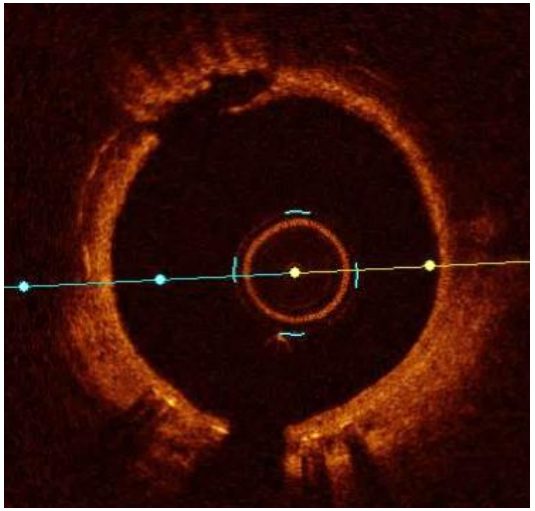
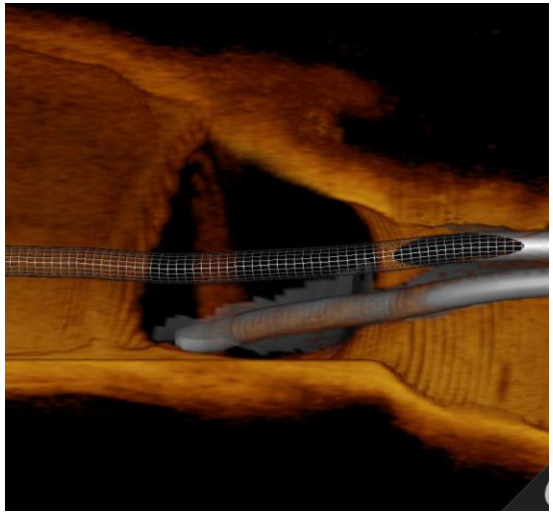
TCTAP 2019

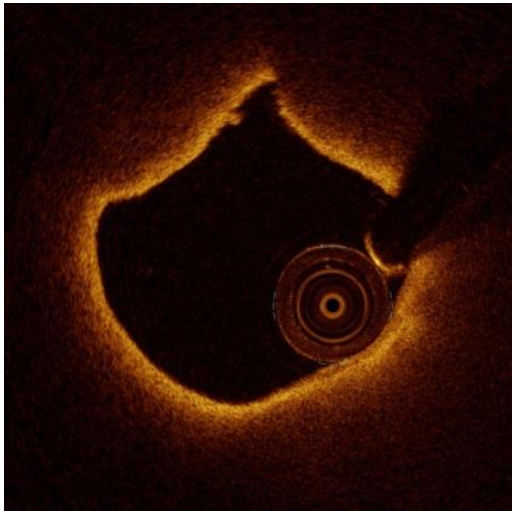
A Wholehearted Approach to Complex PCI

Seoul, Korea, 28 April 2019

Fun Diving into OCT-Guided PCI in the Daily Practice







Yongcheol Kim

Chonnam National University Hospital

Gwangju, Korea

Changing Guidelines on Myocardial Revascularisation

2014 ESC/EACTS Guidelines

Recommendations	Class[a]	Level[b]	Ref.[c]
FFR to identify haemodynamically relevant coronary lesion(s) in stable patients when evidence of ischaemia is not available.	I	A	50,51,713
FFR-guided PCI in patients with multivessel disease.	IIa	B	54
IVUS in selected patients to optimize stent implantation.	**IIa**	**B**	702,703,706
IVUS to assess severity and optimize treatment of unprotected left main lesions.	IIa	B	705
IVUS or OCT to assess mechanisms of stent failure.	**IIa**	**C**	
OCT in selected patients to optimize stent implantation.	**IIb**	**C**	

2018 ESC/EACTS Guidelines

UPGRADES

For PCI of bifurcation lesions, stent implantation in the main vessel only, followed by provisional balloon angioplasty with or without stenting of the side branch

Immediate coronary angiography and revascularization, if appropriate, in survivors of out-of-hospital cardiac arrest and an ECG consistent with STEMI

Assess all patients for the risk of contrast-induced nephropathy

OCT for stent optimization

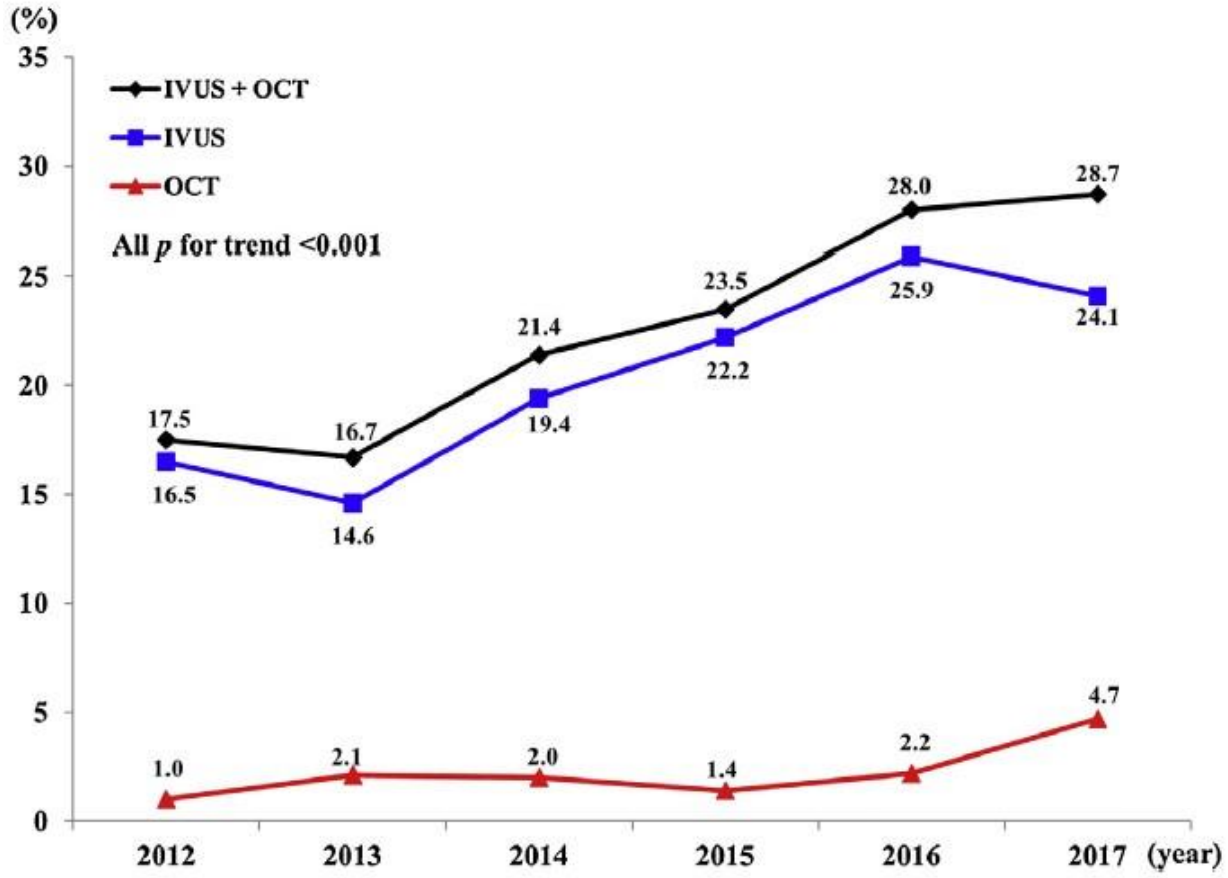
Recommendations	Class[a]	Level[b]
IVUS or OCT should be considered in selected patients to optimize stent implantation.[603,612,651–653]	**IIa**	**B**
IVUS should be considered to optimize treatment of unprotected left main lesions.[35]	IIa	B

Intravascular imaging for procedural optimization should be considered

Review

The role of optical coherence tomography in the setting of acute myocardial infarction

Yongcheol Kim (MD)[a], Thomas W. Johnson (MD)[b], Takashi Akasaka (MD)[c], Myung Ho Jeong (MD)[a,*]



Annual trend of image-guided PCI in patients with AMI (data from KAMIR)

J Cardiol 2018;72:186-192

Evidence of OCT-guided PCI

Angiography alone versus angiography plus optical coherence tomography to guide decision-making during percutaneous coronary intervention: the Centro per la Lotta contro l'Infarto-Optimisation of Percutaneous Coronary Intervention (CLI-OPCI) study

EuroIntervention 2012;8:823-9.

Optical coherence tomography imaging during percutaneous coronary intervention impacts physician decision-making: ILUMIEN I study

Eur Heart J 2015;36:3346-55.

Comparison of Stent Expansion Guided by Optical Coherence Tomography Versus Intravascular Ultrasound The ILUMIEN II Study

JACC Cardiovasc Interv 2015;8:1704-14

Evidence of OCT-guided PCI

Optical Coherence Tomography to Optimize Results of Percutaneous Coronary Intervention in Patients with Non–ST-Elevation Acute Coronary Syndrome

Results of the Multicenter, Randomized DOCTORS (Does Optical Coherence Tomography Optimize Results of Stenting) Study

Circulation 2016;27:906-17.

Optical coherence tomography compared with intravascular ultrasound and with angiography to guide coronary stent implantation (ILUMIEN III: OPTIMIZE PCI): a randomised controlled trial

Lancet 2016;388:2618-28.

Optical frequency domain imaging vs. intravascular ultrasound in percutaneous coronary intervention (OPINION trial): one-year angiographic and clinical results

Eur Heart J 2017;38:3139-47.

Article types
Clinical Trial
Review
Customize ...

Text availability
Abstract
Free full text
Full text

Publication dates
5 years
10 years
Custom range...

Species
Humans
Other Animals

Clear all

Show additional filters

Search results

Items: 7

Did you mean: *optical coherence tomography AND **kim, yongcheol*** (7 items)

1. Assessment for ambiguous angiographic finding in patient with acute myocardial infarction by **optical coherence tomography**.
   Kim Y, Jeong MH, Kim MC, Sim DS, Hong YJ, Kim JH, Ahn Y.
   Cardiol J. 2018;25(4):536-537. doi: 10.5603/CJ.2018.0086. No abstract available.

2. Optimal drug-eluting stent implantation with the aid of **optical coherence tomography** in the stenotic lesion of ectatic coronary artery.
   Kim Y, Jeong MH, Kim MC, Sim DS, Hong YJ, Kim JH, Ahn Y.
   Cardiol J. 2018;25(4):534-535. doi: 10.5603/CJ.2018.0085. No abstract available.

3. Multivessel Disease With Recanalized Thrombus - Etiologic Insights From **Optical Coherence Tomography**.
   Kim Y, Jeong MH, Kim MC, Sim DS, Hong YJ, Kim JH, Ahn Y.
   Circ J. 2019 Feb 25;83(3):688. doi: 10.1253/circj.CJ-18-0526. Epub 2018 Aug 31. No abstract available.

4. The role of **optical coherence tomography** in the setting of acute myocardial infarction.
   Kim Y, Johnson TW, Akasaka T, Jeong MH.
   J Cardiol. 2018 Sep;72(3):186-192. doi: 10.1016/j.jjcc.2018.03.004. Epub 2018 Apr 9. Review.

5. Very late stent thrombosis derived from thin-cap neoatheroma and fibroatheroma with plaque rupture assessed by **optical coherence tomography**.
   Kim Y, Jeong MH, Kim MC, Sim DS, Hong YJ, Kim JH, Ahn Y.
   Cardiol J. 2017;24(6):704-705. doi: 10.5603/CJ.2017.0146. No abstract available.

6. The role of **optical coherence tomography** in decision making during the acute phase of spontaneous coronary artery dissection.
   Kim Y, Deharo P, Adlam D, Baumbach A, Johnson TW.
   Int J Cardiol Heart Vasc. 2016 Nov 26;14:6-7. doi: 10.1016/j.ijcha.2016.11.010. eCollection 2017 Mar. No abstract available.

7. A new technique for lipid core plaque detection by **optical coherence tomography** for prevention of peri-procedural myocardial infarction: A case report.
   Kim Y, Gnanadesigan M, van Soest G, Johnson TW.
   Medicine (Baltimore). 2017 Jun;96(23):e7125. doi: 10.1097/MD.0000000000007125.

Sort by:
Best match | Most recent

Find related data
Database: Select
Find items

Search details
("tomography, optical coherence"[MeSH Terms] OR ("tomography"[All Fields] AND "optical"[All Fields] AND "coherence"[All Fields]) OR "optical coherence tomography"[All Fields] OR ("optical"
Search
See more...

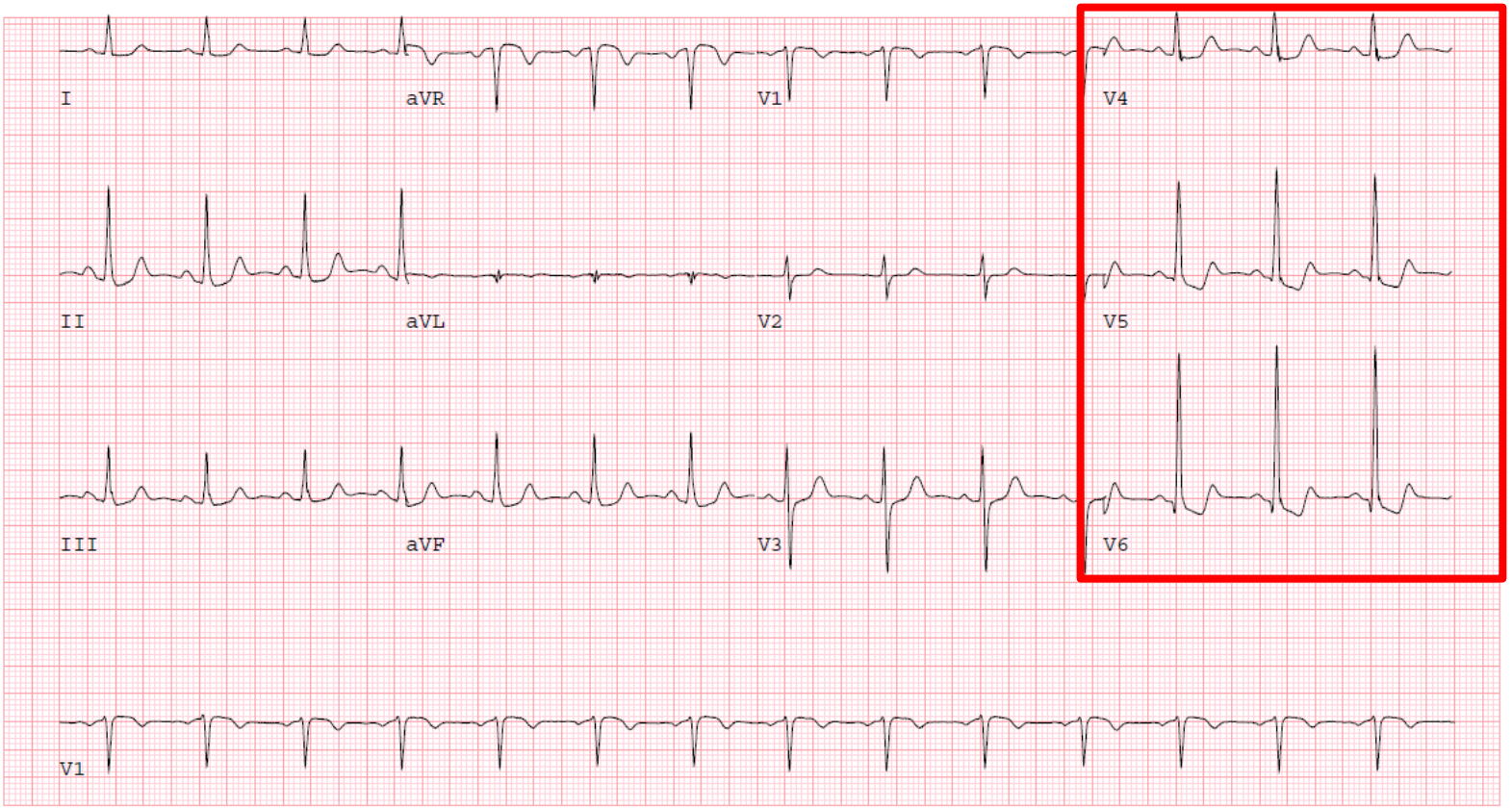
Recent Activity

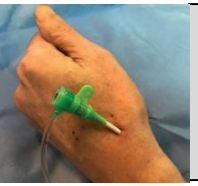
Choi OO (57/M)

Chief complaint: Effort angina (CCS Class II- 8month ago)

V/S: stable **2D-Echo: EF 71%, no RWMA**

Treadmill test: High-risk (7.0 METs, 2mm down sloping STD on resting)





Initial coronary angiogram

(Lt. snuffbox approach using 6 Fr. sheath)

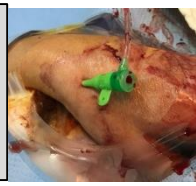
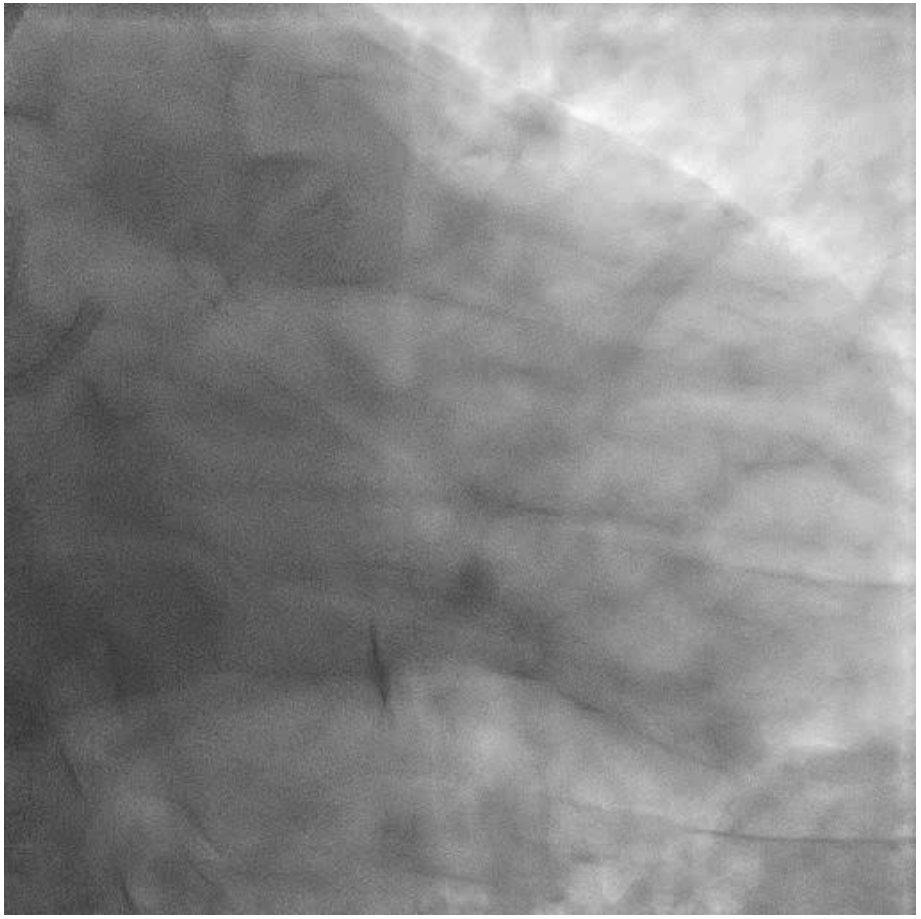
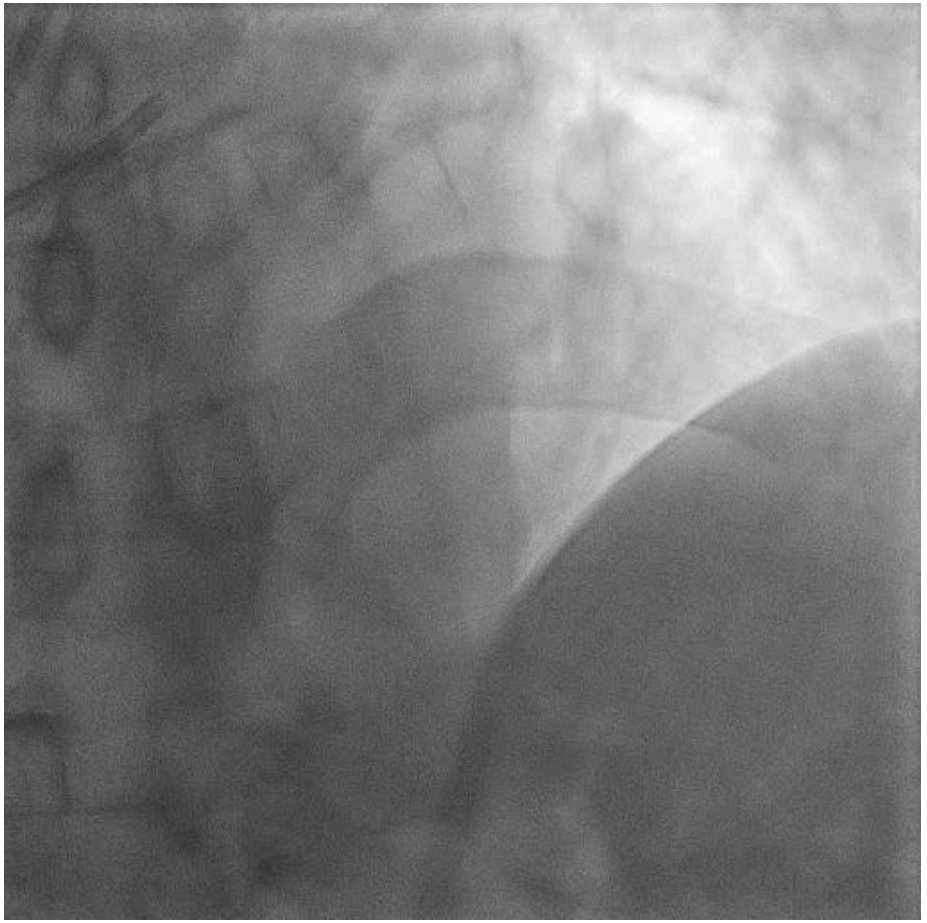


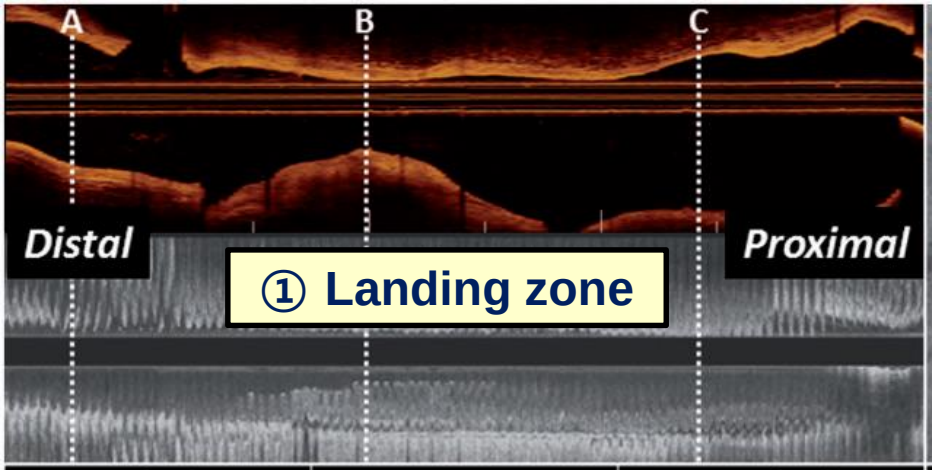
Image-guided PCI for stent optimization in patient with LM disease

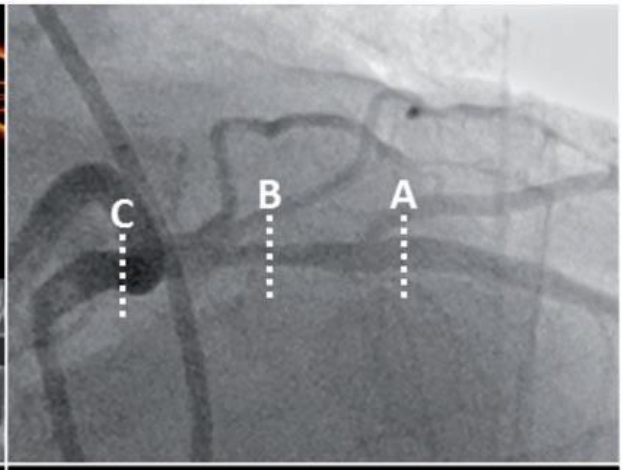


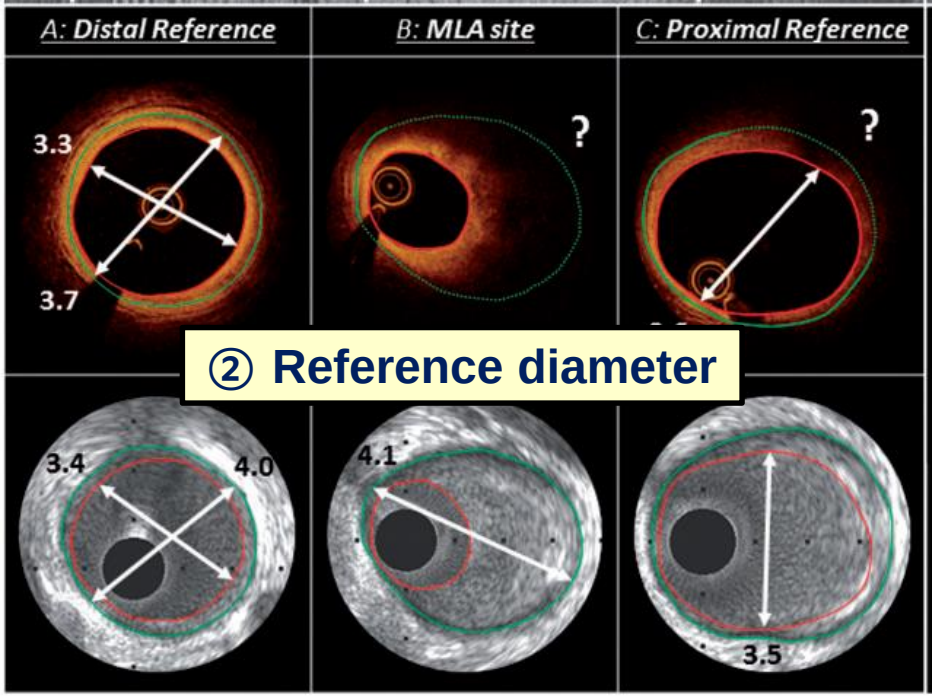


Significant stenosis in dLM bifurcation (Medina 1,0,0)

The factors for stent optimization
(① appropriate stent selection)







Aggressive

Conservative

OCT (mm)

Smallest reference EEL	3.7
Largest reference lumen	3.6
Mean reference lumen	3.5
Smallest reference lumen	3.3

IVUS

EEL-to-EEL (lesion)	4.1
Smallest reference EEL	4.0
Mean mid-wall reference	3.8
Largest reference lumen	3.5
Mean reference lumen	3.4
Smallest reference lumen	3.4

Expert consensus of the EAPCI, Eur Heart J May 16, 2018

The factors for stent optimization
(② appropriate post-stenting strategy)

Box 4 Criteria to assess optimal stent result

- A relative stent expansion of >80% (MSA divided by ave area) should be obtained in routine clinical practice.
- An MSA of >5.5 mm^2 by IVUS and > 4.5 mm^2 by OCT should be achieved in non-left main lesions.
- The clinical relevance of acute malapposition is uncertain. Nonetheless, extensive malapposition after stent implantation should be avoided and corrected, if anatomically feasible. Early strut coverage may be promoted by full apposition.
- Acute malapposition of <0.4 mm with longitudinal extension <1 mm c taneous neointimal integration is anticipated. This cut-off requires prospective validation.
- Late acquired malapposition represents an established cause of late and very late stent thrombosis.
- Tissue prolapse in ACS as compared with stable CAD is adversely related to outcomes, likely because of differences in the composition of the protruding tissue.
- Large dissections detected by IVUS or OCT are independent predictors of MACE. Presence of residual plaque burden, extensive lateral (>60°), and longitudinal extension (>2 mm) tia) and localization distal to the stent increase the risk for adverse events.
- Stent edge haematoma may be detected by IVUS or OCT in case of angiographic appearance of a residual stent edge stenosis.

① MSA

② Severe malapposition

③ Stent edge dissection

Expert consensus of the EAPCI, Eur Heart J May 16, 2018

The factors for stent optimization
(② appropriate post-stenting strategy)

Box 4 Criteria to assess optimal stent result

- A relative stent expansion of >80% (MSA divided by ave area) should be obtained in routine clinical practice.
- An MSA of >5.5 mm^2 by IVUS and > 4.5 mm^2 by OCT should be achieved in non-left main lesions.
- The clinical relevance of acute malapposition is uncertain. Nonetheless, extensive malapposition after stent implantation should be avoided and corrected, if anatomically feasible. Early strut coverage may be promoted by full apposition.
- Acute malapposition of <0.4 mm with longitudinal extension <1 mm c taneous neointimal integration is anticipated. This cut-off requires prospective validation.
- Late acquired malapposition represents an established cause of late and very late stent thrombosis.
- Tissue prolapse in ACS as compared with stable CAD is adversely related to outcomes, likely because of differences in the composition of the protruding tissue.
- Large dissections detected by IVUS or OCT are independent predictors of MACE. Presence of residual plaque burden, extensive lateral (>60°), and longitudinal extension (>2 mm) tia) and localization distal to the stent increase the risk for adverse events.
- Stent edge haematoma may be detected by IVUS or OCT in case of angiographic appearance of a residual stent edge stenosis.

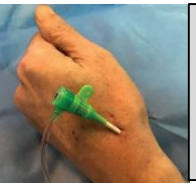
① MSA

② Severe malapposition

③ Stent edge dissection

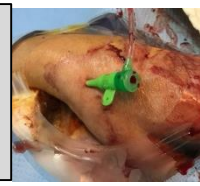
Expert consensus of the EAPCI, Eur Heart J May 16, 2018

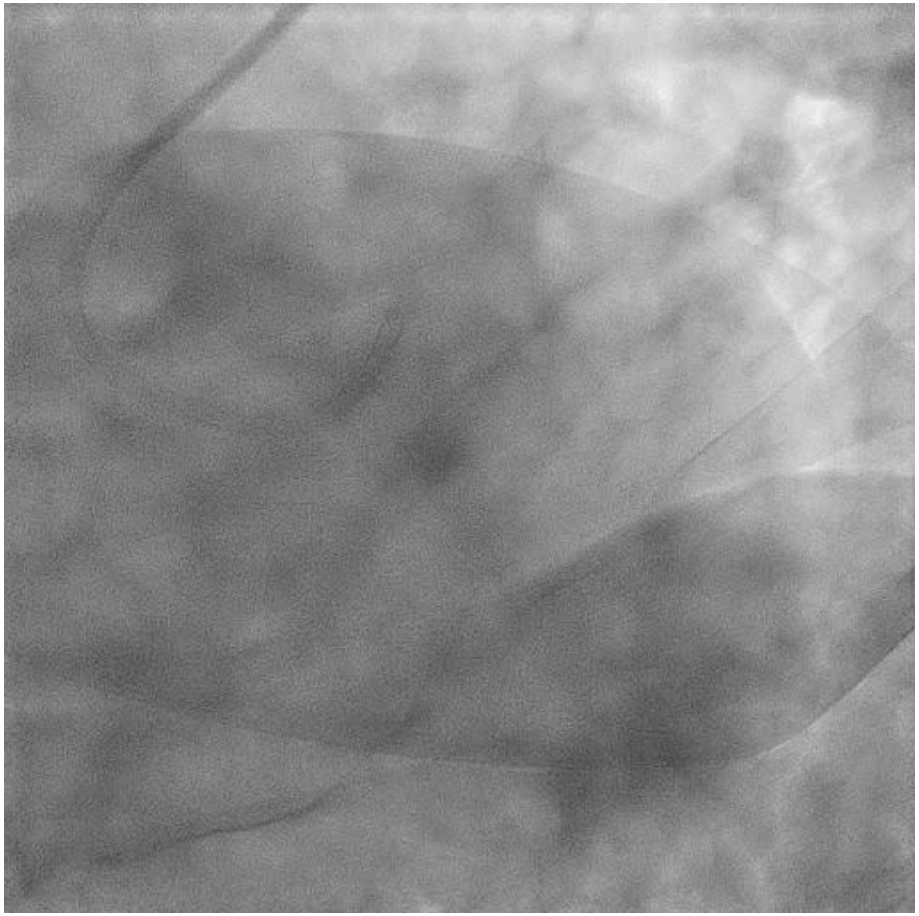
- **The choice of IVUS or OCT is just depend on how familiar it is with operator**
- **Important thing is that we are planning to image-guided PCI!!!**



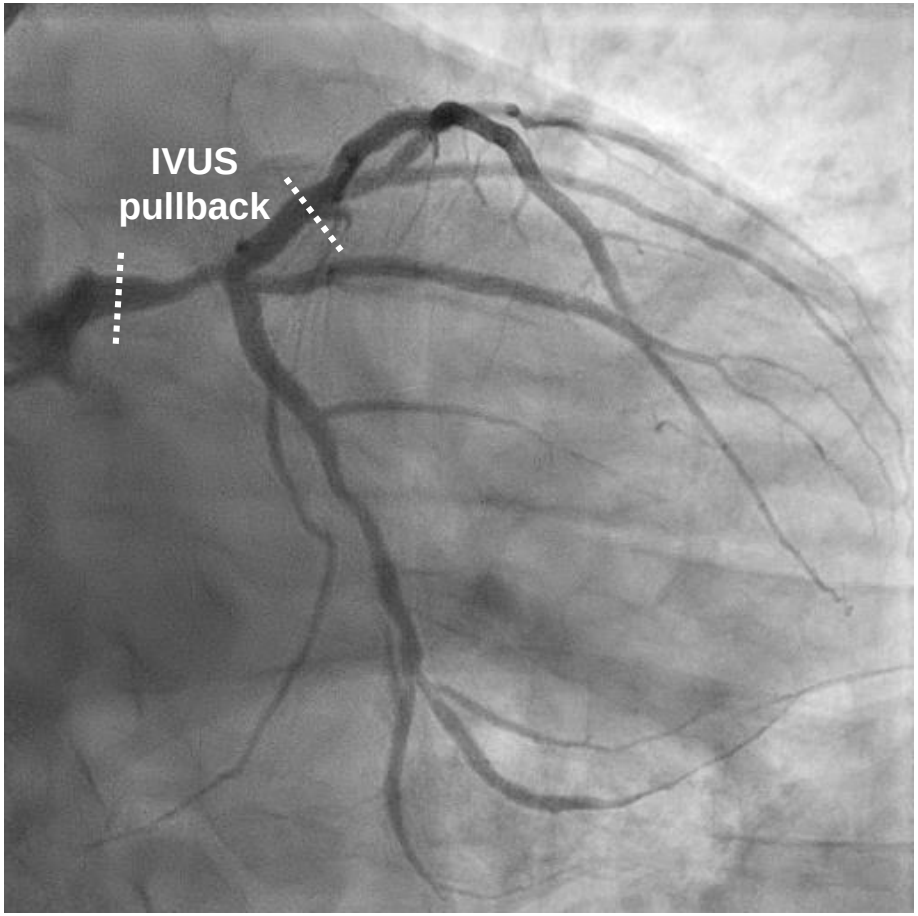
Initial coronary angiogram

(Lt. snuffbox approach using 6 Fr. sheath)

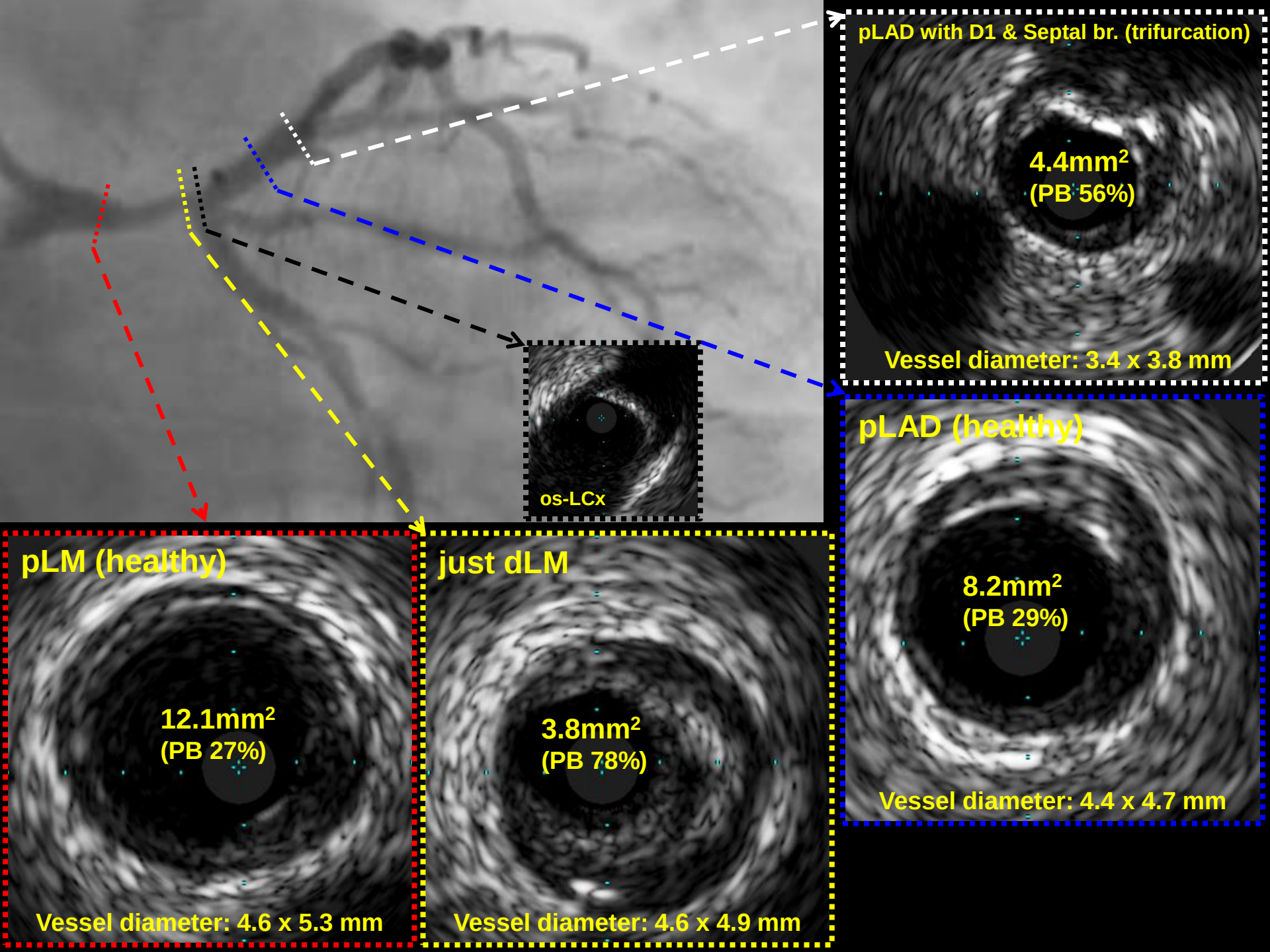


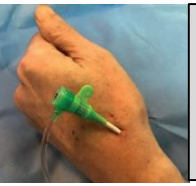


Angiographically healthy of os-LCx



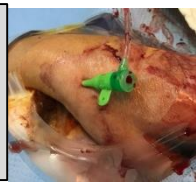
Assessment of LM to pLAD lesion with IVUS

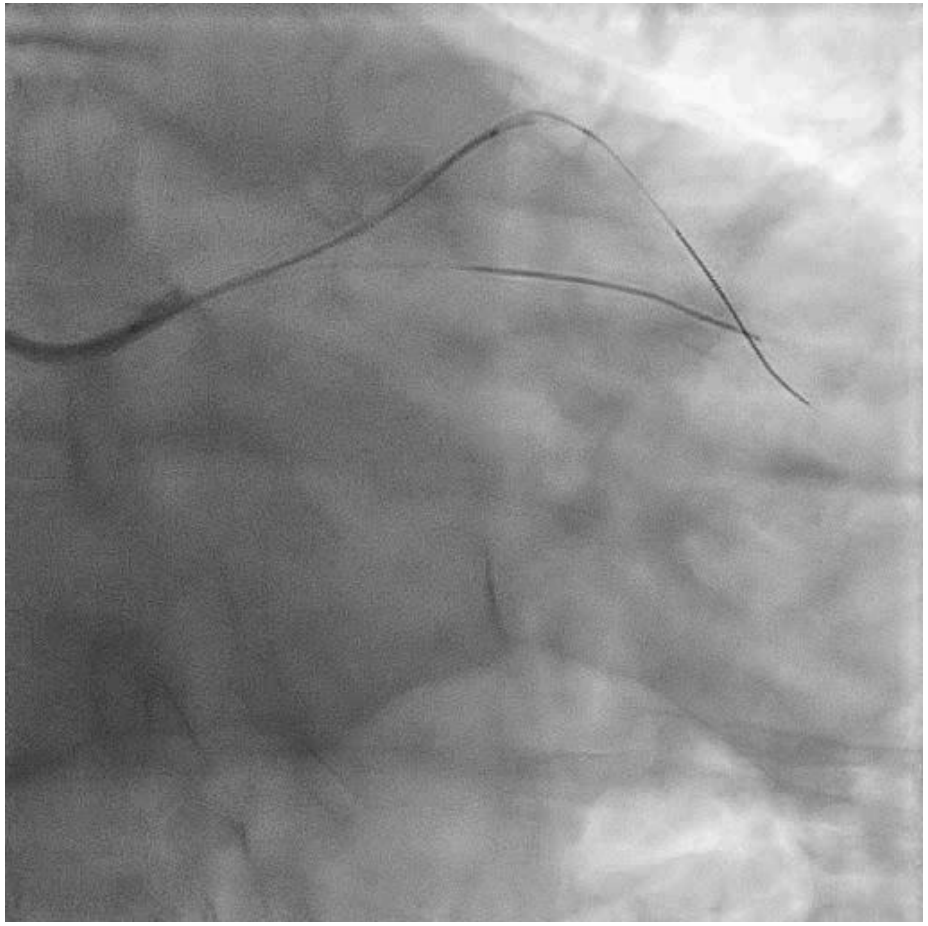

pLAD with D1 & Septal br. (trifurcation)
4.4mm²
(PB 56%)
Vessel diameter: 3.4 x 3.8 mm
os-LCx
pLAD (healthy)
8.2mm²
(PB 29%)
Vessel diameter: 4.4 x 4.7 mm
pLM (healthy)
12.1mm²
(PB 27%)
Vessel diameter: 4.6 x 5.3 mm
just dLM
3.8mm²
(PB 78%)
Vessel diameter: 4.6 x 4.9 mm

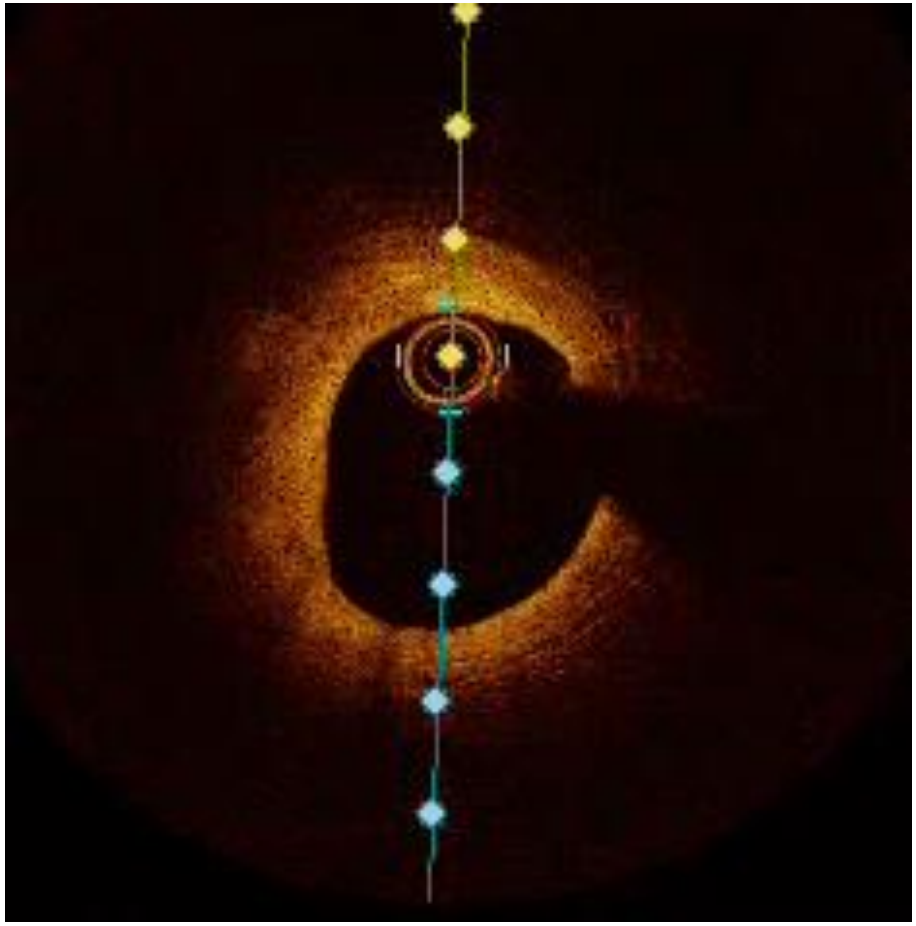


OCT-guided PCI for distal LM lesion

(Lt. snuffbox approach using 6 Fr. sheath)

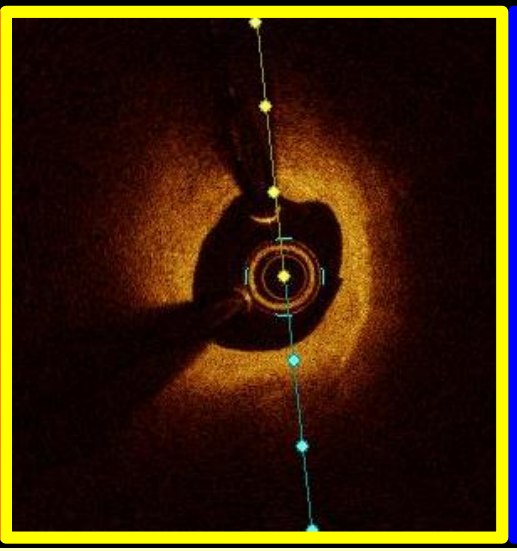
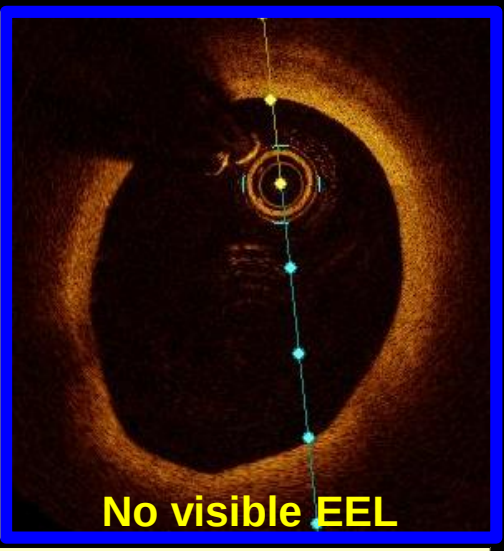






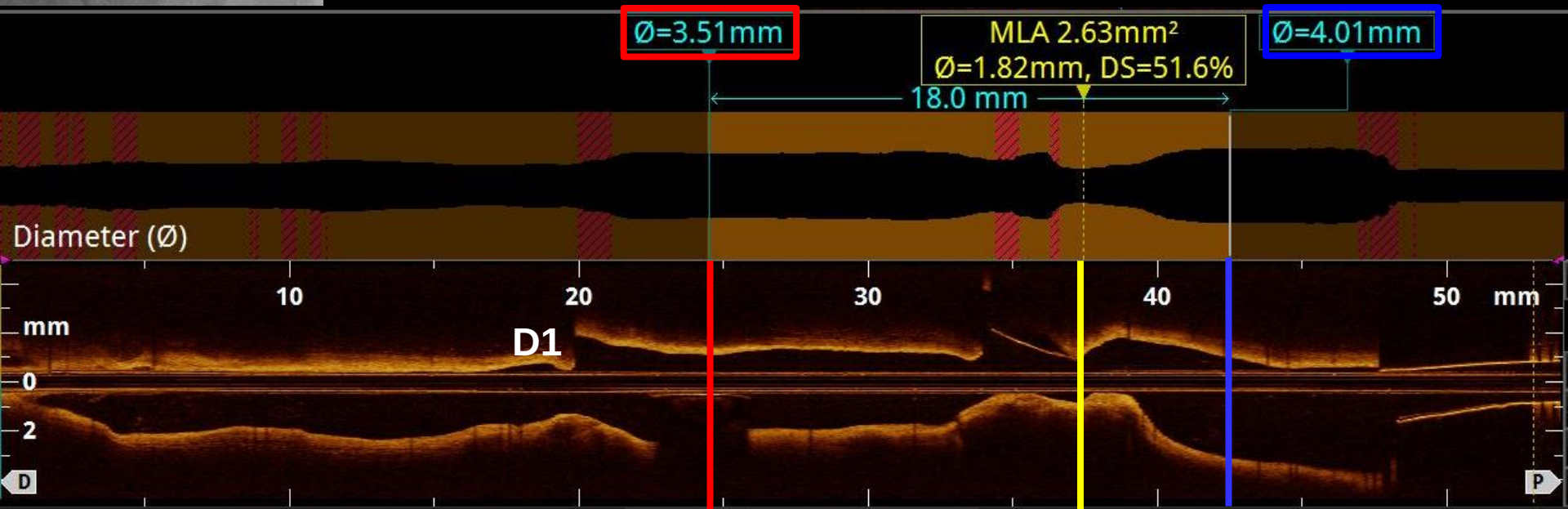
Contrast: 4cc/s, 16cc/4s, 250 PSI

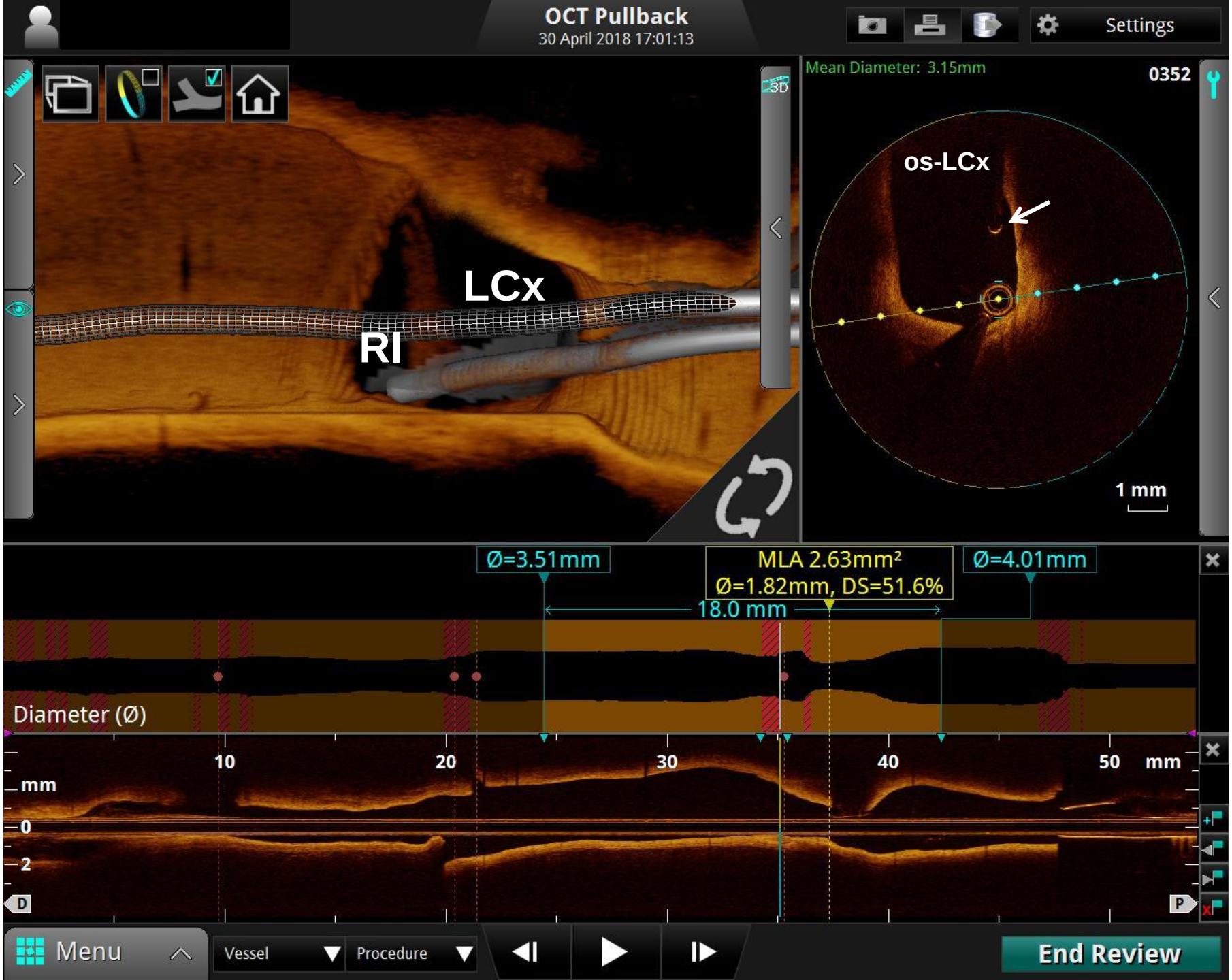
Pre-OCT pullback image

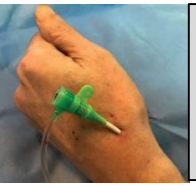
Distal landing zone	Minimal Lumen Area	Proximal landing zone
		
No visible EEL		No visible EEL

Diffuse fibroatheroma including both landing zones

(fibroatheroma = vulnerable plaque = lipid core plaque = necrotic core)

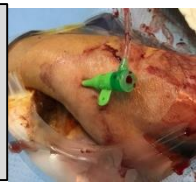



OCT Pullback
30 April 2018 17:01:13
Settings
LCx
RI
Mean Diameter: 3.15mm
0352
os-LCx
1 mm
Ø=3.51mm
MLA 2.63mm²
Ø=1.82mm, DS=51.6%
Ø=4.01mm
18.0 mm
Diameter (Ø)
10
20
30
40
50
mm
mm
0
2
D
P
Menu
Vessel
Procedure
End Review

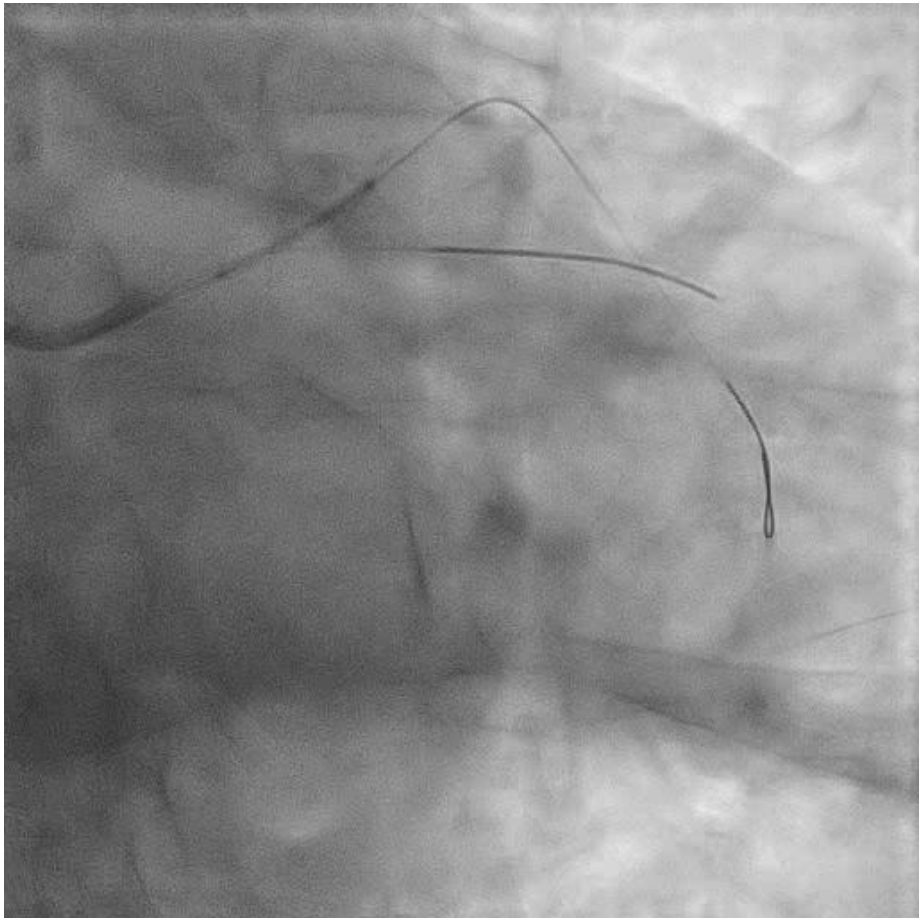


OCT-guided PCI for distal LM disease

(Lt. snuffbox approach using 6 Fr. sheath)

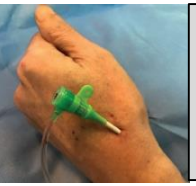


3.76 mm in DRD & 4.26 mm in PRD



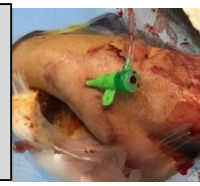
3.5 x 18mm Xience Alpine

3.5 x 18mm Xience @ 16 atm (3.75mm)

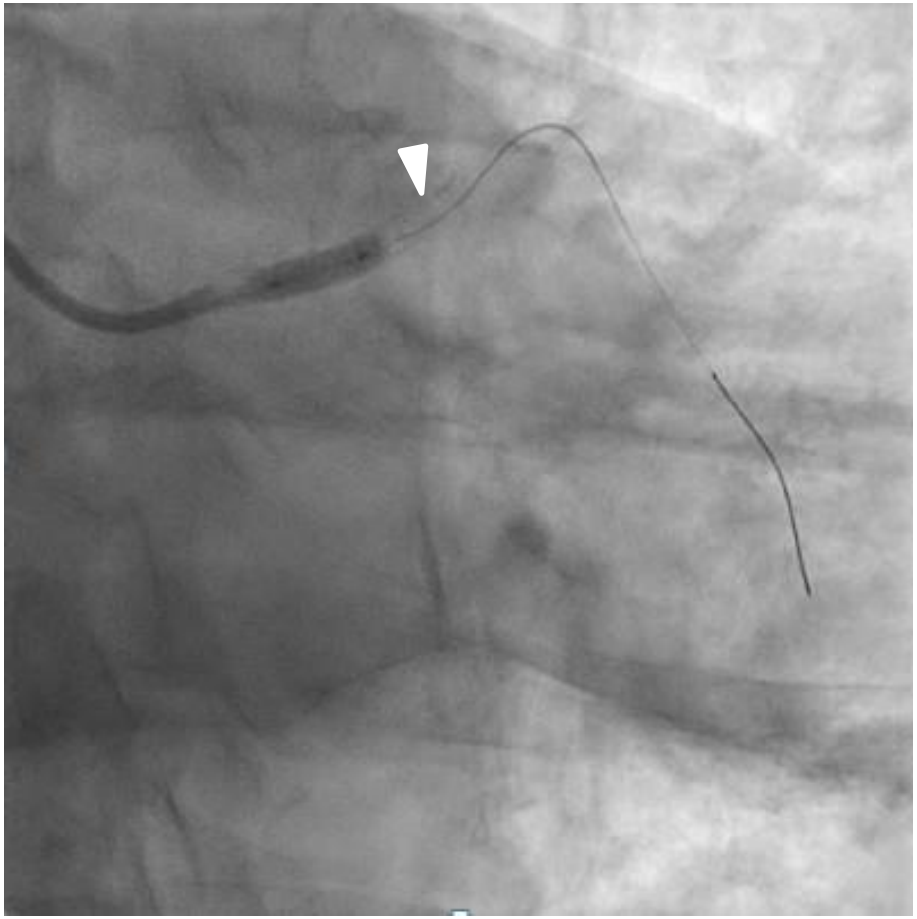


OCT-guided PCI for distal LM disease

(Lt. snuffbox approach using 6 Fr. sheath)

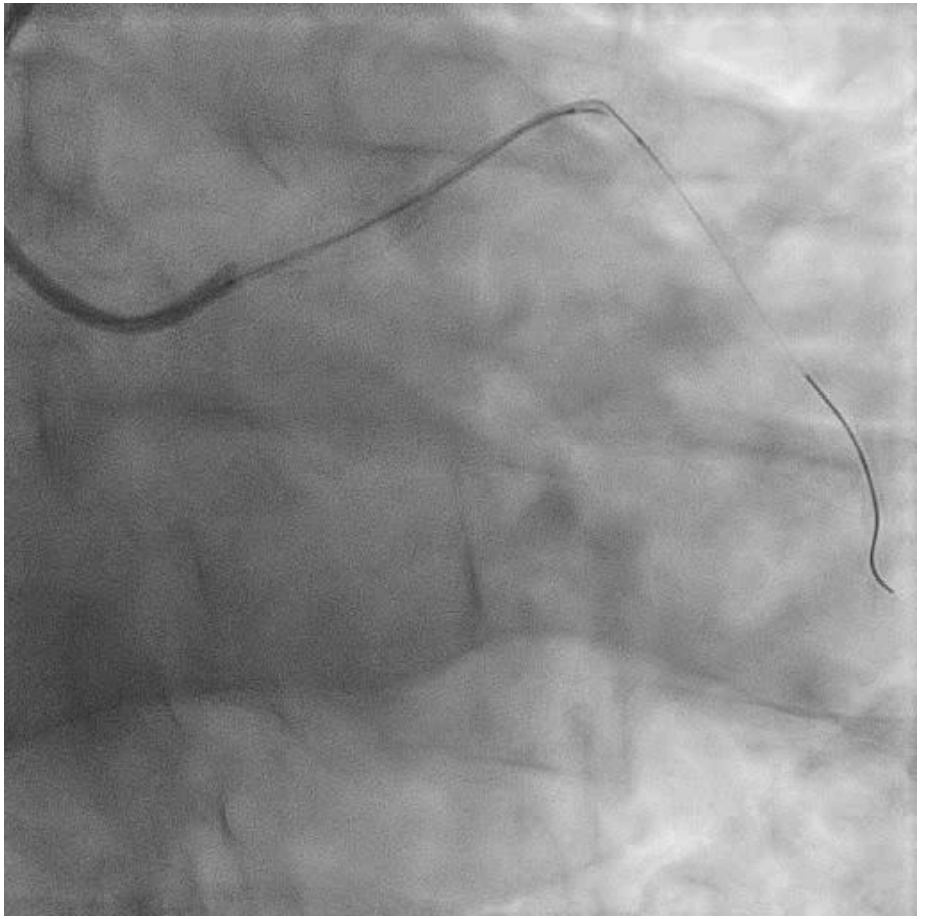


3.76 mm in DRD & 4.26 mm in PRD

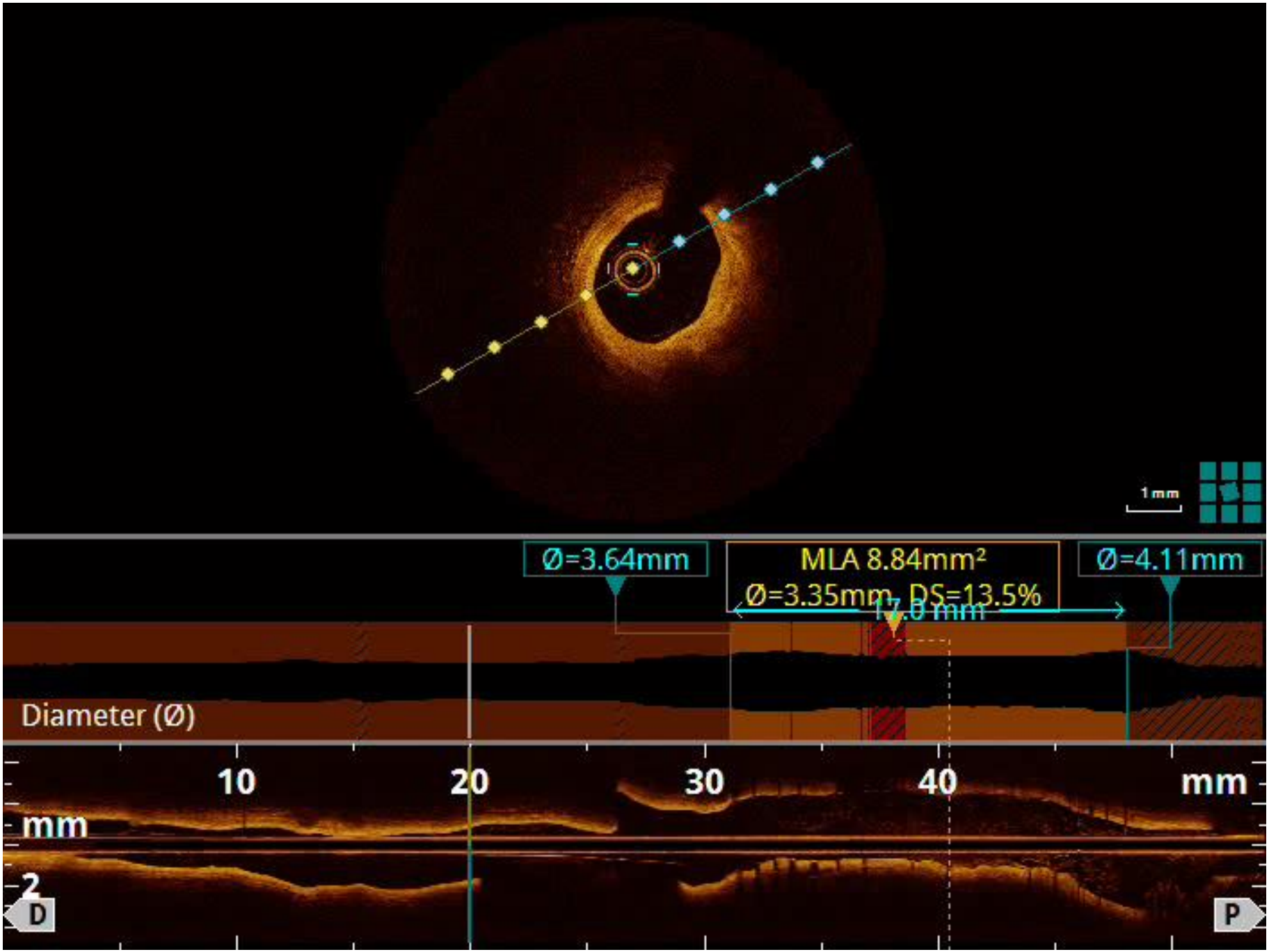


4.0 x 10mm NC balloon @ upto 22 atm (4.26mm) in the prox. portion of stent

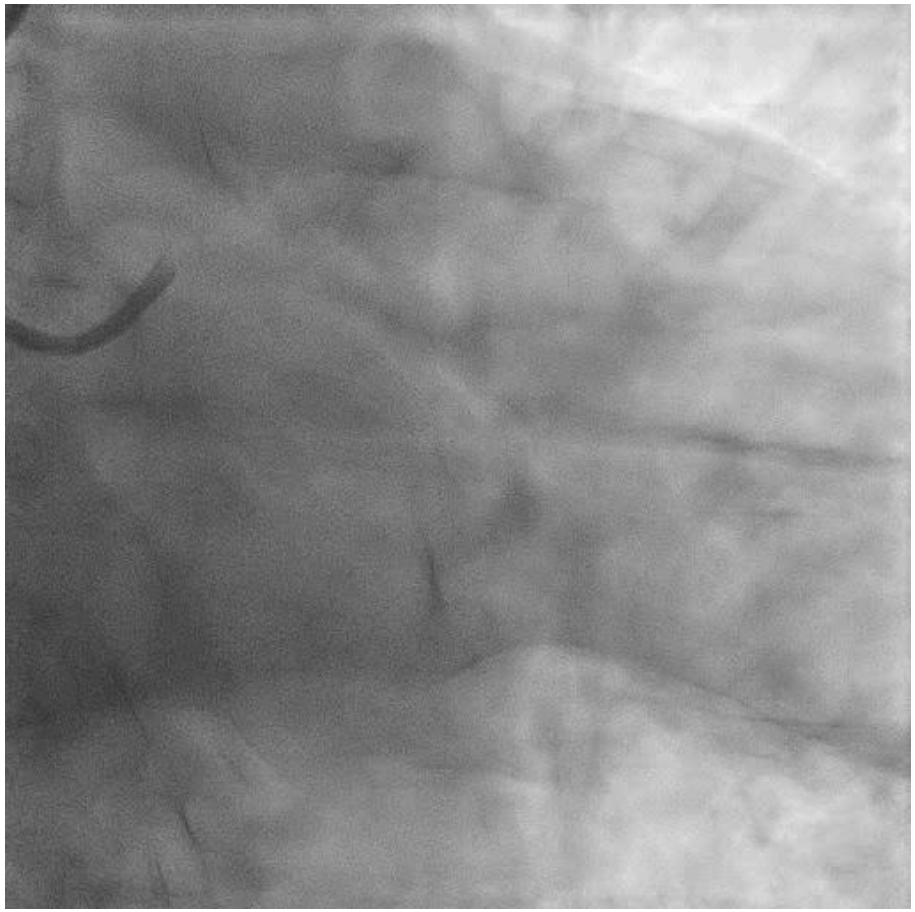
FU OCT pullback



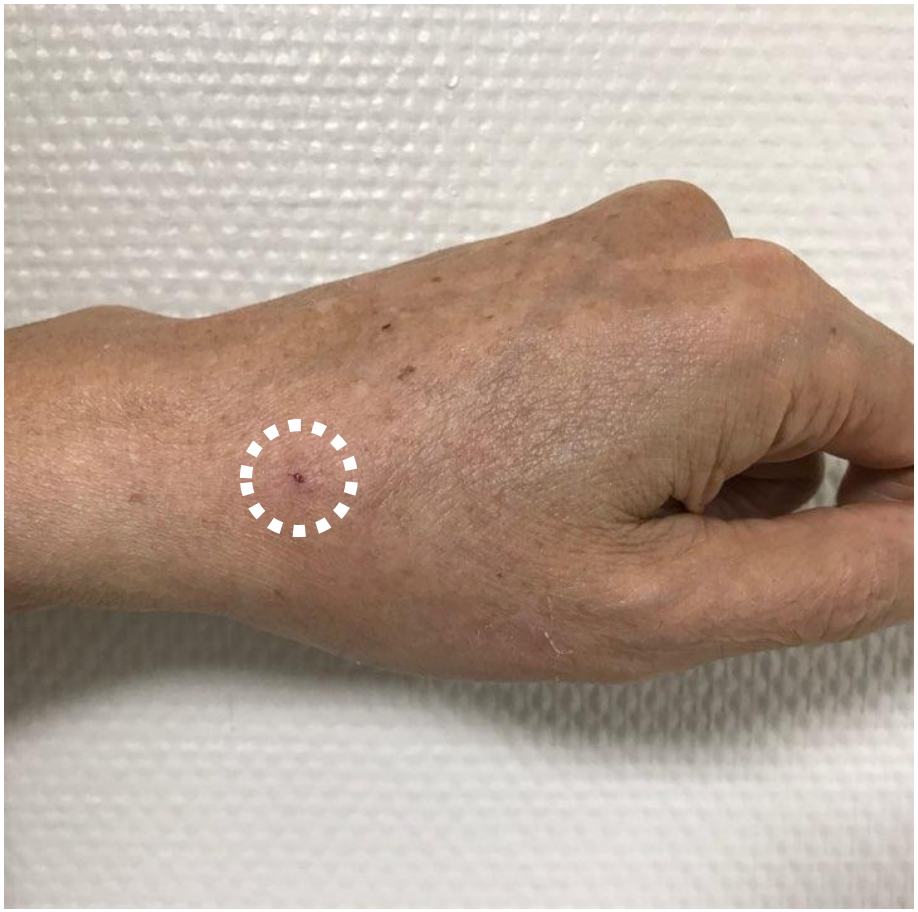
Contrast: 4cc/s, 20cc/5s, 300 PSI


1 mm
Ø=3.64mm
MLA 8.84mm²
Ø=3.35mm, DS=13.5%
17.0 mm
Ø=4.11mm
Diameter (Ø)
10
20
30
40
mm
mm
2
D
P

Successful OCT-guided PCI for distal LM disease



Final CAG



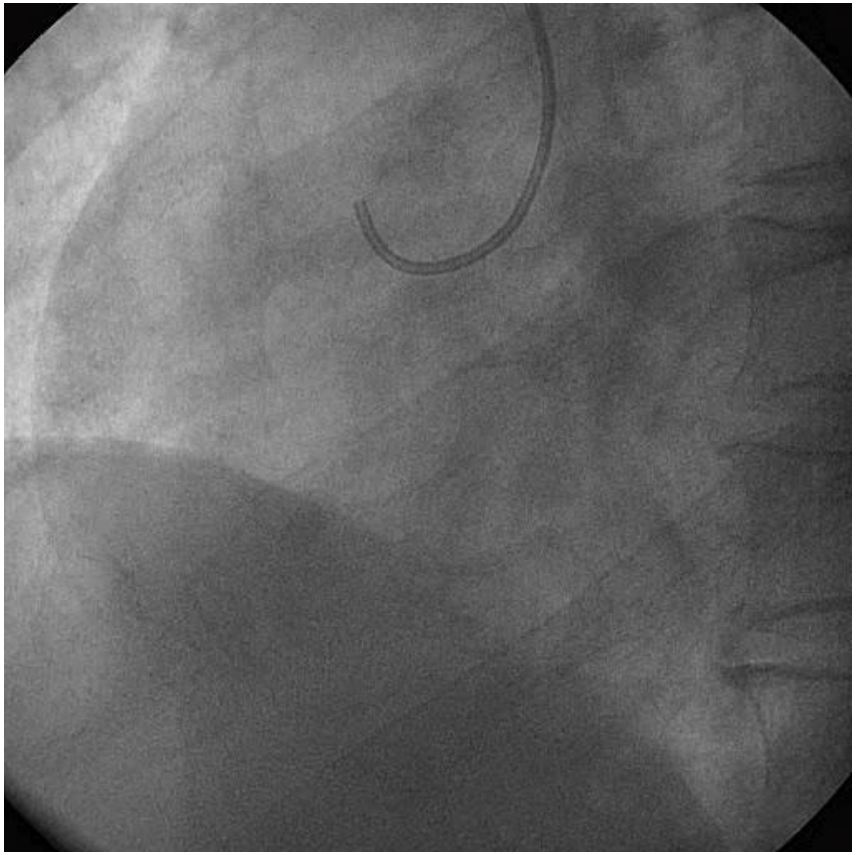
Hemostasis for 3 hours

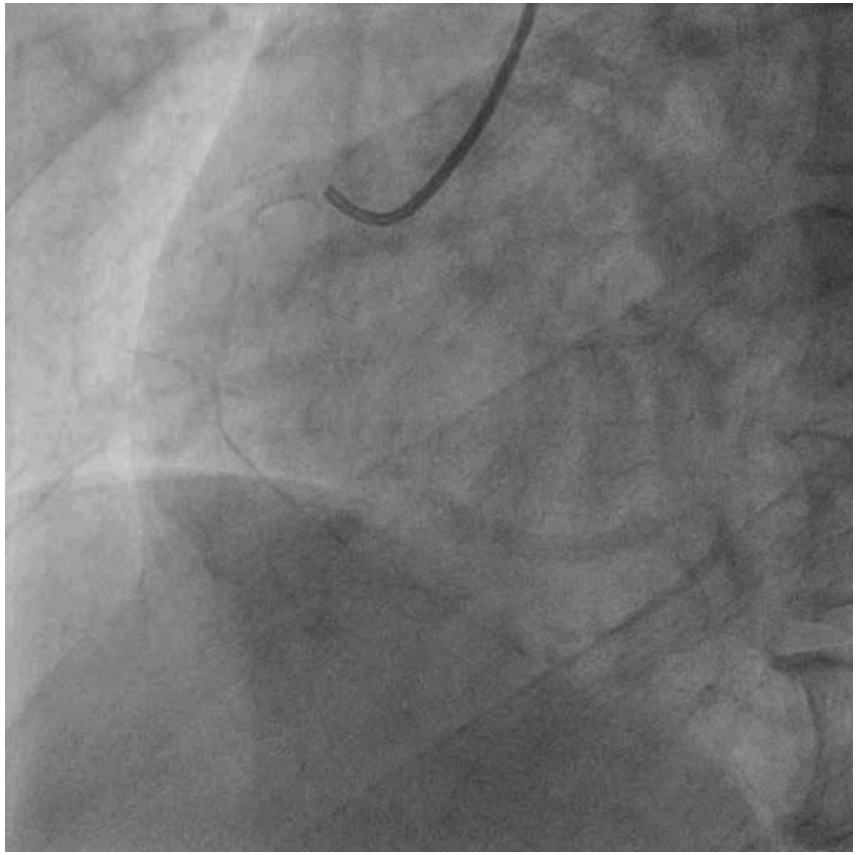
Park OO (59/M)

- Intermittent resting chest pain 1 day ago
- No complaining of chest pain at ER
- Known HTN and dyslipidemia
- Hx of PCI due to STEMI 3 years ago
- Changing DAPT (ASA + CLO) into SAPT (ASA) 4 month ago
- Initial TnI: 9.2 ng/dL
- ECG: No ST-segment deviation
- Ticagrelor 180mg loading before PCI

Urgent coronary angiography

IVUS or OCT guidance for stent optimization?

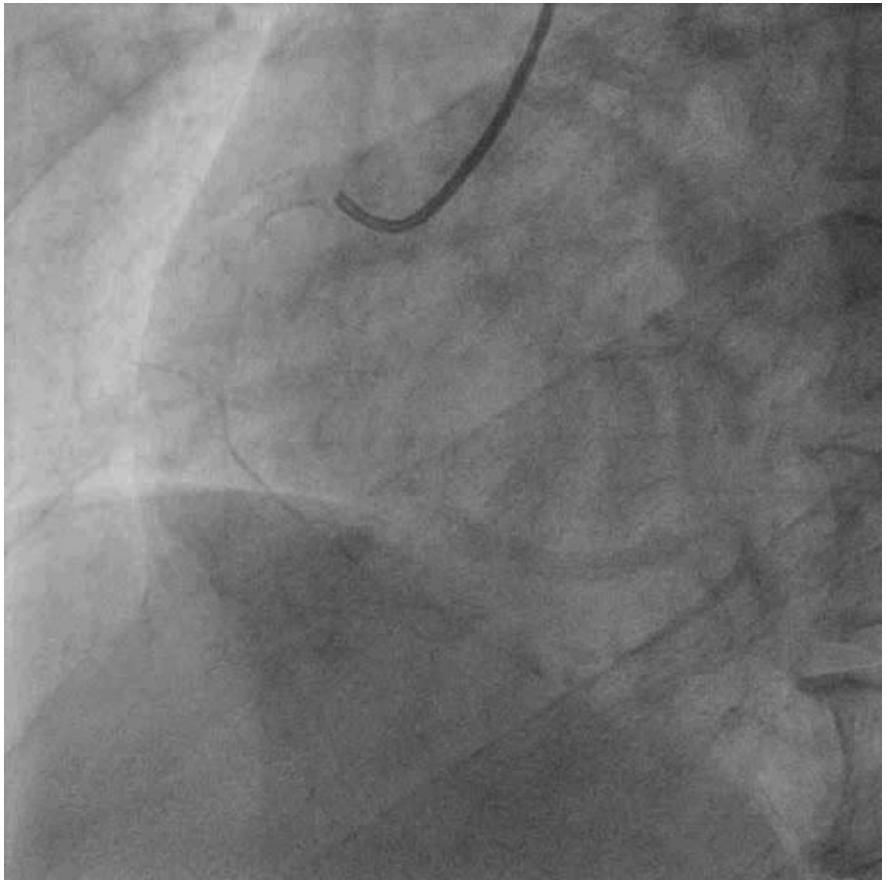




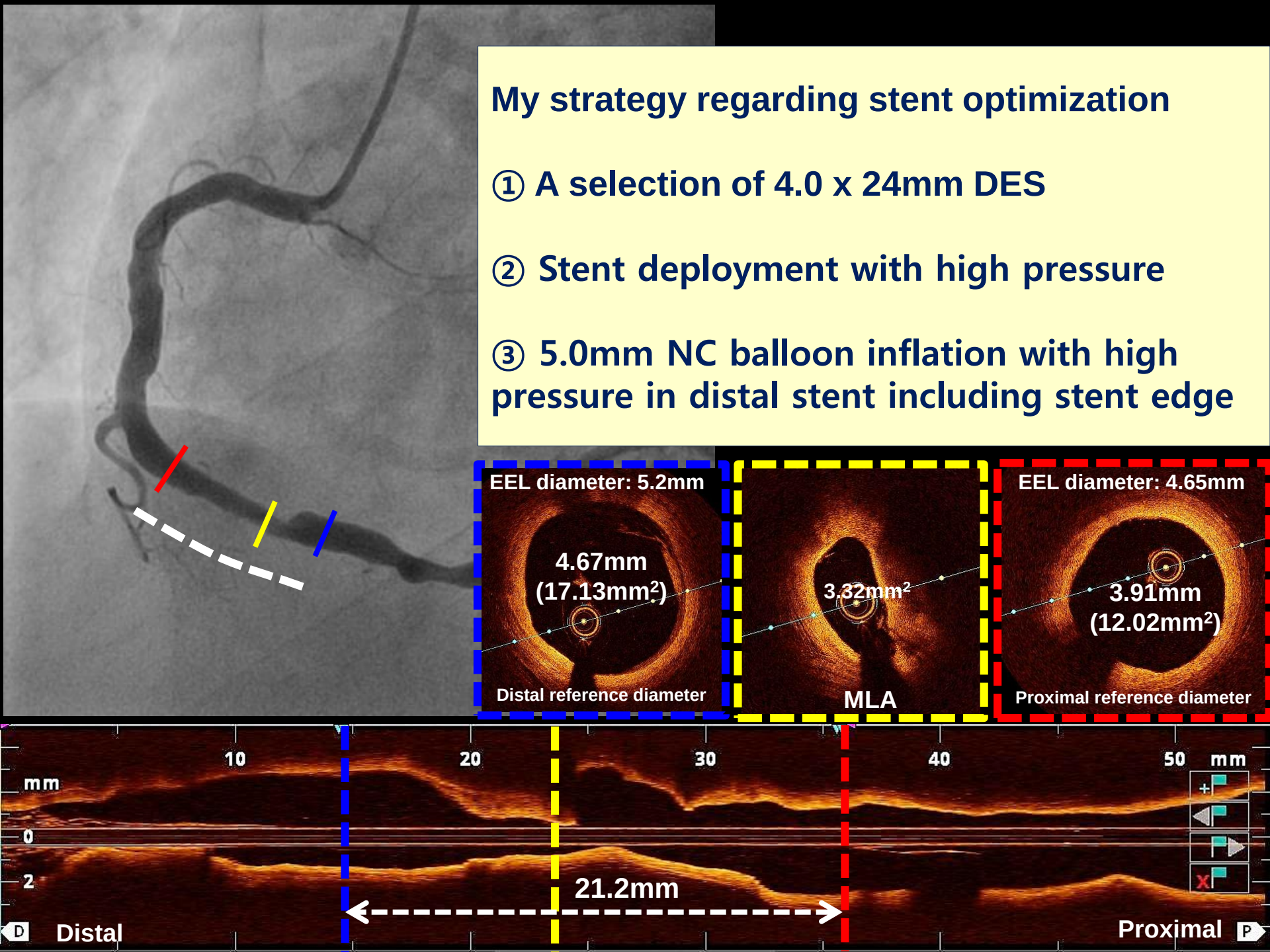
2014.06.23
4.5x16mm BMS in pRCA

2017.08.03
Patency of stent in pRCA
Severe stenosis in ectatic dRCA

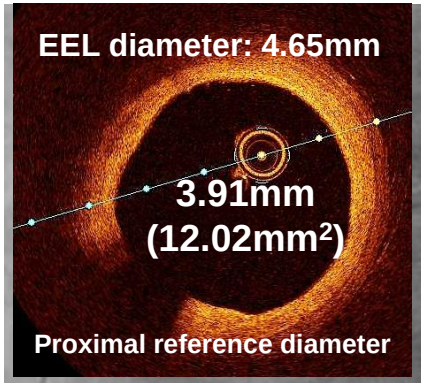
OCT-guidance would be safe in patients with AMI?

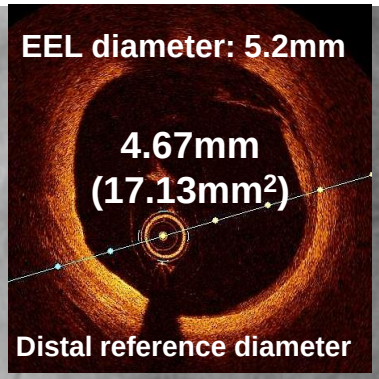


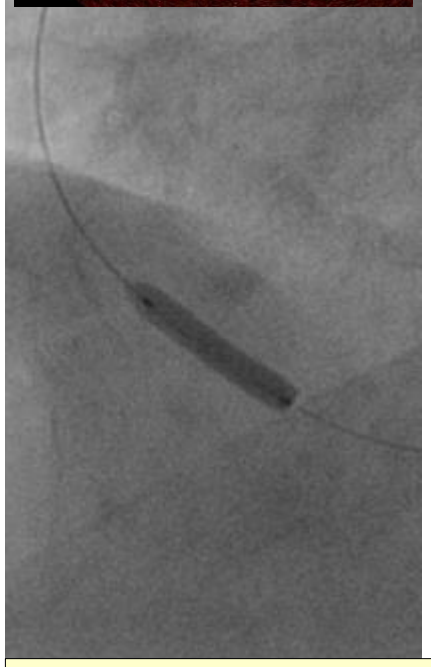
1) TIMI flow:
2) STD on the ECG:
3) Chest pain:

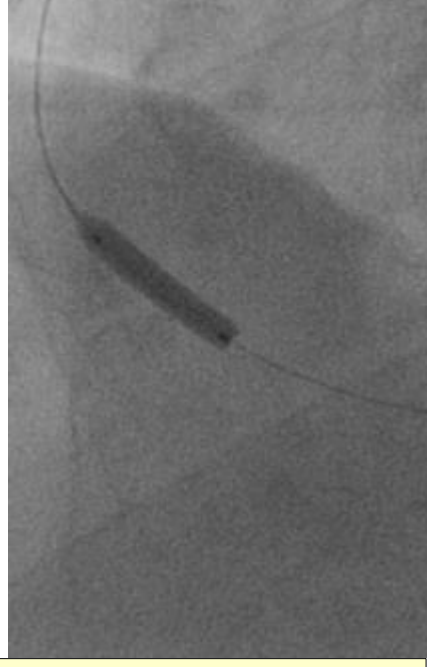

My strategy regarding stent optimization
① A selection of 4.0 x 24mm DES
② Stent deployment with high pressure
③ 5.0mm NC balloon inflation with high pressure in distal stent including stent edge
EEL diameter: 5.2mm
4.67mm
(17.13mm²)
Distal reference diameter
3.32mm²
MLA
EEL diameter: 4.65mm
3.91mm
(12.02mm²)
Proximal reference diameter
mm
10
20
30
40
50
mm
0
2
21.2mm
Distal
Proximal

OCT-guided PCI for stent optimization in AMI patient with ectatic coronary artery

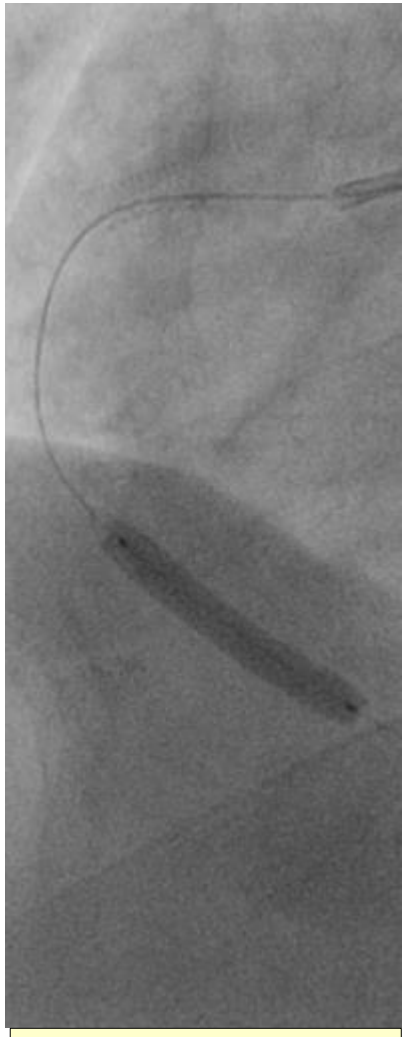




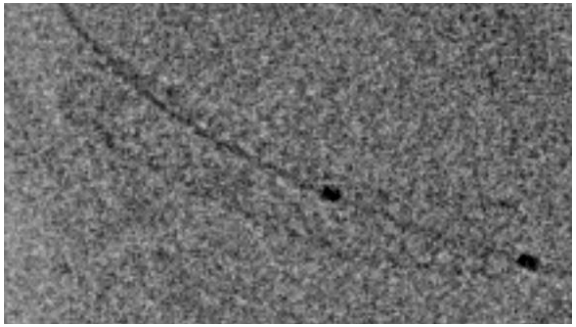


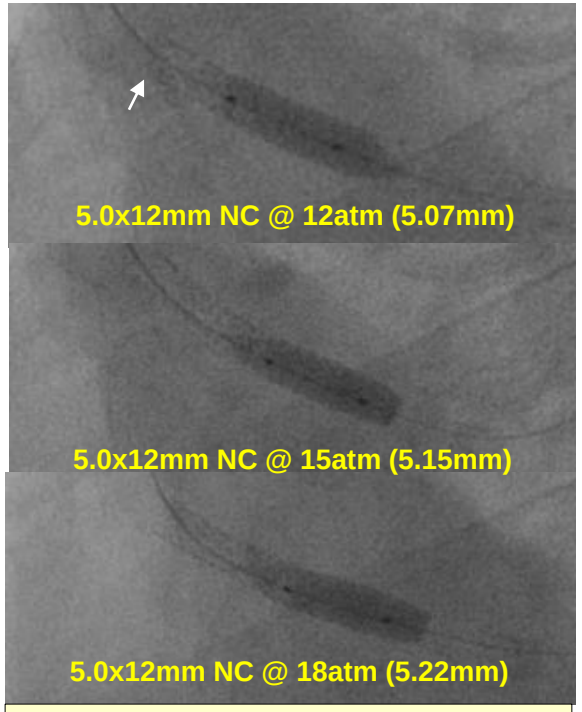


Predilation with 3.0x15mm balloon at 10atm (3.08mm)



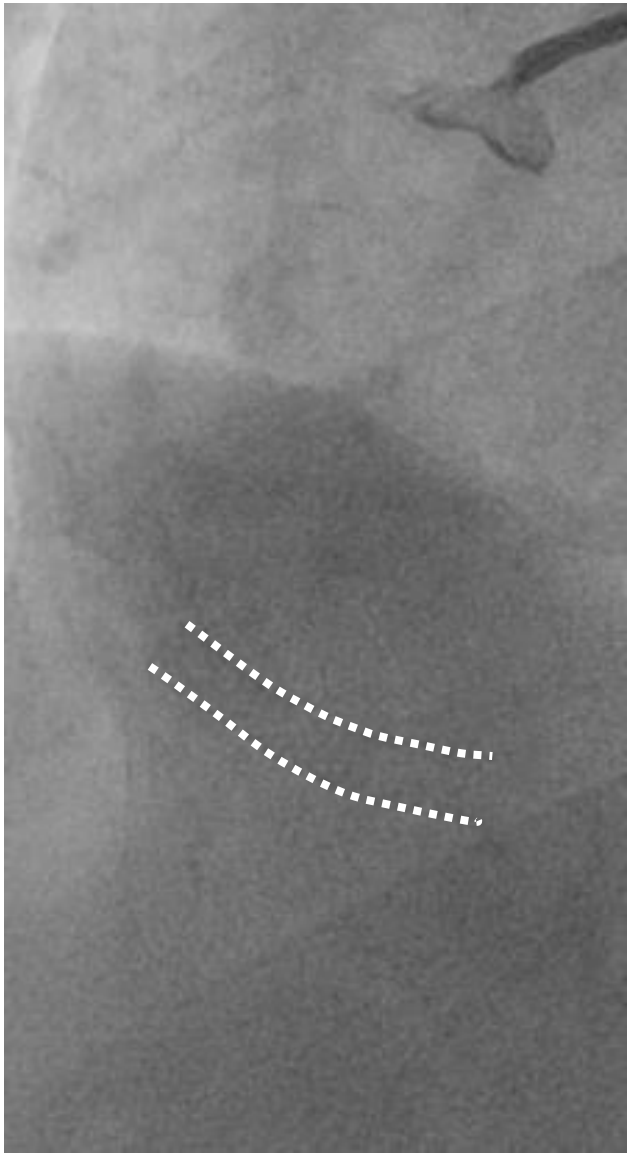
DES 4.0x24mm @ 16atm (4.48mm)

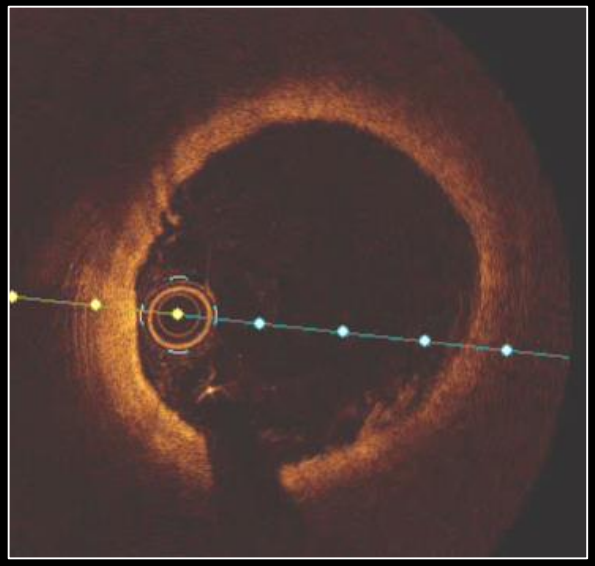


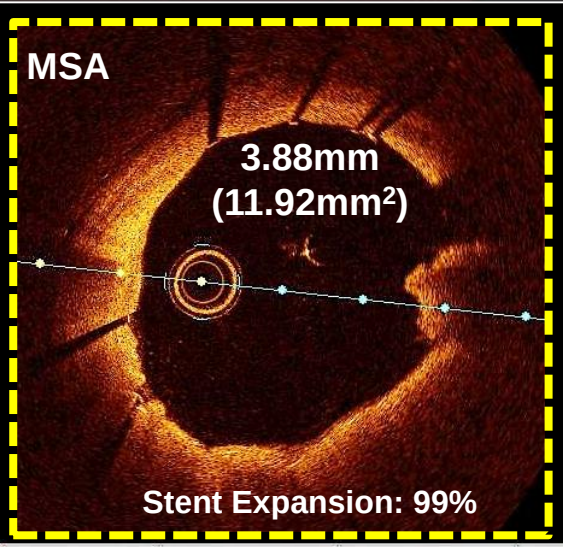


Sequential postdilation with a 5.0 NC balloon

OCT-guided PCI for stent optimization in AMI patient with ectatic coronary artery

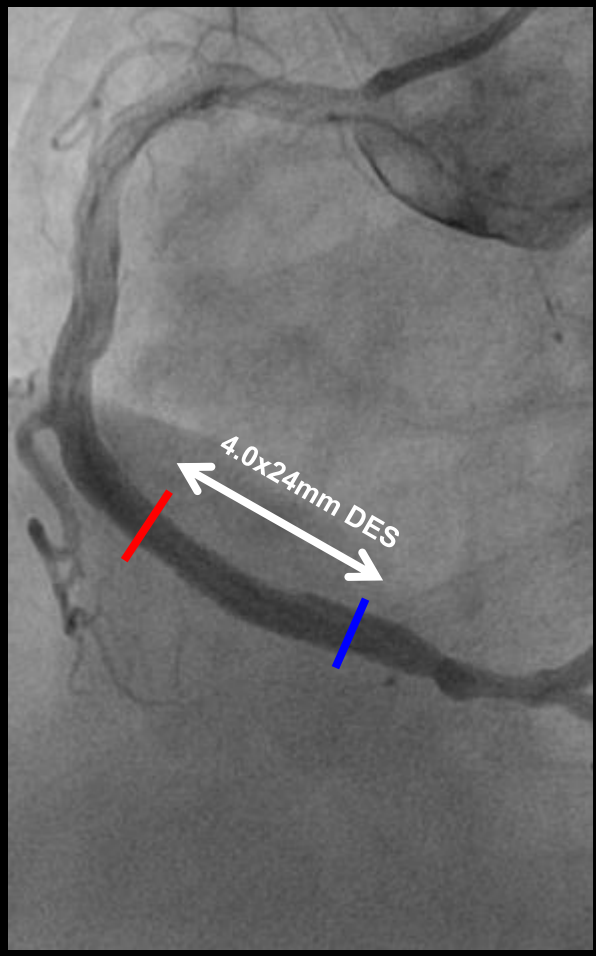


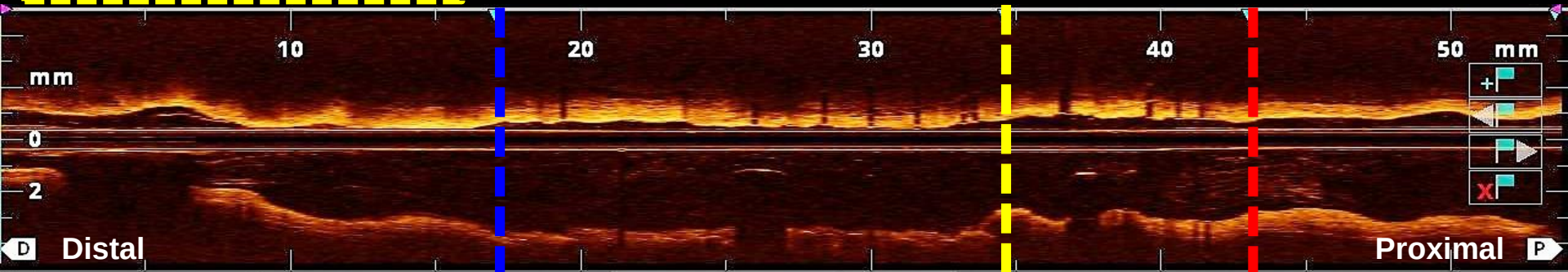




Initial Strategy

Final Result

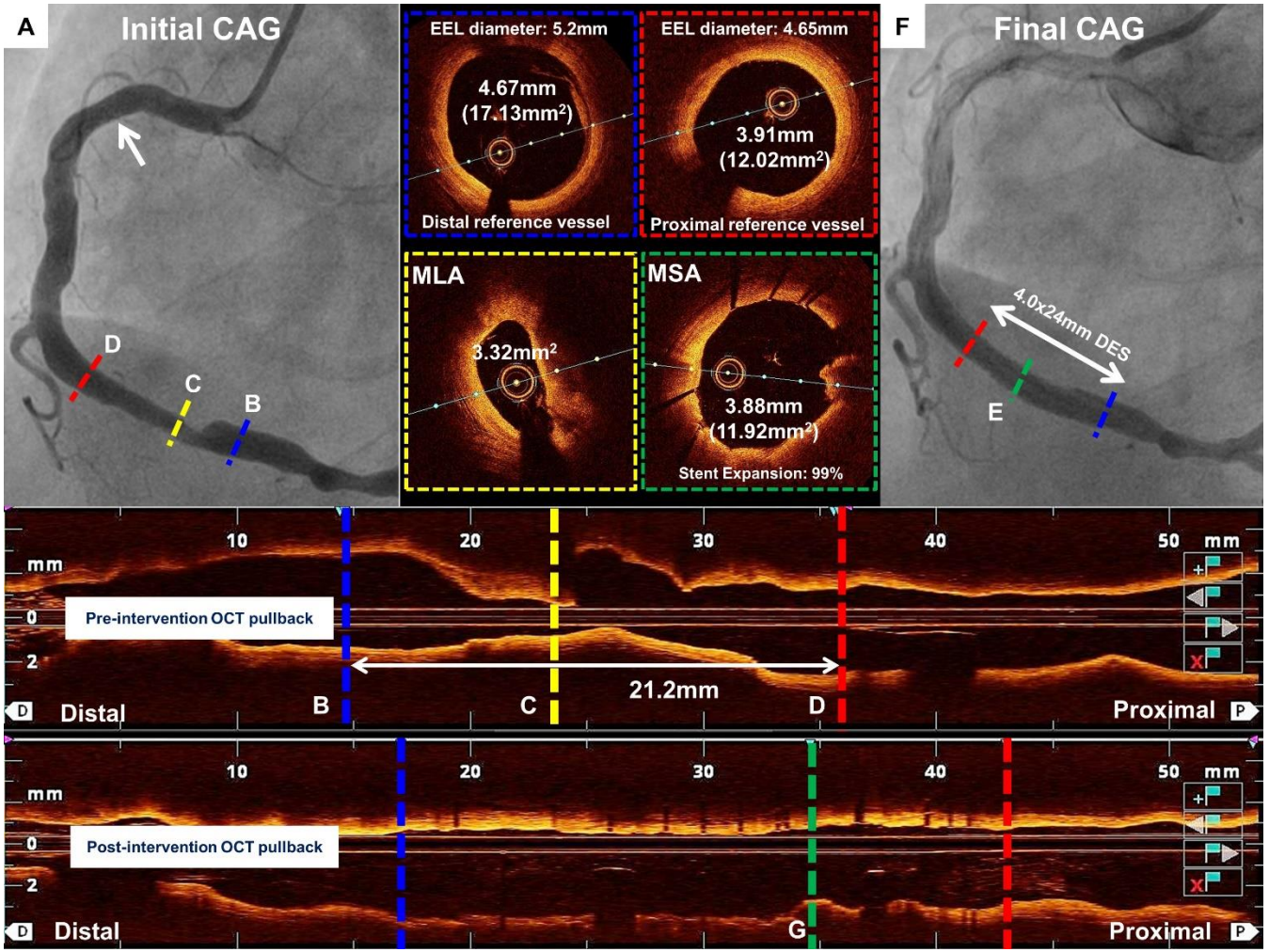




Optimal drug-eluting stent implantation with the aid of optical coherence tomography in the stenotic lesion of ectatic coronary artery

Yongcheol Kim, Myung Ho Jeong, Min Chul Kim, Doo Sun Sim, Young Joon Hong, Ju Han Kim, Youngkeun Ahn

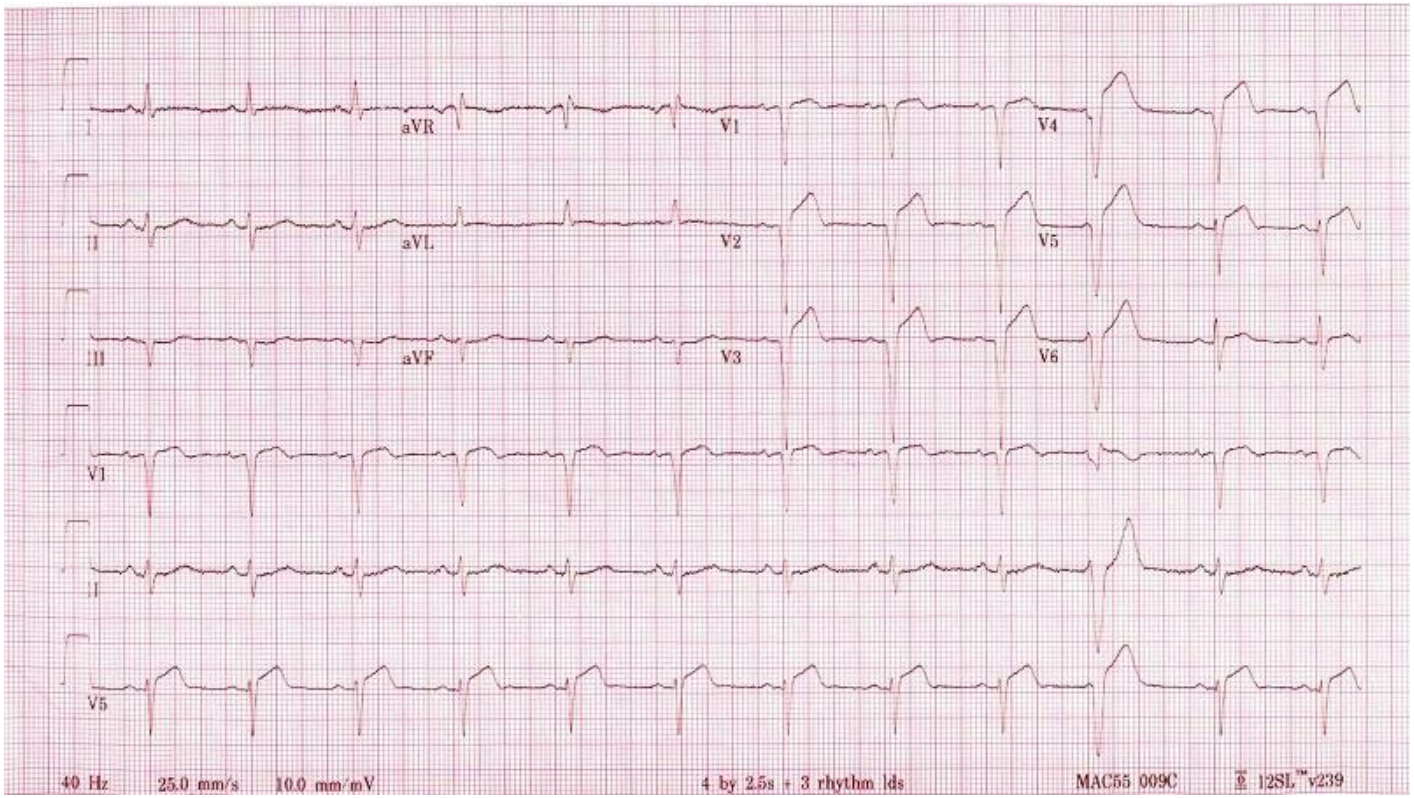
Division of Cardiology, Chonnam National University Hospital, Gwangju, Korea



Cardiol J 2018;25:534-535

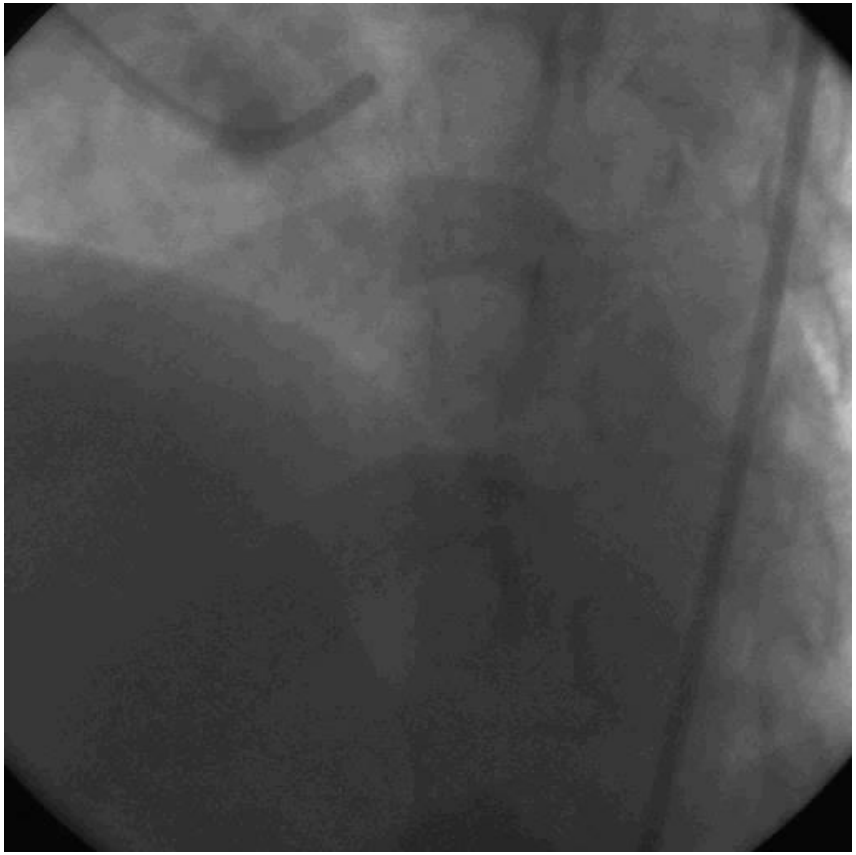
Jo OO (49/F)

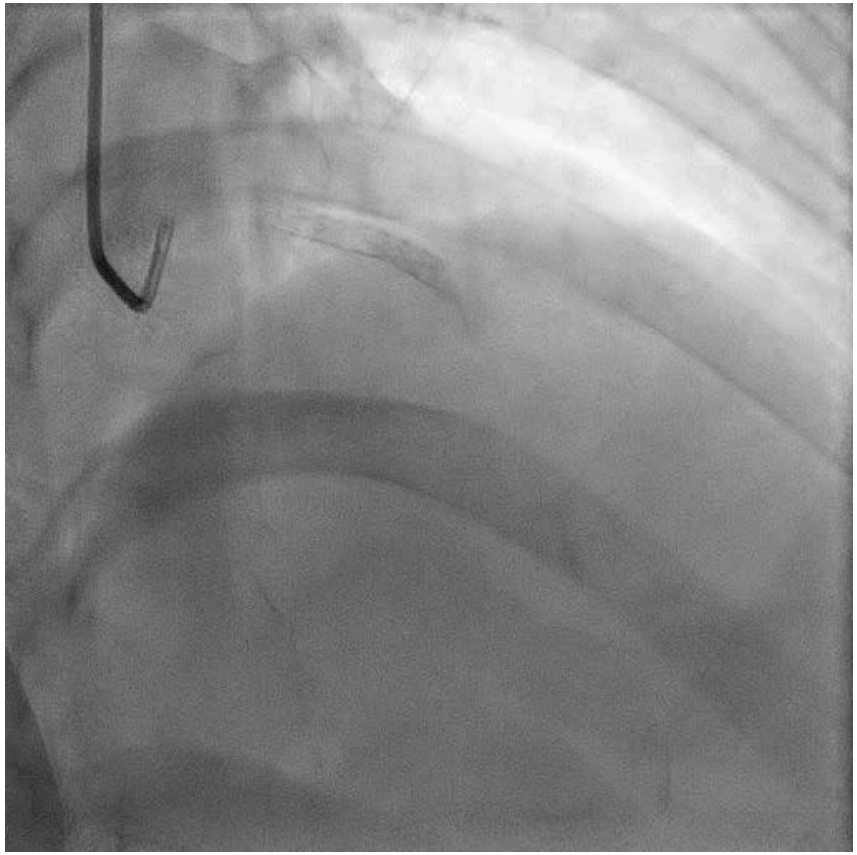
- Sudden onset resting chest pain during the last 6 h
- PCI with DES due to SIHD 9 year ago
- DAPT & statin was discontinued since 3 years ago
- Clopidogrel 600mg loading before PPCI



OCT-guided primary PCI in patients with STEMI

Very Late Stent Thrombosis (VLST)



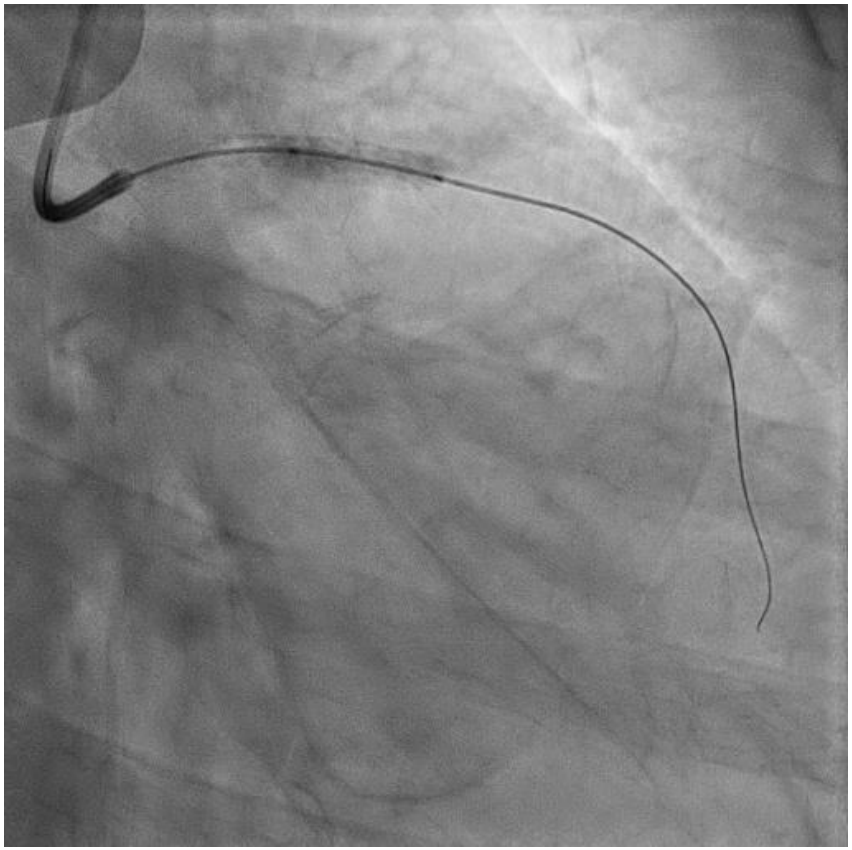


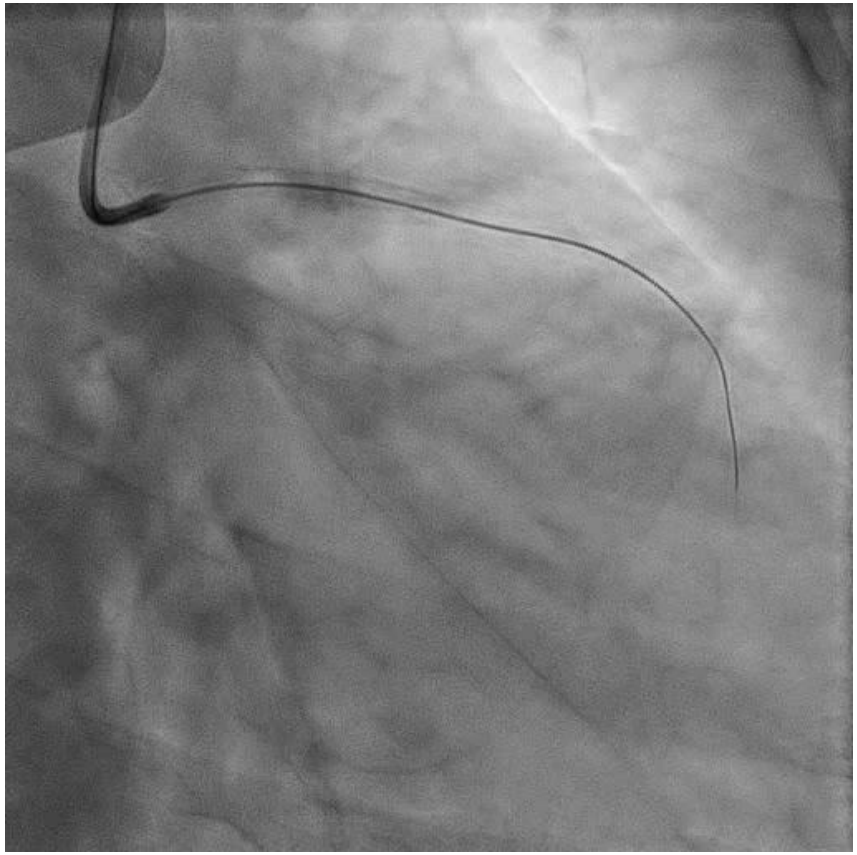
2008.10.17 SAP
3.5x23mm Cypher in pLAD

2017.08.24
Very rate stent thrombosis

OCT-guided primary PCI in patients with STEMI

3.5x23mm Cypher in pLAD in 2008





Predilation with 2.5x10mm balloon in the body and distal portion of stent

FU CAG after predilation

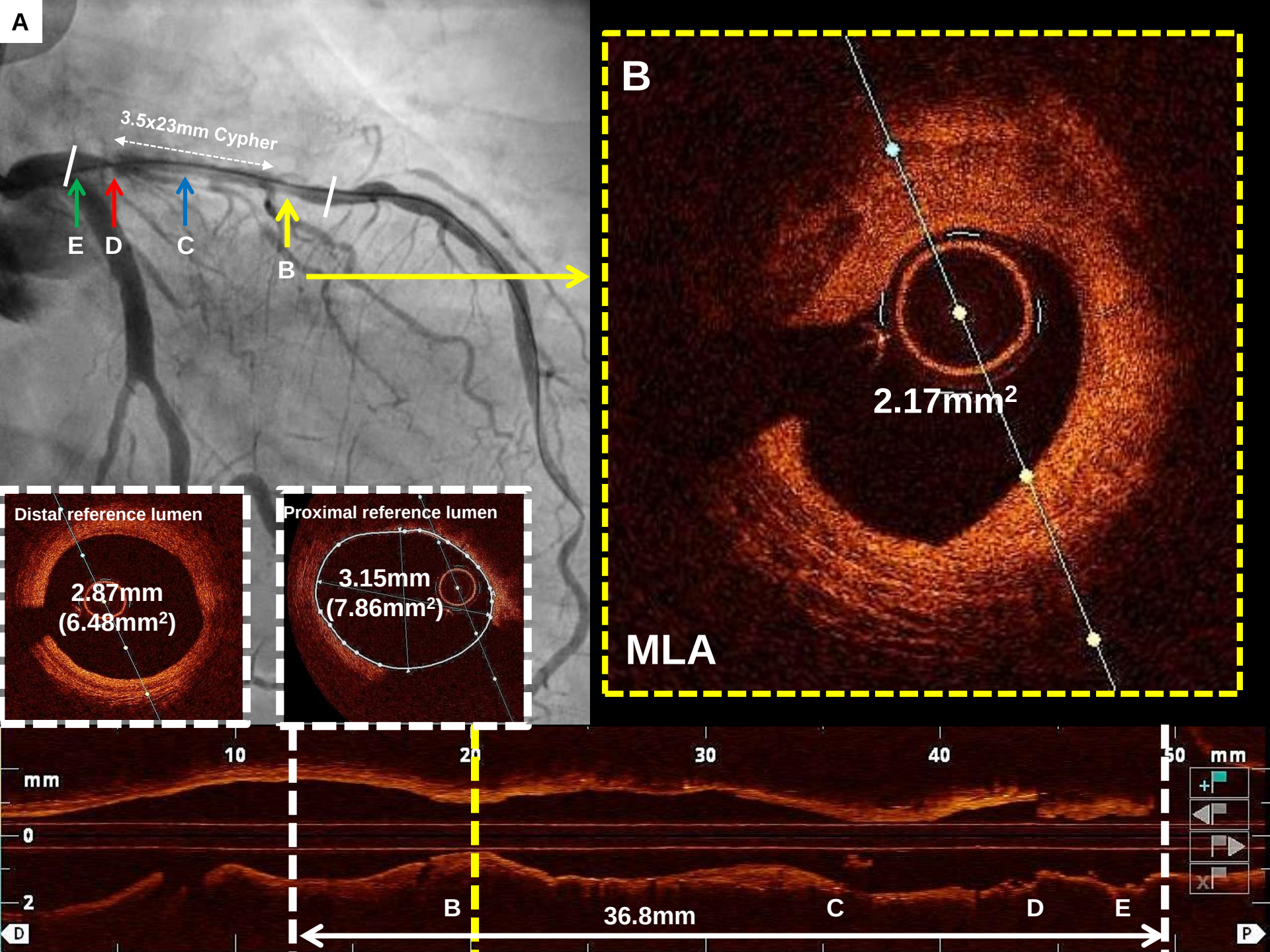
ESC European Society of Cardiology
European Heart Journal (2018) **00**, 1–96
doi:10.1093/eurheartj/ehy394

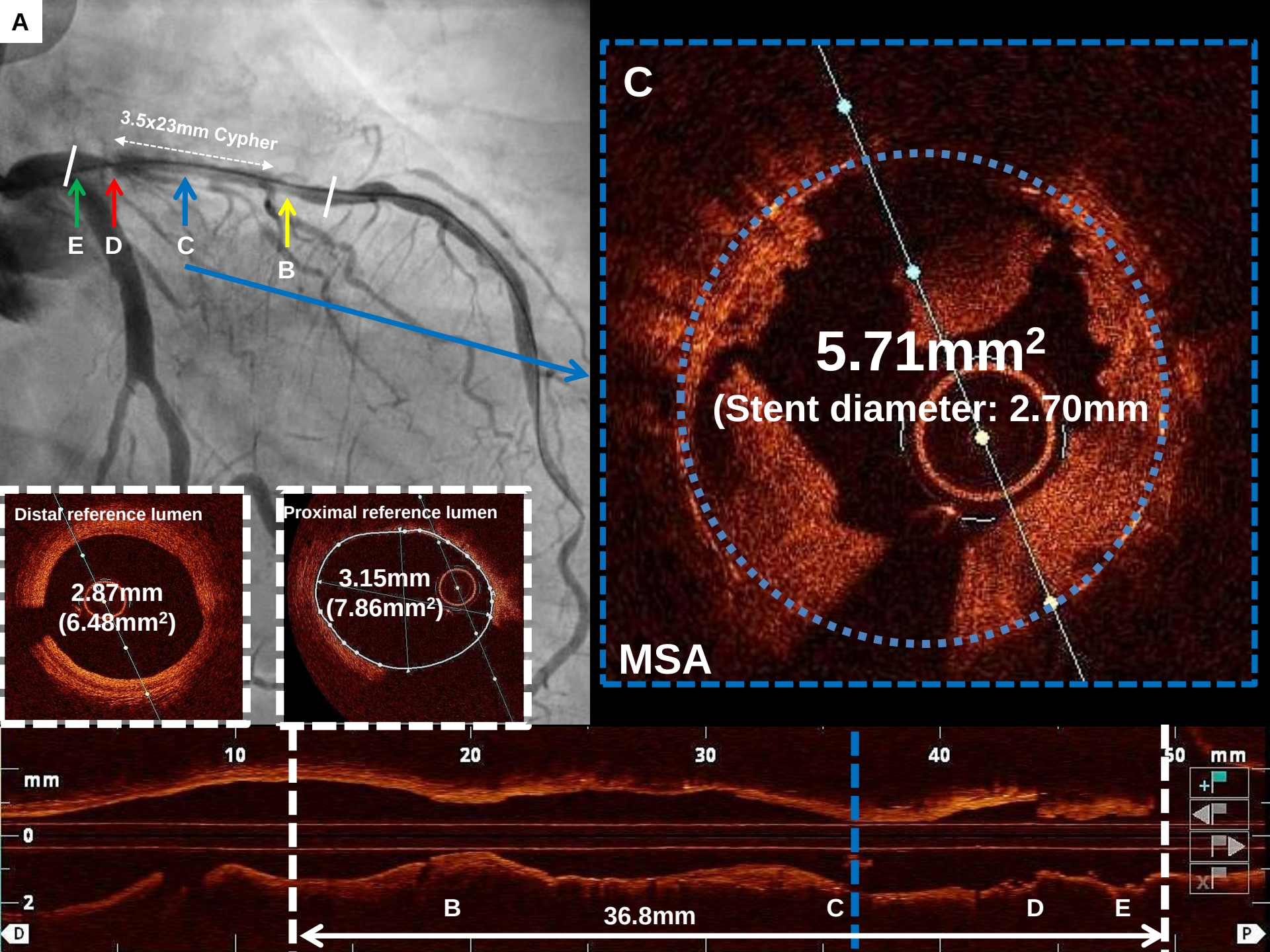
2018 ESC/EACTS Guidelines on myocardial revascularization

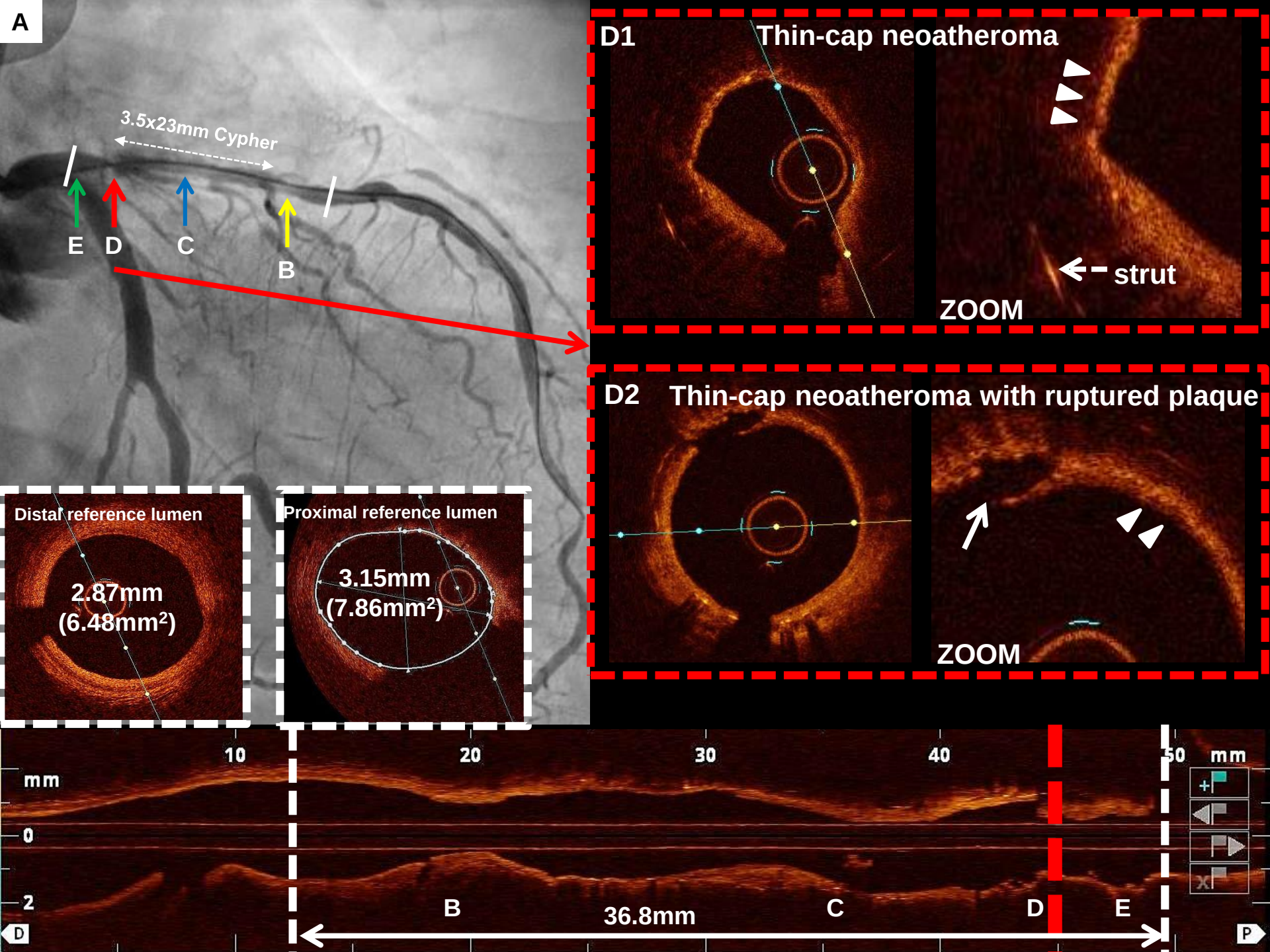
Recommendations on repeat revascularization

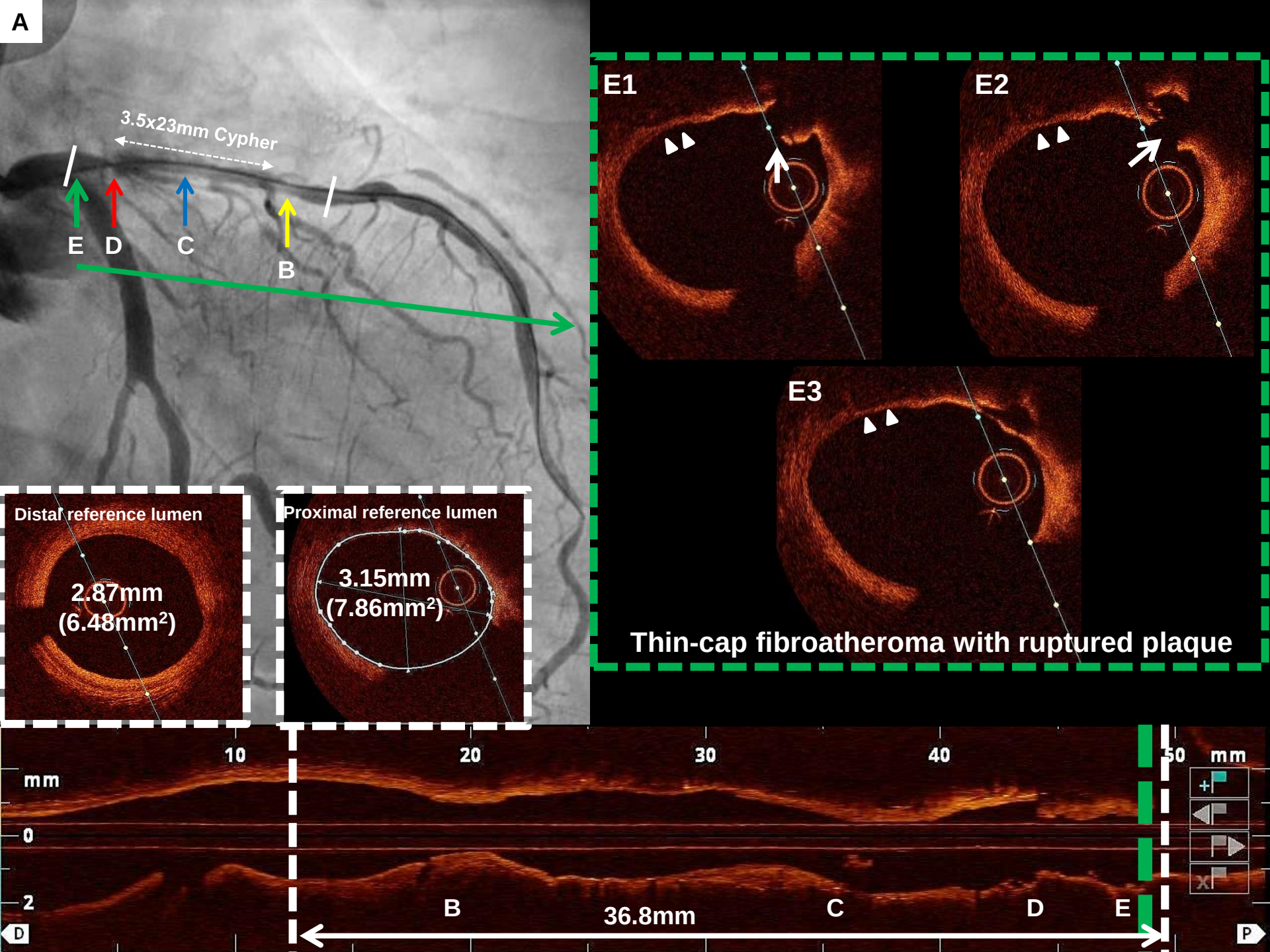
Recommendations	Class[a]	Level[b]
Restenosis		
DES are recommended for the treatment of in-stent restenosis of BMS or DES.[373,375,378,379]	I	A
Drug-coated balloons are recommended for the treatment of in-stent restenosis of BMS or DES.[373,375,378,379]	I	A
In patients with recurrent episodes of diffuse in-stent restenosis, CABG should be considered by the Heart Team over a new PCI attempt.	IIa	C
IVUS and/or OCT should be considered to detect stent-related mechanical problems leading to restenosis.	IIa	C

©ESC 2018


A
3.5x23mm Cypher
E
D
C
B
B
2.17mm²
MLA
Distal reference lumen
2.87mm
(6.48mm²)
Proximal reference lumen
3.15mm
(7.86mm²)
mm
10
20
30
40
50
mm
0
2
B
36.8mm
C
D
E
D
P

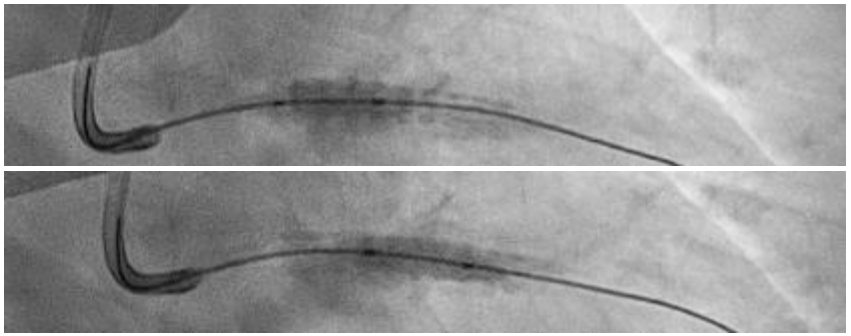

A
3.5x23mm Cypher
E
D
C
B
C
5.71mm²
(Stent diameter: 2.70mm
MSA
Distal reference lumen
2.87mm
(6.48mm²)
Proximal reference lumen
3.15mm
(7.86mm²)
10
20
30
40
50
mm
mm
0
2
B
36.8mm
C
D
E
D
P


A
3.5x23mm Cypher
E
D
C
B
D1
Thin-cap neoatheroma
strut
ZOOM
D2
Thin-cap neoatheroma with ruptured plaque
ZOOM
Distal reference lumen
2.87mm
(6.48mm²)
Proximal reference lumen
3.15mm
(7.86mm²)
mm
10
20
30
40
50
0
2
B
C
D
E
36.8mm
D
P


A
3.5x23mm Cypher
E
D
C
B
E1
E2
E3
Thin-cap fibroatheroma with ruptured plaque
Distal reference lumen
2.87mm
(6.48mm²)
Proximal reference lumen
3.15mm
(7.86mm²)
mm
10
20
30
40
50
mm
0
2
B
C
D
E
36.8mm
D
P

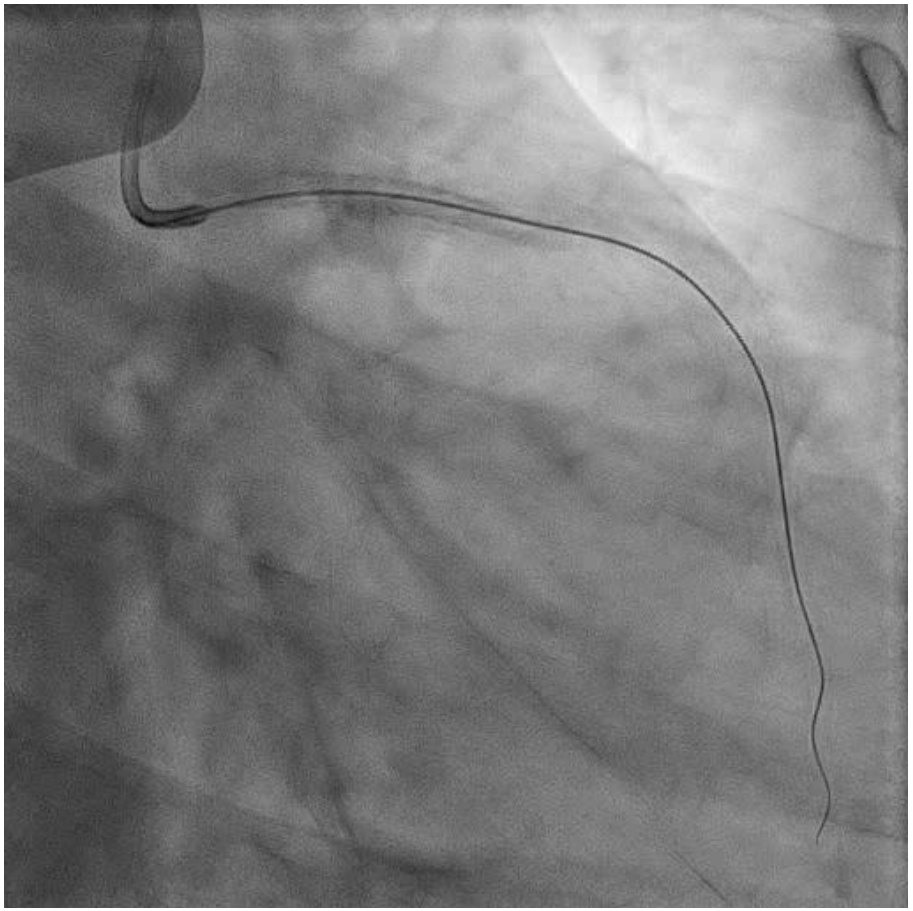
OCT-guided primary PCI in patients with STEMI

3.5x23mm Cypher in pLAD in 2008

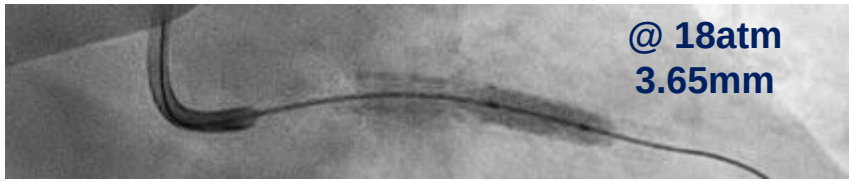


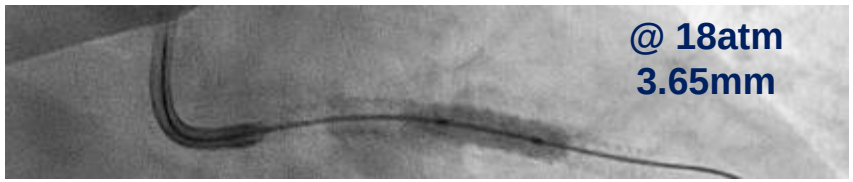
3.5x10mm NC balloon @ 18atm (3.65mm)

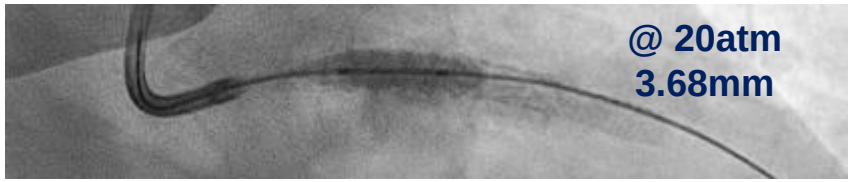
Xience 3.25x38mm @ 10atm (3.22mm)



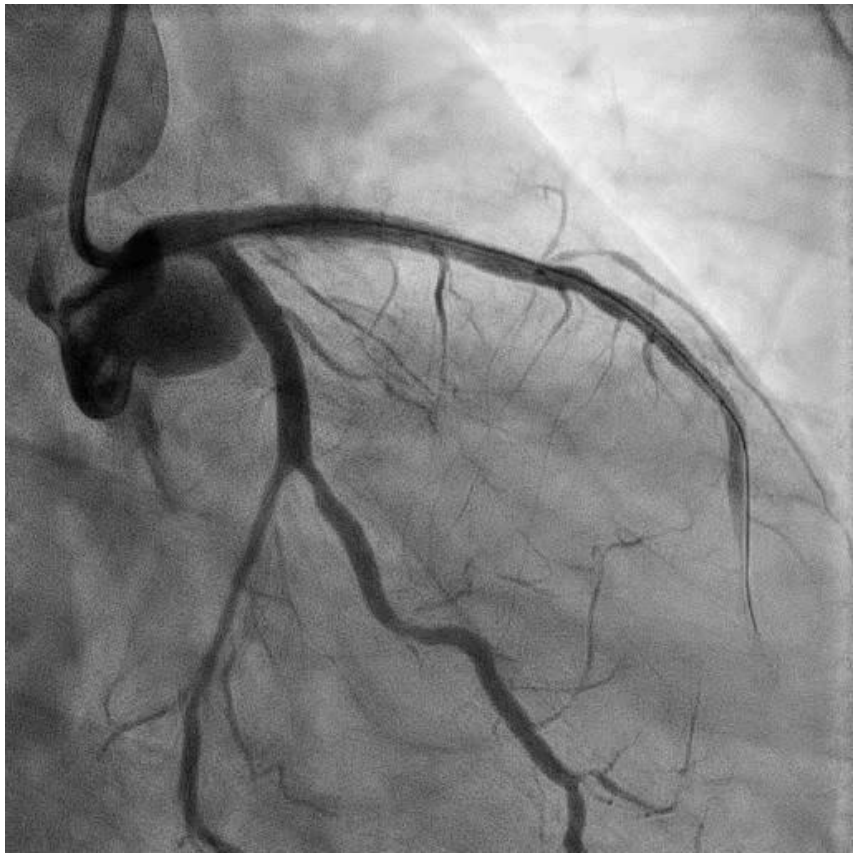
OCT-guided primary PCI in patients with STEMI

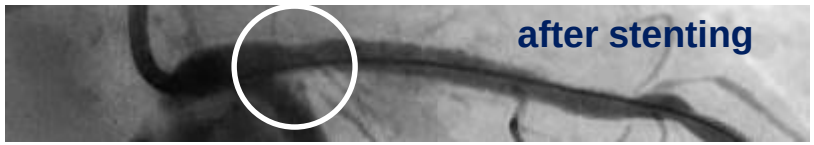


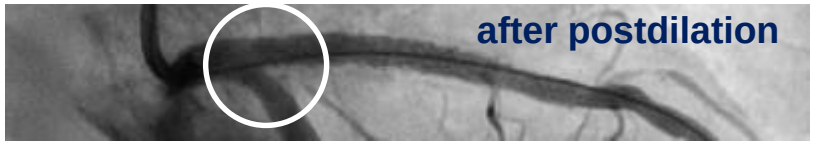


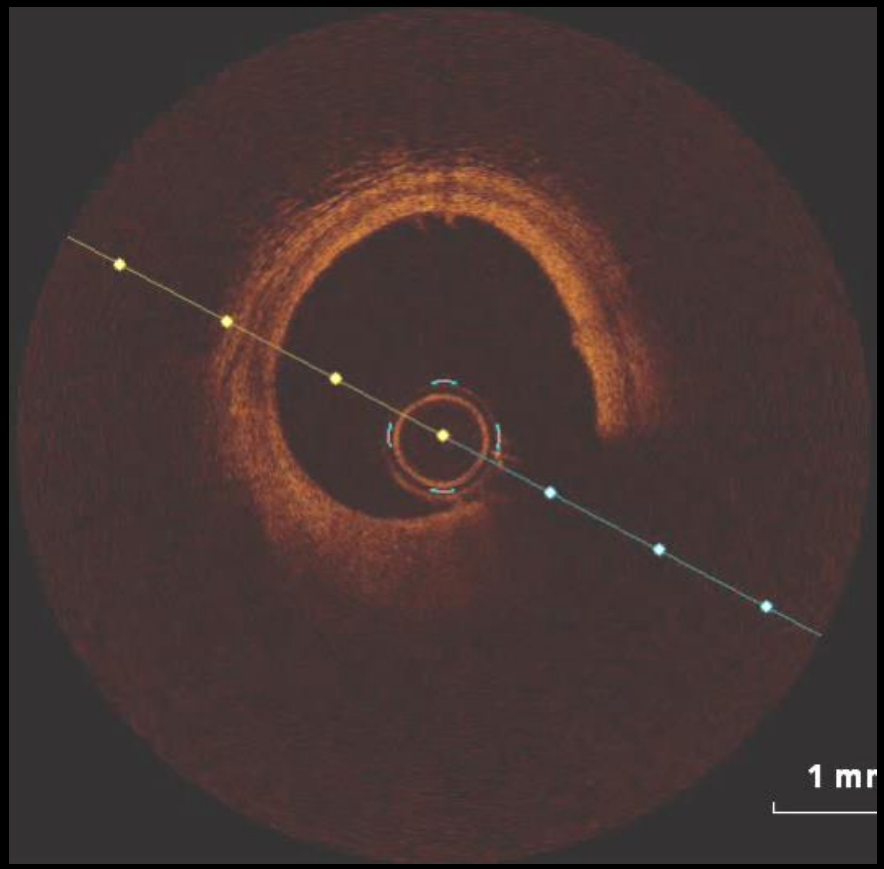


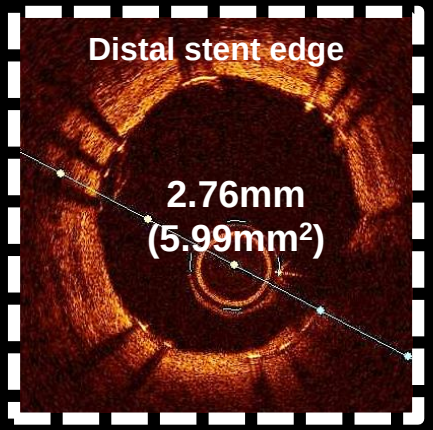
Postdilation with 3.5x10mm NC balloon

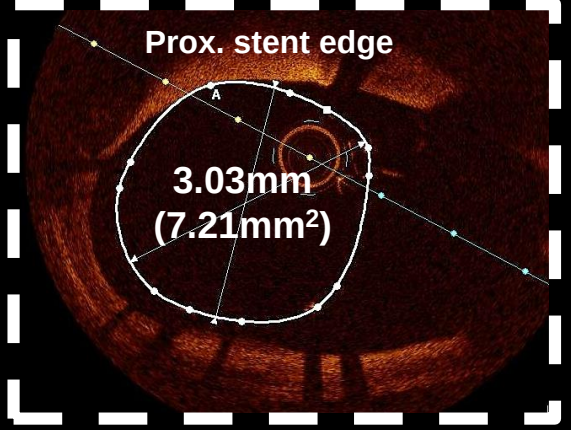


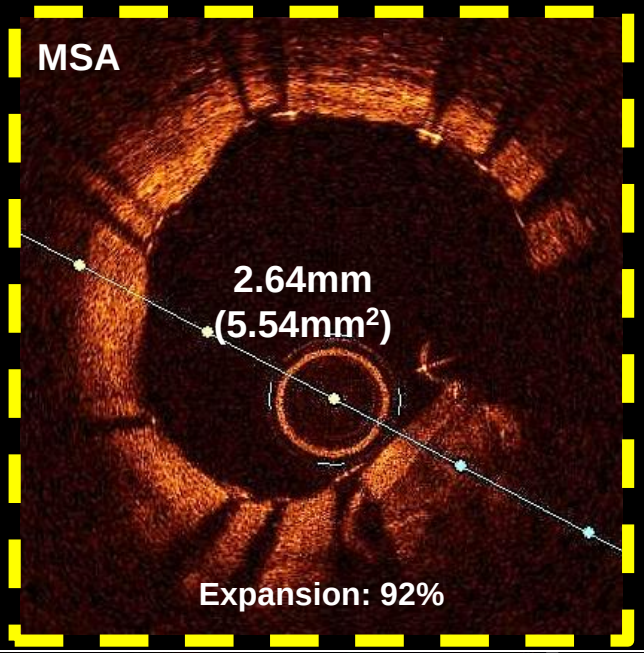


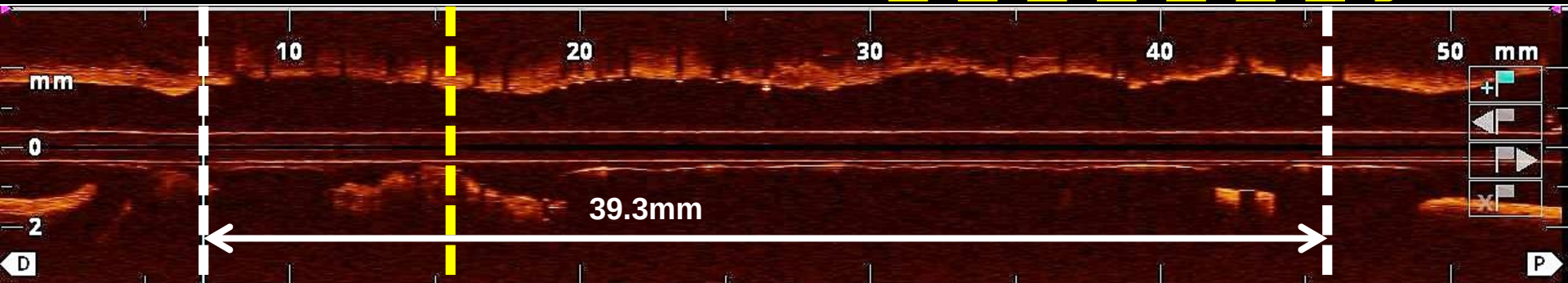



1 mm

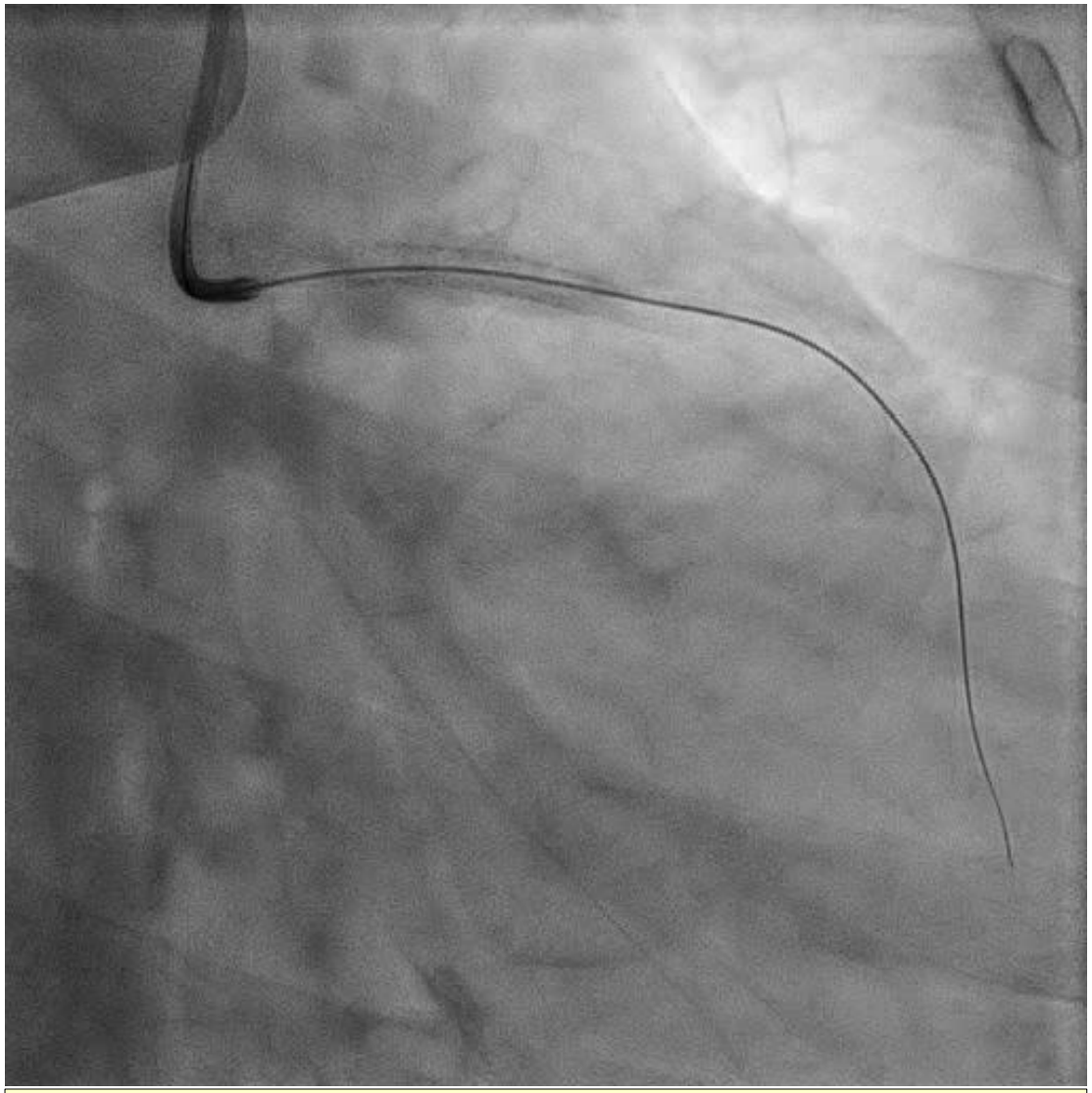

Distal stent edge
2.76mm
(5.99mm²)


Prox. stent edge
3.03mm
(7.21mm²)


MSA
2.64mm
(5.54mm²)
Expansion: 92%


mm
10
20
30
40
50
mm
0
2
39.3mm
D
P

Successful OCT-guided PPCI in patients with STEMI



Final CAG after postdilation with 3.5x10 NC balloon @ 20atm in prox. edge of stent

CARDIOLOGY JOURNAL

November 2017, Vol. 24, No. 6, pp. 589–714 www.cardiologyjournal.org

Very late stent thrombosis derived from thin-cap neoatheroma and fibroatheroma with plaque rupture assessed by optical coherence tomography

Editors-in-Chief:

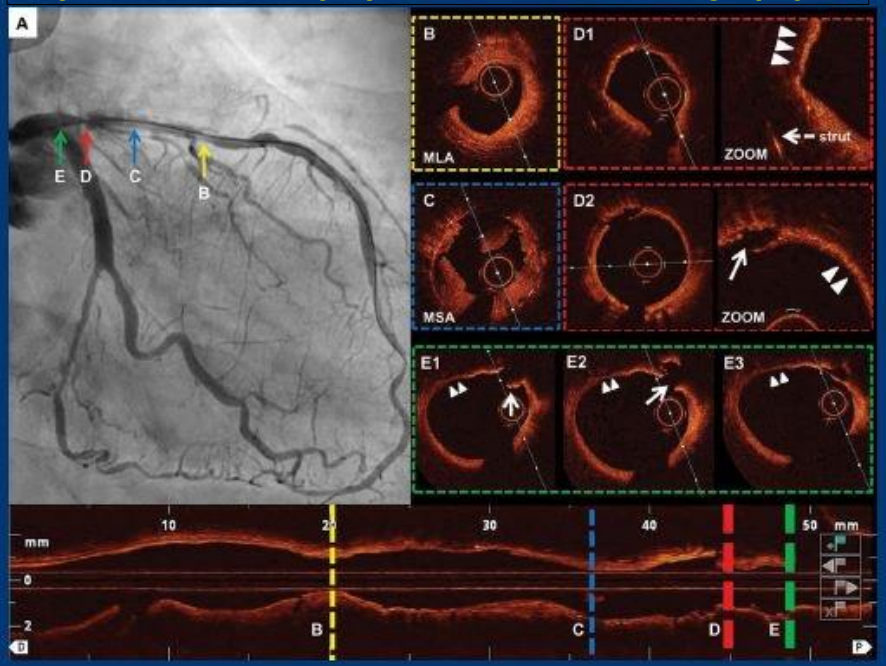
Juan Luis Gutiérrez-Chico
Miłosz J. Jaguszewski

Section Editors:

José Luis Zamorano
Carlo Di Mario
Paweł Buszman
Heleen van Beusekom
Philipp Sommer

International Honorary Editor:

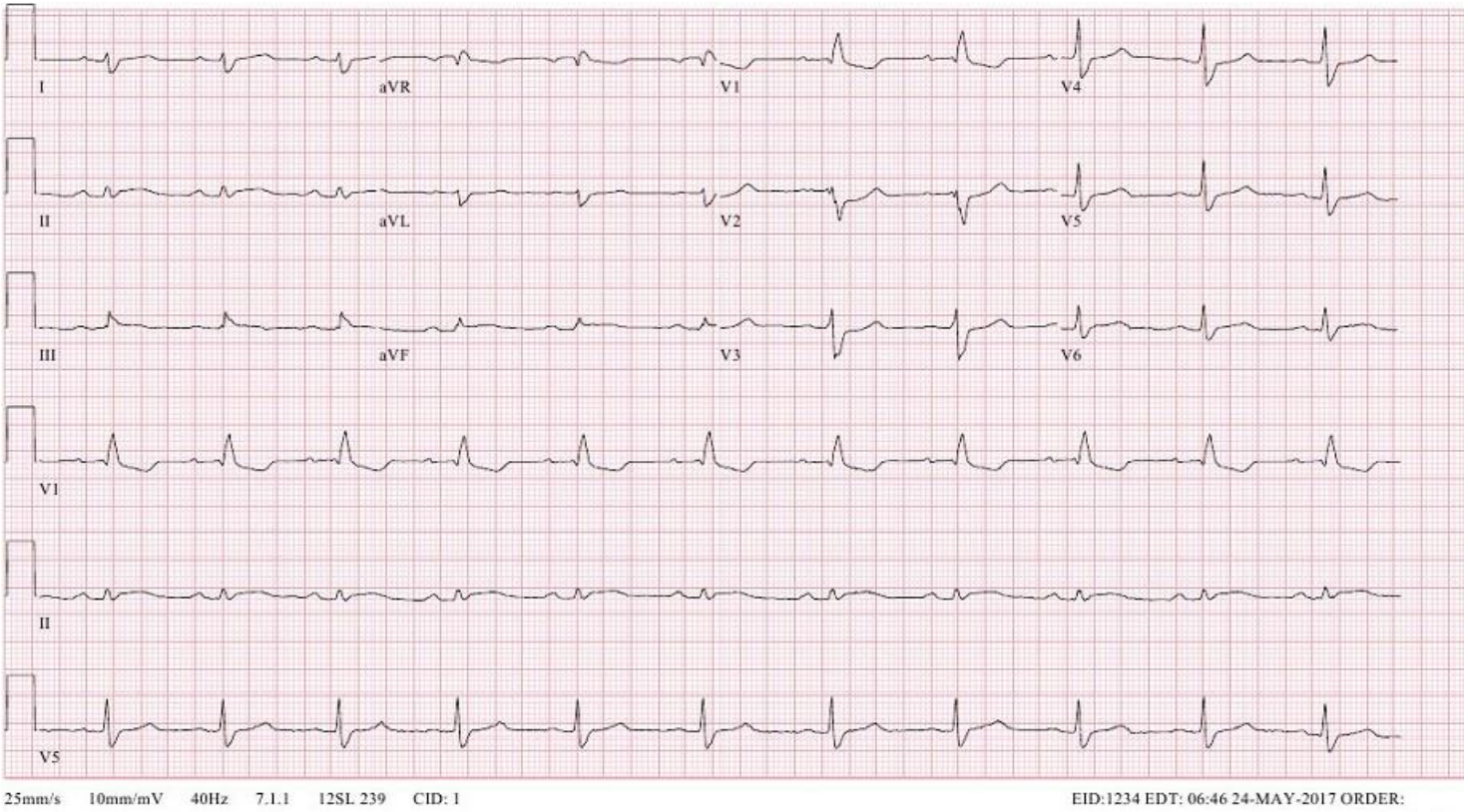
Thomas F. Lüscher



Kim Y et al., see figure legend on page 704

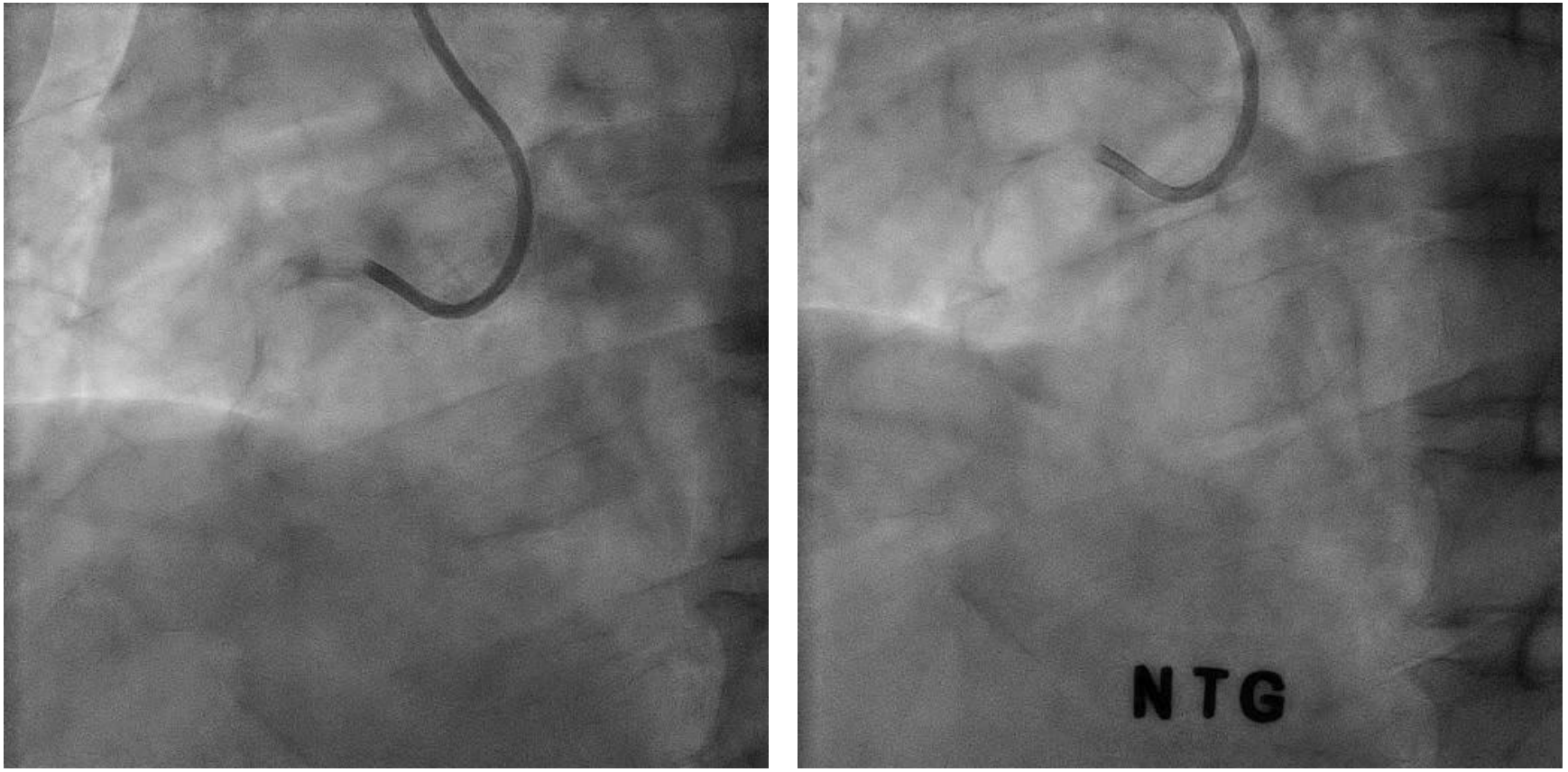
Oh OO (72/M)

- Known DM, never smoking and alcohol
- Intermittent resting chest pain at rest 5 hours ago
- HR: 78bpm BP: 140/87 Chest: clear
- hsTroponin-T 3.20 ng/mL (Troponin I 16.1 ng/ml)



Urgent Coronary angiogram

LAO view



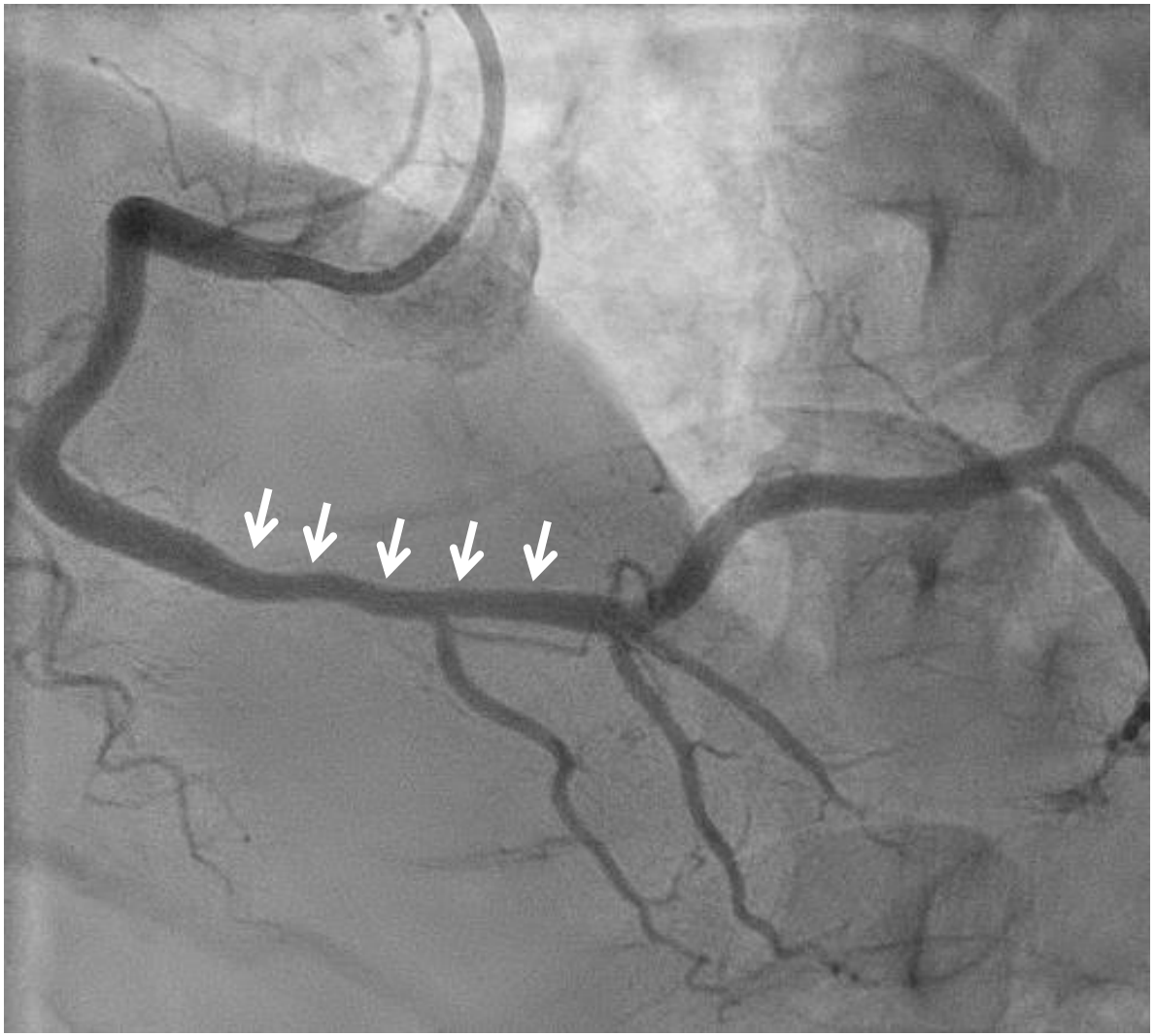
RCA dominant system and mild to intermediate stenosis from dRCA to PL br.

What should we do?

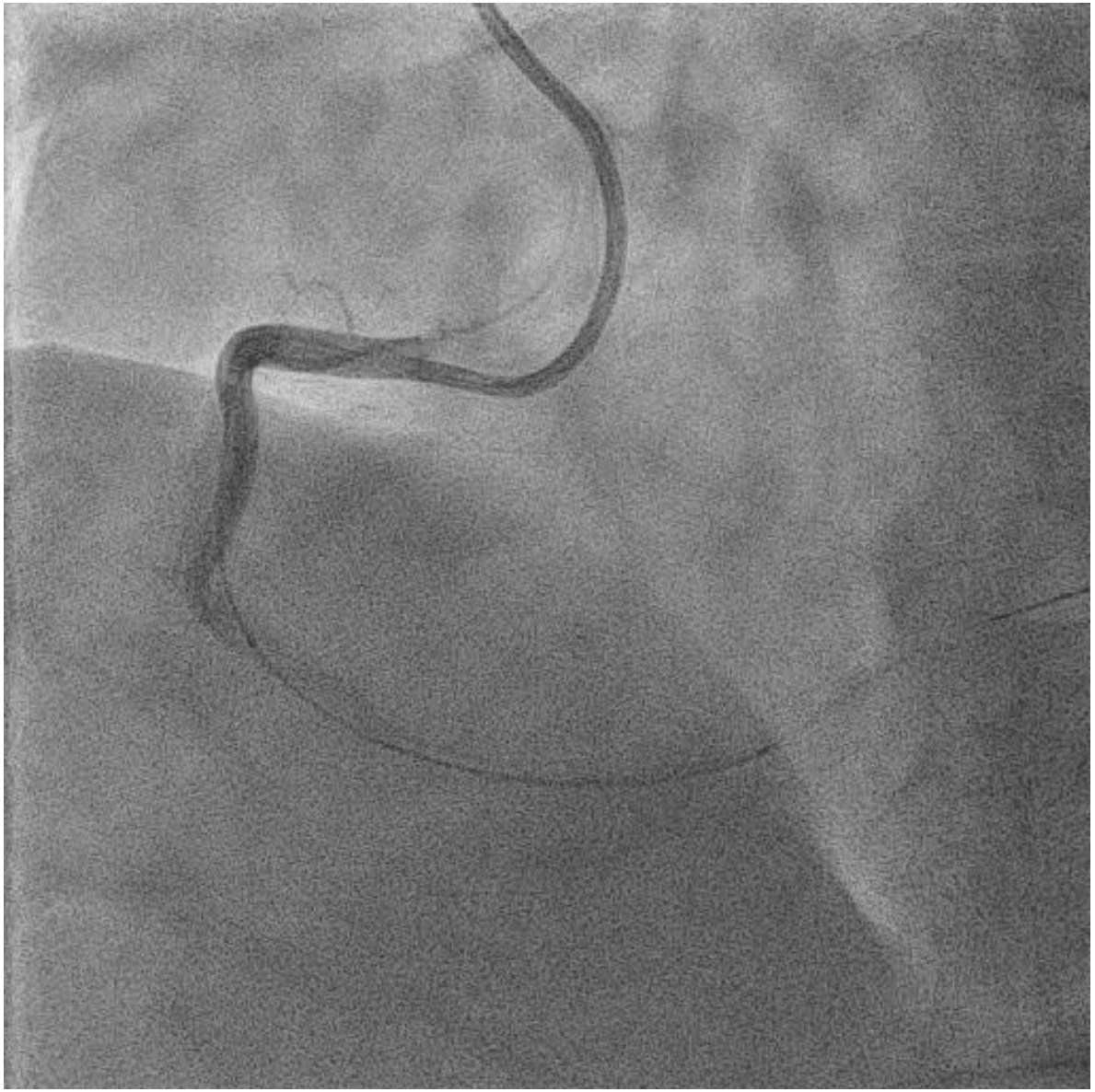
Ambiguous CAG + elevated Troponin + chest pain

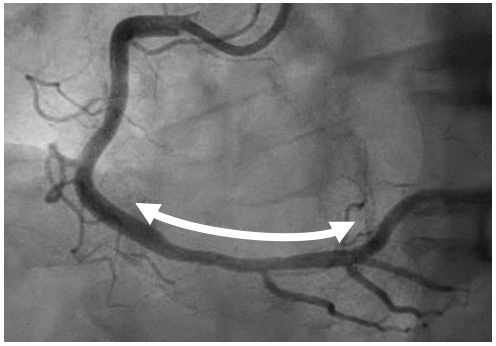
What should we do?

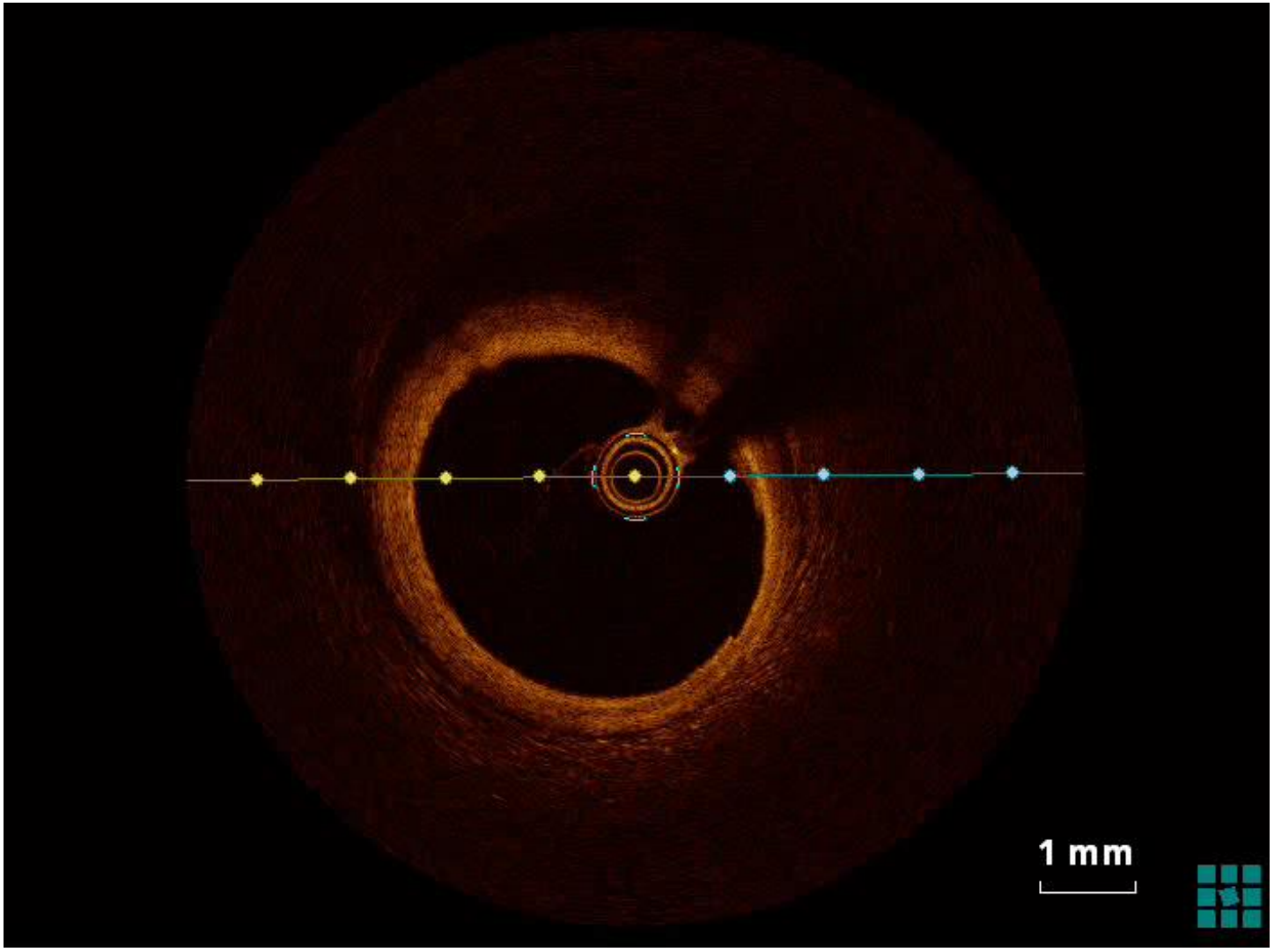
Ambiguous CAG + elevated Troponin + chest pain

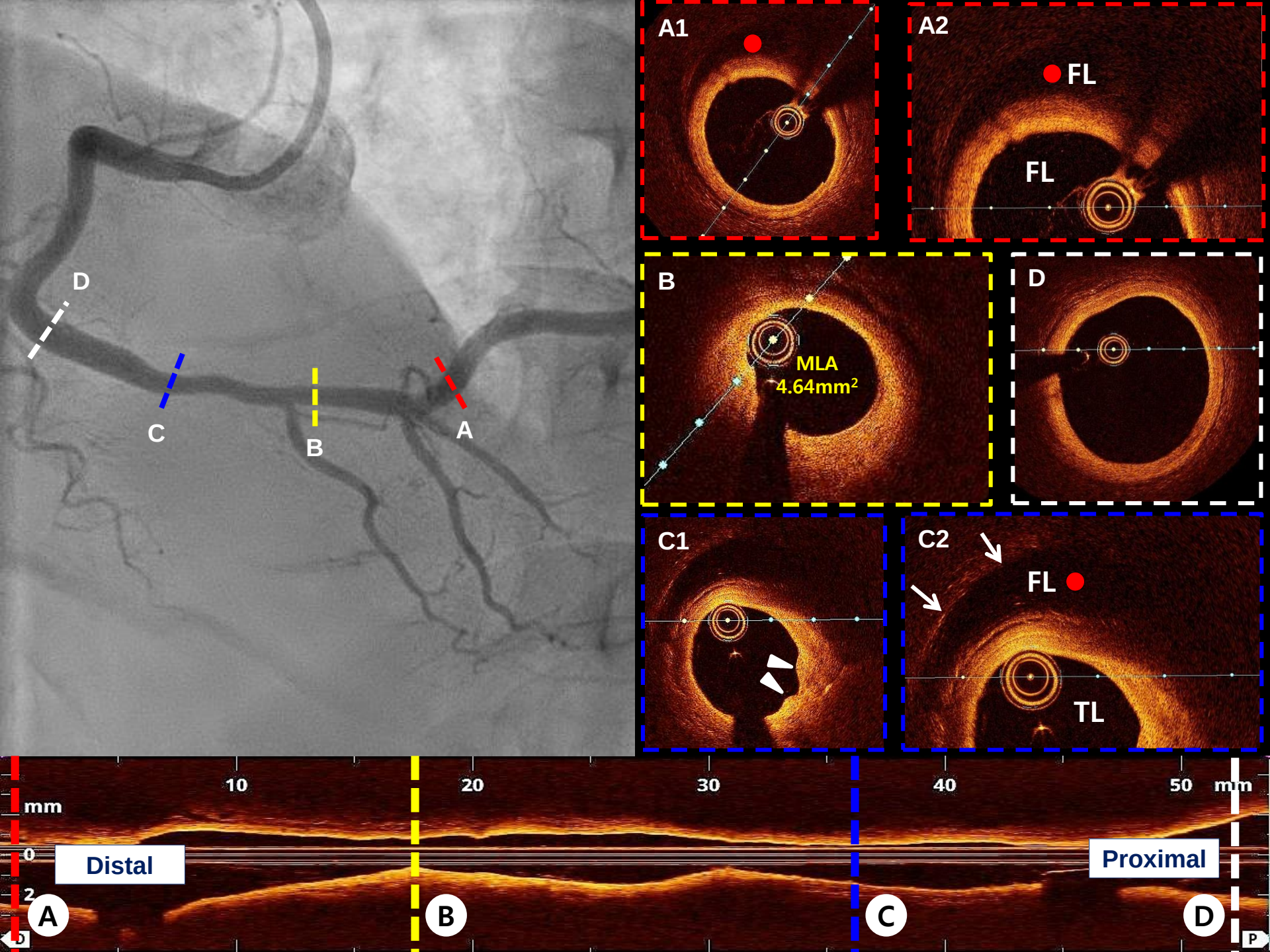


OCT for assessment of lesion characteristics

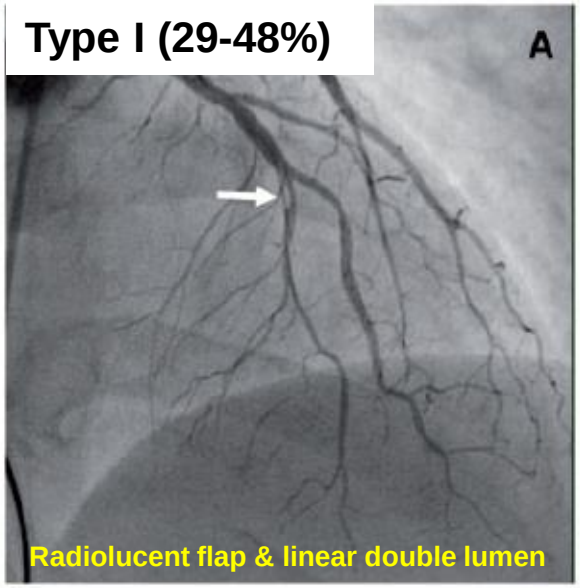


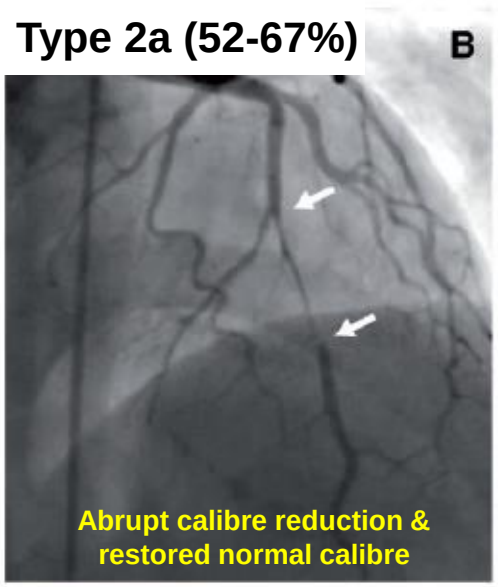


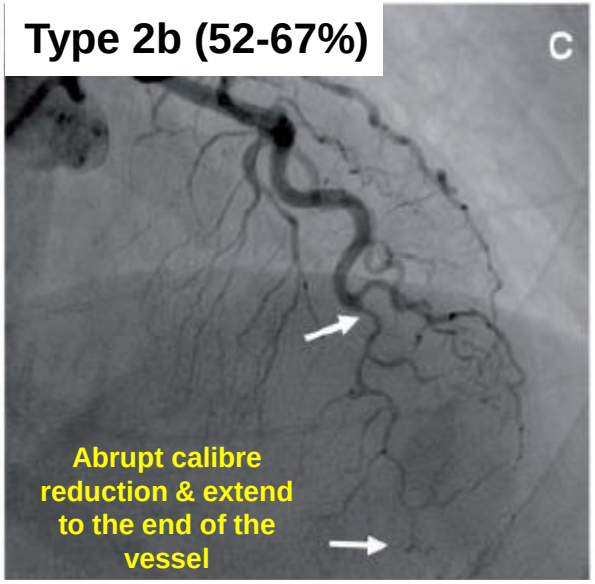

1 mm

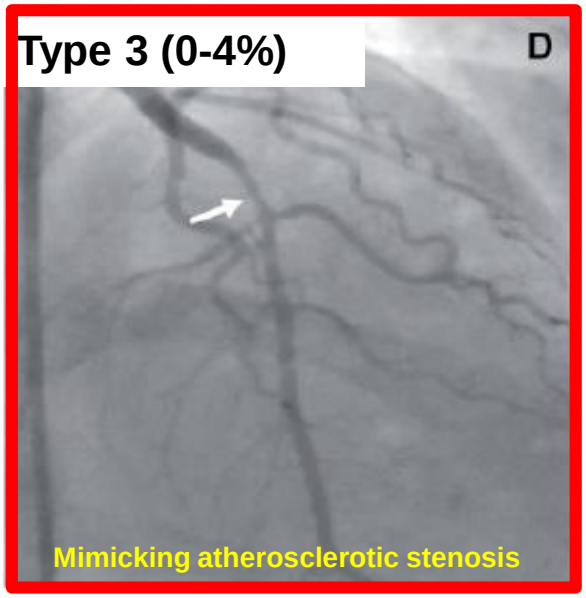

D
C
B
A
A1
A2
FL
FL
B
MLA
4.64mm²
D
C1
C2
FL
TL
mm
10
20
30
40
50
mm
0
2
Distal
Proximal
A
B
C
D
D
P

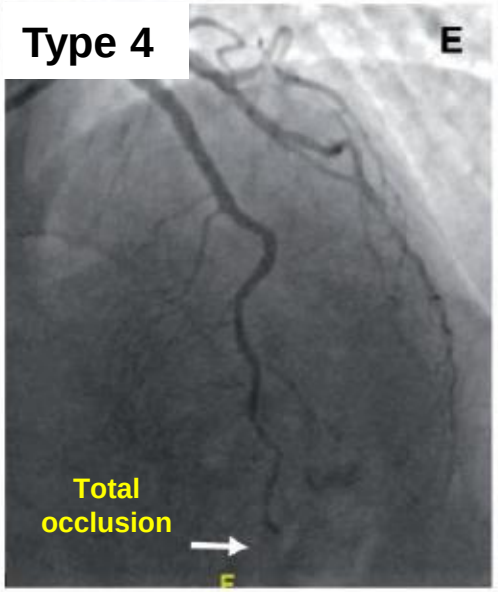
Type of spontaneous coronary artery dissection







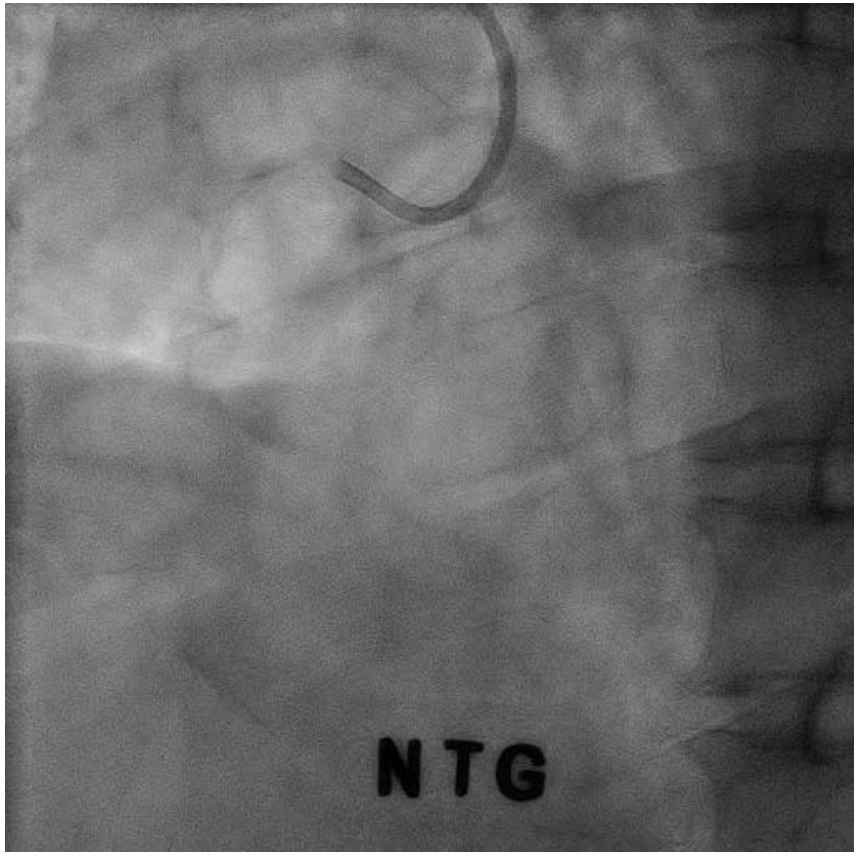


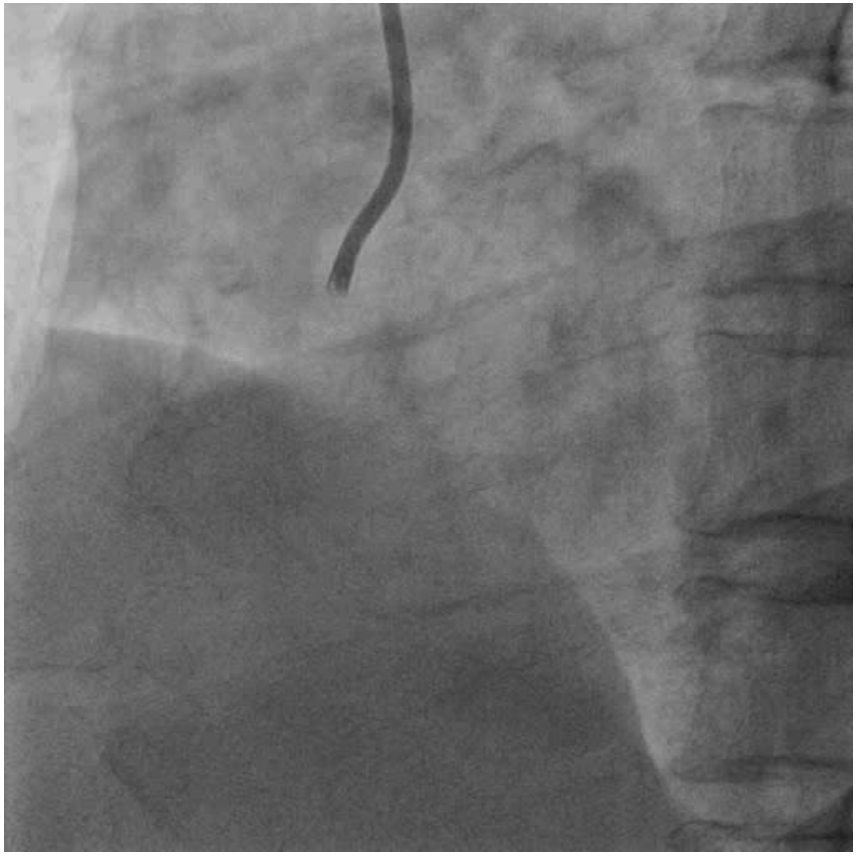


JACC Cardiovasc Interv 2015;8:1704-14

FU CAG after 6 month DAPT

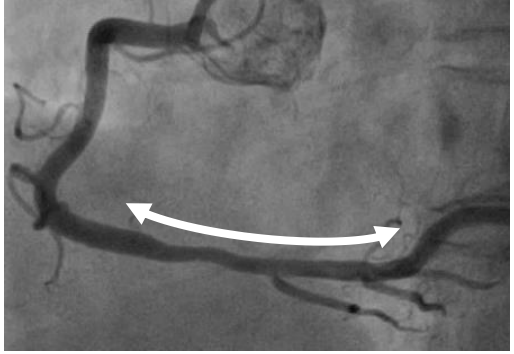
LAO view

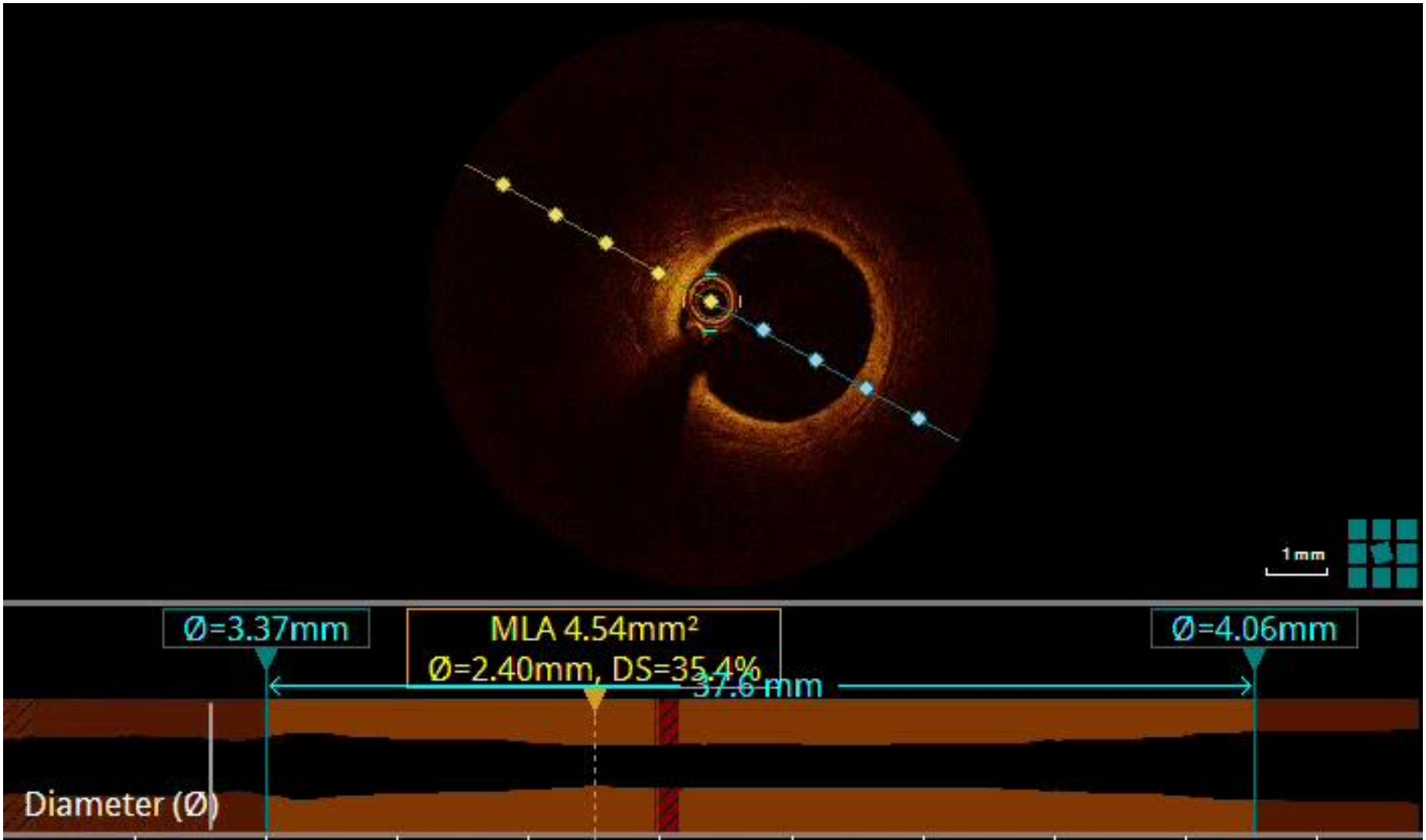




Initial CAG

6-month FU CAG

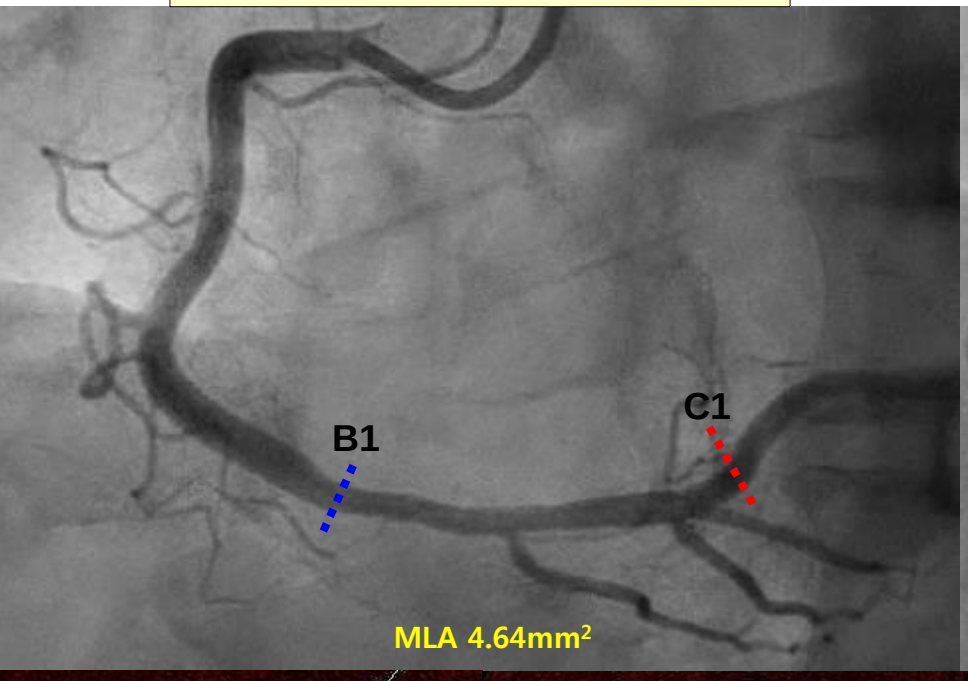


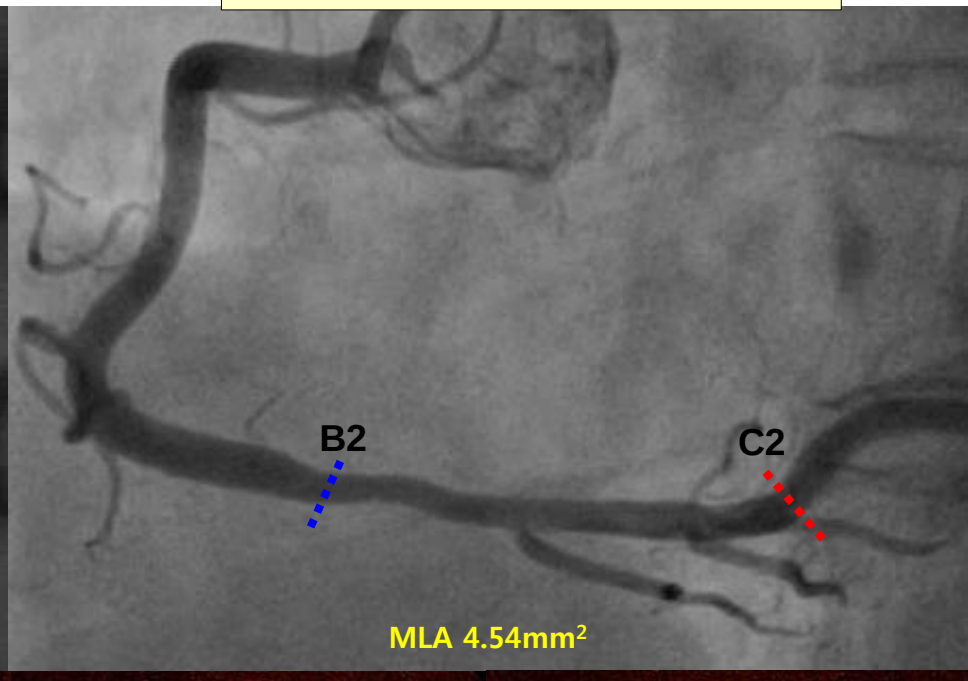

1 mm
Ø=3.37mm
MLA 4.54mm²
Ø=2.40mm, DS=35.4%
Ø=4.06mm
37.6 mm
Diameter (Ø)

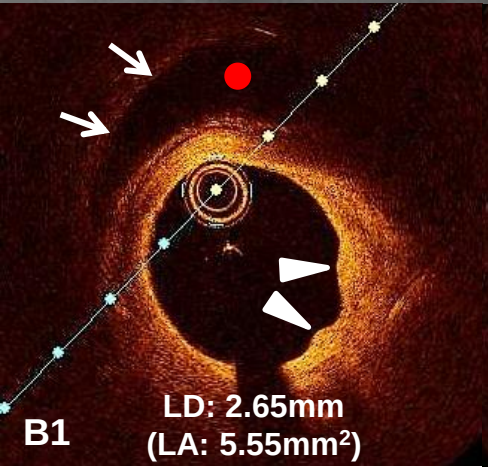
Comparison Initial with 6-month

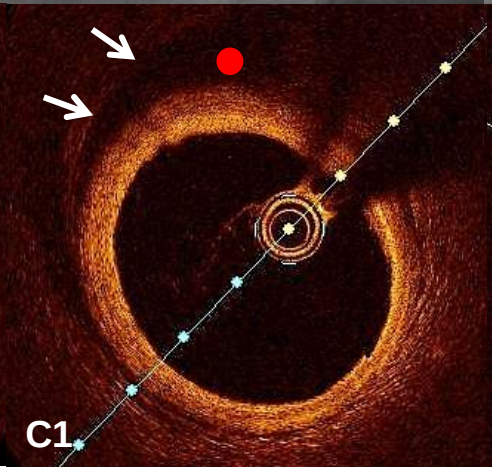
Initial CAG & OCT

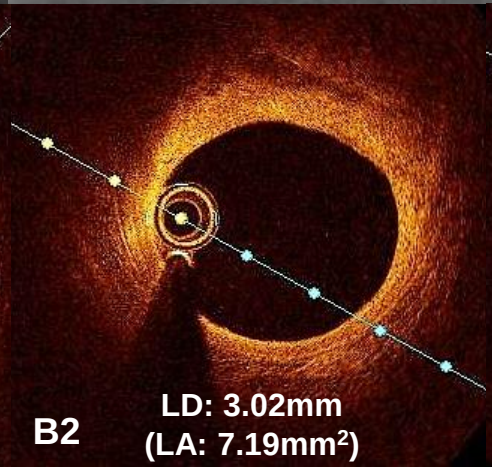
6-month FU CAG & OCT

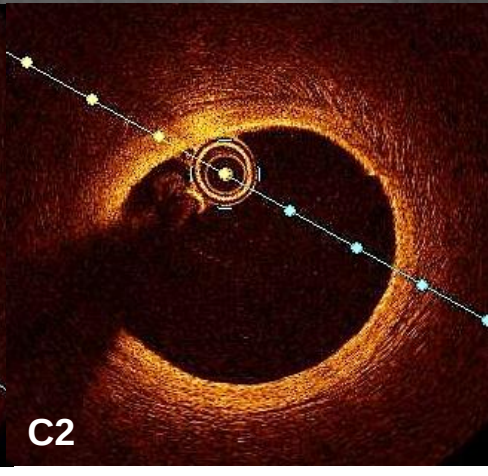












VIA MEDICA

IMAGE IN CARDIOVASCULAR MEDICINE

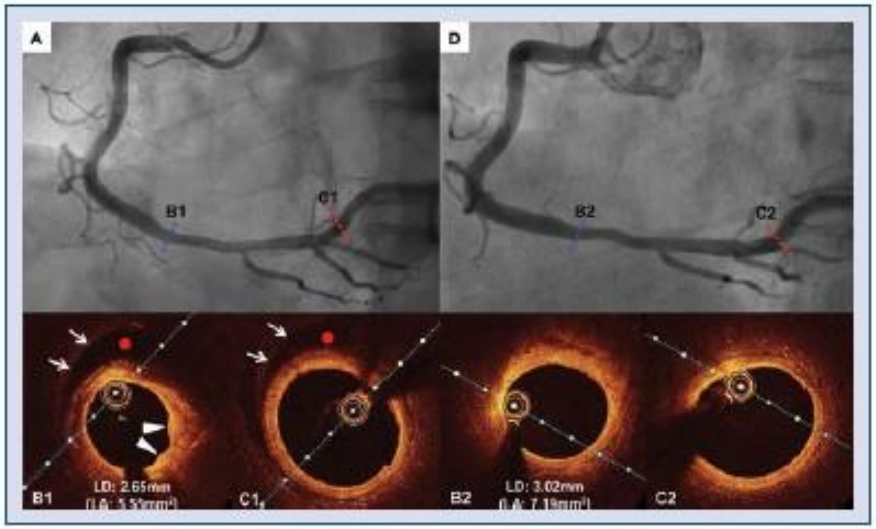
Cardiology Journal
2018, Vol. 25, No. 4, 596–597
DOI: 10.5603/CJ.2018.0086
Copyright © 2018 Via Medica
ISSN 1897–5593

Assessment for ambiguous angiographic finding in patient with acute myocardial infarction by optical coherence tomography

Yongcheol Kim, Myung Ho Jeong, Min Chul Kim, Doo Sun Sim, Young Joon Hong, Ju Han Kim, Youngkeun Ahn

Division of Cardiology, Chonnam National University Hospital, Gwangju, Korea

A 72-year-old man with history of treated hypertension, presented with sudden onset of chest pain at rest and evidence of minimal ST-segment elevation in the inferior electrocardiogram leads. Urgent coronary angiography (CAG) demonstrated the diffuse mild stenosis from distal right coronary artery (RCA) to posterolateral branch (Fig. 1A). The non flow-limiting nature of the lesion and the suspicious RCA, potentially a culprit lesion, led to assessment with optical coherence tomography (OCT). OCT demonstrated false lumen with intramural hematoma between distal RCA and posterolateral branch and folding of the luminal intimal contour at distal RCA (Fig. 1 — B1, C1).



Take Home Message

- **If IVUS can do it, OCT can do it as well**

  (Except for very limited cases such as os-LM disease or TIMI flow ↓)

- **Especially, OCT can give precise information to stent optimization in the setting of stent failure and dilated coronary artery.**

- **OCT can be useful tool for evaluation of ambiguous angiographic finding.**

- **Do not think of OCT as a research tool anymore.**

Thank you for your attention