14th National Congress of Cardiology, Azerbaijan Society of Cardiology, Baku, Azerbaijan, 13.12.2025

HOSPITAL ZUM HEILIGEN GEIST
Kempen

Calcium Modification in Complex PCI: From Imaging to Intervention

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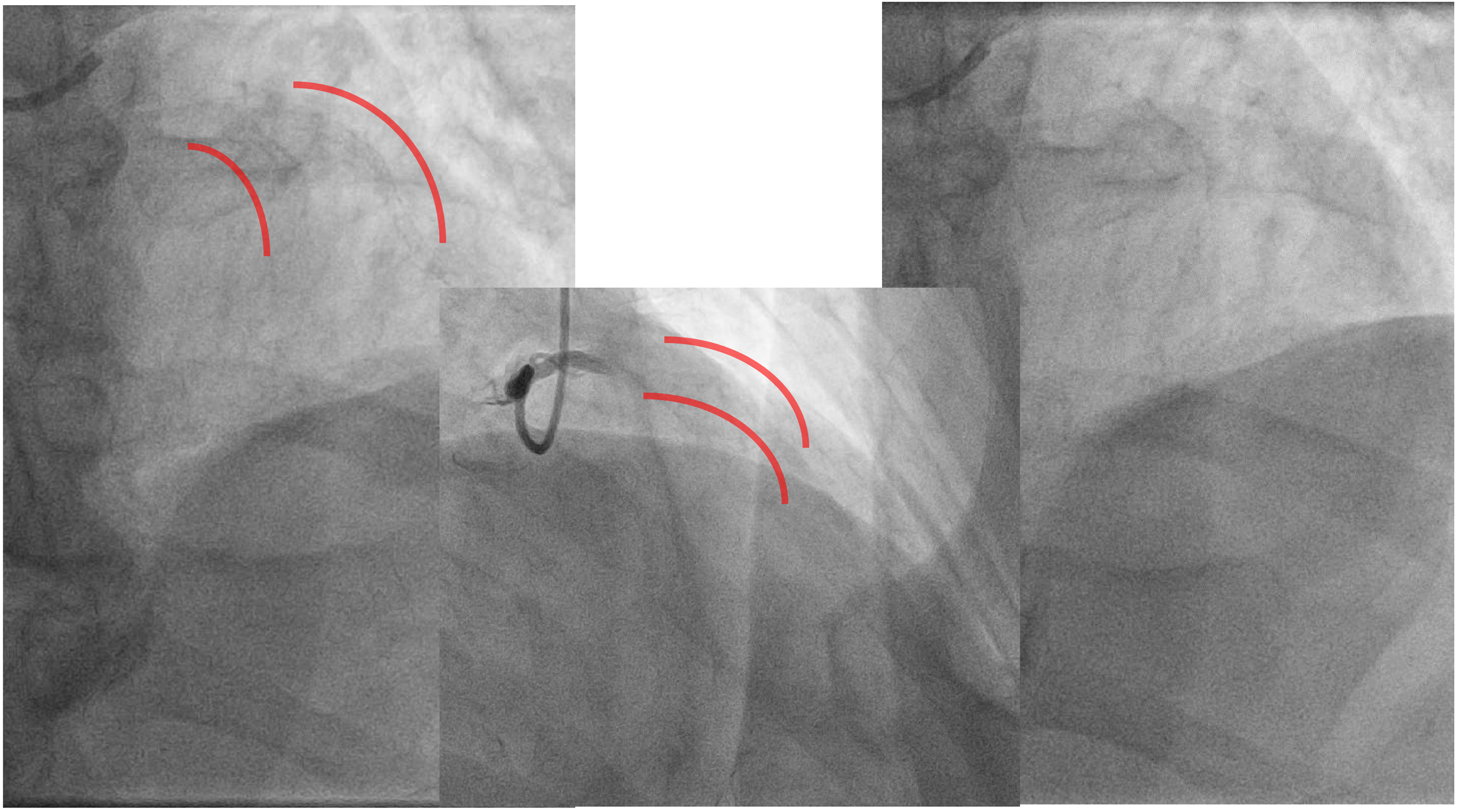
DEFINITION OF CALCIFIED LESIONS – ANGIOGRAPHY/FLUOROSCOPY

Readily apparent densities noted within the vascular wall at the site of the stenosis

- **Moderate**: Densities seen prior to contrast injection, but only during cardiac motion
- **Severe**: Densities seen prior to contrast injection, but w/o cardiac motion and usually involve both sides of the arterial wall

Mintz et al. Circulation 1995;91:1959-65.



COMPARISON OF IMAGING TECHNIQUES FOR CORONARY CALCIUM DETECTION, CHARACTERIZATION, AND QUANTIFICATION

Diagnostic Accuracy	Angiography	IVUS	OCT
Severe LHCC	●●●	●●●	●●●
Mild/Moderate LHCC	●	●●	●●●
Deep calcium	●	●●●	●●
Calcium arch	✗	●●●	●●●
Calcium thickness	✗	✗	●●●
Longitudinal calcium length	✗	●	●●●
Non-homogeneous plaque / Necrotic core	✗	●●●	●

●●● Optimal ●● Moderate ● Modest

lesions with high calcium content (LHCC)

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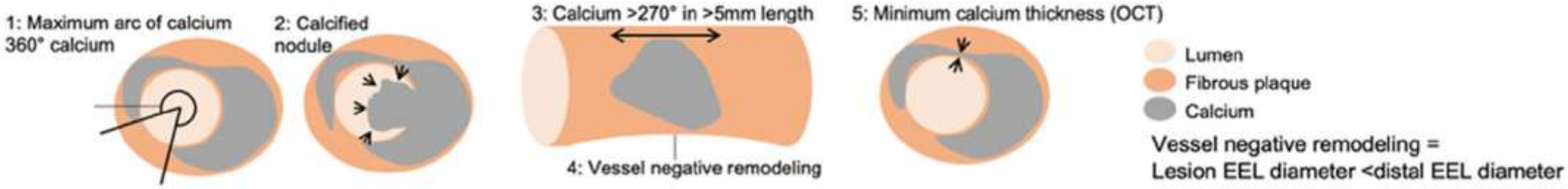
J Am Coll Cardiol Intv 2019;12:1465–78

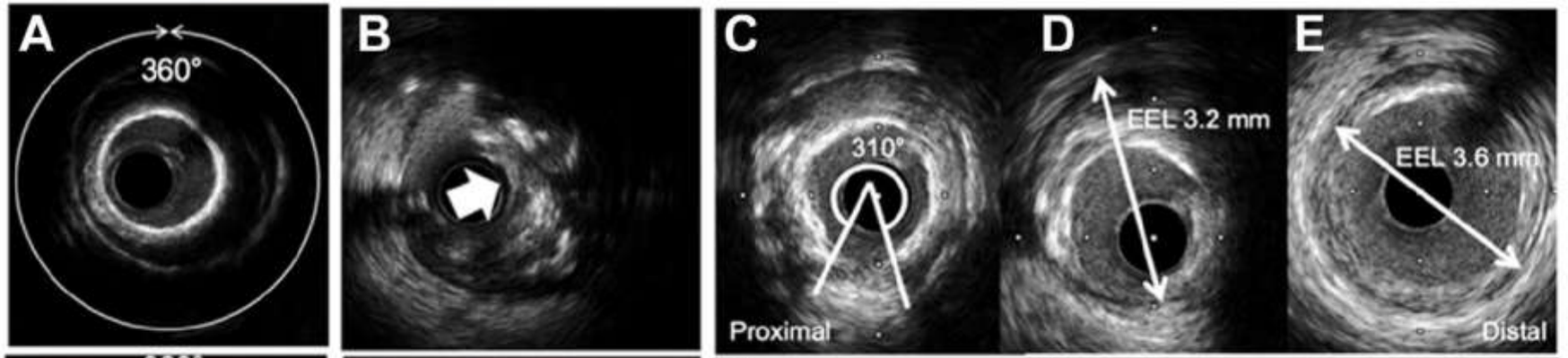
CRITERIA FOR CORONARY CALCIUM MODIFICATION

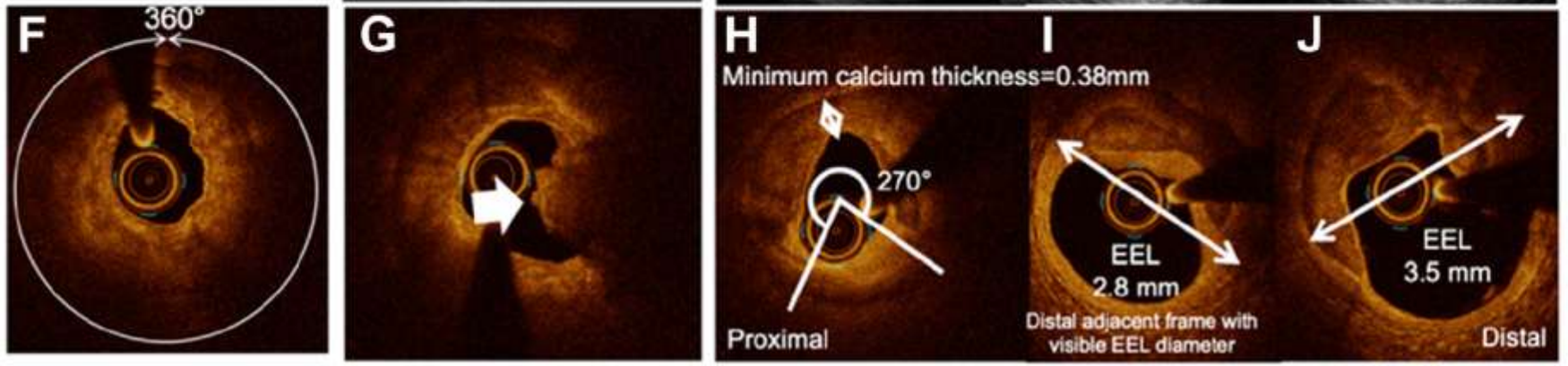
Angiographic Criteria

Fluoroscopic radiopacities noted without cardiac motion prior to contrast injection involving both sides of the arterial wall in ≥1 location and total length of calcium of ≥15 mm

Intravascular Imaging Criteria

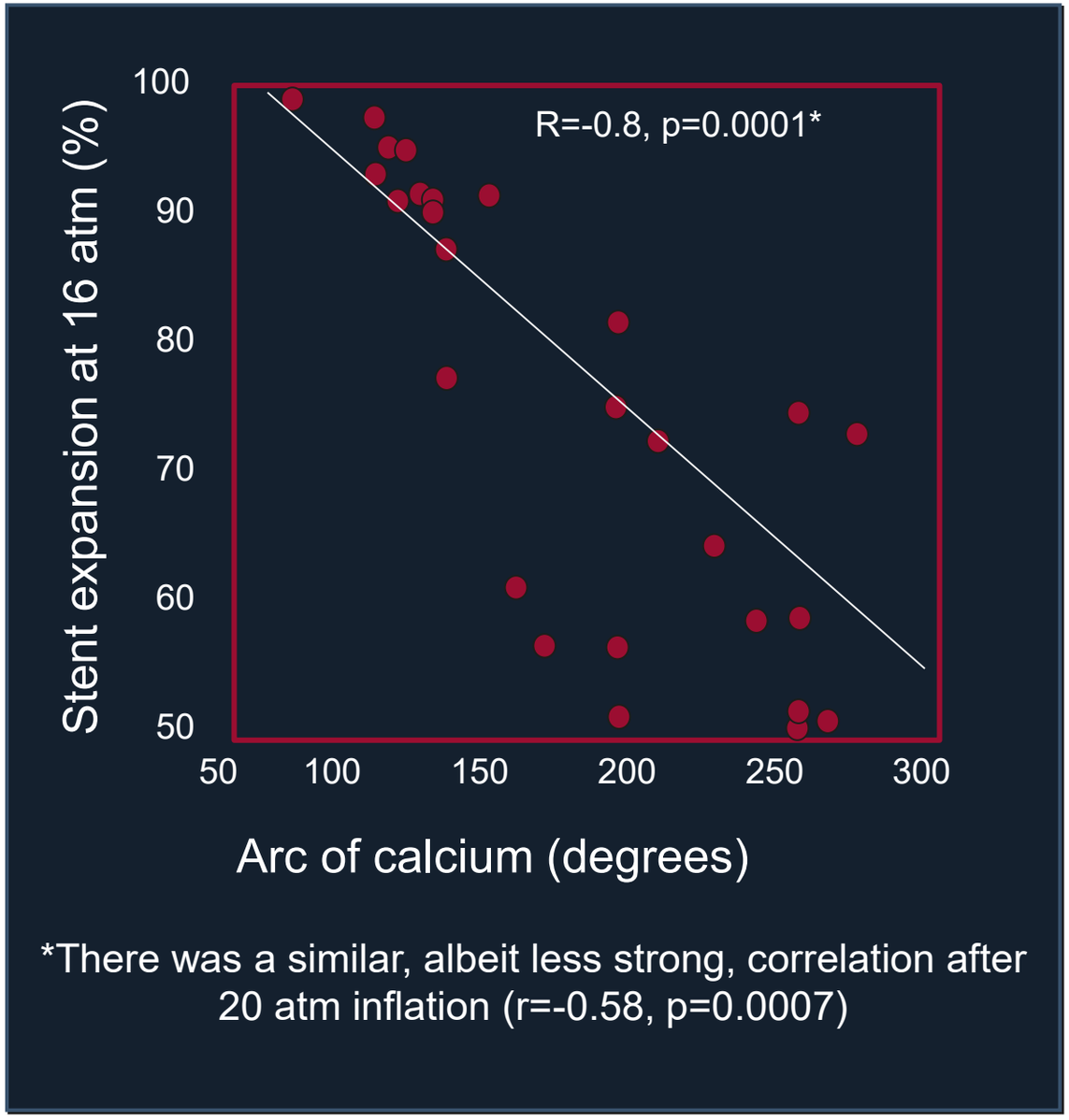






SCAI Expert Consensus Statement on the Management of Calcified Coronary Lesions
Journal of the Society for Cardiovascular Angiography & Interventions, 2023
https://doi.org/10.1016/j.jscai.2023.101259

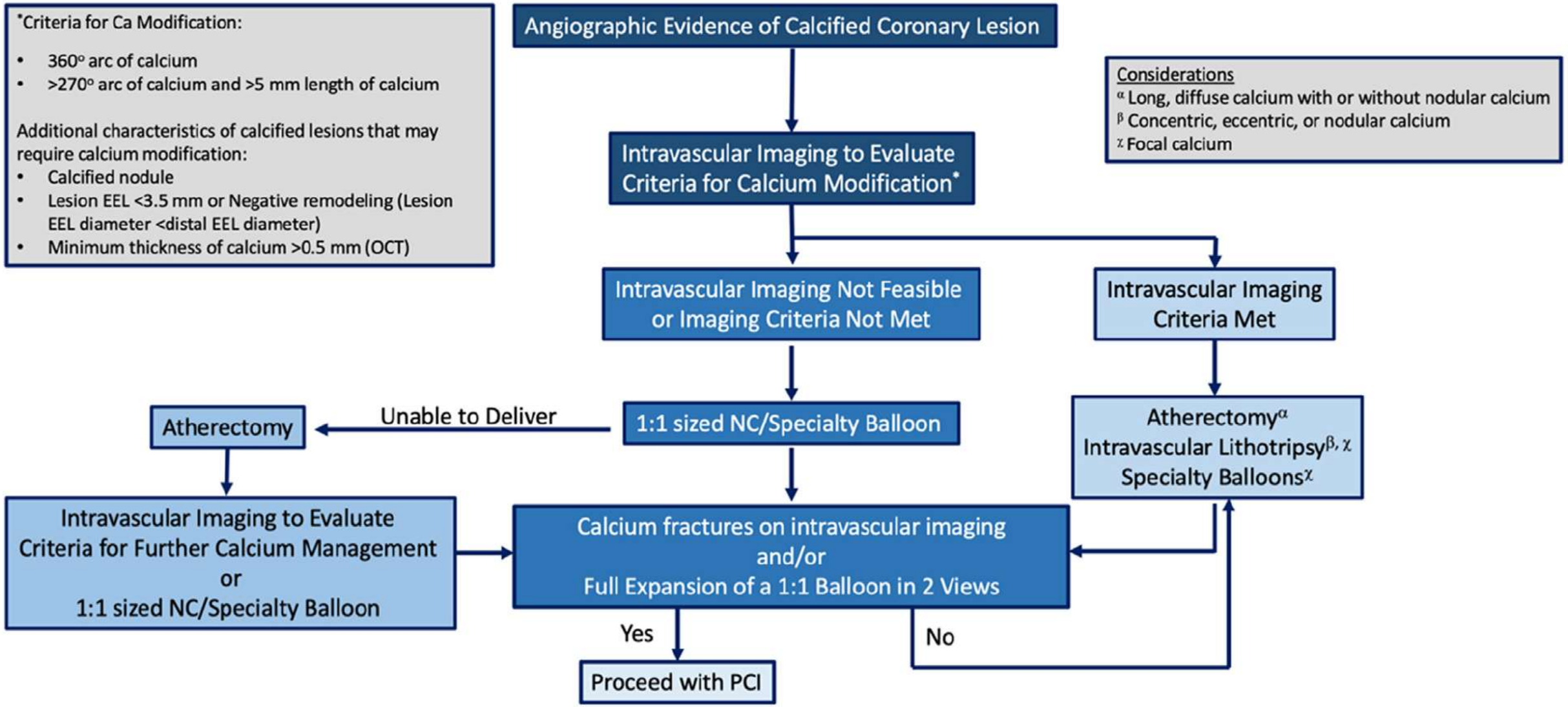
Stent expansion in calcified lesions



*There was a similar, albeit less strong, correlation after 20 atm inflation (r=-0.58, p=0.0007)

Vavarunakis et al. Catheter Cardiovasc Interv 2001;52:164-172

TREATMENT ALGORITHM FOR CALCIFIED CAD.



SCAI Expert Consensus Statement on the Management of Calcified Coronary Lesions
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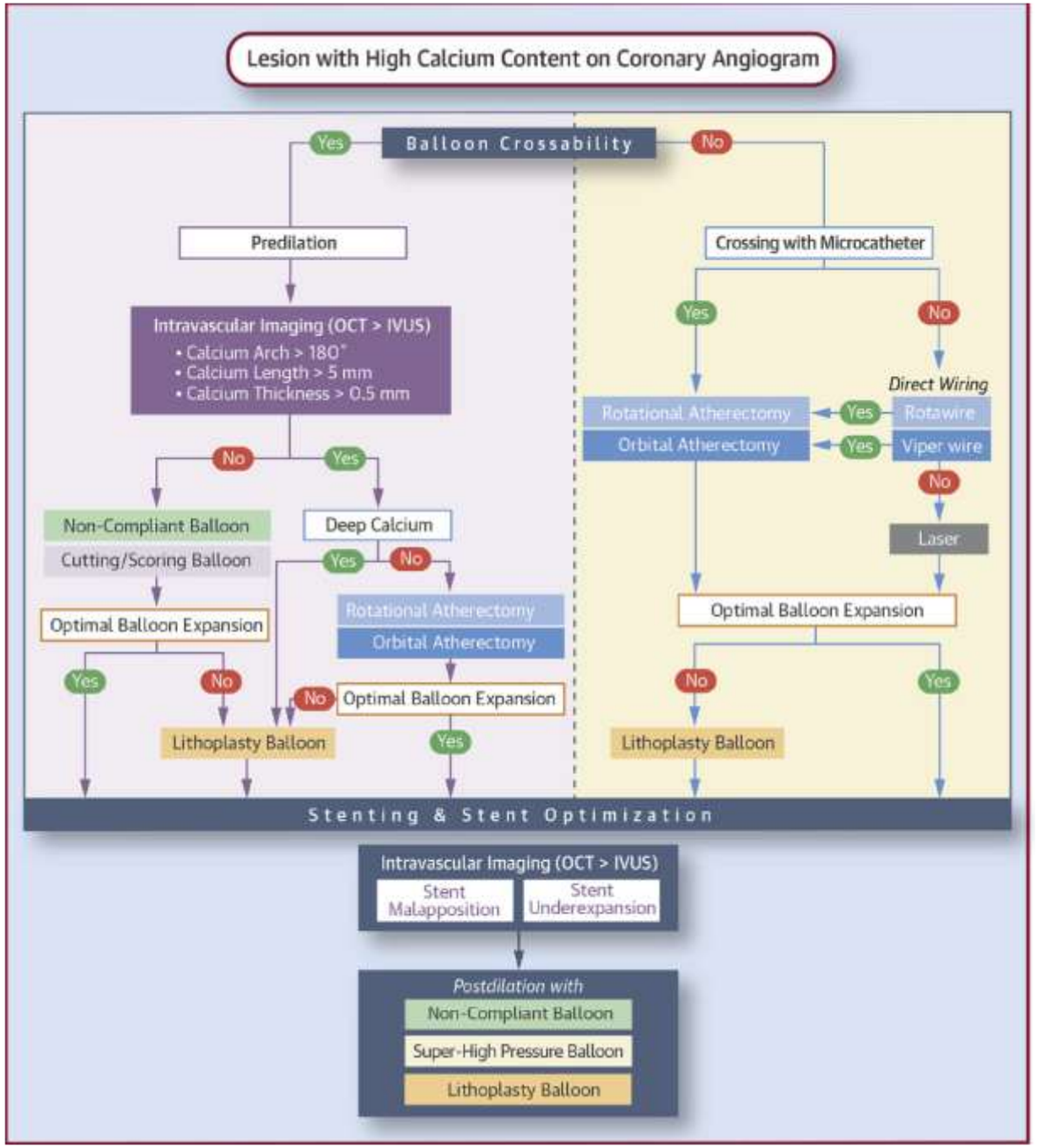
ALGORITHM FOR OPTIMAL MANAGEMENT OF CORONARY CALCIFIED LESIONS



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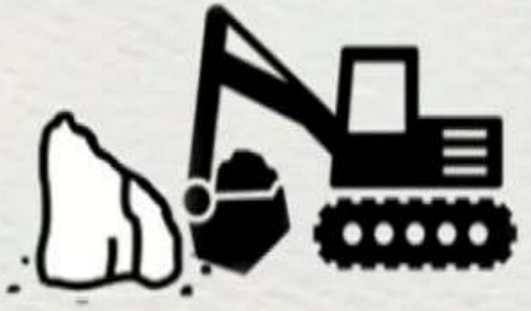
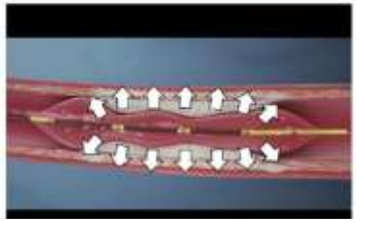
ESSENTIAL SOLUTIONS: Cracking and Volume Reduction

Conventional Balloon	CBA	IVL	Rotablation
			
No Effect	Simple Cracking	Multi Cracking	Volume Reduction



❖ IVL AND ROTABLATION FOR CALCIFICATION

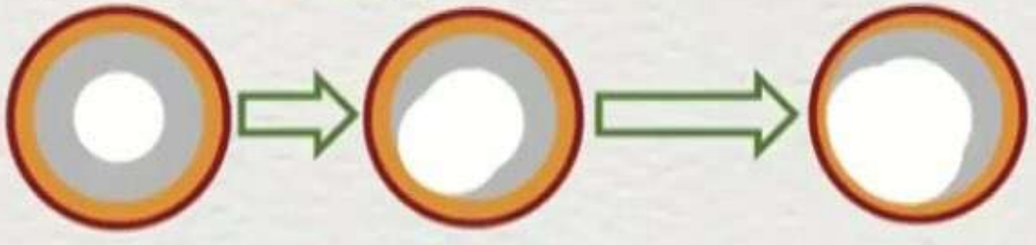
◆ IVL

Creating cracks

Stretch of the crack parts
Dividing into multiple parts
Plaque compression behind the calcification

Weak point:
No change in the calcification volume

◆ ROTABLATION



Volume reduction

Open the calcification at the rotablation site
Plaque compression around the rotablation site

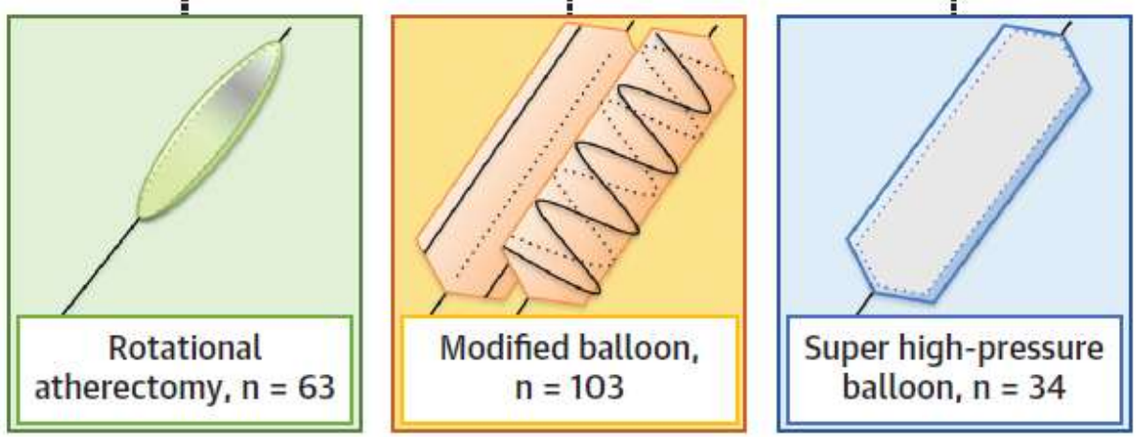
Weak point:
Almost no effect to the opposite site of rotablation

Yoshifumi Kashima MD, Sapporo Heart Center, Sapporo, Japan

ROTATIONAL ATHERECTOMY OR BALLOON-BASED TECHNIQUES TO PREPARE SEVERELY CALCIFIED CORONARY LESIONS

Patients With Severely Calcified Coronary Artery Lesions Amenable to Drug-Eluting Stent Implantation and Enrolled in the Randomized PREPARE-CALC and ISAR-CALC Trials (N = 274)

Patients with available OCT imaging after stenting included in the pooled analysis (n = 200)



Main outcomes				Main findings
Stent expansion, %	73.2 ± 11.6	70.8 ± 13.6	71.8 ± 12.2	No significant difference
Maximal stent eccentricity	0.70 ± 0.06	0.70 ± 0.08	0.74 ± 0.09	Super high-pressure balloon better
Strategy success, %	100	86.4	91.2	Rotational atherectomy better

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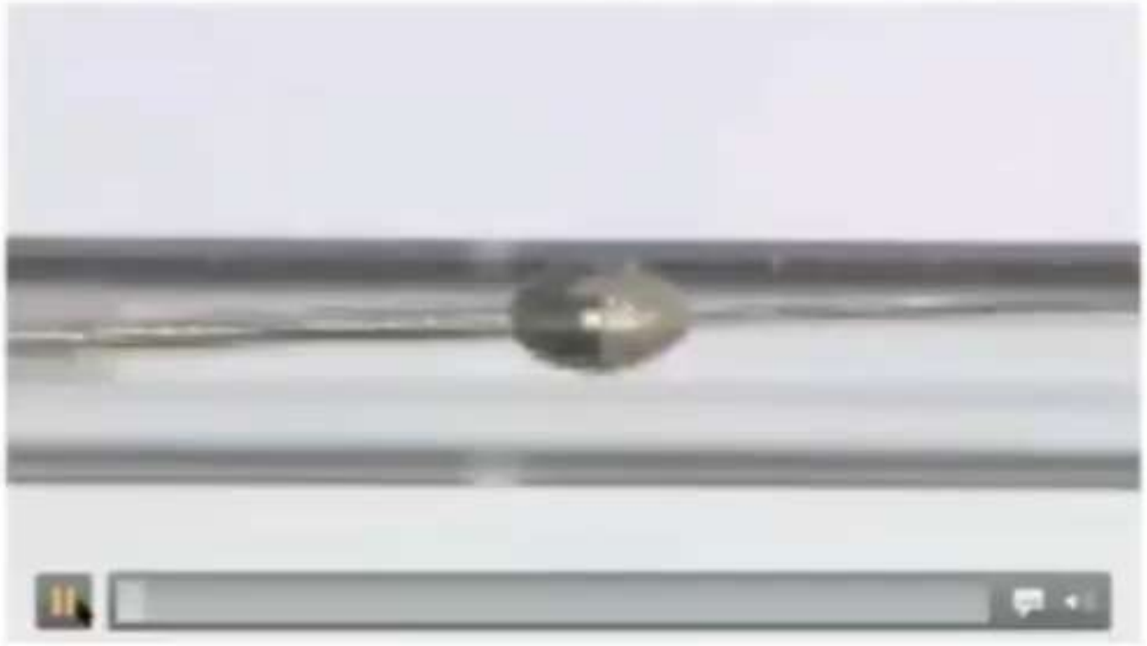
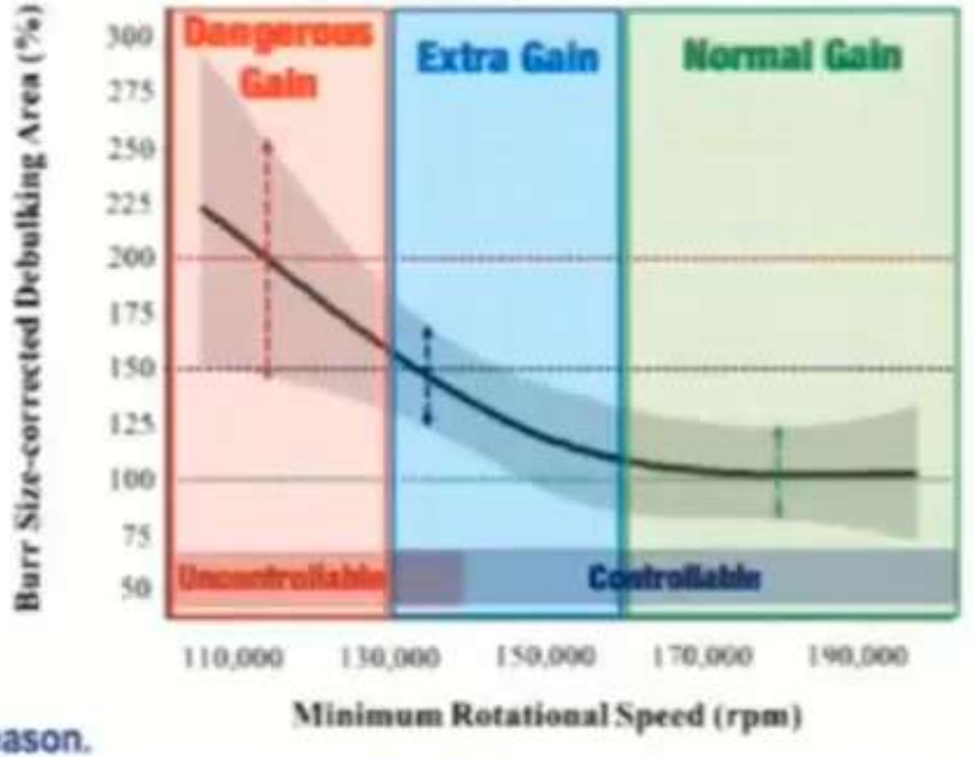
J Am Coll Cardiol Intv 2022;15:1864–1874





➤ The rotational speed setting must not go below 130K rpm even for any reason.

➤ If you think about a coronary perforation risk for the target lesion, you have to set more than 180K RPM as your rotational speed.

Sapporo Heart Center
Sapporo Cardio Vascular Clinic

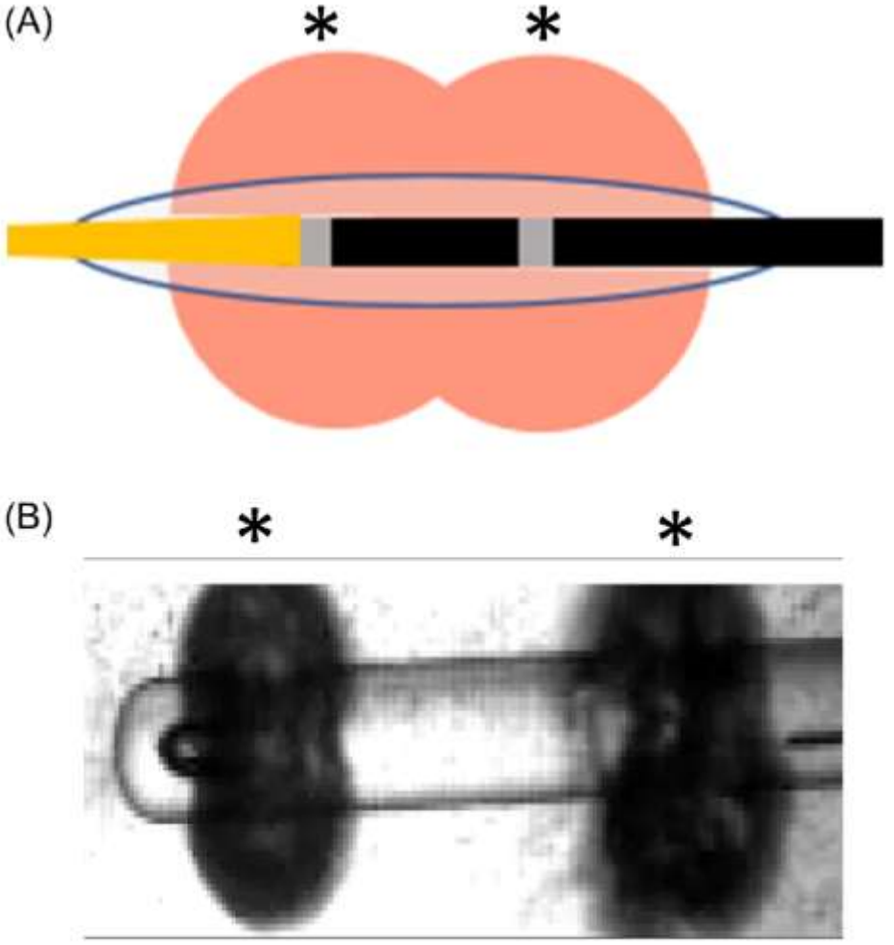
Asia Medical Group
Wuhan-Xinjiang-HK-Sapporo

Rise
Realization of Intervention Strategy Based on Leading-Edge Knowledge and Skill for CTO and Calcified Lesion

OPTIMAL
ONLINE 2020

Yoshifumi Kashima MD, Sapporo Heart Center, Sapporo, Japan

IVL



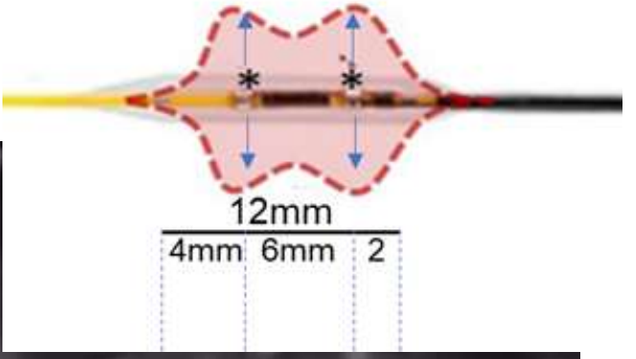


FIGURE 1 Intravascular lithotripsy (IVL) catheter designs. (A) Cartoon of coronary shockwave electric IVL catheter (C2) with two emitters (*) in balloon. Acoustic pressures are aligned with the emitter. (B) Cavitation bubbles generated by laser IVL catheter with two emitters (*). [Color figure can be viewed at

Catheter Cardiovasc Interv. 2024;103:295–307.

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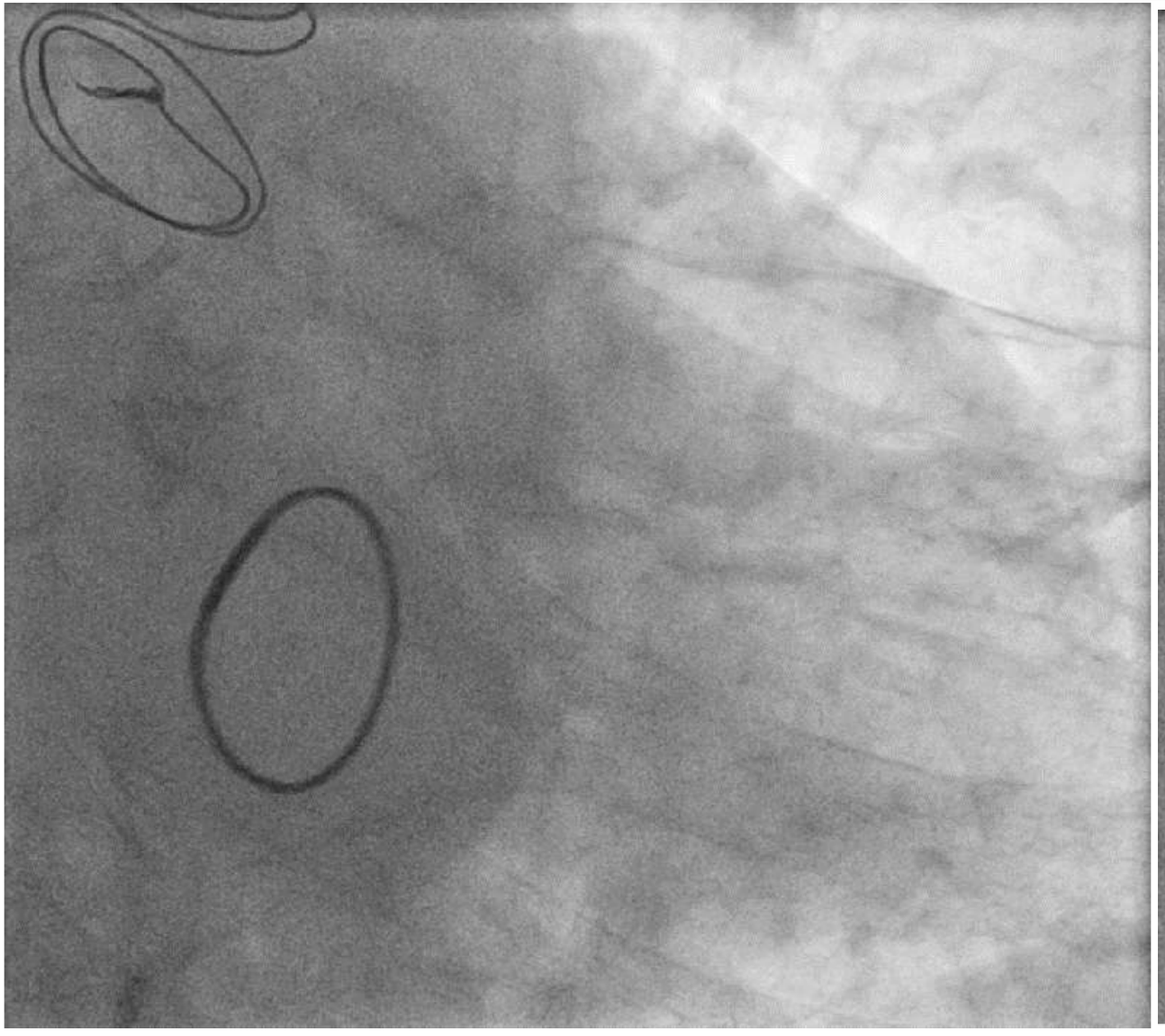
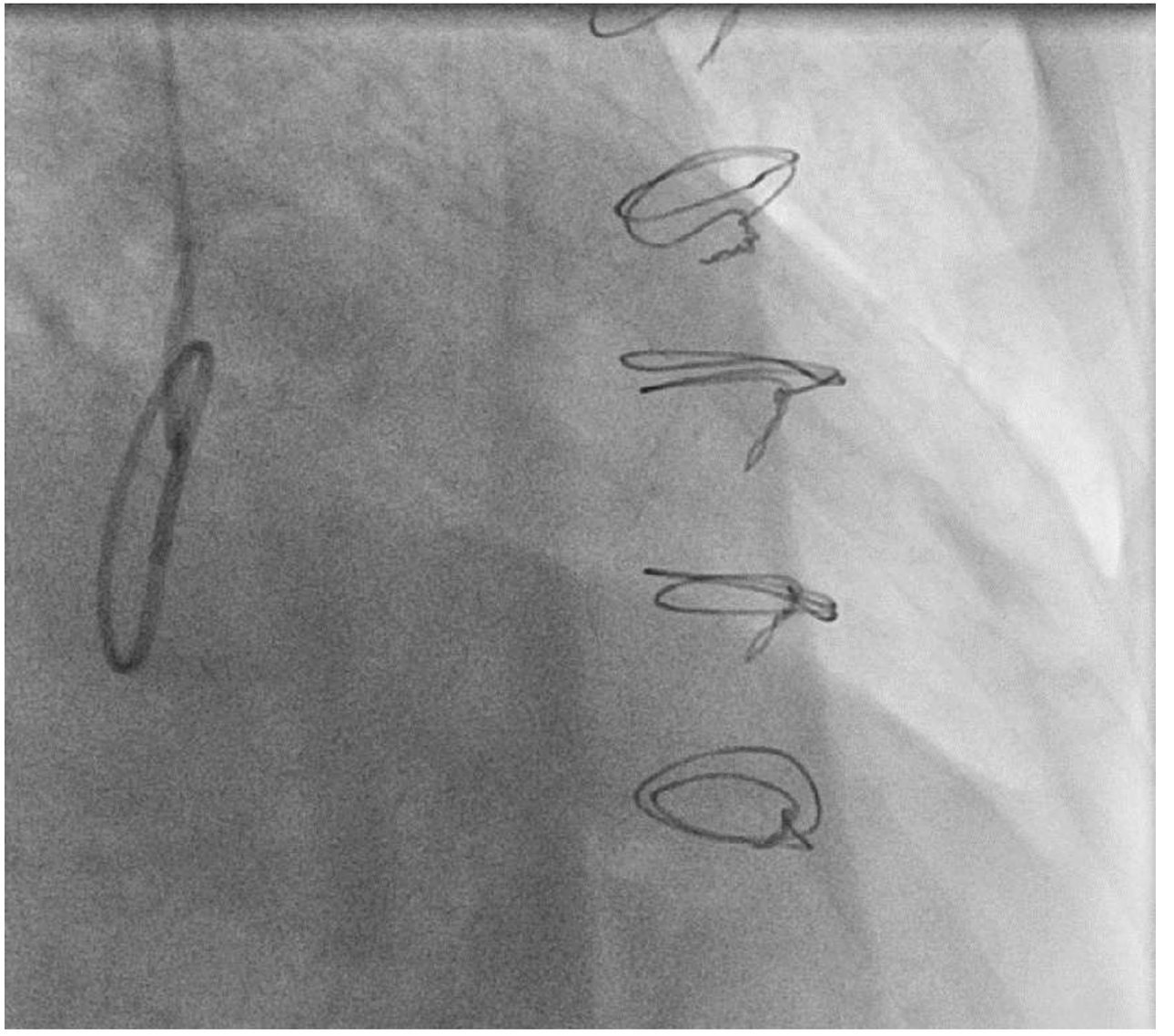
Case 1. LAD-PCI (♂ 85 y.o., AVS 0,6 cm2, LVEF 30%, MVR 2010)





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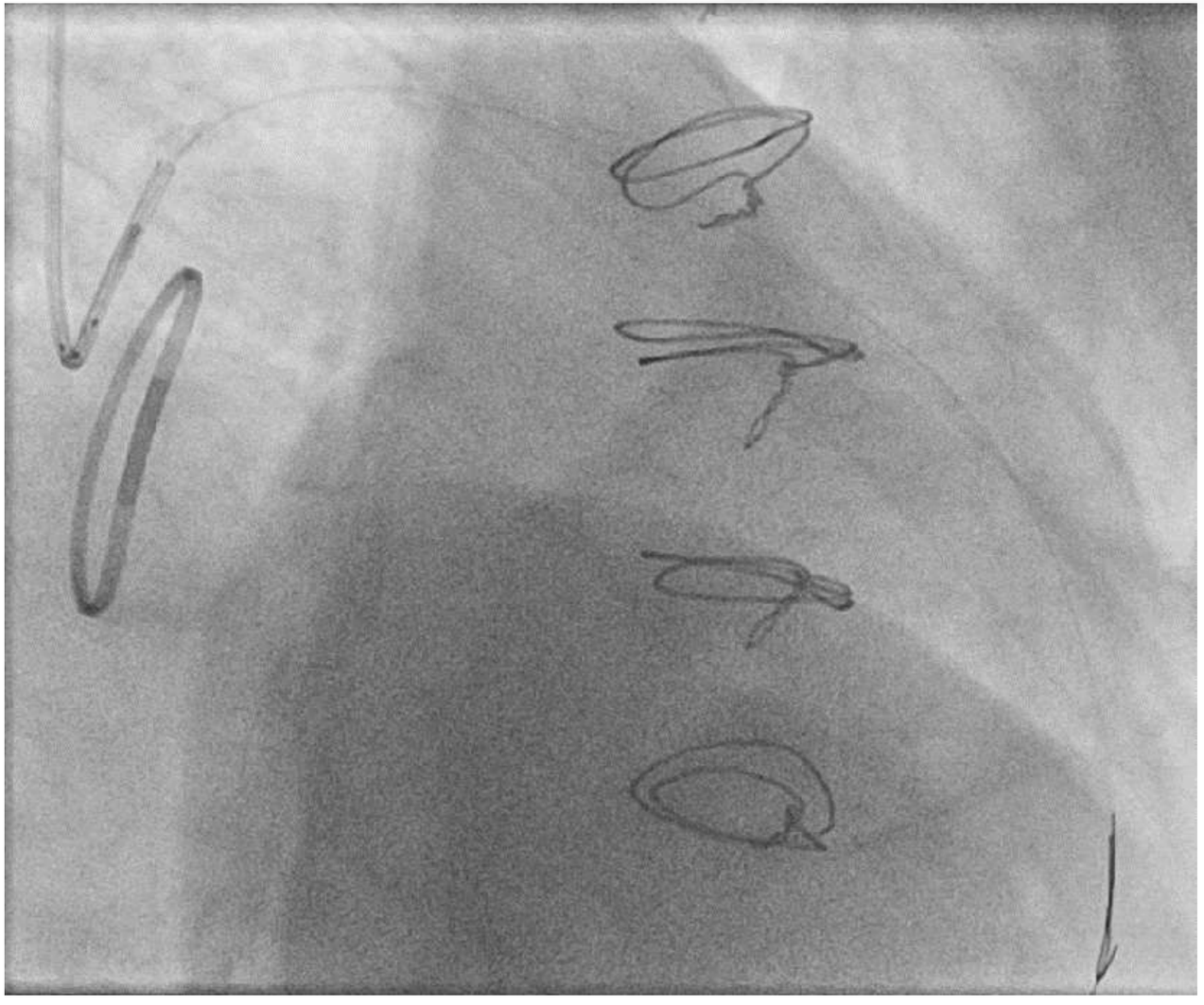
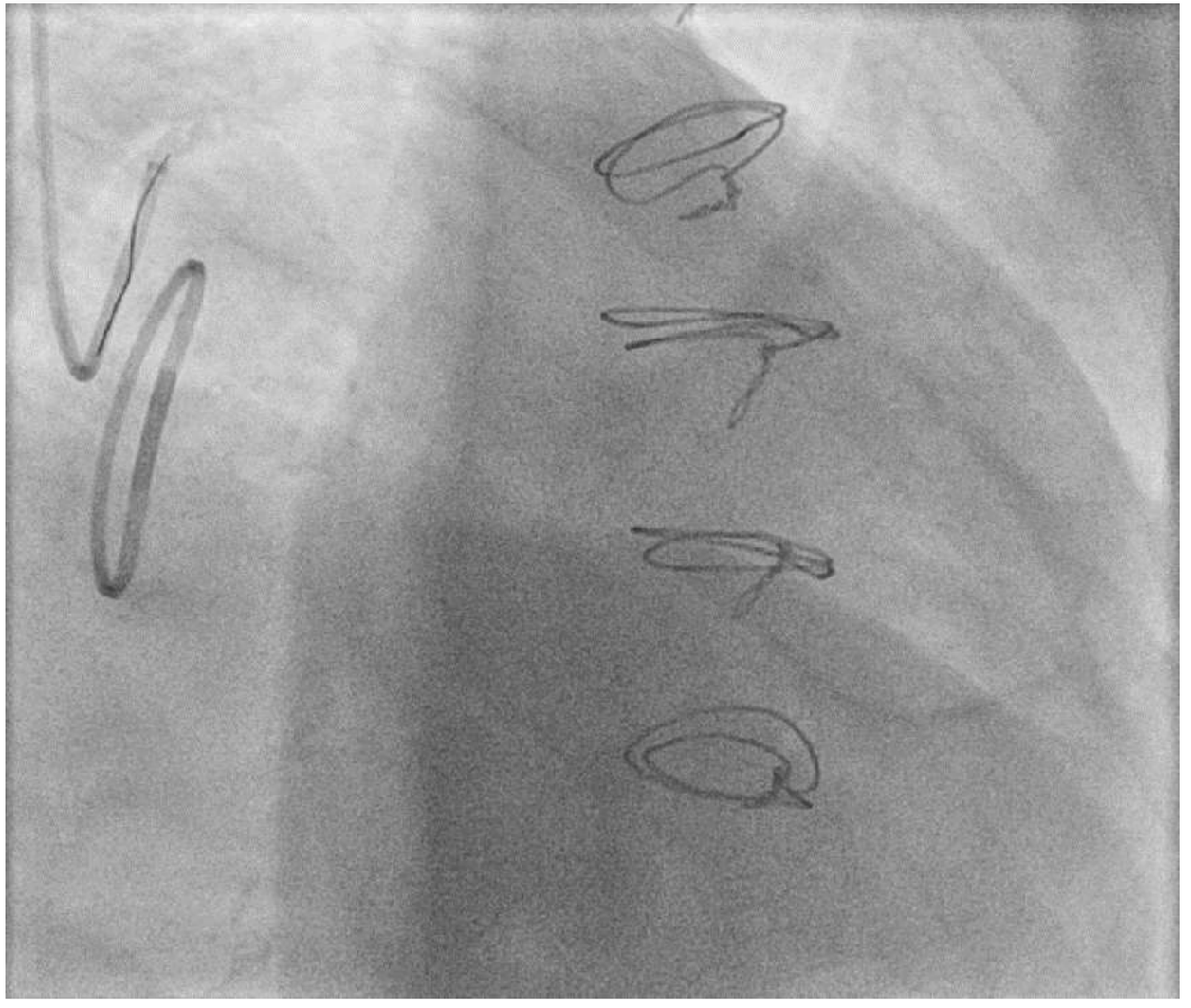
Snuff box r. 6F IL3,5 6F, IVUS

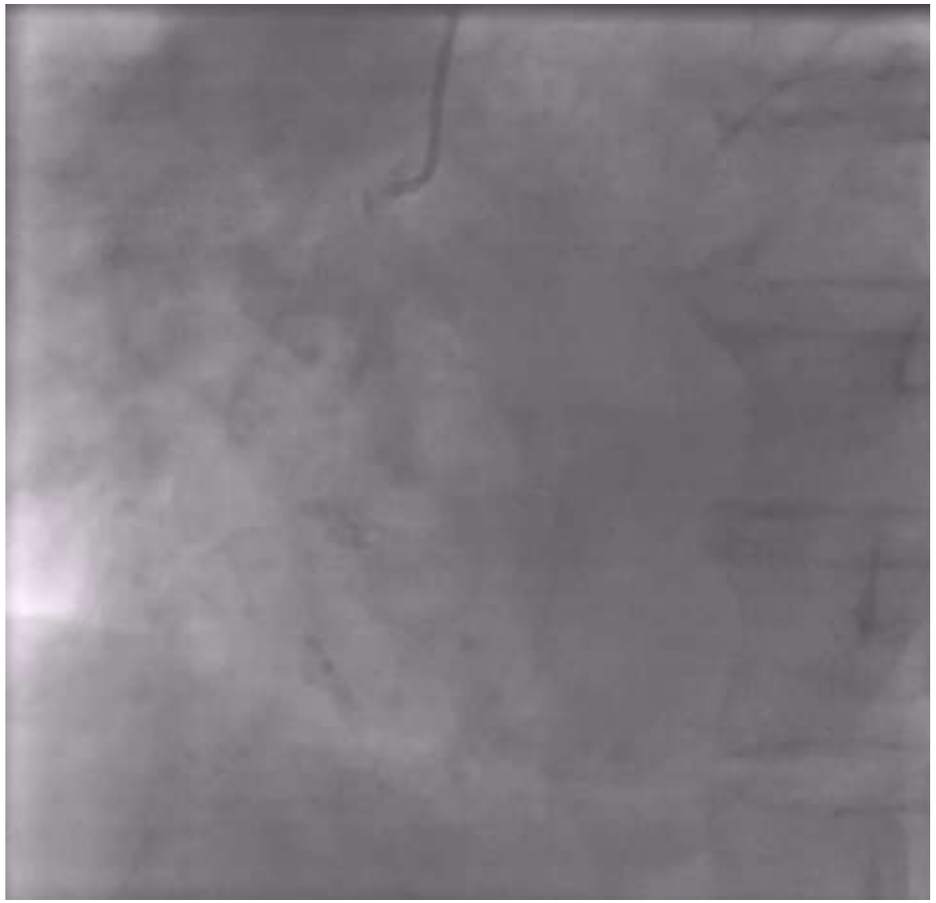
Case 1. LAD-PCI (♂ 85 y.o., AVS 0,6 cm2, LVEF 30%, MVR 2010)

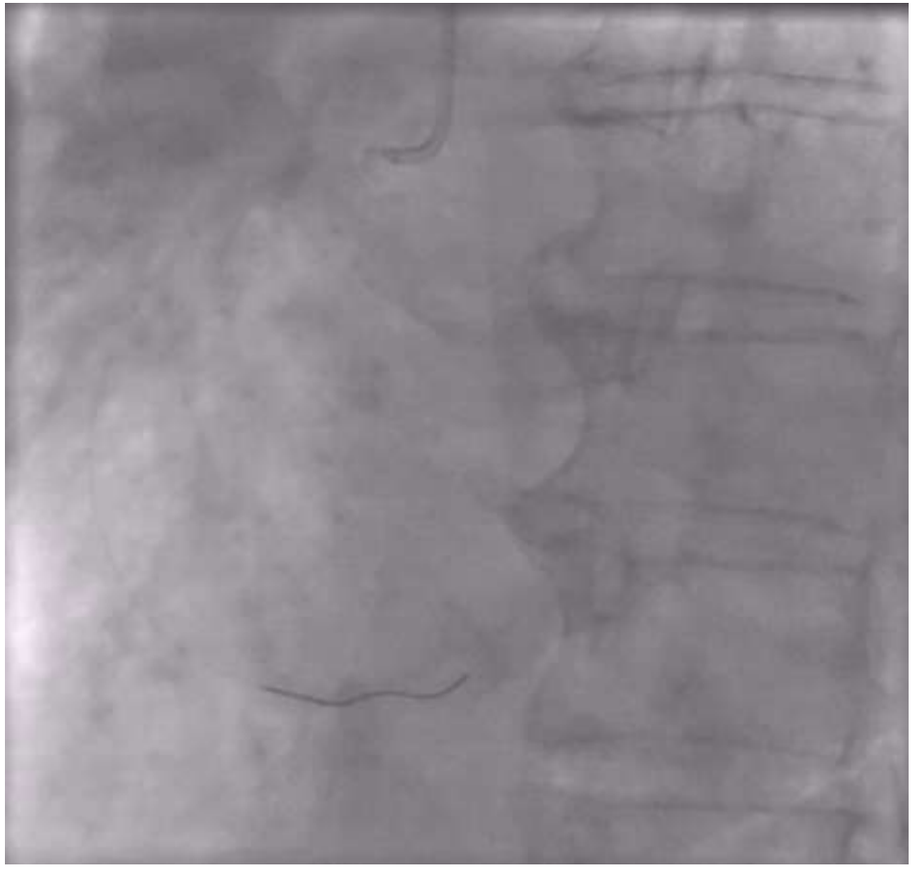




LAD-PCI: PTCA with 2 and 2,5 NC balloons, IVUS (diameter proximal 4mm, medial 3,5mm, 2 lesions with severe 360°-calcification), Shockwave with 3,5mm balloon, IVUS - good calcium modification, DES (Supraflex Cruz 3,5x36mm), POT with 3,5- and 4 mm NC balloons, IVUS with good stent apposition.

Case 2. Pat. 72 y.o.

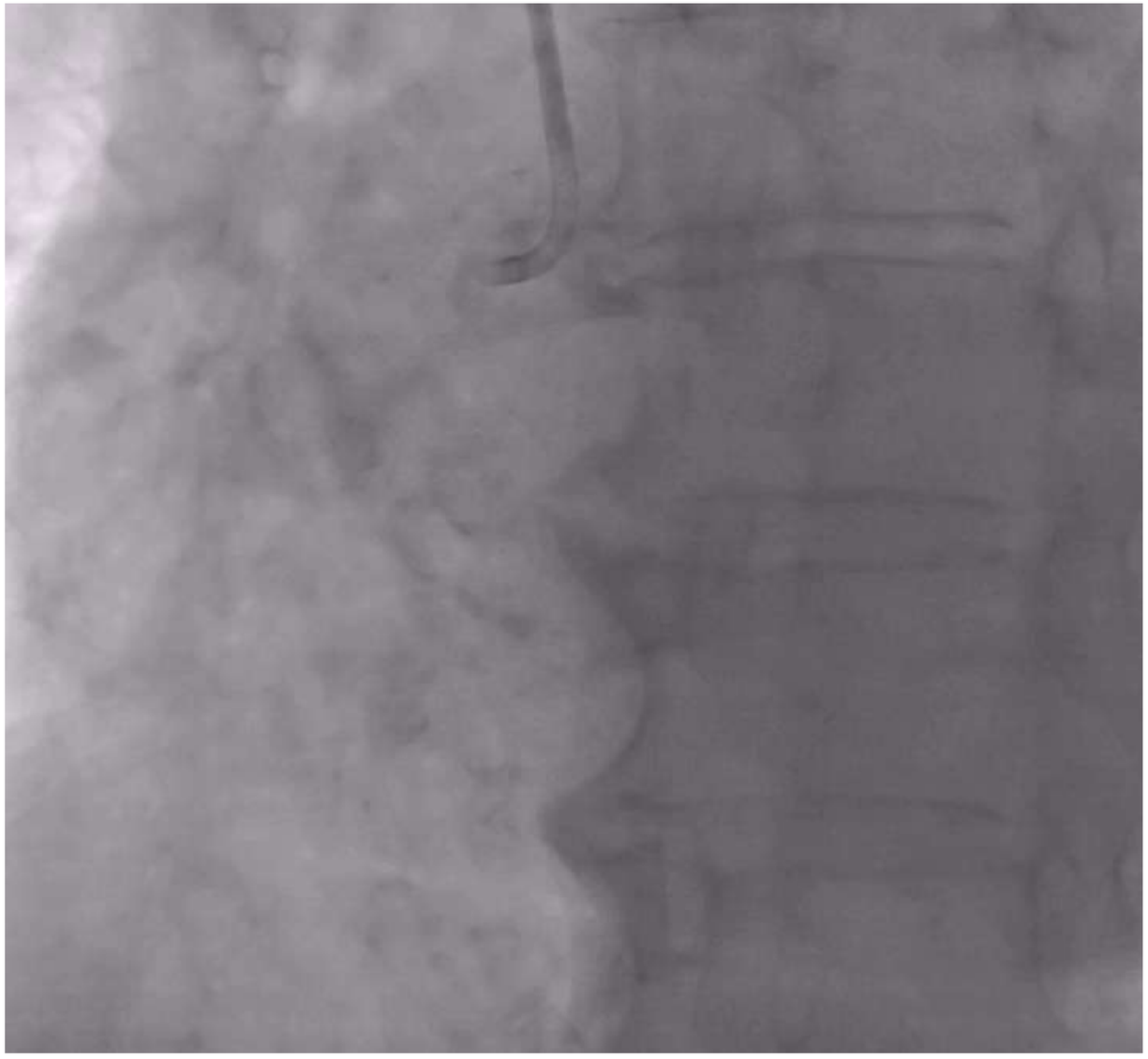


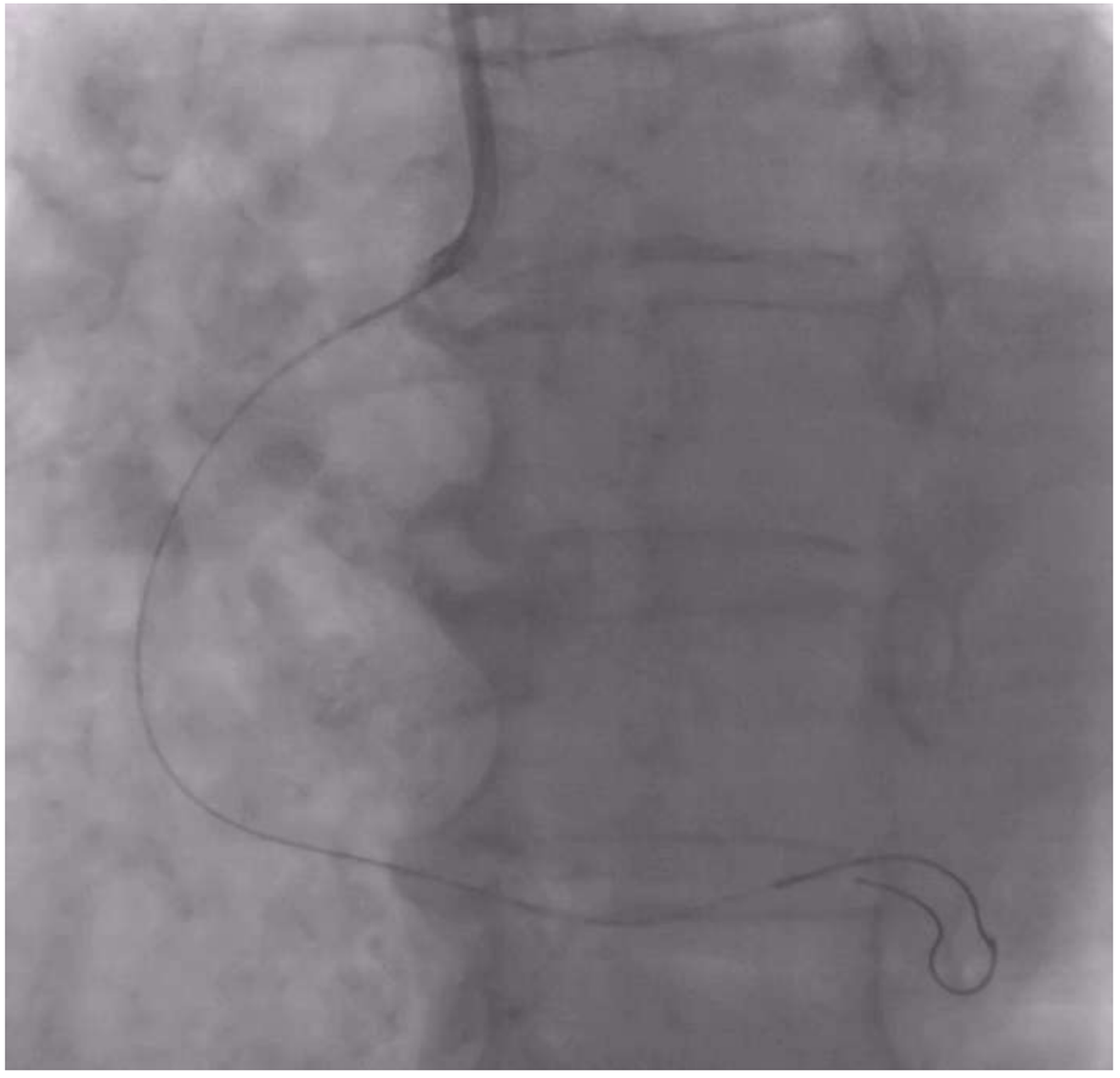


RCA: ostial very calcified 70-80% stenosis. RCA-iFR 0.79.

RCA-PCI: PTCAs with NC balloons, blade angioplasty (NSE Alpha 2,75x13mm), DEB-PCI (Sequent Please Neo 3,0x15mm). iFR - after PCI 0.96.

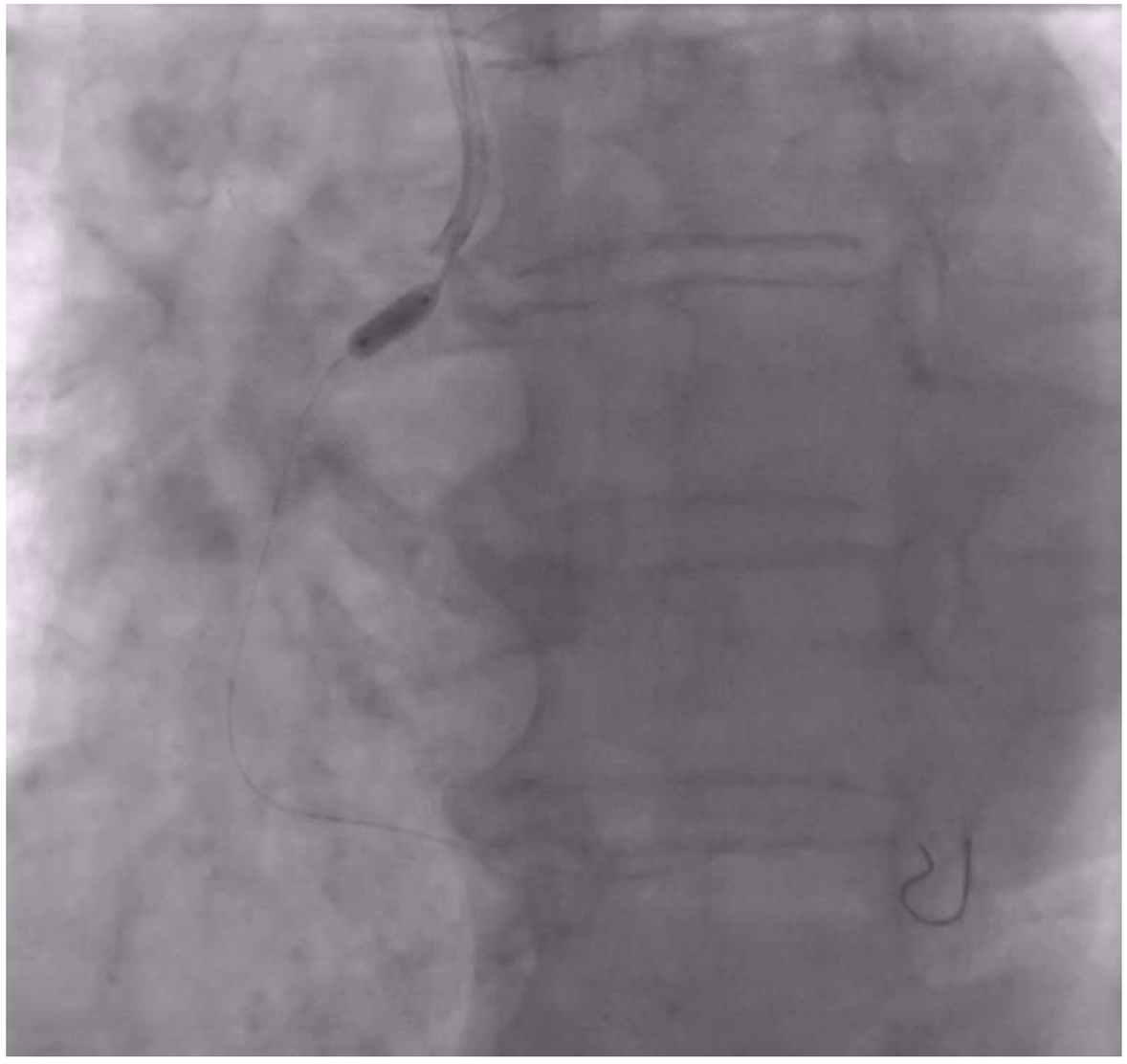
Case 2. Pat. 72 y.o.





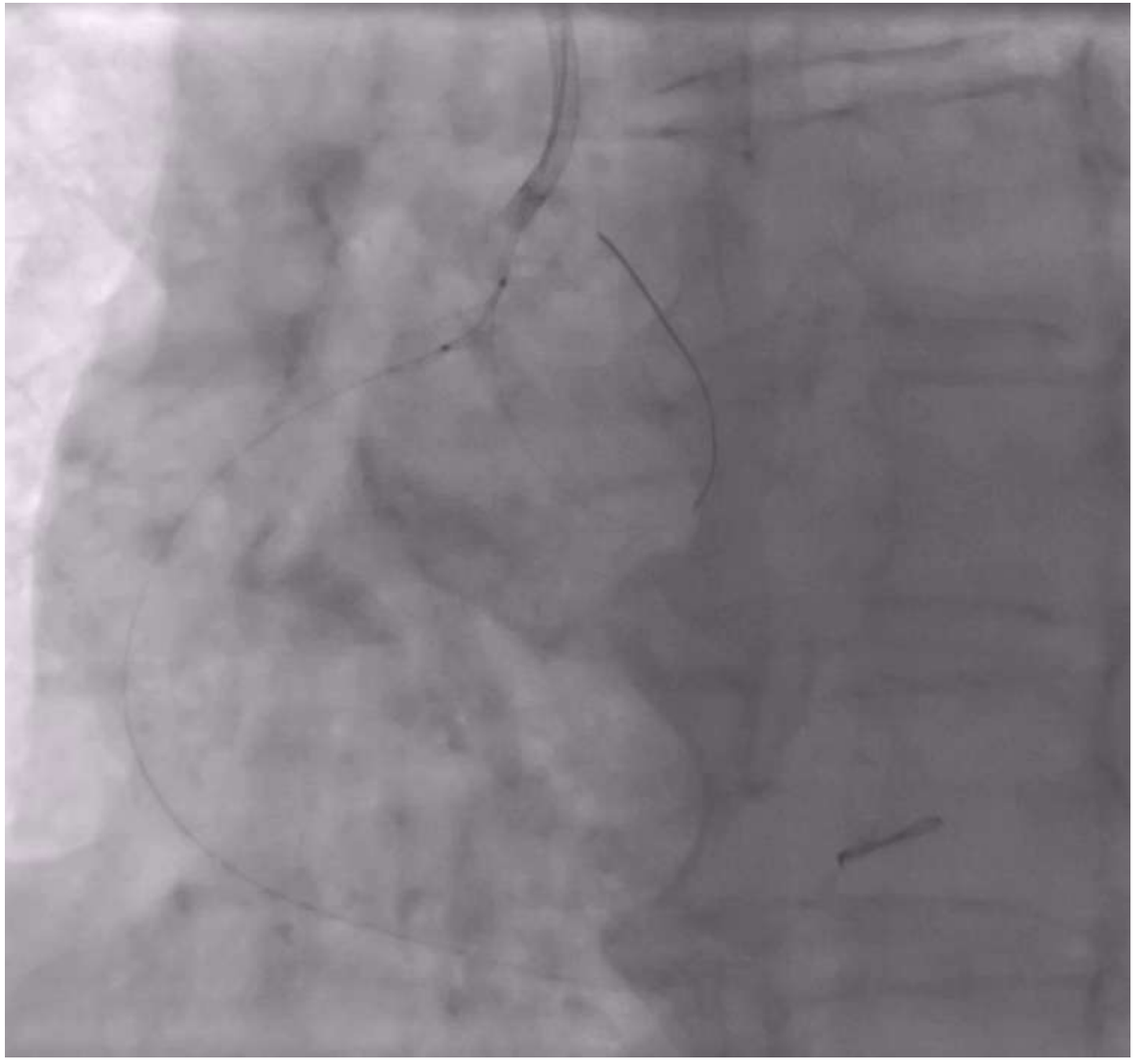
RCA-PCI: OTW balloon, Runthrough, Rotawire, Rotablation (1,75mm) ostial, NC balloon rupture

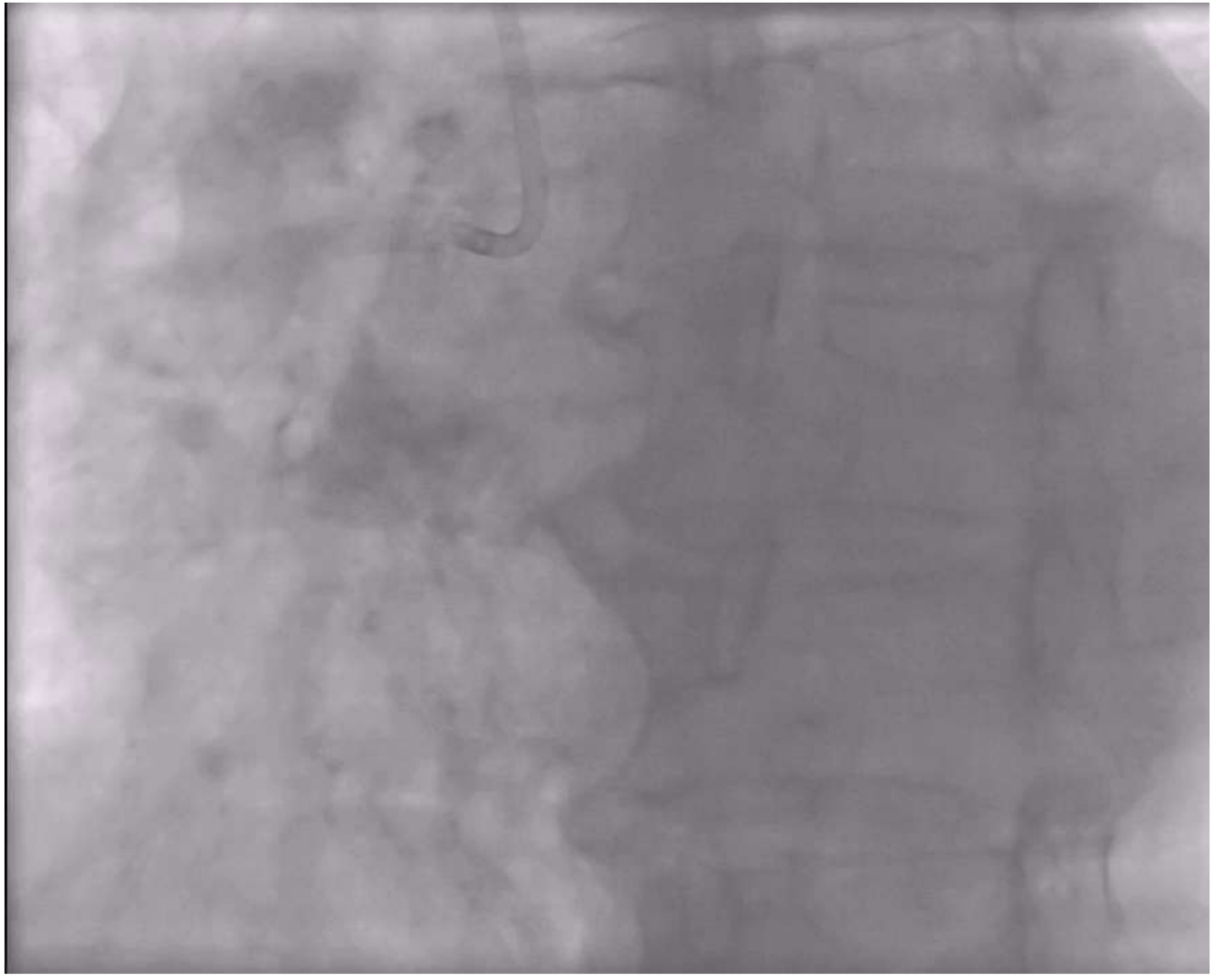
Case 2. Pat. 72 y.o.



RCA-PCI: cutting balloon, NC balloon, IVUS, DES (Resolute Integrity 3,0x18mm)

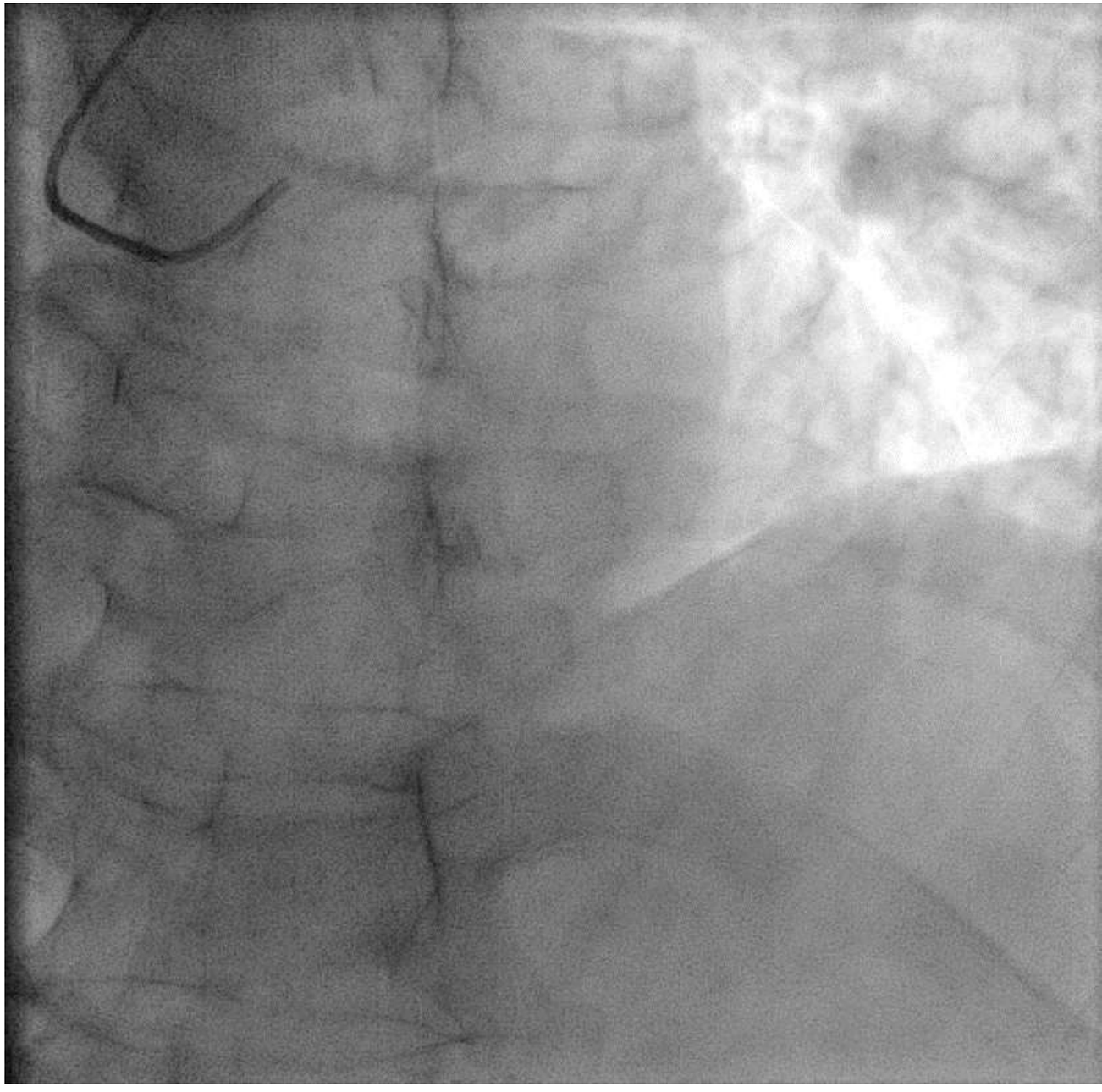
Case 2. Pat. 72 y.o.





RCA-PCI: stent optimisation with NC balloon 3,25x15mm, IVUS.

Case 3. LAD-CTO-PCI (Pat. 67 y.o.)



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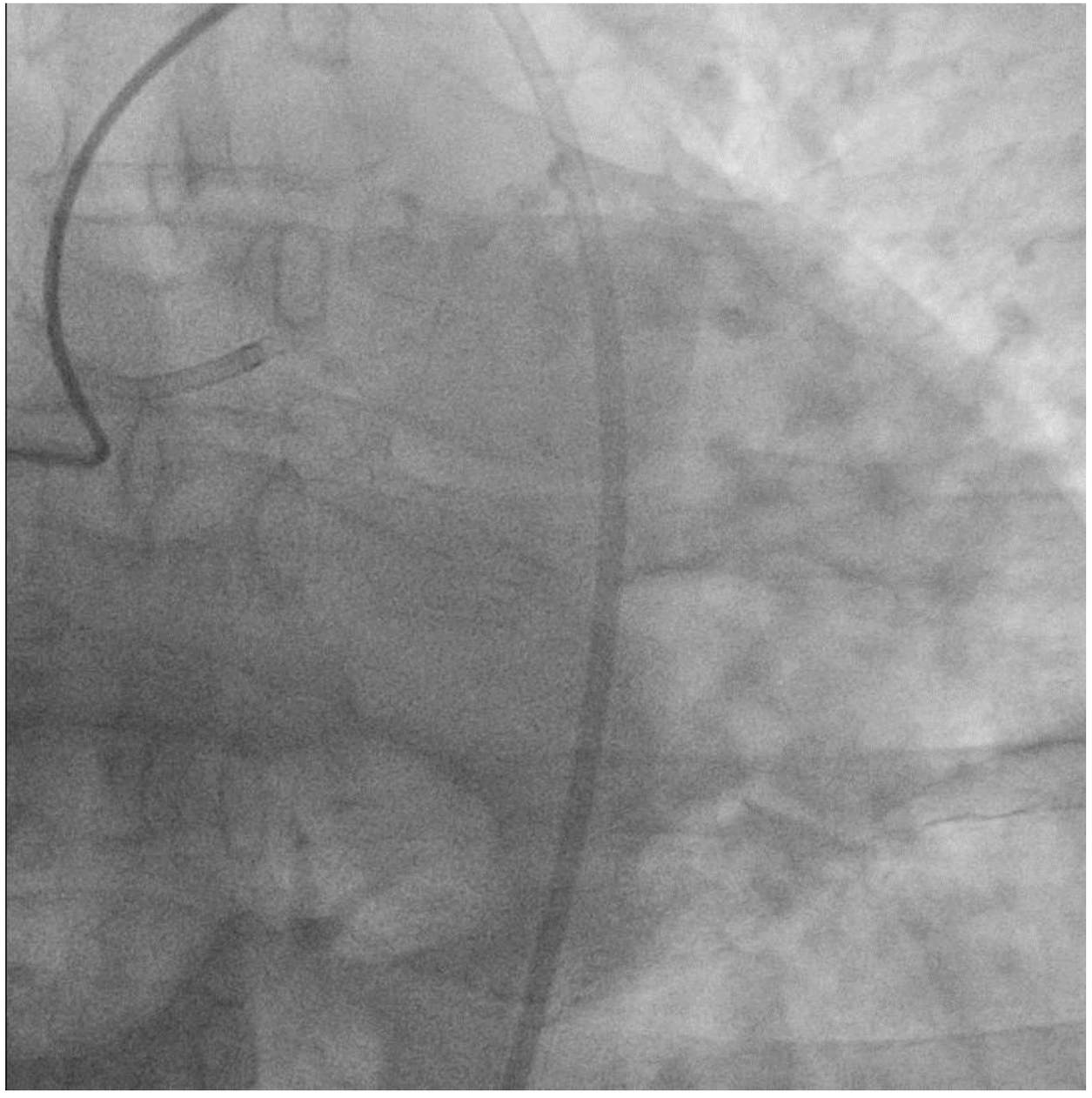

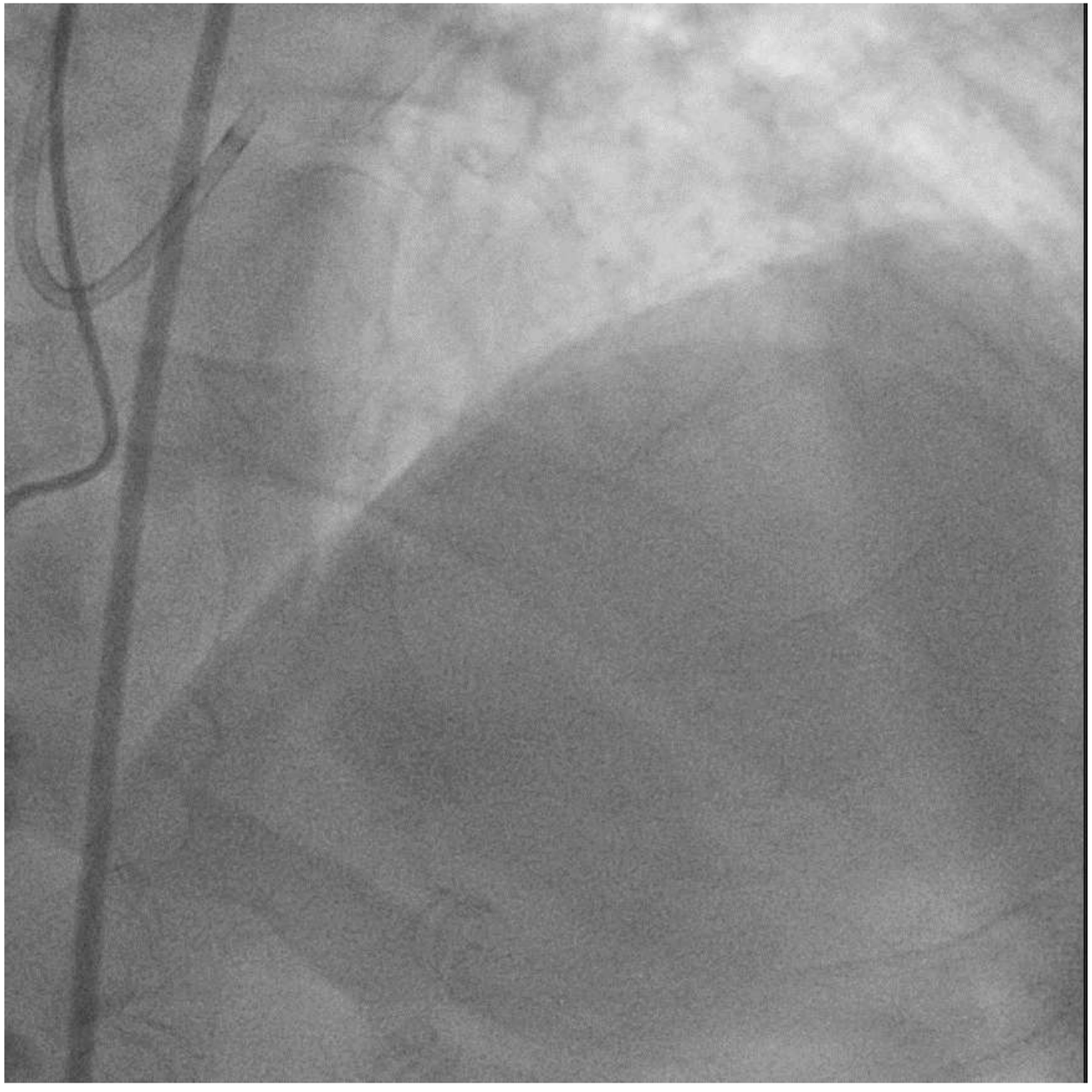

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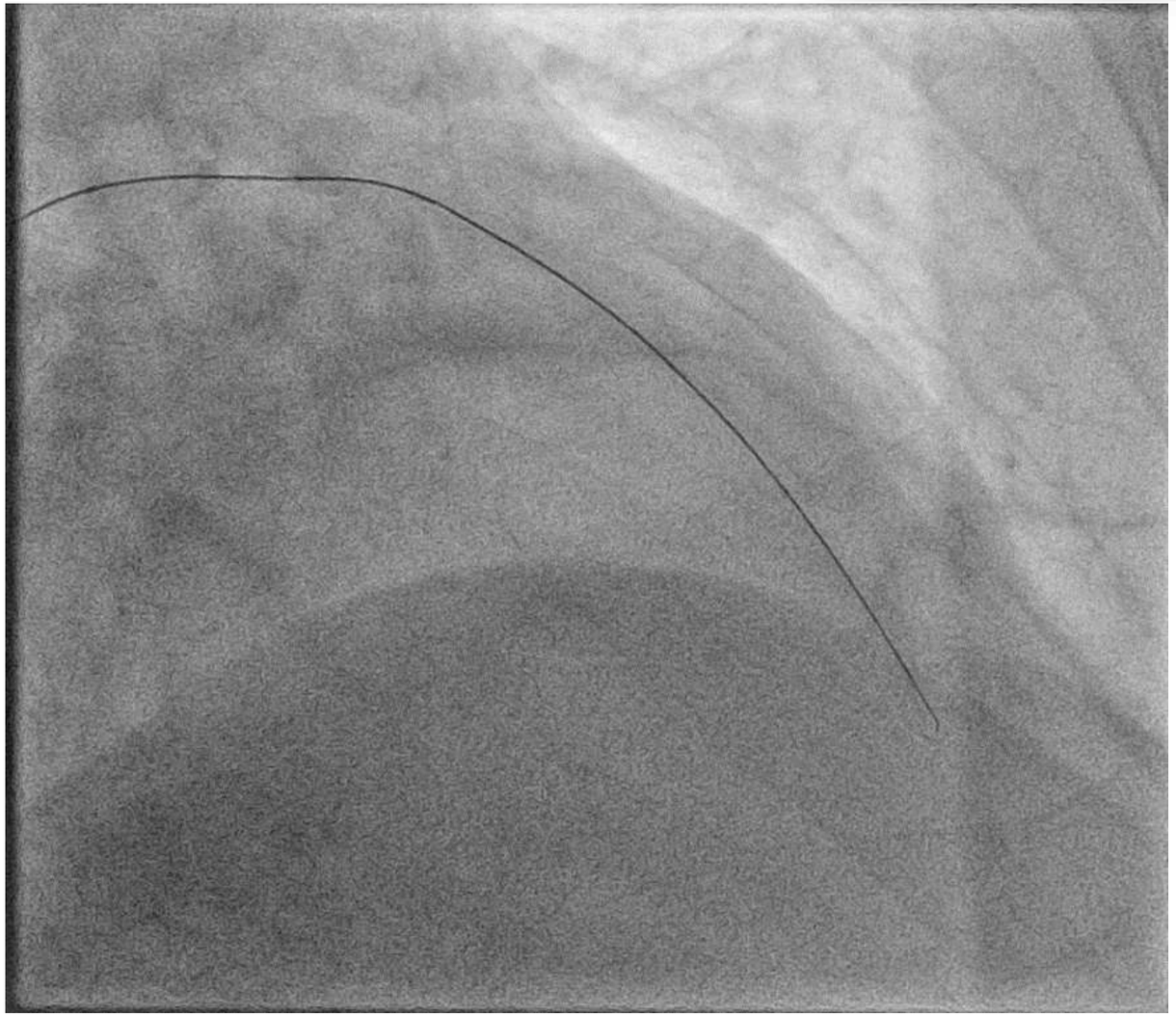
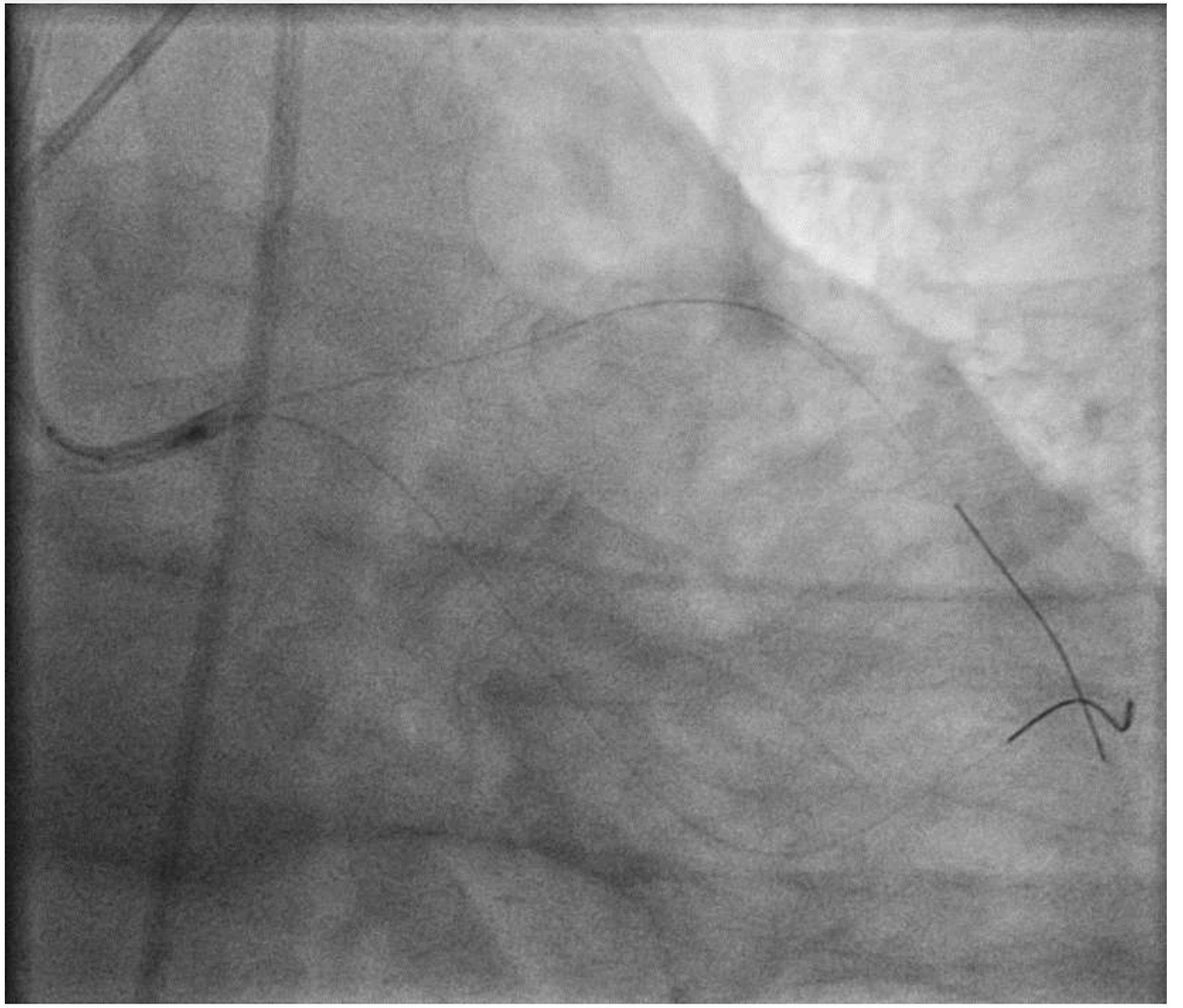
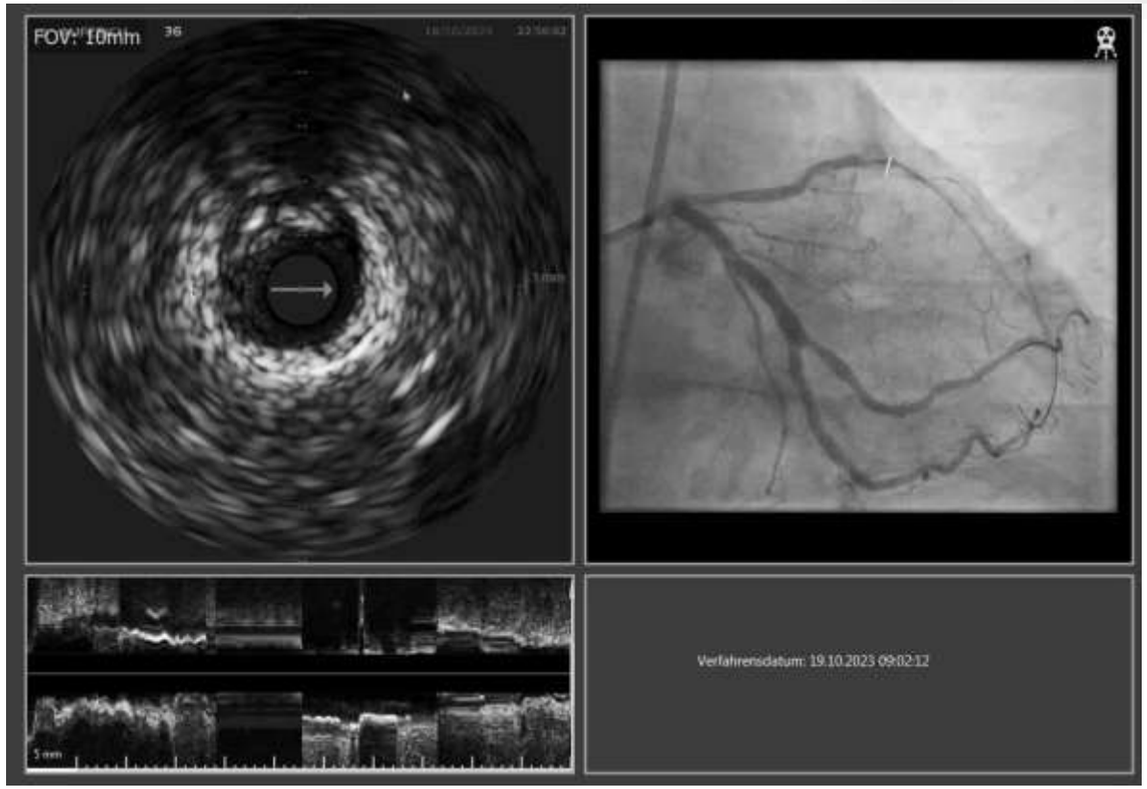
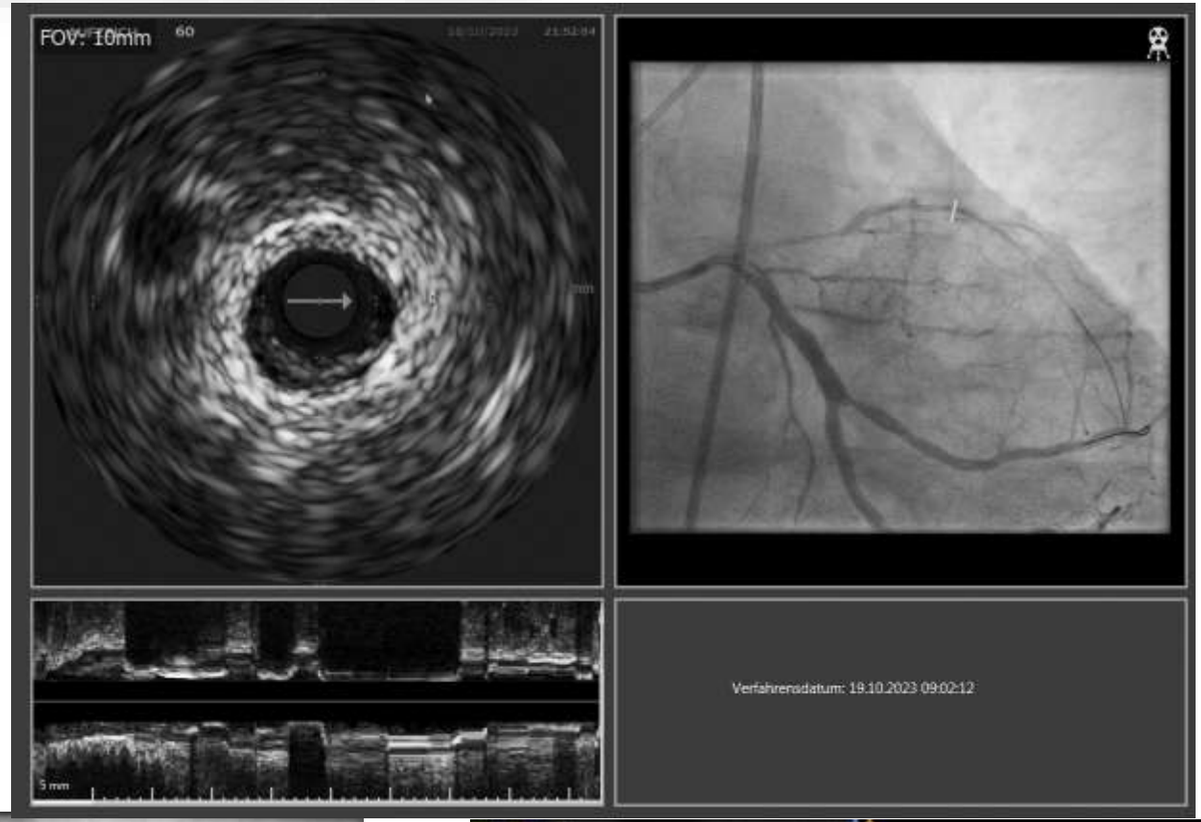


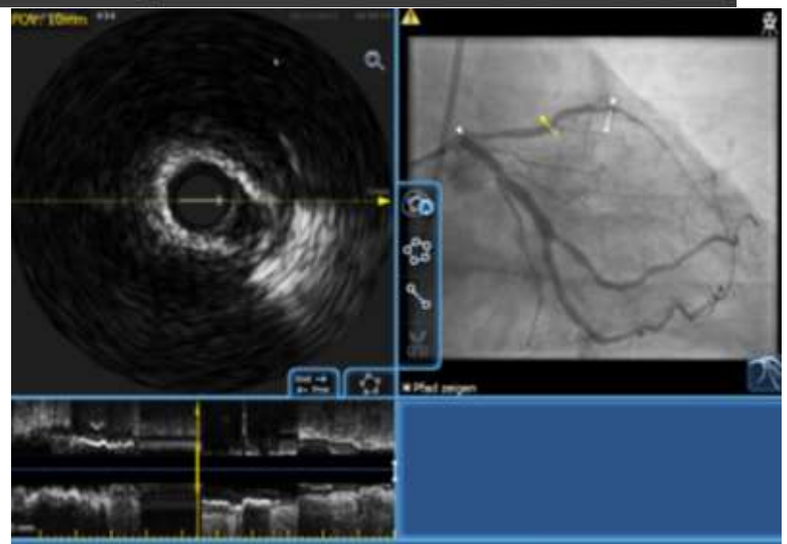


LAD-CTO-PCI: FineCross, Fielder-XT-A unsuccesful, Gaia Second succesfull, Runthrough, trapping, PTCA, IVUS, Shockwave 4x12mm with 120 applications, PTCAs with NC balloons 3 und 3,5mm

Case 3. LAD-CTO-PCI (Pat. 67 y.o.)







IVUS: LAD medial 3mm, proximal 3,5-4,3mm, in the CTO area extreme calcification 360° (more in the distal cap). LM 6,5mm without disease.

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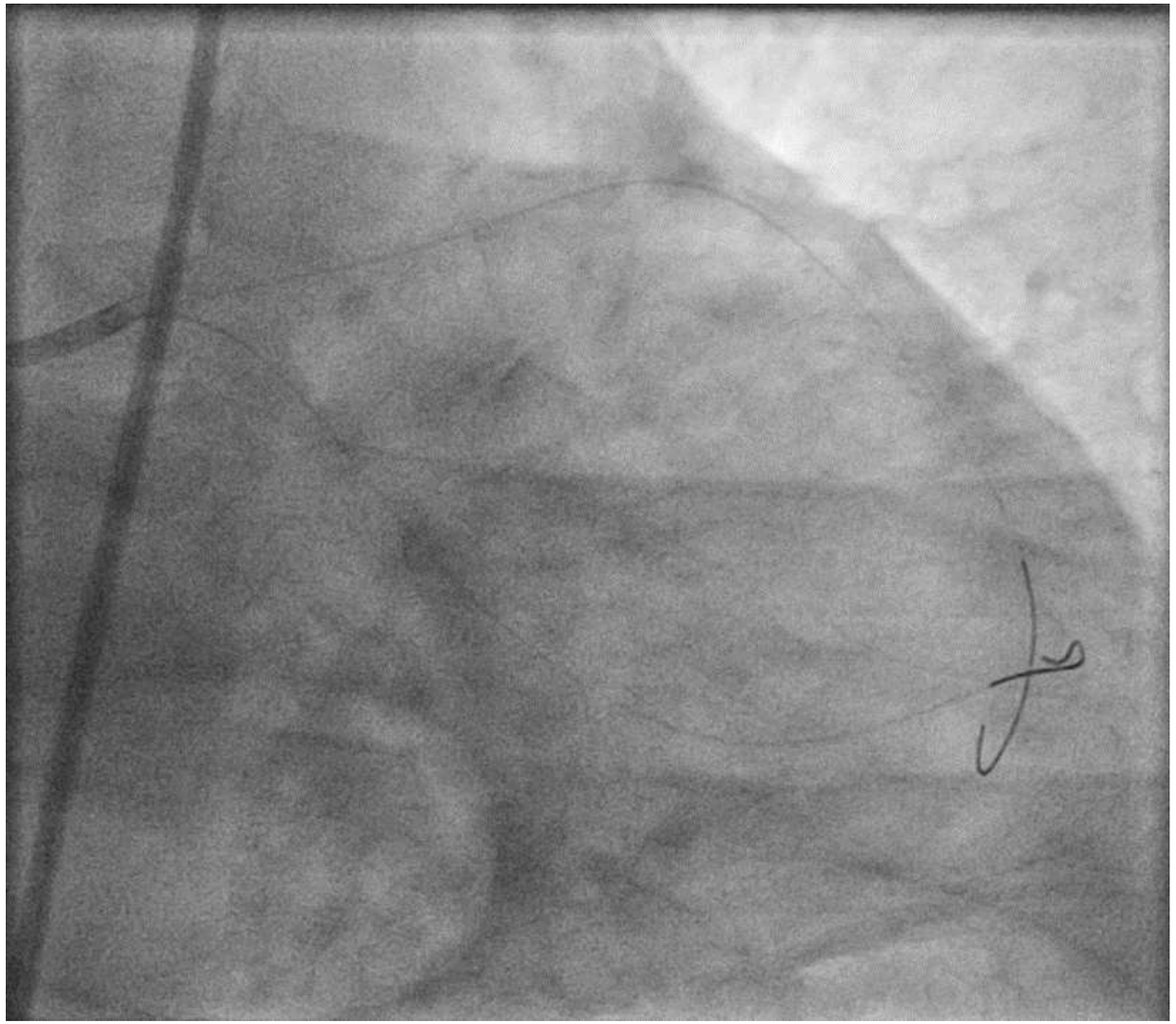
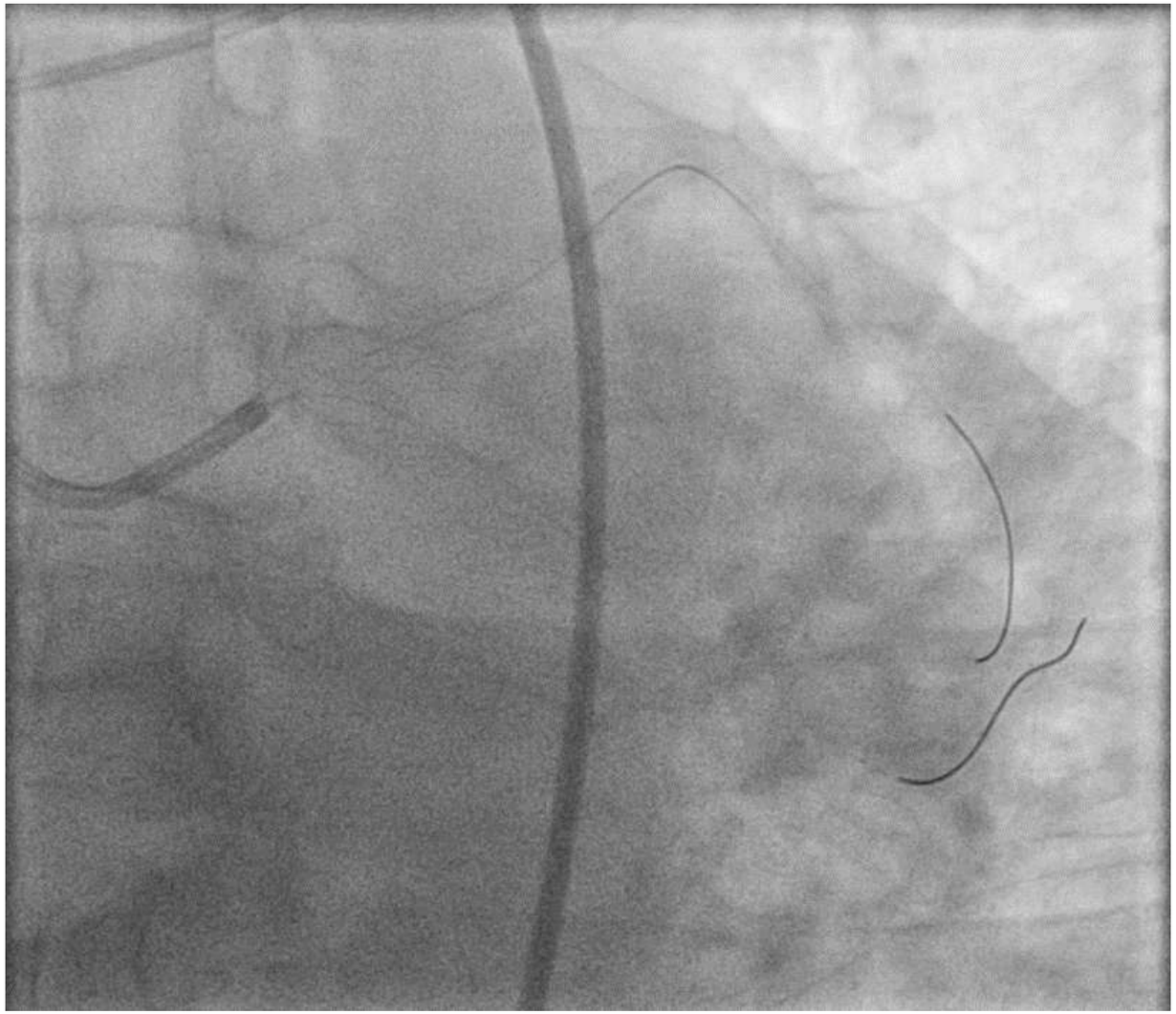
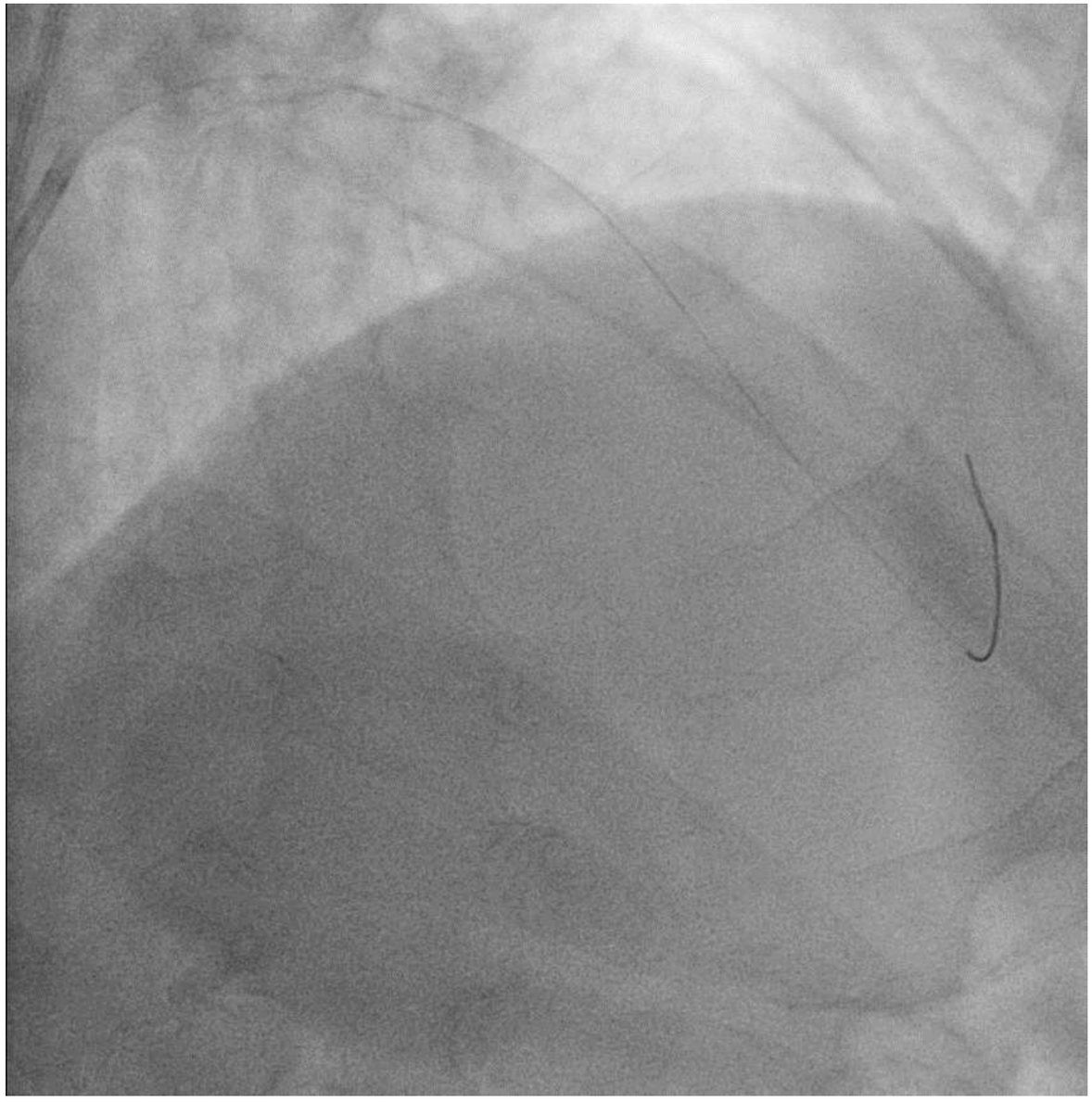
Case 3. LAD-CTO-PCI (Pat. 67 y.o.)

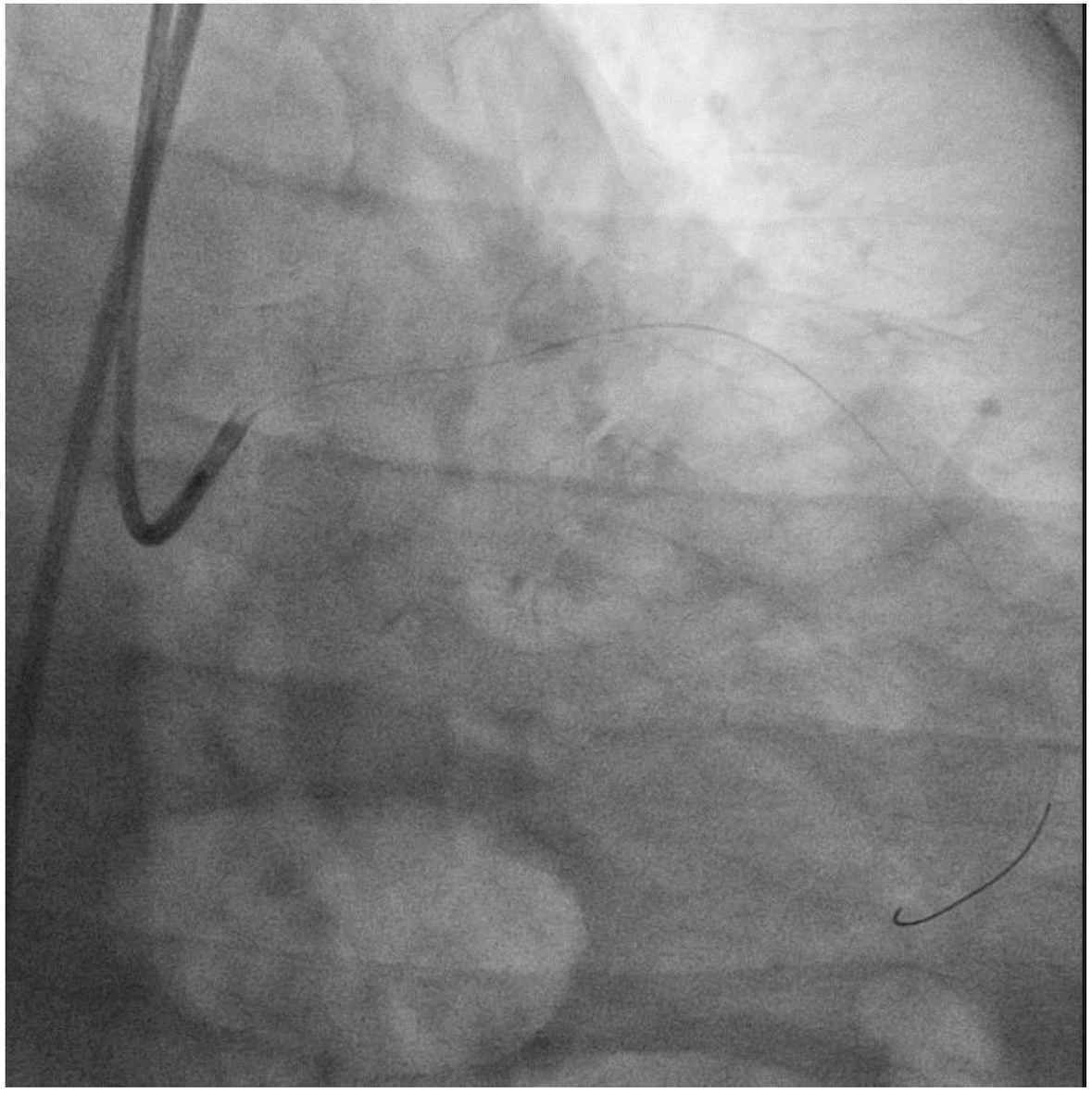




LAD-CTO-PCI: IVUS – no calcium modification in the area of the distal cap, here multiple blade angioplasty (Wolverine 3.50x15mm), PTCA with 3.75 NC balloon, IVUS still no sufficient calcium modification, contraindication for stent implantation - 3xDCB (Sequent Please 3.0x30mm, 3.0x25mm and 3.5x20mm), finally good results with TIMI 3 flow without dissection.

Case 3. LAD-PCI (Pat. 67 y.o.) in 2 Mon.





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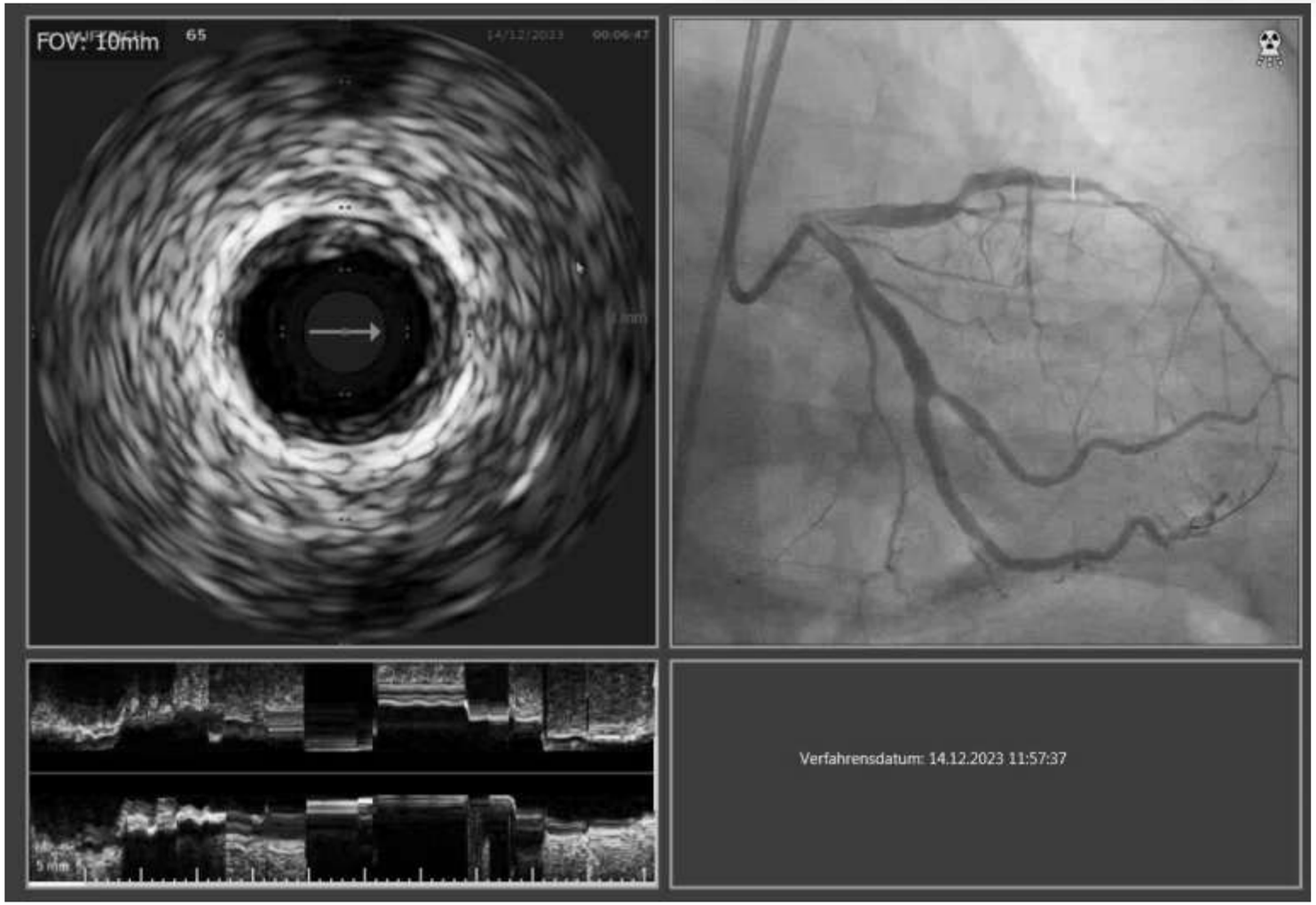
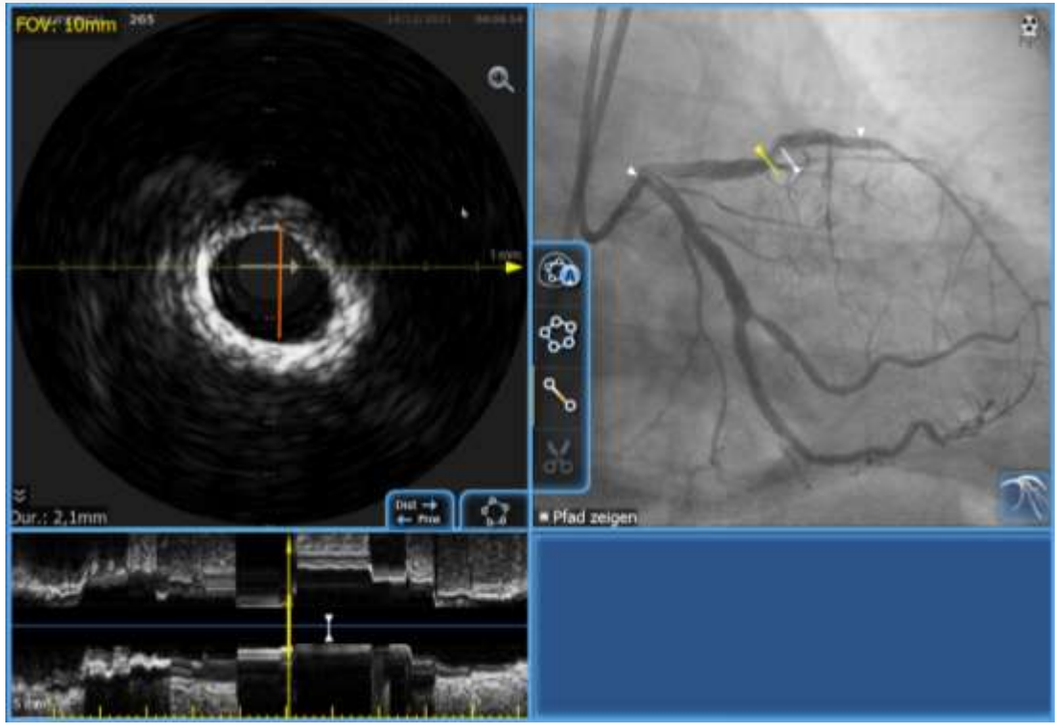
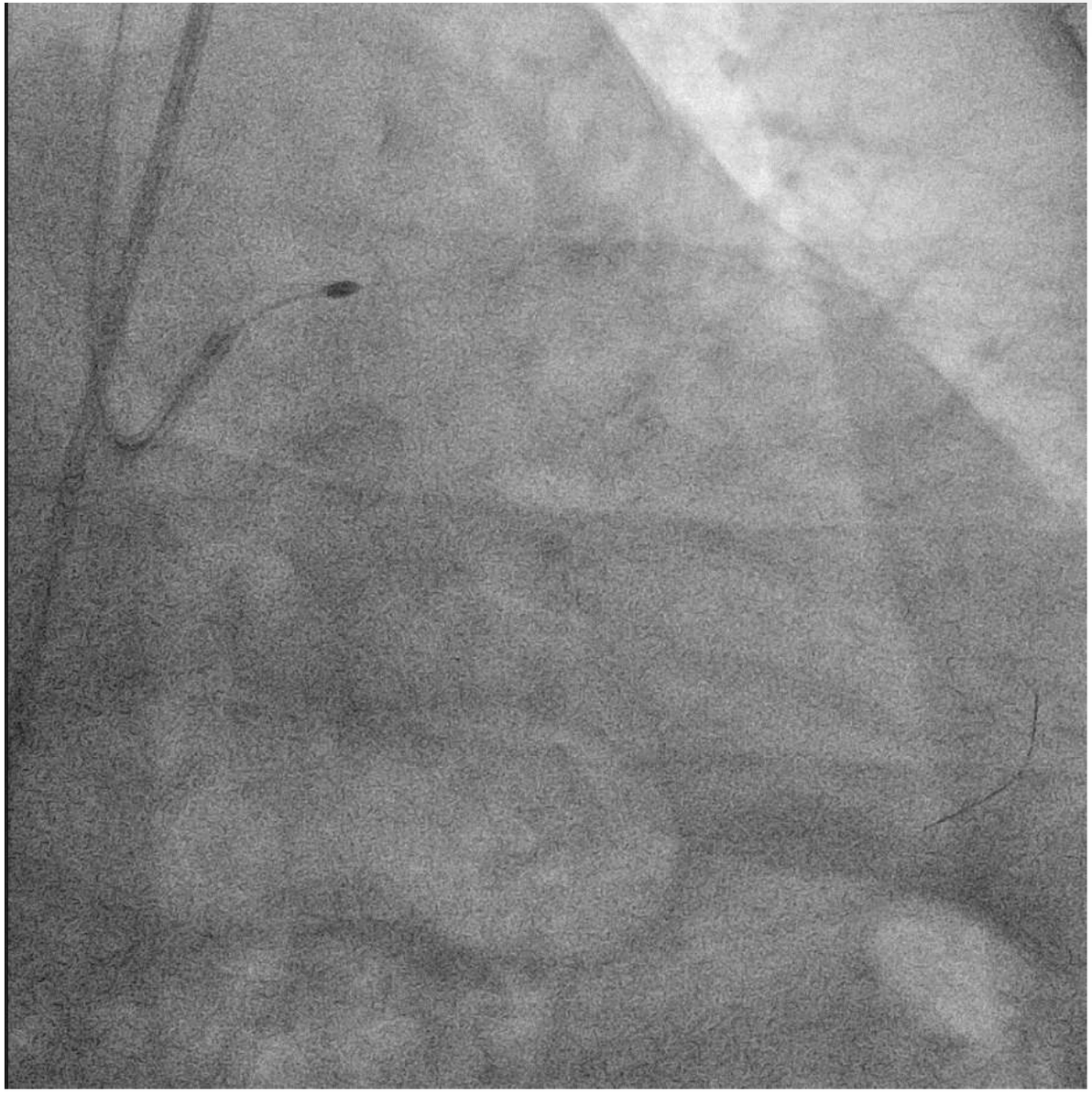
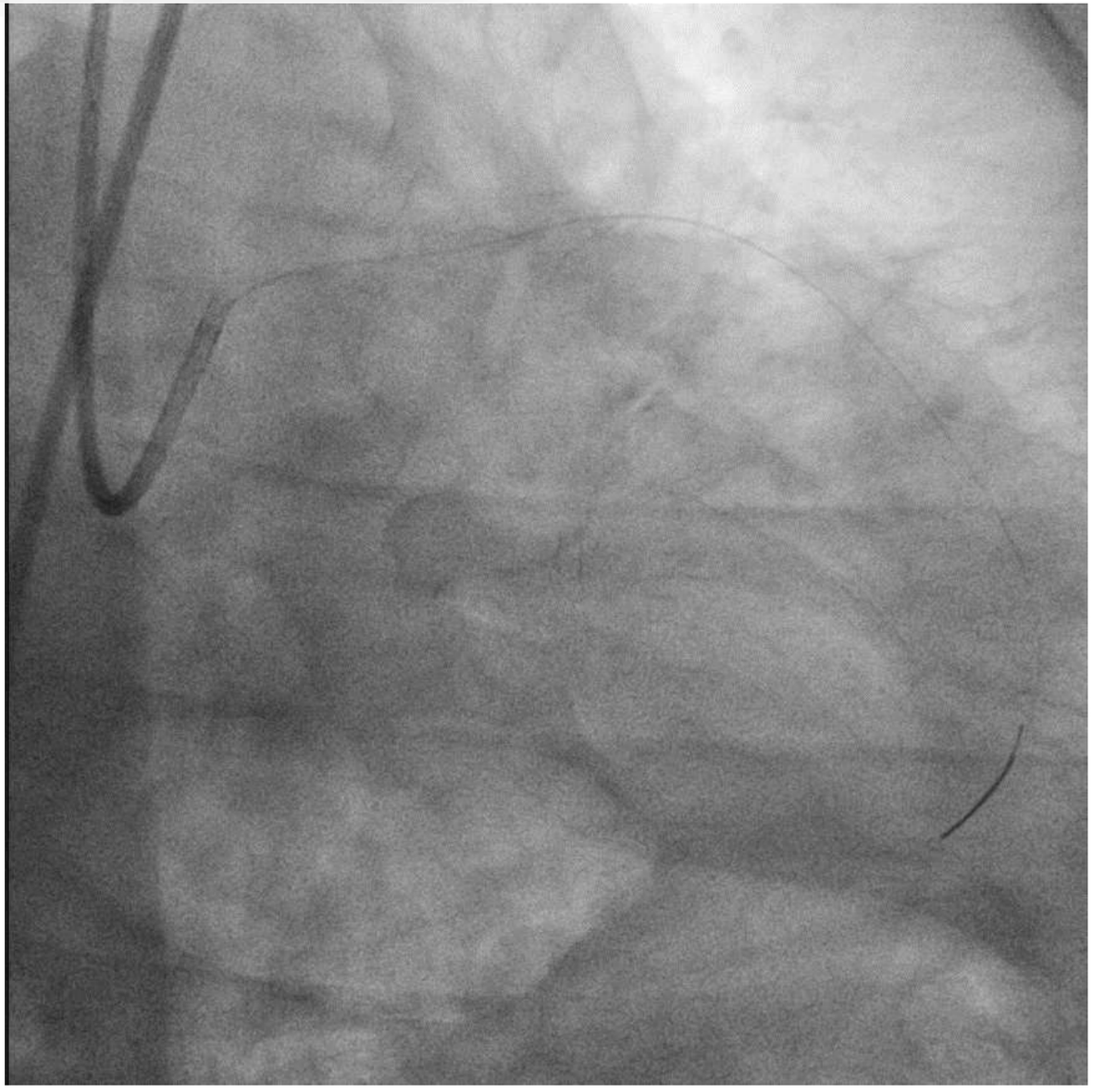




IVUS: LAD: proximal 4,5-5mm, good result after CTO-PCI with DCB, unchanged calcified ring proximal

Case 3. LAD-PCI (Pat. 67 y.o.) in 2 Mon.





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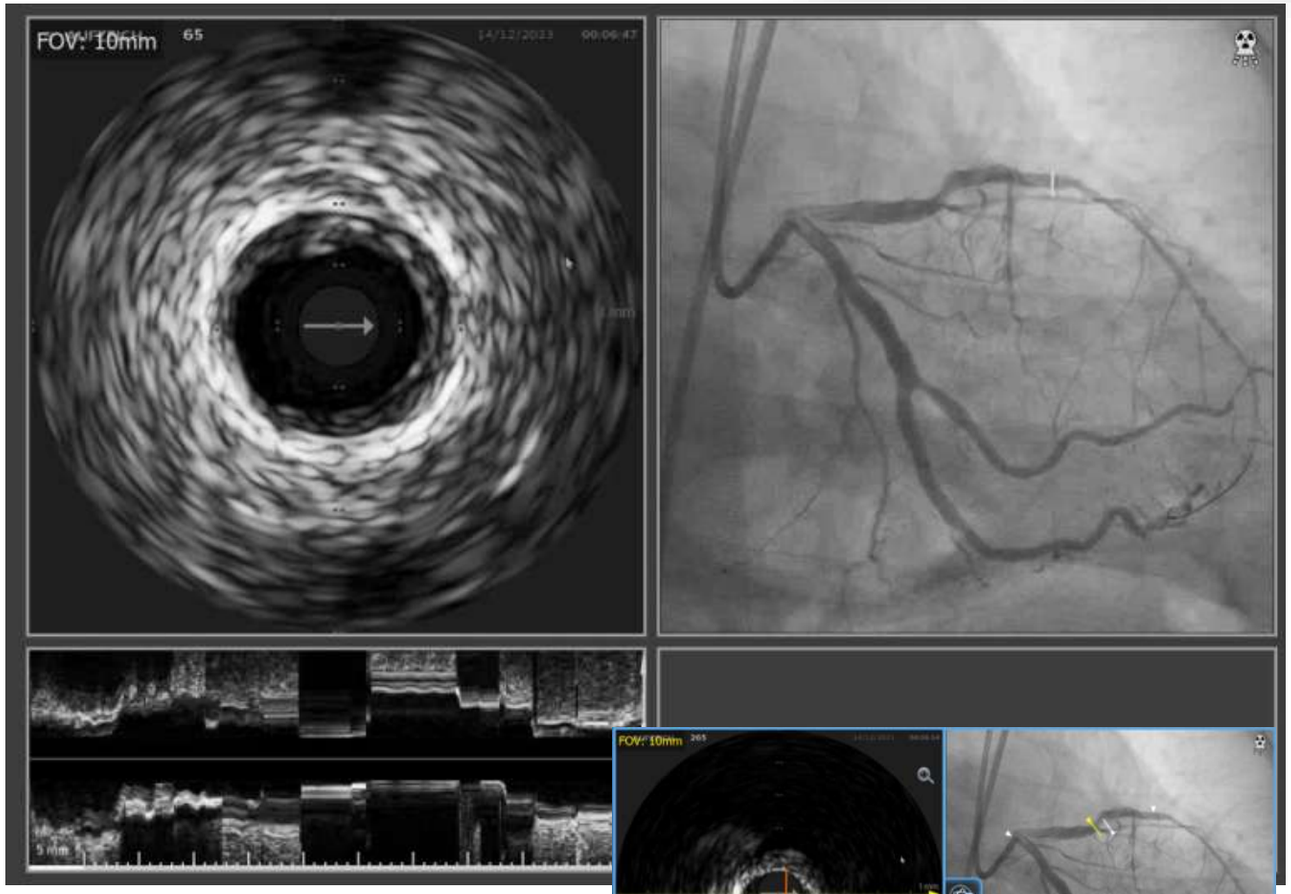
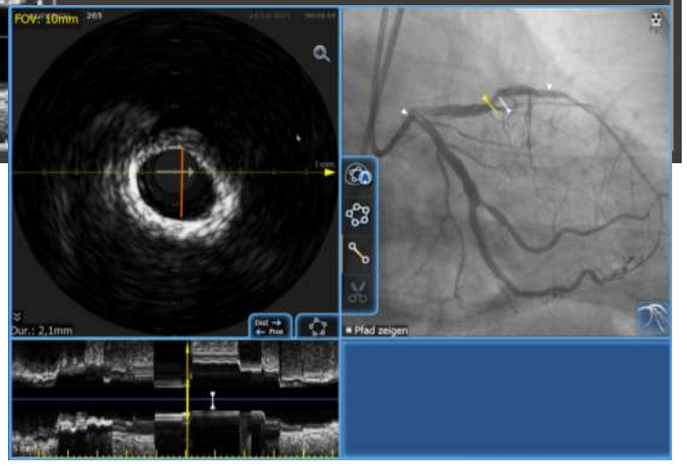
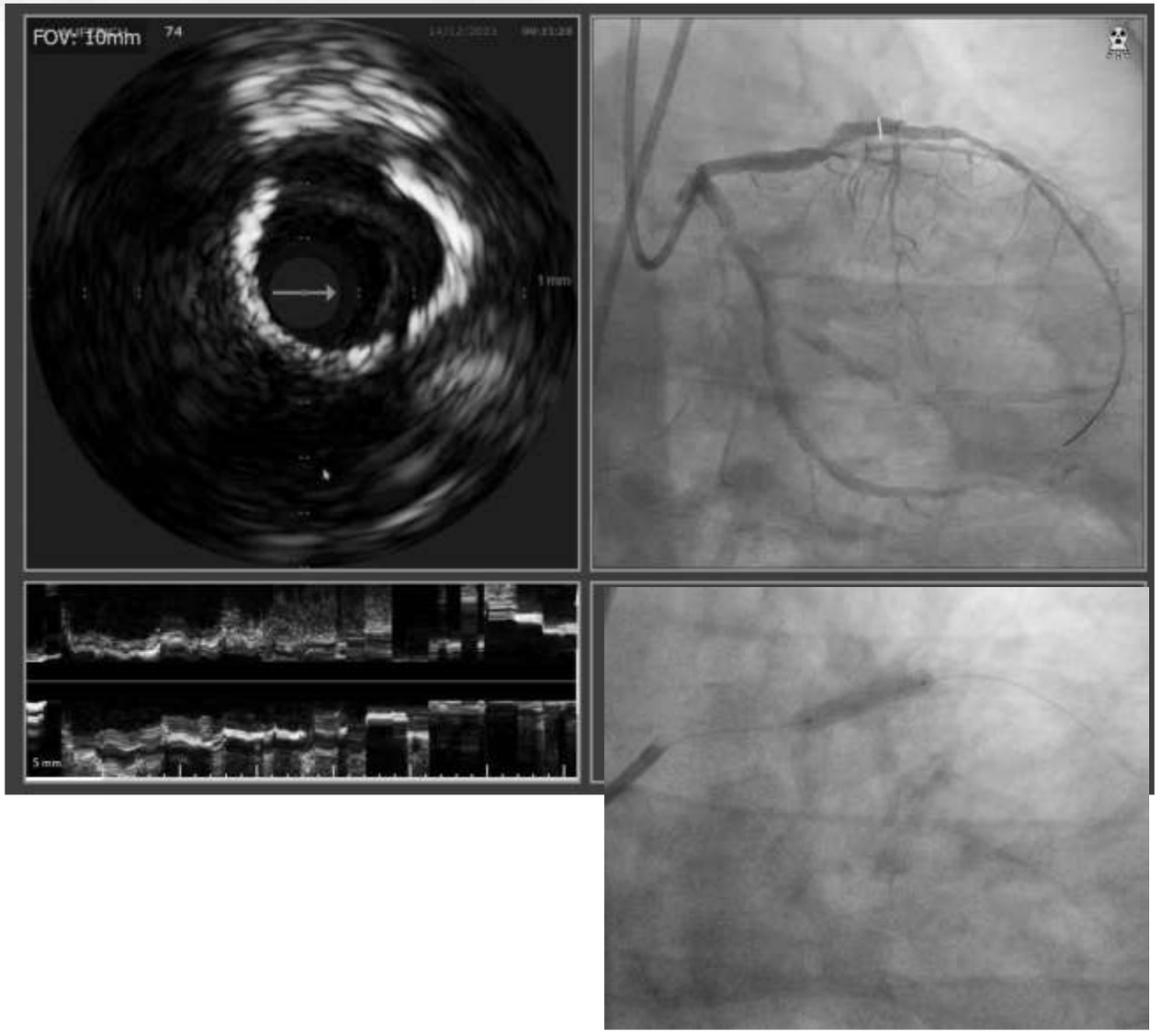
RIVA-PCI: IVUS, rotablations with 1,75mm burr

Case 3. LAD-PCI (Pat. 67 y.o.) in 2 Mon.



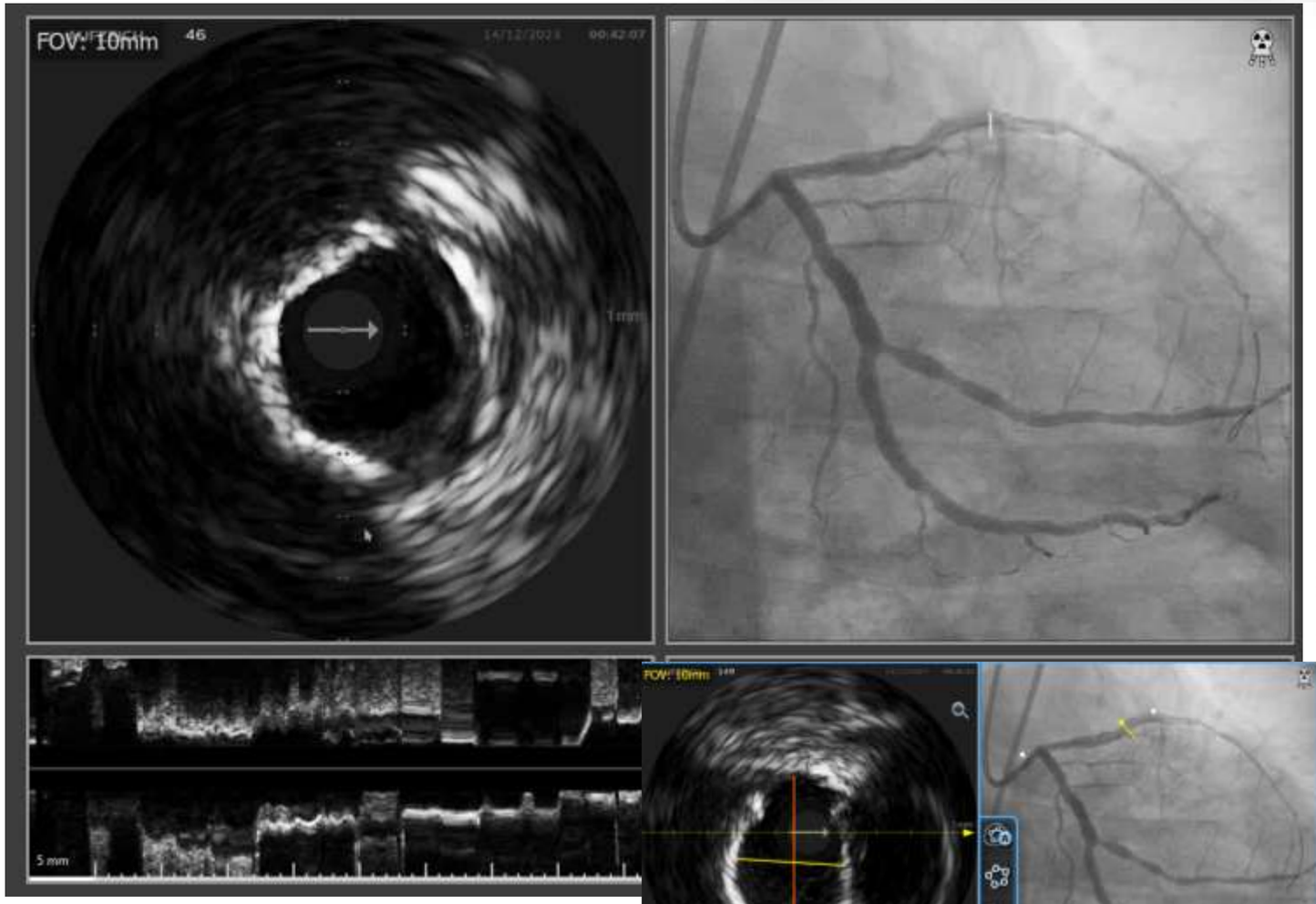


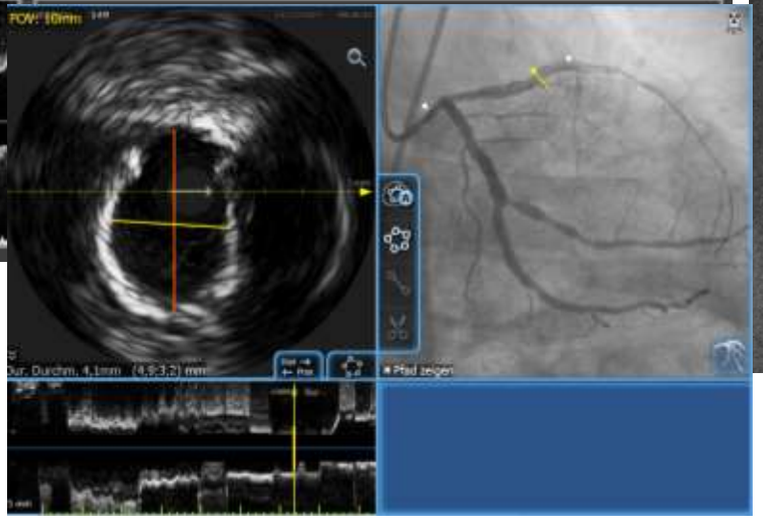
IVUS: LAD - proximal 4,5-5mm, good result after CTO-PCI with DCB, unchanged calcified ring proximal.

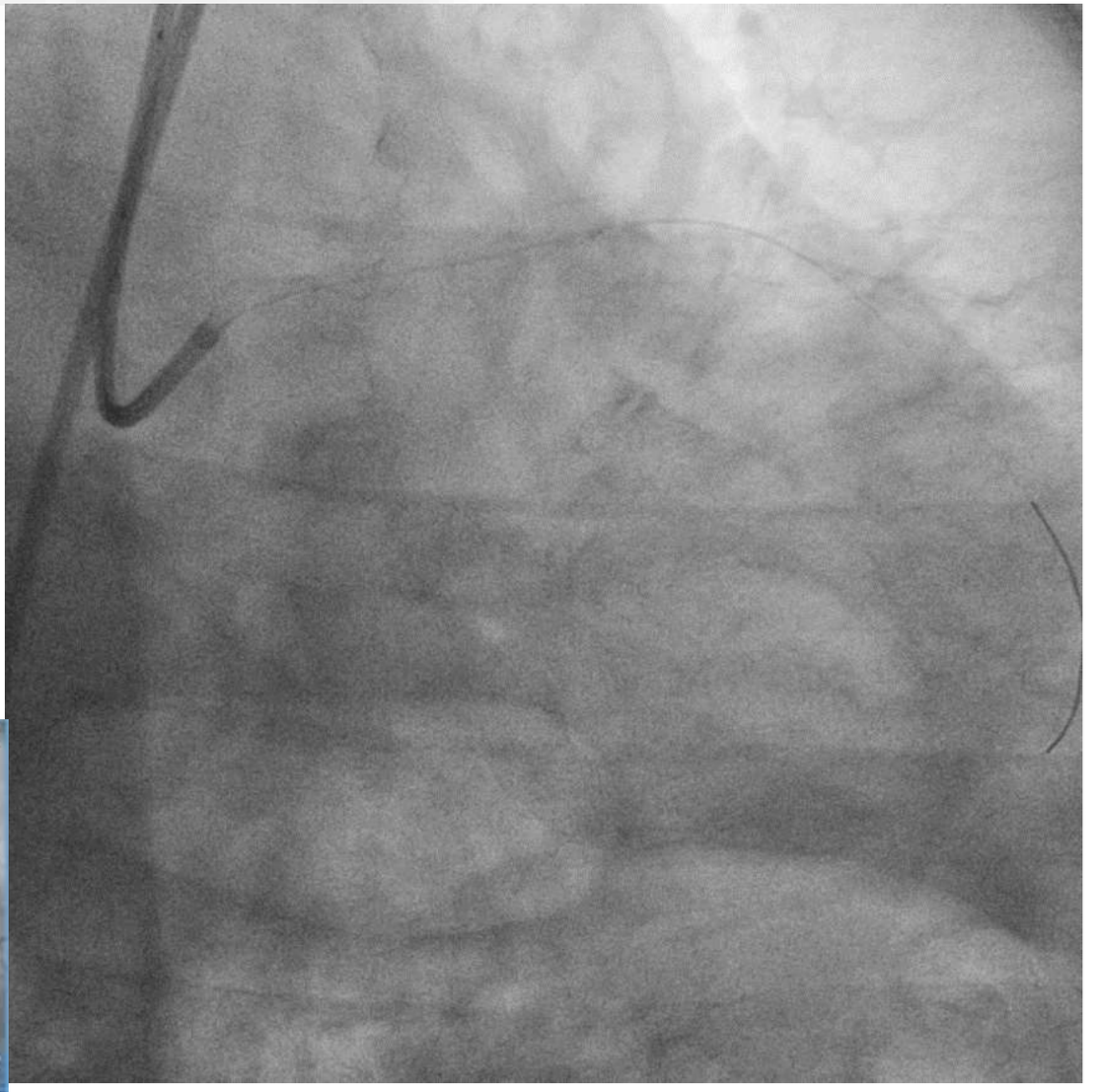


IVUS (fractures in calcification), PTCAs with 3,5 und 4,5mm NC balloons

Case 3. LAD-PCI (Pat. 67 y.o.) in 2 Mon.

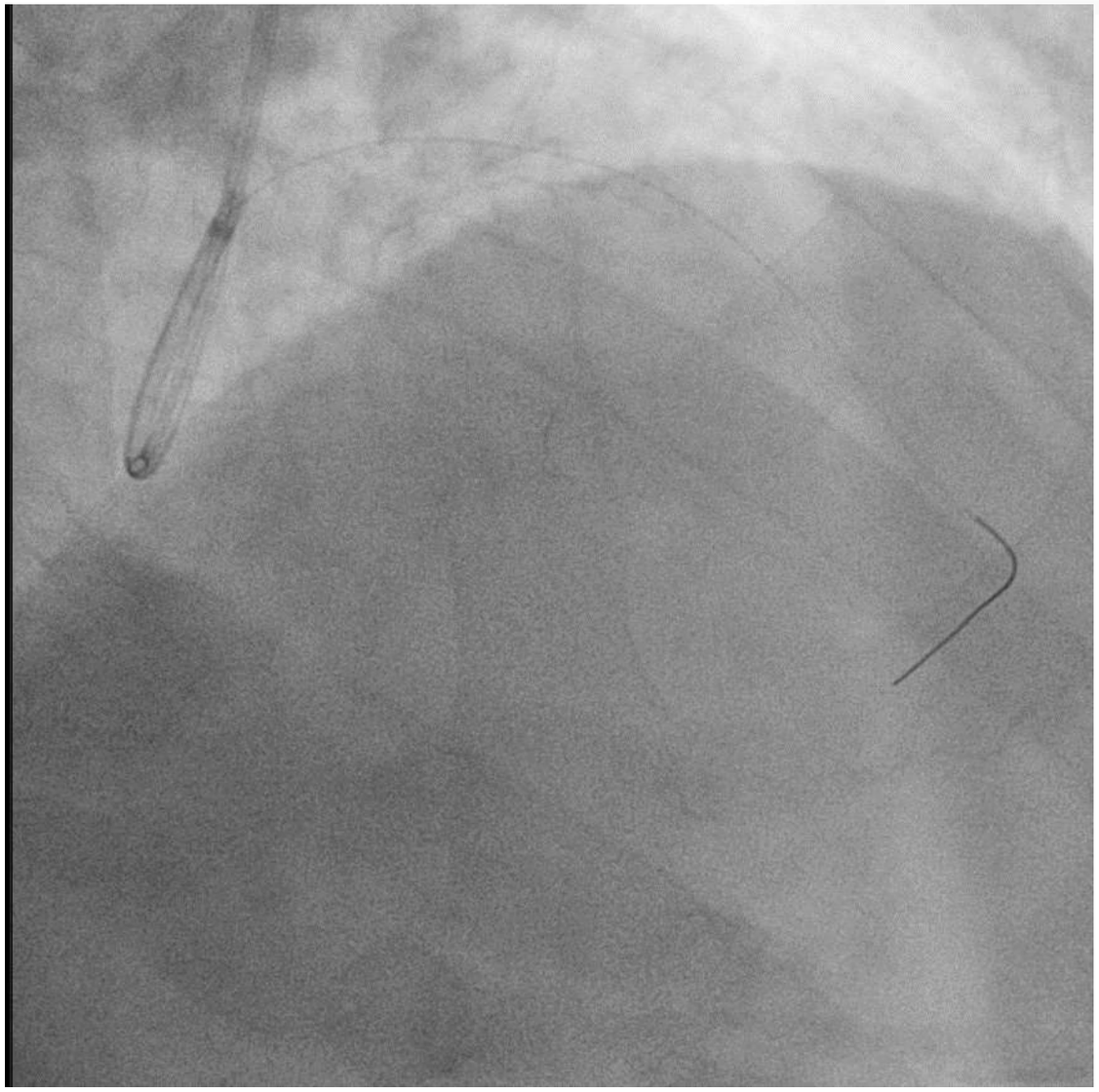


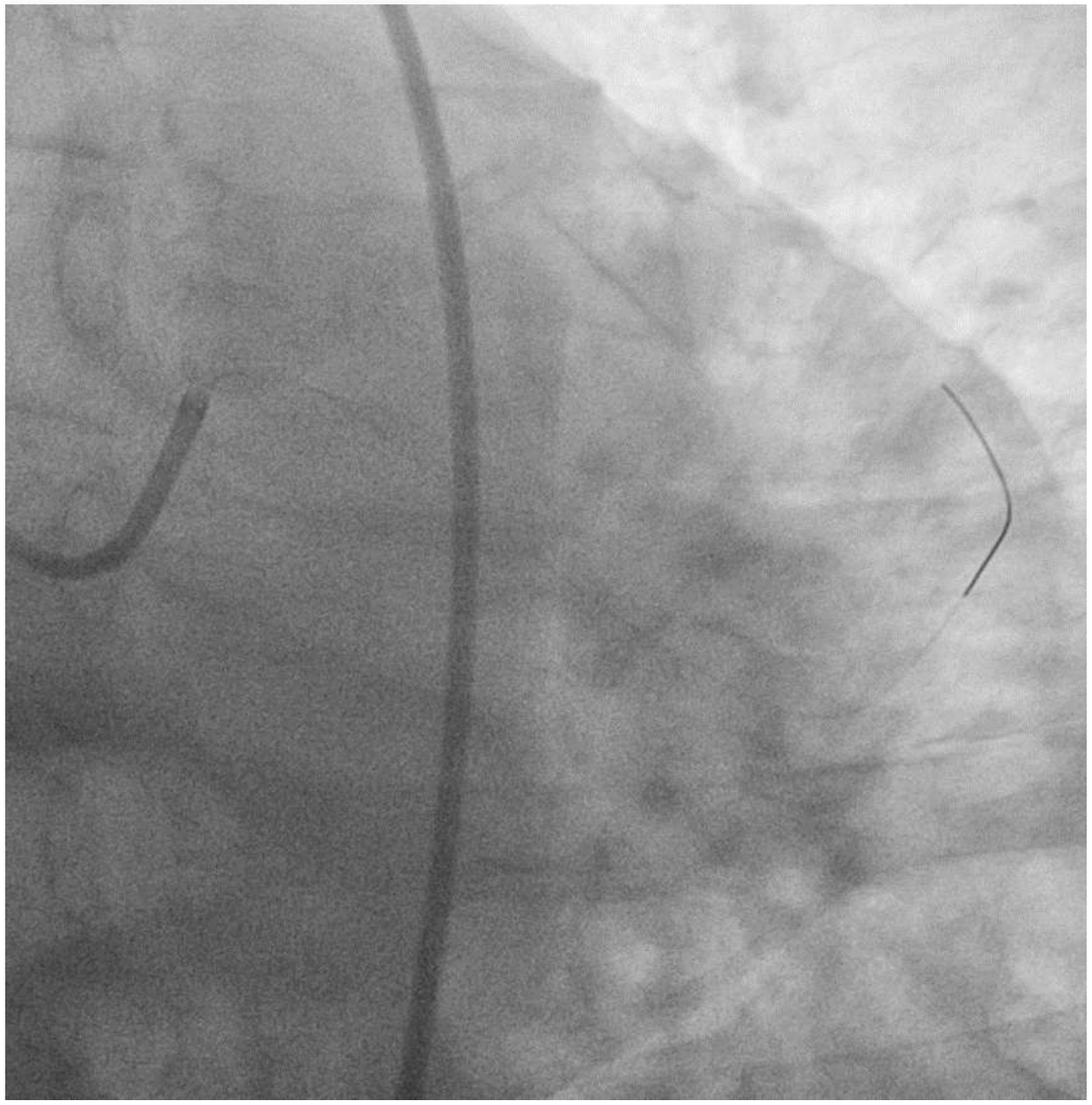




RIVA-PCI: IVUS with good calc modification, no dissektion, DCB-PCI (Sequent Please Neo 4,5x15mm).

Case 3. LAD-PCI (Pat. 67 y.o.) in 2 Mon.





DGK.AKADEMIE

RIVA-PCI: DCB-PCI (Sequent Please Neo 4,5x15mm).
OM-PCI: IVUS, PTCA, DCB-PCI (Sequent Please Neo 3,5x15mm).

Conclusions

- Calcific CAD is common, undertreated and associated with poor outcomes

- Calcification significantly complicates PCI (impaired stent delivery, complications - dissection, perforations) and may cause stent mal-apposition, under expansion, stent fracture, and higher restenosis rates

- Calcium modification makes complex lesion simple

THANK YOU FOR YOUR ATTENTION