Excimer Laser Coronary Atherectomy (ELCA)

The use of Laser Atherectomy for Patients with Complex CAD

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History of ELCA

- ELCA has been performed since the late 1980s.
- ELCA can play a pivotal role in treating more complex lesions and facilitating stent delivery/deployment.

Excimer Laser

LASER

Light

Amplification

by

Stimulated

Emission

of

Radiation

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Physics of ELCA

- Absorption of laser light by tissue may lead to photochemical, photothermal, and photomechanical interactions.
- Predominant effect of ELCA involves a thermomechanical process of rapidly expanding and imploding vapor bubbles.

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The Five S's of Laser Success

- **Selection of patient -** multiple morphology lesions
- **Sizing** - catheter to vessel ratio
- **Settings** - fluence and pulse rate
- **Saline** - Flush 1-2cc/sec (sometimes Contrast)
- **Speed** - advance speed 1mm/sec

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Fluence and Rate

- Fluence = energy = size of vapor bubble
- Rate = pulses/sec. Correlates to expansion and collapse = jack hammer

- 0.9mm Laser is the workhorse for coronaries. 5F or 6F system.

  Vessels 2.0 to 4.0
- 1.4mm Laser for periphery-bigger vapor bubble. 6F or 7F.

  Vessels > 2.8mm

  Diameter of Vapor bubble is 2.5x the size of the catheter.

Laser Algorithm

- Calibrates at 45/25
  60/40
  60/60
  80/80

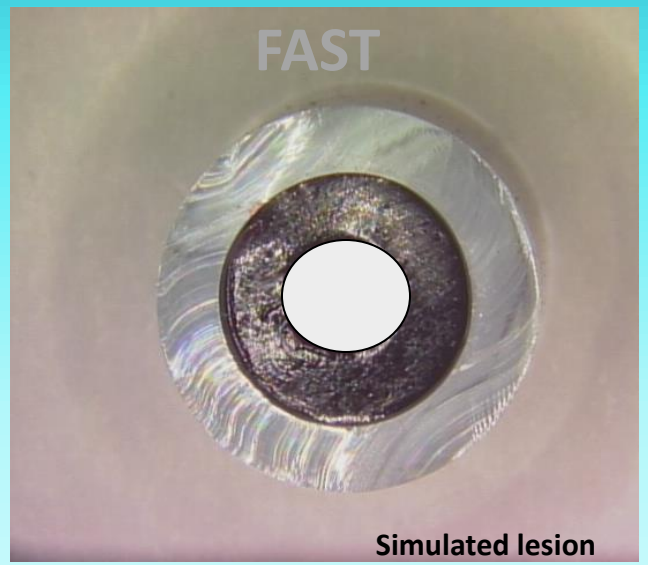
Advance **Slowly** <1mm/sec

Soft Plaque or thrombus Fluence important (larger vapor bubble)

Fibrotic or Calcified Plaque Rate is important (jack hammer)

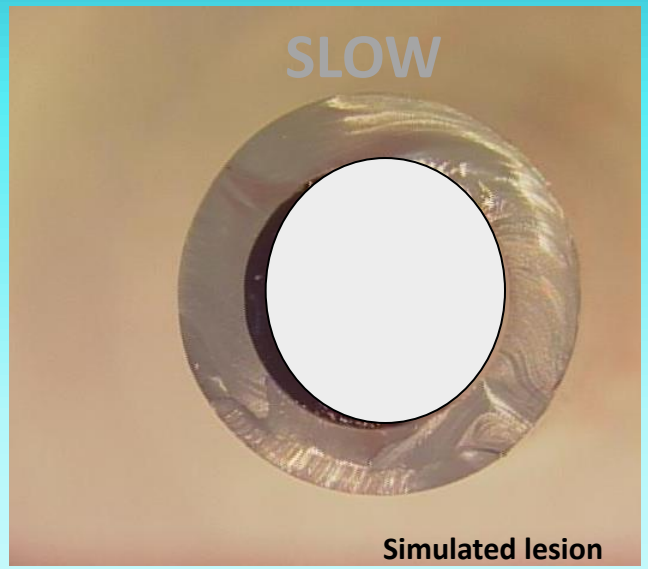
Spectranetics Excimer Laser

2.3 TURBO in 6mm tube



Lumen diameter with
FAST ADVANCEMENT
(greater than 1mm/ second)

2.3 TURBO in 6mm tube



Lumen diameter with
SLOW ADVANCEMENT
(less than 1mm/ second)

Slow Advancement is KEY!

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Indications of ELCA

*In-stent restenosis lesions:

lesions which previously failed PCI/underdilated Stents,

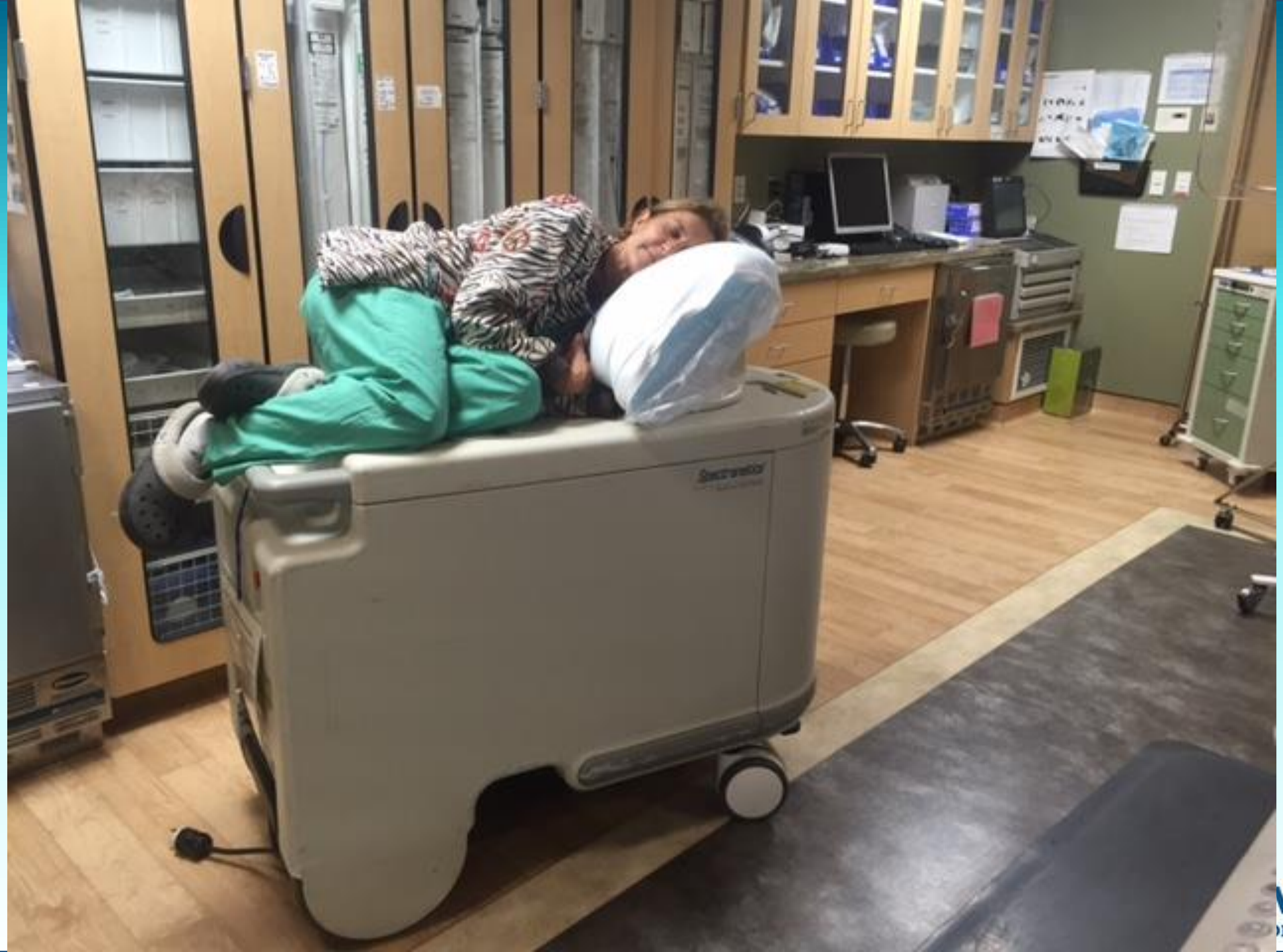
lesion prep

*Total/sub-total occlusions traversable by only by a guidewire

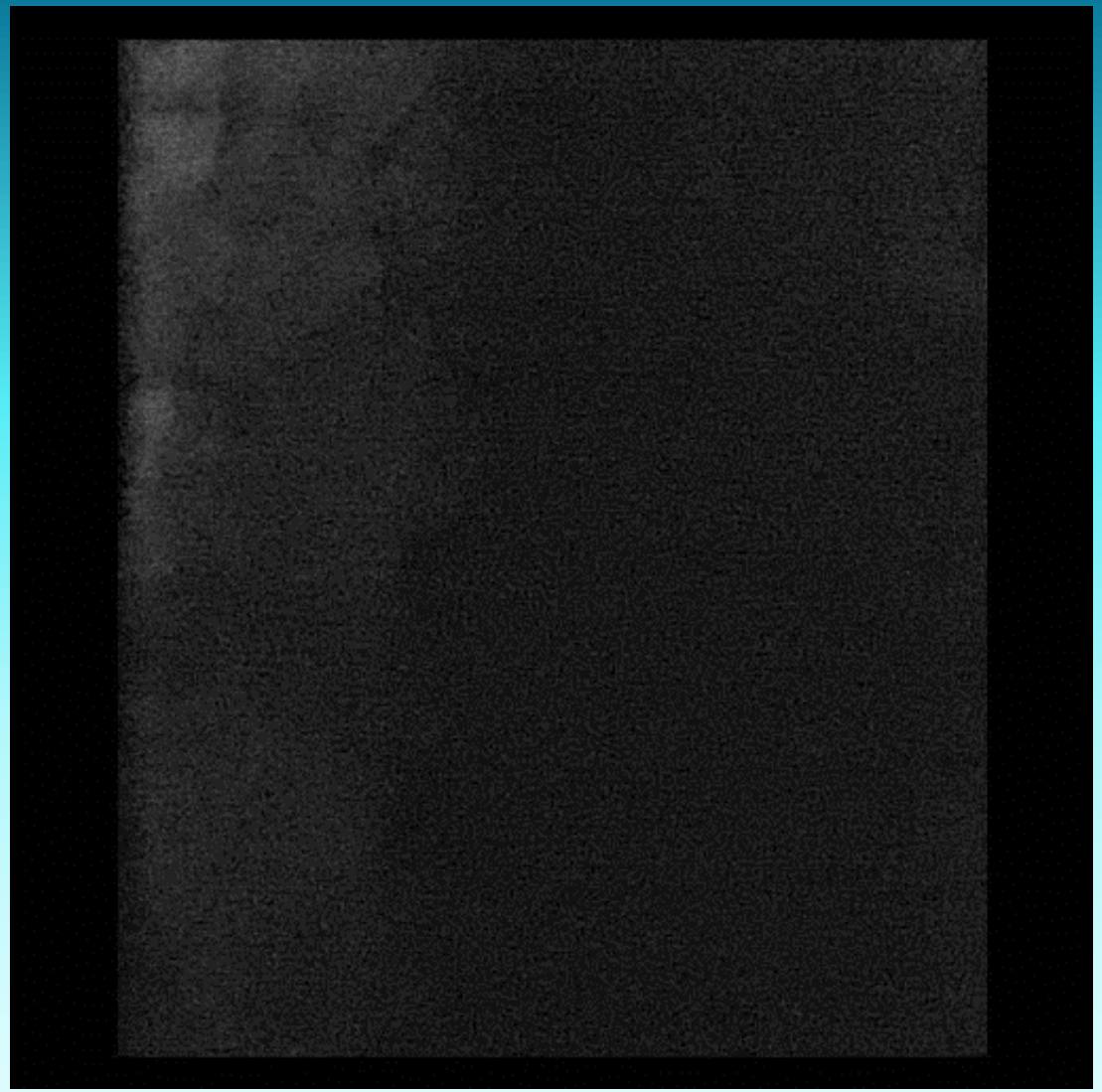
- Fibrotic Lesions
- Ostial lesions
- Long lesions (>20mm)
- Moderate to Severely calcified Lesions; solo or combo

(SVG lesion-Serial ISR)

- 70 year-old male
- Hypertension, dyslipidemia, diabetes mellitus
- Past history of CABG and PCI to SVG-RCA



ISR(multiple) lesion in the SVG



0.9 mm ELCA catheter 3 passes with saline flush

Fluence 80 mJ/mm^2, Frequency 80 Hz/s

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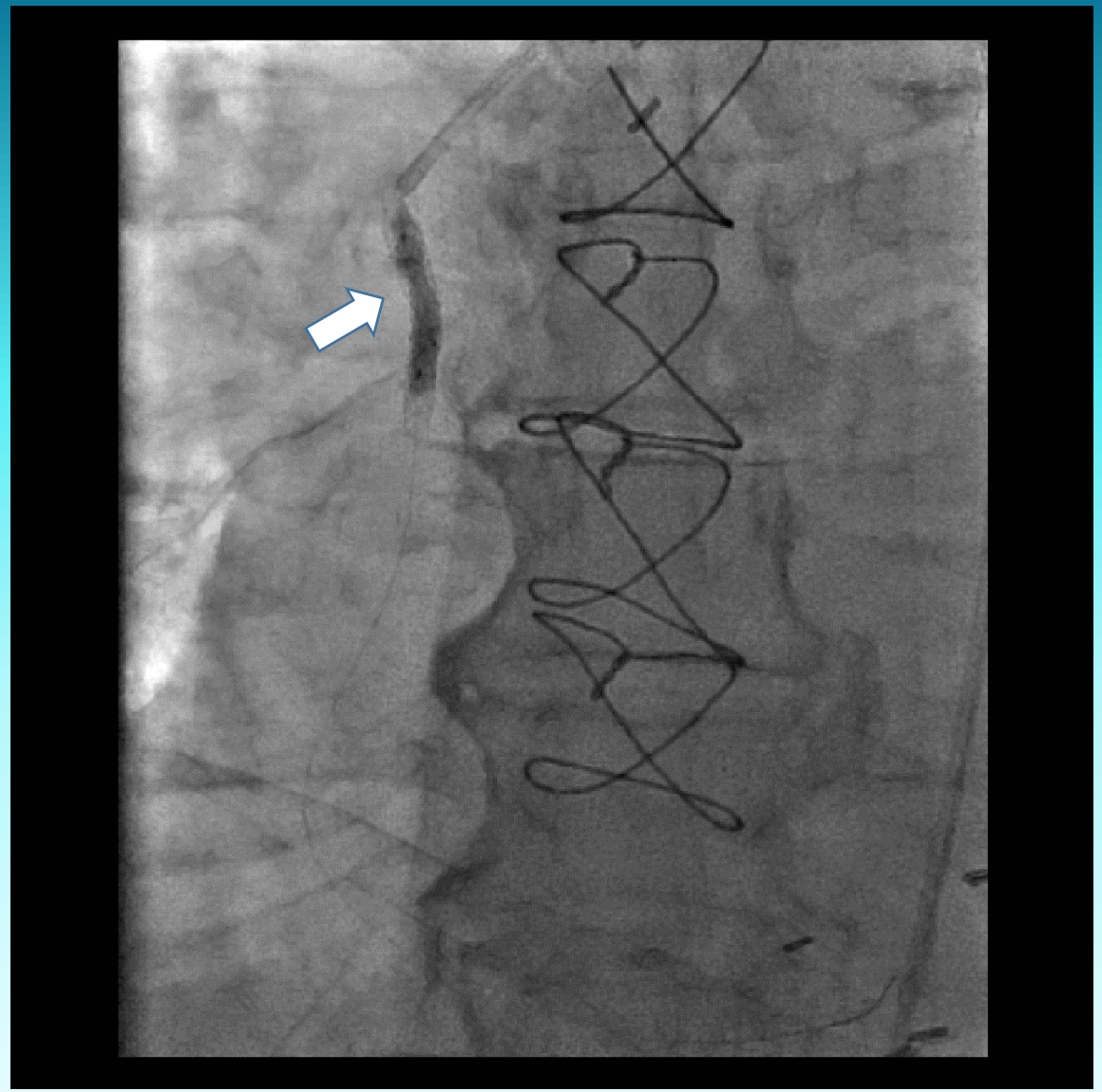

3.0/20mm balloon at 20atm

Final result

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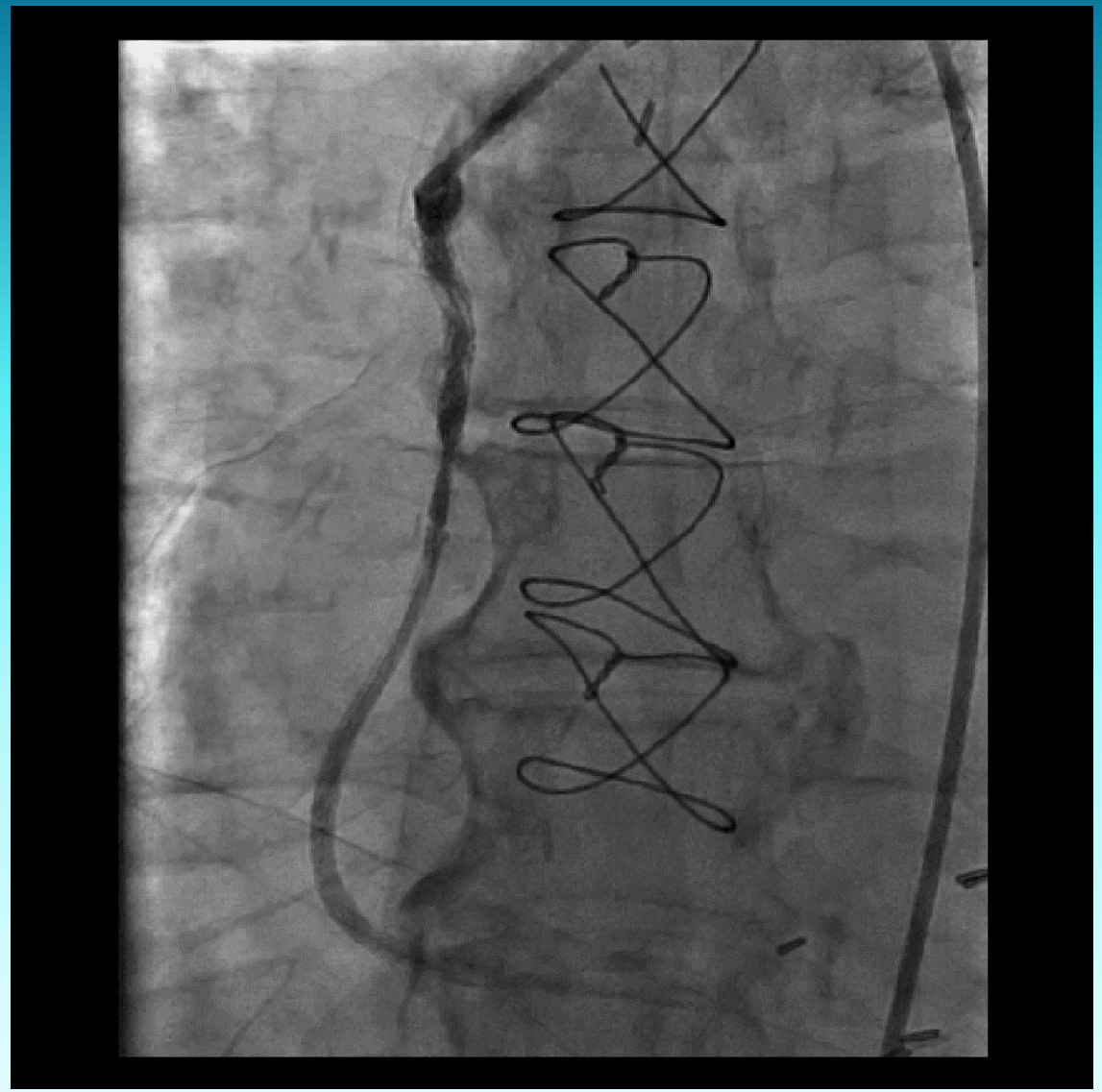

Pre PCI

Post PCI

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PCI for severe calcified and tortuous RCA lesion


EXIT

Case

- 80-year-old female with a history of hypertension, dyslipidemia and diabetes mellitus.
- Pt was admitted to another hospital with an inferior MI.
- Angio showed sub-total occlusion of mid RCA.
- PCI failed because a guide wire could not cross due to a severe calcified angulated lesion.
- Pt was transferred to our hospital for re-PCI.

PCI procedure

Right femoral approach

Temporary pacing

Guiding catheter

Mach 1 7Fr AL1.0

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Guide wire

Runthrough NS

→did not cross.

Whisper

(with a balloon support)

→ did not cross.

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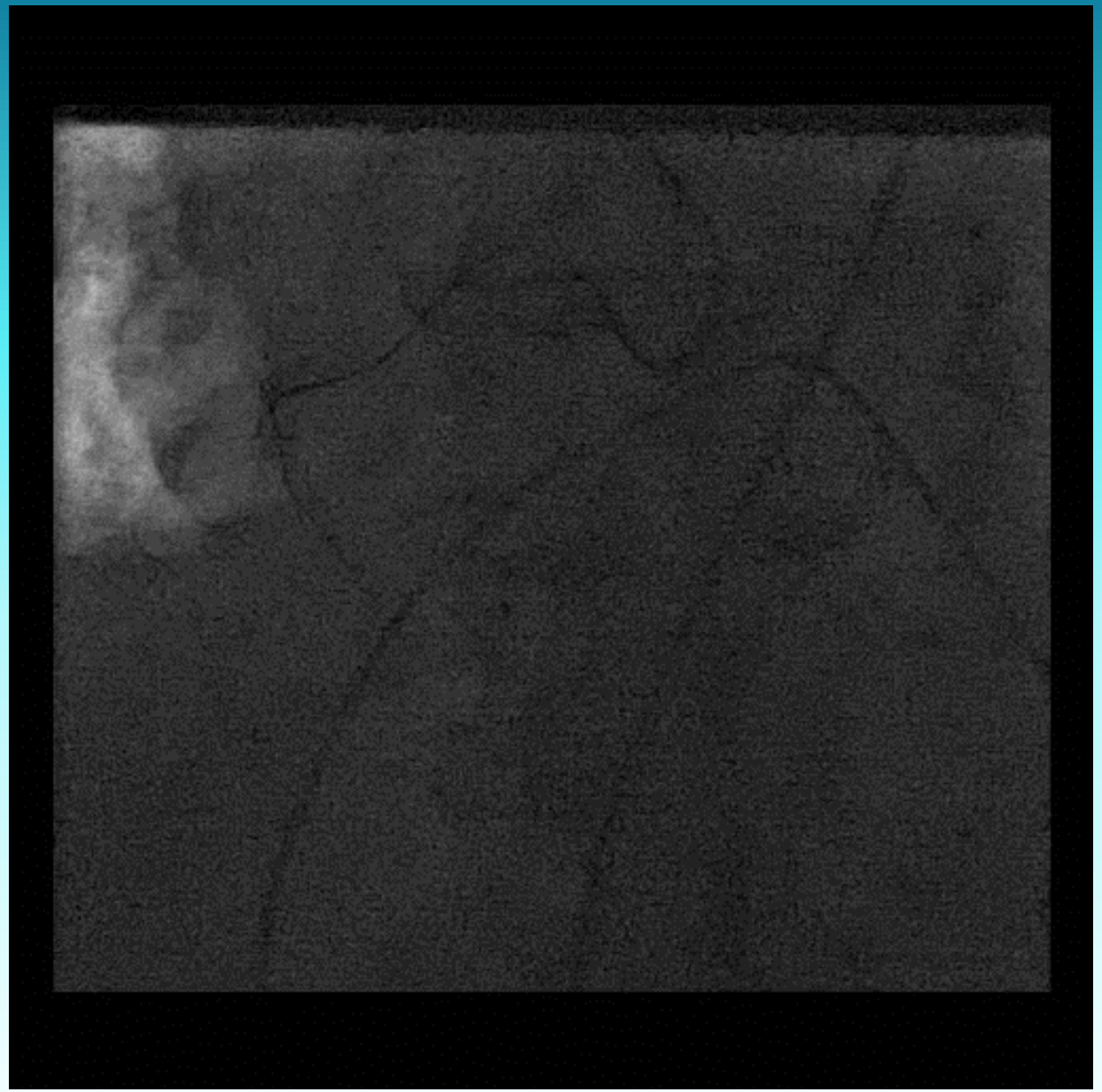

Guide wire

Marvel

(with a SuperCross microcatheter)

→ did cross.

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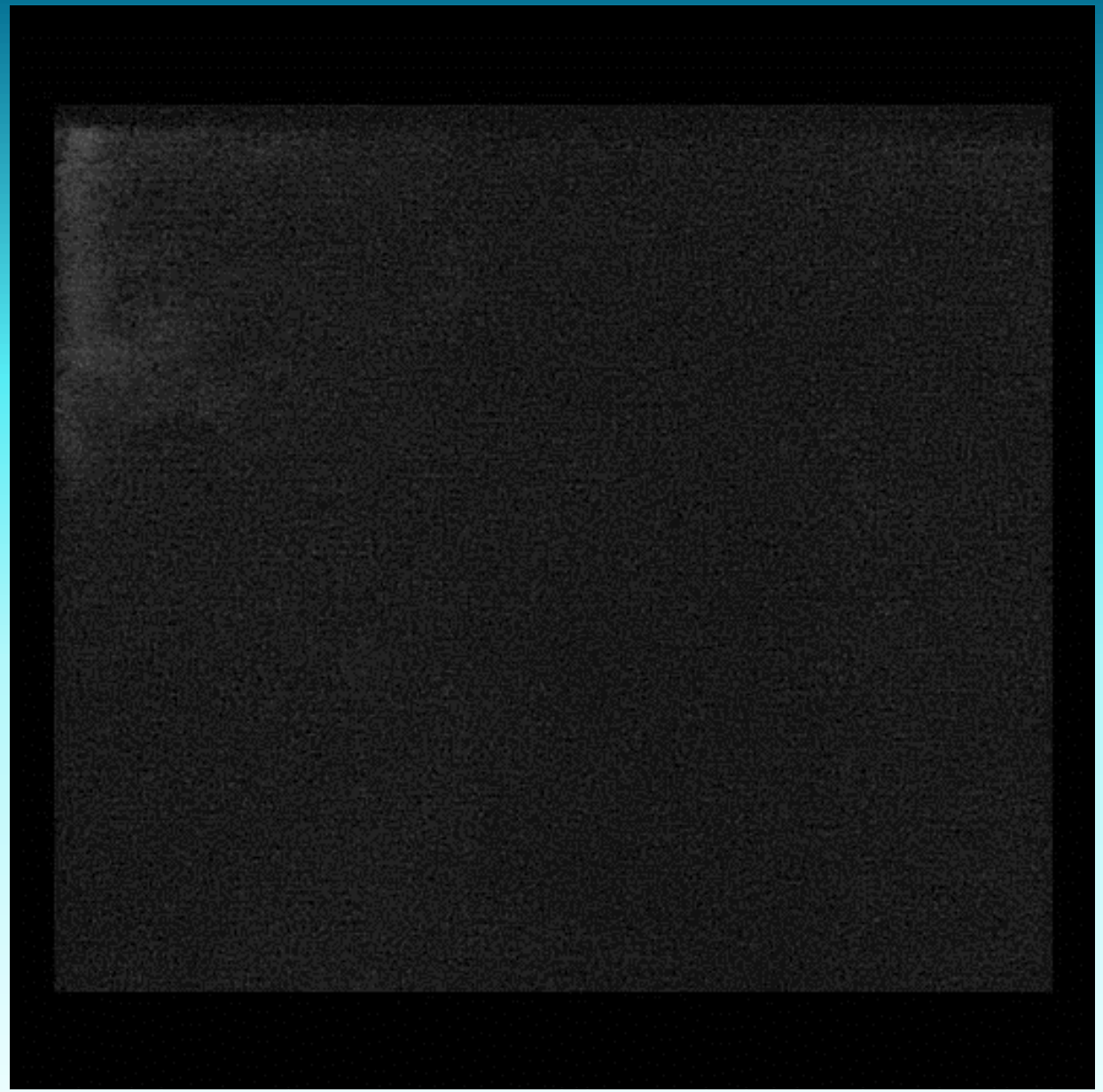
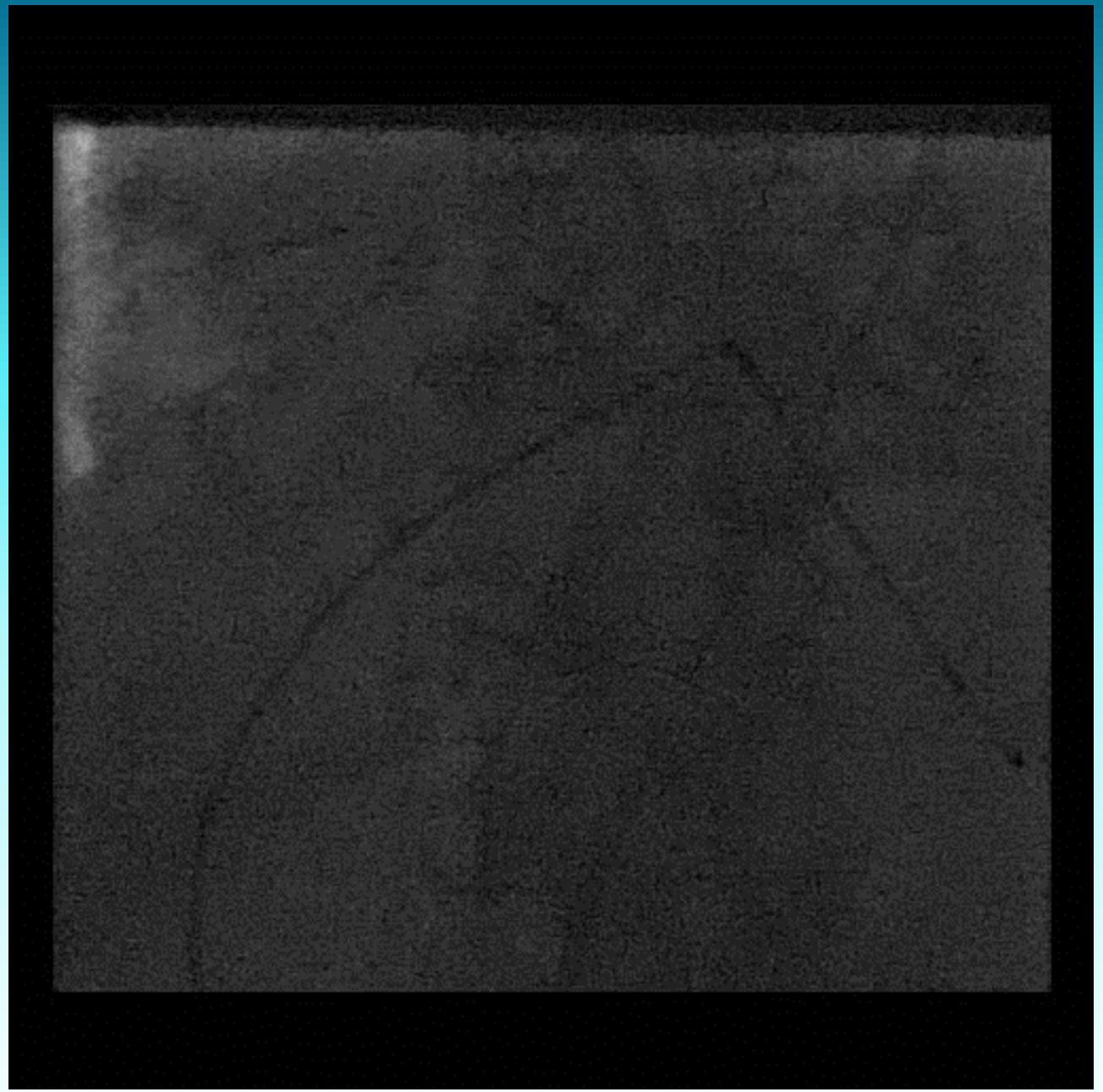


Predilatation

2.0 x 12 mm Marverick was inflated at 12 atm.



TIMI 0 to TIMI 1

However, the 2.0 x 12 mm Marverick balloon failed to completely cross the culprit lesion because of severe calcification.

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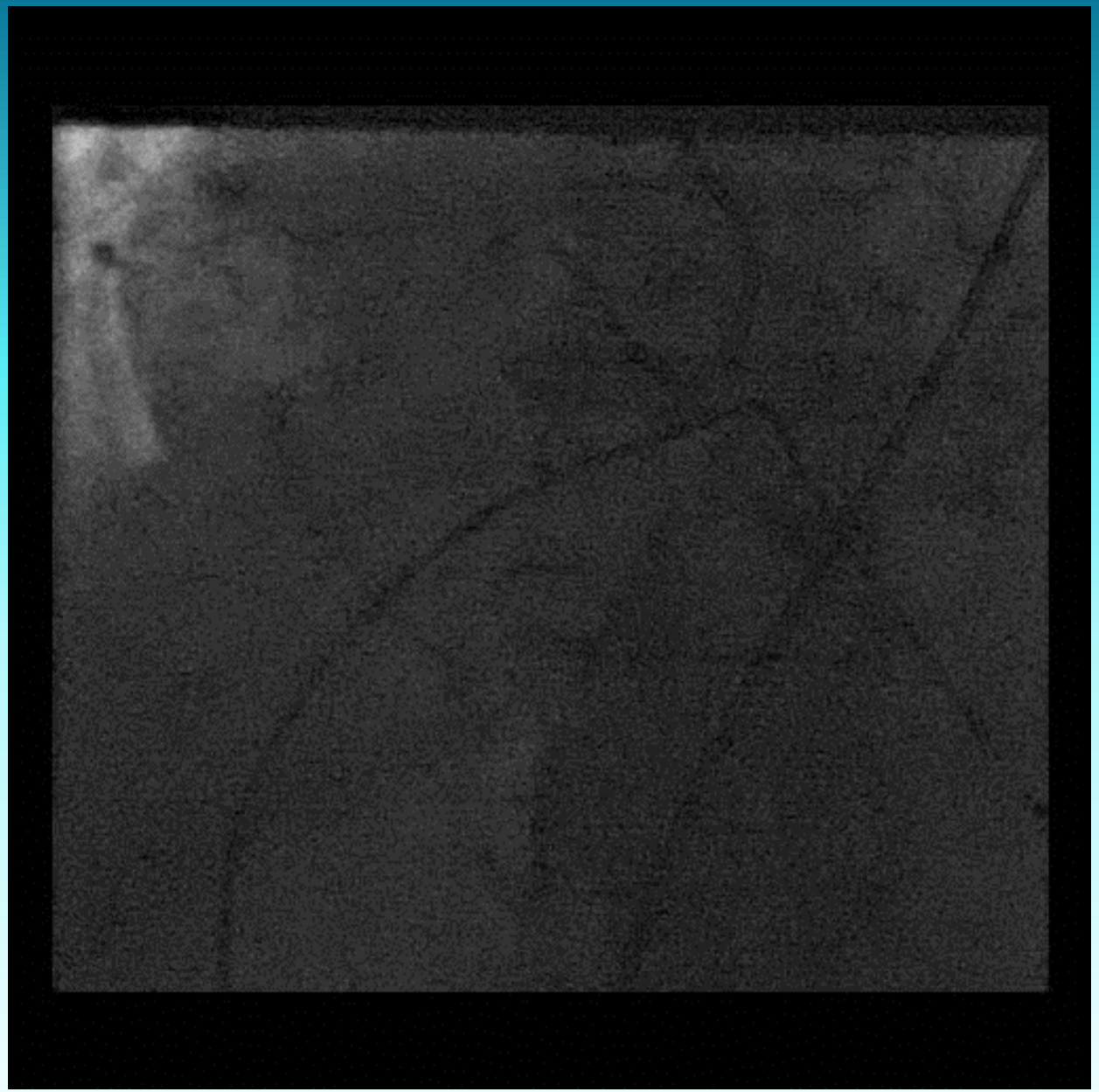

GuideLiner and ELCA were introduced.

0.9 mm ELCA X-80 catheter passed 2 times at a fluence of 60 mJ/mm^2 and a frequency of 80 Hz/s with saline flush.

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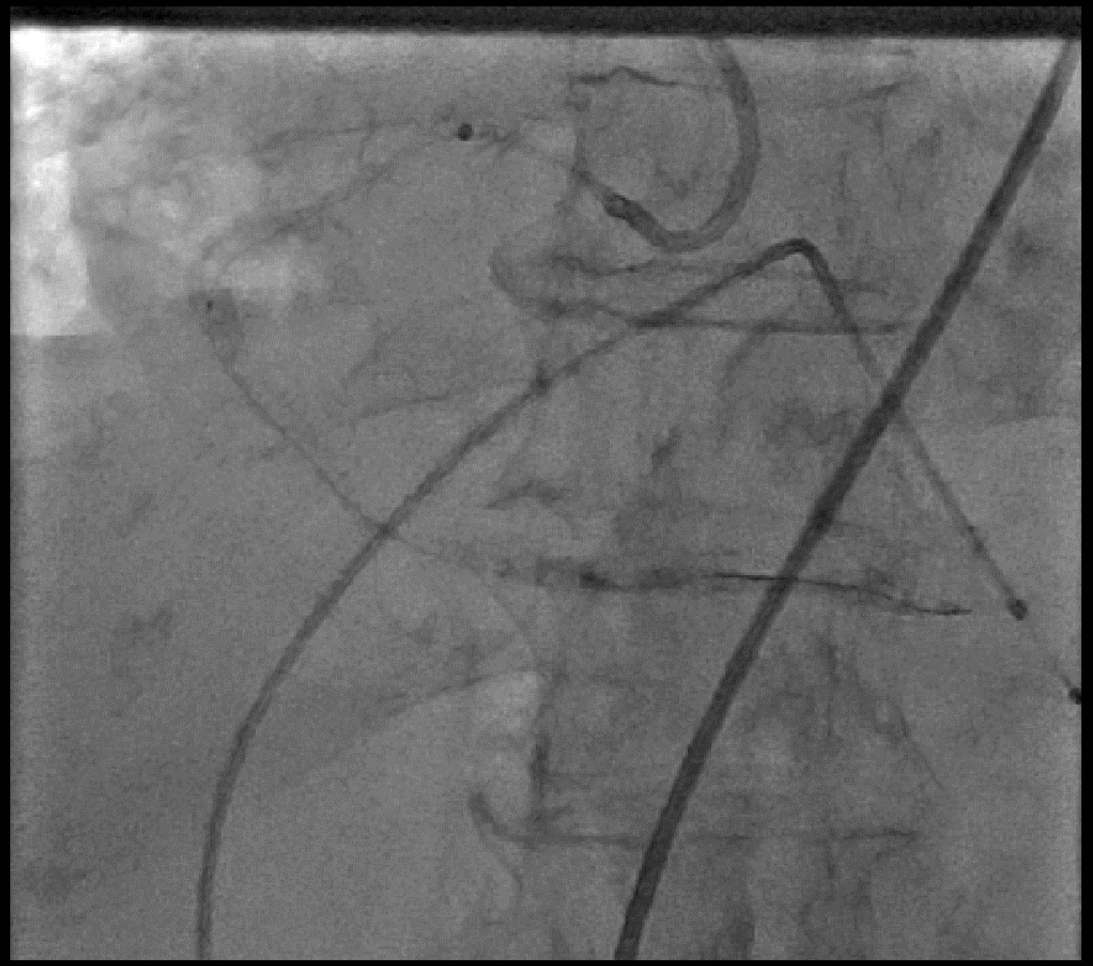

1.2 x 12 mm Threader was inflated at 16 atm.

2.0 x 12 mm NC Quantum Apex was inflated at 18 atm.

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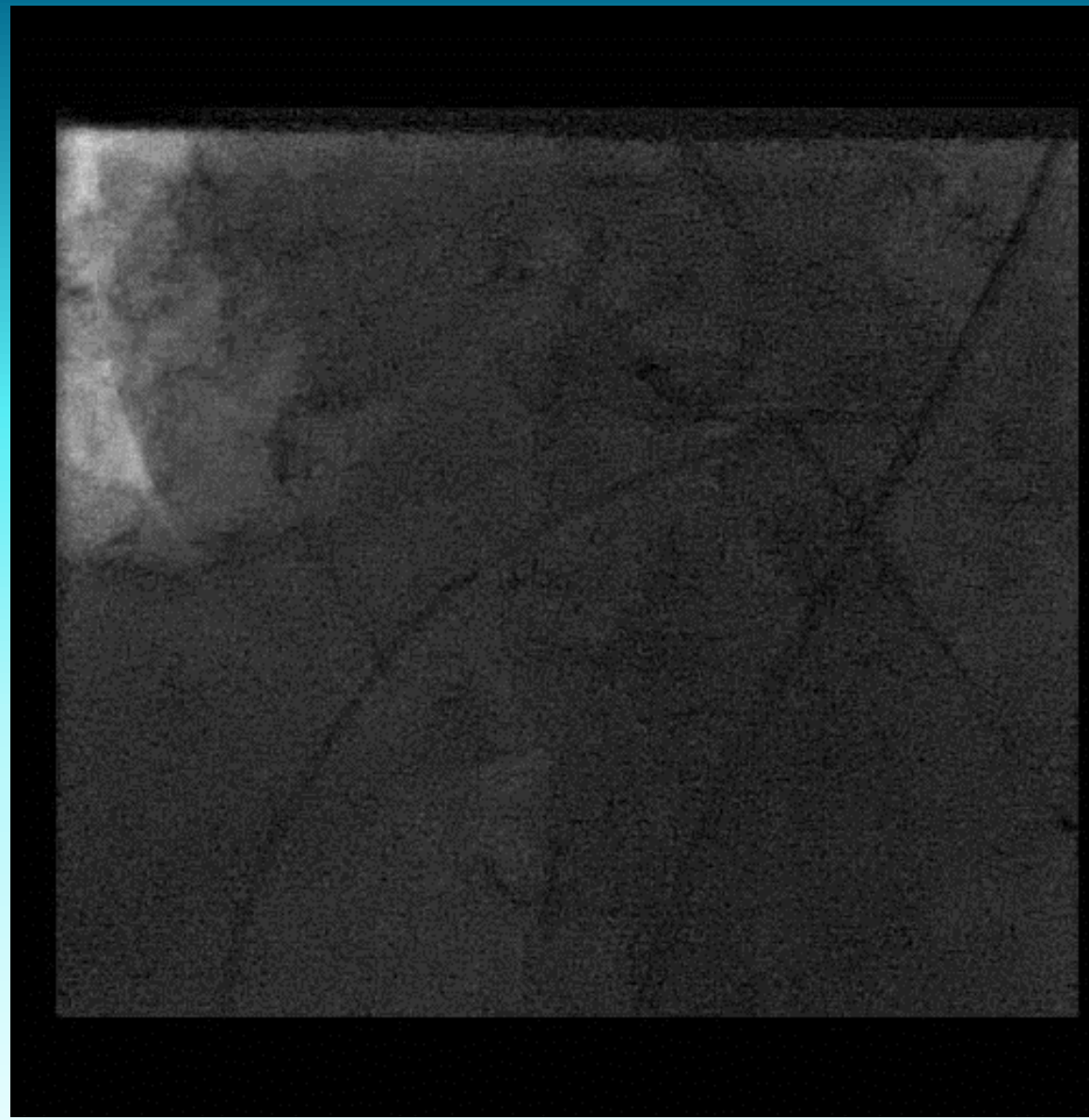

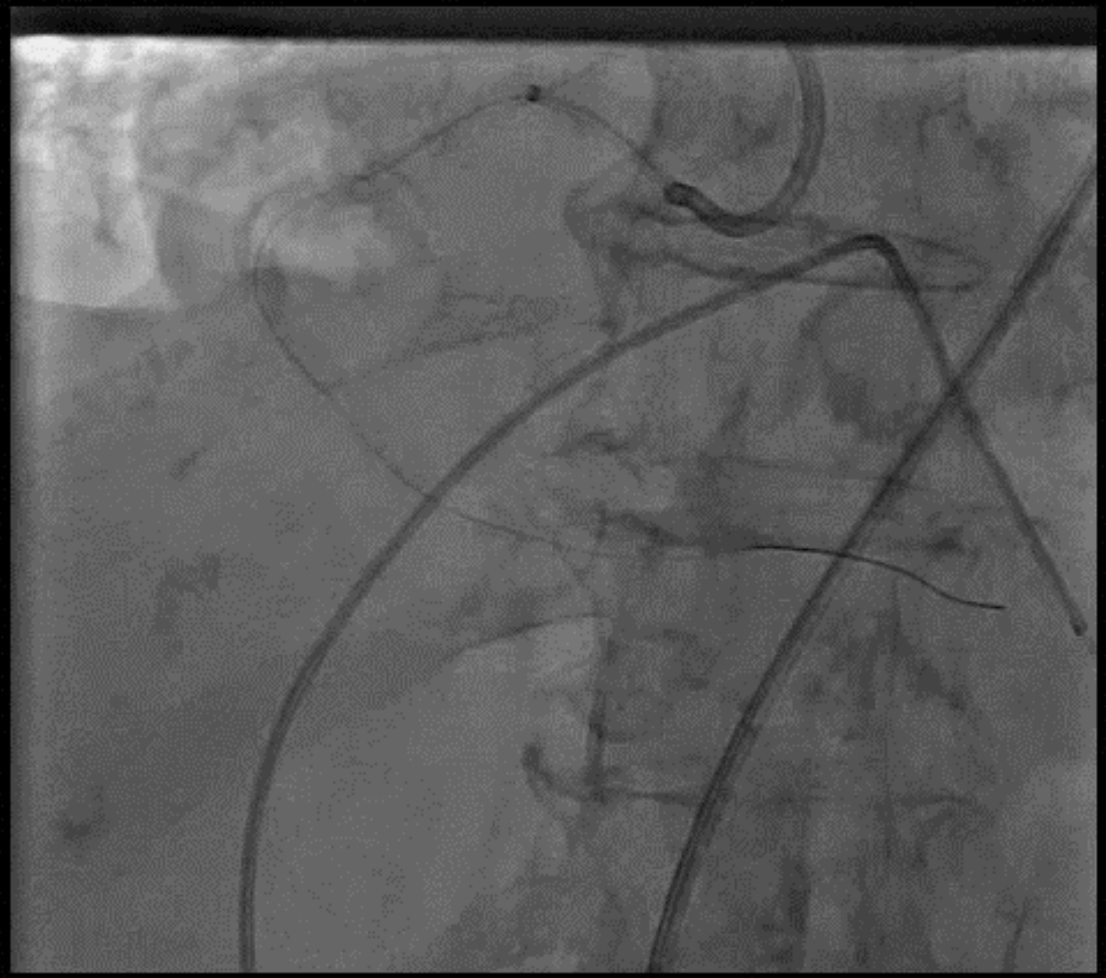

3.0 x 12 mm NC Quantum Apex was inflated at 22 atm.

TIMI 1 to TIMI 3

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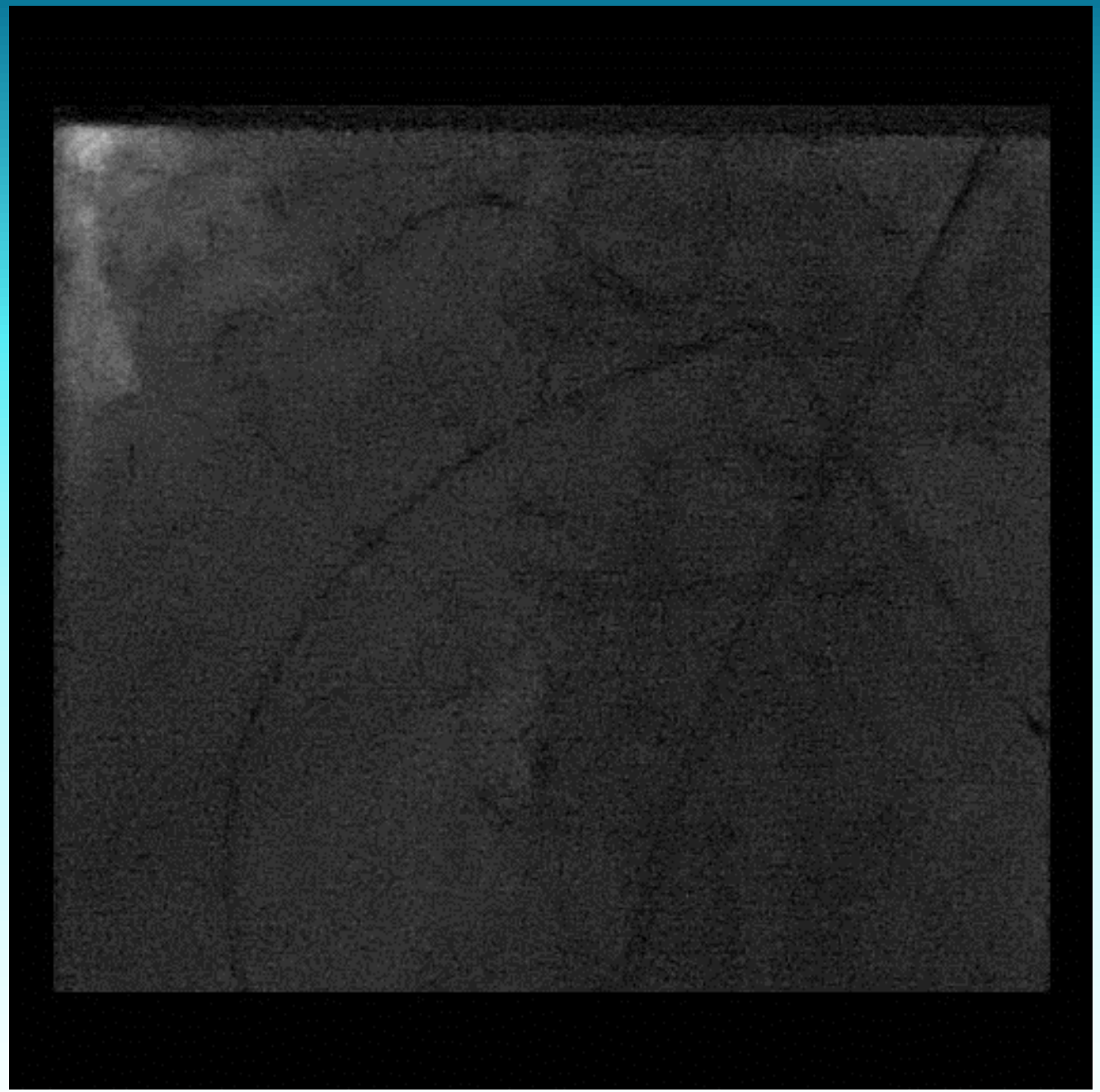

3.5 x 12 mm DES was advanced through GuideLiner and deployed in the mid RCA at 18atm.

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Postdilatation

3.5 x 12 mm NC Quantum Apex was inflated at 22 atm.

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Final Result

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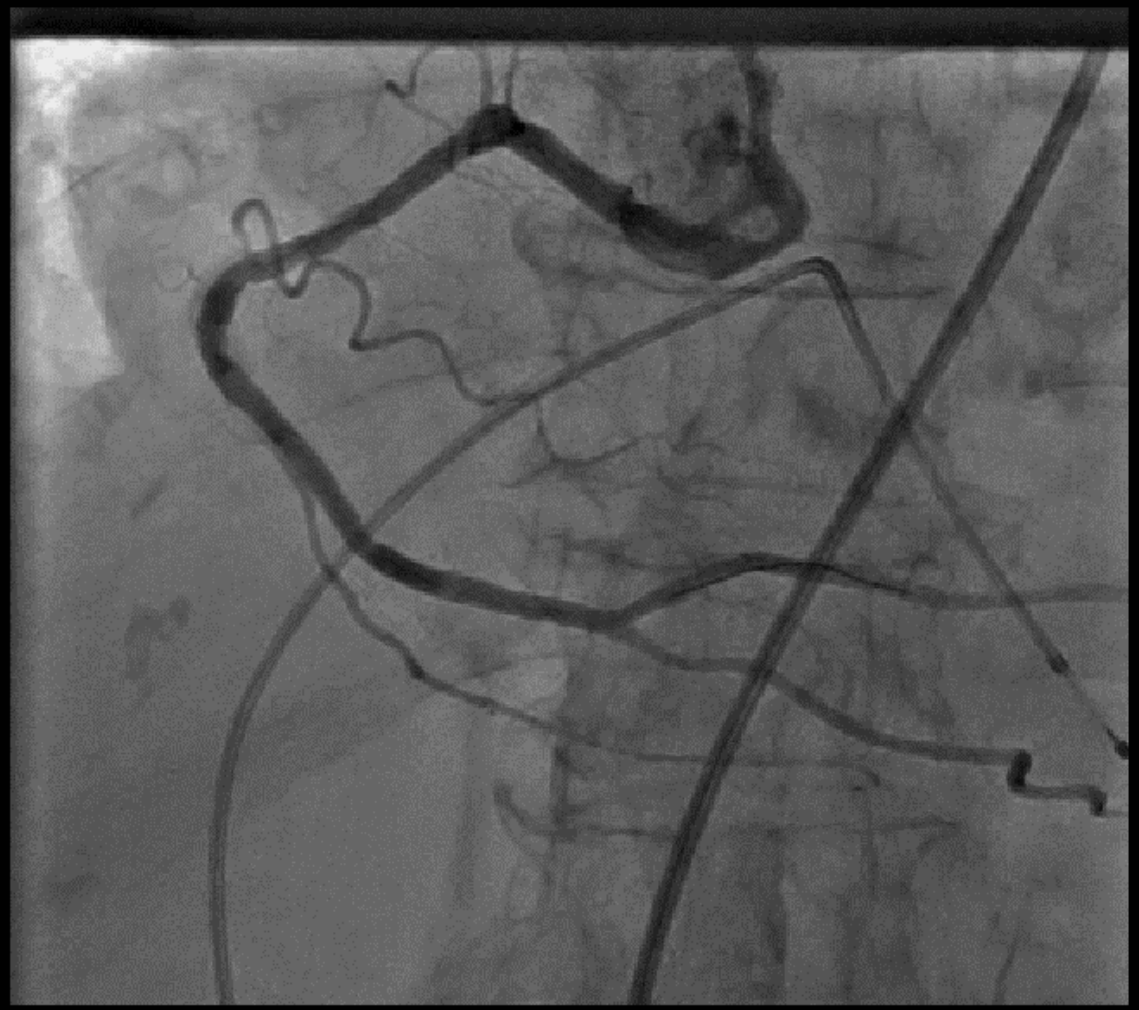

Pre PCI

Final result

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Entrapped Guide Wire

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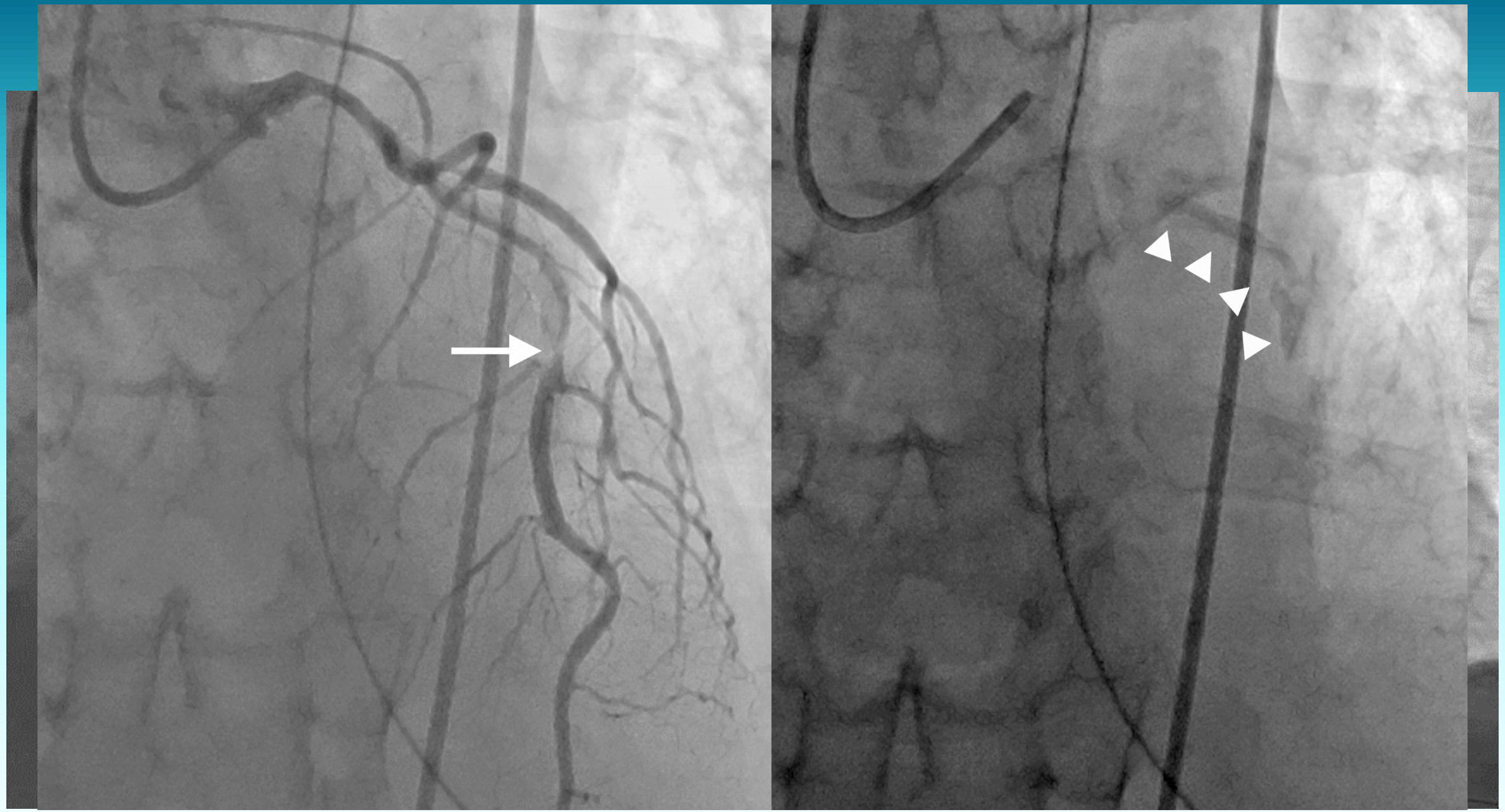
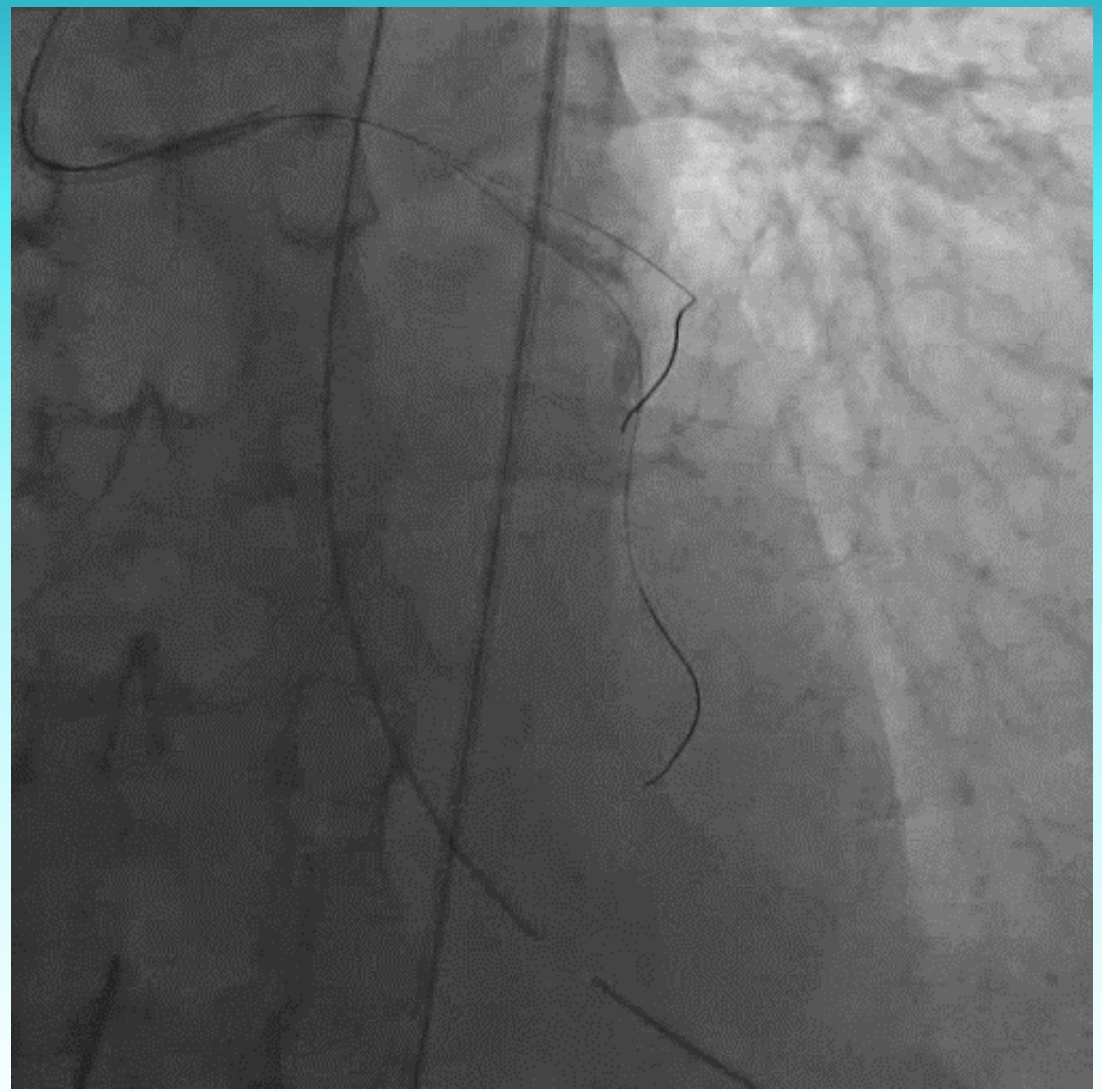
Case

- 72-year-old male, hypertension, hyperlipidemia, and transitional cell carcinoma of the left kidney.
- He was admitted for open nephrouretectomy. Postoperatively, due to postoperative ileus and aspiration pneumonia, he was intubated.
- On the evening of postoperative day 8, he became hypotensive requiring multiple vasopressors and inotropes. The following morning, ECG showed new ST-segment elevation in the precordial leads, consistent with anteroseptal STEMI. He was taken for emergent cardiac catheterization.



99% lesion with severe calcification in the mid LAD

PCI



Femoral approach

6-Fr EBU 3.5

Guide wire LAD Luge

D1 BMW

Thrombectomy

Pronto LP Extraction Catheter

No visible clot was aspirated.

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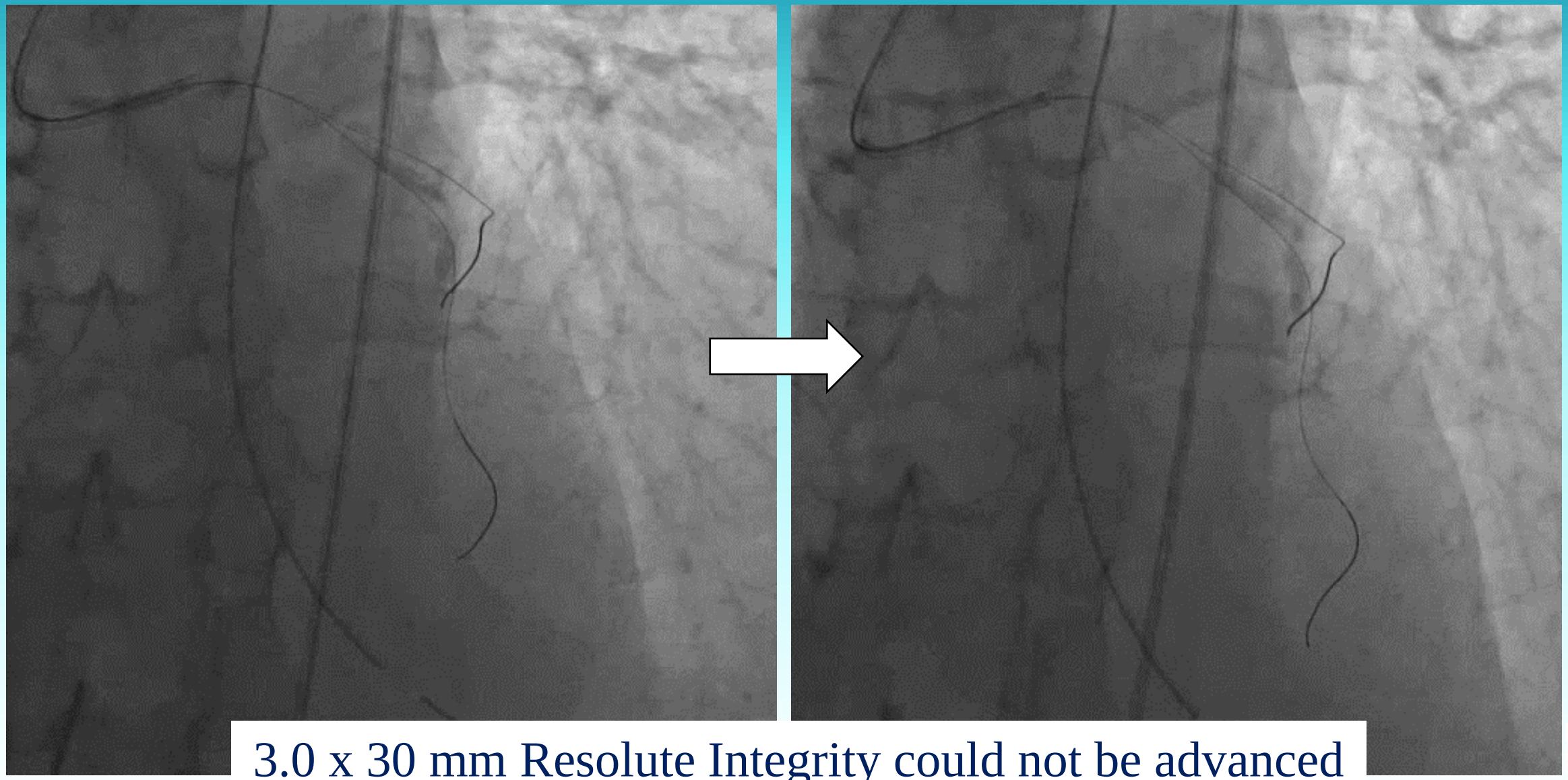
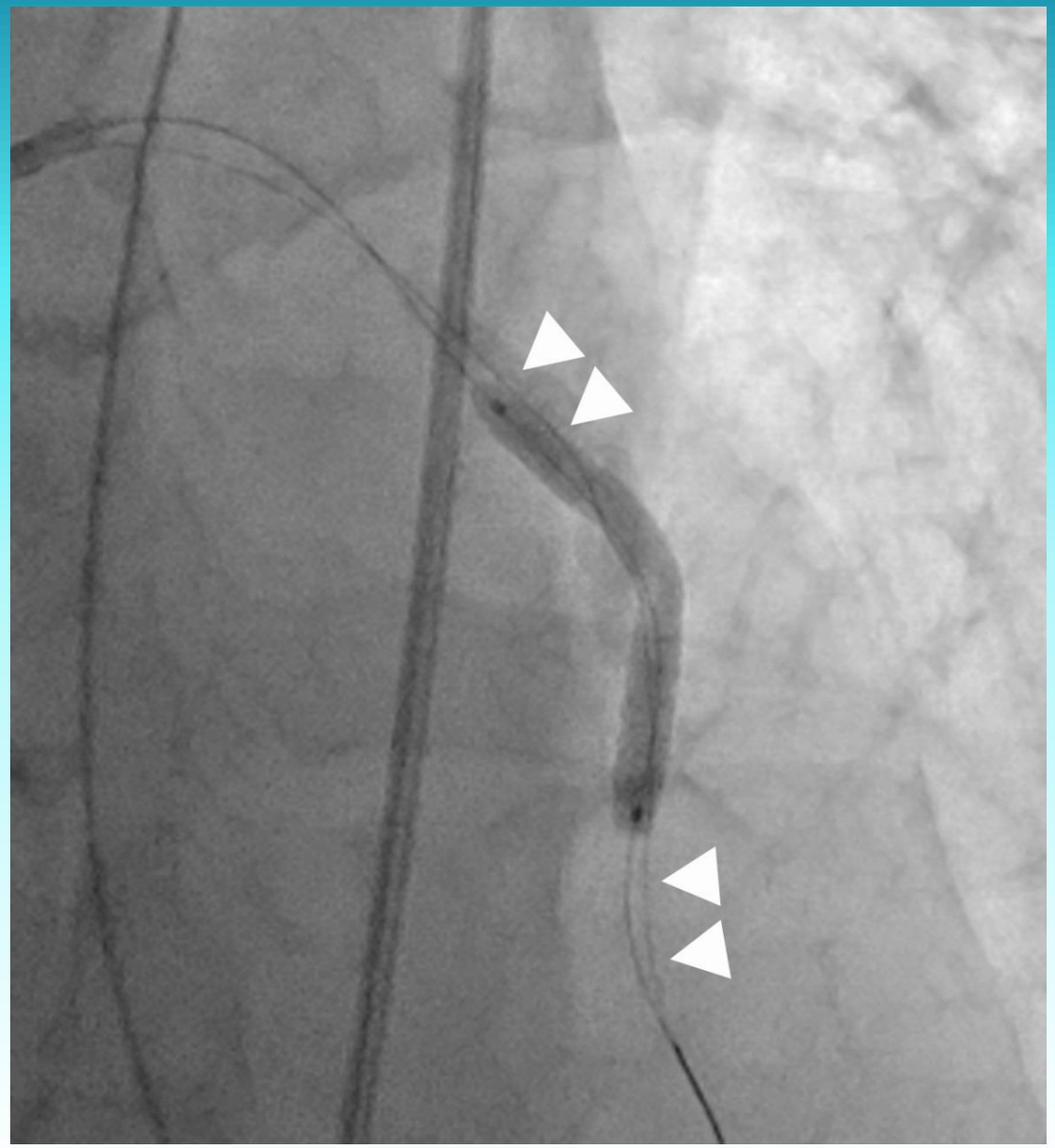
Predilatations

LAD TREK 2.5 x 12mm, TREK 3.0 x 12 mm; D1 TREK 2.5 x 12mm



3.0 x 30 mm Resolute Integrity could not be advanced

Stenting and Entrapment of GW



BMW inserted into LAD alongside the original Luge.

3.0 x 30 mm Resolute Integrity was advanced over the Luge and deployed at 16 atm.

The BMW was entrapped.

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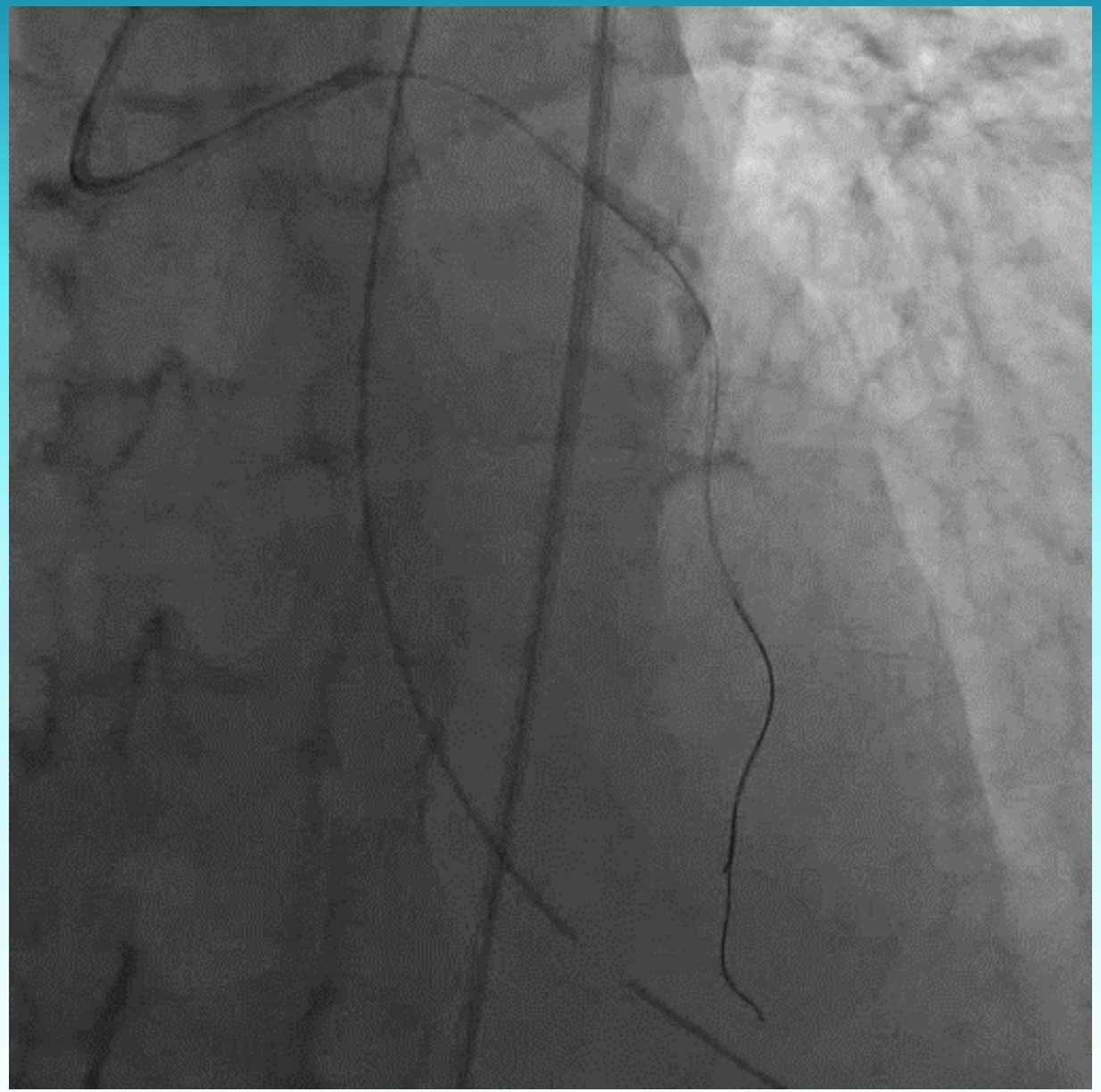
After Stenting



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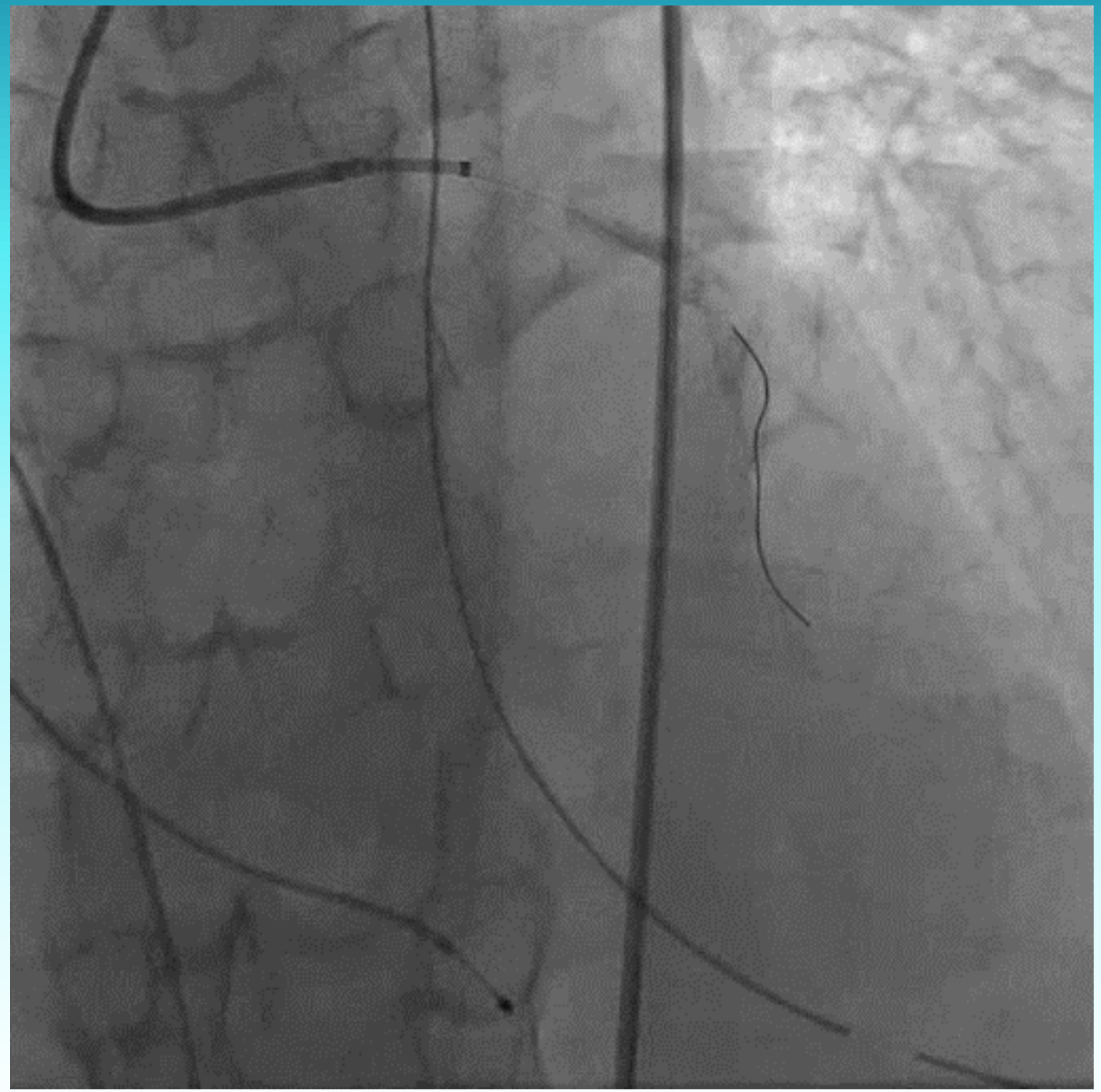
Failure to Retrieve the Entrapped BMW

1. 1.5 x 8 mm Mini TREK over the entrapped BMW could not be advanced along side the stent.
2. Deep intubation using the 6-Fr EBU guide catheter and insertion of 6-Fr Guideliner.
3. Neither 1.25 x 12 mm Sprinter Legend nor 1.8Fr/150cm Finecross MG microcatheter advanced along side the stent.
4. 2.5 x 15 mm Maverick 2 was inserted on the BMW one third of the way down outside of the stent and inflated.
5. With these tools in place to increase leverage and support, the BMW would not budge.
6. The Luge in the LAD was exchanged for Grand Slam.

ELCA

1. 0.9 mm ELCA X-80 catheter (Spectranetics) passed 7 times inside the deployed stent at a fluence of 80 mJ/mm^2 and a frequency of 80 Hz/s with saline flush.

After ELCA



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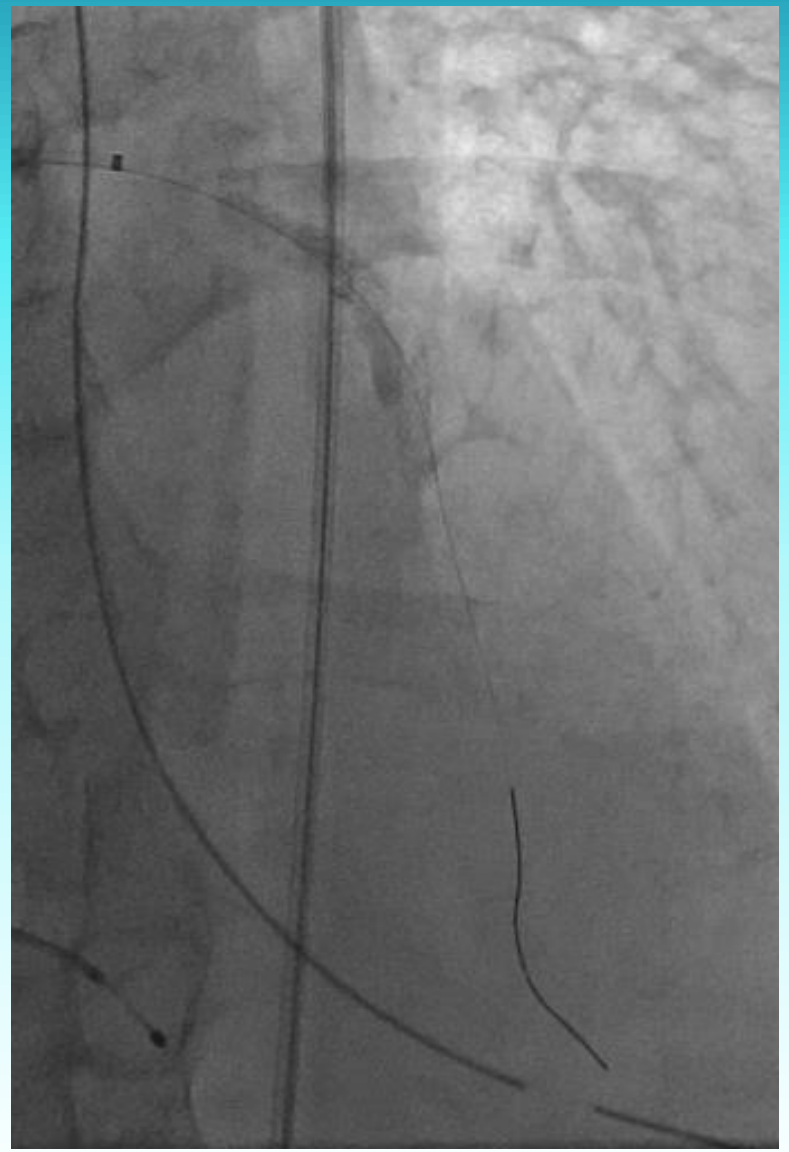
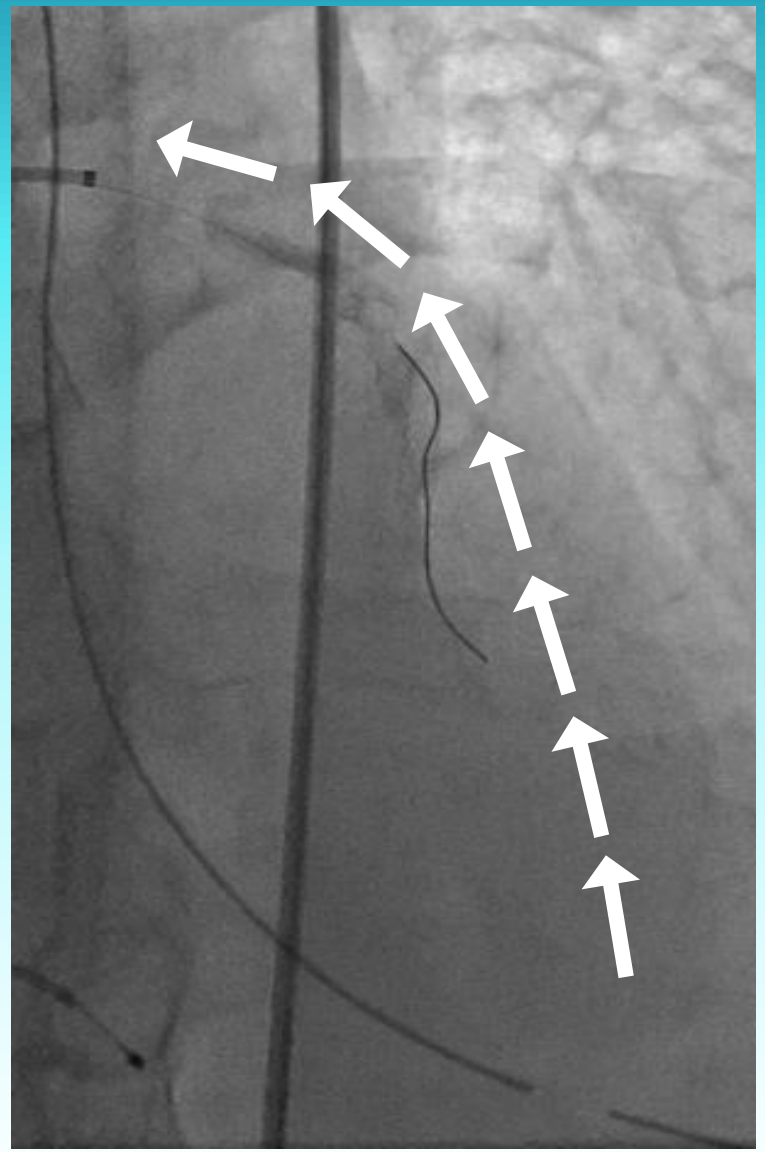
Successful Retrieval of the Entrapped BMW





Summary

- ELCA remains a safe and effective atherectomy device.
- ELCA can vaporize plaque in complex coronary anatomy containing fibrous tissue, calcium, soft atheroma, and thrombus.
- As increasingly challenging and complex cases are encountered during PCI, ELCA is a useful tool.

Thank you for your attention

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Case Courtesy of

Drs. Azeem Latib and Antonio Colombo

San Raffaele Scientific Institute and
EMO-GVM Centro Cuore Columbus

Milan, Italy

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CASE SUMMARY

Patient Demographics

Age: 73 yrs
Gender: female

Risk Factors

Diabetes type II
Hypertension

Clinical Presentation

Presented in April 2010 with:
Resuscitated cardiac arrest
Cardiogenic shock and Complete HB
Taken to Cath Lab with external percutaneous pacing

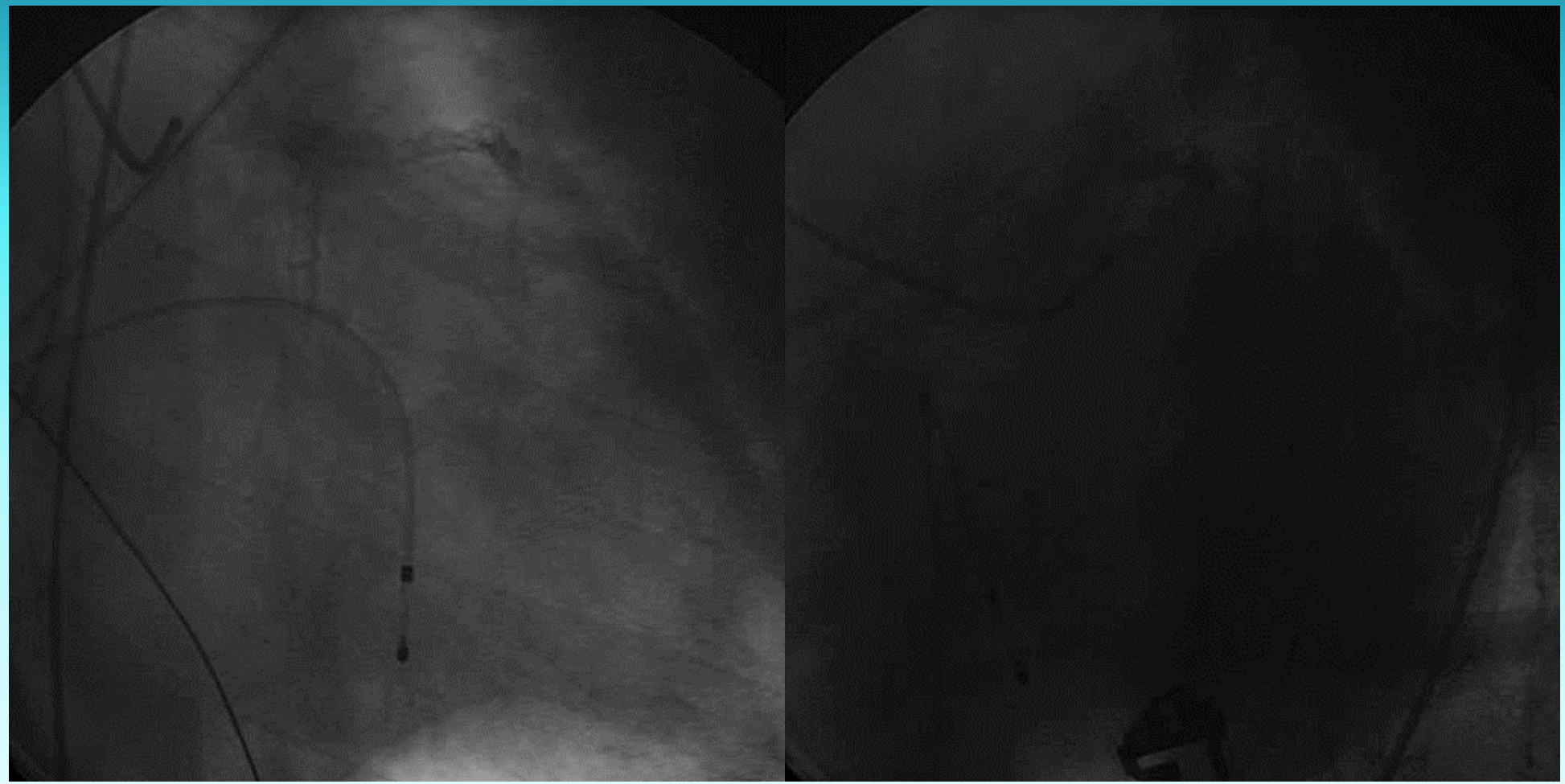
Past Medical History (at another hospital)

2005: PCI to Cx ostium and LAD-prox (Cypher)
Dec 2009: ACS – V-stenting of LM-CX-LAD with Xience (No IVUS performed)

Angiographic Findings

Triple-vessel CAD (with CTO in RCA)
Late stent thrombosis of ostial Cx stent

Stent thrombosis and Cardiogenic Shock



Late ST 3 months after Xience

What would be your treatment strategy in this patient?

A. Urgent CABG

B. PCI – Only POBA

C. PCI with stent (either DES or BMS)

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The Strategy was:

Primary PCI to revascularize LCX with only POBA and possibly BMS if suboptimal result

- Temporary pacemaker
- IABP insertion
- Bivalirudin + Intracoronary Reopro
- 6Fr XB guide catheter

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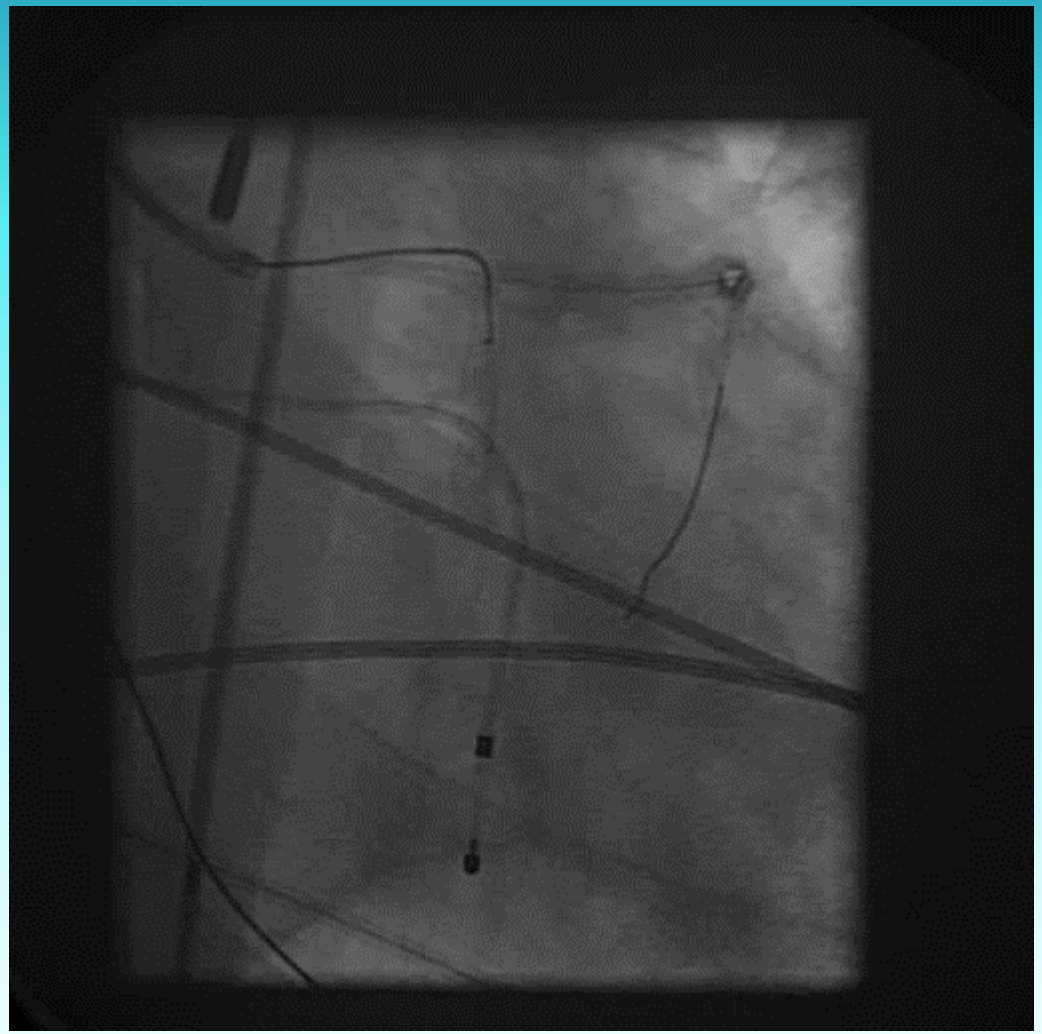
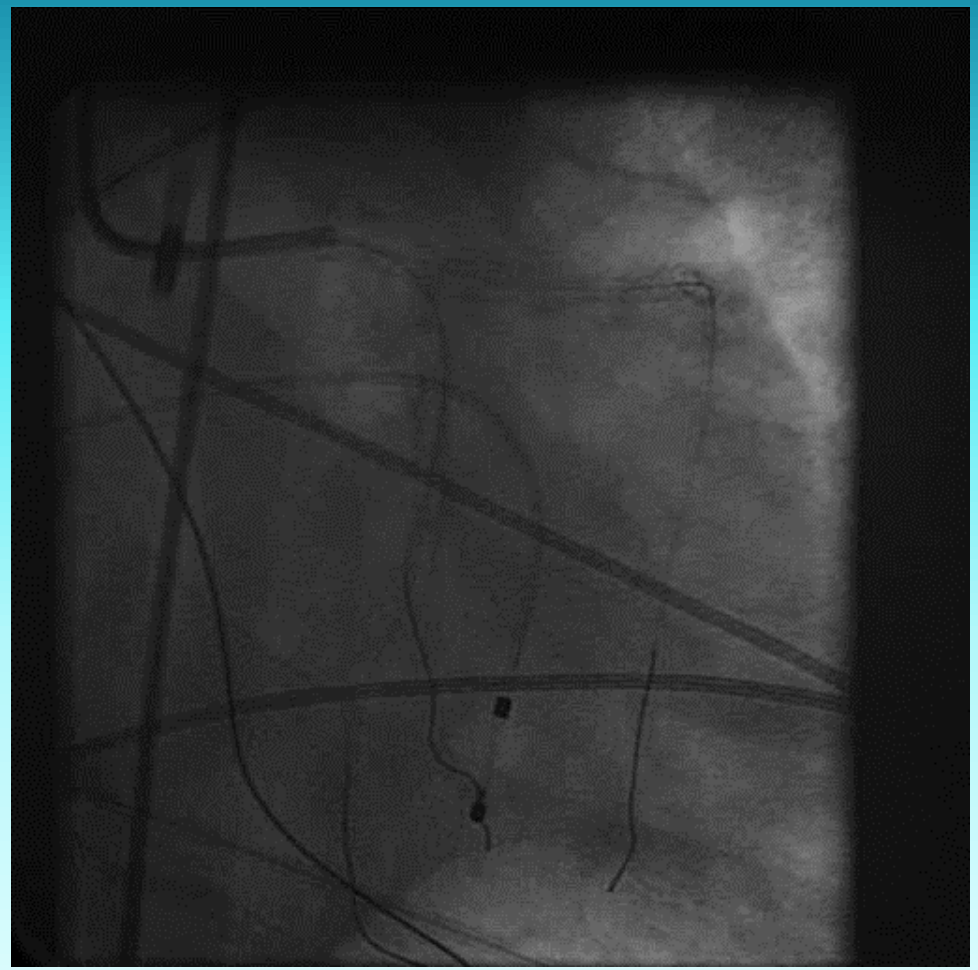
Angulated SB access

Venture catheter + BMW guidewire



NB: Venture Catheter in small vessels and S-bends not helpful

Result after POBA



After POBA (3.0mm NC balloon at 12atm in LM-Cx) and Kissing balloon inflation

Hemodynamically dependent on TABP; in sinus rhythm

What would be your treatment strategy toward suboptimal result in LCX ?

A. TIMI 3 flow – Leave as is

B. Cross-over stenting from LM to LCX with DES

C. Spot BMS at LCX ostium

D. Spot DES at LCX ostium

E. Drug-eluting balloon

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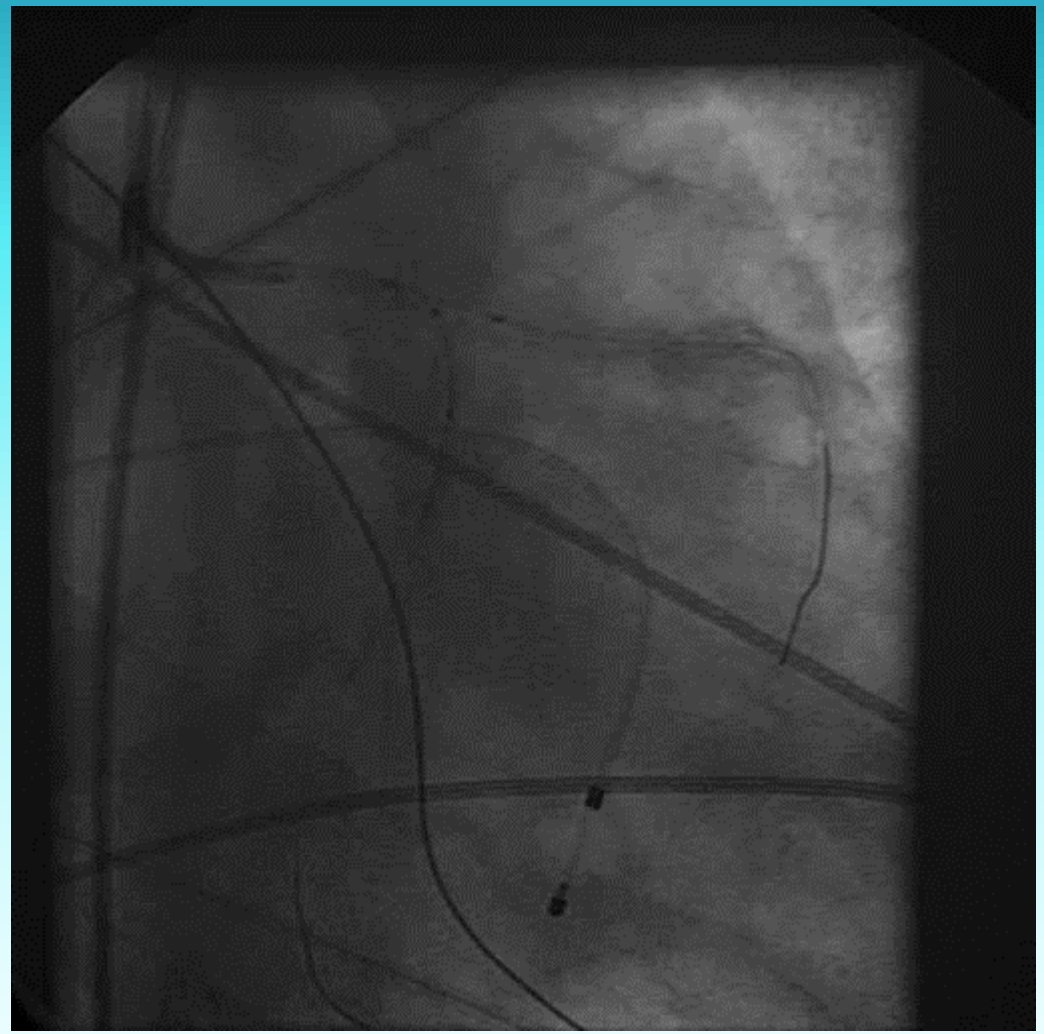
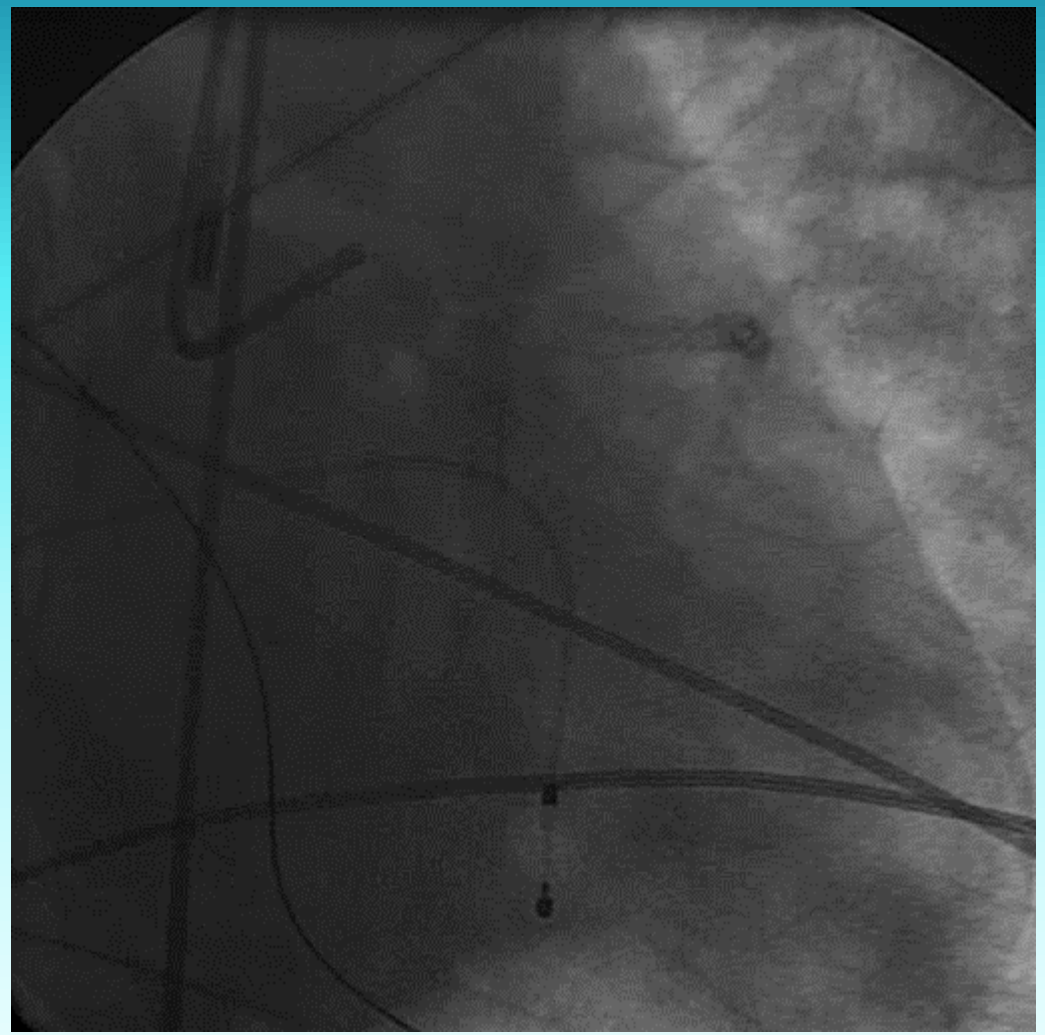
T-balloon stenting
(BMS in Cx, Balloon in LM-LAD)



Final Result



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1 week later,

VF arrest and sent to CCU

CAG: diffuse in LAD, CTO in RCA,
stents in Cx/LAD open

(Patient had history of stent thrombosis)

Underwent CABG
LIMA to LAD and SVG to RCA

3 months later,

Aggressive BMS-ISR at LCX ostium

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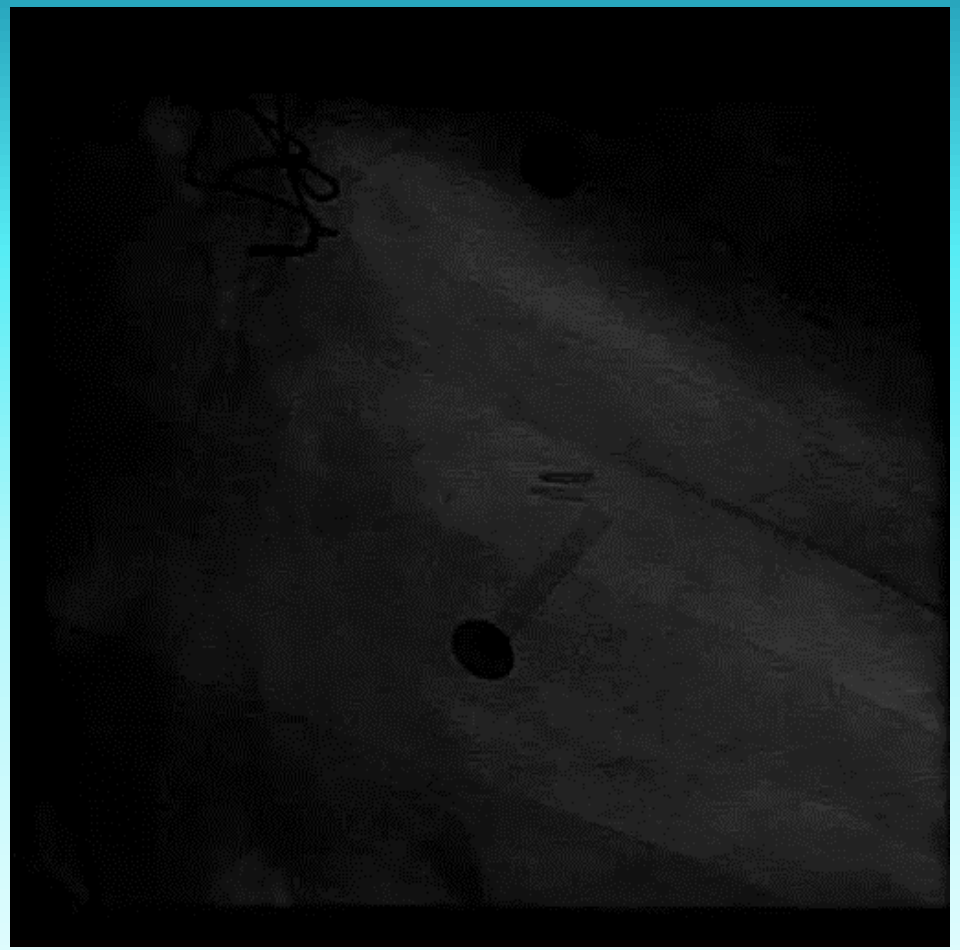
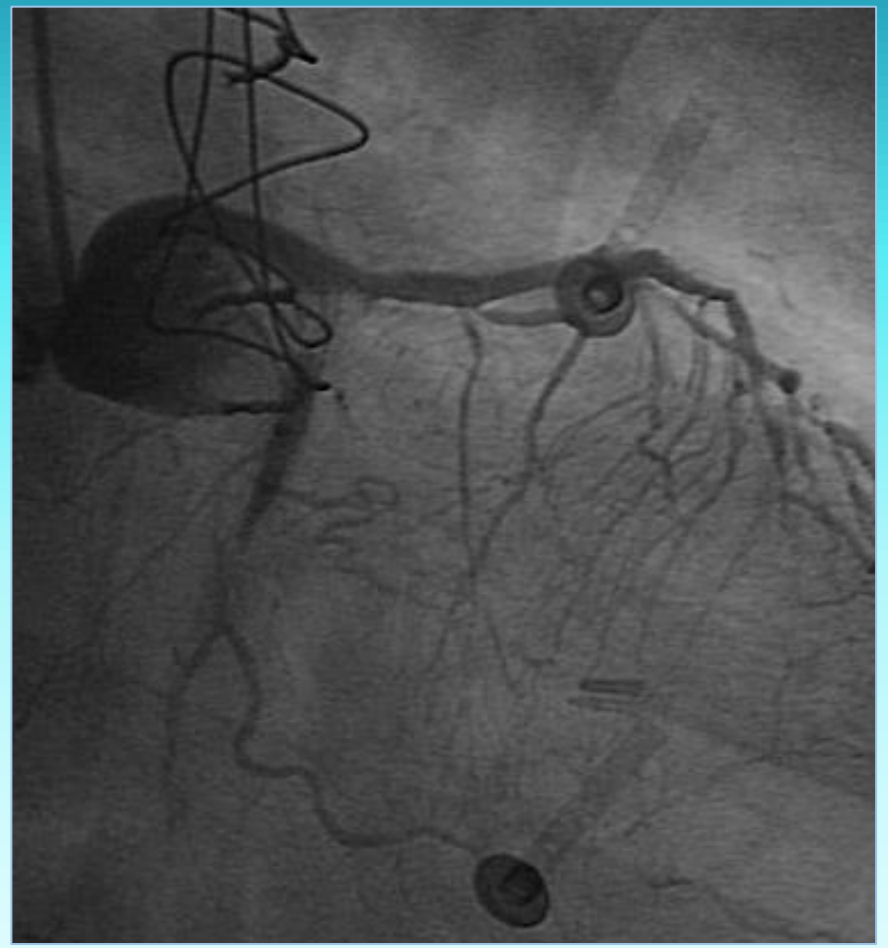
Aggressive BMS-ISR 3 months later





Baseline

(RCA:CTO, LIMA-LAD and SVG-RCA open)

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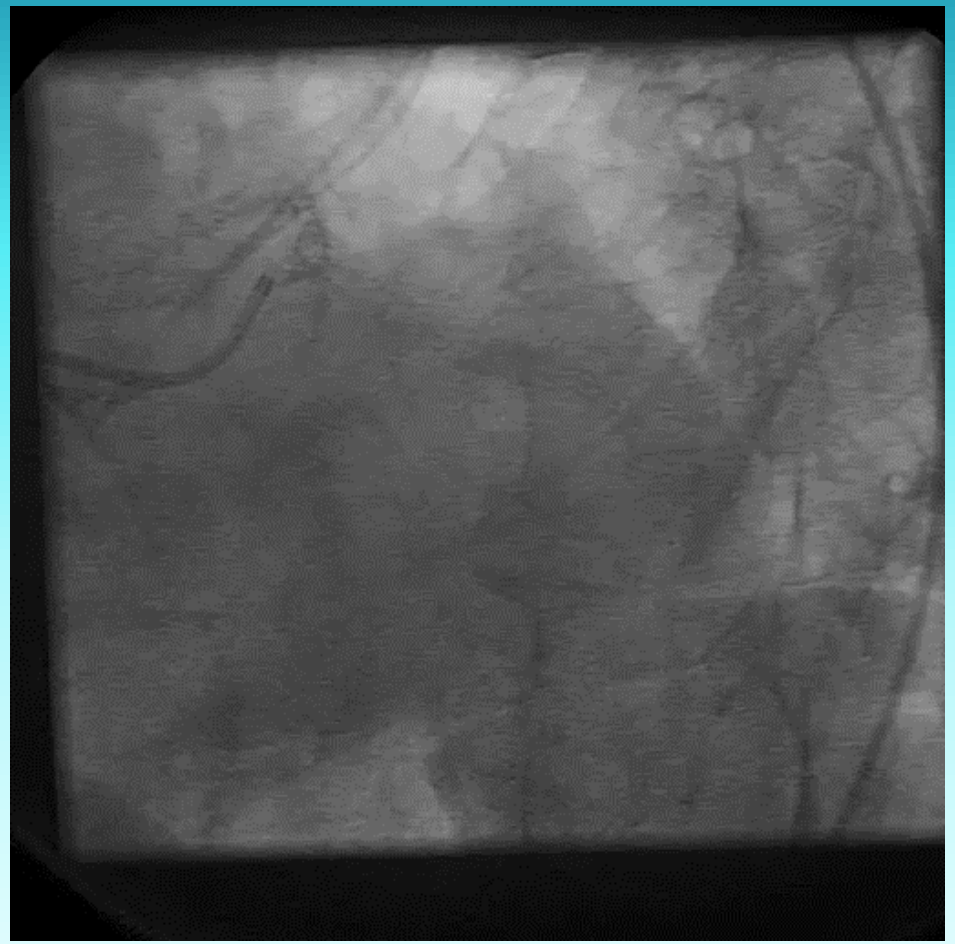
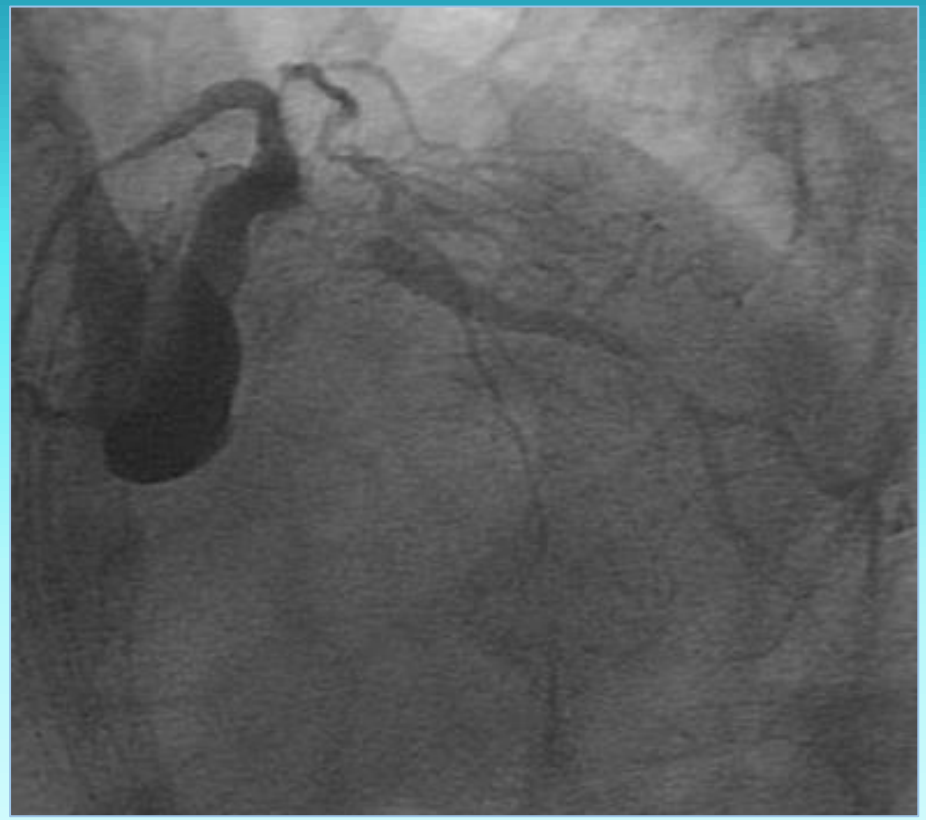
Aggressive BMS-ISR





Baseline

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What would be your treatment strategy toward the BMS-ISR?
(already 3 stents at LCX ostium)

A. POBA

B. DES implantation

C. Drug-eluting balloon

D. DCA

E. Cutting balloon

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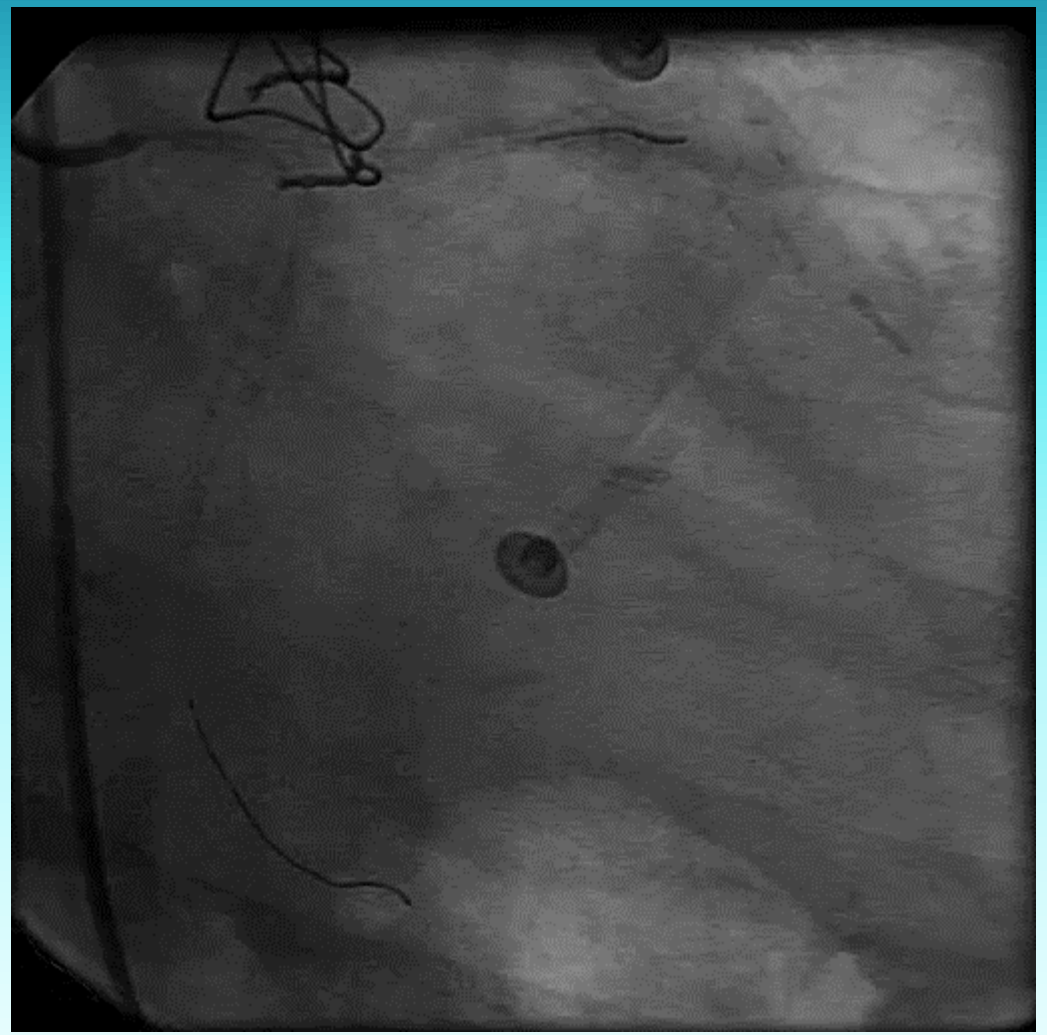
Aggressive BMS-ISR

Drug Eluting Balloon

In.Pact Falcon 3.5x40mm



After Drug Eluting Balloon

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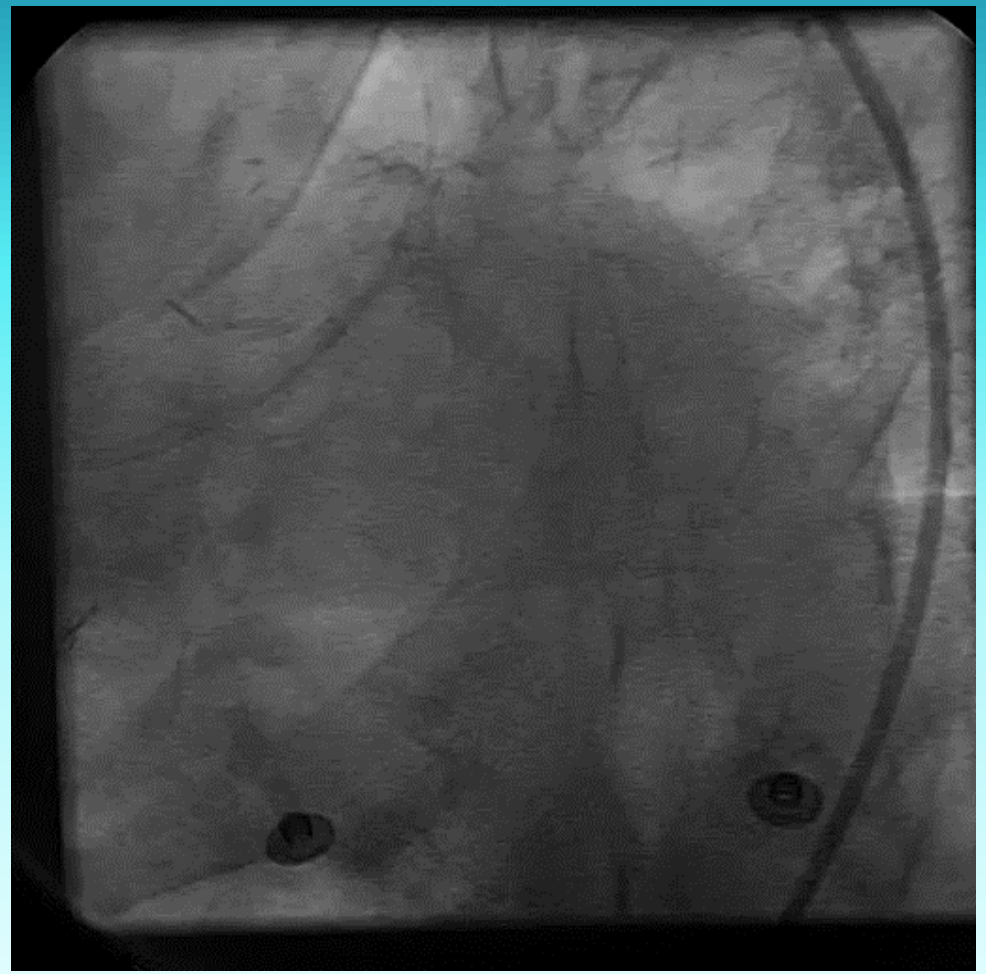
Suboptimal result after DEB



After Drug Eluting Balloon

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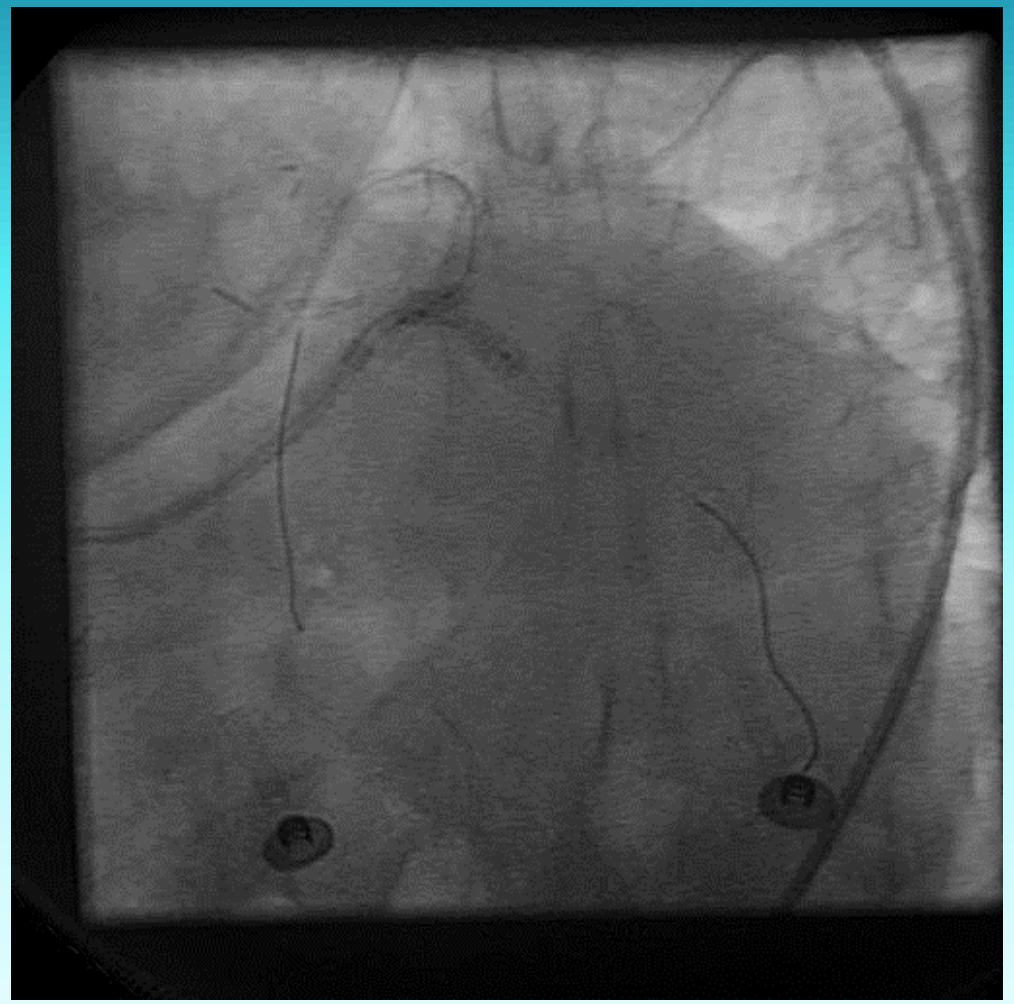
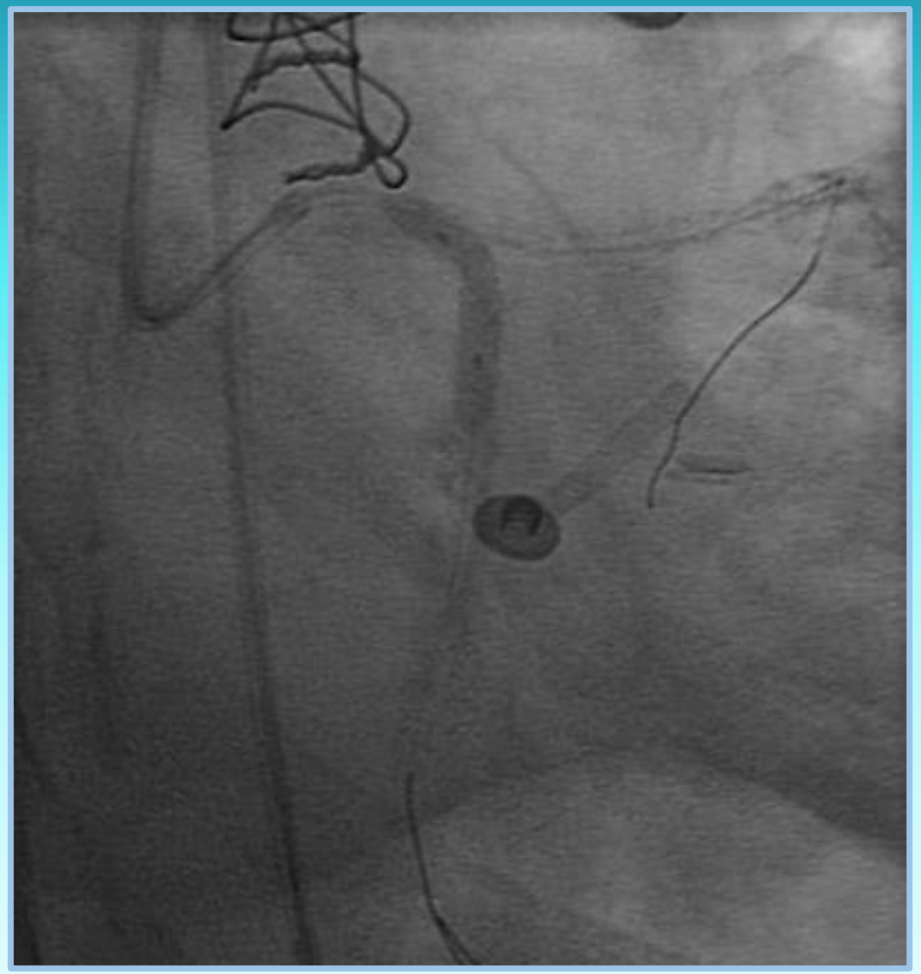
DES implantation – 4th stent at Cx ostium



Promus Element 3.5x8mm (Cx ost)

(Quantum Maverick 3.5mm (LM-LAD))



Postdilatation Quantum Maverick 3.5x15mm at 30atm

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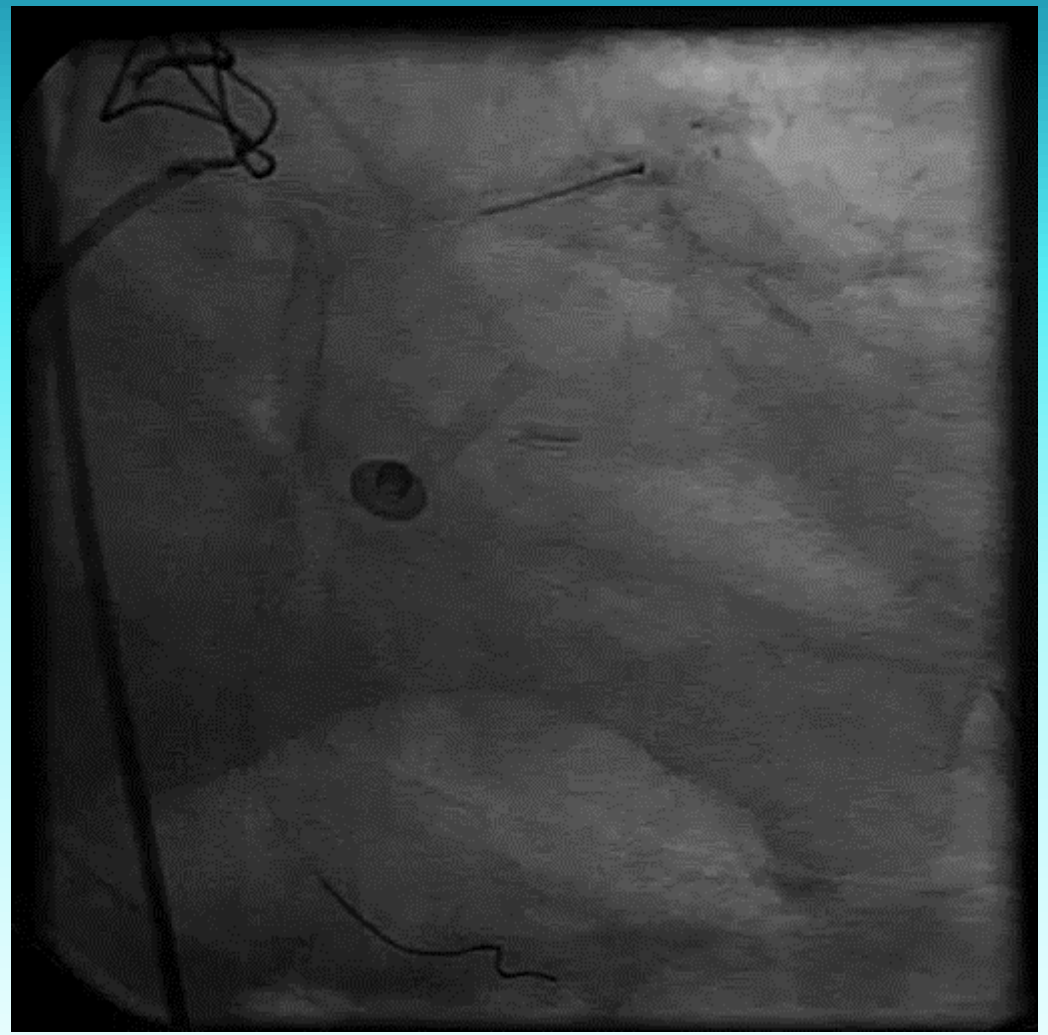
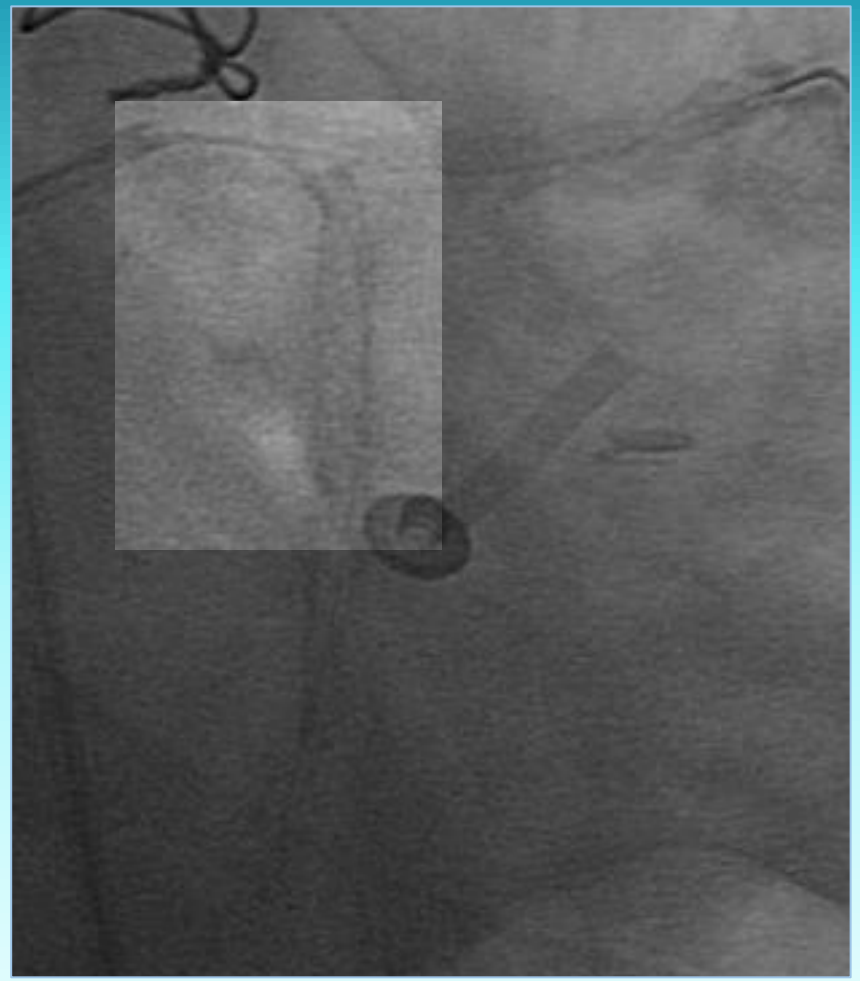
Stent underexpansion and Undilatable lesion





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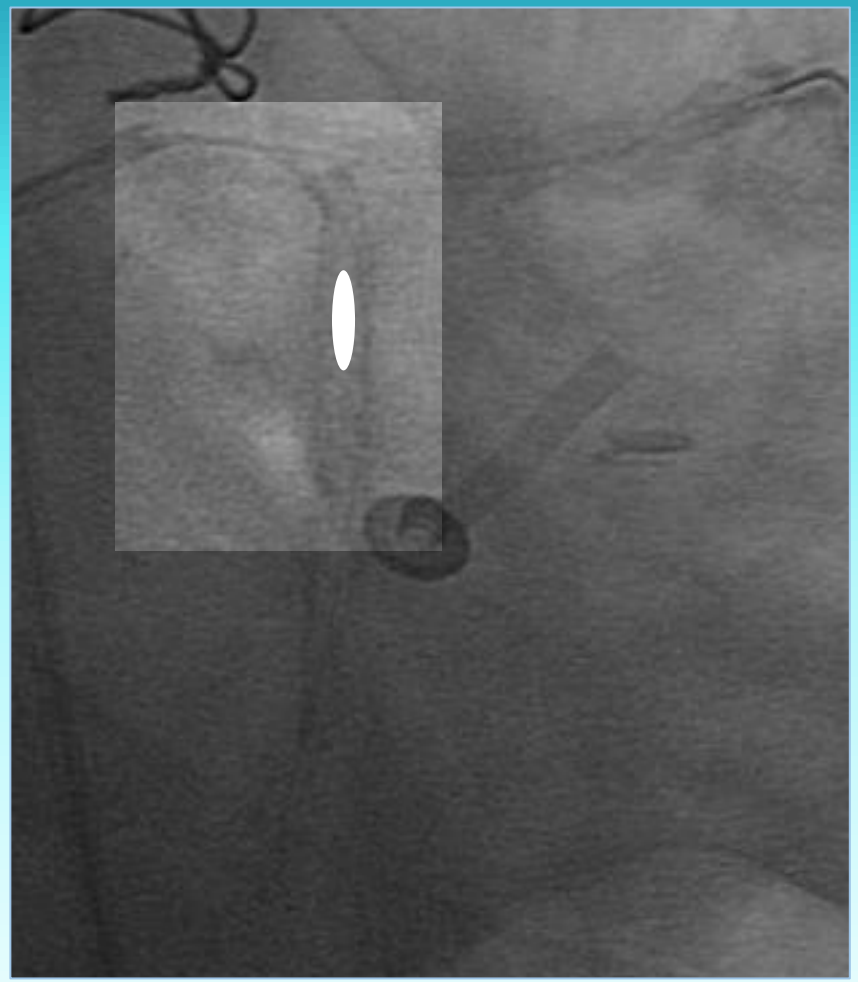
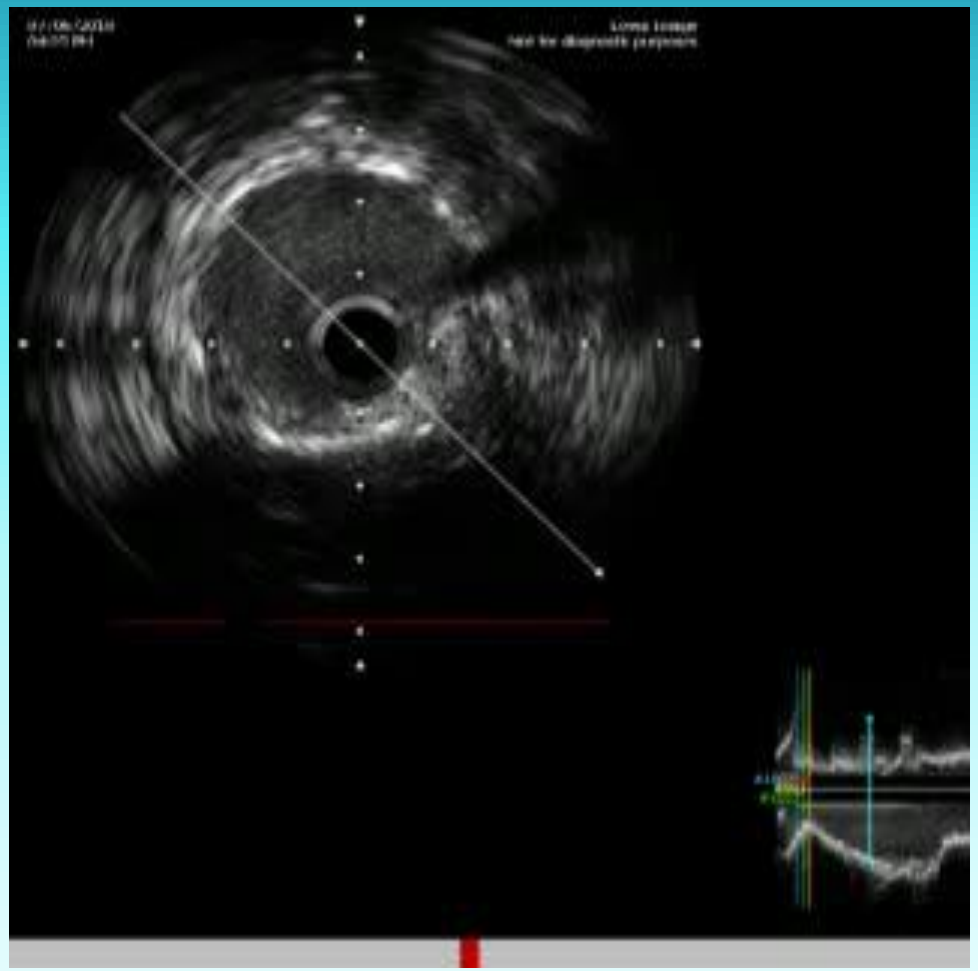
Stent underexpansion and Undilatable lesion





→ Next: Question

Q. What would you do next?
(4 stents at LCX ostium)

(* Poll : Audio Response System)

A. Nothing! Accept defeat as nothing can be done

B. Rotablator

C. Call for HELP!!

Antonio Colombo

TurboLaser 1.7mm during contrast injection

Fluency 60 mJ/mm², Rate 60 Hz

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Undilatable Lesion

TurboLaser 1.7mm (Fluency 60mJ Frequency 60Hz)

(Laser cath did not cross the lesion)

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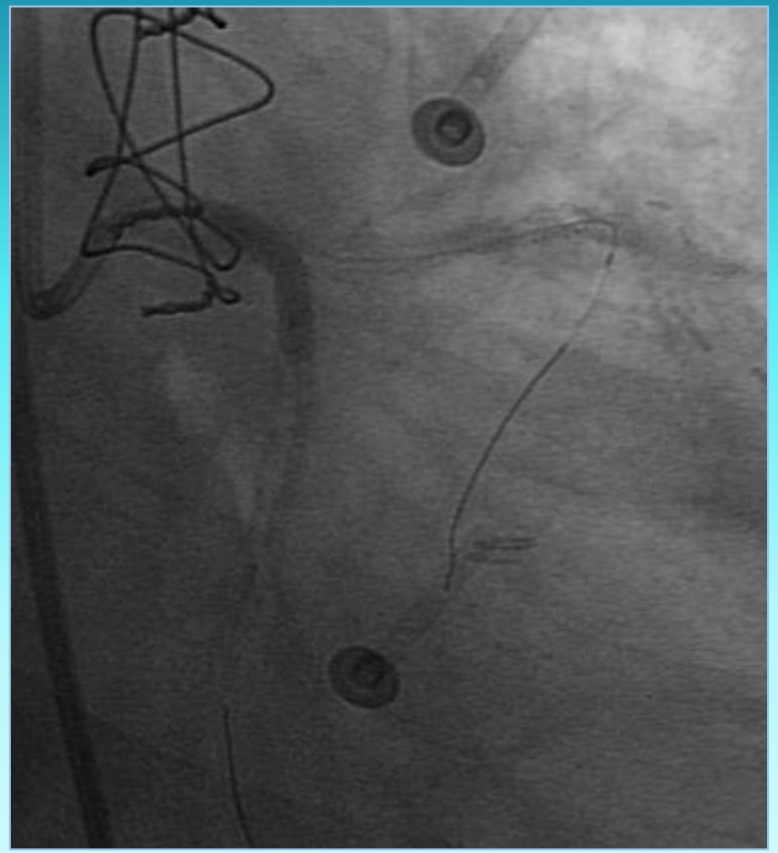
Postdilatation



Quantum Maverick 3.5x15mm

After POBA

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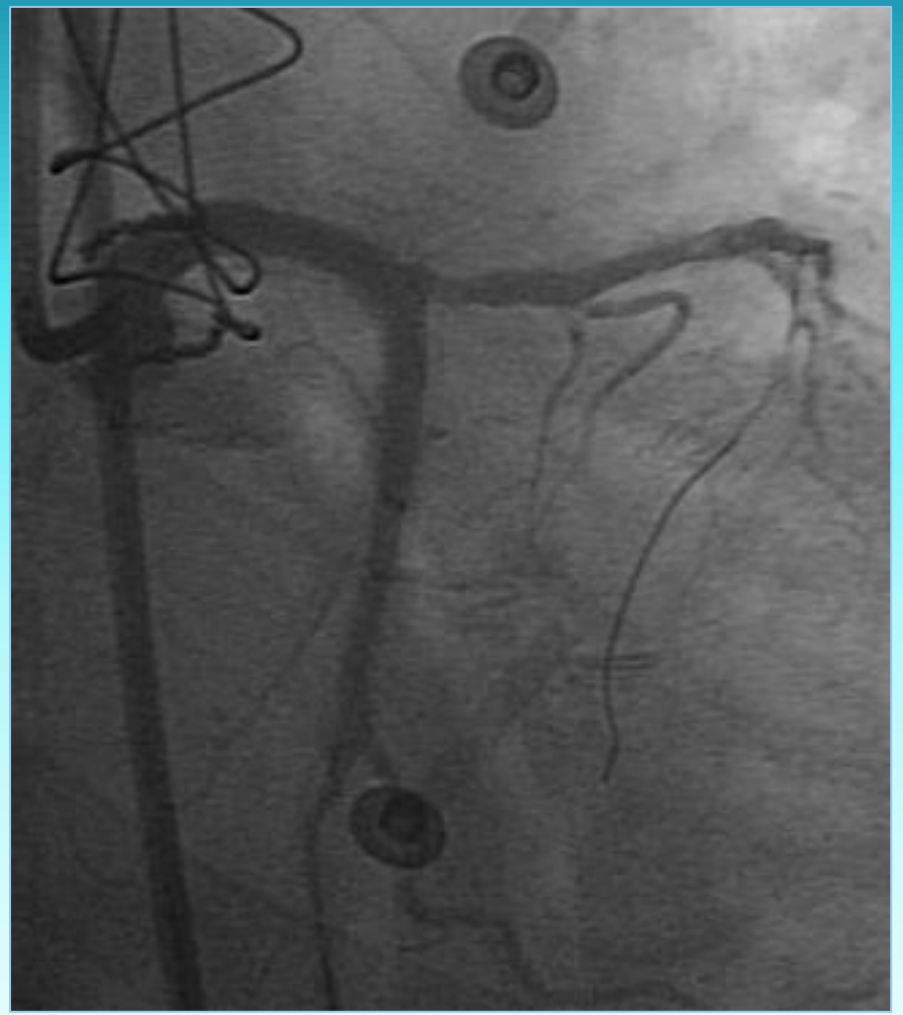
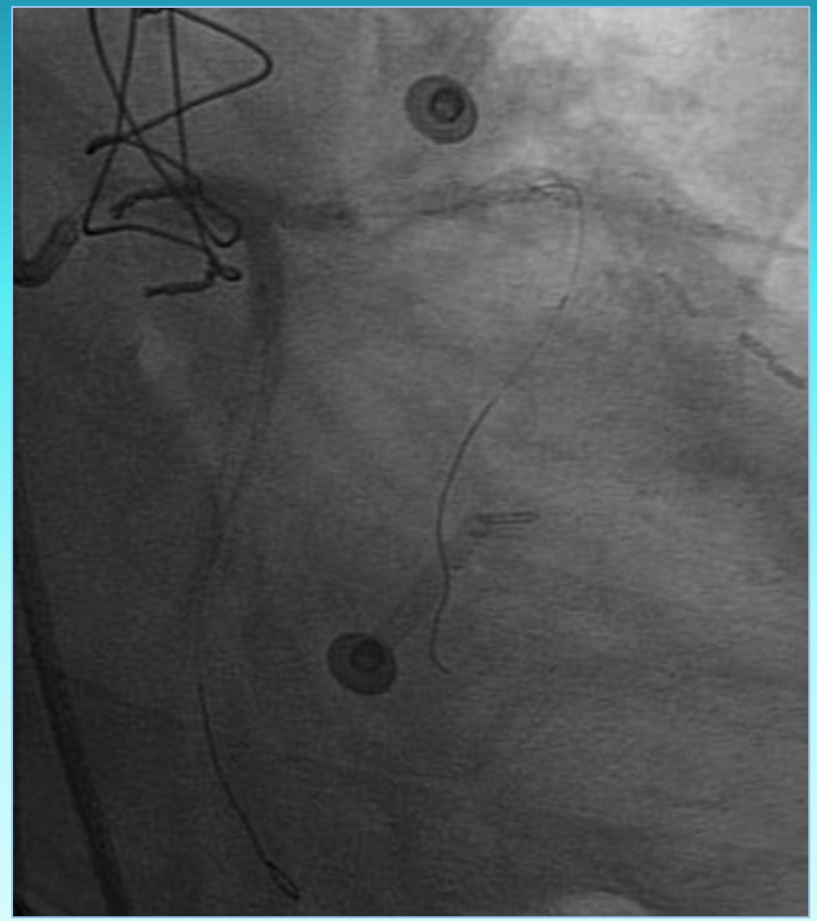
Undilatable Lesion



After POBA



Kissing Balloon

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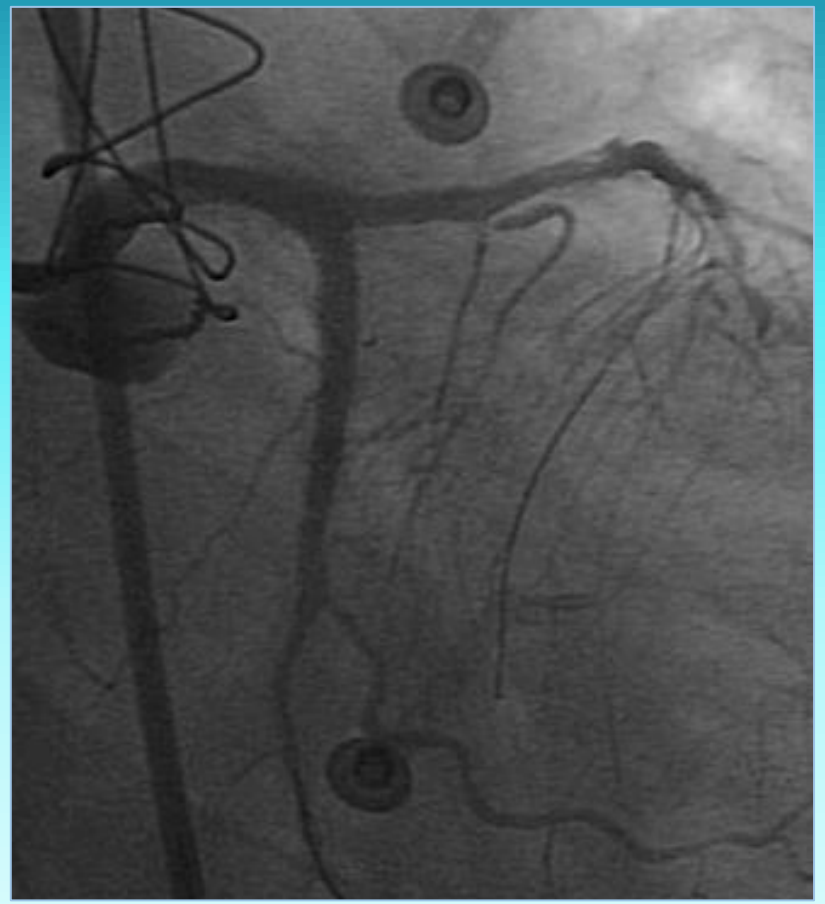
Undilatable Lesion



Final Result

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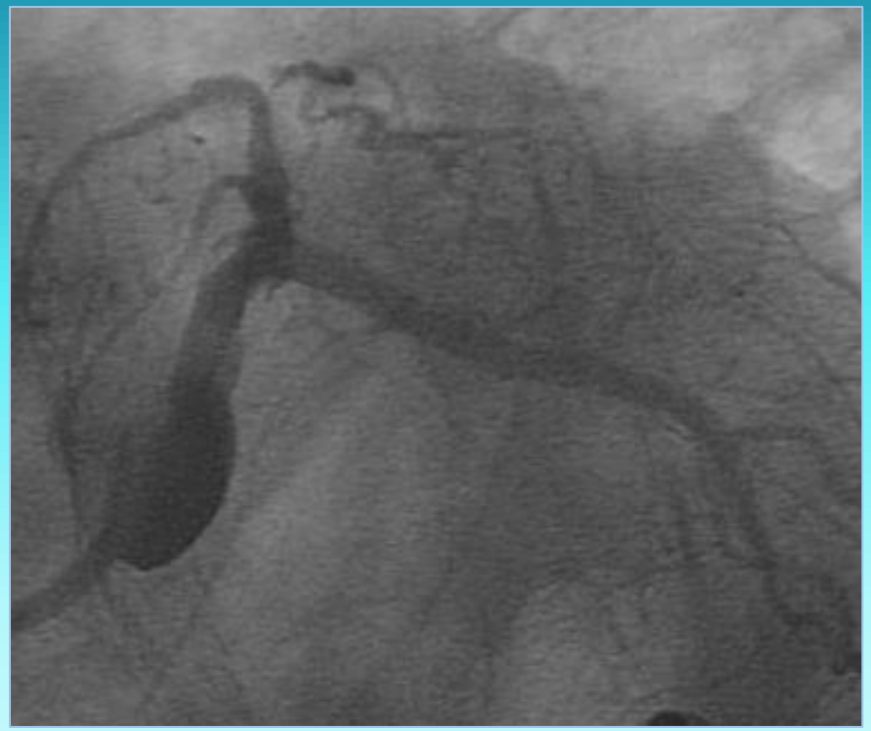
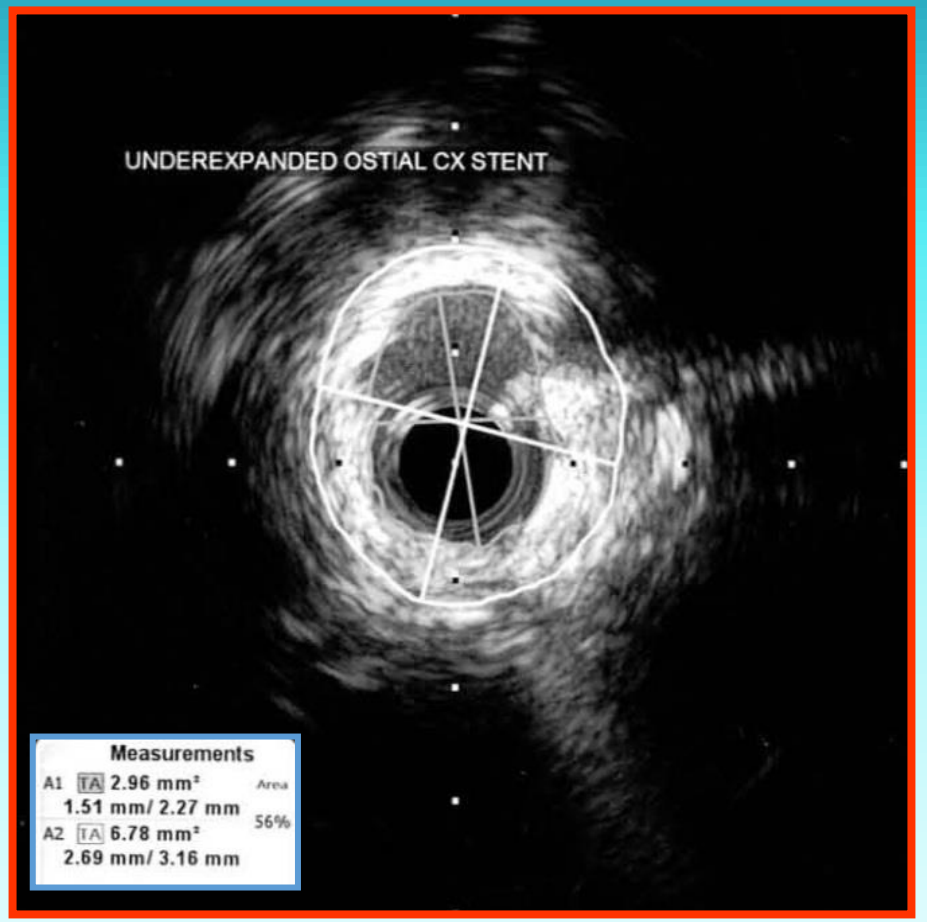
Undilatable Lesion



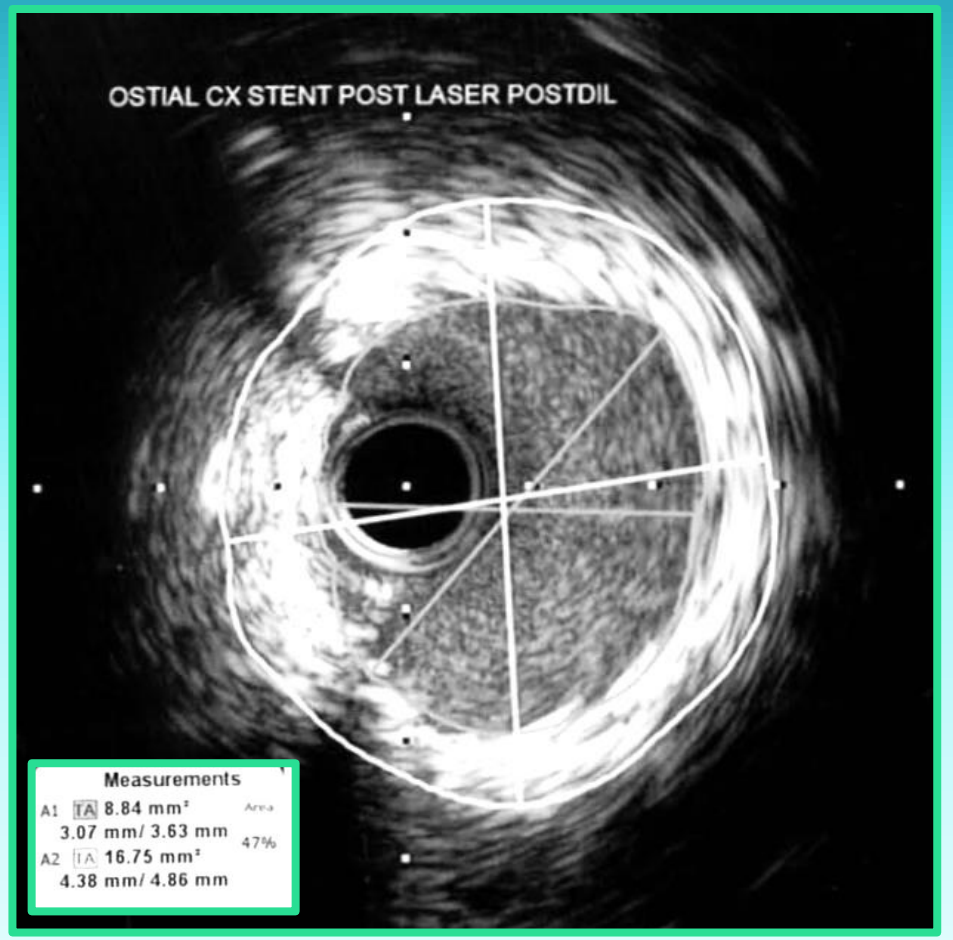
Final Result

HSR 61456/10

Undilatable Lesion



Pre Laser Treatment



Final Result

HSR 61456/10