

6th COMPLEX PCI 2021 Virtual

2021. November. 25-26.

Featuring Training Session and Clinical Workshop 2:
Step 2. Lesion Preparation

Make it Perfect: How to Use Invasive Imaging in Complex PCI

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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.

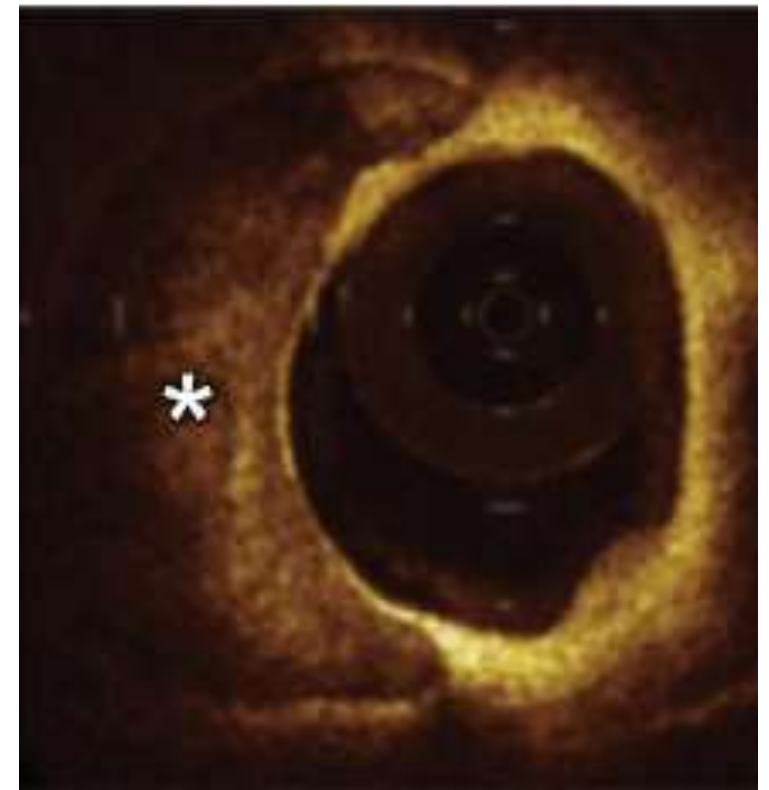
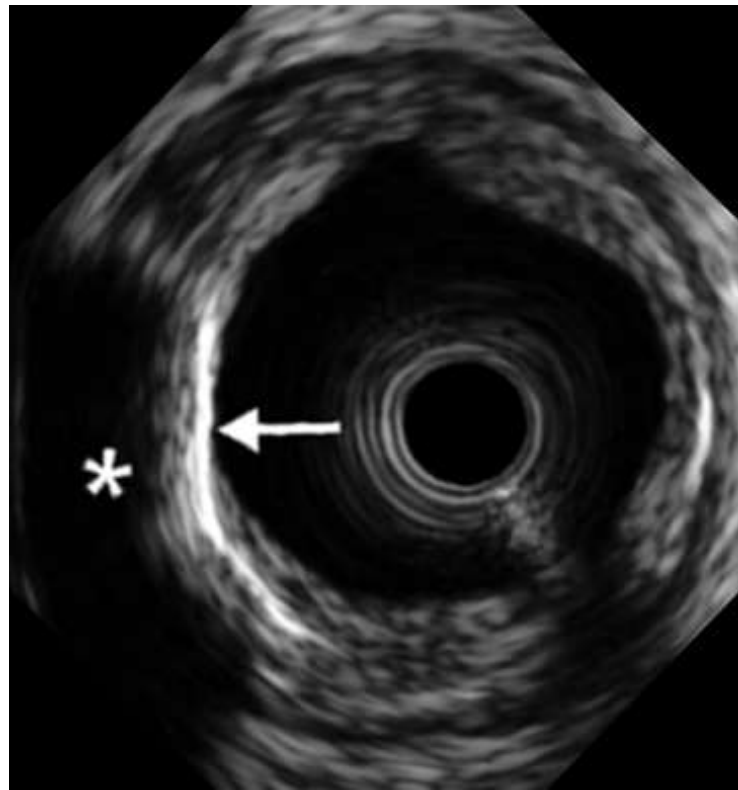
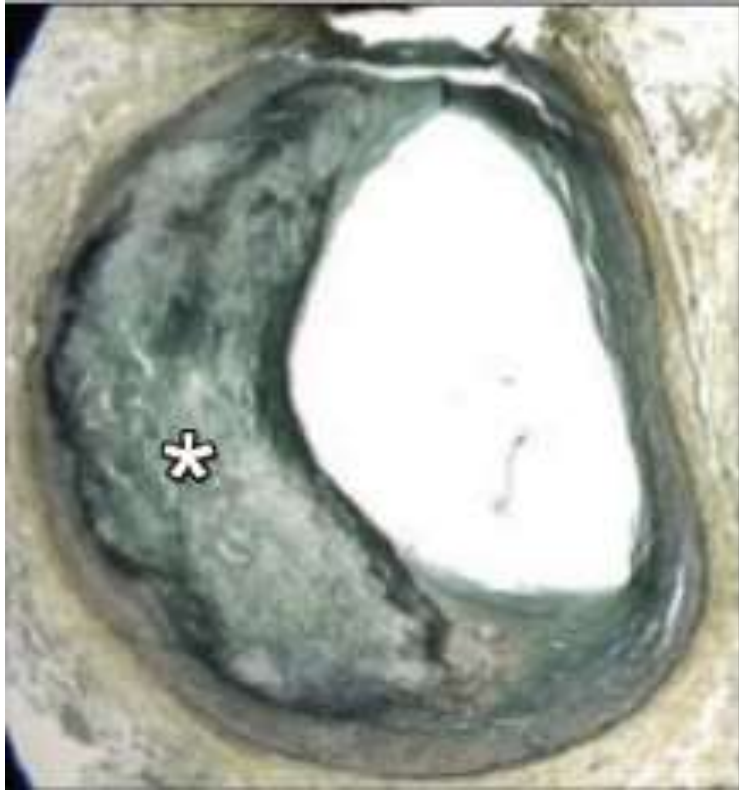
Affiliation/Financial Relationship

Company

- | | |
|----------------------------------|------|
| • Grant/Research Support | • No |
| • Consulting Fees/Honoraria | • No |
| • Major Stock Shareholder/Equity | • No |
| • Royalty Income | • No |
| • Ownership/Founder | • No |
| • Intellectual Property Rights | • No |
| • Other Financial Benefit | • No |

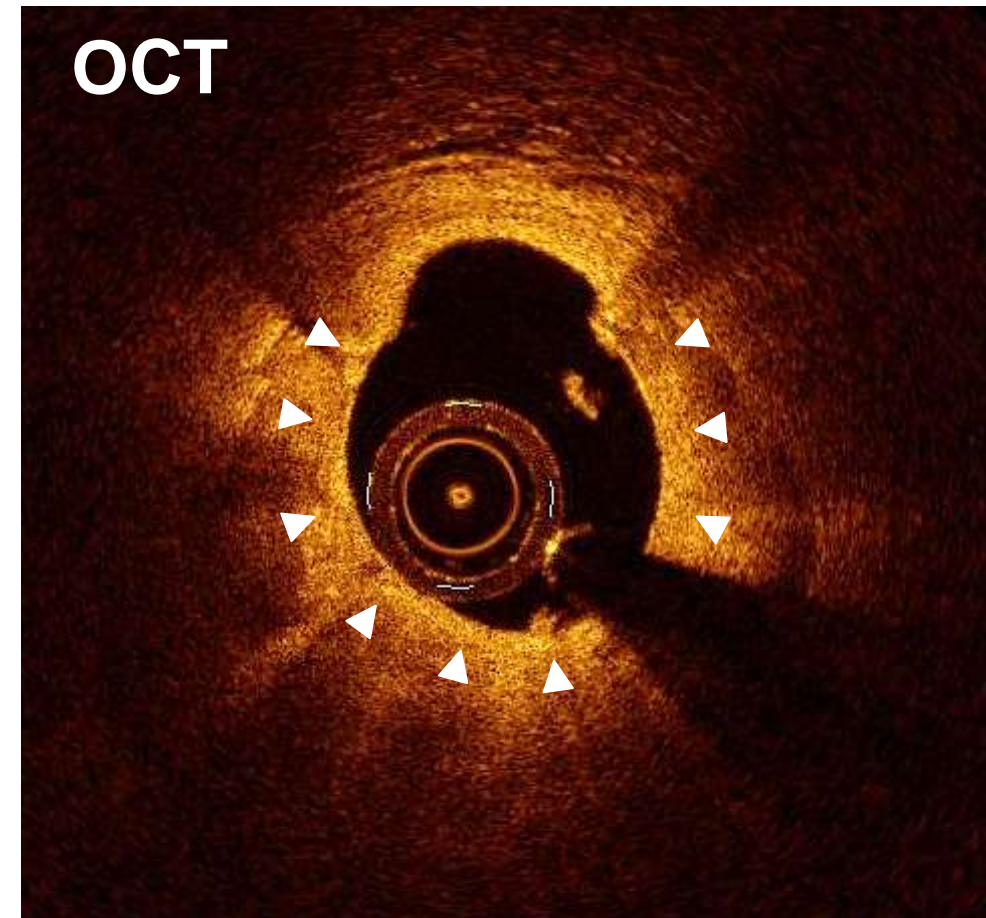
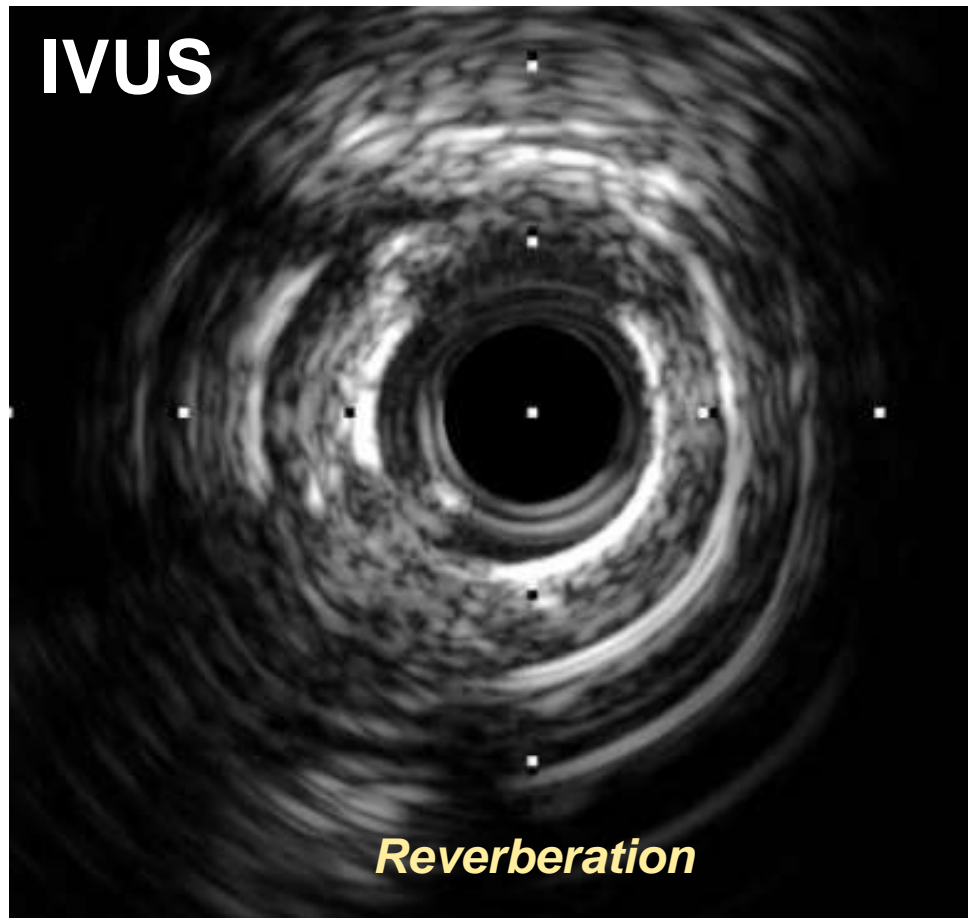


IVUS and OCT images of calcified plaque



On the IVUS image, note the bright leading edge of superficial calcium with deeper shadowing that corresponds to the histopathological calcium. Calcium thickness and area cannot be assessed. On the OCT image, note the signal-poor and heterogeneous region with sharply delineated leading, trailing, and lateral borders. Calcium thickness and area can be measured.

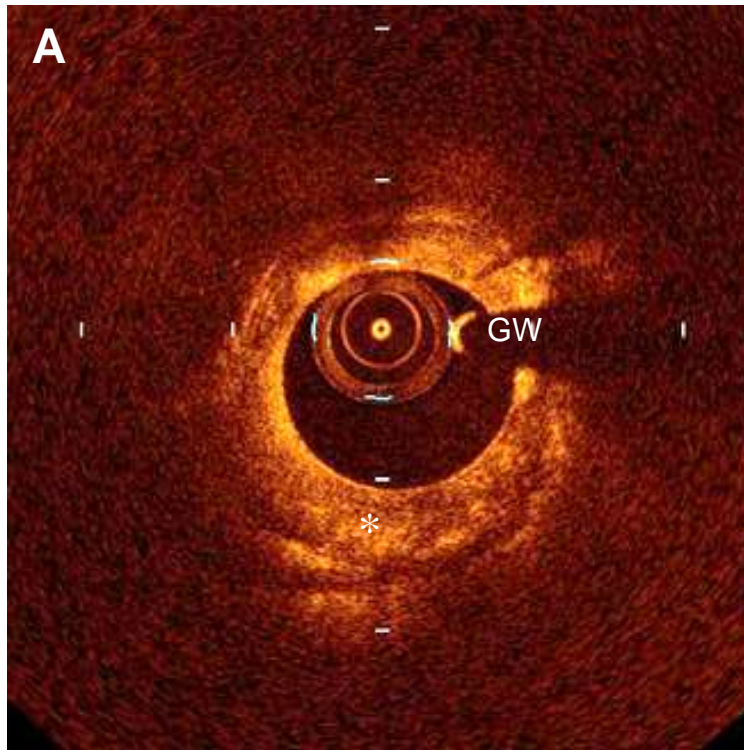
Rotablator atherectomy



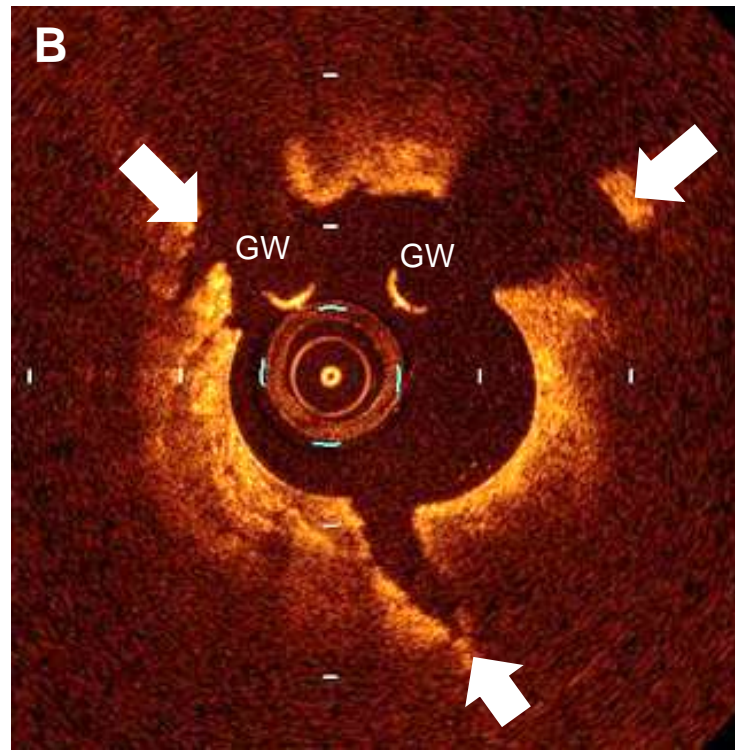
After rotational atherectomy, there is an artifact, reverberation in IVUS. But OCT can provide clear image of cutting surface of coronary vessel wall without artifact (arrow heads).

Calcium fracture by cutting balloon

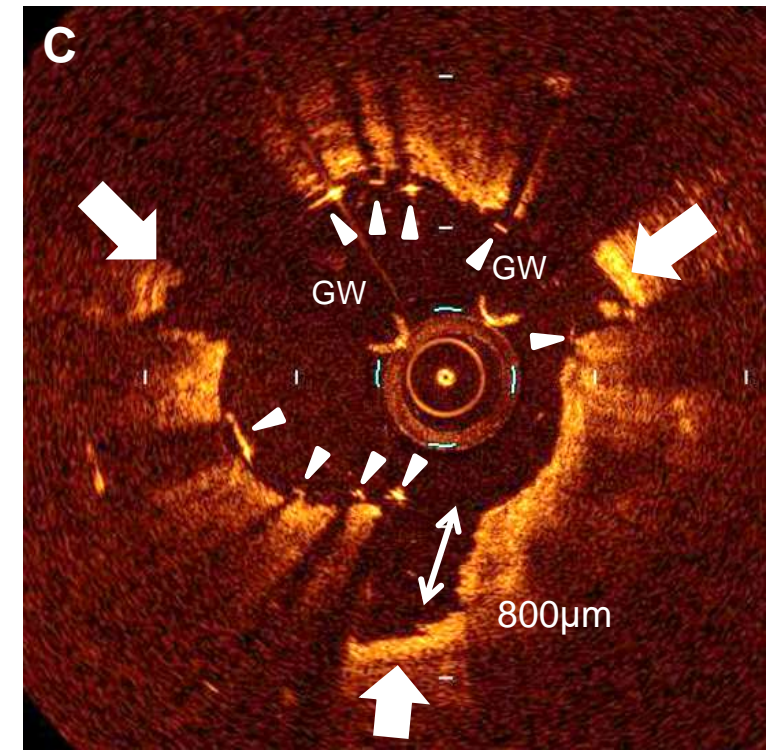
Pre-PCI



Cutting balloon



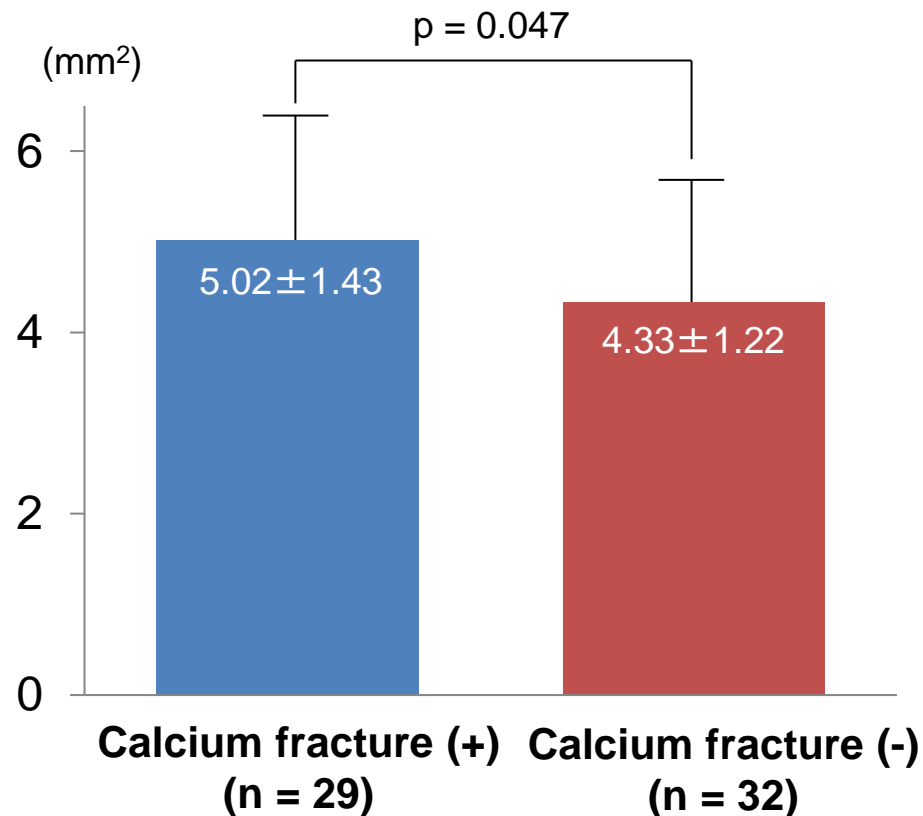
Stent



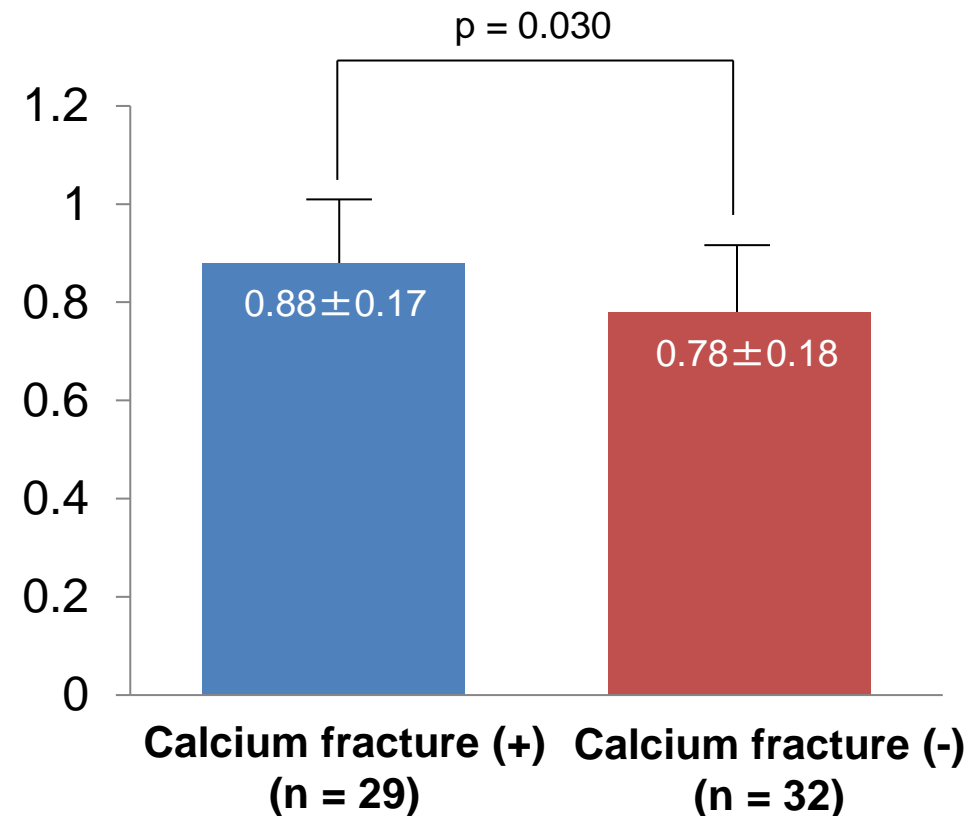
OCT before PCI (A) showed entire circumferential calcium. OCT after cutting balloon angioplasty (B) and after PCI (C) demonstrated calcium fracture (arrows). Thickness of the calcium fracture was 800µm (double headed arrow). Arrow heads = stent struts; Asterisk = Calcium; GW = guide wire.

Stent expansion at post-PCI

Minimum stent area



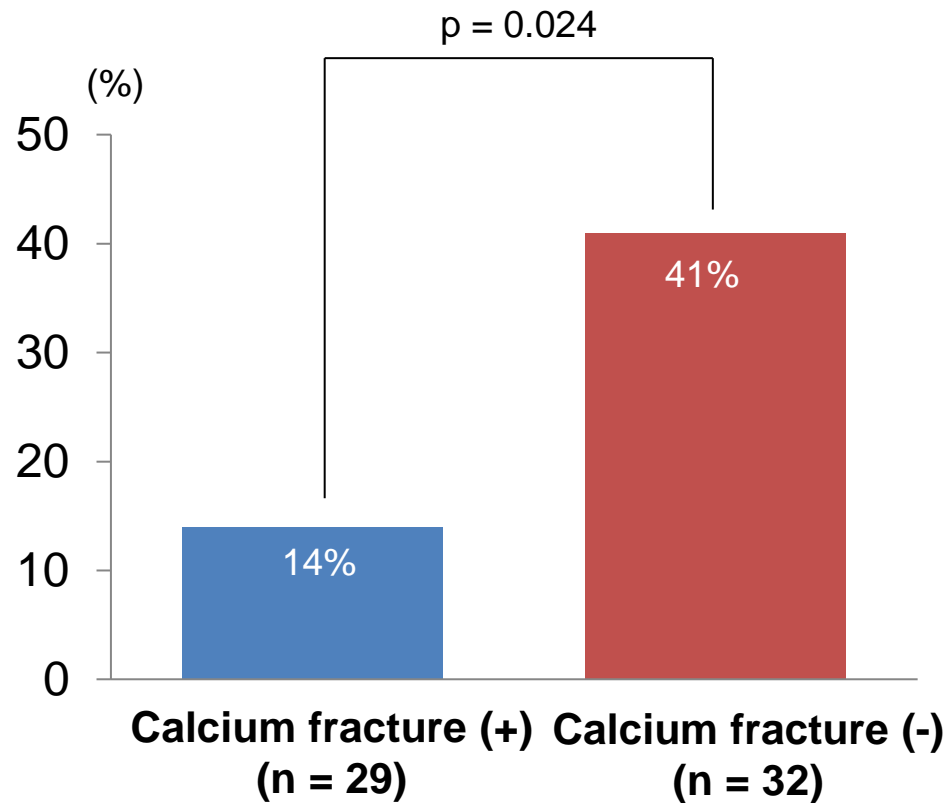
Stent expansion index



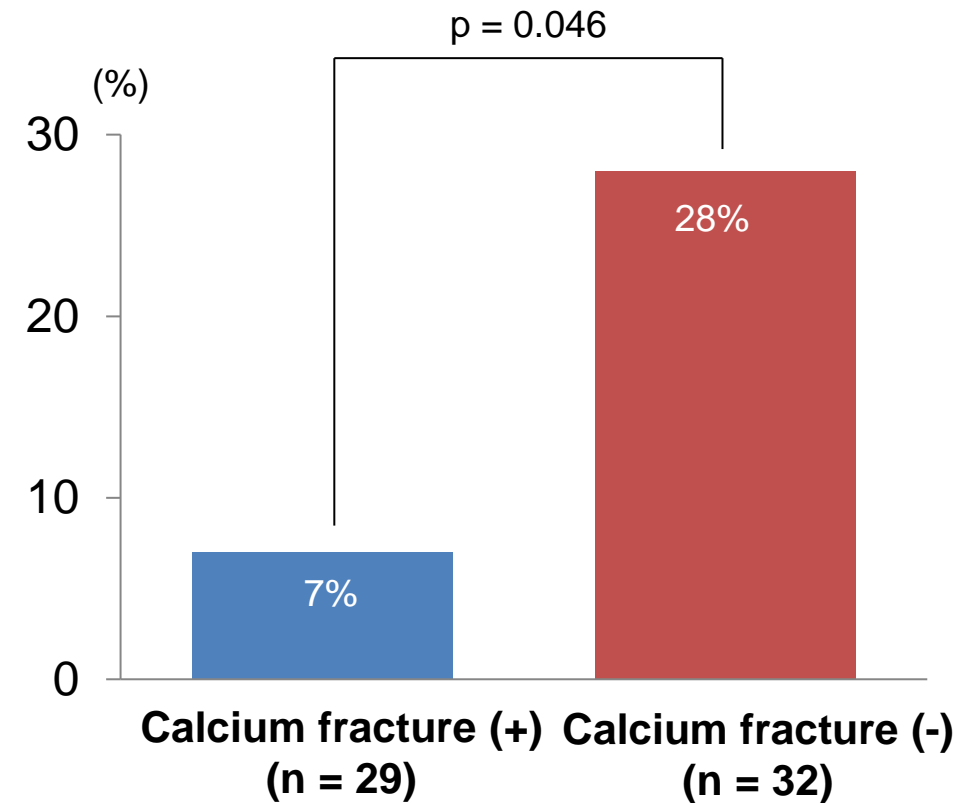
Minimum stent area and stent expansion index were significantly greater in the group with calcium fracture compared with the group without calcium fracture.

Restenosis and TLR at 10 months follow-up

Binary restenosis



Target lesion revascularization

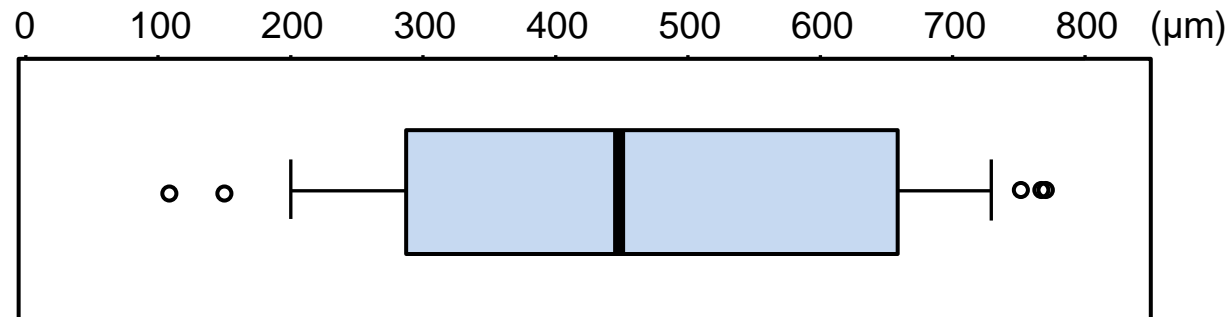


The frequency of binary restenosis and target lesion revascularization was significantly lower in the group with calcium fracture compared with the group without calcium fracture.

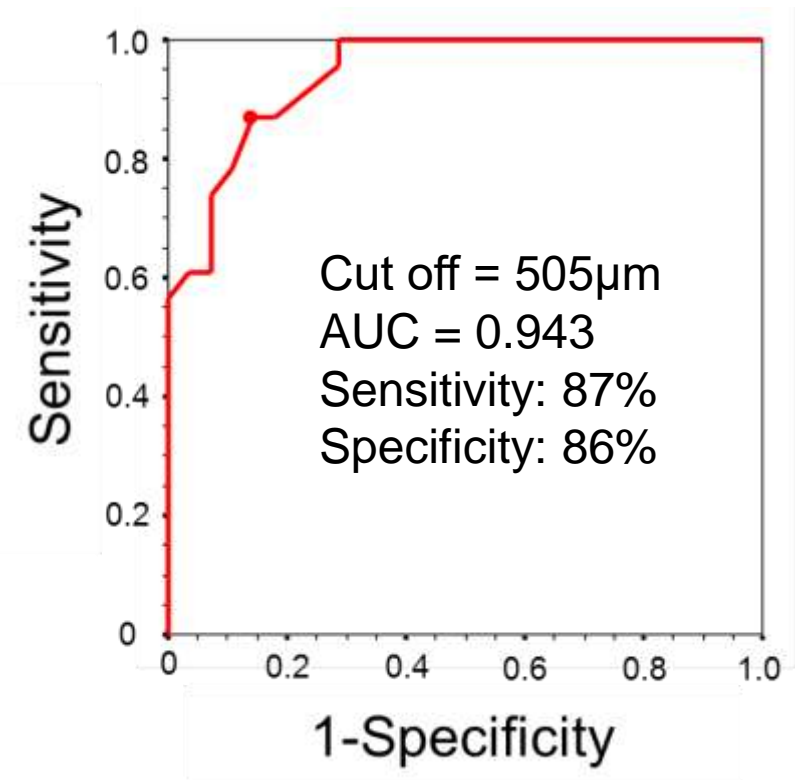
Prediction of calcium fracture by ballooning

OCT was performed to assess vascular response immediately after high pressure ballooning in 61 patients with severe calcified coronary lesion.

Thickness distribution of calcium fracture



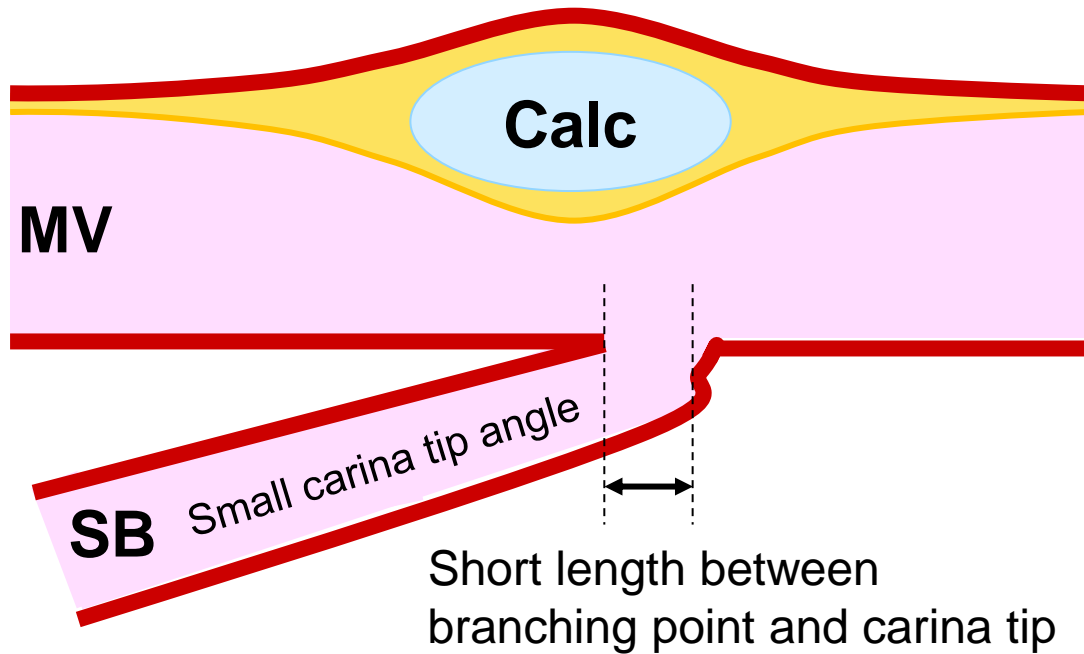
Median = 450 μm ; Lower quartile = 300 μm ; Upper quartile = 660 μm ; Minimum = 110 μm ; and Maximum = 770 μm .



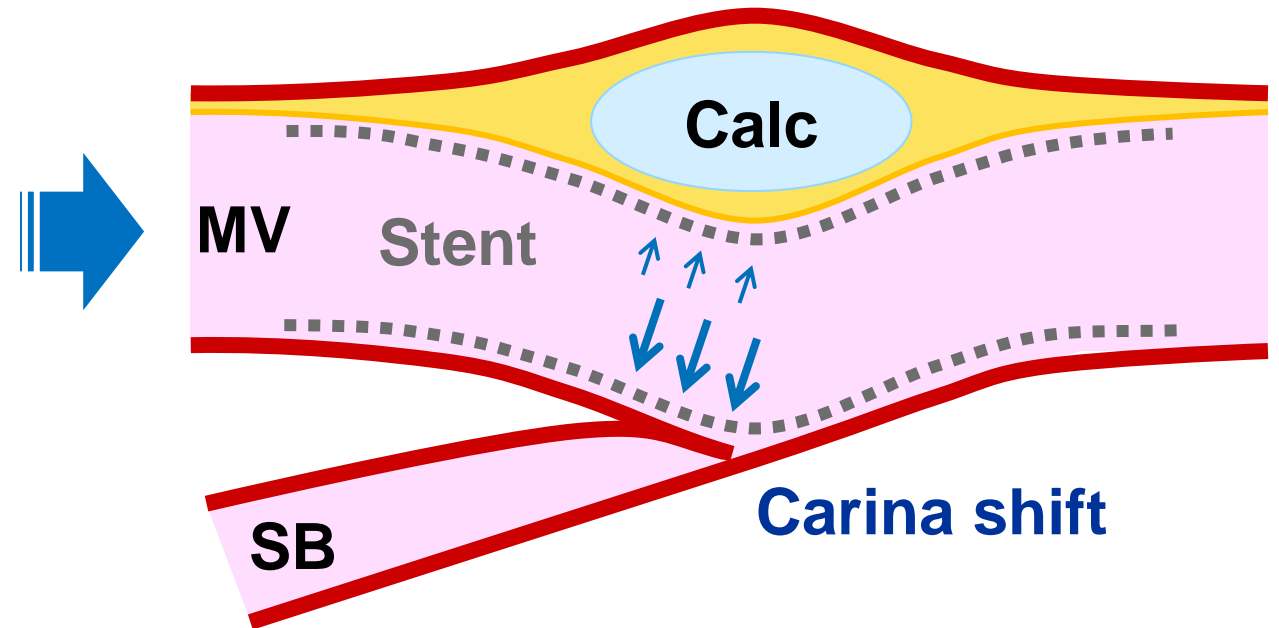
A calcium plate thickness < 505 μm was the corresponding cut-off value for predicting calcium fracture by high pressure ballooning.

Carina shift and SB ostial occlusion

Pre-intervention



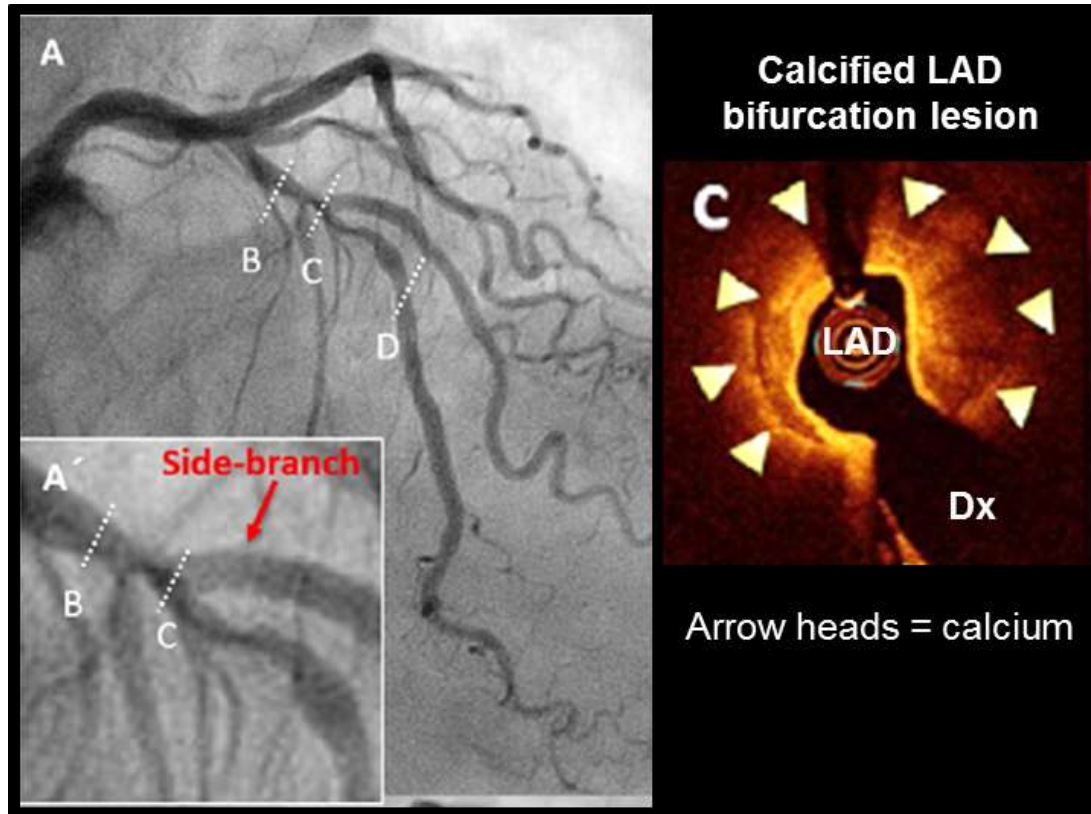
Post stent implantation



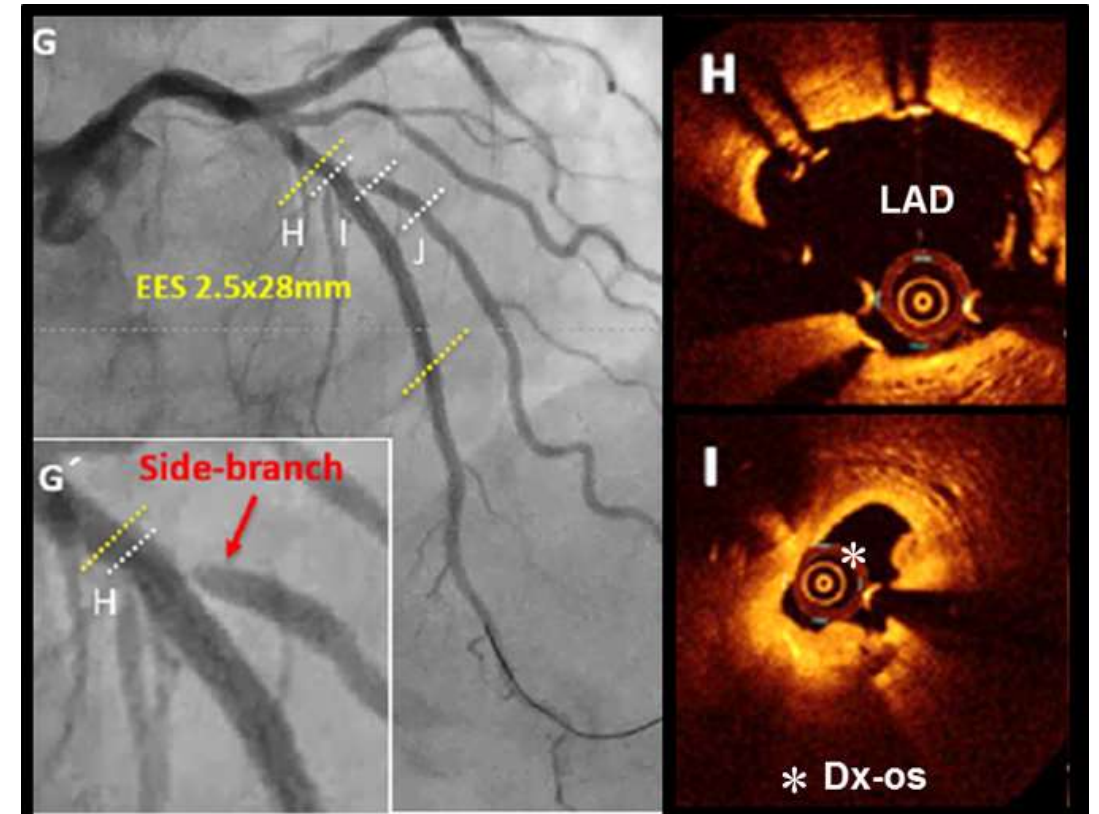
The stent does not spread toward hard calcification, but toward soft carina, causing carina shift and side branch ostial occlusion.

PCI in calcified bifurcation lesion: SB complication

Pre-intervention

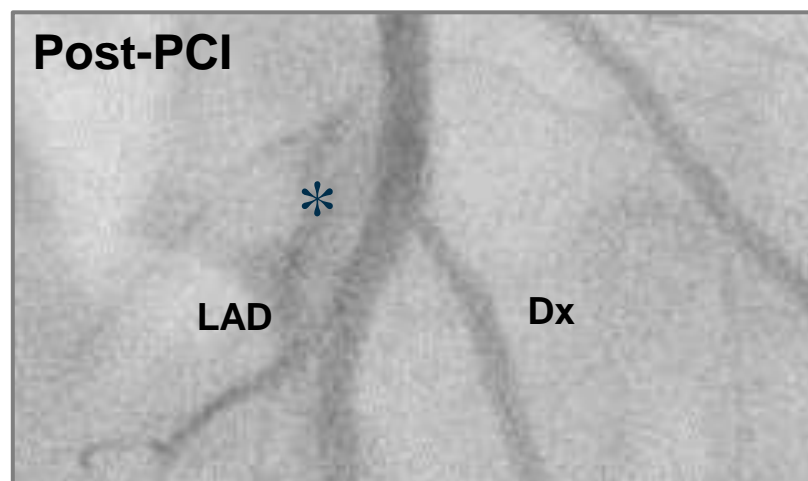
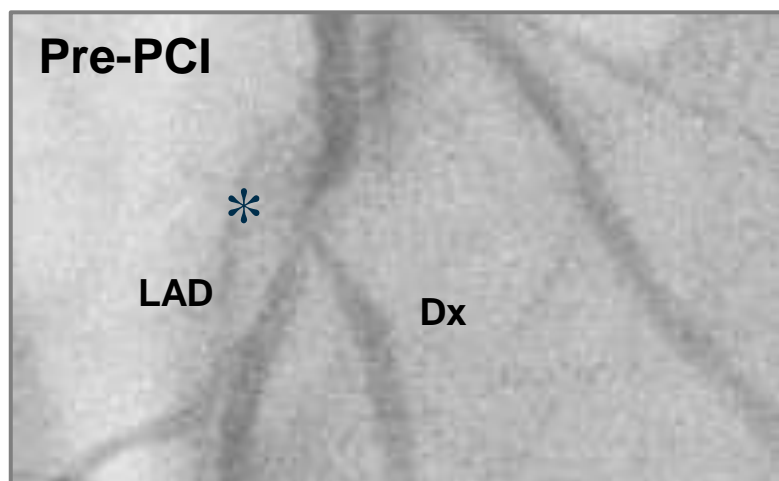


Post stent implantation in LAD

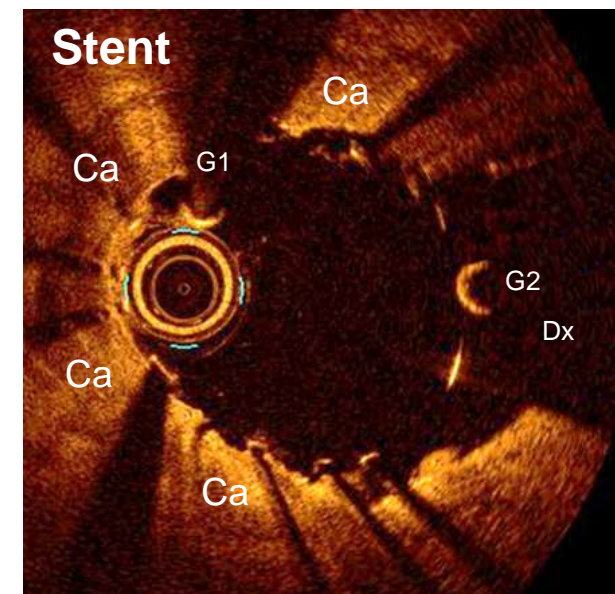
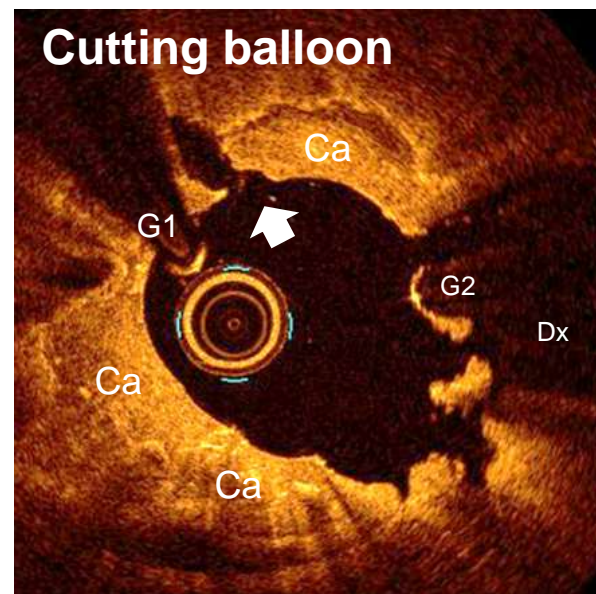
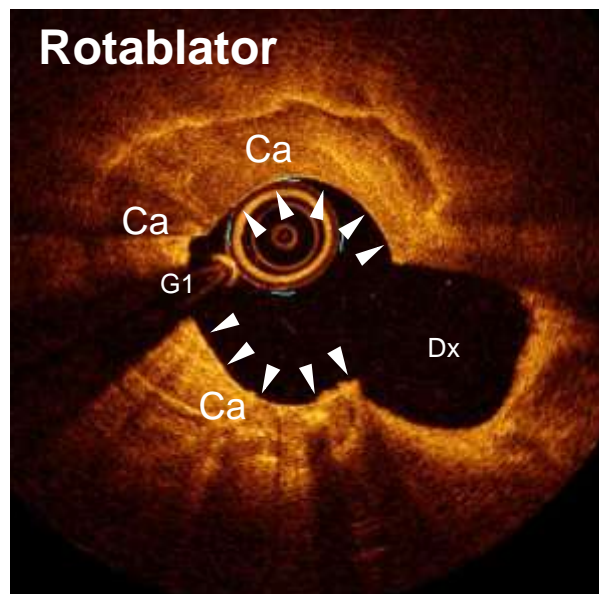
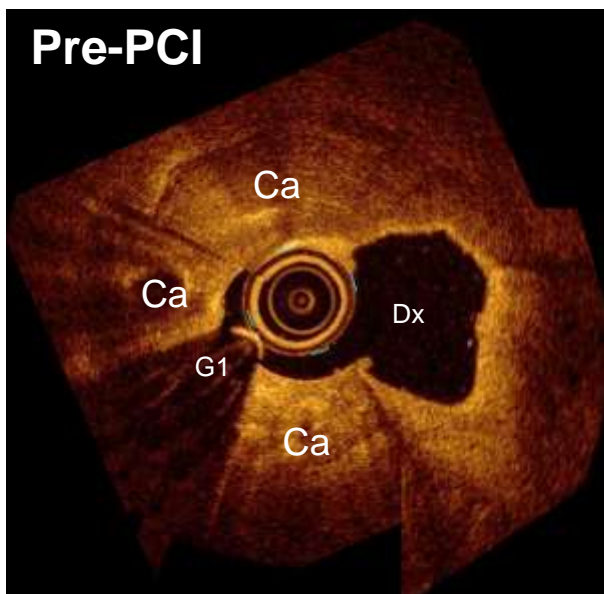


Angiography at pre-stent implantation showed LAD bifurcation lesion. OCT demonstrated severe calcification in the LAD bifurcation lesion (C). After stent implantation in LAD, angiography and OCT disclosed stenosis at side branch ostium.

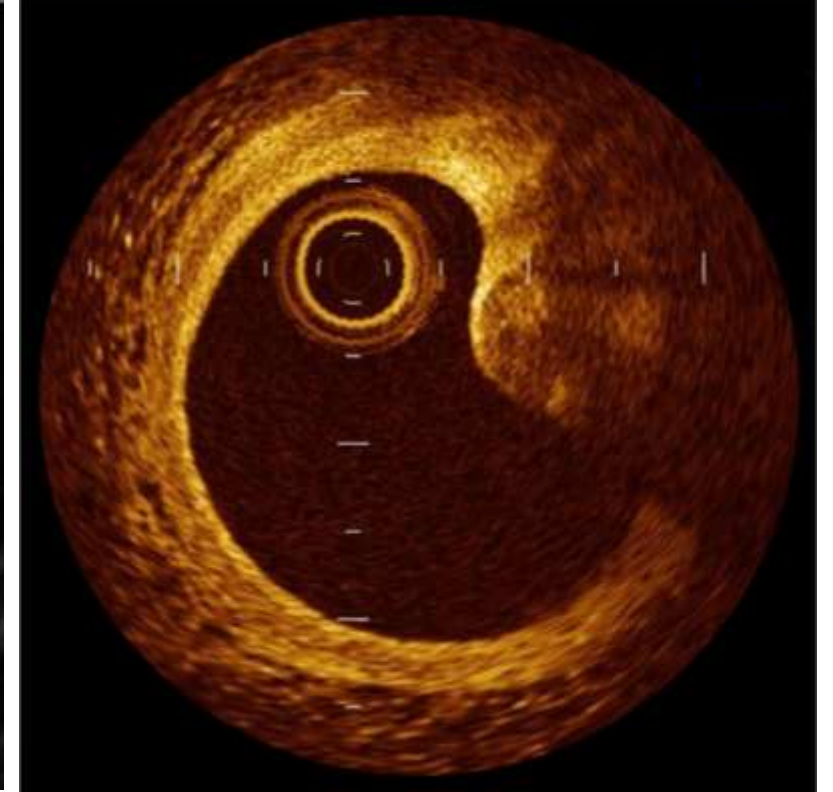
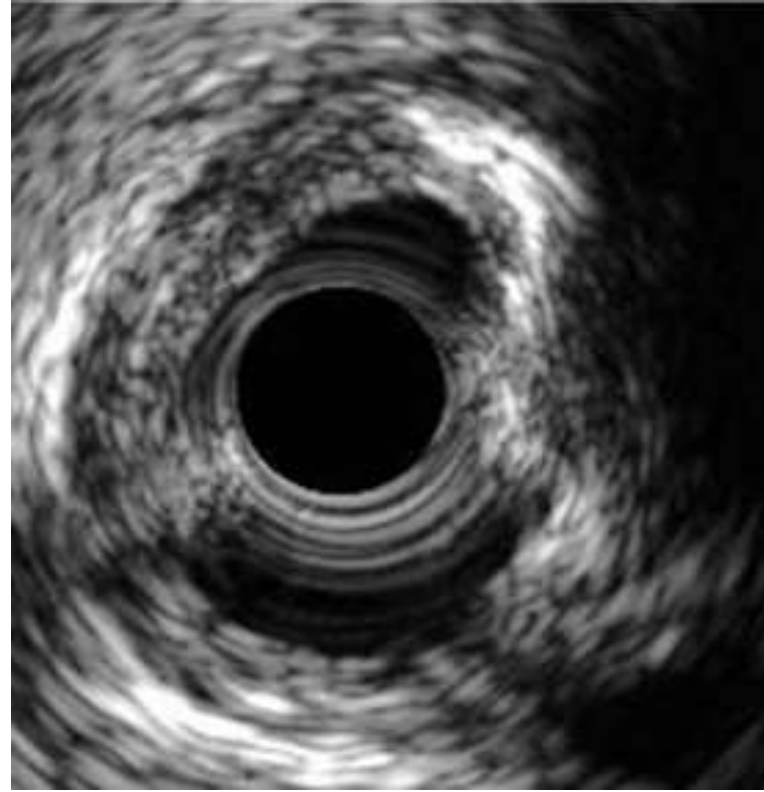
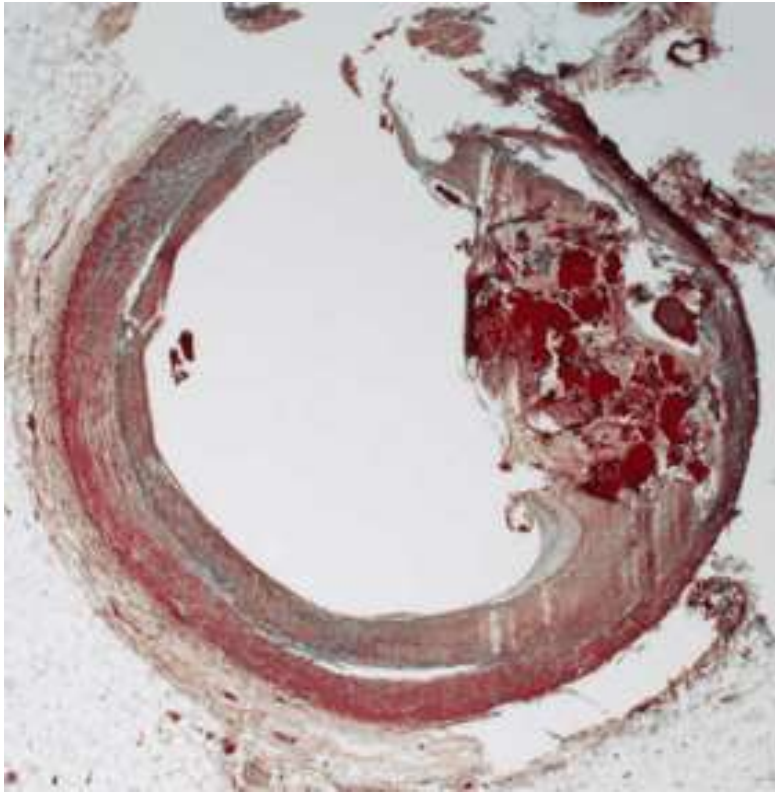
PCI in calcified bifurcation lesion: no SB complication



Arrow = calcium fracture
Arrow heads = cutting surface after rotablator atherectomy
Asterisk = target lesion
Ca = calcification
Dx = diagonal branch
G = guidewire
LAD = left anterior descending



IVUS and OCT images of calcified nodule



The IVUS image shows the convex shape of the luminal surface and luminal side of calcium and the irregular luminal surface and leading edge of calcium. The OCT image shows protrusion of a signal-poor or heterogeneous region with a sharply delineated border (i.e., calcium) into the lumen.

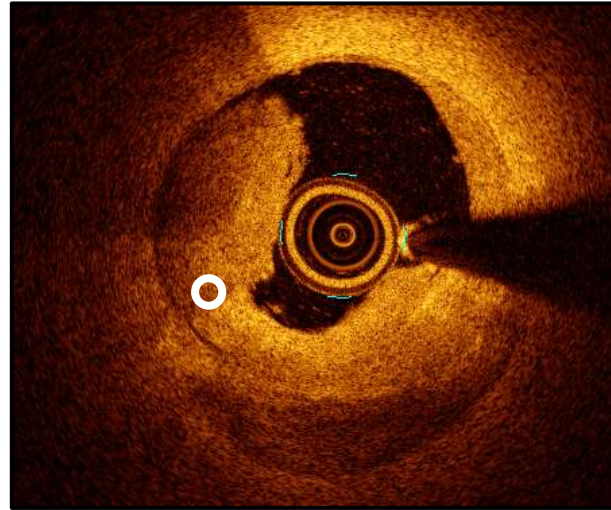
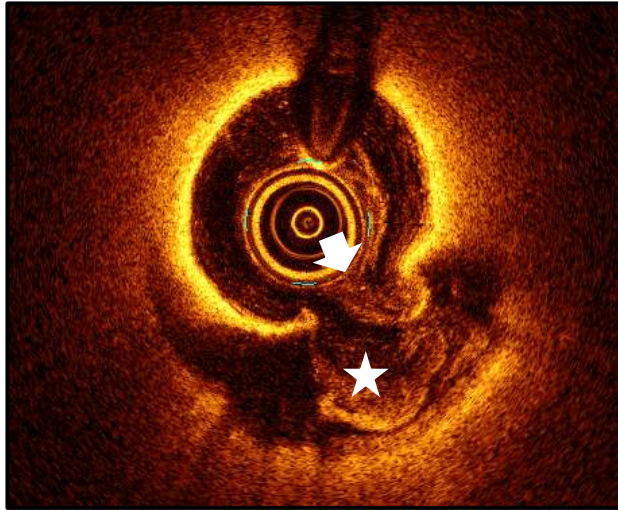
Stent expansion in ACS culprit lesions

Plaque rupture

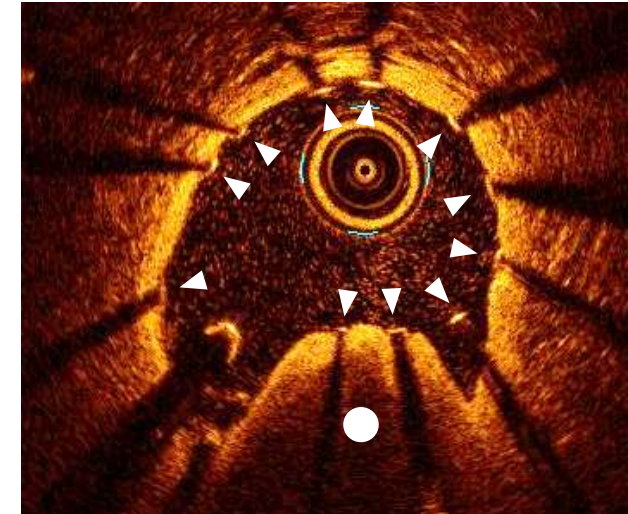
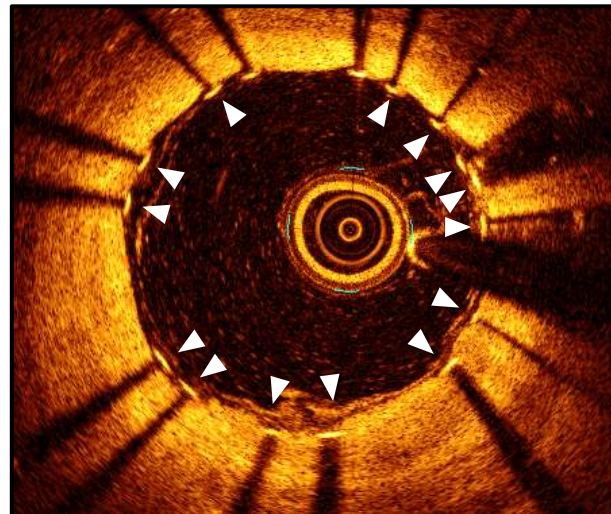
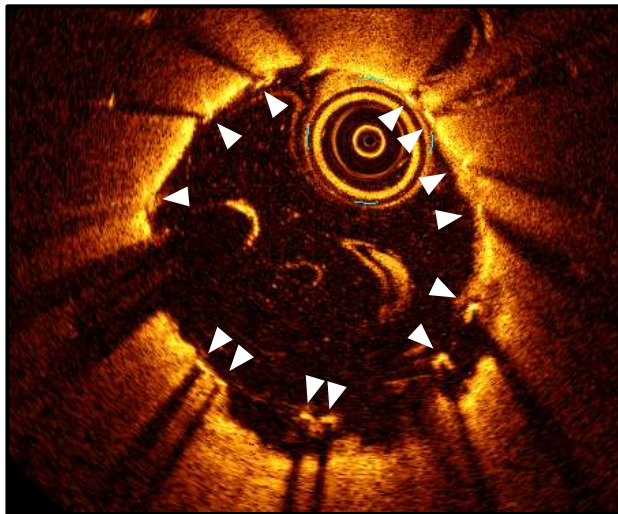
Erosion

Calcified nodule

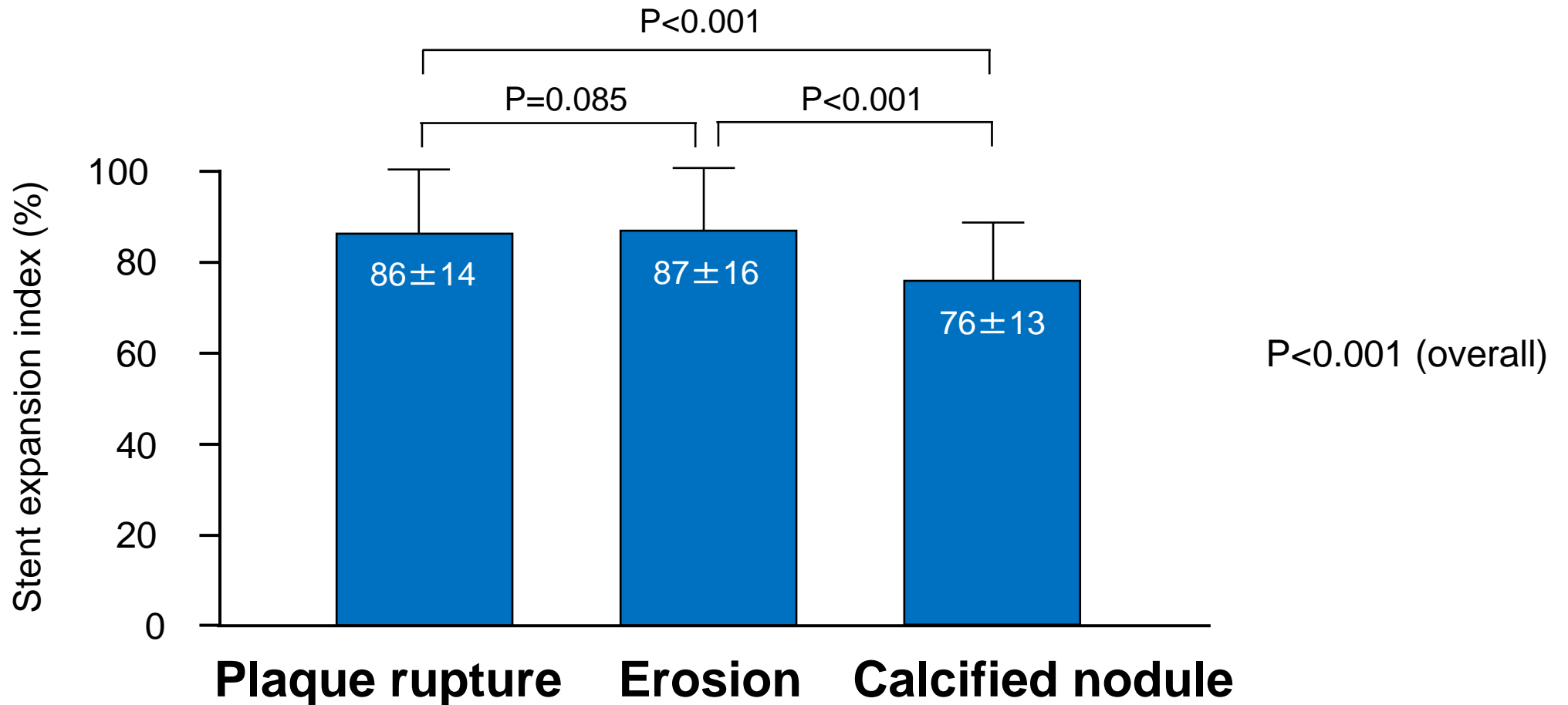
Pre PCI



Post PCI



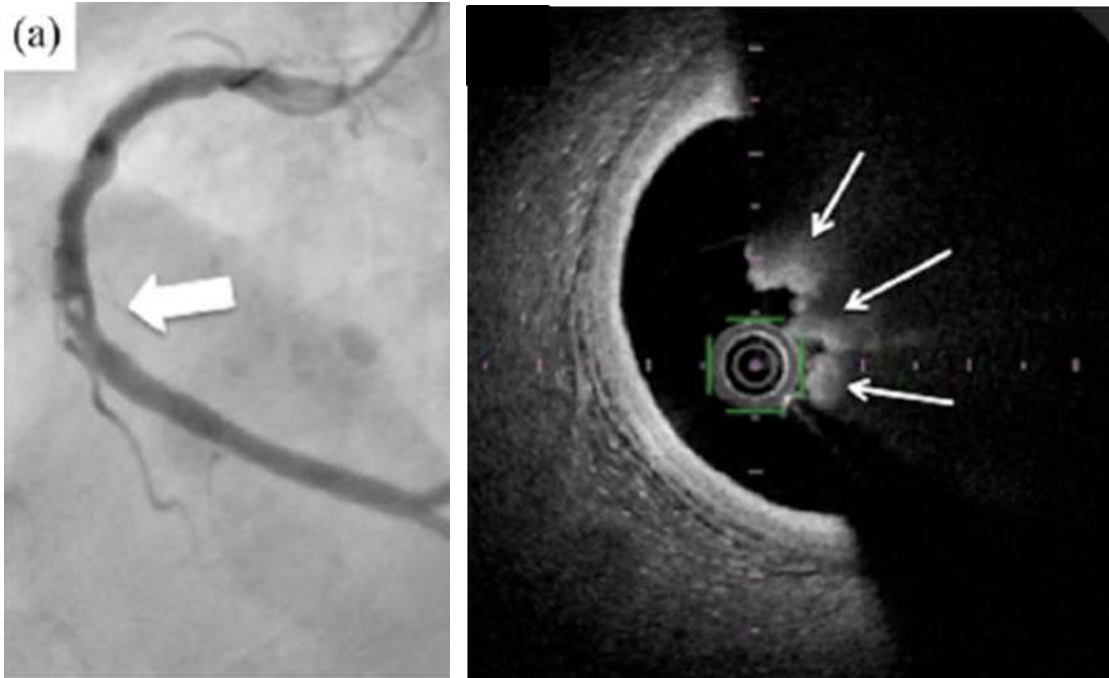
Post-PCI stent expansion index



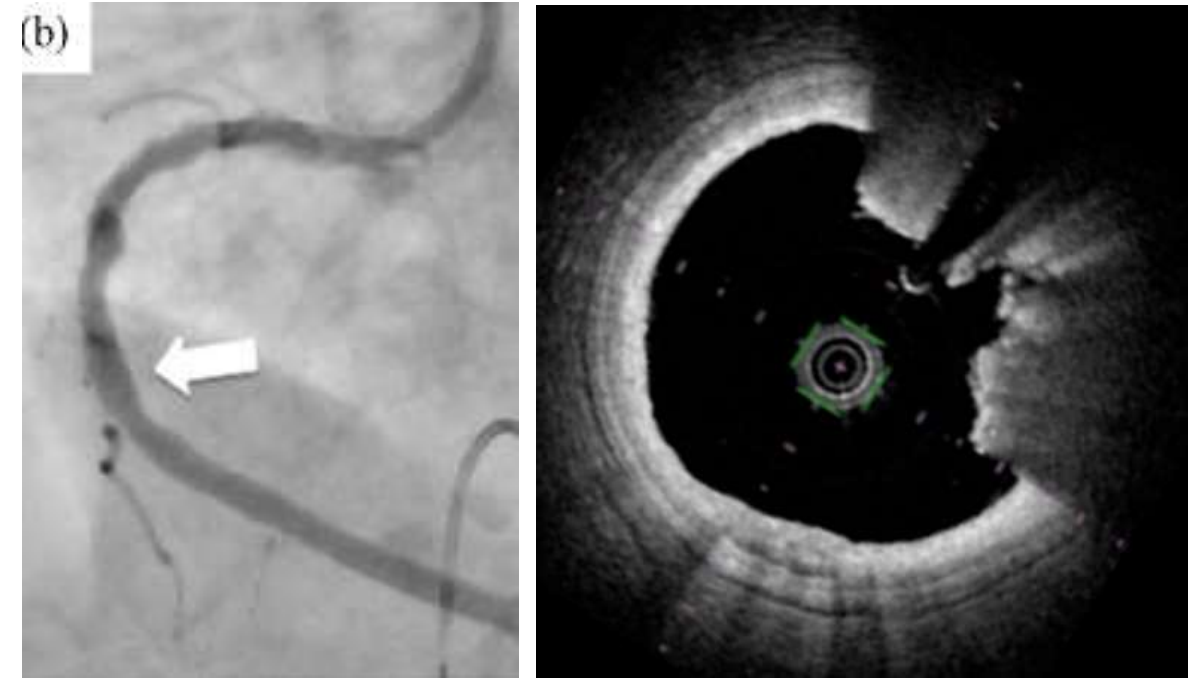
Stent expansion index was smallest in OCT-CN, followed by OCT-PR and OCT-PE. A p value <0.05 was statistically significant in overall comparison. A p value <0.0167 was statistically significant in multiple pairwise comparisons.

Calcified nodule: rotablator atherectomy

Before intervention



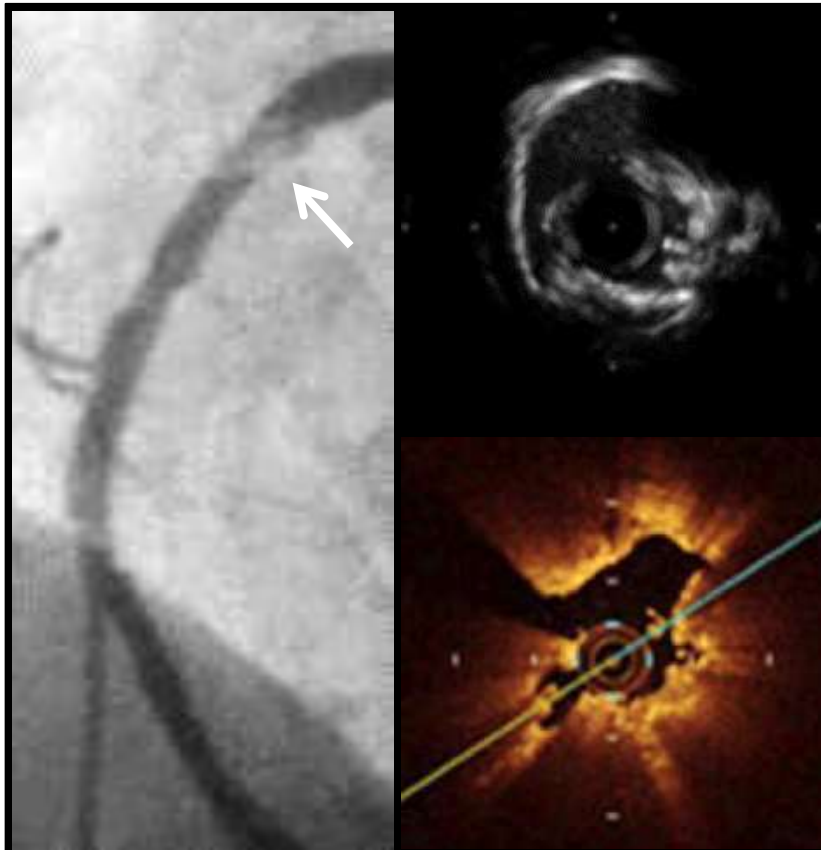
After rotablator



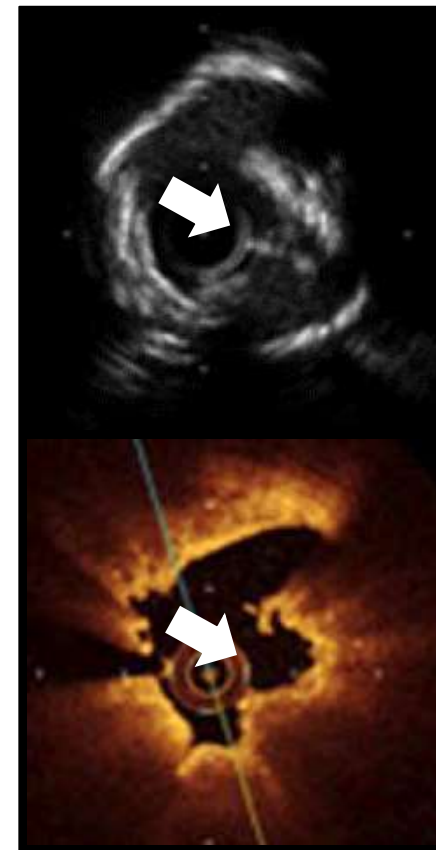
A 62-year-old man with effort chest pain. Calcified nodule disappeared after rotablator atherectomy with a 2.25 mm burr.

Calcified nodule: laser atherectomy

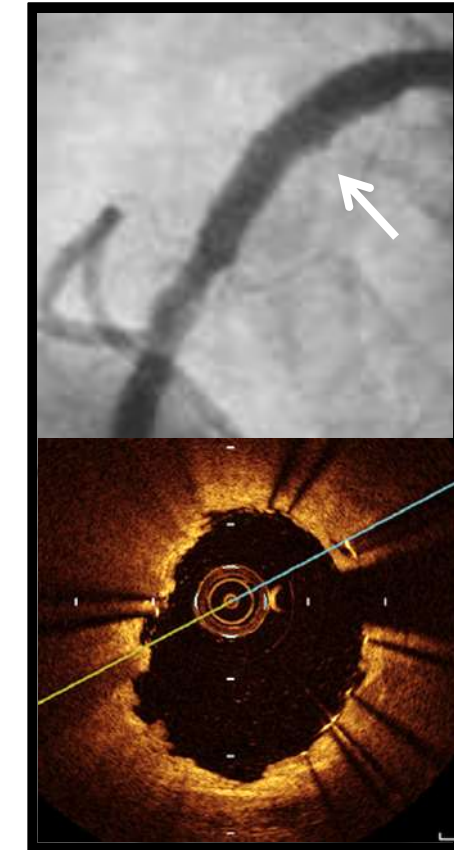
Before intervention



ELCA



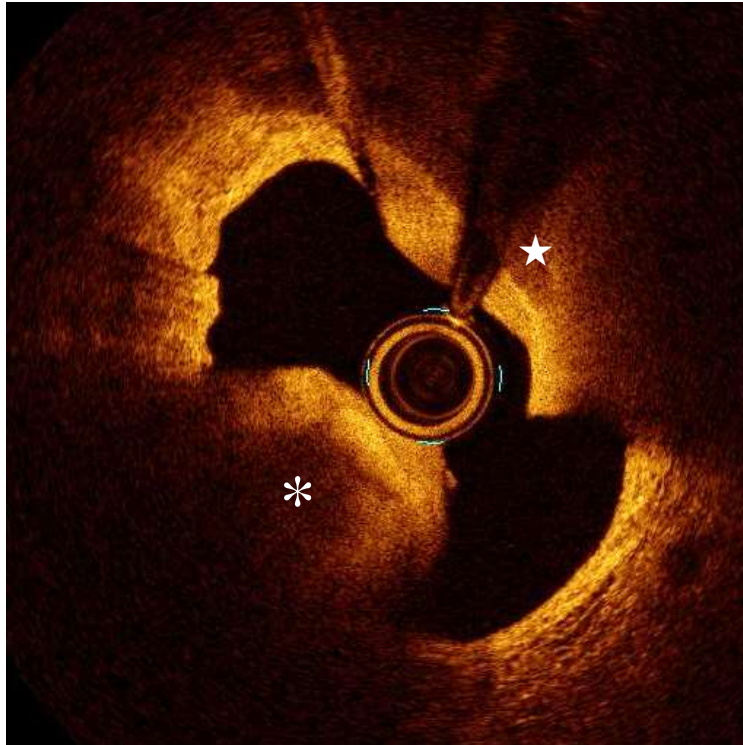
Stent



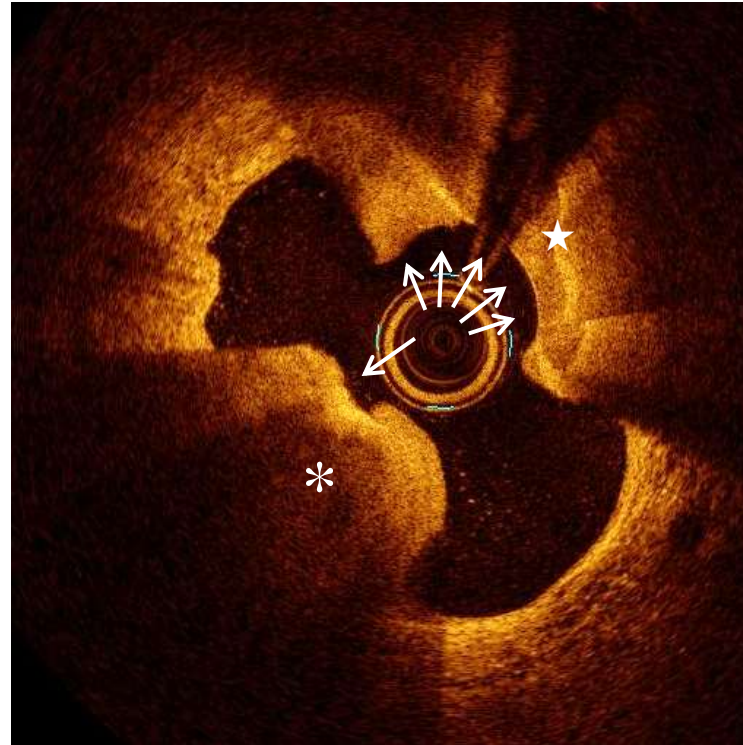
A 69-year-old female with ACS. Excimer laser coronary angioplasty (ELCA, max laser energy at 50 fluence and 30 Hz) altered underlying lesion morphology of calcified nodule.

Calcified nodule: Orbital atherectomy

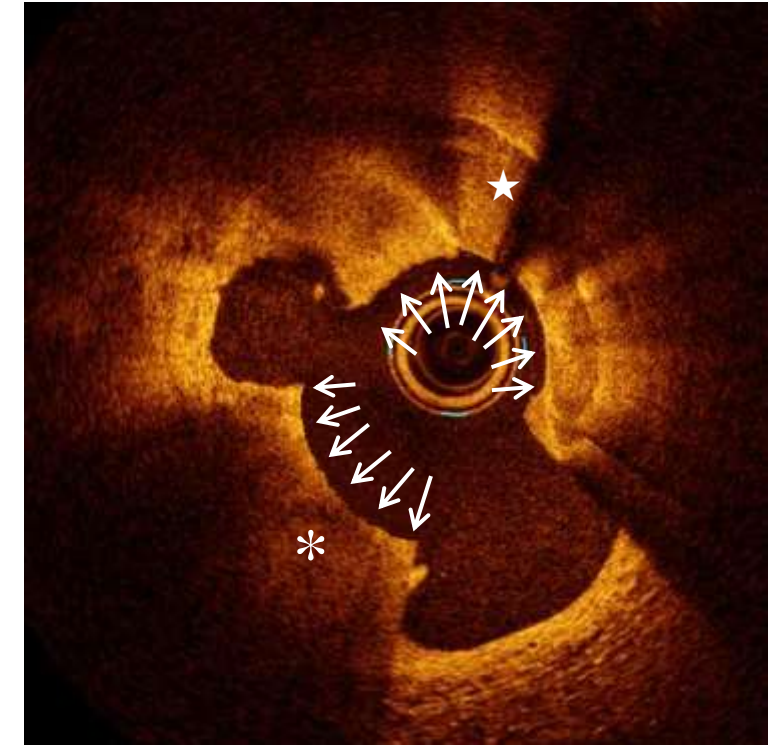
Baseline



1st (low speed)

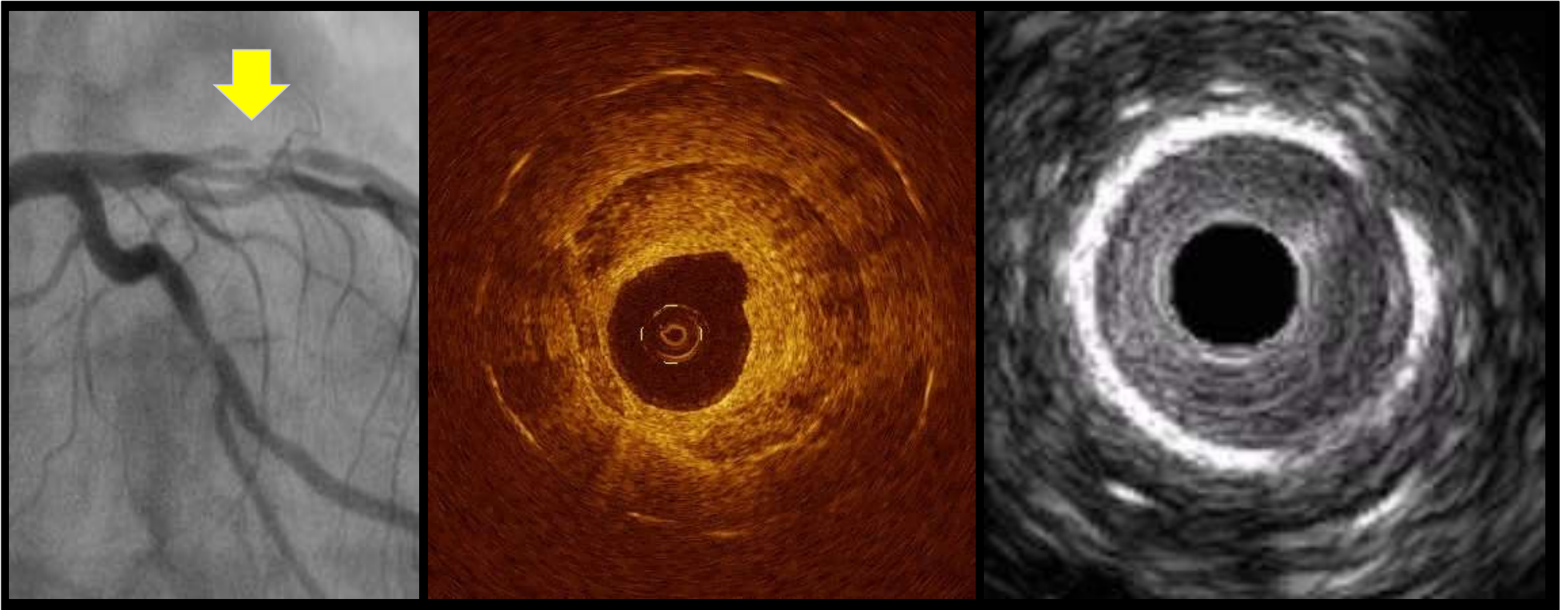


2nd (high speed)



- (A) Asterisk = calcified nodule. Star = calcium plate.
- (B) Low speed orbital atherectomy ablated mainly calcium plate (★).
- (C) High speed orbital atherectomy ablated calcium nodule (*).

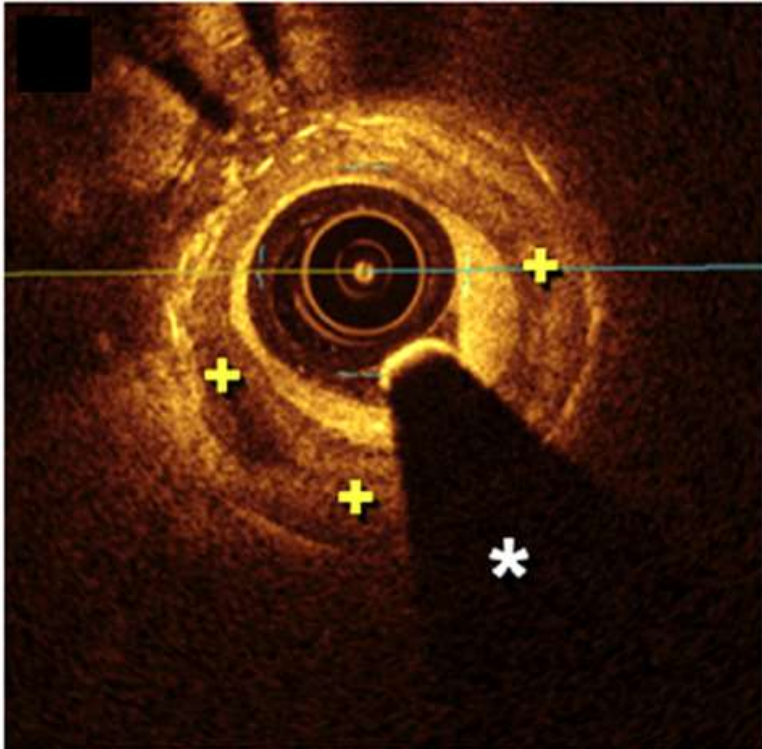
Neoatherosclerosis: calcified neointima



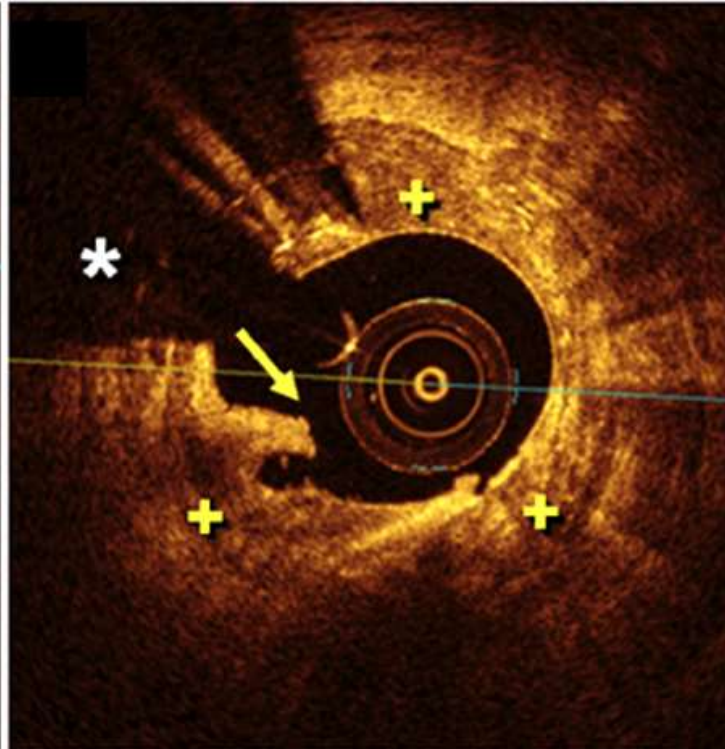
A 73-year-old man. In-stent restenosis at 11 years after stent implantation. Angiography showed severe in-stent stenosis in proximal LAD. OCT and IVUS identified superficial calcification in the neointima.

Calcified neointima: rotablator atherectomy

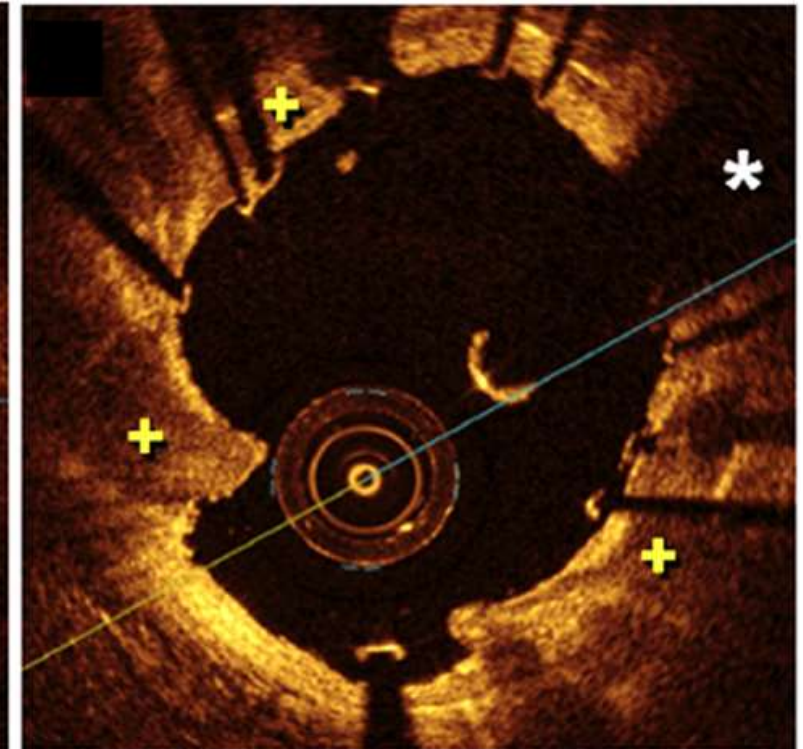
Before intervention



After rotablator atherectomy



After stent implantation and high-pressure balloon inflations



Undilatable ISR presenting 11 years after initial stent implantation. OCT disclosed severe calcified neoatherosclerosis as the underlying substrate of ISR. Multiple high-pressure inflations with noncompliant balloons and the use of buddy-wire techniques and scoring balloons all failed to dilate this lesion. Eventually, rotational atherectomy was required to obtain procedural success. Rotational atherectomy was able to ablate the calcified intrastent tissue allowing subsequent vessel dilation and repeat stent implantation with adequate final stent expansion. + signs denote calcium; * denotes wire artifact.

Summary

IV imaging guidance have a great impact on the PCI strategies in severe calcified lesions.

Detailed evaluation of coronary artery calcification by IV imaging enables prediction of stent expansion, evaluation of Rotablator effect, risk assessment of bifurcation side branch occlusion, and diagnosis of calcified nodule and calcified neointima.

