

3:06 – 3:14 PM
May, 06, 2023
Presentation Theater
1, Vista 3, B2



OLLSCOIL NA GAILLIMHE
UNIVERSITY OF GALWAY

How Can OCT Predict Outcome in Bifurcation

Left Main Bifurcation – Update from EBC

Yoshinobu Onuma MD, PhD

**Kai Ninomiya MD, Kotaro Miyashita MD, Akihiro Tobe MD,
Patrick W. Serruys MD, PhD, eESC, FACC**

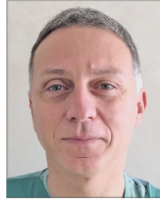
University of Galway, Ireland, CORRIB Research Centre
for advanced imaging and core laboratory

Disclosure

I, (Yoshinobu Onuma) DO NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

Percutaneous coronary intervention for bifurcation coronary lesions: the 15th consensus document from the European Bifurcation Club

EuroIntervention 2021;16:1307-1317.



Francesco Burzotta^{1*}, MD, PhD; Jens Flensted Lassen², MD, PhD; Thierry Lefèvre³, MD; Adrian P. Banning⁴, MD, PhD; Yiannis S. Chatzizisis⁵, MD, PhD; Thomas W. Johnson⁶, MD; Mirosław Ferenc⁷, MD, PhD; Sudhir Rathore⁸, MD; Remo Albiero⁹, MD; Manuel Pan¹⁰, MD, PhD; Olivier Darremont¹¹, MD; David Hildick-Smith¹², MD; Alaide Chieffo¹³, MD; Marco Zimarino¹⁴, MD, PhD; Yves Louvard³, MD; Goran Stankovic¹⁵, MD, PhD

Topic	Previously established (and confirmed) recommendations	New recommendations
<p>Intracoronary imaging</p> <p>General issues.</p> <p>Details regarding IVUS use and OCT use in bifurcations reported in specific consensus papers^{16,17}.</p>	<ul style="list-style-type: none"> – Intracoronary imaging is a valuable tool in PCI on bifurcation lesion and LM since it facilitates technical planning and optimisation of the final result. – Selection of a preferred imaging modality should reflect operator experience and the primary objective of assessment – IVUS is gold standard for LM – <u>OCT is feasible for distal LM lesions</u> – OCT provides superior evaluation of stent and wire positions – Pullback in both MV & SB is recommended for 2-stent procedures 	<ul style="list-style-type: none"> – <u>OCT combined with angio co-registration and sophisticated real-time analysis software provides real advantages for a stepwise bifurcation approach, especially 3D reconstruction to facilitate guidewire re-crossing towards the SB</u> – Intracoronary imaging should be available in the cath lab and it is recommended that it is used when faced with procedural complications or unexpected technical challenges.

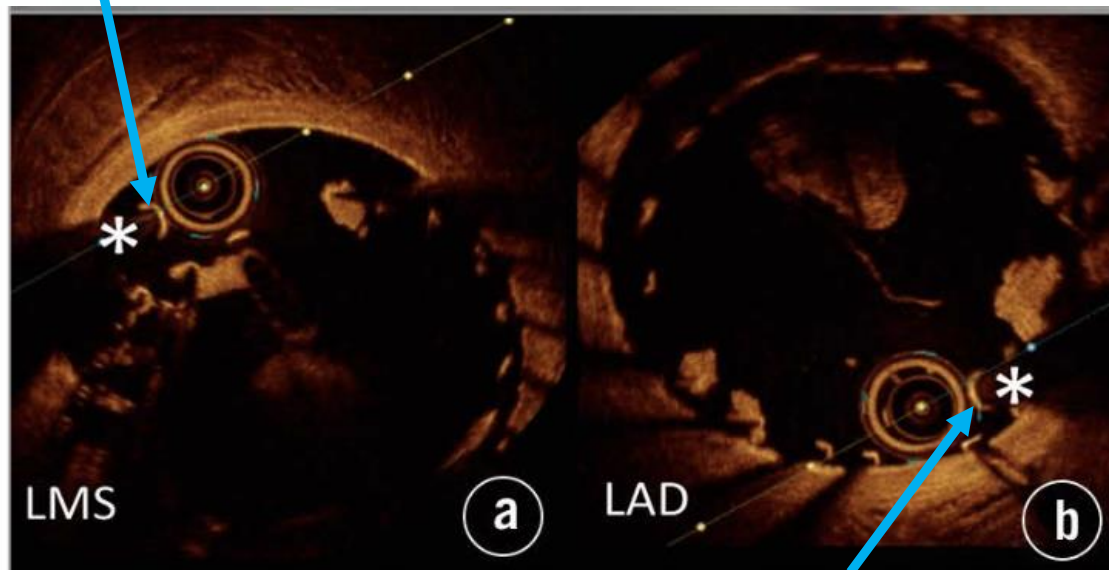
- **Imaging guided PCI for LMT is established. OCT is feasible for distal LM lesions.**
- **OCT provides potential advantages for specific steps of bifurcation interventions, including visualization of the site of guidewire crossing and stent optimization tools.**

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

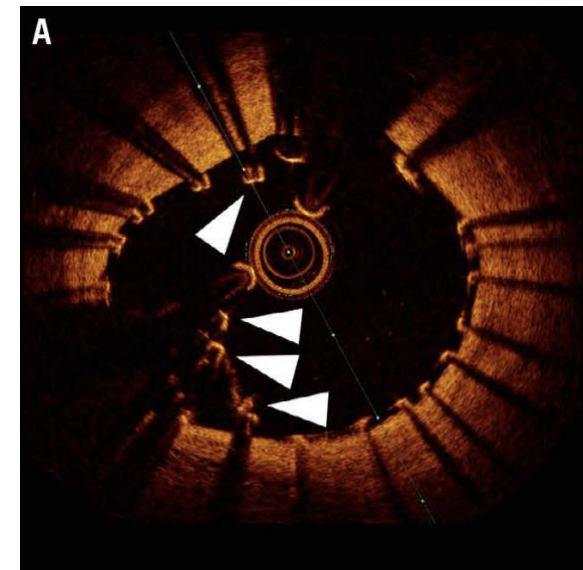
Eurointervention.2022;18(5):e362-e376

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

abluminal



luminal



LM stent deformation

- Provisional strategy is a dynamic approach and operators must know its pitfalls and countermeasures.
- OCT enables us to detect the pitfalls such as abluminal guidewire position and stent deformation.

Comparison of IVUS and OCT in bifurcation treatment

	IVUS	OCT
Pre-procedure		
Co-registration with angiogram	++	++
Sizing of vessel	++	+
Sizing of lumen	++	++
Assessment of plaque distribution	++	+
Plaque characterization	++	+
Assessment of side branch ostium in the pullback of main branch	x	++
Determination of landing zone and stent length	++	++
During stent implantation		
Guidance of position of the guidewire towards the side branch	x	++
Post-procedure		
Evaluation of stent dimensions according to flow conservation law	++	++
Stent underexpansion	++	++
Edge dissection	+	++
ISA	+	++
Anatomic subgroups		
LMT lesion	++	+

Feasibility of OCT on LM

Ref	Study Aims	Modality	Feasibility of OCT		
			Proximal LM	Mid LM	Distal LM
Muramatsu, et al. <i>Circ J</i> 2013	Detection of coronary intimal flap	OFDI	91.1 % (3137/3443 frames)		
Fujino, et al. CCI 2013	FD-OCT vs IVUS	FD-OCT	12.5% (4/32pts)	90.6% (29/32pts)	
Burzotta, et al. EuroIntervention. 2015	Feasibility of LM imaging by FD-OCT	FD-OCT	56.7%	88.6%	97.9%
Dato, et al. Int J Cardiol 2017	Clinical impact of OCT guided management for LM disease	FD-OCT	93% (122/131pts)		
IDEAL-LM OCT substudy	LMT healing analysis on OCT	FD-OCT	95% (102/107 pts)		
LEMON study EuroIntervention 2021	Feasibility, safety and impact of OCT-guided LMS PCI	FD-OCT	100% (70/70 pts)		

Definitions and Standardized Endpoints for Treatment of Coronary Bifurcations



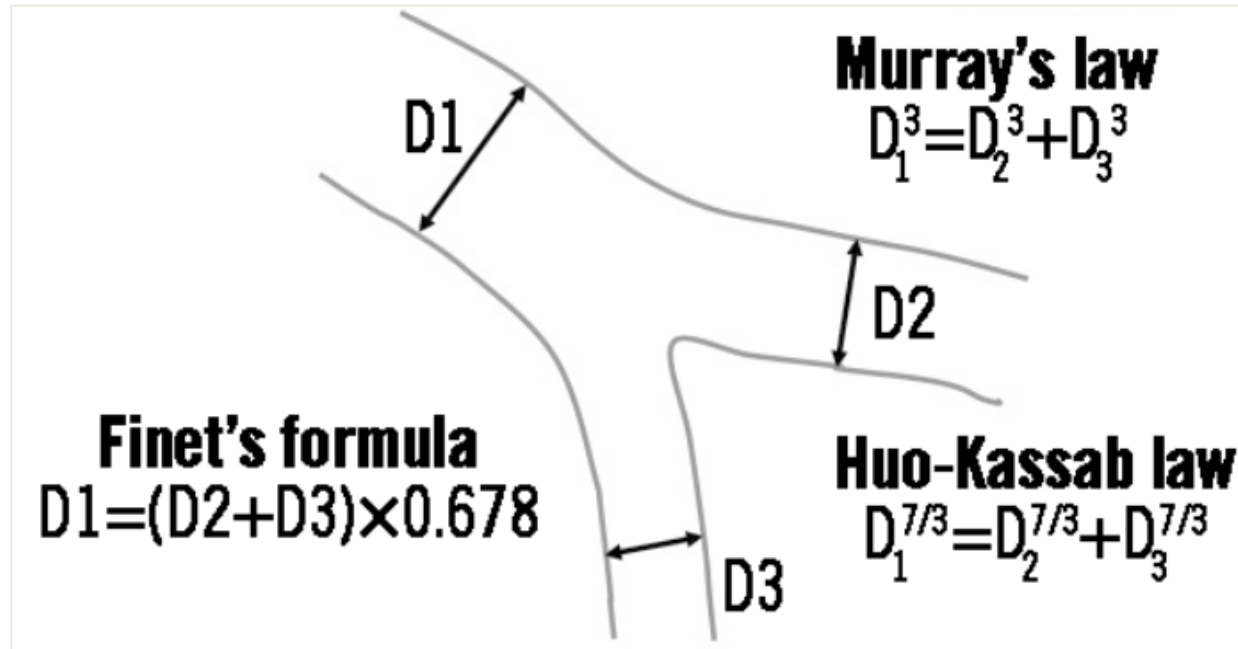
Mattia Lunardi, MD, MSc,^{a,b} Yves Louvard, MD,^c Thierry Lefèvre, MD,^c Goran Stankovic, MD, PhD,^d Francesco Burzotta, MD, PhD,^e Ghassan S. Kassab, PhD, MSc,^f Jens F. Lassen, MD, PhD,^g Olivier Darremont, MD,^h Scot Garg, MD, PhD,ⁱ Bon-Kwon Koo, MD, PhD,^j Niels R. Holm, MD, PhD,^k Thomas W. Johnson, MD,^l Manuel Pan, MD, PhD,^m Yiannis S. Chatzizisis, MD, PhD,ⁿ Adrian Banning, MD, PhD,^o Alaide Chieffo, MD,^p Dariusz Dudek, MD, PhD,^q David Hildick-Smith, MD,^r Jérôme Garot, MD, PhD,^c Timothy D. Henry, MD,^s George Dangas, MD, PhD,^t Gregg W. Stone, MD,^t Mitchell W. Krucoff, MD,^u Donald Cutlip, MD,^v Roxana Mehran, MD,^t William Wijns, MD, PhD,^{a,w} Faisal Sharif, MD, PhD,^a Patrick W. Serruys, MD, PhD,^{a,x} Yoshinobu Onuma, MD, PhD,^a on behalf of the Bifurcation Academic Research Consortium and European Bifurcation Club

Joint consensus on the use of OCT in coronary bifurcation lesions by the European and Japanese bifurcation clubs



Yoshinobu Onuma¹, MD, PhD; Yuki Katagiri², MD; Francesco Burzotta³, MD; Niels Ramsing Holm⁴, MD; Nicolas Amabile⁵, MD, PhD; Takayuki Okamura⁶, MD, PhD; Gary S. Mintz⁷, MD; Olivier Darremont⁸, MD; Jens Flensted Lassen⁹, MD, PhD; Thierry Lefèvre¹⁰, MD; Yves Louvard¹⁰, MD; Goran Stankovic¹¹, MD, PhD; Patrick W. Serruys^{12*}, MD, PhD

Anatomic considerations in coronary bifurcation



Lefèvre et al. EuroIntervention. 2015;11 Suppl V:V106-10.

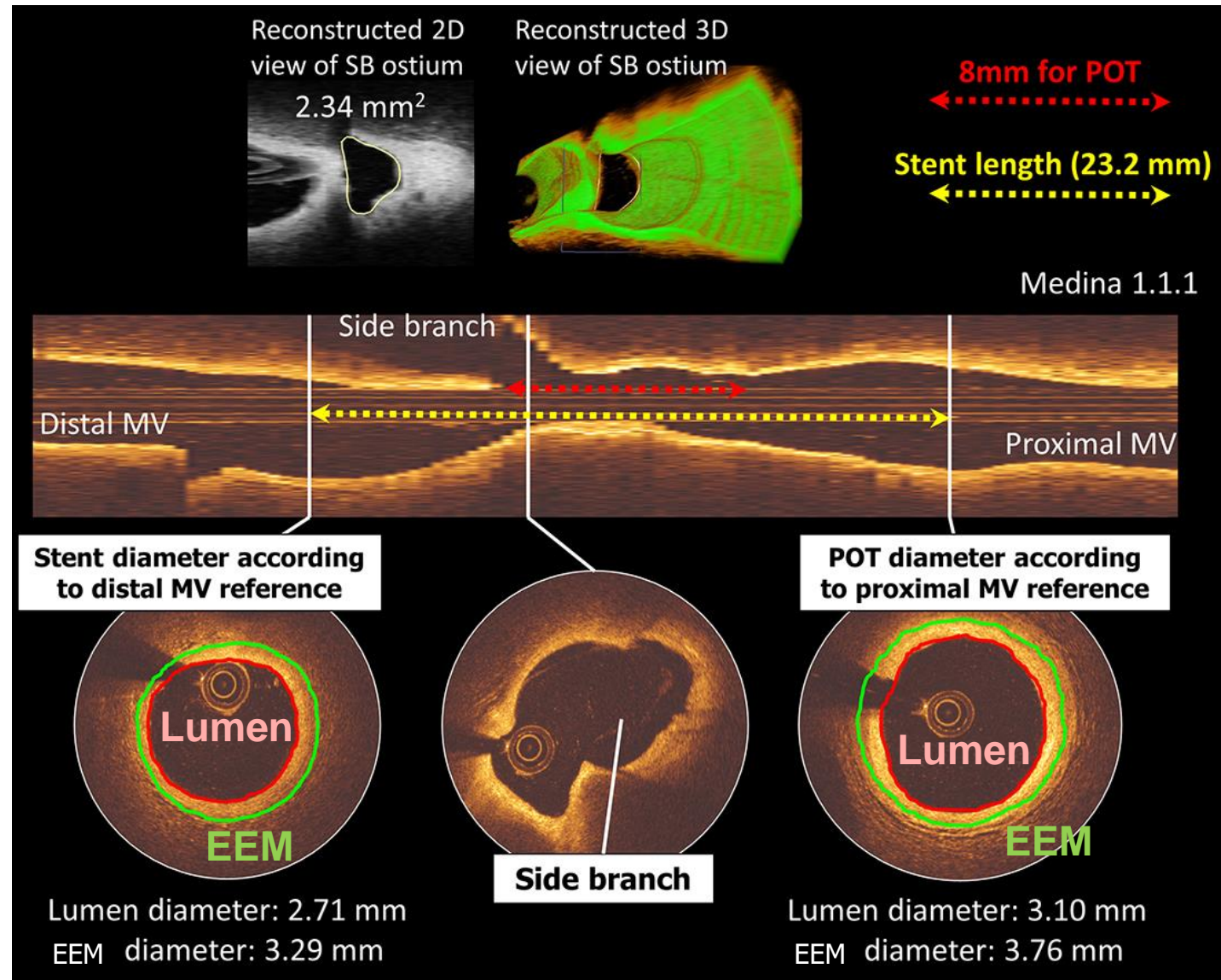
Tapering, fractal geometry and the law of flow conservation

The relation between the bifurcation vessel segments may be used for estimating optimal reference sizing for a vessel, knowing the size of the two other vessels. This is of particular value when the reference diameter for one vessel cannot be estimated directly.

EEM- vs. Lumen- measurement for stent sizing

EuroIntervention 2019;14:e1568-e1577

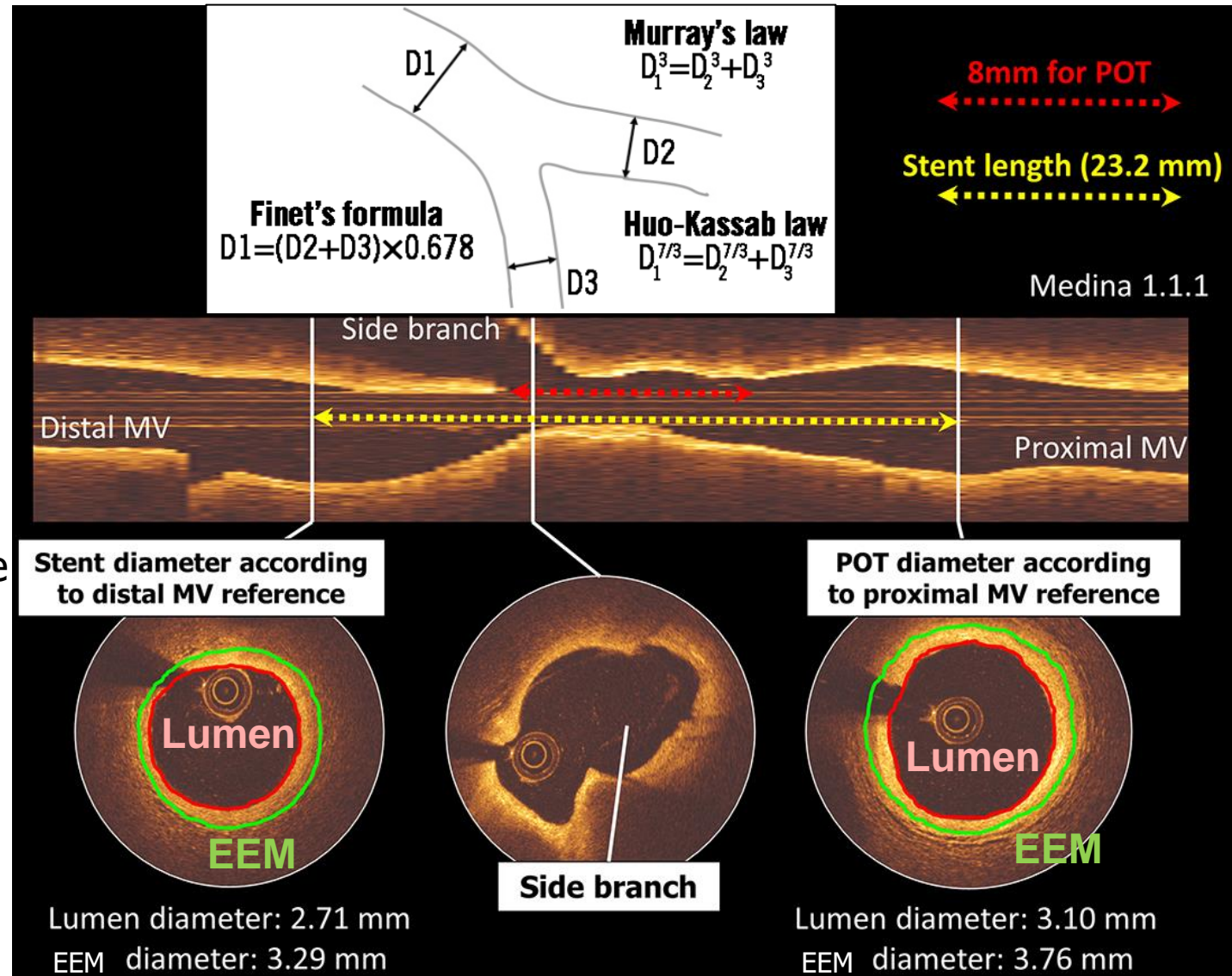
- EEM areas or lumen areas could be used for sizing of the vessel.
- Whenever the proximal vessel is too large to measure EEM, stent sizing according to lumen area measurement is recommended.



EEM- vs. Lumen- measurement for stent sizing

EuroIntervention 2019;14:e1568-e1577

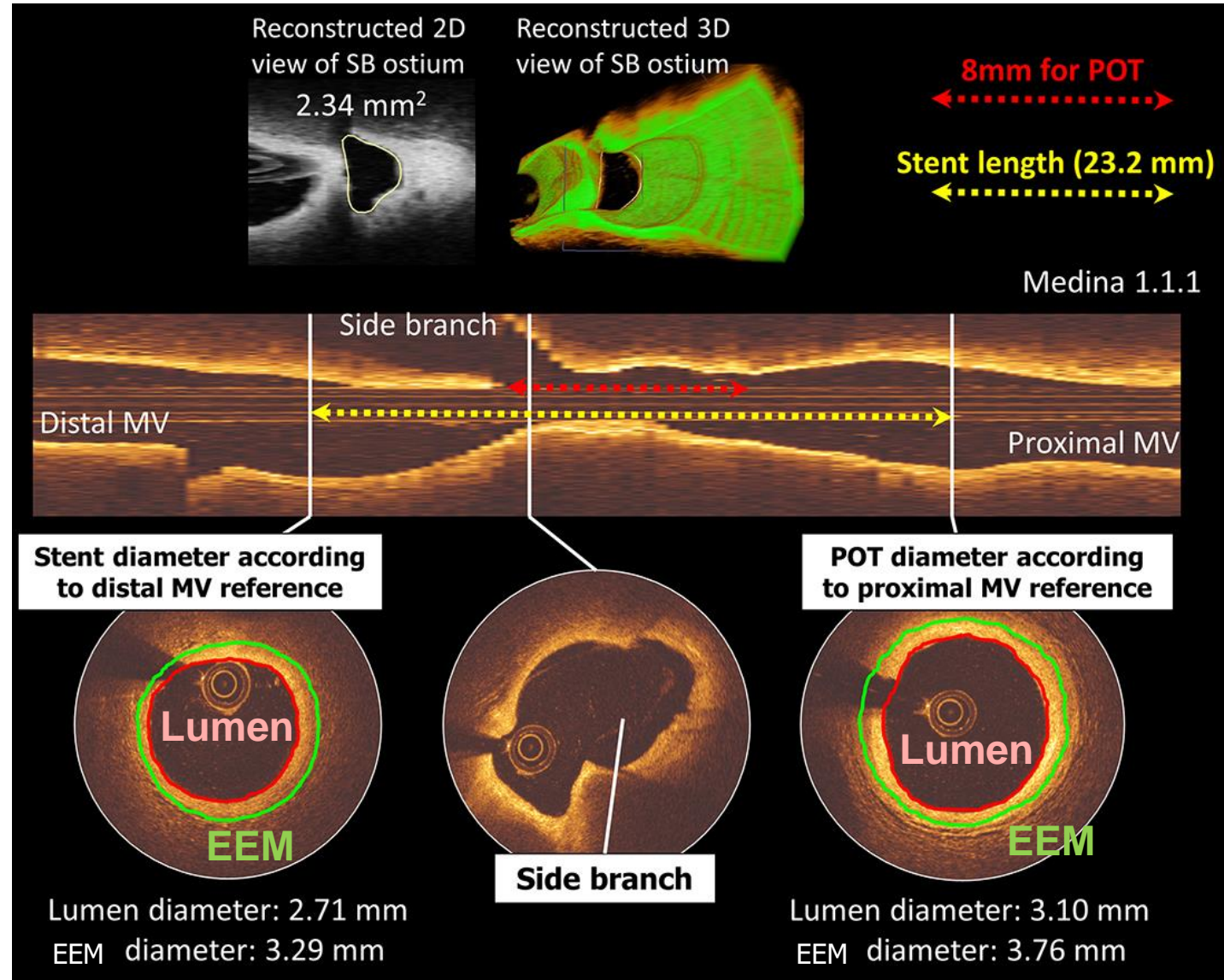
- The size of stent should be selected aiming at the fractal geometry of bifurcation according to the law of flow conservation.
- The MV stent should be sized according to the distal MV reference diameter, whereas the MV stent should allow for expansion to the reference diameter of the proximal MV.



Length and positioning of stent in bifurcations

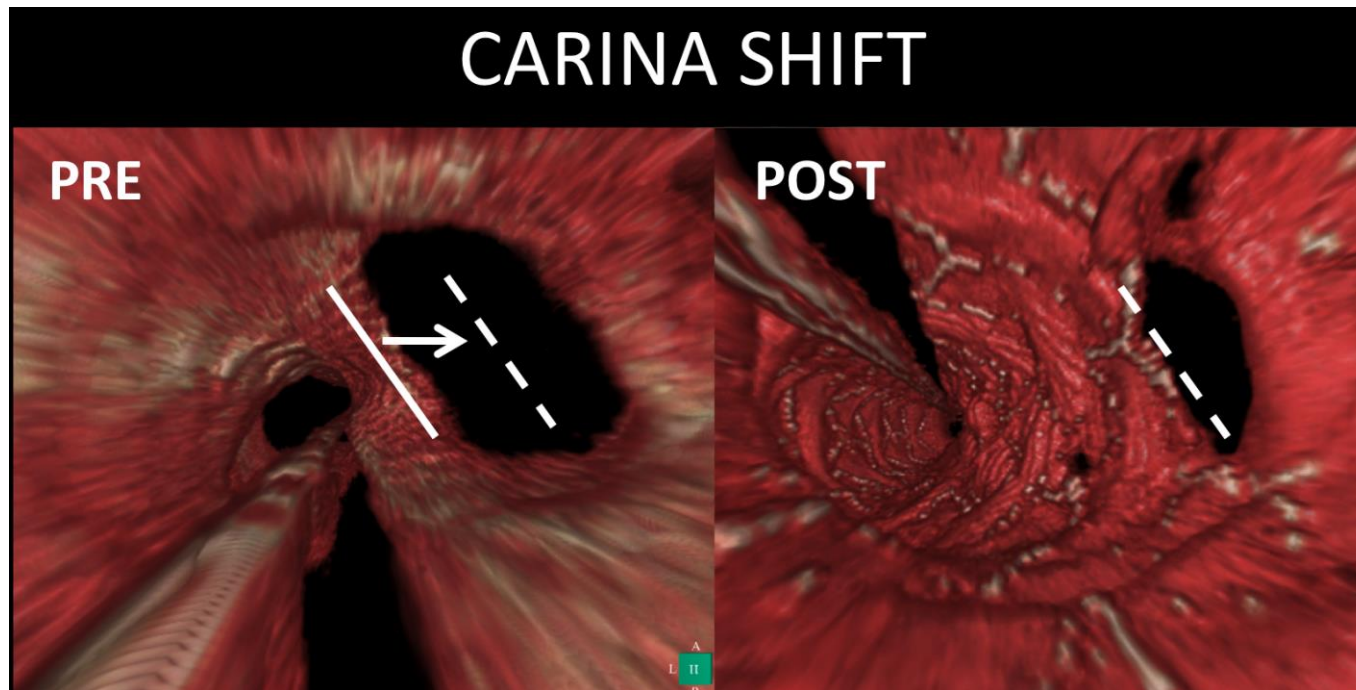
EuroIntervention 2019;14:e1568-e1577

- The operator should aim at covering the bifurcation stenosis segment at least 6-8 mm from the proximal stent edge to the bifurcation carina to enable subsequent POT with a short balloon.



On-line and off-line software for 3-D OCT

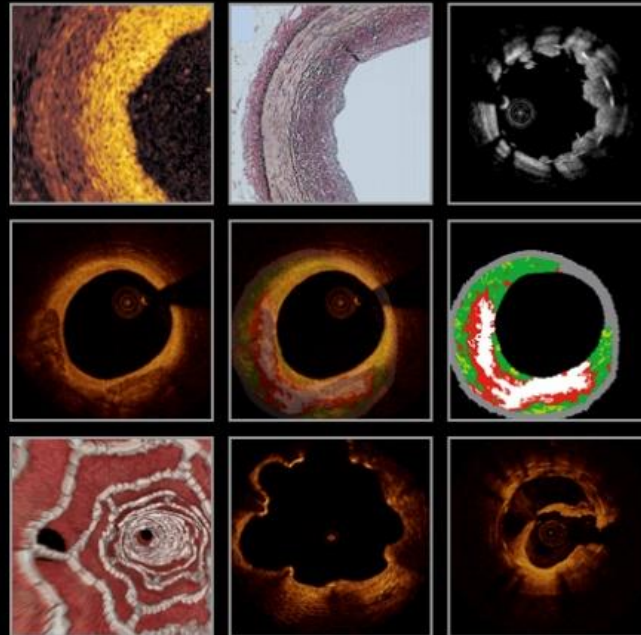
Whenever available, use of on-line 3-D reconstruction is recommended to facilitate the understanding of complex coronary anatomy and device-vessel interaction during bifurcation PCI.



Online-3D visualizations of The Jailed SideB Ostium on OFDI

PCR

Educational content endorsed
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of the European Society
of Cardiology



THE CLINICAL ATLAS OF OPTICAL COHERENCE TOMOGRAPHY

EDITORS

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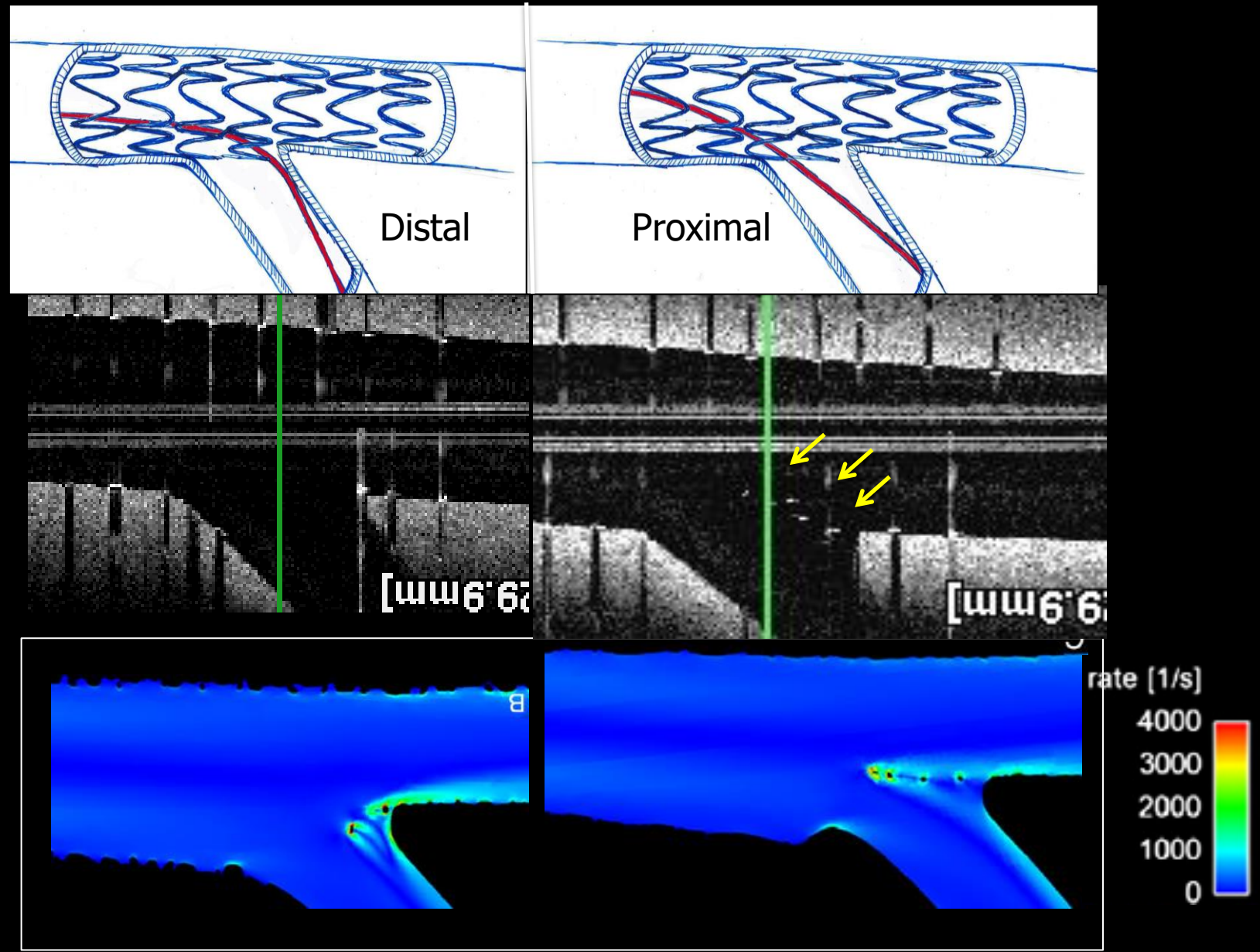
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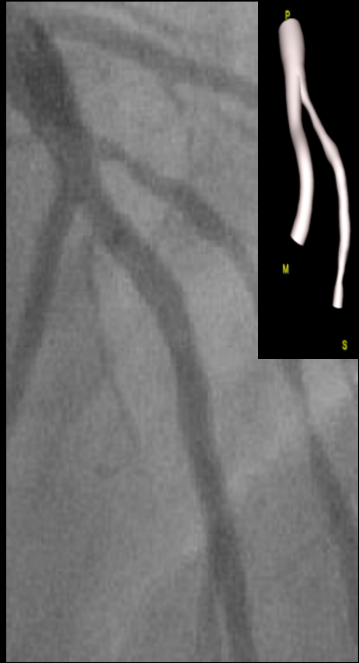
Patrick W. Serruys



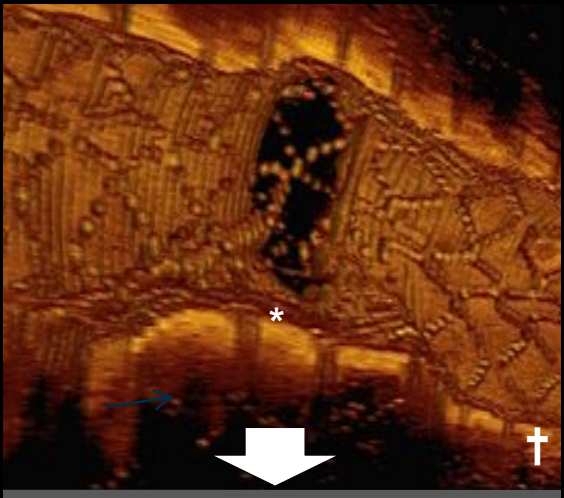
Impact of recrossing wire position on shear stress after ballooning

Onuma et al. Eurointervention
Foin et al.





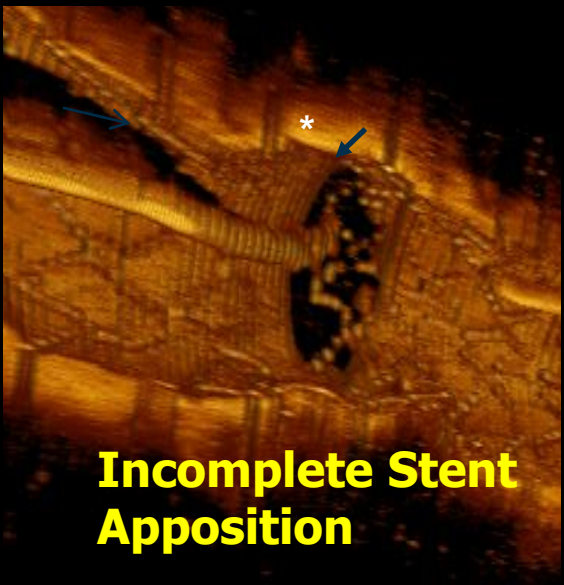
Proximal recrossing



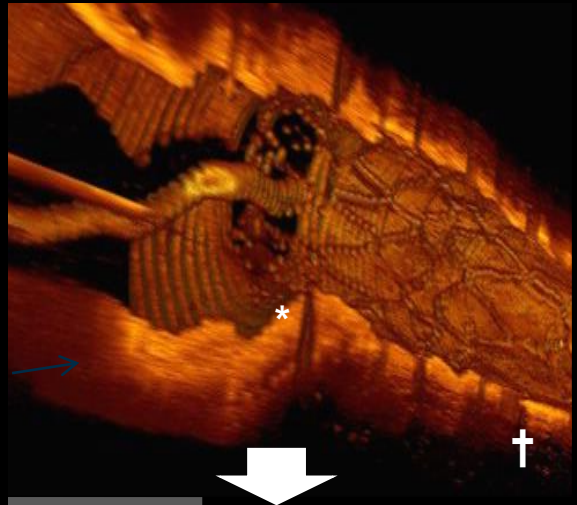
After KB



Incomplete Stent Apposition



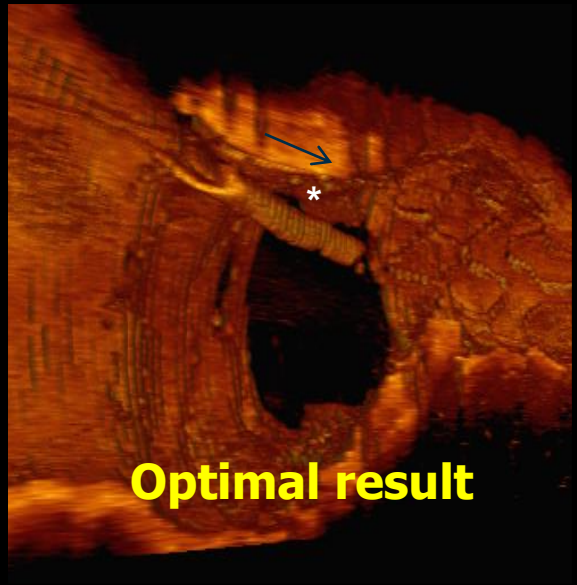
Distal recrossing

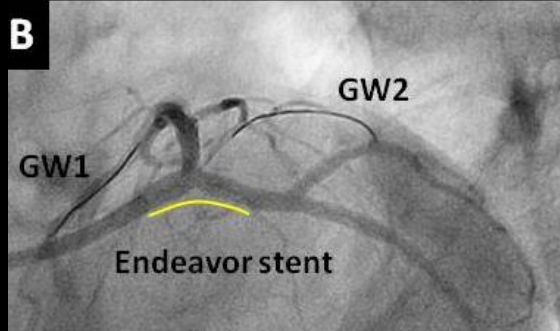


After KB



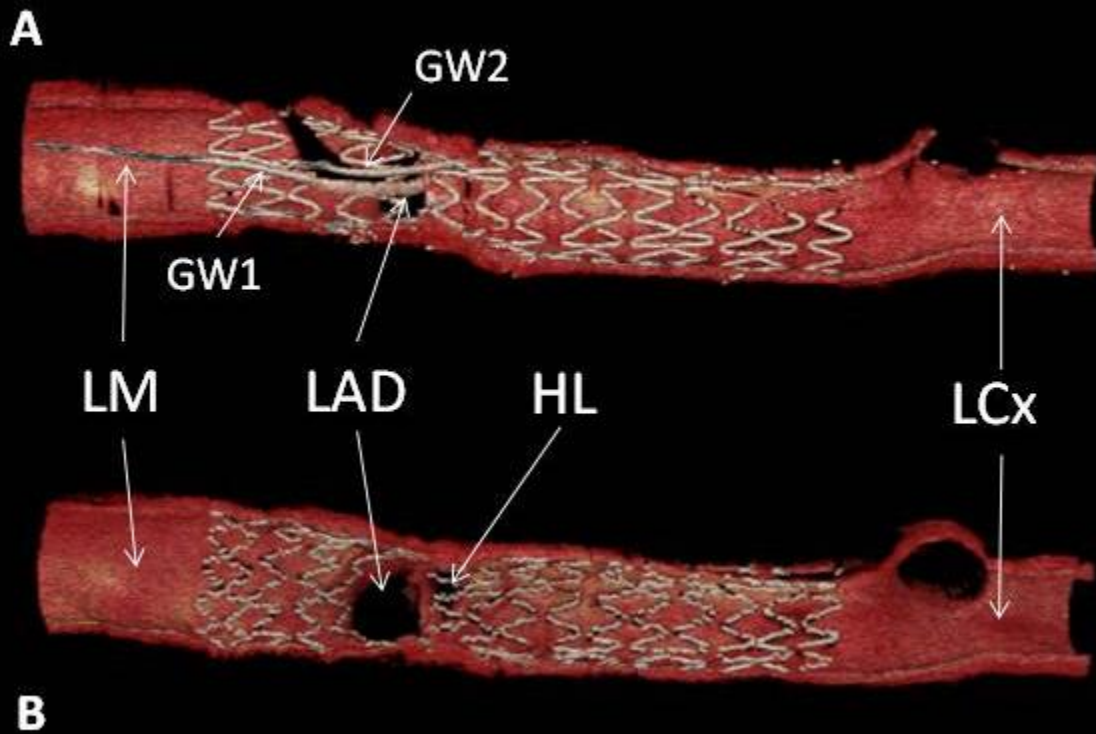
Optimal result



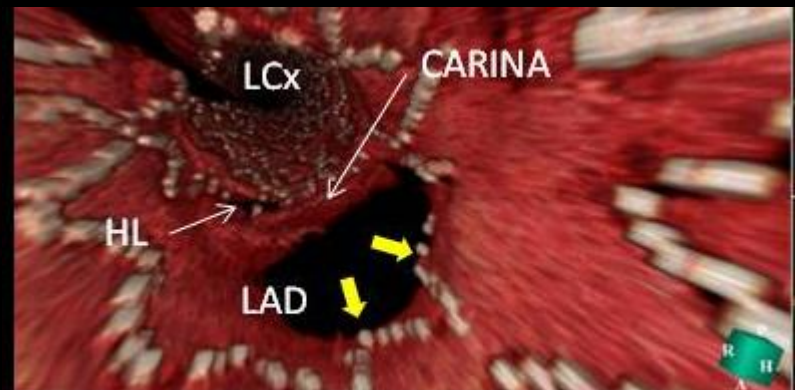
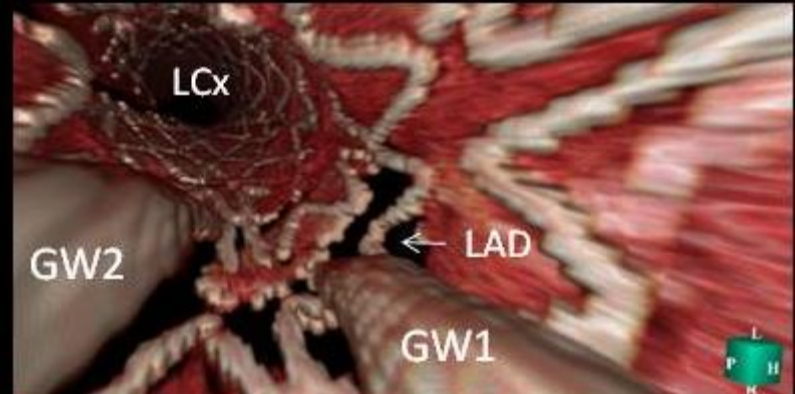


Assessment of wire re-crossing point in LM

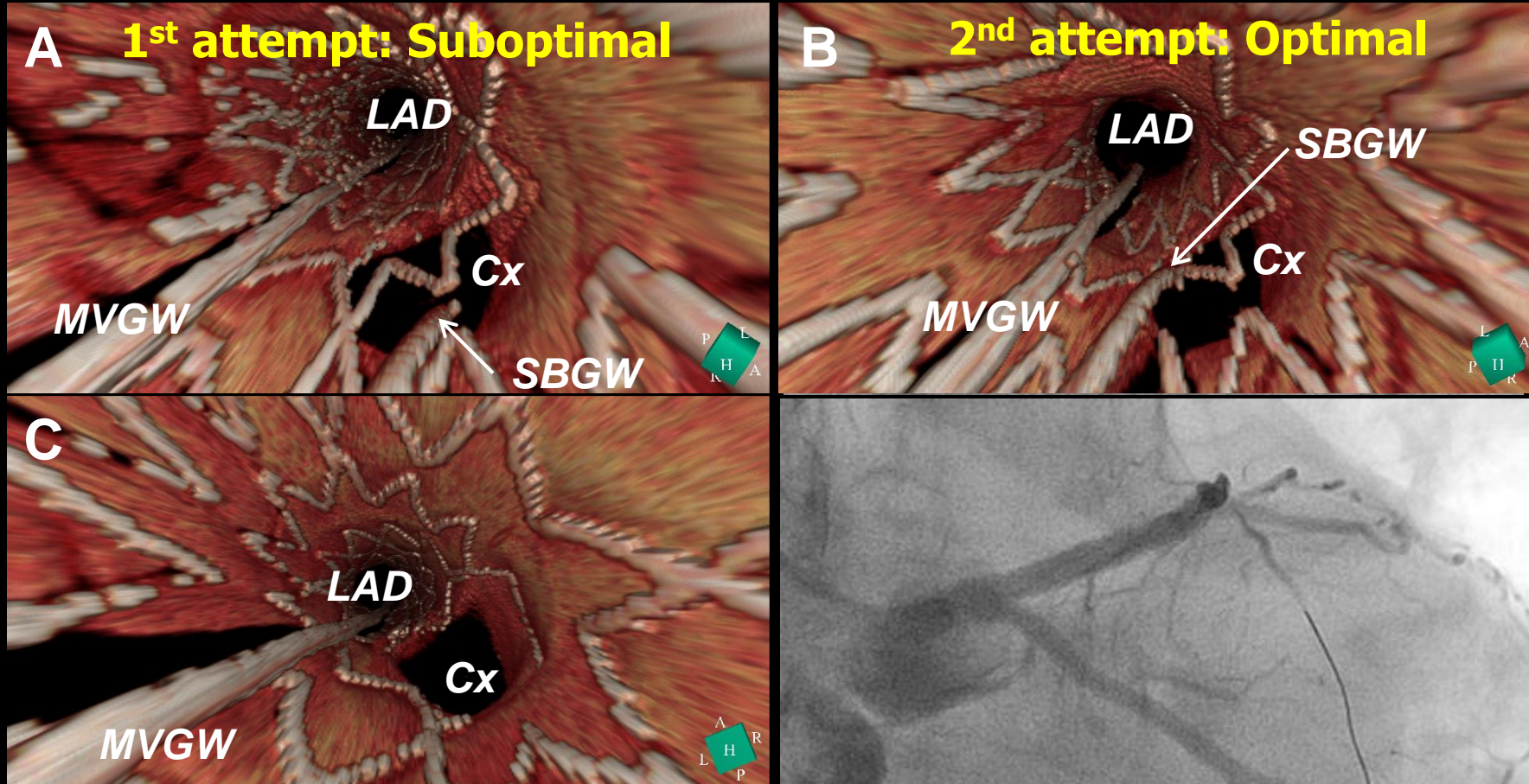
LONGITUDINAL CUT-AWAY VIEW



FLY THROUGH VIEW FROM LM



OFDI guided re-crossing with on-line 3D



Guidance of the rewiring in a distal cell of the stent overhanging a side branch ostium

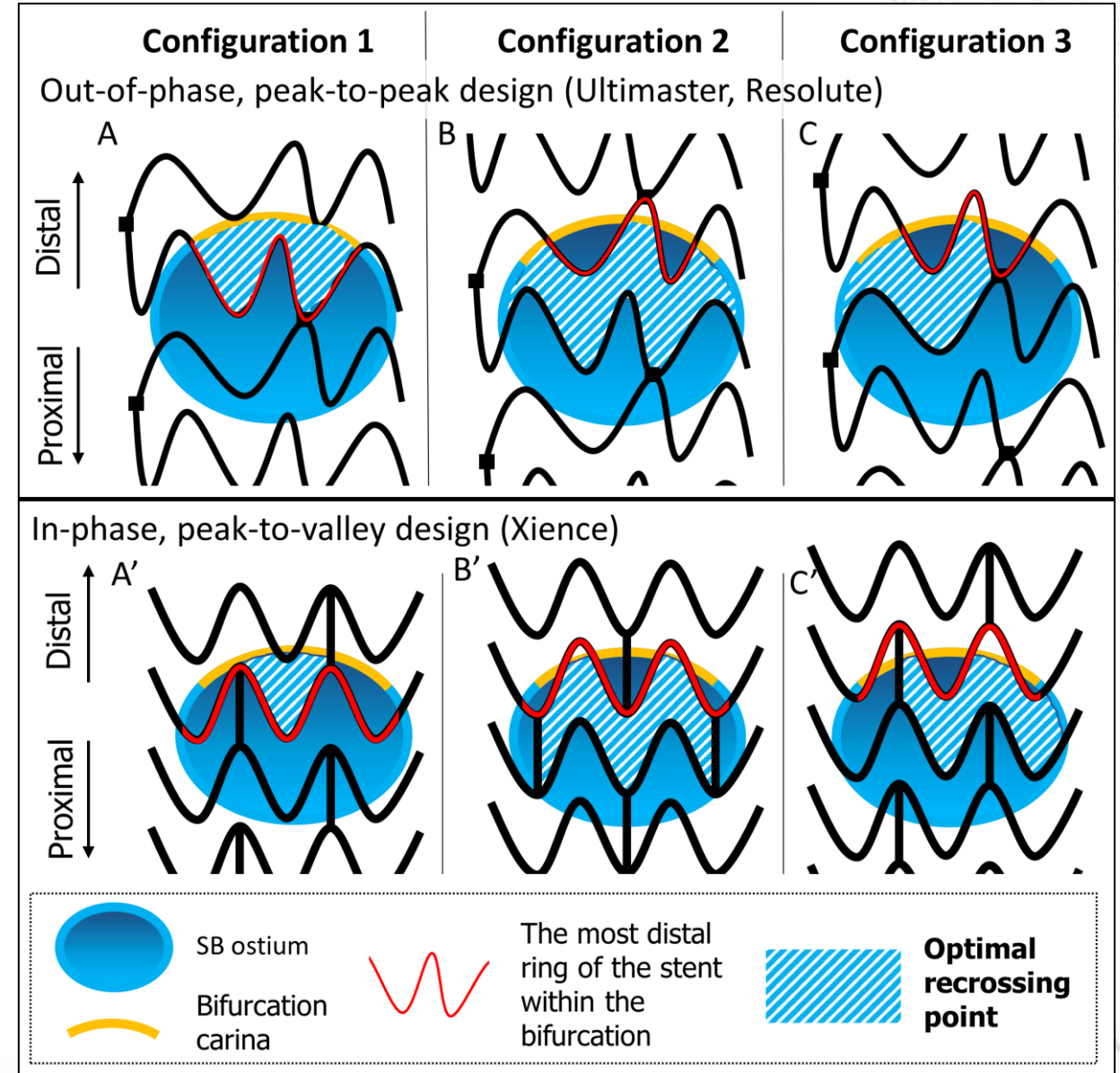
Joint consensus on the use of OCT in coronary bifurcation lesions by the European and Japanese bifurcation clubs



Yoshinobu Onuma¹, MD, PhD; Yuki Katagiri², MD; Francesco Burzotta³, MD; Niels Ramsing Holm⁴, MD; Nicolas Amabile⁵, MD, PhD; Takayuki Okamura⁶, MD, PhD; Gary S. Mintz⁷, MD; Olivier Darremont⁸, MD; Jens Flensted Lassen⁹, MD, PhD; Thierry Lefèvre¹⁰, MD; Yves Louvard¹⁰, MD; Goran Stankovic¹¹, MD, PhD; Patrick W. Serruys^{12*}, MD, PhD

EuroIntervention 2019;14:e1568-e1577

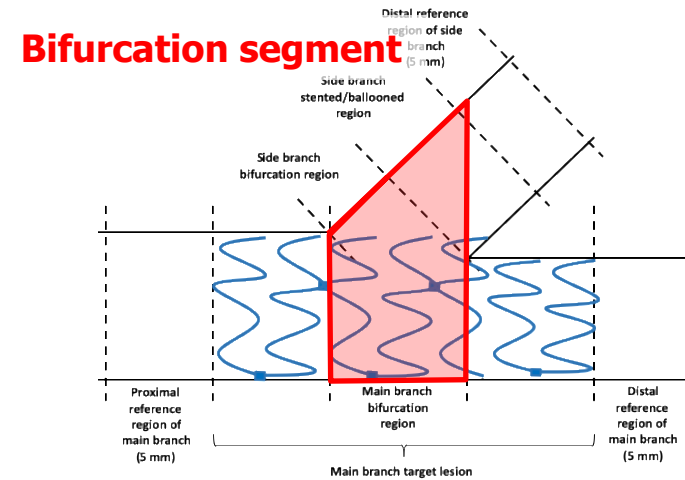
Prior to kissing balloon after stenting, it is important to re-cross the side-branch ostium strut cell with a wire in the most distal cell to minimise the risk of pushing struts towards the main vessel.



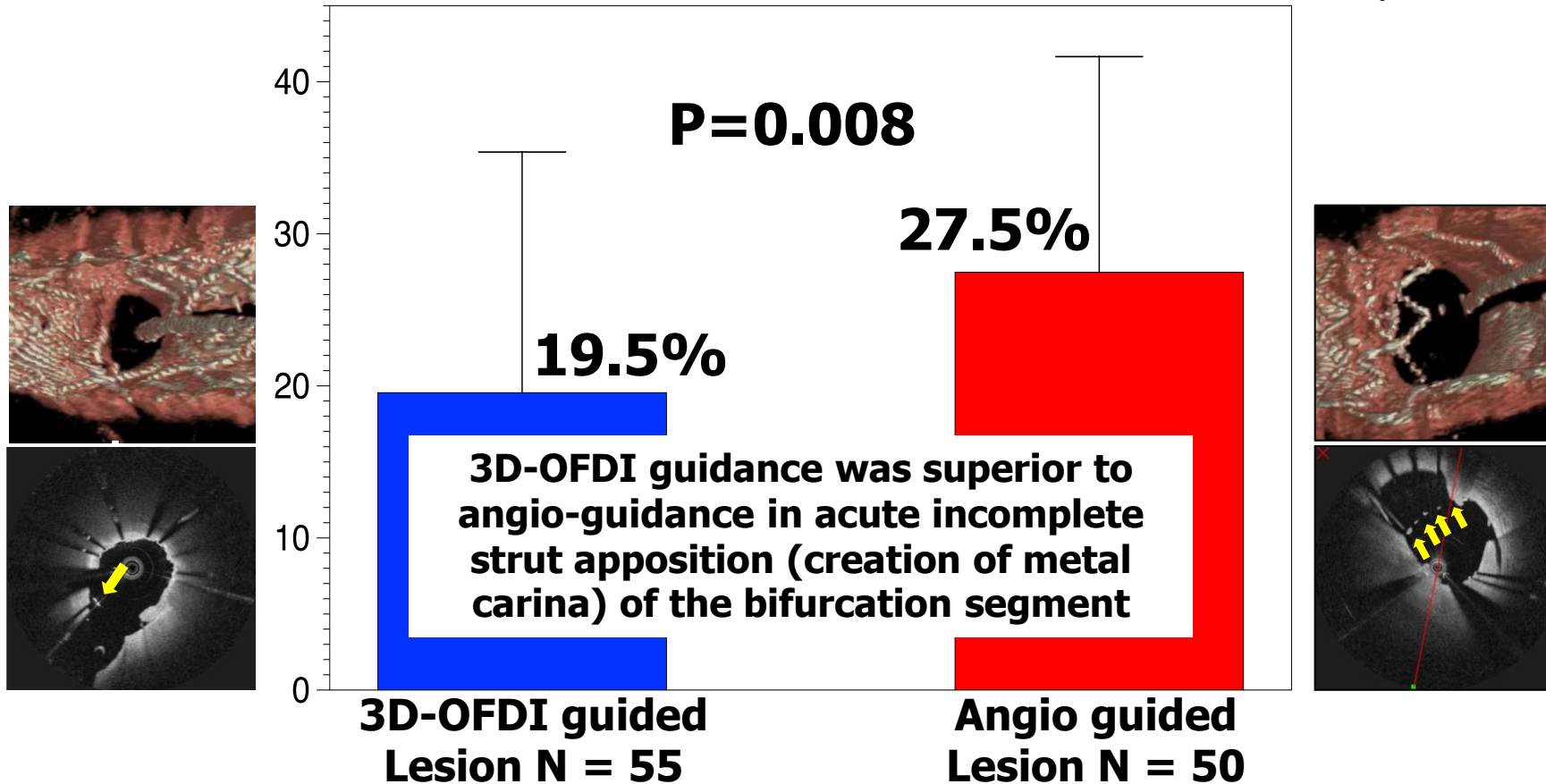
OPTIMUM study

Acute Incomplete Stent Apposition at bifurcation

Primary endpoint:



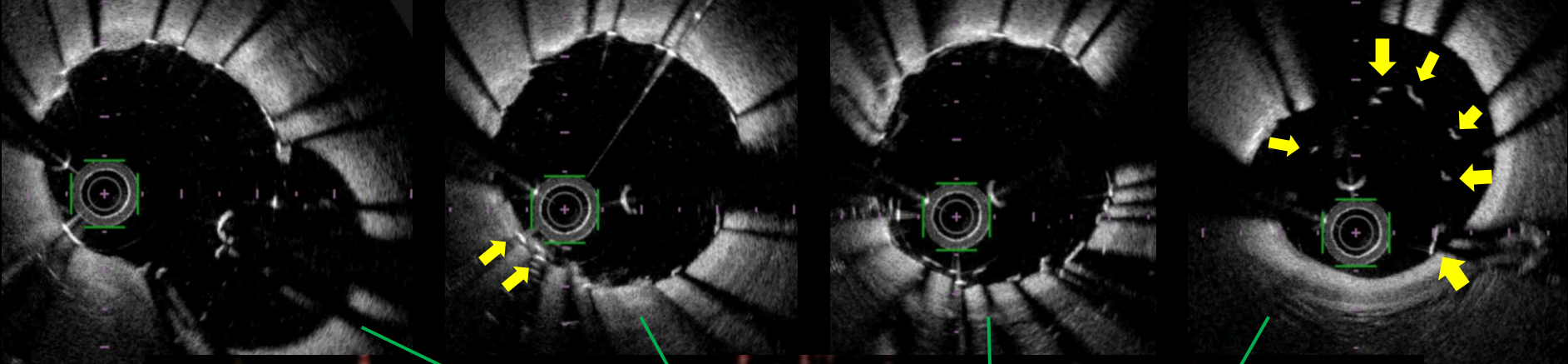
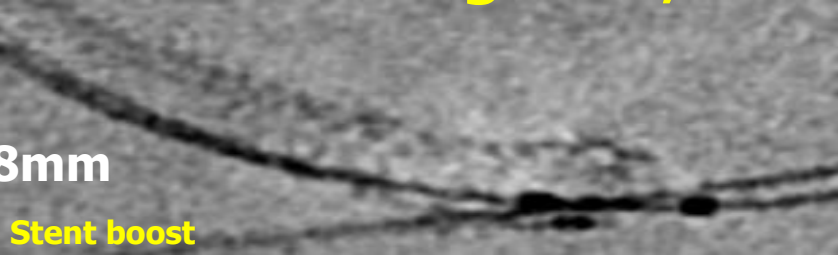
Incidence of ISA (%)



OCT during LM PCI – after recrossing wire, balloon did not advance to LCx

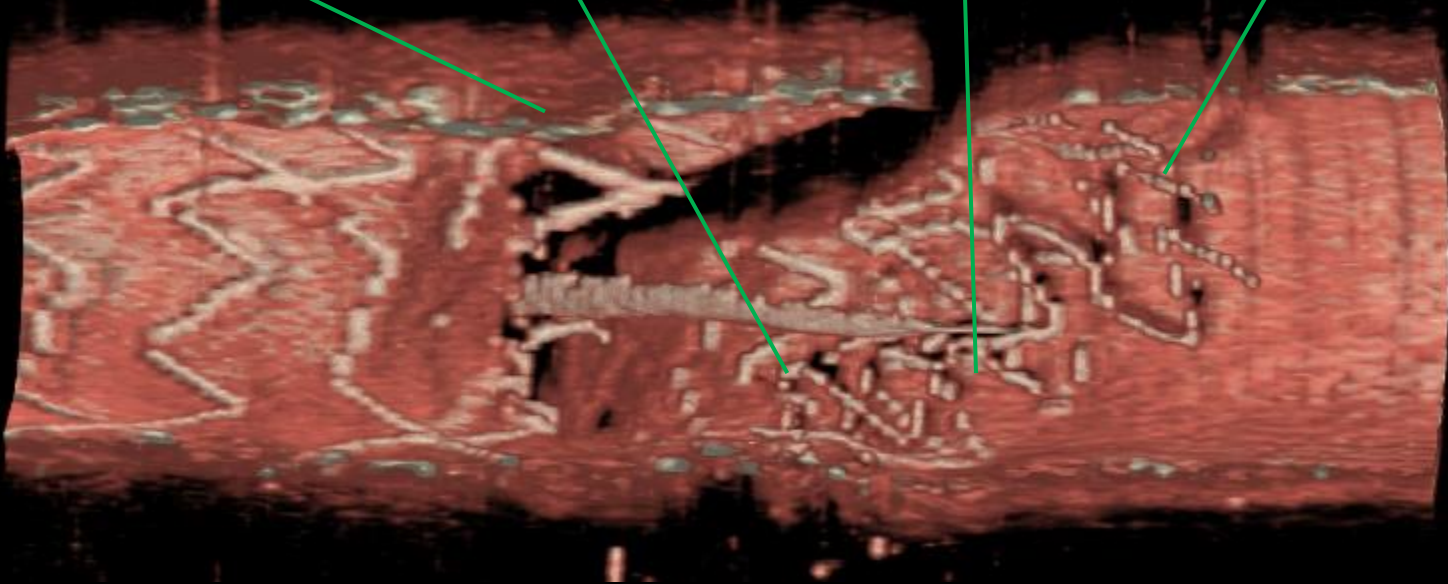
Stent 3.0x38mm

Stent boost

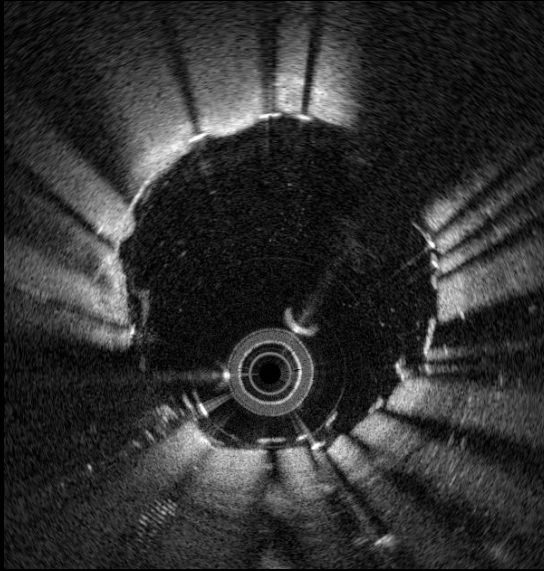


← Distal

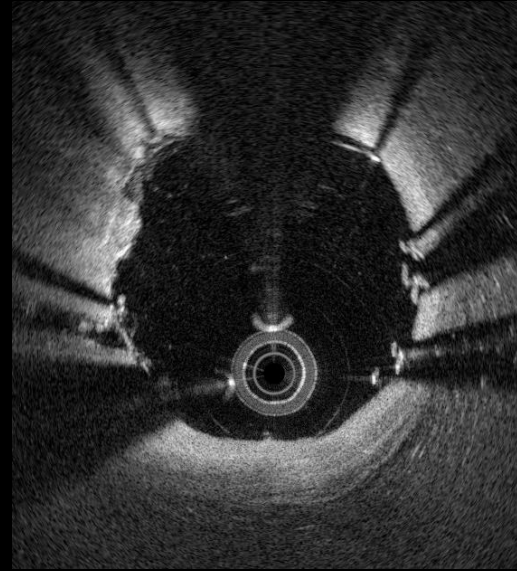
→ Proximal



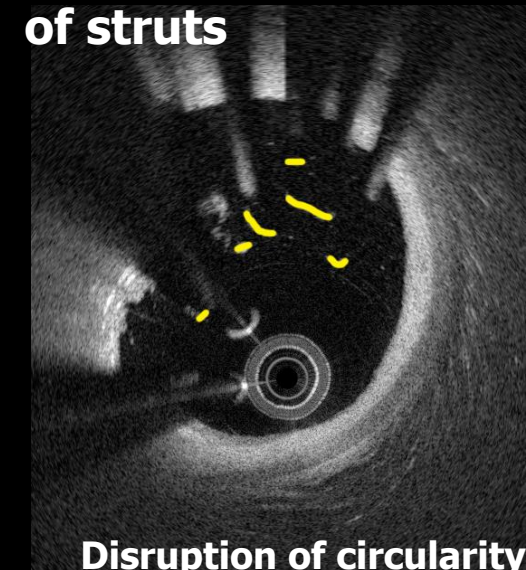
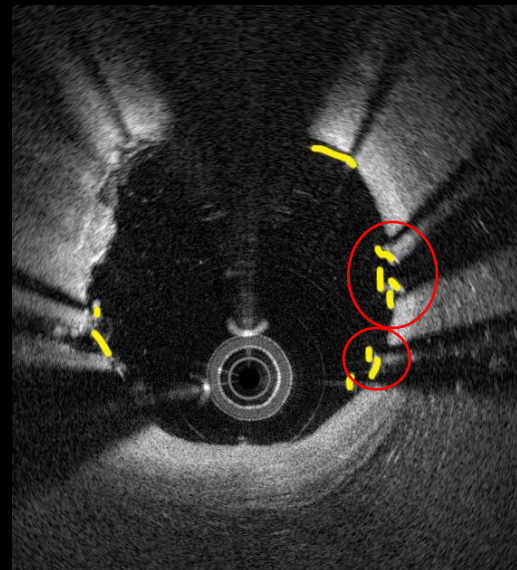
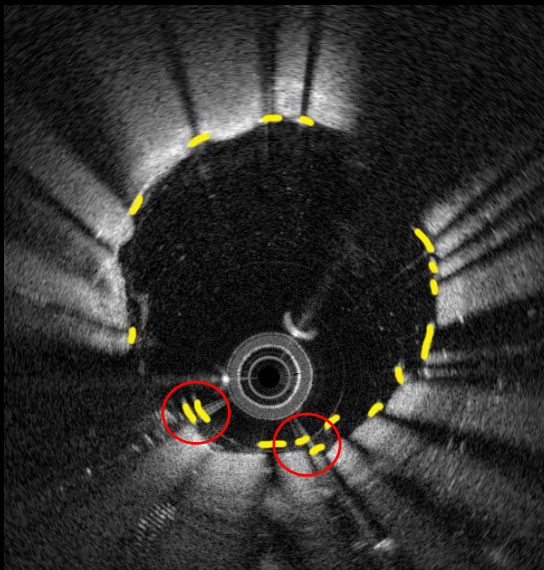
Cross-sectional finding of deformation



Stacked struts (overlap)



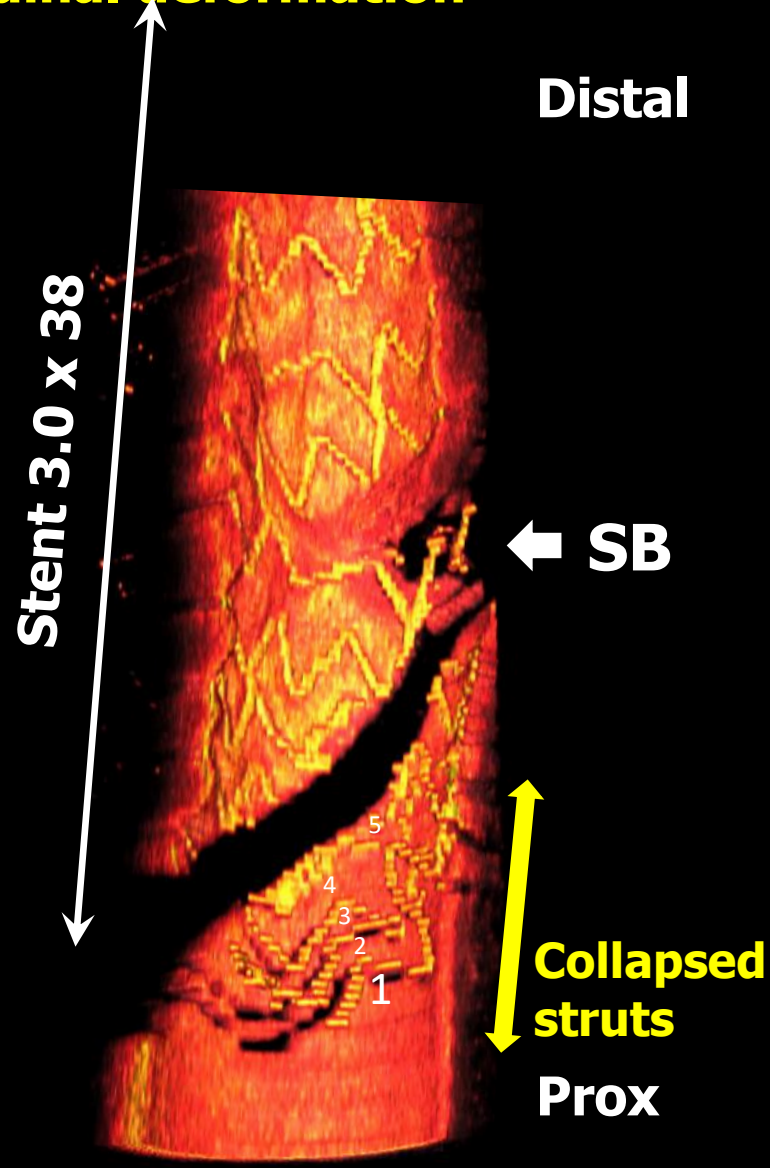
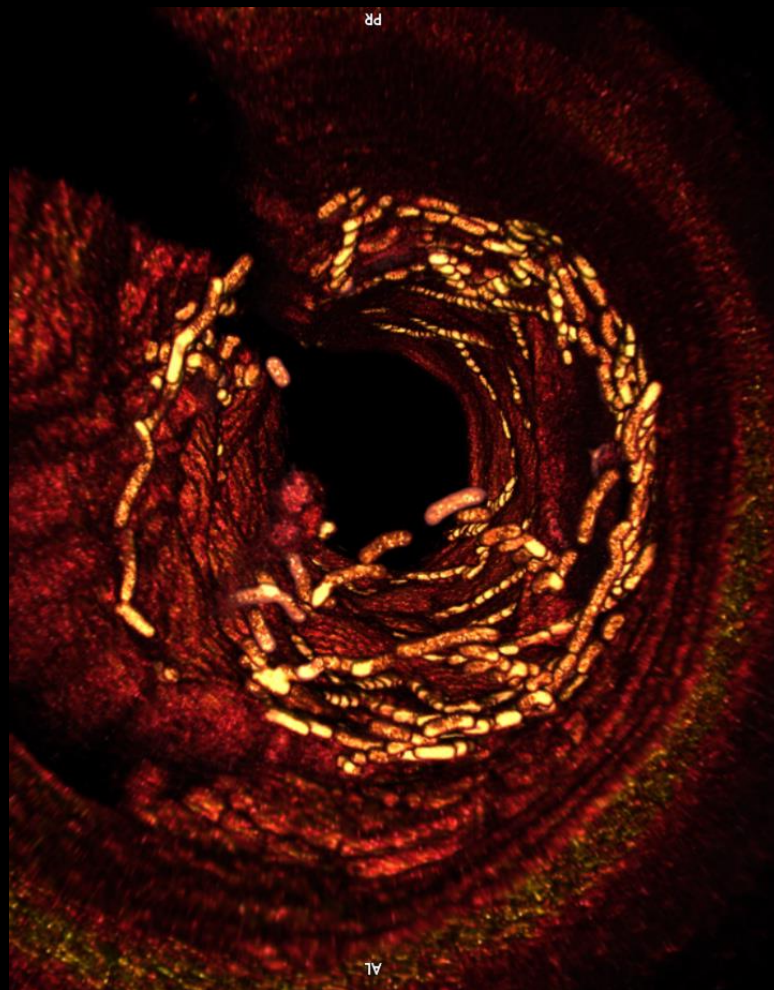
**Overhanging struts
Malapposed struts,
unequal distribution
of struts**



Disruption of circularity

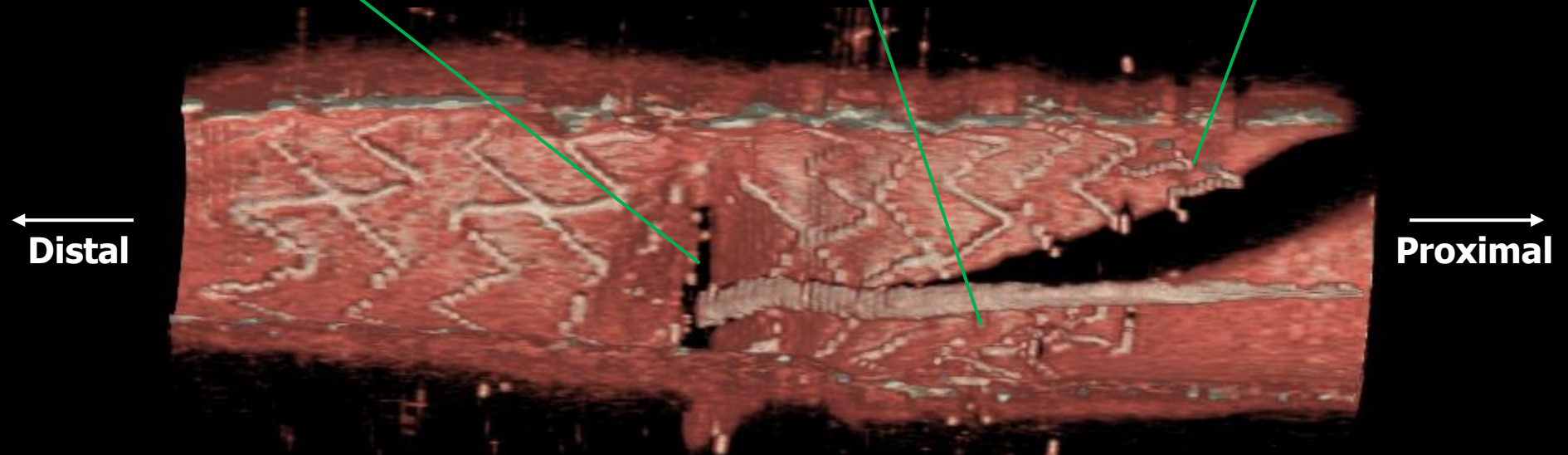
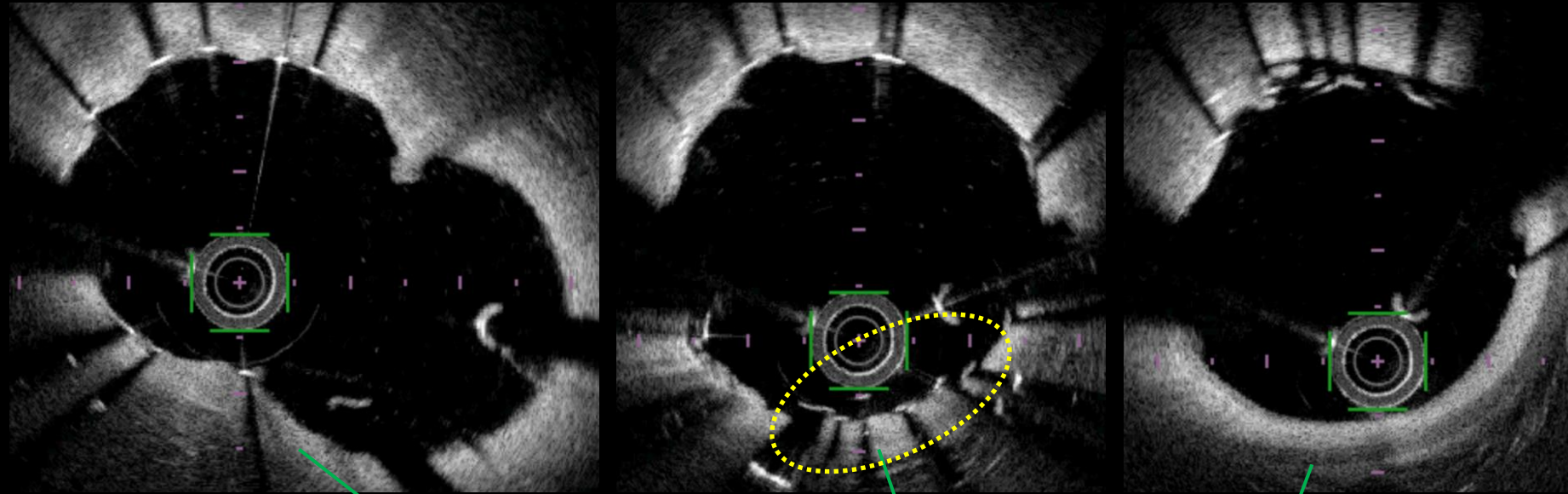
3D reconstruction of proximal part of the stent demonstrated deformation and malapposition – longitudinal deformation

3D reconstruction
Prox → Distal



Longitudinal Distortion case

Final OFDI After POT and KBT



Definitions and Standardized Endpoints

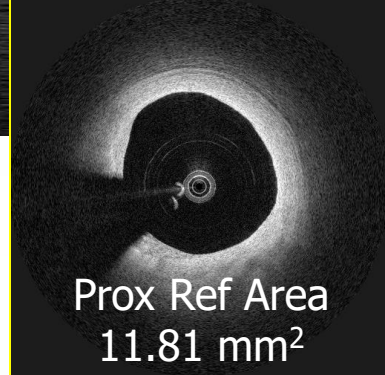
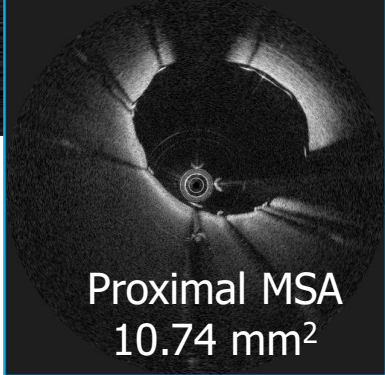
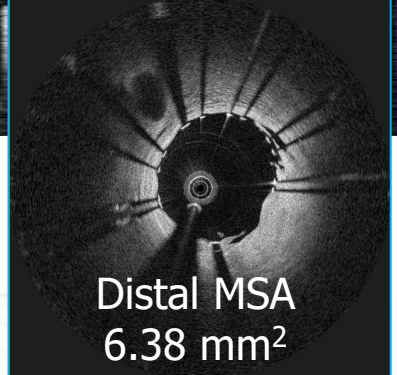
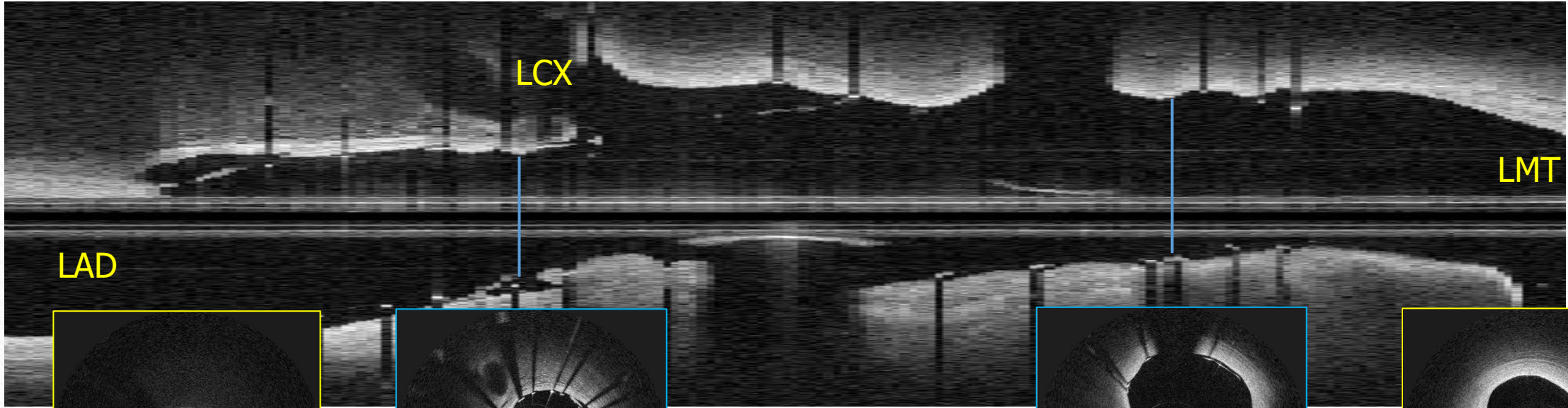


Crite
1

Proximal MSA / Ref Area = 90.9%

Distal MSA / Ref Area = 95.4%

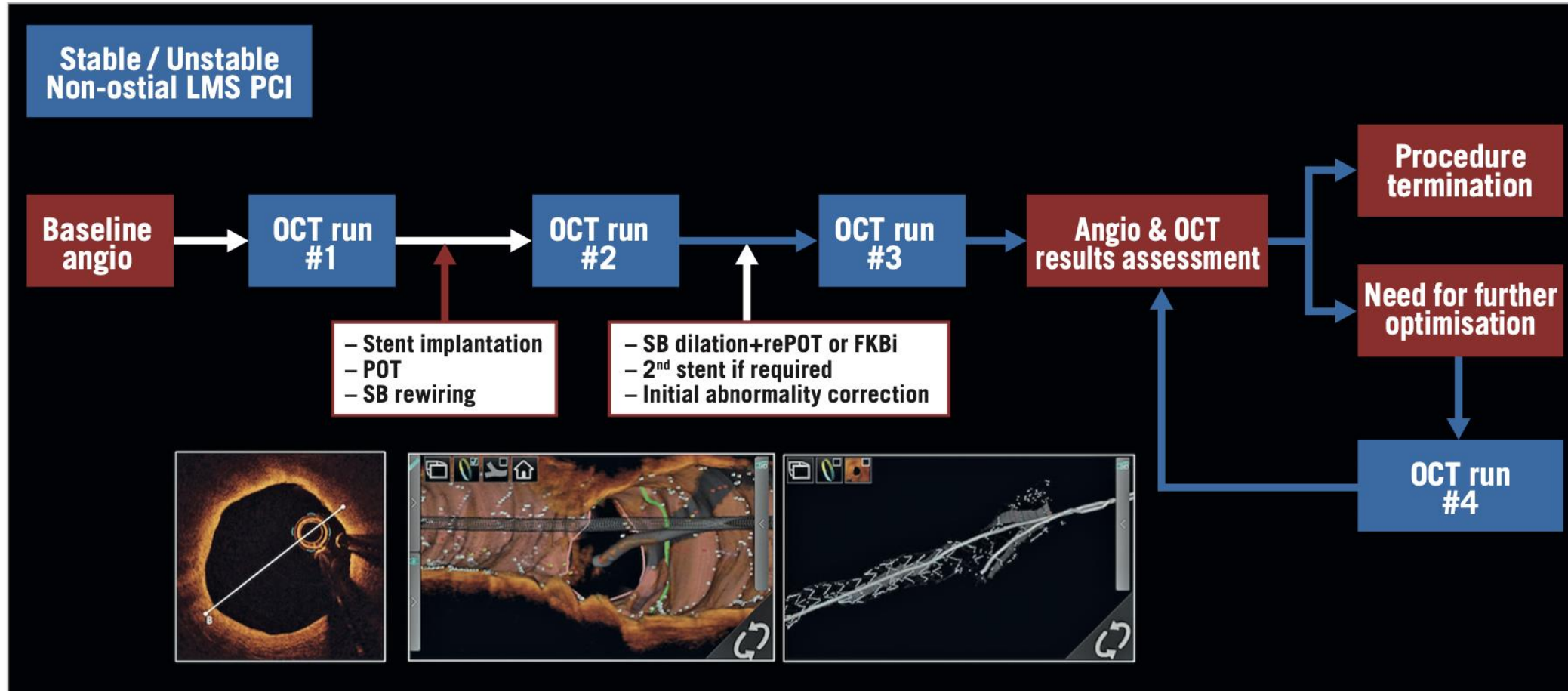
Expansion
≥ 80%



How do we optimize OCT-guided LM PCI - the LEMON study-

Amabile N, et al. EuroIntervention 2021;17:e124-e131

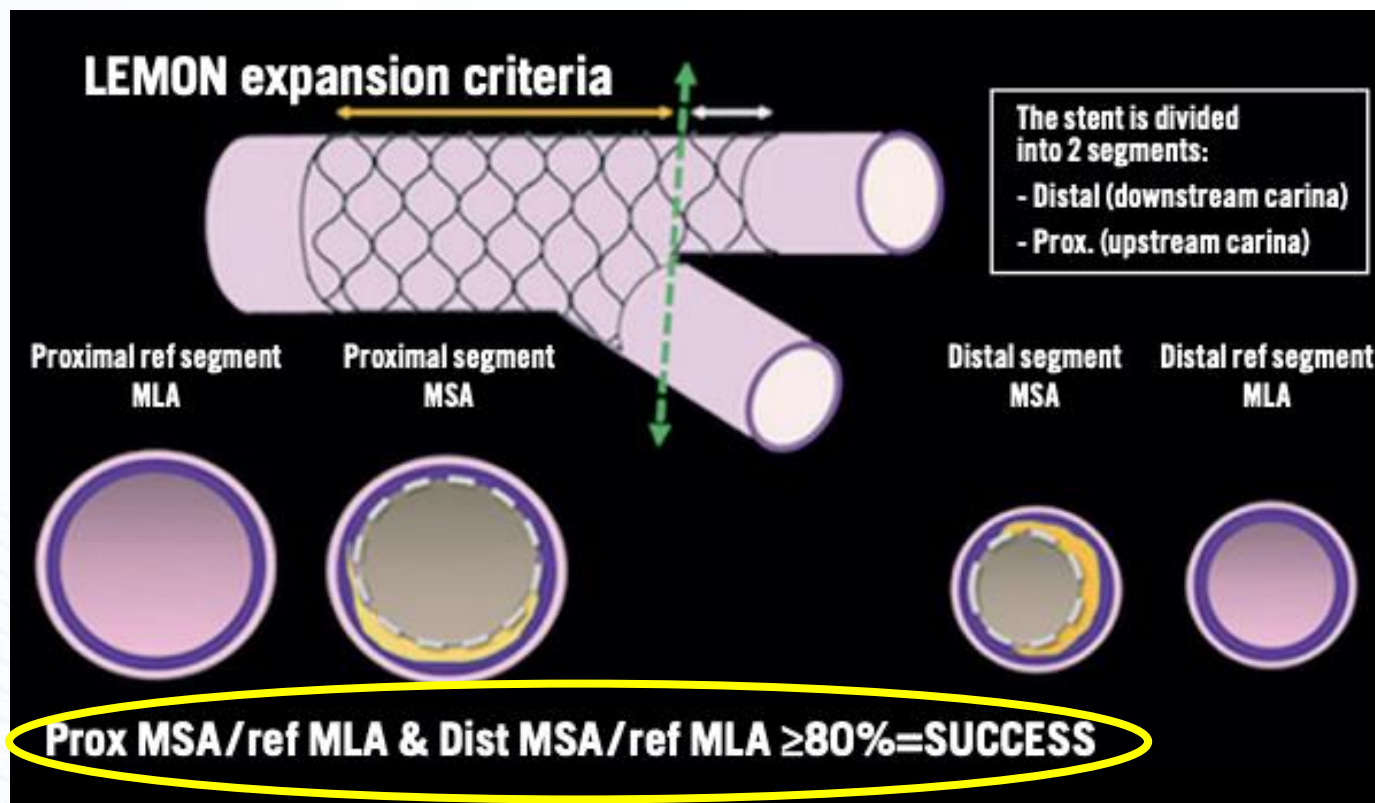
- ✓ LEMON is a prospective and multi-center trial investigating OCT-guided LM bif PCI.



- ✓ OCT is assessed at multiple timing along with the procedure.

How do we optimize OCT-guided LM PCI - the LEMON study-

Amabile N, et al. EuroIntervention 2021;17:e124-e131



		N=70
Bifurcation, n (%)		58 (83)
Trifurcation, n (%)		12 (17)
LMS lesion QCA pre, %		59 (56-61)
PCI technique, n (%)	Balloon predilatation	48 (69)
	1-stent technique	58 (83)
	2-stent technique	12 (17)
		N=70
Lesion type		
	Medina 1,1,1	11 (16)
	Medina 1,1,0	39 (56)
	Medina 1,0,1	4 (6)
	Medina 0,1,1	5 (7)
	Medina 1,0,0	11 (16)

- 1) Achievement of the primary endpoint in 86%
- 2) Significant edge dissection in 30%
- 3) OCT guidance modified operator strategy in 26% of patients
- 4) 1-year survival free from major clinical adverse events of 98.6% (97.2%-100%)



Conclusions

- **Imaging guided PCI for LMT is established.**
- **In absence of ostial lesion, OCT guidance is feasible in LM.**
- **OCT provides potential advantages for specific steps of bifurcation interventions, including visualization of the site of guidewire crossing, stent deformation and stent optimization.**
- **OCT can visualize and predict the acute malapposition at sidebranch ostium. The clinical impact of those acute malapposition should further be investigated.**
- **Ongoing trials (e.g. OCTOBER etc) investigate potential advantage of OCT guidance in bifurcation PCI.**