

# How to treat Heavily Calcified lesions PCI

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No conflicts to disclose

In AVIO Trial (IVUS guided PCI, AHJ, 2013, A. Chieffo )  
the Investigators where not able to achieve optimal  
stent expansion in about 40% of the lesions

The technologies to treat calcified  
and fibrotic lesions were not  
present or not fully utilized

# Approach to calcified lesions

High pressure balloon

Rotablator/Orbital Atherectomy

Angiosculpt/Cutting balloon inflated at 20 atm

Shockwave balloon

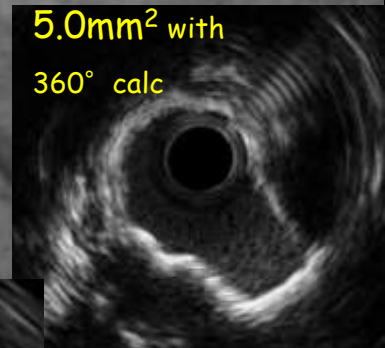
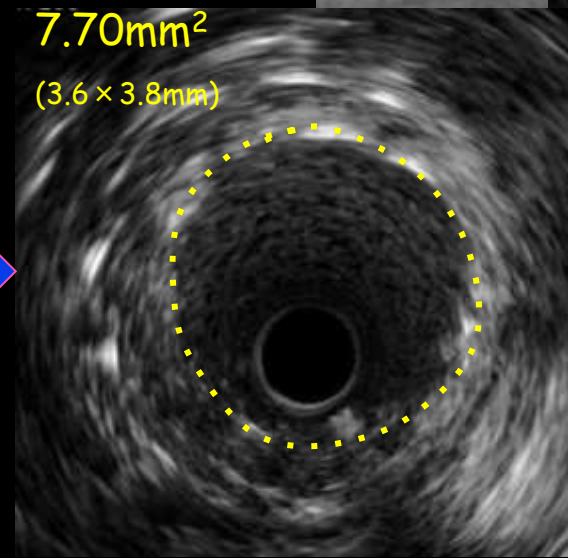
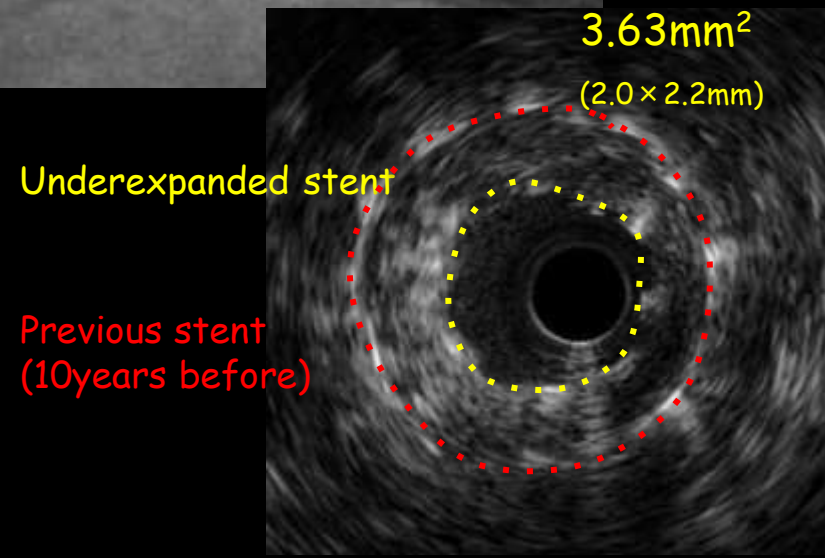
Laser

Post-NC3.0mm20atm

Not always effective

Post-OPN  
3.5mm40atm

**OPN NC® Super High Pressure PTCA Balloons**  
Highest rated burst pressure of 35 bar

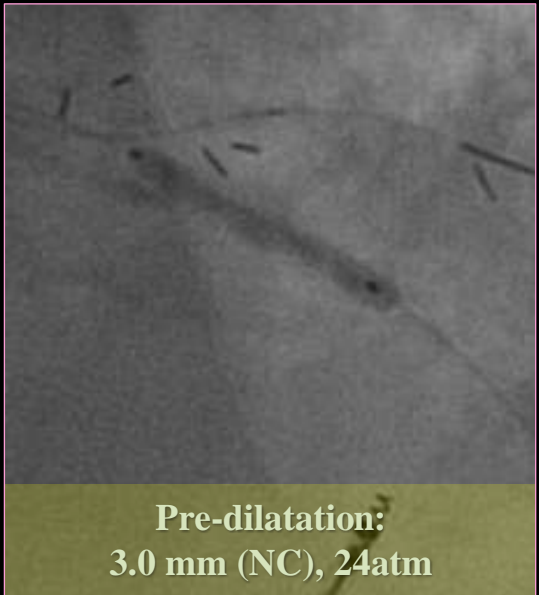


# Rotablation and NC Balloon

## Cutting Balloon when needed



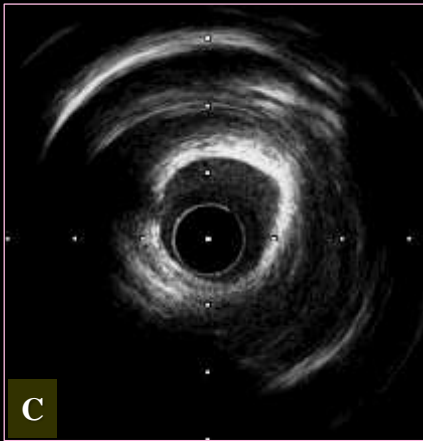
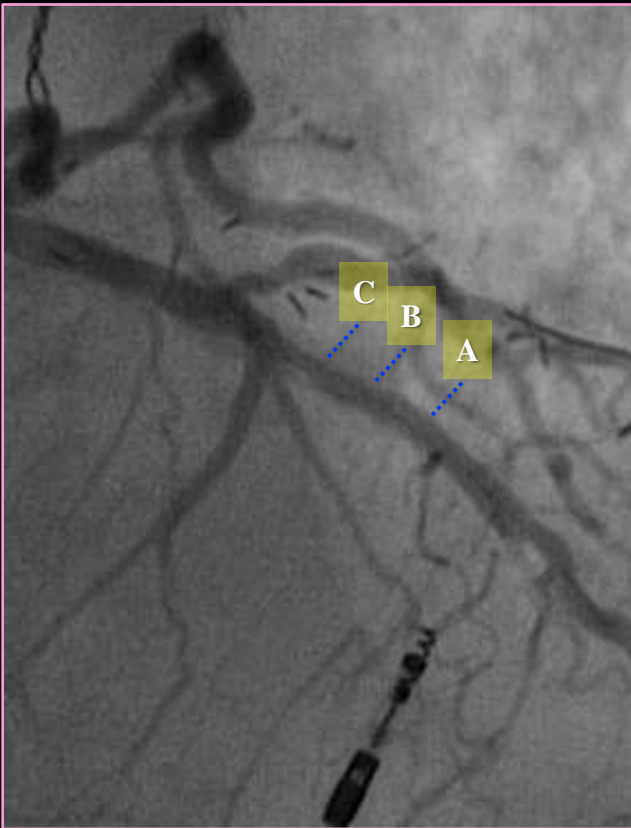
Rota burr (1.75 mm) successfully crossed the lesion.



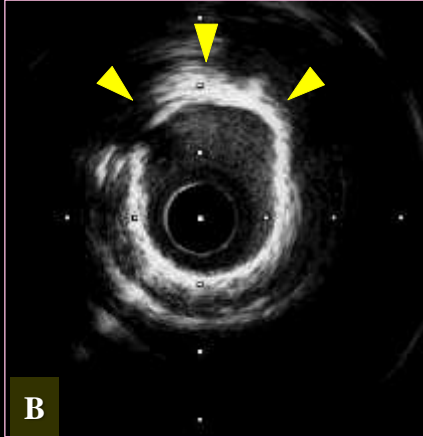
Subsequent pre-dilatation with 3.0 mm NC balloon at high pressure (24atm)

→ The lesion could not be expanded sufficiently.

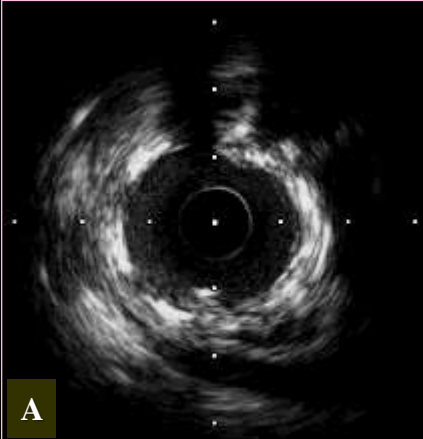
### IVUS findings after rotational atherectomy



- ✓ Circumferential calcification
- ✓ MLA  
2.51 mm<sup>2</sup> (1.71/1.88 mm)



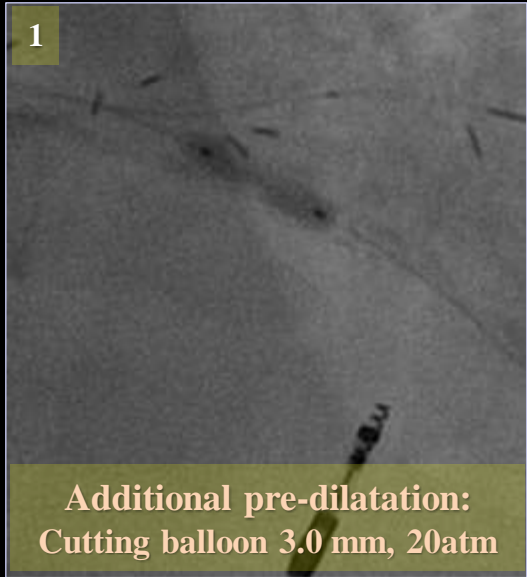
- ✓ Circumferential calcification
- ✓ Evidence of debulking by rotational atherectomy



- ✓ Previous stent
- ✓ Lumen area  
4.64 mm<sup>2</sup> (2.43/2.58 mm)



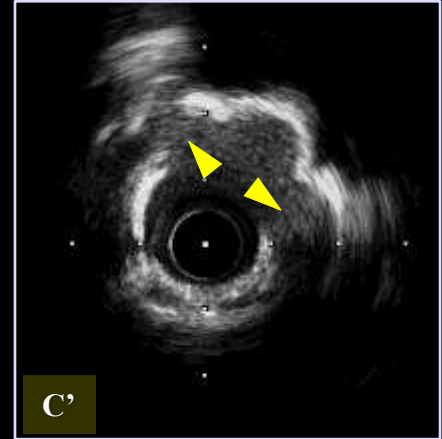
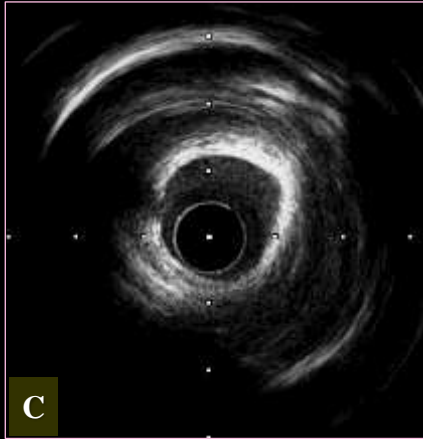
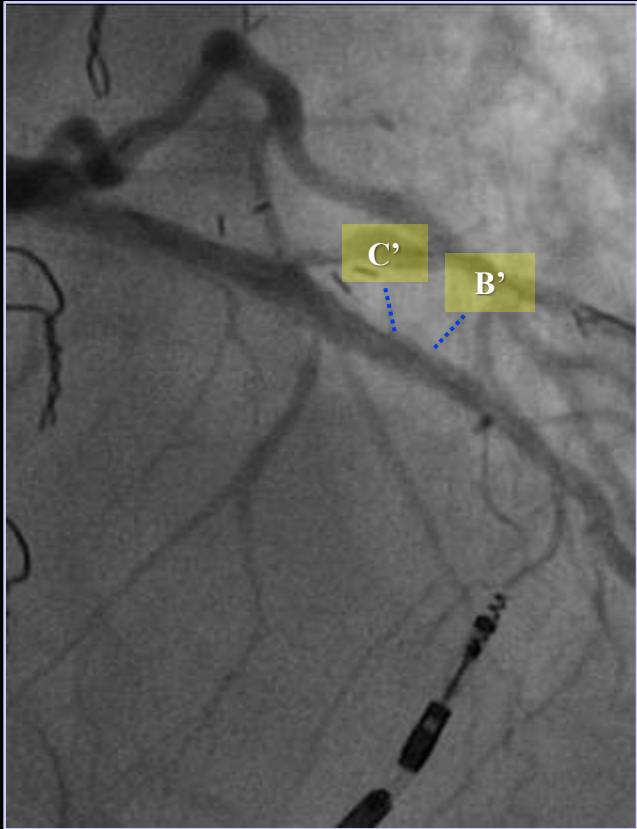
# Additional lesion preparation: cutting balloon



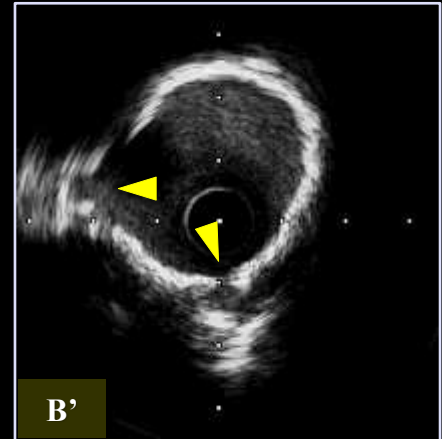
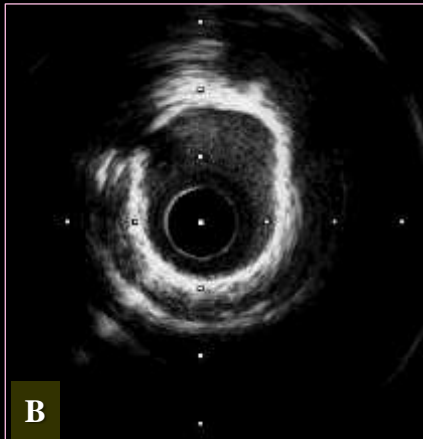
Considering **severely calcified lesions**, pre-dilatation with **cutting balloon at high pressure** was additionally attempted.

➔ **The lesion could be expanded.**

IVUS findings  
after cutting and NC balloons

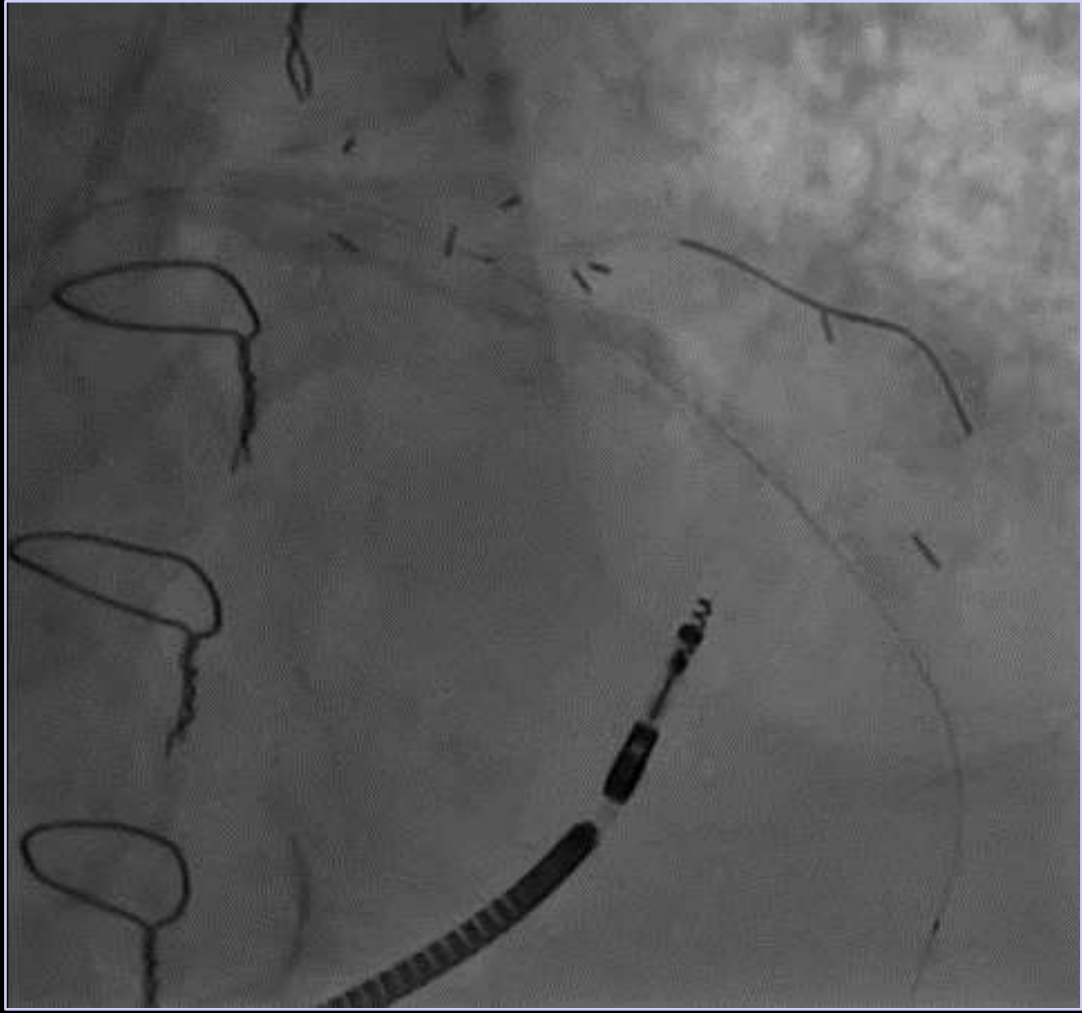


Cracks on the calcification



Before cutting balloon

After cutting balloon  
(+ 3.0 mm NC balloon)



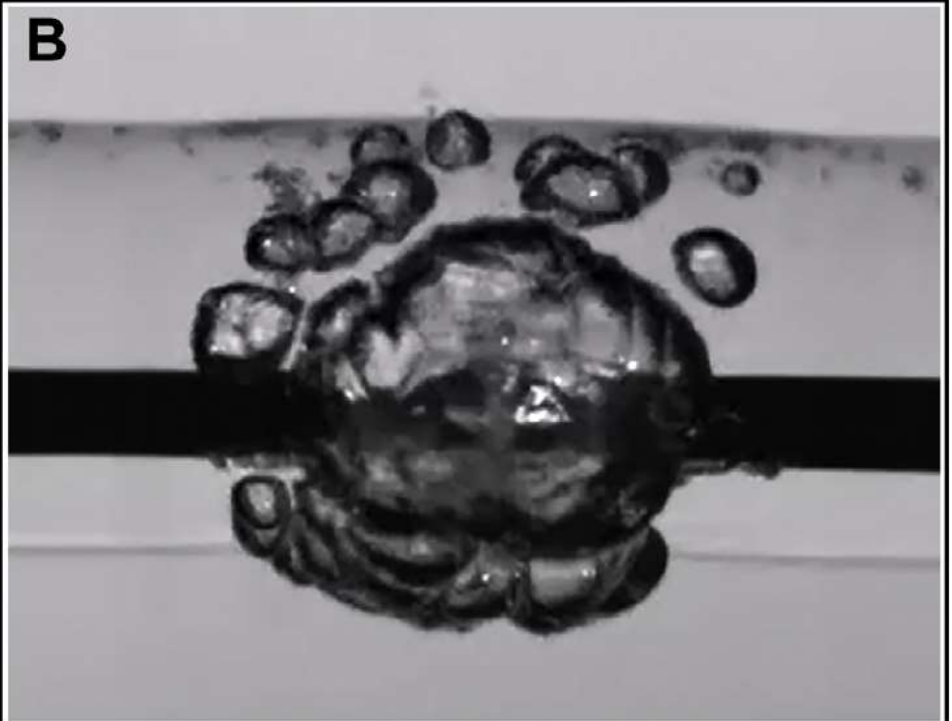
Final angiography: **Excellent angiographic results**

# Shockwave Balloon

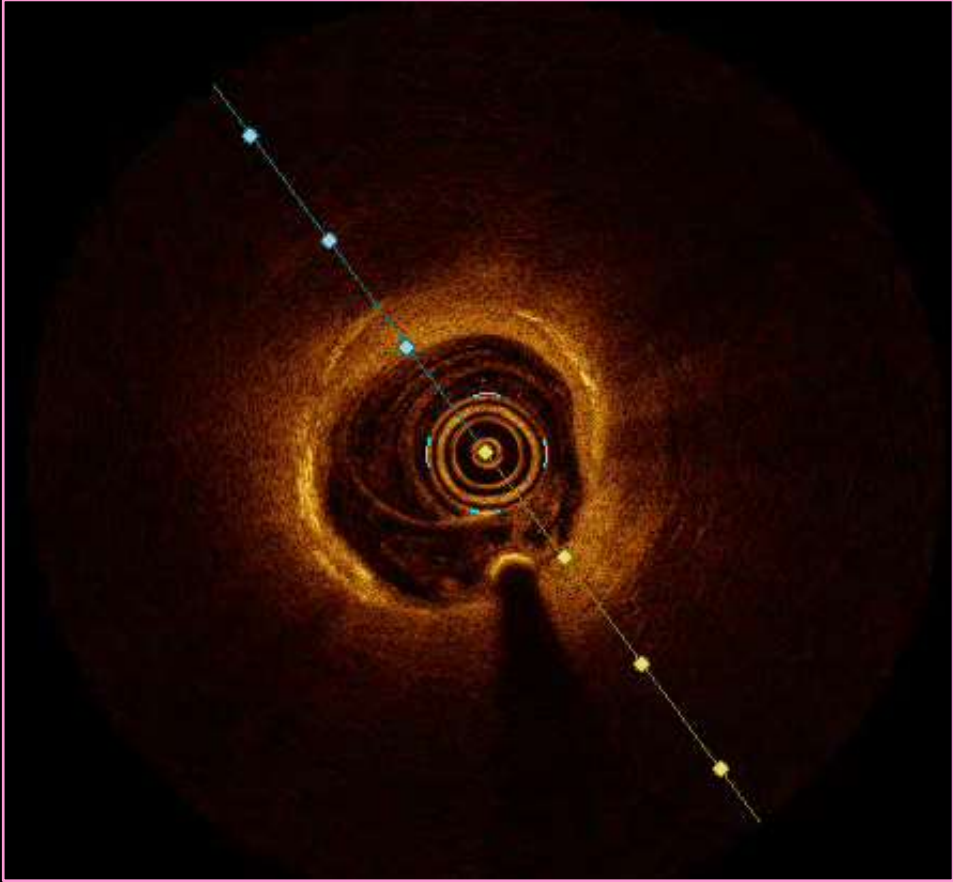
A



B

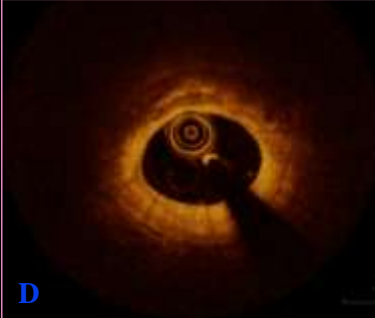
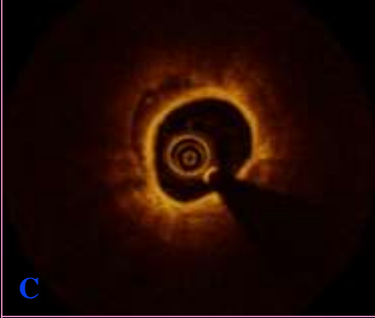
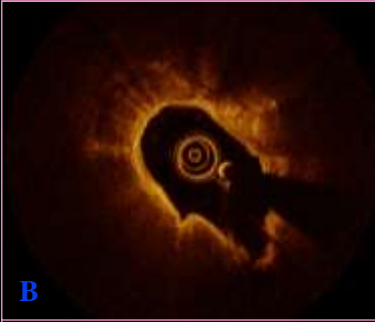
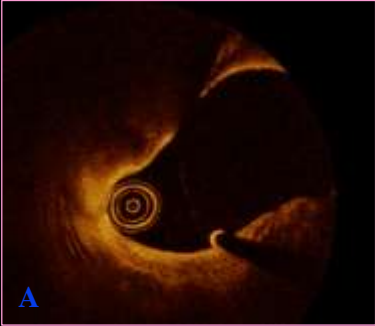
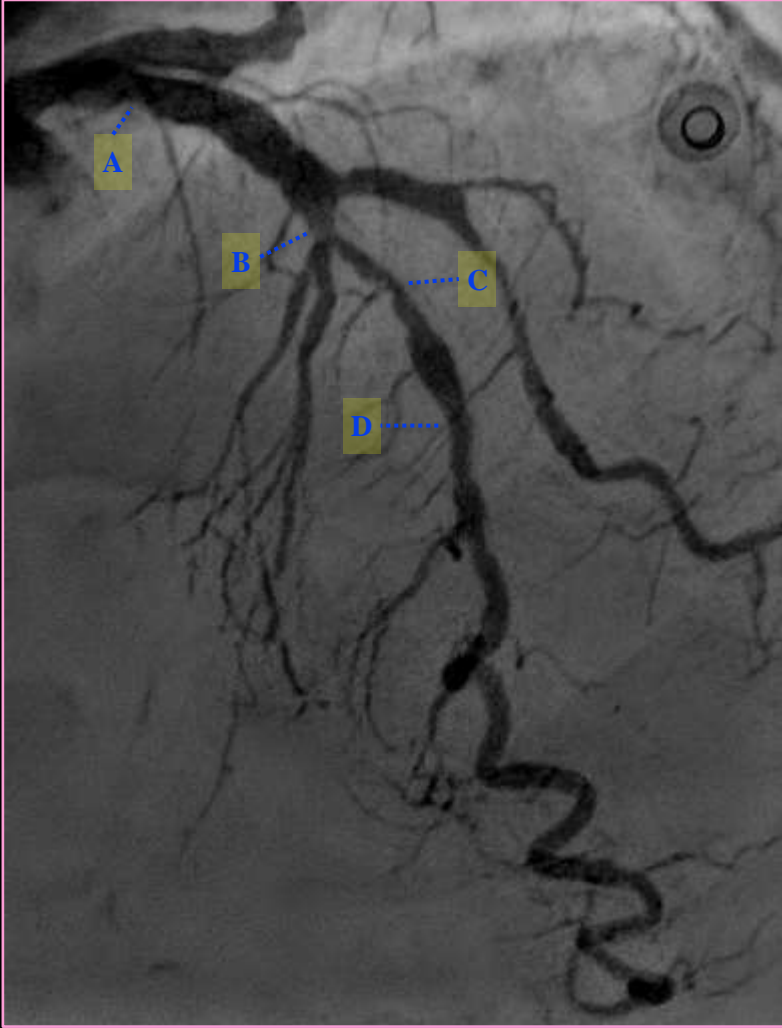


Case 1. diffuse mid LAD lesion



Baseline OCT pullback:  
➔ Diffusely and severely calcified lesion

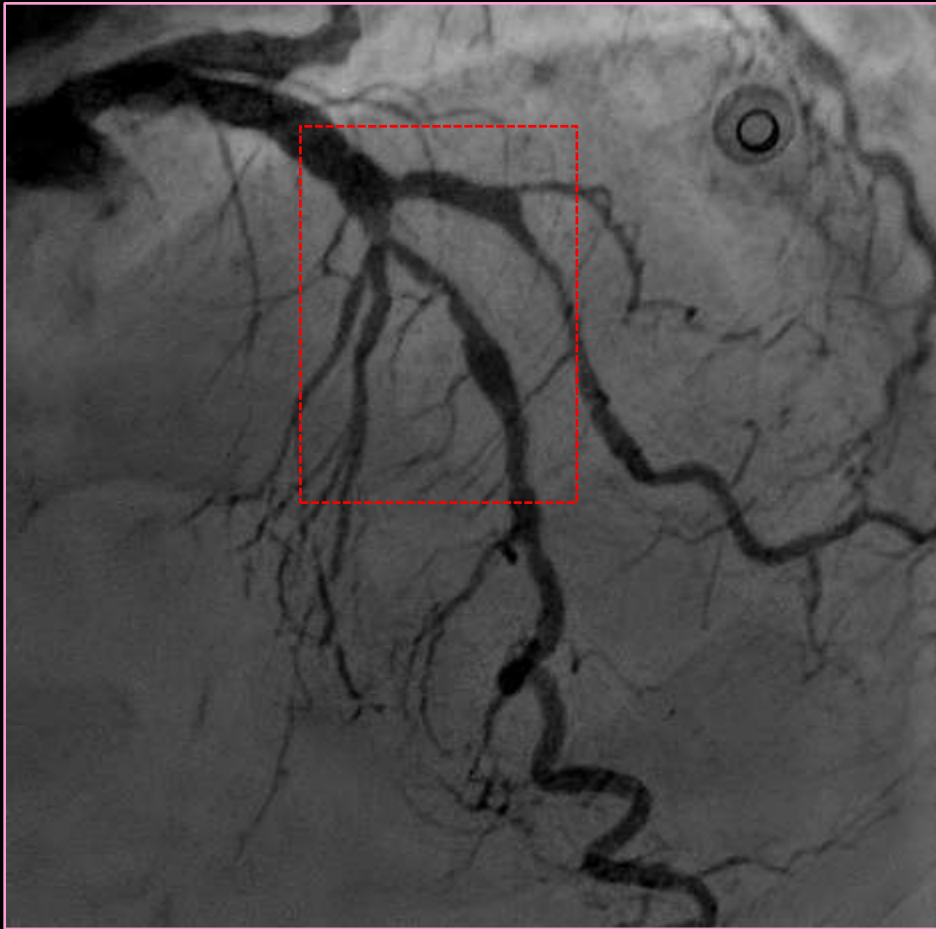
# Case 1. diffuse mid LAD lesion



## Diffusely and severely calcified LAD

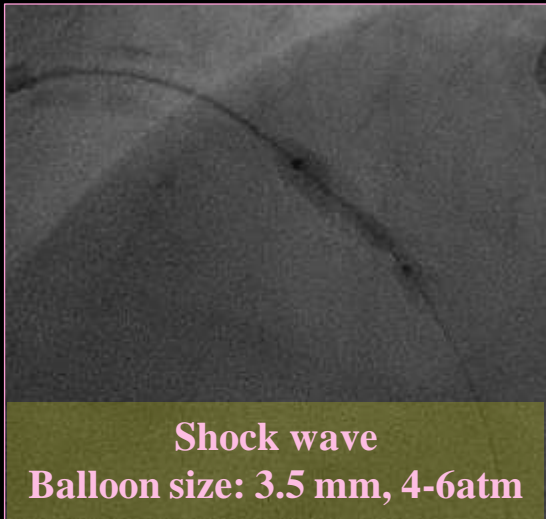
- ✓ Large arc (>180 degrees)
- ✓ Thick calcification

# Lesion preparation with shock wave

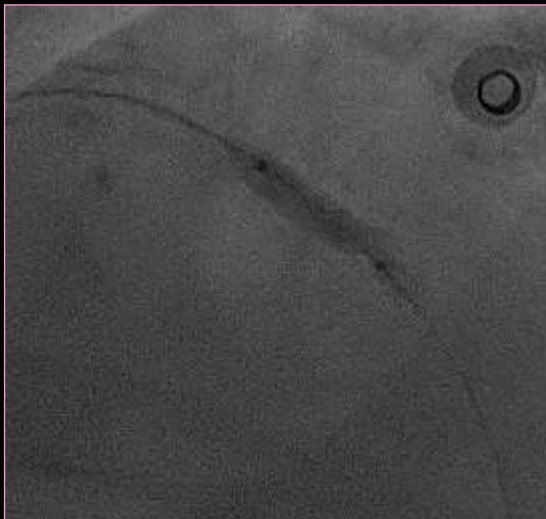


## Lesion preparation with shock wave

Balloon inflation: 4atm (10 sec shock wave)  
⇒ 6atm ⇒ deflation  
(Maximum: 8 sessions/ catheter)

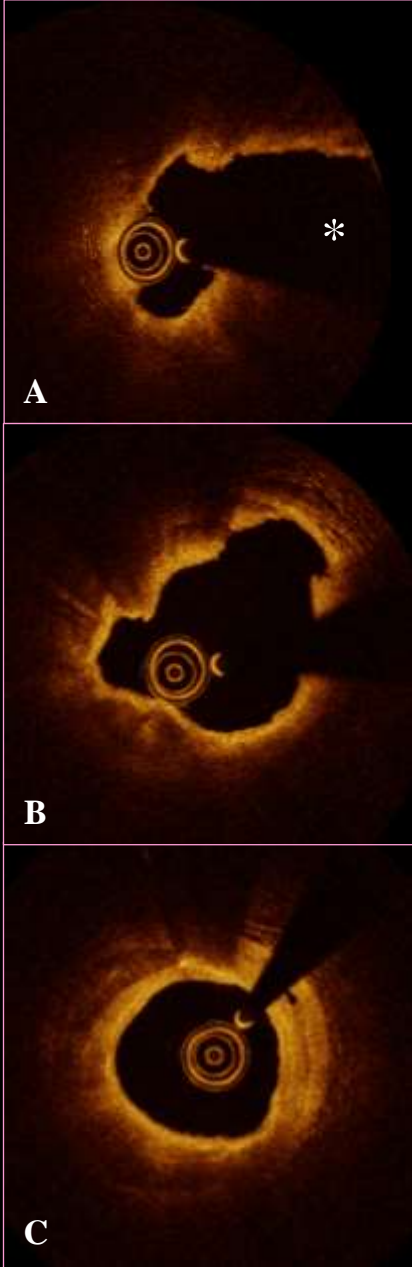
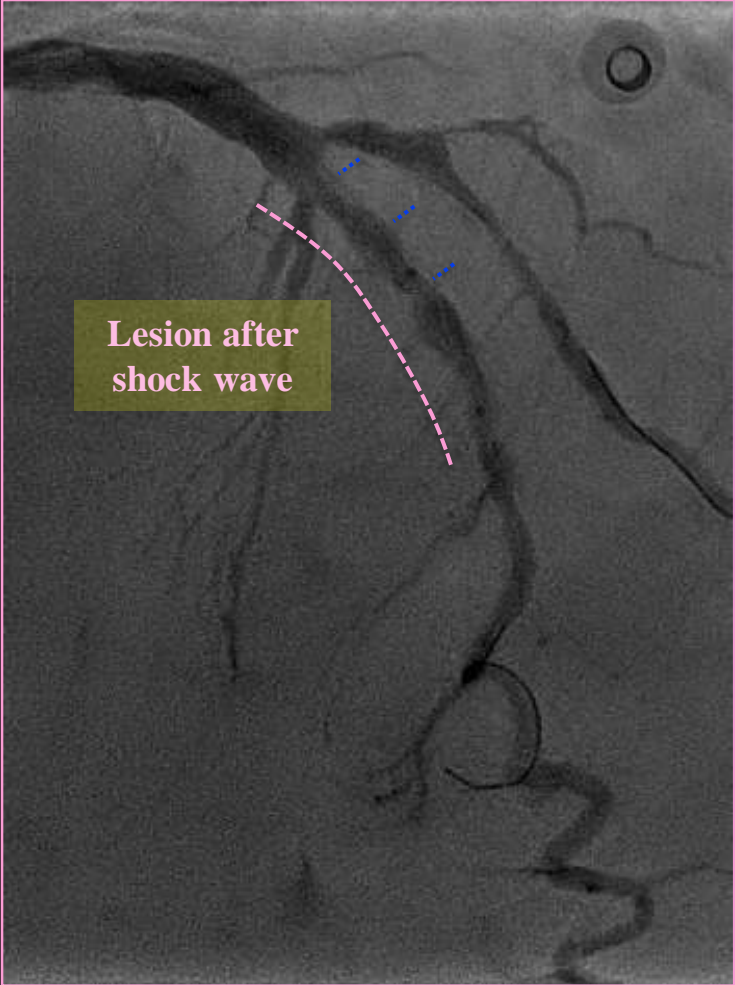


1<sup>st</sup> -3<sup>rd</sup> session: the lesion was undilated



4<sup>th</sup> session: the lesion was dilated

# OCT findings after shock wave



Lesions were expanded;

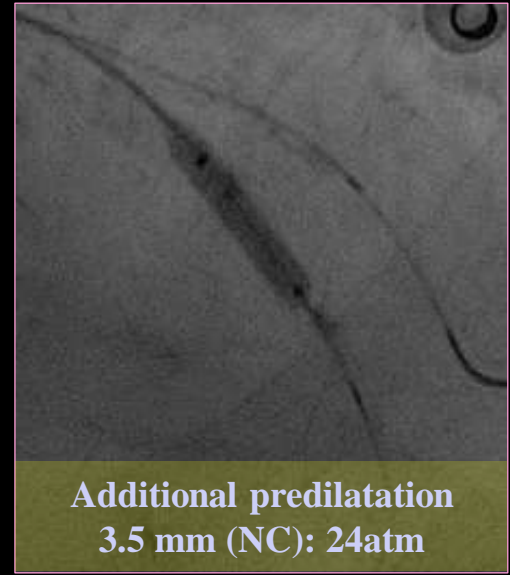
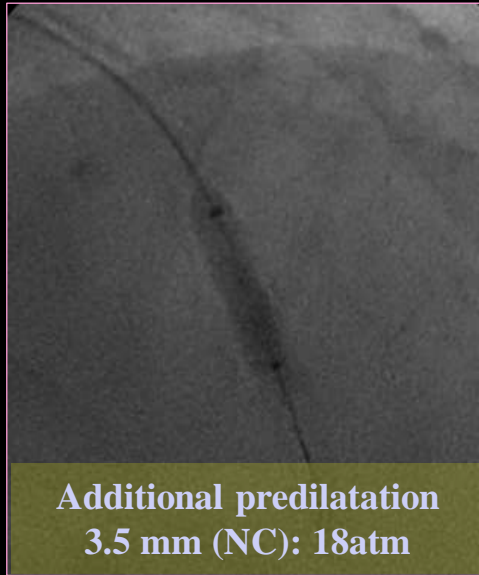
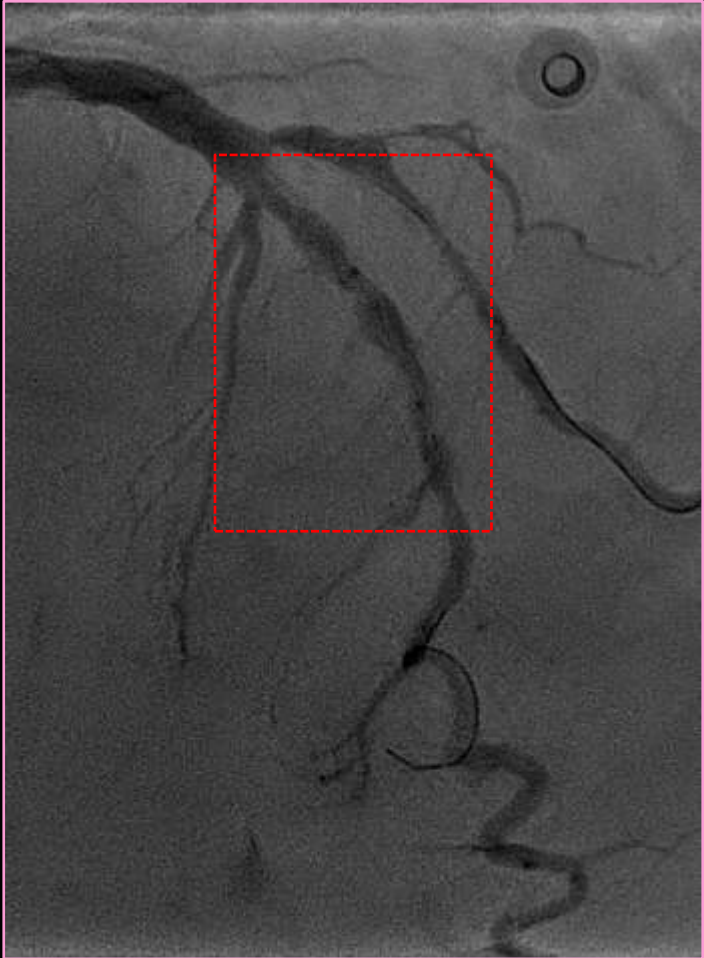
➔ ✓ No obvious cracks of calcification

✓ Dissection around calcifications

A: \* Septal branch



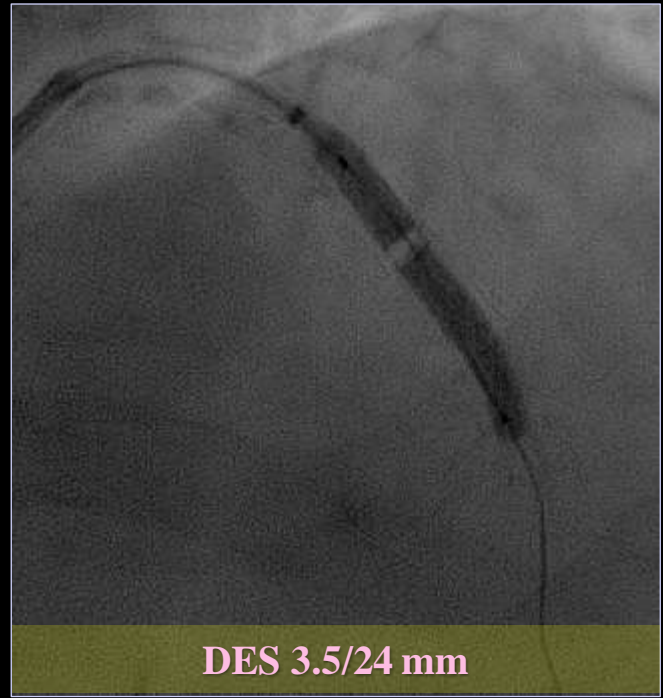
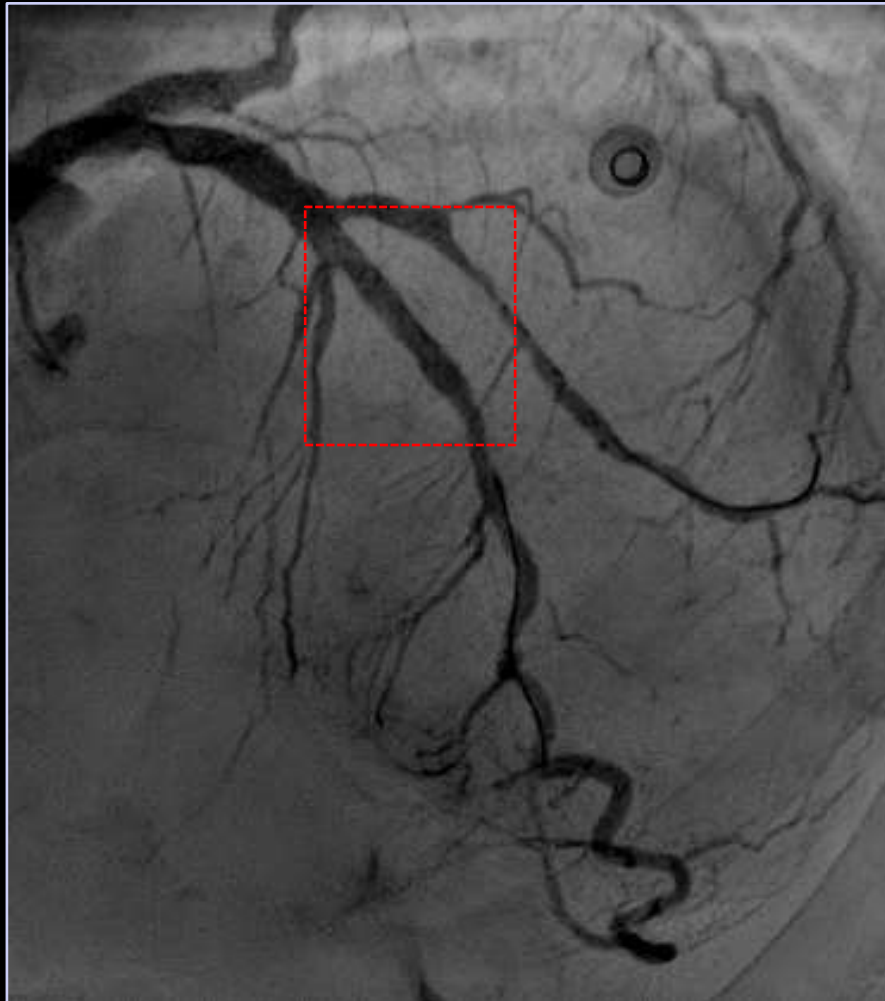
# Additional predilatations after shock wave



Multiple additional predilatations  
for the lesions underwent shock wave

➔ Appropriate lesion expansion

After shock wave  
➔ Additional predilatations

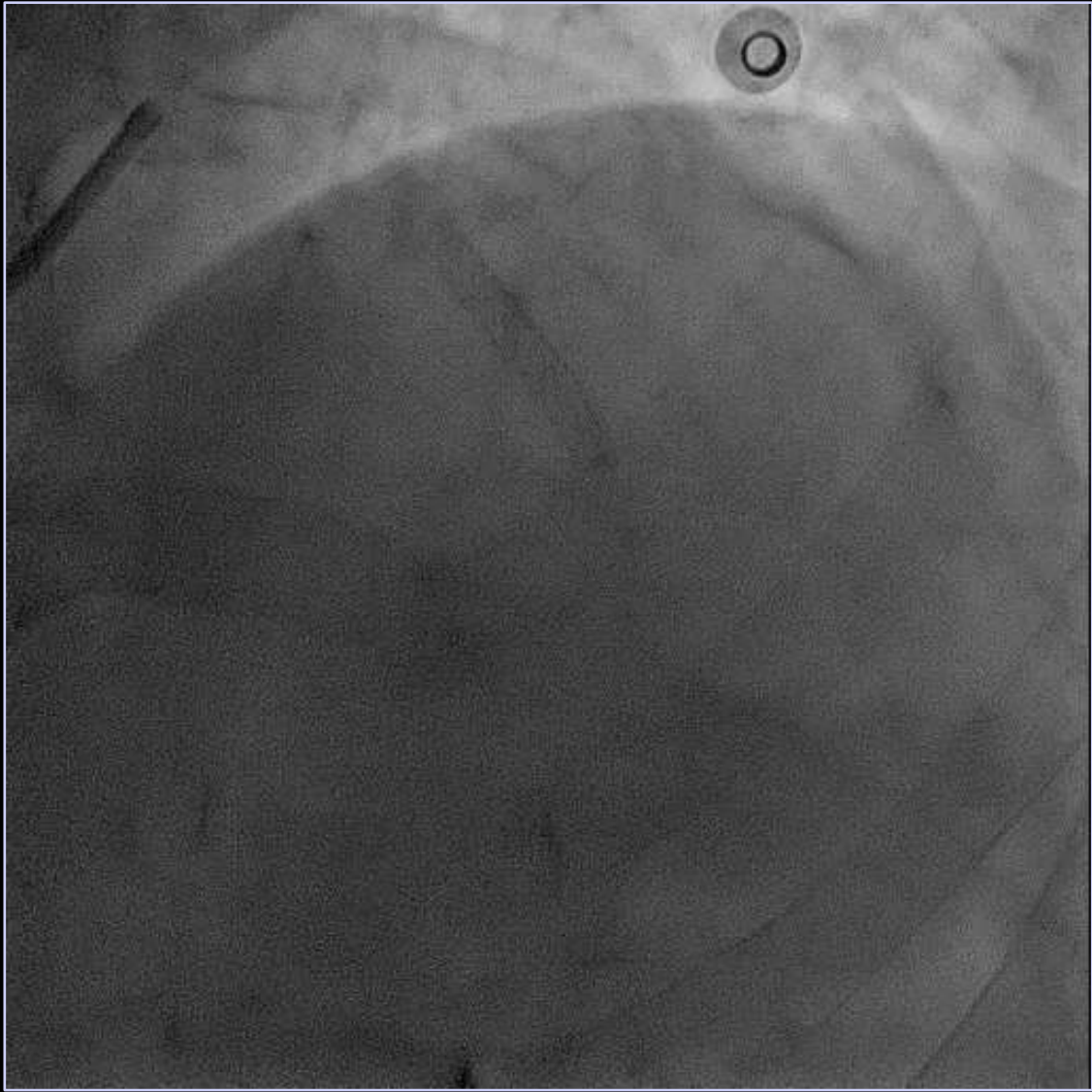


Because of the difficulty to deliver relatively long stent, GuideLiner support was required.

➔ **Post-dilatation: 3.5 mm (NC): 18-24atm**

DES implantation  
after appropriate lesion preparation

# DES implantation after appropriate lesion preparation



→ Excellent angiographic results

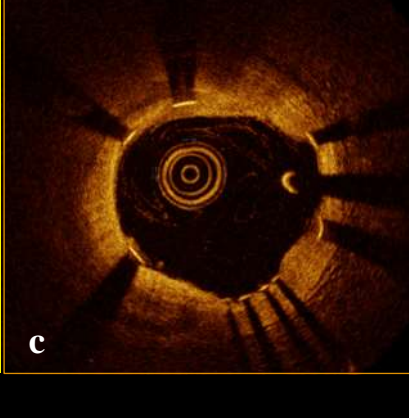
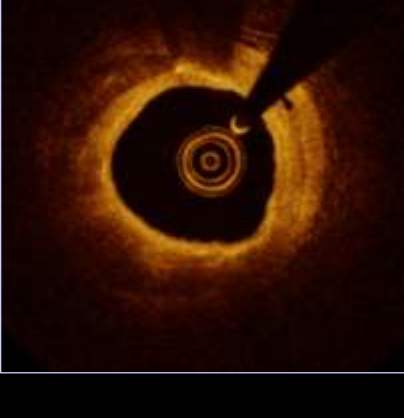
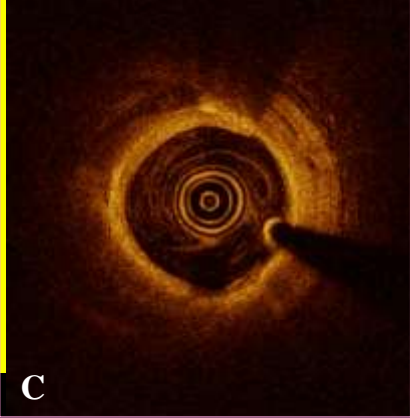
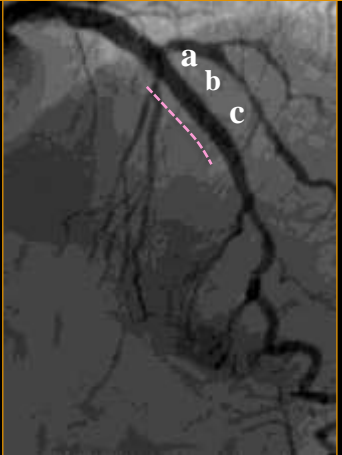
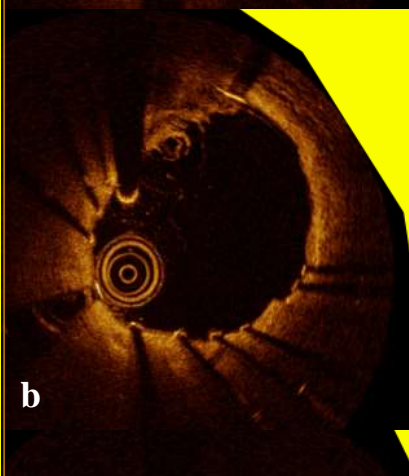
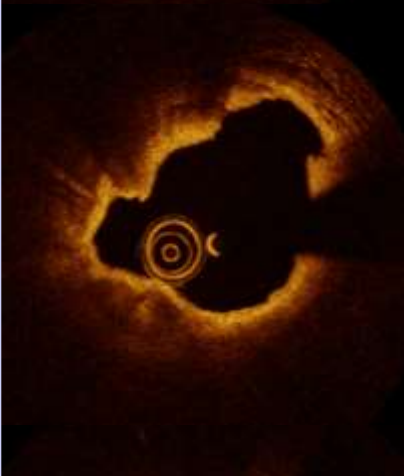
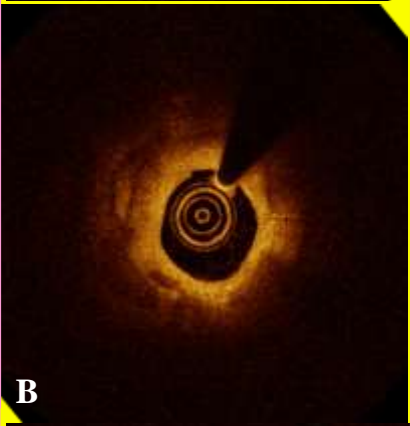
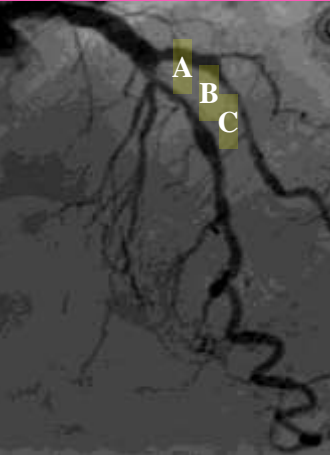
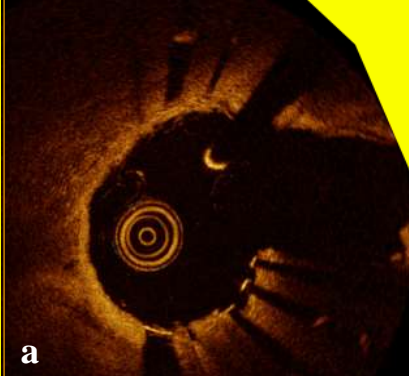
**Baseline**

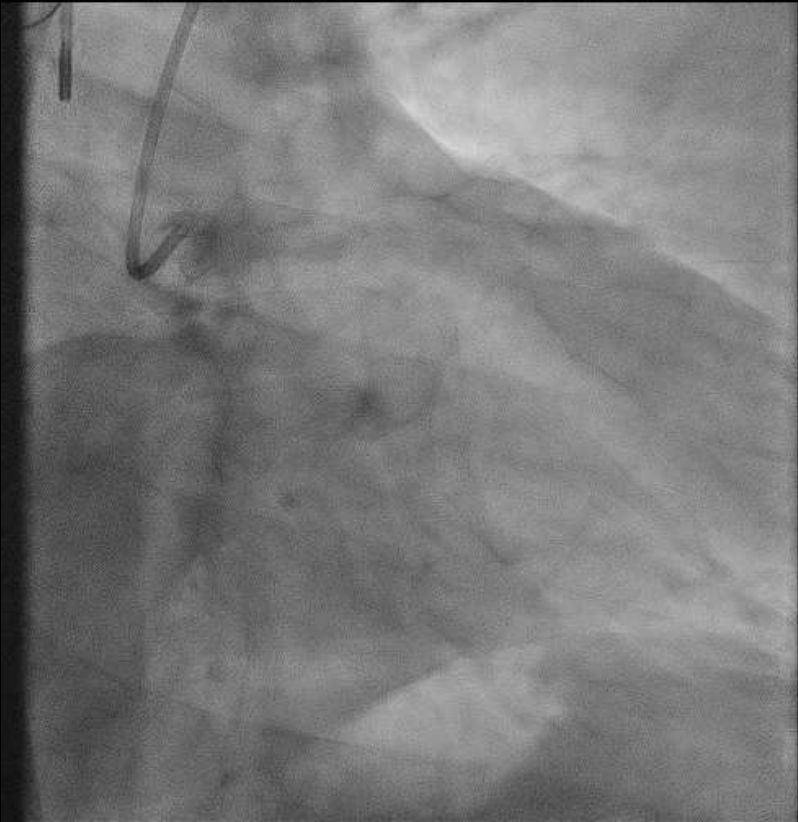
**After  
shock wave**

**Final**

**Baseline**

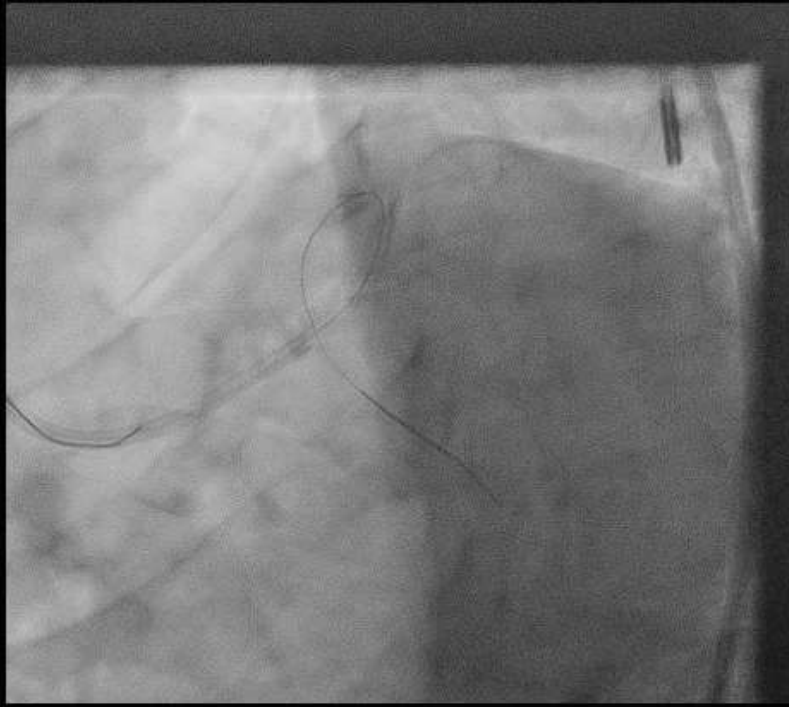
**Final**





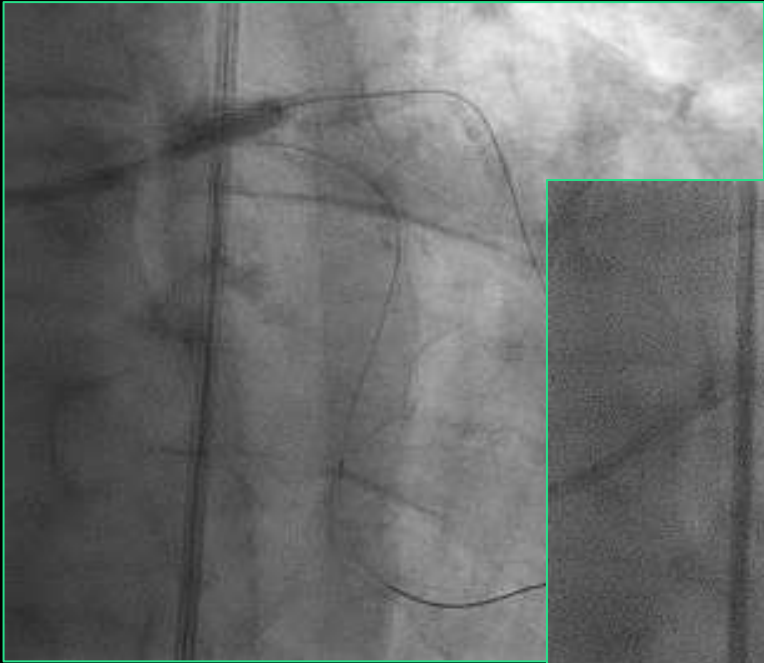
Baseline

# Femoral access 7 F, elective IABP

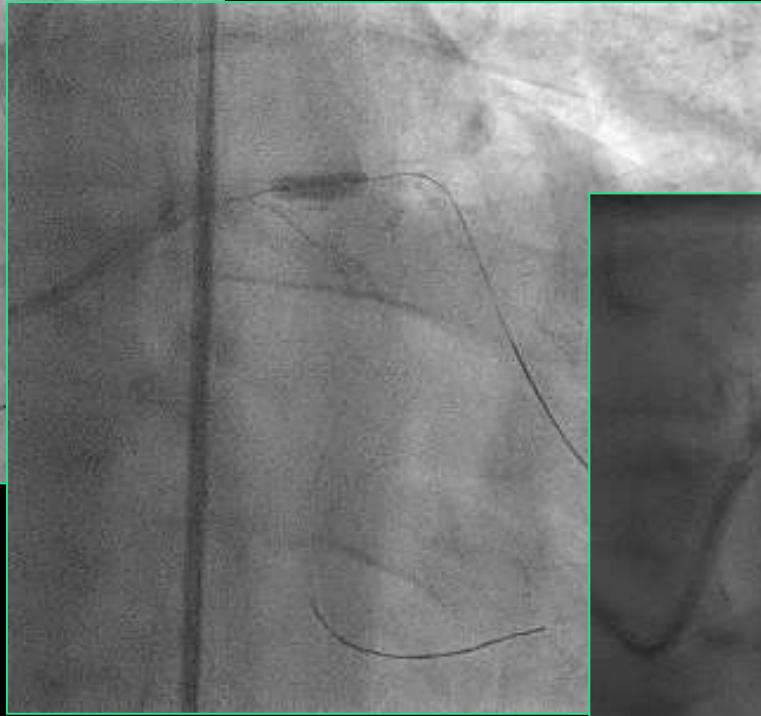


Baseline

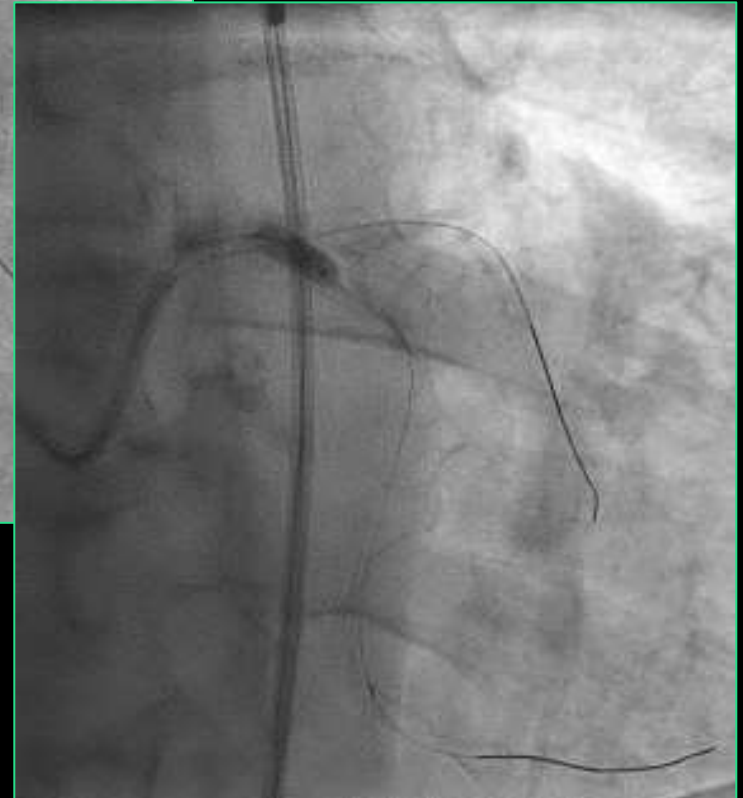
# 3.75 mm Shockwave balloon 8 runs in total



Shockwave LM

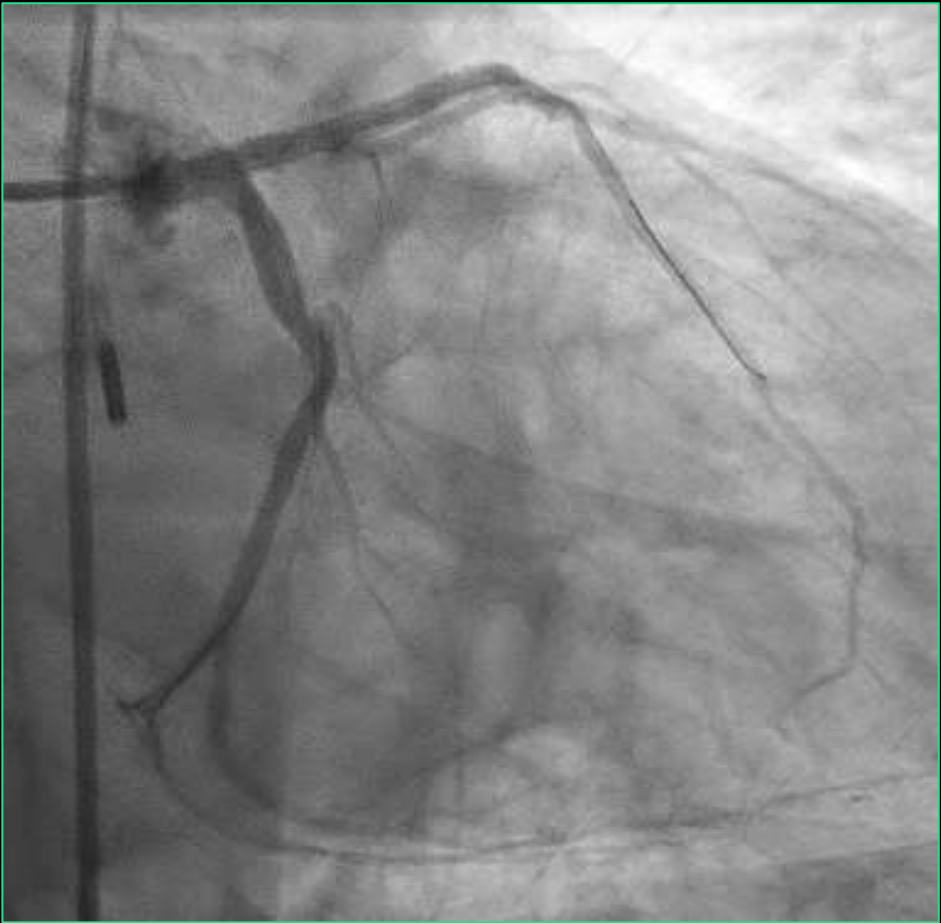
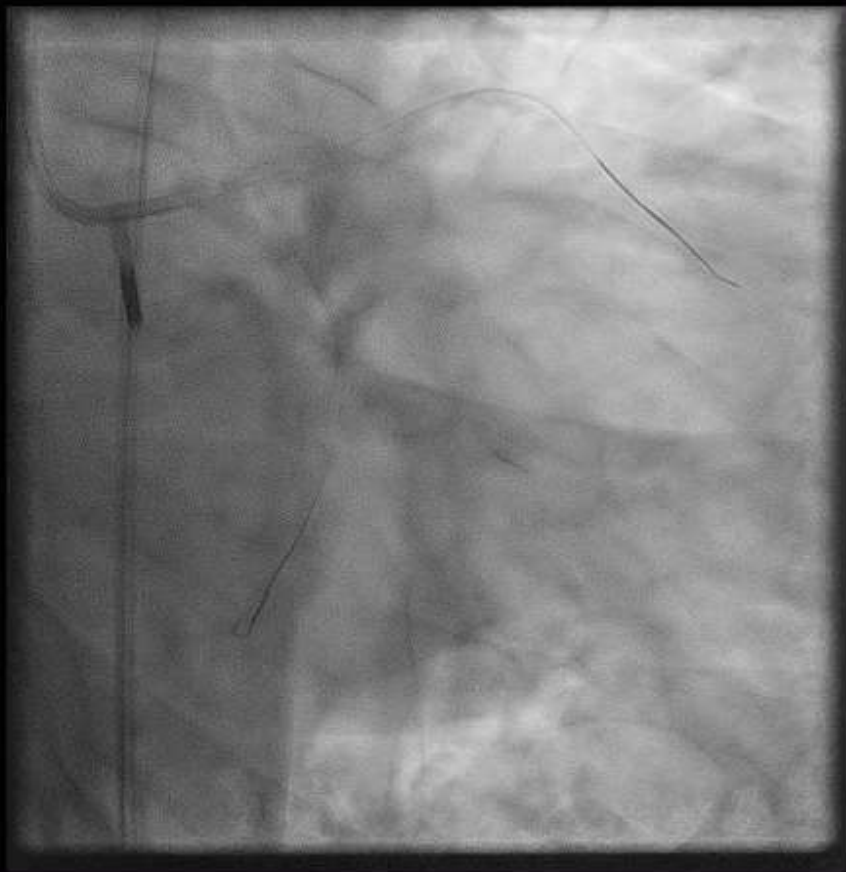


Shockwave LAD



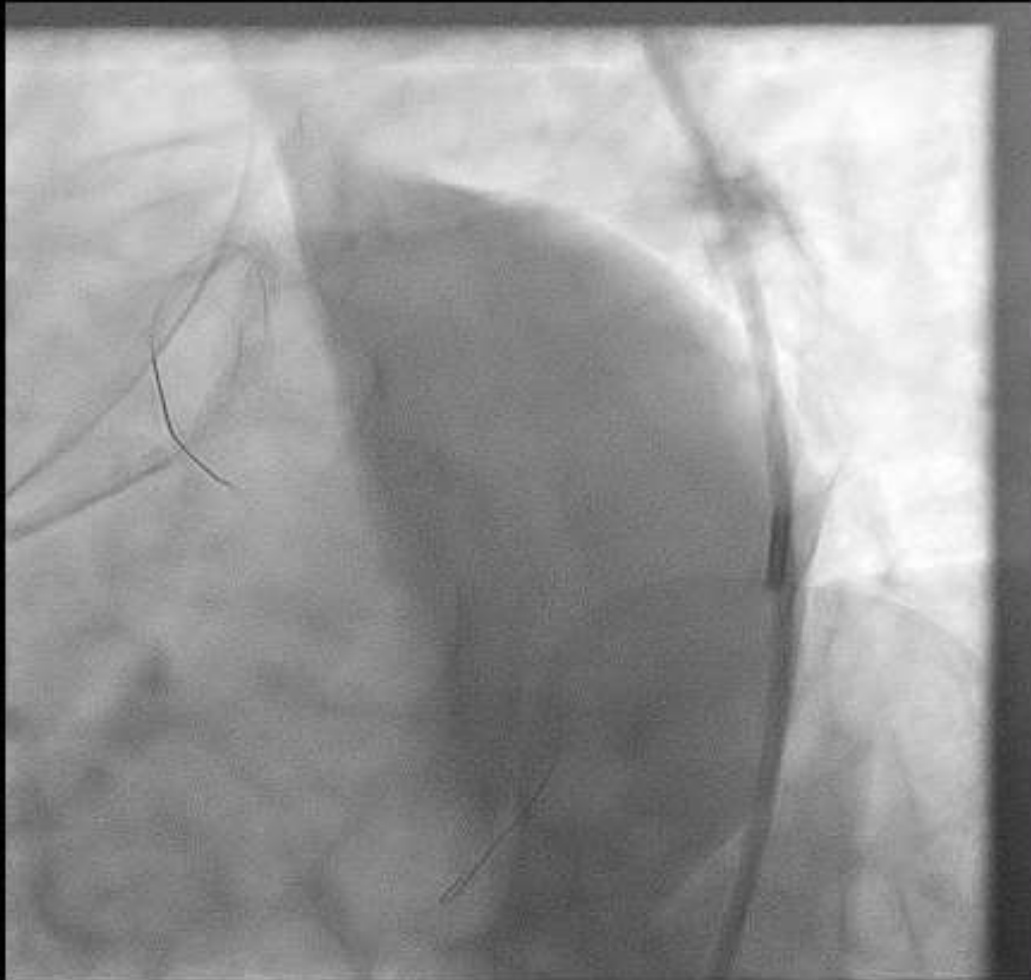
Shockwave LCx

# Final Result





# Final Result



# DISRUPT CAD III 1 yr. outcome in 384 pts

MACE 13.8%

Cardiac Death 1.1%

MI 10.5% (3.2% after 30 days)

Stent Thrombosis 1.1%

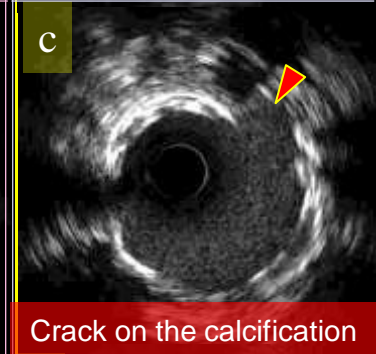
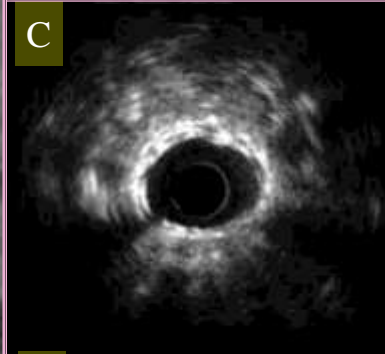
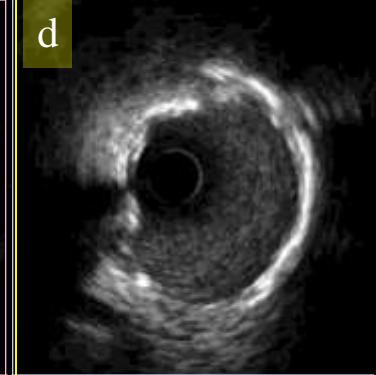
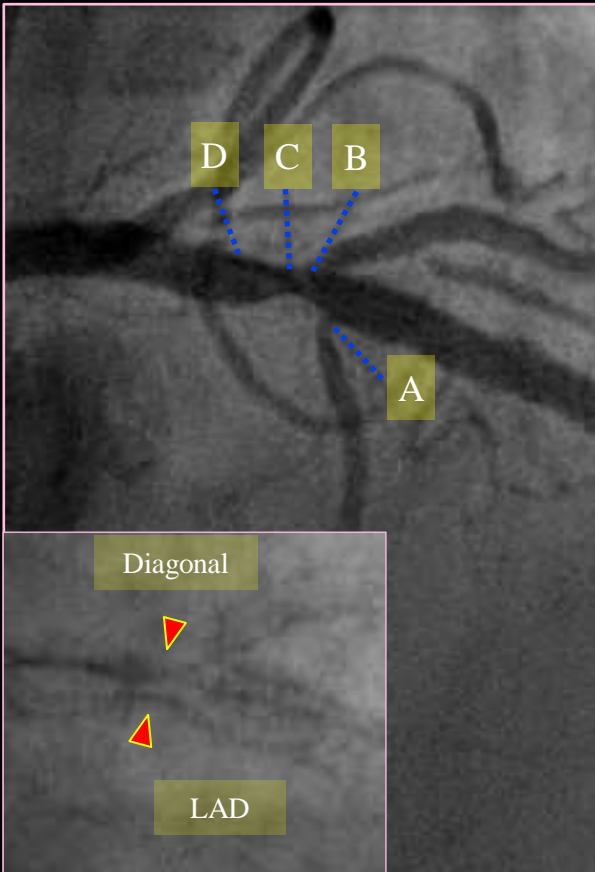
Ischemia driven TLR 6%

# Shockwave may not work in Focal Calcium

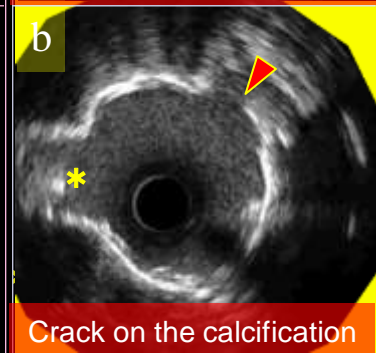
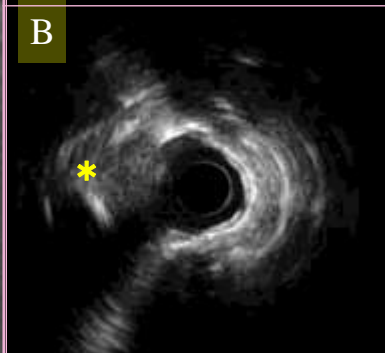


# Excimer Laser 0.9 mm

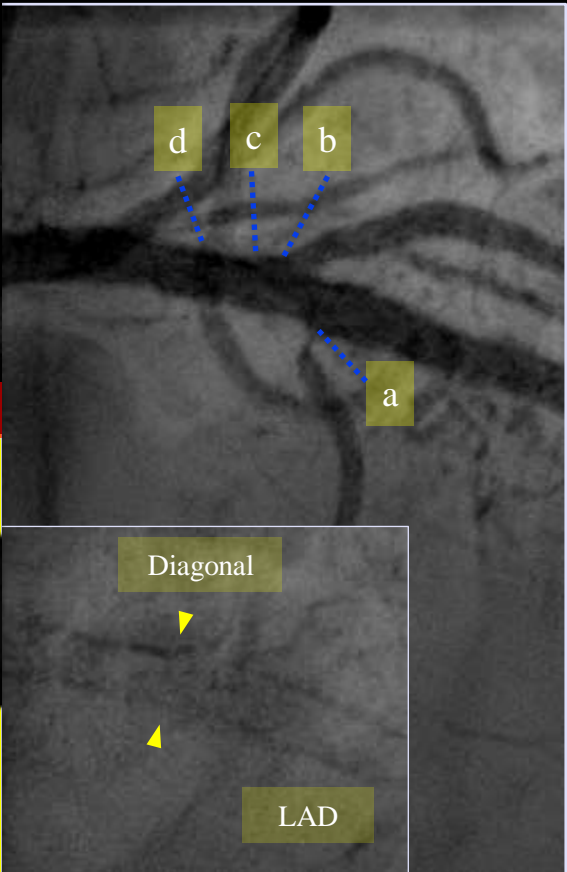
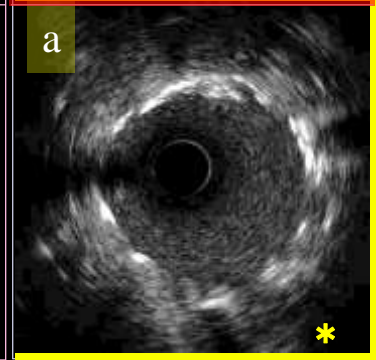
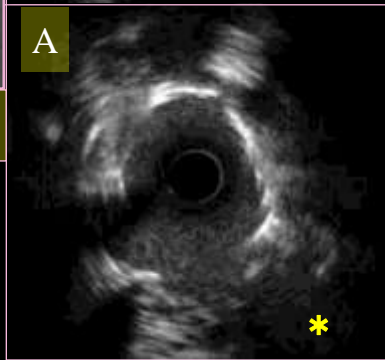
# Contrast Injec.



Crack on the calcification



Crack on the calcification



Final at the index PCI

Final at the 2nd PCI

80 mJ/80 Hz

Rotablator

Orbital Atherectomy (CSI)

Cutting or Angiosculpt at very high pressure (IVUS important for sizing)

OPN very high pressure dedicated balloon (over 40 atm.)

Shockwave balloon (lithoplasty)

Laser-ELCA; contrast injection only for underexpanded stent

**One approach may not be sufficient and be liberal to use more than one**