

“HOW SHOULD I TREAT?”: NODULI CALCIFICI

How did I treat?

Dr. Andrea Moretti
Policlinico Universitario Tor Vergata
Roma



Not all calcium is the same.

Three patterns. Three behaviors. Three different fights.



Superficial

lining the lumen

- Sheets of calcium hugging the intima.
- Resists dilation; balloons slip and recoil.
- The classic candidate for atherectomy or IVL — modify, then expand.



Deep

in the medial layer

- Hidden under fibrous cap; invisible by angiography alone.
- Detected by IVUS / OCT — never by gut feeling.
- Pressure cracks, not surface fractures, are needed.



Calcific Nodule

the protruding stone

- Eruptive, often ostial, often eccentric.
- High-risk substrate: thrombus, ACS, stent malapposition.
- Demands a layered strategy — no single tool wins.



When calcium wins.

Under-expansion is not a cosmetic flaw. It is the seed of every late event.



Under-expansion drives thrombosis

MSA $<5.0 \text{ mm}^2$ is the single strongest predictor of stent failure.



Drug elution suffers

Calcium shadows the vessel wall — limus does not penetrate fractured-but-unprepared plaque.



Late events accumulate

Restenosis curves diverge after month 6 — by year 2, the gap is irreversible.



Debulking vs. Modification.

DEBULKING

Remove the stone.

- Rotational atherectomy (Rotablator)
- Orbital atherectomy (Diamondback)
- Excimer laser atherectomy (ELCA)
- Best when: heavy concentric calcium, uncrossable lesion, balloon refusal.
- Risk: dissection, slow-flow, embolization.

MODIFICATION

Crack the stone.

- Intravascular Lithotripsy (IVL — Shockwave)
- Cutting / Scoring balloons (AngioSculpt, Wolverine)
- Super-high-pressure NC balloons (OPN)
- Best when: deep medial calcium, eccentric plaque, post-debulking finishing.
- Strength: vessel-respecting, fractures without removing tissue.

Image first. Then choose.

A pragmatic algorithm for the calcified lesion in front of you.

OCT / IVUS

calcium arc, thickness, length, nodule?

CROSSABLE + superficial

Concentric arc $\geq 180^\circ$, thick

First-line: ATHERECTOMY

- ▶ Rotablator or orbital
- ▶ Then NC / OPN balloon
- ▶ Consider IVL for residual deep Ca^{2+}

DEEP / DIFFUSE

Medial calcium, eccentric

First-line: IVL

- ▶ Shockwave 80 pulses
- ▶ Re-image (OCT) before stent
- ▶ Pre-dilate, then DES

NODULE / OSTIAL

Eruptive, irregular surface

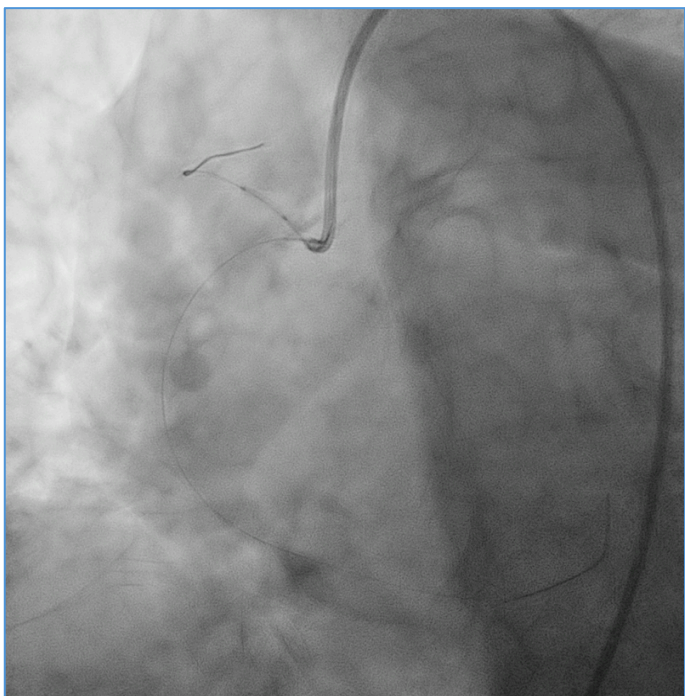
OUR CASE TODAY

Layered: LASER → IVL

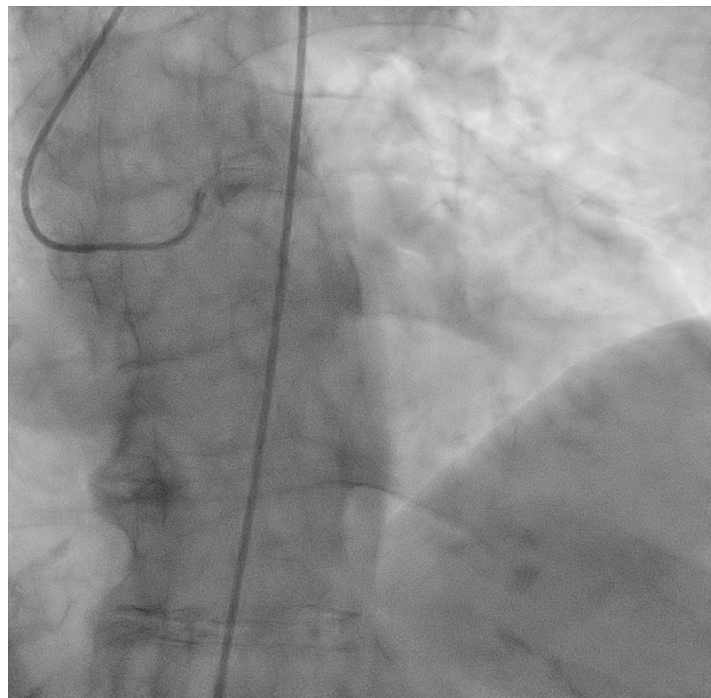
- ▶ ELCA opens & ablates the nodule
- ▶ IVL fractures residual matrix
- ▶ Image-confirmed expansion → DES

A 79-year-old woman.

Two prior NSTEMIs. An ostial RCA that refuses to be crossed.



Ostial RCA — uncrossable
Uncrossable Lesion - "anchoring" technique required



LM-LAD — patent
successful prior PCI on LM-LAD (2024–25)

PATIENT M.G. (Sangiorgi case)

RISK PROFILE

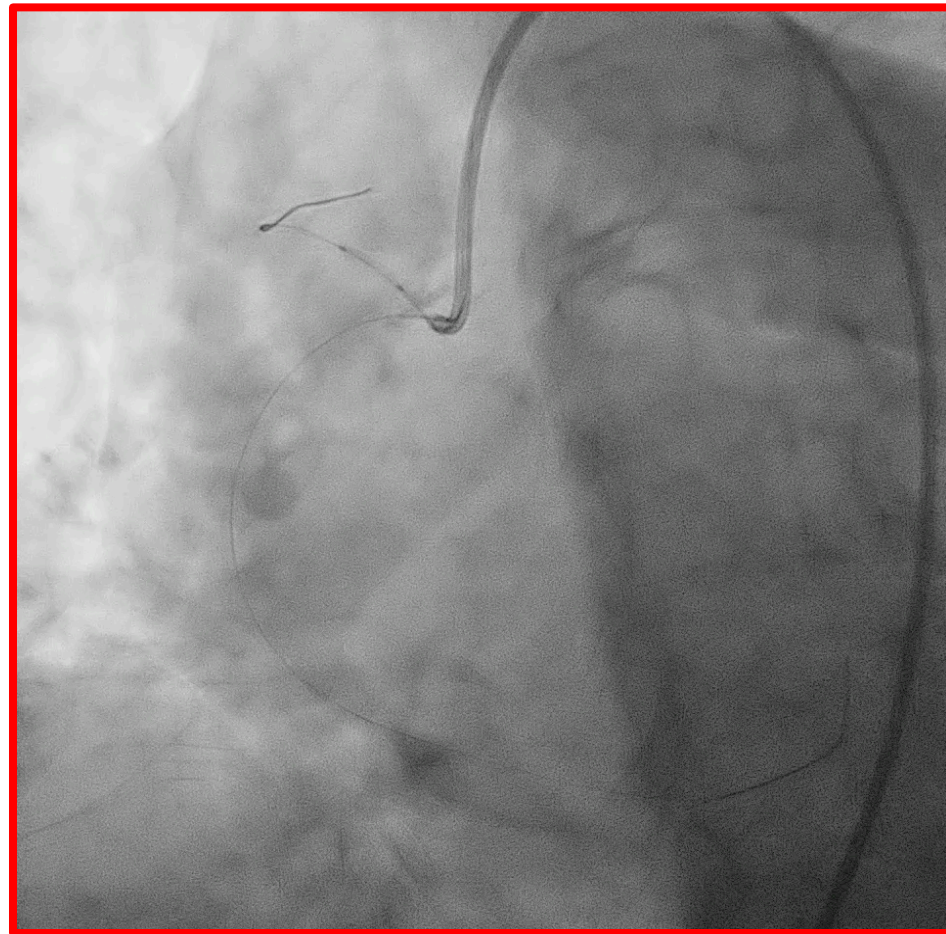
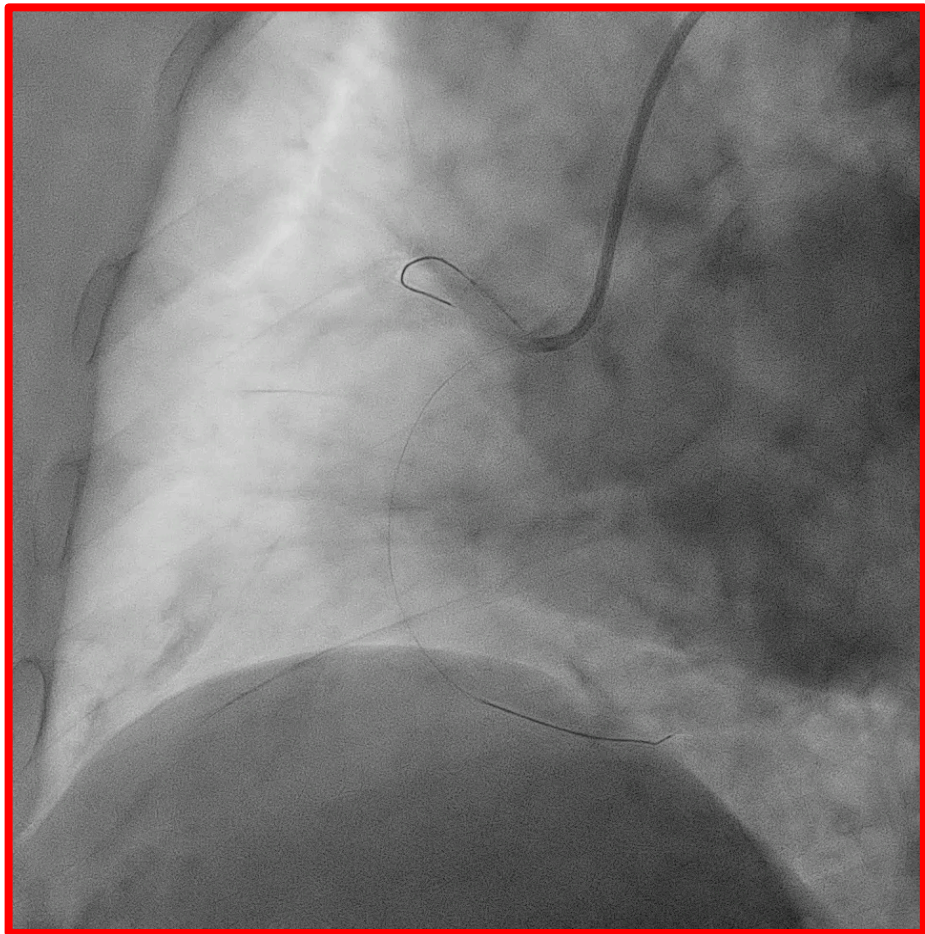
79 y.o. woman · hypertension · dyslipidemia
ESRD · NAFLD

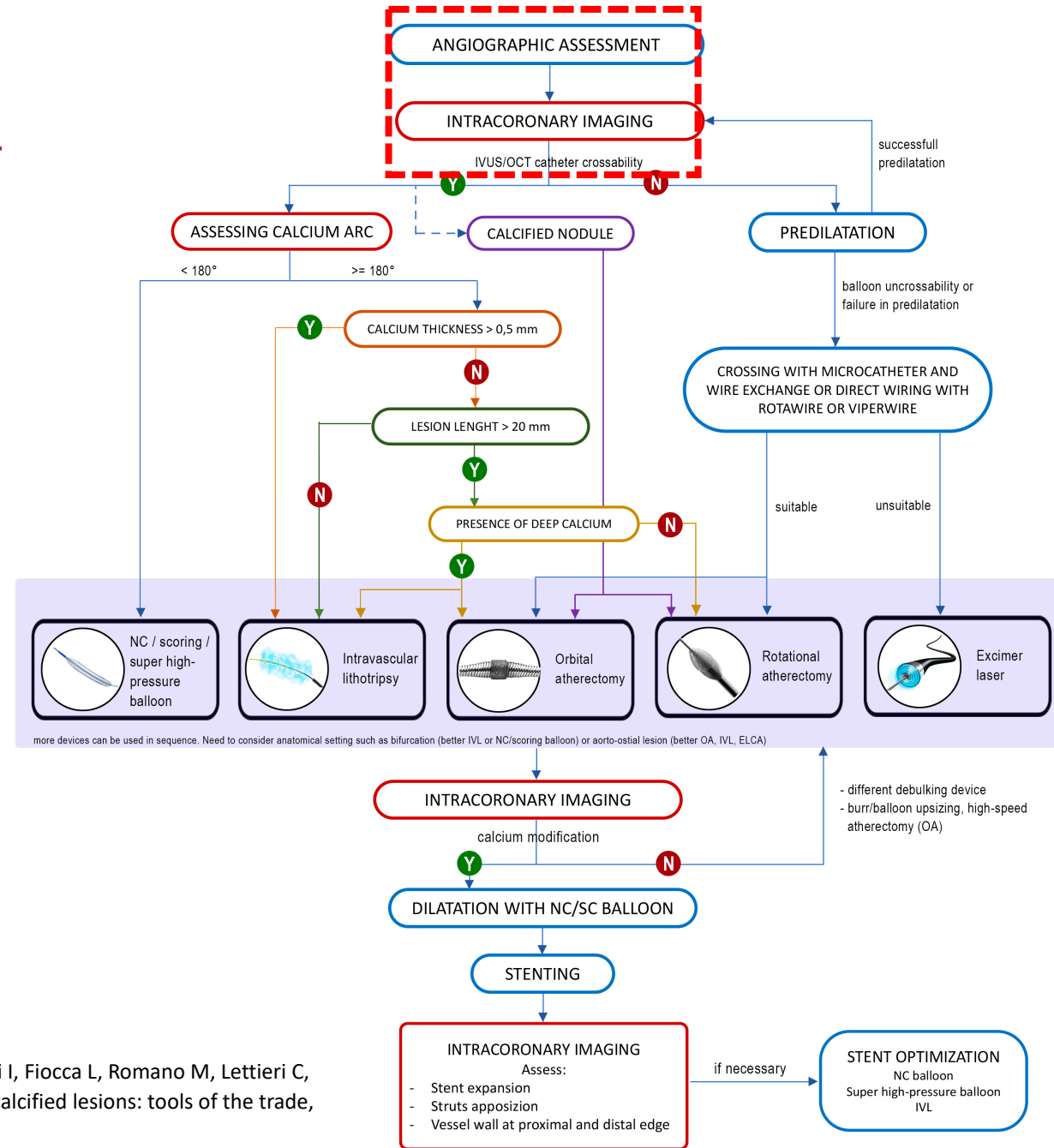
CLINICAL HISTORY

2024 NSTEMI — PCI + 1 DES LM-LAD
2025 NSTEMI — ISR LM-LAD + 1 DES
Worsening angina × 2 months

IMAGING

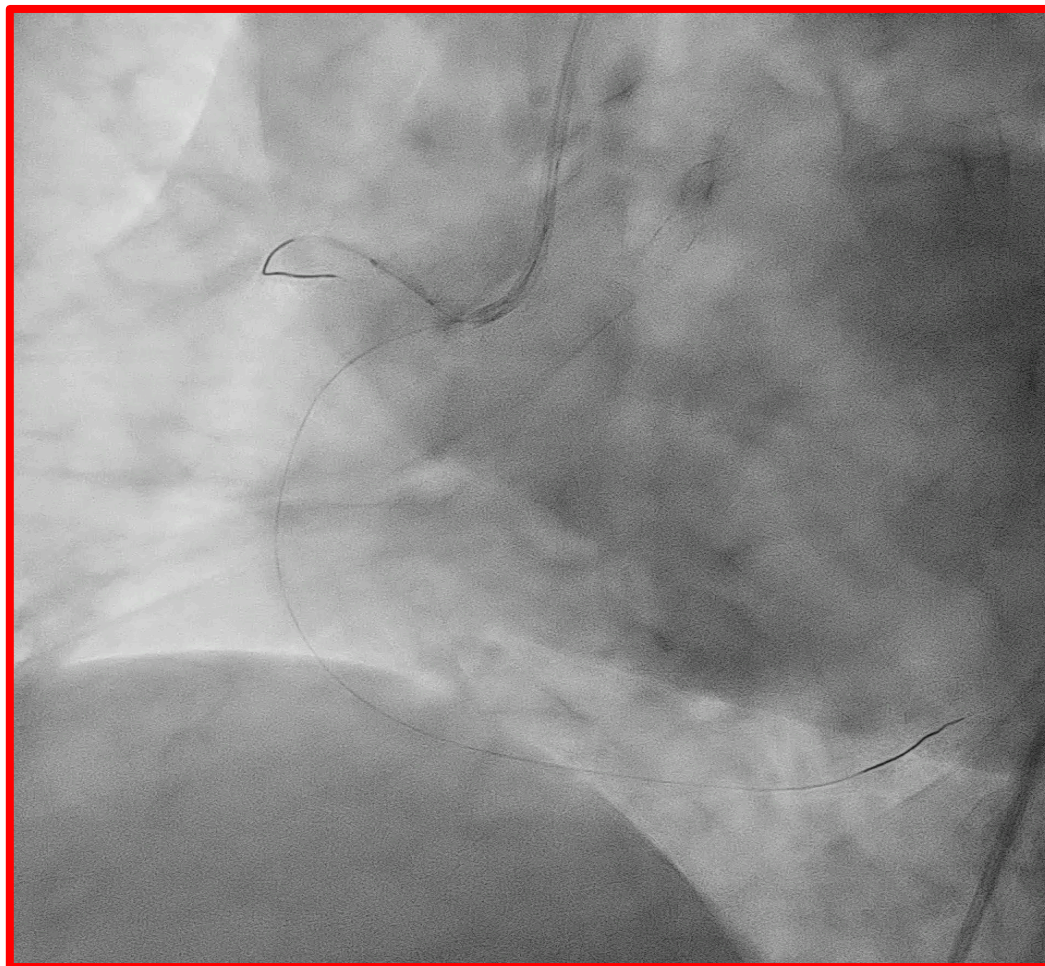
EKG normal · ECHO EF 55%
Heavy calcific ostial RCA subocclusion





Russo D, Massaro G, Benedetto D, Russo G, Canova P, Pescetelli I, Fiocca L, Romano M, Lettieri C, Chiricolo G, Sangiorgi GM. Contemporary approach to heavily calcified lesions: tools of the trade, challenges, and pitfalls. Vessel Plus 2024;8:9.





SC 2.0 mm balloon do not cross

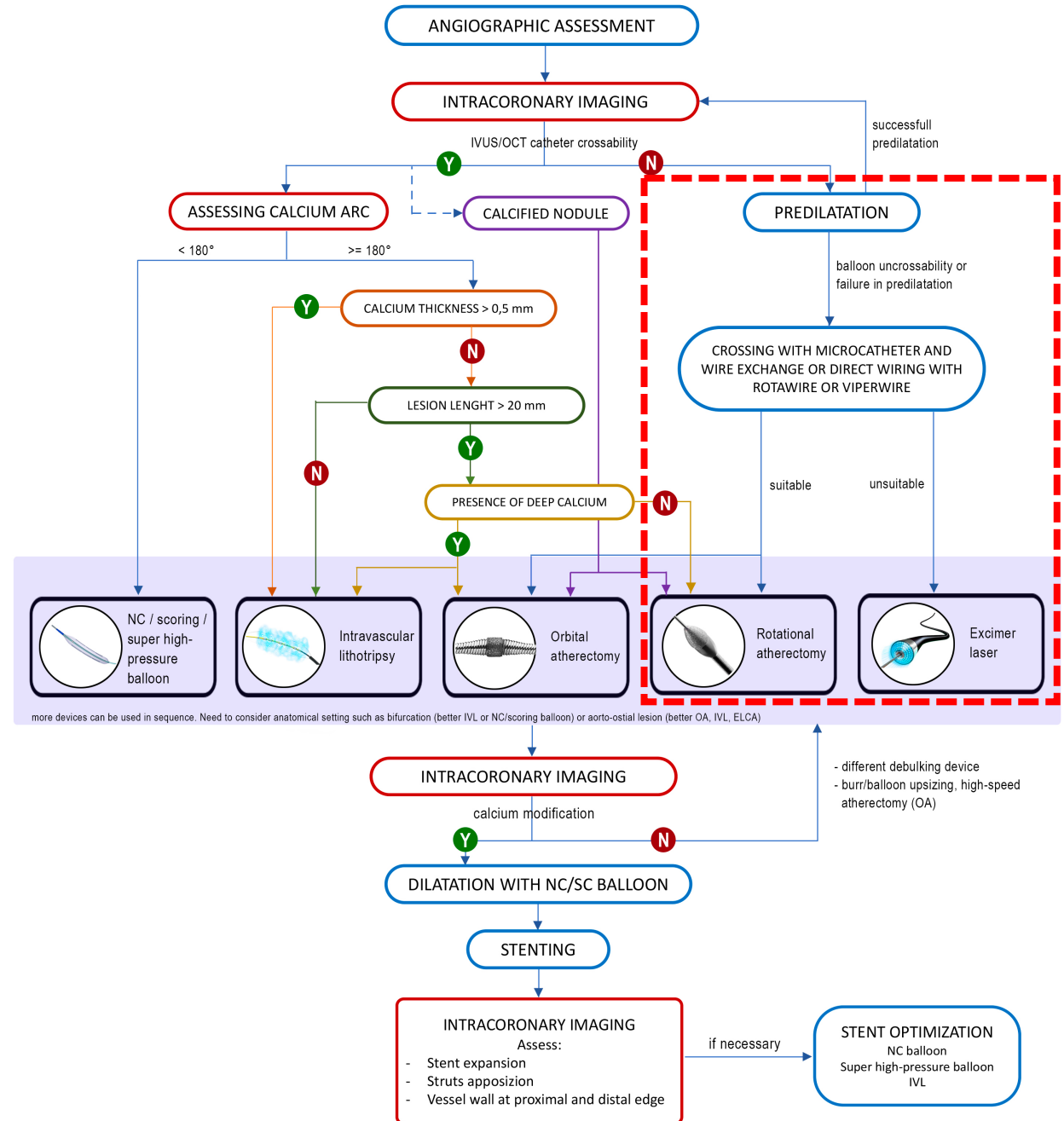


OUR SETTING

Heavily calcified ostial lesion

Uncrossable

Poor guiding catheter support
JR6 Fr + Guide extension

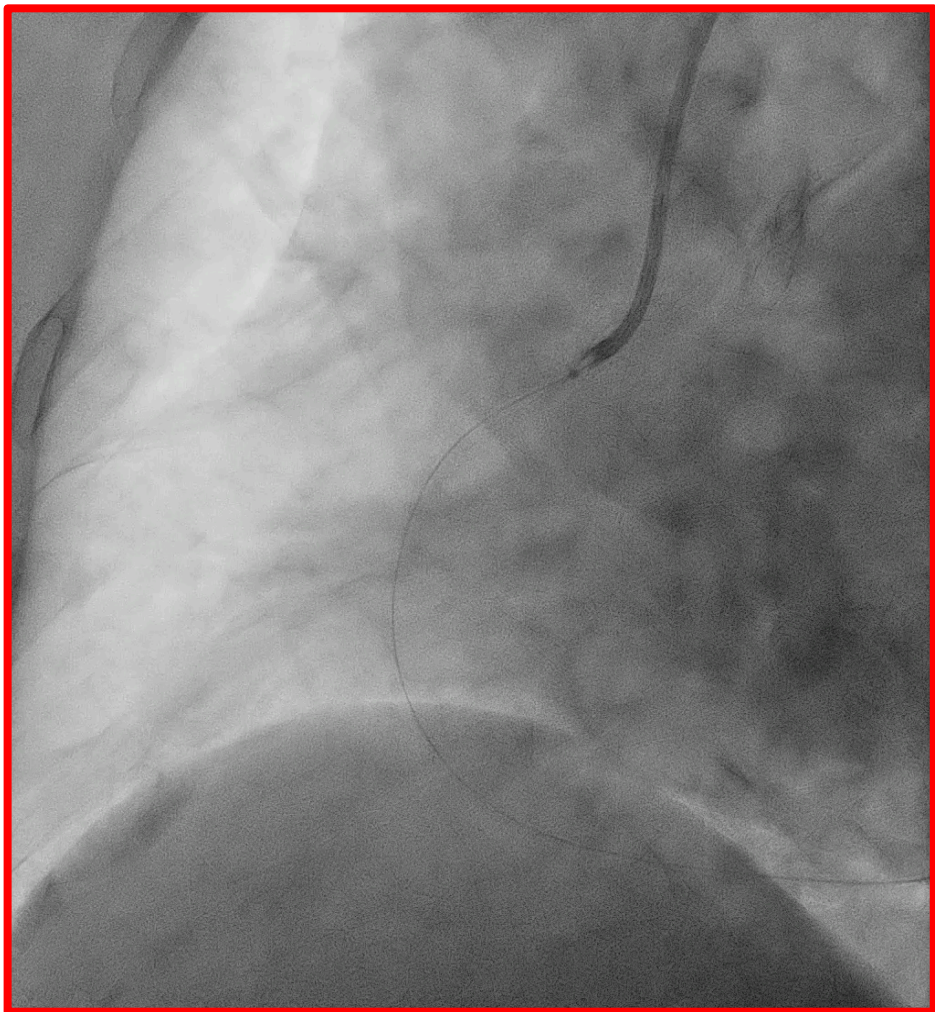


A Cath Lab Nightmare



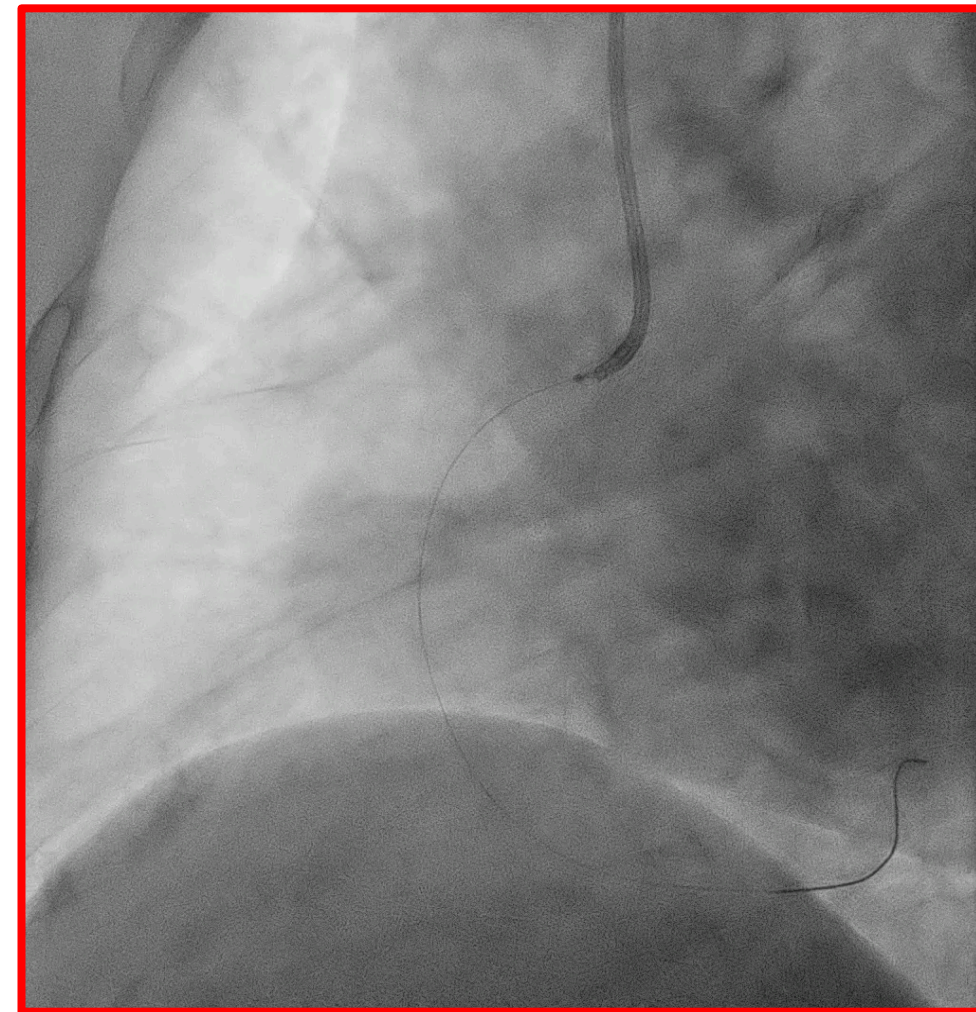
THE LASIX STRATEGY



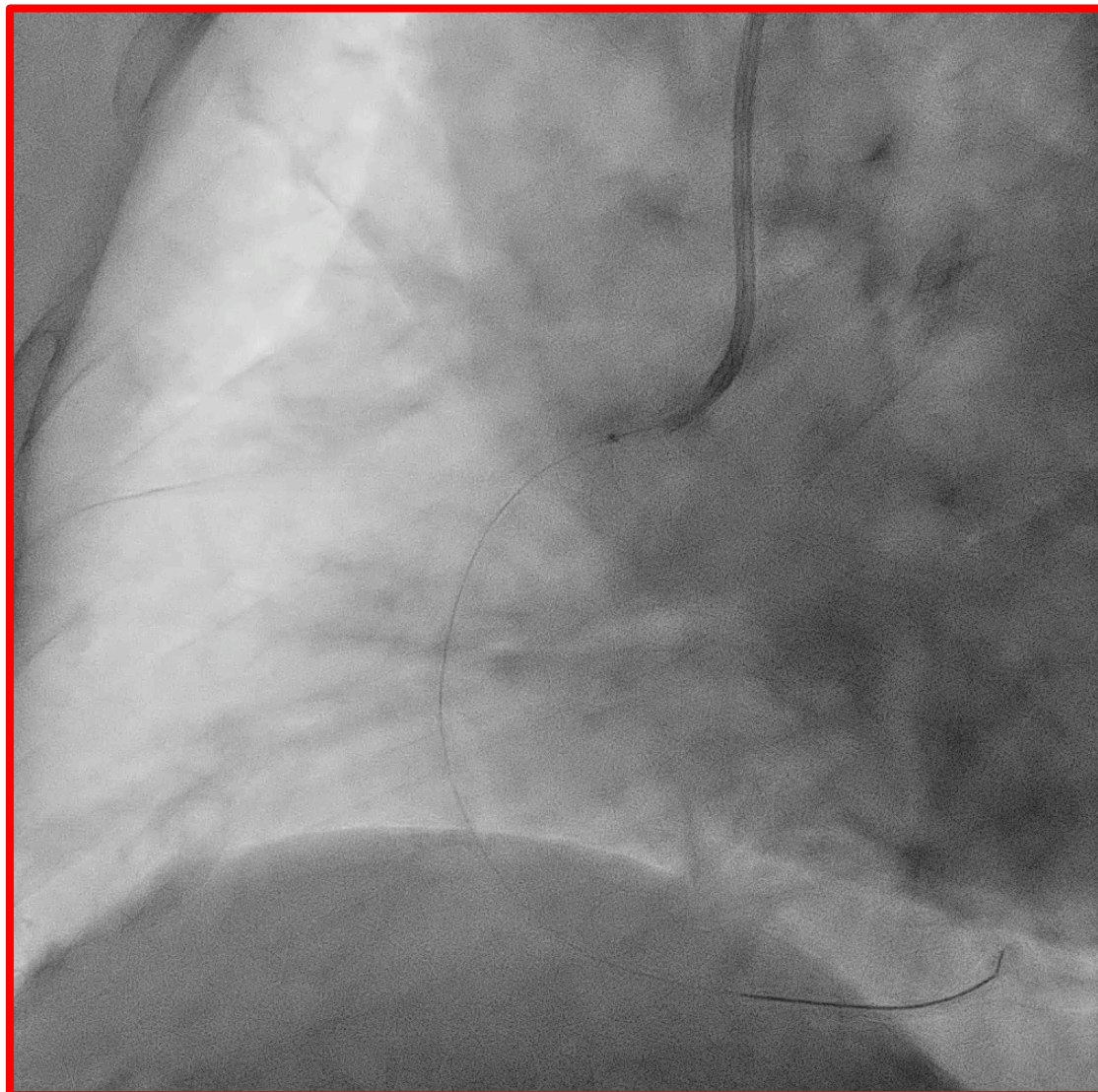


PROBE: 0.9 mm

MEDIUM: Blood

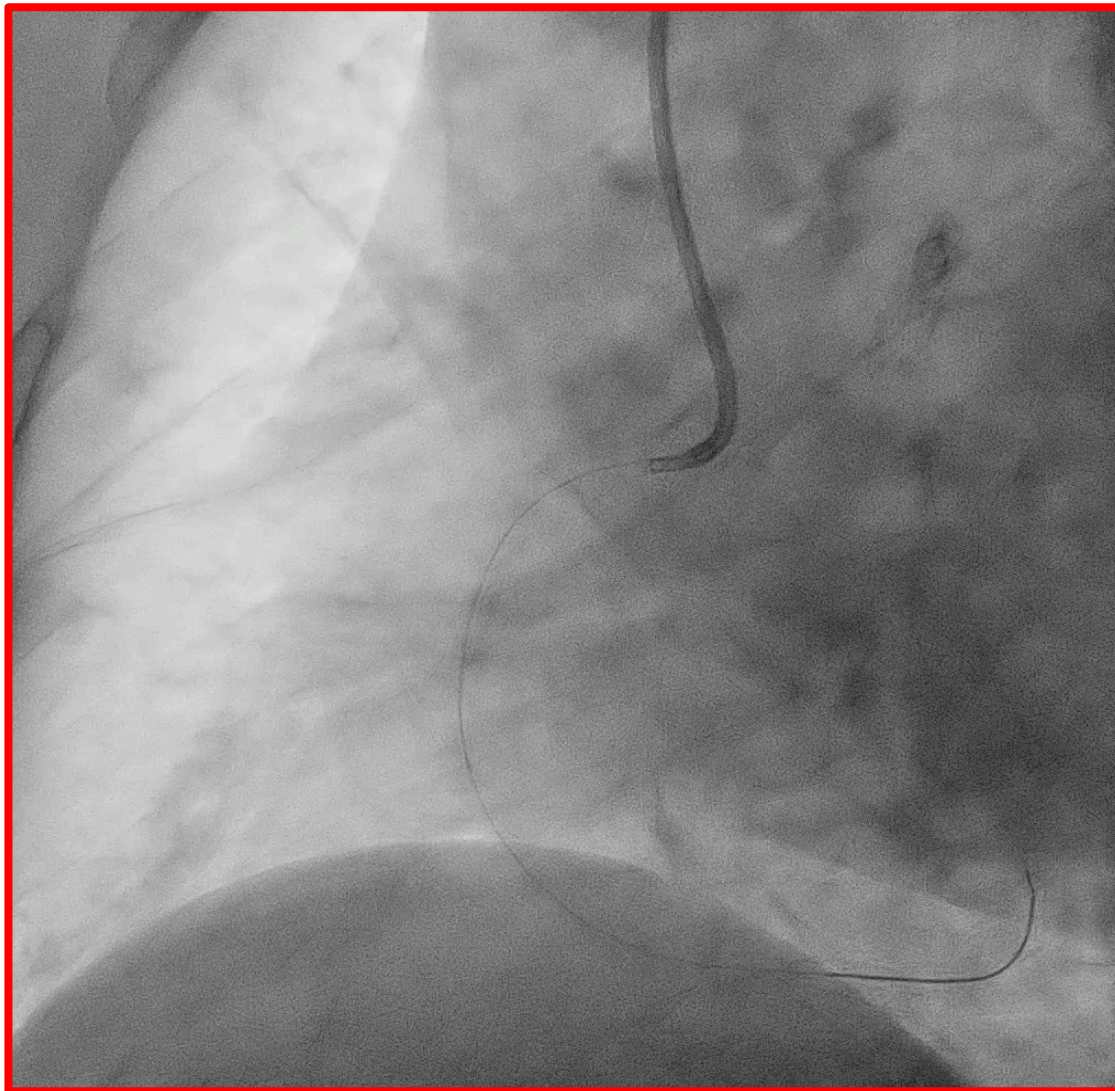


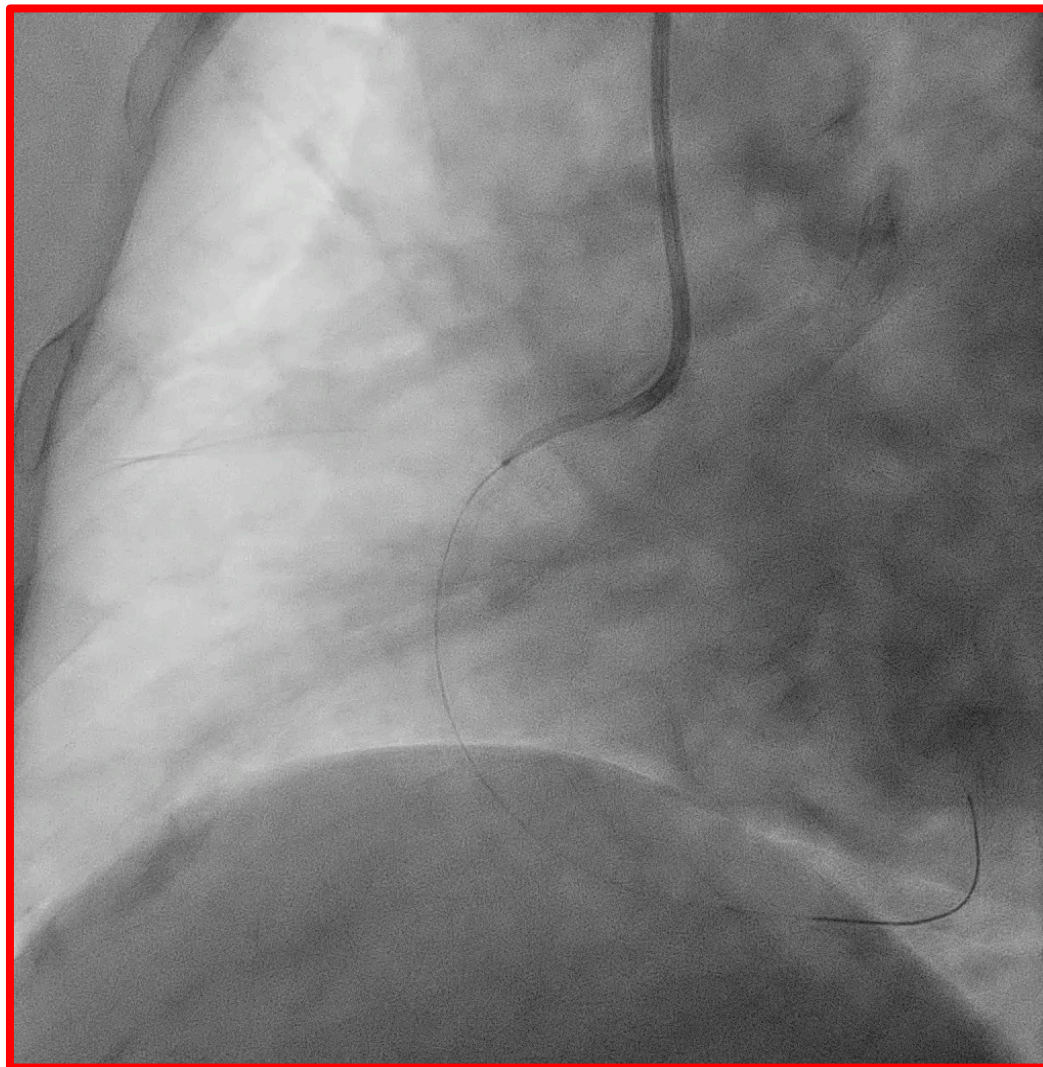
LASER cross the lesion



ANGIOGRAPHIC RESULT

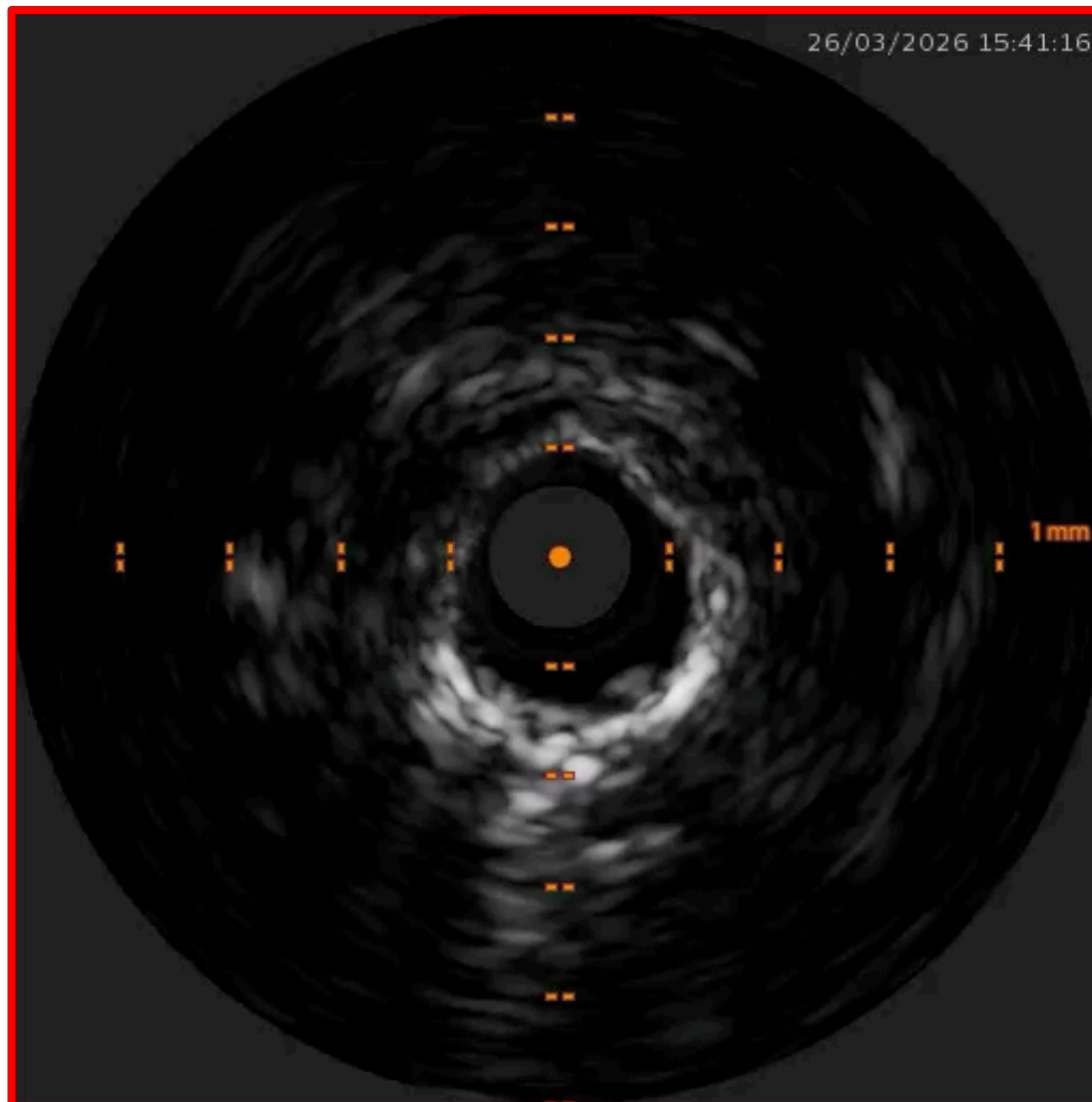
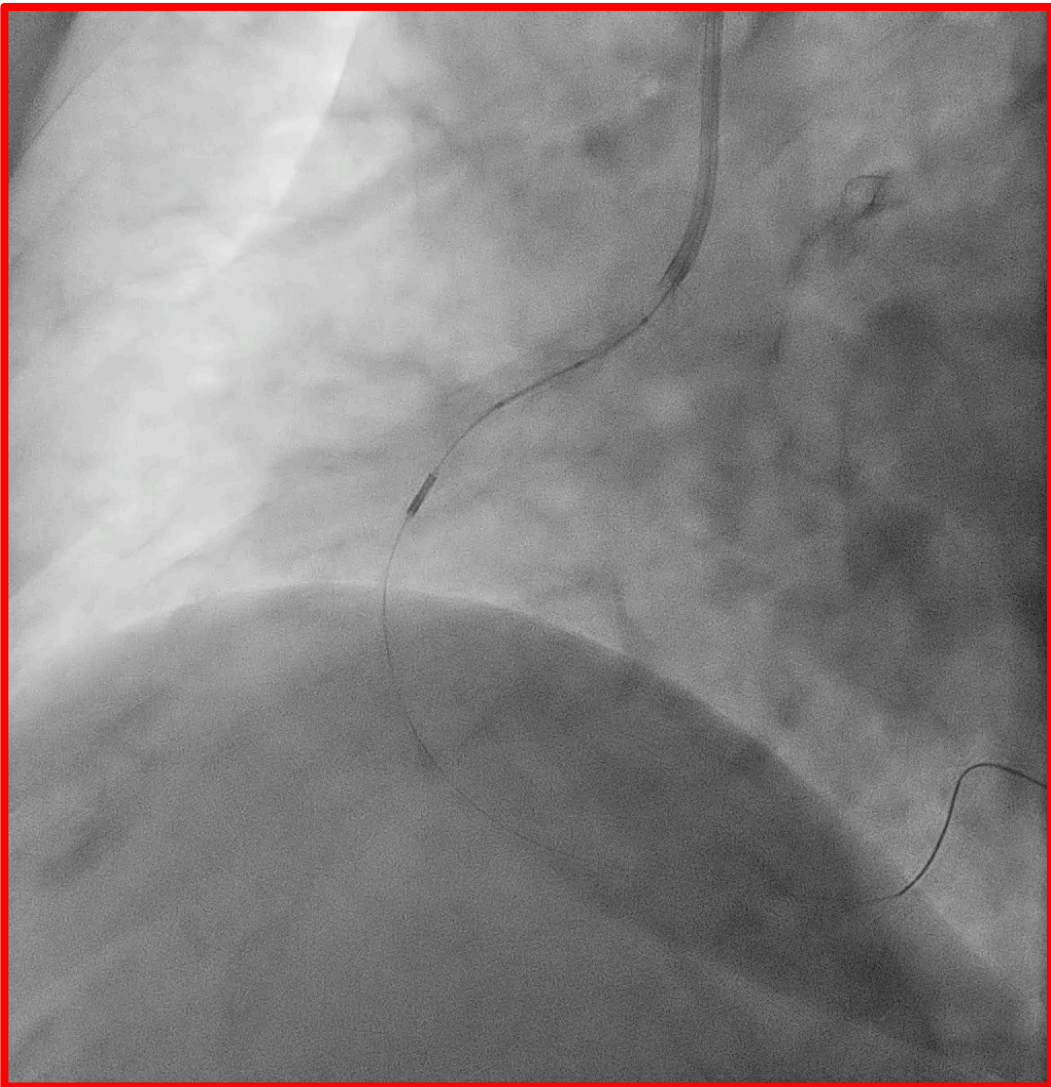
after LASER
Plaque debulking
Plaque modification

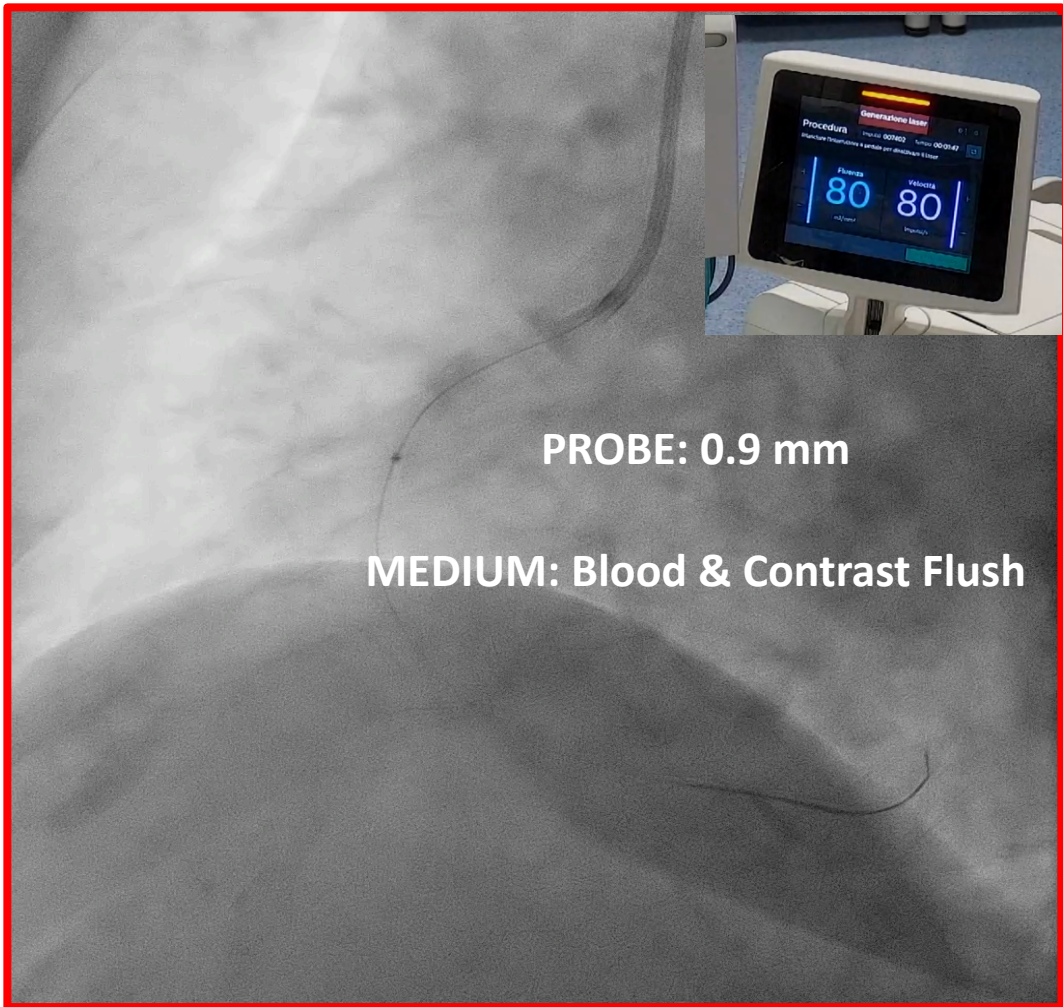




Predilation with NC 2.5 mm balloon



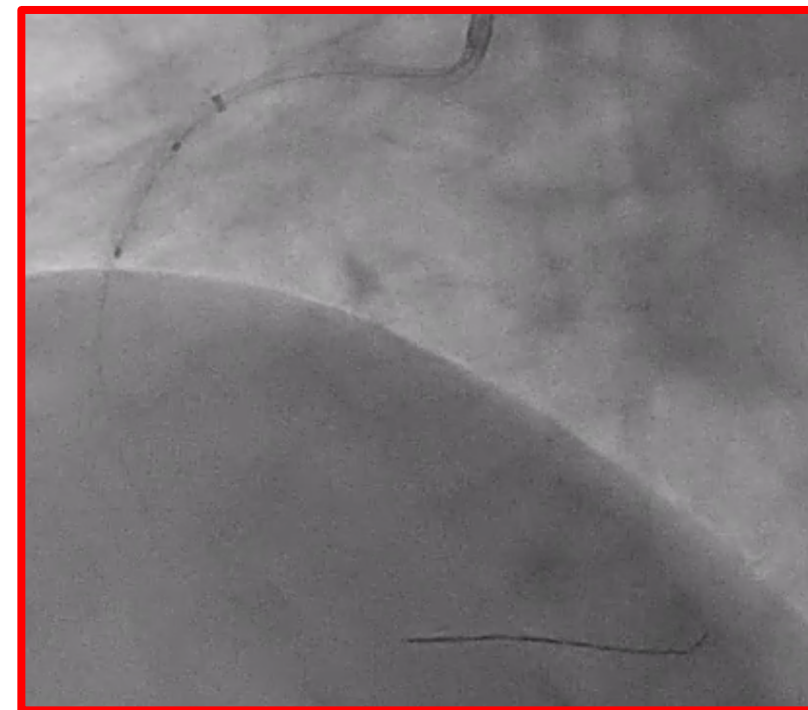
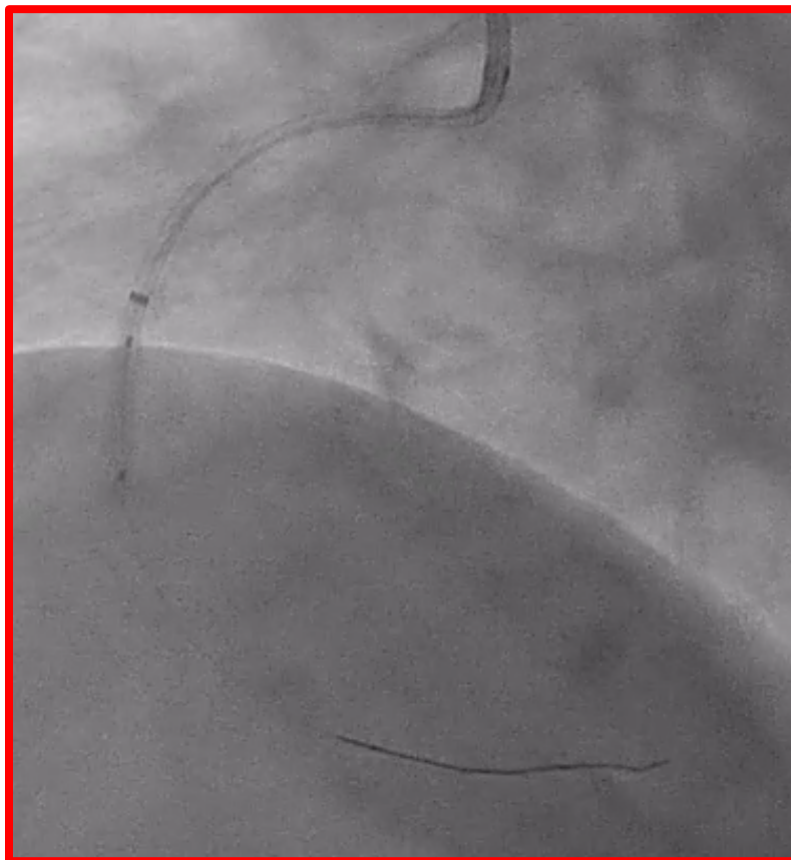
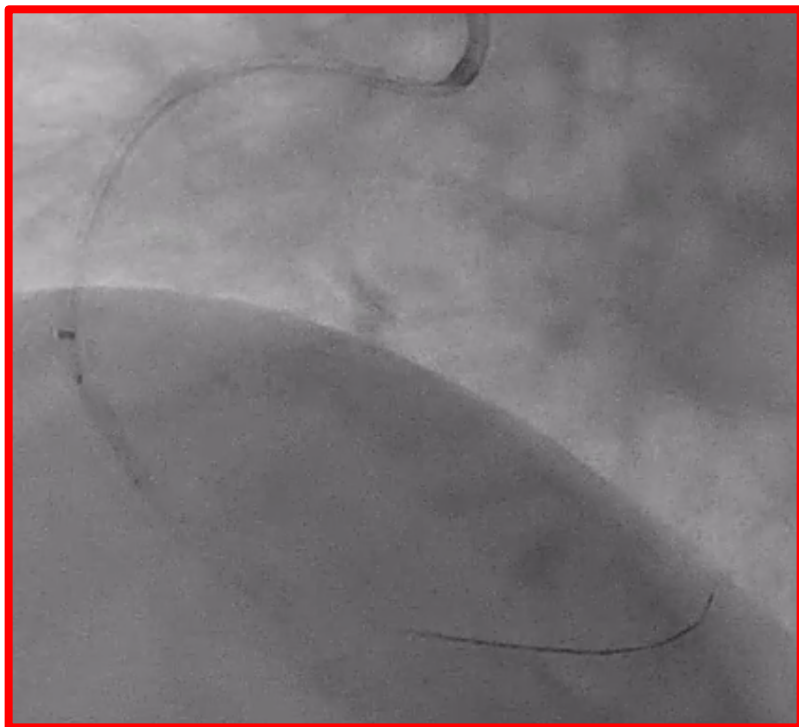




LITHIX-IVL
3.5 mm

8 atm





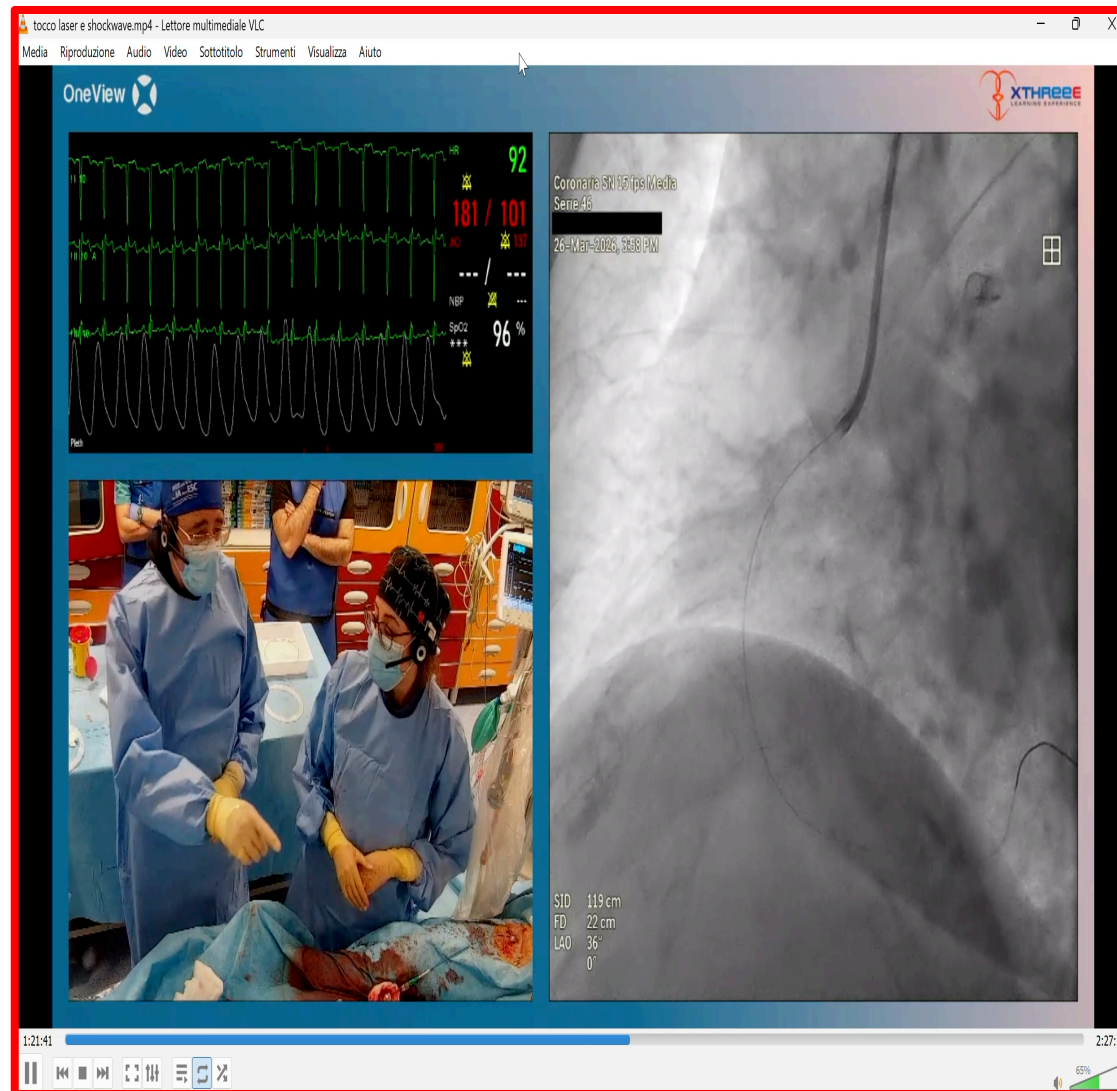
LITHIX - IVL 3.5 mm at 6 atm



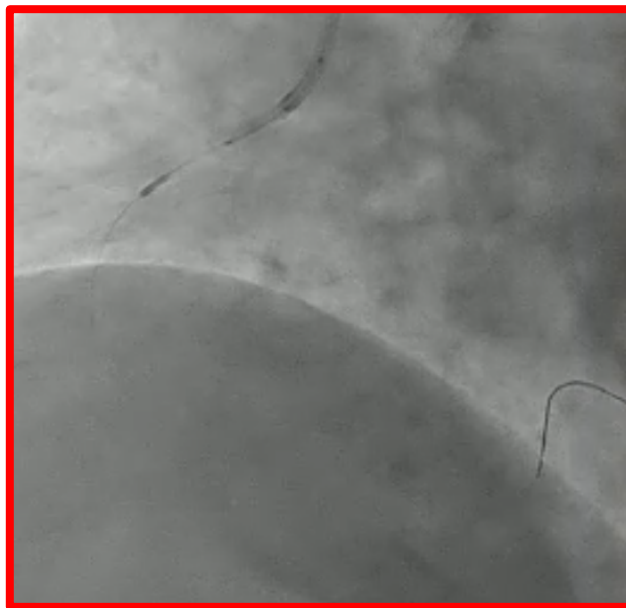
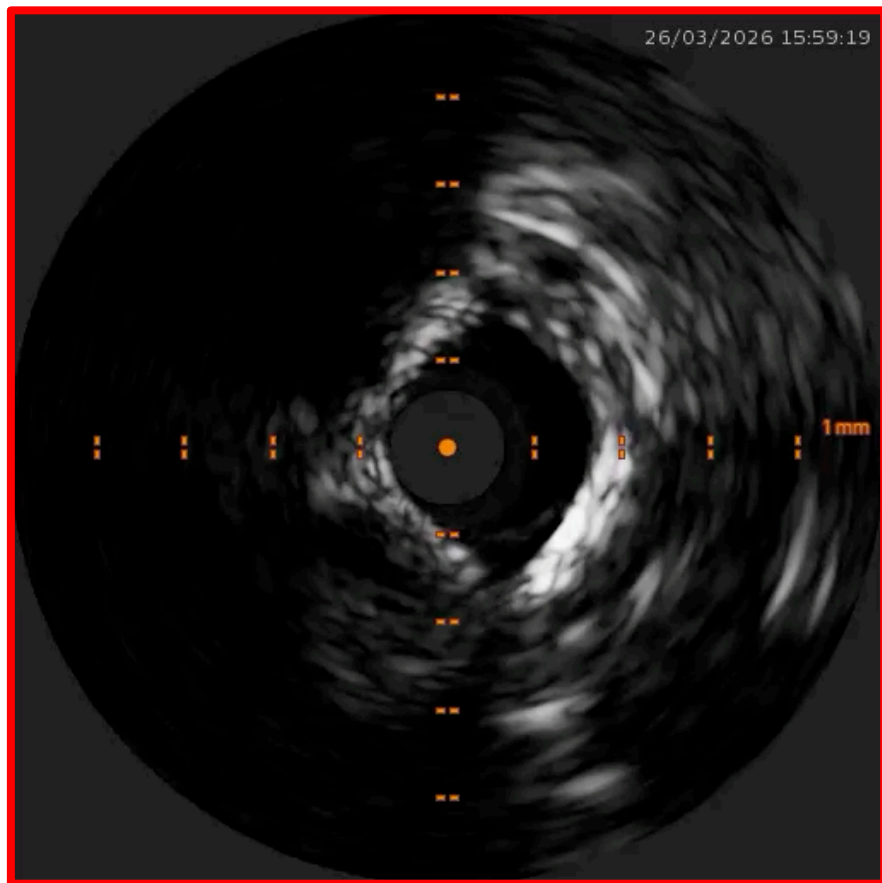
ANGIOGRAPHIC RESULT

after **LAS(er)(lith)IX**

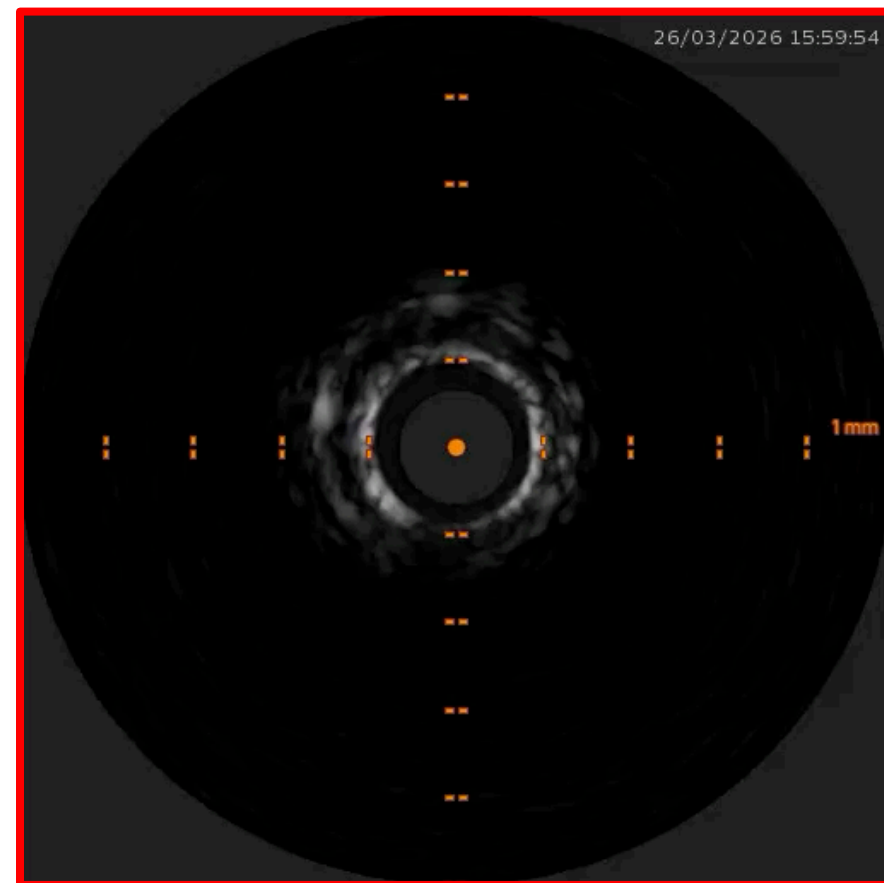
Plaque debulking
Plaque modification

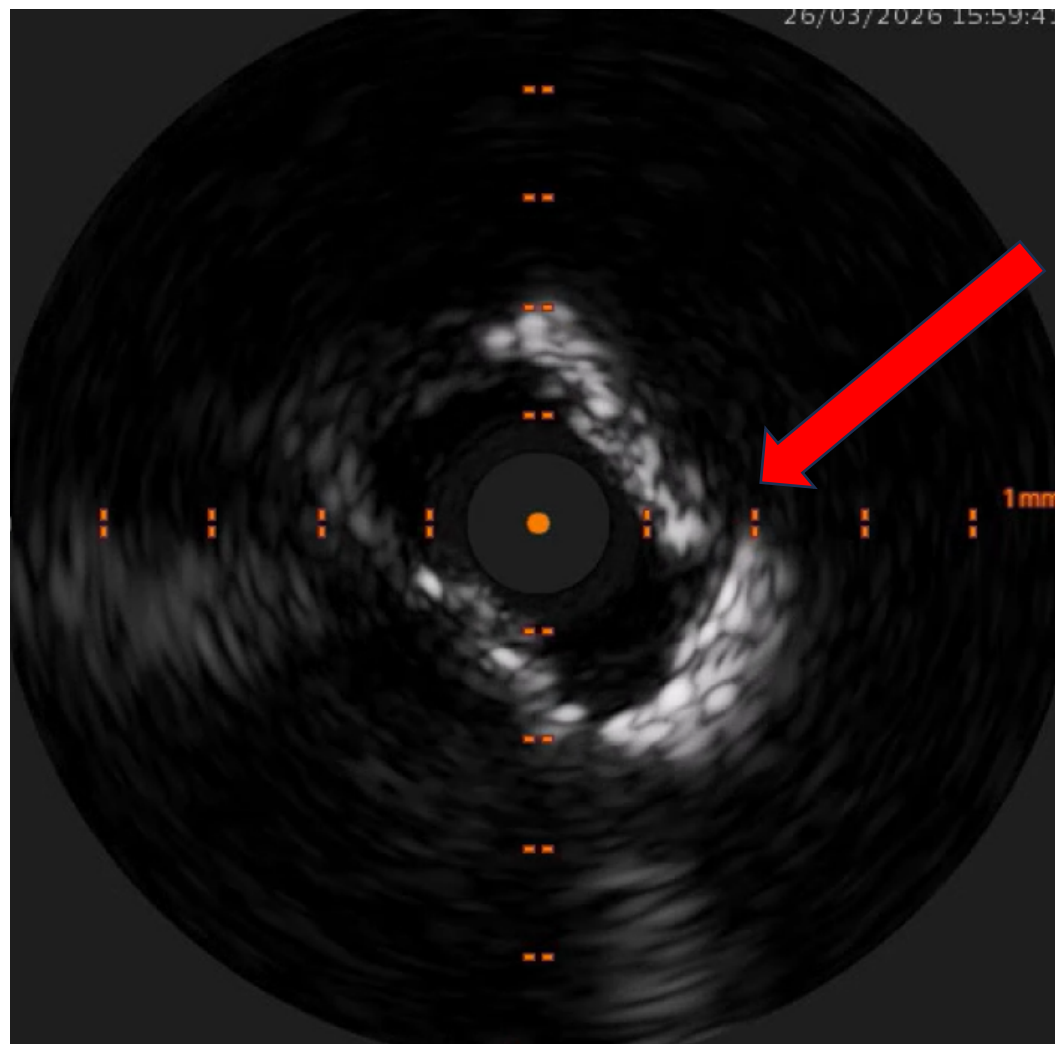


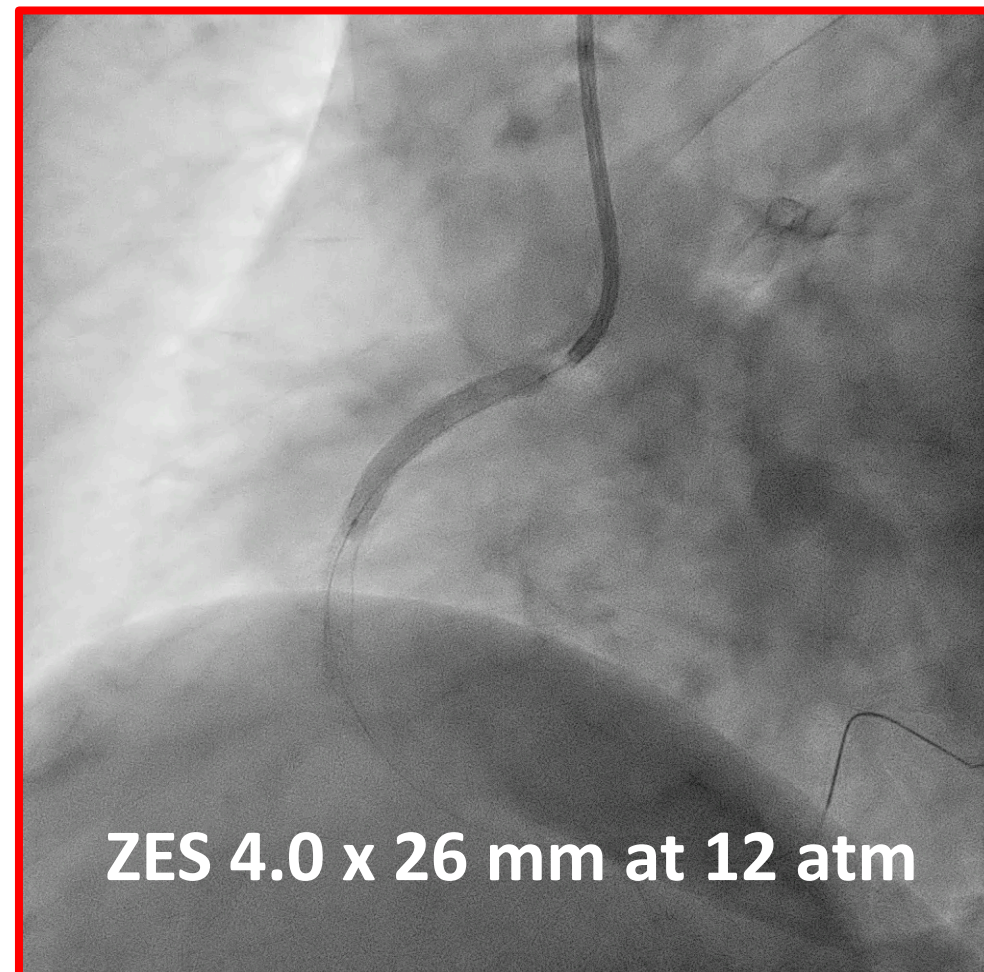
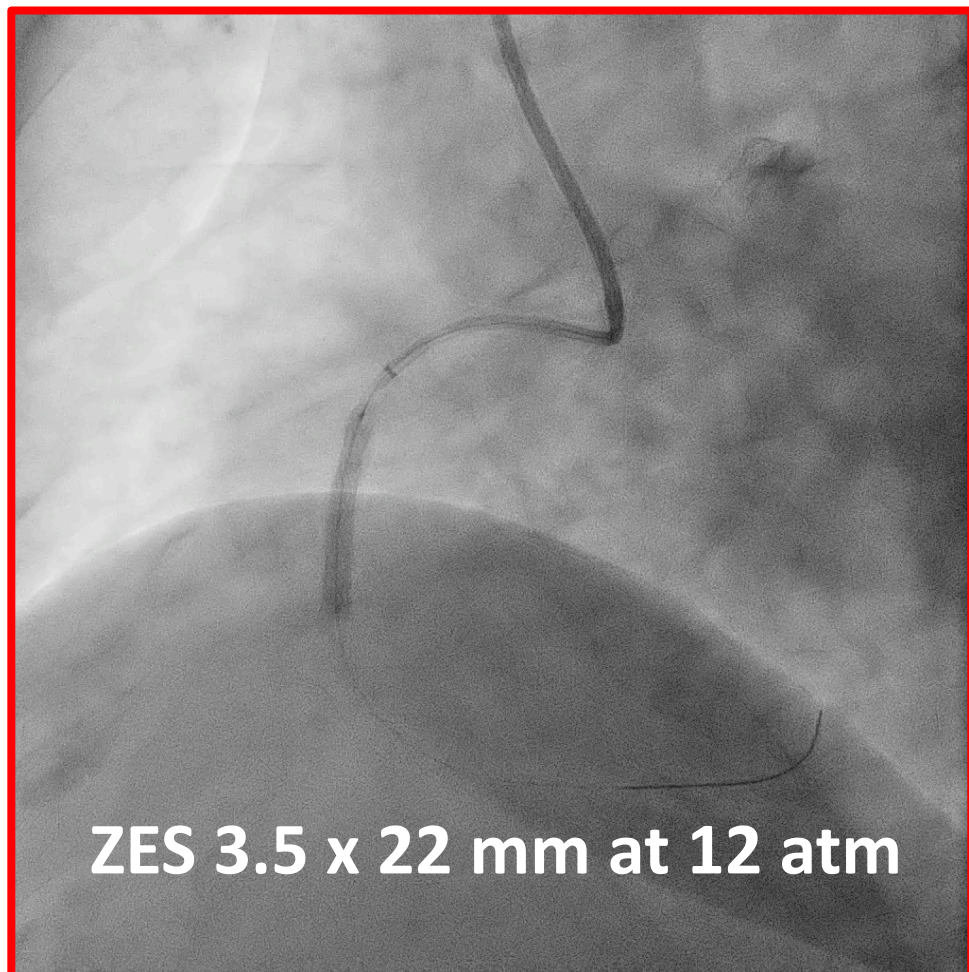
PULLBACK RUN



ANTEGRADE ADVANCEMENT

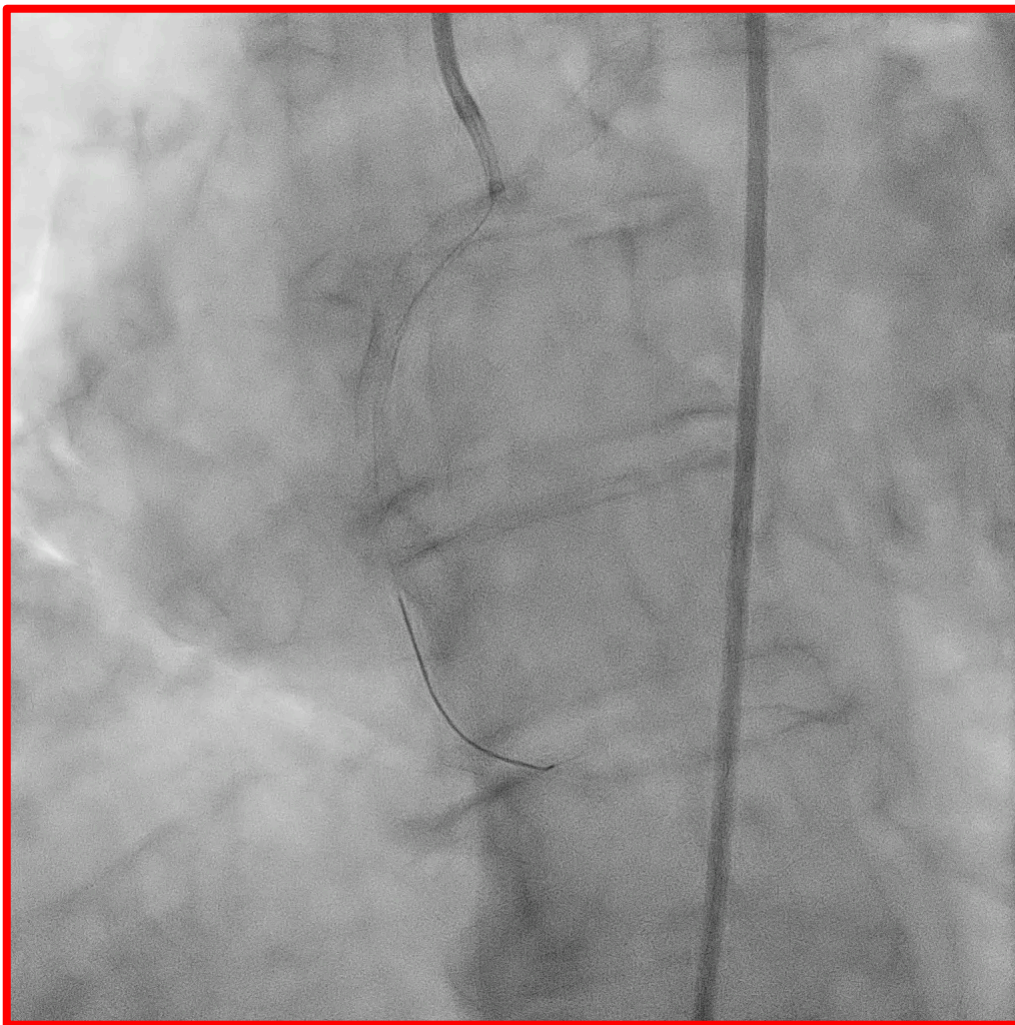






NC 4.5 mm at 20 atm





FINAL IVUS

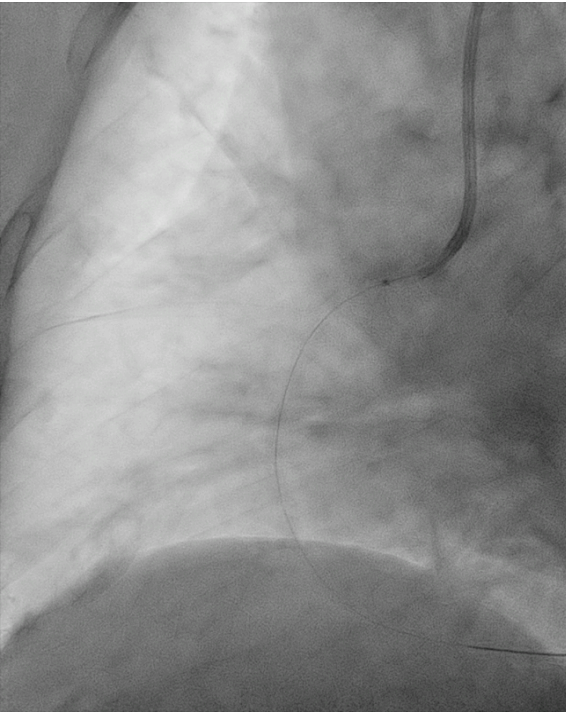
90% stent expansion



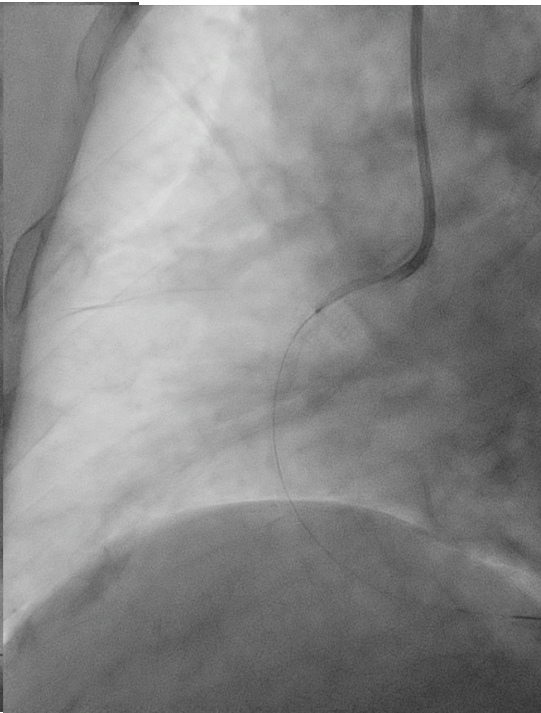
STEP 1

LESION PREPARATION BY PLAQUE DEBULKING AND MODIFICATION
WITH ELCA (BLOOD) AND NC BALLOON IVUS GUIDED

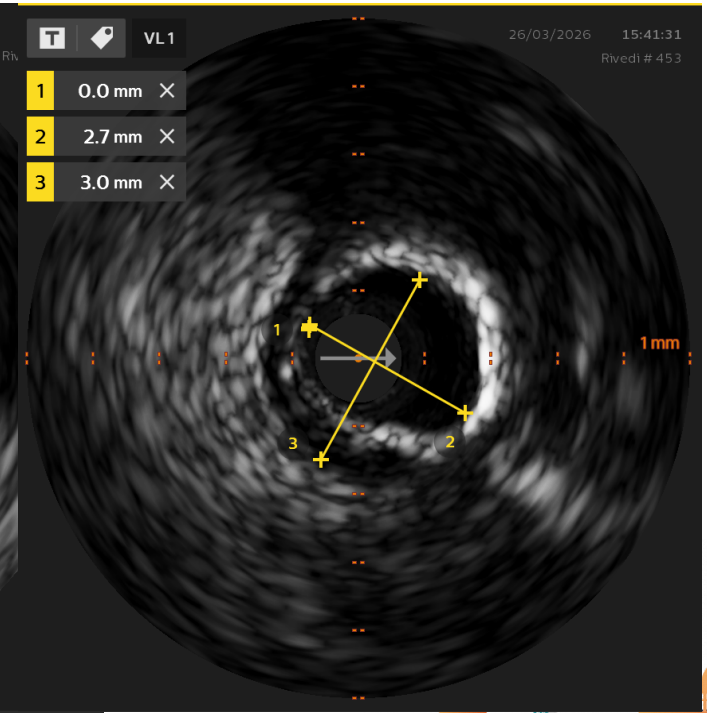
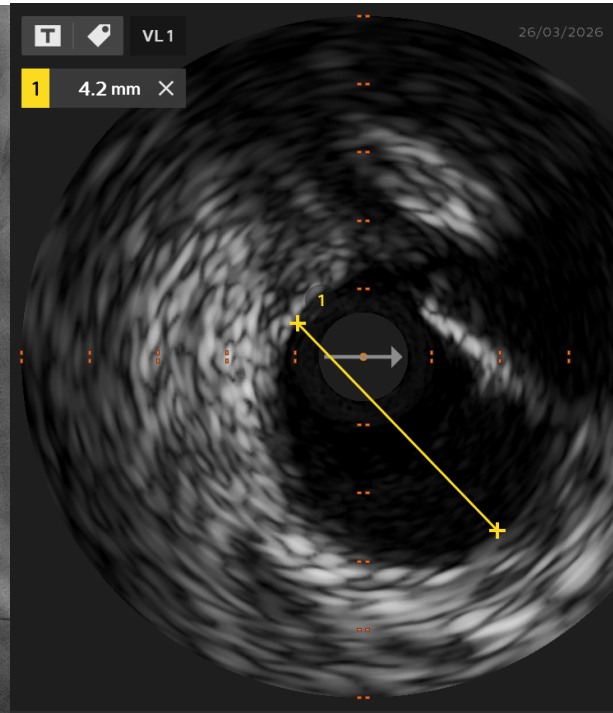
ELCA 80/80



NC 2.5 MM



IVUS ON RCA OSTIAL CALCIFIC NODULE



Light that opens the door.

ELCA — Excimer Laser Coronary Atherectomy.



How it works

308-nm pulsed ultraviolet light vaporizes plaque at the catheter tip. Photo-thermal, photo-mechanical, and photo-chemical effects combine — ablating fibro-calcific tissue, disrupting micro-thrombi, and creating a working channel where balloons could not pass.

Best uses

- Uncrossable / undilatable lesions
- Under-expanded stents (rescue)
- Thrombus-laden ACS substrates
- Ostial calcific nodules with eccentricity



Practical parameters

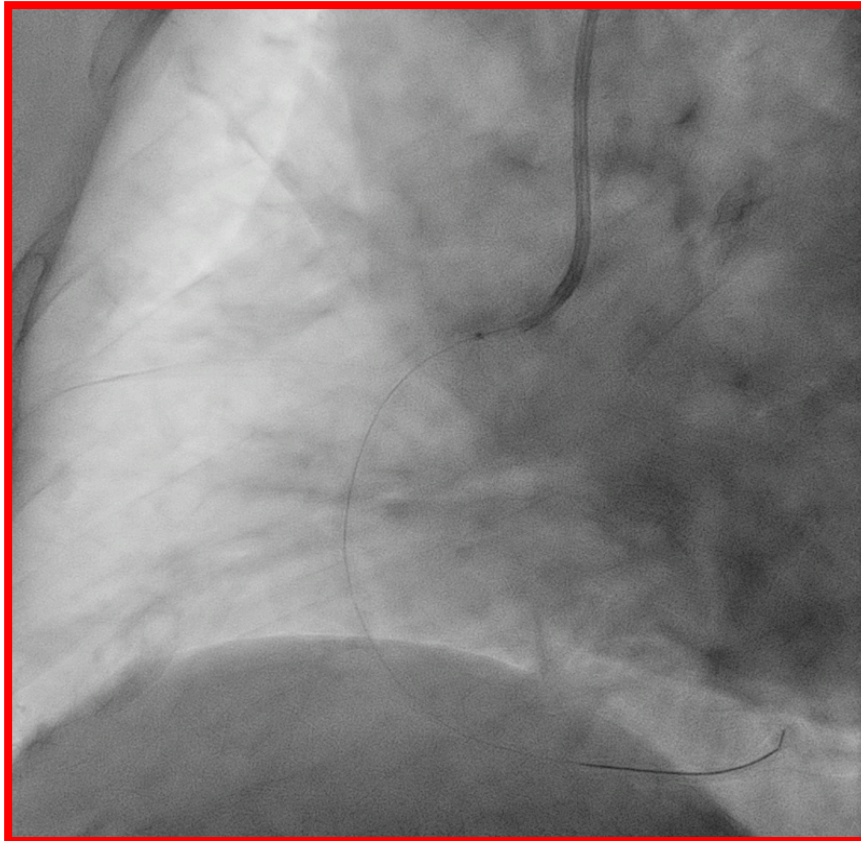
Setting	Calcified lesion	Under-exp. stent
Fluence (mJ/mm ²)	60 → 80	80
Frequency (Hz)	40 → 80	80
Contrast flush	saline	Contrast flush (controlled)



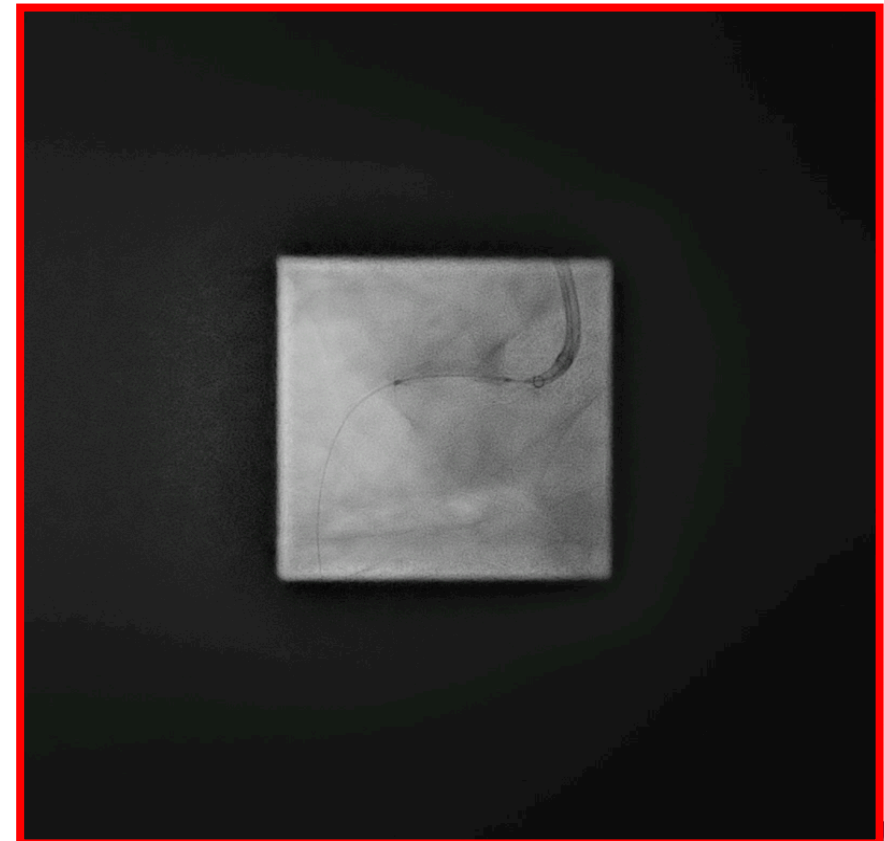
STEP 2

OPTIMIZATION OF PLAQUE MODIFICATION AND LESION PREPARATION BY SECOND ELCA CYCLE (BLOOD+FLUSH CONTRAST) AND LITHIX WITH 3.5 BALLOON

ELCA 80/80



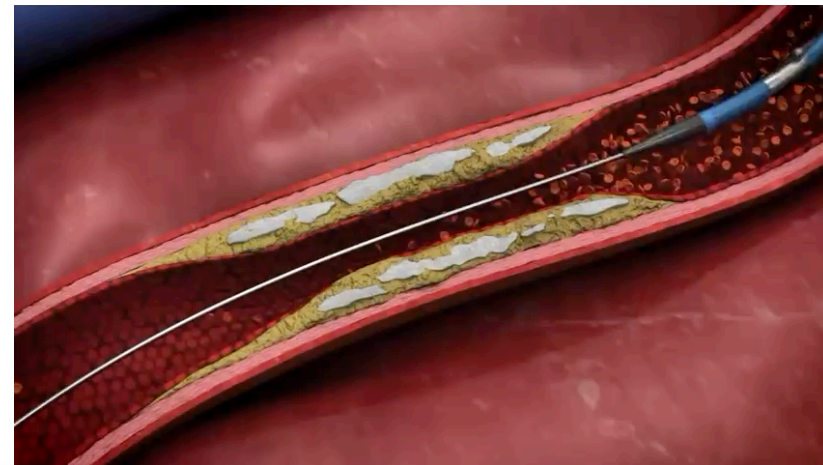
LITHIX 3.5 MM at 8 atm



So we built one.

The LASIX strategy.

LASer + lithIX — layered modification of the ostial calcific nodule.



L

LIGHT

Excimer laser ablates the nodule and creates a working channel.

A

ASSESS

Re-image with IVUS — reassess calcium, surface, dissection.

S

SHOCK

IVL (Lithix-class) fractures residual deep + superficial calcium.

I

INSPECT

Final IVUS confirms expansion-ready substrate. No residual nodule.

X

EXPAND

DES deployment + post-dilation with NC balloon. Image-verified MSA.

Considerazioni fisiche sull'equivalenza del Lithix vs. Shockwave

LITHIX™ È IL PRIMO SISTEMA IVL A CONTATTO HERTZIANO NON BASATO SU ENERGIA.

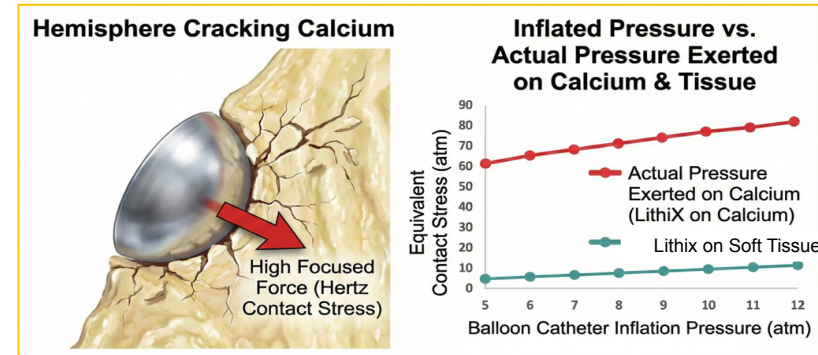
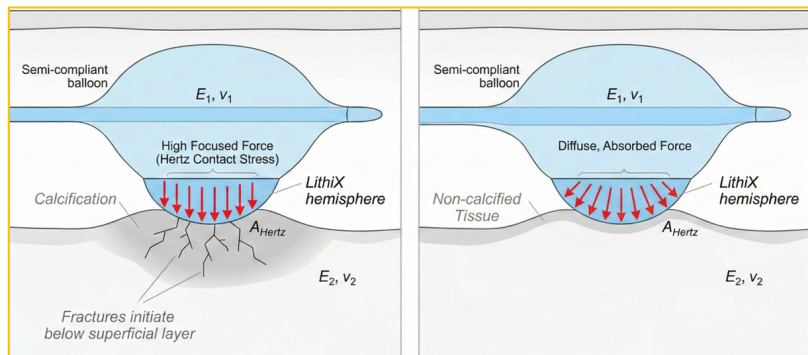
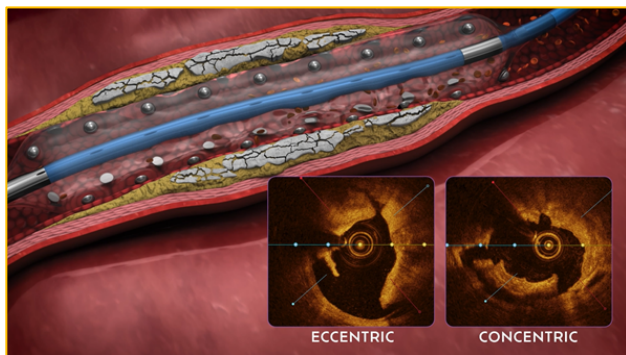
FORNISCE UN'EFFICACE FRATTURA DEL CALCIO ATTRAVERSO IL PURO PRINCIPIO FISICO DELLO STRESS DA CONTATTO DI HERTZ, ELIMINANDO LA NECESSITÀ UTILIZZARE UNA FONTE DI ENERGIA ESTERNA.

SCOPERTA DA HEINRICH RUDOLF HERTZ (1857-1894), QUESTA TEORIA RAPPRESENTA IL FONDAMENTO DEL MODERNO CAMPO DELLA MECCANICA DEL CONTATTO:

QUANDO UN CORPO CURVO CON UNA PICCOLA AREA DI CONTATTO PREME CONTRO UN MATERIALE MOLTO PIÙ DURO, CON ALTO MODULO DI ELASTICITÀ, LA REGIONE DI CONTATTO SPERIMENTA STRESS LOCALIZZATI MOLTO ELEVATI; AL CONTRARIO, UNA SUPERFICIE PIÙ COMPLIANTE (A BASSO MODULO DI ELASTICITÀ) NON MOSTRA LA STESSA AMPLIFICAZIONE DELLO STRESS.

CON BASSA PRESSIONE DI GONFIAGGIO DEL PALLONE, TRA 5 E 12 ATM, LE EMISFERE GENERANO STRESS FOCALI LOCALIZZATI DISCRETI NEL CALCIO, AMPLIFICATI FINO A 60-80 ATM, PROVOCANDO FRATTURE.

IL TESSUTO NON CALCIFICATO A BASSO MODULO DI ELASTICITÀ SPERIMENTA LA STESSA FORZA DELLA PRESSIONE DEL PALLONE, OVVERO DA 5 A 12 ATM (ATRAUMATICO).



Source: Pinnacle I - data on file

Five things to carry home.

If you remember nothing else from this presentation.....

01

Calcium is a prognosis, not a finding.

Treat it that way from the moment you see the angiogram.

02

Image first. Then choose.

OCT or IVUS dictates the tool. Operator preference is a bias, not a strategy.

03

Debulking and modification are partners, not rivals.

Layered strategies outperform any single tool — especially in nodules.

04

Earn the stent.

Pre-stent under-expansion is the single largest predictor of every late event.

05

LASIX is a sequence, not a recipe.

Each step earns the next. Skip Assess or Inspect at the patient's expense.



THANK YOU FOR YOUR ATTENTION

