TCTAP

KCTA (Korean Cardiovascular Technology Association) Symposium

Image guided MVD PCI

State – of – the – art image guided

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Today's Lecture

Hot Topic & Hot Discussion; PCI Option for Multi vessel Disease

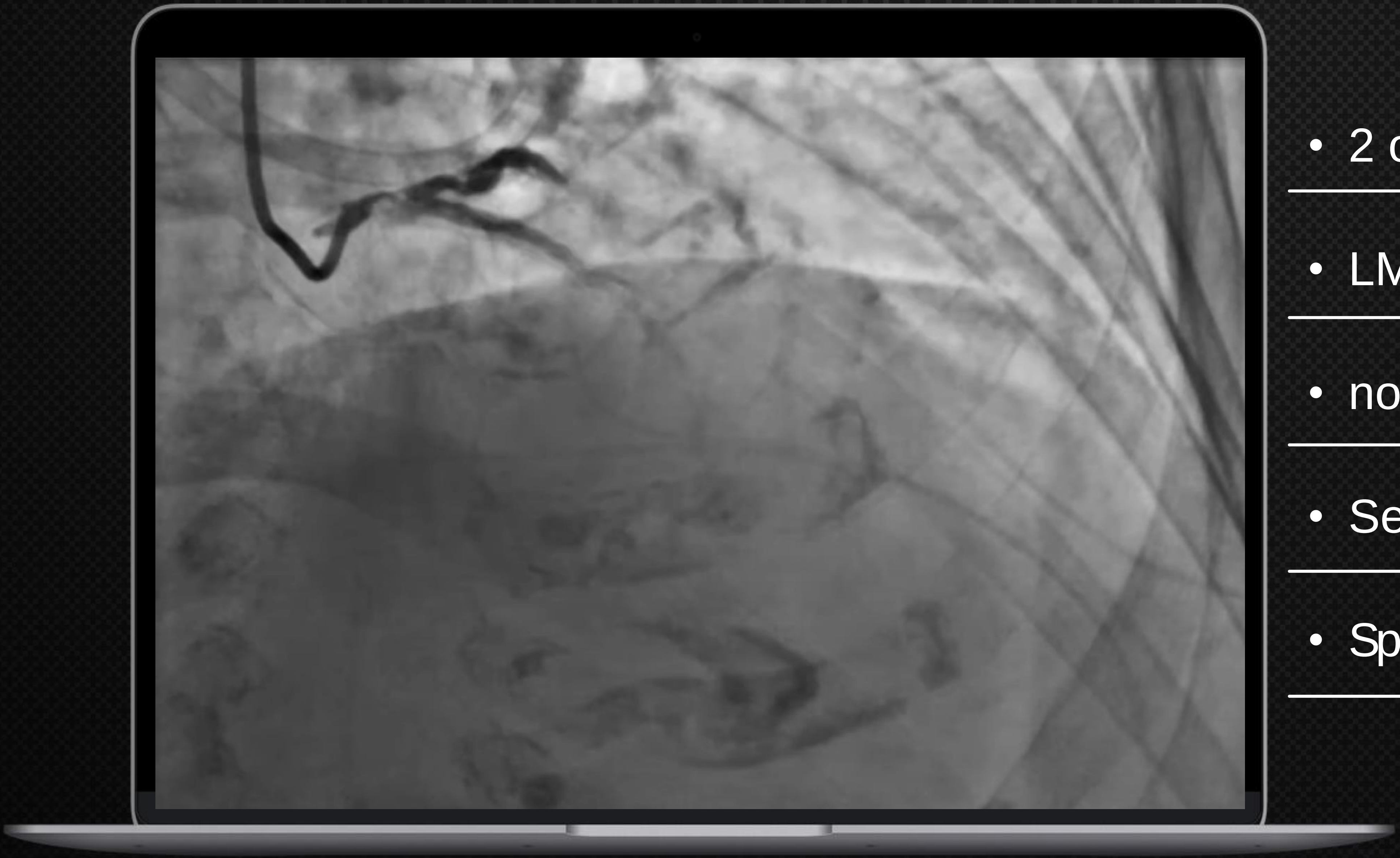
FFR Guided MVD PCI

Do Hyeng Lim. RT

STEMI with MVD

Sang Man Park. RT

MVD



- 2 or 3 VD
- LM Bifurcation
- non - LM Bifurcation
- Serial or Diffuse
- Special situation - AMI, CTO, CABG

It is the most frequent lesion during PCI, and it is necessary to decide whether to treat or not.

The most important thing about MVD is how you treat it. .

MVD

Complex PCI

- 2 or 3 VD
- LM Bifurcation
- non - LM Bifurcation
- Serial or Diffuse
- Special situation - AMI, CTO, CABG

It is the most frequent lesion during PCI, and it is necessary to decide whether to treat or not.

The most important thing about MVD is how you treat it. .

What is complete?

Revascularisation of All stenosis

>50% or >70% or >90% on angiography?

with impact on physiology?

with impact on prognosis?

How to assess?

Revascularisation angio guided

vs physiology guided

What means?

Complete revascularisation

Complete revascularization

clinical presentation

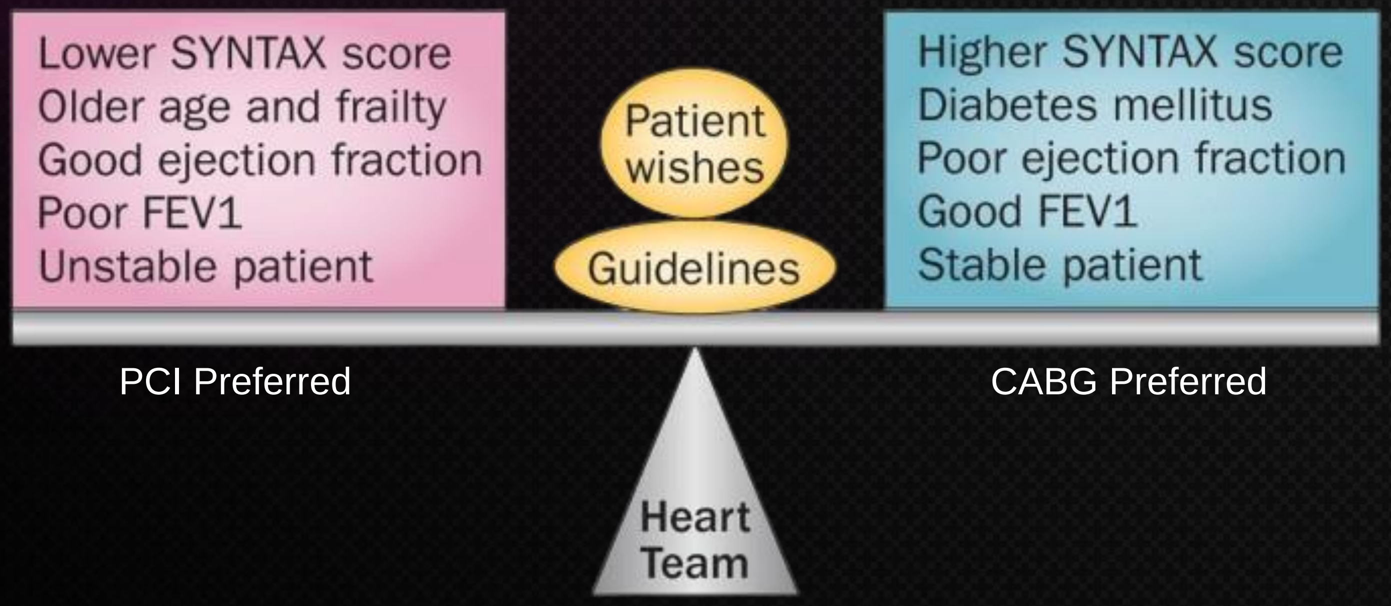
ACS

- Revascularisation of culprit lesion is life-saving procedure
- Non culprit lesions are considered as stable ones

CCS

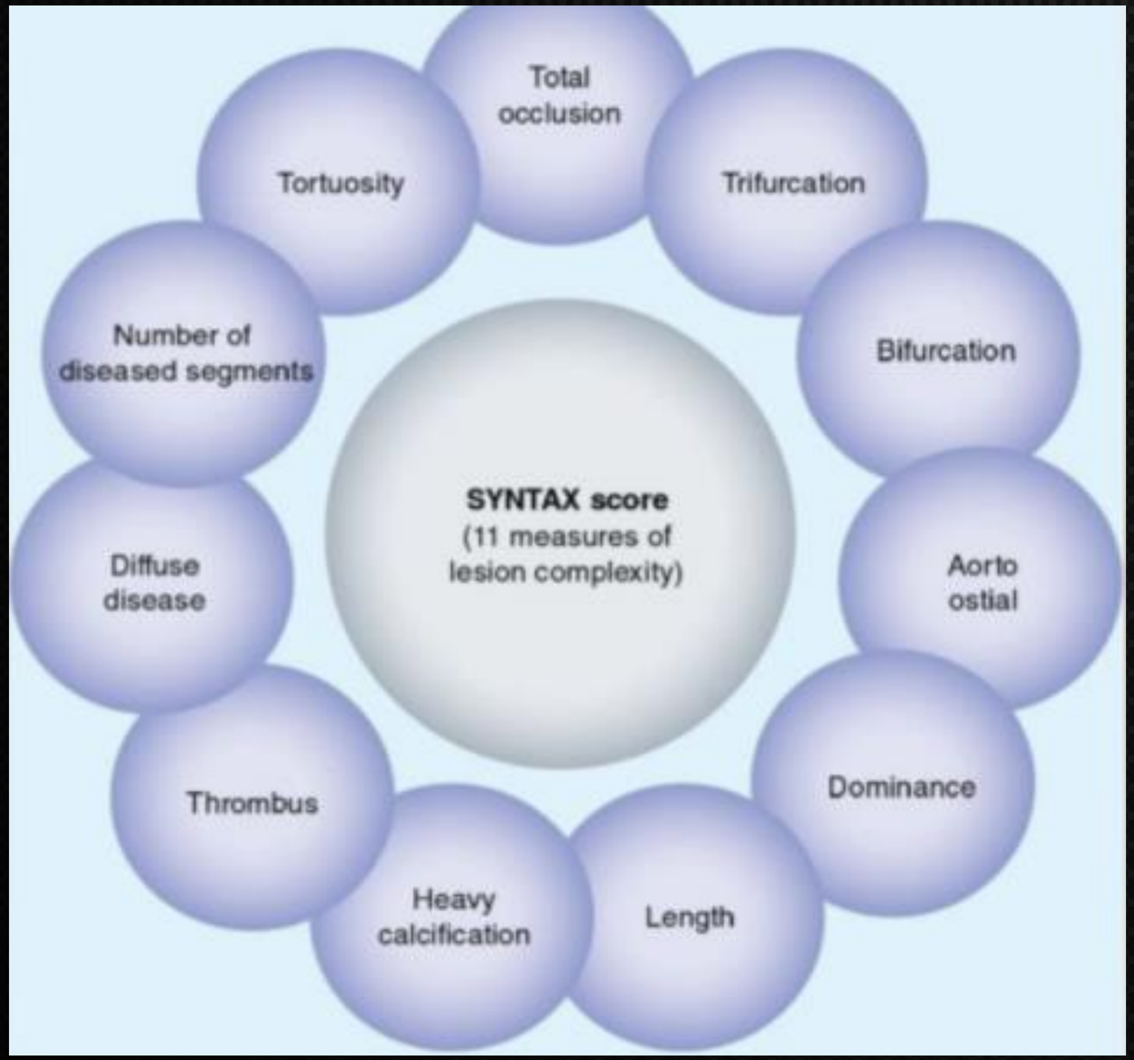
- All Lesion in MVD are considered as stable ones

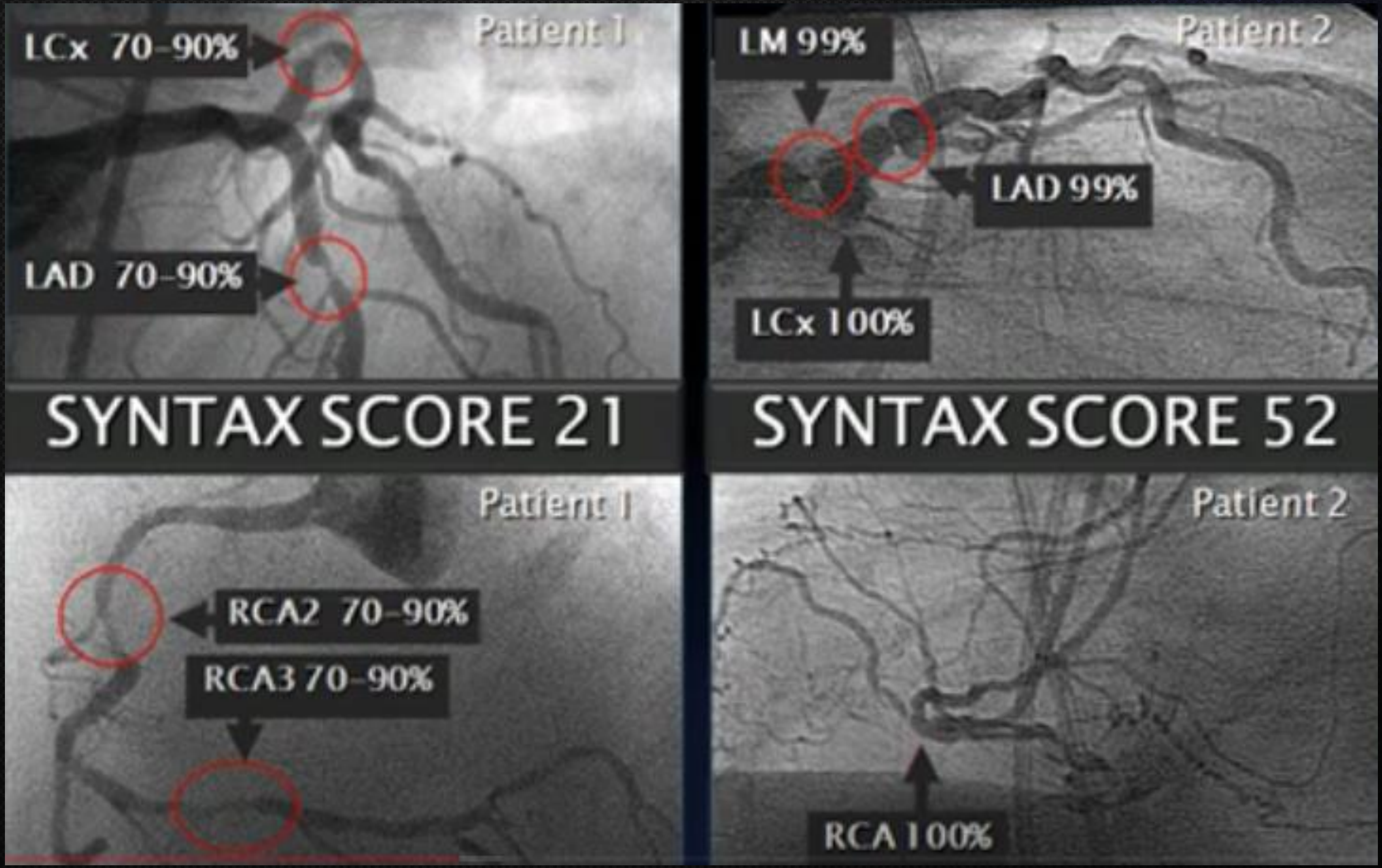
Key decision points in MV Revascularization



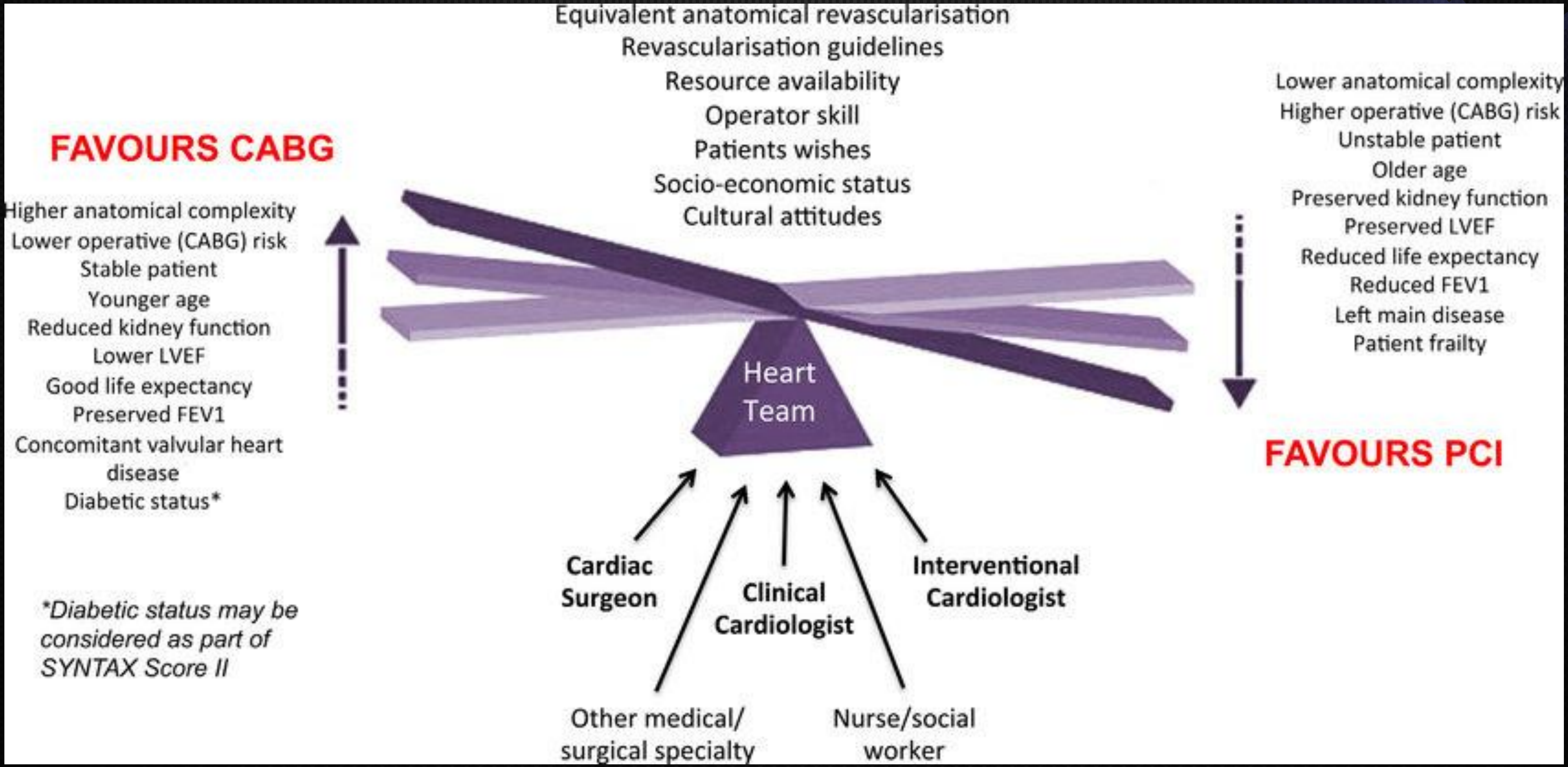
1. What are the goals of therapy?
2. Can the patient take/adhere to DAPT
3. Is the patient high surgical risk?
4. Is the patient insulin dependent?
5. WHAT DOSE THE PATIENT WANT?

New Perspectives in Coronary Artery Disease Lessons from SYNTAX





Arrangement of necessary elements for CABG



EuroIntervention 2019;15:434-451. DOI: 10.4244/EIJY19M06_02

Pitfalls and issue relevant to SYNTAX score application in clinical practice

1. Time-consuming, with interobserver and intraobserver variability

2. Does not account for clinical of procedural variables that are known to impact outcomes during and after PCI

3. Underpowered outcomes based upon subgroup analysis

4. Does not include any subset of lesion (i.e. in-stent restenosis , stenotic bypass grafts, coronary abnormalies, muscular bridged, aneurysms)

5. Does not account for patient choice

Capodanno, et al. Am Heart j 2011;161;462-70

Image guided MVD PCI

1

Whether to treat or not

Where to treat compared to FFR?

Which one is more realistic in an AMI environment?

2

Practical help of image guided

Help in the ambigous CAD

Longitudinal Miss

Stent Optimization

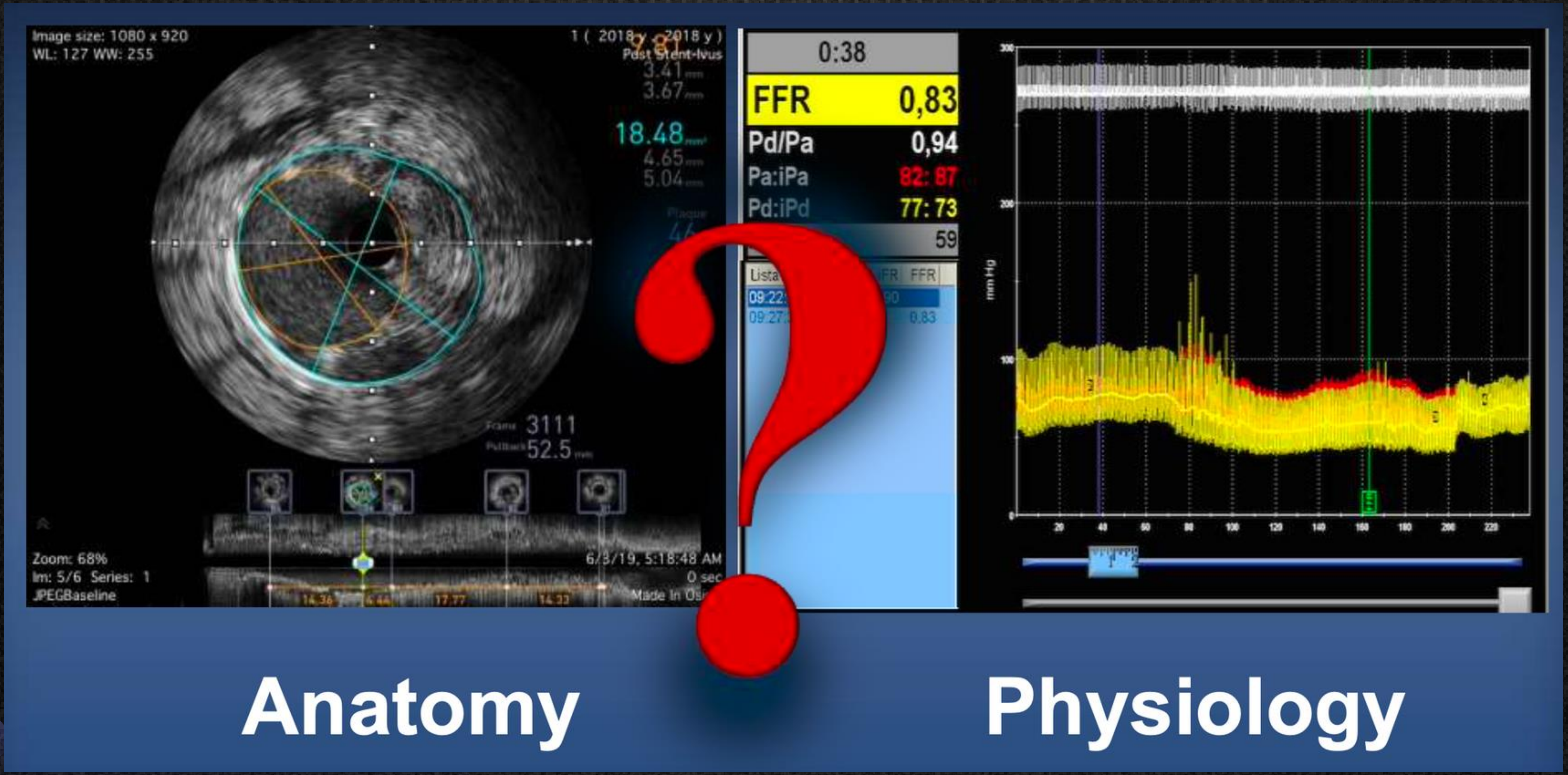
3

The evolution of image tools

Combination with ANGIO.

Combining with other image sources

It is not a matter of which is more important



Integrated Use of Imaging and Physiology in Left Main PCI: Updates and Impact Your Daily Practice, Duk-Woo Park, MD, PhD (in Press)

State-of-the-art PCI in MVD

CORONARY INTERVENTIONS
CLINICAL RESEARCH

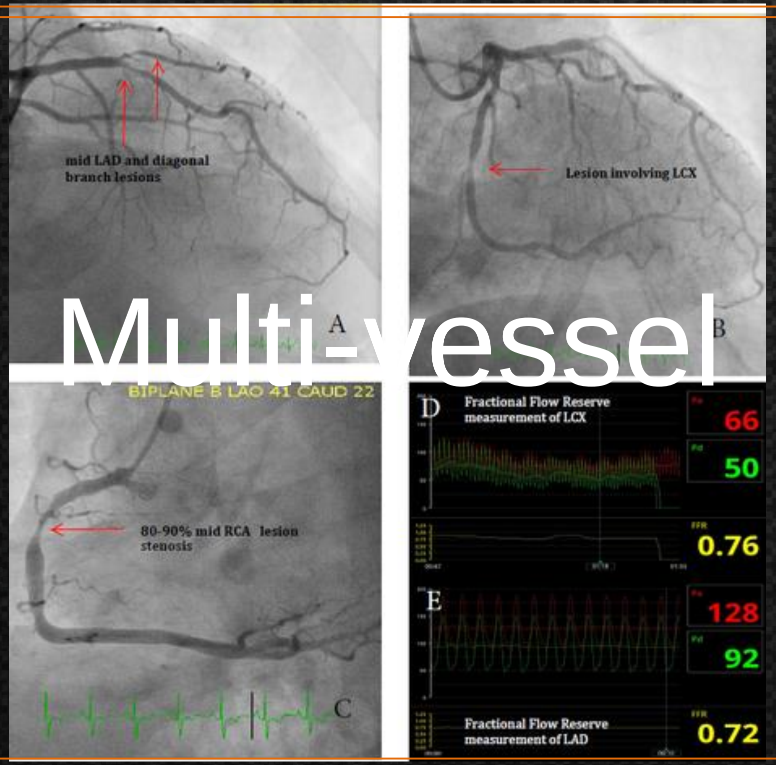
EuroIntervention 2019;15:e244-e252 published

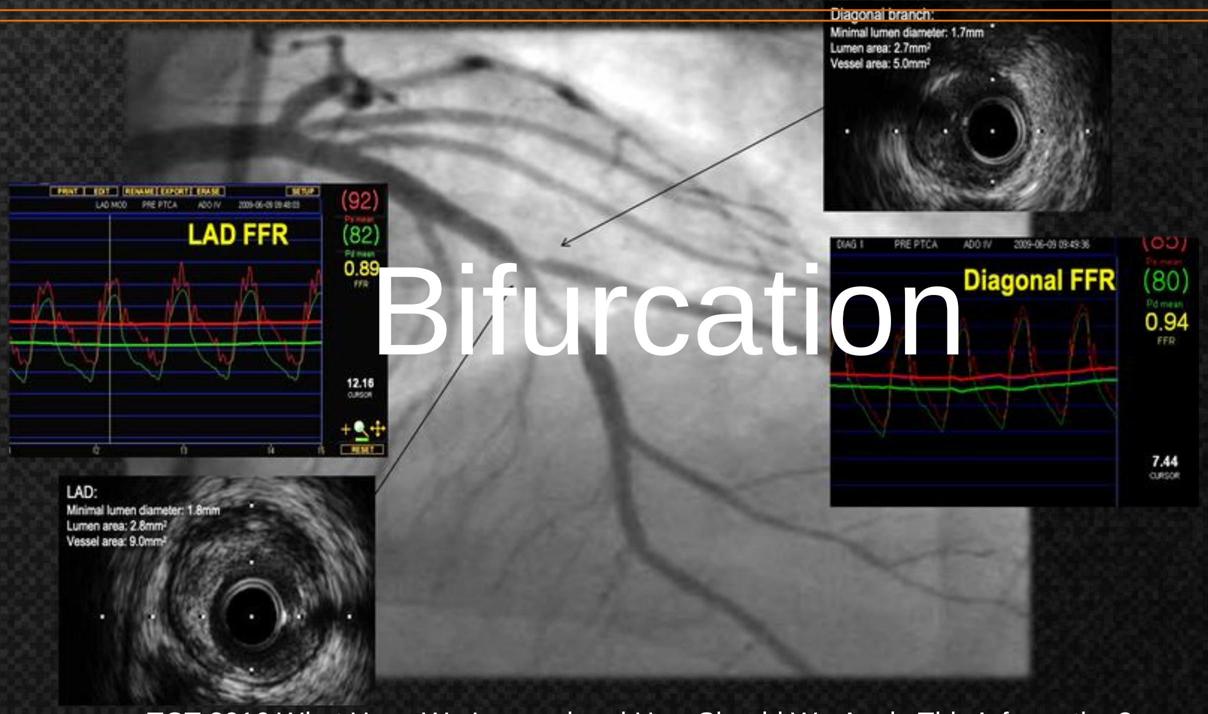
Clinical outcomes of state-of-the-art percutaneous coronary revascularisation in patients with three-vessel disease: two-year follow-up of the SYNTAX II study

Patrick W. Serruys[1,2*], MD, PhD; Norihiro Kogame[3], MD; Yuki Katagiri[3], MD; Rodrigo Modolo[3], MD; Pawel E. Buszman[4,5], MD, PhD; Andres Iniguez[6], MD, PhD; Javier Goicolea[7], MD, PhD; David Hildick-Smith[8], MD; Andrzej Ochala[5], MD, PhD; Dariusz Dudek[9], MD, PhD; Jan J. Piek[3], MD, PhD; Joanna J. Wykrzykowska[3], MD, PhD; Javier Escaned[10], MD, PhD; Adrian P. Banning[11], MBBS, MD; Vasim Farooq[12], MBChB, PhD; Yoshinobu Onuma[2], MD, PhD

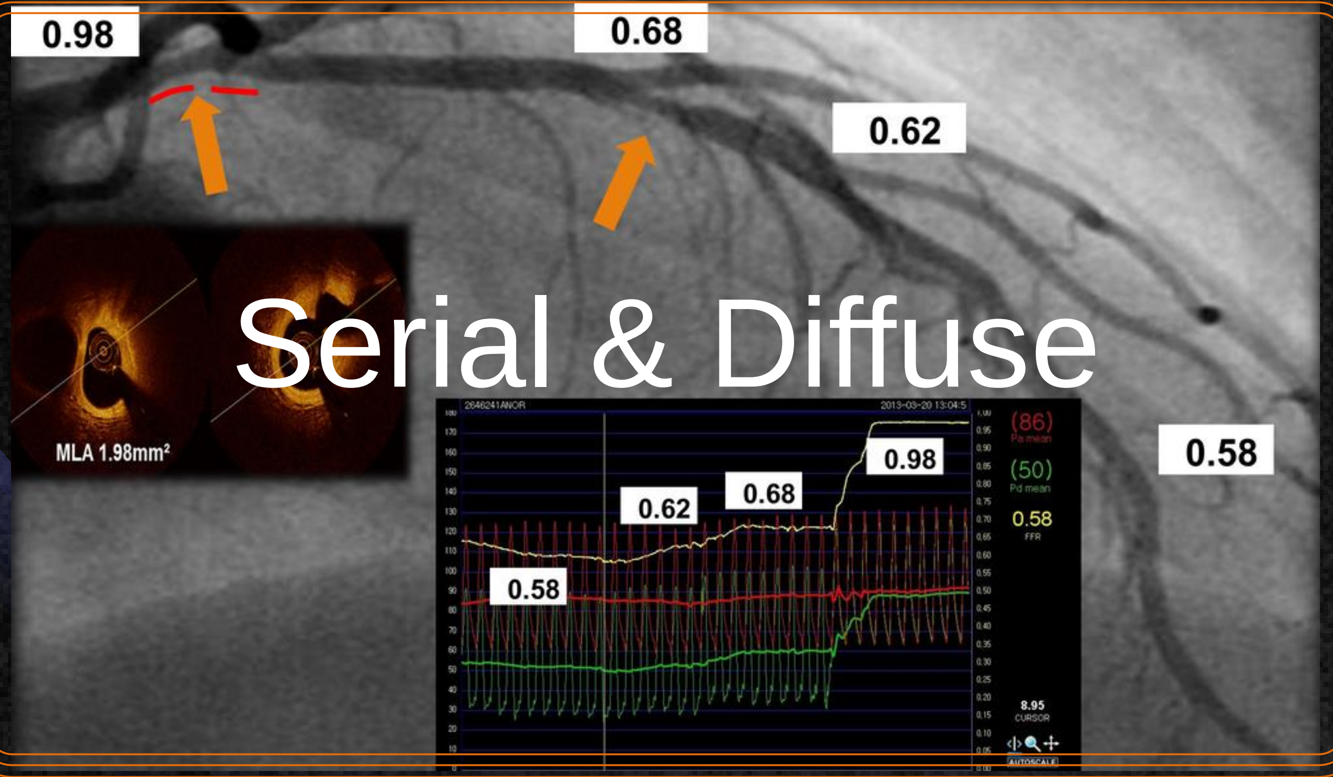
1. Heart-team discussion
2. Functional-guided approach (FFR/iFR)
3. IVUS-guided PCI optimization
4. Contemporary PCI/CTO techniques
5. GDMT (guideline-directed medical therapy)

Anatomy vs. Functional signficance





TCT 2016 What Have We Learned and How Should We Apply This Information?
Bon-Kwon Koo, MD, PhD?



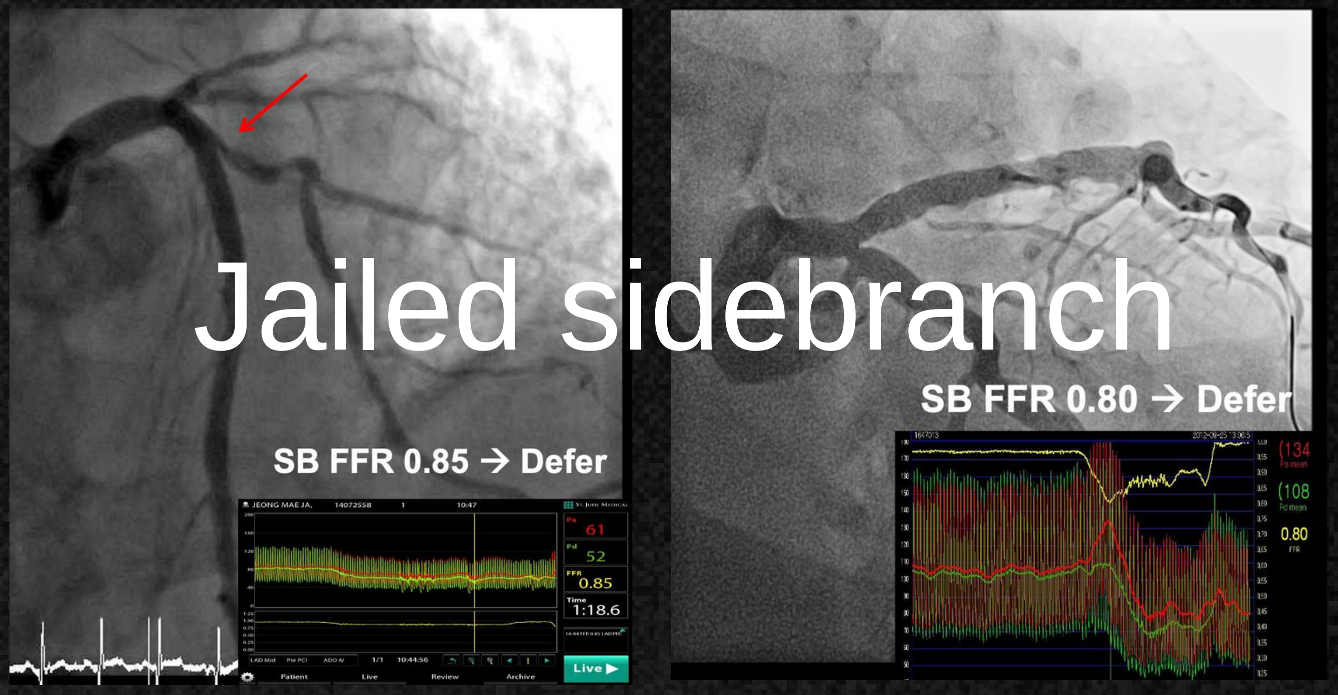
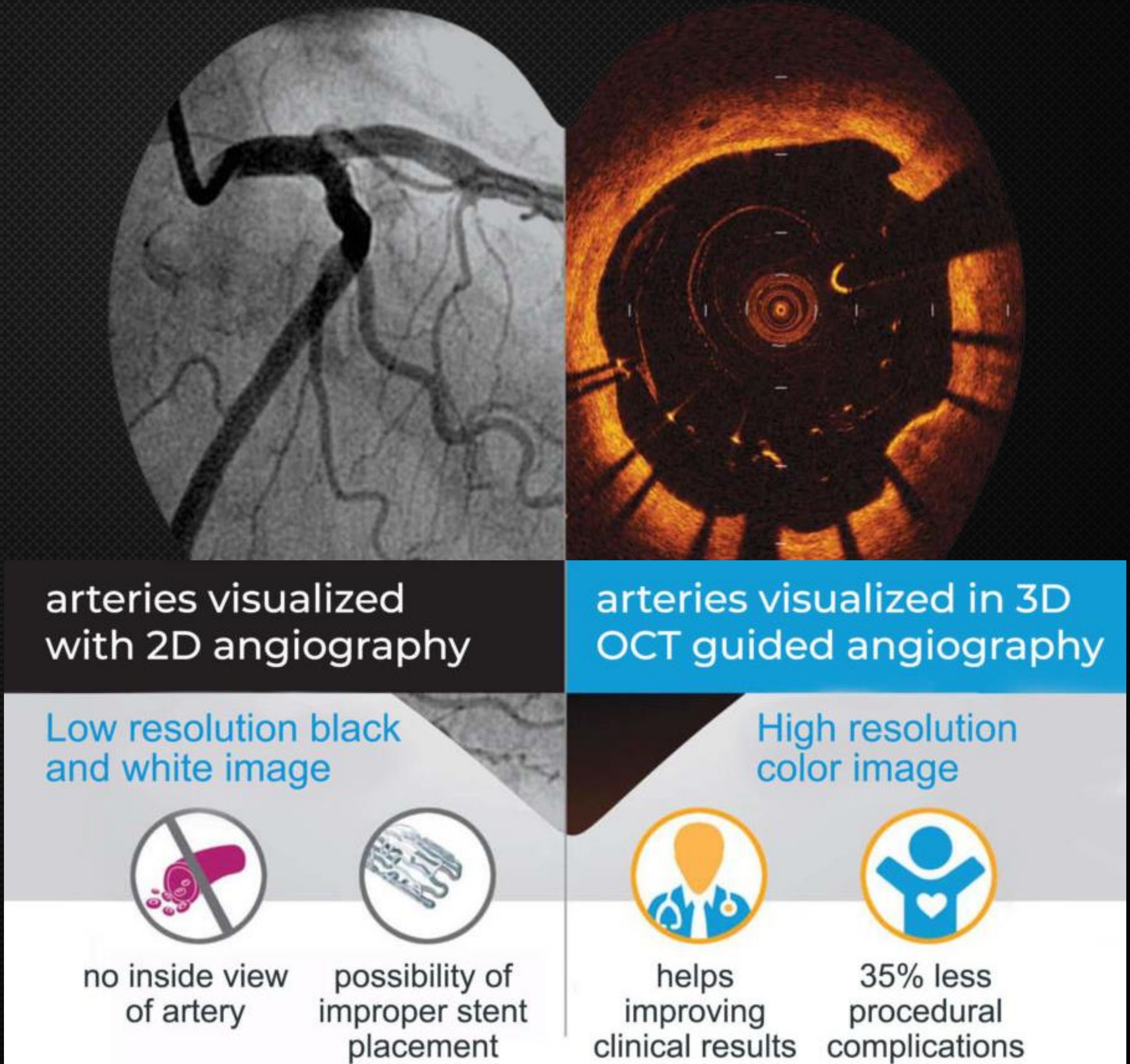


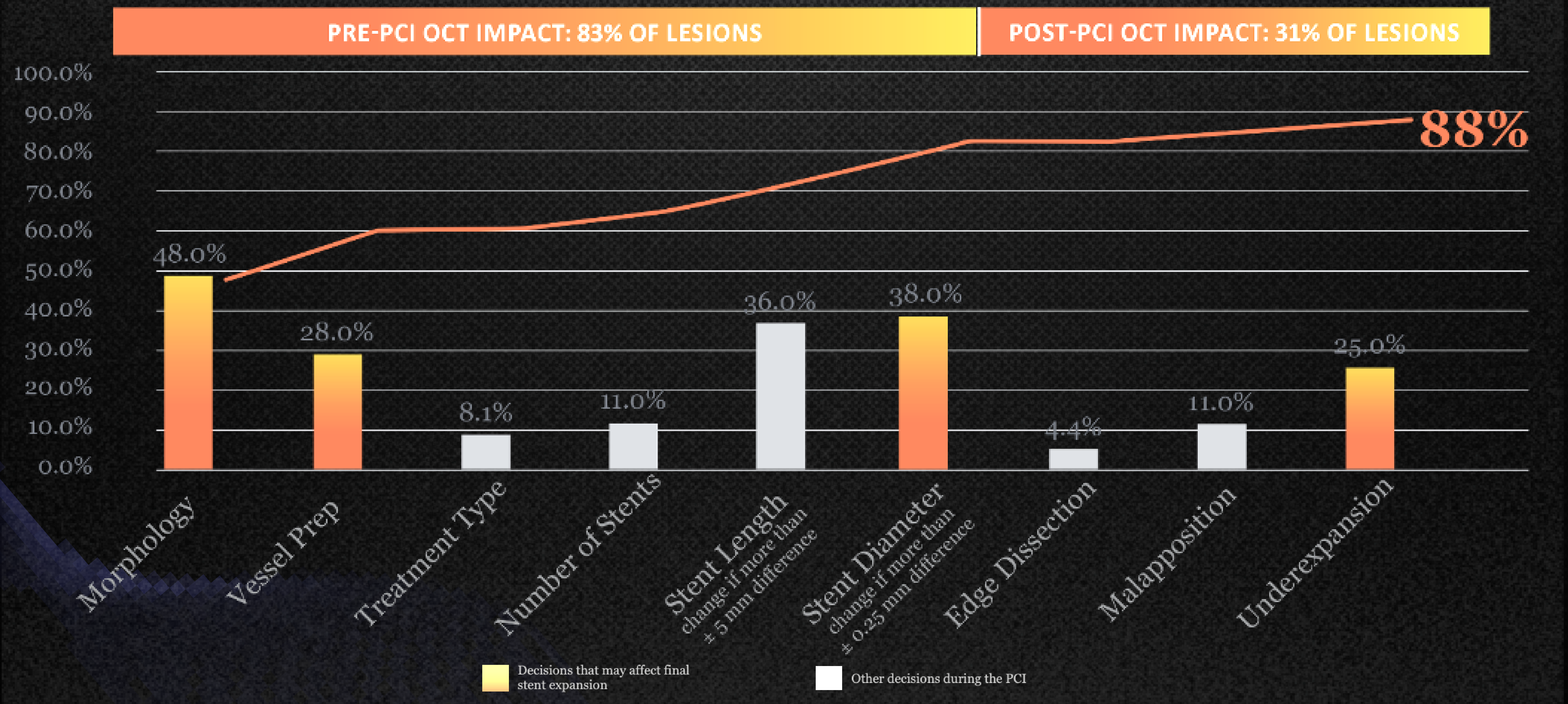
Image Guided

Angio Guided vs IVUS/OCT Guided

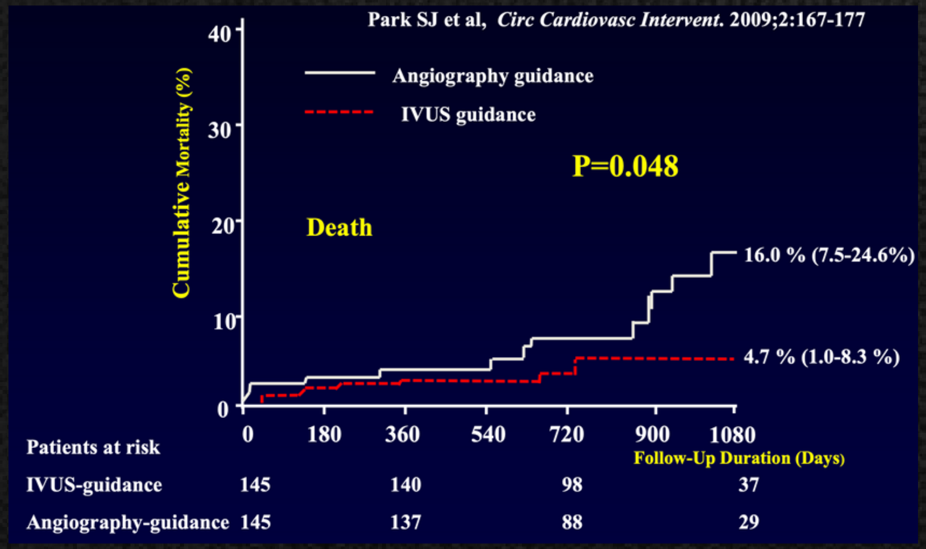


OCT Changed Angiographic-based Decisions in 88% of Lesions

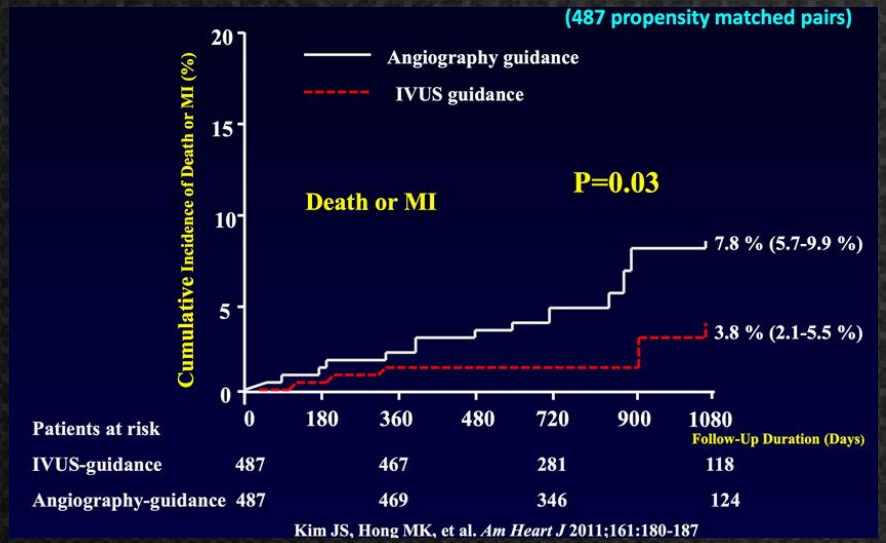
OCT significantly changes physician decisions at steps in a PCI that MAY AFFECT EXPANSION, A LEADING INDICATOR OF ADVERSE EVENTS:



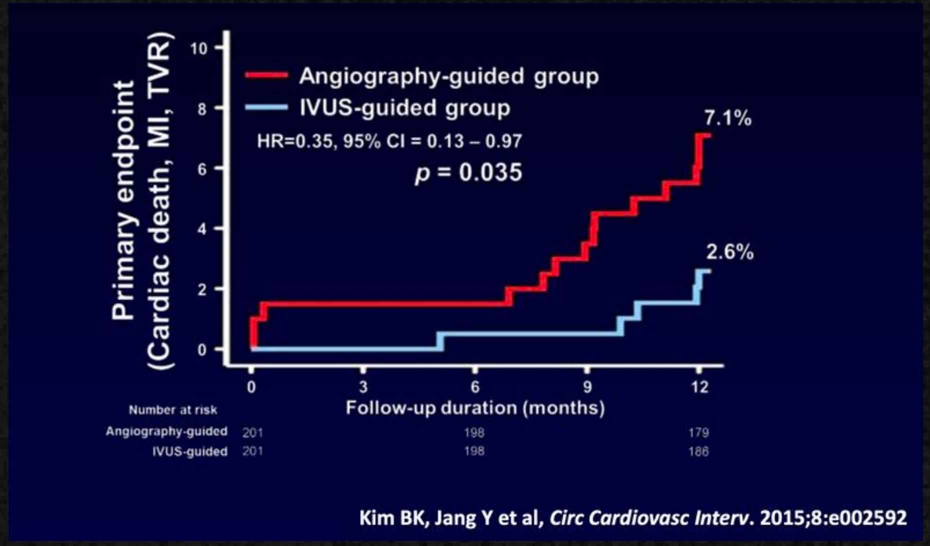
LM



Bifurcation



CTO



Diffuse

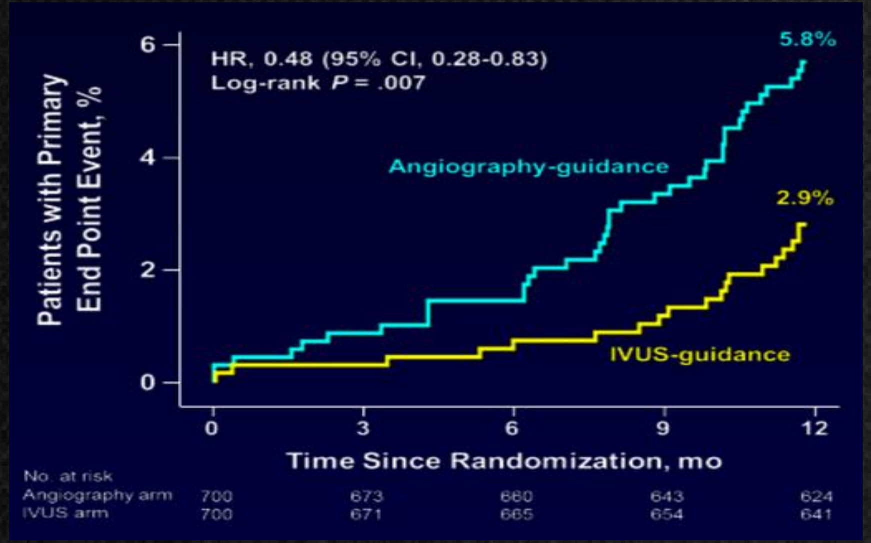
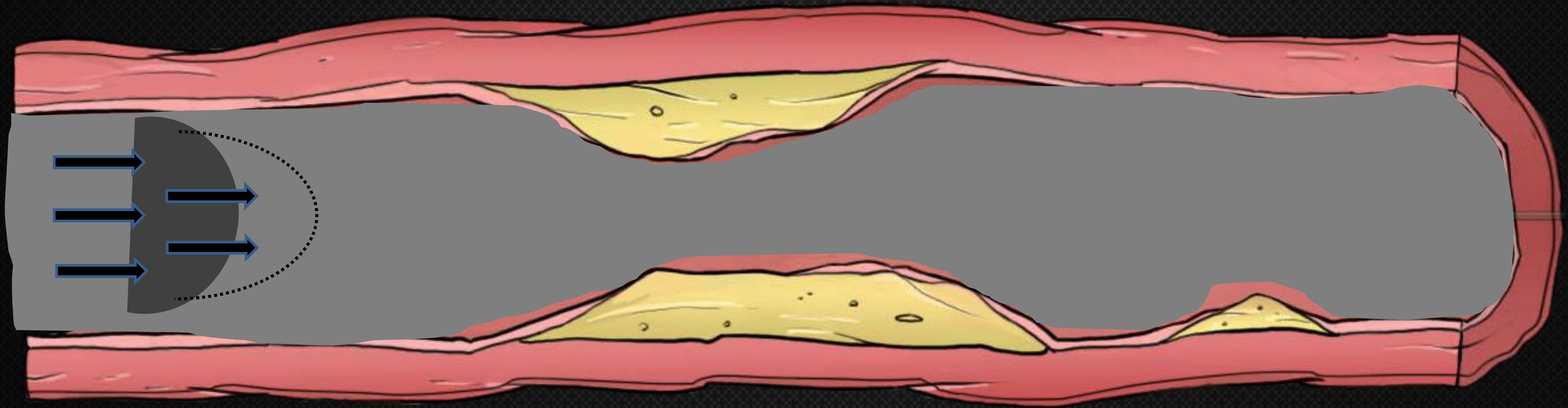


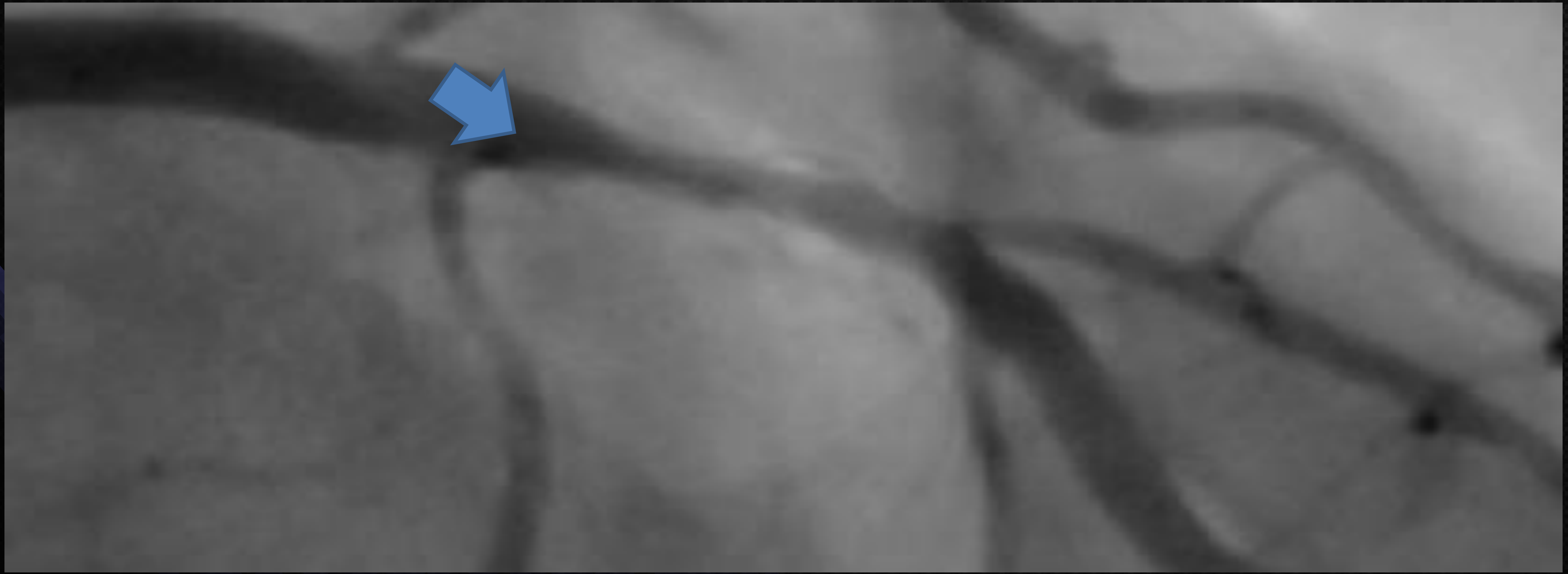
Image guided

vs

Angio guided

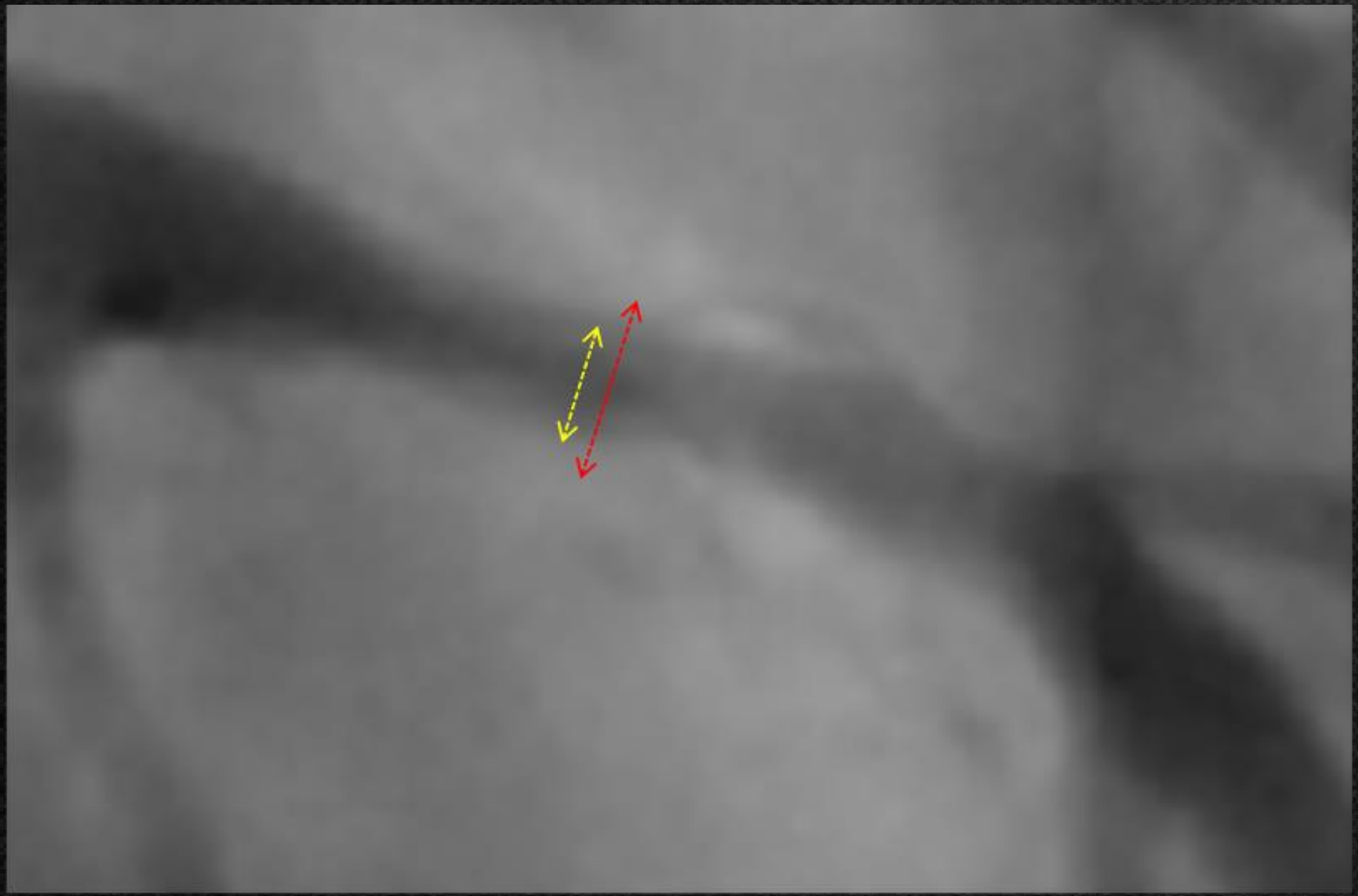
Angiogram → Lumino-gram



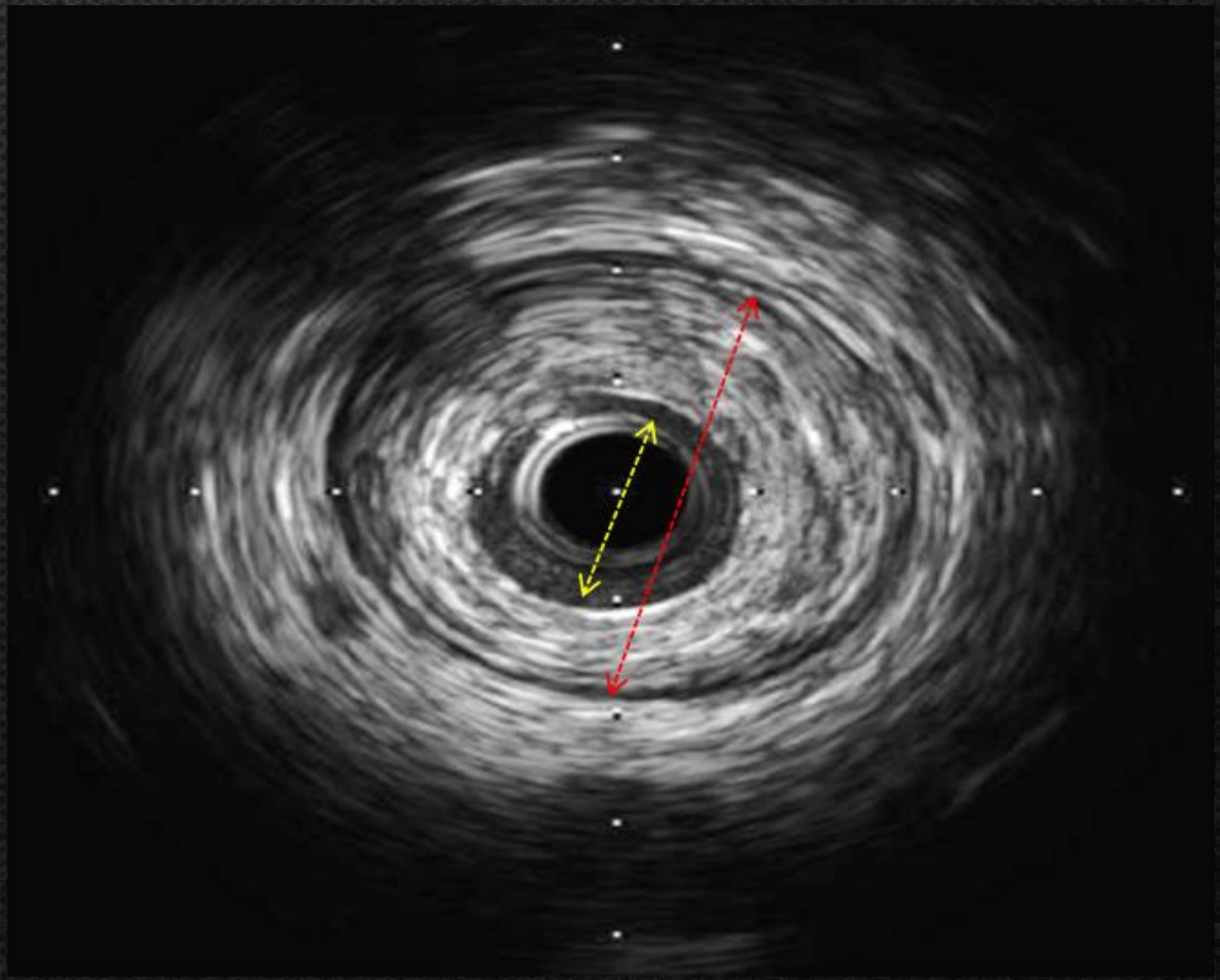


Lumino-gram
:혈관내강조영

Angiogram (Lumino-gram) vs IVUS (Tomo-gram)

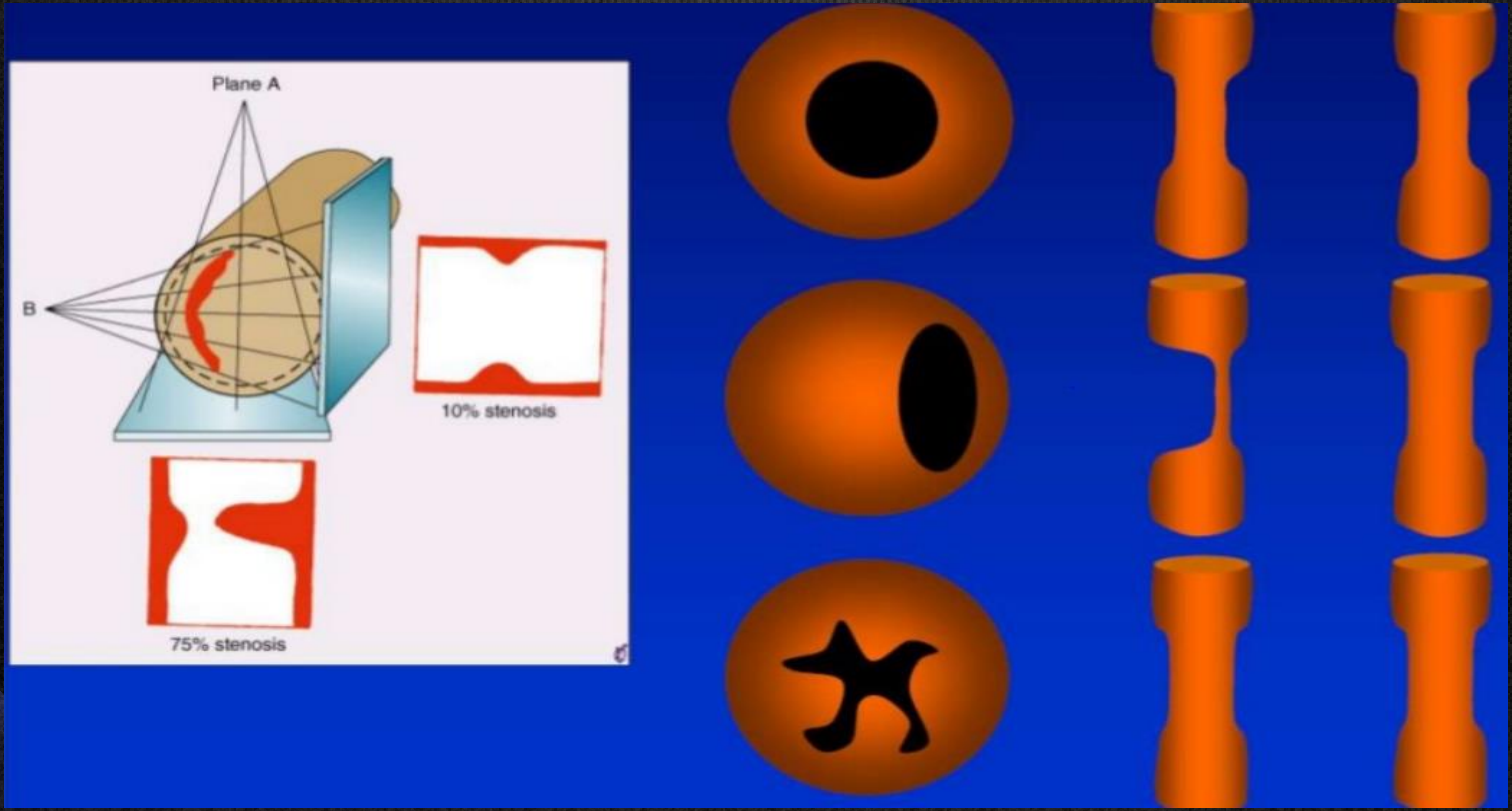


MLD 1.3 mm

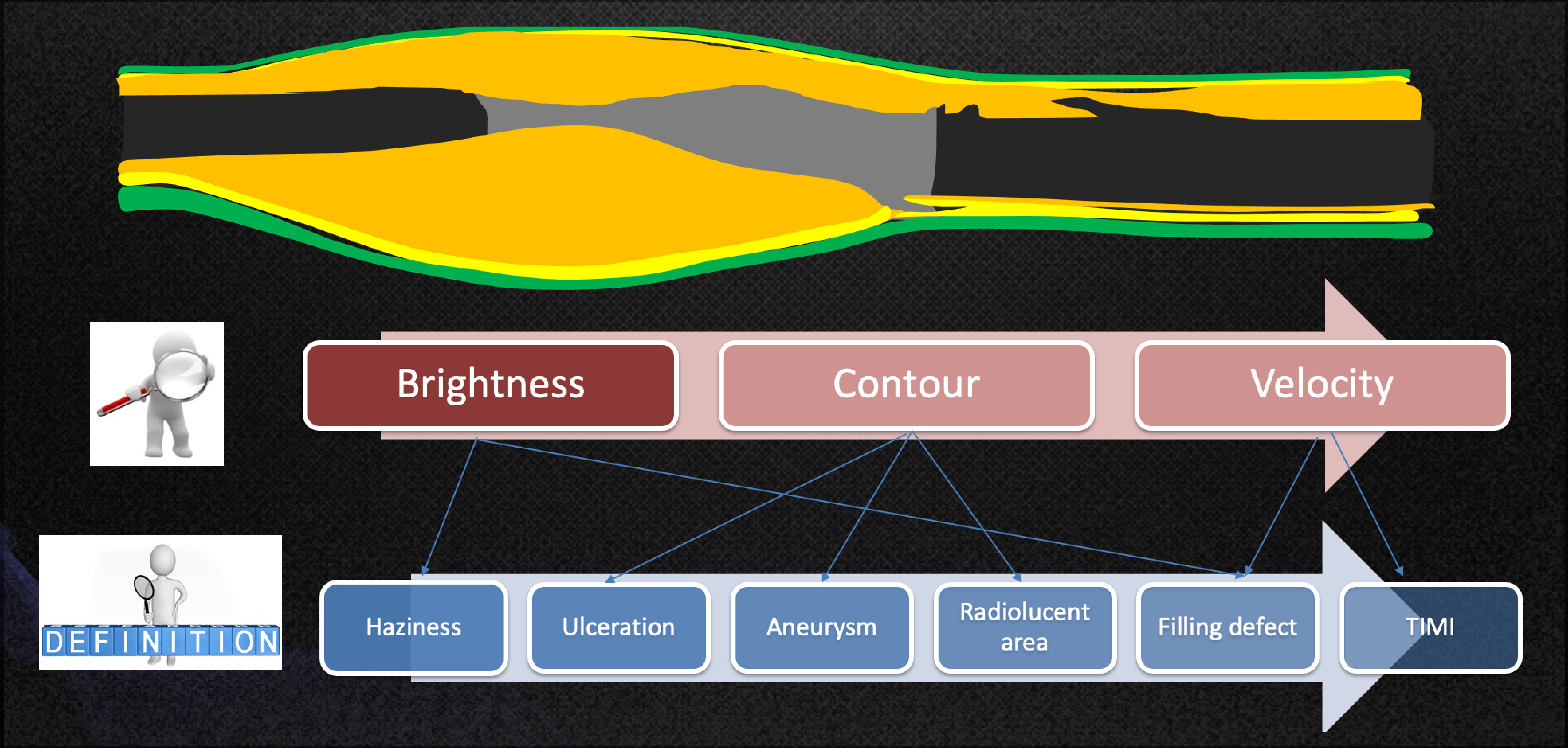


MLD 1.3 mm / M to M 3.4mm

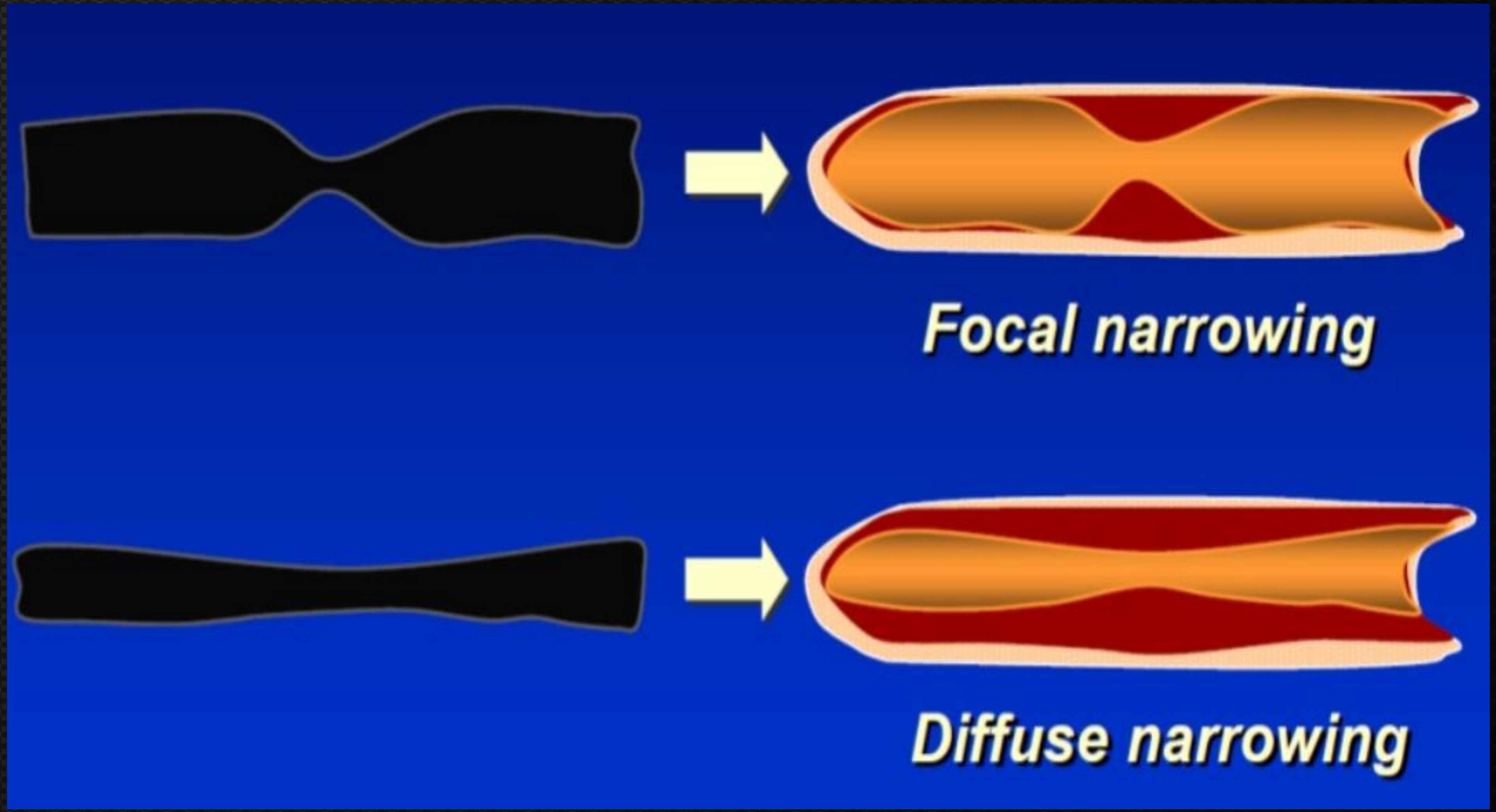
Pitfall of CAG – Axial miss



In to the deep dive about plaque morphology



Pitfall of CAG – Longitudinal miss



Very diffuse lesion (Os to distal) →

Ref. miss →

Image & physiology miss →

Hard to Procedure

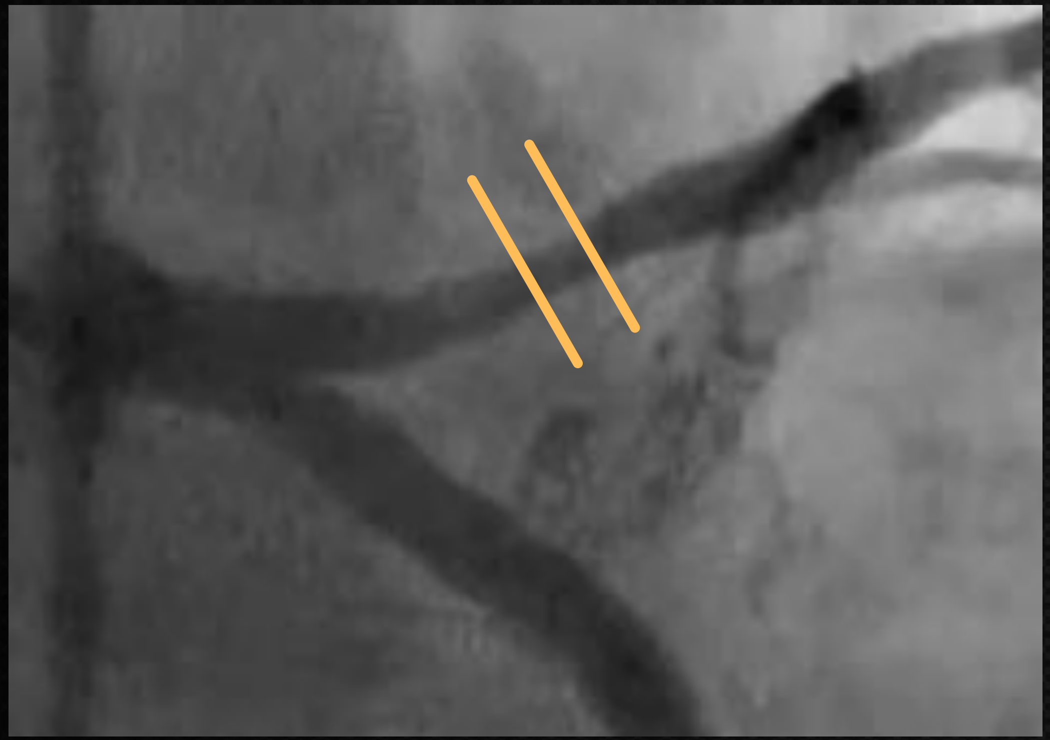
CASE 1

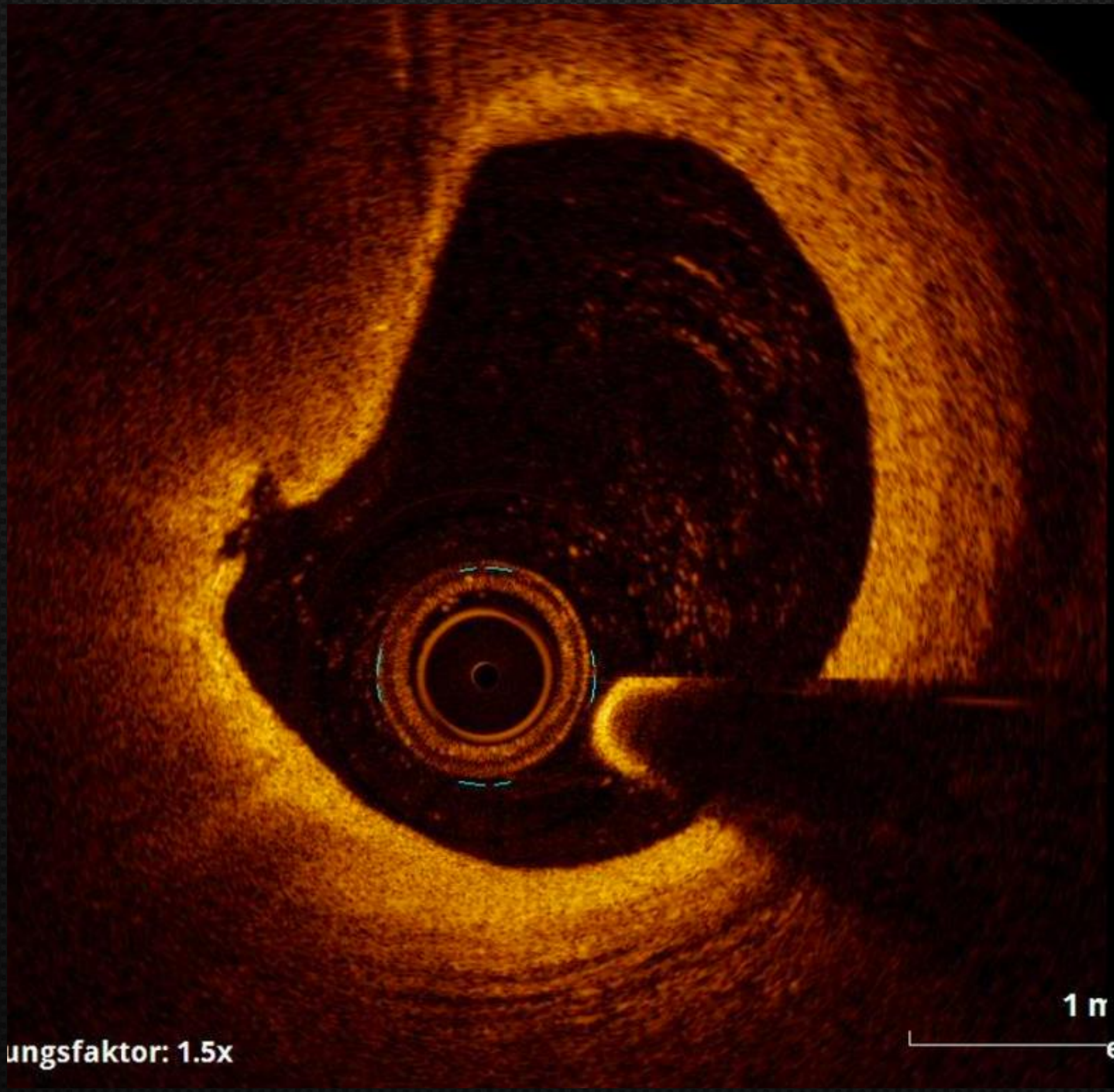
widowmaker heart attack

Heart attacks can be deadly, and the widow maker is one of the deadliest kind. It can happen suddenly when a key artery that moves blood to the heart gets almost or completely blocked. Without emergency treatment, you may not survive.

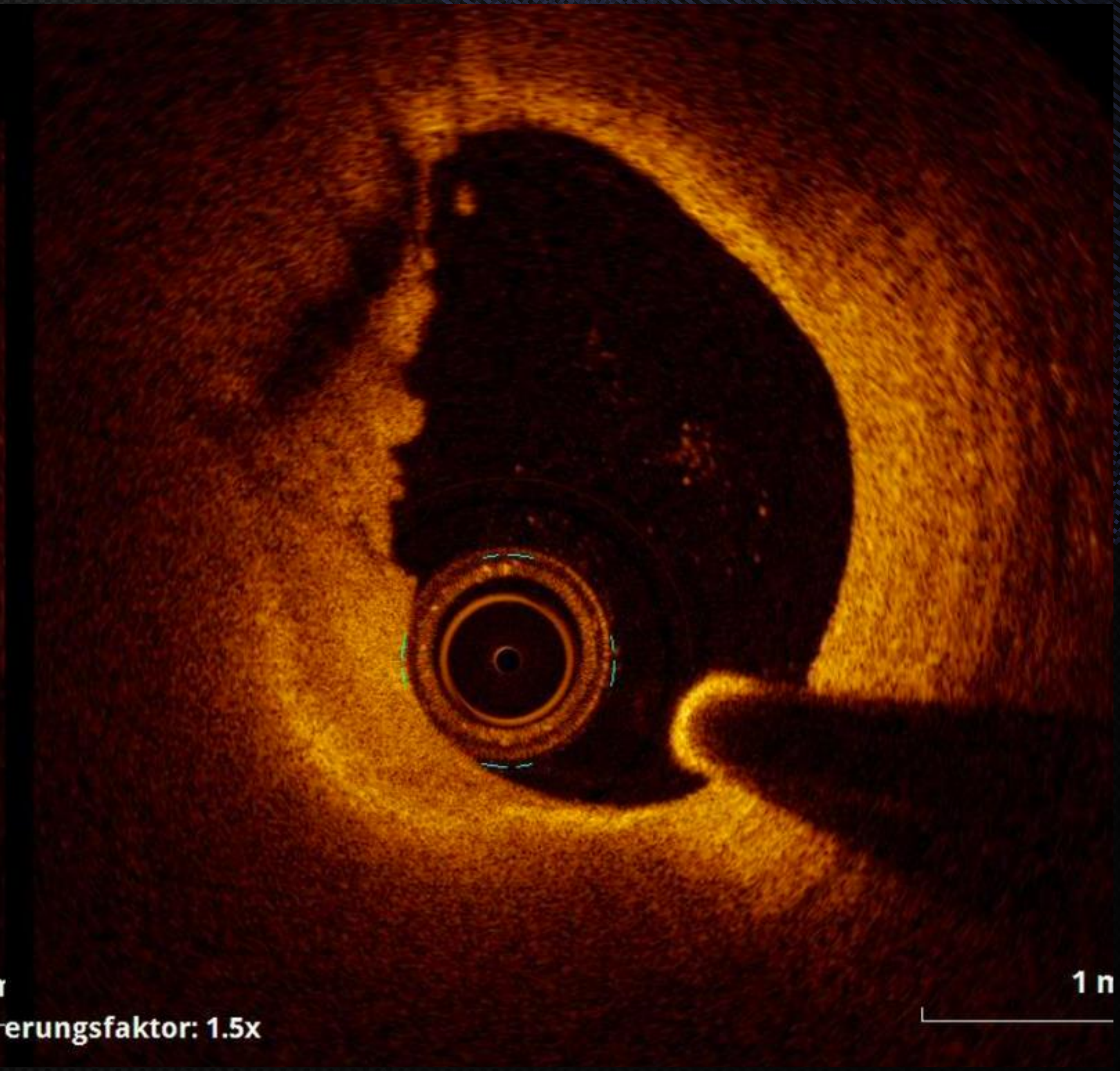
CASE 1

OCT-imaging of the proximal LAD





Thin-cap fibroatheroma with ruptured intima at 9 o'clock

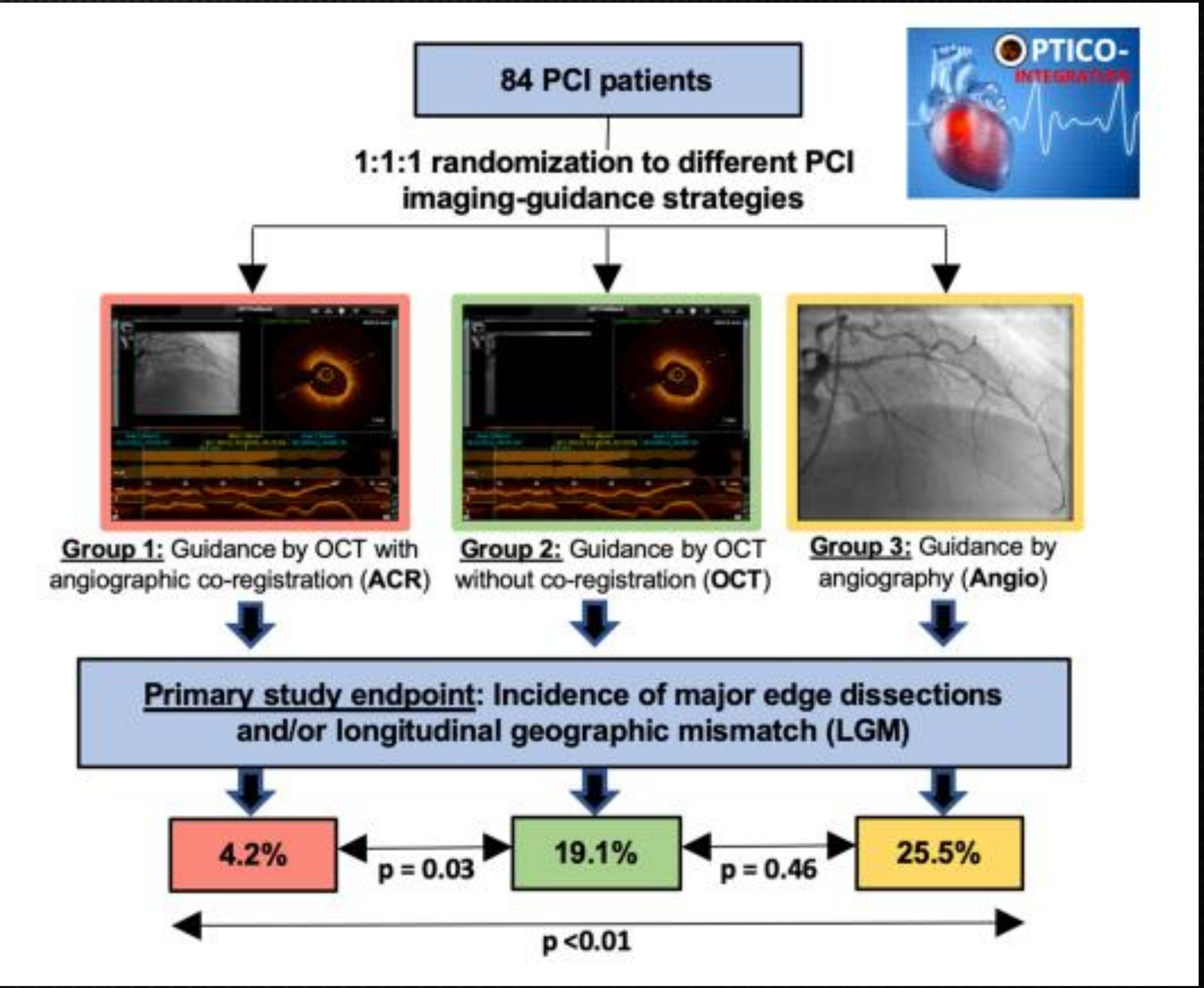


Thrombus on the surface of the lipid rich plaque

CASE 2

OPTICO-integration II

Impact of real-time angiographic co-registered optical coherence tomography on percutaneous coronary intervention



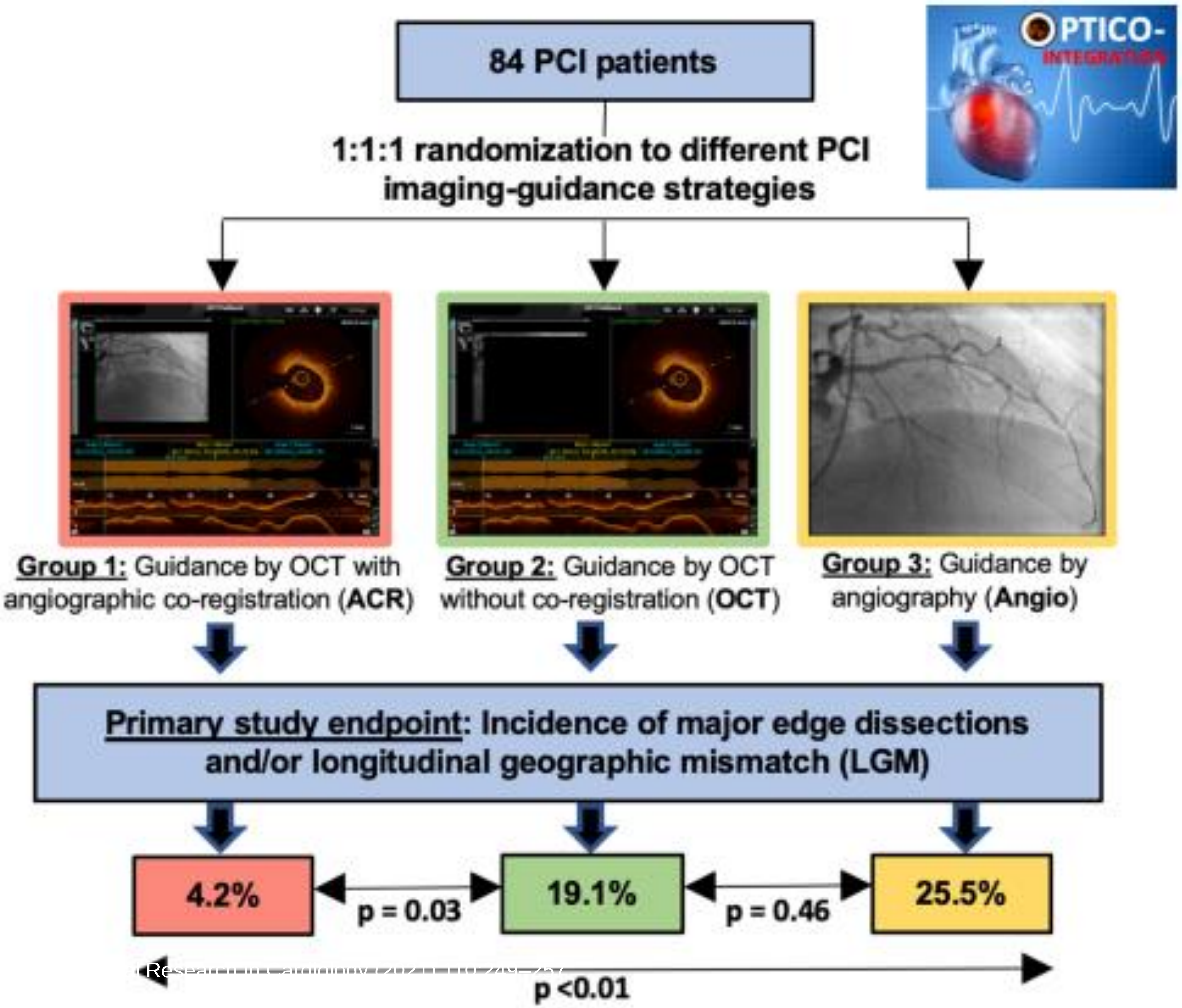
This study for the frst time demonstrates superiority of ACR-guided PCI over OCT- and angiography-guided PCI in reducing the composite endpoint of major edge dissection and LGM, which was meanly driven by a reduction of LGM.

Clinical Research in Cardiology (2021) 110:249–257

CASE 2

OPTICO-integration II

Impact of real-time angiographic co-registered optical coherence tomography on percutaneous coronary intervention:

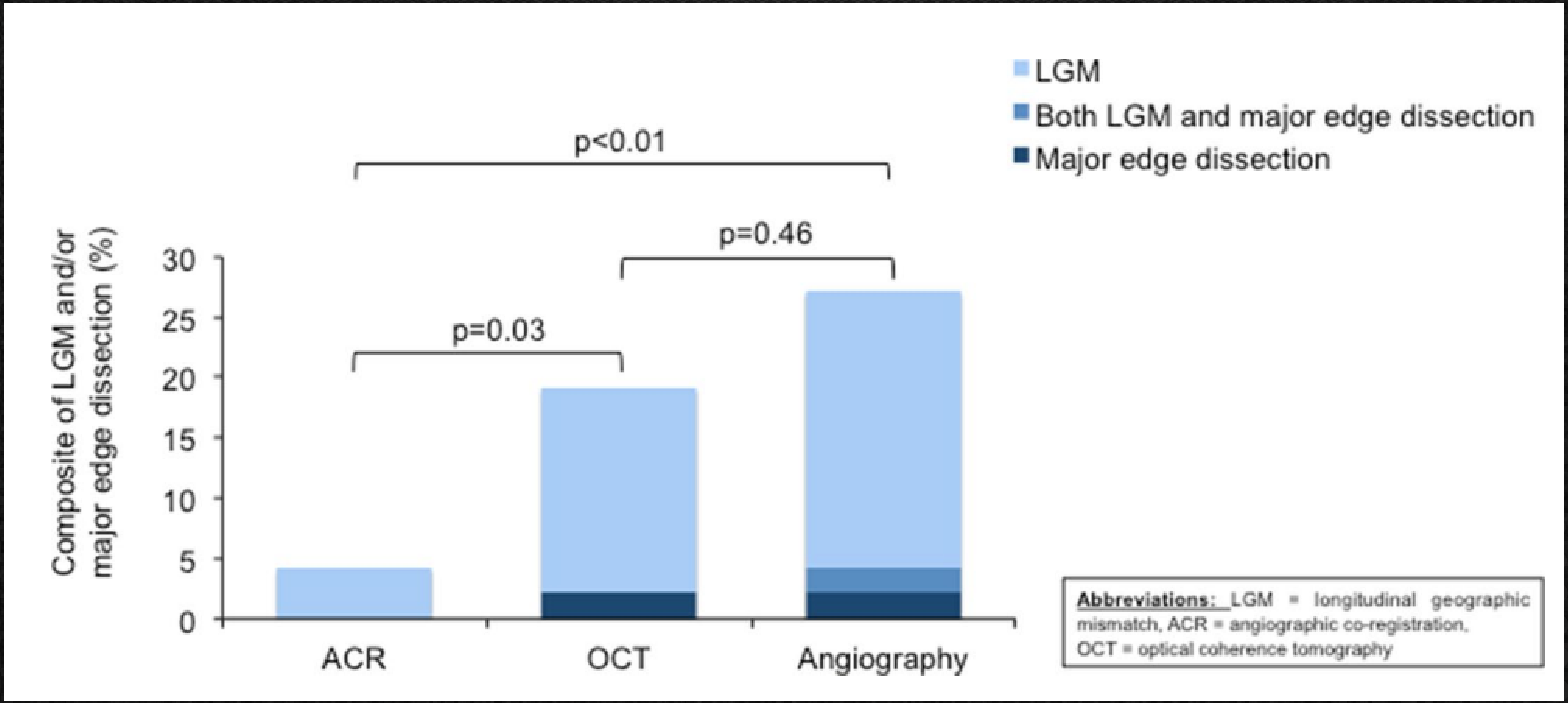


Research in Cardiology (2021) 110:249–257

CASE 2

OPTICO-integration II

Predictors of longitudinal geographic missmatch and/or major edge dissection

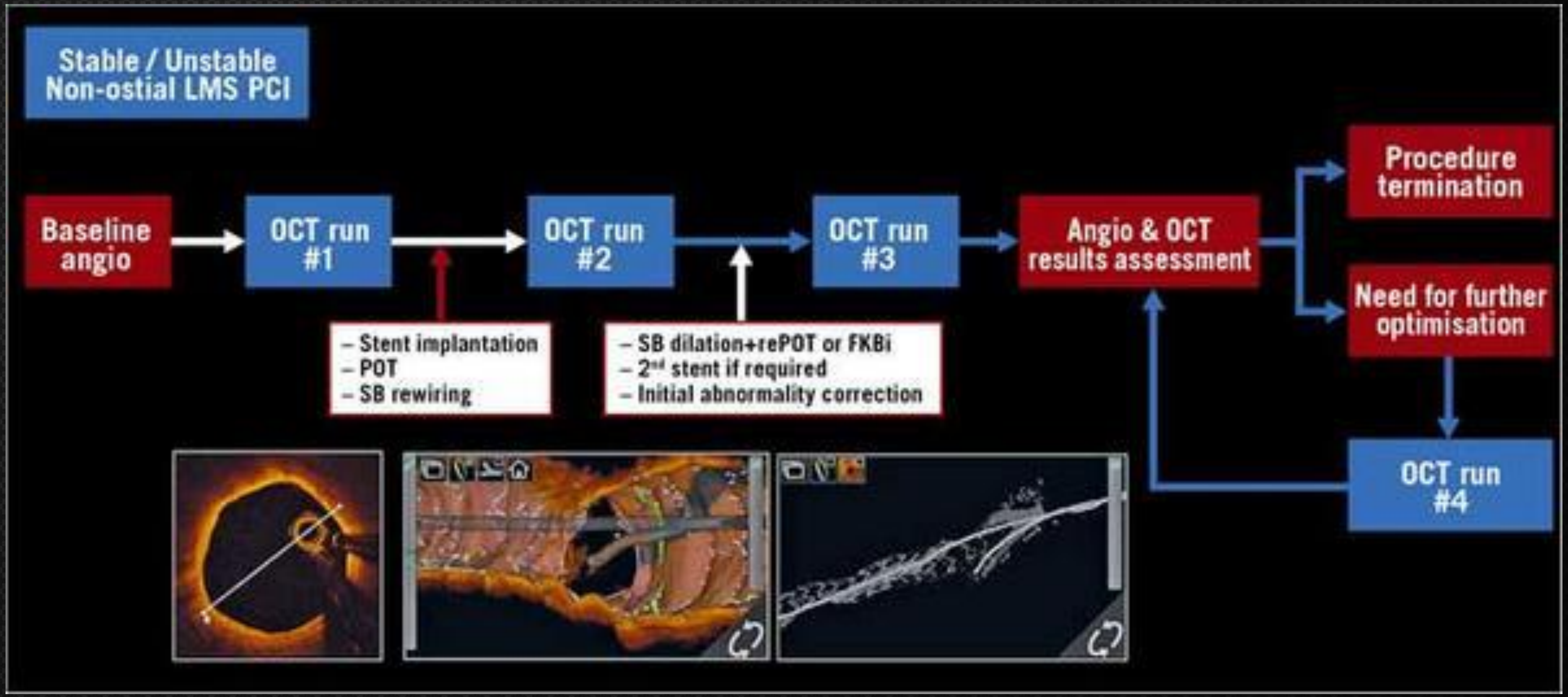


Clinical Research in Cardiology (2021) 110:249–257

CASE 3

LEMON study

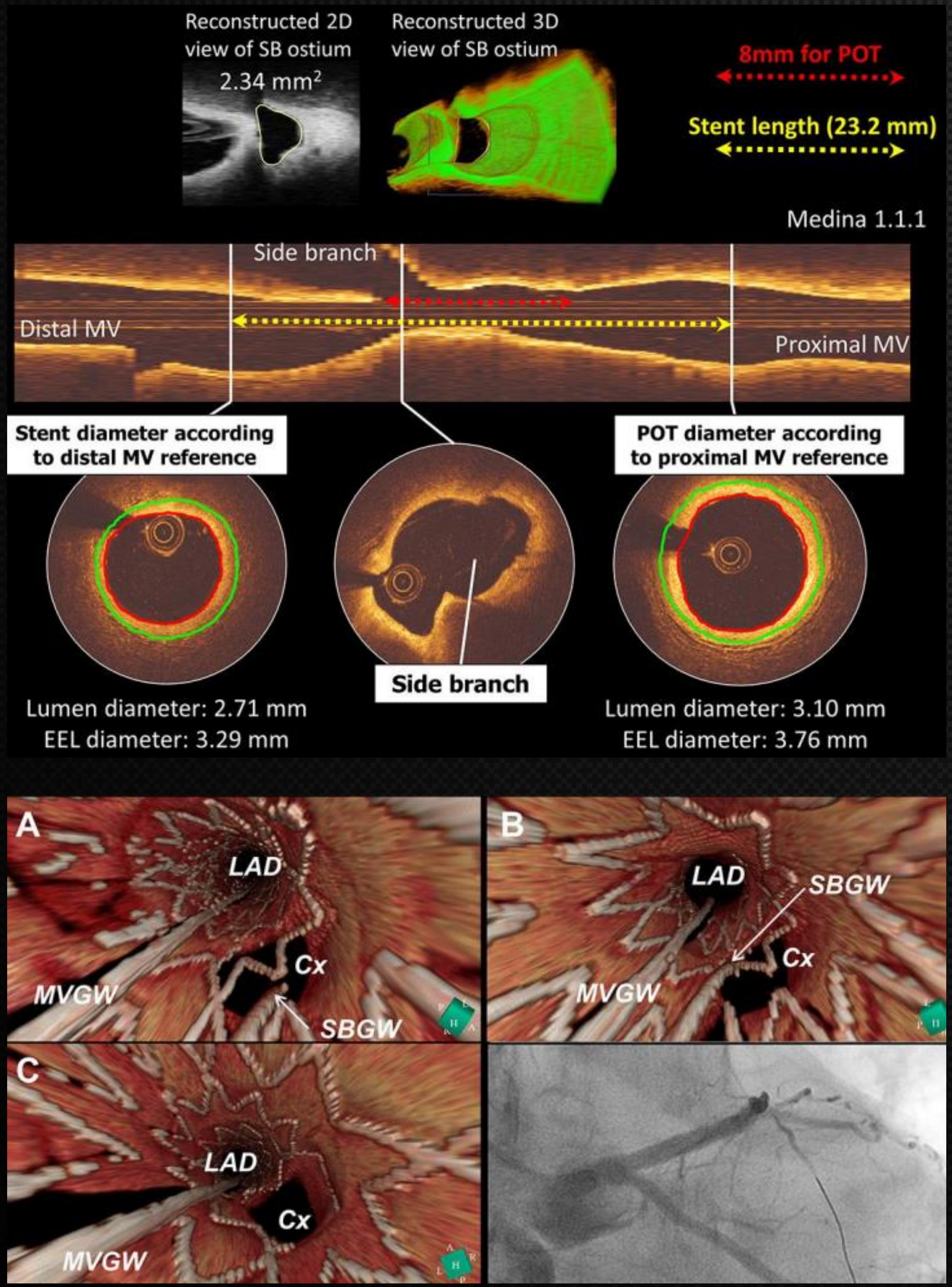
Optical coherence tomography to guide percutaneous coronary intervention of the left main coronary artery: the LEMON study

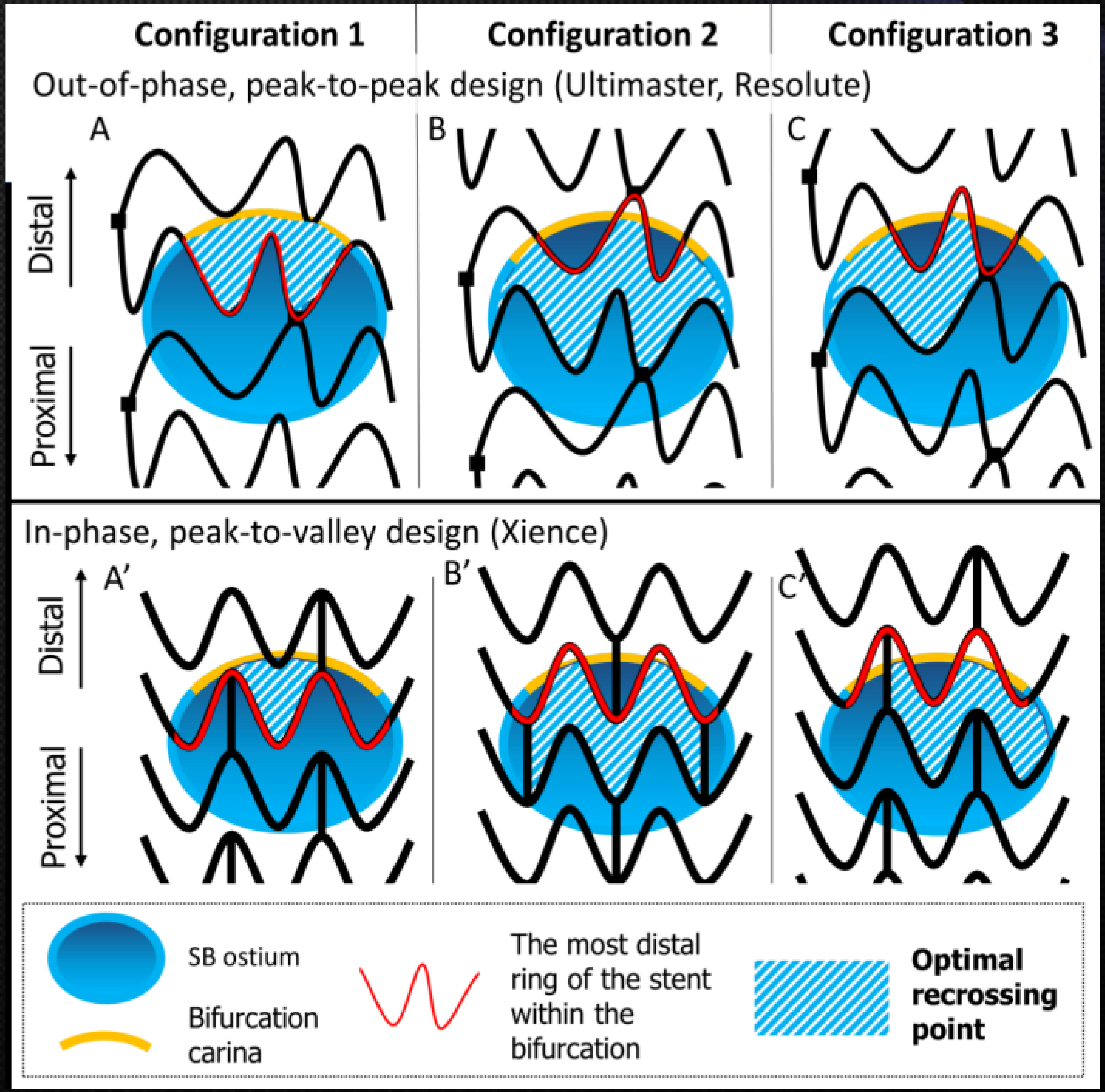


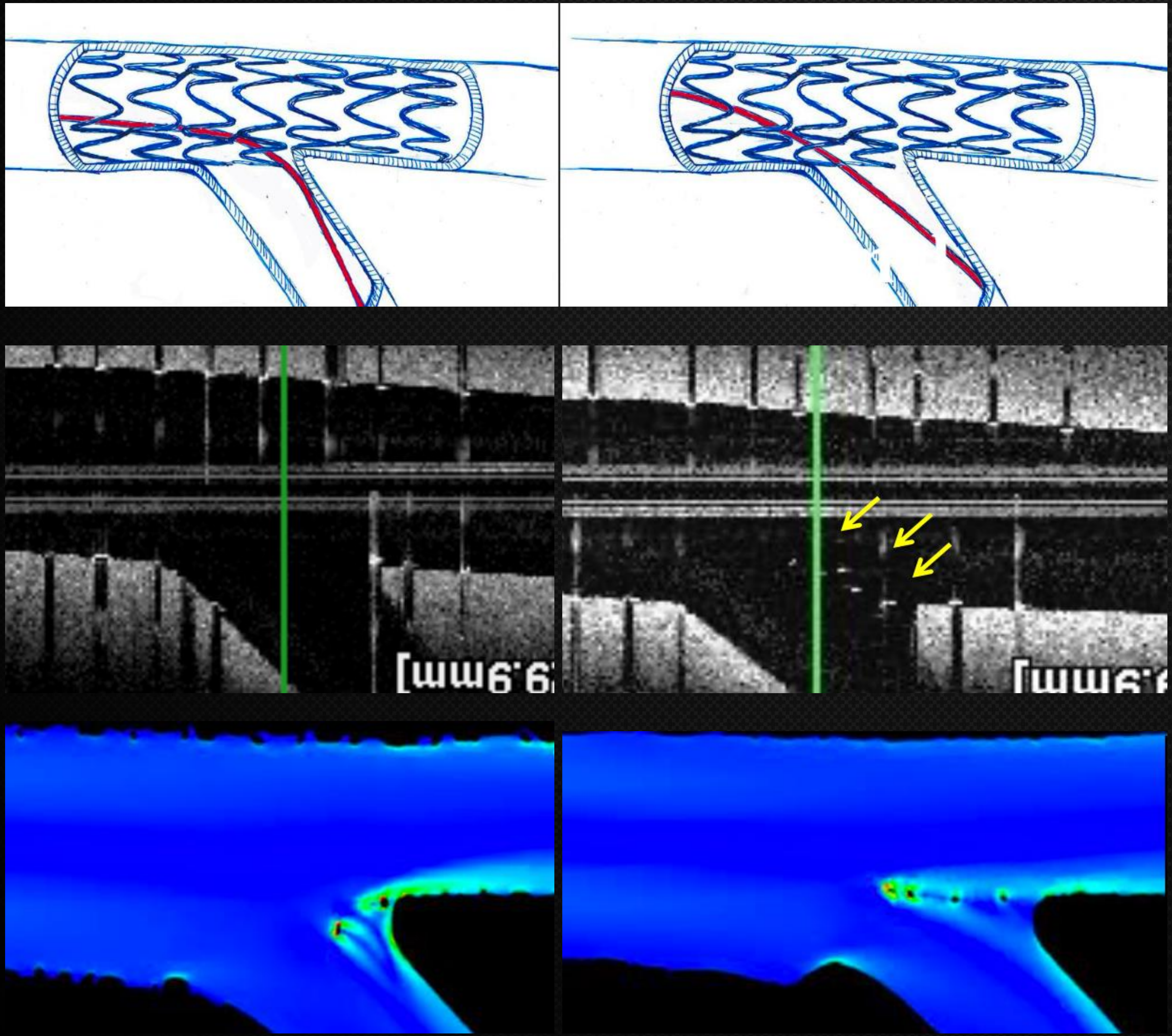
This pilot study is the first to report the feasibility and performance of OCT-guided LMS PCI according to a pre-specified protocol.

EuroIntervention 2021;17:e124-e131. DOI: 10.4244/EIJ-D-20-01121

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





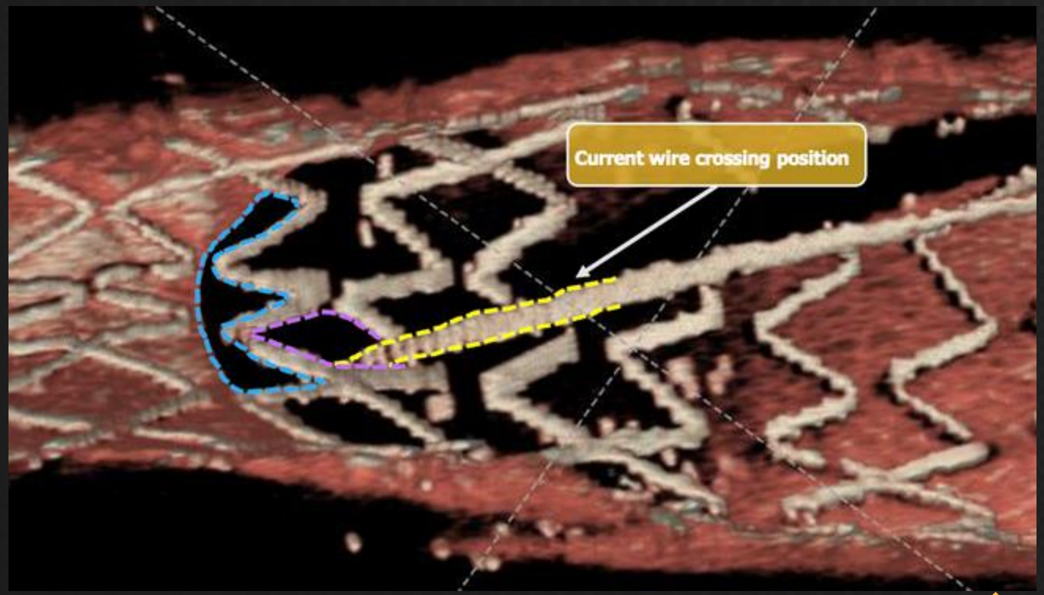


Impact of recrossing wire position on shear stress after ballooning

OCT is Better than IVUS especially for bifurcation PC,
Yoshinobu Onuma

Wire re-crossing to side branch after stent deployment

1



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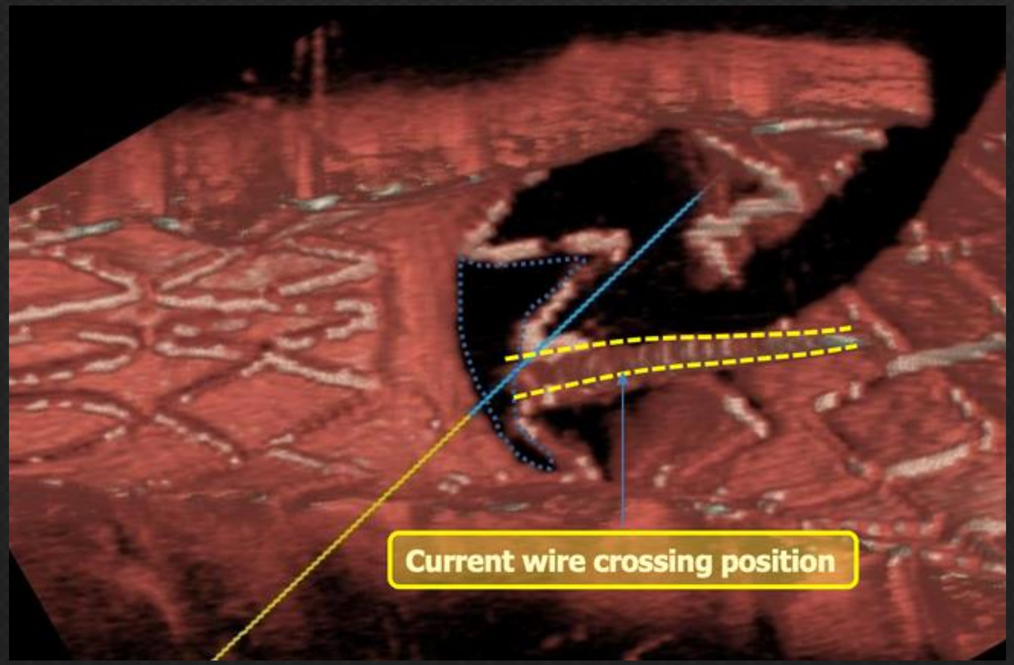
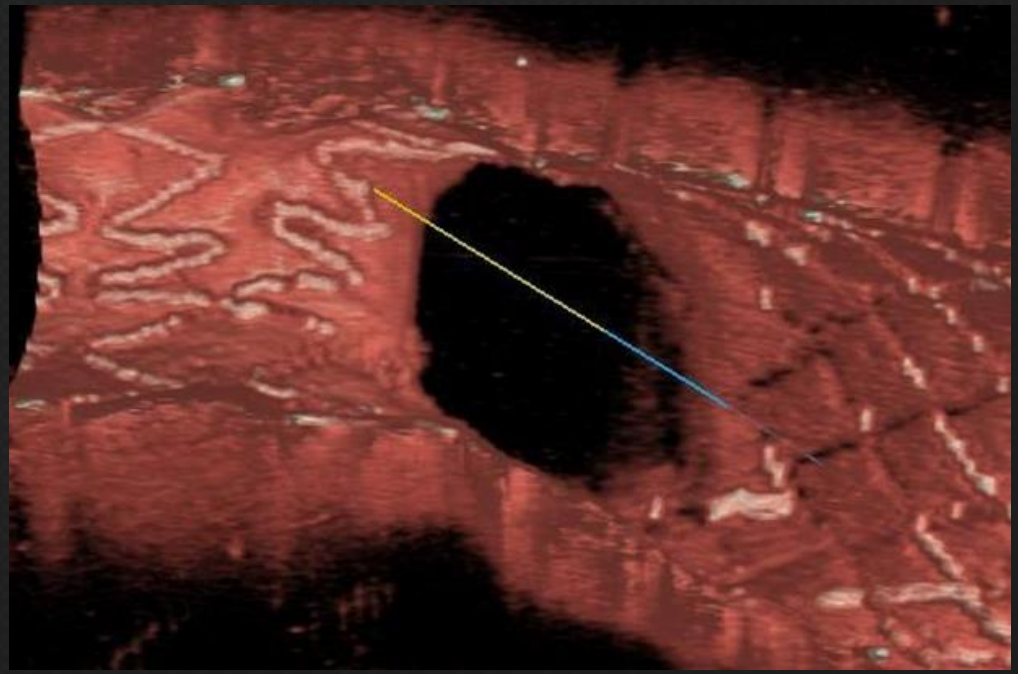


3



OCT is Better than IVUS especially for bifurcation PC, Yoshinobu Onuma

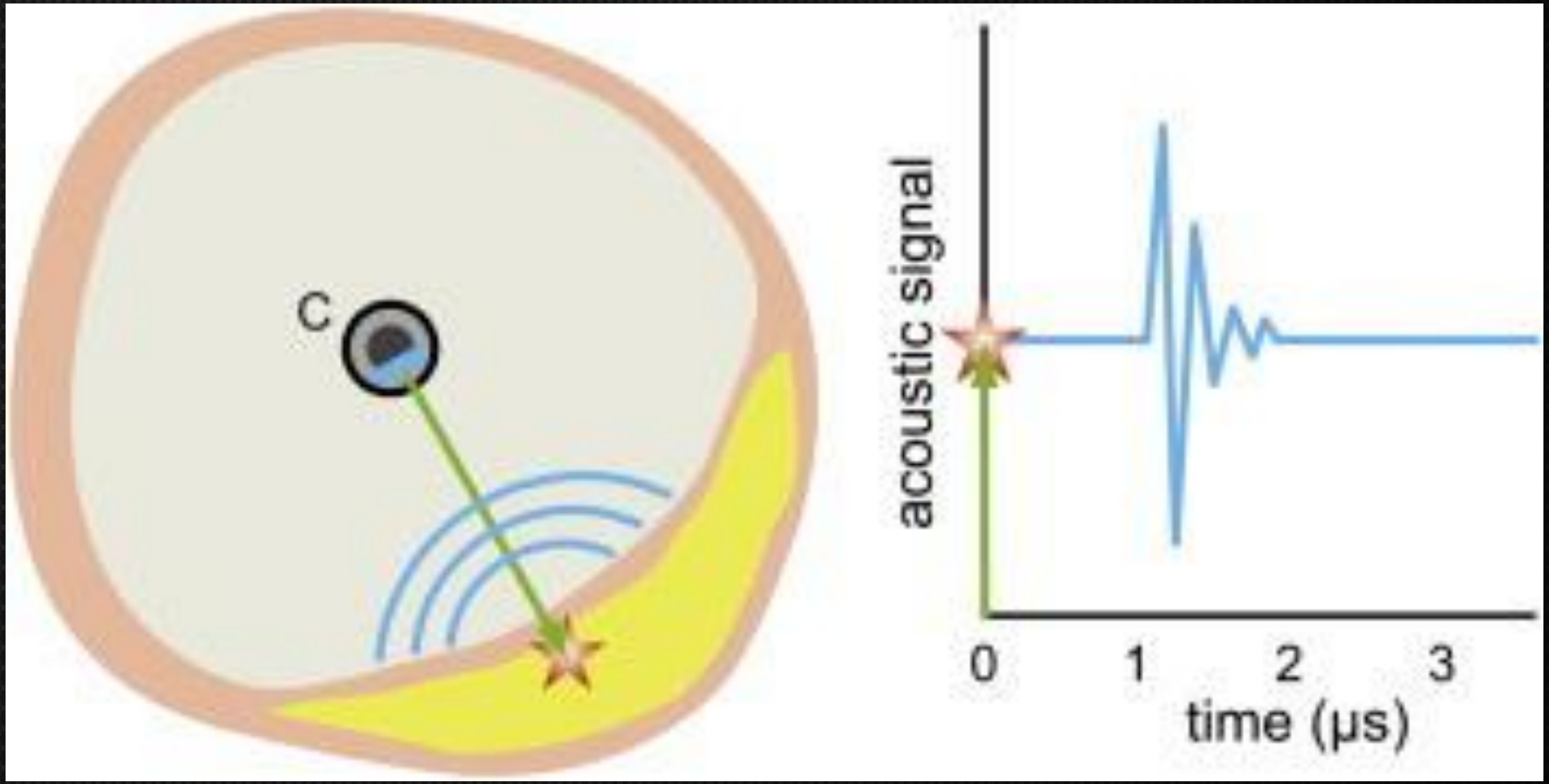
Ongoing RCTs comparing OCT versus angiography-guided bifurcation PCI

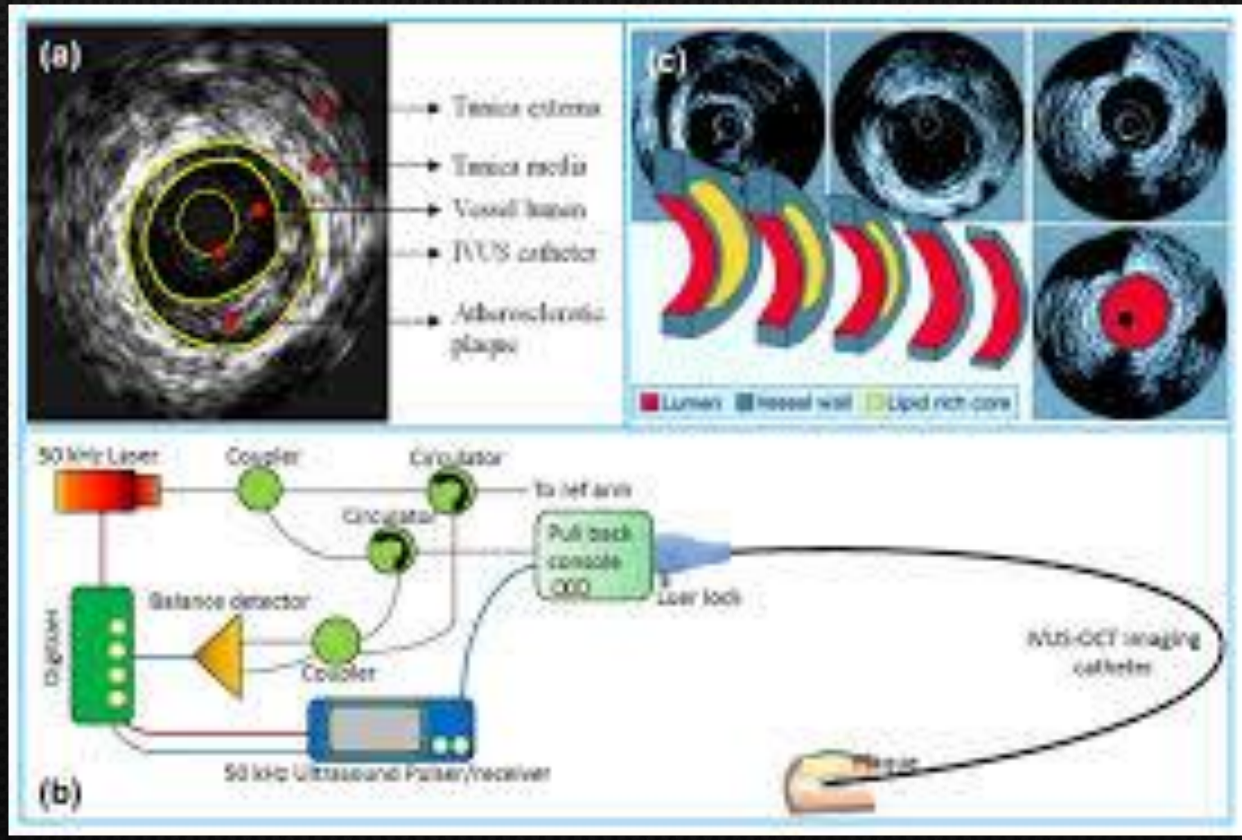
	Number of patients	Endpoint
DOCTOR Recross	60 (angiography: 30, OCT: 30)	Cross sectional stent strut malapposition in the main vessel bifurcation segment facing the side-branch ostium after procedure
OPTIMUM	103 (angiography guided: 53, OCT guided: 53)	Acute incomplete strut malapposition in bifurcation
OCTOBER	1200 (angiography guided: 600, OCT guided: 600)	To compare median two-year clinical outcome after OCT guided vs. standard guided revascularization of patients requiring complex bifurcation stent implantation

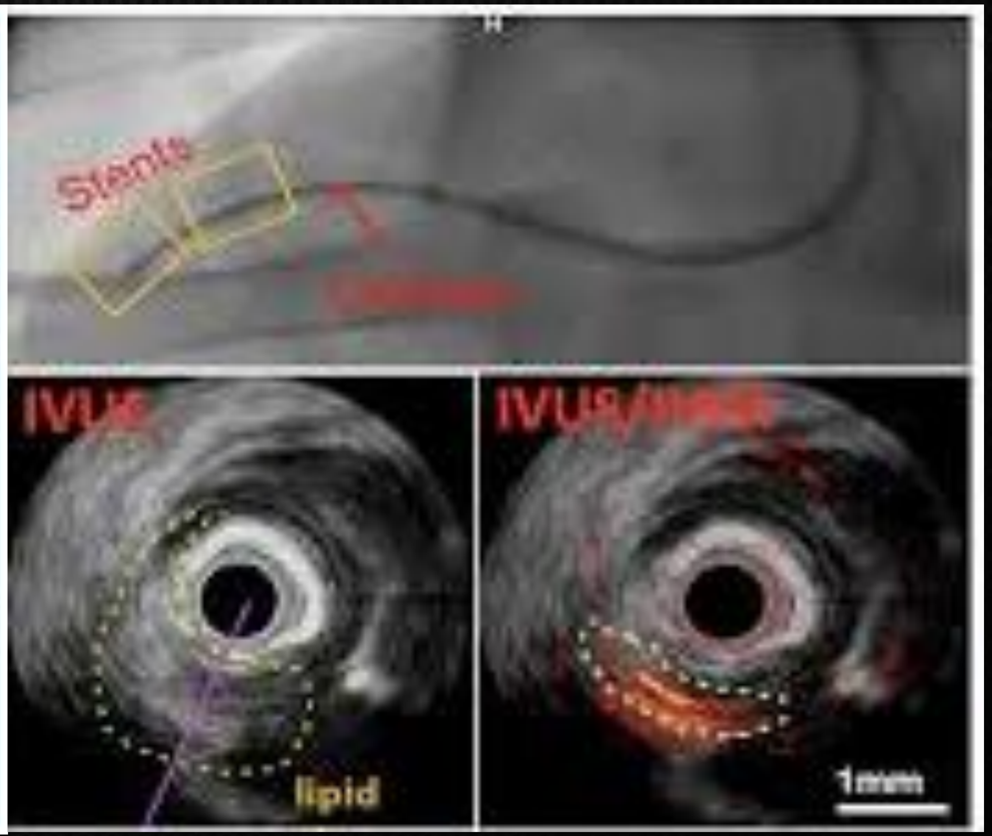
Latest intravavascular image

- **It will be possible to detection of LIPID Pool in a better way through combination with a new image source.**

- Change of treatment policy through prediction if vulnerable groups







Through the new modality, it is possible to predict the change of treatment indication.

- It will be possible to detection of LIPID Pool in a better way through combination with a new image source.

- Change of treatment policy through prediction of vulnerable groups

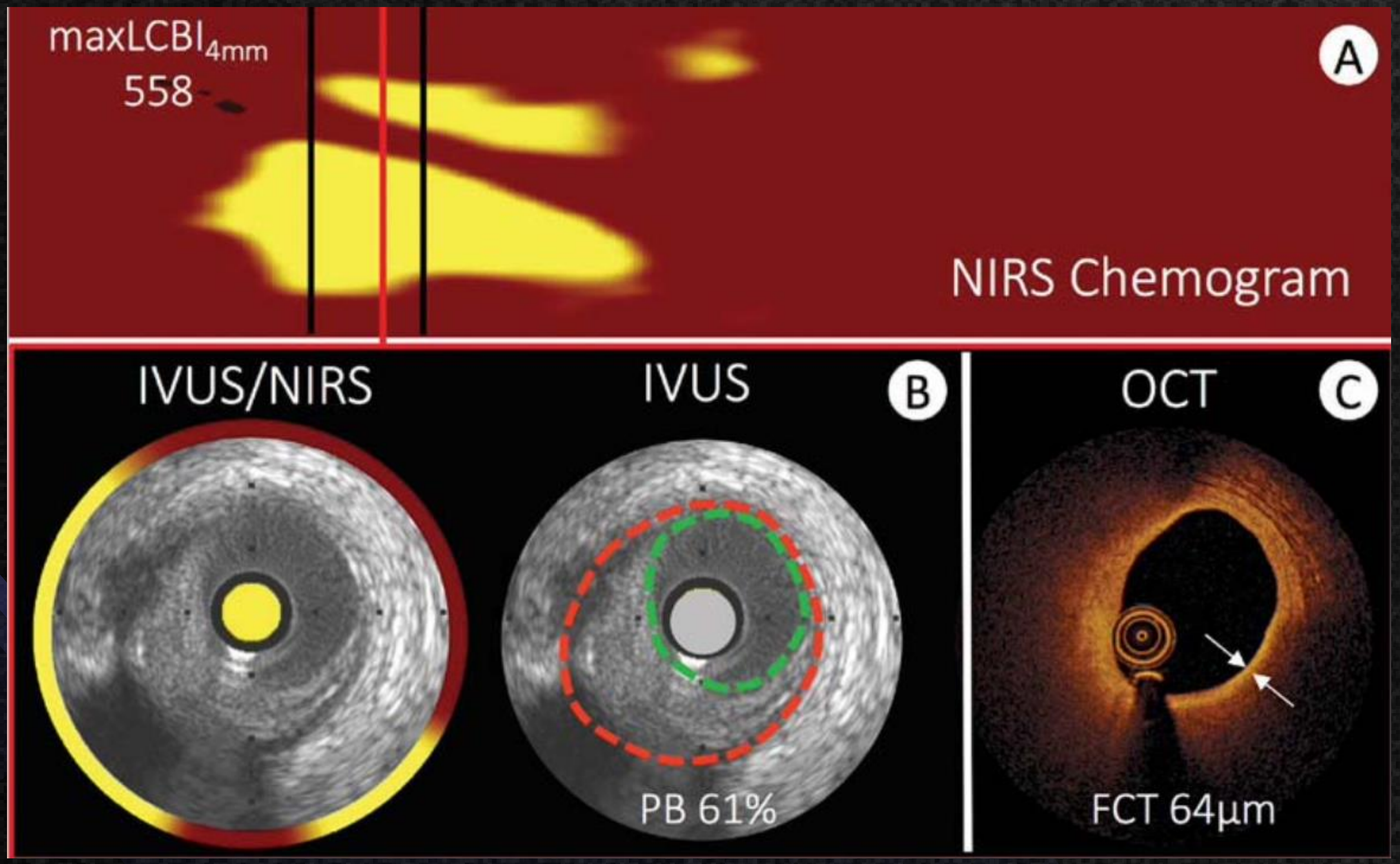
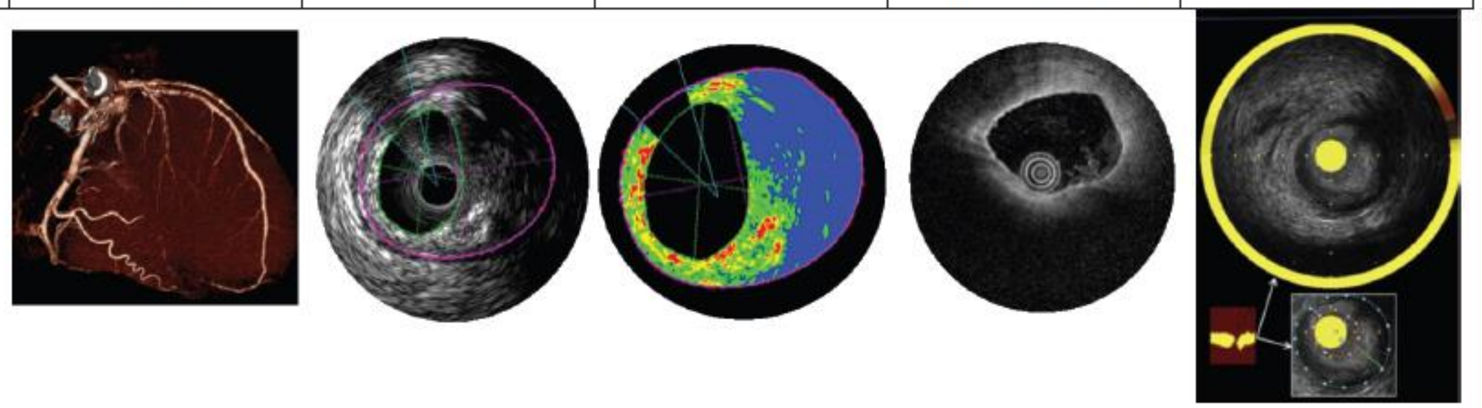
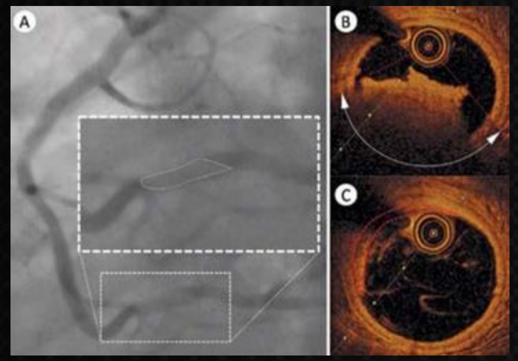


Figure 2: Characteristics of Invasive and Non-invasive Coronary Imaging Modalities to Detect High-risk Vulnerable Plaques

Modality	CCTA	IVUS	IVUS-RF Analysis	OCT/OFDI	NIRS
Energy source	X-ray	Ultrasound (20–60 MHz)	Ultrasound (20–40 MHz)	Near-infrared light	Near-infrared light
Resolution	0.5–1 mm	100–200 µm	100–200 µm	10–15 µm	NA
Penetration	NA	8–10 mm	8–10 mm	2–3 mm	1–2 mm
Features of high-risk plaque	Eccentric pattern, outward remodeling, low attenuation plaque by HU, spotty calcification, napkin ring sign	Eccentric pattern, outward remodeling, large plaque burden, large lipid core (echolucent core), spotty calcification	Plaque composition (fibrous, fibro -fatty, necrotic core, And calcification), large necrotic core (RF-IVUS-derived TCFA)	Thin fibrous cap, macrophage infiltration, neovascularization, large lipid core, spotty calcification	High lipid contents (high LCBI)
Limitation	Radiation, contrast agent, limited spatial resolution	Invasiveness, limited spatial resolution	Invasiveness, limited spatial resolution,	Invasiveness, limited tissue penetration, need for flushing	Invasiveness, limited tissue penetration

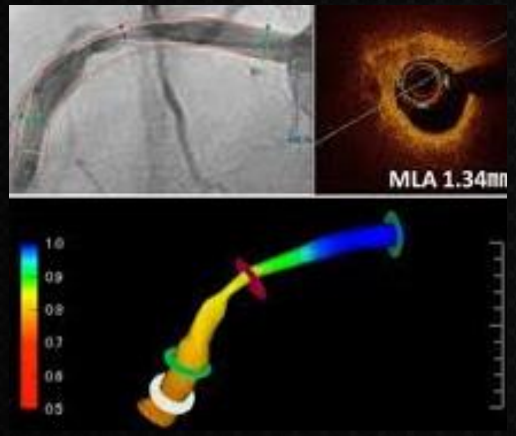


CCTA = coronary CT angiography; HU = Hounsfield unit; IVUS = intravascular ultrasound; RF = radiofrequency; OCT = optical coherence tomography; OFDI = optical frequency domain imaging; NIRS = near-infrared spectroscopy; NA = not applicable; TCFA = thin-cap fibroatheroma; LCBI = lipid-core burden index. Source: Madder et al.[13] Adapted with permission from Elsevier.



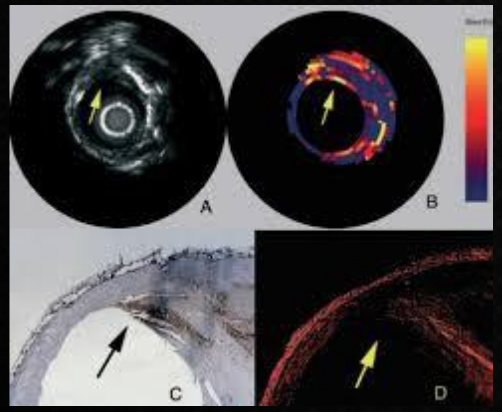
Ambigous CAD

- Imaging of angiographically ambiguous coronary findings
- Find of reference size



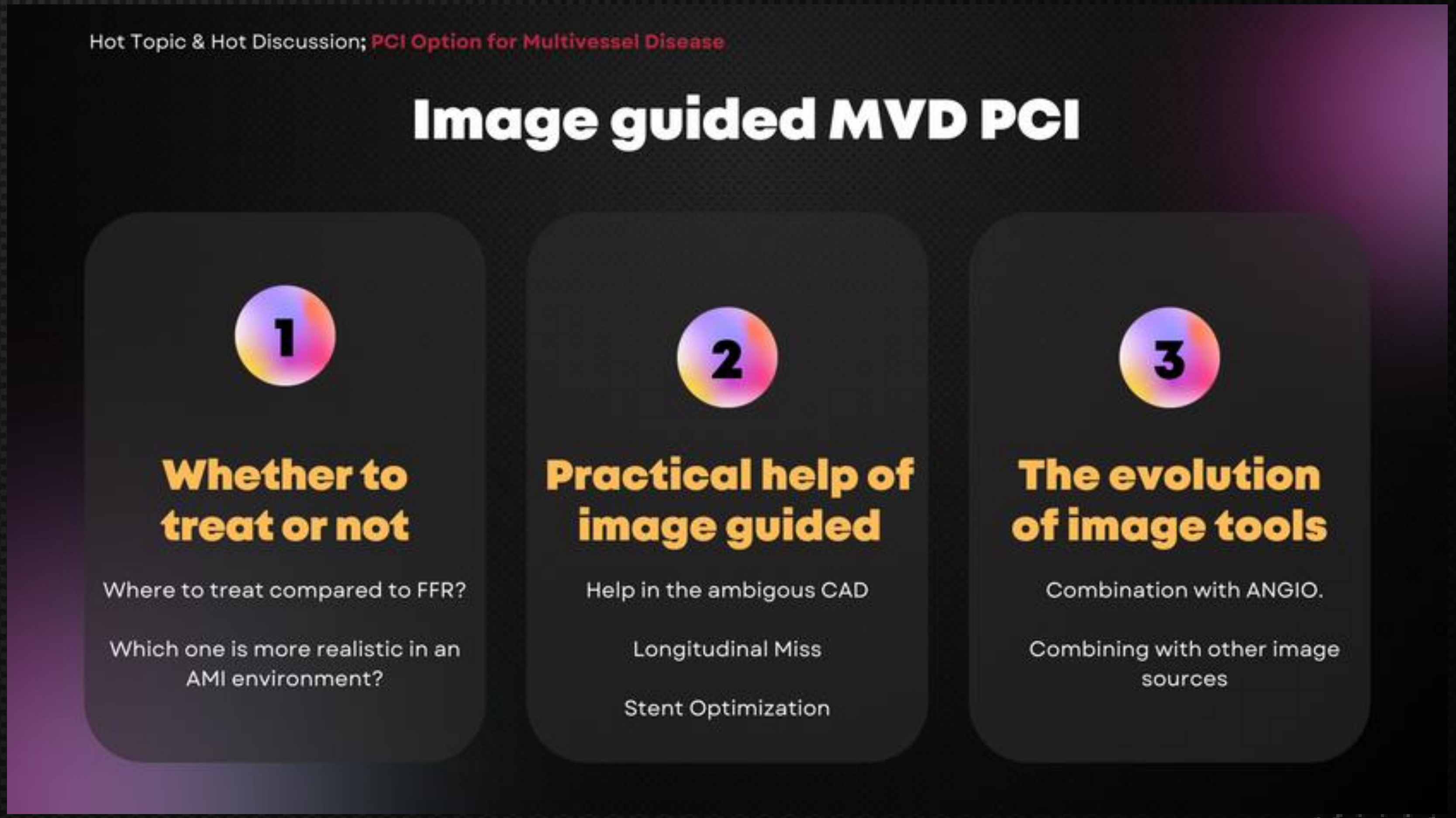
MLA

- Anatomical significant is used as a reference value



Vulnarability

- Change of treatment policy through prediction of vulnerable groups



Today's Message

What is the key
to complete revascularization in MVD?
What treatment will help the patient?
It evaluates and decides which treatment to perform.

Image guided is essential for MVD treatment, and the recent development of the device helps more accurate and effective treatment.

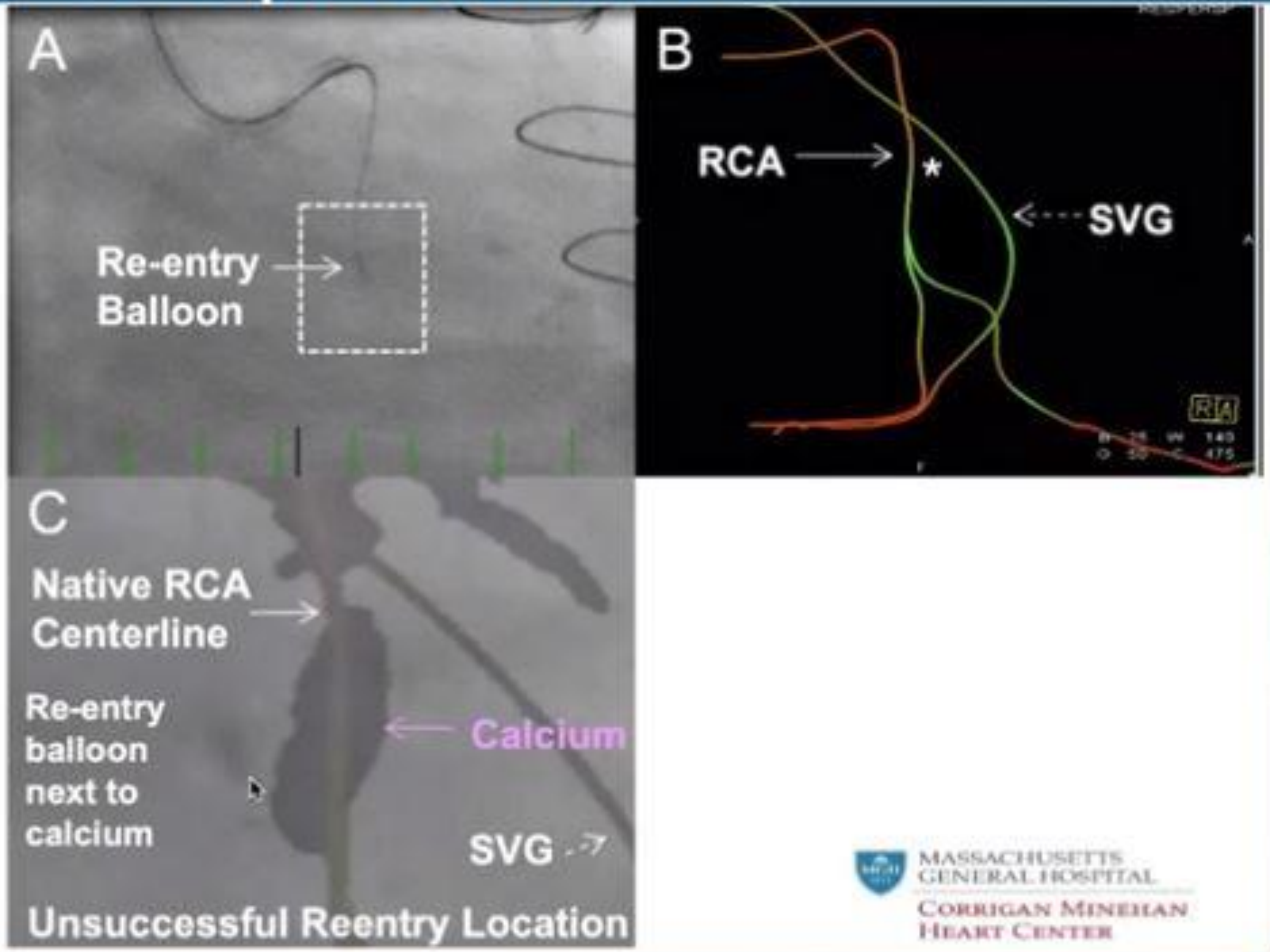
If the vulnerability of the lesion is evaluated through the synthesis and development of various modalities in the future, the treatment direction will be more diversified.

It is not a matter of which is more important

Real-time CT fusion reveals how calcium affects ADR procedures

- Antegrade dissection reentry (ADR) requires re-entering the true lumen. Reentry is facilitated using a controlled balloon such as the Stingray.
- However, reentry may not be successful due to lesional factors.
- Real-time CT fusion showed how calcium affected am ADR failure and success

-*European Radiology 2017*

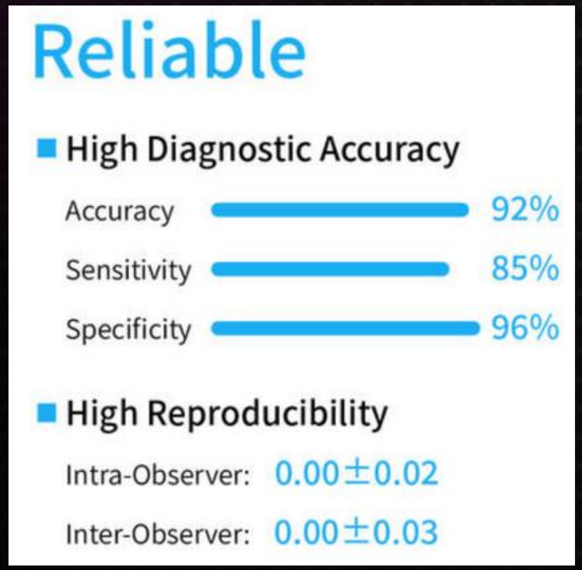


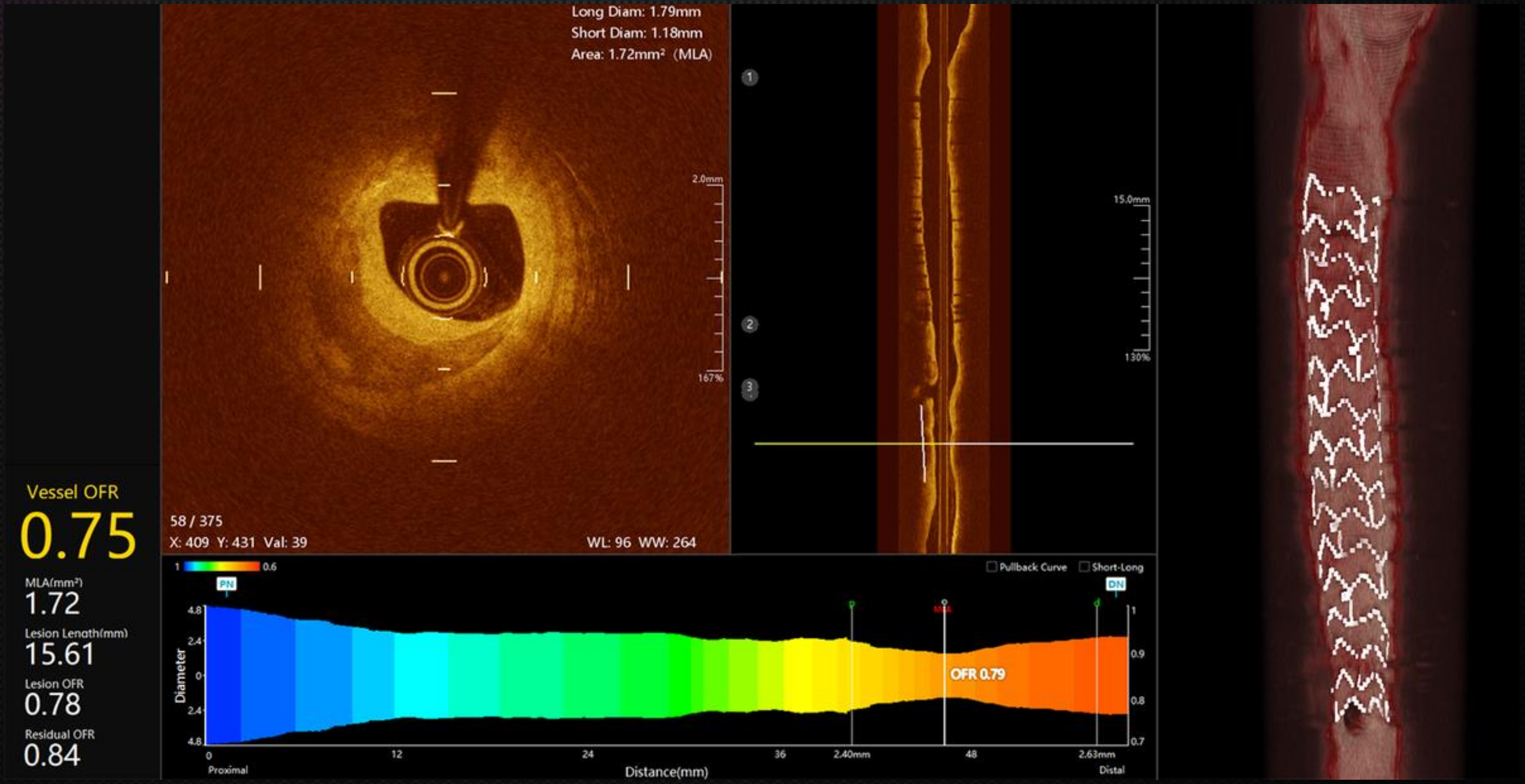
Massachusetts General Hospital
Corrigan Minehan Heart Center

Serruys P.W. Et al. Eurointervention 2019;15:e244-e252

OFR

OCT based FFR





Dogma of complete revascularisation

Balancing the riks

PRO

Less Ischemia

Less Symptom

=> Better Prognosis

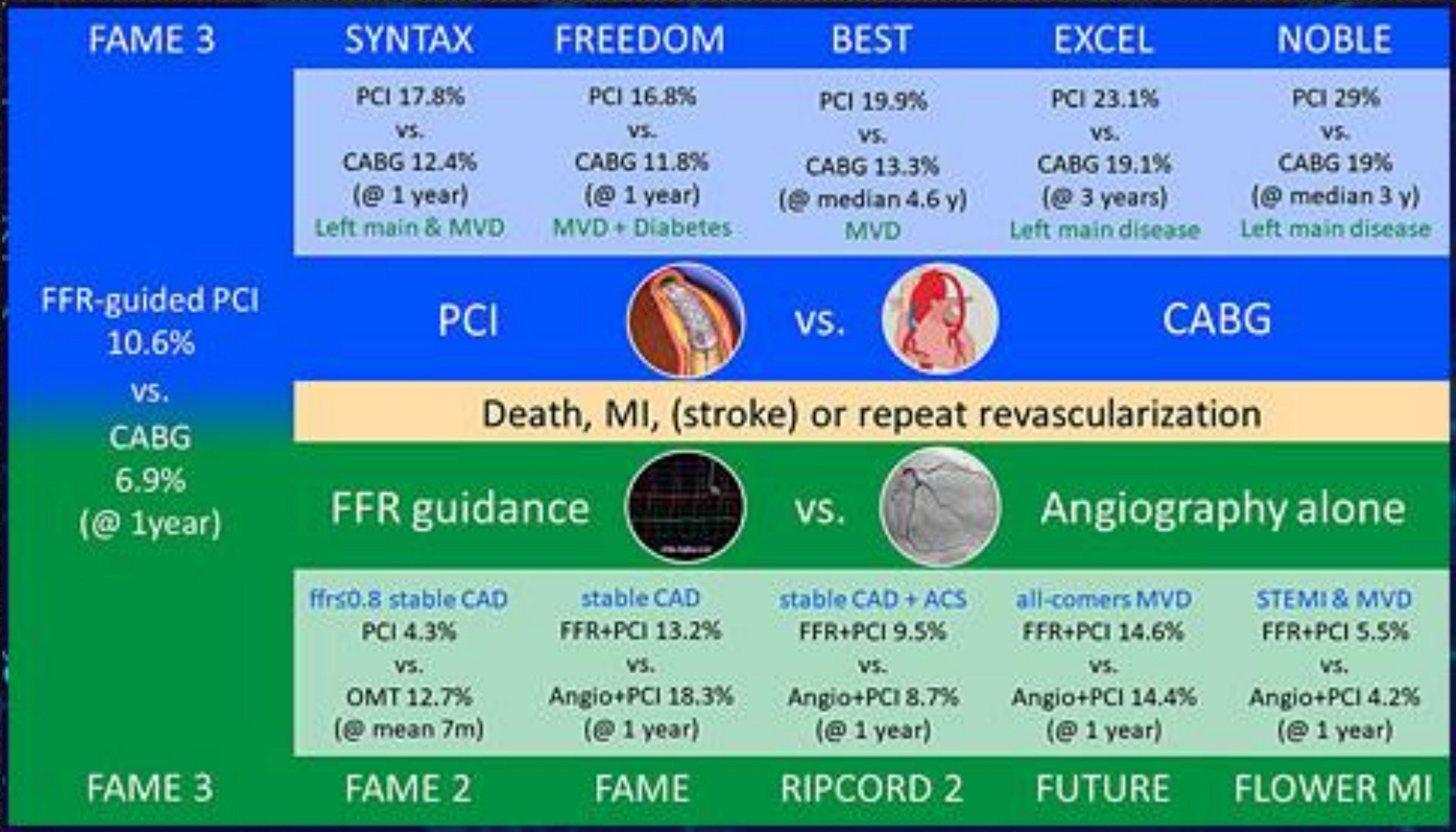
CONS

Procedural complication

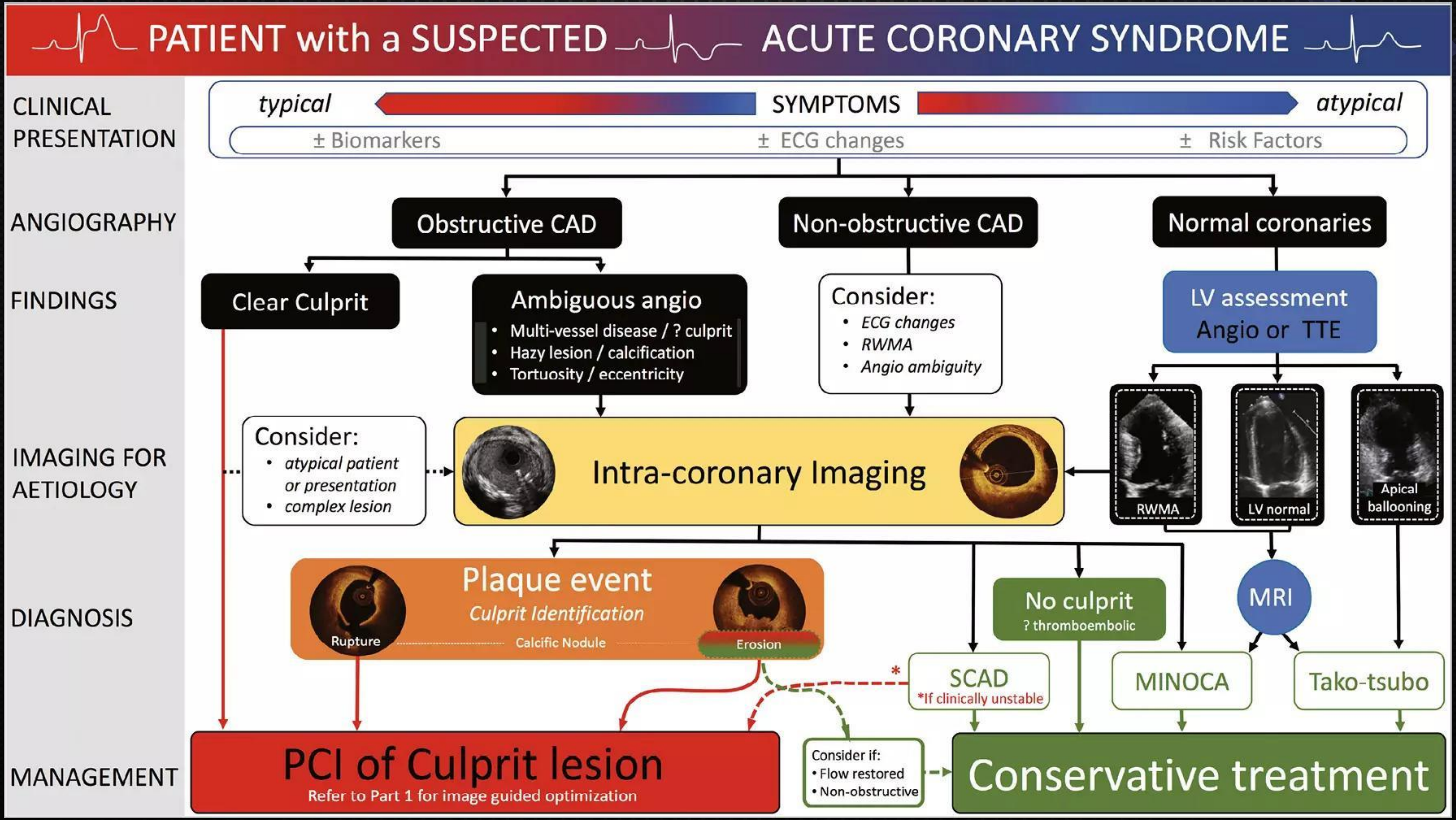
More Stents (High risk ST and ISR)

=> Impaired Prognosis

Physiology guided MVD PCI



Clinical use of intracoronary imaging



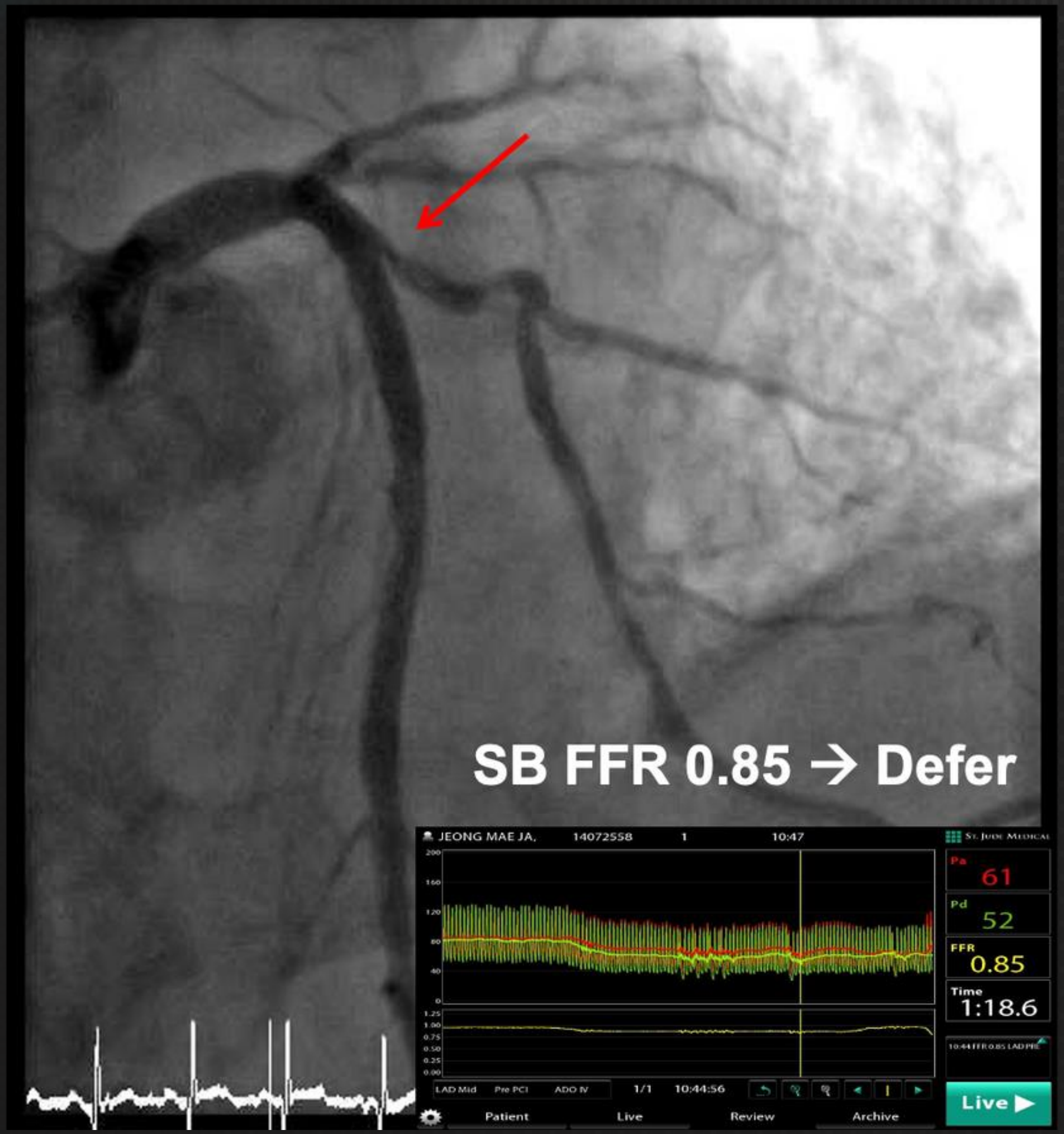
EuroIntervention 2019;15:434-451. DOI: 10.4244/EIJY19M06_02

Five years follow-up of IVUS XPL trial

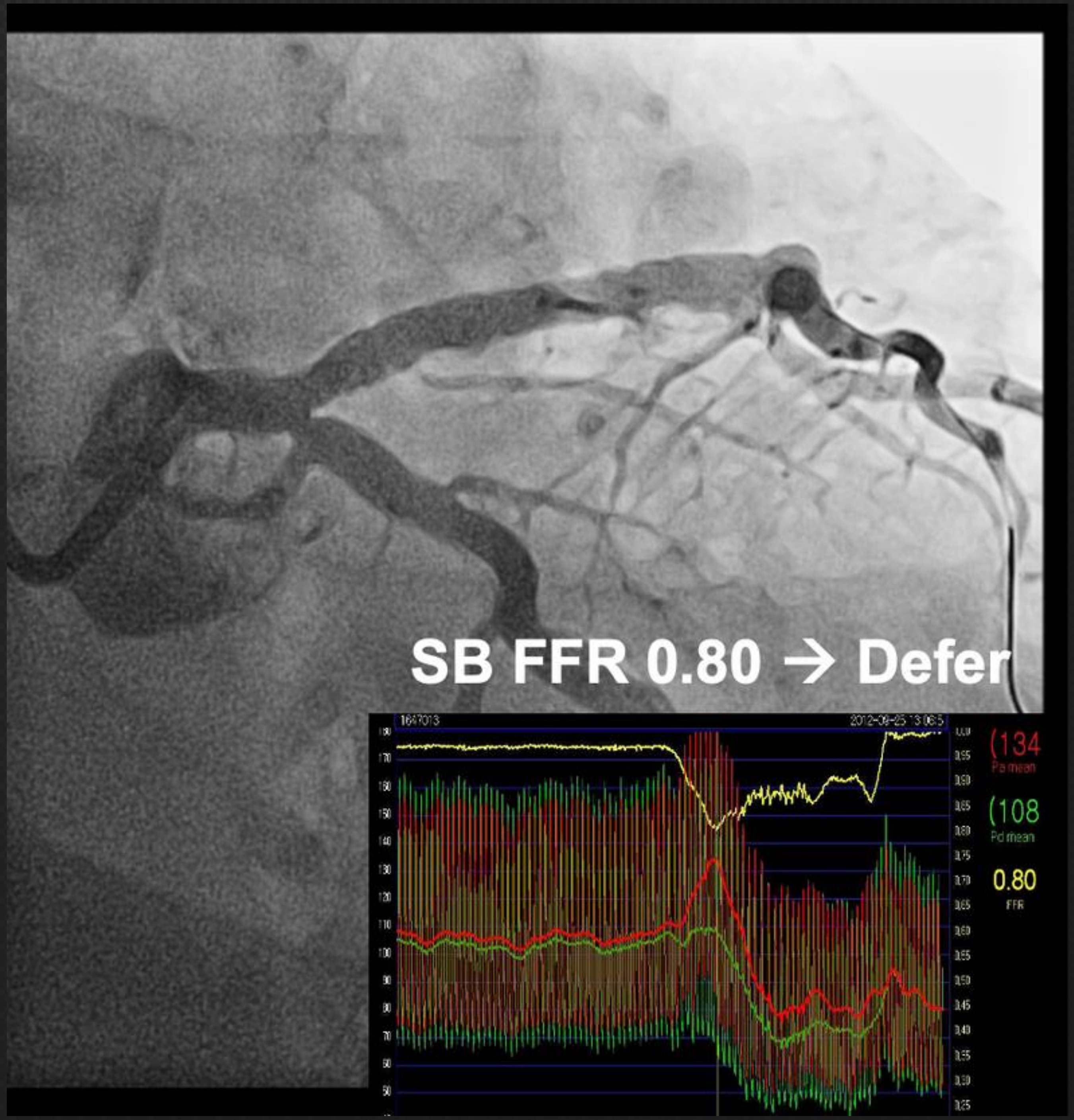
Courtesy of Mintz GS

Evaluation of Jailed side branch

LAD-D1

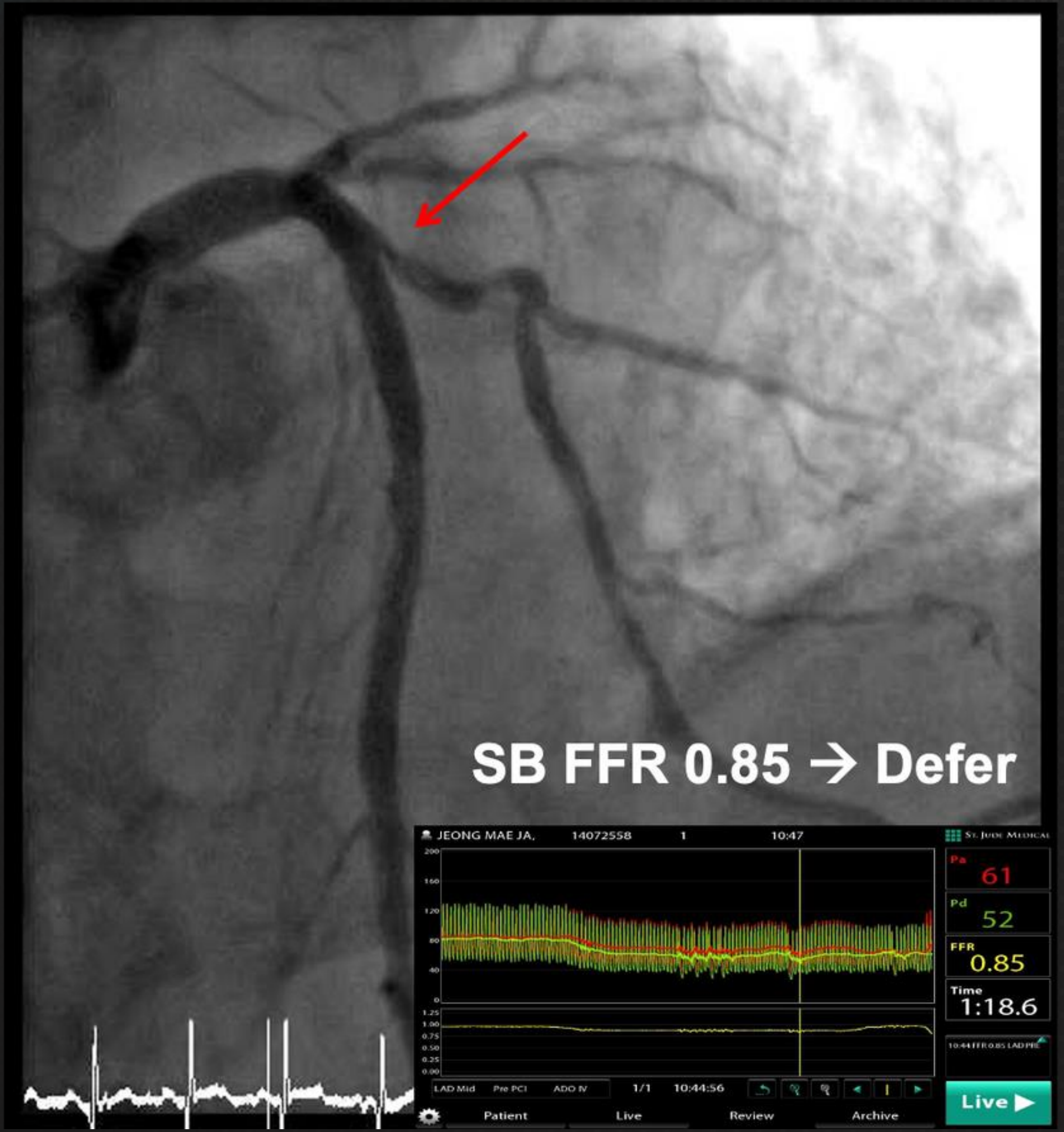


LM-LCX os



Evaluation of Jailed side branch

LAD-D1



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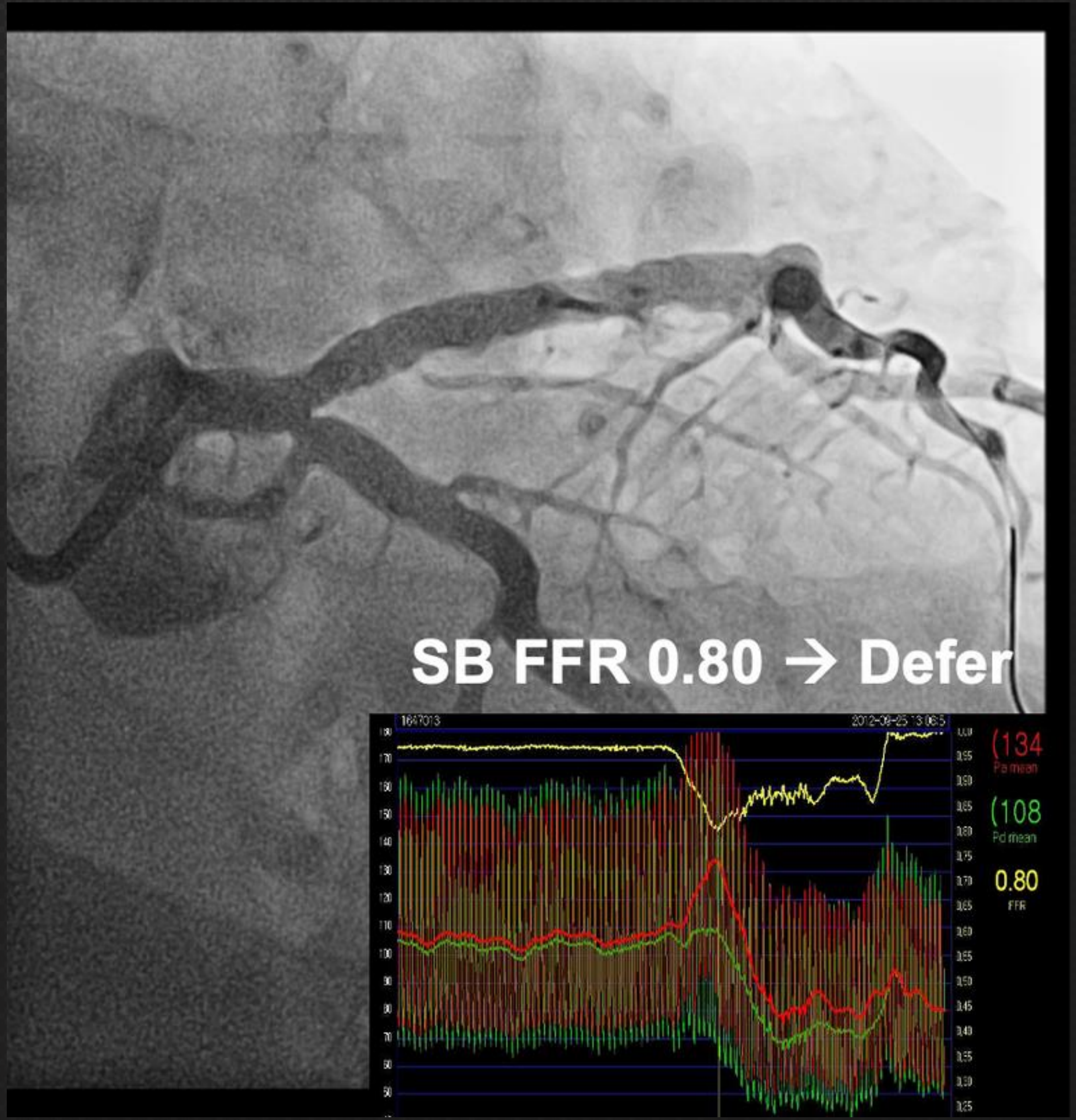
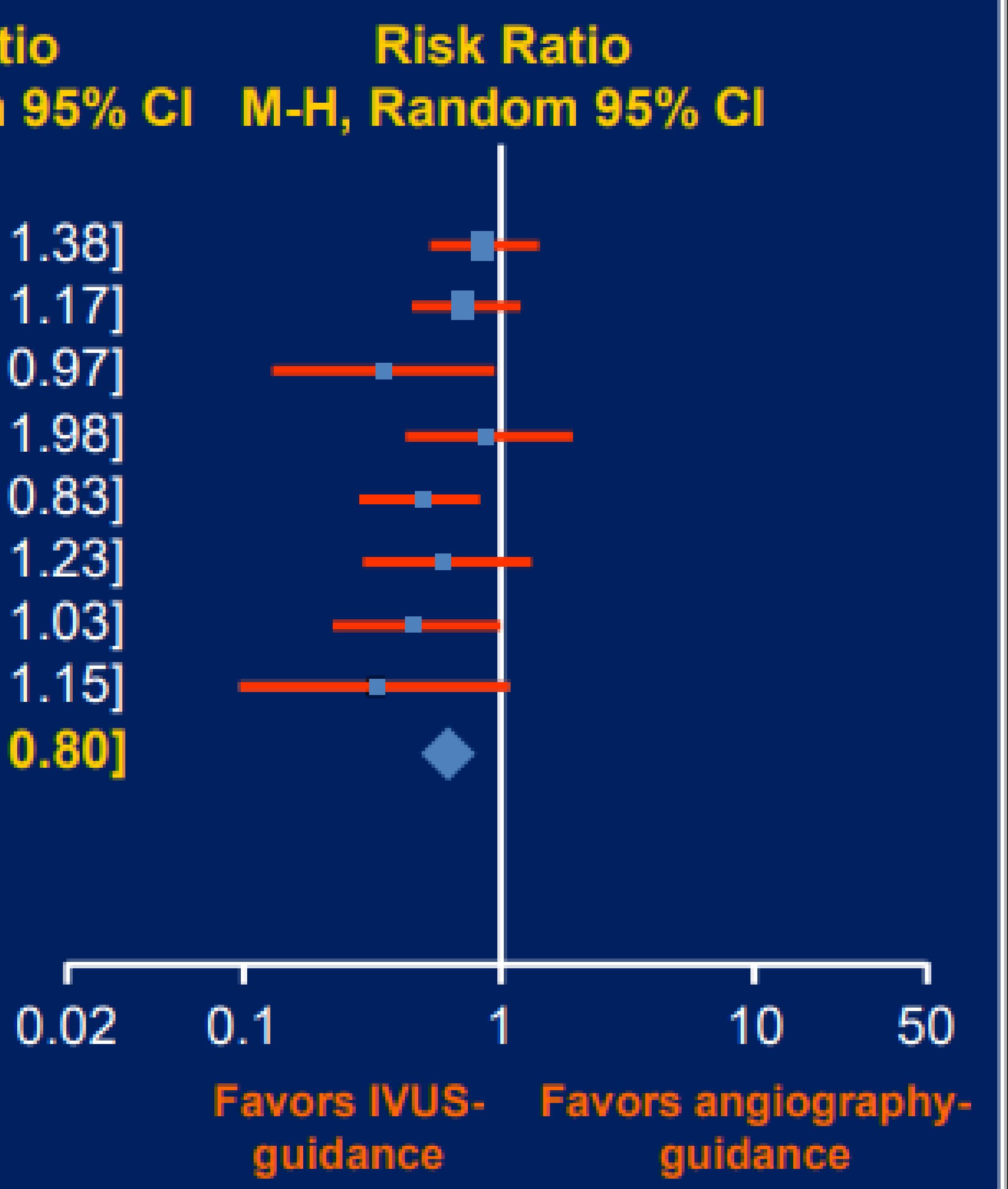


Meta-analysis of IVUS-Guided DES

Study or Subgroup	IVUS guided PCI Events	IVUS guided PCI Total	Angiography guided PCI Events	Angiography guided PCI Total	Weight	Risk Ratio M-H, Random 95% CI
MACE						
AIR-CTO, 2015	25	115	29	115	23.2%	0.86 [0.54, 1.38]
AVIO, 2013	24	142	33	142	22.9%	0.73 [0.45, 1.17]
CTO-IVUS, 2015	5	201	14	201	5.1%	0.36 [0.13, 0.97]
HOME DES IVUS, 2010	11	105	12	105	8.5%	0.92 [0.42, 1.98]
IVUS-XPL, 2015	19	700	39	700	17.6%	0.49 [0.28, 0.83]
RESET, 2013	12	269	20	274	10.5%	0.61 [0.30, 1.23]
Tan et al, 2015	8	61	17	62	8.8%	0.48 [0.22, 1.03]
Zhang et al, 2016	3	42	9	42	3.3%	0.33 [0.10, 1.15]
Subtotal (95%)		**1635**		**1641**	**100.0%**	**0.64 [0.51, 0.80]**
Total events	107		173			

Heterogeneity: Tau^2=0.00; Chi^2=6.67, df=7 (P=0.46); I^2=0%

Test for overall effect: Z=3.88, P=0.0001



Bavishi C and Stone GW. AHJ 2017;185:26-34