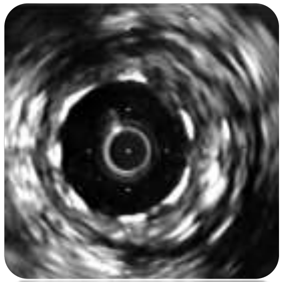
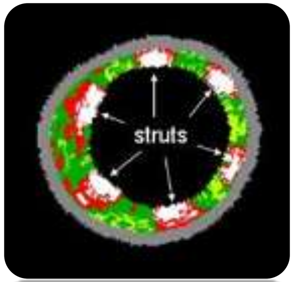
7th IMAGING & PHYSIOLOGY SUMMIT 2014

Grand International Seoul Palmas, Seoul Korea

December 5, 2014 14:10-14:20 Grand Ballroom 1, Level 5

Image workshop I: OCT
Basic concept and interpretation

Stented vessel


Takashi Kubo MD, PhD

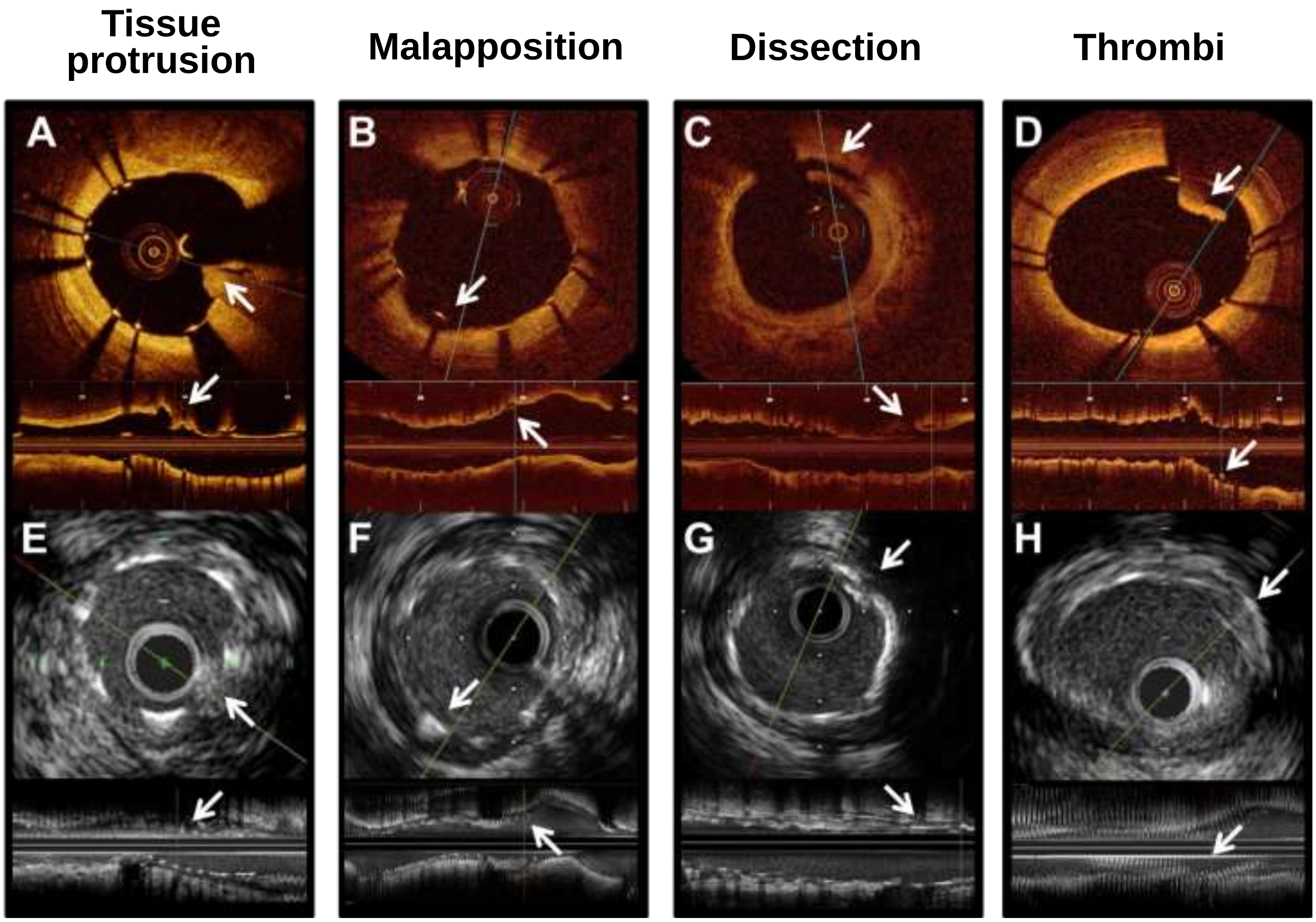
Wakayama Medical University, Wakayama, Japan

Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

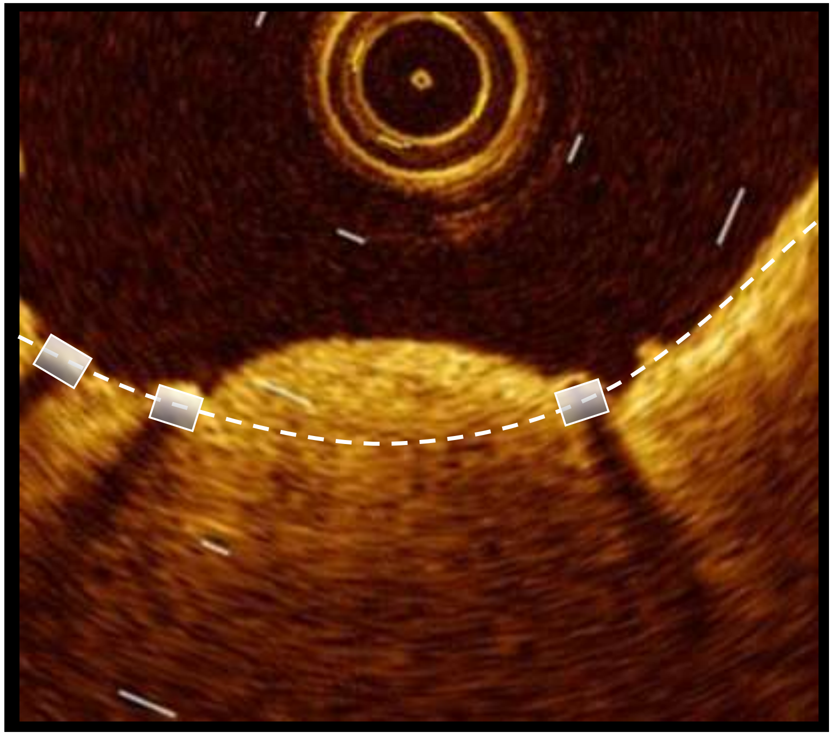
Affiliation/Financial Relationship	Company
Grant/Research Support	St. Jude Medical, Terumo, Abbott Vascular, Pfizer
Consulting Fees/Honoraria	St. Jude Medical, Terumo, Sumitomo
Major Stock Shareholder/Equity	No
Royalty Income	No
Ownership/Founder	No
Intellectual Property Rights	No
Other Financial Benefit	No

OCT and IVUS images of stented lesions



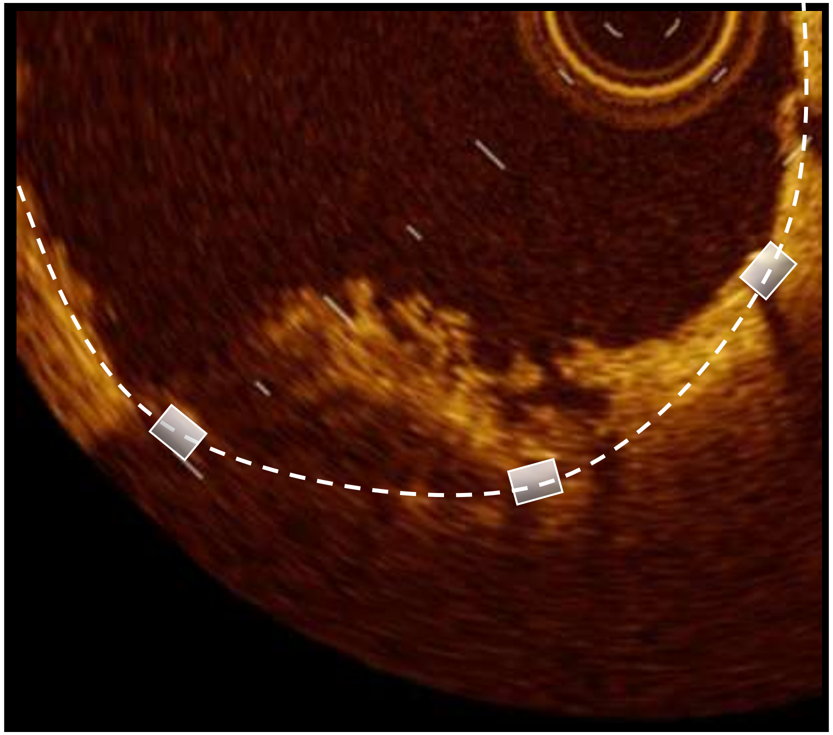
Tissue protrusions

Plaque protrusion



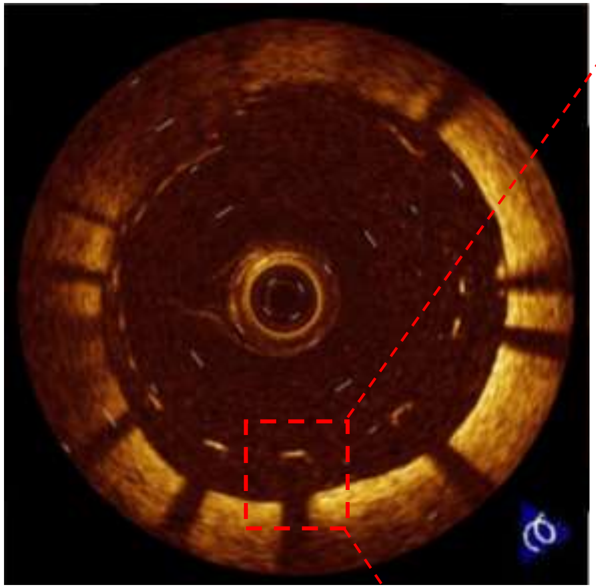
Smooth surface
Signal attenuation (-)

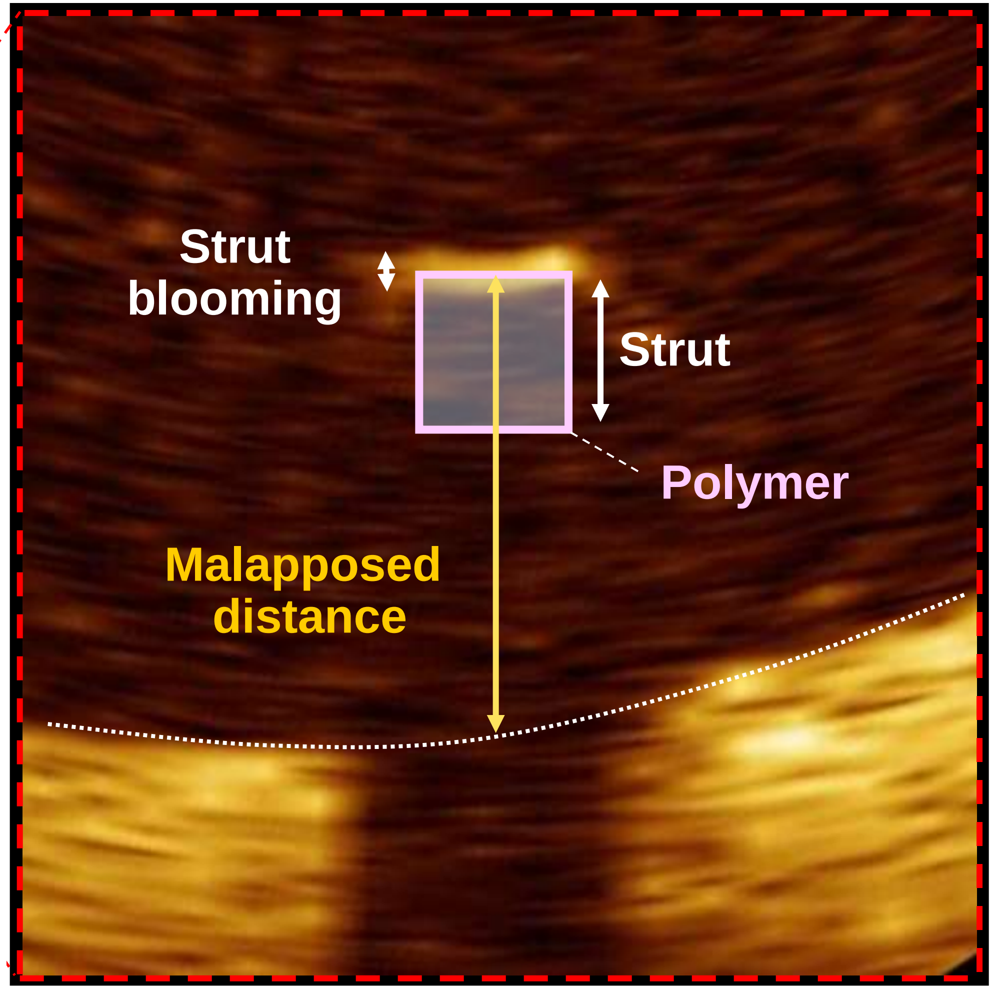
Thrombus



Irregular surface
Signal attenuation (+)

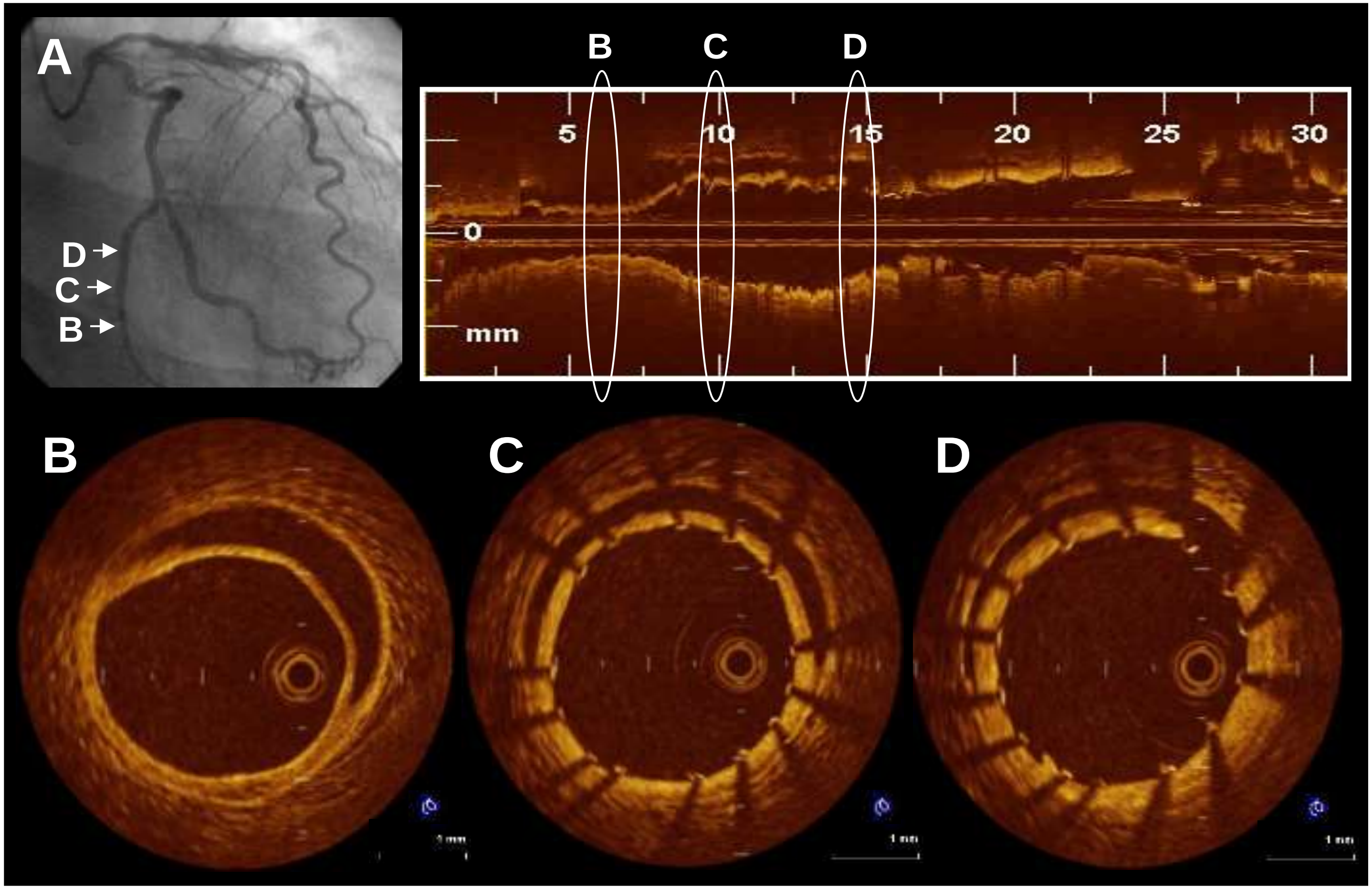
Stent malapposition





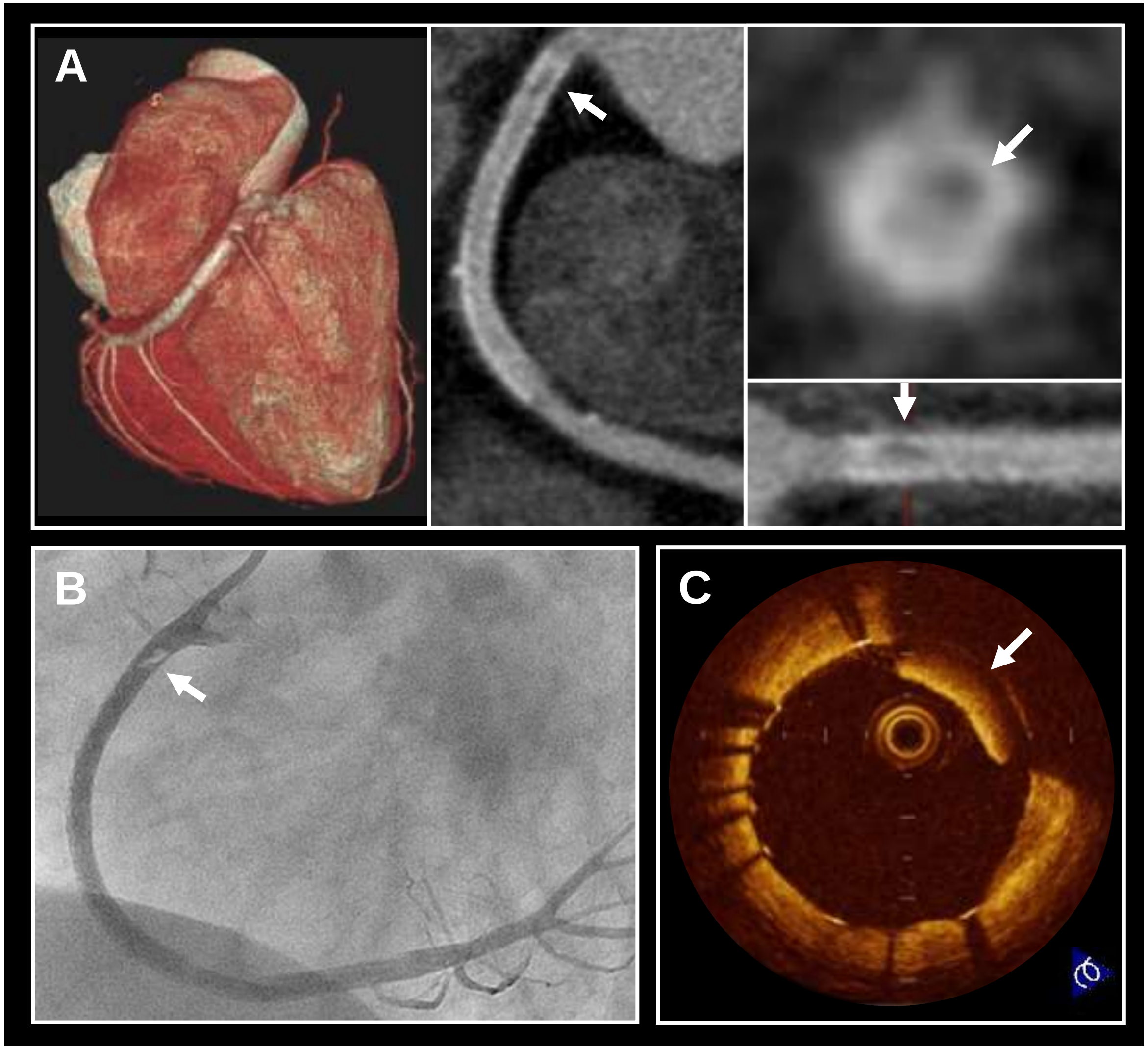
- **OCT can not visualize whole stent strut.**
- **The stent surface is located at the center of the stent strut blooming.**
- **Malapposition is defined when the measured distance from the stent surface to the lumen contour is greater than the total thickness of the stent strut + polymer.**

Coronary dissection



(A) A stent was deployed in LCX. (B, C) Coronary dissection was observed at the distal stent edge.
(D) An entry site of coronary dissection behind the stent was also visualized by OCT.

Early stent thrombosis



A 56-year-old male underwent coronary imaging 3 days after stent implantation in the right coronary artery (Liberté bare-metal stents: 4.0 x 28 mm and 4.0 x 32 mm, overlapping).

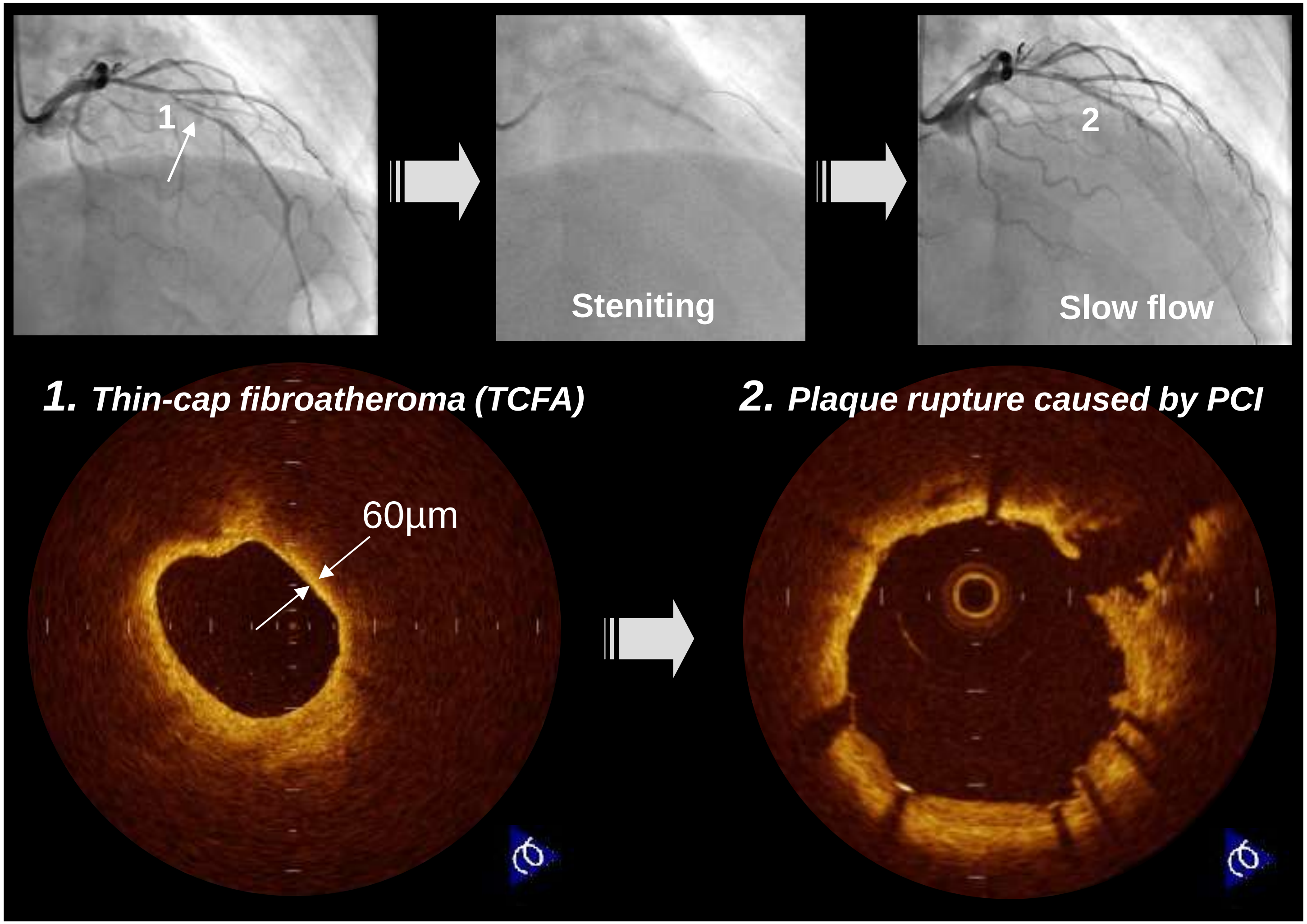
(A) MSCT demonstrated a hypodense lesion in the proximal segment of the stent (arrow). The cross section indicated the presence of a mural thrombus within the stent (arrow).

(B) Coronary angiography showed intraluminal filling defect in the proximal segment of the stent (arrow).

(C) OCT visualized a non-occlusive thrombus within the stent, corresponding with angiography and MSCT image.

Kubo, Akasaka et al. JACC img 2011;4:1040-3

PCI-induced plaque rupture



A 73-year-old male underwent PCI for the treatment of mid-LAD lesion (arrow).

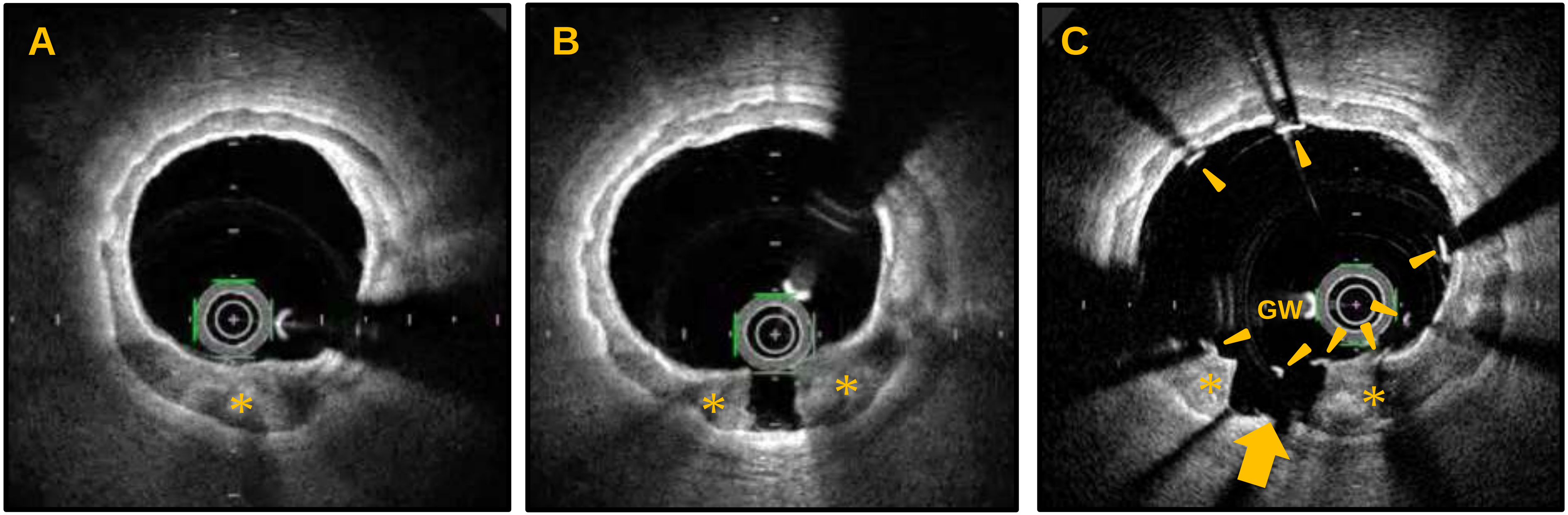
In OCT image at pre-intervention, the culprit lesion presented lipid-rich plaque with thin-fibrous cap.

After stenting, angiogram showed no-reflow, and OCT disclosed plaque rupture behind stent.

TCFA is easy to be ruptured by PCI and has a high risk for coronary no-reflow.

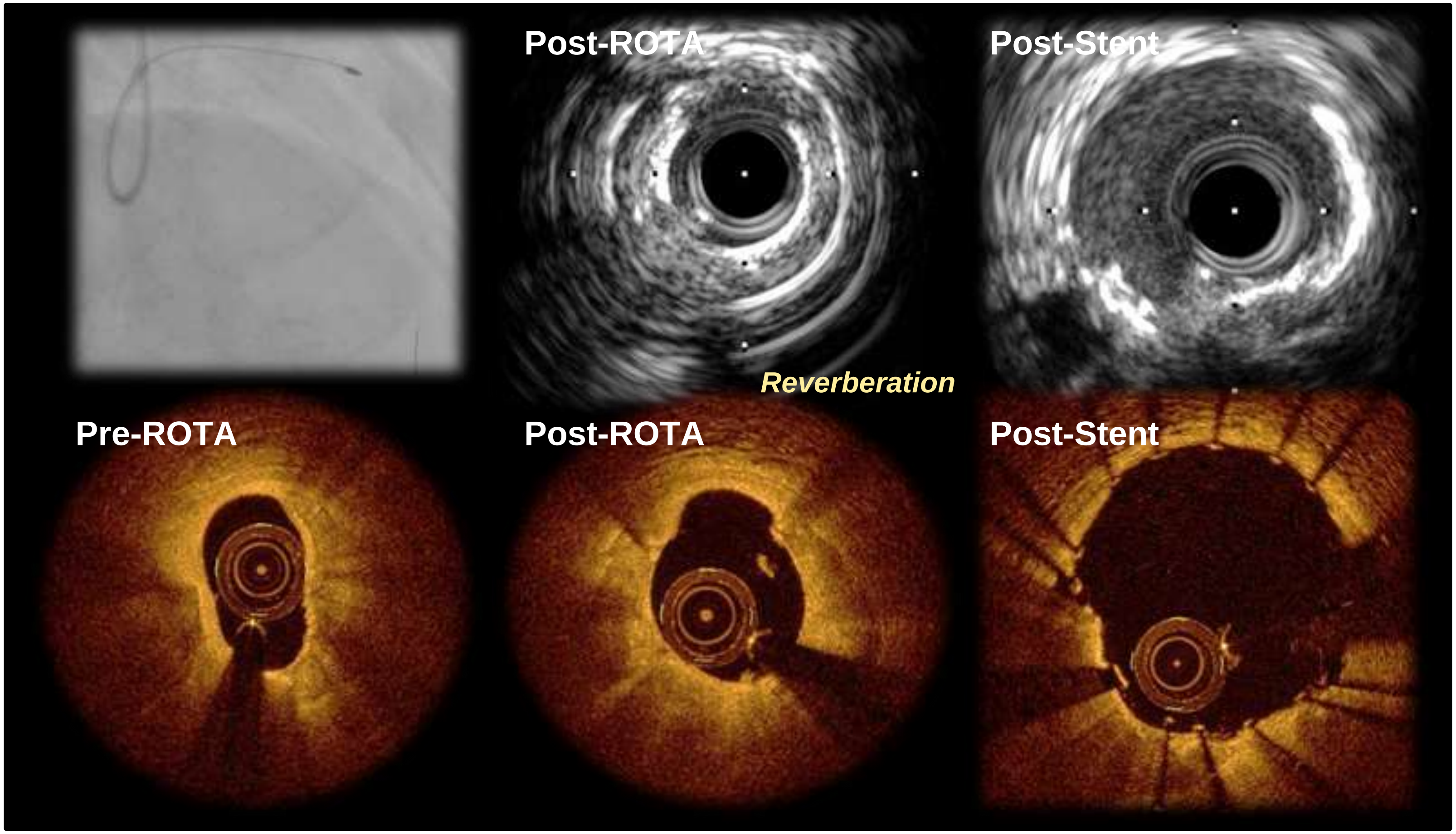
PCI-induced calcium fracture

Pe-PCI ***Balloon angioplasty*** ***Stent***



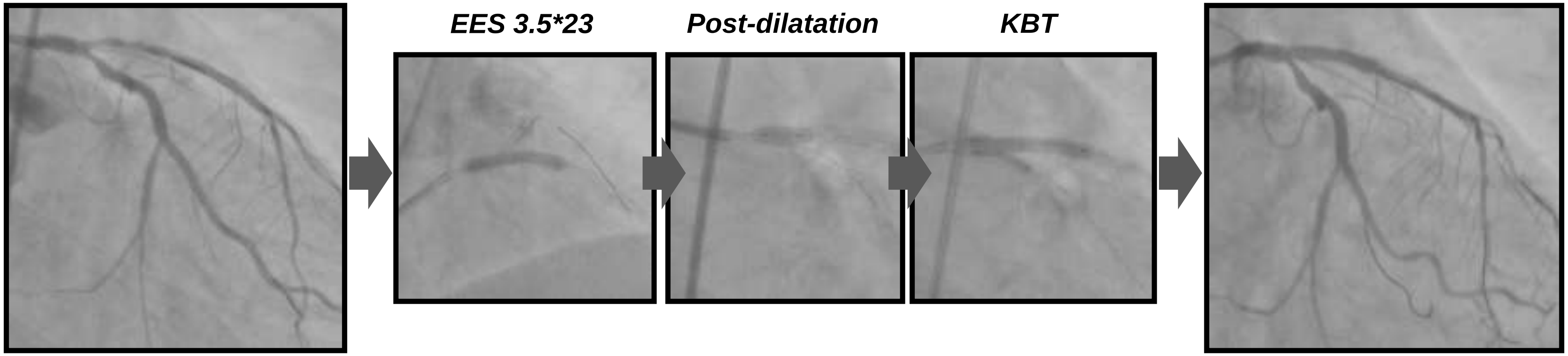
OCT before PCI (A) showed entire circumferential calcium. OCT after balloon angioplasty (B) and after stent implantation (C) demonstrated calcium fracture (6 o'clock). Thickness of the calcium fracture was 710 μm (arrow). Arrow heads = stent struts; Asterisk = Calcium; GW = guide wire.

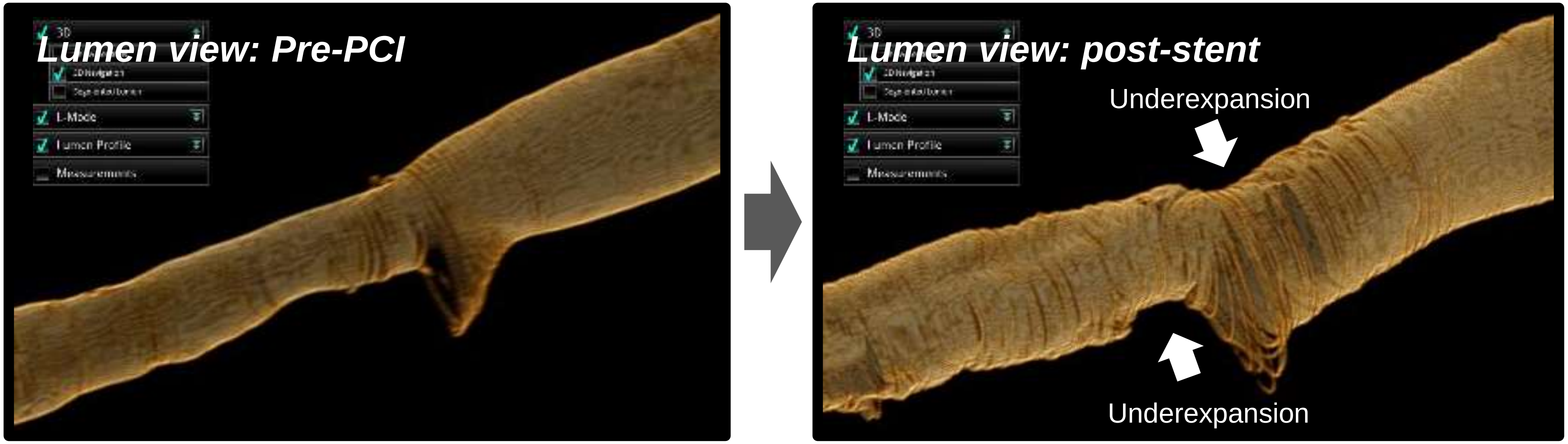
Rotational atherectomy



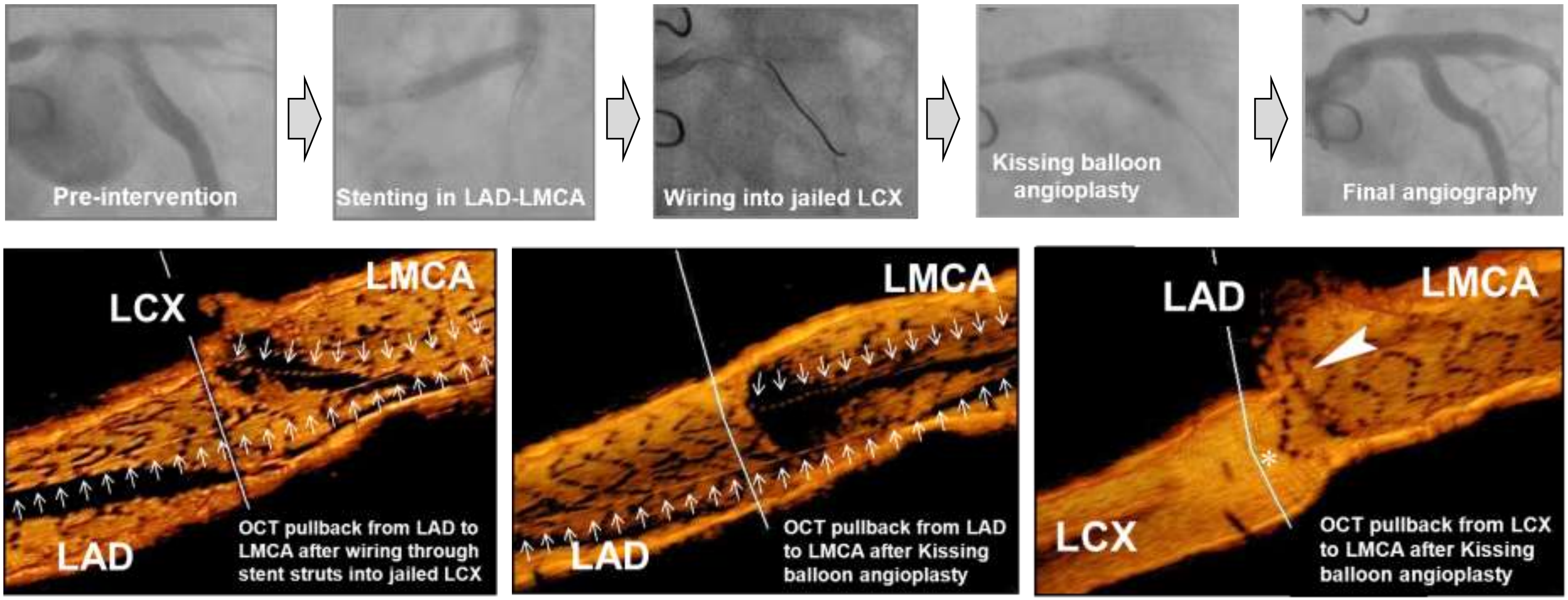
75yo, F. Rotational atherectomy to severe calcified lesion in LAD. After rotational atherectomy, IVUS has an artifact, reverberation. But OCT can provide clear image of coronary vessel wall without artifact.

3D OCT images of stent underexpansion

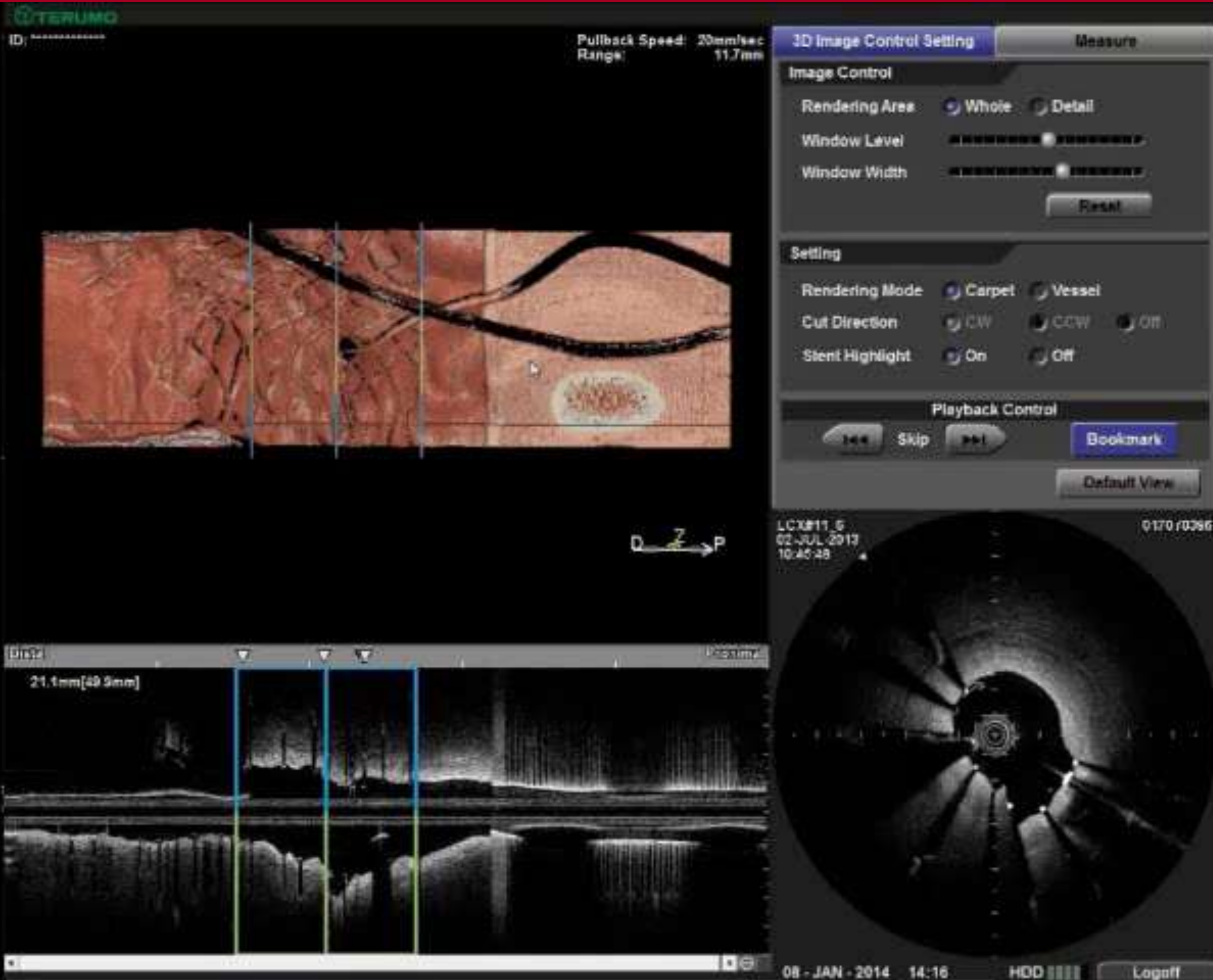




3D OCT images in bifurcation angioplasty



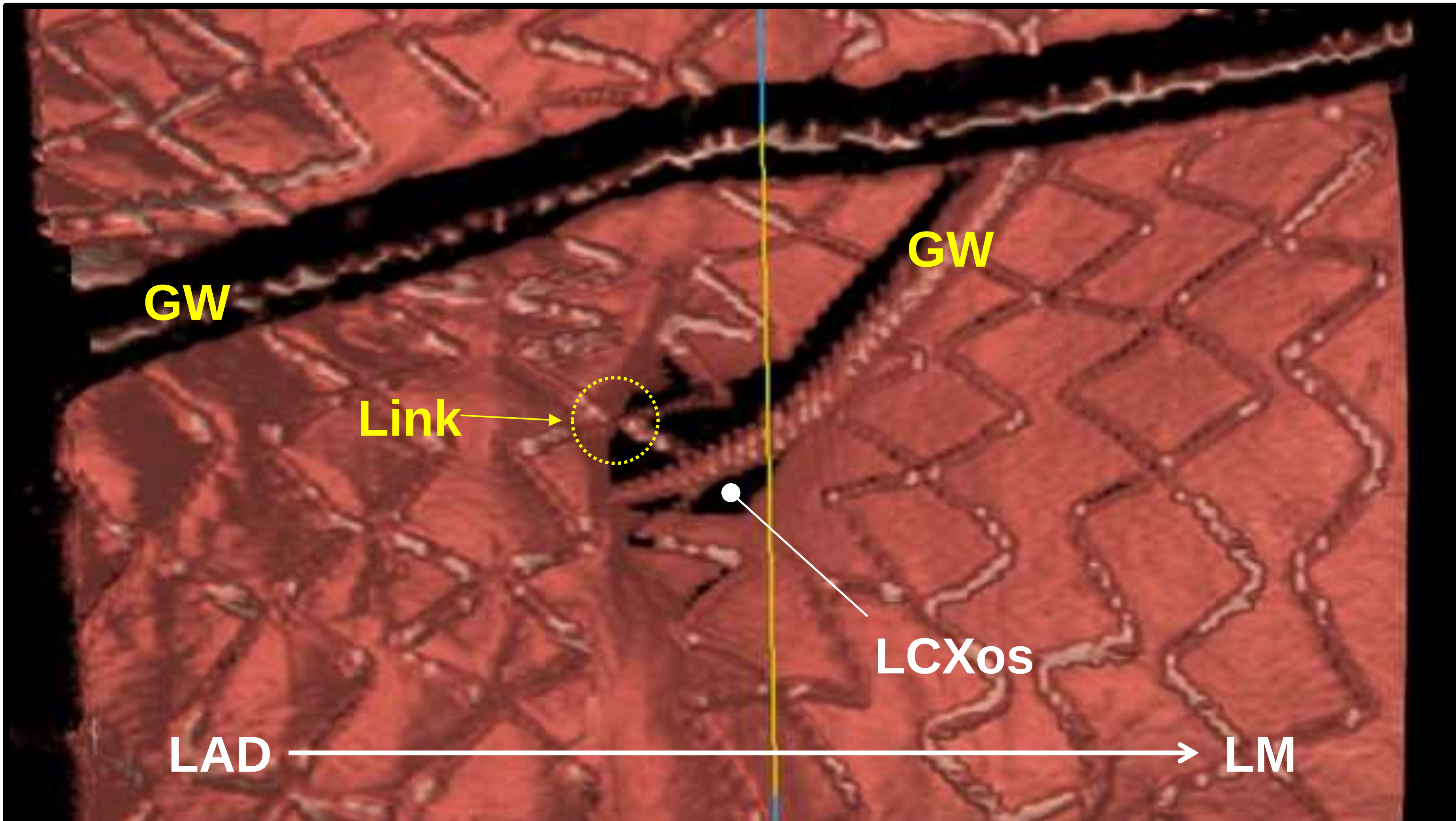
Left main bifurcation disease was treated with a single-stent technique across the left main coronary artery (LMCA) to the proximal left anterior descending coronary artery (LAD). Three-dimensional OCT imaging was useful to guide the rewiring through the distal compartment of the stent struts into jailed left circumflex coronary artery (LCA) after main branch stenting (arrows = guidewire). In addition, 3-dimensional OCT images demonstrated widely opened LCX ostium and well modified stent struts (*) without carina shift (arrow head) after kissing balloon angioplasty.



TERUMO
ID:
Pullback Speed: 20mm/sec
Range: 11.7mm
3D Image Control Setting
Measure
Image Control
Rendering Area
Whole
Detail
Window Level
Window Width
Reset
Setting
Rendering Mode
Carpet
Vessel
Cut Direction
CW
CCW
Off
Stent Highlight
On
Off
Playback Control
Skip
Bookmark
Default View
D
P
21.1mm[49.9mm]
LCX#11_6
02-JUL-2013
10:45:48
0170 /0396
08 - JAN - 2014
14:16
HDD
Logoff

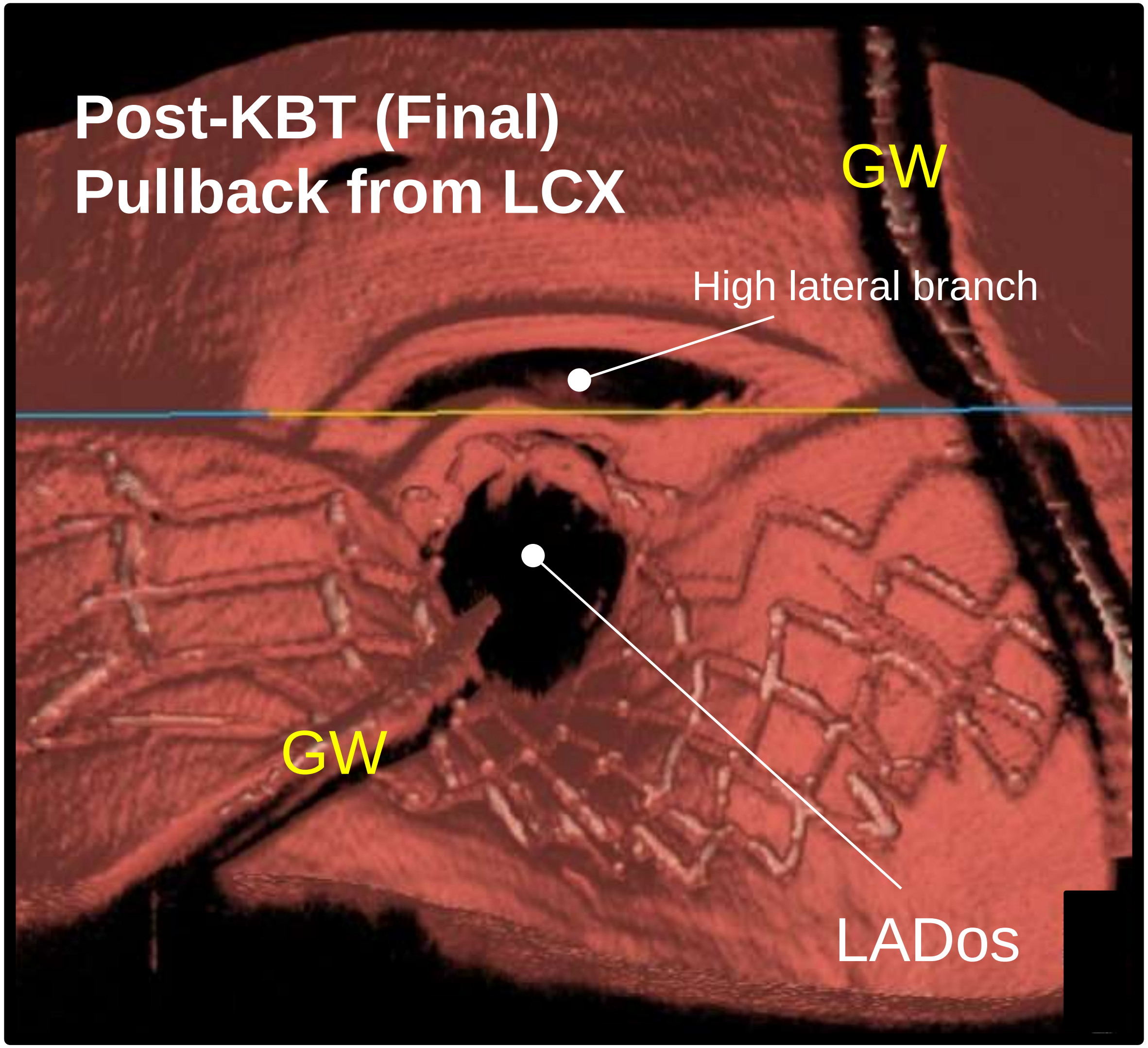
3D-OFDI image: Carpet view

"Link" of stent struts at side branch ostium



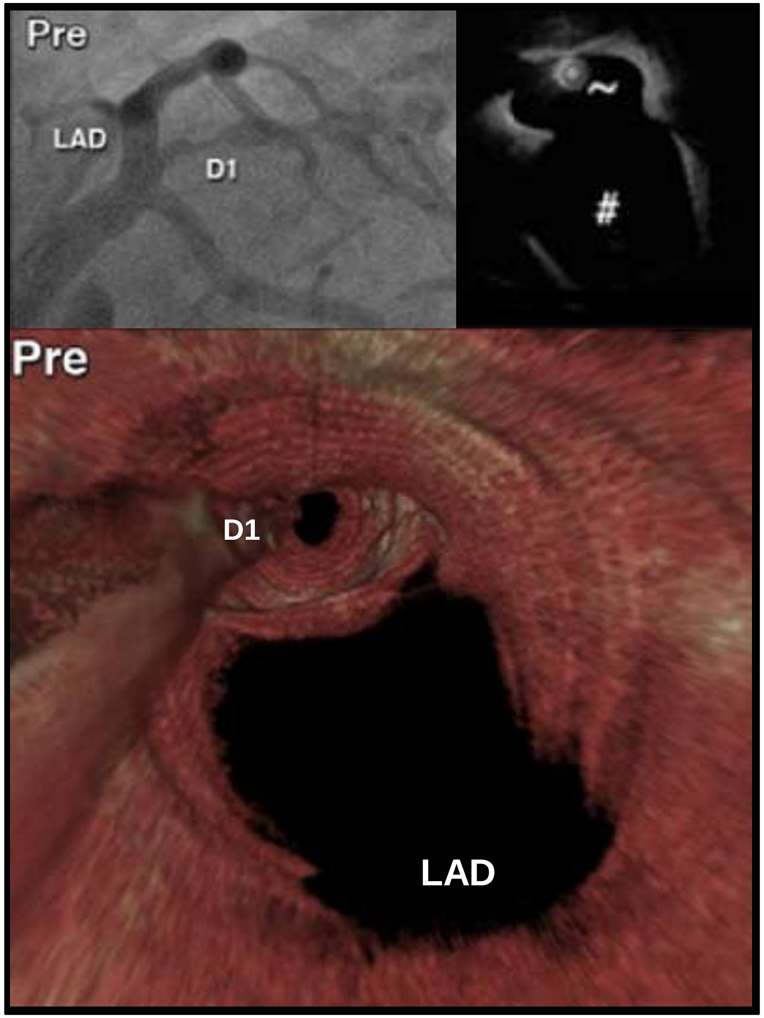
3D-OFDI image: Carpet view

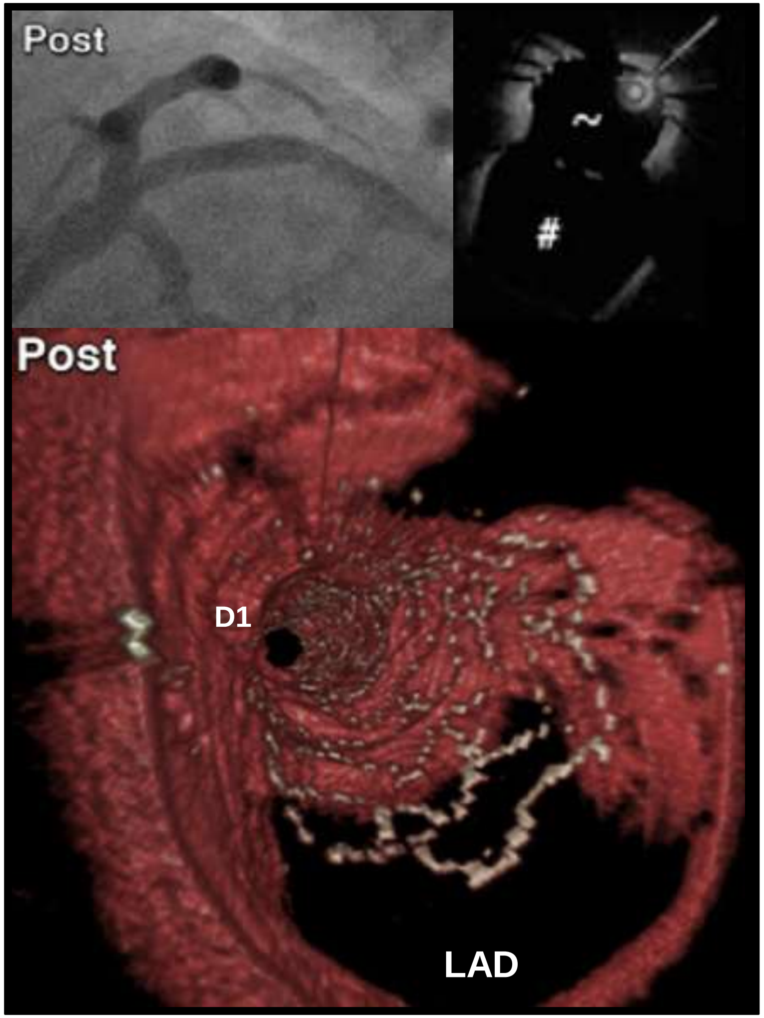
"Ostial stenosis of side branch" due to carina sift



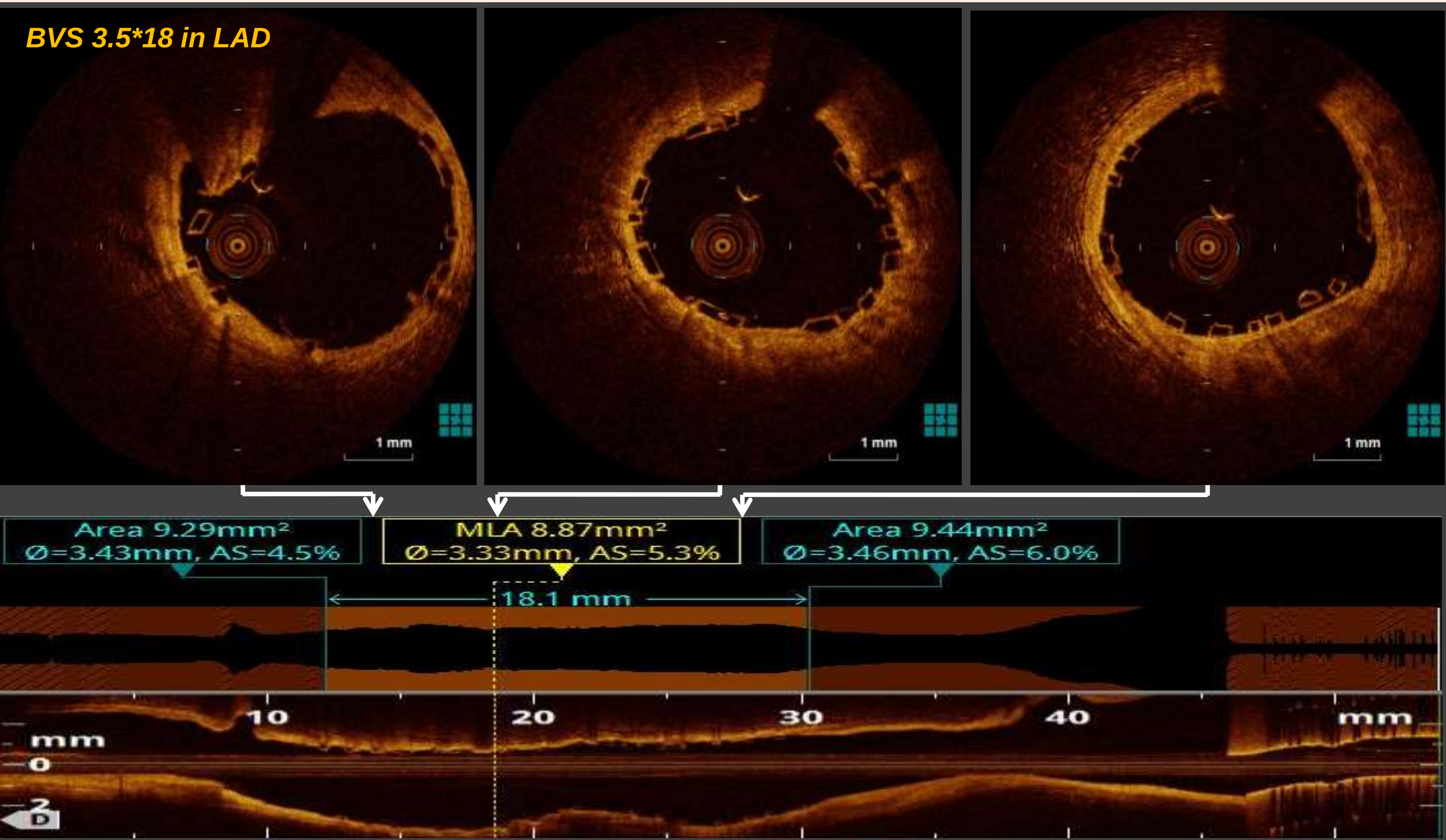
3D-OFDI images: Fly-thorough view

"Overhanging" struts of the D1 stent into the LAD orifice



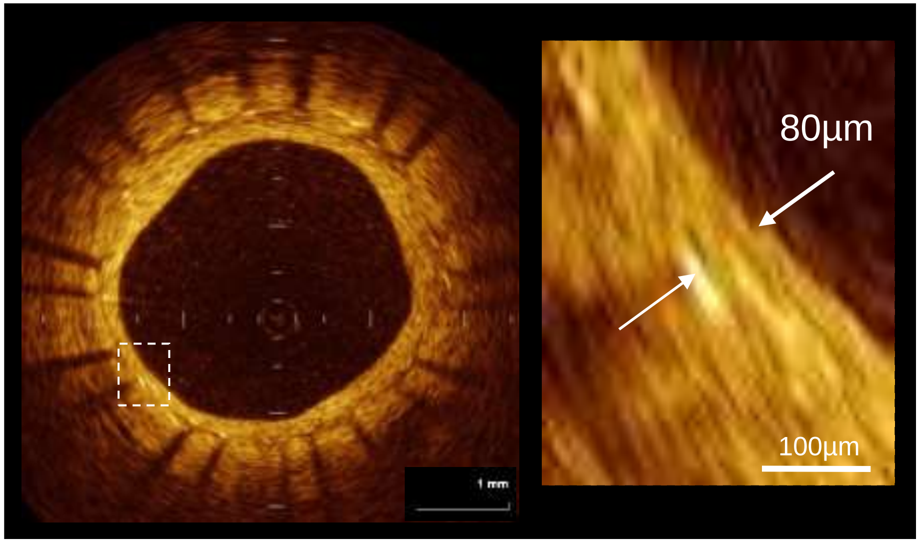


Bioresorbable vascular scaffold: BVS

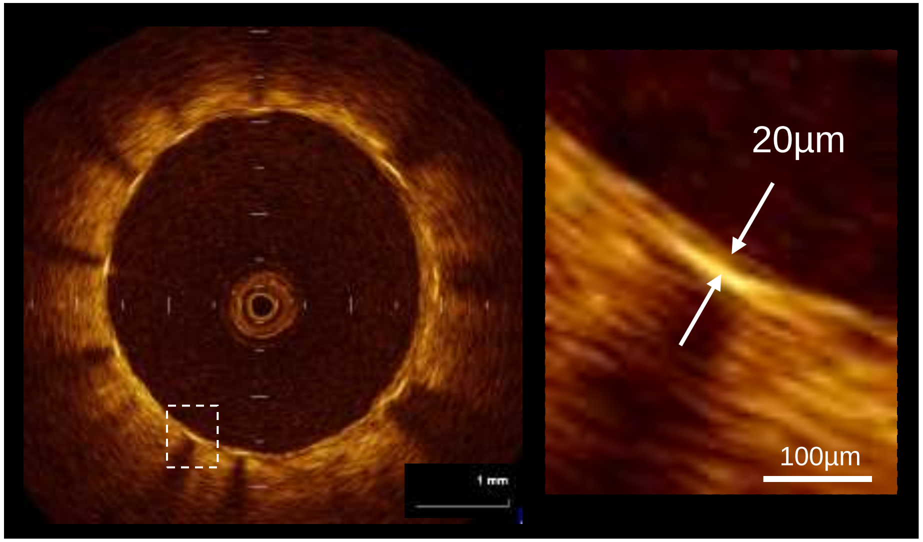


Neointimal hyperplasia after stenting

Bare-metal stent



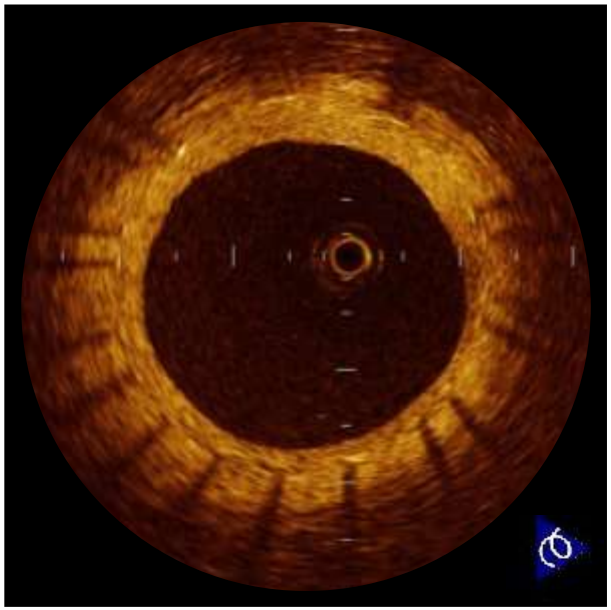
Drug-eluting stent



- OCT visualized thin neointimal hyperplasia at 9-month after stent implantation clearly. The thickness of neointimal hyperplasia at the thinnest site was 80μm in bare-metal stent, and it was 20μm in drug-eluting stent.
- Because the resolution of OCT is 10 μm, neointimal coverage of stent strut was defined as the struts covered by neointima >10μm.

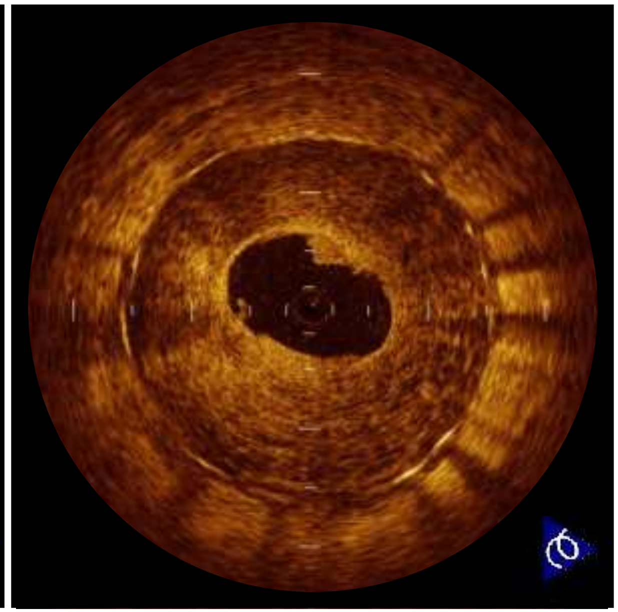
Neointimal tissue characterization by OCT

Homogeneous



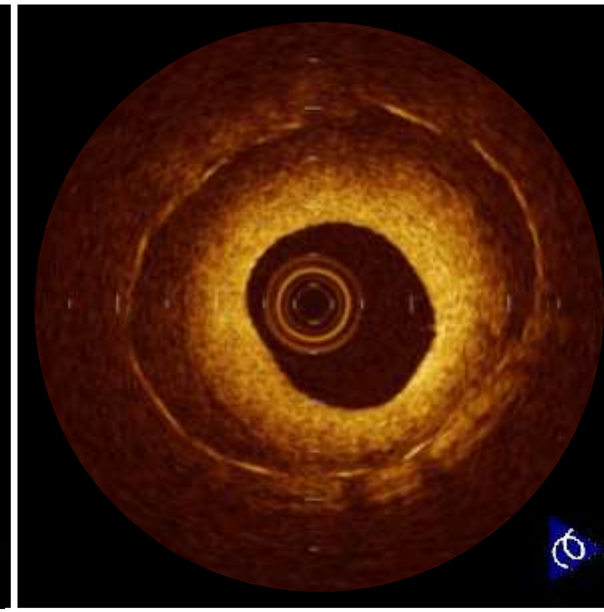
Restenotic tissue has uniform optical properties and dose not show focal variations in backscattering pattern.

Heterogeneous



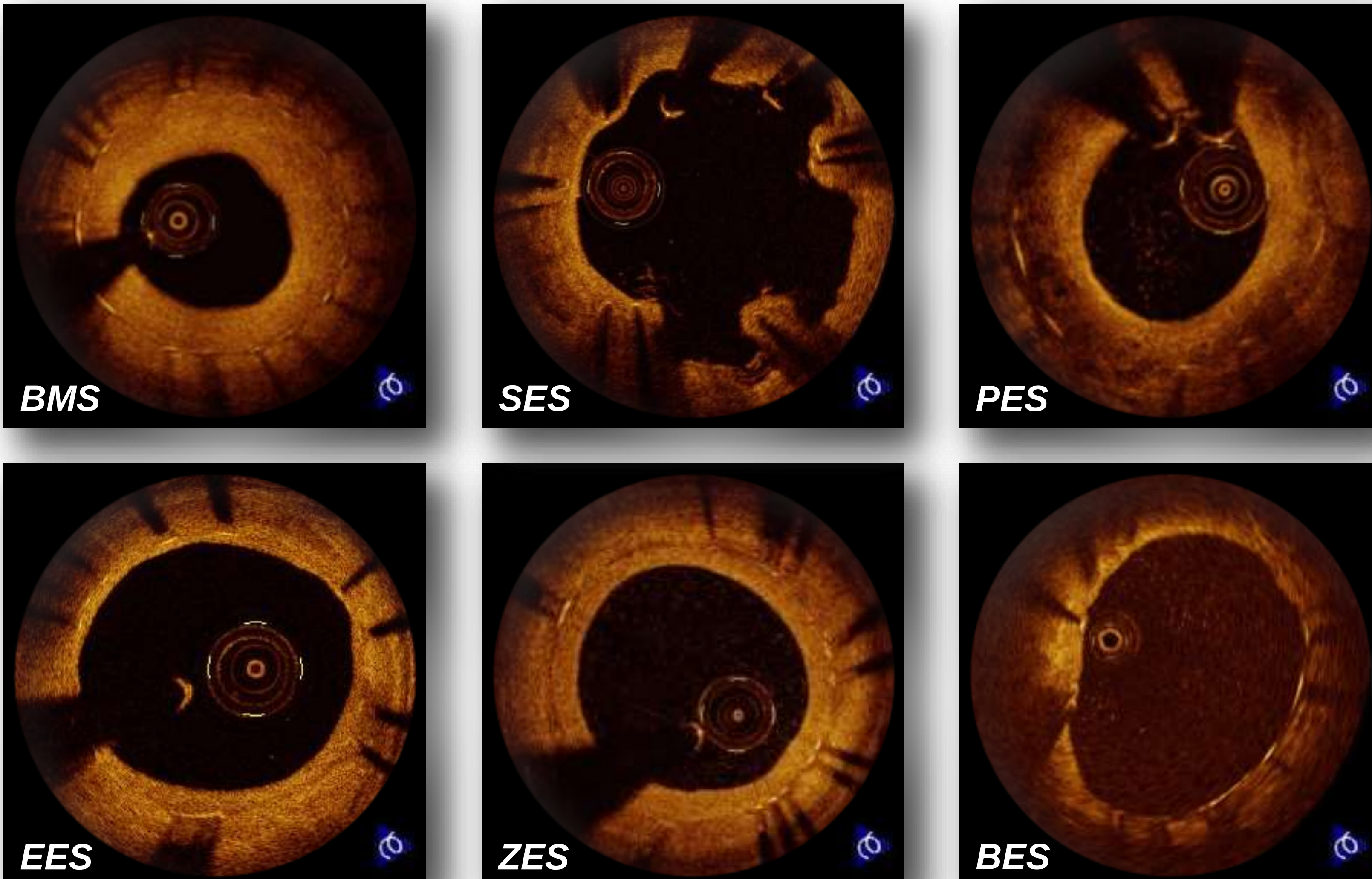
Restenotic tissue has focally changing optical properties and show various backscattering patterns.

Layered

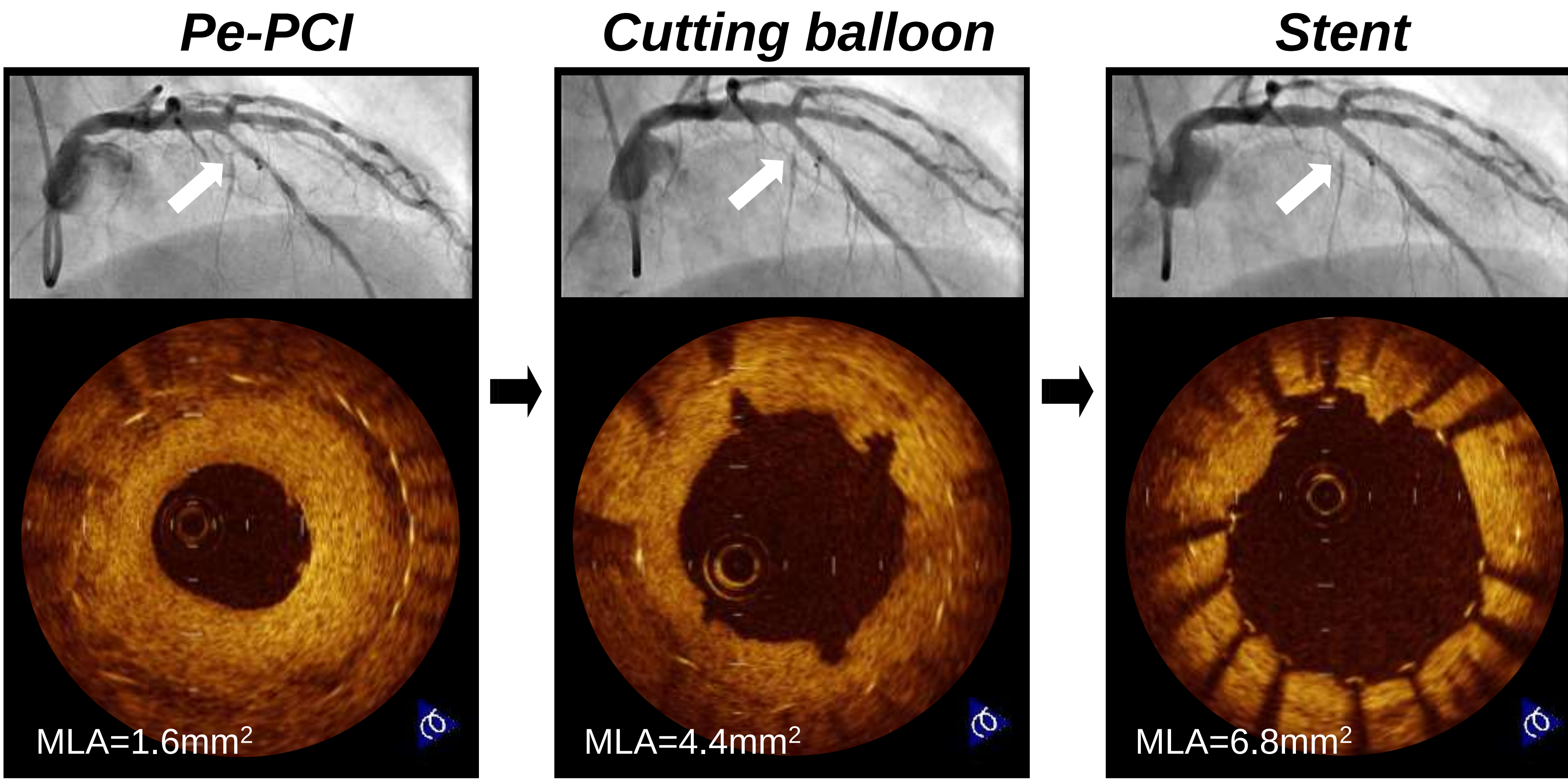


Restenotic tissue consists of concentric layers with different optical properties: an adluminal high scattering layer and adluminal low scattering layer.

Representative OCT images of coronary stents at follow-up



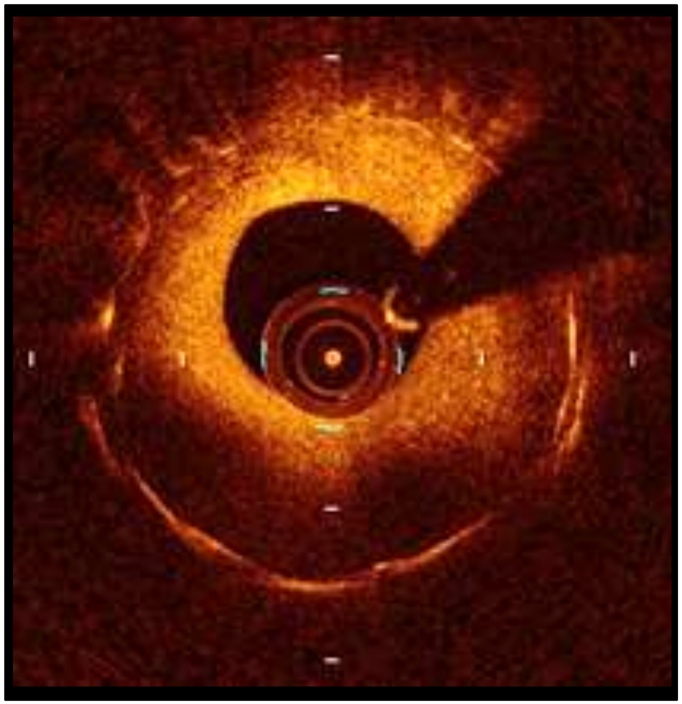
Cutting balloon angioplasty to in-stent restenosis



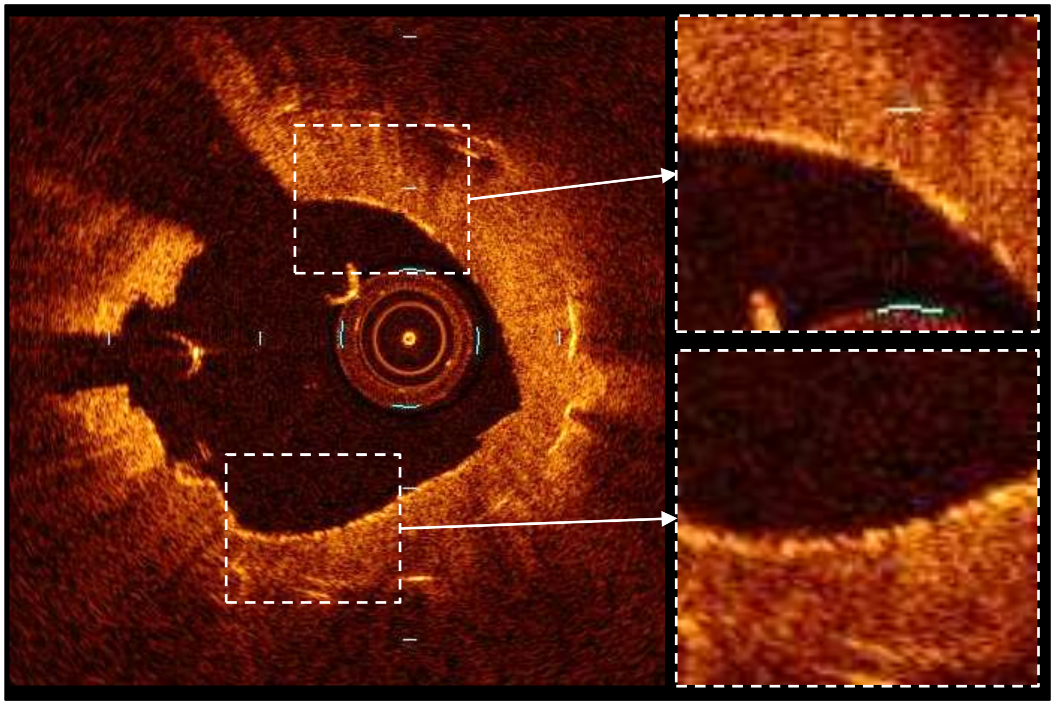
72yo, M. In-stent restenosis 9 months after BMS implantation in proximal LAD.
OCT demonstrated clefts in the neointima after cutting balloon angioplasty.

Drug-coated balloon angioplasty

Pre-PCI

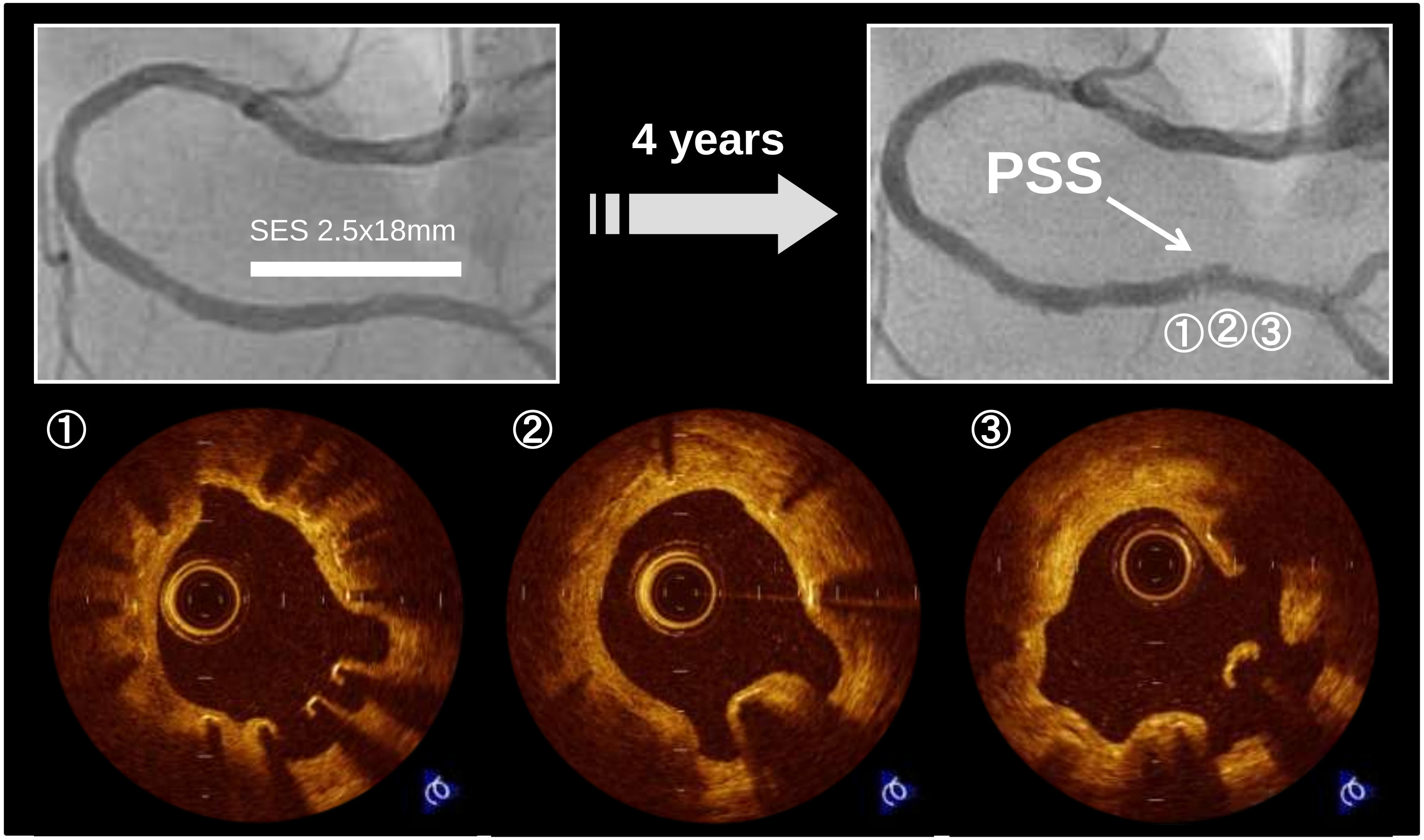


Post-PCI with DCB



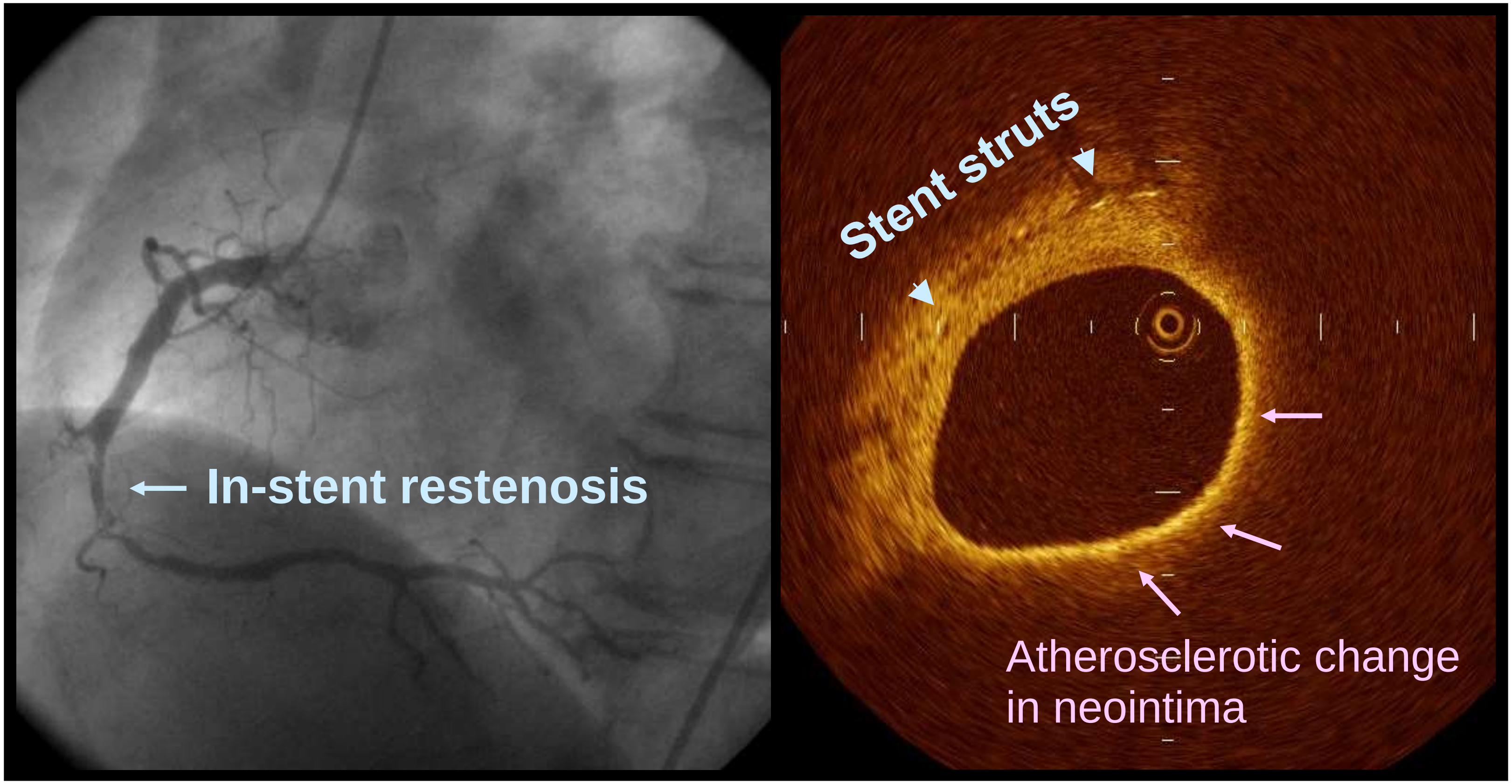
64yo, M. In-stent restenosis 10 months after EES implantation in proximal LAD.
The surface of neointima treated with DCB is visualized as a bright line with shadowing in OCT image.

Late acquired stent malapposition



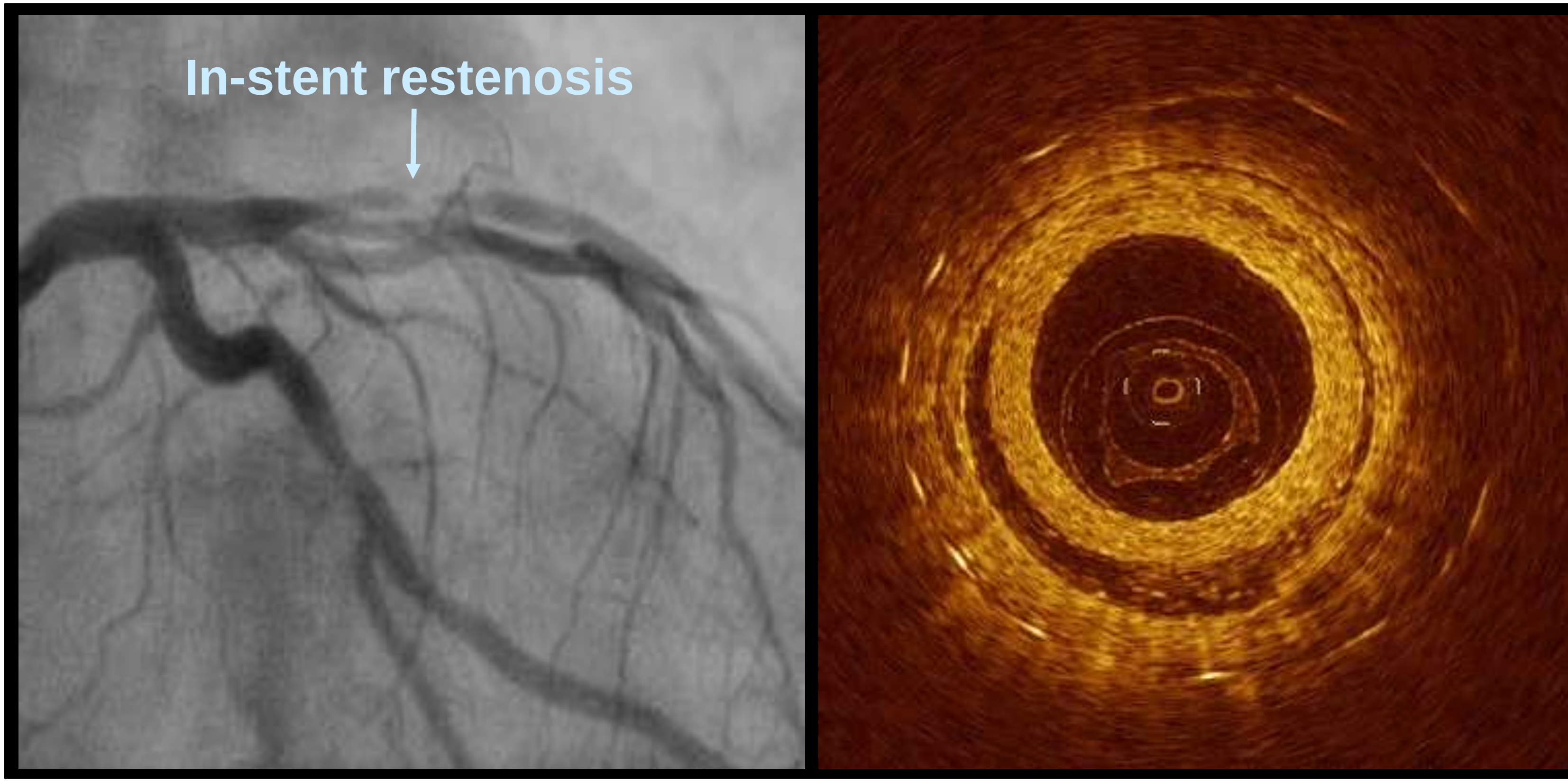
A 78-year-old female underwent SES implantation in distal RCA. At 4 years follow-up, angiography showed peri-stent contrast staining (arrow). OCT revealed late acquired stent malapposition and thrombi.

Neoatherosclerosis: lipid-rich neointima



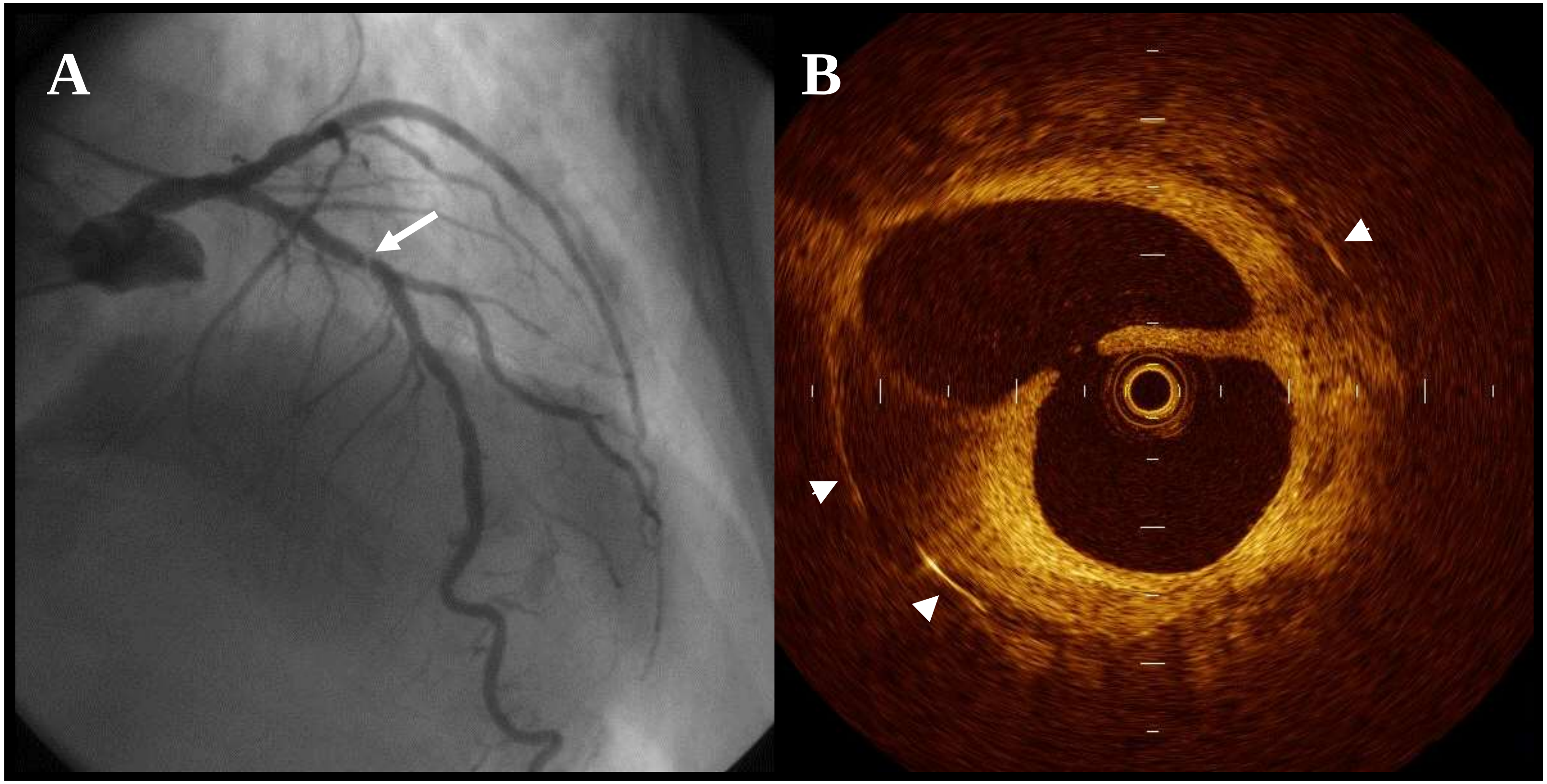
A 58-year-old man. In-stent restenosis at 7 years after BMS implantation.
Angiography showed severe in-stent stenosis in RCA. OCT demonstrated atherosclerotic change in the neointima (arrows).

Neoatherosclerosis: calcified noeintima



A 73-year-old man. In-stent restenosis at 11 years after BMS implantation.
Angiography showed severe in-stent stenosis in proximal LAD. OCT revealed superficial calcification in the neointima (asterisk).

Neoatherosclerosis: noeintima rupture



An 89-year-old man. Very late stent thrombosis at 9 years after BMS implantation. Angiography showed focal filling-defect in the stented segment. OCT clearly disclosed atherosclerotic change of neointima and plaque rupture within the stent.

Conclusion

- OCT is a promising technology in the evaluation of acute and late vascular response after stent implantation.