Updated Imaging-Guided ISR PCI 2021

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Disclosure Statement of Financial Interest

I, Do-Yoon Kang, 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.

In-Stent Restenosis

- Reduction in lumen diameter after PCI

- Angiographic Restenosis (diameter stenosis ≥ 50%)
- Clinical Restenosis (requirement for ischemia-driven repeat revasc.)

- ~10% of PCI in US (NCDR registry)
- ~5% of PCI in Korea (IRIS-DES / DEB registry)

Dangas et al. JACC. 2010;56:1897-1907, Moussa et al. JACC. 2020;76:1521-1531

Causes of In-Stent Restenosis

Mechanical Factors

- Stent under-expansion
  - Undersized stent, Recoil, Peri-stent heavy calcification
- Stent fracture
- Gap

Tissue Re-growth

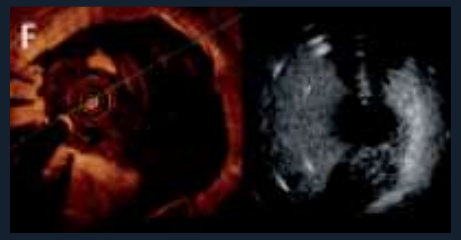
- Neointimal hyperplasia
- Neoatherosclerosis

Intravascular Imaging for ISR provides Information of underlying mechanisms

Edge dissection

Neointimal Hyperplasia

Neoatherosclerosis

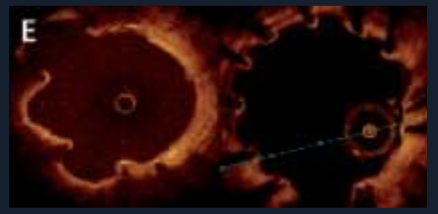


Stent crush

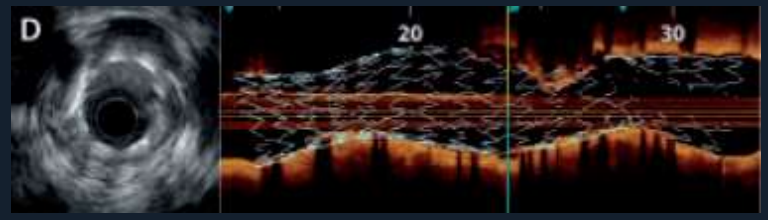
Stent Failure

Late Acquired Malapposition

Evaginations



Underexpansion



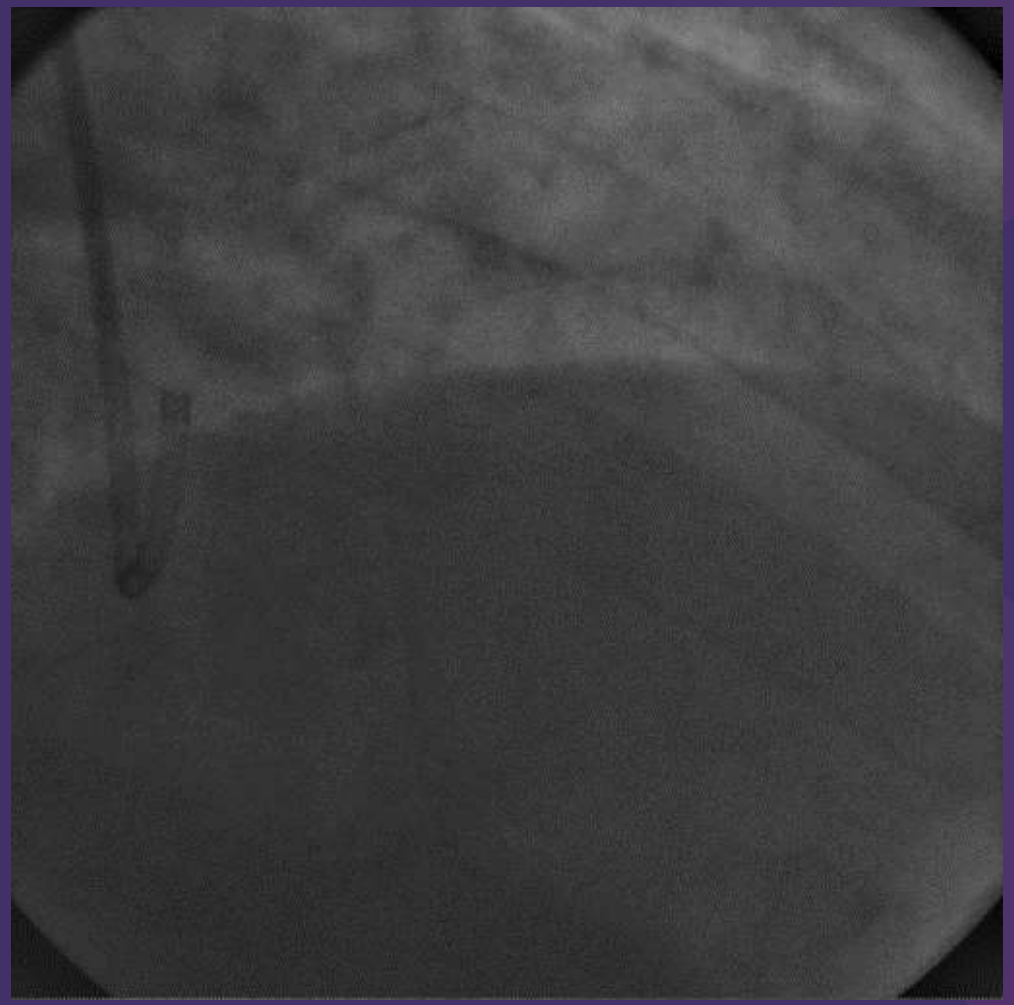
Neumann FJ et al., Eur Heart J. 2019;40:87-165.

Case Information

- M/75
- Admitted for aggravated angina for 1 month

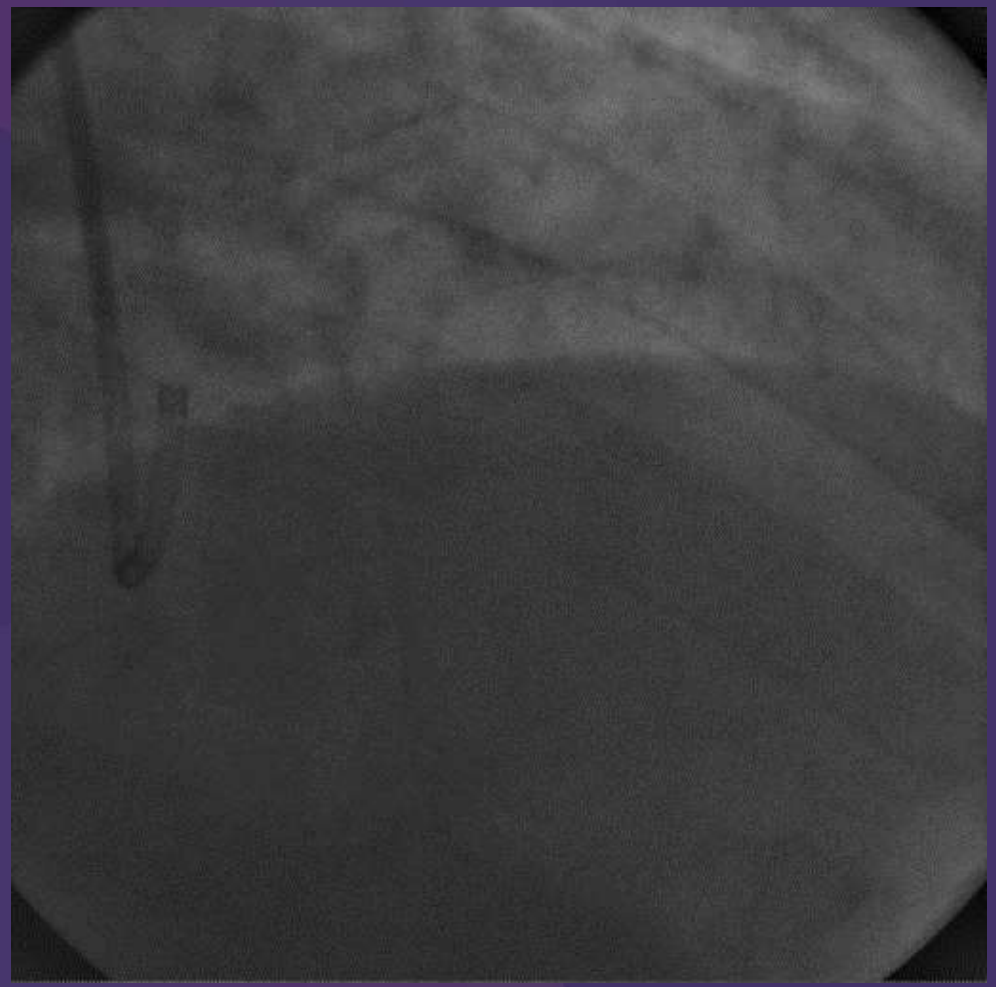
- DM, HT on medication
- 3.0 x 24 mm DES implantation at proximal LAD - 13 years ago

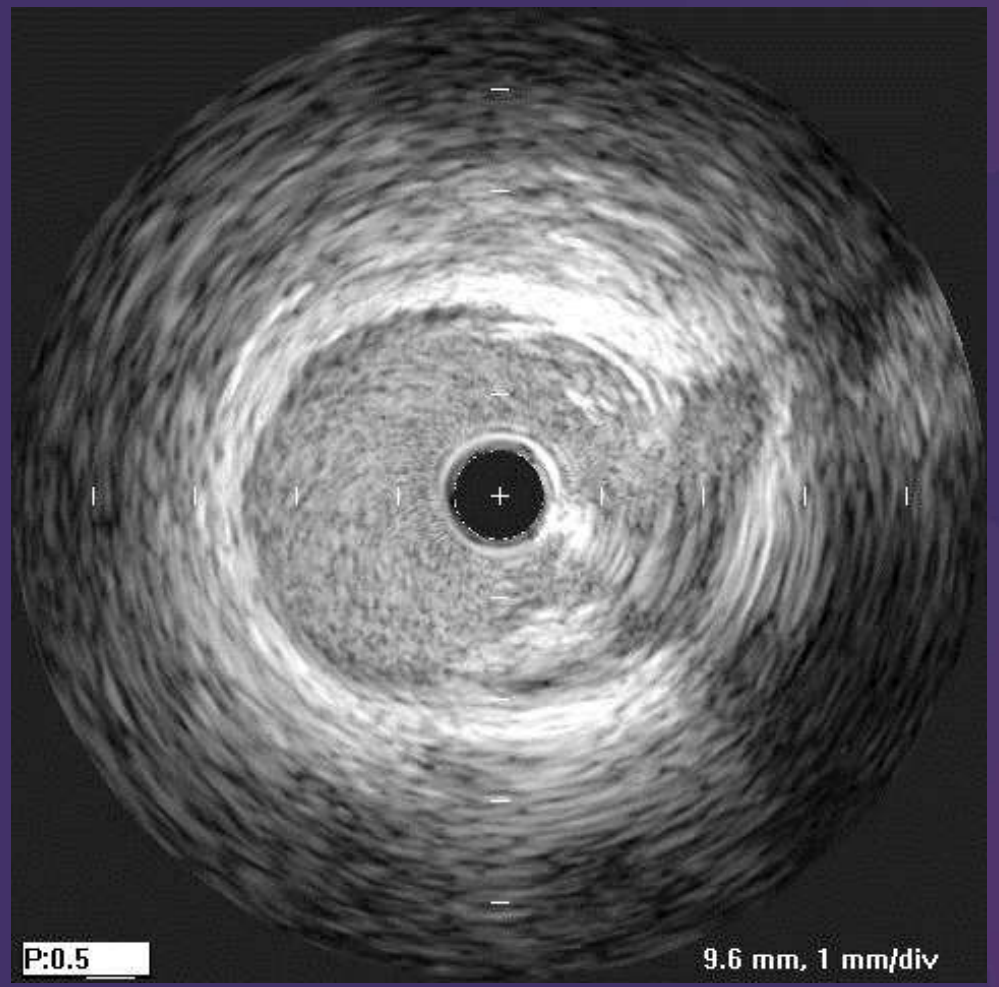
CAG & PCI at LAD – 13 Years ago



3.0 x 24 mm DES upto 18 atm (3.3 mm)

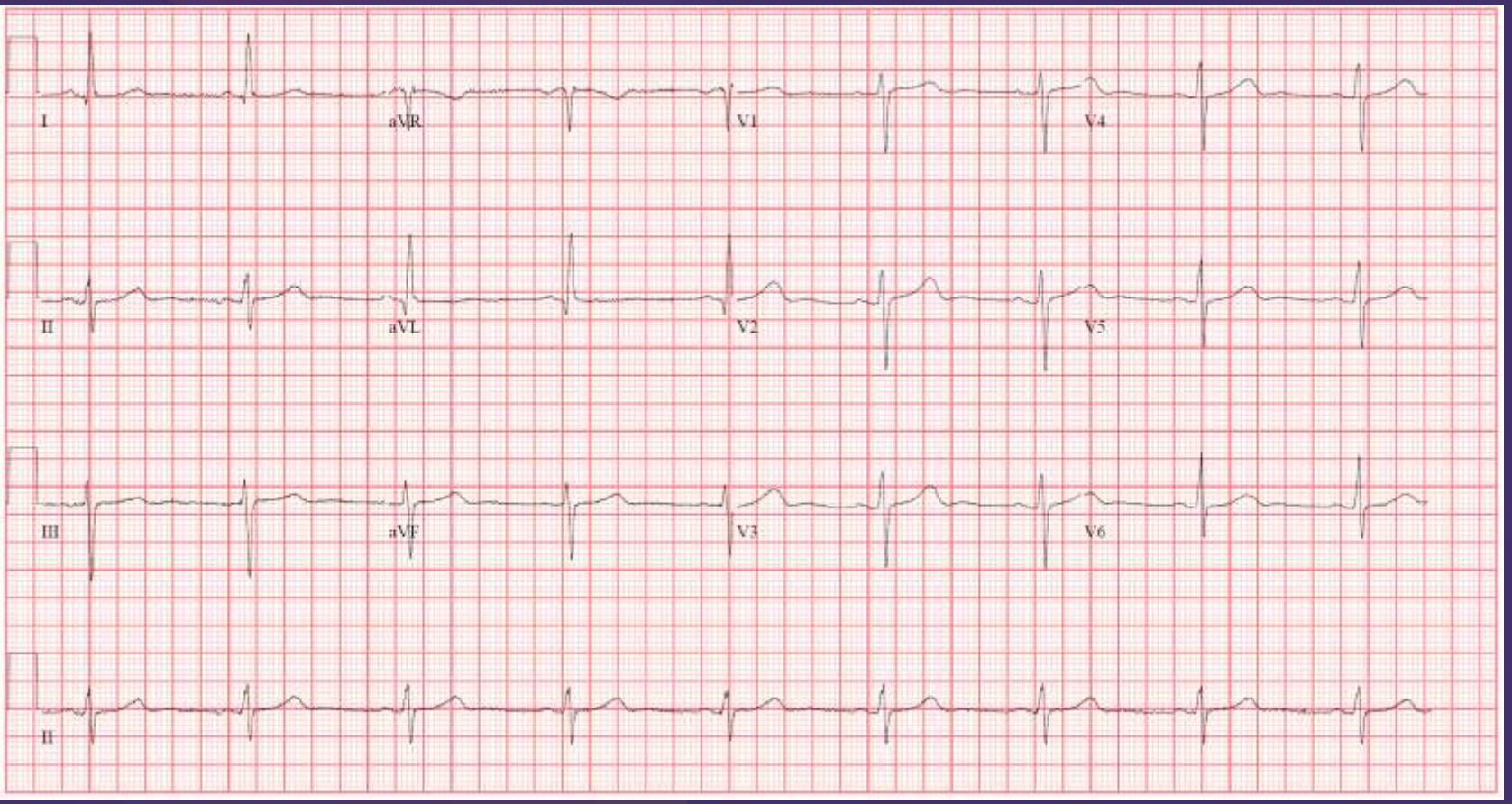
PCI at LAD 13 Years ago – Final Angio & IVUS



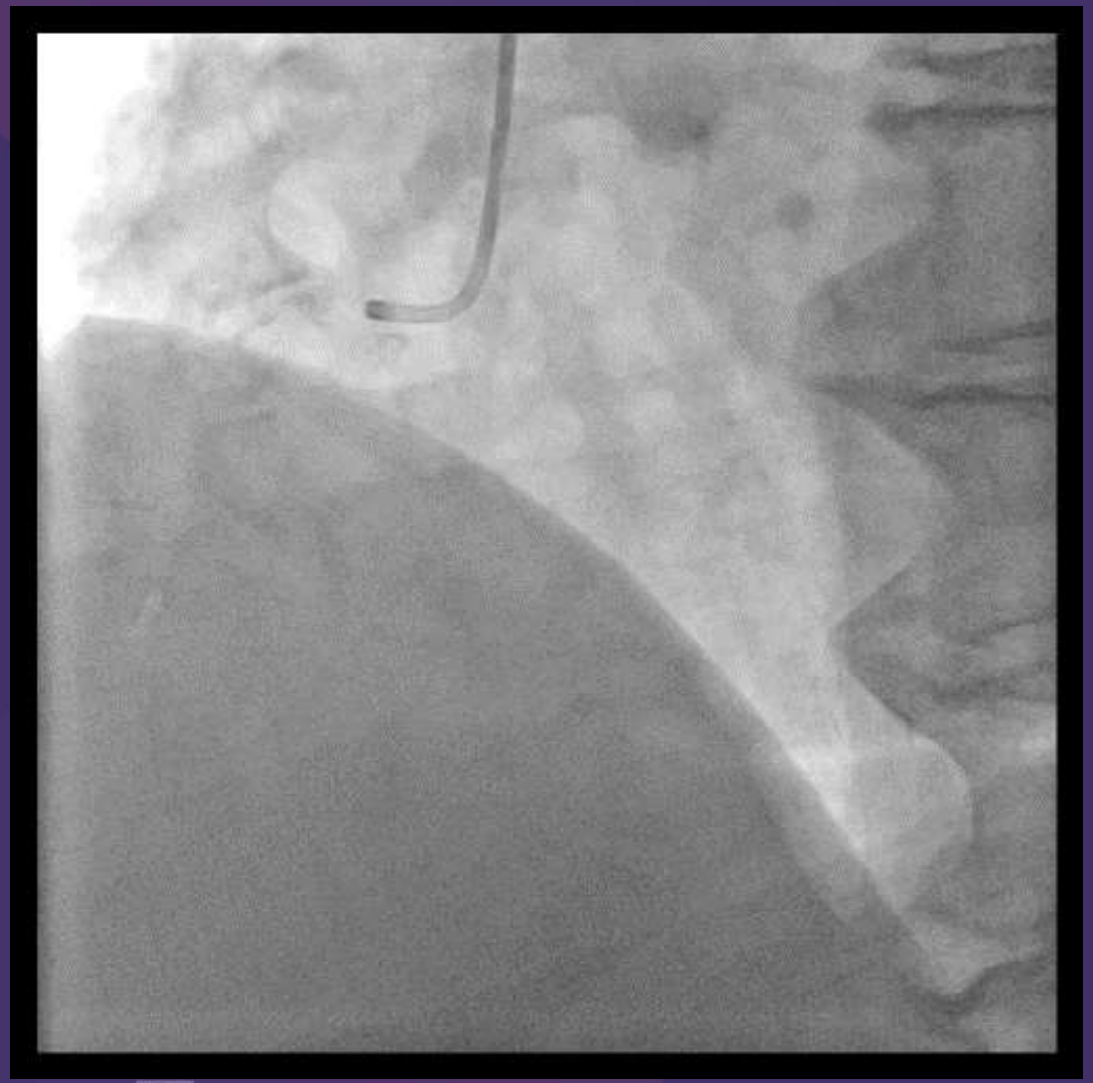


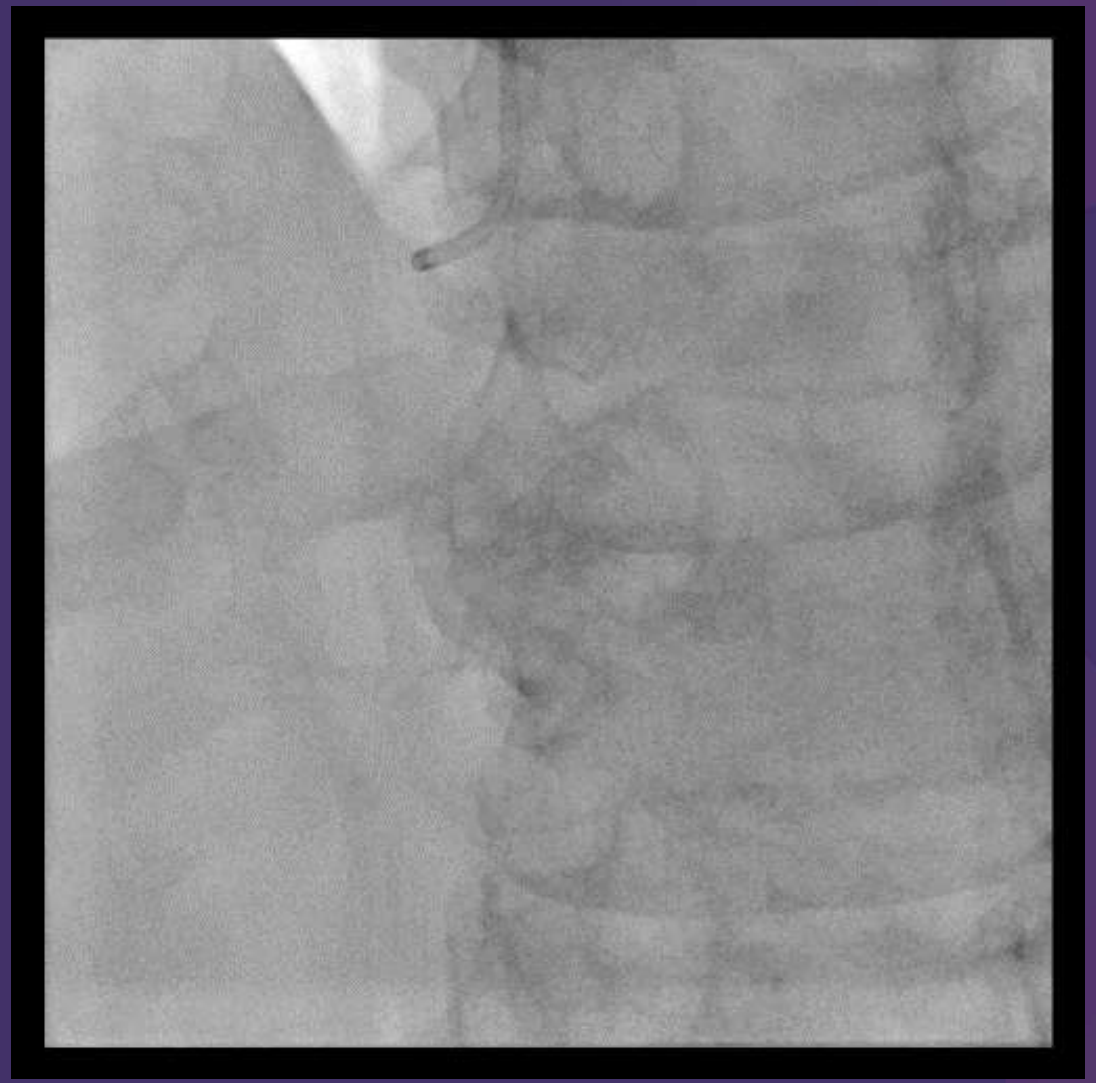
M/75 with Angina

- TTE : Normal LV size and systolic function (EF 60%)



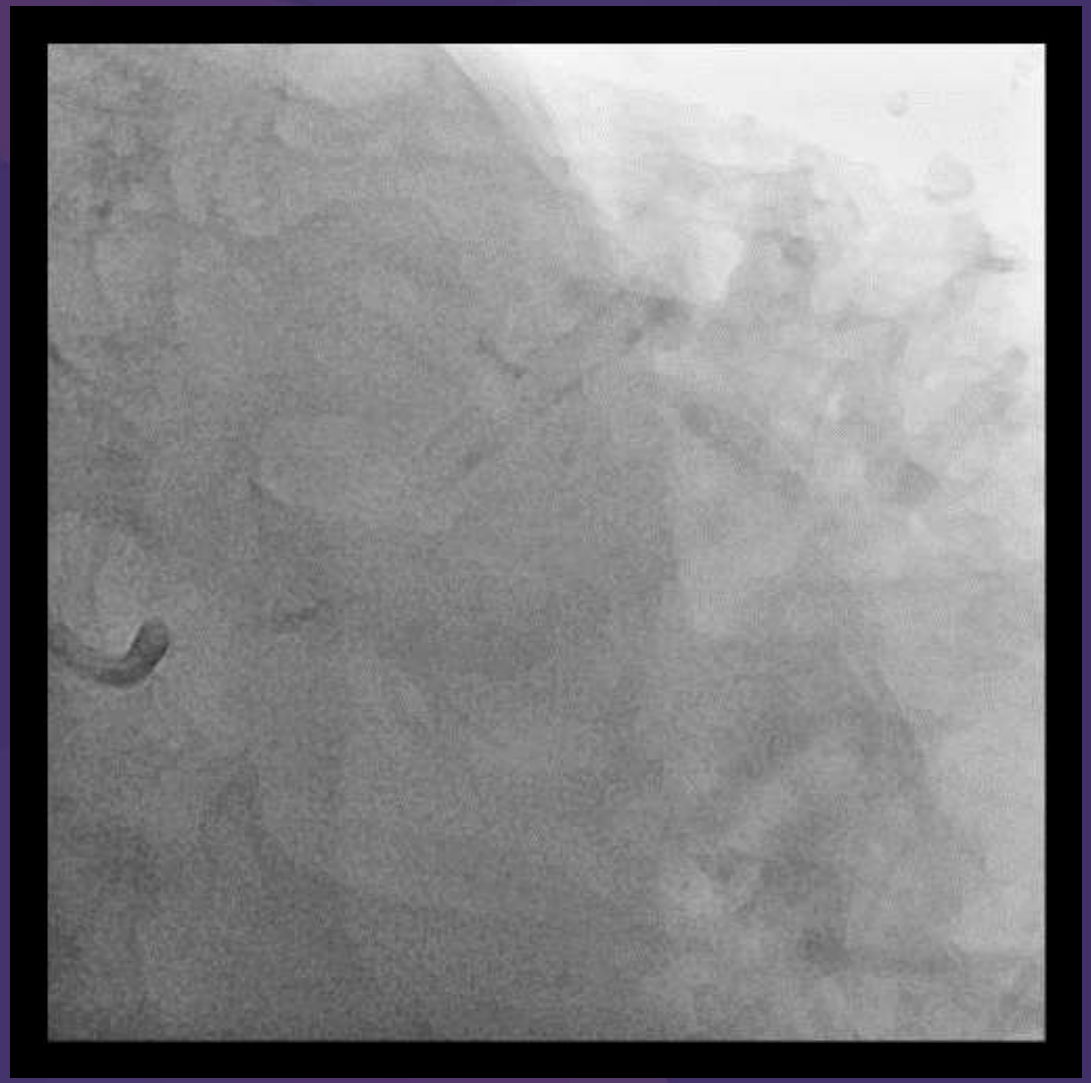
CAG





CAG

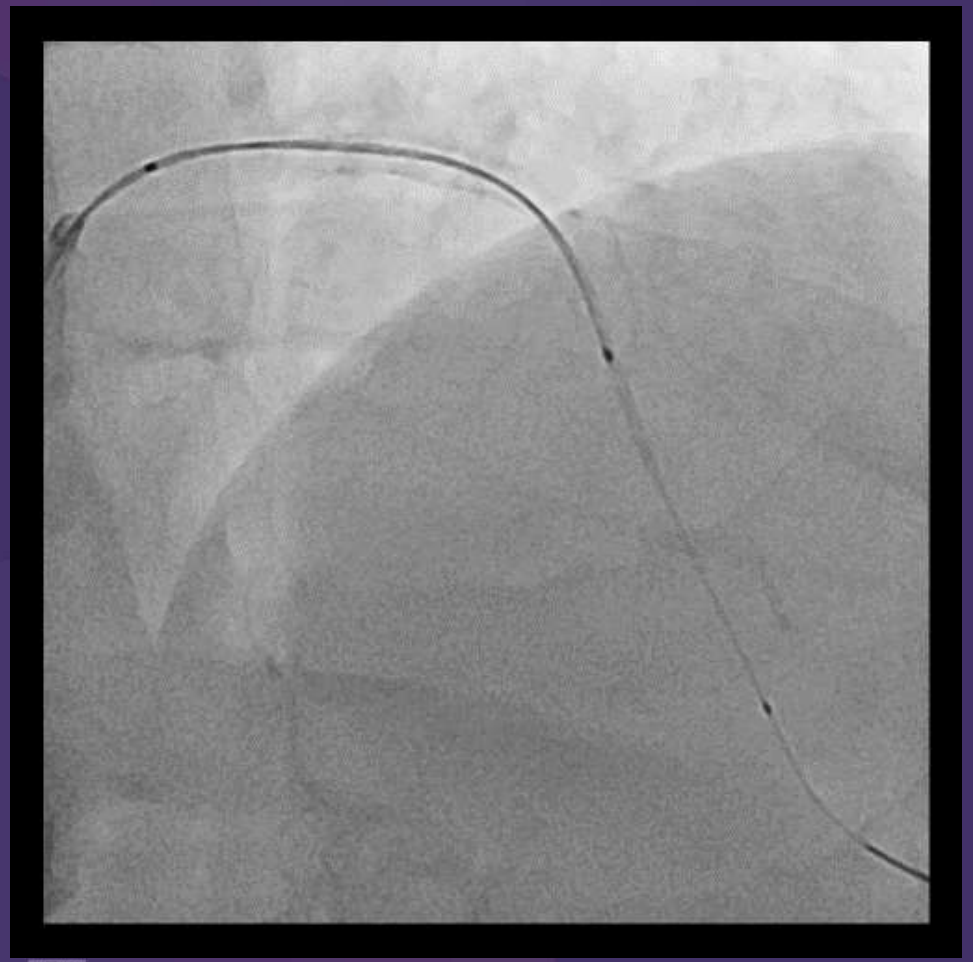
PCI at LAD ISR



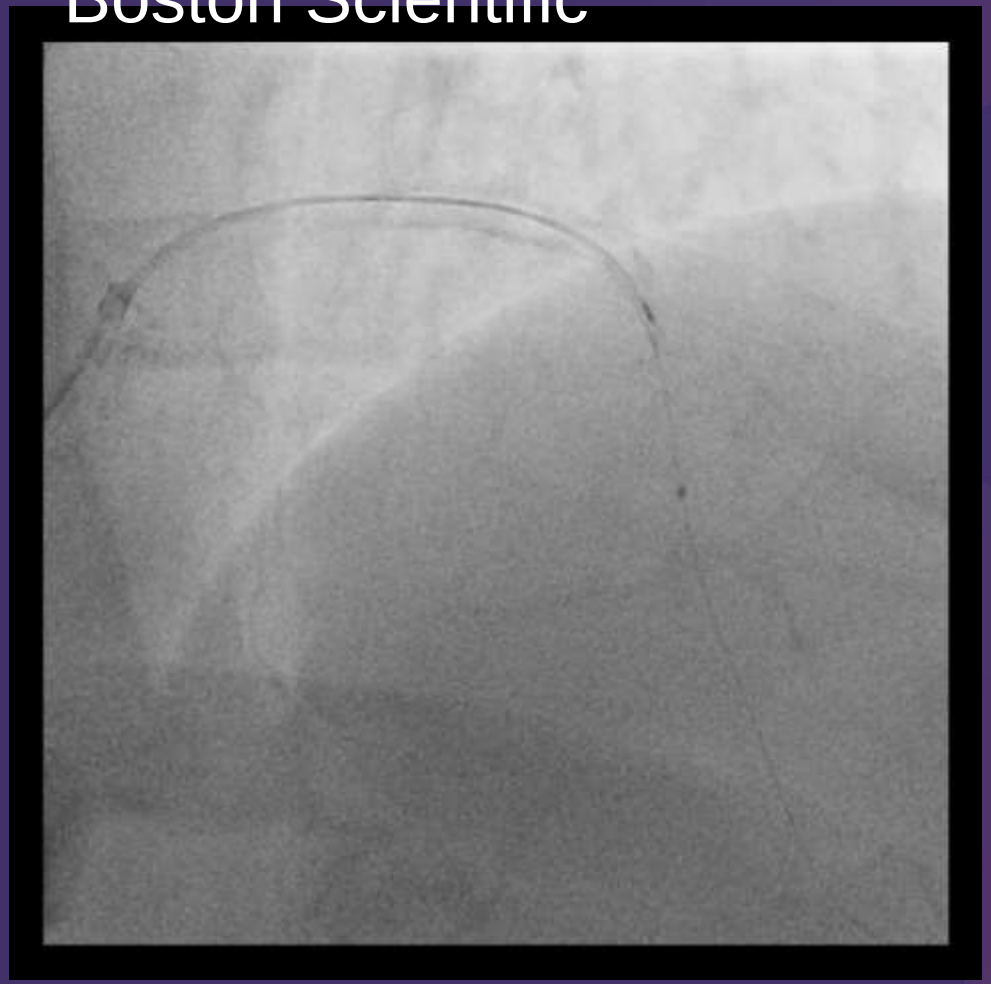
FFR 0.74

Baseline OCT / IVUS

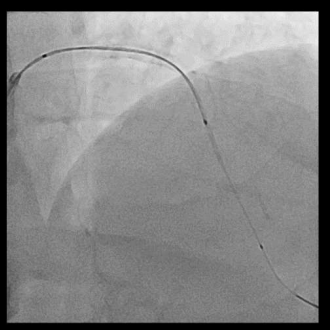
OCT, OPTIS™, Abbott

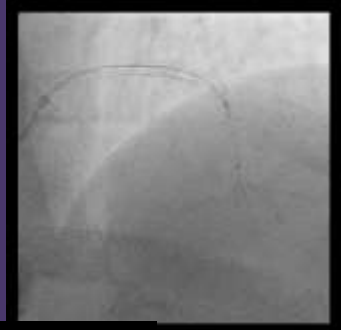


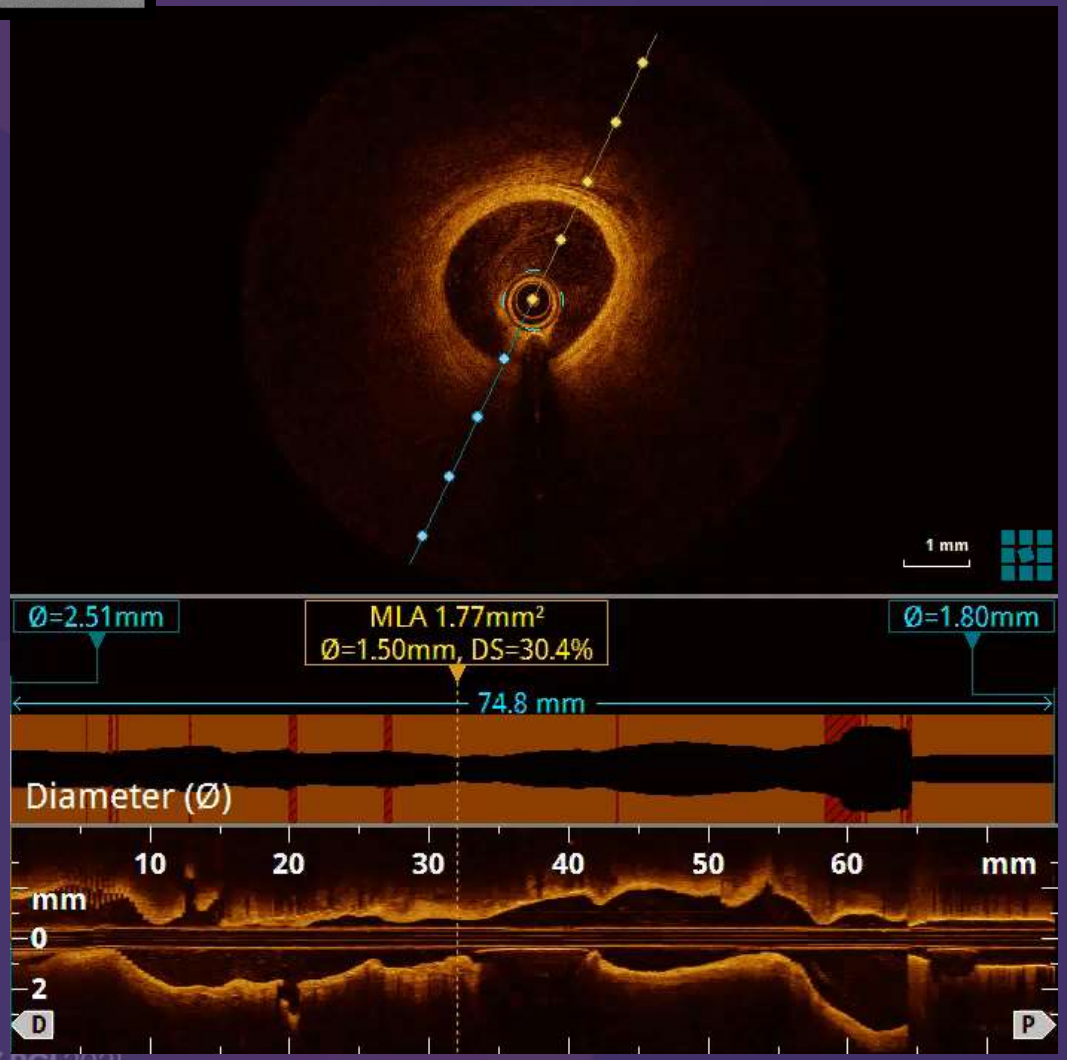
HD-IVUS,OPTICROSS™, Boston Scientific

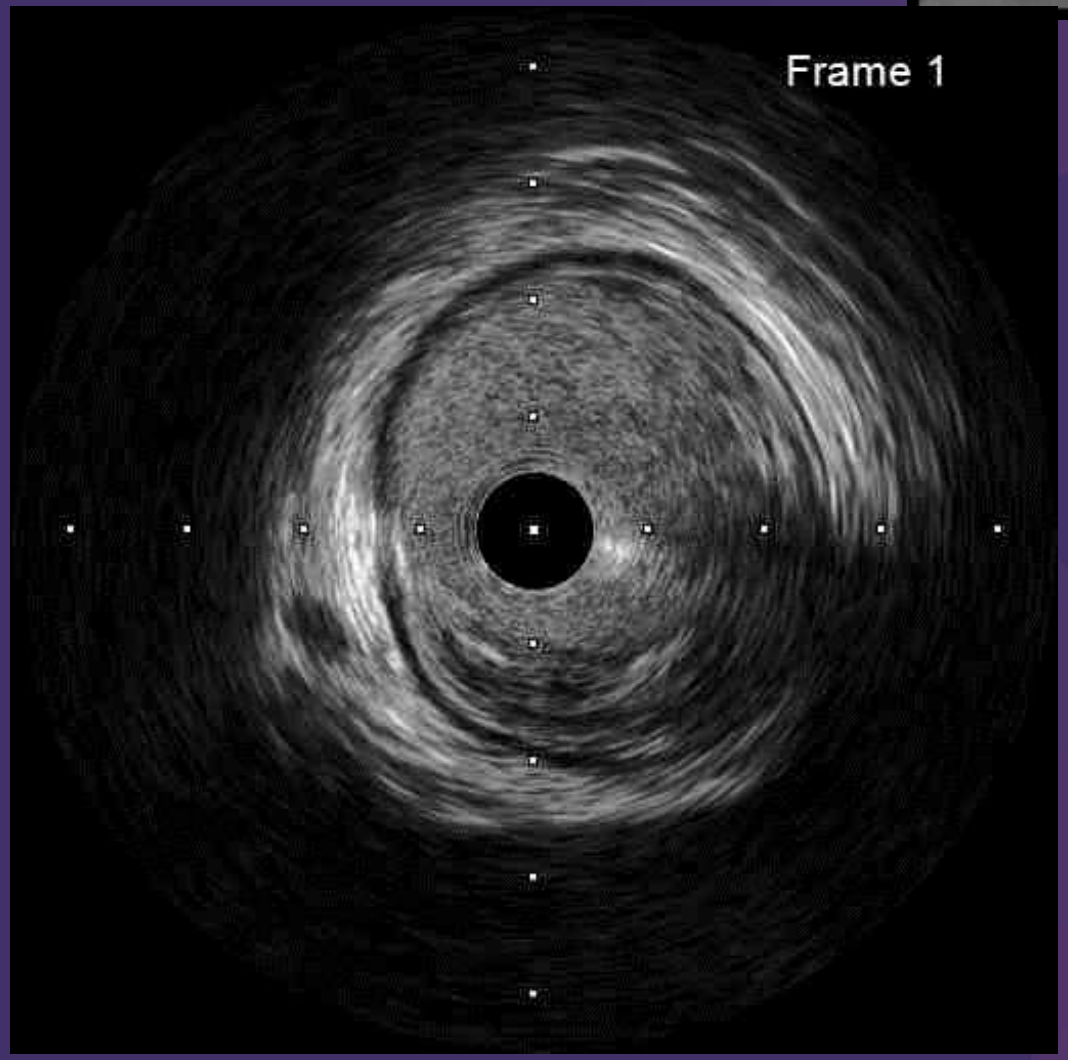


Baseline OCT / IVUS

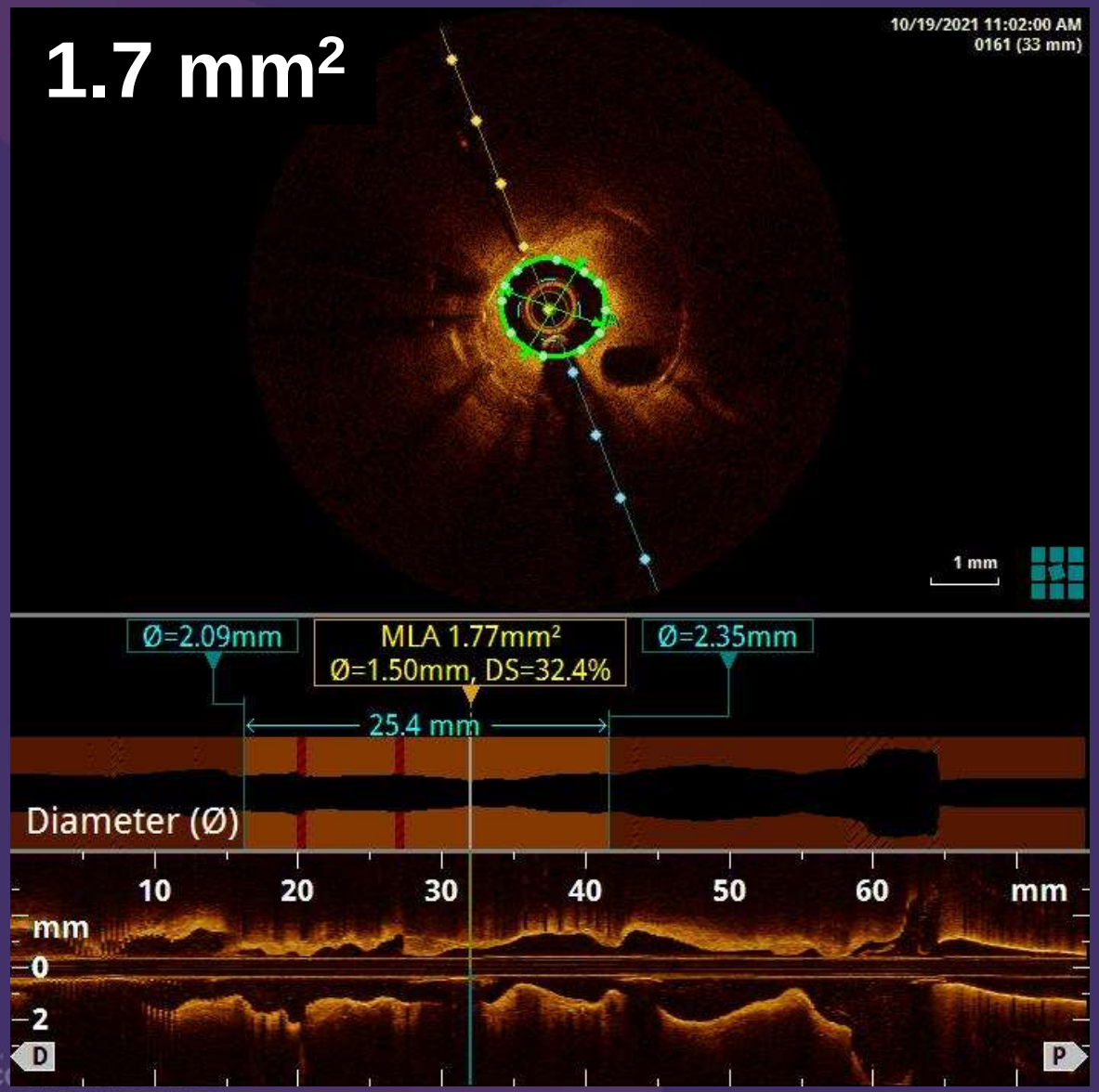


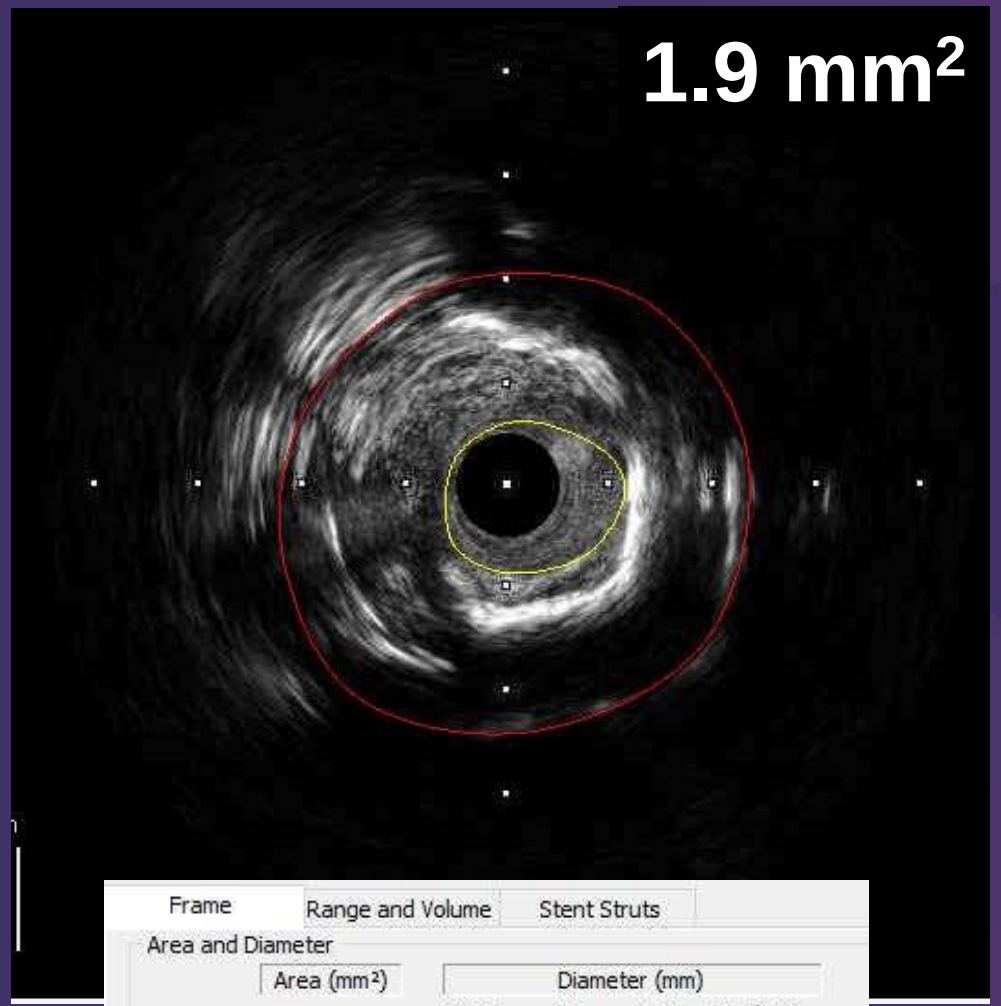






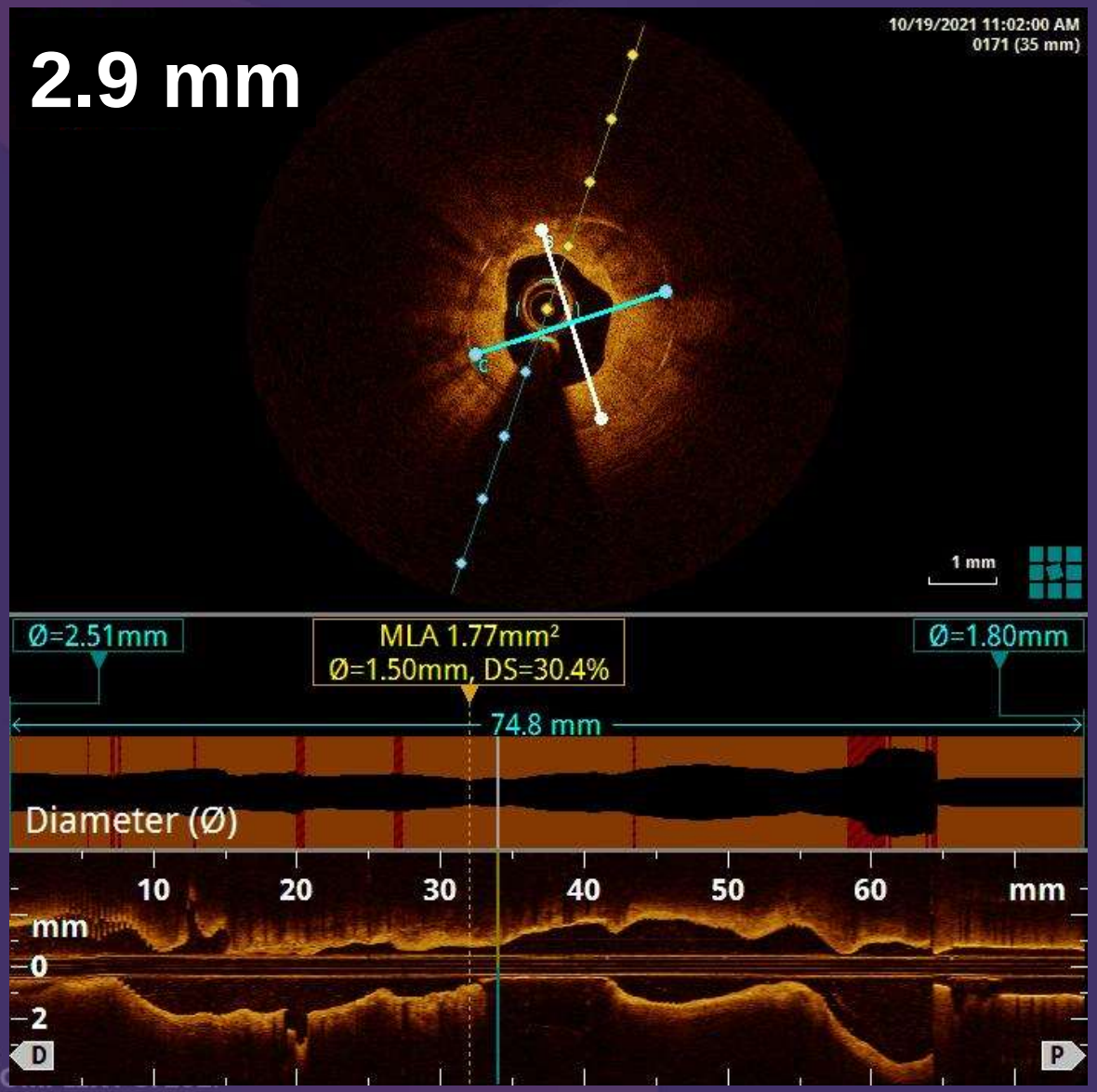
ISR with Neoatherosclerosis

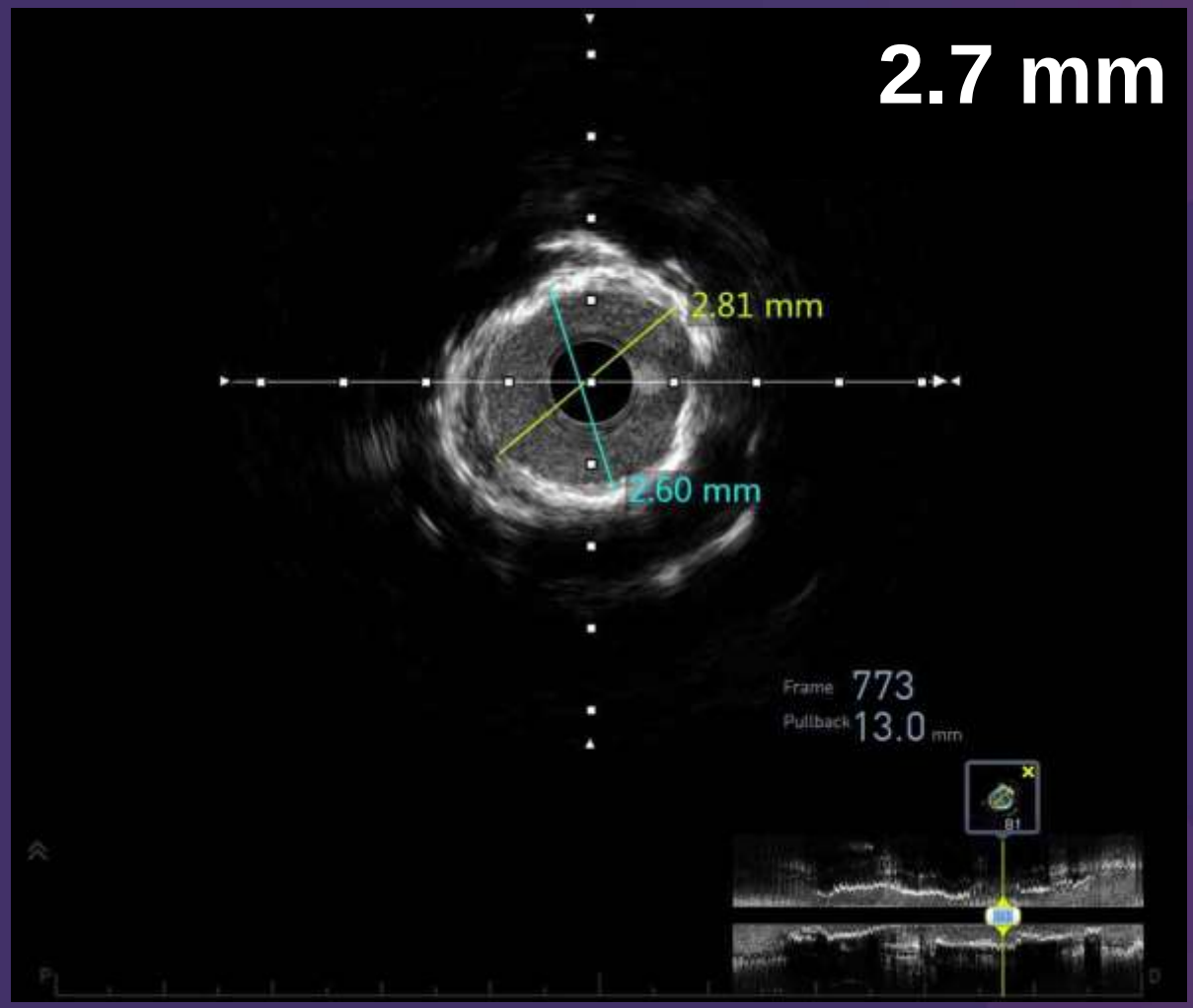




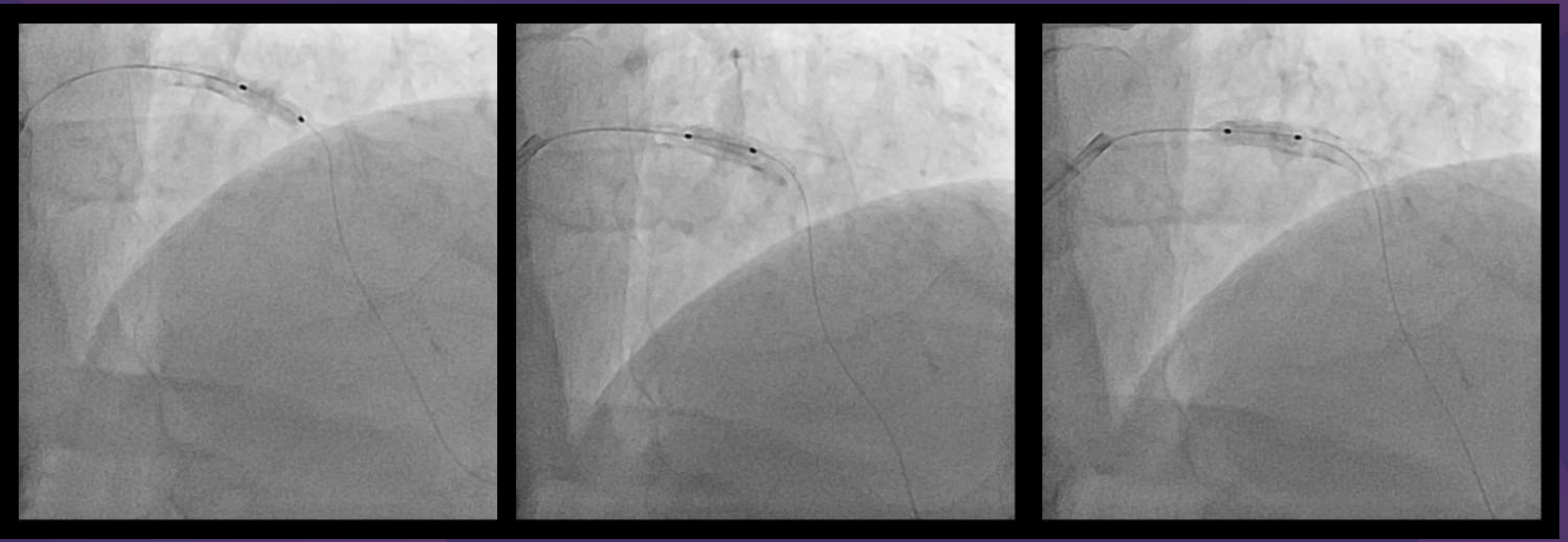
Frame	Range and Volume	Stent Struts			
Area and Diameter					
	Area (mm²)	Diameter (mm)			
		Mean	Min	Max	Min/Max
Lumen	1.95	1.59	1.44	1.76	0.82
Vessel	16.54	4.60	4.46	4.78	0.93
Stent					
Plaque	14.59 (88.2% of Vessel)				

ISR with Under-expansion





Cutting Balloon

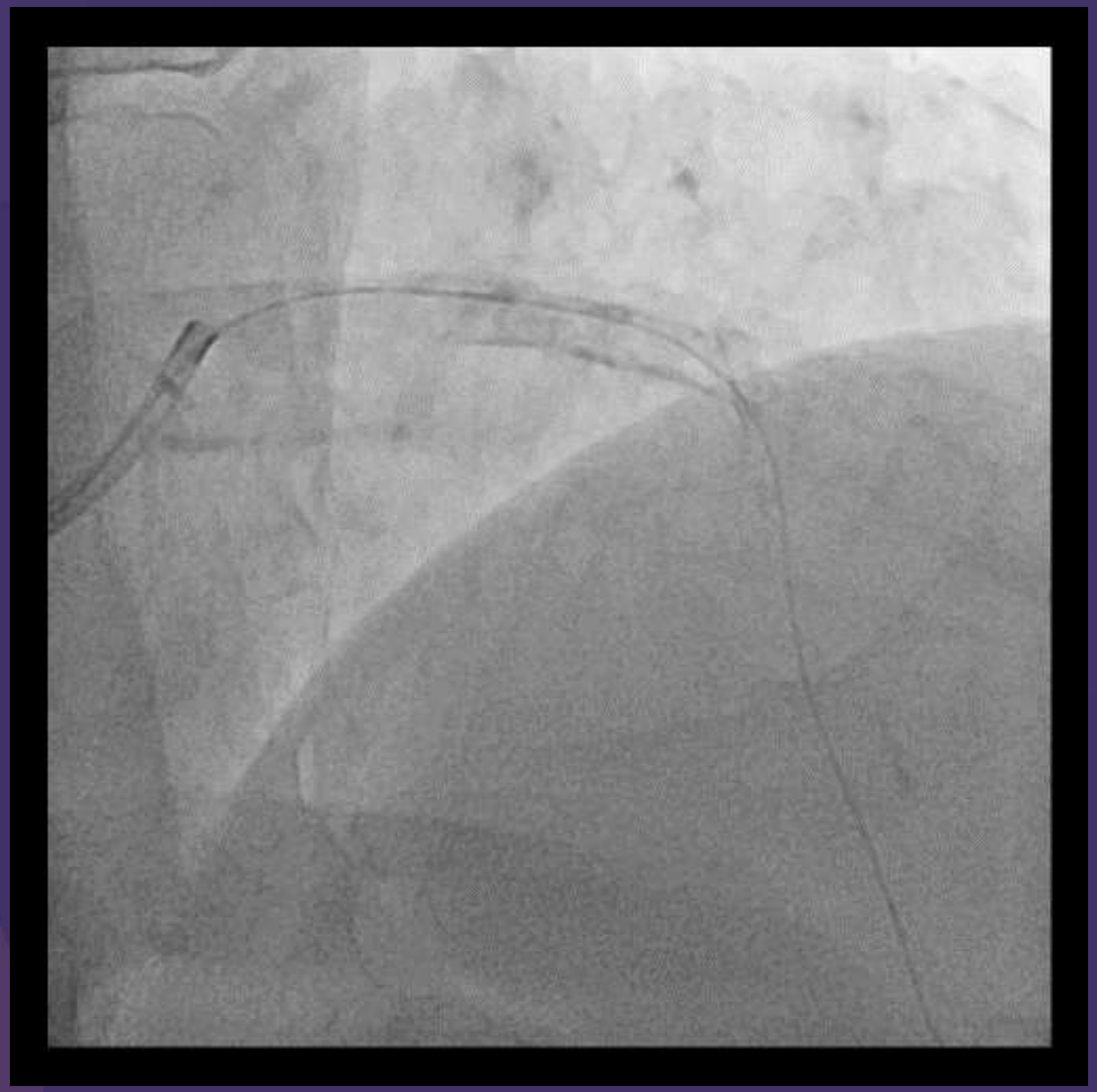


Flextome Cutting balloon 3 x 10 mm upto 20 atm

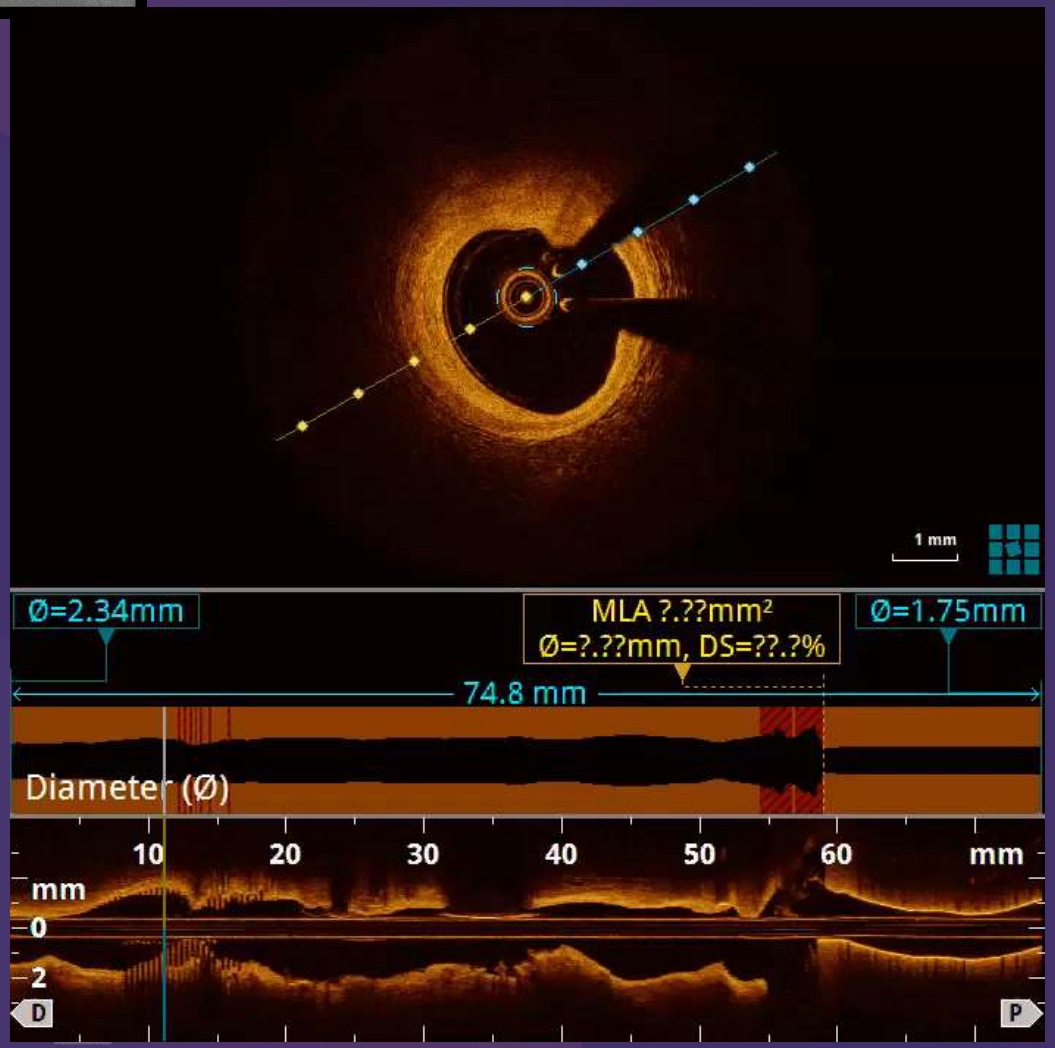
Cutting Balloon

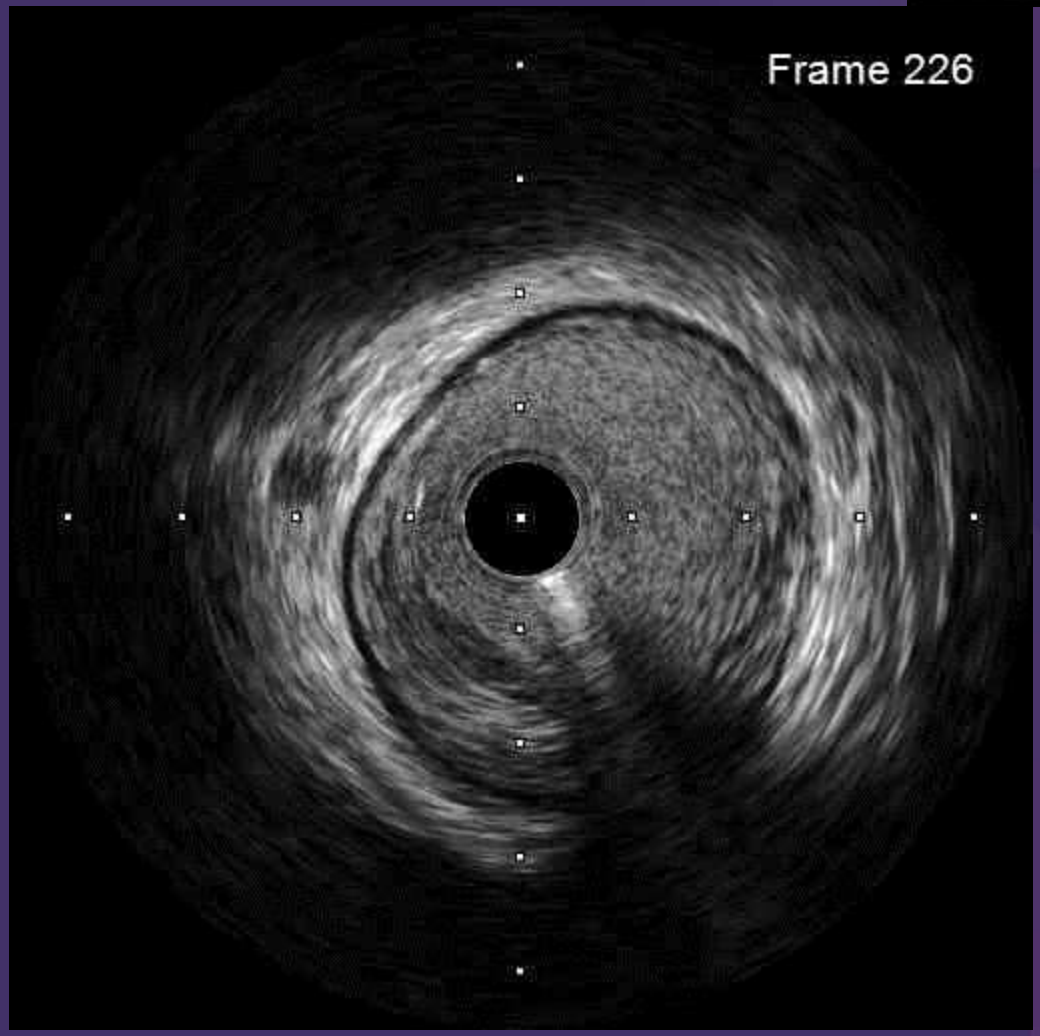
Again & again…

After Cutting Balloon



OCT / IVUS after Cutting Balloon





Non-Compliant 3.5 x 15 mm Balloon upto 26 atm

Then, How to Treat?

DCB vs DES, Which is Better?
: Meta-analyses comparing DCB vs DES

Percutaneous coronary interventic treatment of in-stent restenosis: a

George C M Siontis, Giulio G Stefanini, Dimitris Mavridis, Konstantinos C Siontis, Fe
Adnan Kastrati, Bernhard Meier, Georgia Salanti, Peter Jüni, Stephan Windecker

	EES	DCB	SES	PES	VBT
EES	99·6 (0·98)	−9·0% (−15·8 to −2·2)	−9·4% (−17·4 to −1·4)	−10·2% (−18·4 to −2·0)	−19·2% (−28·2 to −1
DCB	..	73·7 (0·00)	−0·2% (−6·2 to 5·6)	−1·2% (−6·4 to 4·2)	−10·2% (−17·0 to −3
SES	..	..	72·8 (0·01)	−0·8% (−6·4 to 4·6)	−10·0% (−15·4 to −4
PES	..	..	..	67·7 (0·01)	−9·0% (−15·6 to −2
VBT	..	..	..	..	38·9 (0·00)
BMS	..	..	..	..	..
BA	..	..	..	..	..
ROTA	..	..	..	..	..

Estimates are expressed as differences in percent diameter stenosis, with 95% CIs in parentheses; estim
appendix. Negative differences show that the intervention listed in the left column is more beneficial th
efficacy ranking. Surface under the cumulative ranking curve values are given in the diagonal, with the p
surface under the cumulative ranking curve value, the better the treatment. EES=everolimus-eluting st
PES=paclitaxel-eluting stents. VBT=vascular brachytherapy. BMS=bare metal stents. BA=balloon angio

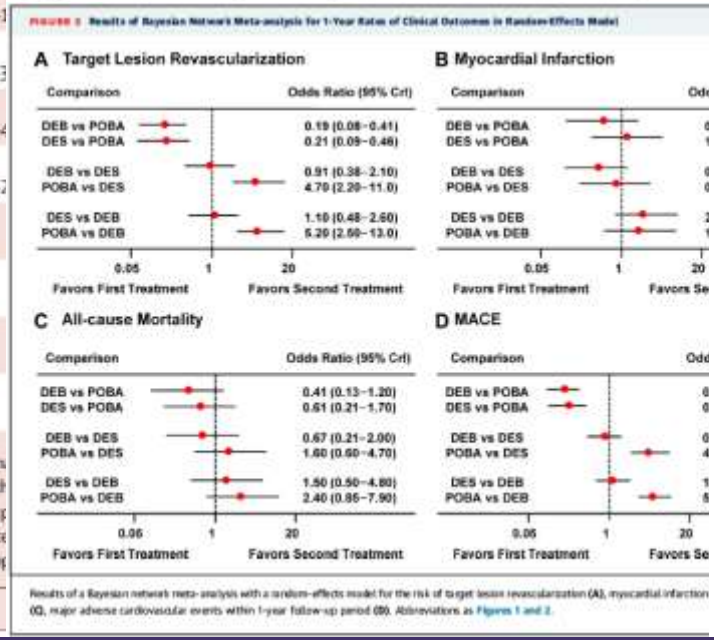
Table 2: Estimated differences of the effect of interventions on percent diameter stenosis

Sionitis GC et al., Lancet, 2015

Comparison Among Drug-Eluting Ball Drug-Eluting Stent, and Plain Balloon Angioplasty for the Treatment of In-S Restenosis

A Network Meta-analysis of 11 Randomized, Controlled T

Joo Myung Lee, MD, MPH,* Jonghanne Park, MD,* Jeehoon Kang, MD,* Ki-Hyun Jeon, MD,* Ji
Sang Eun Lee, MD, PhD,* Jung-Kyu Han, MD, PhD,* Hack-Lyoung Kim, MD, PhD,† Han-Mo Yan
Kyung Woo Park, MD, PhD,* Hyun-Jae Kang, MD, PhD,* Bon-Kwon Koo, MD, PhD,* Hyo-Soo Ki

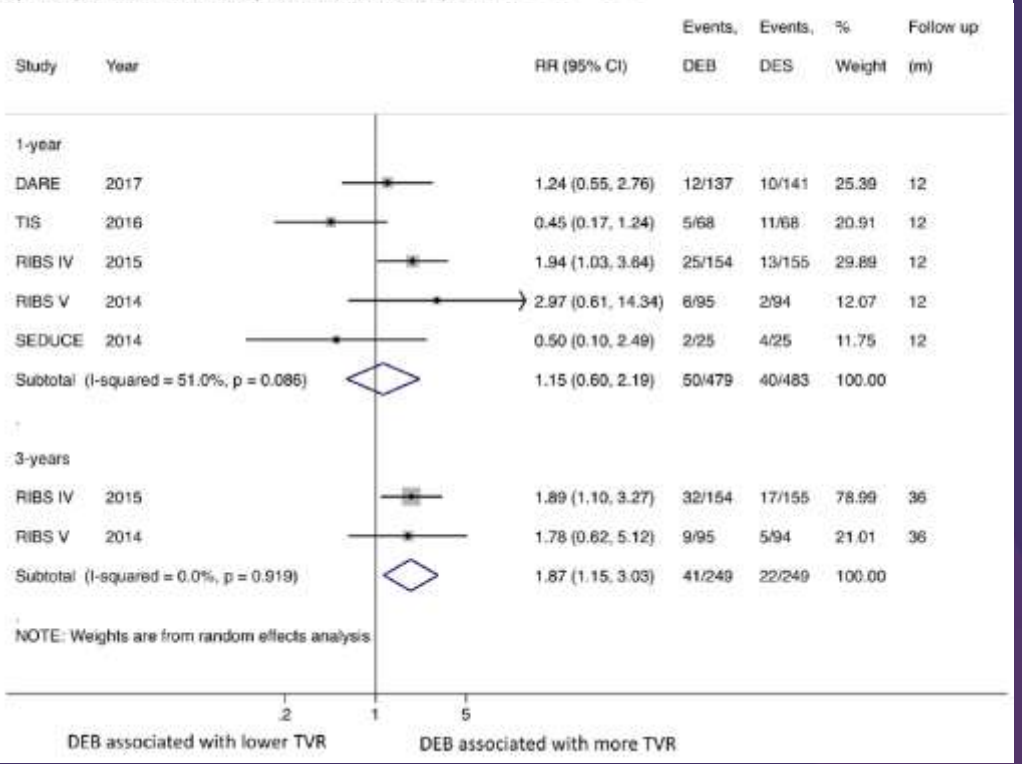


Lee et al., JACC CV Interv. 2015

Drug-eluting balloons versus everolimus-eluting stents for in-stent restenosis: A meta-analysis of randomized trials☆

Islam Y. Elgendy [a,*], Ahmed N. Mahmoud [a], Akram Y. Elgendy [a], Mohammad K. Mojadidi [a], Ayman Elbadawi [b], Parham Eshtehardi [c], María José Pérez-Vizcayno [d], Siddharth A. Wayangankar [a], Hani Jneid [e], R. David Anderson [a], Fernando Alfonso [f]

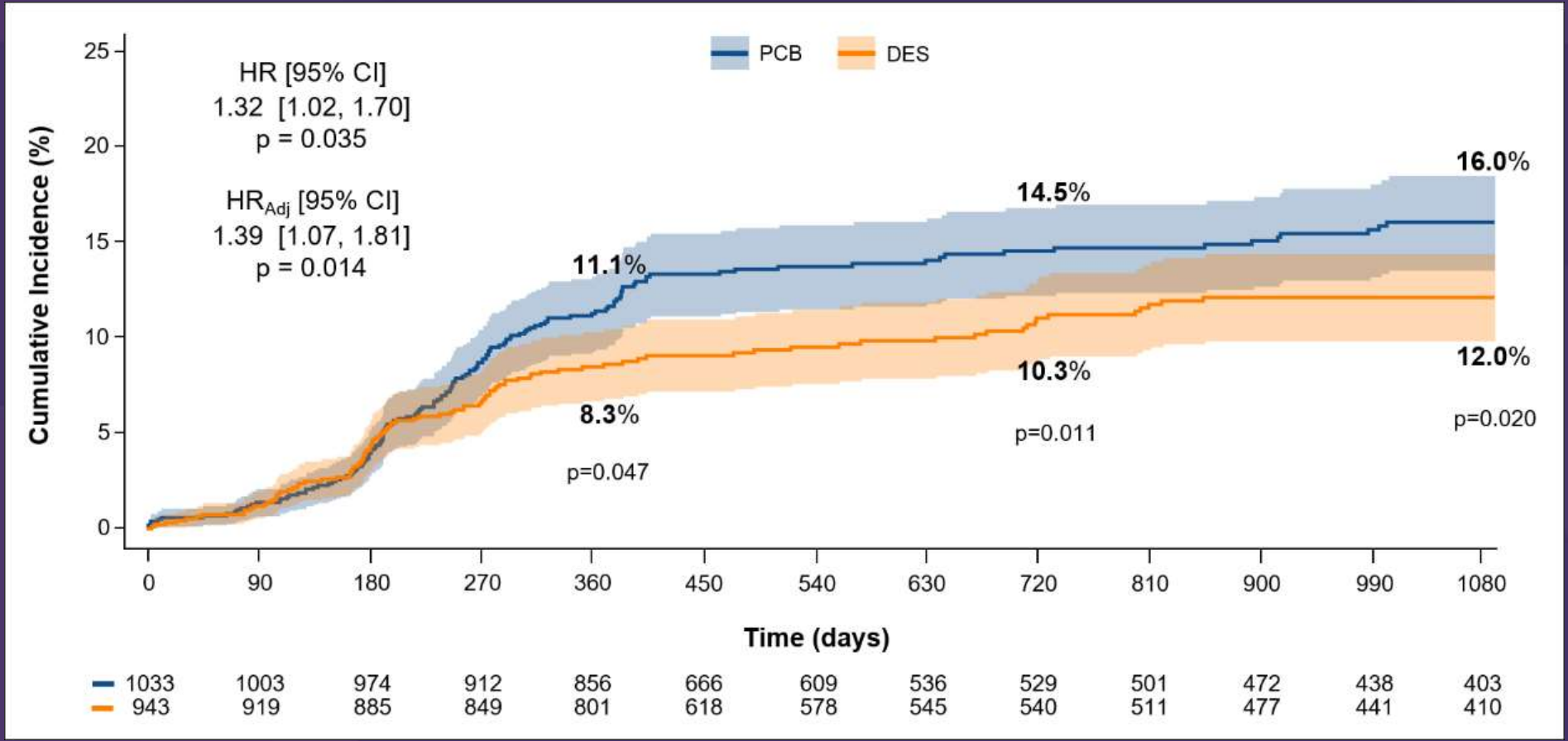
[a] Division of Cardiovascular Medicine, Department of Medicine, University of Florida, Gainesville, FL, United States of America
[b] Department of Medicine, Rochester General Hospital, Rochester, NY, United States of America



Elgendy IY, Alfonso F et al., Cardiovasc Revasc Med. 2018

DCB vs DES, Which is Better?
: Patient-level Pooled analysis of 10 RCTs - DAEDALUS study

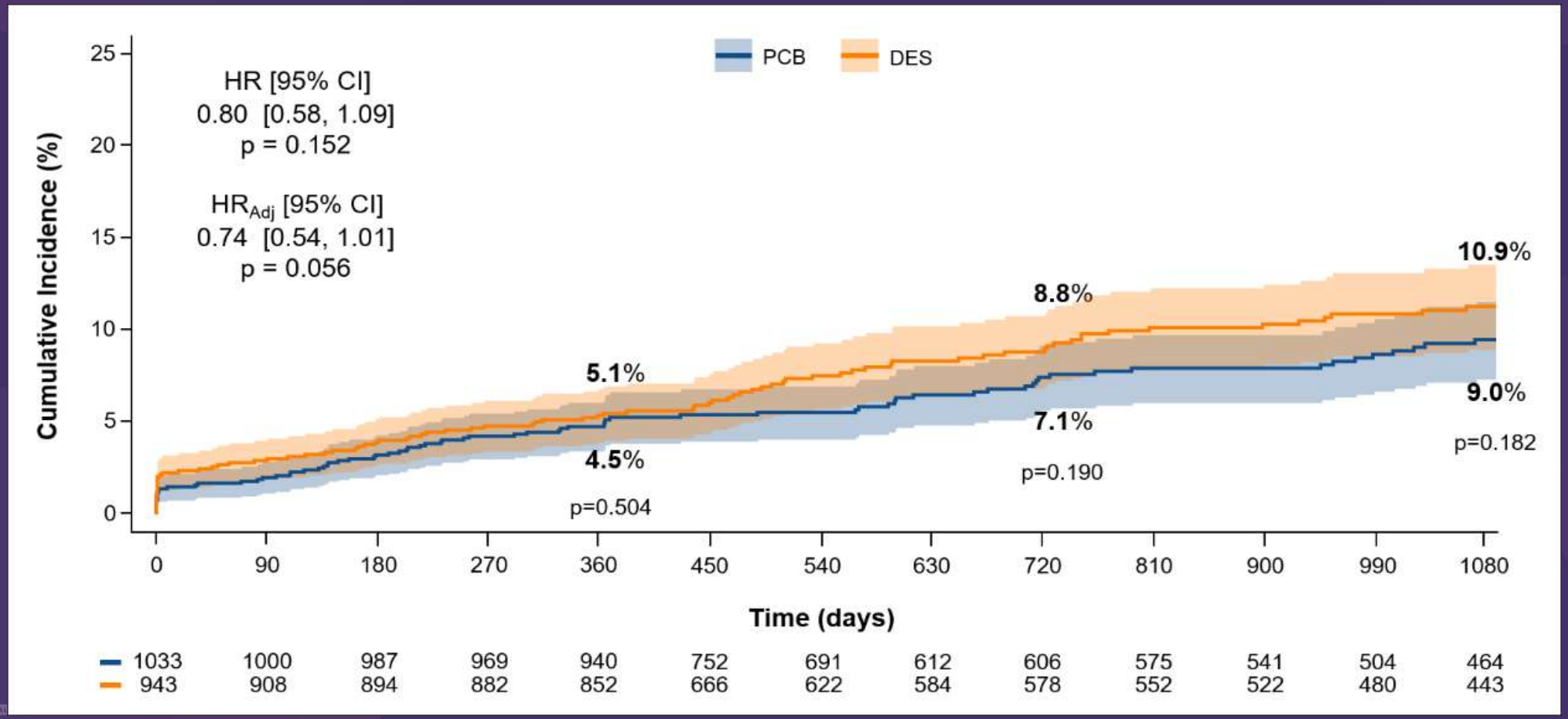
Target Lesion Revascularization of ISR



Giacoppo D et al., Eur Heart J. 2020;41(38):3715-3728.

DCB vs DES, Which is Better?
: Patient-level Pooled analysis of 10 RCTs - DAEDALUS study

Composite of all-cause death, MI, or target lesion thrombosis

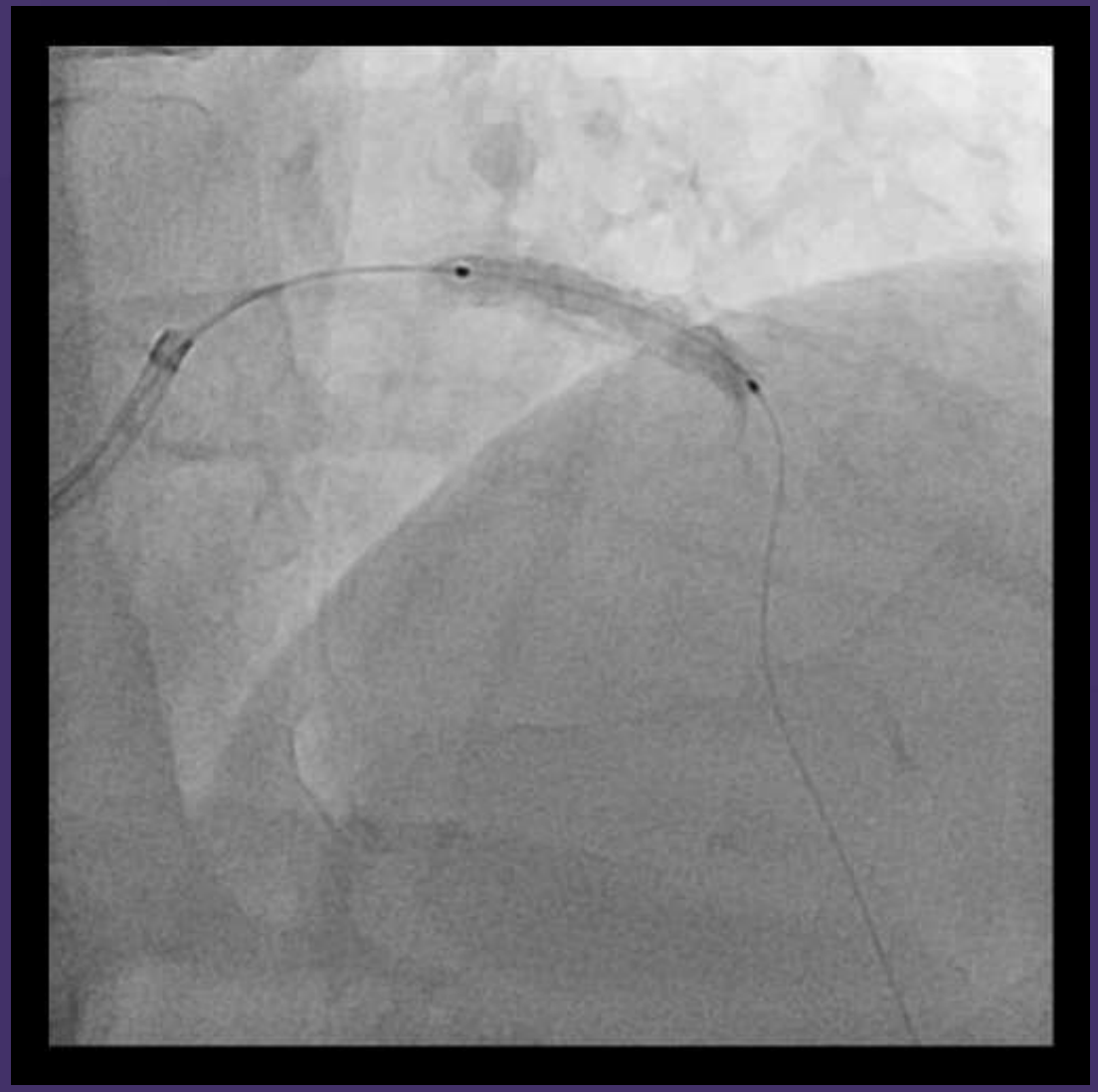


Giacoppo D et al., Eur Heart J. 2020;41(38):3715-3728.

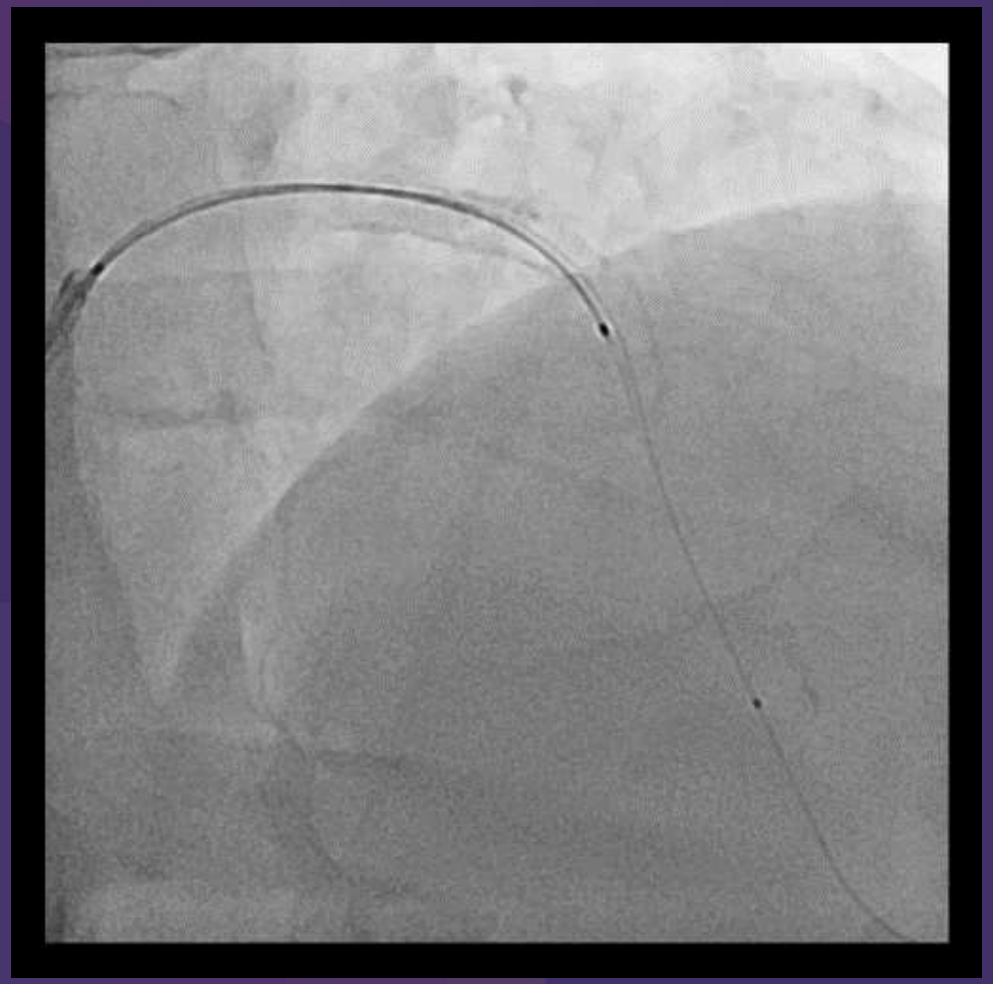
DCB vs DES, Which is Better?

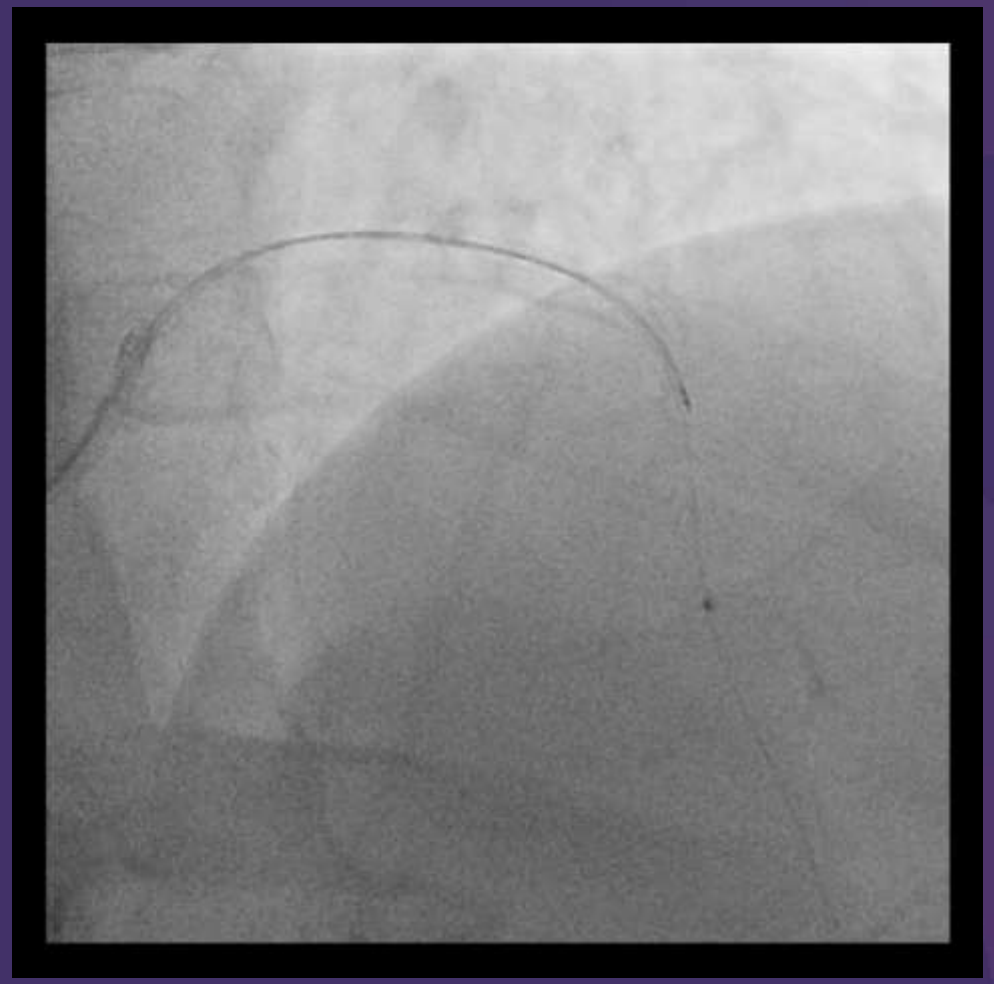
- Data consistently showed,
  - Slightly better angiographic outcomes in DES,
  - More TLR in DCB,
  - Comparable hard outcomes (death, MI, thrombosis).

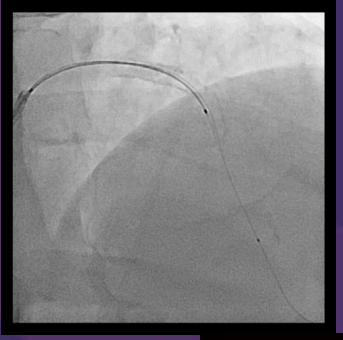
DCB (Paclitaxel) 3.5 x 25 mm at 8 atm for 1 minute



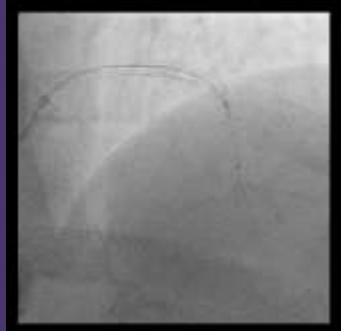
Final OCT / IVUS

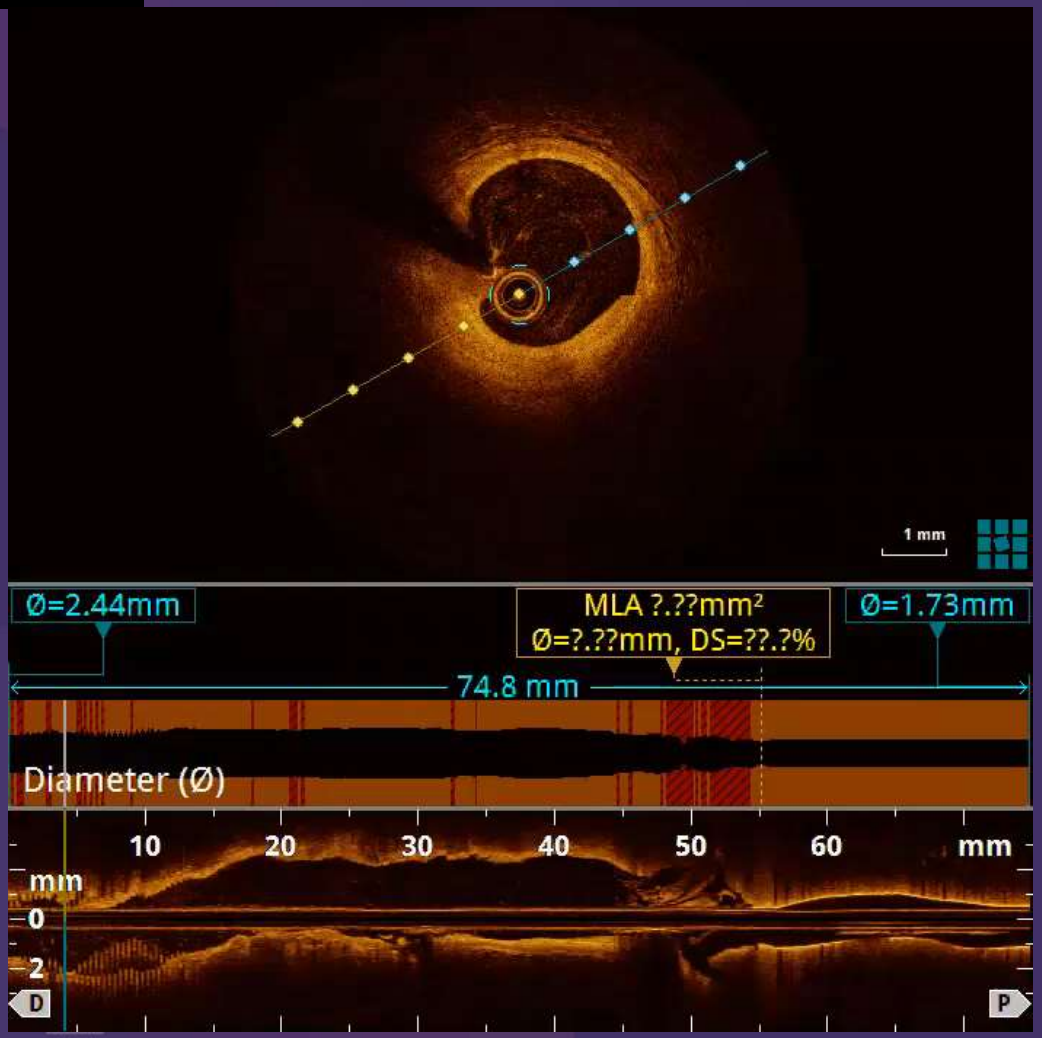


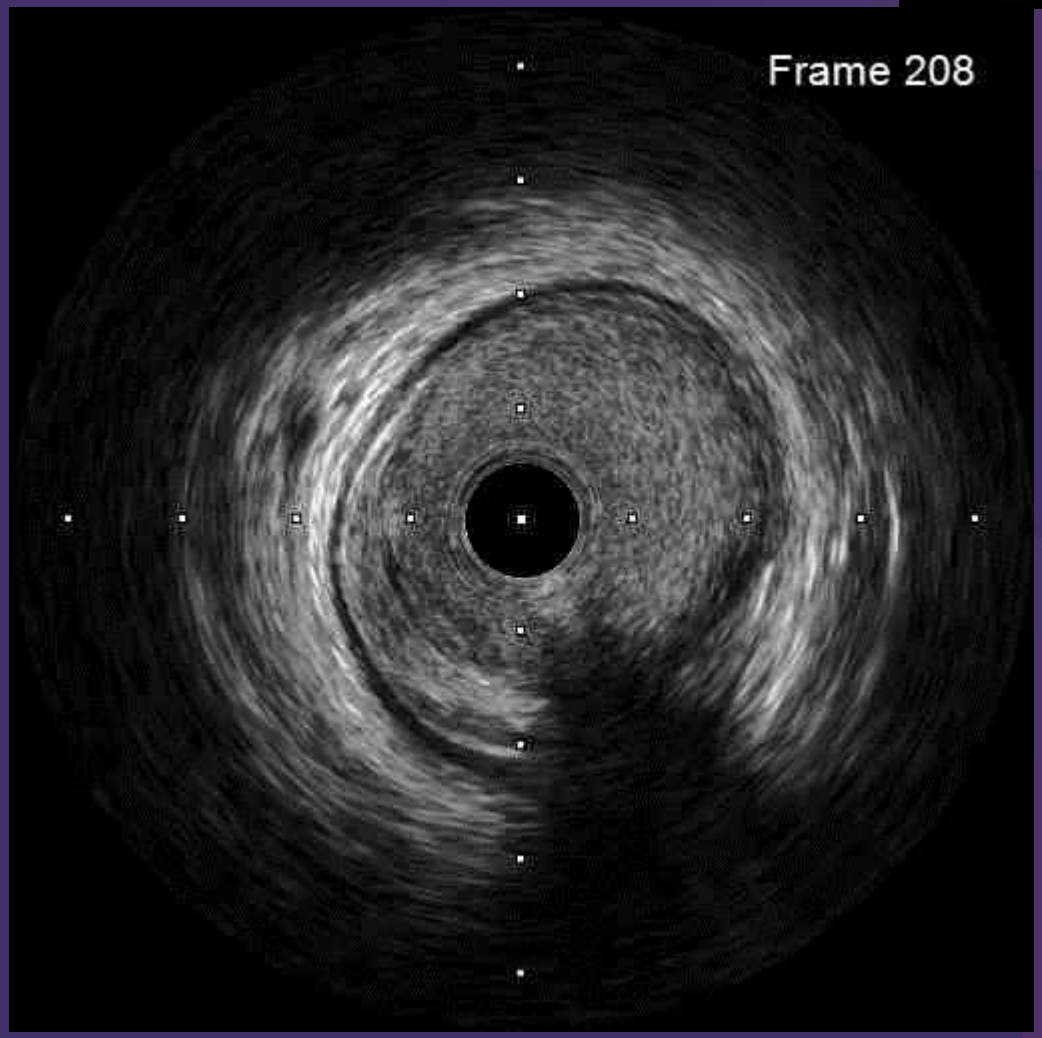




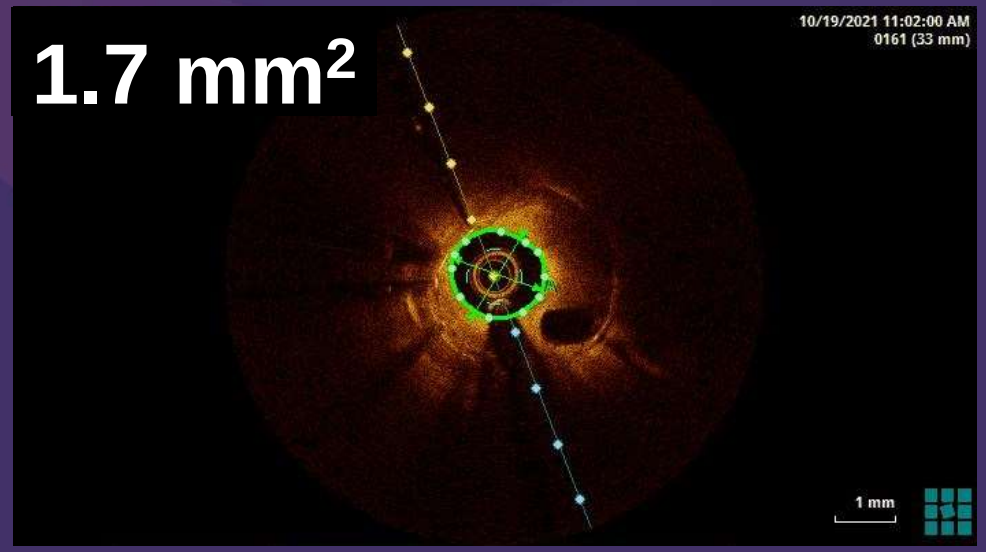
Final OCT / IVUS



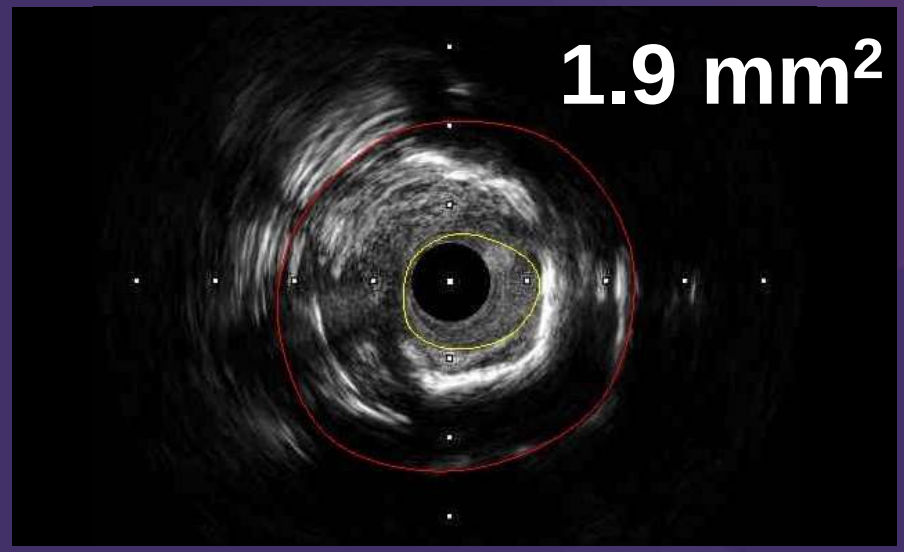


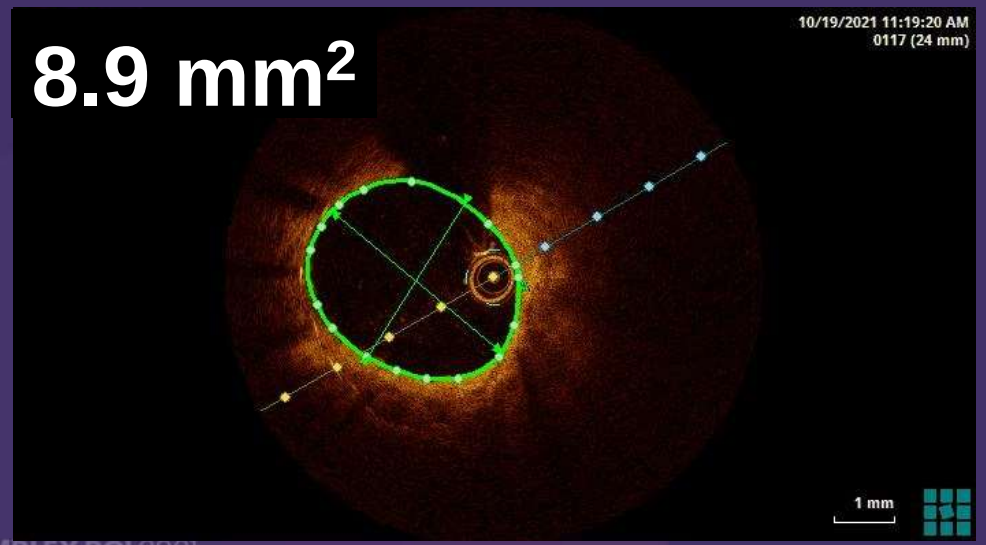


MLA Before / After PCI

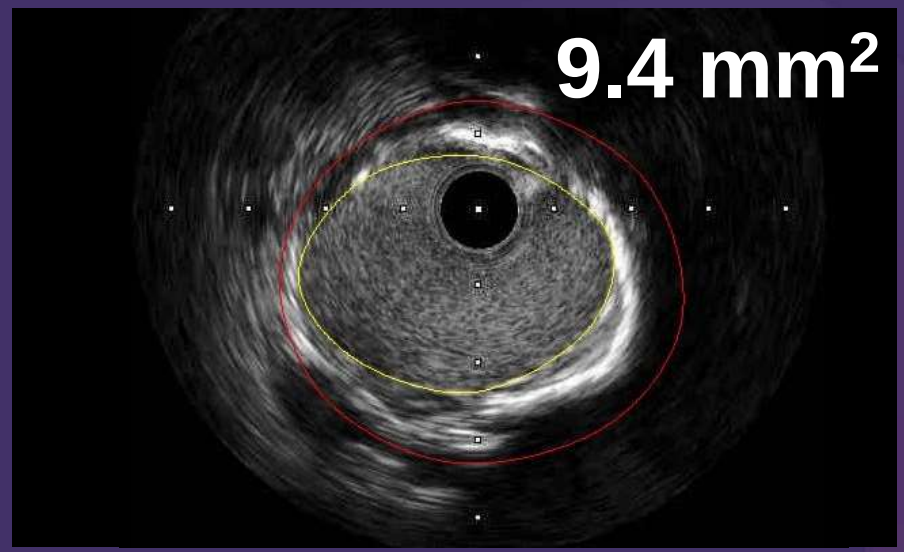


Pre

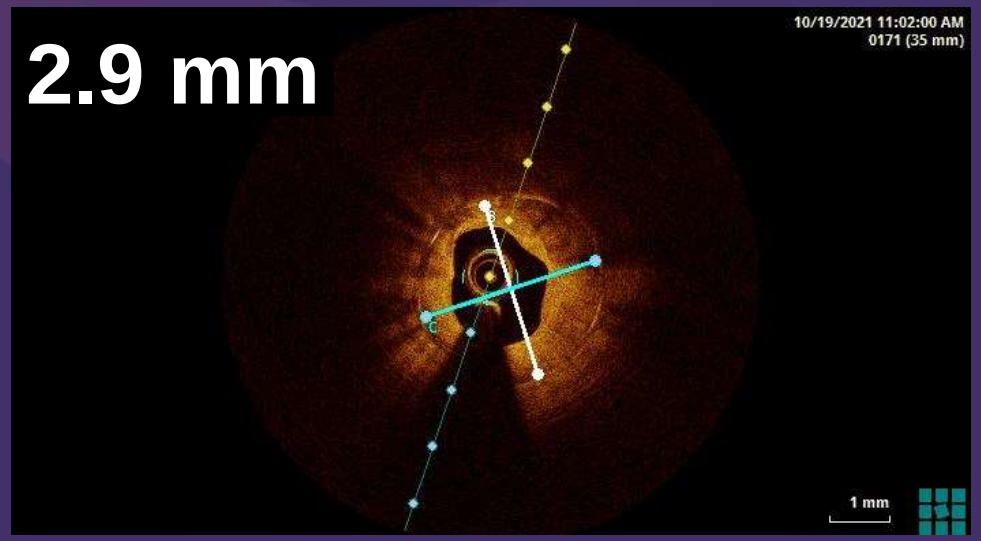




Post



Stent Diameter Before / After PCI



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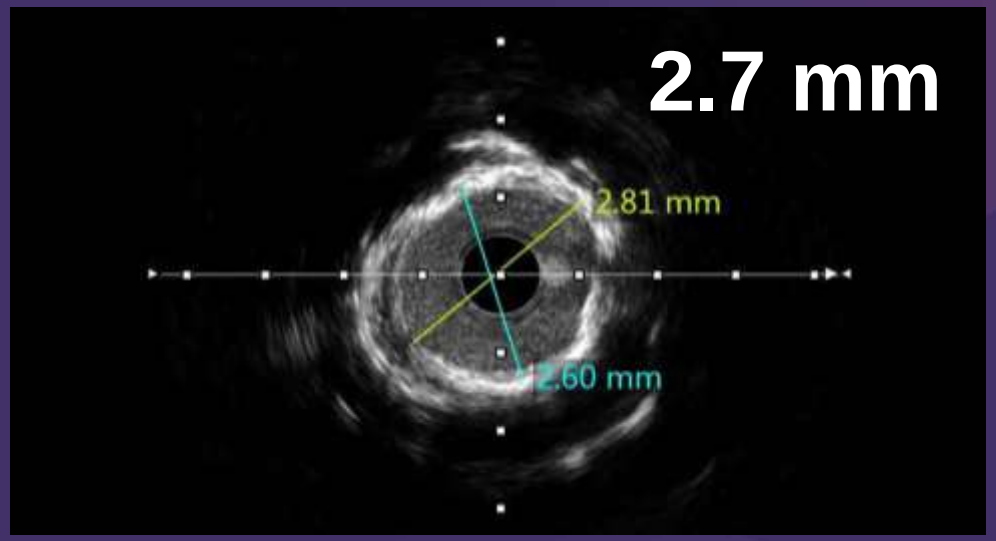
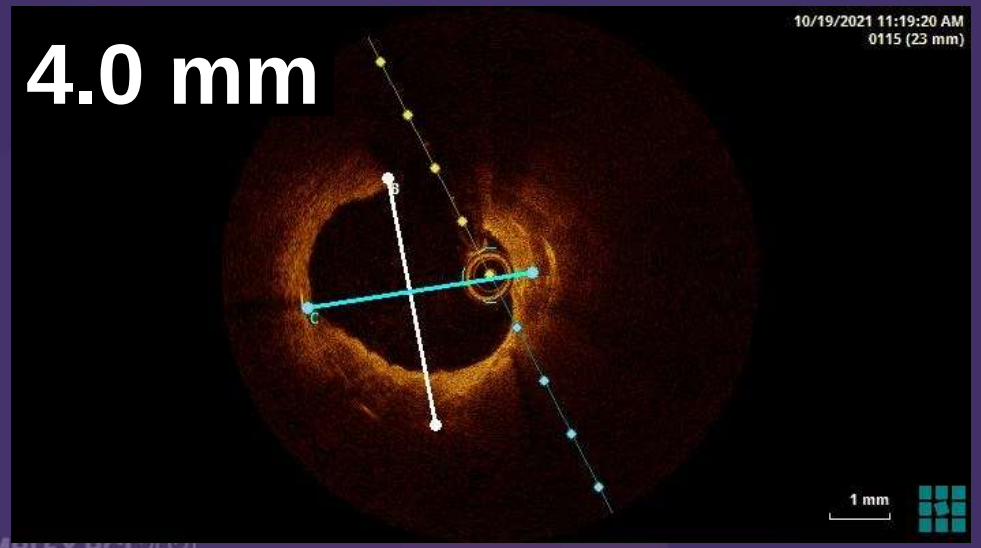
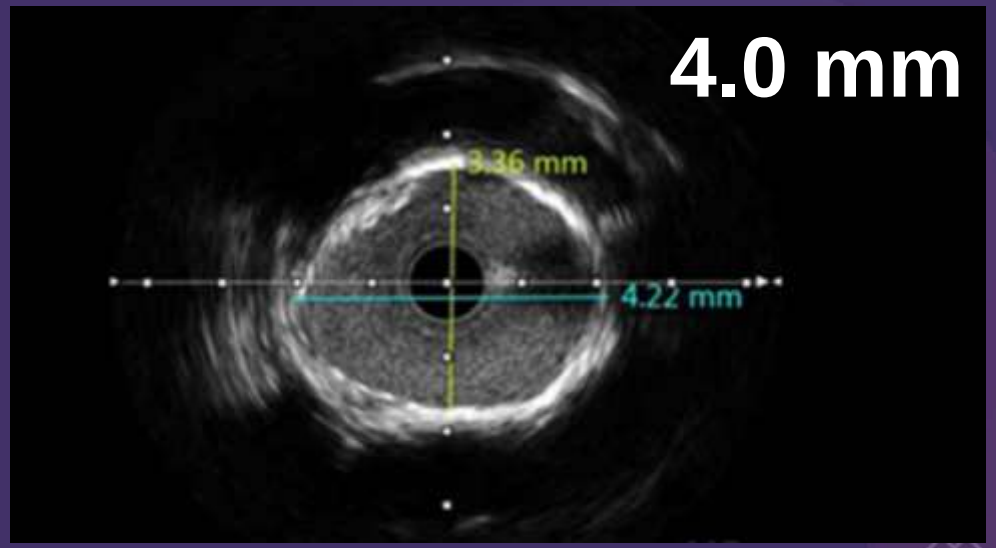
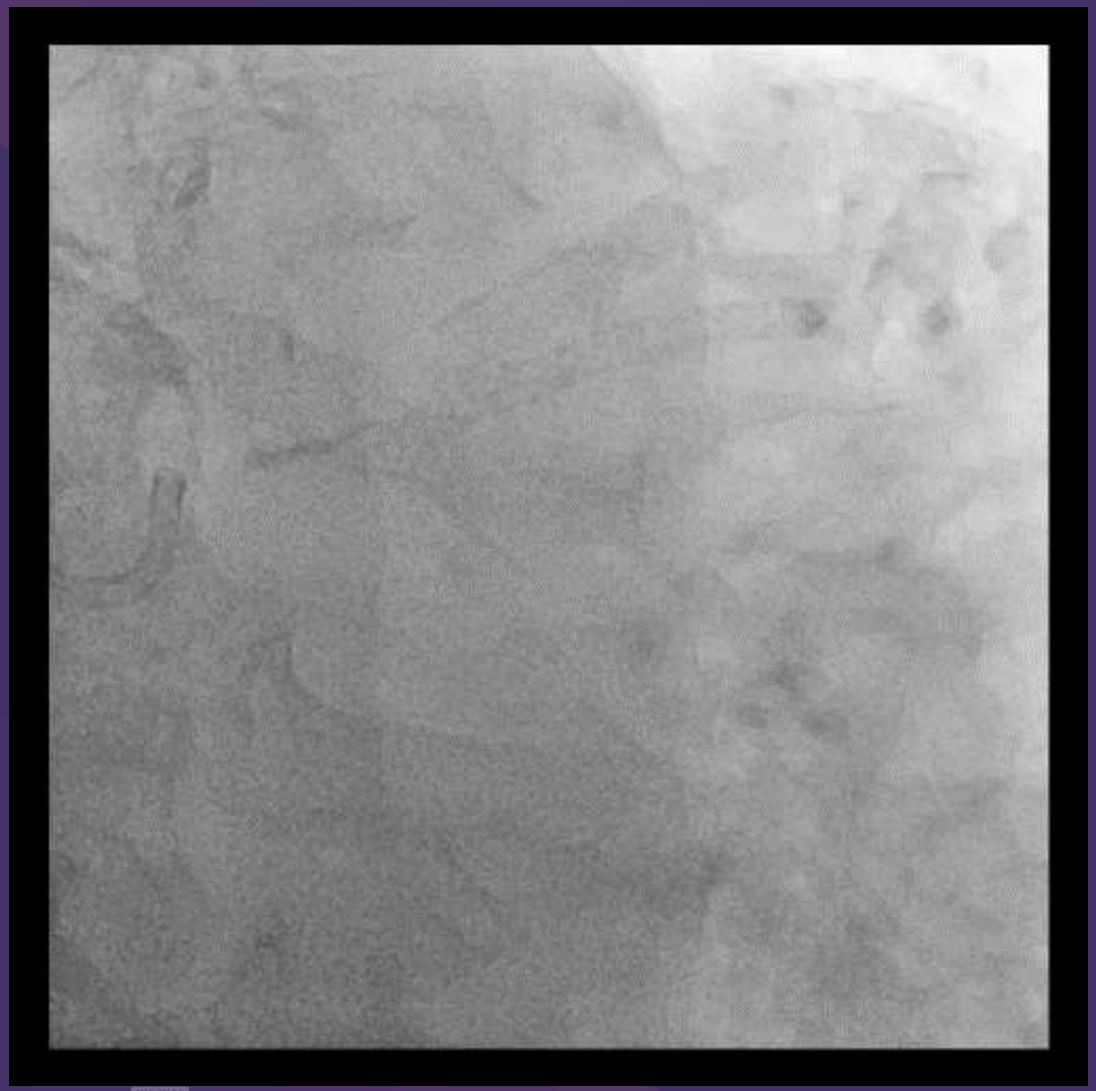


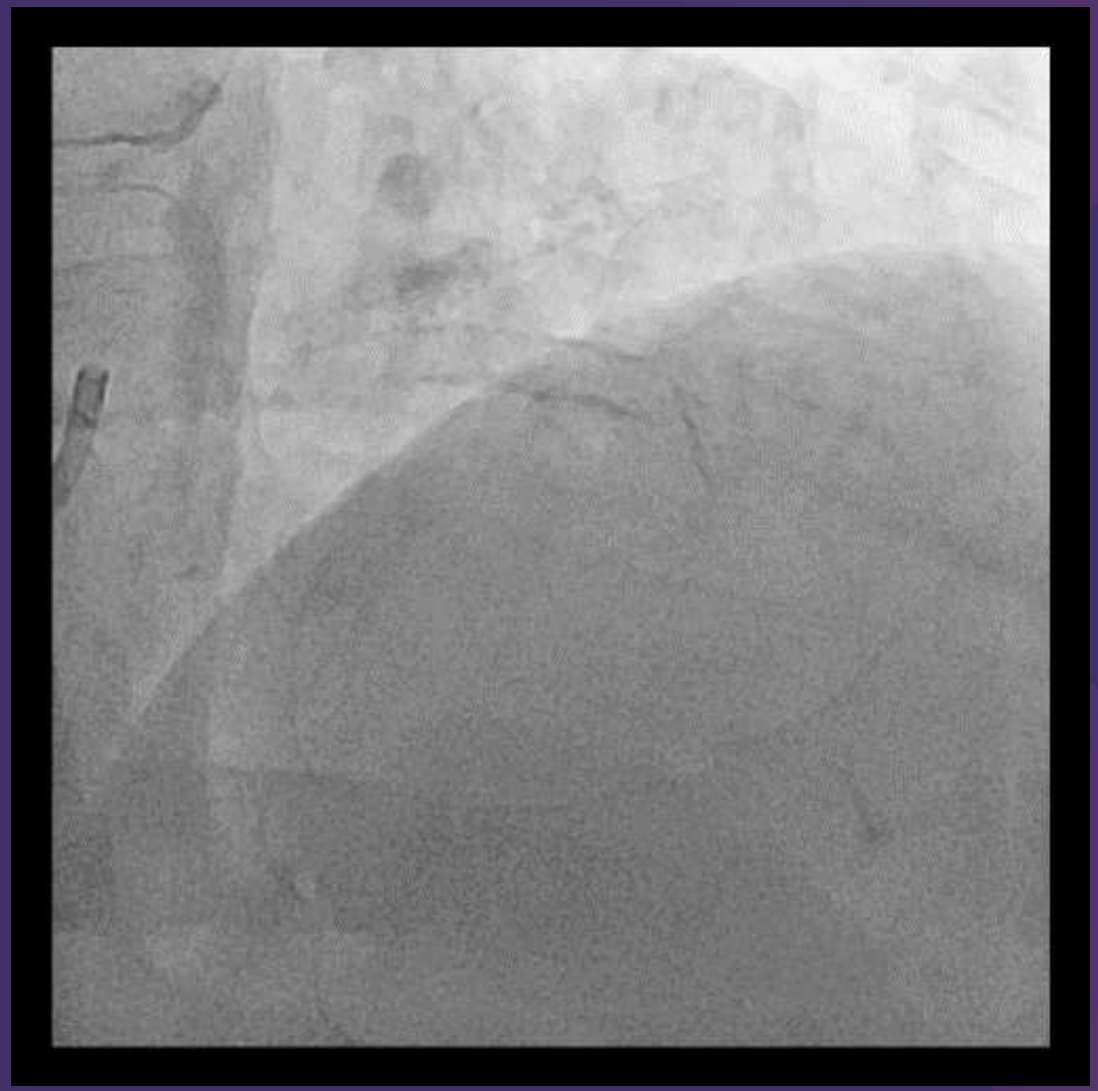


Post



Final Angiography





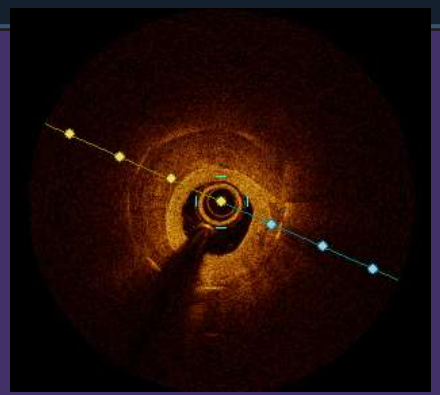
Intravascular Imaging in ISR PCI can Help to

- Identify the mechanism of restenosis
- Select the optimal treatment modality
  - High-pressure balloon for underexpansion
  - DES for fracture, gap, or edge problems
  - DEB/DES for neointimal hyperplasia
  - Atherectomy / lithotripsy for undilatable ISR
- Optimize the ISR PCI (lumen area, complication assessment)
- Give instant feedback to the operator

OCT vs. IVUS for ISR Imaging

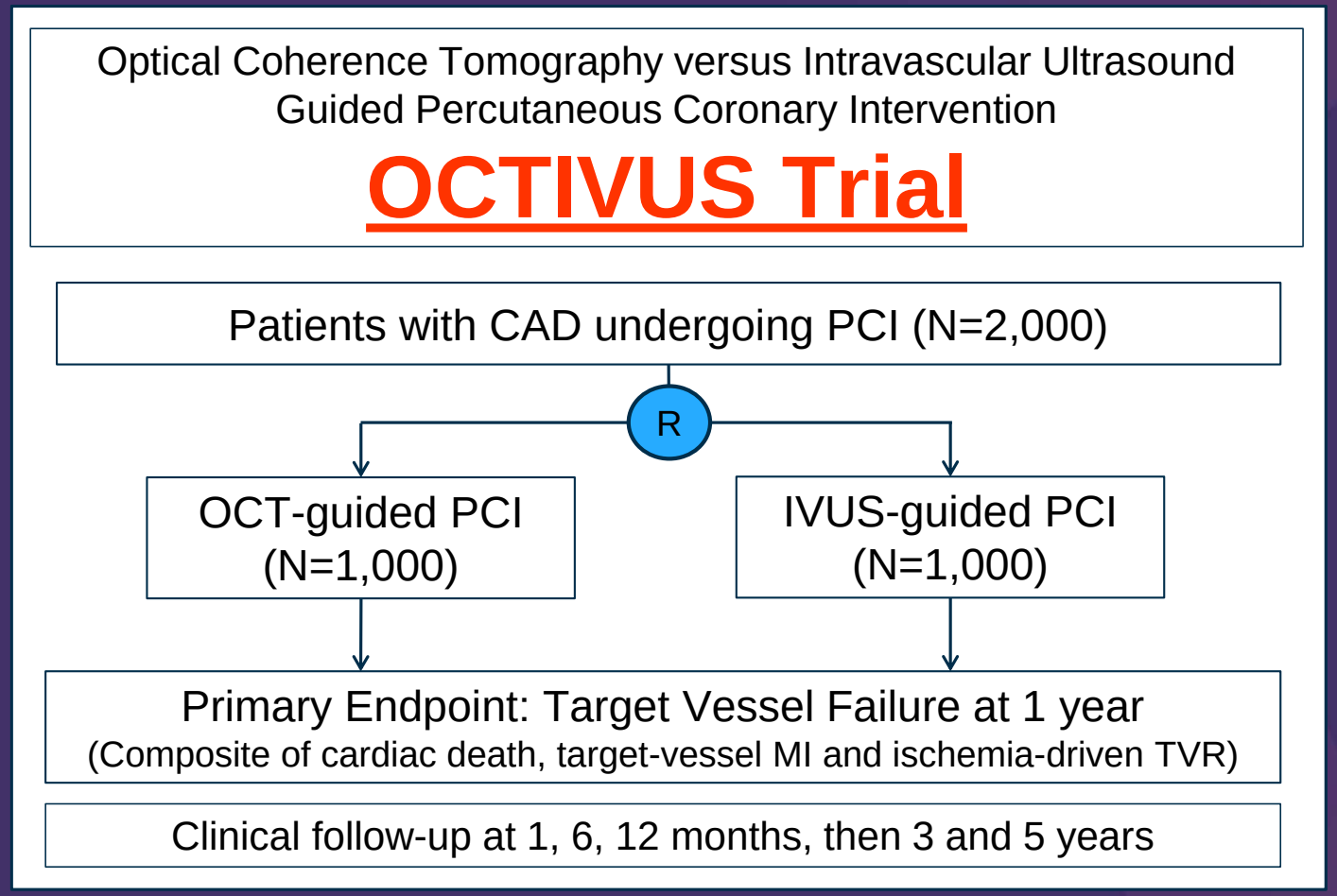
OCT can visualize in more detail,
- Stent strut coverage,
- Discrimination between stent and calcium,
- Dissection, edge problem, other complications,
- Bioresorbable scaffold

However, it needs contrast filling,
it has difficulty in ostial visualization.


Ongoing OCTIVUS Trial

- Pragmatic RCT
- All-comer PCI including
  LM, Bifurcation, CTO, ISR…
- 6 academic hospitals in Korea
- 96% enrolled on Oct 2021
- NCT03394079



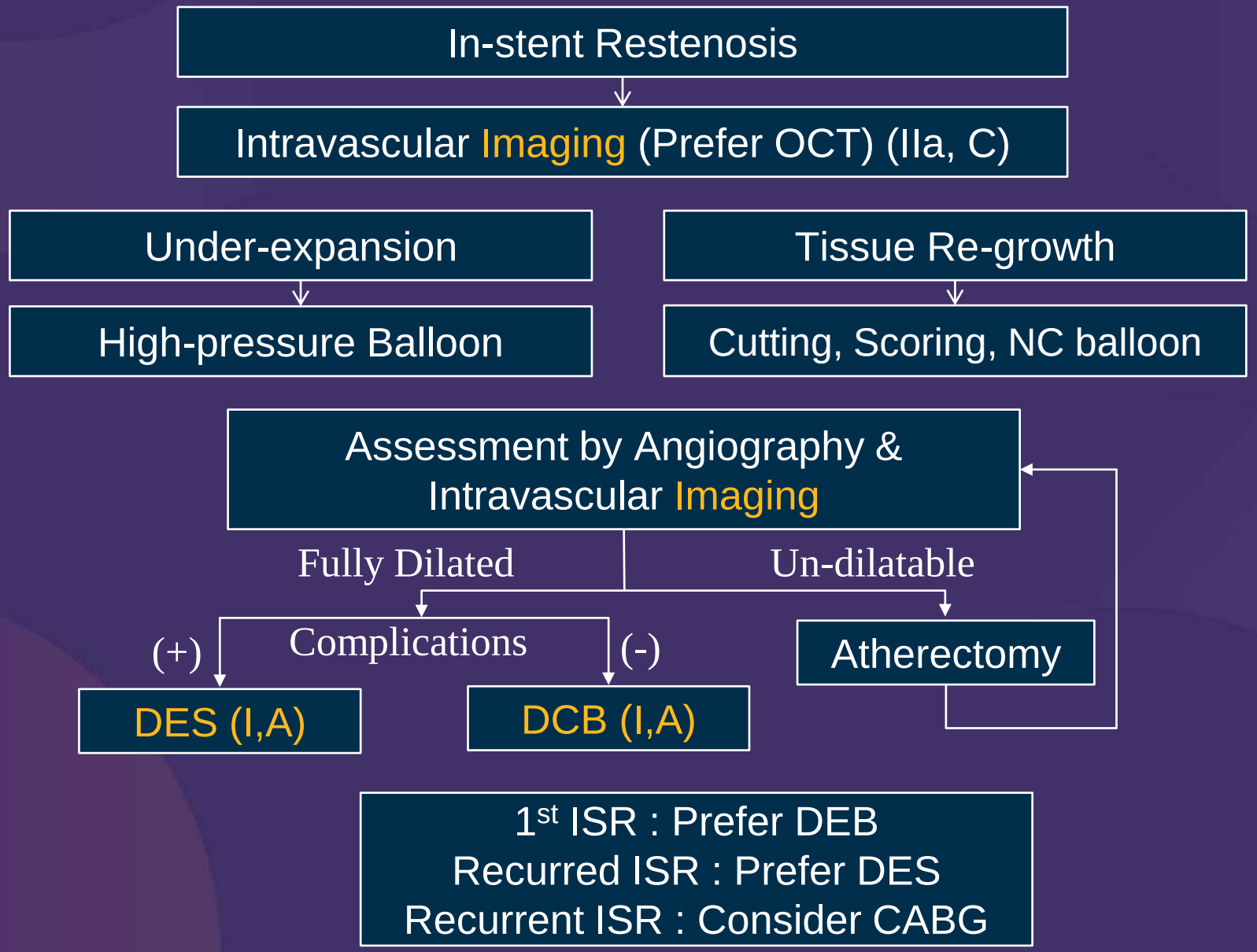
Kang DY et al. Am Heart J. 2020;228:72-80.

2018 ESC Guideline for ISR Treatment

	COR	LOE
➢ DES are recommended for the treatment of in-stent restenosis of BMS or DES.	I	A
➢ Drug-coated balloons are recommended for the treatment of in-stent restenosis of BMS or DES	I	A
➢ IVUS and/or OCT should be considered to detect stent-related mechanical problems leading to restenosis	IIa	C

Neumann FJ et al., Eur Heart J. 2019;40:87-165.

My Treatment Strategy for ISR



Conclusion

- Intravascular imaging help to Identify the mechanism of ISR, to Select optimal treatment modality, and to Optimize the acute result of the ISR-PCI.
- DCB and DES both are recommended as 1st line Tx for ISR.
- Prevention is better than cure. Intravascular imaging-guided optimal stenting at initial PCI would minimize the ISR.