

How and When to Use Intravascular Imaging

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Why, How and When to Use Intravascular Imaging

Prof. Hector M. Garcia-Garcia MD, PhD

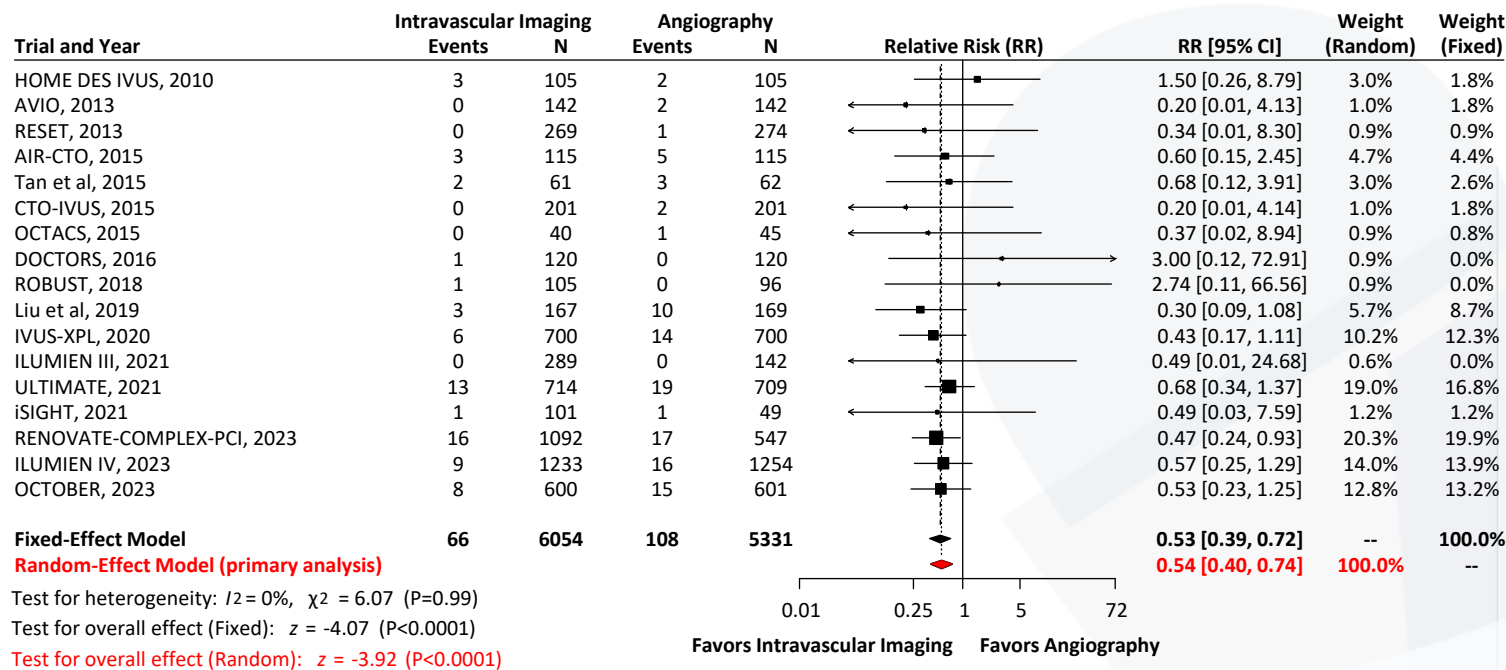
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Why? ... because **IVI** saves lives

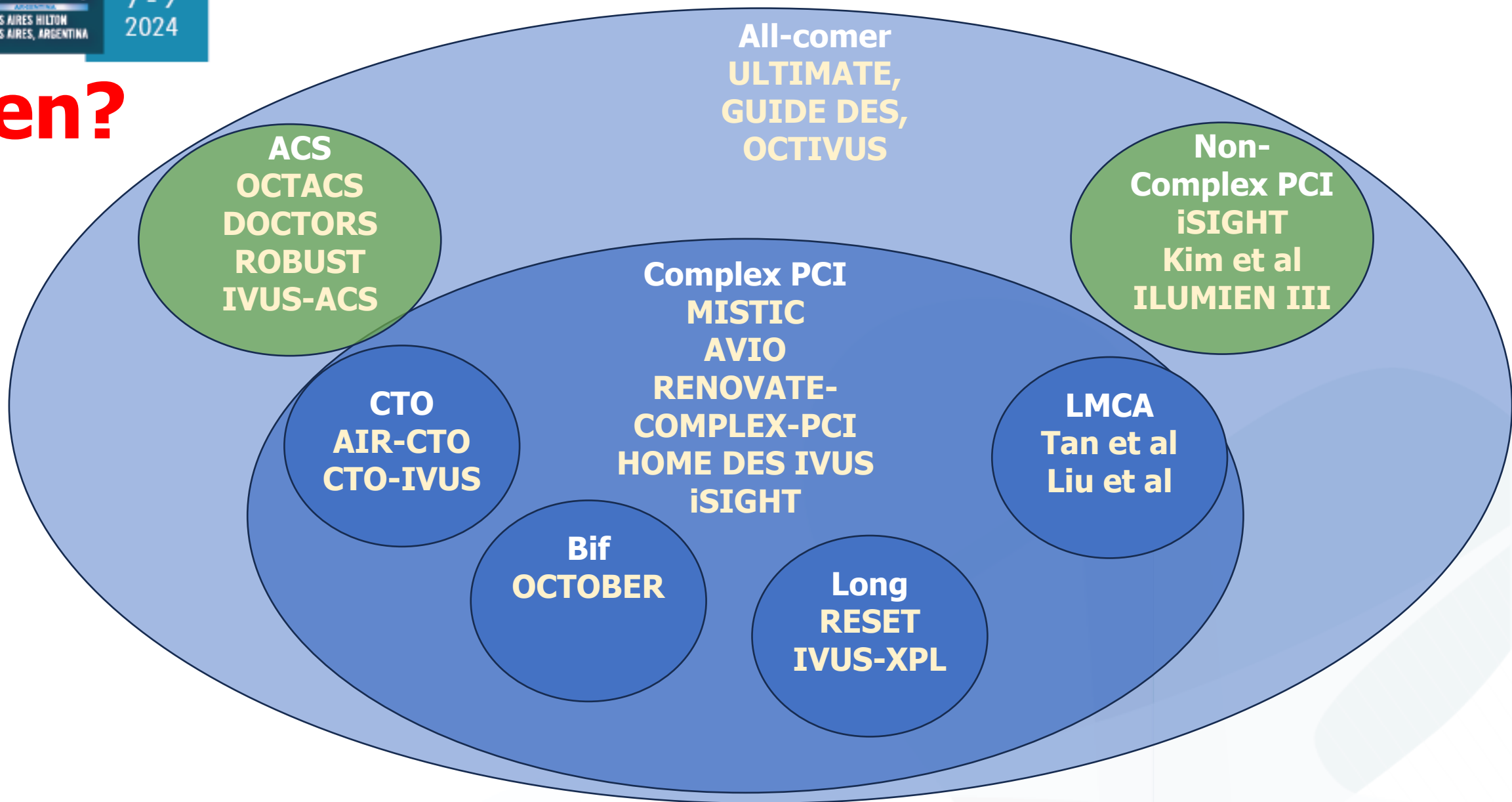
Cardiac Death (Direct Evidence): IV Imaging vs. Angio

17 trials, 11,385 patients, 174 events

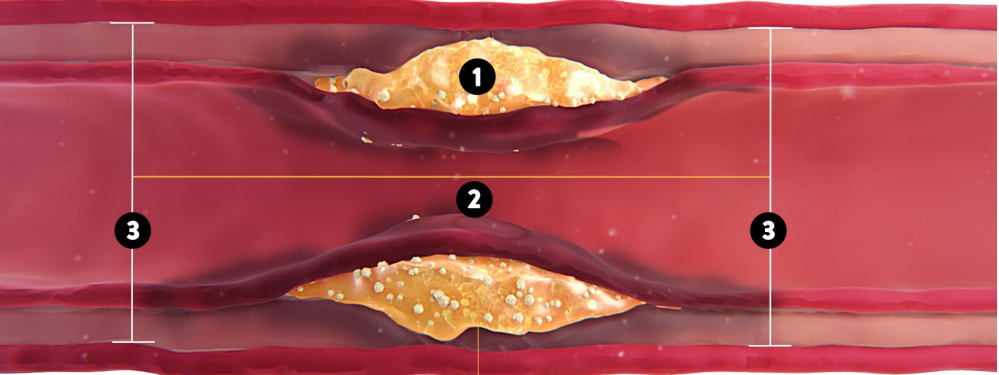
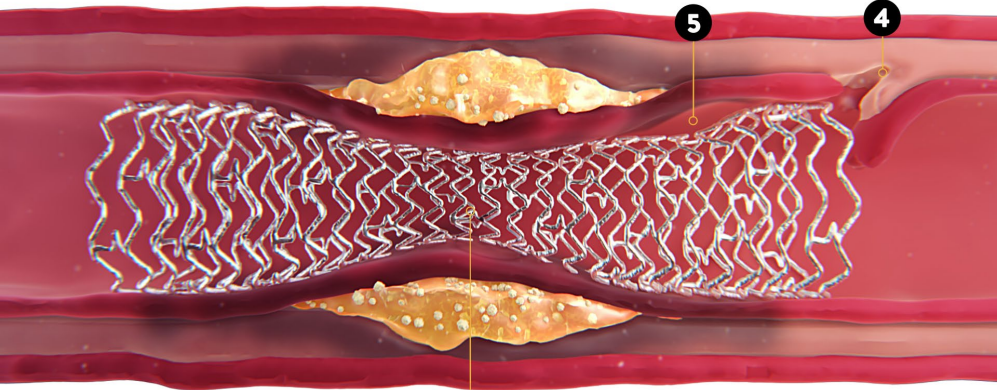


RR 0.54, 95% CI 0.40-0.74

When?



How? #OCT/IVUS are helping in ALL phases of the PCI

Pre-PCI	M¹ morphology¹ I^{SR} L² length² D³ diameter³ 
Post-PCI	M² medial dissection⁴ A⁵ apposition⁵ X⁶ expansion⁶ M² missed plaque  Proximal Distal

#OCT/IVUS are helping in ALL phases of the PCI

Pre-PCI

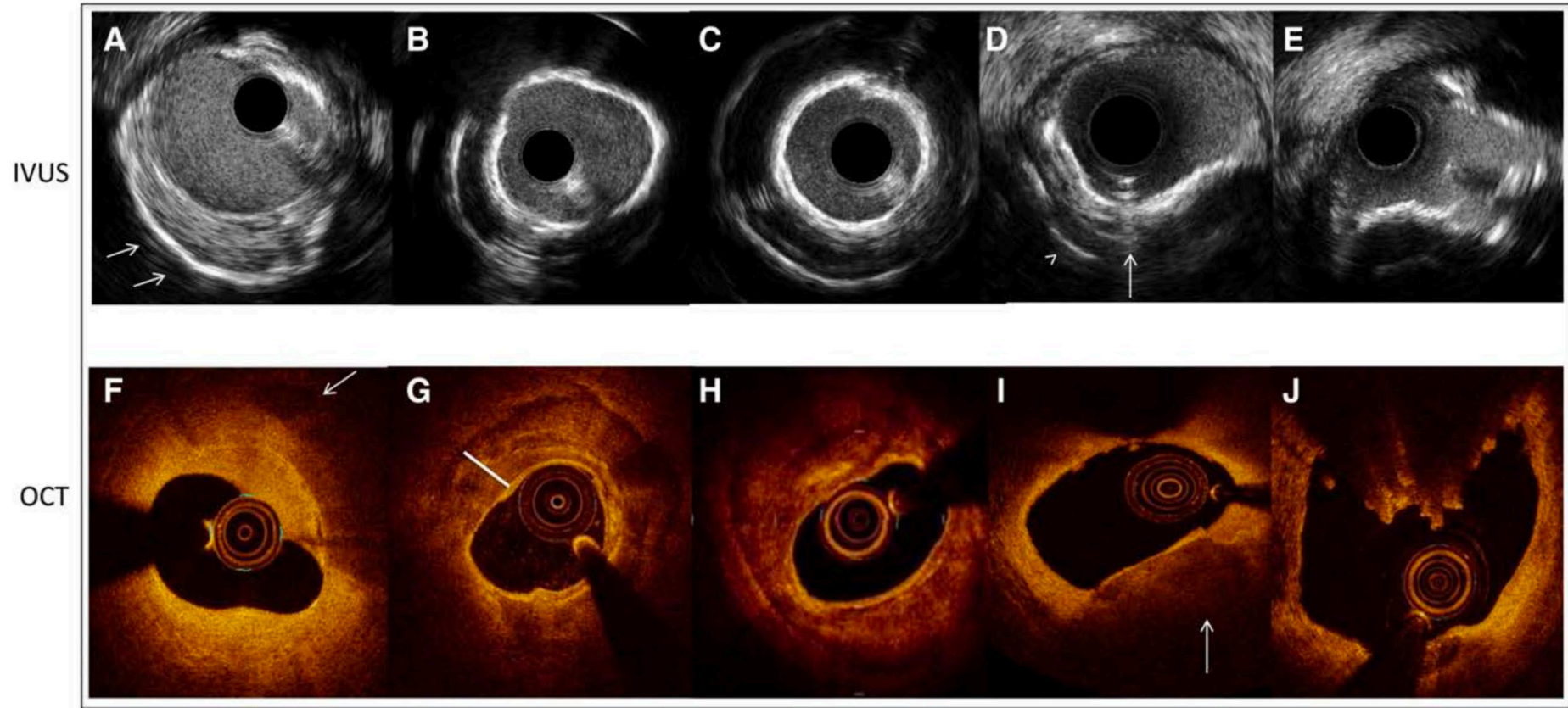
Morphology¹

ISR

Length²

Diameter³

A Deep calcium Superficial calcium Concentric calcium Eccentric calcium Calcified nodule



Shlofmitz E, et al. *Circ Cardiovasc Interv.* 2020

#OCT/IVUS are helping in ALL phases of the PCI

Pre-PCI

Morphology¹

ISR

Length²

Angiographic calcium?

Yes

IVUS: Maximum Superficial Calcium >270°?

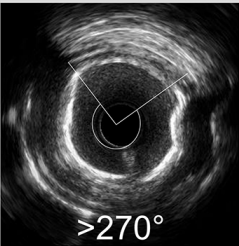
Yes

Calcium Score Calculation: 0~4

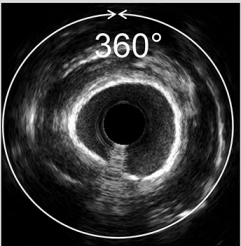
If any below is “Yes”, add point 1.

IVUS Calcium Score

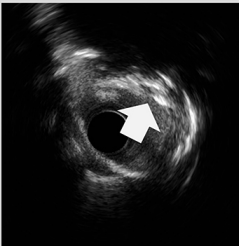
Calcium >270°
in ≥ 5 mm?



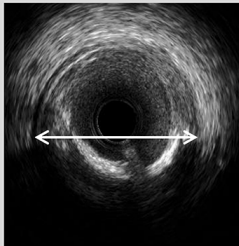
360° of calcium?



Calcified nodule?

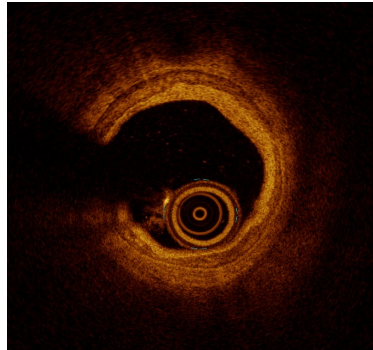
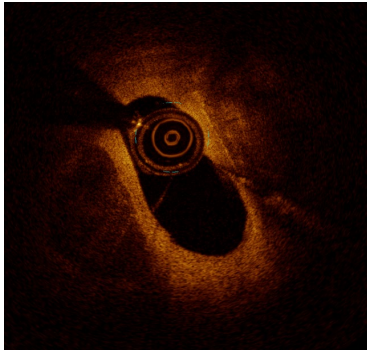


Vessel diameter
<3.5 mm?



Calcium Score = 2, 3, or 4 ?

Consider atherectomy



OCT-based calcium score

1. Maximum calcium angle (°)	≤180° ➡ 0 point >180° ➡ 2 points
2. Maximum calcium thickness (mm)	≤0.5 mm ➡ 0 point >0.5 mm ➡ 1 point
3. Calcium length (mm)	≤5.0 mm ➡ 0 point >5.0 mm ➡ 1 point
Total score	0 to 4 points

#AI IVUS is helping in ALL phases of the PCI

Pre-PCI

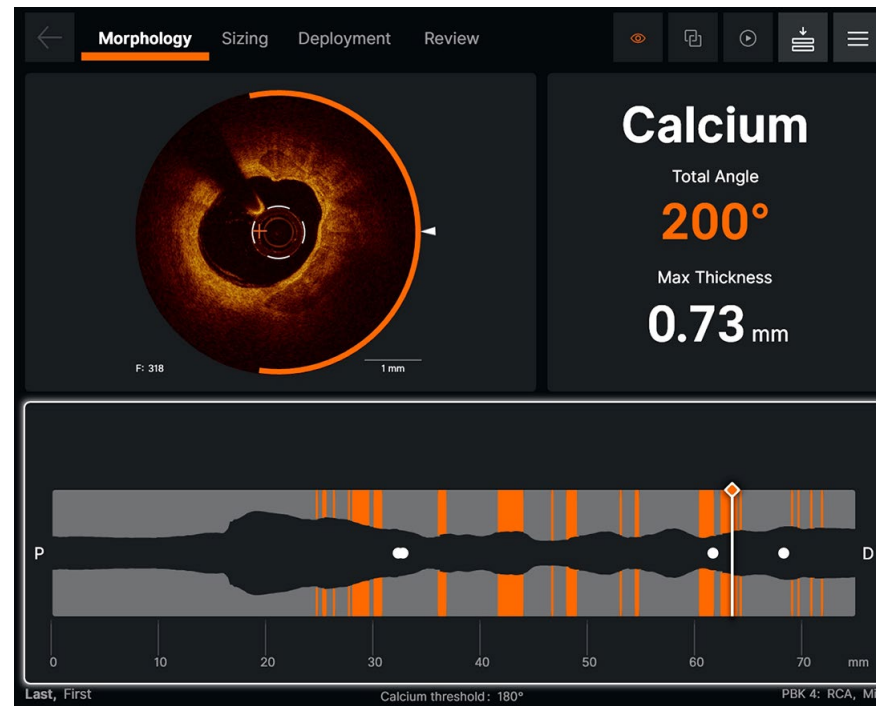
Morphology¹

ISR

Length²

Diameter³

Ultrreon™ Software uses artificial intelligence (AI) to automatically detect and quantify calcification.¹



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Pre-PCI

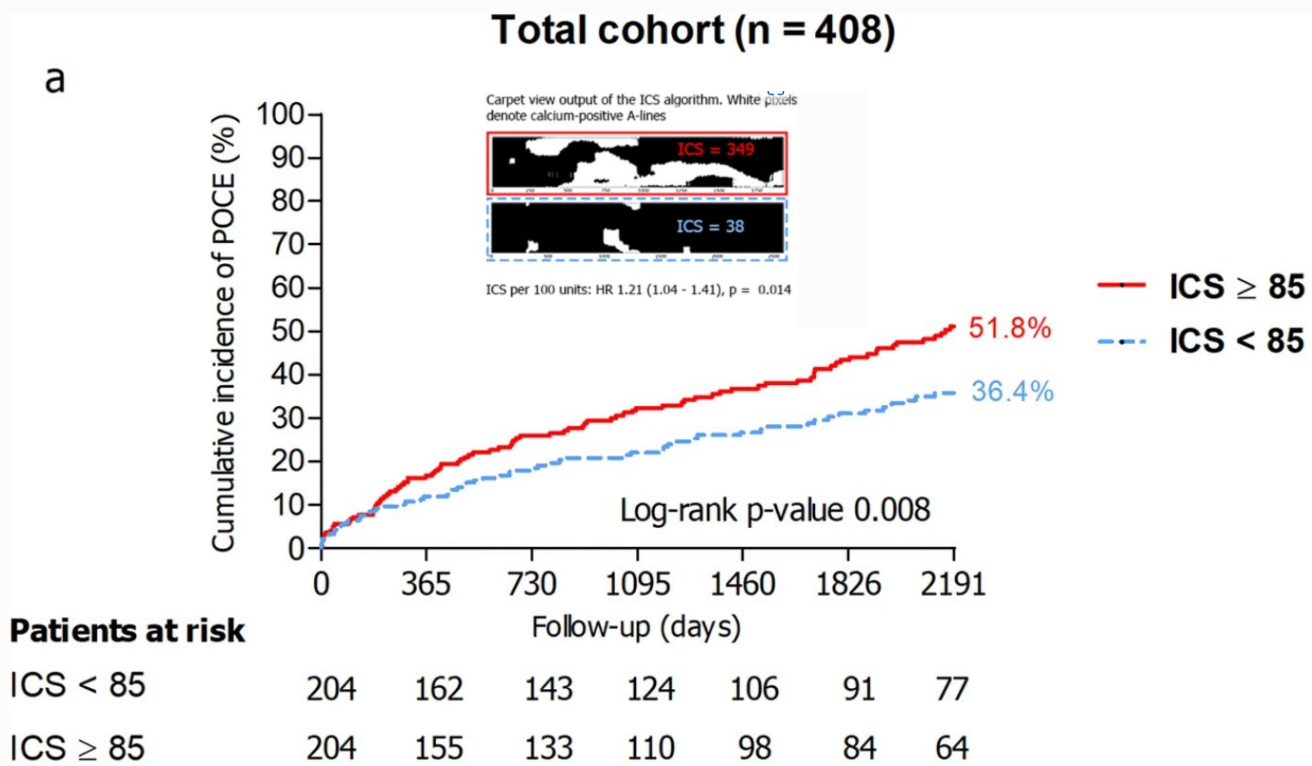


Both an ICS ≥ 85 and a 100 unit increase in ICS increased the risk of **POCE at 6-year** follow-up (**aHR** **1.51**, 95%CI 1.05–2.17, p value = 0.026, and **aHR** **1.21**, 95%CI 1.04–1.41, p value = 0.014, respectively).

ISR

Length²

Diameter³

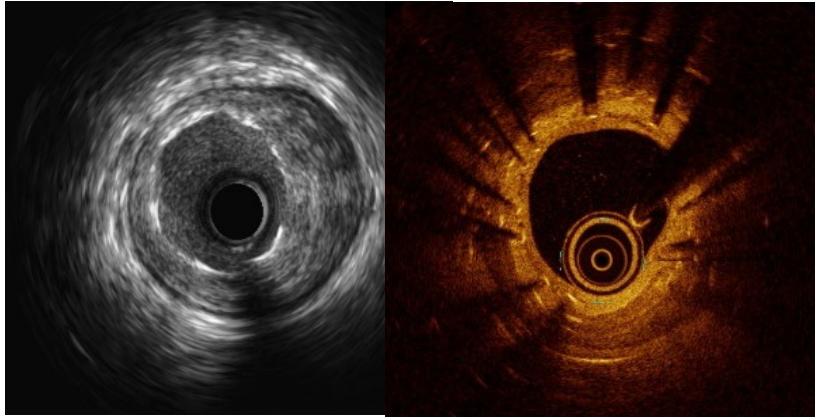


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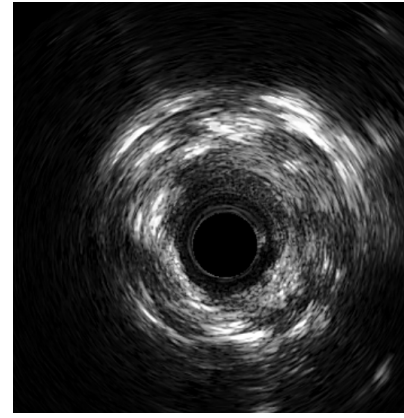
Pre-PCI

Morphology¹

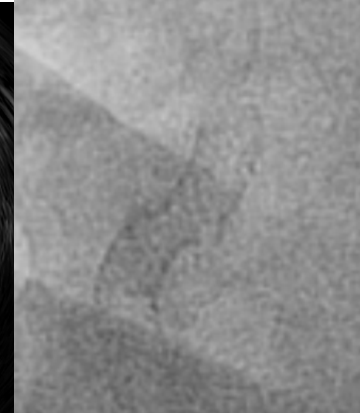
Type I Mechanical



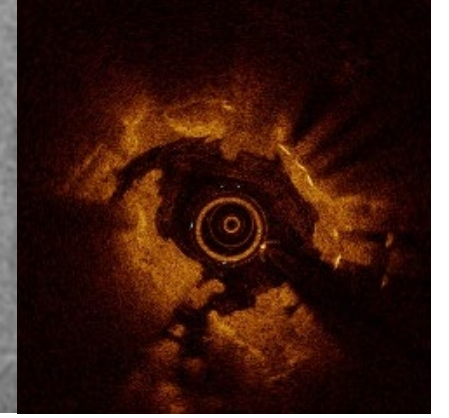
ISR



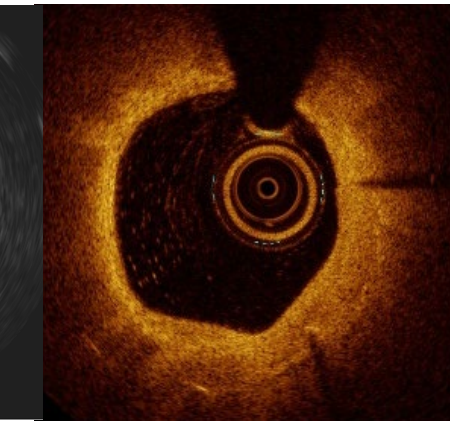
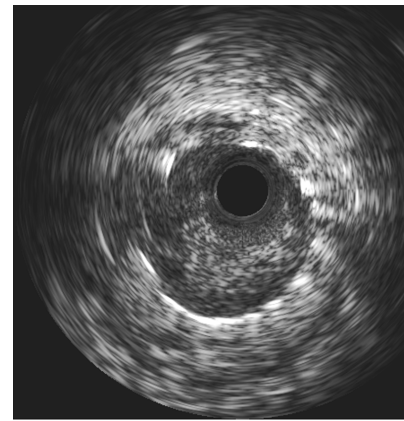
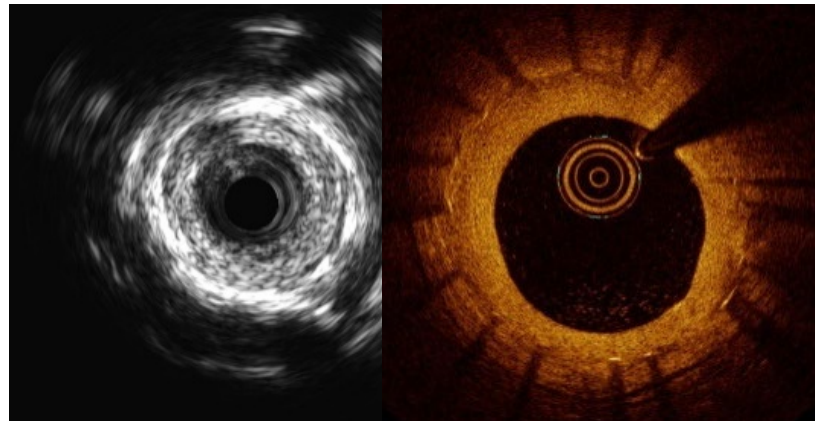
Length²



Diameter³



Type II Biologic



Type III Mixed

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Pre-PCI

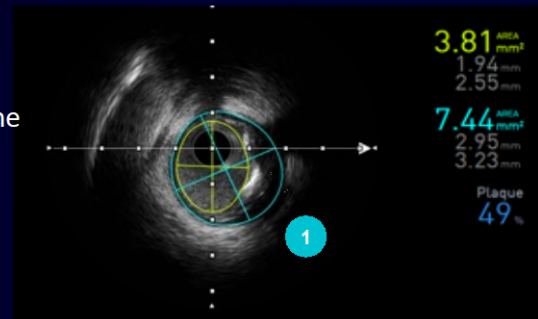
AVIGO+ Automated Lesion Assessment ALA™ System

ALA leverages Machine Learning to automatically deliver with accuracy key measurements and borders



1 Vessel and Lumen Borders

- Vessel and lumen borders on every frame
- Vessel area, lumen area and diameter measurements on every frame



2 Vessel Profile

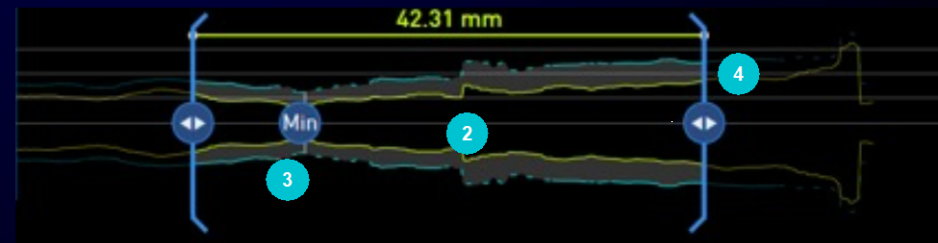
Graphical representation of the average vessel and lumen diameters

3 Min Key Frame marker

Minimum lumen area in IVUS run

4 Distal & Proximal Key Frame markers

Proximal and distal key frame markers represented at ≤50% plaque burden from minimum frame.



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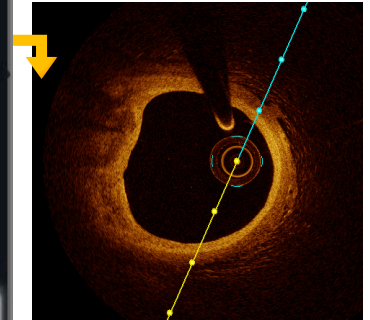
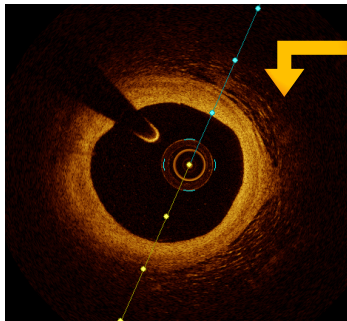
Pre-PCI

Morphology¹

ISR

Length²

Diameter³



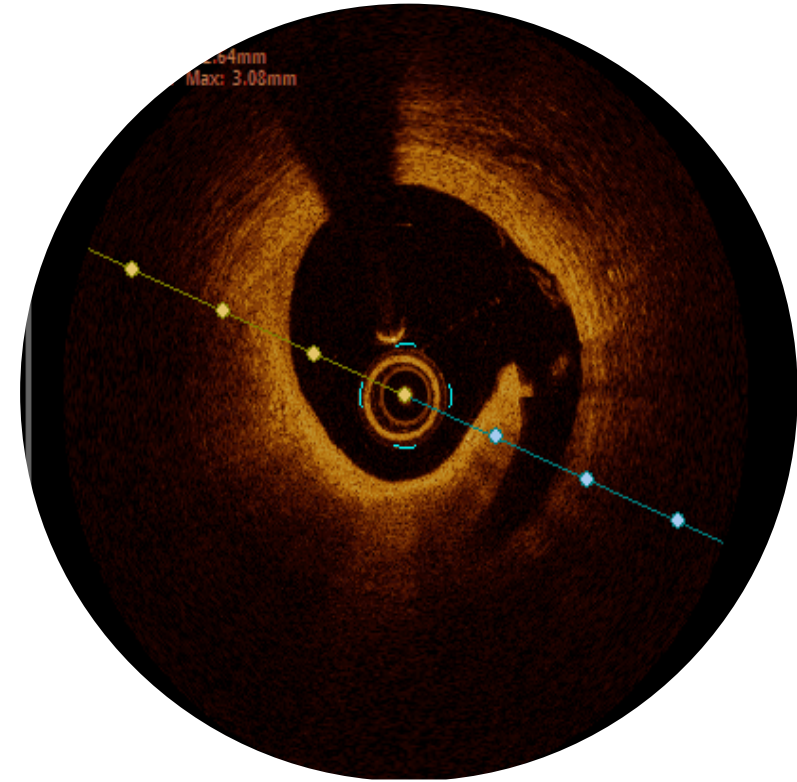
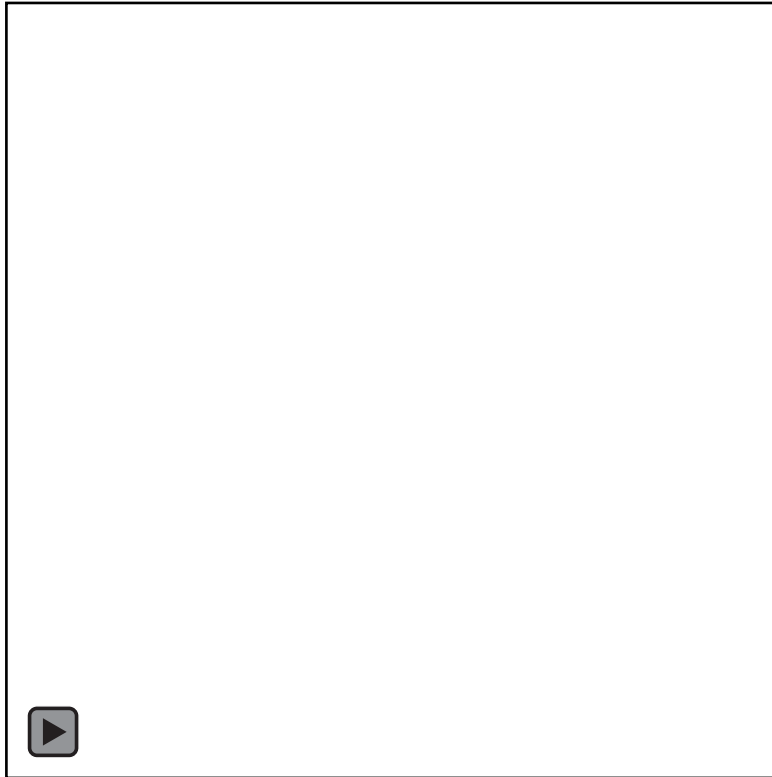
#AI OCT/IVUS are helping in ALL phases of the PCI

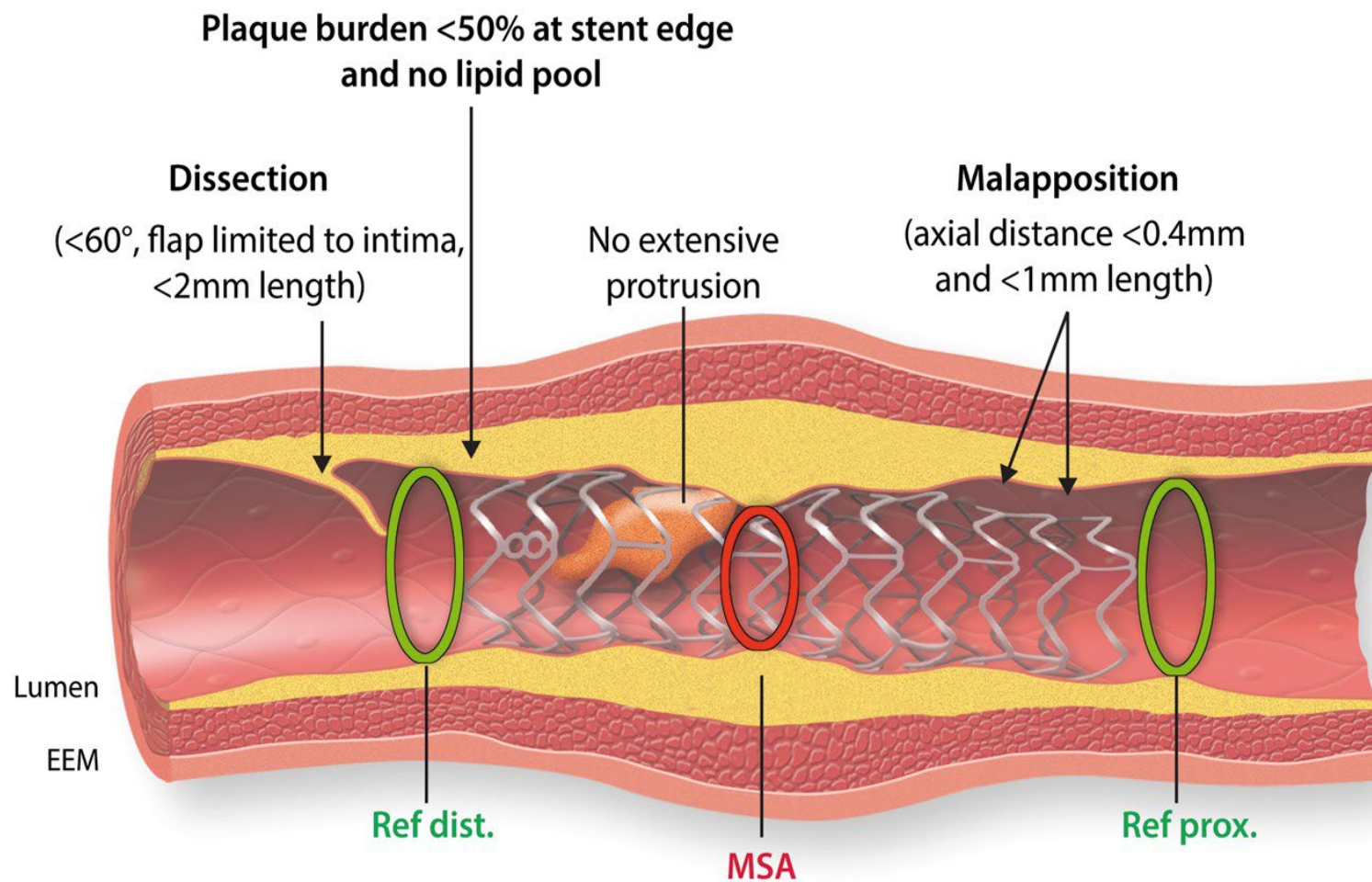
Post-PCI

Medial dissection⁴

Apposition⁵

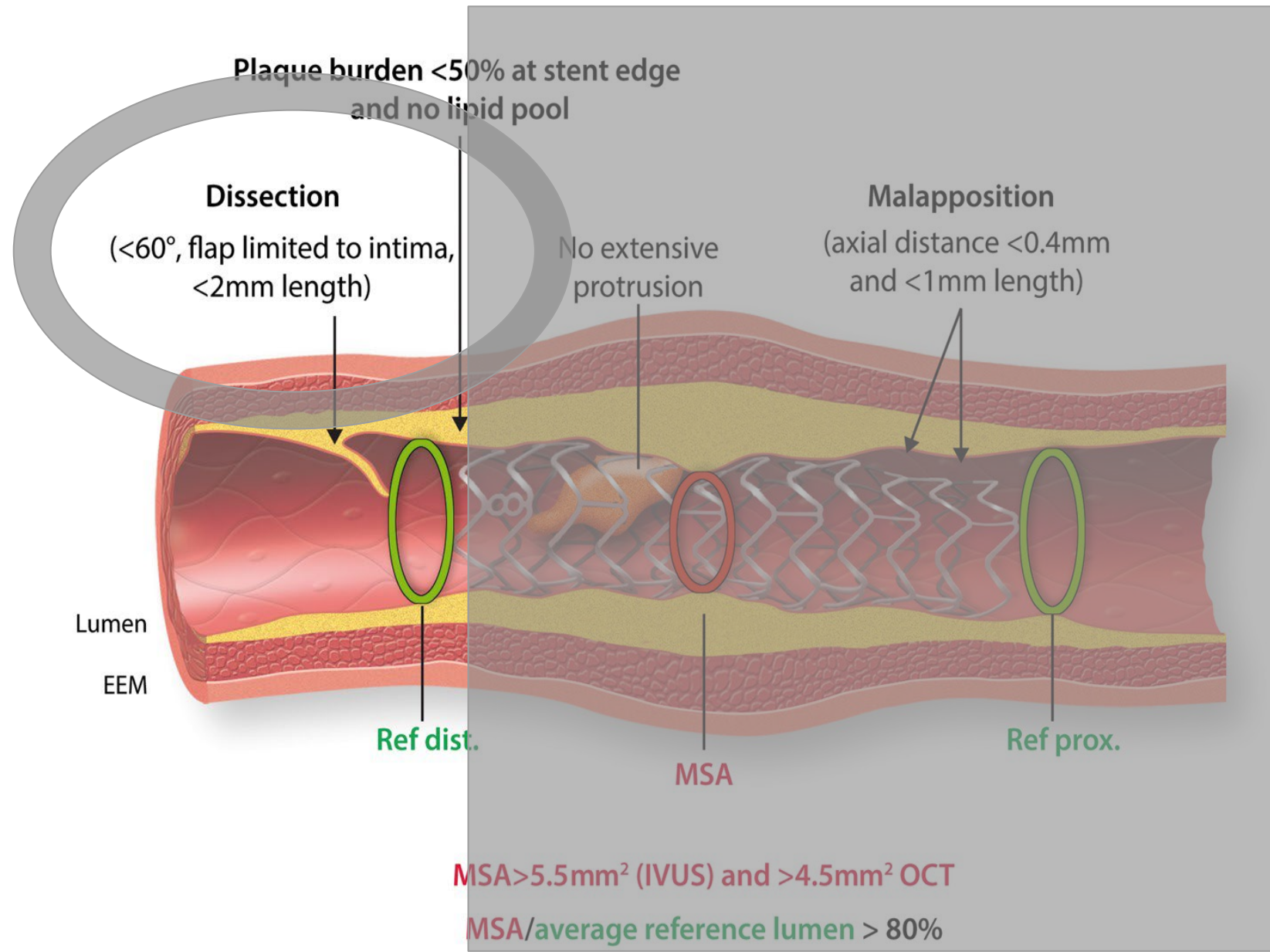
Xpansion⁶





MSA > 5.5mm² (IVUS) and > 4.5mm² OCT

MSA/average reference lumen > 80%



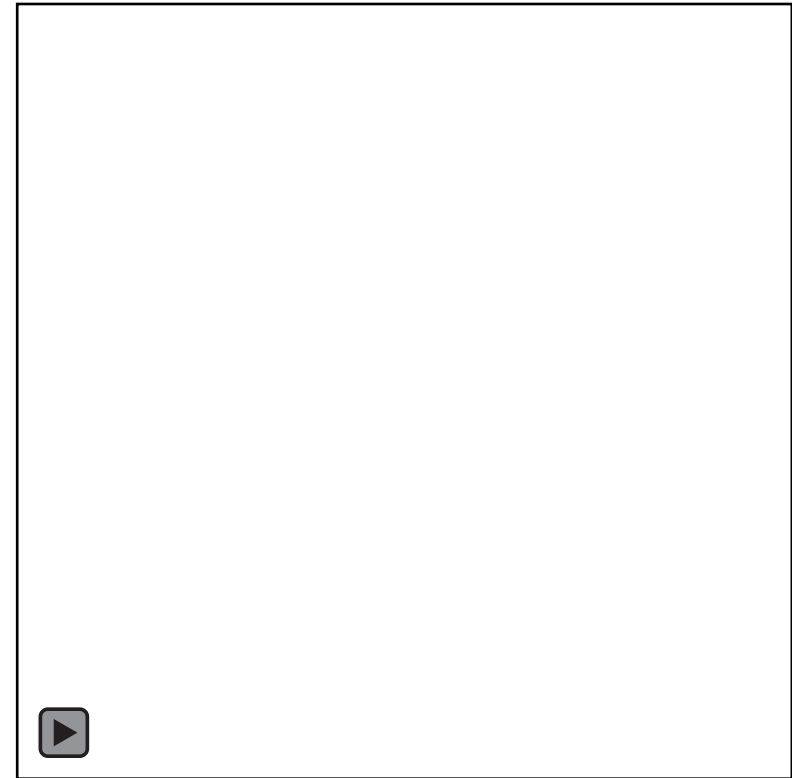
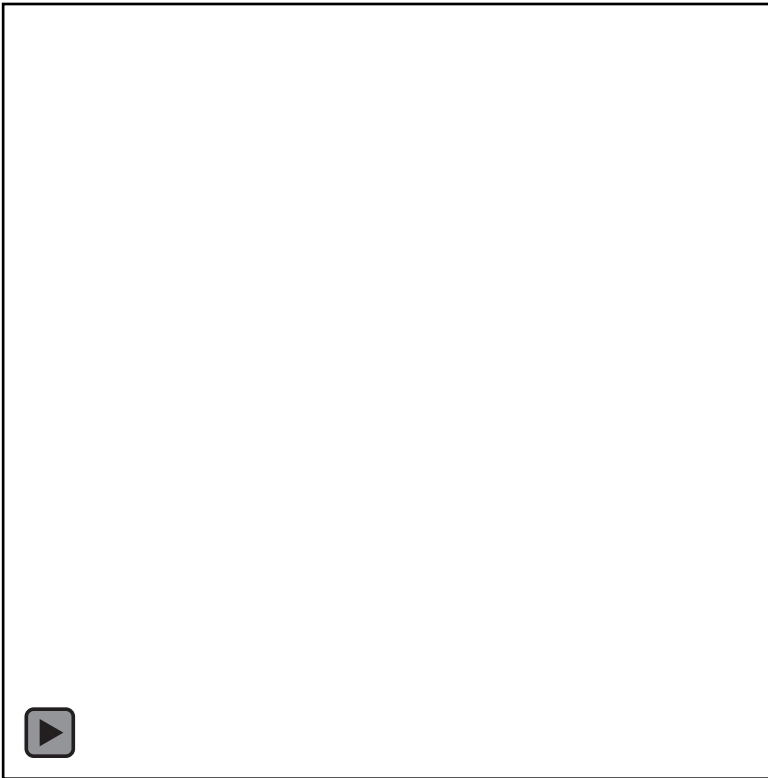
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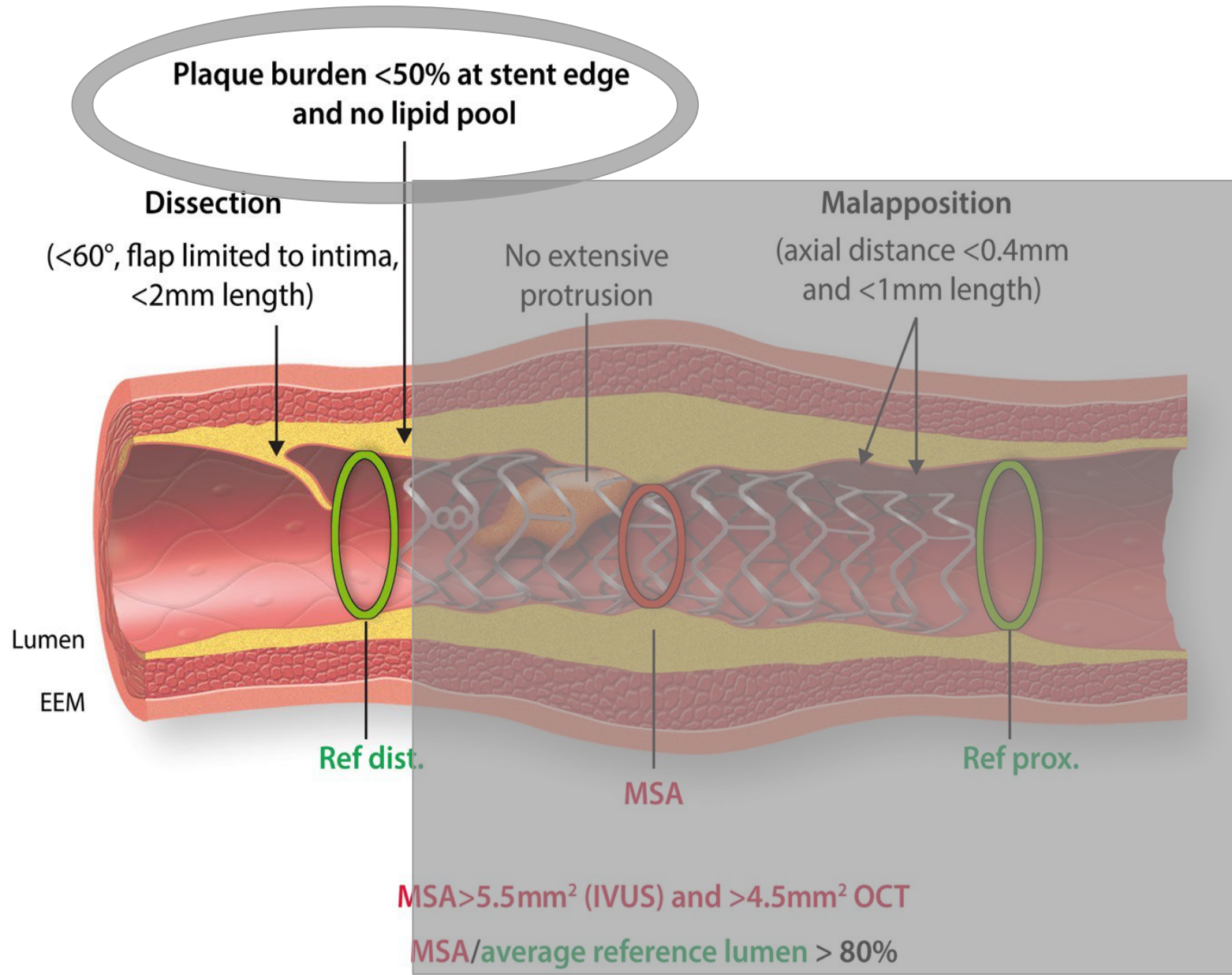
Post-PCI

M²issed plaque

Apposition⁵

Xpansion⁶





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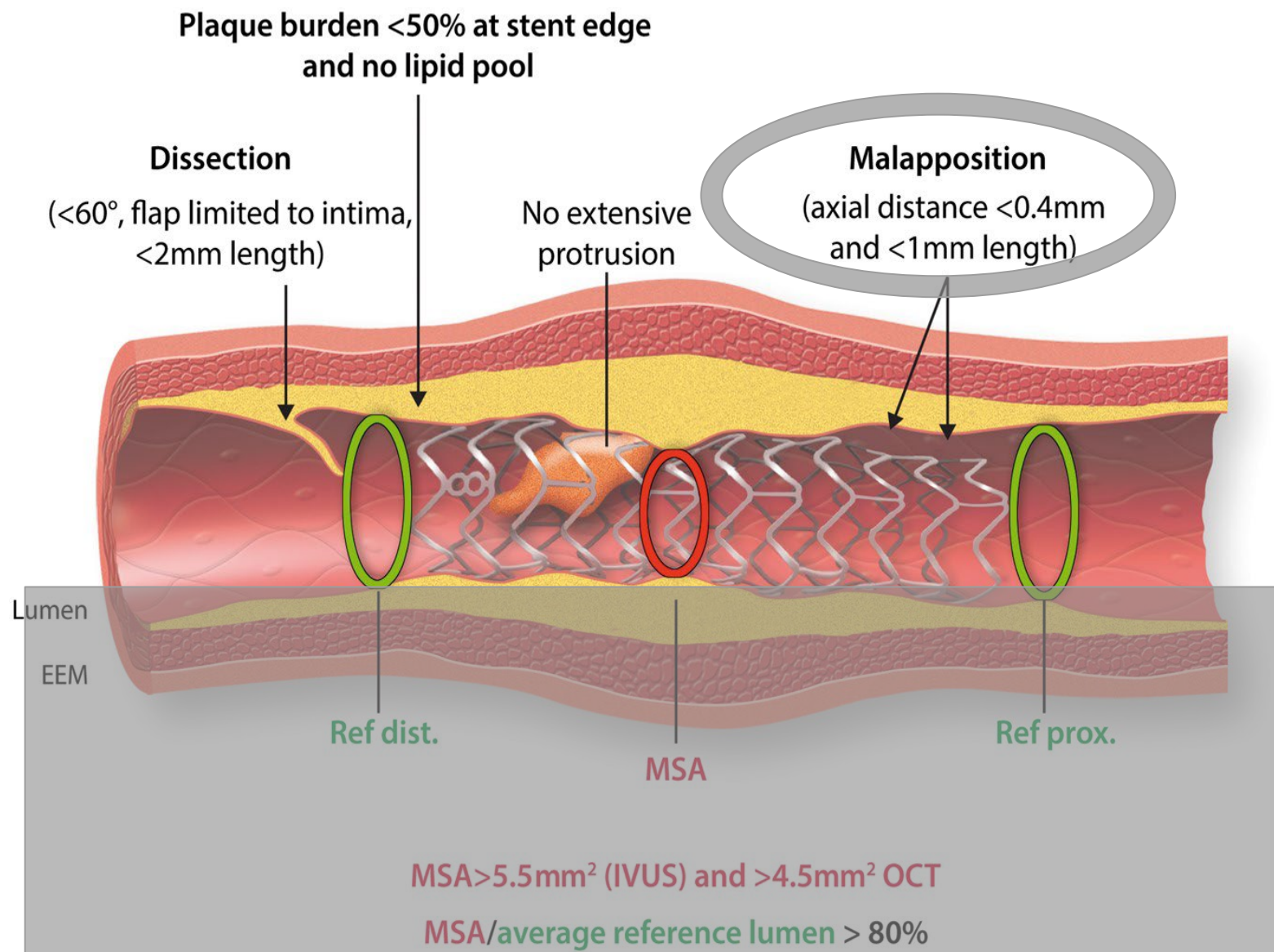
Post-PCI

Medial dissection⁴

Apposition⁵

Xpansion⁶





#AI OCT/IVUS are helping in ALL phases of the PCI

Post-PCI

Medial dissection⁴

Apposition⁵

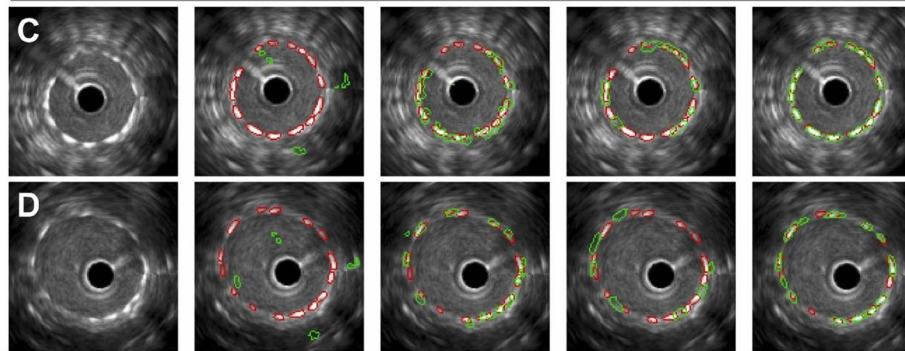
Expansion⁶



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Post-PCI

Medial dissection⁴

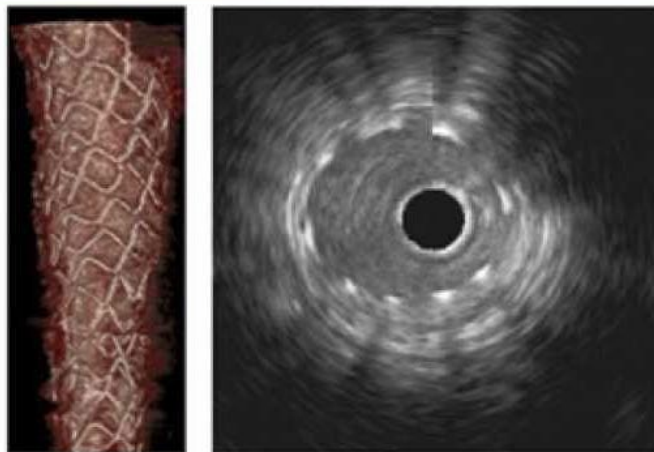


Apposition⁵

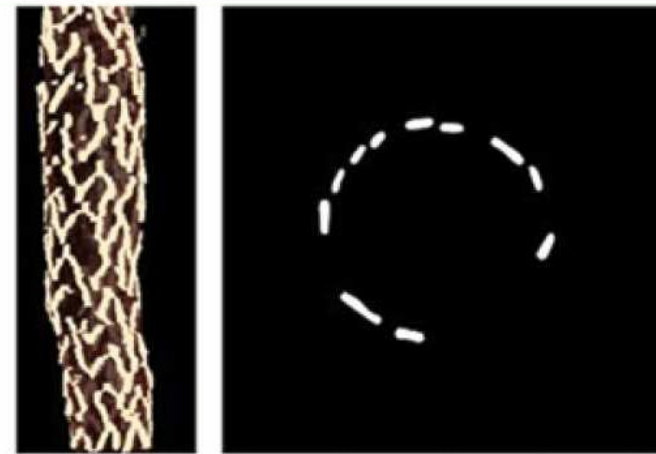
Xpansion⁶

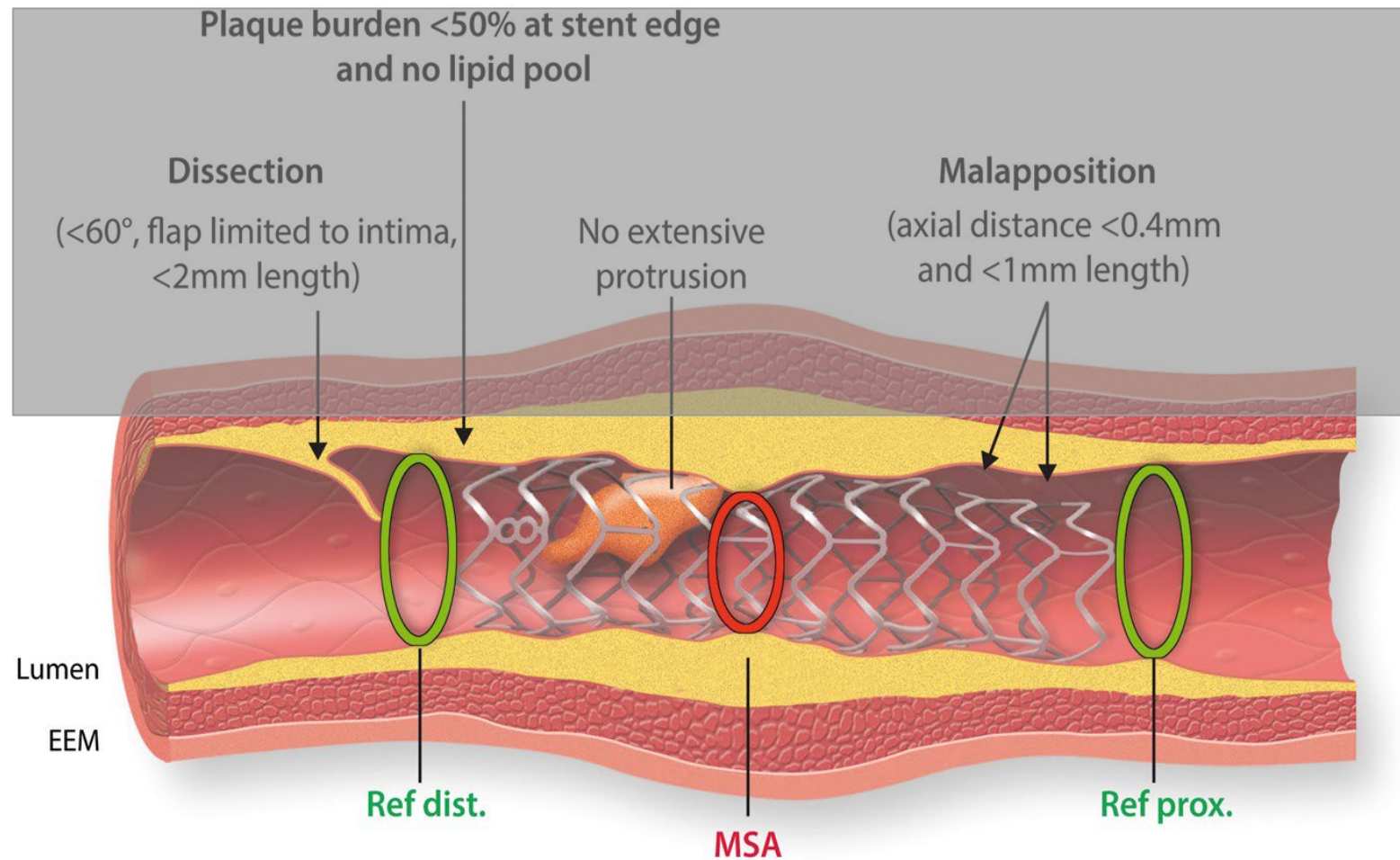
ML stent 3D reconstruction
in
both HD-IVUS and IVUS
with good performance

Synthetic Post-PCI IVUS



Post-PCI IVUS Stent Mask





MSA $> 5.5\text{mm}^2$ (IVUS) and $> 4.5\text{mm}^2$ OCT

MSA/average reference lumen $> 80\%$

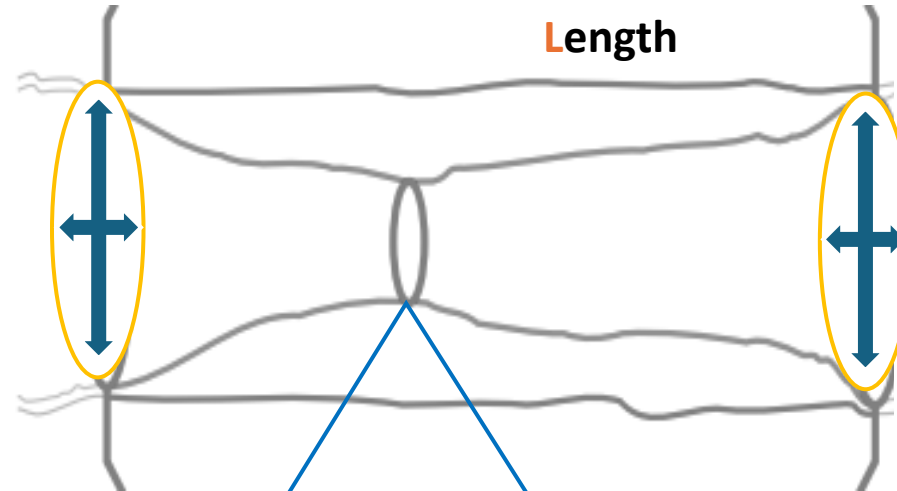
In Summary Pre-PCI – CALL-Di

Actionable variables

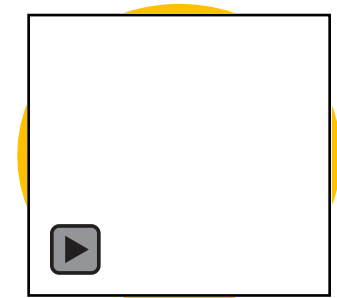
Calcium*

Length

Diameter



Diameter
Max and Min



IVUS Device Sizing
all are diameters

EEM to EEM diam at the lesion

Smallest reference EEM

Mean mid-wall

Largest reference lumen

Mean reference lumen

Smallest reference lumen

Variable	IVUS Calcium* Score
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Max calcium angle (°)	>360 = 1 point
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Calcium length (mm)	>270 in ≥ 5mm= 1 point
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Calcified nodule	If yes = 1 point
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Vessel diameter (mm)	<3.5mm = 1 point
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In Summary Post-PCI – DIAL-X

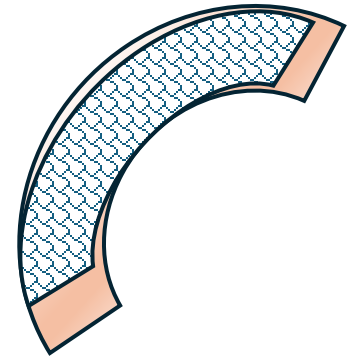
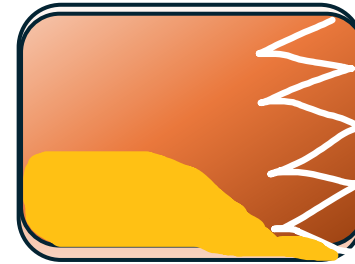
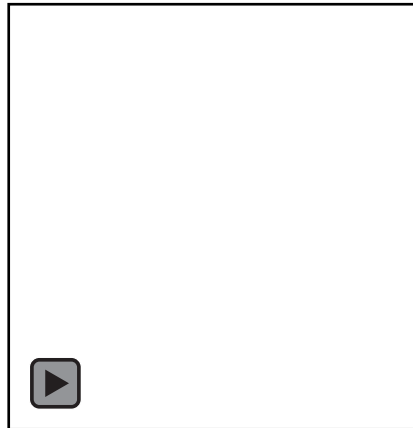
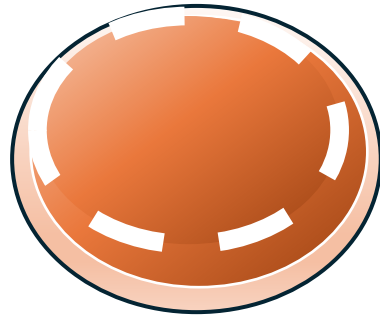
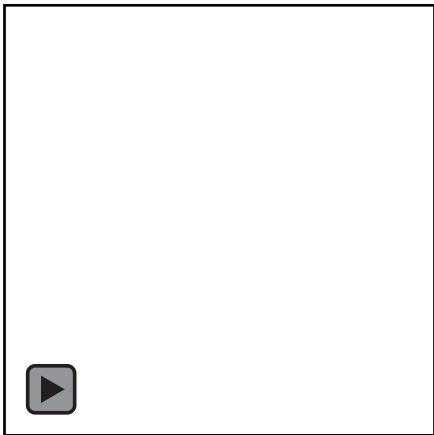
Actionable variables

Dissection

Apposition

Lesion residual

Xpansion



**% stent expansion =
MSA / average of reference
lumen area**

In Summary Post-PCI – DIAL-X

Actionable variables

Dissection

Apposition

Lesion residual

Xpansion

Consistent, Accurate,

Reproducible. Efficient/effective &

Safe

% stent expansion =
MSA / average of reference
lumen area

