New findings from OCT, PCI-guidance and evaluation of vulnerable plaque

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Improvement of OCT machine in ILUMIEN OPTIS (C8)
New 2 modes for pull back

Long Pullback Survey-mode (S-mode)

By S-mode, able to scan coronary of 75mm length with one pull back.(almost 1/2~ 2/3 of one vessel).

- Useful for pre-PCI lesion assessment to select the stent landing zone.
- Useful for three vessel scanning for unstable plaque detection.

High-density Pullback (HD-mode)

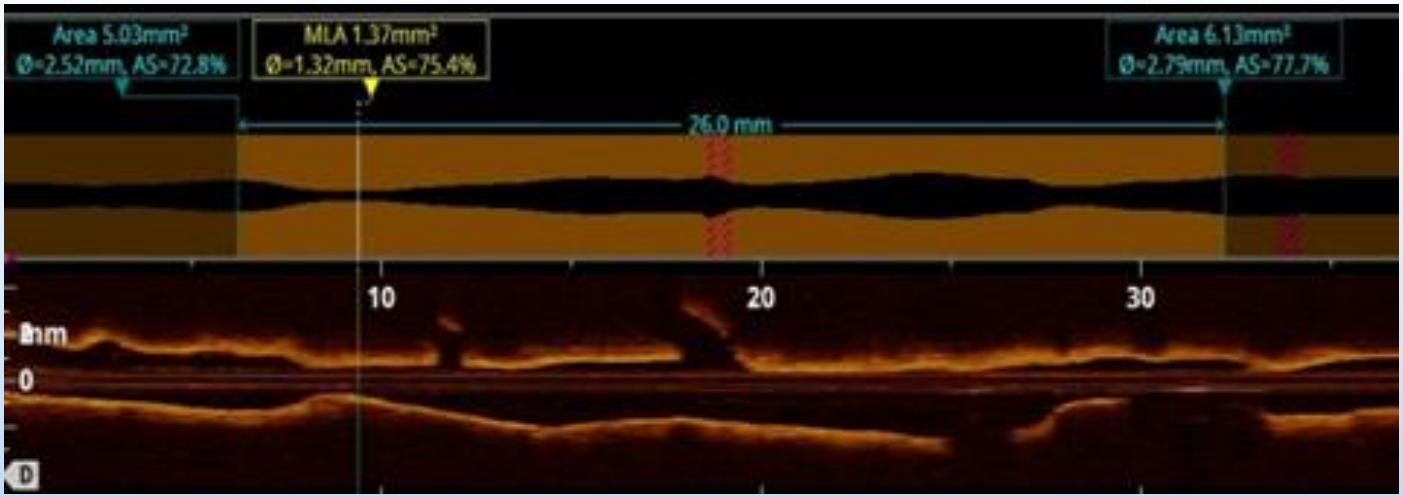
By HD-mode, 3D reconstruction image can be obtained.

- Useful for assessment of coronary morphology, or stent strut configuration especially in bifurcation lesion.

Automated Lumen Profile

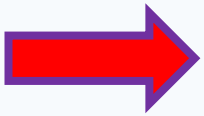
This shows mean diameter in every frame in long axis view.

- Operator can easily determine stent size and length according to the lumen profile display.



Number of catheterization in our hospital 2012.10.01～2013.09.30

	NO
CAG	1074
PCI	451
OCT	353
IVUS	77
others	21



OCT-guided PCI

78.3%

To get clear OCT image

Power injecter is useful

- Flow rate
  - RCA: 2.5～4.0ml/sec
  - LCA: 3.0～4.0ml/sec
- Volume limit
  - Flow rate x 4 sec (10～16ml)

To minimize contrast volume in OCT procedure

- Do simultaneous procedure of angiography and OCT image aquisition.
- Stop contrast injection if the OCT lens just cross the lesion of interest.
- To evaluate stent expansion, OCT scanning without flushing is useful.

OCT is Useful for PCI guide especially in

1. Bifurcation stenting

2. Rotablation for calcified lesion

3. Guide for ACS PCI

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3. Guide for ACS PCI

OCT 3D reconstruction is useful to guide PCI in bifurcation lesion

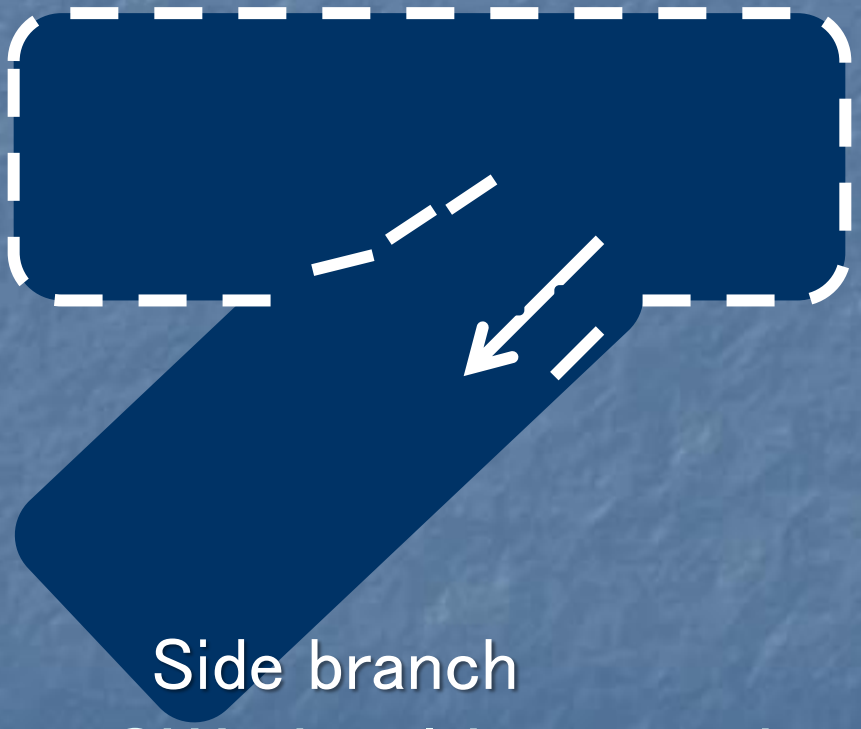
How should we treat for bifurcation lesion

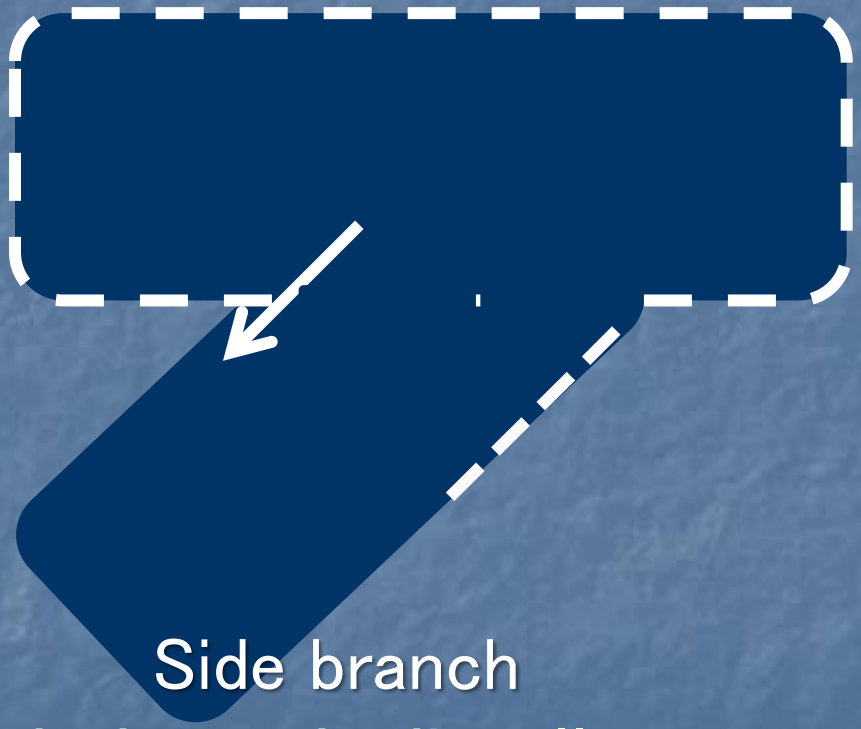
For bifurcation, most of the lesions should be finished with single stenting with KBT. Otherwise, culotte or T-stenting.
In these lesions, stent full expansion, well apposition with side branch orifice opening is important.

The case of single stenting with KBT

If the GW cross the side branch proximally, jailed struts remain at carina.

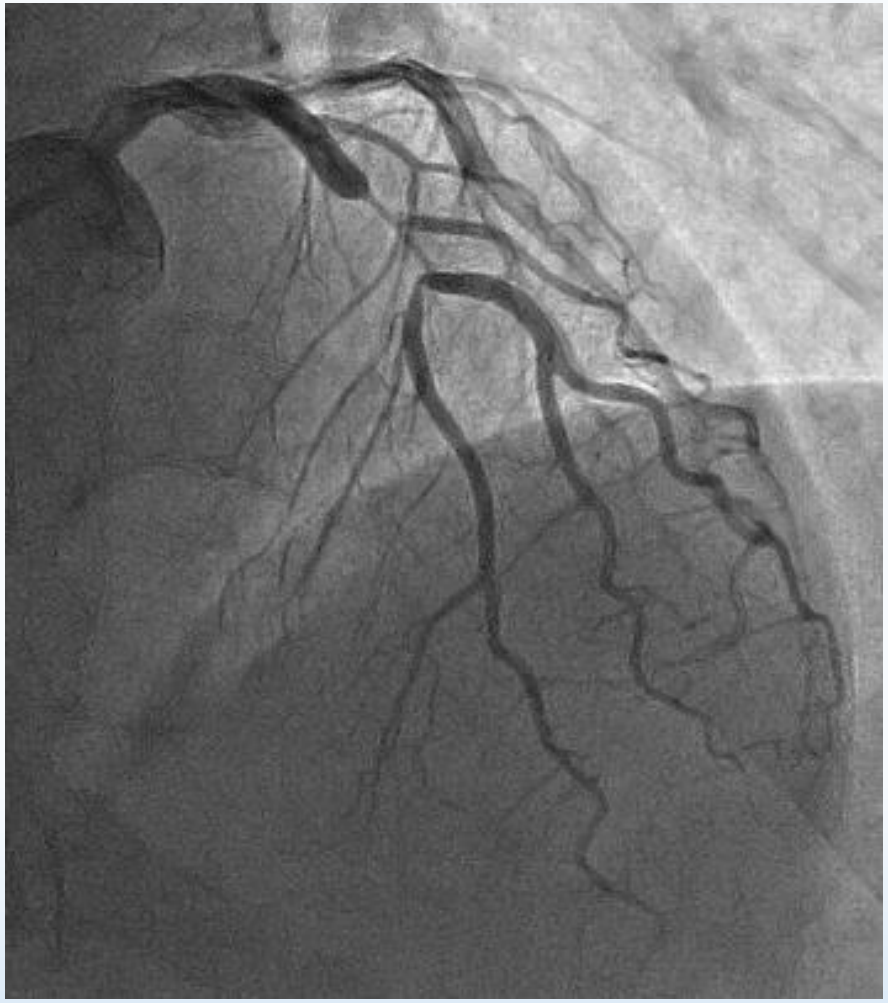
If the GW cross distally, jailed struts shift to opposite site of side branch.



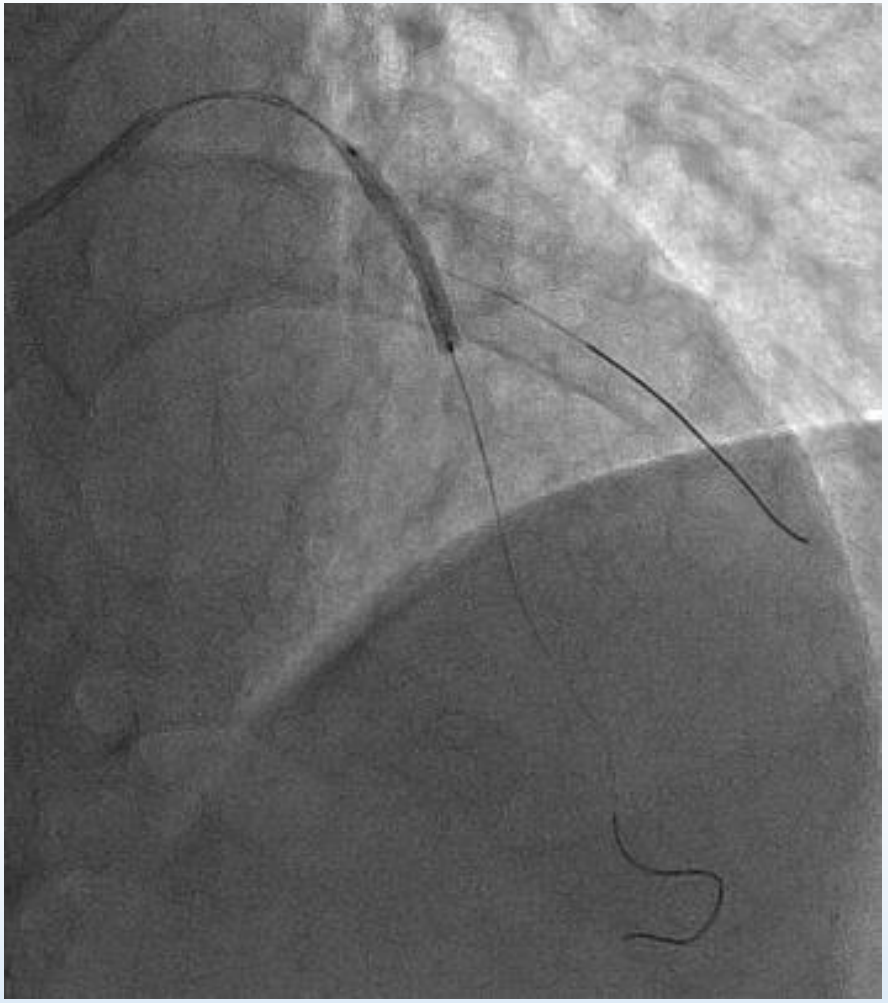


GW should cross the side branch distally , close to the carina.

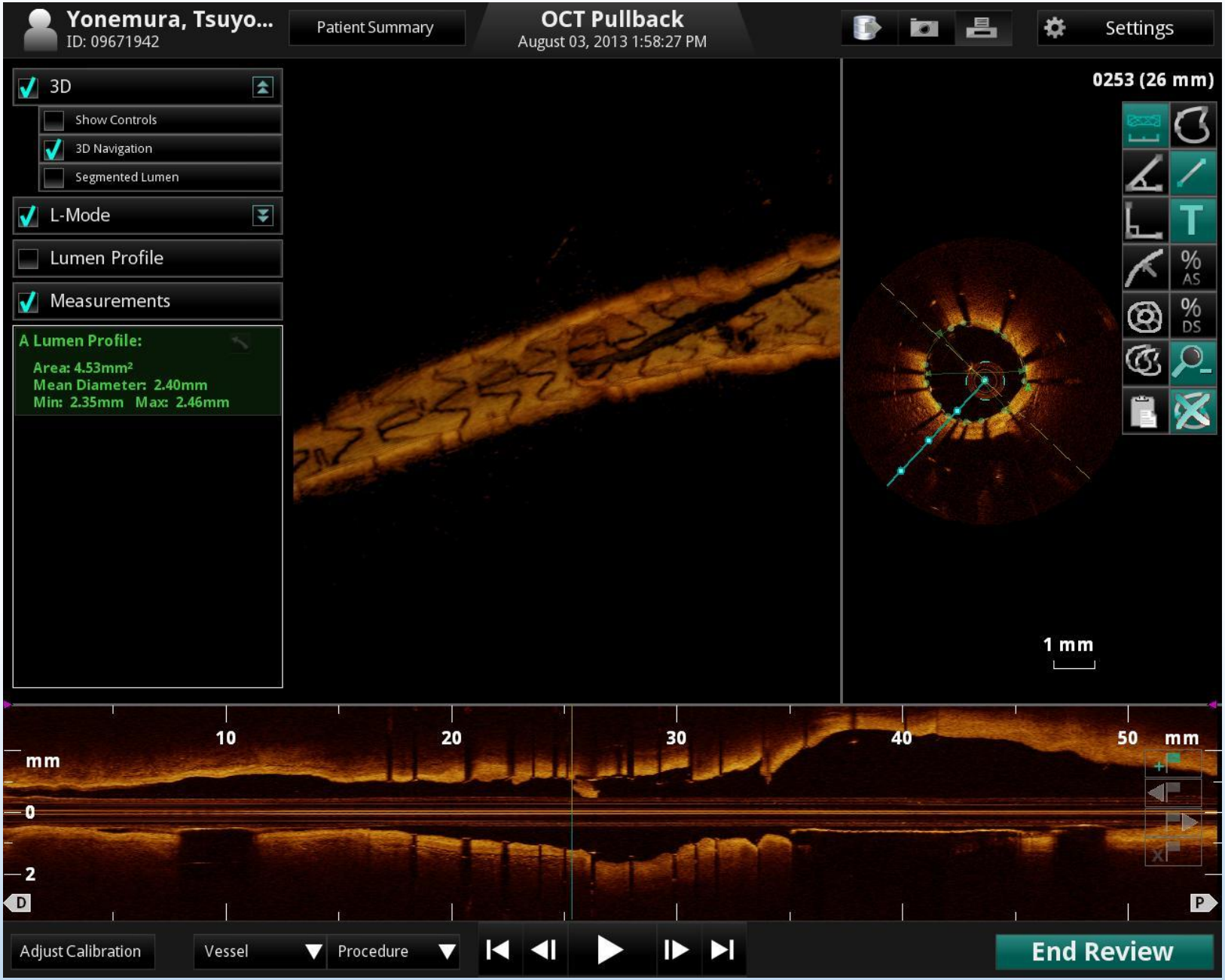
A case of single stenting with KBT OCT 3D reconstruction guide

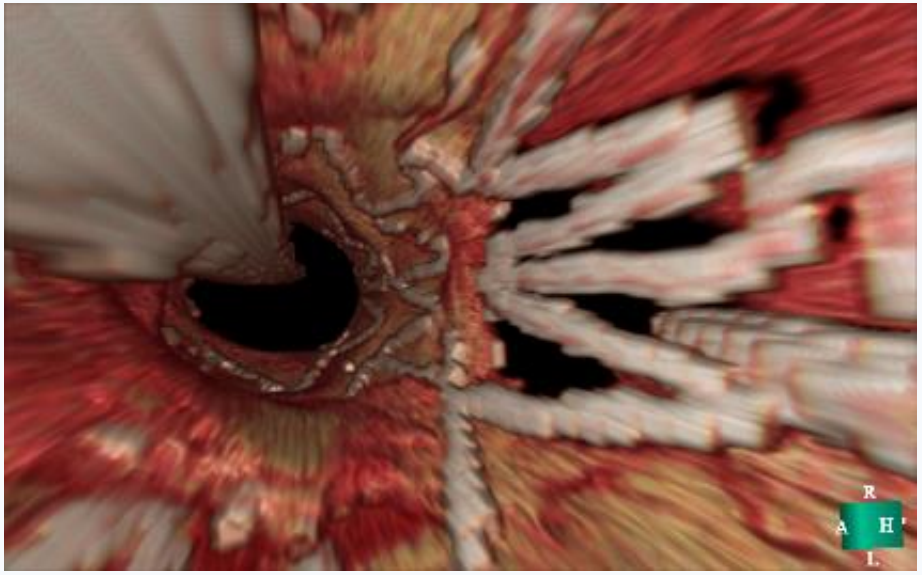


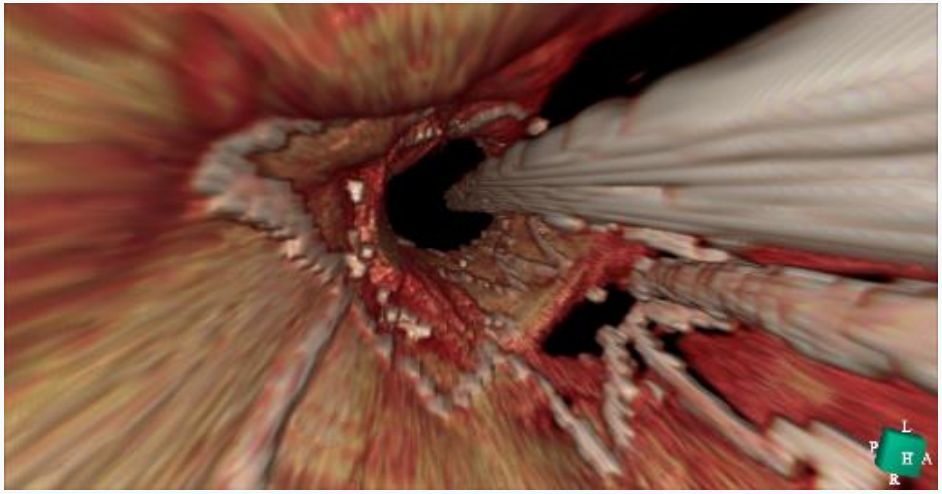
Pre PCI

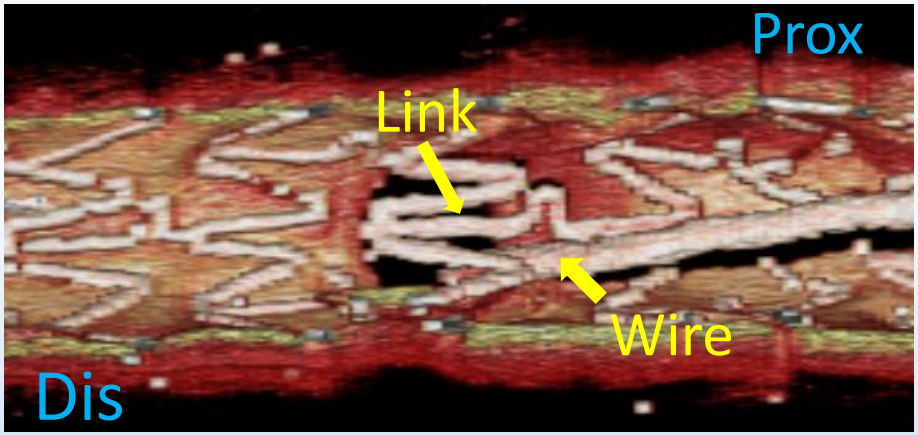


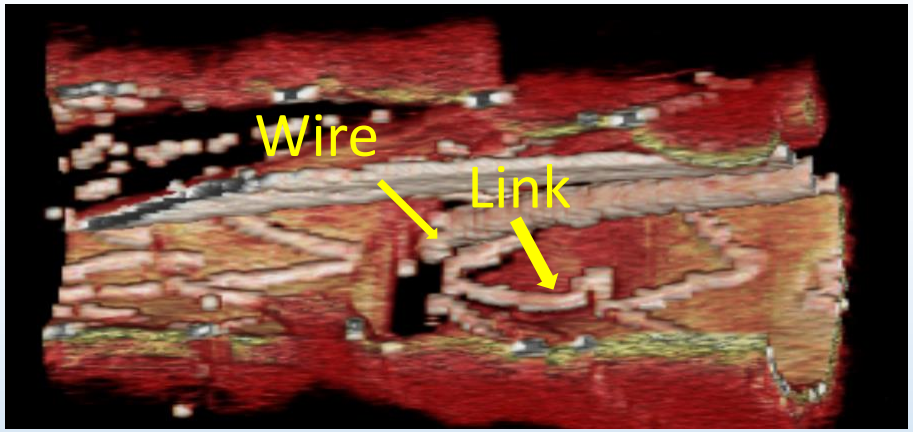
Stent implantation
and
GW re-cross to Dx


Yonemura, Tsuyo...
ID: 09671942
Patient Summary
OCT Pullback
August 03, 2013 1:58:27 PM
Settings
3D
Show Controls
3D Navigation
Segmented Lumen
L-Mode
Lumen Profile
Measurements
A Lumen Profile:
Area: 4.53mm²
Mean Diameter: 2.40mm
Min: 2.35mm Max: 2.46mm
0253 (26 mm)
% AS
% DS
1 mm
10
20
30
40
50
mm
mm
0
2
D
P
Adjust Calibration
Vessel
Procedure
End Review



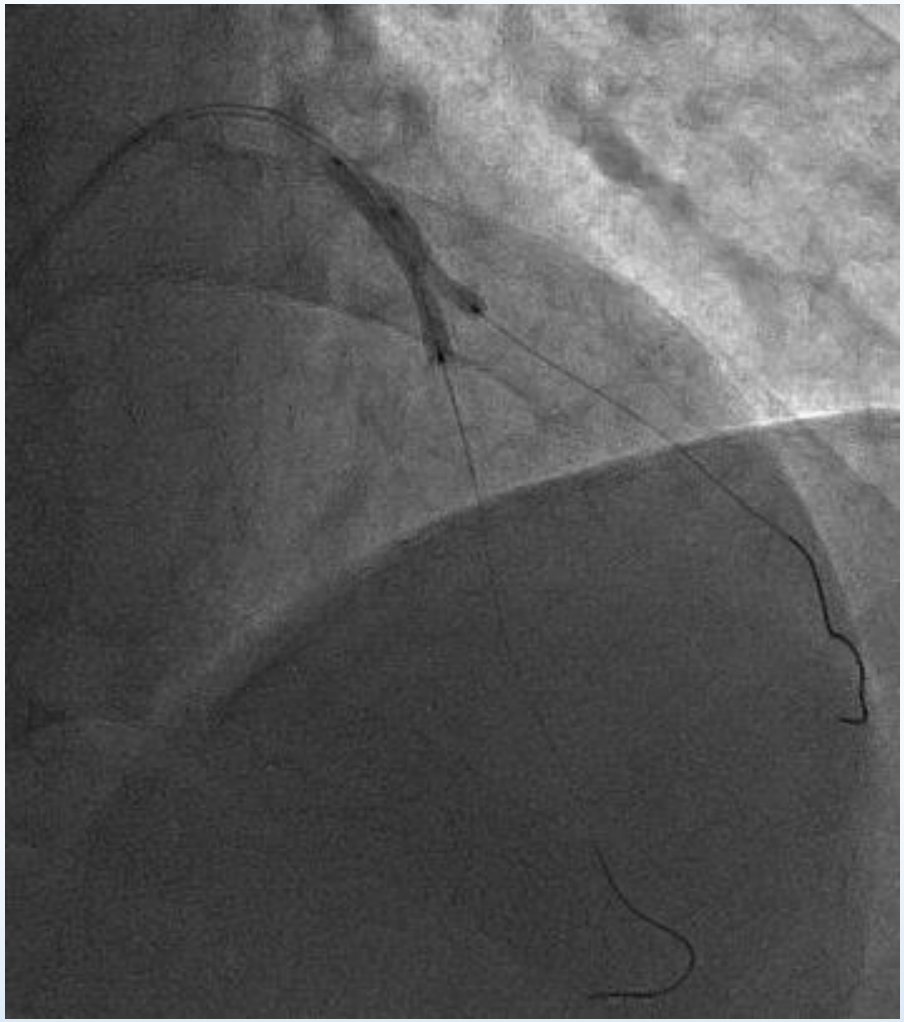






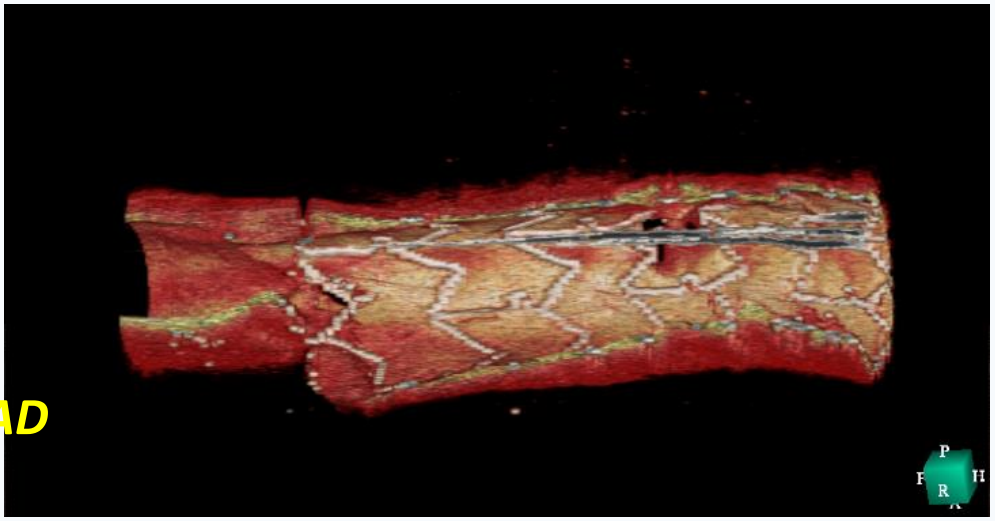
3-D OCT shows GW crossing proximal part of the link

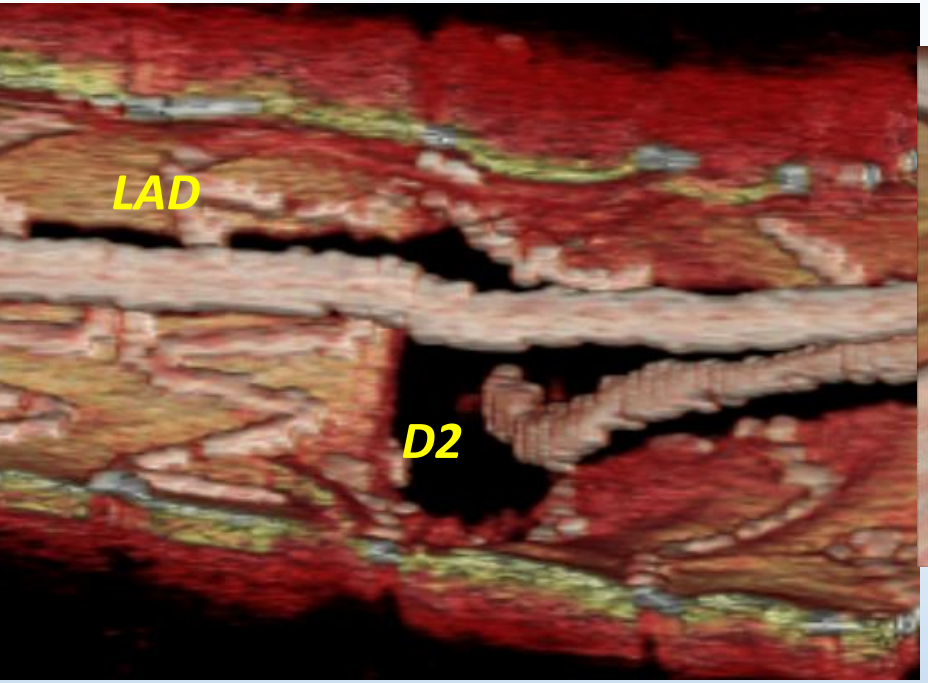
After bigger size POBA
GW can cross distal part of the link

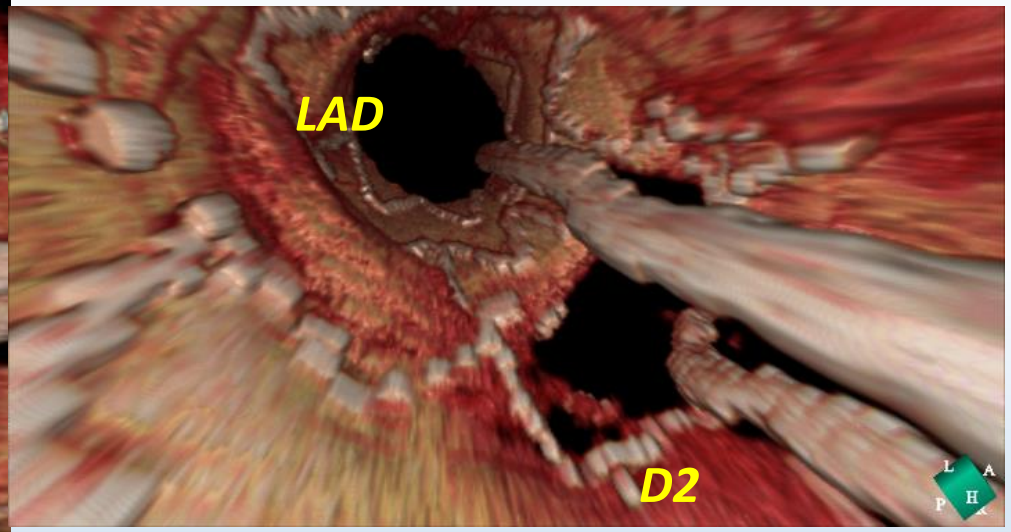


KBT

Final







3-D OCT images after KBT showing wide open D2.

3-D reconstruction OCT image is useful to make sure the GW recrossing point after stenting resulting in optimal kissing balloon technique.

This procedure should be applied to stenting to bifurcation involving major side branch.

OCT is Useful for PCI guide especially in

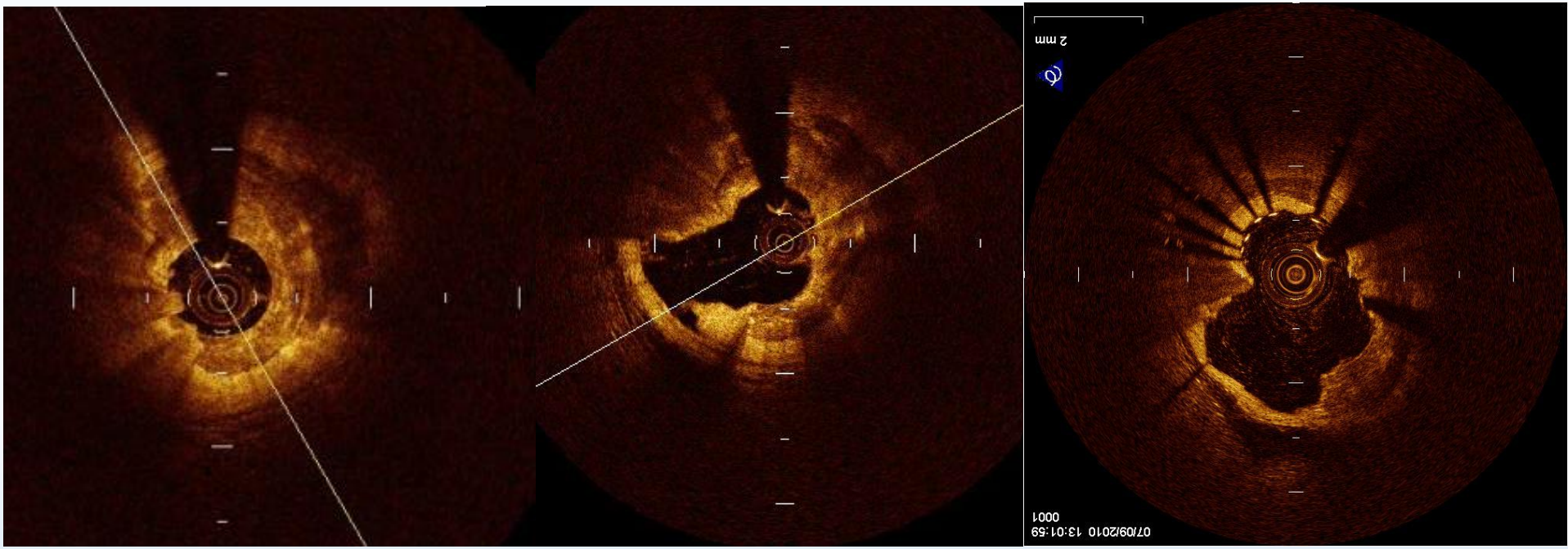
1. Bifurcation stenting
2. Rotablation for calcified lesion
3. Guide for ACS PCI

OCT can show the thickness of calcium

After Rota

After POBA

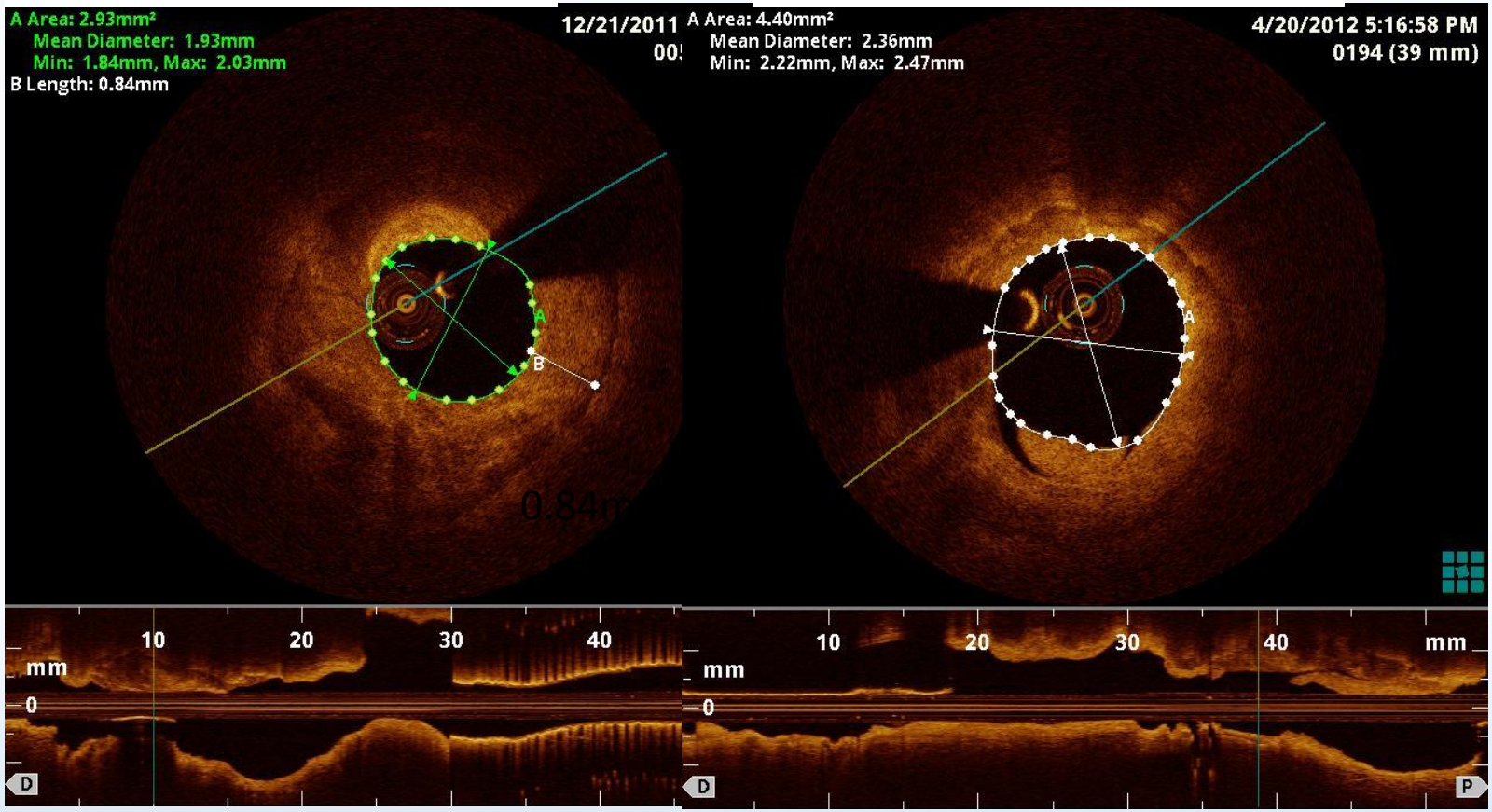
After Stenting



If the ablation area is not enough, even the crack is made, stent will not well expand and sometimes becomes irregular shape.

Post rota 2.0mm

Post rota 2.25mm

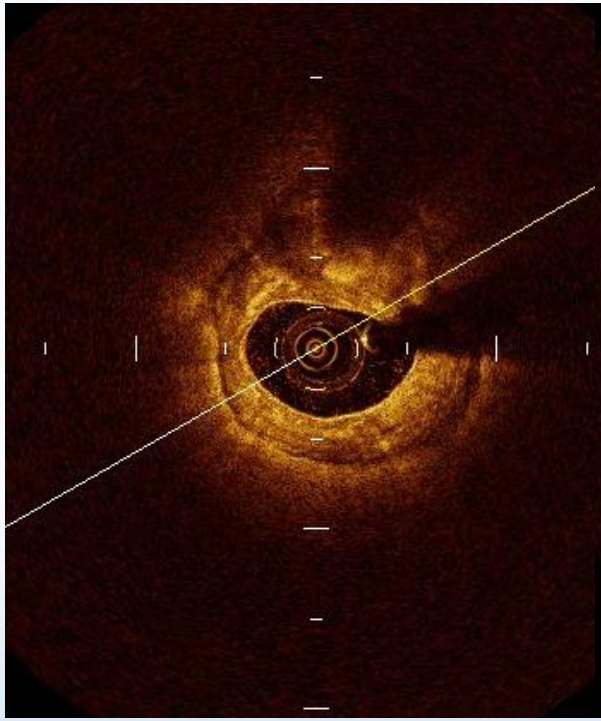


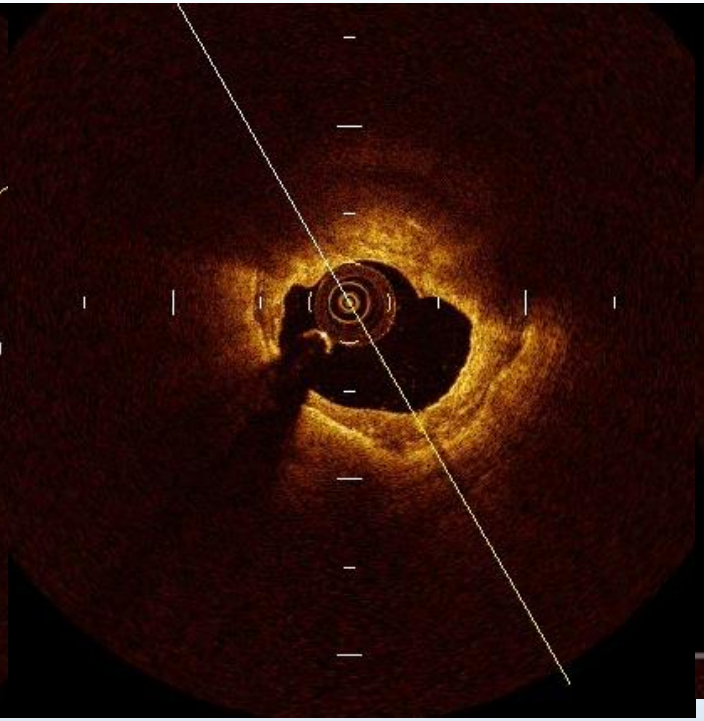
If the ablation area is not enough and all circular thick calcium remains, stent should not be implanted. Further bigger size rotablation recommended.

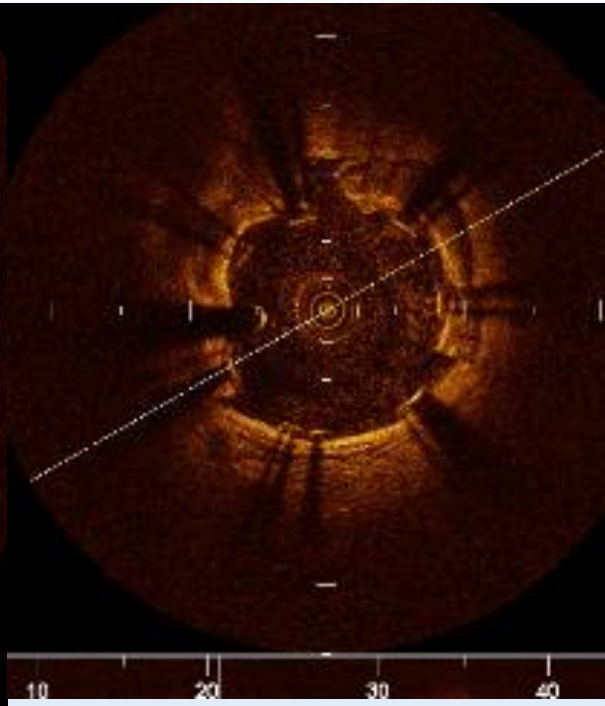
Before Rota

After Rota

After Stenting







If the ablation area is wide enough, stent will well expand.

OCT can show the thickness of calcium and is useful for rotablation guide

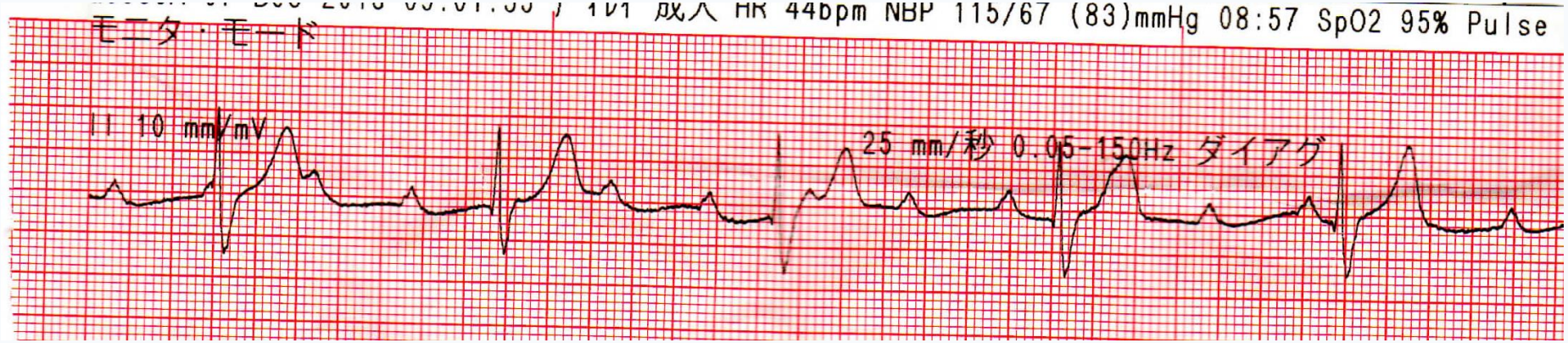
OCT is Useful for PCI guide especially in

1. Bifurcation stenting
2. Rotablation for calcified lesion
3. Guide for ACS PCI

62 y.o. Male

Syncope during car driving

At ER



Blood Examination

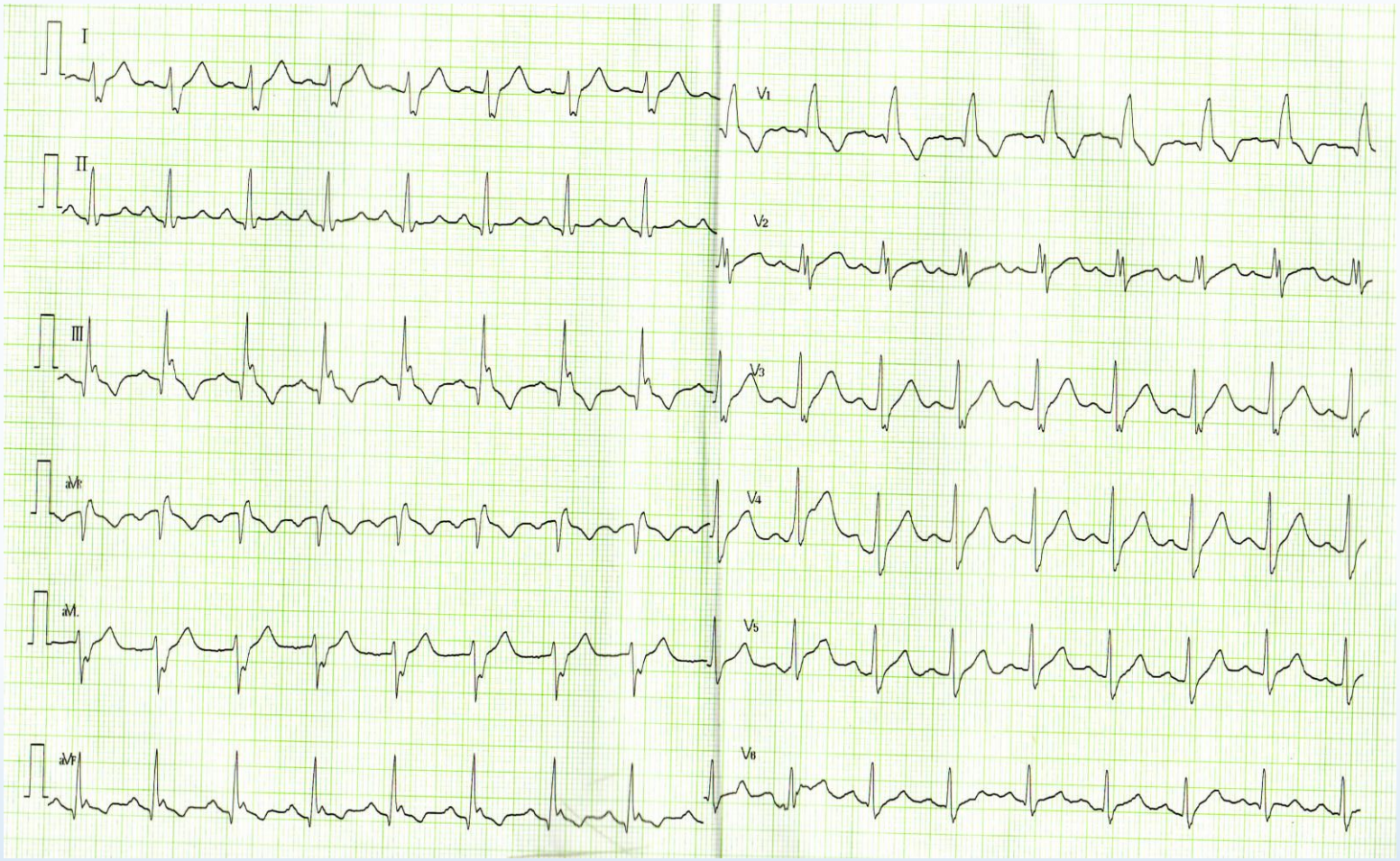
WBC 16500

GOT 87 U/L

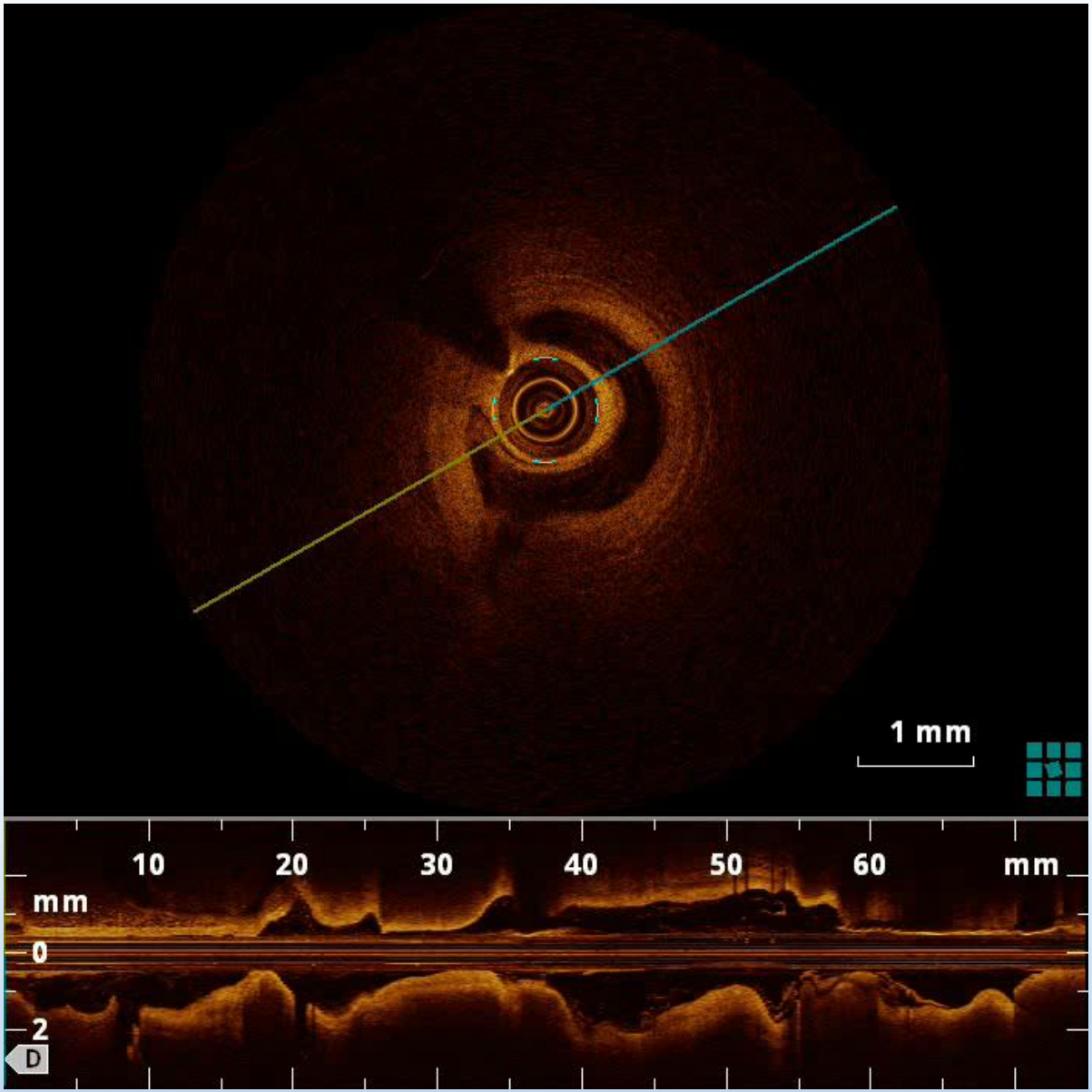
LDH 442 U/L

CPK 493 U/L

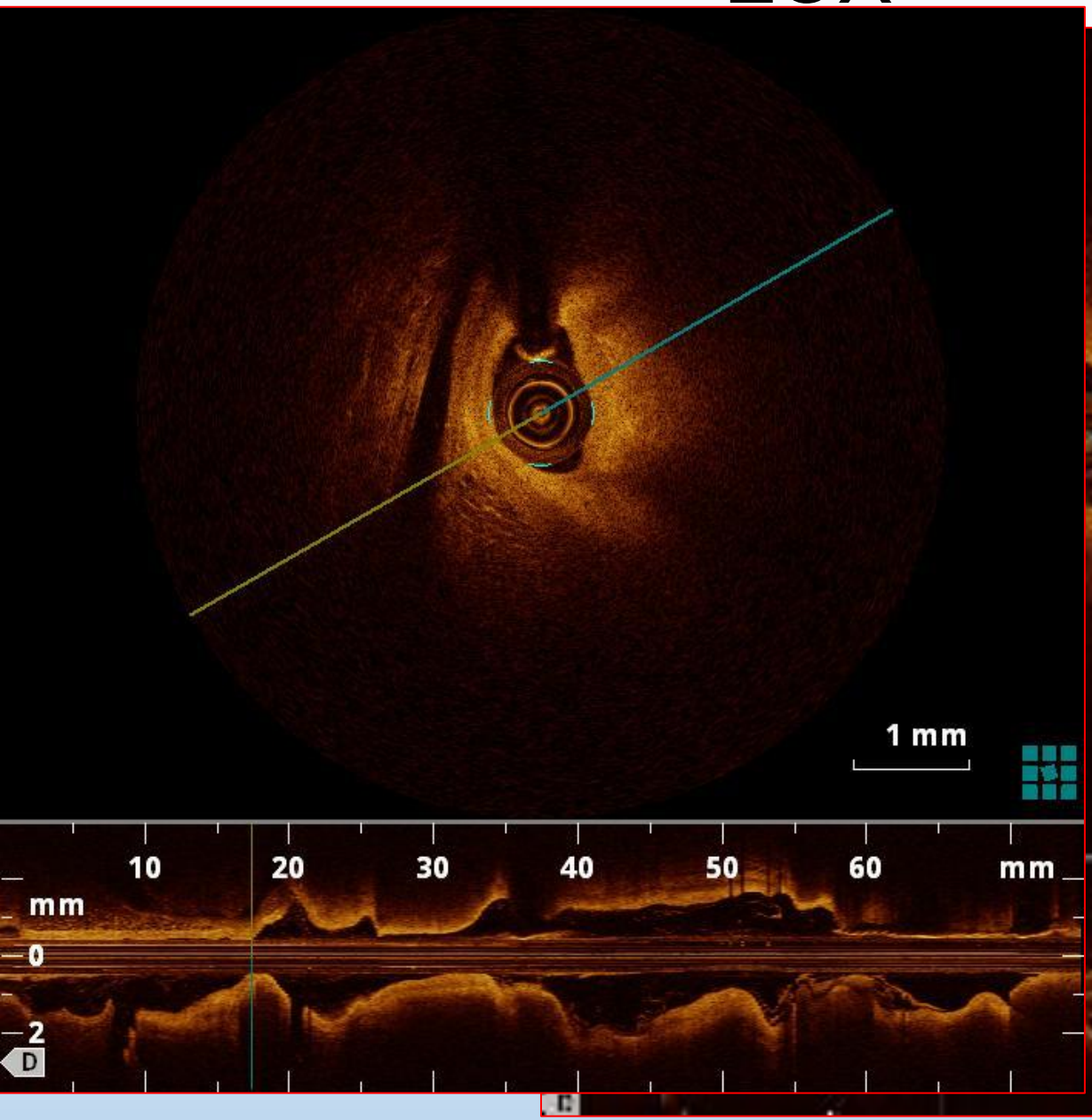
Pre-PCI

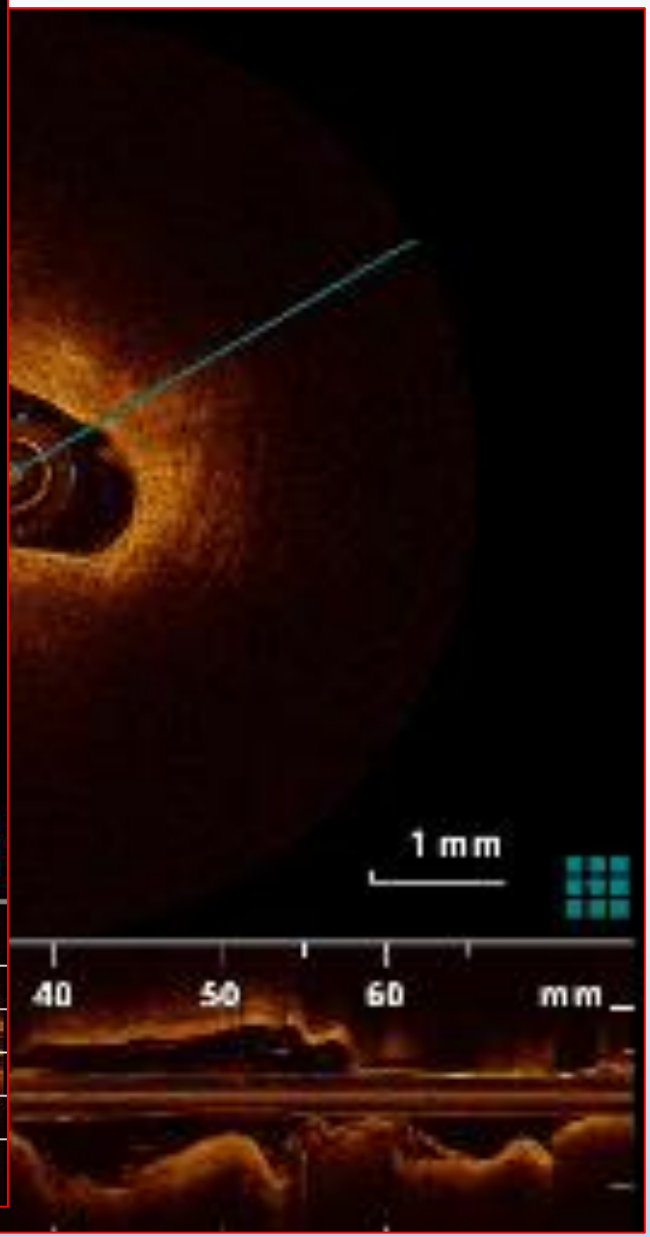



OCT scanning to LCX

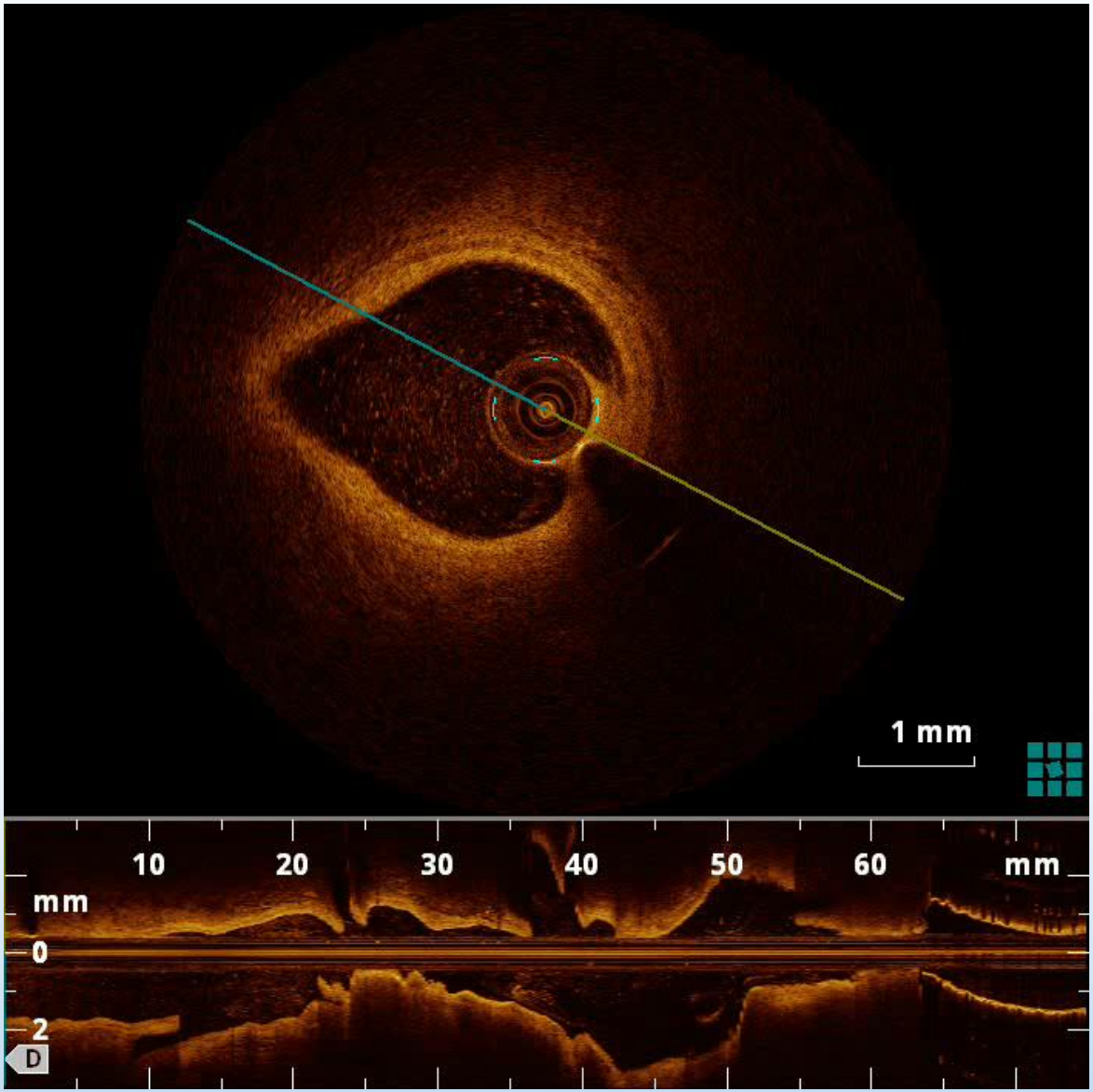


LCX

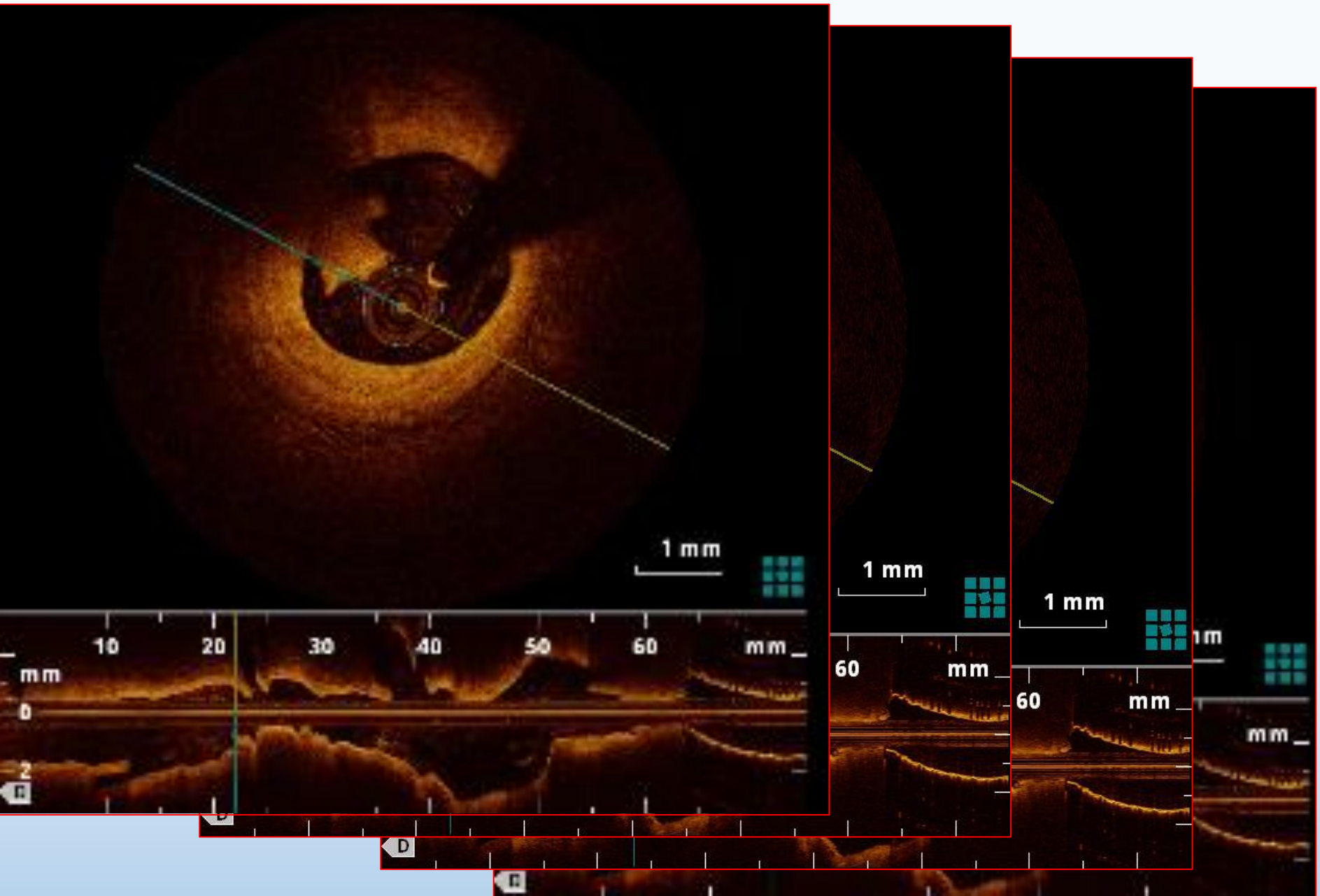




OCT scanning to LAD



LAD



In this case, LAD lesion must be a culprit lesion of ACS.

OCT is useful to determine the culprit lesion of ACS.

In autopsy studies, at least 25% of thrombotic coronary occlusions are caused by plaque erosion without disruption of the fibrous cap. This lesion may not require stent implantation.

OCT-based diagnosis and management of STEMI associated with intact fibrous cap.

Prati F, Uemura S, Souteyrand G, Virmani R, Motreff P, Di Vito L, Biondi-Zoccai G, Halperin J, Fuster V, Ozaki Y, Narula J.

JACC Cardiovasc Imaging. 2013 Mar;6(3):283-7.
doi: 10.1016/j.jcmg.2012.12.007.

Abstract

After aspiration thrombectomy, OCT identified plaque erosion as the cause in 31 STEMI. 40% patients with subcritically occlusive plaque were treated with dual antiplatelet therapy without percutaneous revascularization (group 1), and the remaining 60% of patients underwent angioplasty and stenting (group 2). At a median follow-up of 753 days, all patients were asymptomatic, regardless of stent implantation.

These observations support an alternative treatment strategy for patients with acute coronary events. OCT-verified intact fibrous cap (or plaque erosion), where non-obstructive lesions might be managed without stenting.

Challenge to estimate the coronary plaque tissue characterization

1. Prediction of the stenosis progression, and future ACS events.

2. Evaluation of the treatment effect for vulnerable plaque.

Challenge to estimate the coronary plaque tissue characterization

1. prediction of the stenosis progression, and future ACS events.
2. evaluation of the treatment effect for vulnerable plaque.

Thin-cap fibroatheroma and microchannel findings in optical coherence tomography correlate with subsequent progression of coronary atheromatous plaques

Shiro Uemura*, Ken-ichi Ishigami, Tsunenari Soeda, Satoshi Okayama, Ji Hee Sung, Hitoshi Nakagawa, Satoshi Somekawa, Yukiji Takeda, Hiroyuki Kawata, Manabu Horii, and Yoshihiko Saito

European Heart Journal (2012) 33, 78-85

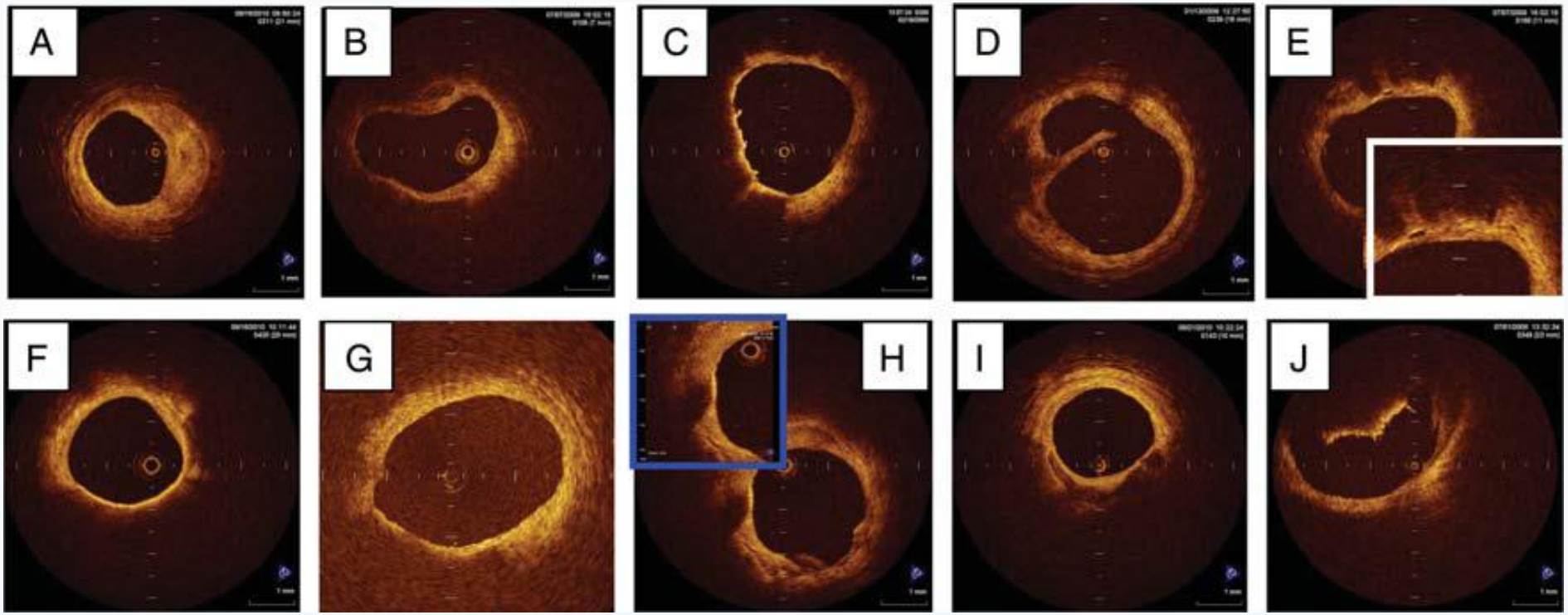


Figure 1 (A) Eccentric plaque distribution; (B) concave lumen shape; (C) intimal laceration; (D) ruptured plaque; (E) microchannel; (F) lipid pool; (G) thin fibrous cap covering lipid pool;
(H) macrophage image; (I) calcium deposition; (J) thrombus formation.

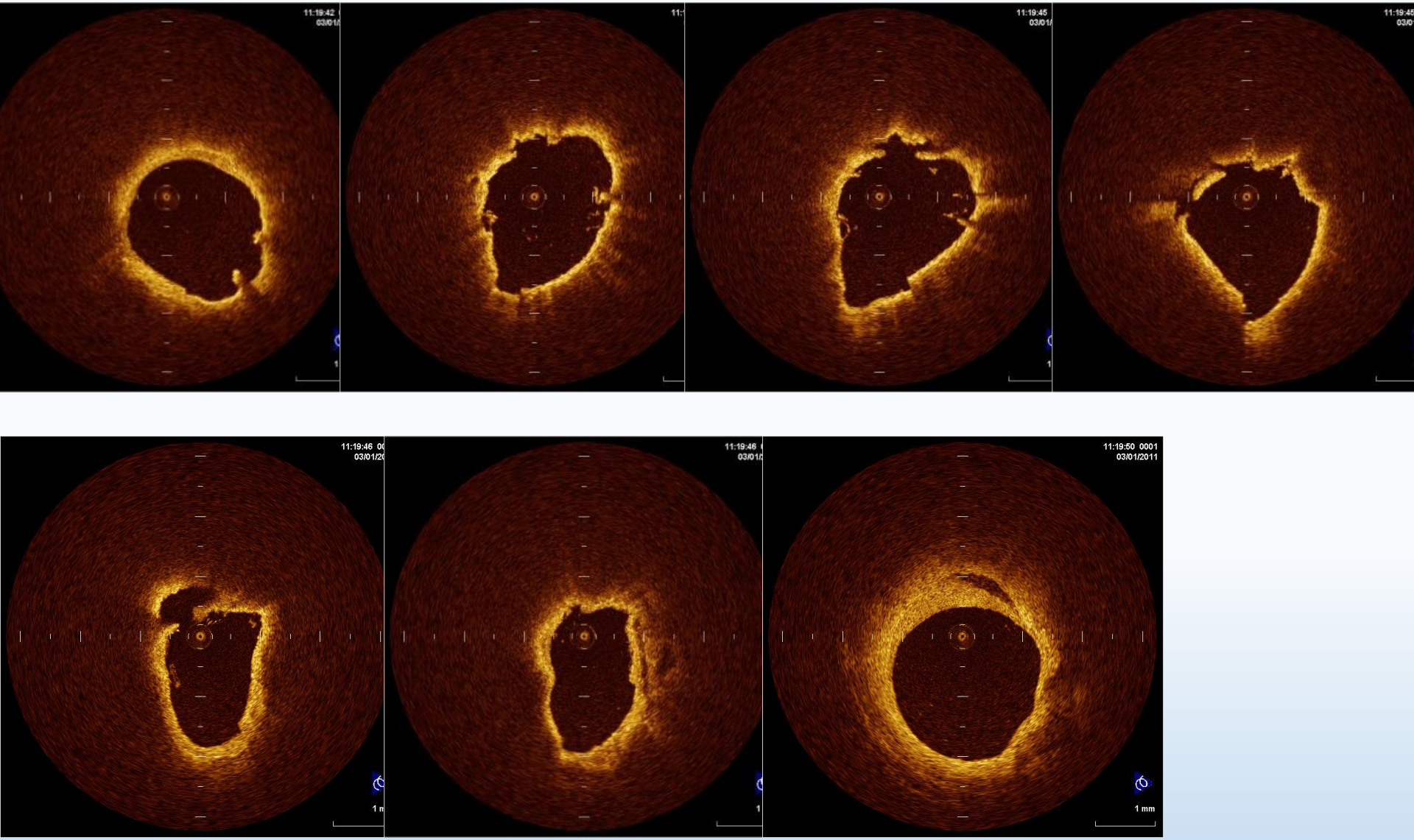
Table 4 Association of 10 OCT-based plaque characteristics and subsequent progression

Univariate analysis

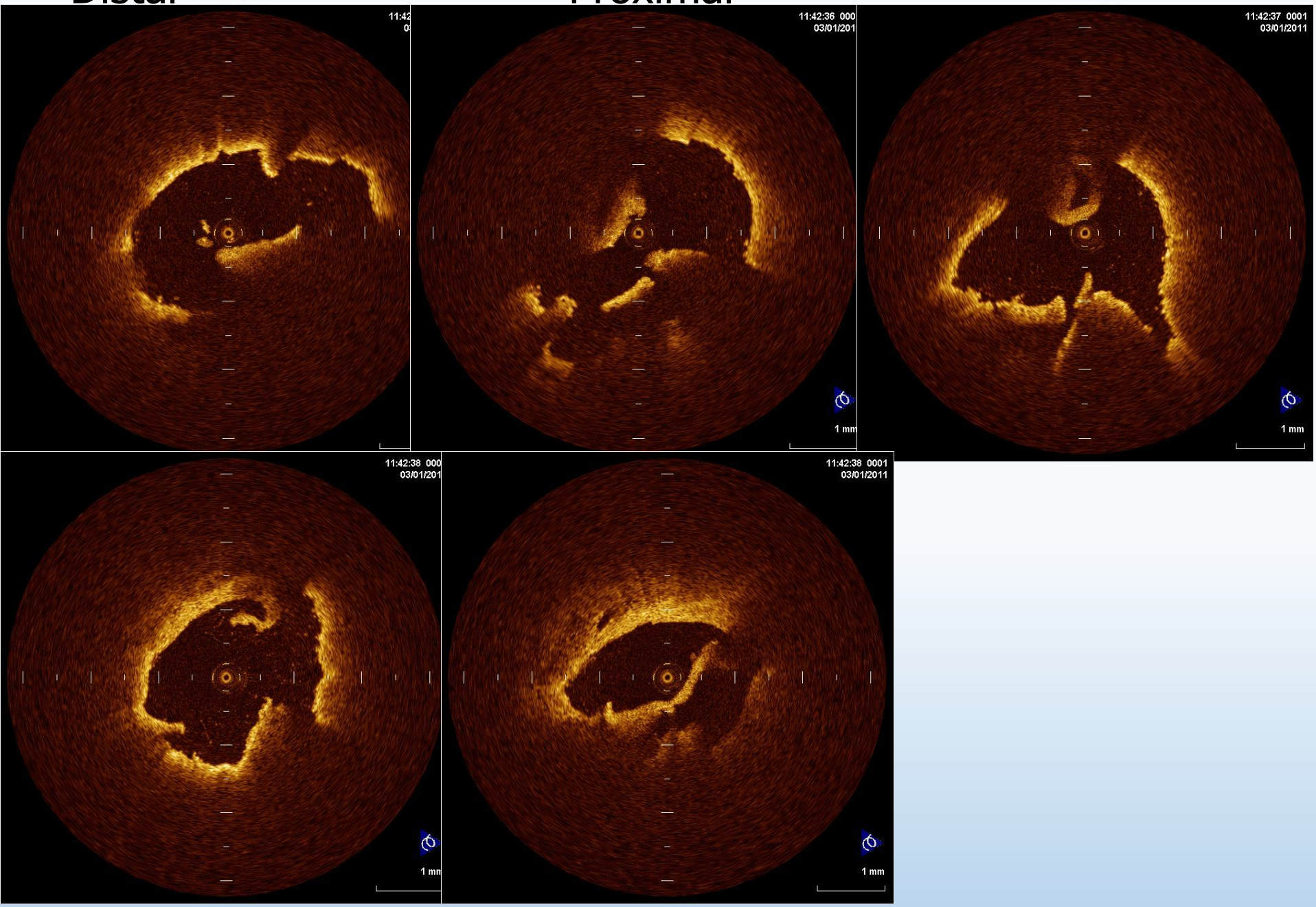
	OR (95% CI)	P-value
Eccentric	3.30 (0.73-14.4)	0.230
Concave shape	3.83 (0.85-16.7)	0.160
Intimal laceration	10.20 (2.77-37.8)	0.001
Rupture	4.90 (0.78-31.23)	0.325
Microchannel	20.00 (4.78-82.6)	0.001
Lipid pool	2.16 (0.57-8.06)	0.222
TCFA	20.00 (4.78-82.6)	0.001
Macrophage	9.60 (2.60-35.6)	0.001
Calcium	1.33 (0.41-4.30)	0.890
Thrombus	12.00 (2.18-64.32)	0.002

OCT-based complex characteristics of TCFA and microchannel were the potential predictors of subsequent progression of non-significant coronary plaques and or future ACS events.

Distal ⟶ Proximal



Distal → Proximal



Challenge to estimate the coronary plaque tissue characterization

1. prediction of the stenosis progression, and future ACS events.
2. evaluation of the treatment effect for vulnerable plaque.

Statin+EPA may be effective for stabilizing vulnerable plaque

Impact of EPA and statin therapy on coronary thin-cap fibroatheroma: Assessment by optical coherence tomography

Kobe University Graduate school of medicine

Ryo Nishio, Junya Shite, Toshiro Shinke, Hiromasa Otake,
Masayuki Nakagawa, Ryoji Nagoshi, Amane Kozuki,
Takumi Inoue, Hirotoshi Hariki, Tsuyoshi Osue, Yu Taniguchi,
Masamichi Iwasaki, Noritoshi Hiranuma,
Akihide Konishi, Hiroto Kinutani, Ken-ichi Hirata

Methods

Patients with untreated dyslipidemia (LDL > 100 mg/dl)
who had non-culprit TCFA lesion detected by OCT

Random assignment

EPA+Statin group	Statin group
EPA1,800 mg/day Rosuvastatin	Rosuvastatin

Blood analysis and OCT examination were performed
Before and 9 months after treatment.

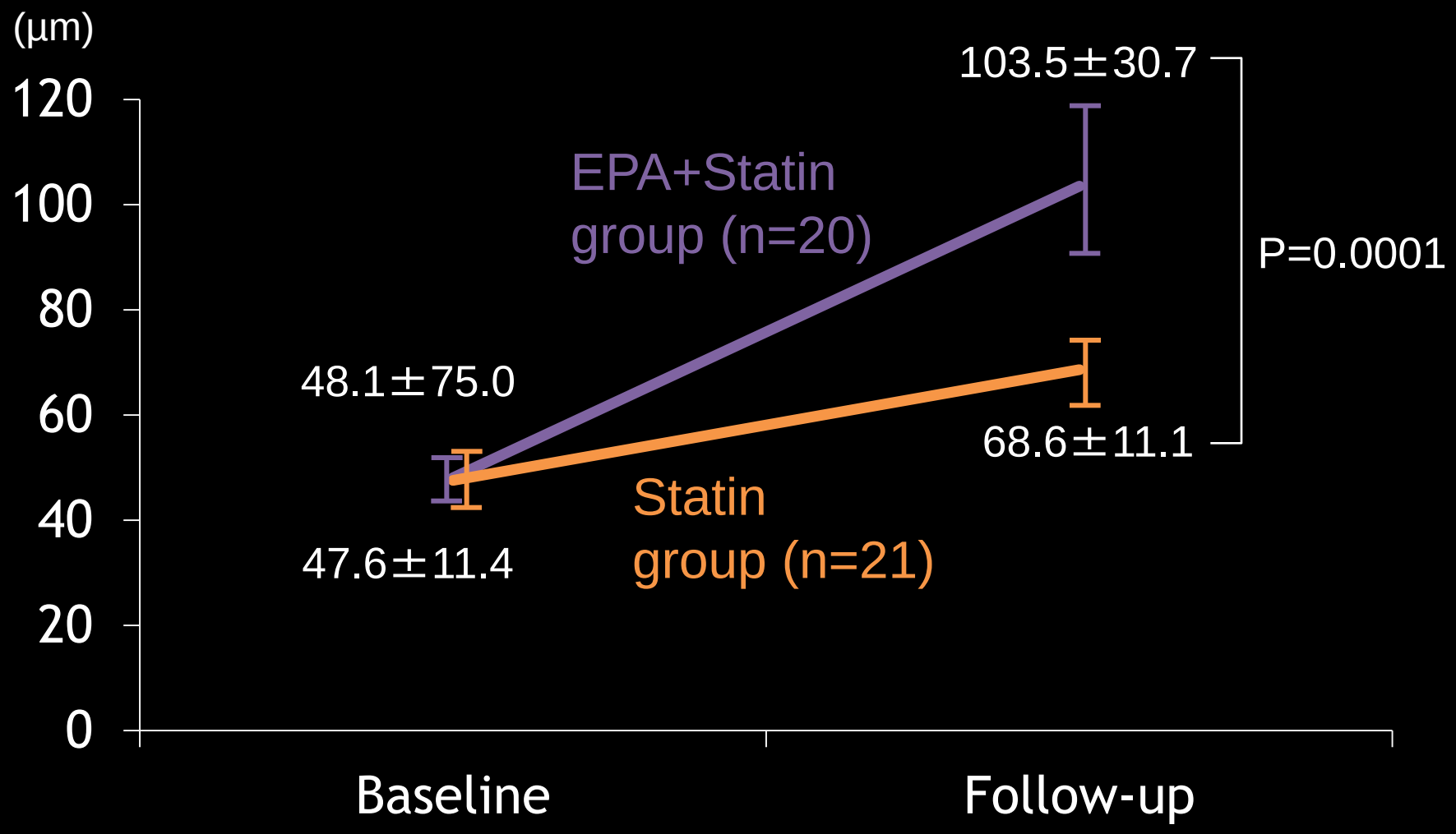
Baseline Profile

	EPA+Statin group (n=13)	Statin group (n=12)	P value
EPA/AA	0.33±0.16	0.30±0.15	0.62
T-Cho (mg/dl)	211.3±40.2	203.4±41.7	0.64
HDL (mg/dl)	41.7±12.5	41.7±7.5	0.99
LDL (mg/dl)	140.3±36.7	134.9±37.4	0.72
hs-CRP (mg/dl)	0.23±0.19	0.26±0.15	0.67
PTX3 (mg/dl)	4.18±2.07	5.25±2.85	0.32

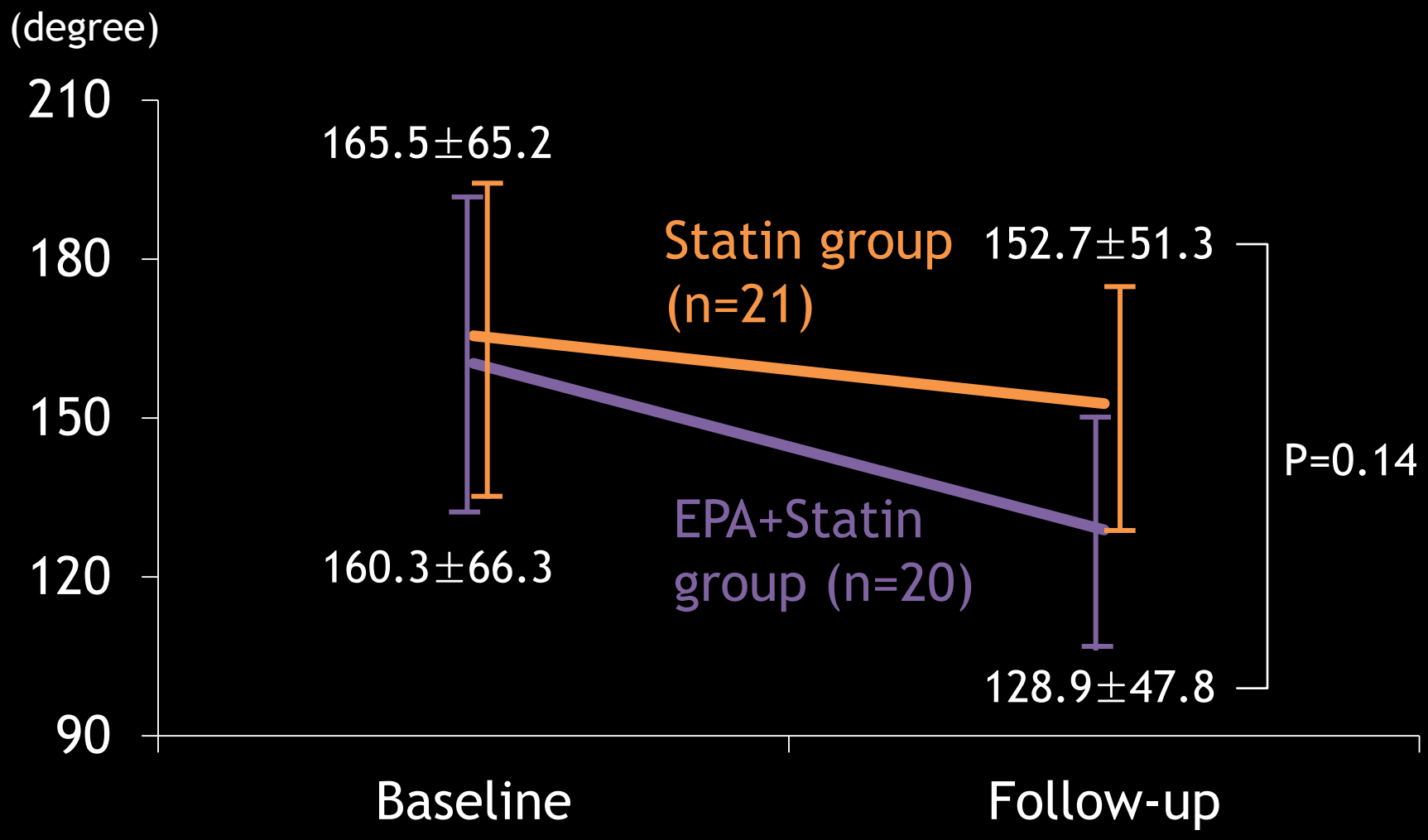
Lipid profile at 9 months after

	EPA+Statin group (n=13)	Statin group (n=12)	P value
EPA/AA	1.27±0.62	0.49±0.36	0.006
T-Cho (mg/dl)	151.1±34.4	145.7±22.9	0.65
HDL (mg/dl)	46.7±9.4	44.1±9.9	0.51
LDL (mg/dl)	85.2±28.5	81.2±21.0	0.69
hs-CRP (mg/dl)	0.06±0.05	0.10±0.08	0.20
PTX3 (mg/dl)	2.70±1.27	4.47±0.59	0.02

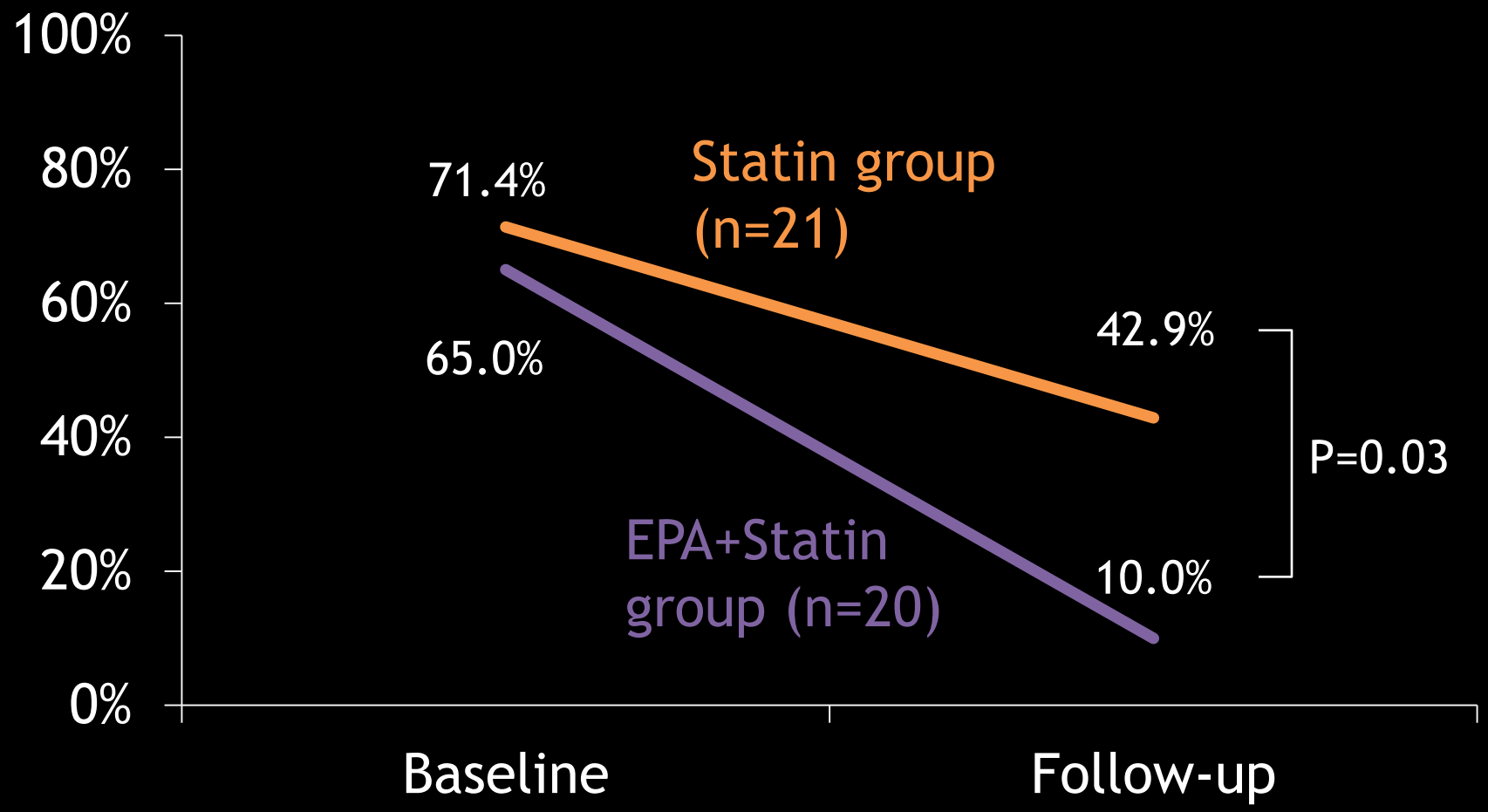
Fibrous-cap thickness



Lipid arc

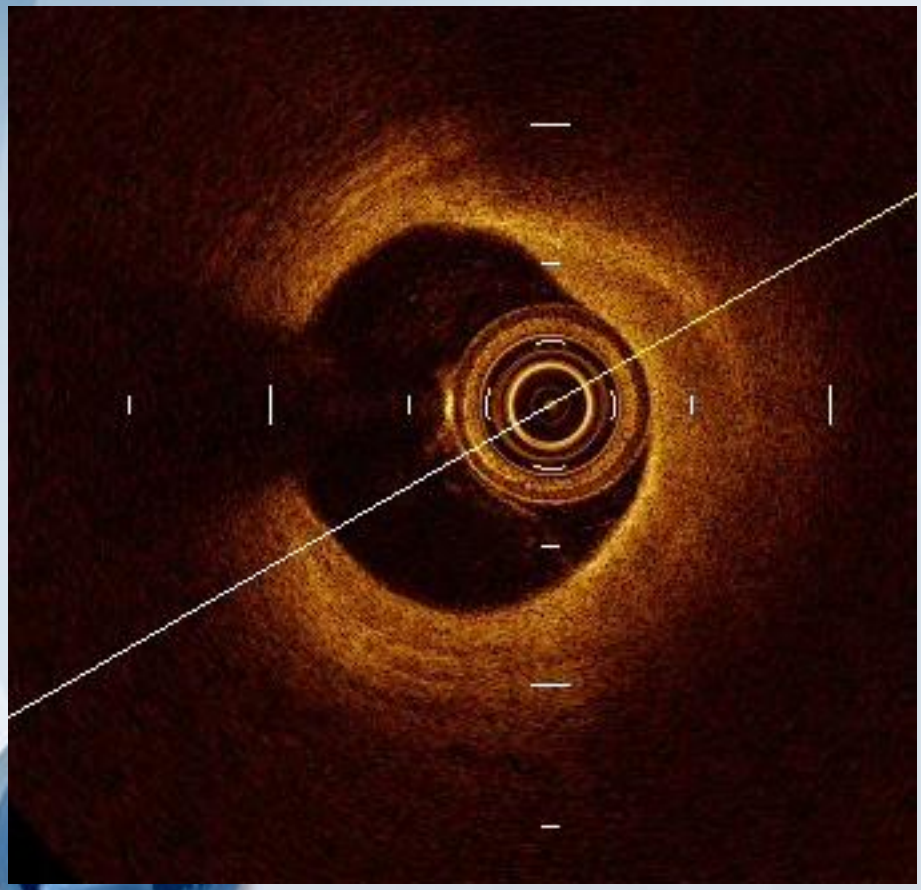

(degree)
210
180
150
120
90
165.5±65.2
160.3±66.3
Statin group
(n=21)
152.7±51.3
EPA+Statin
group (n=20)
128.9±47.8
P=0.14
Baseline
Follow-up

Macrophages accumulation

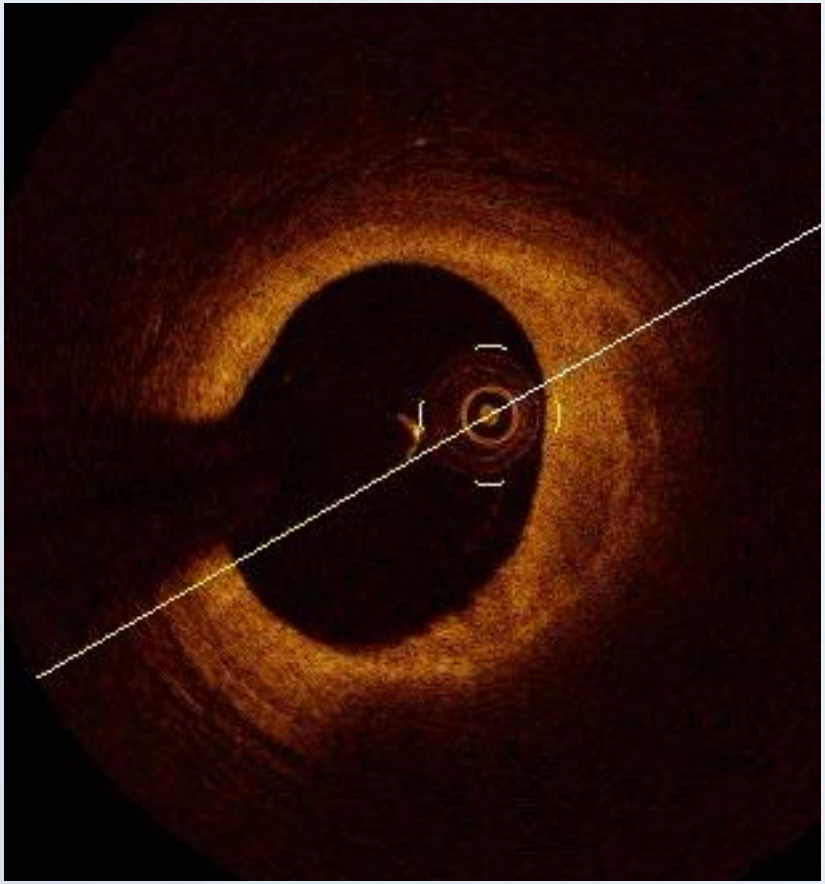


RCA (Rosuvastatin 2.5mg+EPA1800mg)

Before

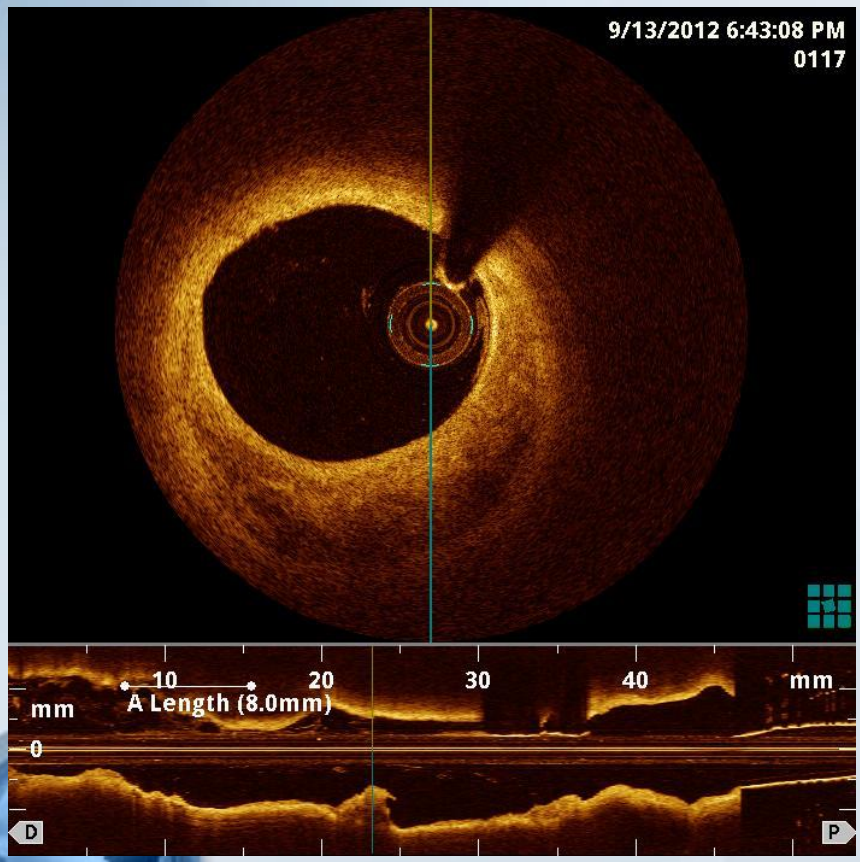


9 month treatment

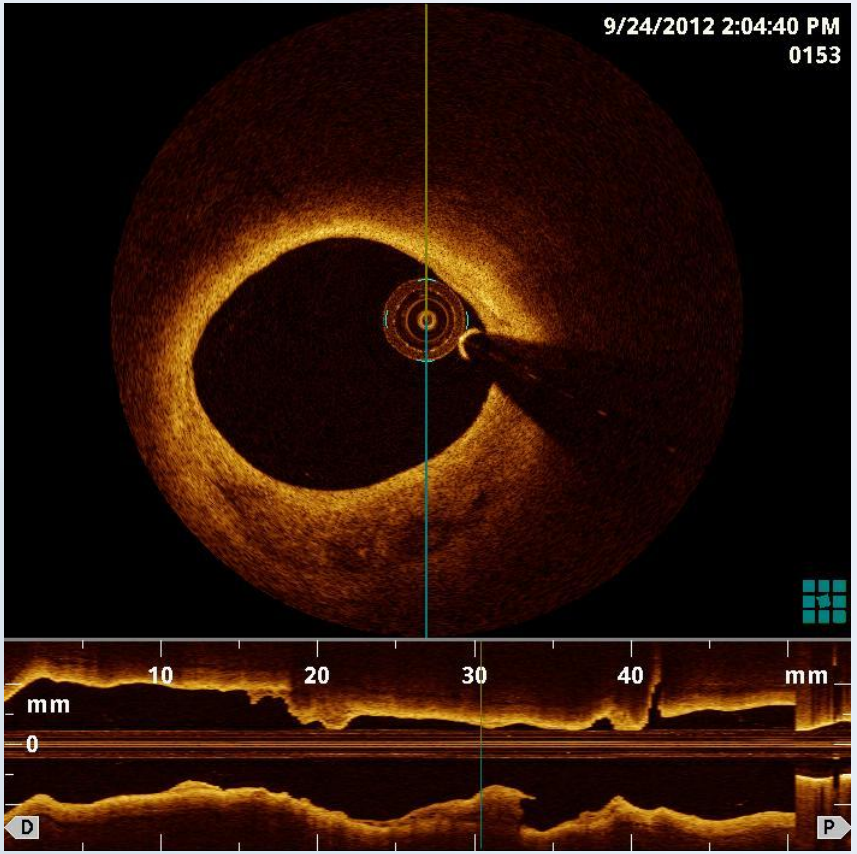


RCA (Rosuvastatin 2.5mg+EPA1800mg)

Before



After treatment



OCT may show the treatment effect in vulnerable plaque,
increase in fibrous cap thickness,
disappearance of macrophage accumulation,
decrease in lipid contents.

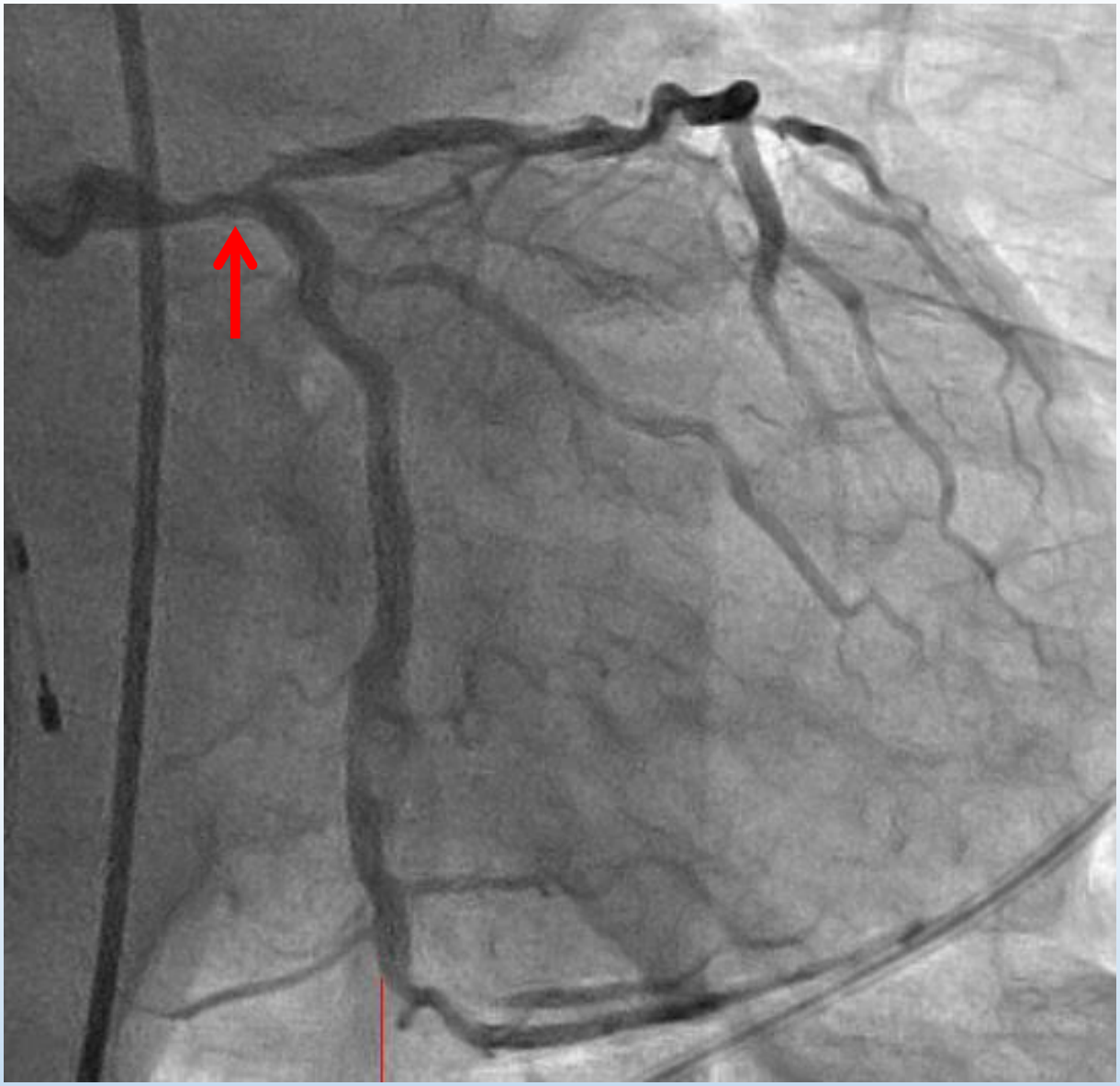
Role of OCT

Useful for PCI guide especially in
1. Bifurcation stenting
2. Rotablation for calcified lesion
3. Guide for ACS PCI

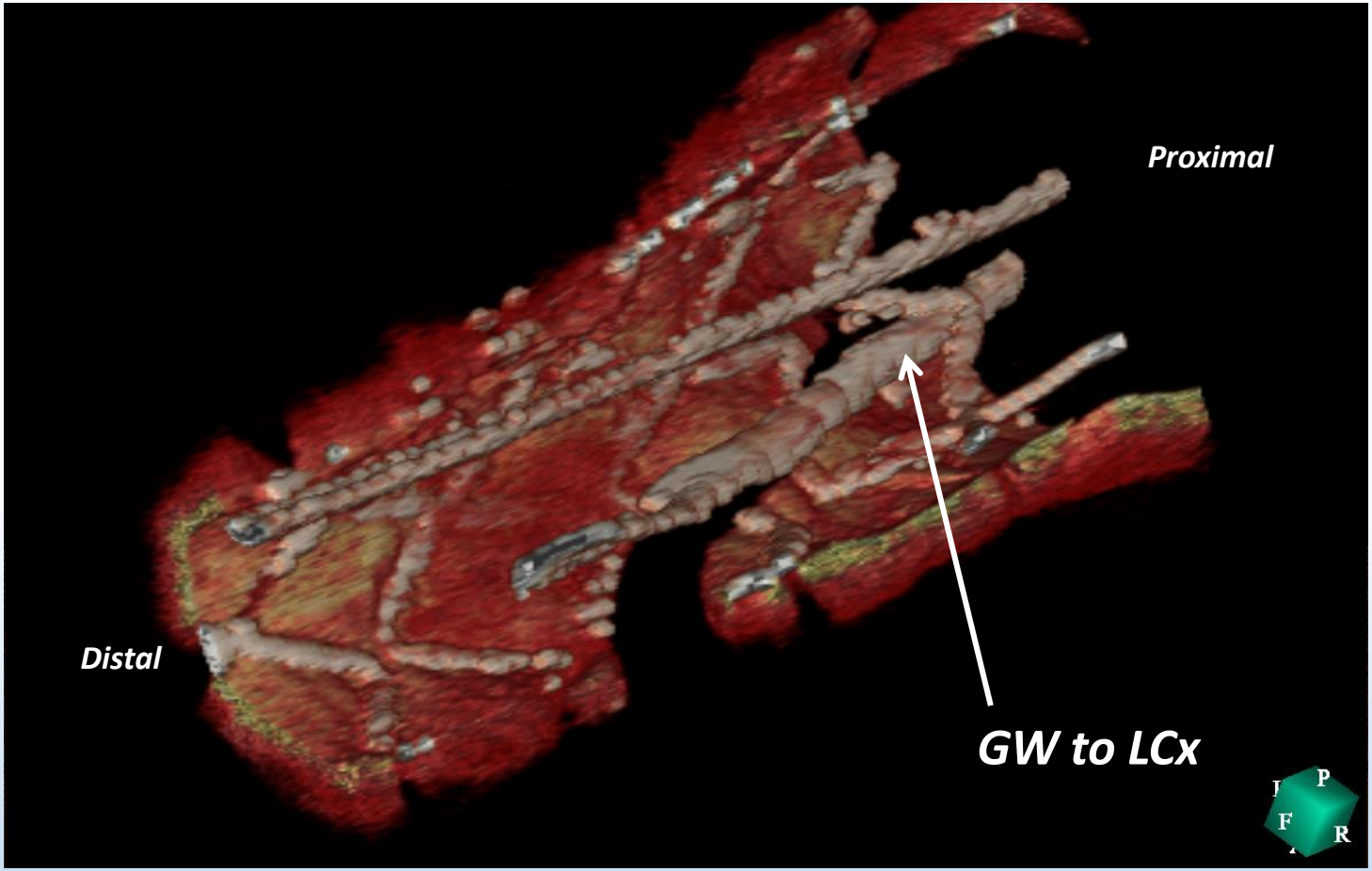
Useful for coronary plaque tissue characterization

risk assessment for future ACS events and evaluation of treatment effect

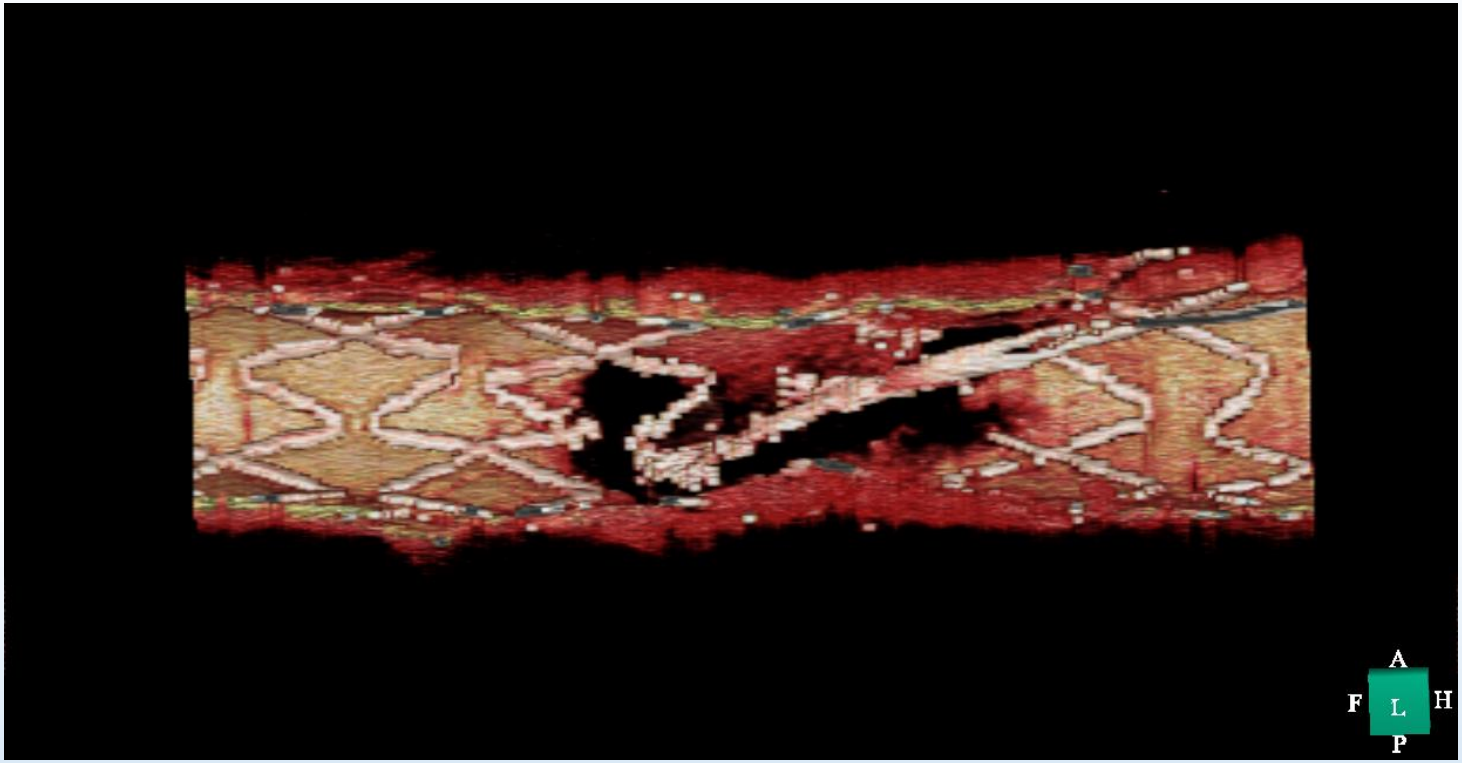

Thank you for your attention !



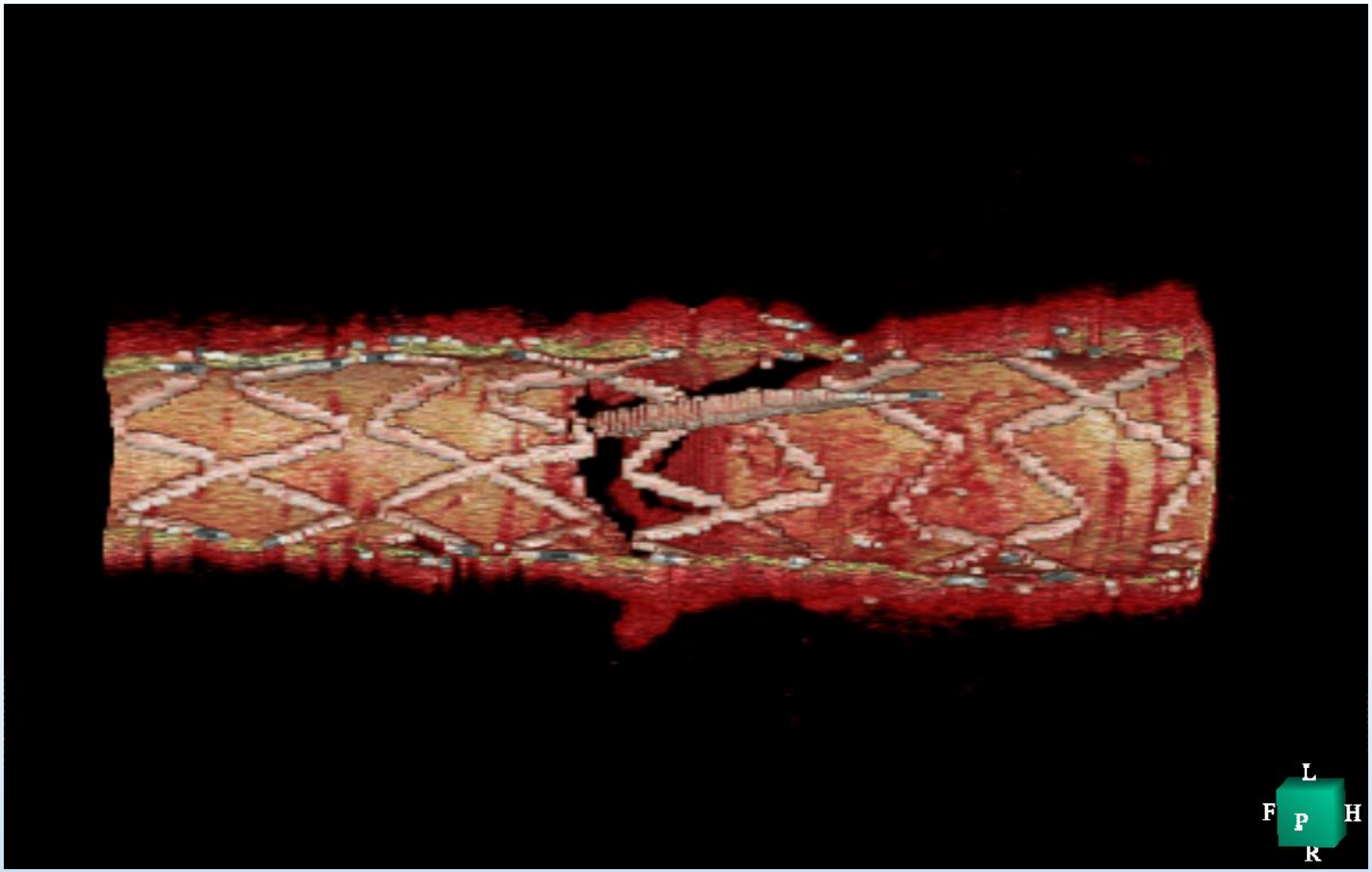
Single stenting (Nobori) to LMT-LAD First rewiring to LCX

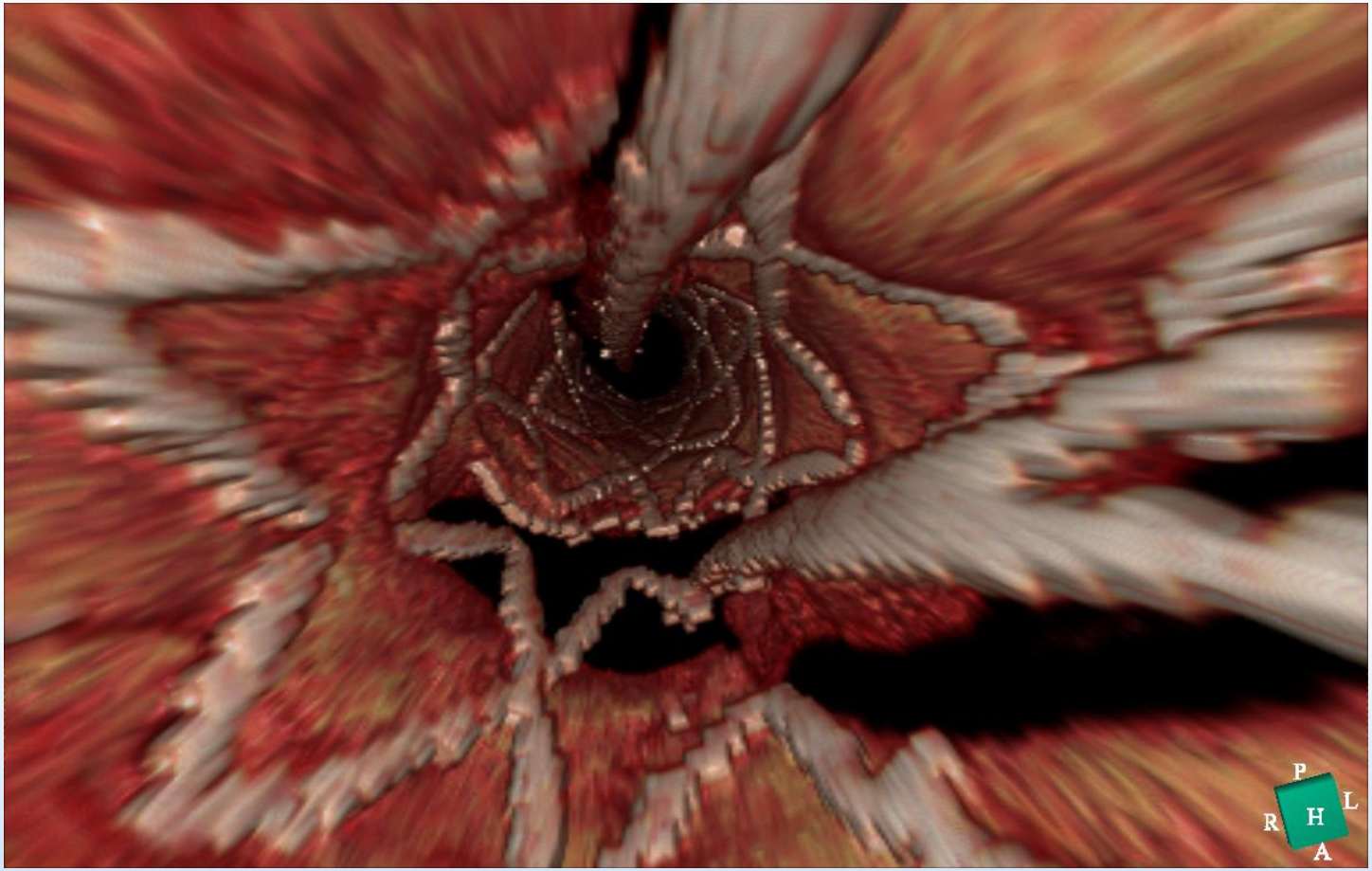


First rewiring



Second rewiring

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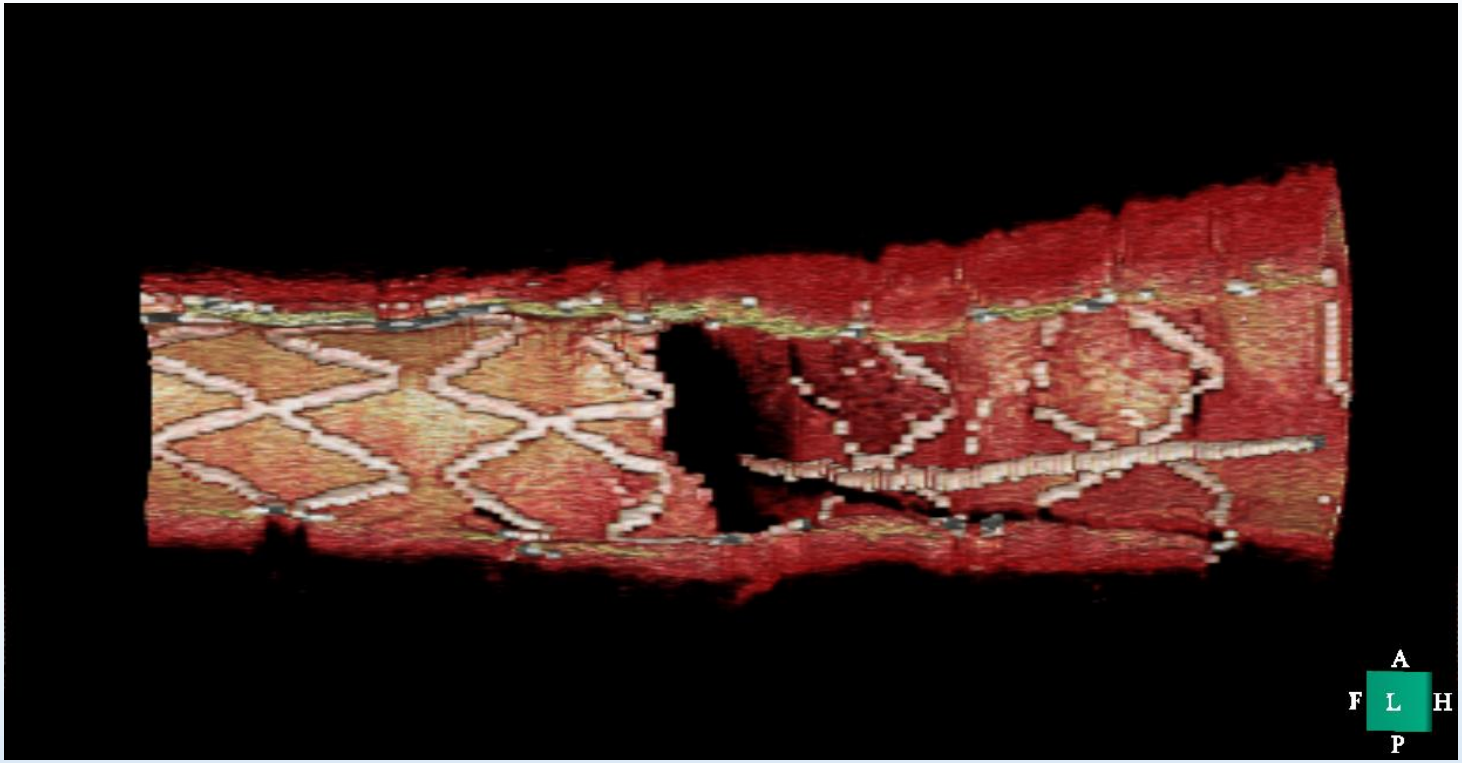
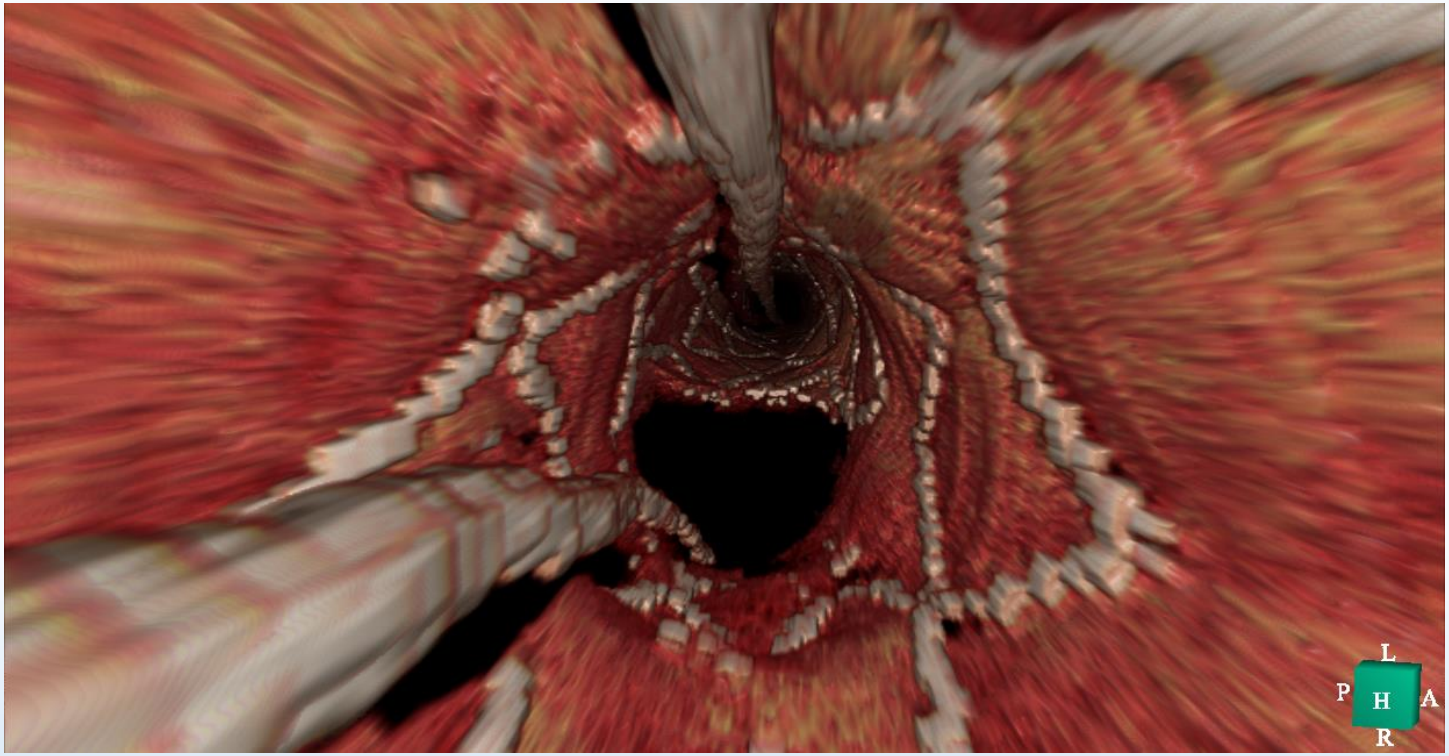
Post KBT

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Comparison between ILUMIEN(C7) and ILUMIEN OPTIS(C8)

Parameter	ILUMIEN	ILUMIEN OPTIS	
		Long Pullback S mode	High-density Pullback HD mode
Frame rate	100 frames/sec	180 frames/sec	180 frames/sec
Pull back speed	20 mm/sec	36 mm/sec	18 mm/sec
Frame interval	5 frames/mm	5 frames/mm	10 frames/mm
Pull back length	54 mm	75 mm	54 mm
Pull back time	2.7 sec	2.1 sec	3.0 sec