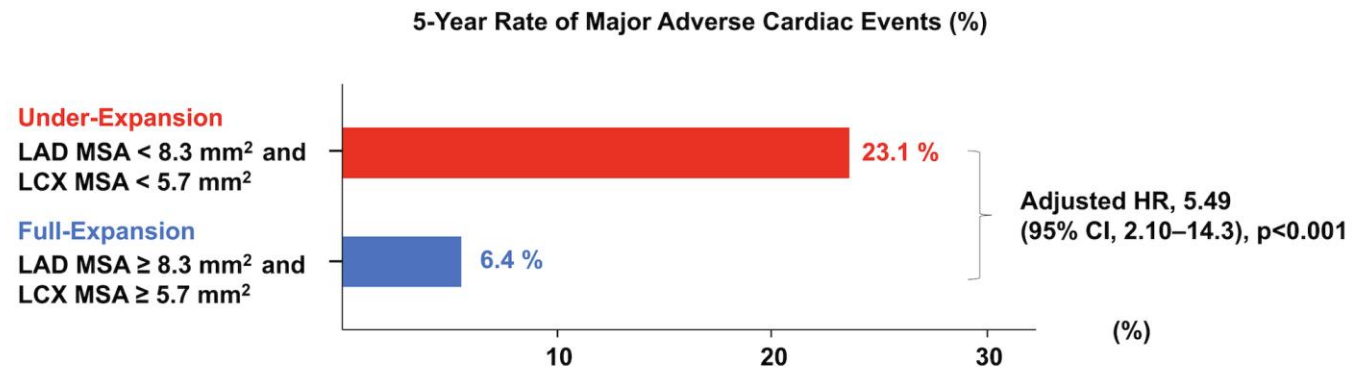
The Optimal Minimal Stent Area within Each Left Main Segment



Stent Under-Expansion Criteria in LM Two-Stenting With the Crush Technique



Major Adverse Cardiac Events at 5 Years according to Stent Under-Expansion



Q: The impact of LCX ostium on outcomes?

A: Minor?

Consecutive 564 patients with unprotected LM (ULMCA) disease who underwent LM PCI with at least 1 year of available follow-up were included in the study (145 patients with ULMCA disease with LCX ostium stenosis, 419 patients with ULMCA disease without LCX ostium stenosis)

Department of Cardiology, Poznań University of Medical Sciences, Poznań, Poland

Mortality: LM (+LCX) vs LM (-LCX)

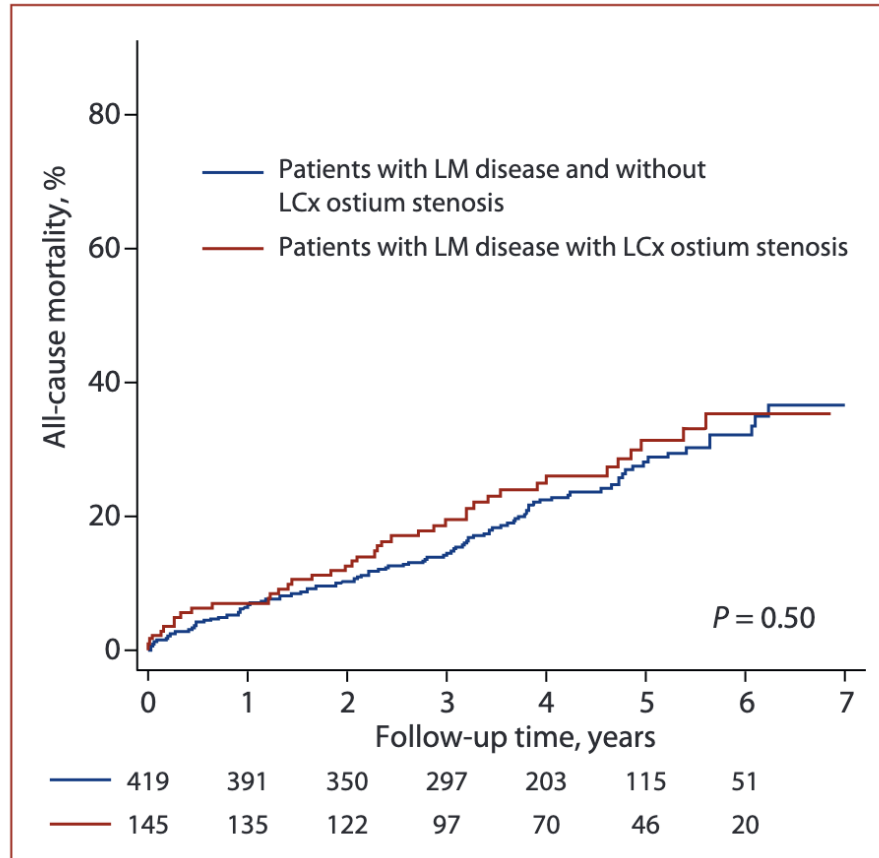


Figure 1. Kaplan-Meier analysis of all-cause mortality: patients with unprotected LM disease with LCx ostium stenosis vs. patients with unprotected LM disease without LCx ostium stenosis

Mortality in LM (+LCX): 1 stent vs 2 stents

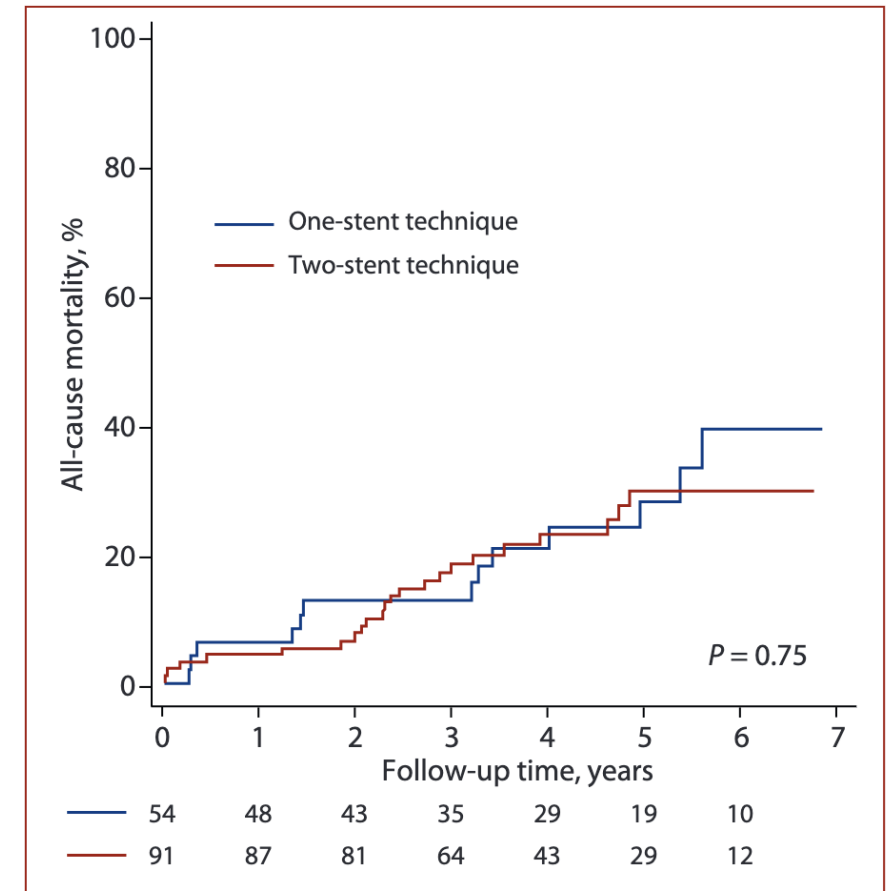


Figure 2. Kaplan-Meier analysis of all-cause mortality: one-stent vs. two-stent technique in patients with unprotected LM disease with LCx ostium stenosis

How to improve outcome in LCX ostium?

Success depends upon previous preparation, and without such preparation there is sure to be failure.

internetpoem.com



Confucius

Treatment of coronary bifurcation lesions, part I: implanting the first stent in the provisional pathway. The 16th expert consensus document of the European Bifurcation Club

Remo Albiero^{1*}, MD; Francesco Burzotta², MD, PhD; Jens Flensted Lassen³, MD, PhD; Thierry Lefèvre⁴, MD; Adrian P. Banning⁵, MD, PhD; Yiannis S. Chatzizisis⁶, MD, PhD; Thomas W. Johnson⁷, MD; Miroslaw Ferenc⁸, MD, PhD; Manuel Pan⁹, MD, PhD; Olivier Darremont¹⁰, MD; David Hildick-Smith¹¹, MD; Alaide Chieffo¹², MD; Yves Louvard⁴, MD; Goran Stankovic¹³, MD

3-stage approach (ABC) to deployment of the first stent:

- **Stage A:** wiring of the MV and SB
 - Imaging - preintervention
- **Stage B:** MV and SB preparation
- **Stage C:** stent implantation and optimisation.
 - Imaging - postintervention

Albiero R, et al. EuroIntervention. 2022 Aug 5;18(5):e362-e376.

Lassen JF, et al. EuroIntervention. 2022 Aug 19;18(6):457-470.

Pan M, et al. EuroIntervention. 2023 May 15;19(1):26-36.

Treatment of coronary bifurcation lesions, part II: implanting two stents. The 16th expert consensus document of the European Bifurcation Club

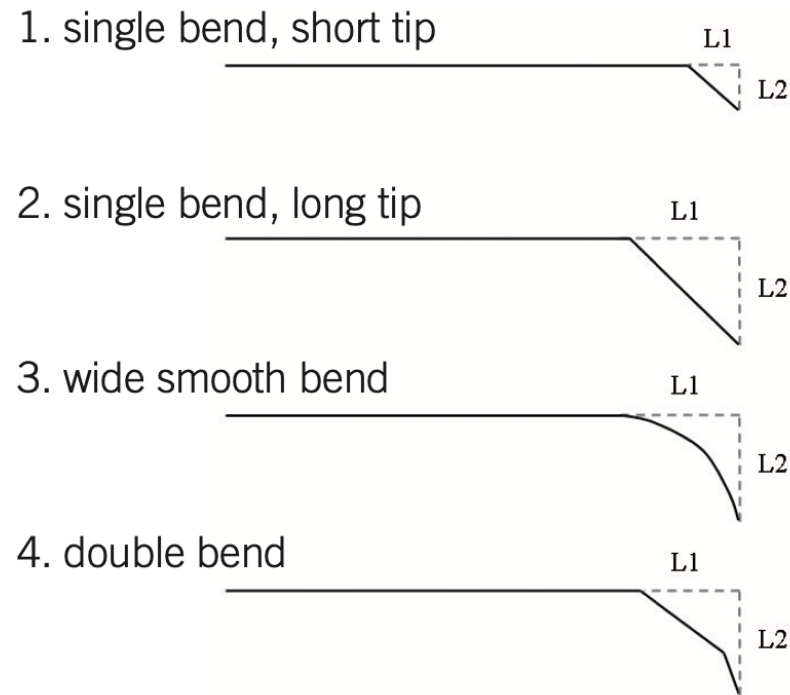
Jens Flensted Lassen^{1*}, MD, PhD; Remo Albiero², MD; Thomas W. Johnson³, MD; Francesco Burzotta⁴, MD, PhD; Thierry Lefèvre⁵, MD; Tinen L. Iles⁶, PhD; Manuel Pan⁷, MD, PhD; Adrian P. Banning⁸, MD, PhD; Yiannis S. Chatzizisis⁹, MD, PhD; Miroslaw Ferenc¹⁰, MD, PhD; Vladimir Dzavik¹¹, MD; Dejan Milasinovic¹², MD; Olivier Darremont¹³, MD; David Hildick-Smith¹⁴, MD; Yves Louvard⁵, MD; Goran Stankovic¹², MD, PhD

The 17th expert consensus document of the European Bifurcation Club – techniques to preserve access to the side branch during stepwise provisional stenting

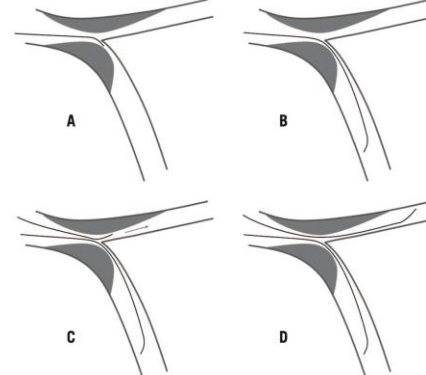
Manuel Pan¹, MD, PhD; Jens Flensted Lassen^{2*}, MD, PhD; Francesco Burzotta³, MD, PhD; Soledad Ojeda¹, MD, PhD; Remo Albiero⁴, MD; Thierry Lefèvre⁵, MD; David Hildick-Smith⁶, MD; Thomas W. Johnson⁷, MD; Alaide Chieffo⁸, MD; Adrian P. Banning⁹, MD, PhD; Miroslaw Ferenc¹⁰, MD, PhD; Olivier Darremont¹¹, MD; Yiannis S. Chatzizisis¹², MD, PhD; Yves Louvard⁵, MD; Goran Stankovic¹³, MD, PhD

Stage A – MV and SB wiring

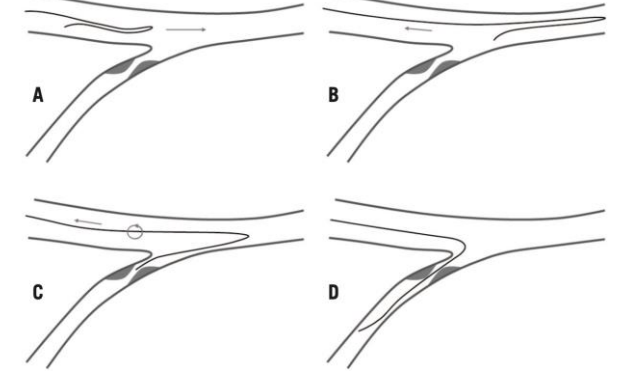
Guidewire selection, shaping and wiring techniques plus operator's experience and creativity



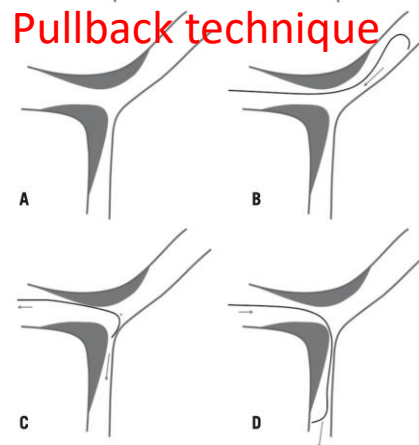
Standard technique



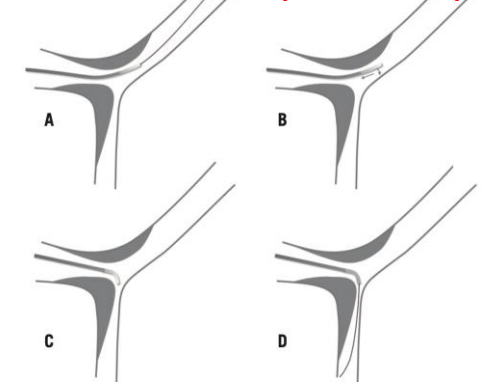
Reverse wire technique



Pullback technique



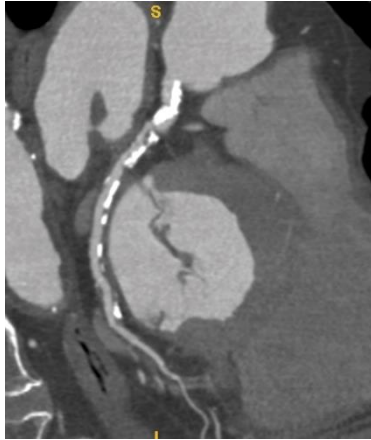
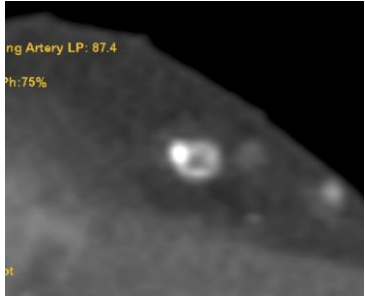
Deflectable-tip technique



Microcatheter-facilitated technique

Balloon backstop technique and others

pre Stage B – Imaging and (?) physiology

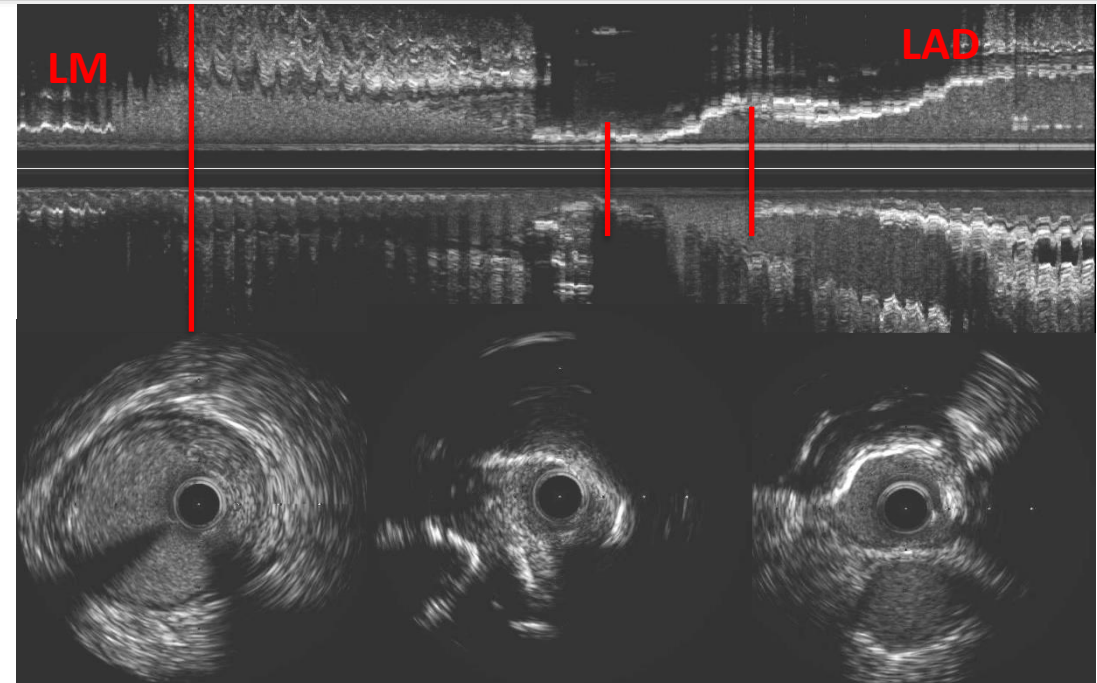
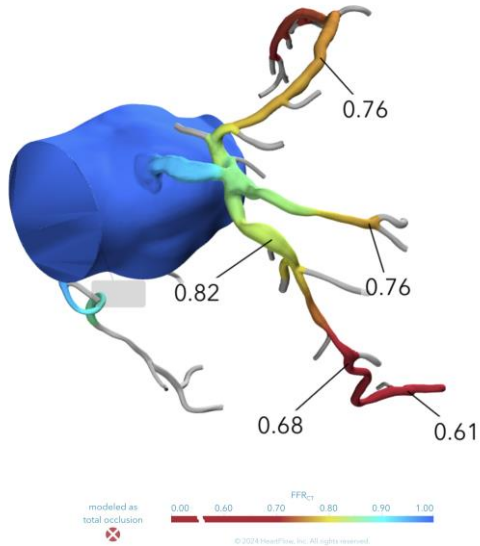


Imaging:

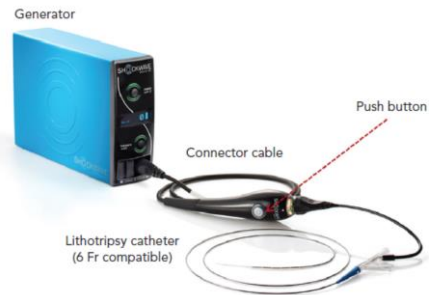
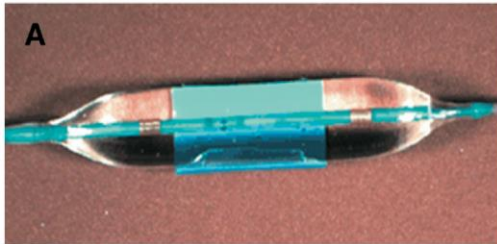
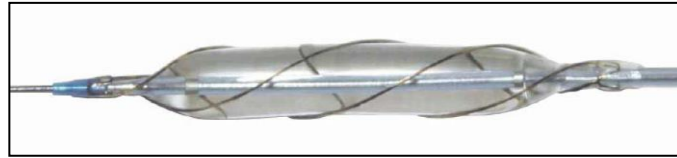
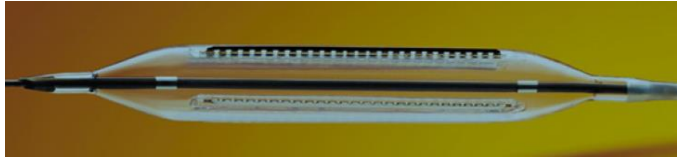
- True lumen/vessel measurements, lesion length
- Plaque burden, morphology and distribution
- Bifurcation angle

Guidance:

- Plaque modification?
- Balloon/stent sizing

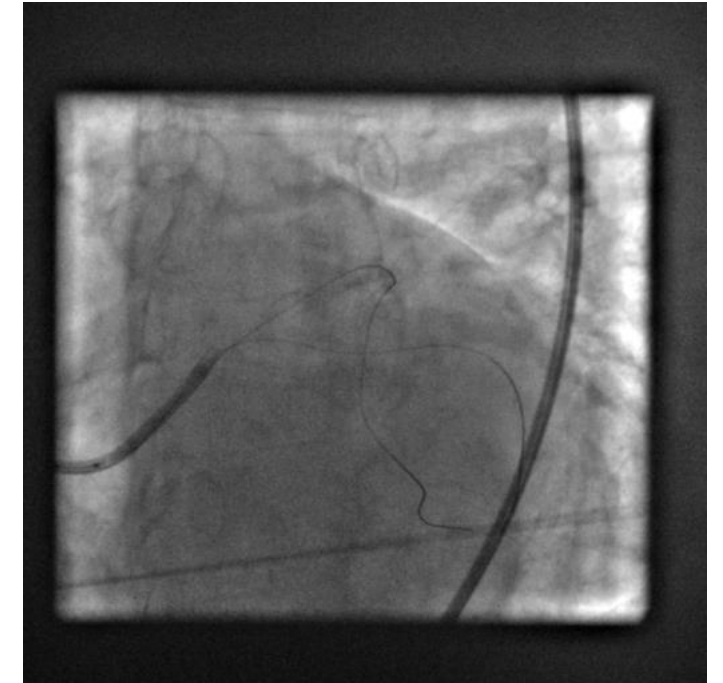
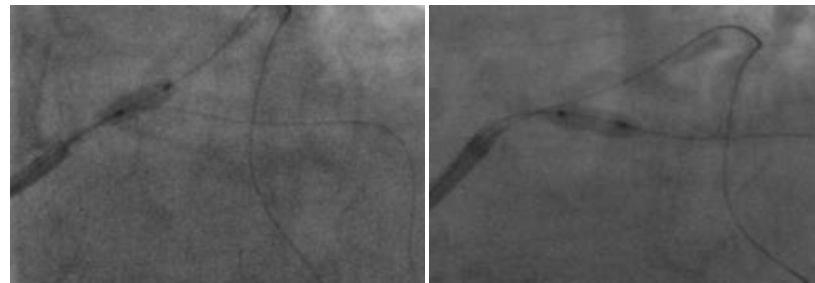
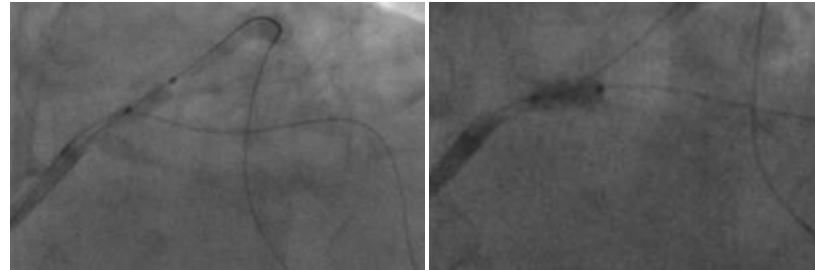


Stage B – MV and SB preparation



Predilatation of LM/LAD
Cutting balloon 3.25x6 mm
8,10,12 bar

Predilatation of LM/LCX
Cutting balloon 3.25x6 mm
8,10,12 bar



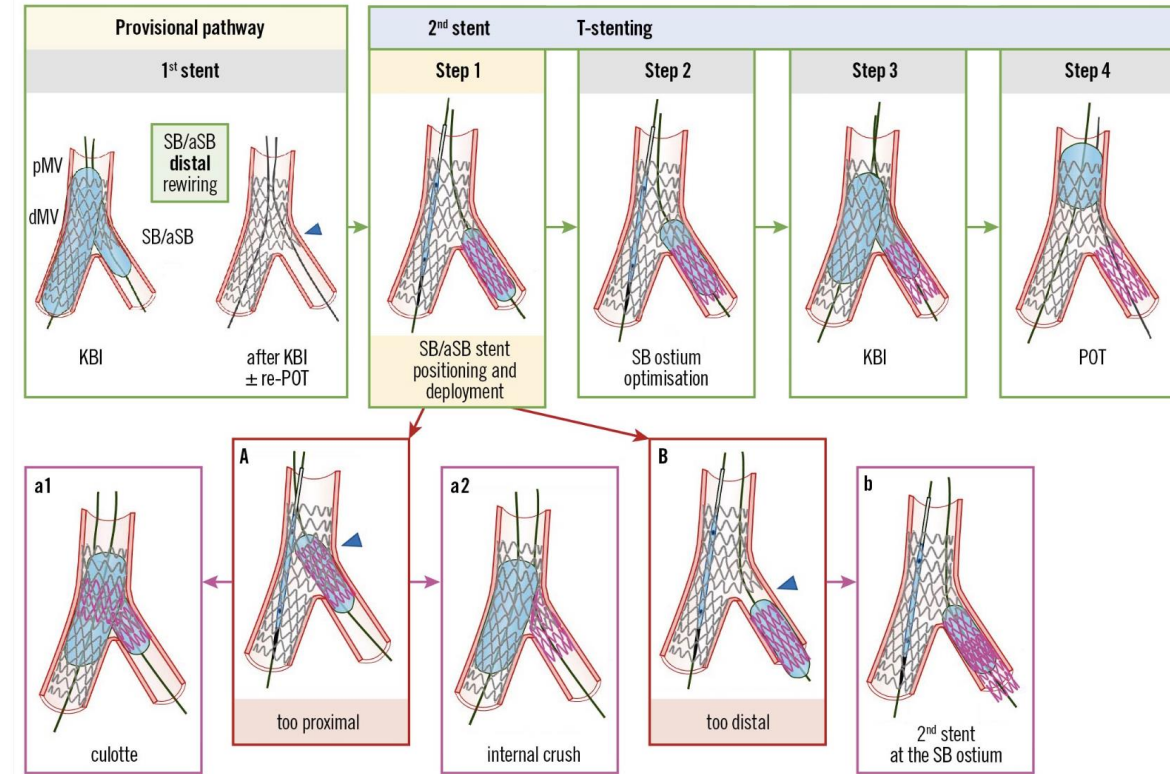
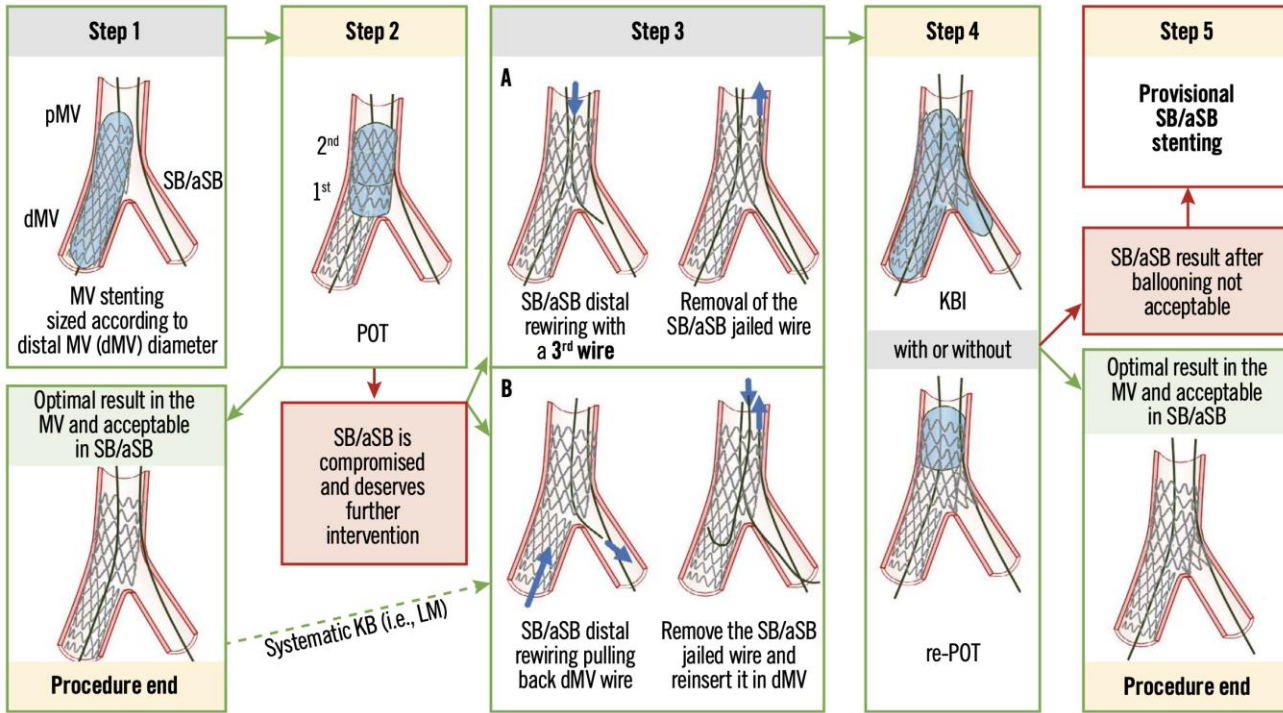
Mandatory preparation of LCX:

Severe stenosis, calcified, angulated lesion

Stage C – Stent implantation and optimisation

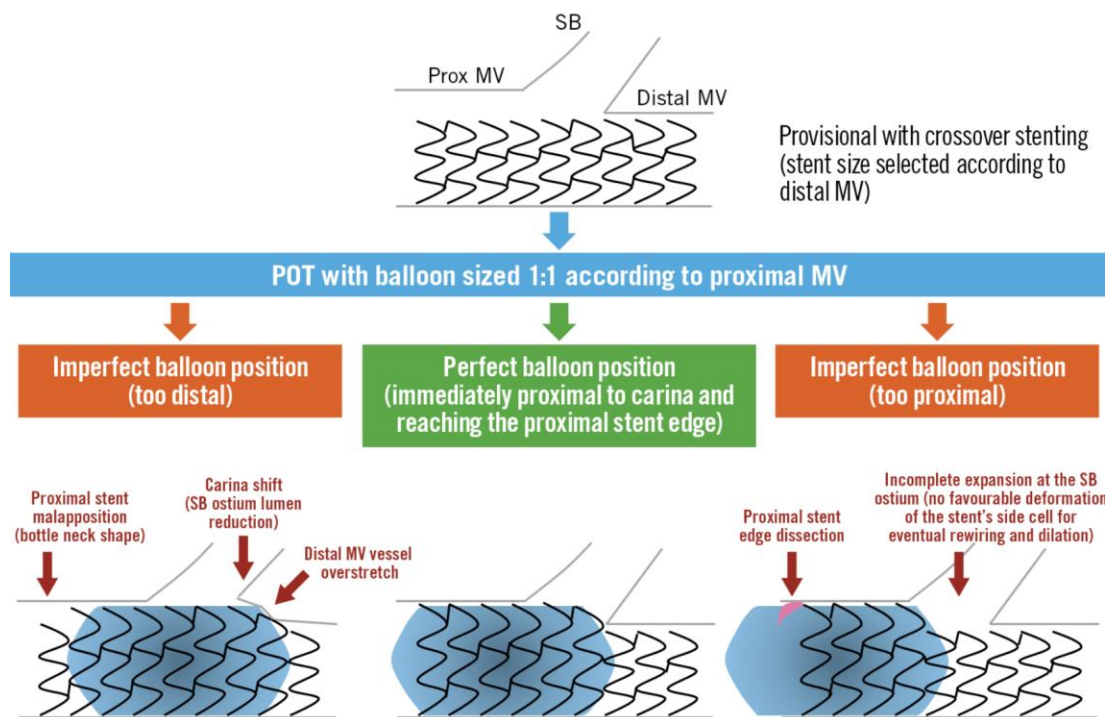
Provision stent strategy

Two-stent strategy, bail-out or upfront

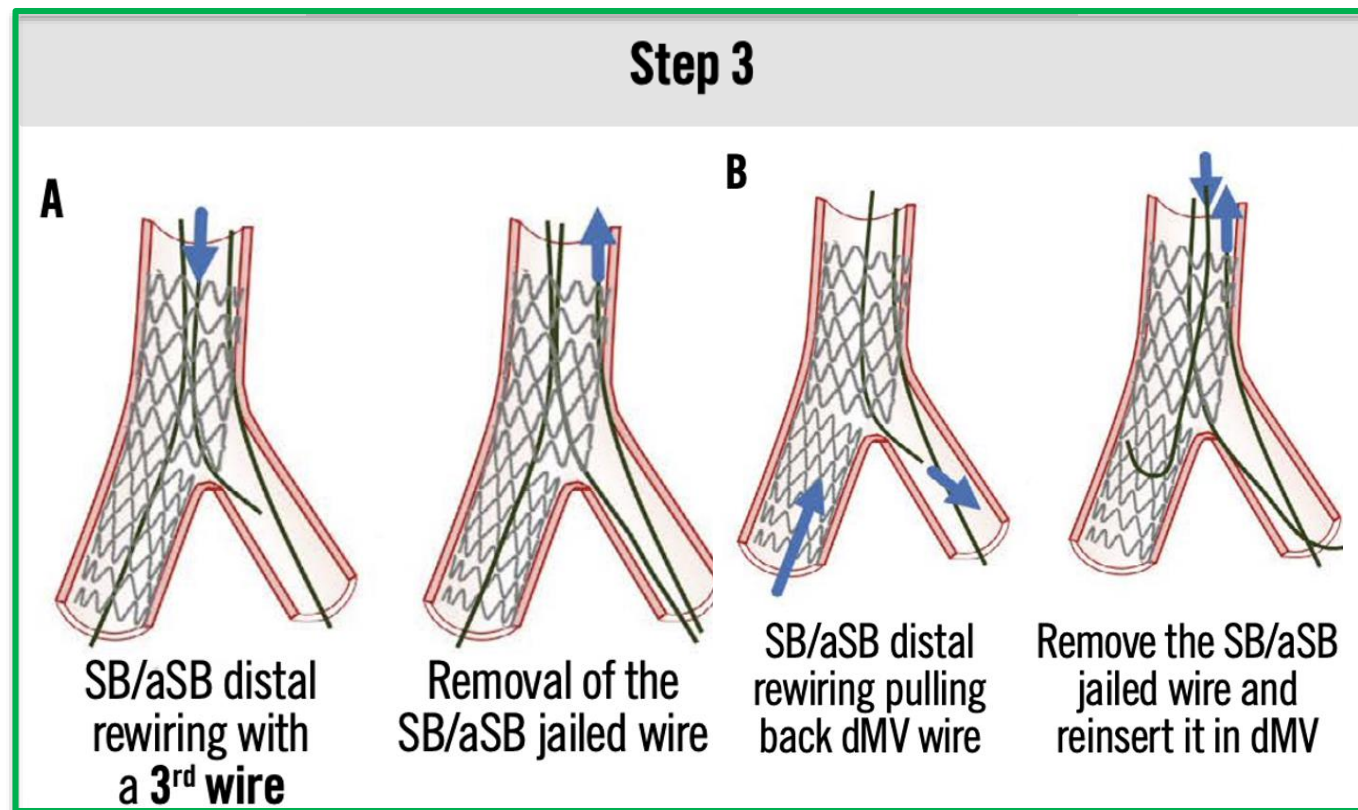


In the presence of significant SB flow limitation or poor angiographic results in an SB supplying a significant myocardial territory, subsequent SB stenting can be performed (T, T and protrusion [TAP] or culotte), with systematic final kissing balloon inflation (KBI) and a finalising POT

POT



Rewiring



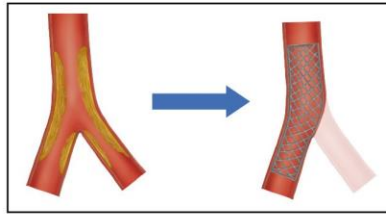
Prevention

Conventional

- Preshaped wires
- Reverse wire technique
- Dual lumen microcatheter
- Angulated microcatheter
- Deflectable microcatheter



Jailed wire



Troubleshooting



Preshaped wires
CTO wires



Angulated
microcatheter



Deflectable
microcatheter



Rescue
jailed balloon

Active protection



Jailed balloon



Balloon-stent kissing



Modified



Semi-inflated



Jailed Corsair

Risk factors:

- Plaque on the same side of the SB
- Reduced TIMI flow at the SB
- Severe % DS of bifurcation core $\geq 70\%$
- Unfavourable bifurcation angle $\geq 90^\circ$
- High ratio MV/SB ≥ 2
- Severe % DS at SB $\geq 90\%$
- Spiky carina
- RESOLVE score > 10

Preserving SB access during provisional stenting

TECHNIQUE	WHEN TO APPLY	DESCRIPTION
Jailed wire	Before MV stenting	Wire placement in the SB
Jailed balloon protection	Before MV stenting	Small-diameter balloon placed in the SB and kept uninflated during MV stent deployment
Jailed microcatheter (including jailed Corsair)	Before MV stenting	Microcatheter placed in the SB and kept uninflated during MV stent deployment
Inflated jailed balloon protection (including modified jailed balloon and balloon-stent kissing)	Before MV stenting	Small-diameter balloon (with different degrees of protrusion in the MV) placed in the SB and kept inflated during MV stent deployment
Semi-inflated jailed balloon protection	Before MV stenting	Small-diameter balloon placed in the SB and inflated at low atmospheres during MV stent deployment
Rescue balloon jailing	After MV stenting, in the case of SB occlusion (or jailed wire entrapment)	Small-diameter balloon advancement and inflation over the jailed wire
Rescue microcatheter jailing	After MV stenting, in the case of SB occlusion (or jailed wire entrapment)	High-penetration microcatheter advancement over the jailed wire

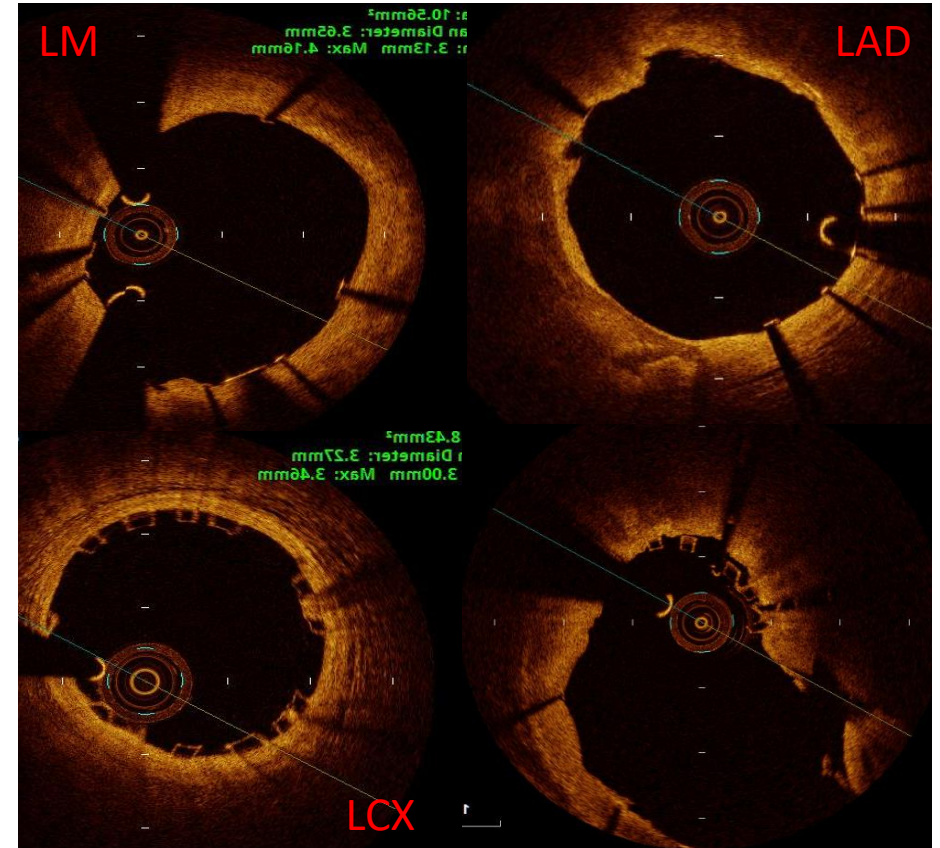
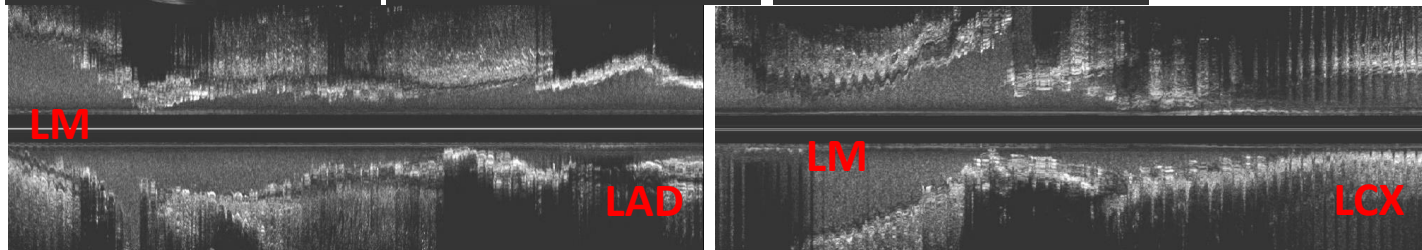
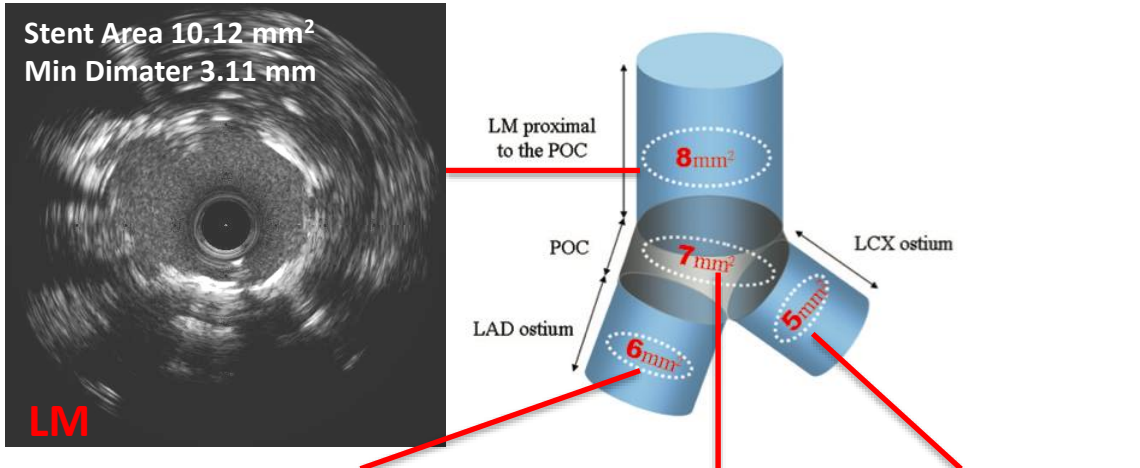
MV: main vessel; SB: side branch

The 17th expert consensus document of the European Bifurcation Club

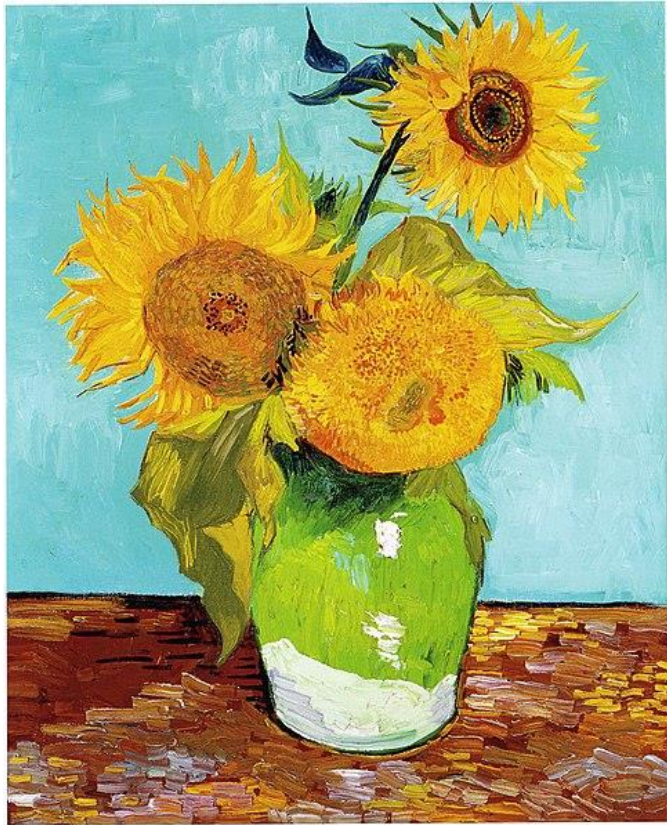
Pan M, et al. EuroIntervention. 2023 May 15;19(1):26-36.

Post Stage C

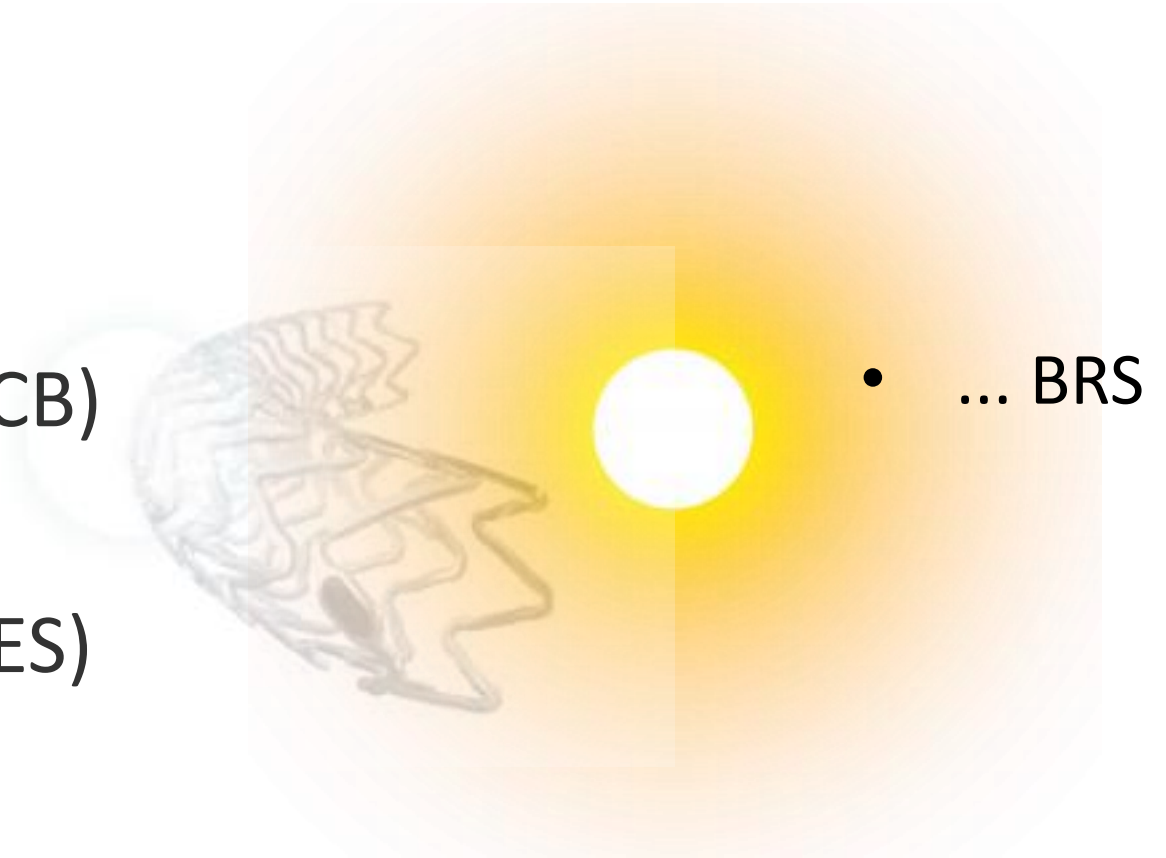
Postintervention imaging and postdilatation if needed



Leave nothing behind but ...



- ... nothing
- ... something (DCB)
- ... everything (DES)

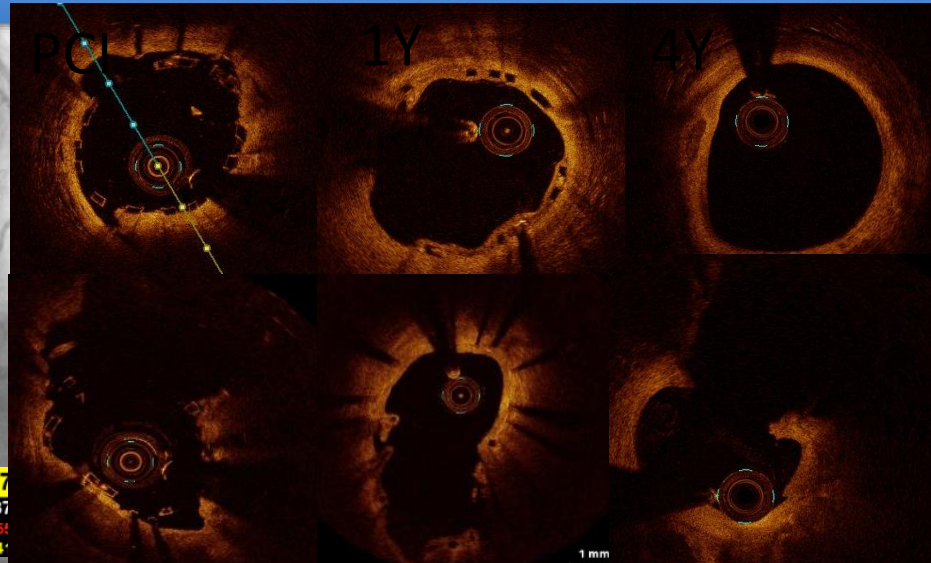


- ... BRS

New personalized treatment for the LM lesions (Synergy DES + BVS)

- Pilot study (2012-2015) Pilot, prospective, consecutive, one center registry analyzing feasibility of IVUS-guided and OCT-optimized two stent technique (Mini-crush or T-stent strategy) using everolimus-eluting platinum chromium coronary stent with bioabsorbable polymer coating (Synergy) in LM/LAD and bioresorbable vascular scaffold (Abbsorb) in Cx for the treatment of distal ULMCA true bifurcation stenosis
- Pilot II (2021, ongoing) IVUS-guided and OCT-optimized two stent technique using: DES in LM/LAD and resorbable magnesium scaffold (Magmaris) in Cx for the treatment of distal ULMCA true bifurcation stenosis

5-year cardiovascular mortality in Pilot study = 0%



Cumulative events at 4 years	All patients (n=46)
Death, n (%)	0 (0.0)
Cardiovascular death, n (%)	0 (0.0)
Myocardial infarction, n (%)	1 (2.2)
Stroke, n (%)	0 (0.0)
TLR, n (%)	9 (19.6)
LM-LAD DES restenosis	1 (2.2)
LCX BVS restenosis	7 (15.2)
LCX BVS stent thrombosis	1 (2.2)
Stent thrombosis	1 (2.2)
MACE (death, myocardial infarction, stroke, TLR)	9 (19.6)

Predictors of MACE at 4 years

MACE (death, myocardial infarction, stroke, TLR)

Variable	MACE +	MACE -	Hazard ratio (95% CI)	p value
Total cholesterol	4.8 ± 1.2	3.9 ± 0.8	2.839 (1.169-6.897)	0.021
Low density lipoprotein	3.0 ± 1.0	2.1 ± 0.7	3.918 (1.396-10.996)	0.009
Side branch plaque modification with cutting balloon	4 (44.4%)	32 (86.5%)	0.125 (0.025-0.630)	0.012
Absorb scaffold diameter ≤ 2.5 mm at the LCX ostium	4 (44.4%)	5 (13.5%)	5.120 (1.016-25.813)	0.048
No post intervention IVUS MB	4 (44.4%)	2 (5.4%)	14.000 (2.014-97.311)	0.008
No post intervention IVUS SB	4 (44.4%)	2 (5.4%)	14.000 (2.014-97.311)	0.009

MACE was not predicted by:

Clinical: Age, Gender, Hypertension, Dyslipidemia, Diabetes, Smoking, Family history, Prior MI, Prior PCI, HF, PAD, EF

Angiographic: Syntax score

Procedural: Pre-IVUS, Pre-OCT, CB in the MB, CB MB diameter, CB SB diameter, Stenting technique, LM DES diameter, Absorb diameter, LM DES length (p=0.068), Absorb length, FKPD, Post-OCT

Univariate logistic regression was used to determine the predictors of MACE.