



**UNIVERSITÄTS**  
FREIBURG · BAD KROZINGEN  
**HERZZENTRUM**

# Heavy calcified CTO: Tips and Tricks

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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

- Consulting Fees/Honoraria

## Company

Ashai Intecc, Boston, Medtronic, Teleflex, Cardinal Health, Abboth, Biotronik, Terumo, AstraZeneca, Daiichi Sankyo

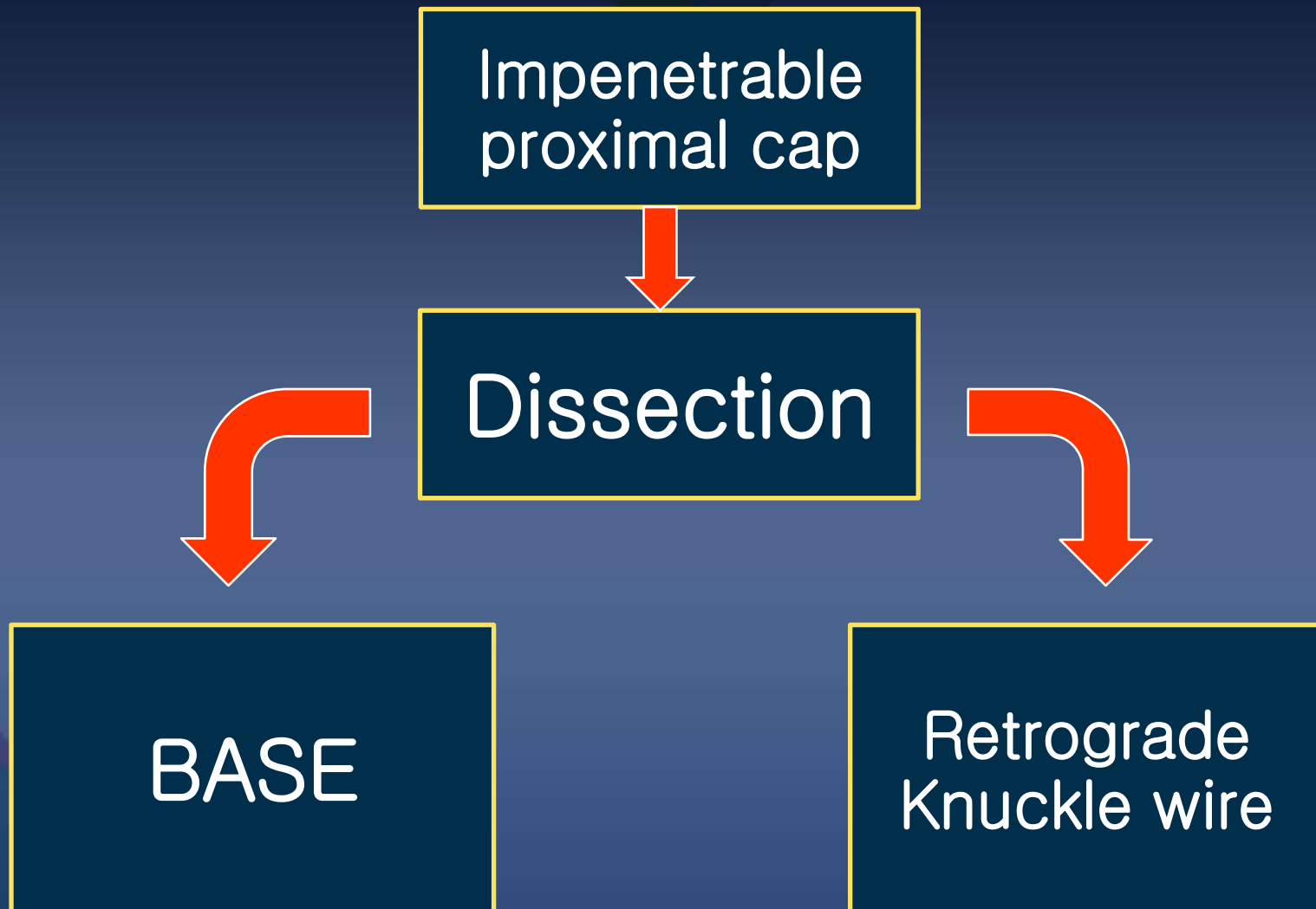
# Problems and Solutions in calcified CTOs:

**Impenetrable  
proximal cap**

**Uncrossable  
CTO body**

**Complex  
Revers  
CART**

# Problems and Solutions in calcified CTOs:

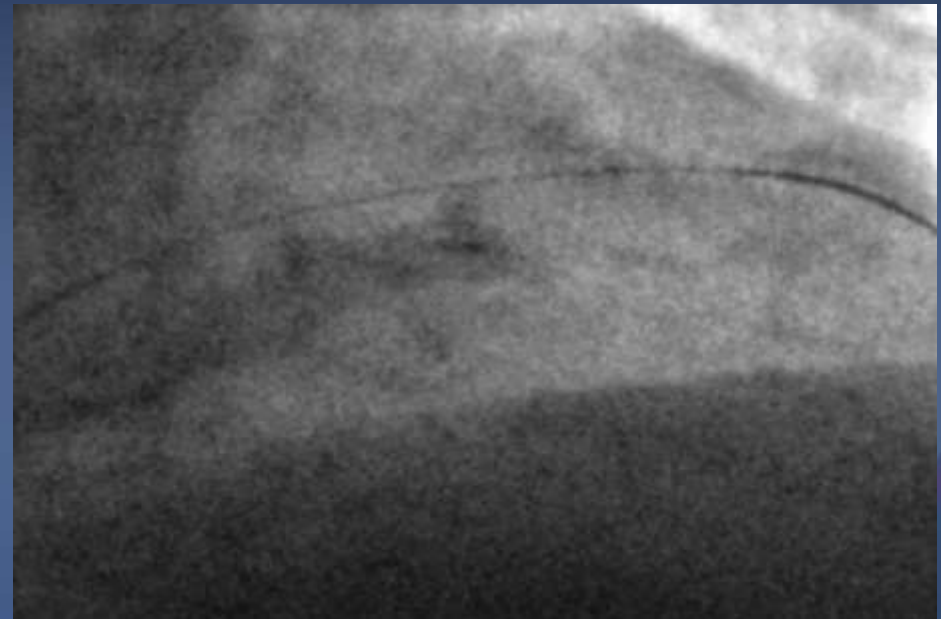


# BASE: balloon assisted subintimal entry

**Blunt stump**  
**Twice failed before**

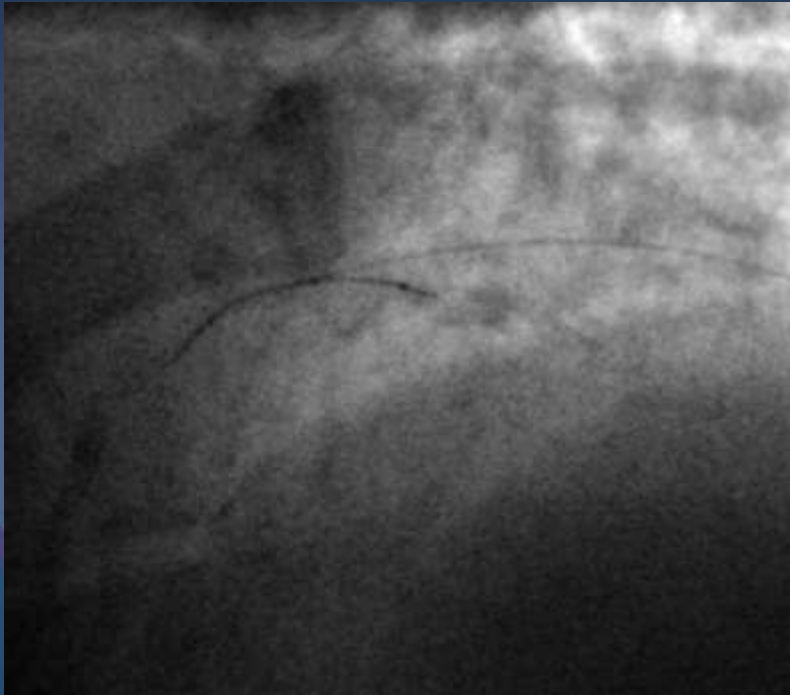


**Failed puncture:**  
**Confianza 12g, Hornet 14g, Aстато 20g**

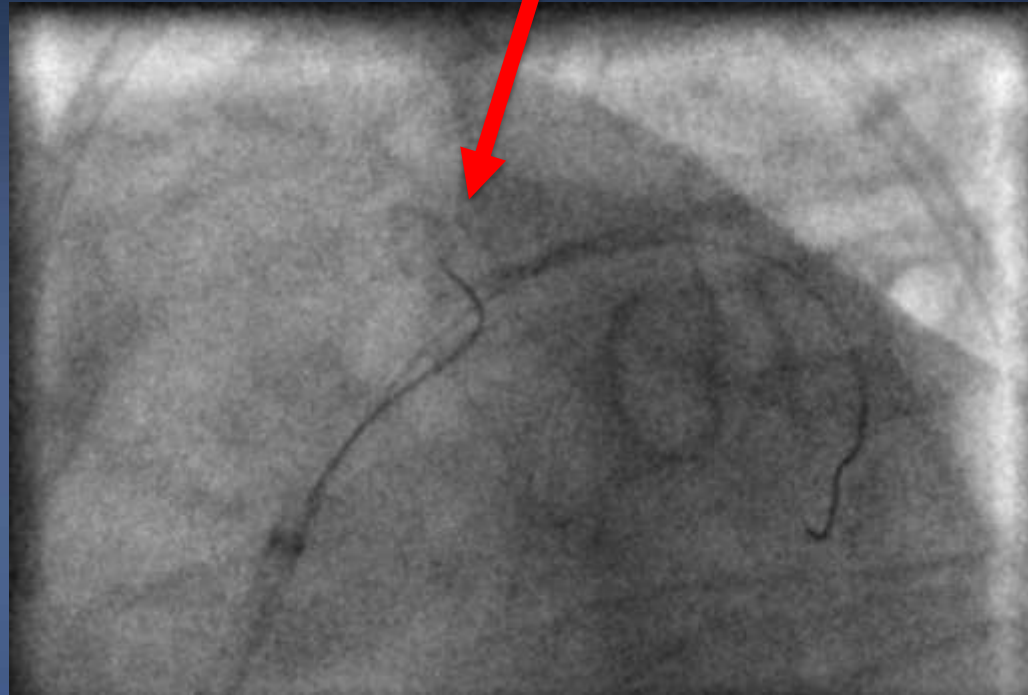


# BASE: balloon assisted subintimal entry

3,0er NC-Balloon 16atm

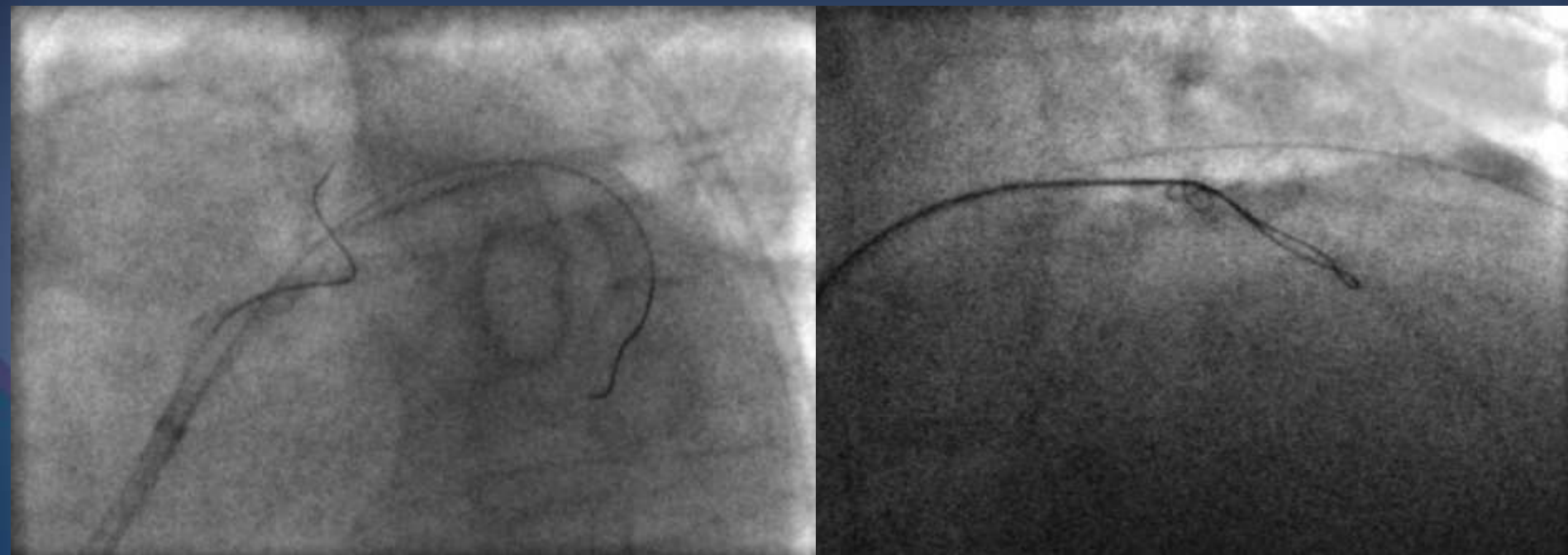


Creating a dissection flap



# BASE: balloon assisted subintimal entry

## Fielder XT-R Knuckle



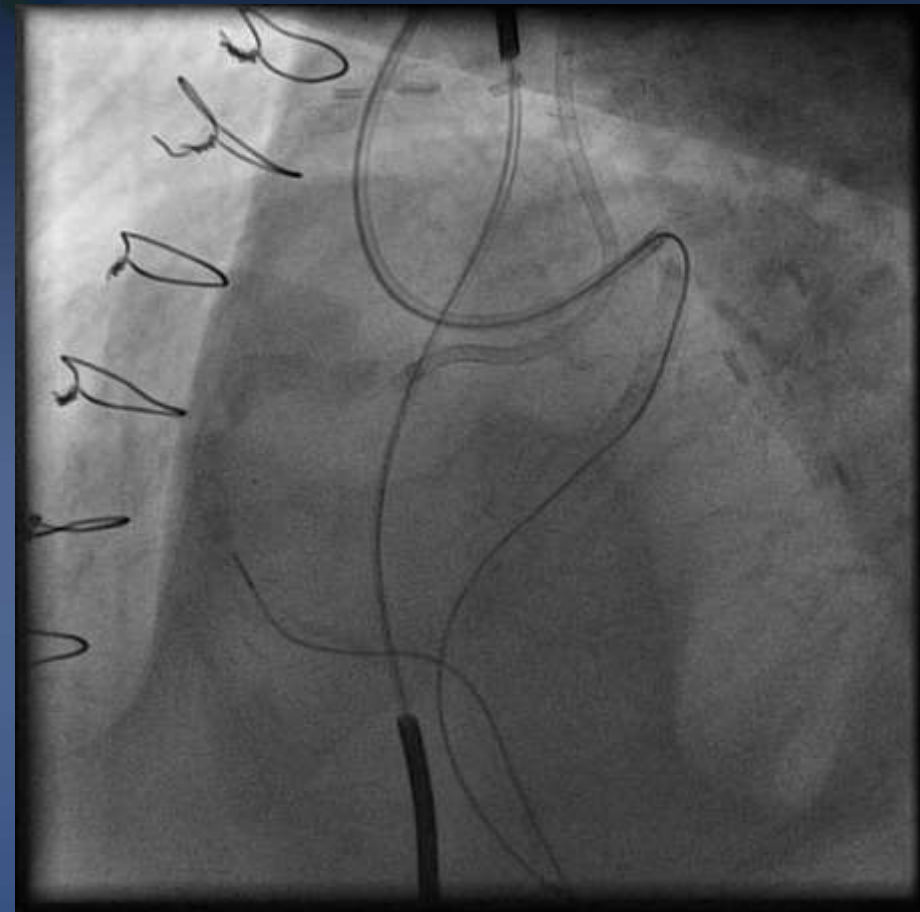
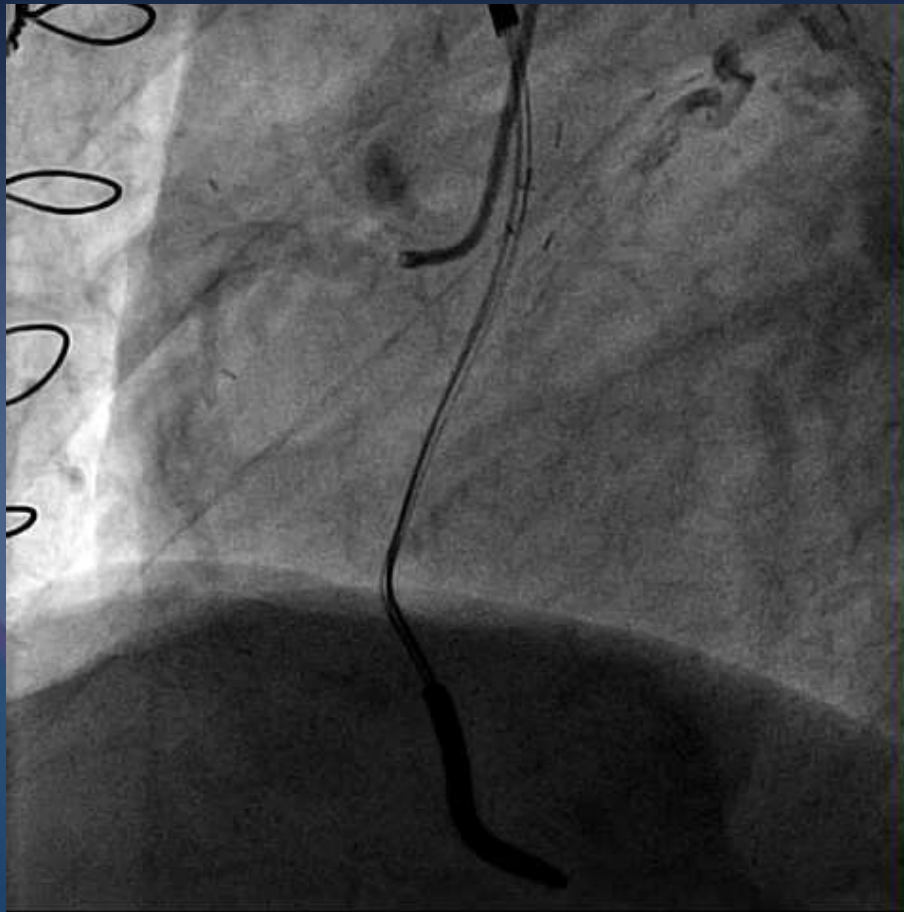
# BASE: balloon assisted subintimal entry





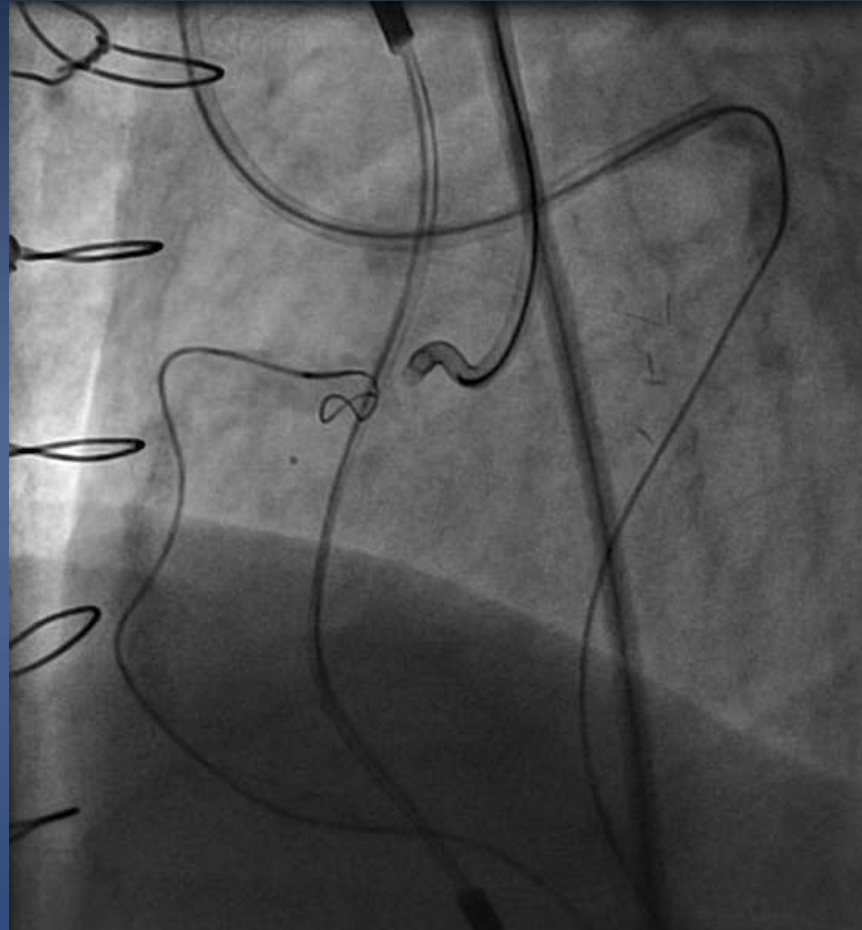
# Retrograde Knuckle wire – ostial CTO

J-CTO Score 4, post CABG, EF 29%



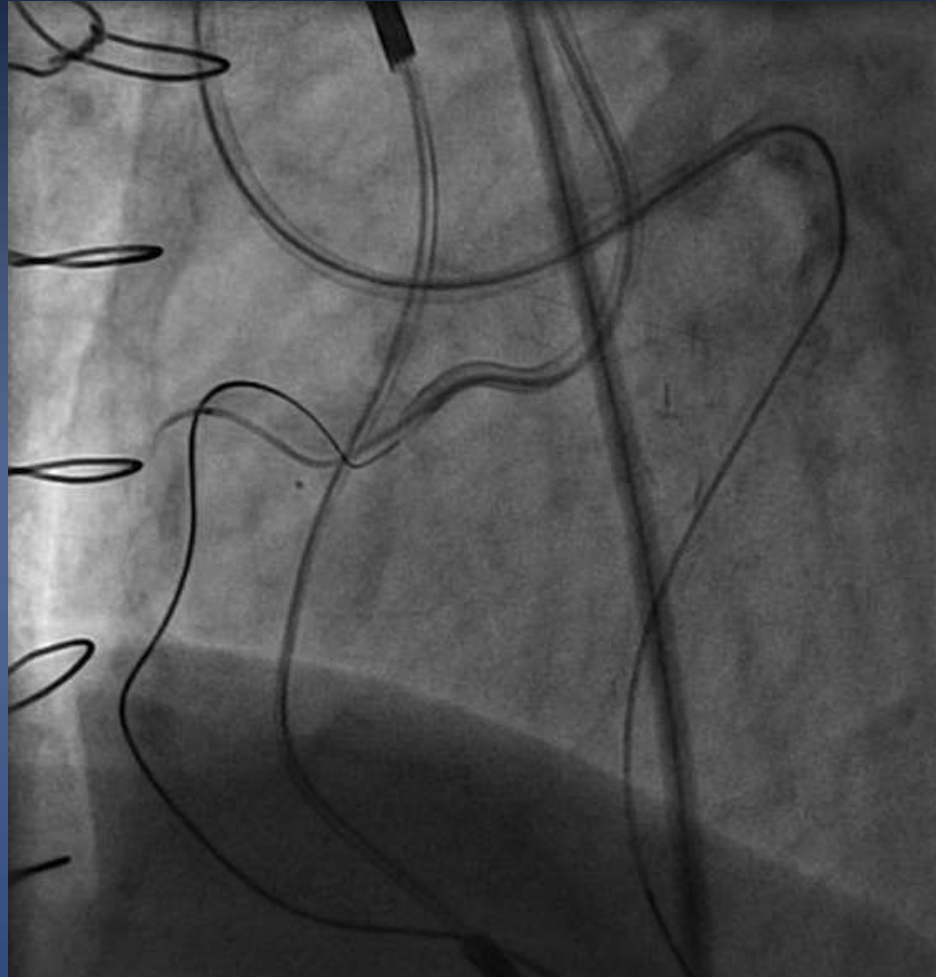
# Retrograde Knuckle wire – ostial CTO

Retrograde penetration to widen up the subintimal space with Astato 20g/Pilot 200 Knuckle



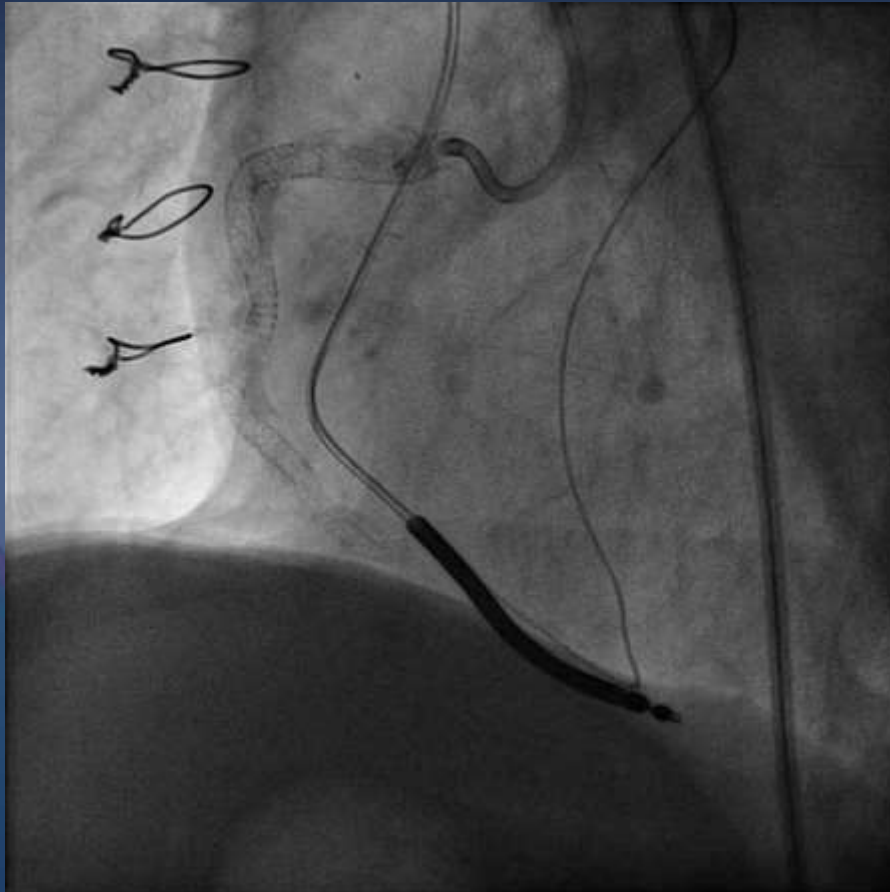
# Retrograde Knuckle wire – ostial CTO

Antegrade picture in to retrograde created subintimal space with Gaia 3<sup>rd</sup> and Corsair

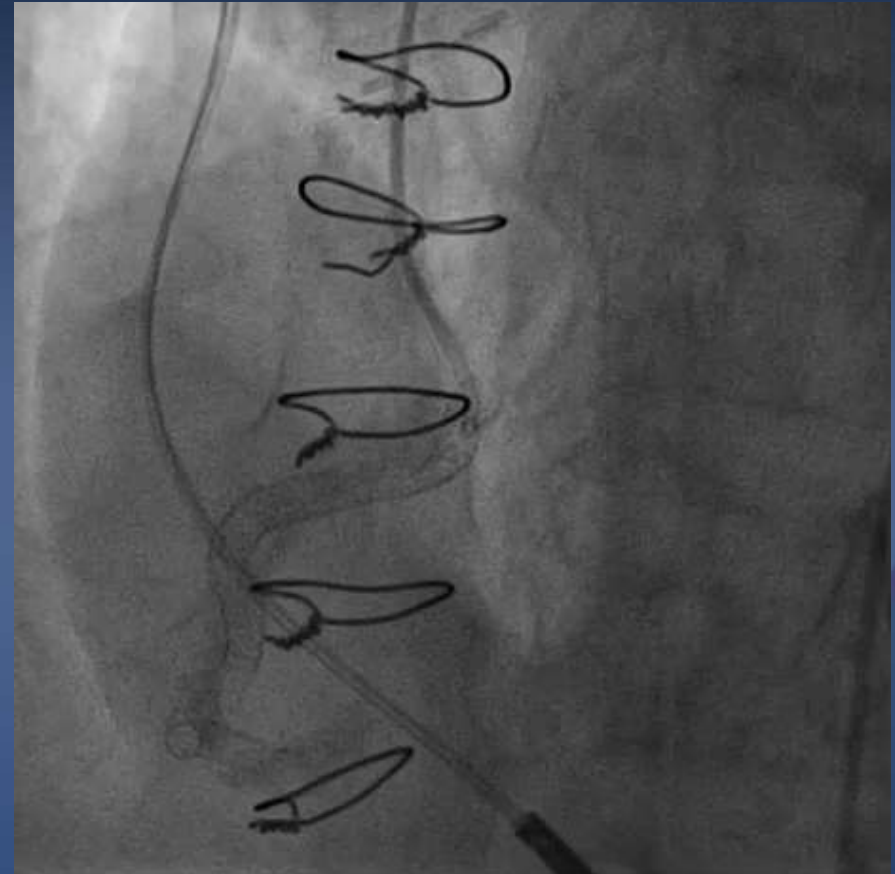


# Retrograde Knuckle wire – ostial CTO

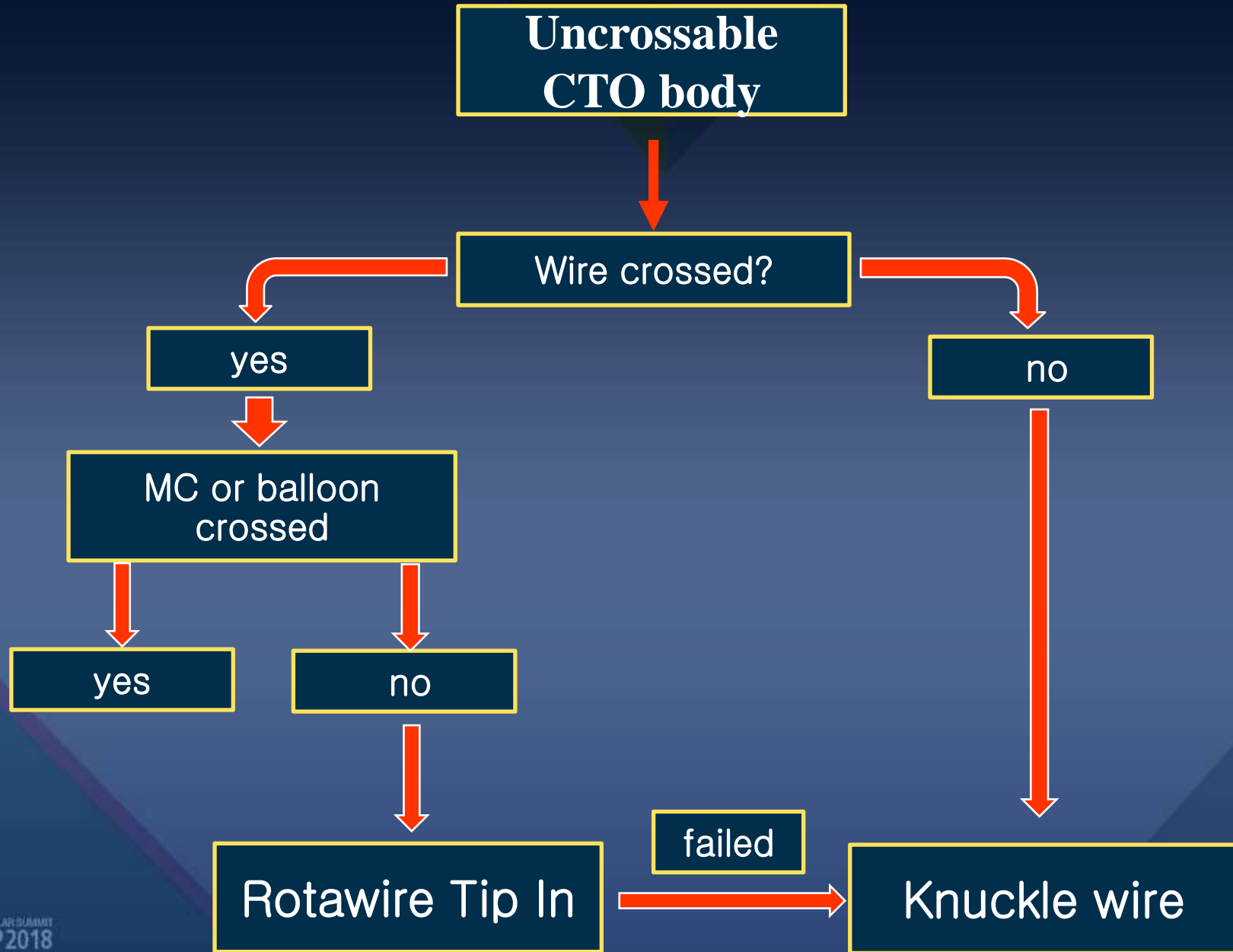
Final result



6 months follow-up

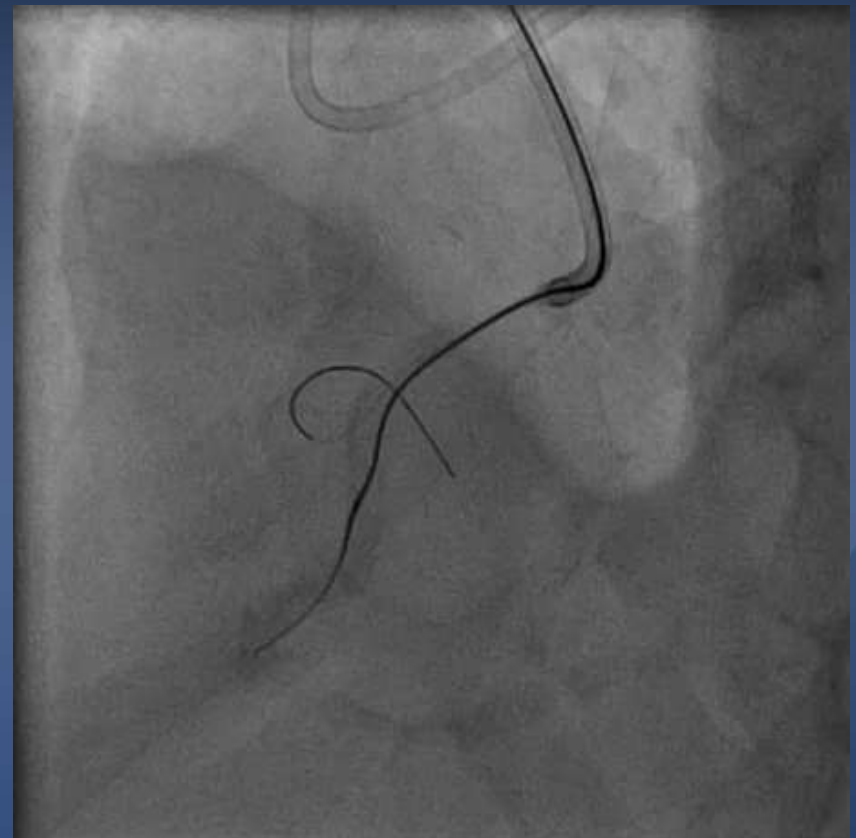


# Problems and Solutions in calcified CTOs:

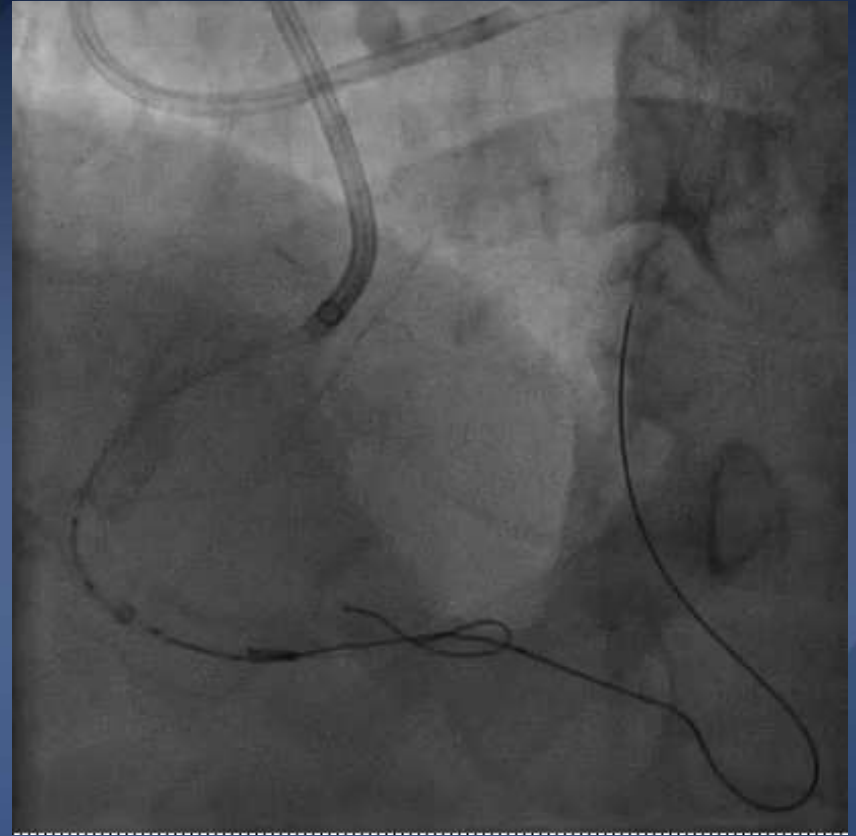
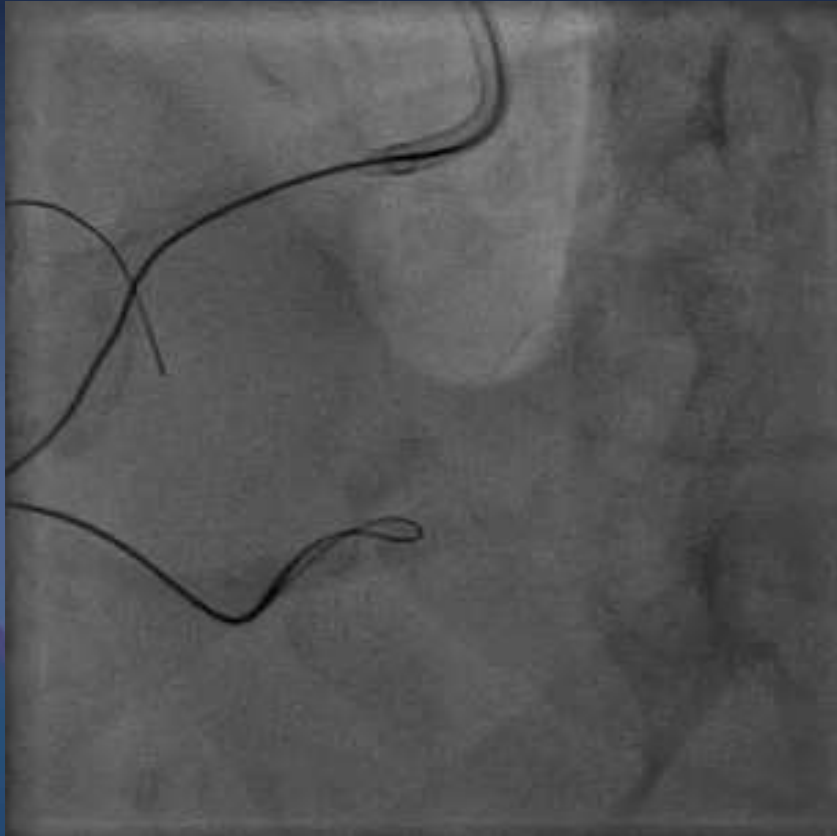


# Uncrossable CTO body: Wiring fails Calcification and Ambiguity

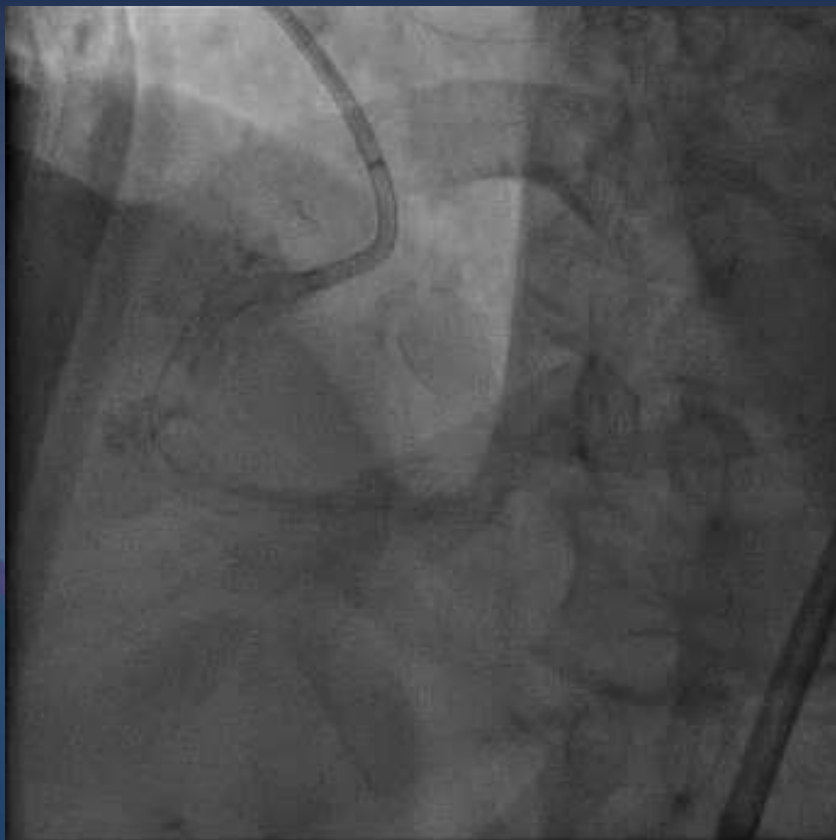
J-CTO 4 due to reattempt



# Uncrossable CTO body: Wiring fails



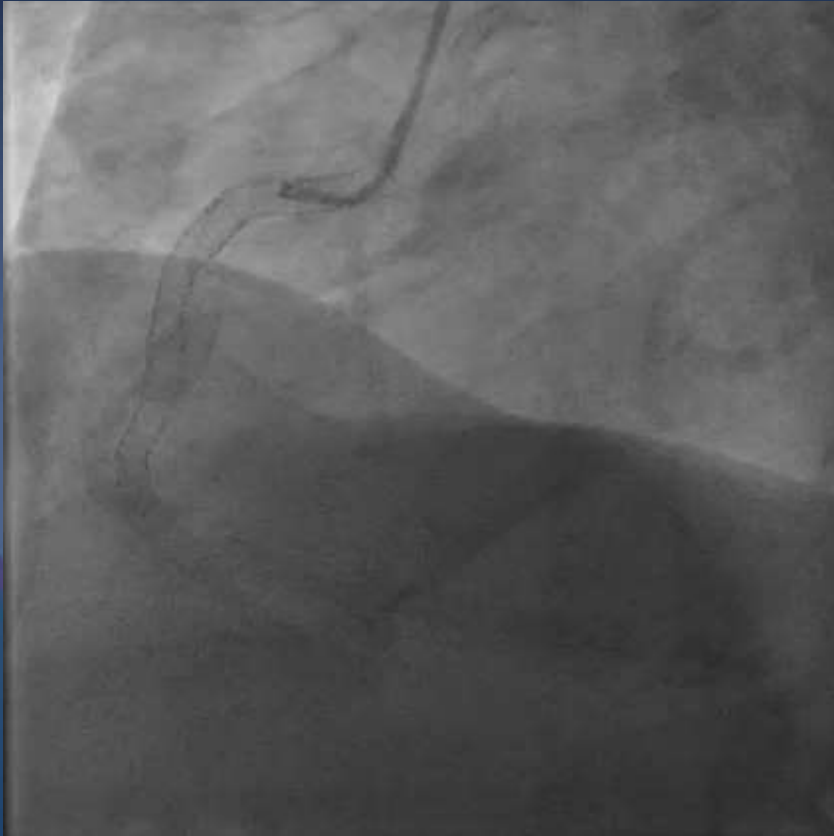
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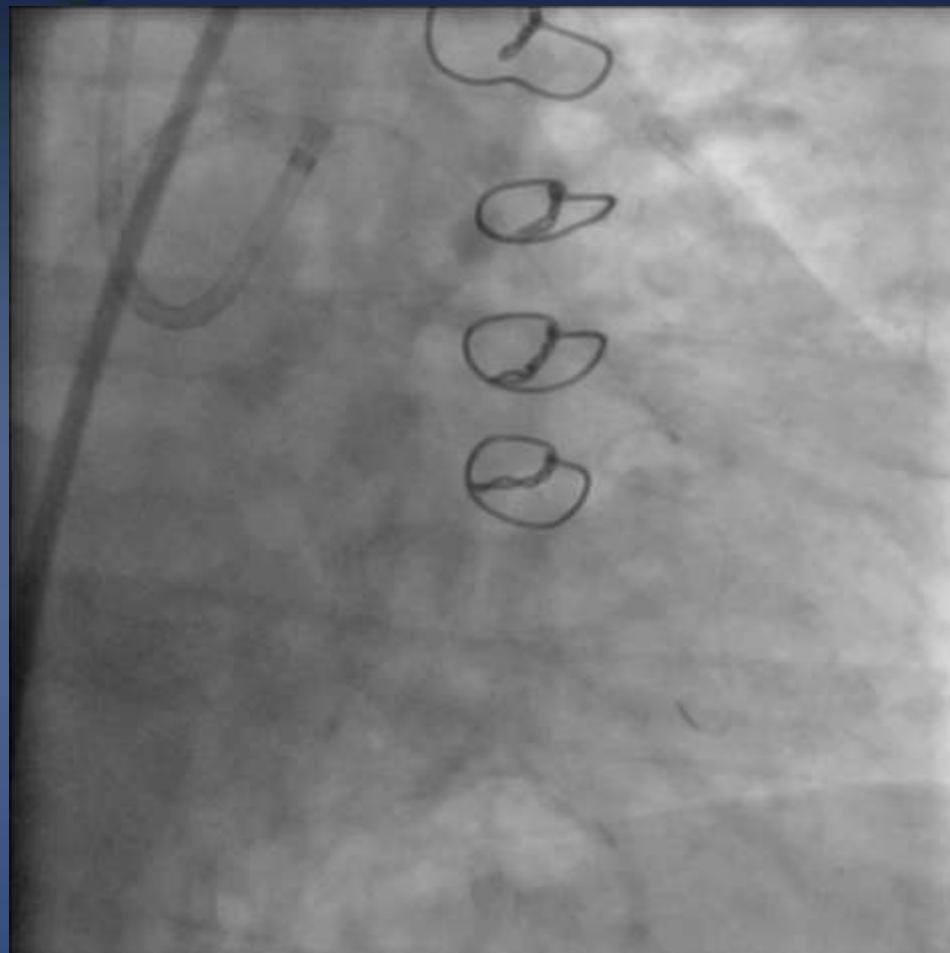
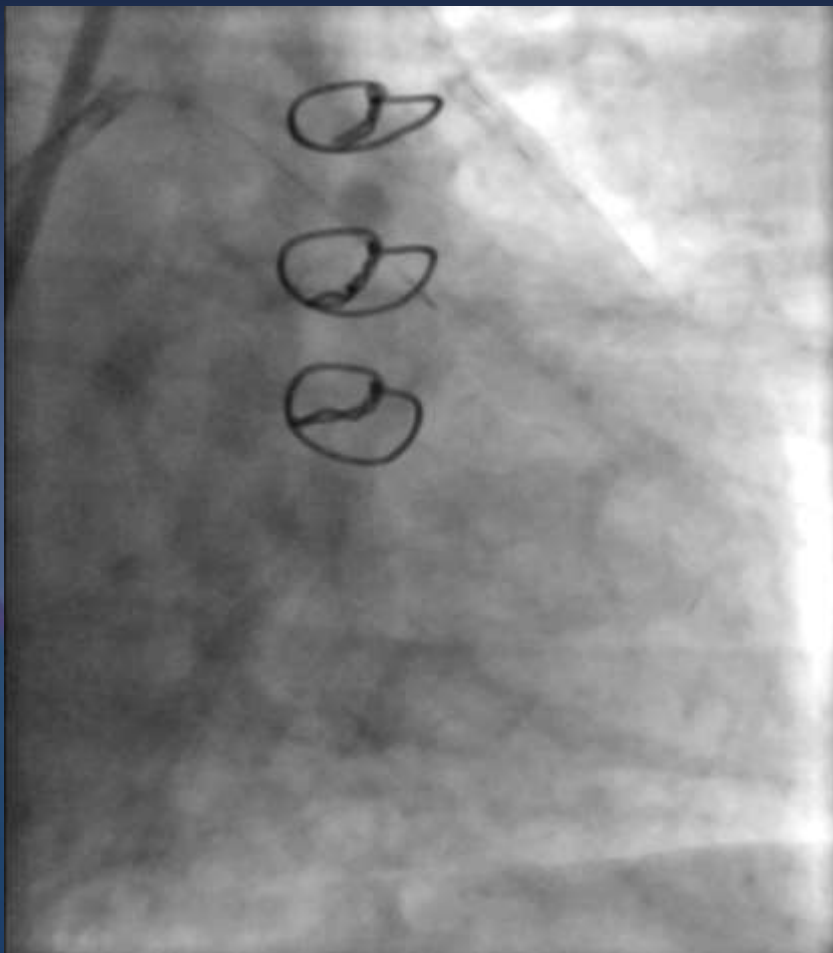


# Uncrossable CTO body: Wiring fails Calcification and Ambiguity

## 12 months follow-up



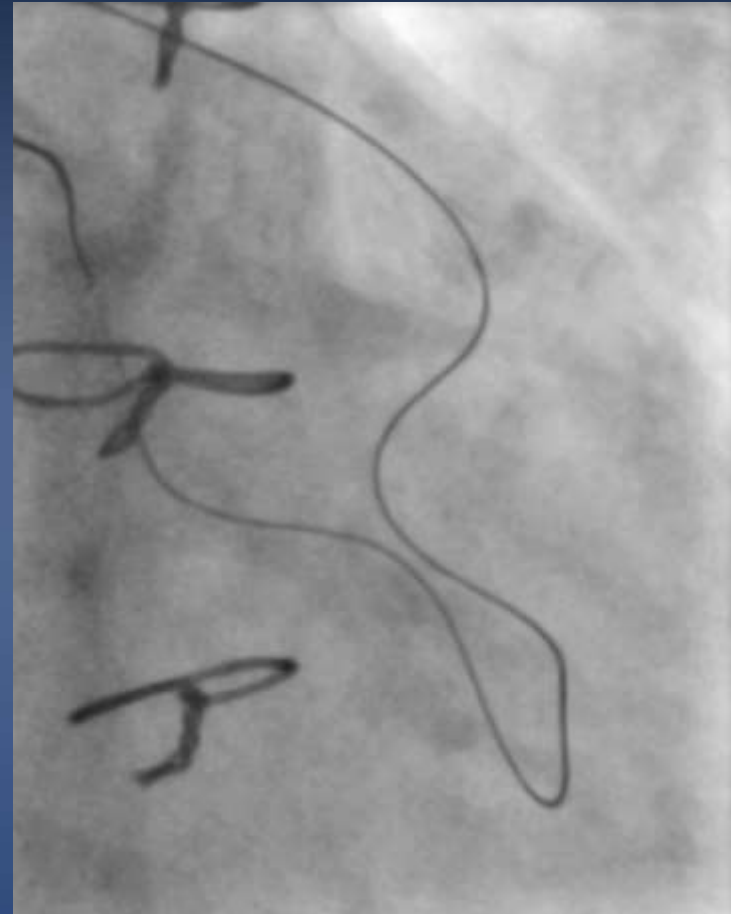
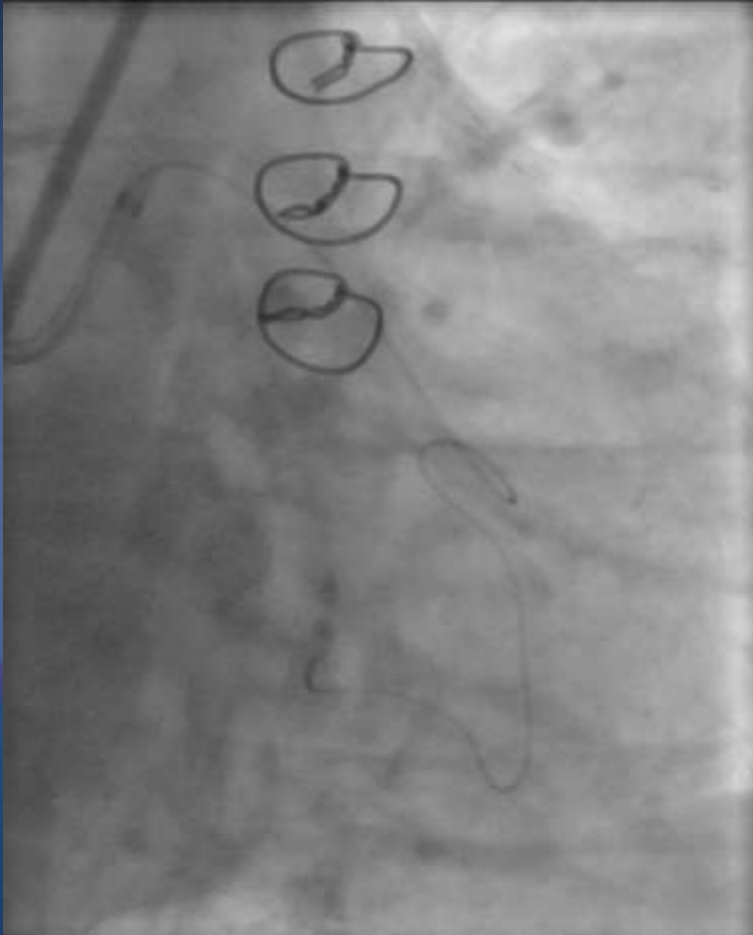
# Uncrossable CTO body: Wire crossed, MC and Balloon not crossable



# Uncrossable CTO body :

## Wire crossed, MC and Balloon not crossable

Antegrade Gaia 3<sup>rd</sup>, retrograde  
marker wire



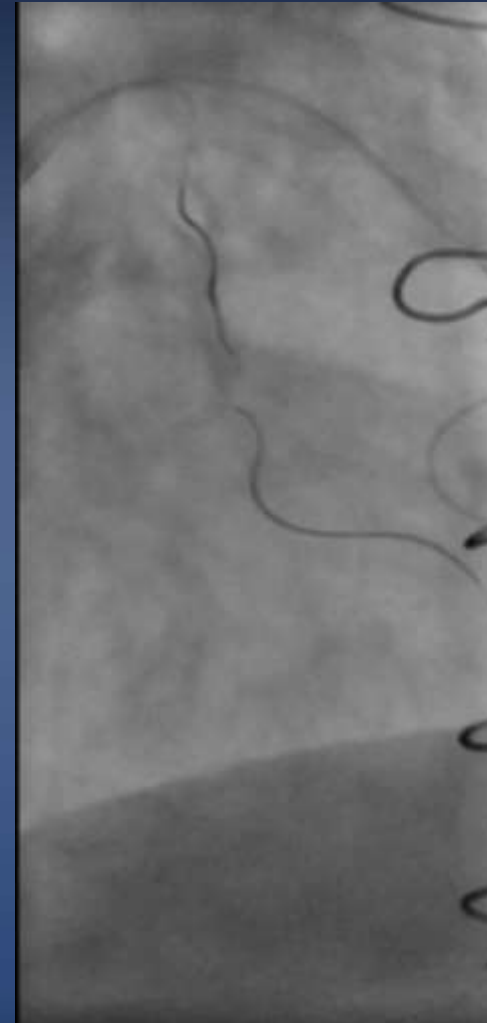
# Uncrossable CTO body :

## Wire crossed, MC and Balloon not crossable

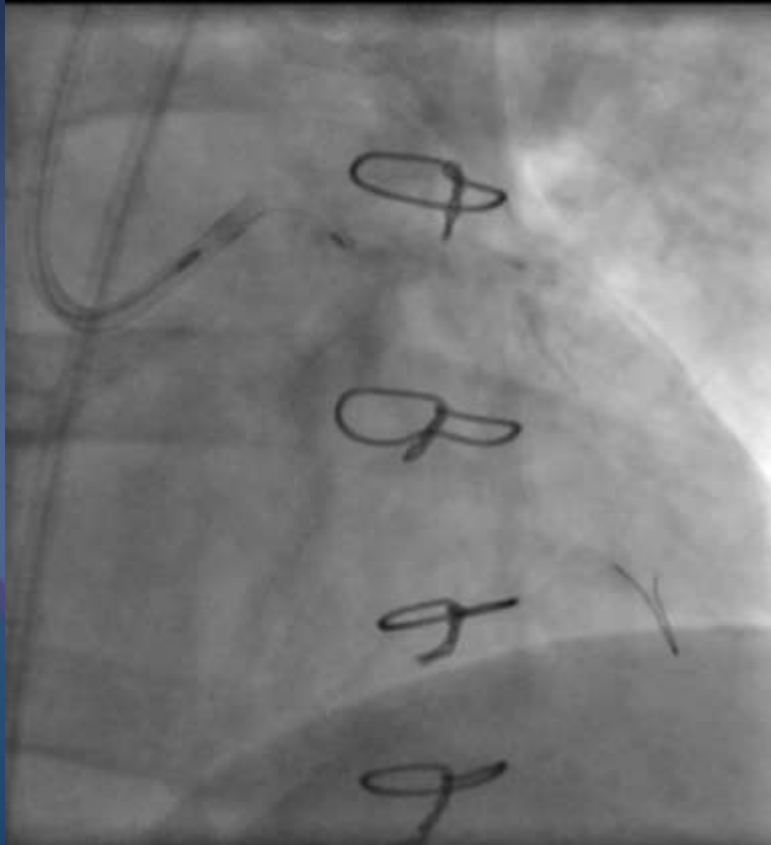
Antegrade Tip-In with Gaia 3<sup>rd</sup>  
in the retrograde Caravel



Change to antegrade rotawire,  
before potential knuckle wire

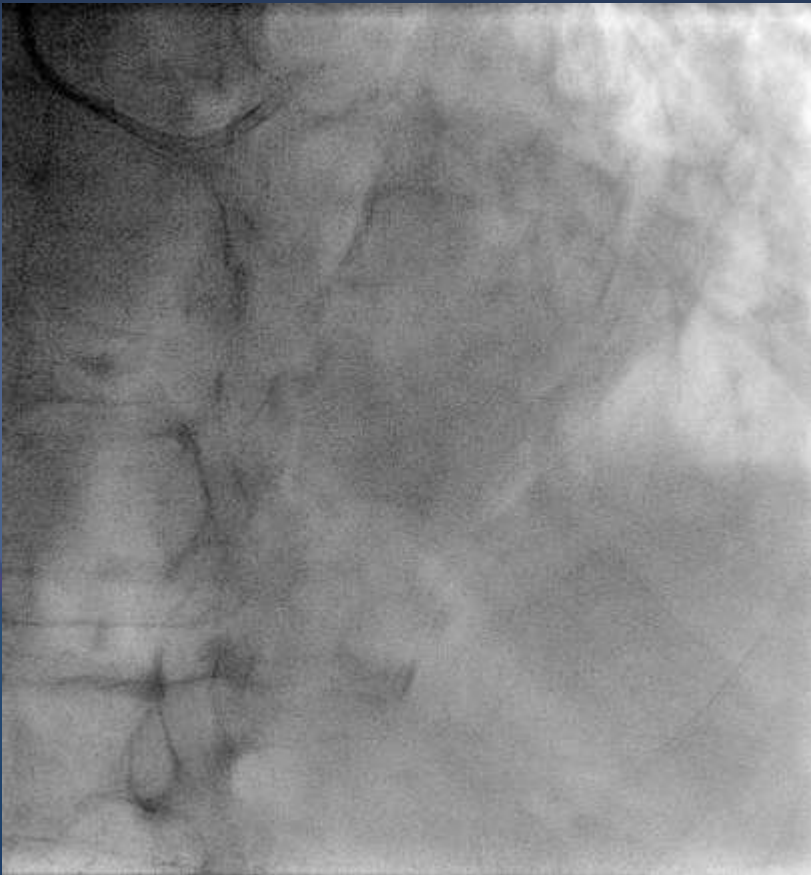


# Uncrossable CTO body : Wire crossed, MC and Balloon not crossable



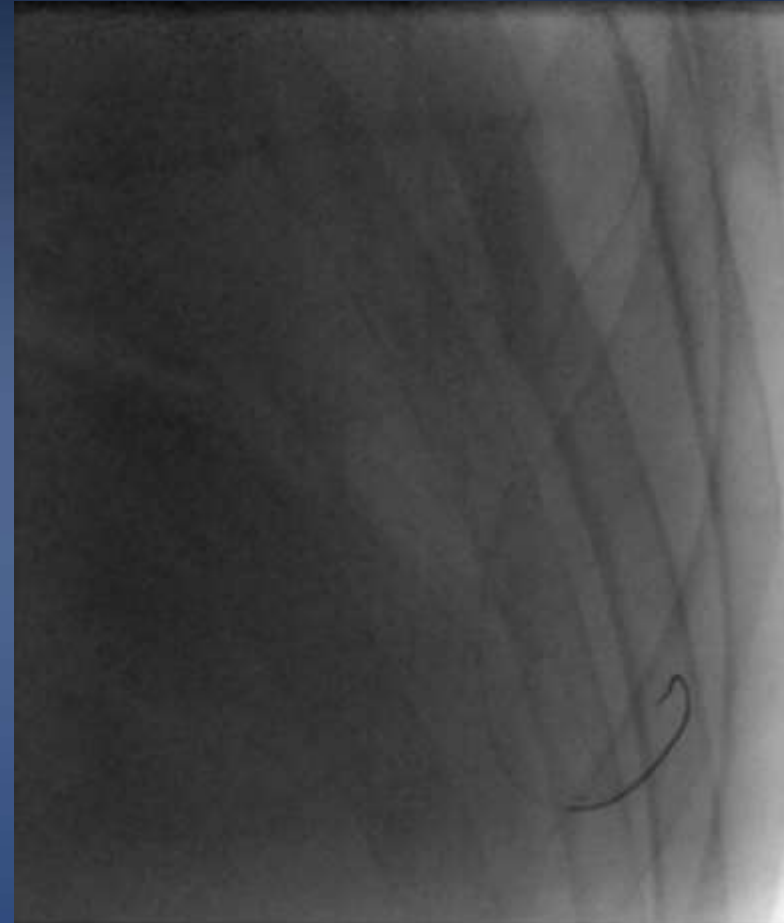
# Uncrossable CTO body : CTO wire pass, but no device

EF 21%, GFR 20ml/min/m<sup>2</sup>, Lupusnephritis  
Single 7F Guide



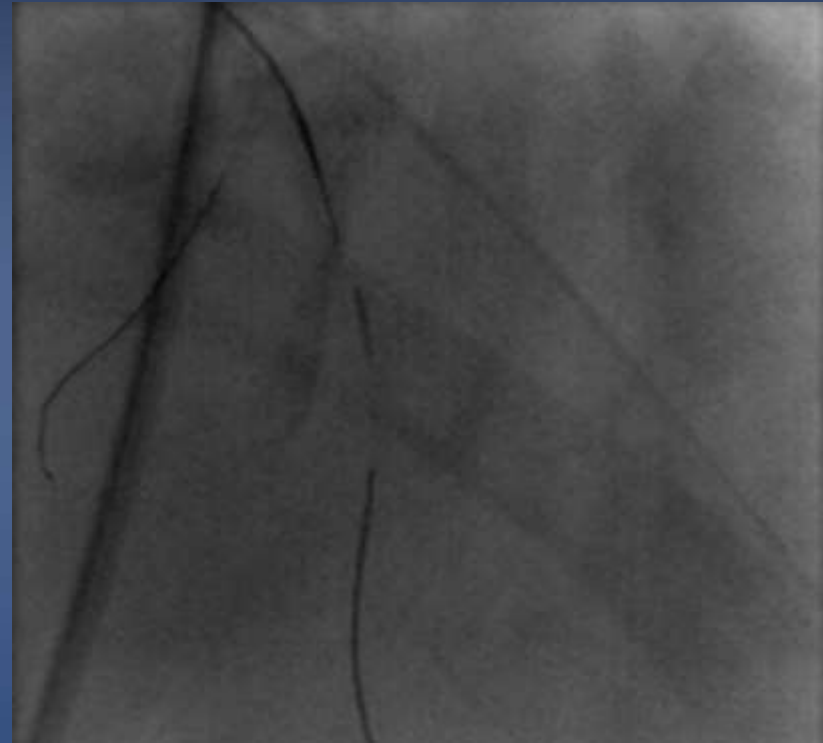
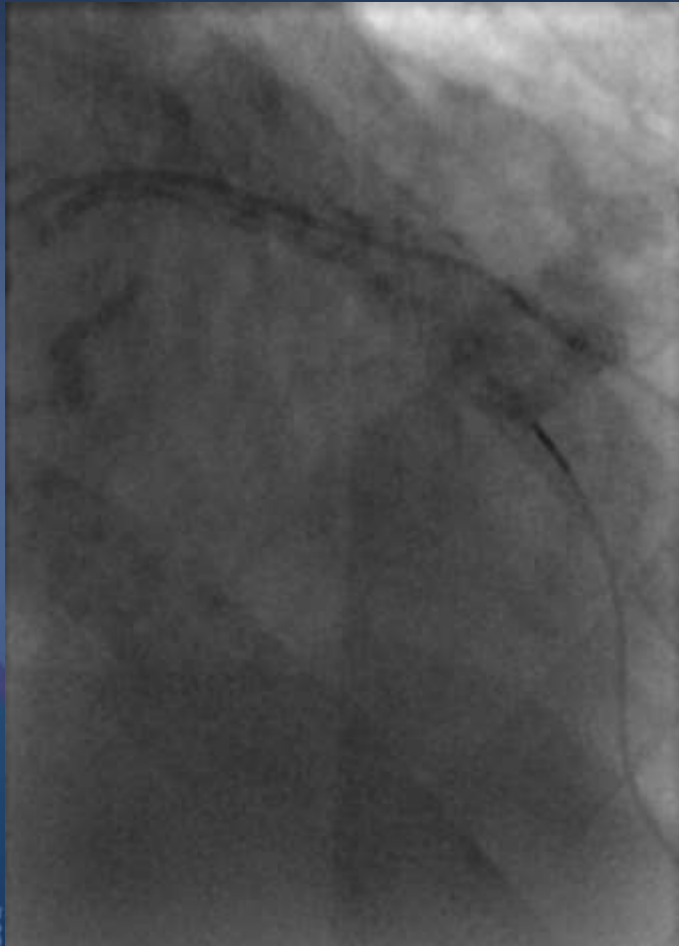
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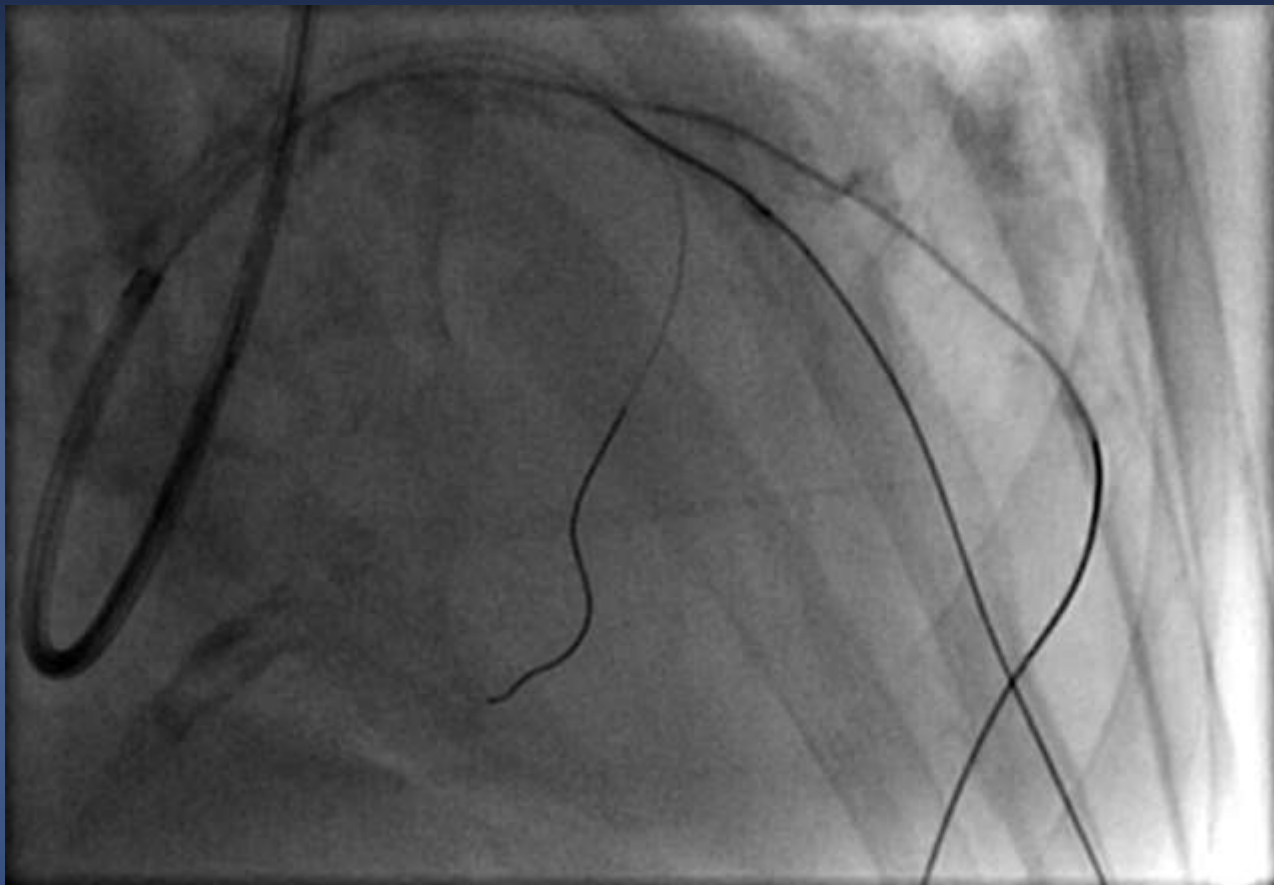
# Uncrossable CTO body : CTO wire pass, but no device

Antegrade Confianza 12g into retrograde Caravel



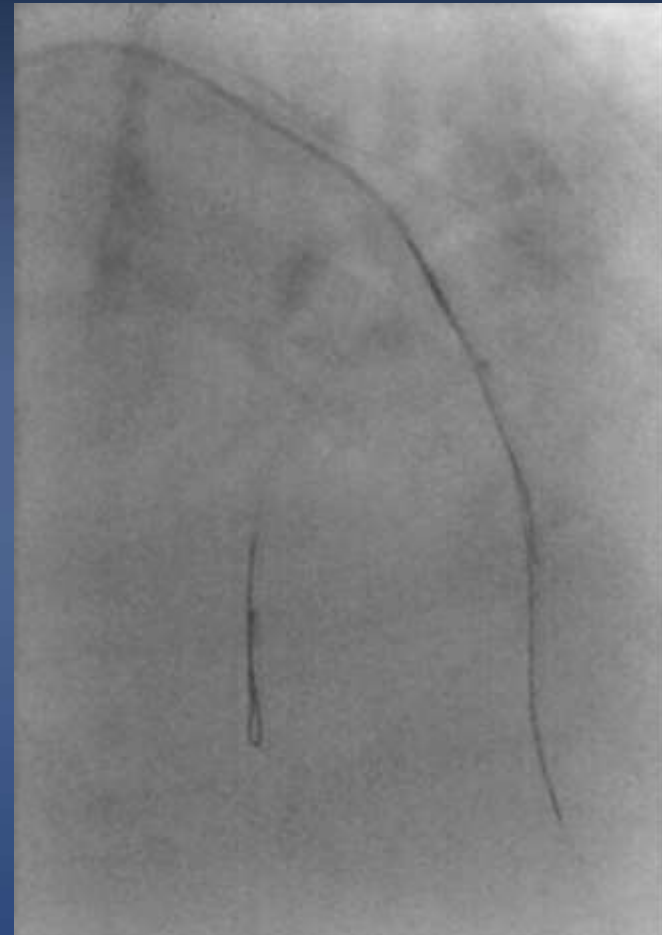


# Uncrossable CTO body : CTO wire pass, but no device



# Uncrossable CTO body : CTO wire pass, but no device

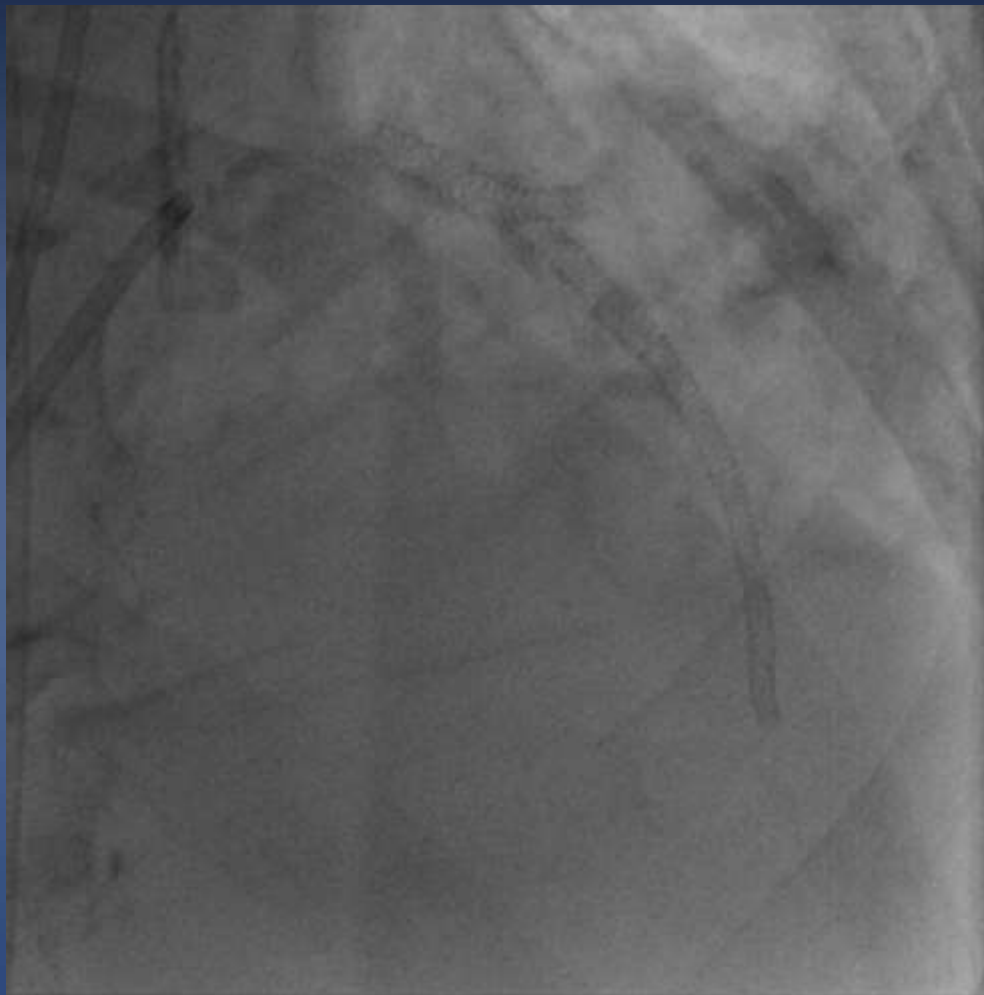
Rotawire Tip-In into retrograde Finewire



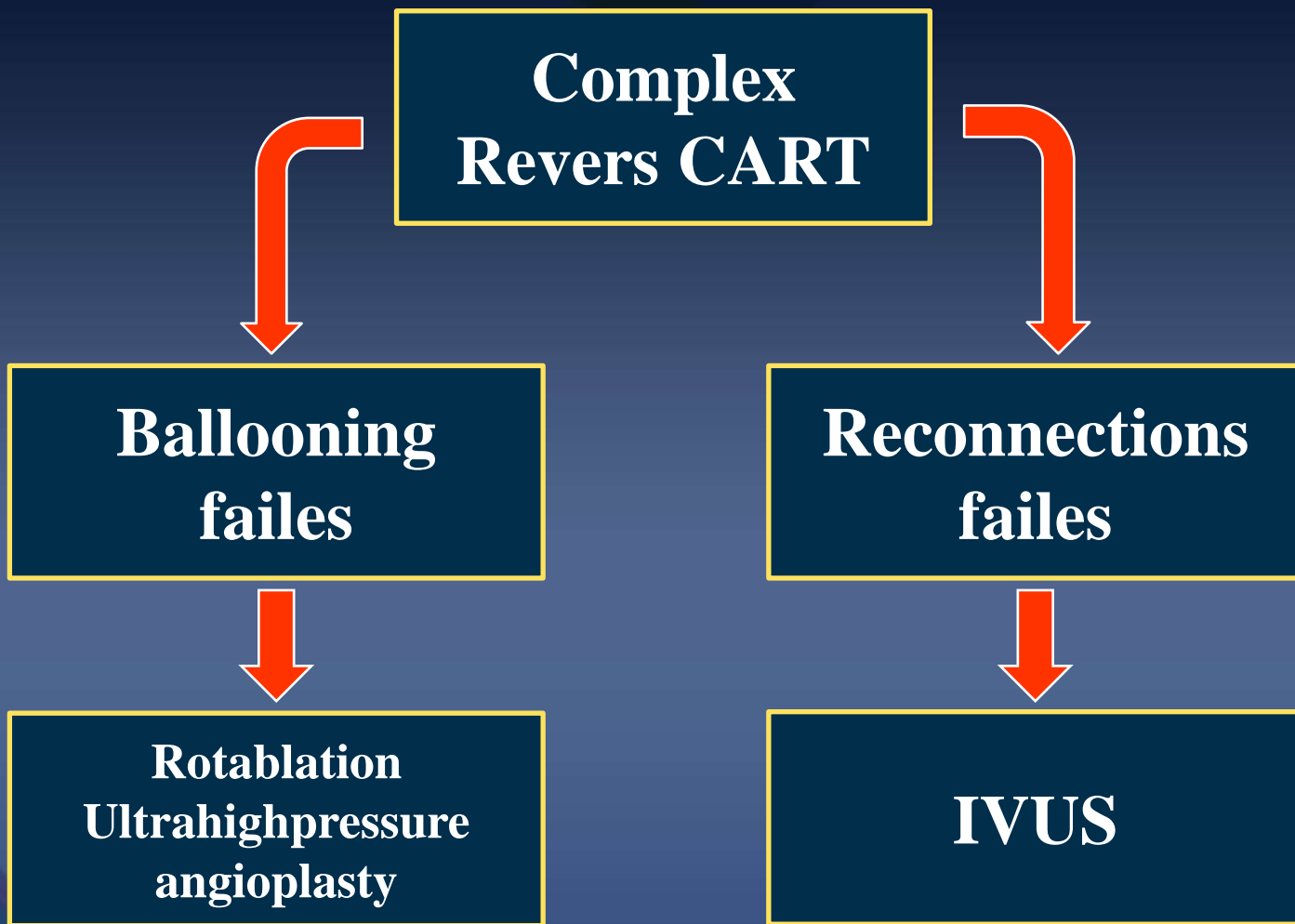
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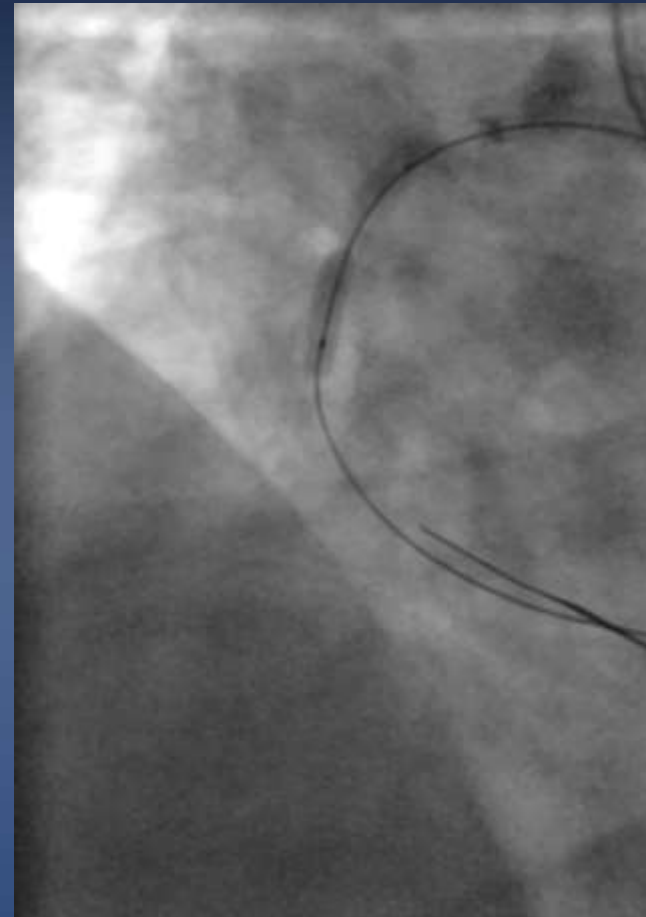


# Problems and Solutions in calcified CTOs:



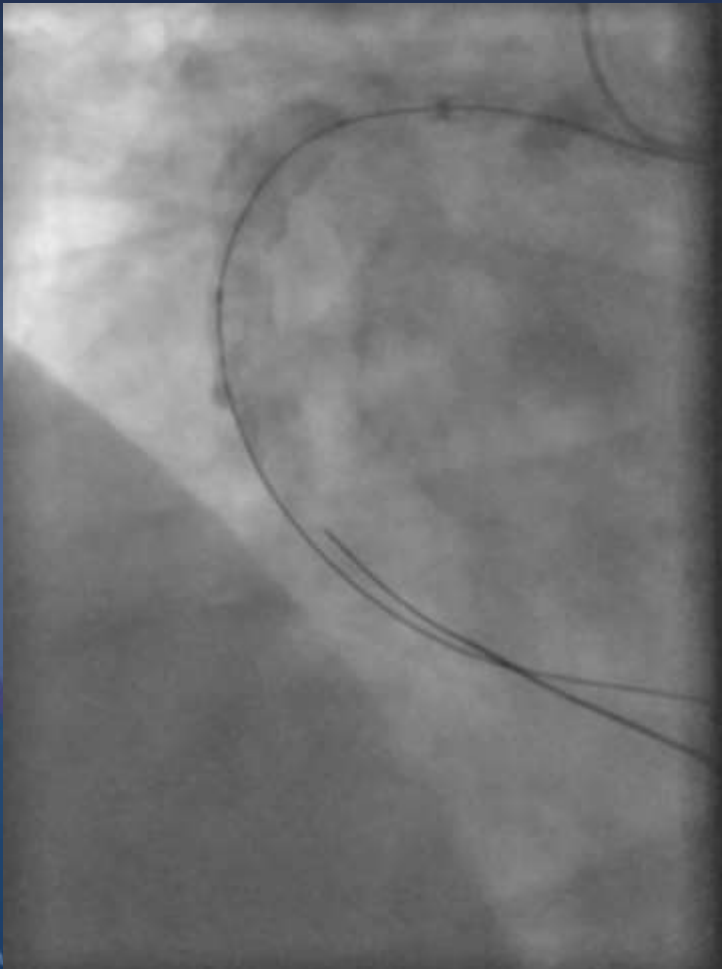
# Revers CART failure: Rotablator assisted revers cart

NC – Balloon at 24atm

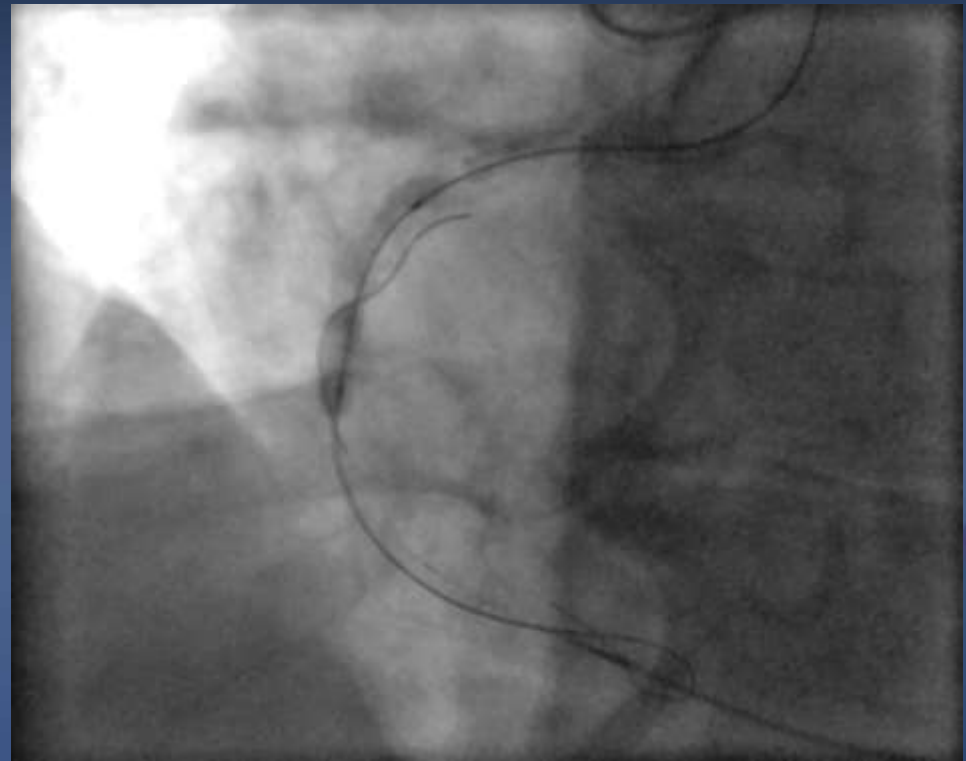


# Revers CART failure: Rotablator assisted revers cart

After balloonrupture



Revers cart failure

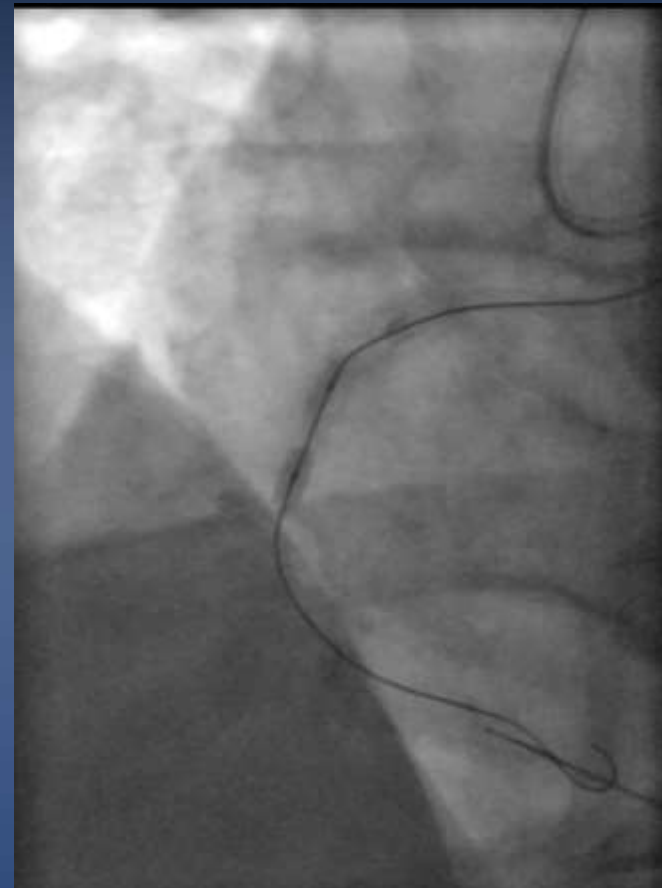


# Revers CART failure: Rotablator assisted revers cart

1,25mm burr



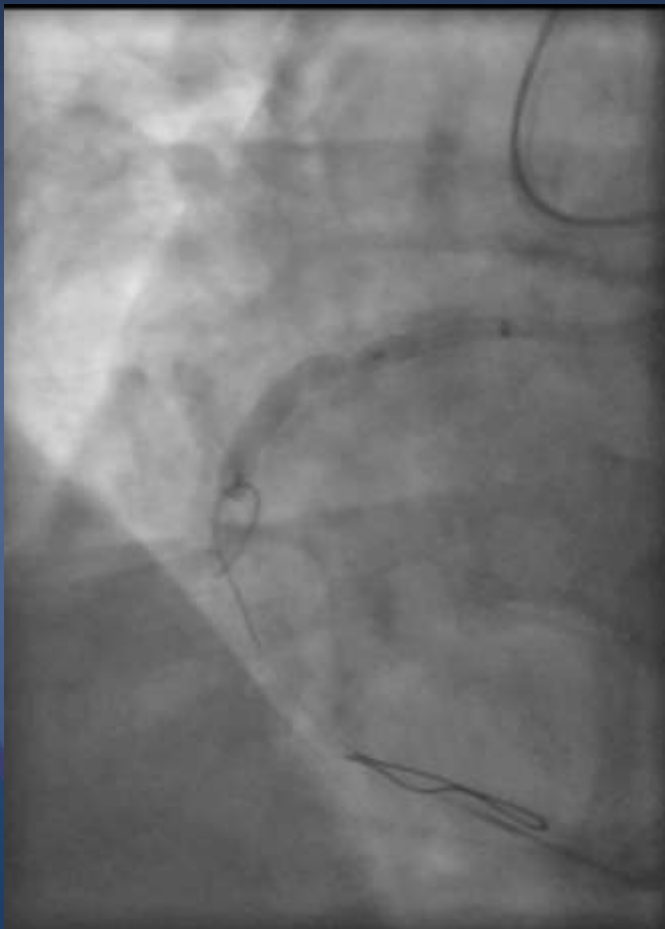
OPNC SIS Medical 45atm





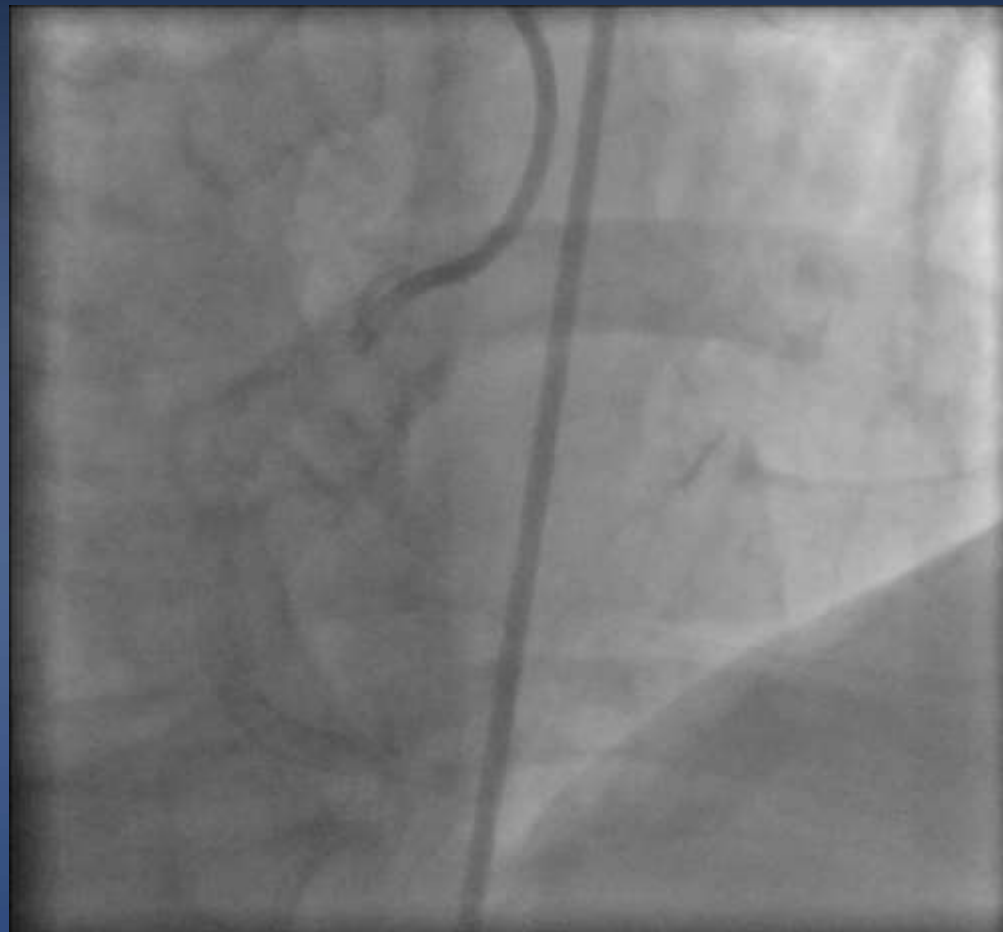
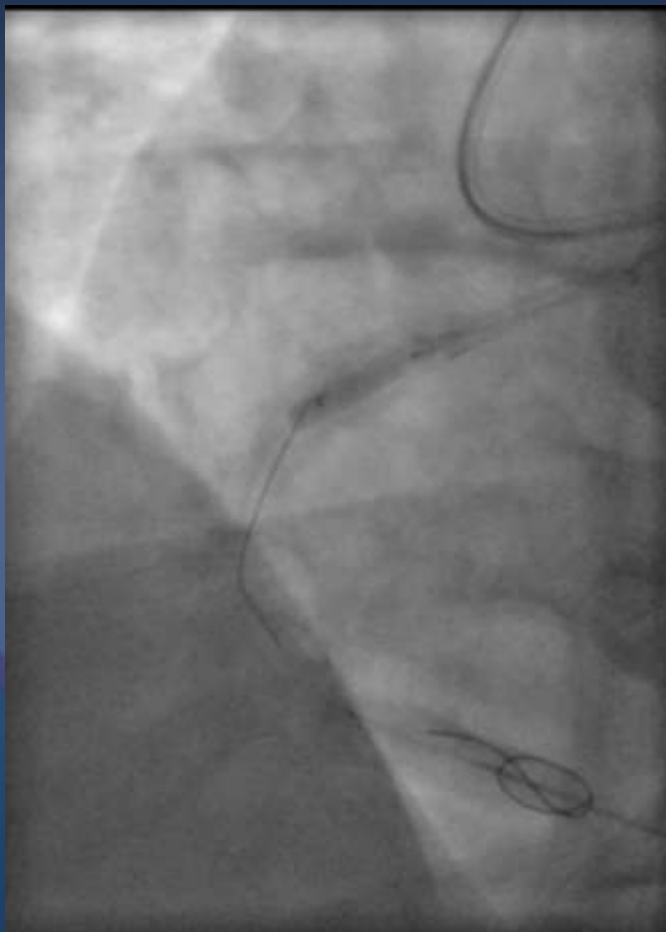
# Revers CART failure: Rotablator assisted revers cart

OPNC SIS Medical  
45atm



# Revers CART failure: Rotablator assisted revers cart

OPNC SIS Medical 55atm



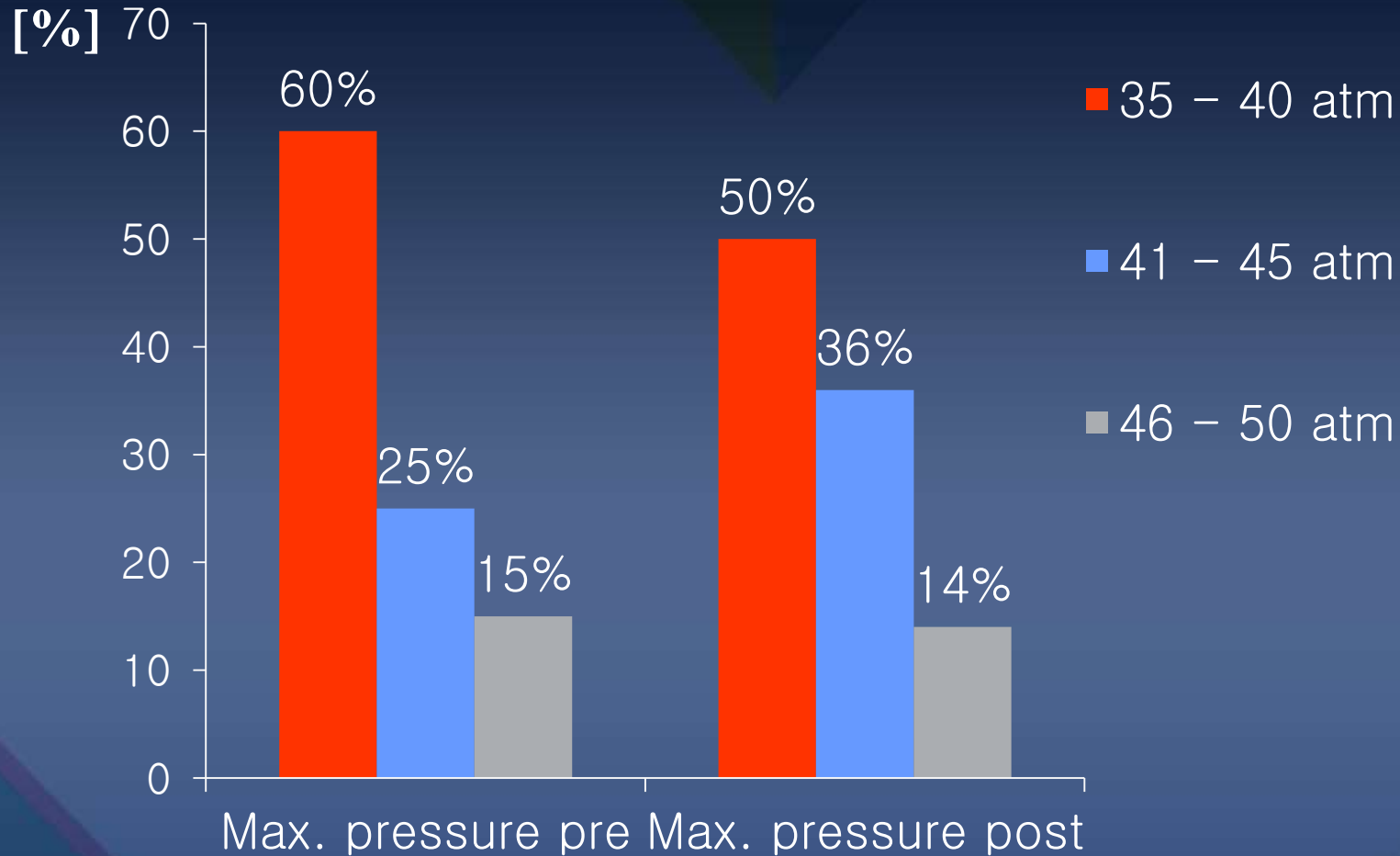
# Ultra-high pressure balloon: OPN NC (SIS Medical)



SIS MEDICAL 40atm Inflation Device	SIS MEDICAL 55atm Inflation Device
For standard and high pressure PTCA up to 40 atm	For super high pressure PTCA up to 55 atm

# Maximum pressures for pre- and post-dilatation

2010 – 2017 n=331 patients n=467 OPN NC balloons



# Conclusion: Heavy calcified CTO

There are three major anatomical issues in heavily calcified CTO:

**Impenetrable proximal cap**

**Uncrossable CTO body**

**Complex revers CART**

**Impenetrable proximal cap** can be overcome with the balloon assisted subintimal entry (BASE) technique or with a retrograde knuckle wire

The **device uncrossable CTO** body can be almost overcome with a rotawire tip in, or with a knuckle wire in case of failed wiring.

In **complex revers CART scenarios** rotablation and ultrahigh-pressure angioplasty can be used. If reconnections fails IVUS confirmation is mandatory.