

# Action Plan Perforation!

**Kambis Mashayekhi**

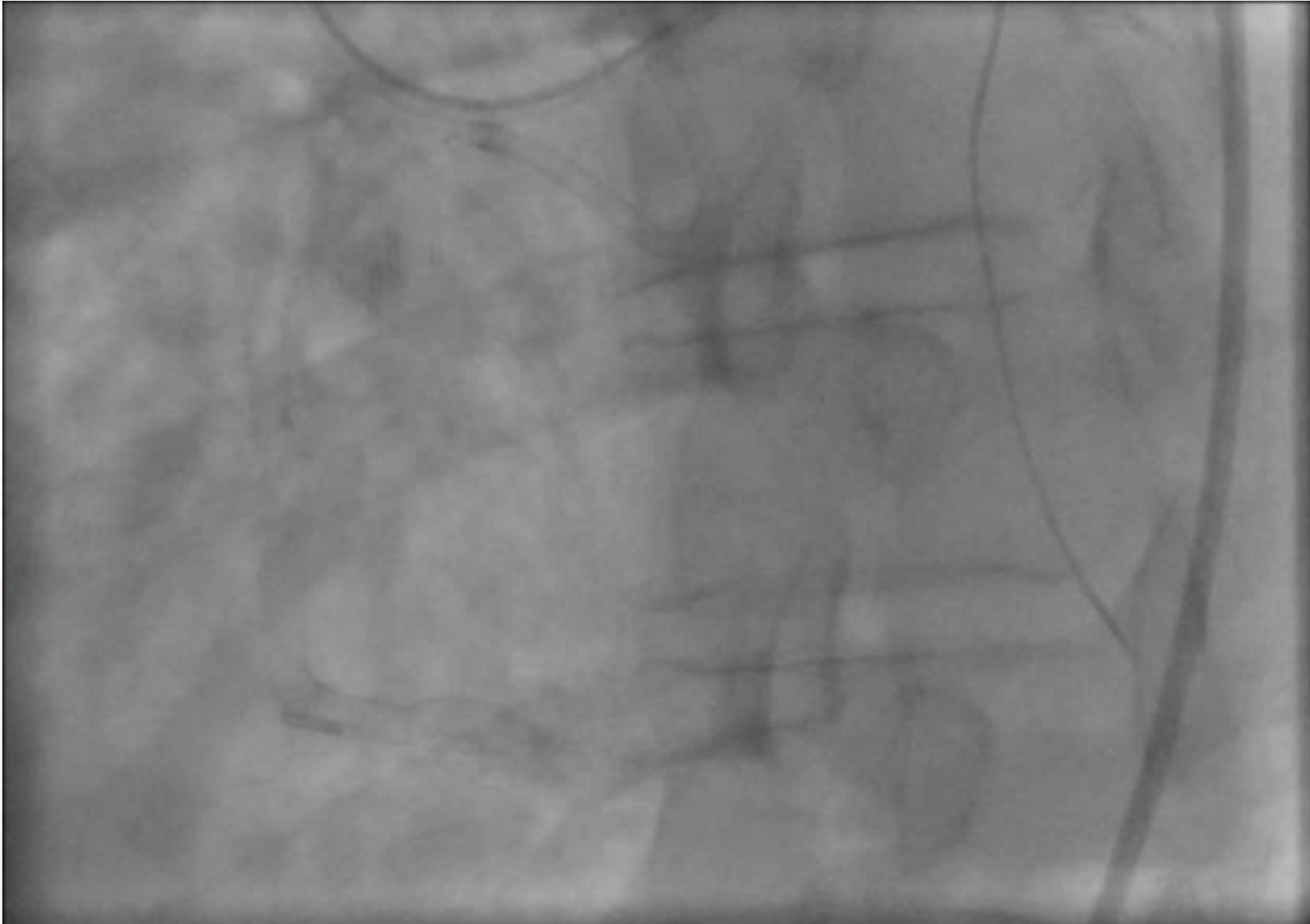
**University-Heartcenter Freiburg • Bad Krozingen**

**UNIVERSITY OF FREIBURG**

# Disclosure

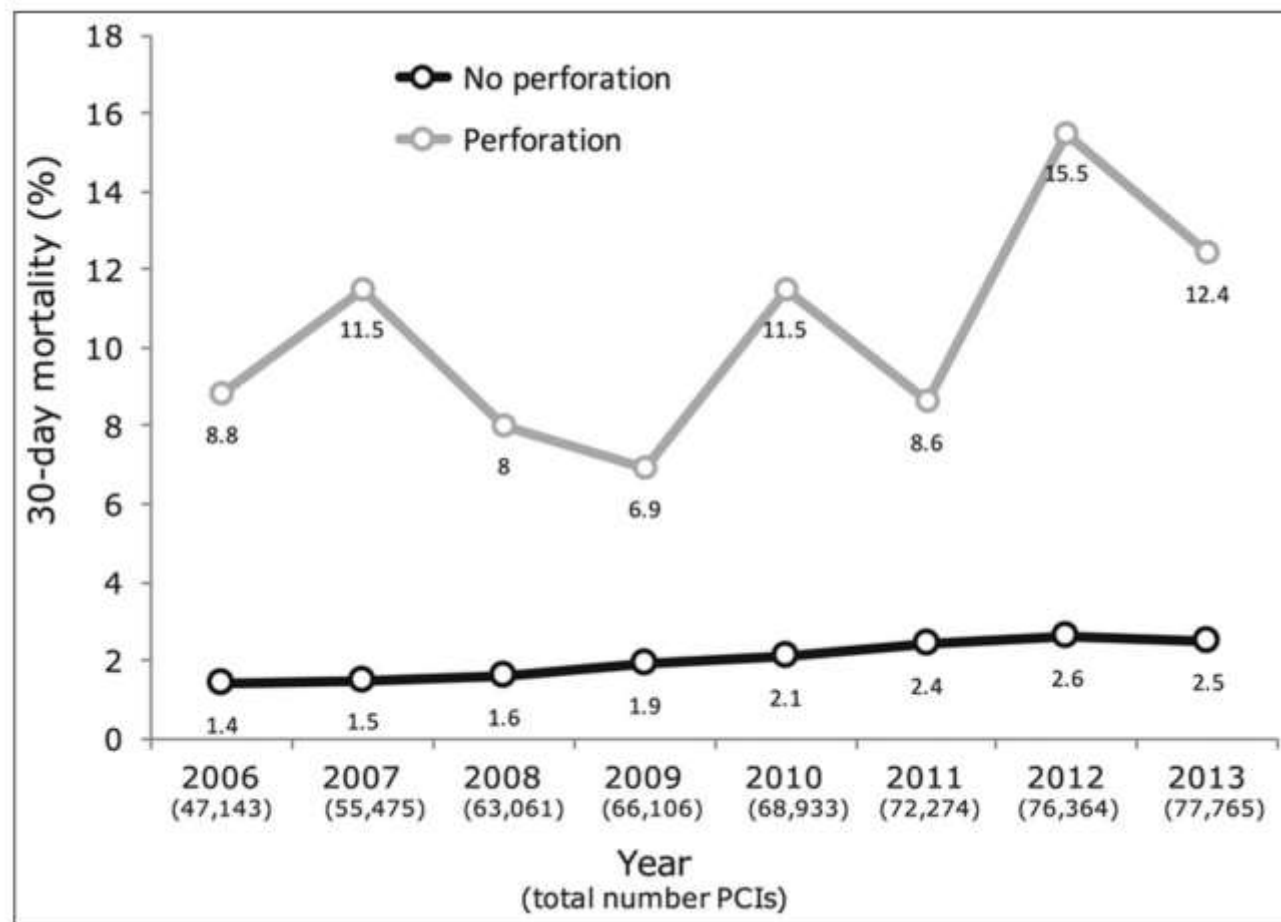
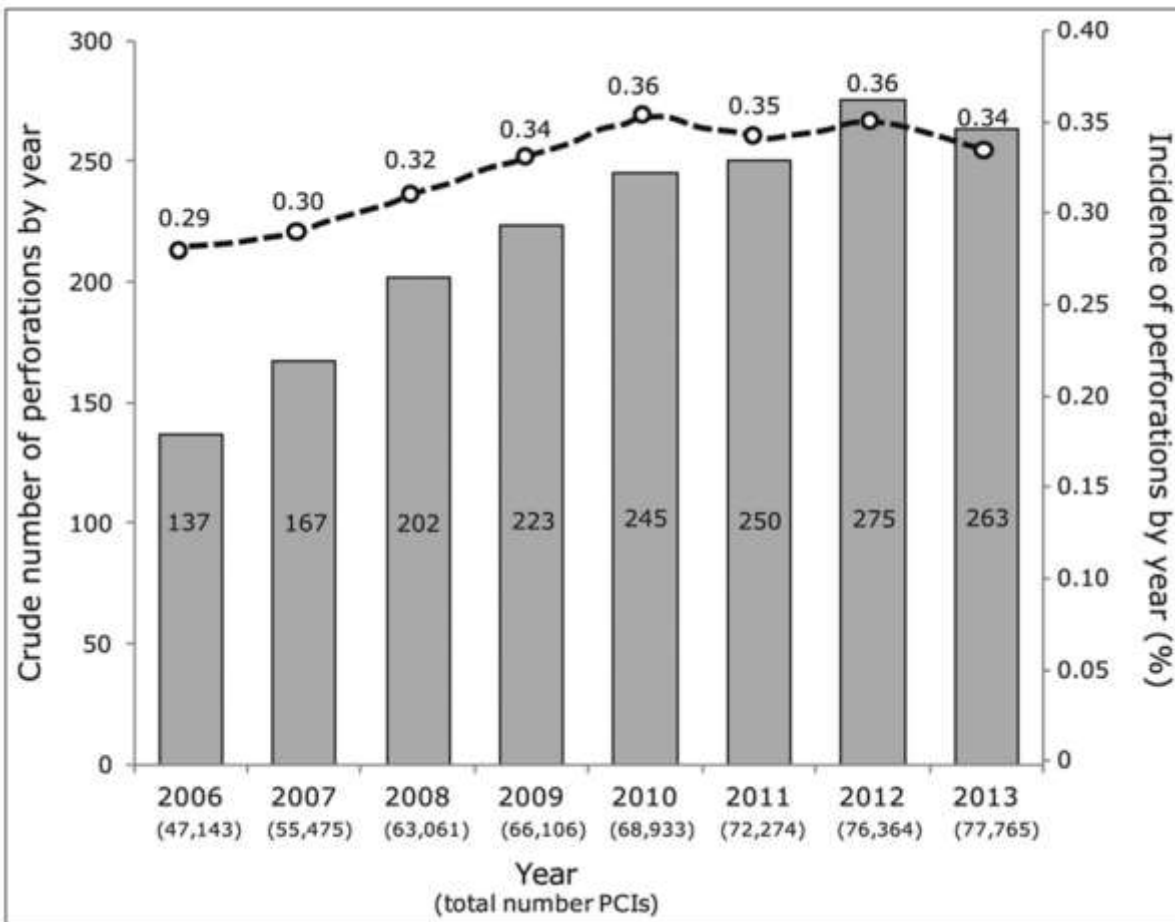
- Kambis Mashayekhi reports consulting/speaker/proctoring honoraria from Abbott Vascular, Abiomed, Ashai Intecc, AstraZeneca, Biotronik, Boston Scientific, Cardinal Health, Daiichi Sankyo, Medtronic, Shockwave Medical, Teleflex, Terumo

# Action!



# Incidence and 30 day-mortality of coronary perforation

*Analysis out of 527121 Cases British Cardiovascular Intervention Society Database*



# Perforations

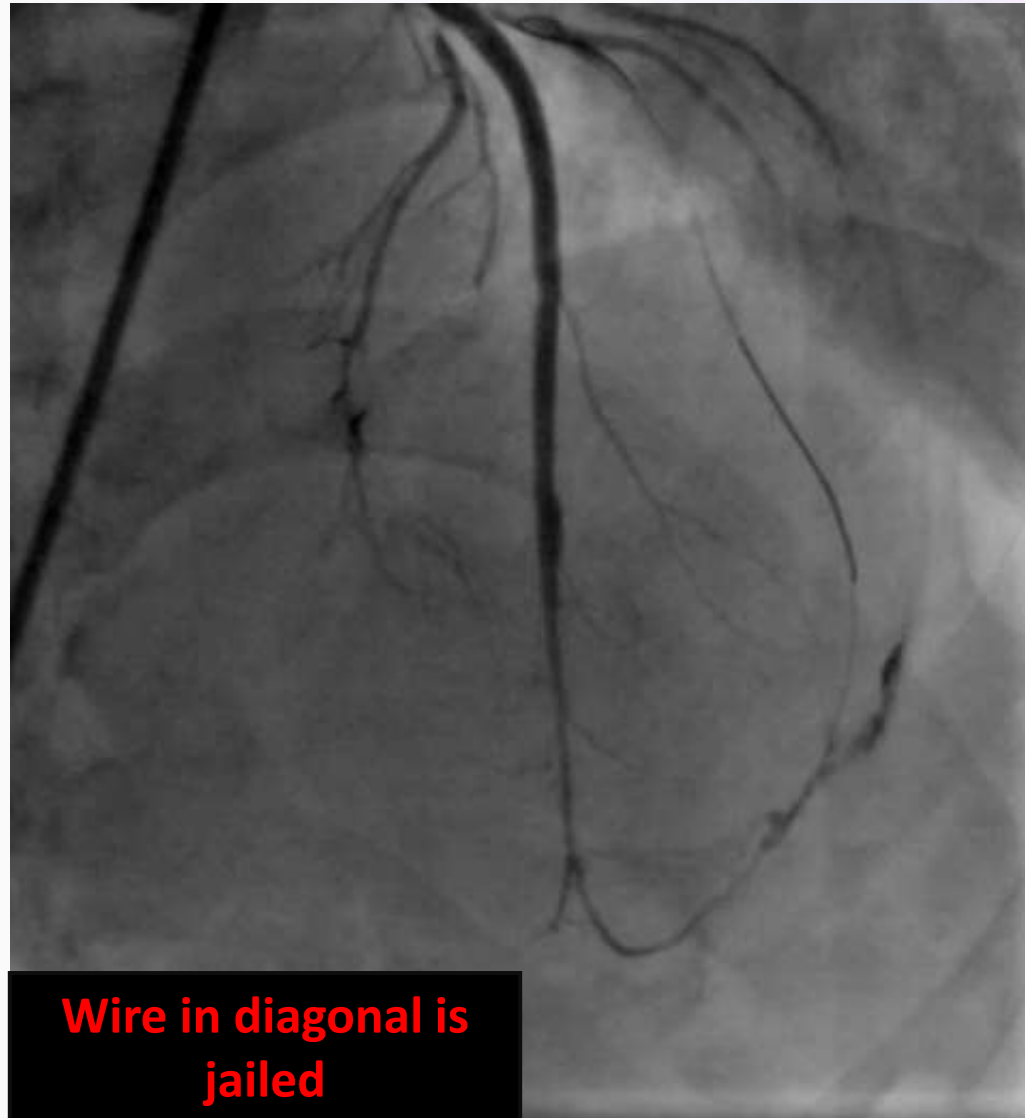
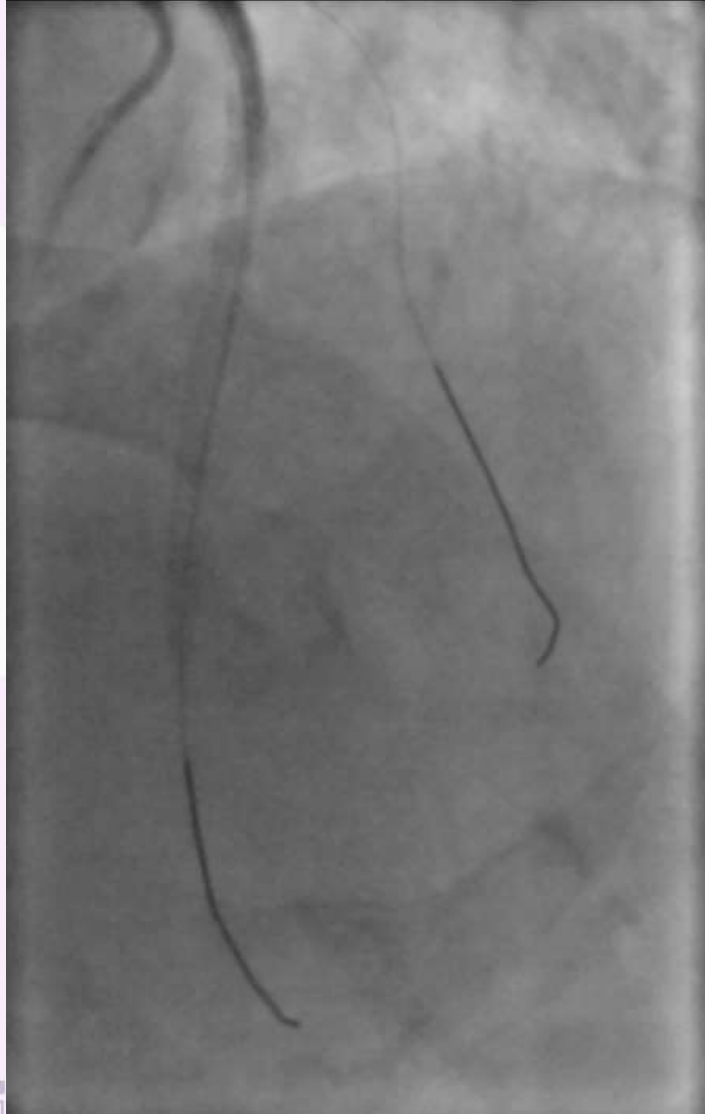


A Venn diagram consisting of two overlapping circles. The left circle is orange and contains the text 'Small vessel perforations'. The right circle is gray and contains the text 'Vessel ruptures'. The overlapping area in the center is a darker shade of brown.

Small  
vessel  
perforations

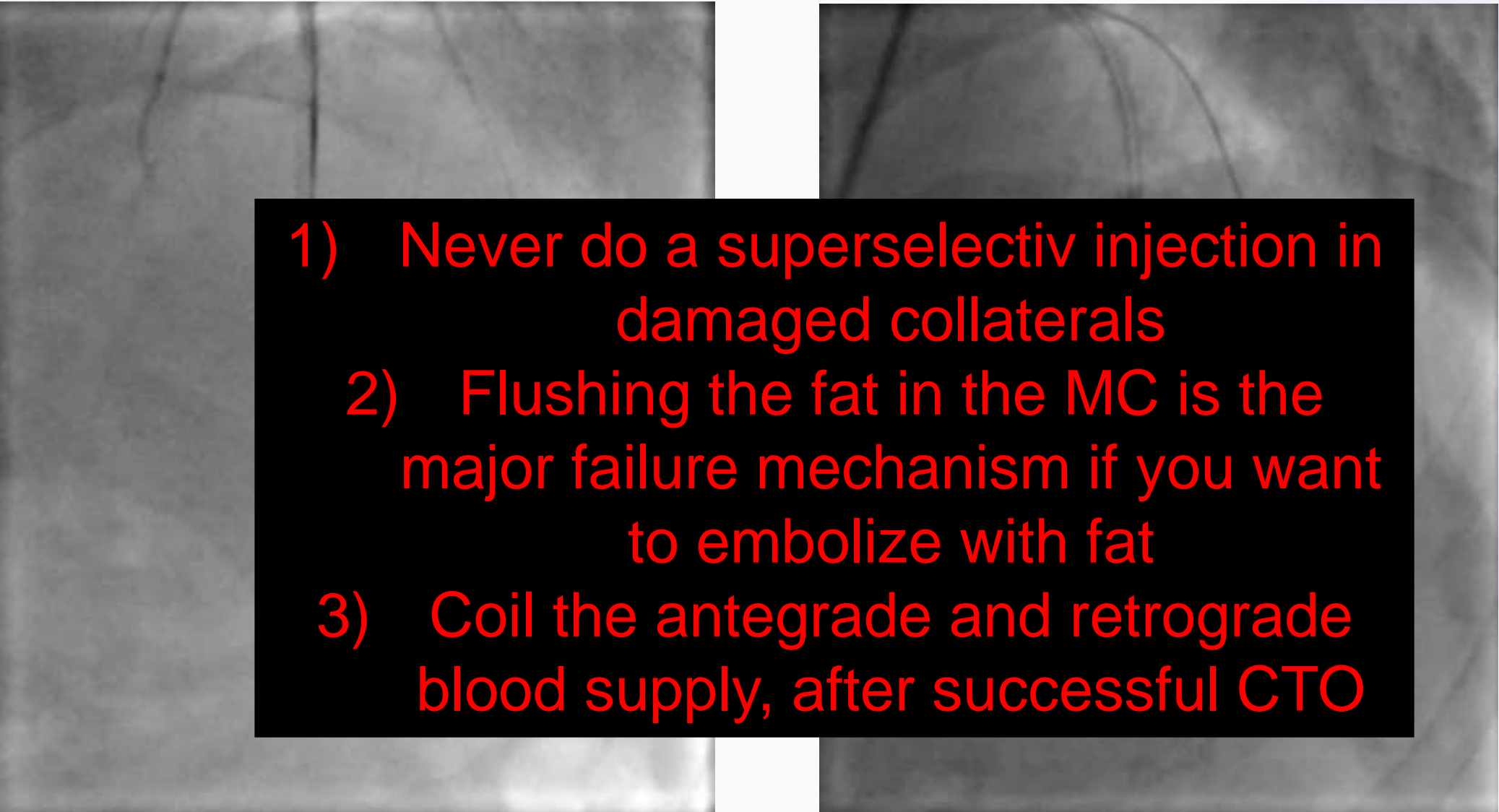
Vessel  
ruptures

# Complications in collaterals



Wire in diagonal is  
jailed

# Complications in collaterals

- 
- 1) Never do a superselective injection in damaged collaterals
  - 2) Flushing the fat in the MC is the major failure mechanism if you want to embolize with fat
  - 3) Coil the antegrade and retrograde blood supply, after successful CTO

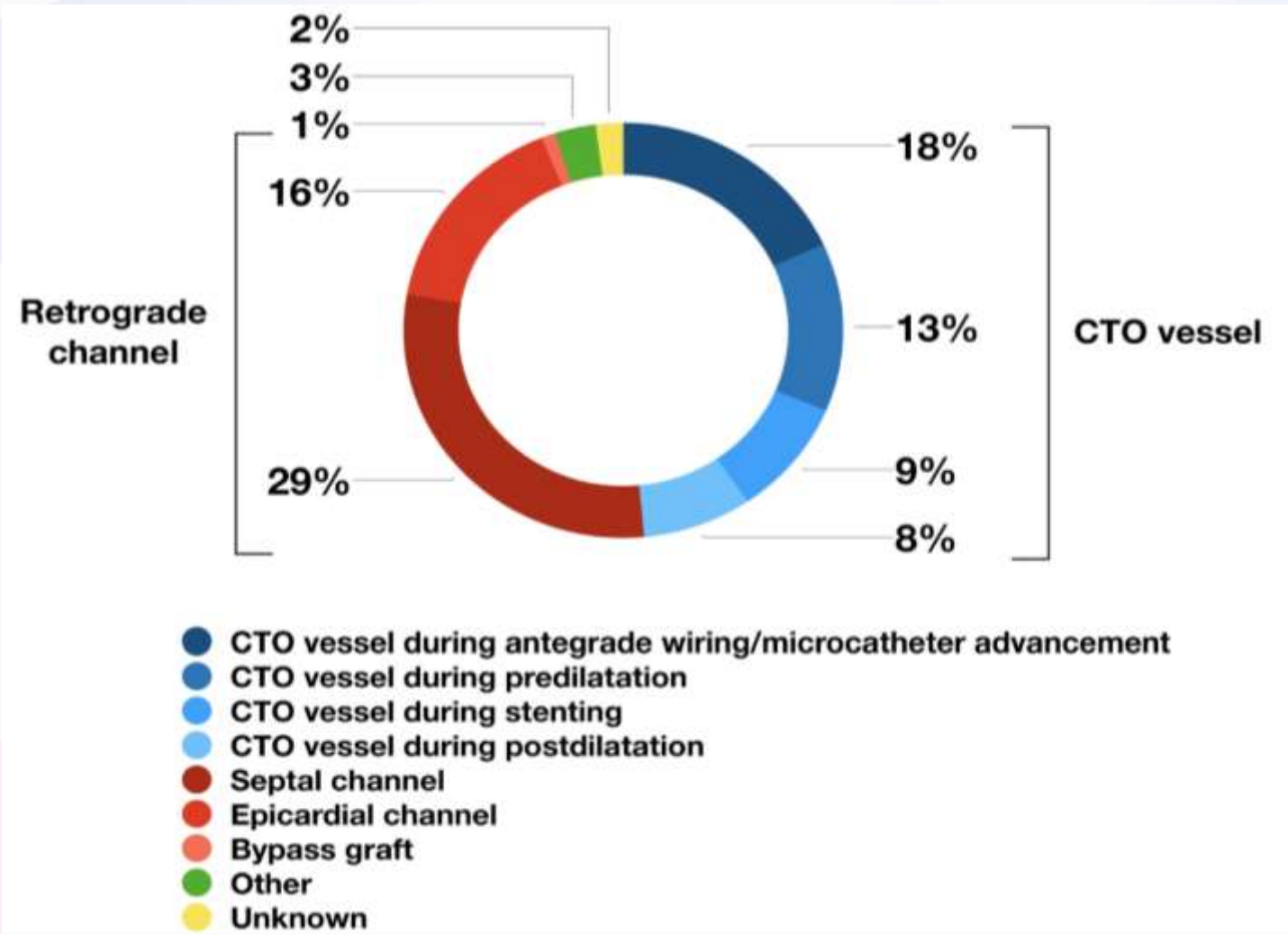
# Complications in collaterals





# Coronary perforation during CTO PCI

European Multicenter Registry including 1811 patients with 99 perforations (5.5%)



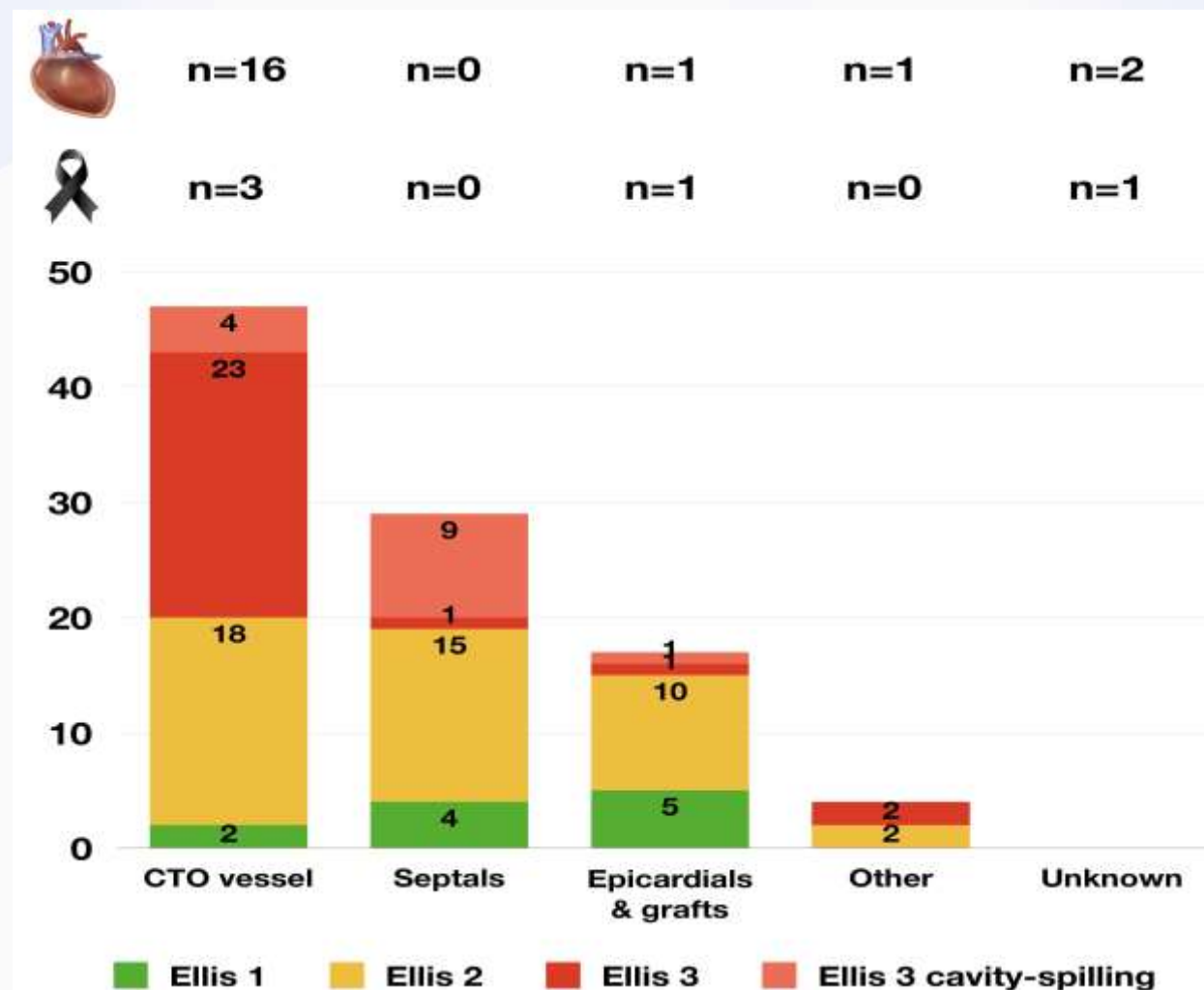
Azallini L, Poletti E, Ayoub M, ....., Mashayekhi K., EuroIntervention 2019

# Coronary perforation during CTO PCI

European Multicenter Registry including 1811 patients with 99 perforations (5.5%), totale rate of tamponade (0,9%)

Tamponade: 20%

Death: 5,5%



Azallini L, Poletti E, Ayoub M, ....., Mashayekhi K., EuroIntervention 2019

# Coronary perforation during CTO PCI

Open CTO Registry including 1000 patients with 89 perforations (8.9%),  
total rate of tamponade (1,0%)

Tamponade: 23.3%

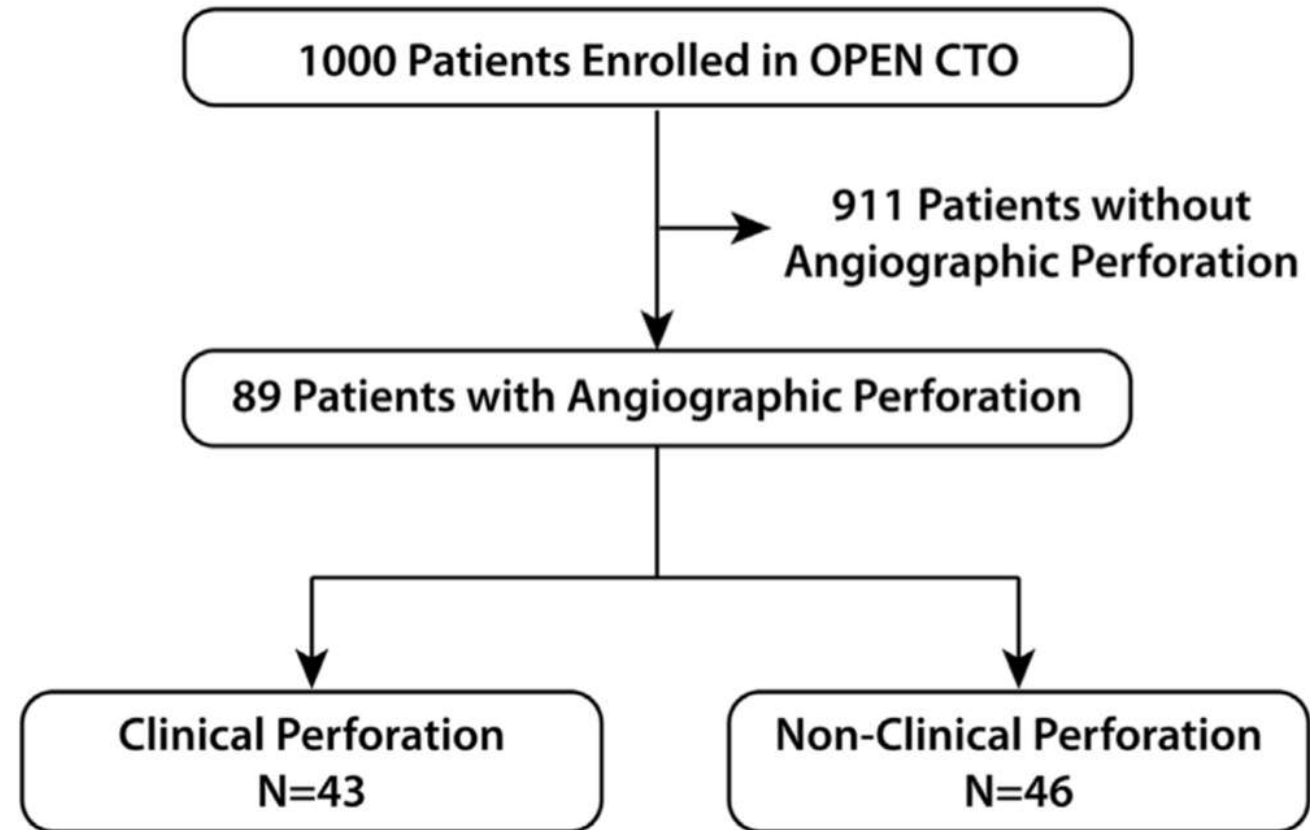
Death: 20.9%

**TABLE 3** Incidence of MAE Among Patients With Angiographic Perforation

	Clinical (n = 43)	Nonclinical (n = 46)	Total (N = 89)	p Value
Combined adverse events	22 (51.2)	3 (6.5)	25 (28.0)	<0.01
In-hospital death	9 (20.9)	0 (0.0)	9 (10.1)	<0.01
Pericardial effusion	18 (41.9)	3 (6.5)	21 (23.5)	<0.01
Cardiac tamponade	10 (23.3)	0 (0.0)	10 (11.2)	<0.01
Pericardiocentesis	6 (14.0)	0 (0.0)	6 (6.7)	0.01
Pericardial window	4 (9.3)	0 (0.0)	4 (4.1)	0.05

Values are n (%).  
MAE = major adverse events.

**FIGURE 1** Flow Diagram of Analytic Population



Hirai et al., JACC Cardiovasc Interv. 2019 Jun 19

# “The dry tamponade” Epicardial Perforation post-CABG



After surgery





# Coils and Microcatheters

**1.8 Fr compatible :**

**Finecross, Caravel, Corsair, Turnpike**

**Axiom or Concerto  
– ev3**

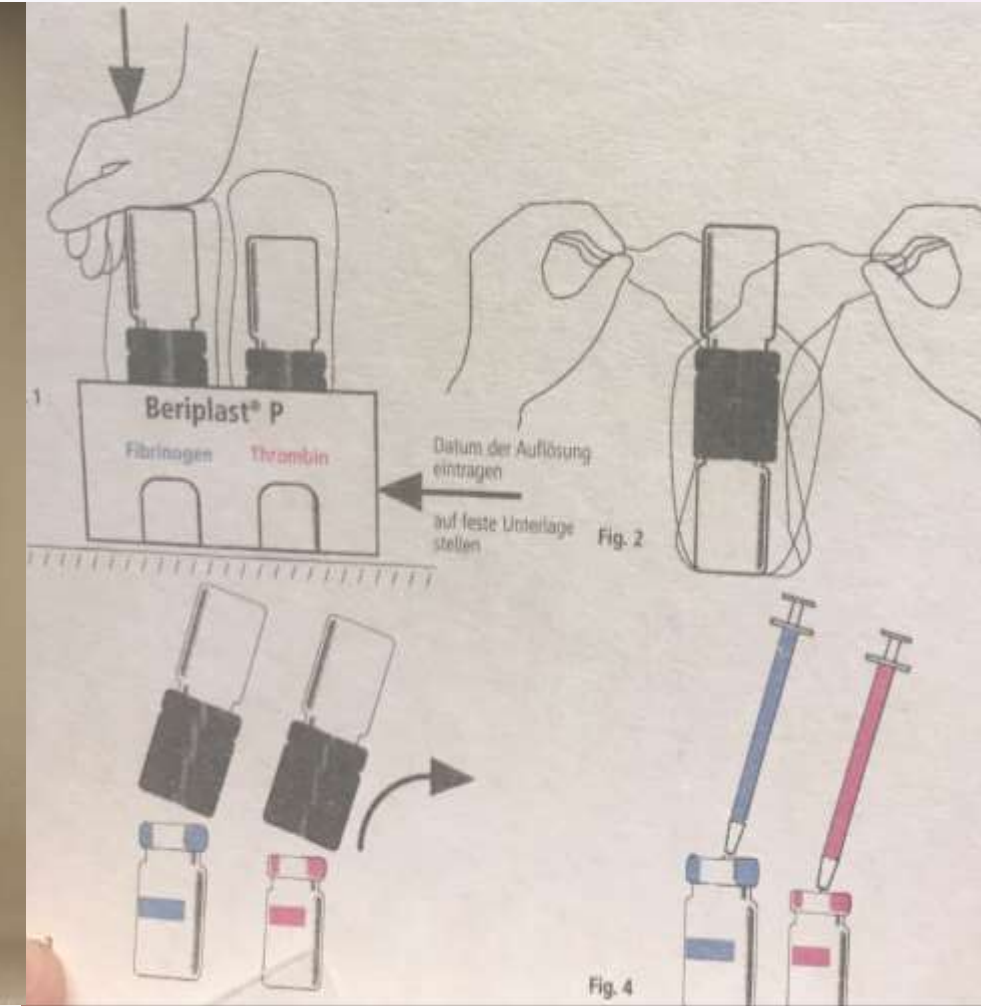
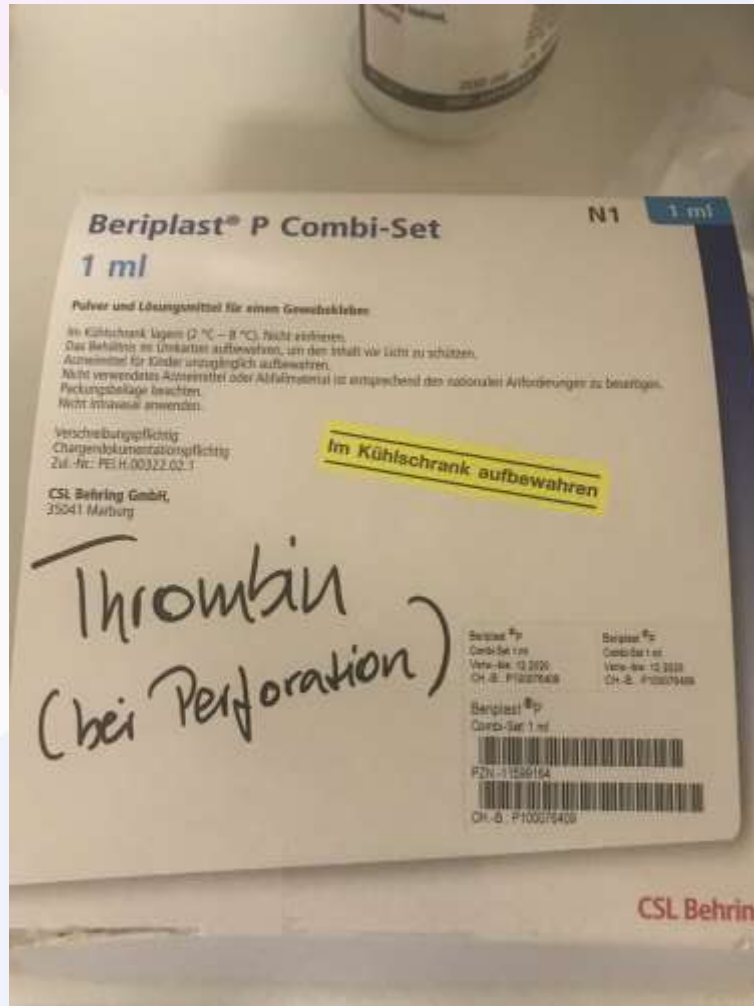
**2.4 Fr compatible:**

**Progreat**

**Boston Figure 8-18, or VortX Diamon – 18,  
Azur-Terumo,**



# Thrombin



# Perforations



A Venn diagram consisting of two overlapping circles. The left circle is orange and contains the text 'Small vessel perforations'. The right circle is gray and contains the text 'Vessel ruptures'. The overlapping area in the center is a darker shade of brown.

Small  
vessel  
perforations

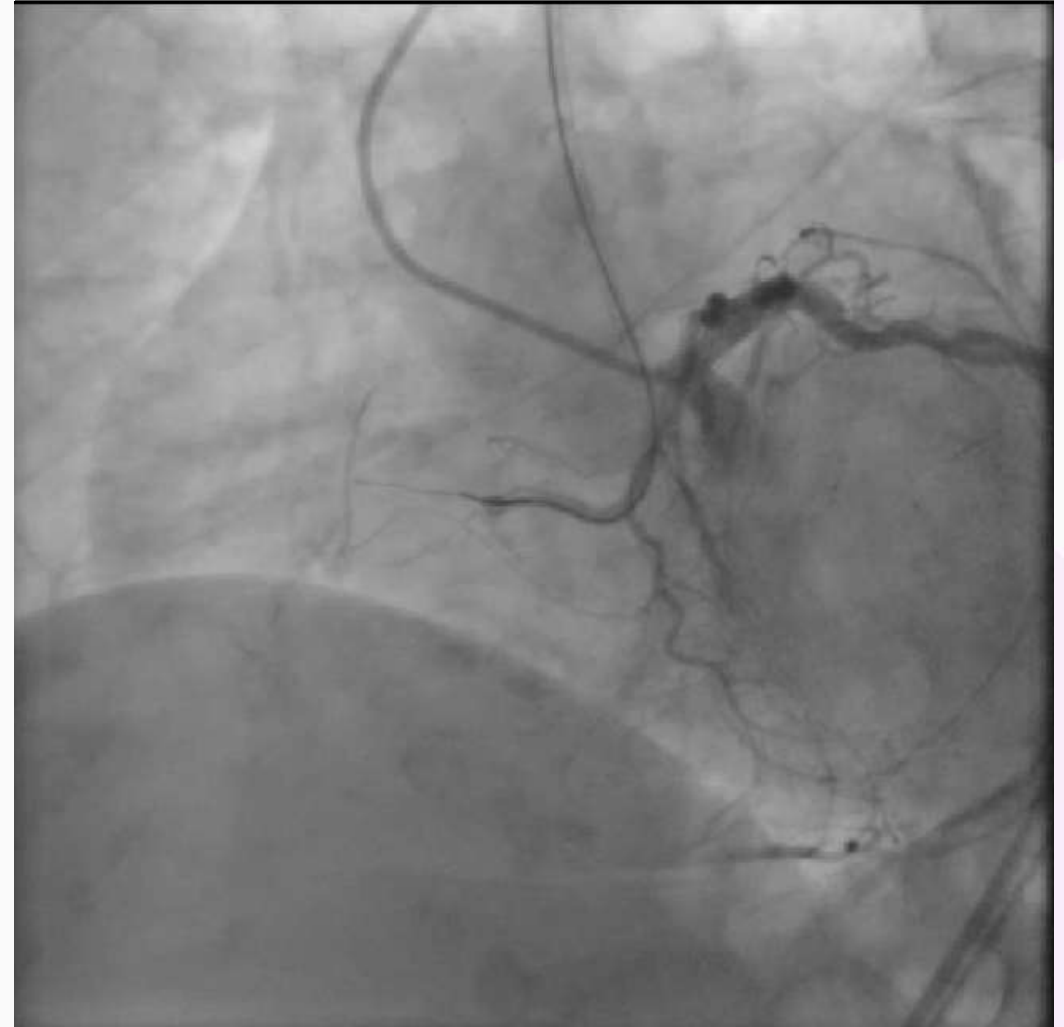
Vessel  
ruptures

# Rota Complication after Antegrade Wire Escalation

7F AL 0.75, Turnpike and  
Confianza 12g

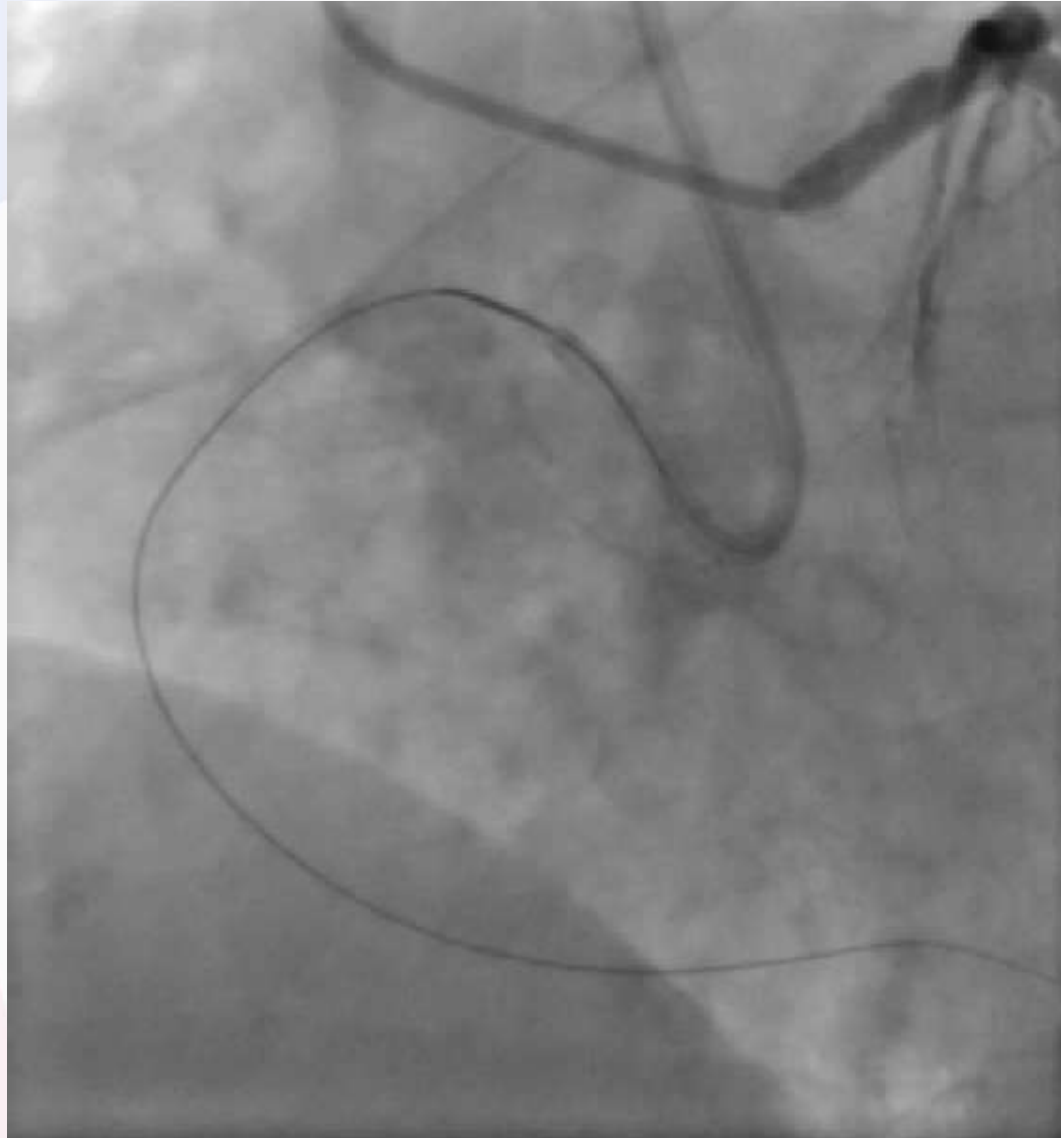


Step down after cap penetration →  
Fielder XT



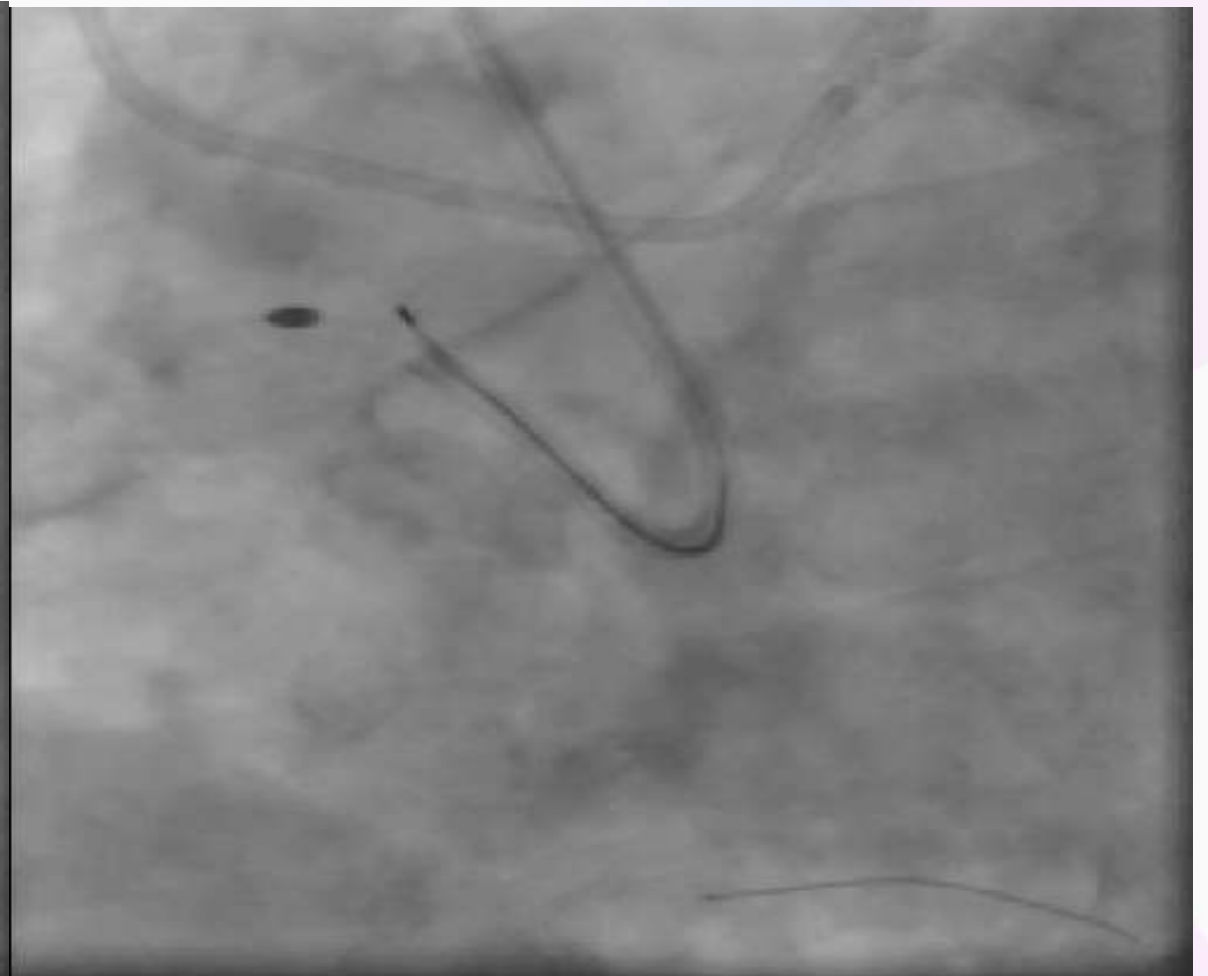


# Successful antegrade Wiring: Confianza pro 12 > Fielder XT > Gaia 3<sup>rd</sup>





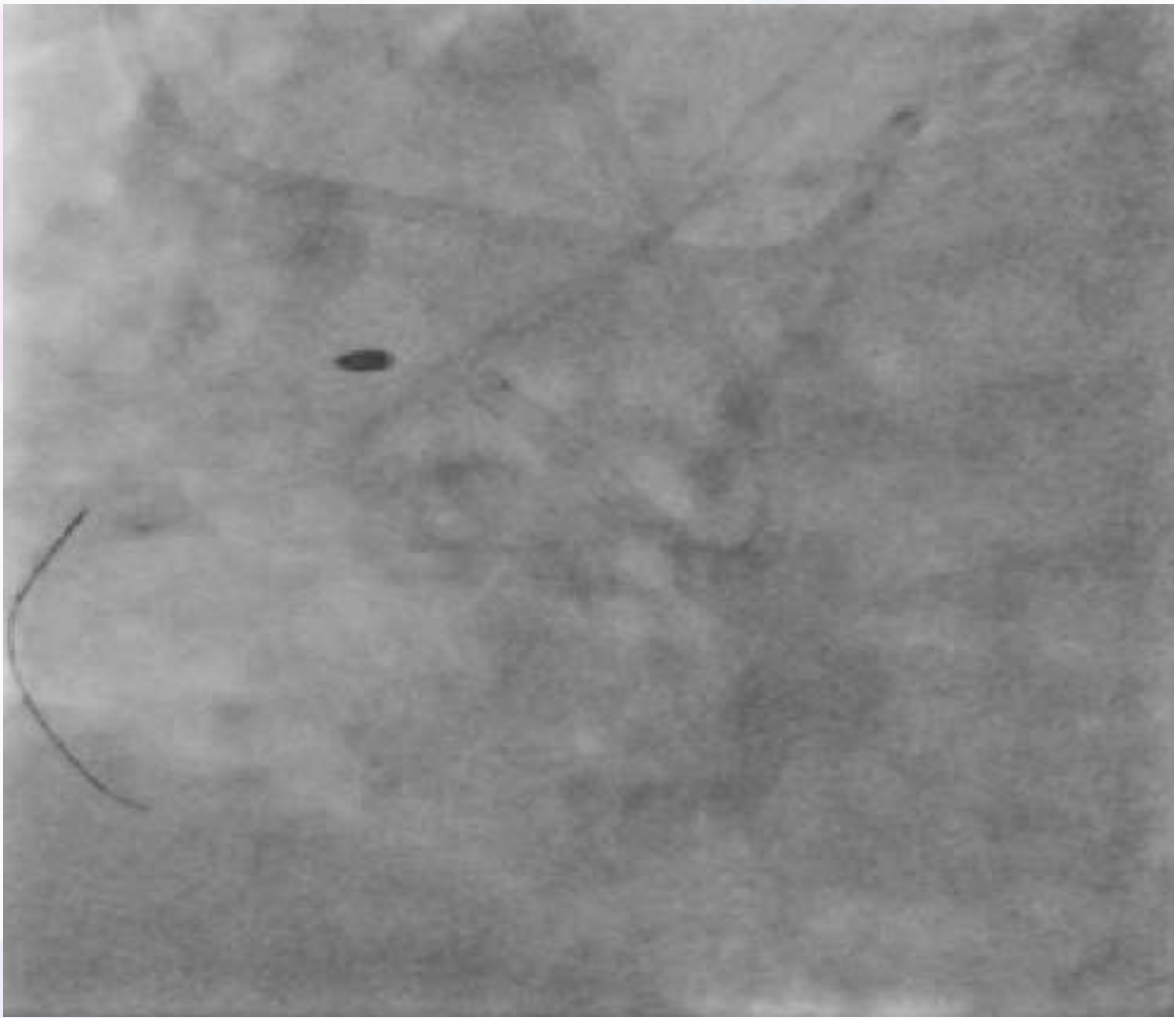
**Entrapment of the  
1.75mm burr after the  
second rota run**



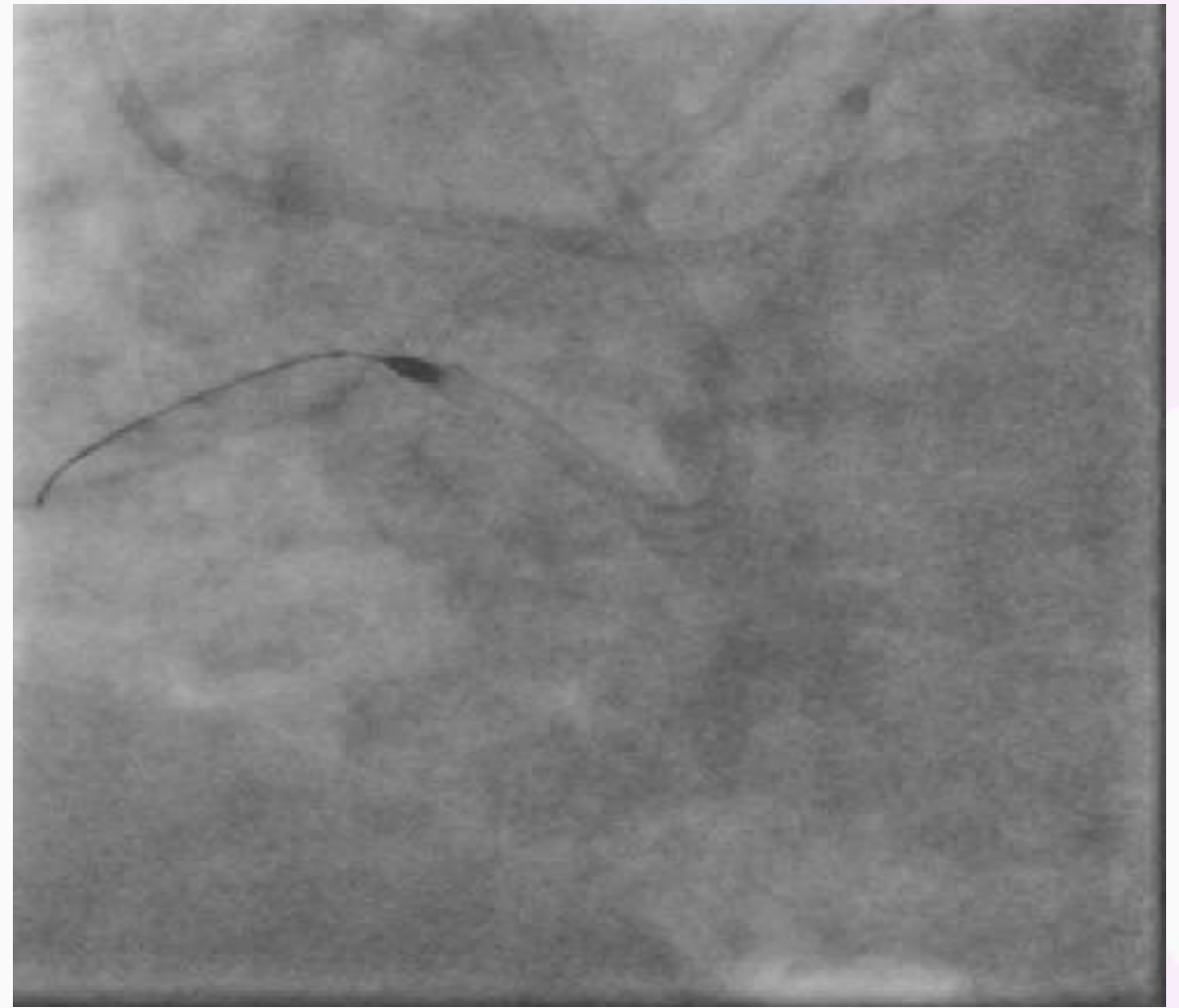
**Rota shaft fracture after snaring  
maneuver**



Preparing for pulling the Rotawire with  
balloon dilatation proximal to the burr



**Gently pull back  
on the rotawire**



**while countertraction is  
applied on the catheter**

# Broken rotashaft with snare and 1.75mm burr



**Vessel  
perforation  
Ellis type III**



**Knuckle wire goes  
into pericard →  
Balloon occlusion**





# Retrograde Rescue CTO PCI

retrograde guiding catheter  
changed to XB 3,5 7Fr



Turnpike MC with selective  
Injection for septal connection



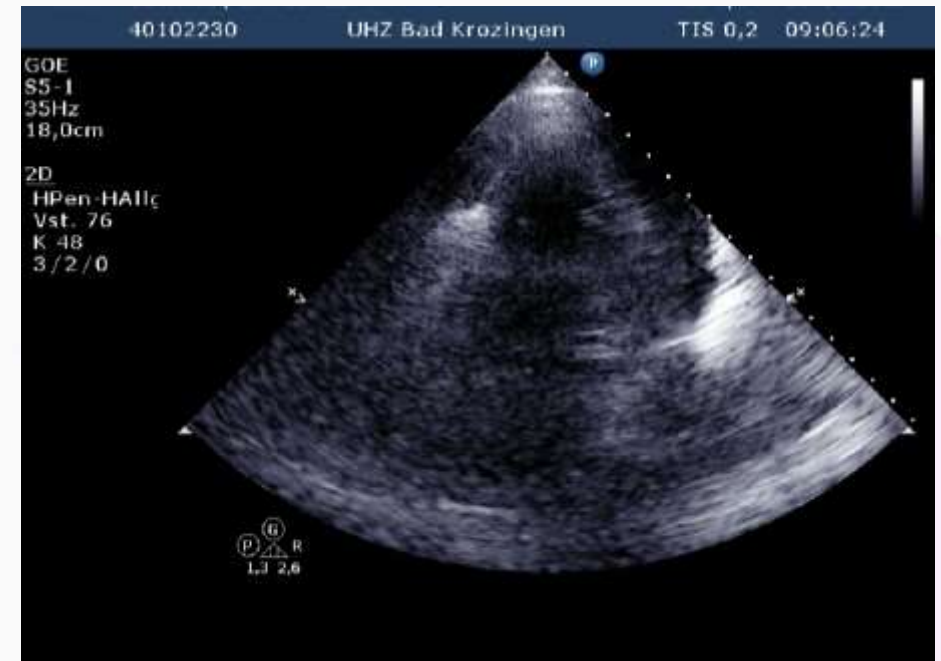
# Septal wiring with sion black





cardiac  
tamponade

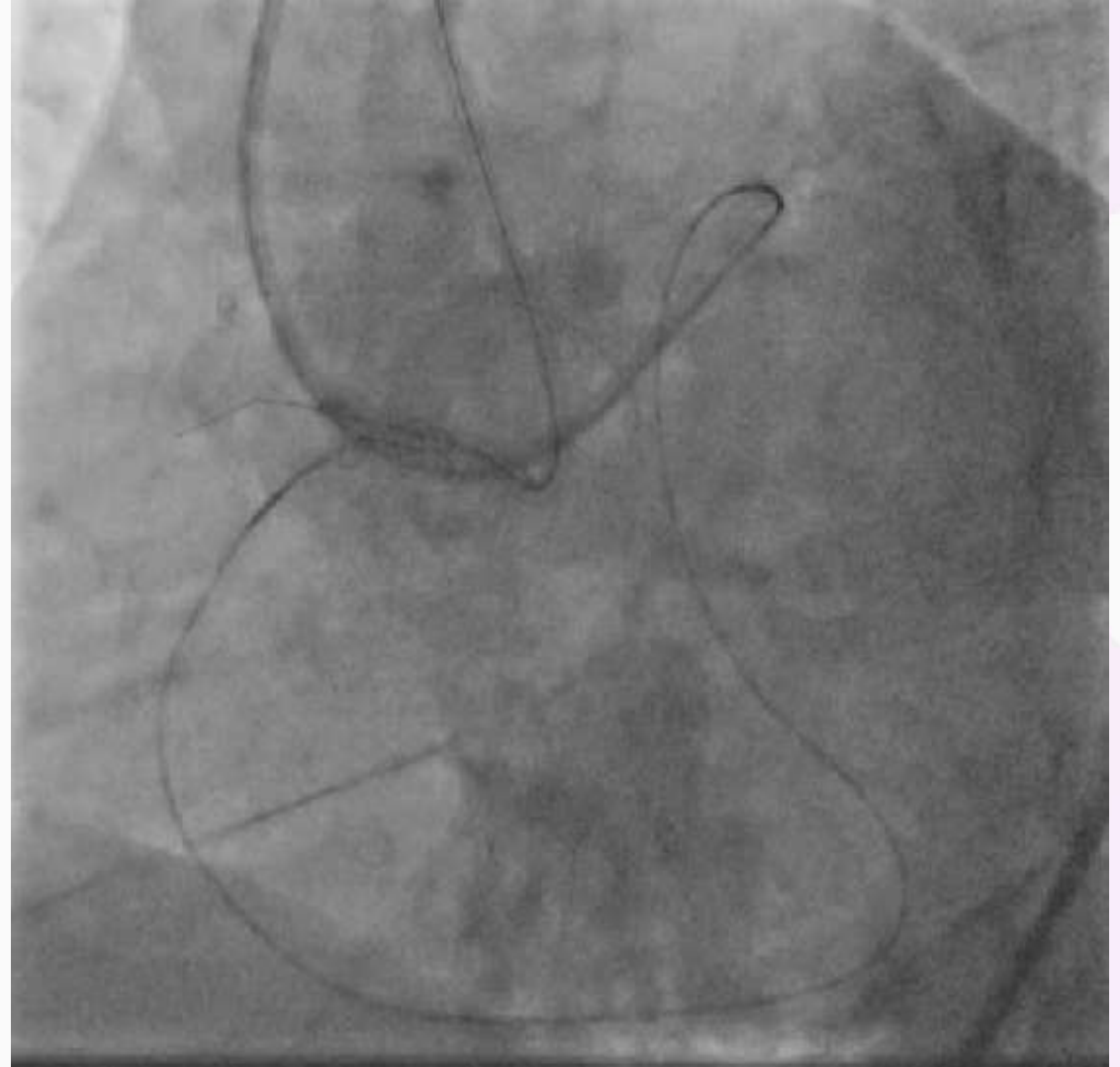
Pericardiocentesis



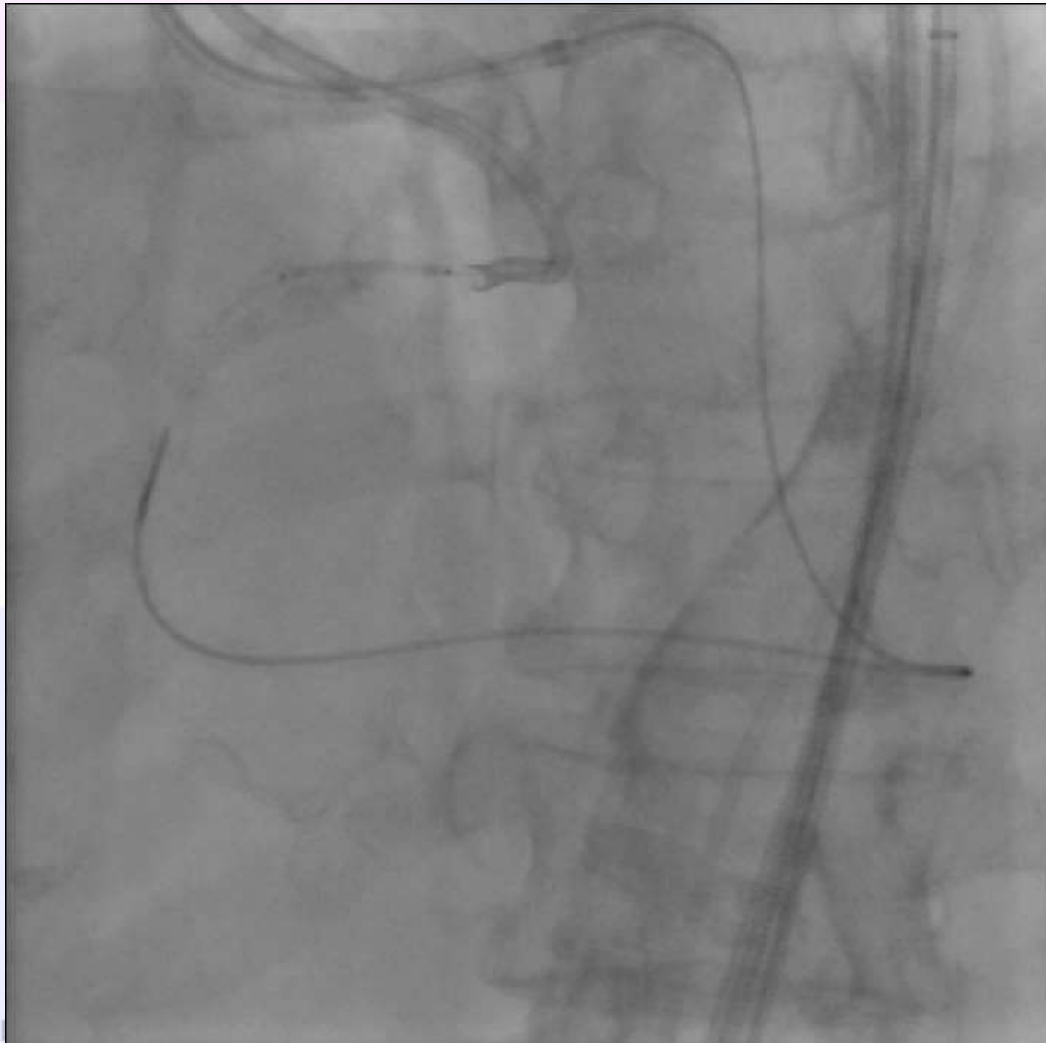
## Selective injection at the distal cap



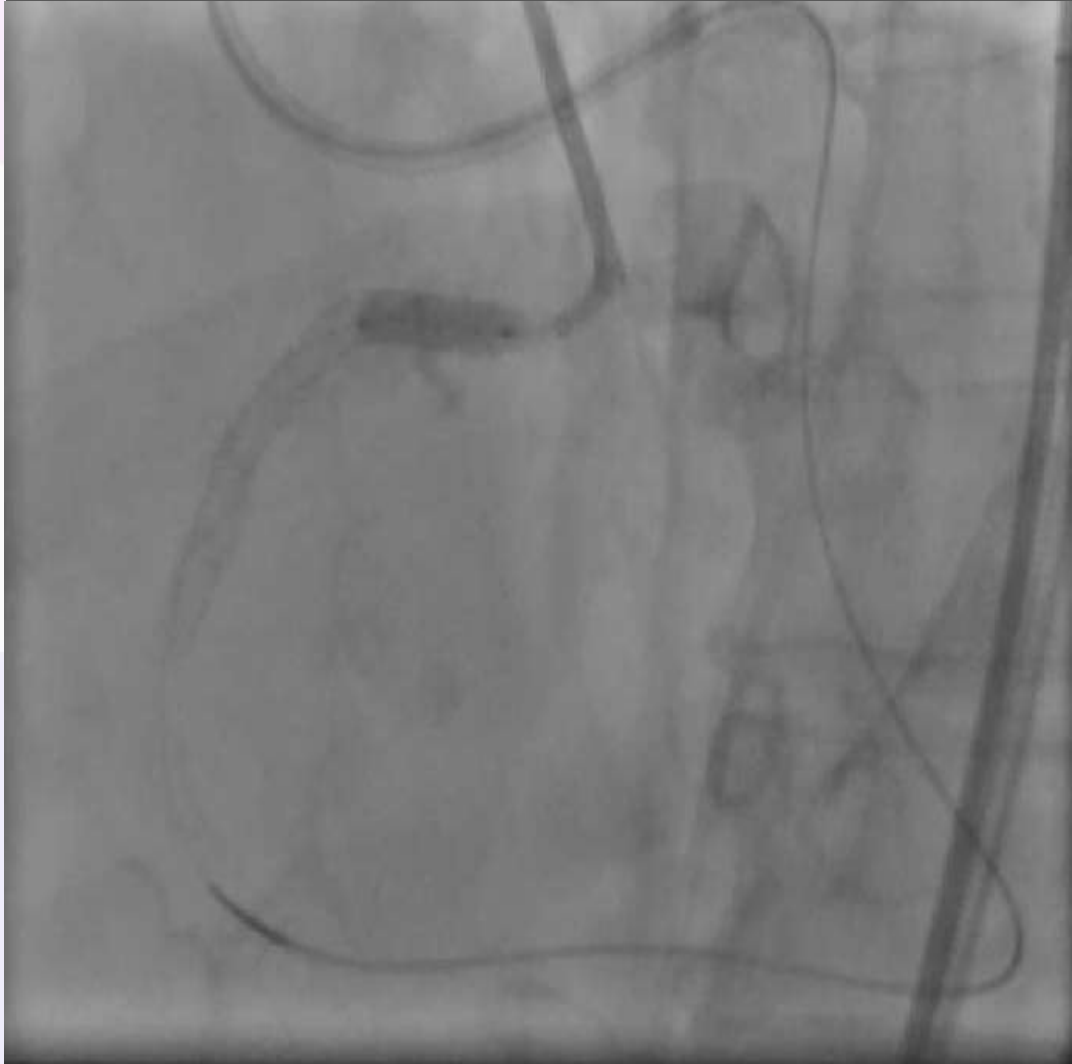
## Knuckling Gladius wire into the ascending aorta



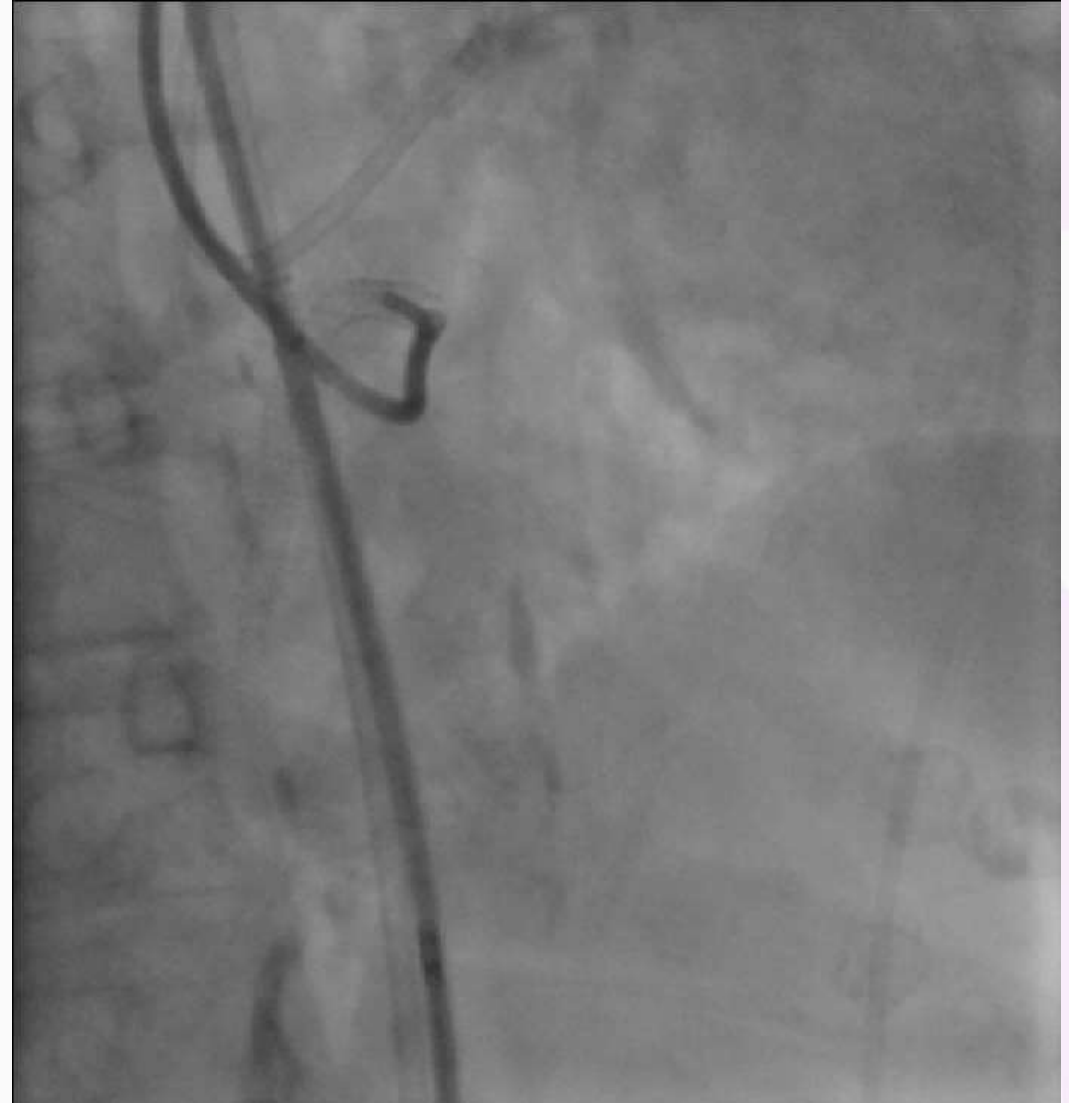
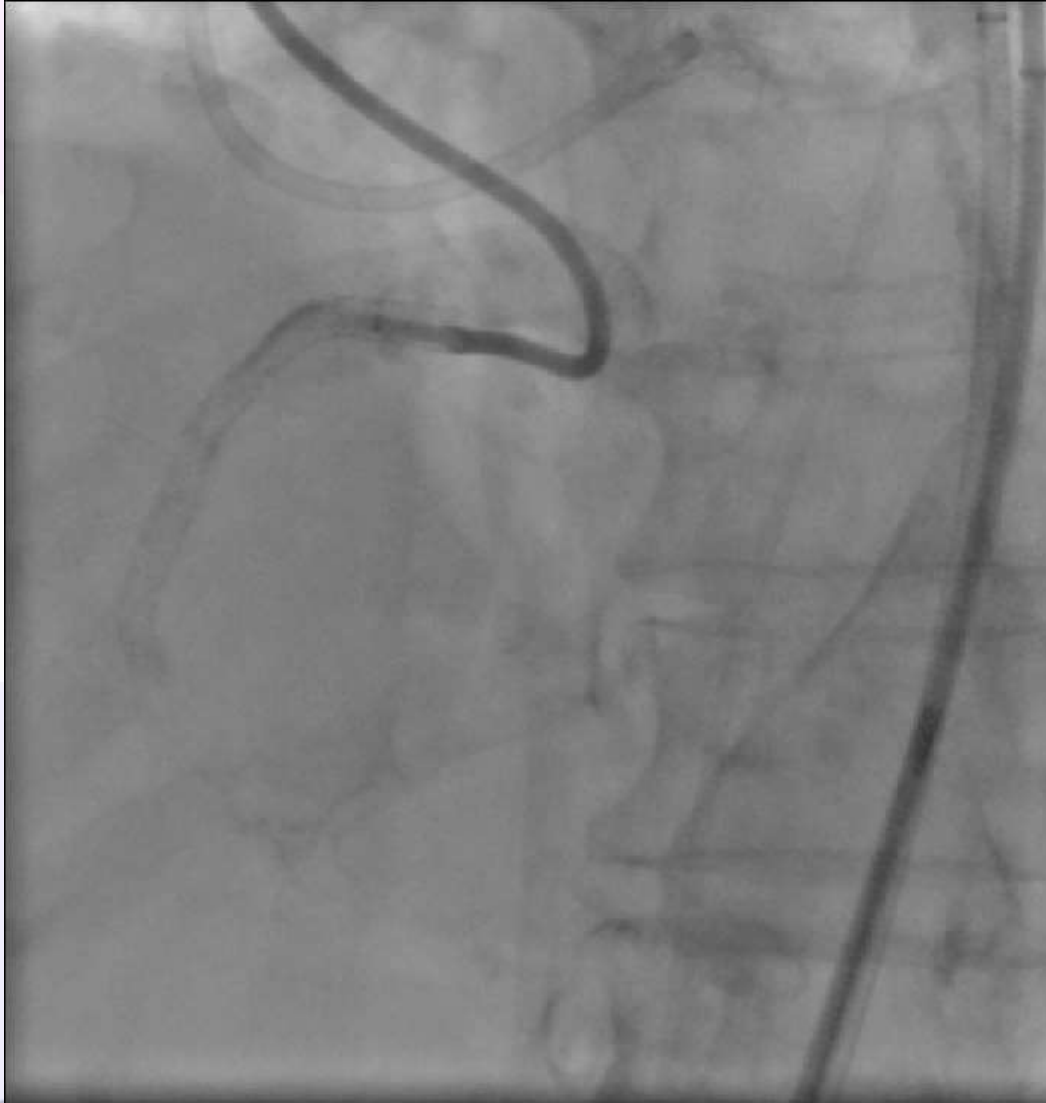
# RG3 externalized and Guideliner assisted stentimplantation performed



# Implantation of 2 cover stents ( Begraft ) into proximal RCA after DES implantation

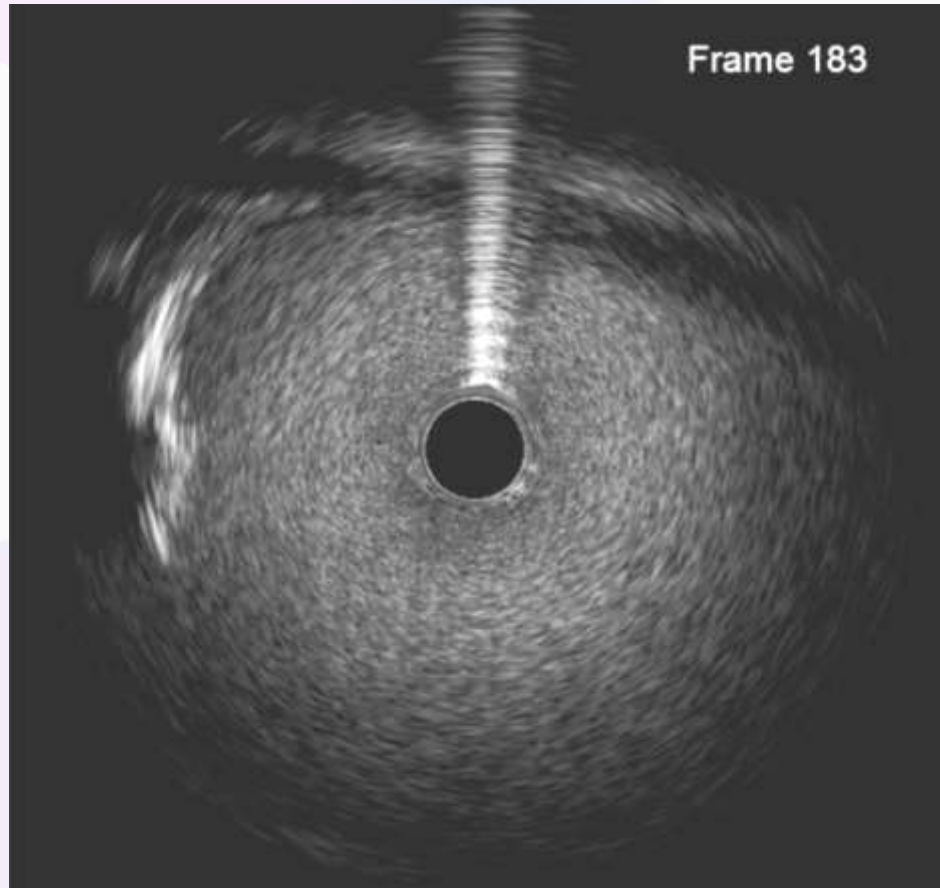


# Final Result

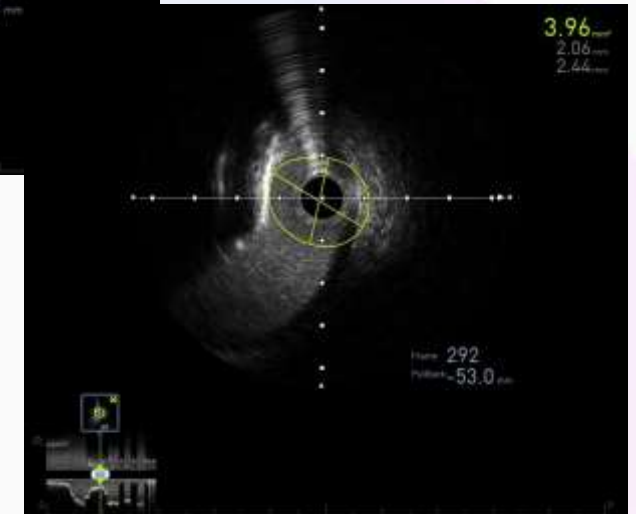
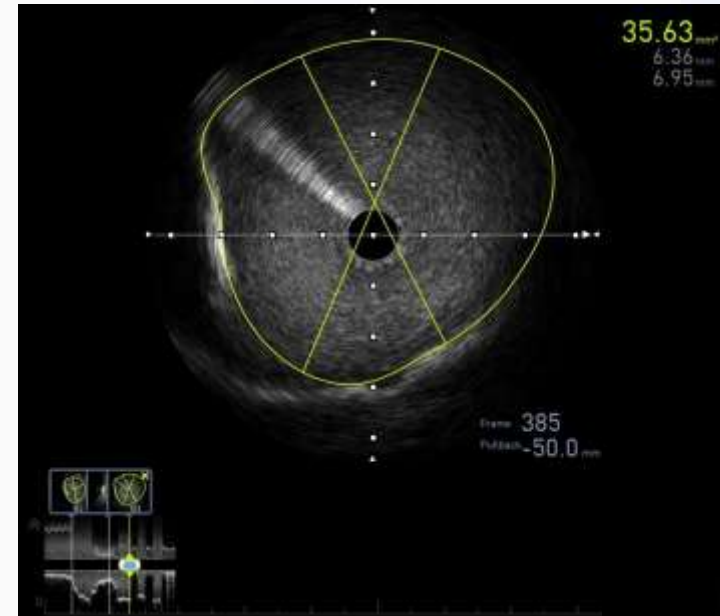


# Left Main PCI

## IVUS Imaging



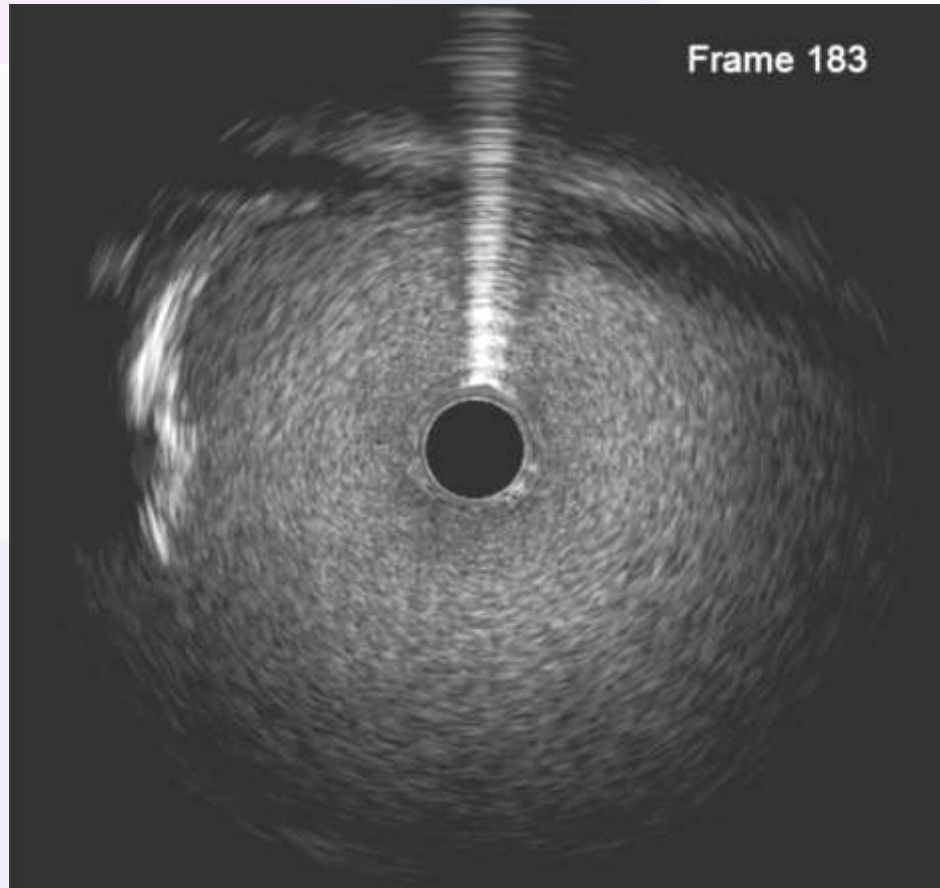
## Diameter by IVUS





# Left Main PCI

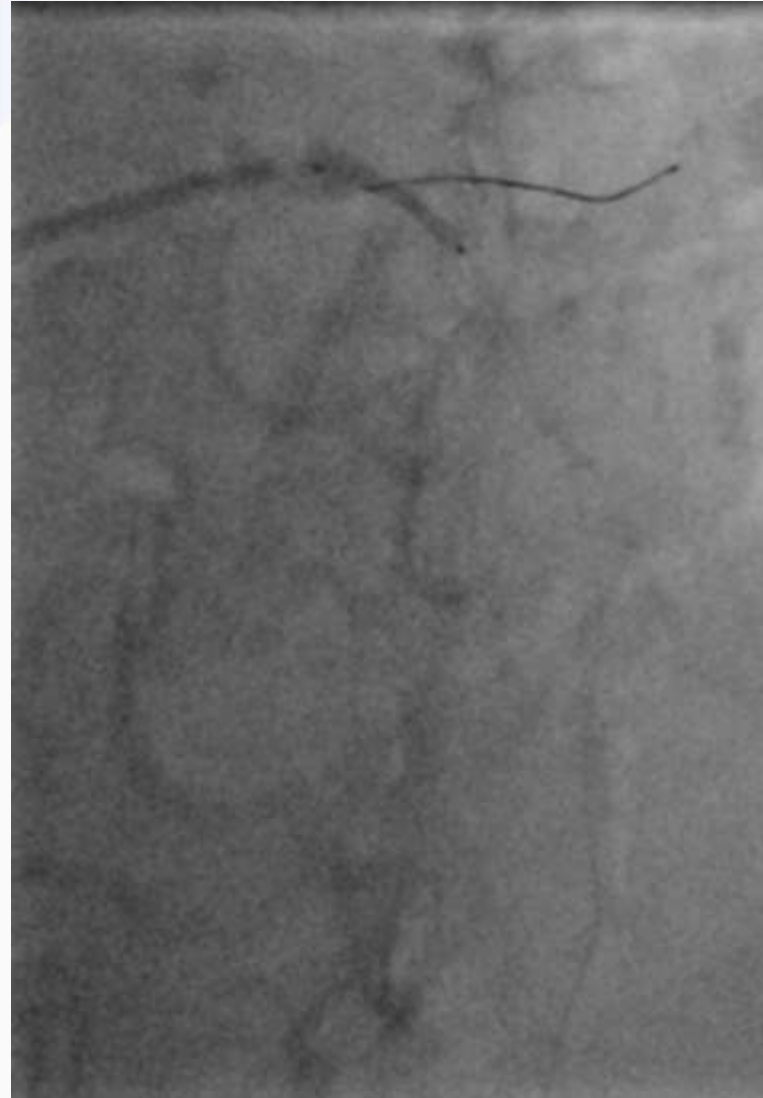
## IVUS Imaging



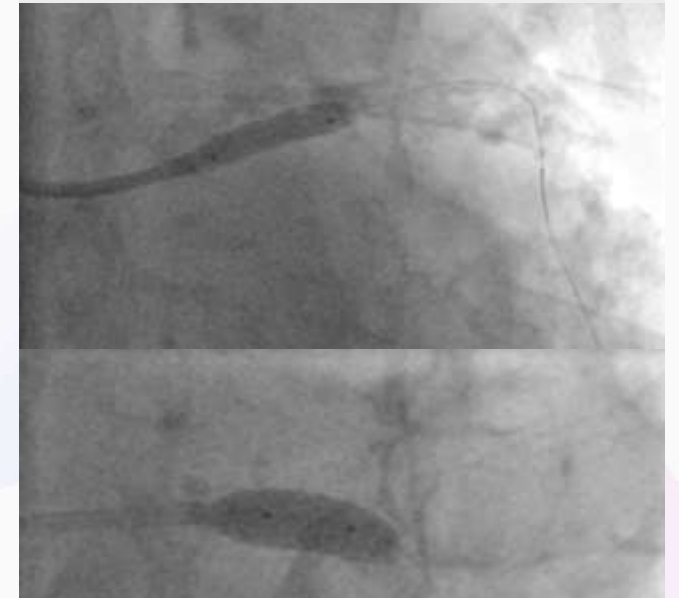
## Cutting Balloon Angioplasty



# Left Main PCI



Predilatation with  
Cutting Balloon  
4,0/15mm



Postdilatation  
6,0mm NC balloon

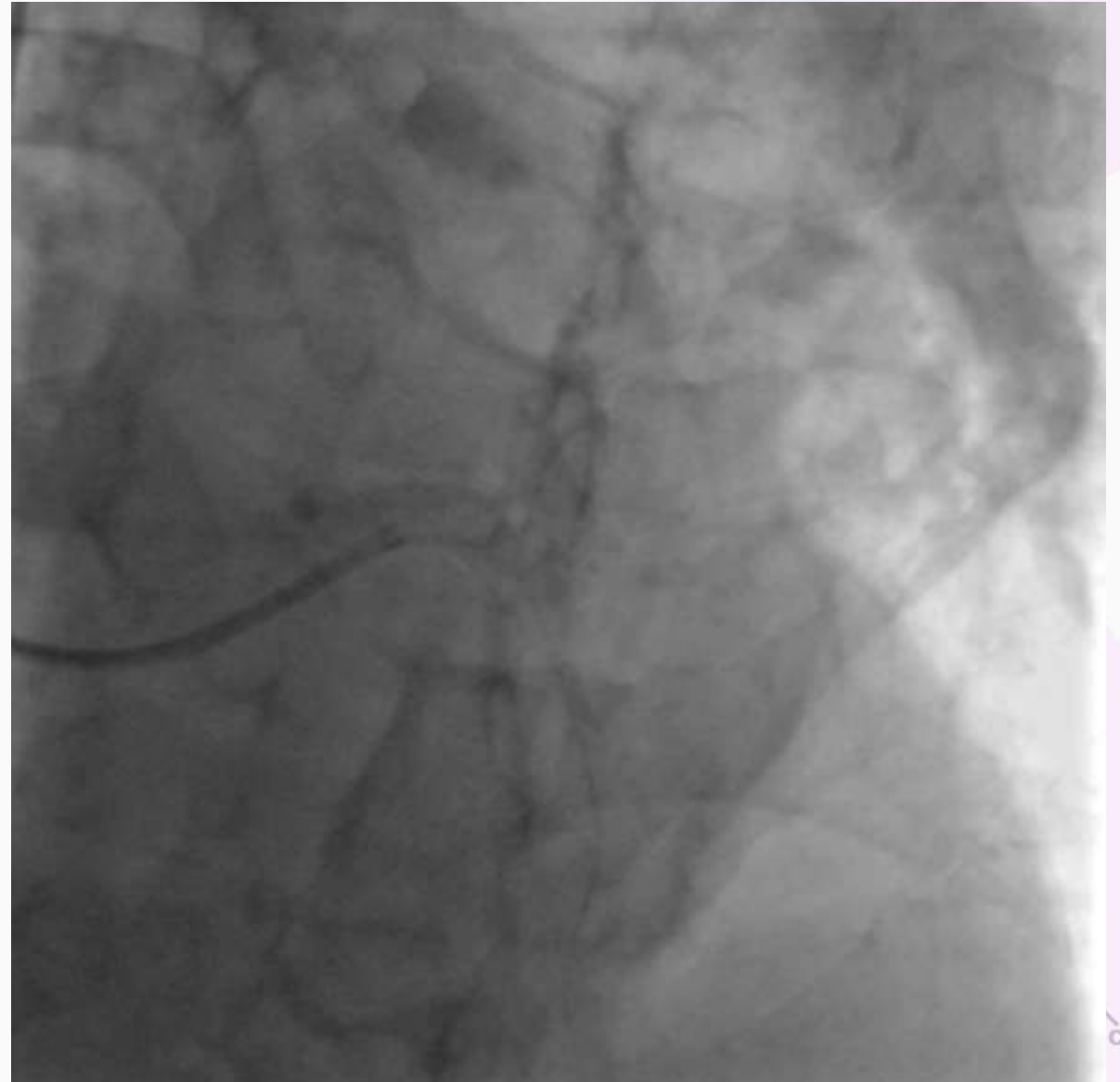


# Left Main PCI

15h20



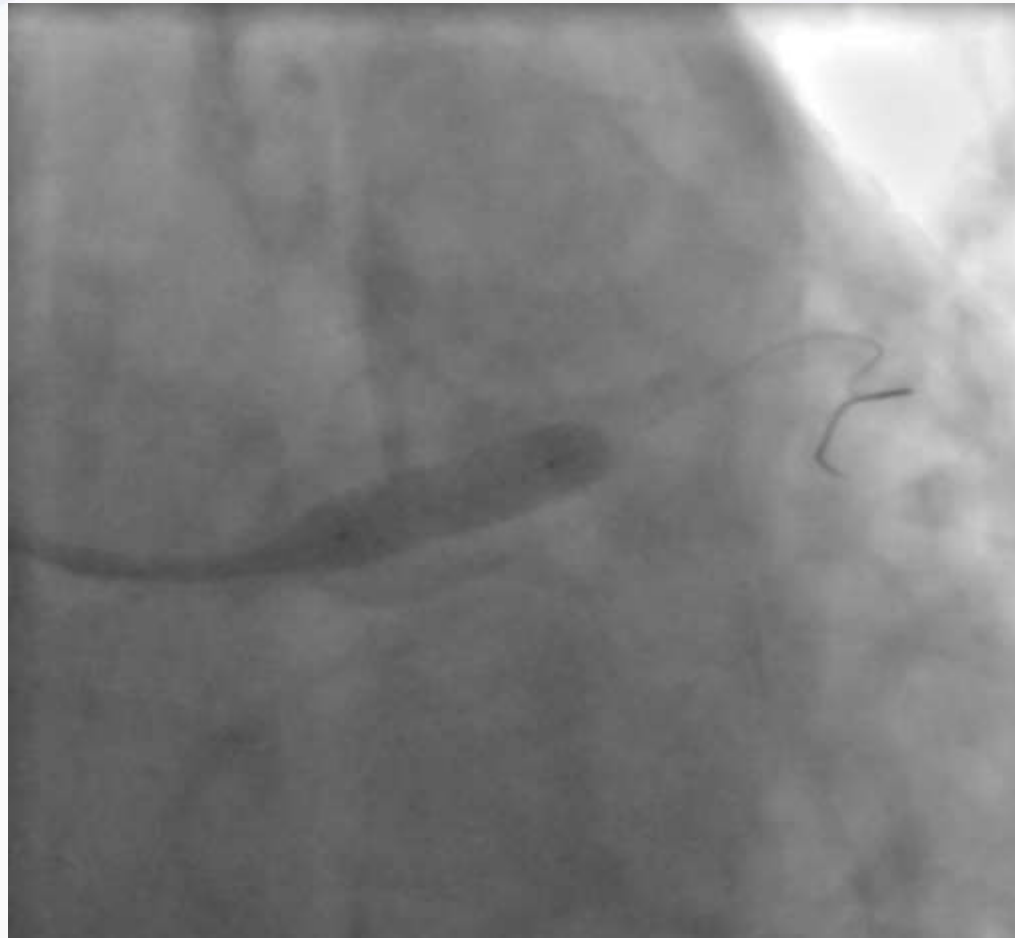
15h21



# Left Main PCI

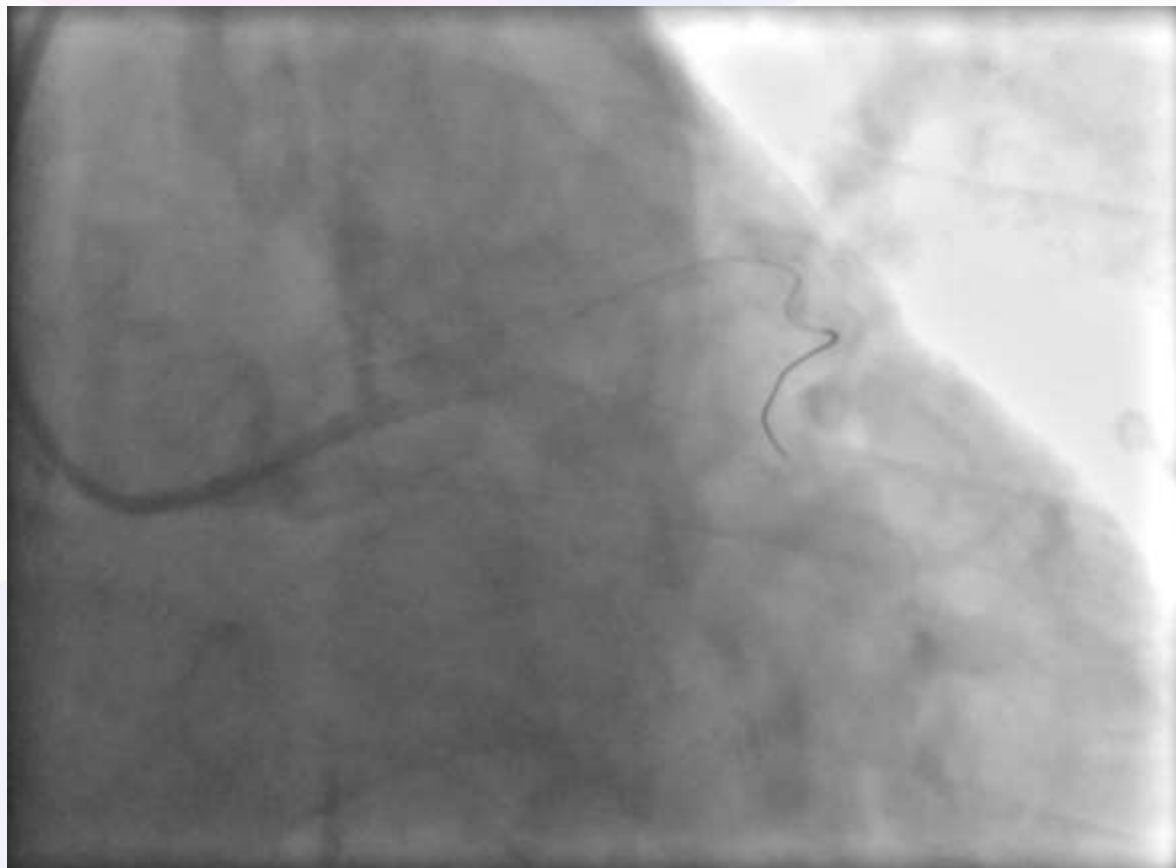
15h22

Papyrus 5,0/15mm



# Left Main PCI

15h22

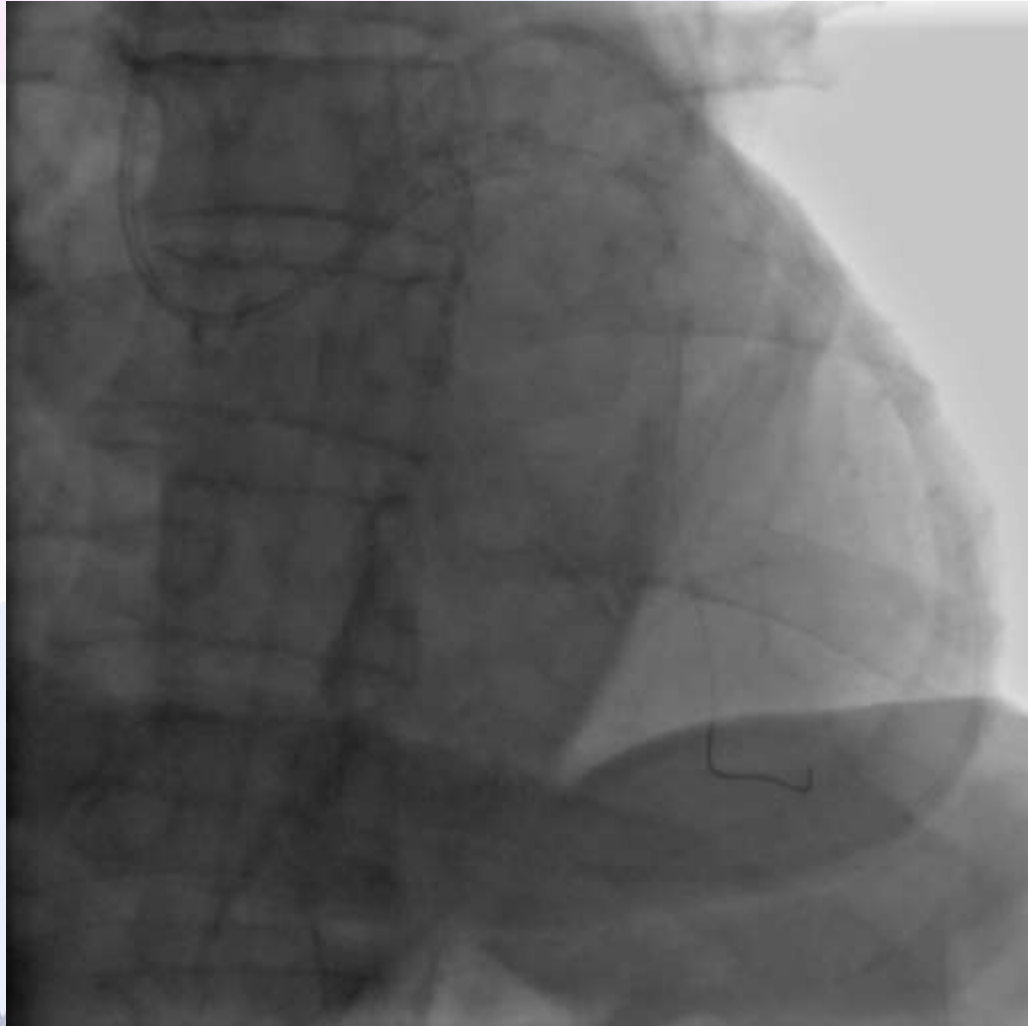


15h23



# Left Main PCI

15h27



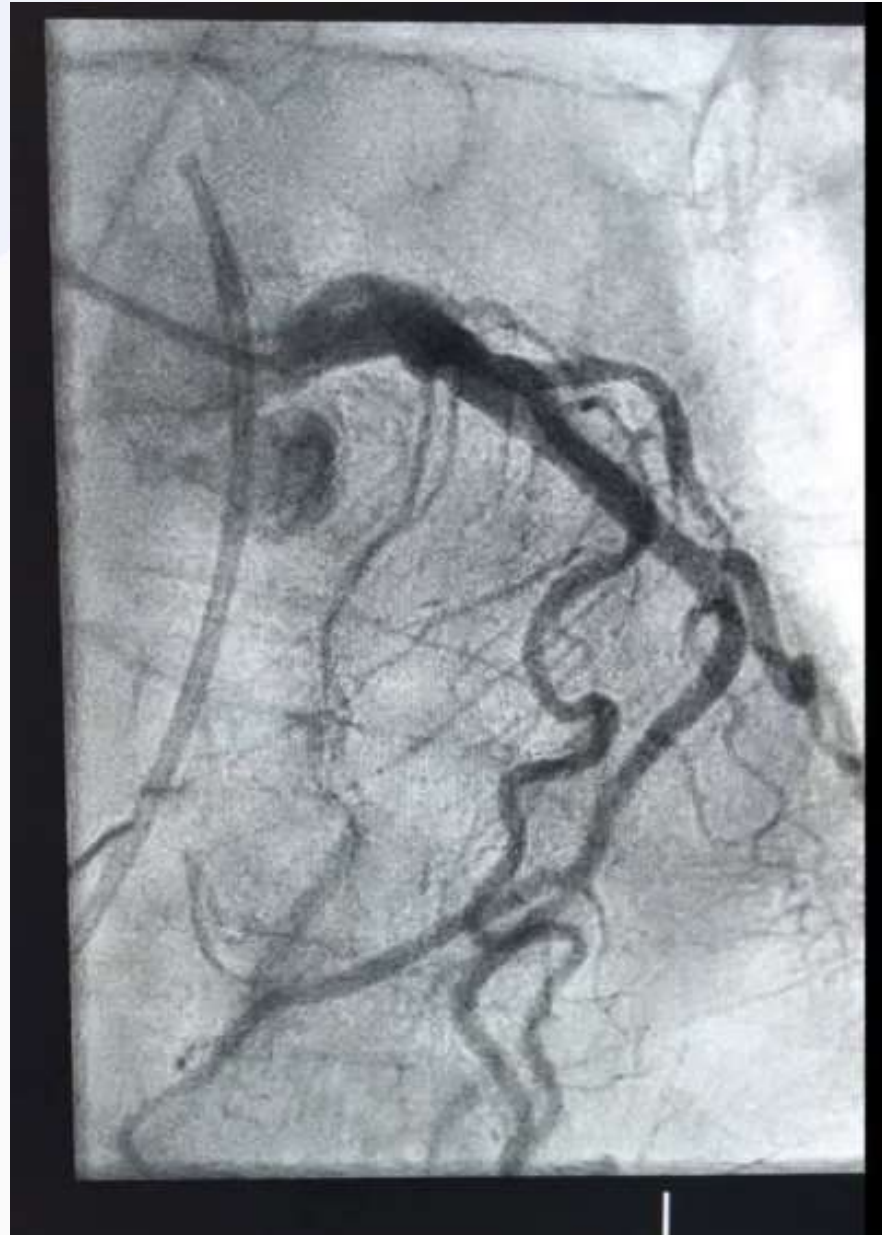
15h53



# Left Main PCI after Thoracotomy

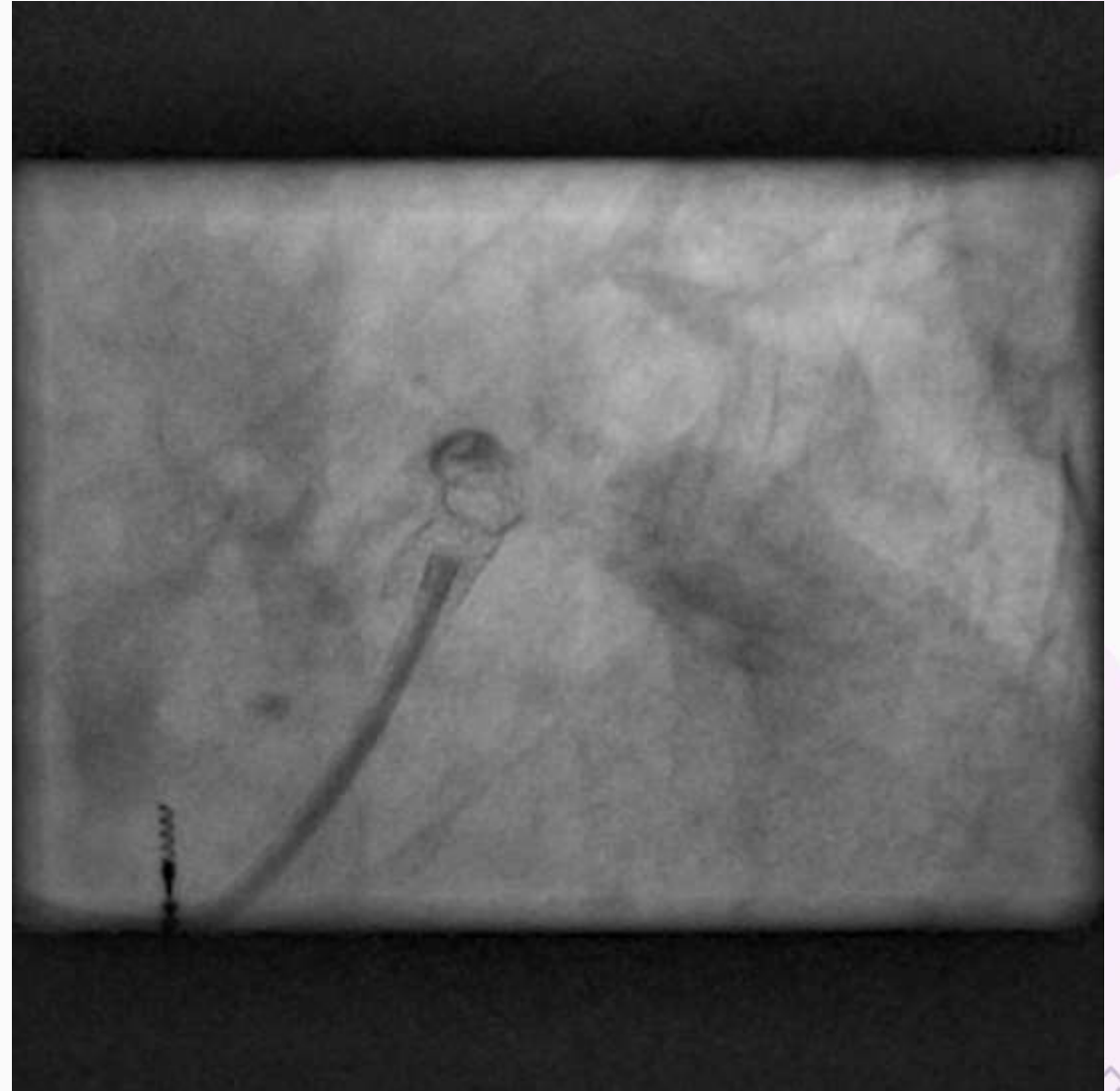
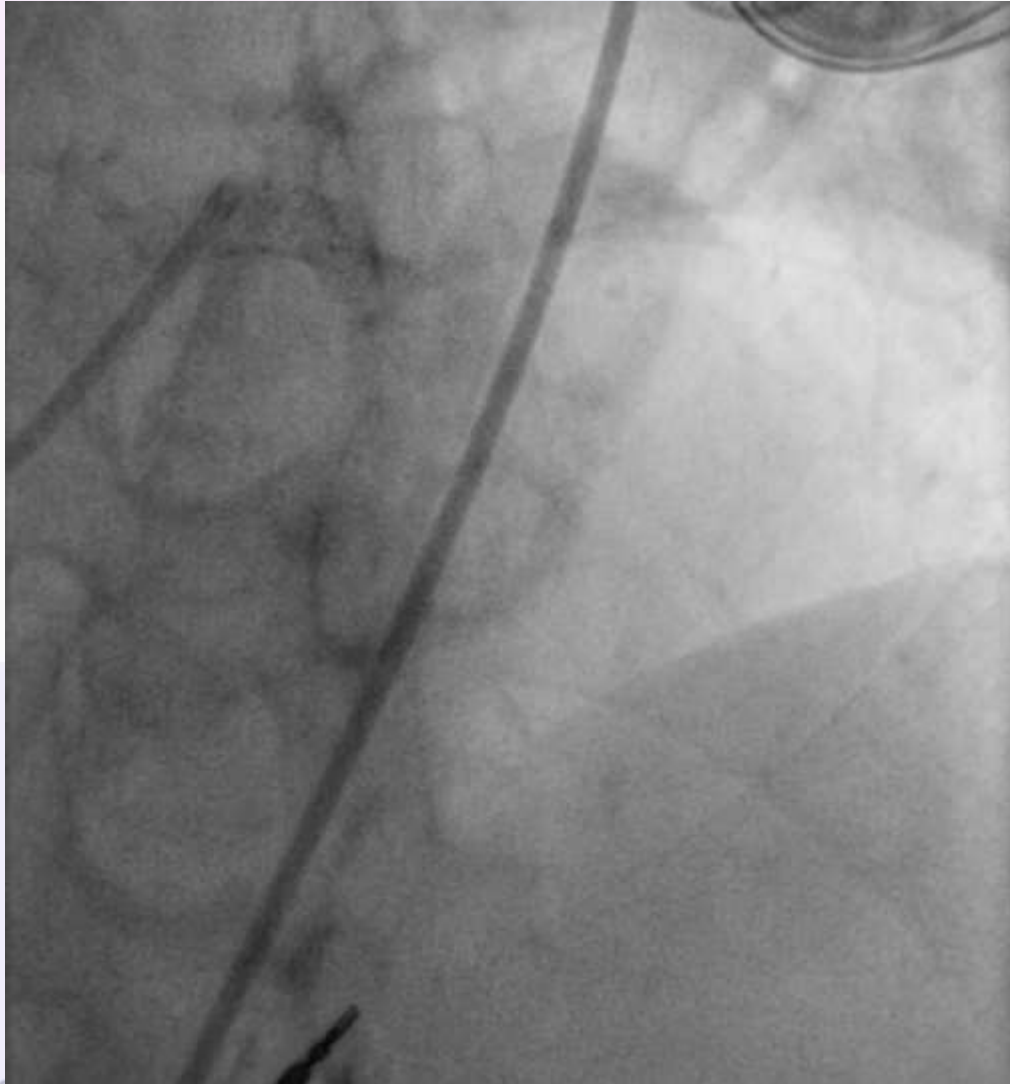


# Left Main PCI after Thoracotomy



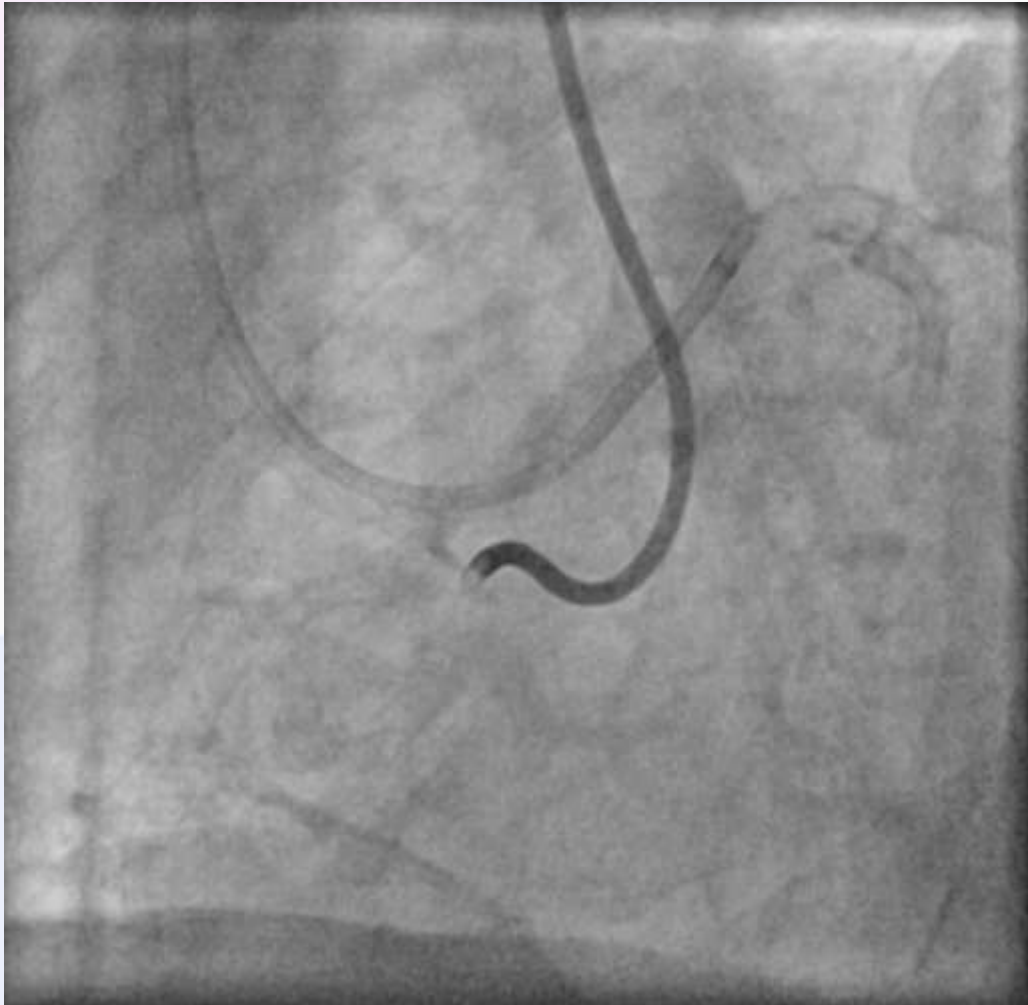


## 6 months follow up after left main perforation

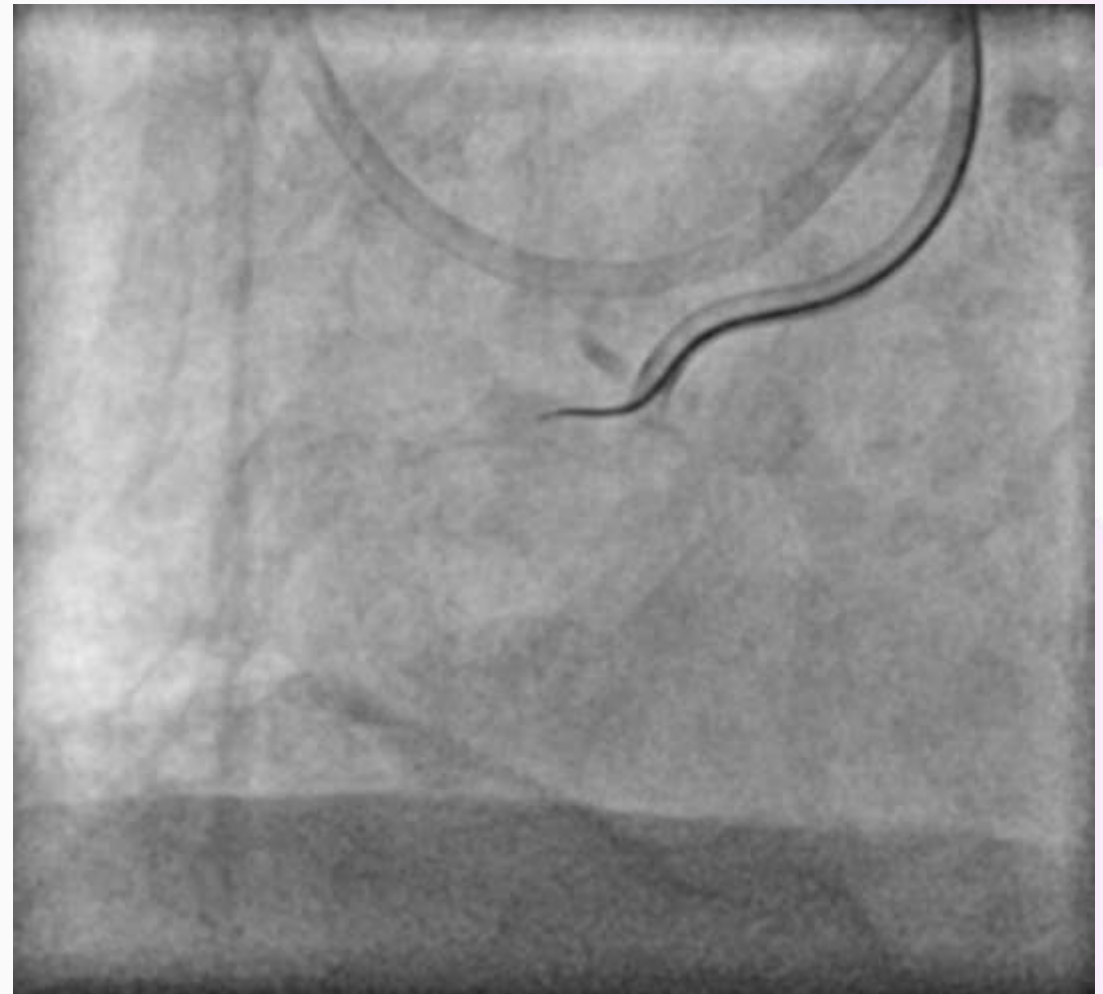


# How to manage the complication?

**calcified RCA CTO, reattempt**



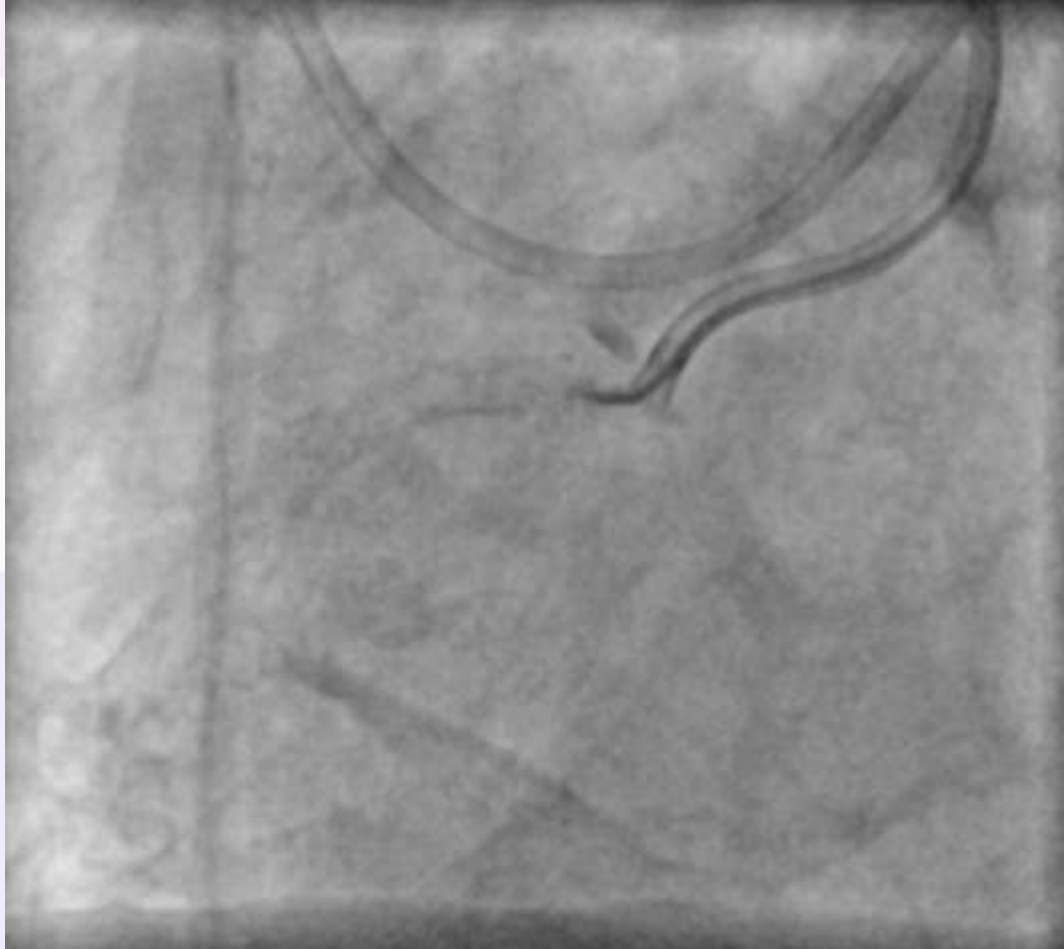
**Wire escalation: Fielder XT->Gaia3rd->CP 12g->Hornet 14g**





# How to manage the complication?

**Carlino technique caused ostial  
dissection**

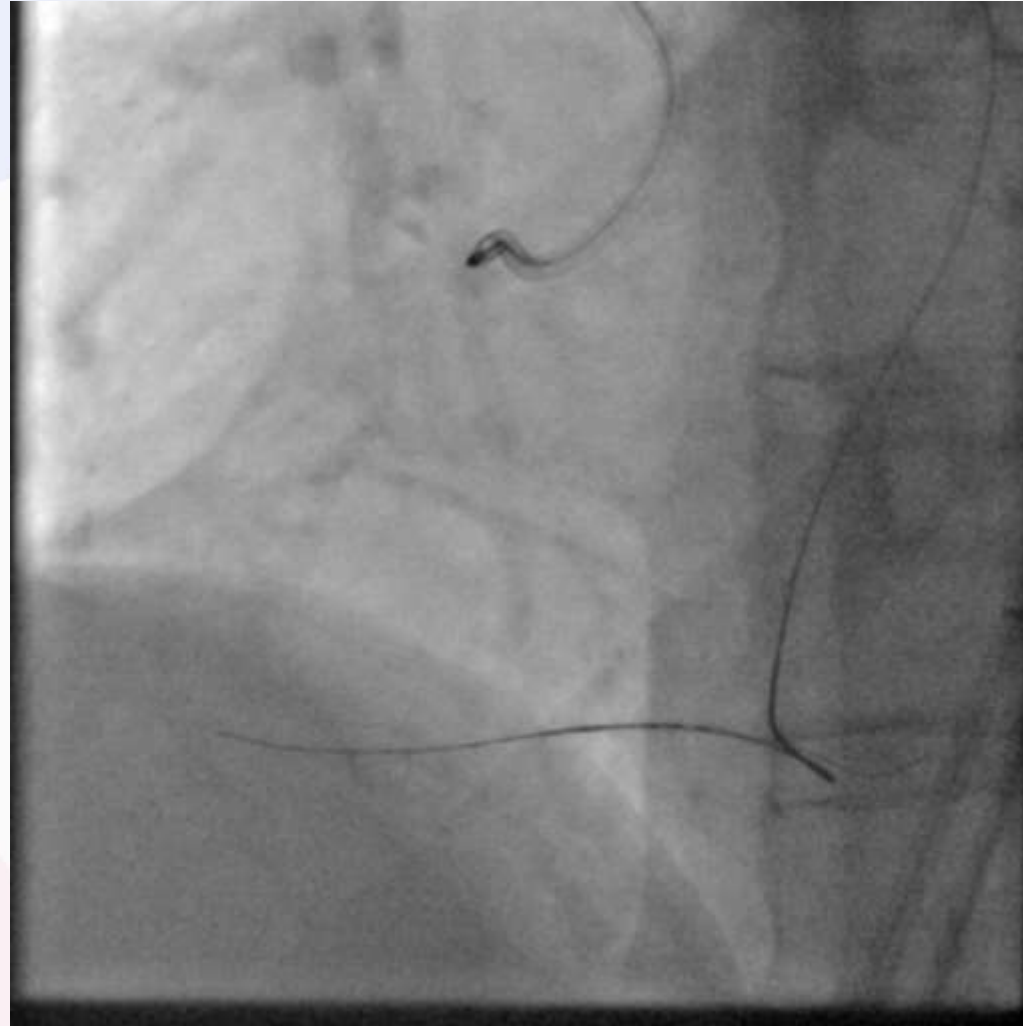


**retrograde attempt**



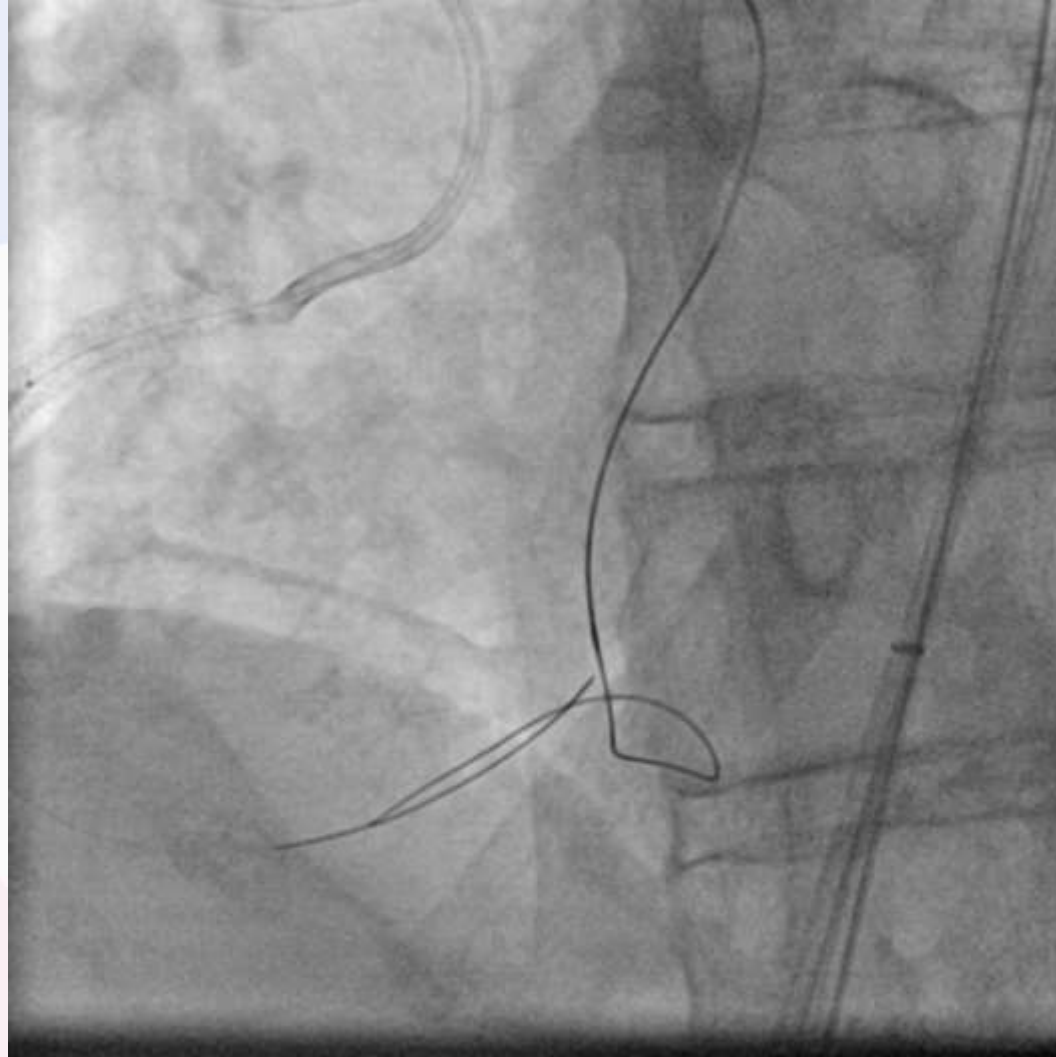
# How to manage the complication?

Astato 20g could pass (kissing wire) -> creating a channel for the rotawire



# How to manage the complication?

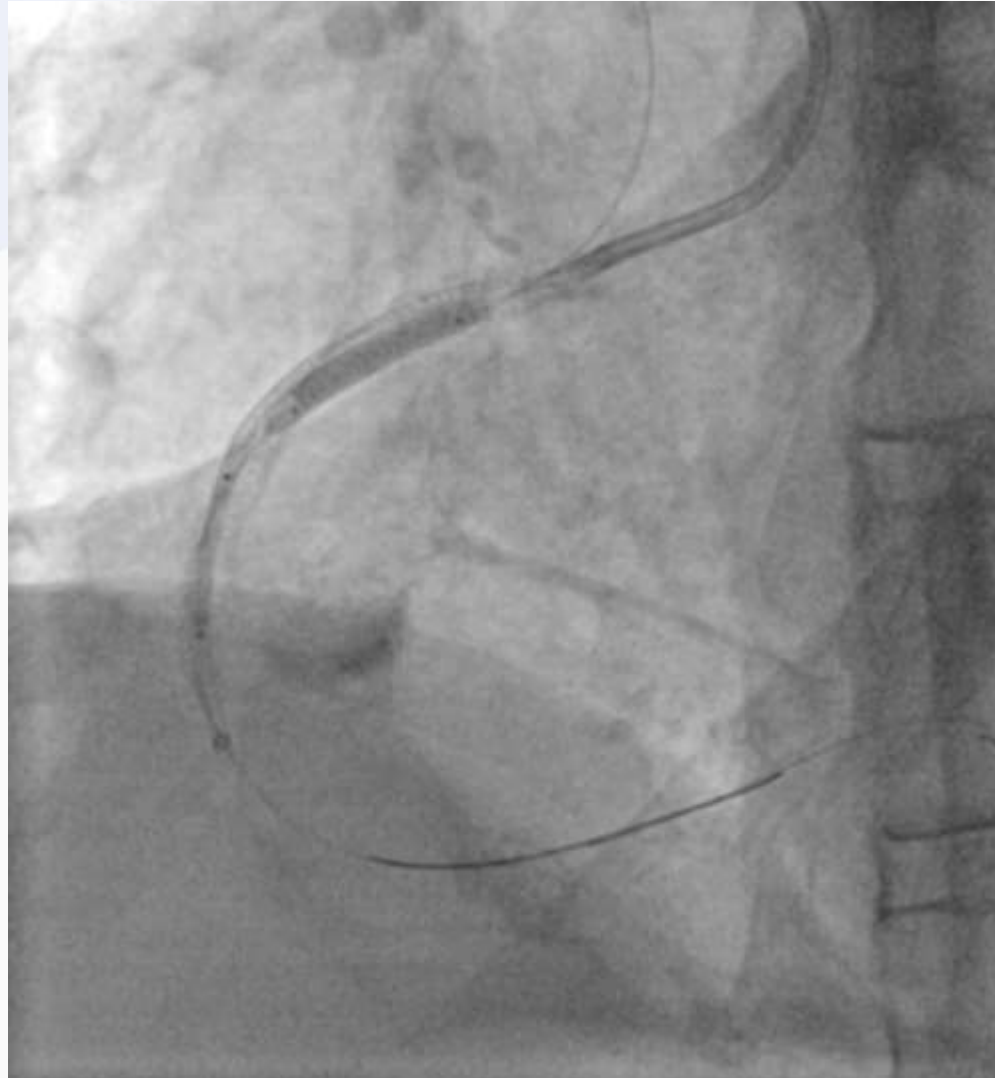
After dilatation with 4,0/15mm OPNC at 25atm



# The Ping Pong Technique

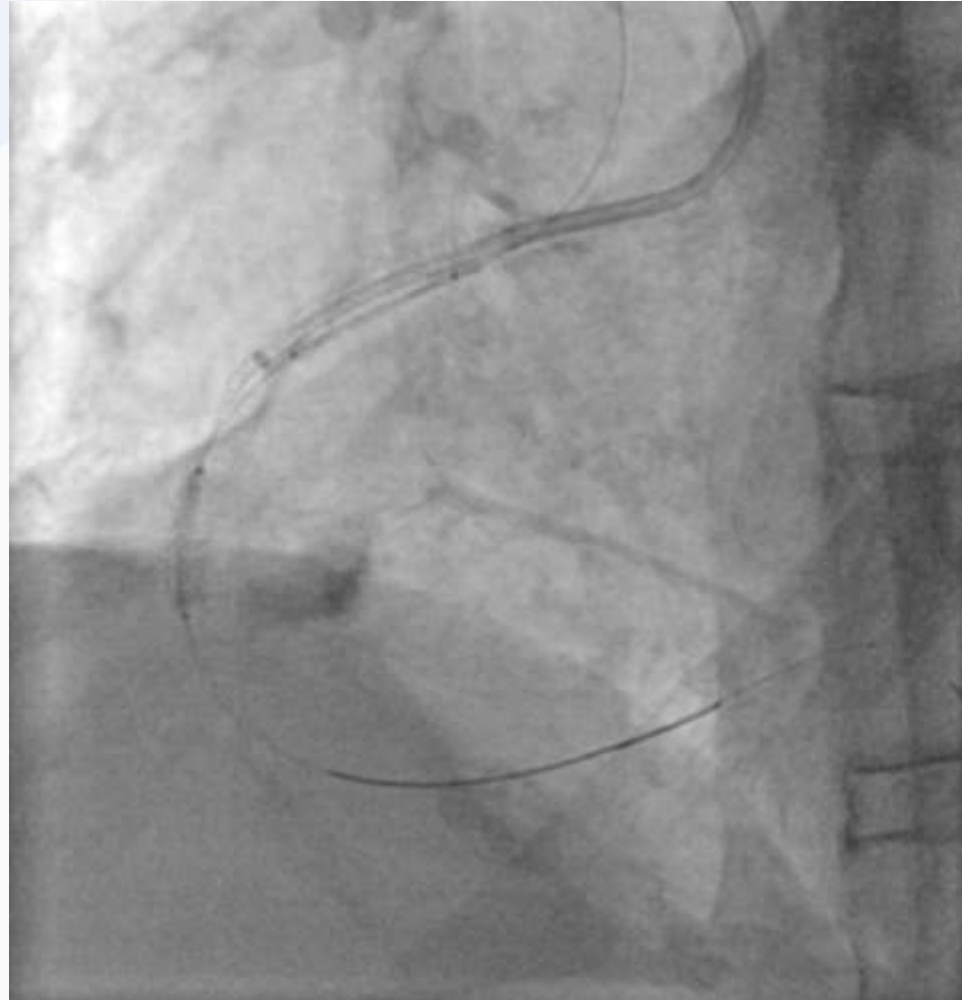


# The Ping Pong Technique



# The Ping Pong Technique

4,0/16mm Begraft





# Final result



# Managing Complications

## Perforations

```
graph TD; A[Perforations] --> B[Antegrade Device Perforation]; A --> C[After Stenting Stenting]; A --> D[Collateral Perforation]; B --> E[1. STOP to inject contrast<br/>2. Balloon deflation<br/>3. Retrograde Rescue ?<br/>4. Stenting (Coverstent?)]; C --> F[1. STOP to inject contrast<br/>2. Long Balloon deflation<br/>3. Ping Pong Technique<br/>4. Coverstent]; D --> G[1. STOP to inject contrast<br/>2. During retrograde wiring:<br/>a. Balloon inflation, Coiling from retrograde<br/>3. After successful CTO:<br/>a. Coiling from ante and retrograde];
```

### Antegrade Device Perforation

1. STOP to inject contrast
2. Balloon deflation
3. Retrograde Rescue ?
4. Stenting (Coverstent?)

### After Stenting Stenting

1. STOP to inject contrast
2. Long Balloon deflation
3. Ping Pong Technique
4. Coverstent

### Collateral Perforation

1. STOP to inject contrast
2. During retrograde wiring:
  - a. Balloon inflation, Coiling from retrograde
3. After successful CTO:
  - a. Coiling from ante and retrograde