

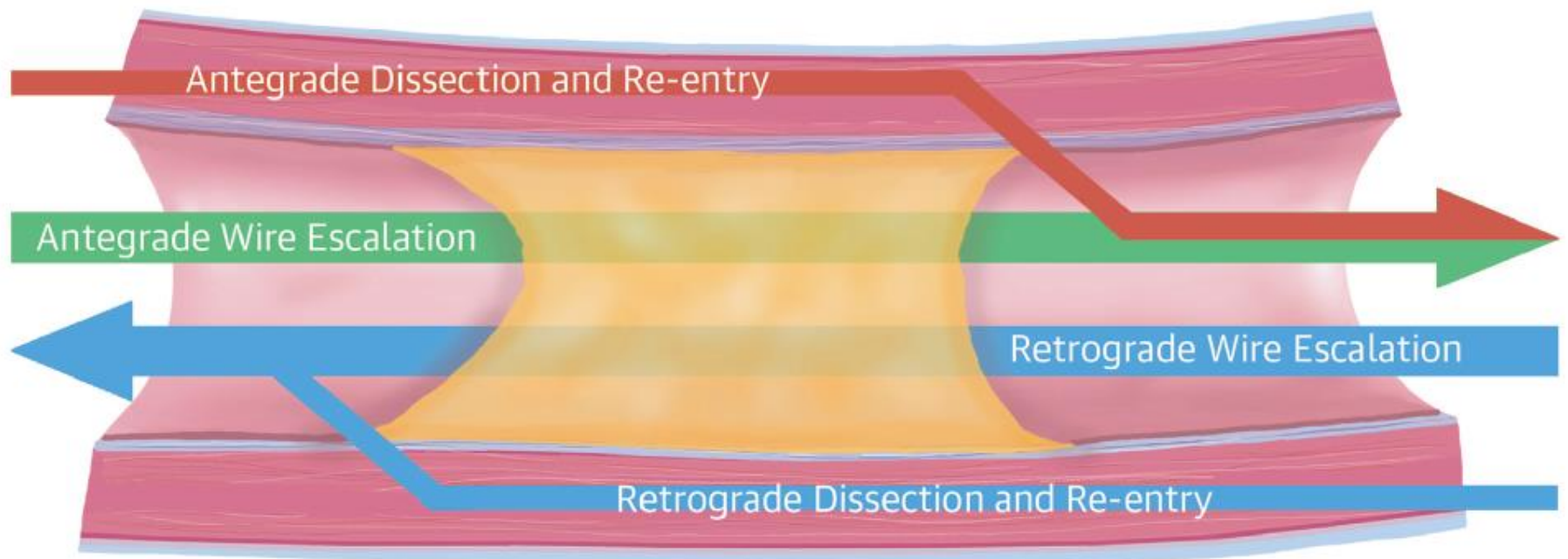
Korea CTO strategy of ADR

Technical tips and trick

Seung-Whan Lee, MD, PhD

Professor of Medicine, University of Ulsan College of Medicine
Asan Medical Center, Seoul, Korea

Four strategies for CTO



J Am Coll Cardiol 2016;68:1958–70

CTO dissection and Re-entry strategy

Antegrade

Dissection

- Knuckle wire
- **Crossboss**

Re-entry

- STAR
- Contrast-guided STAR
- Mini-STAR
- LAST
- **Stingray**

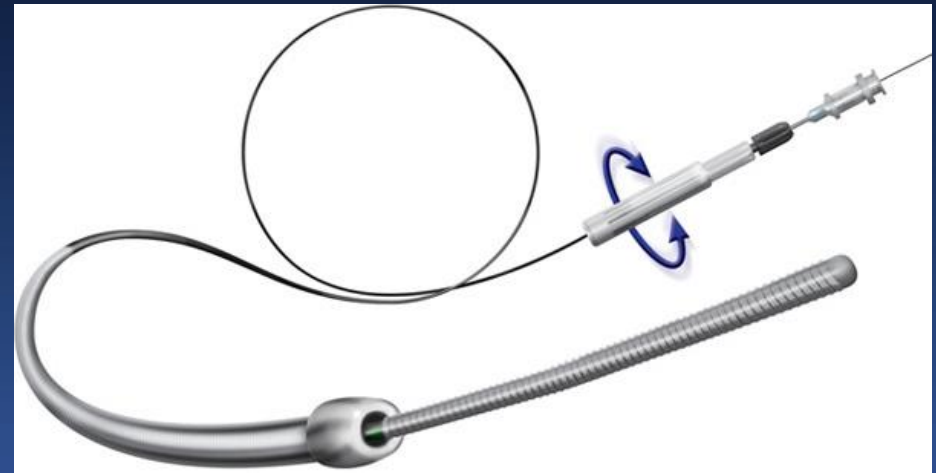
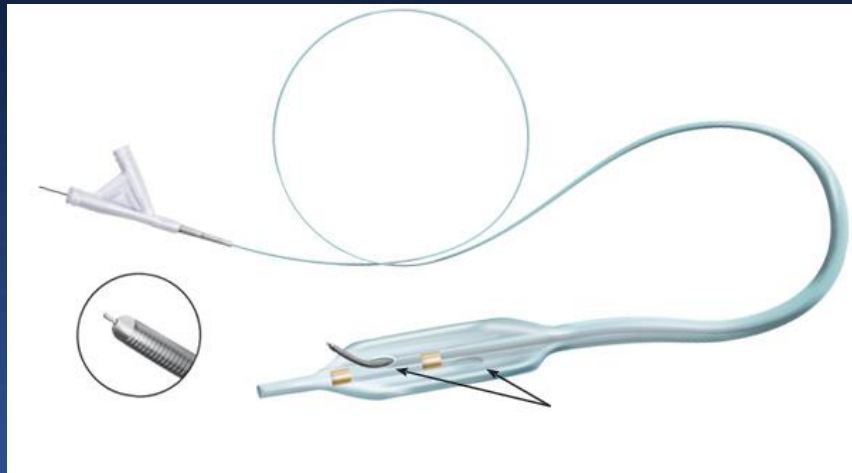
Retrograde

Dissection

- Knuckle wire

Re-entry

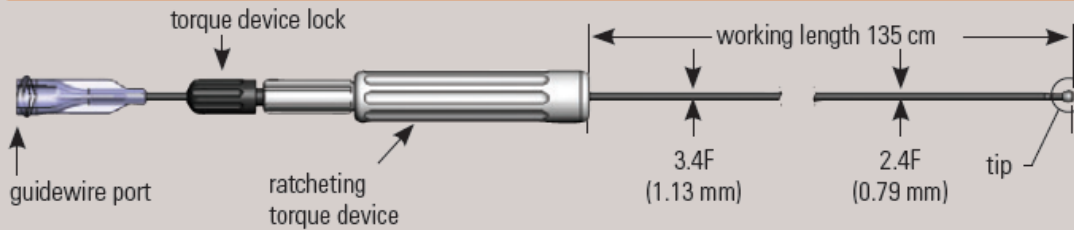
- CART
- Reverse-CART



Product Specifications

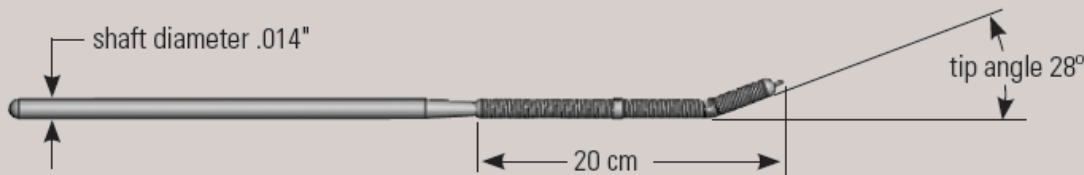
CROSSBOSS

Catheter



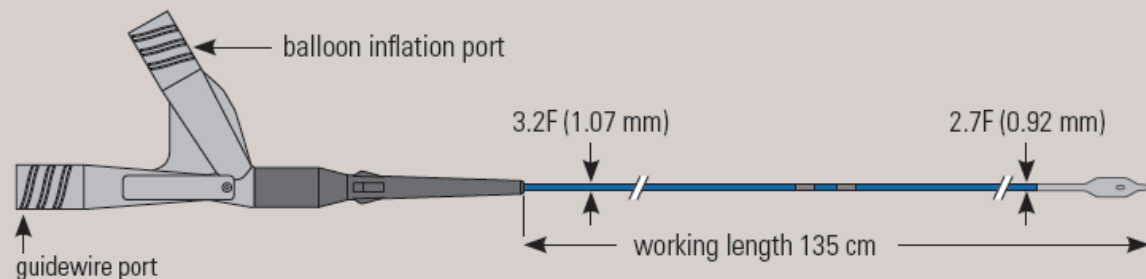
STINGRAY

Guidewire



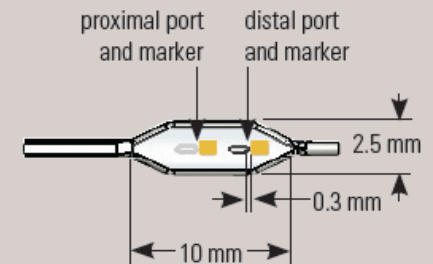
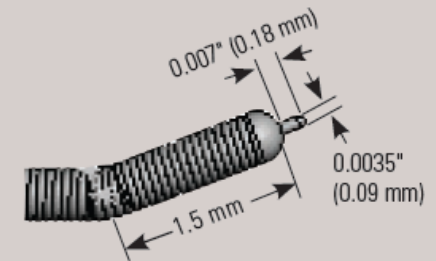
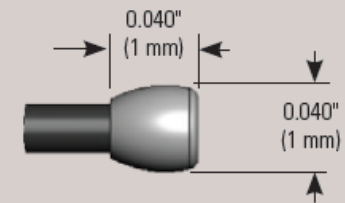
STINGRAY LP

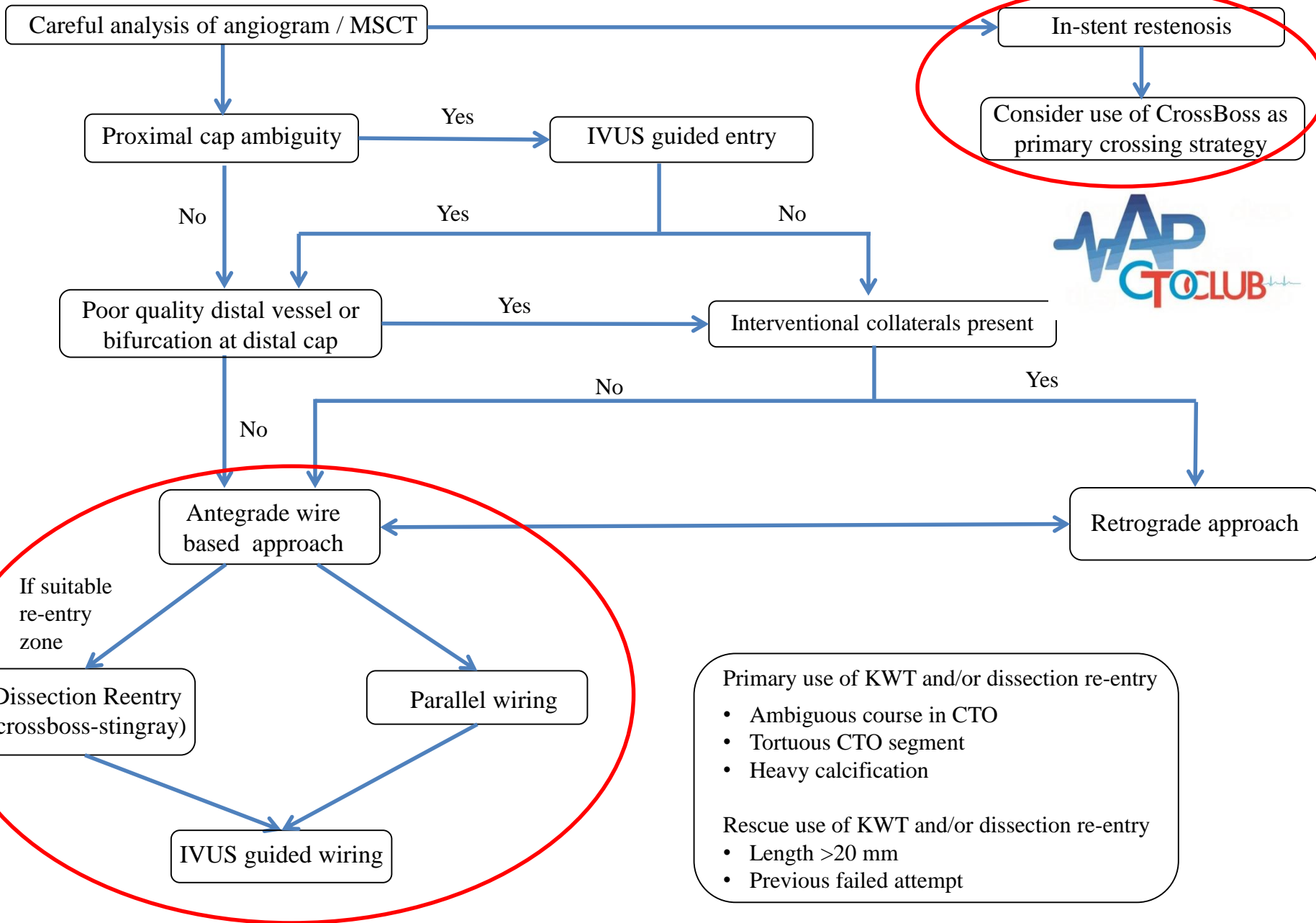
Catheter



SPECIFICATIONS

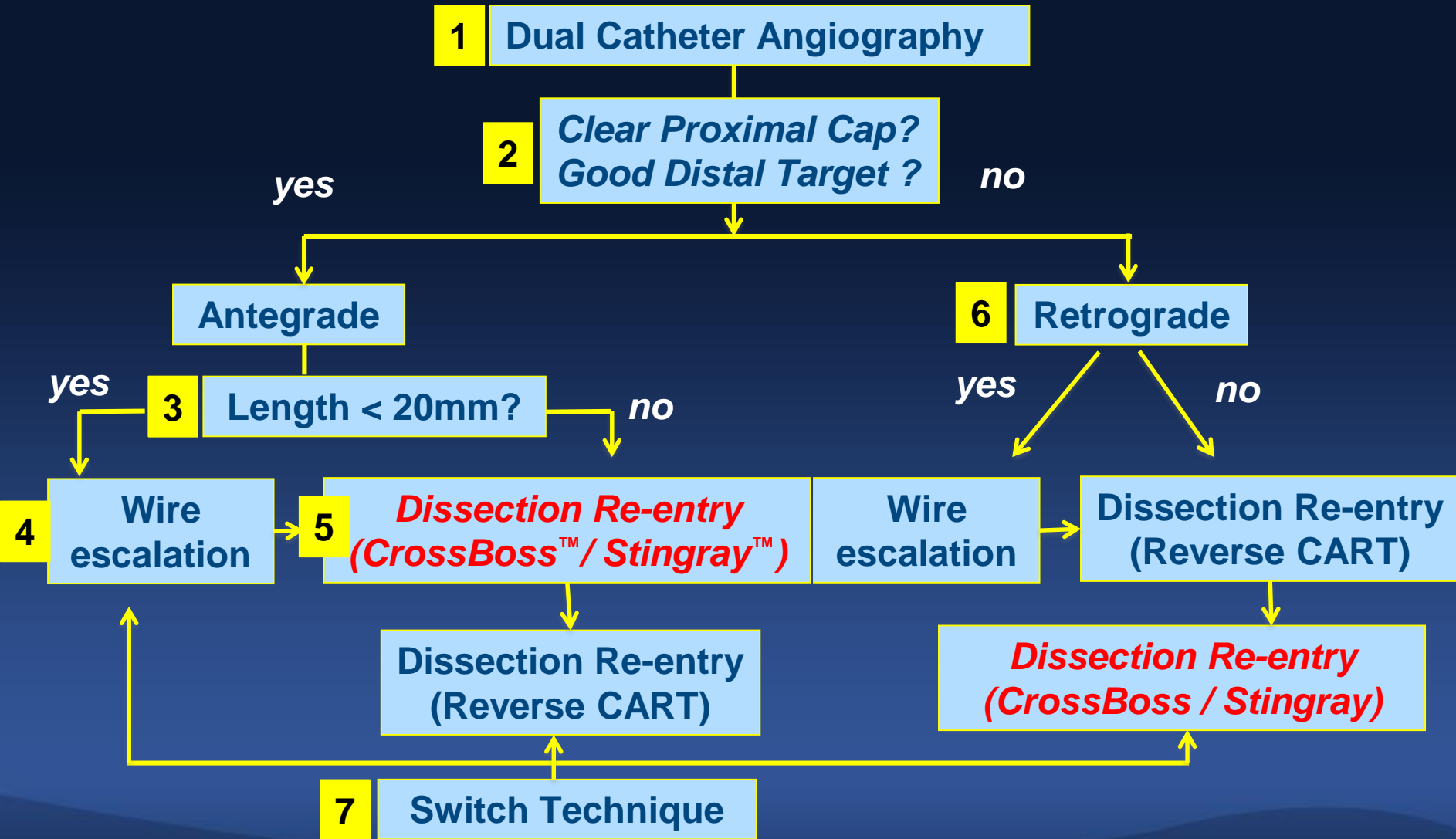
▼ Tip Close Up ▼





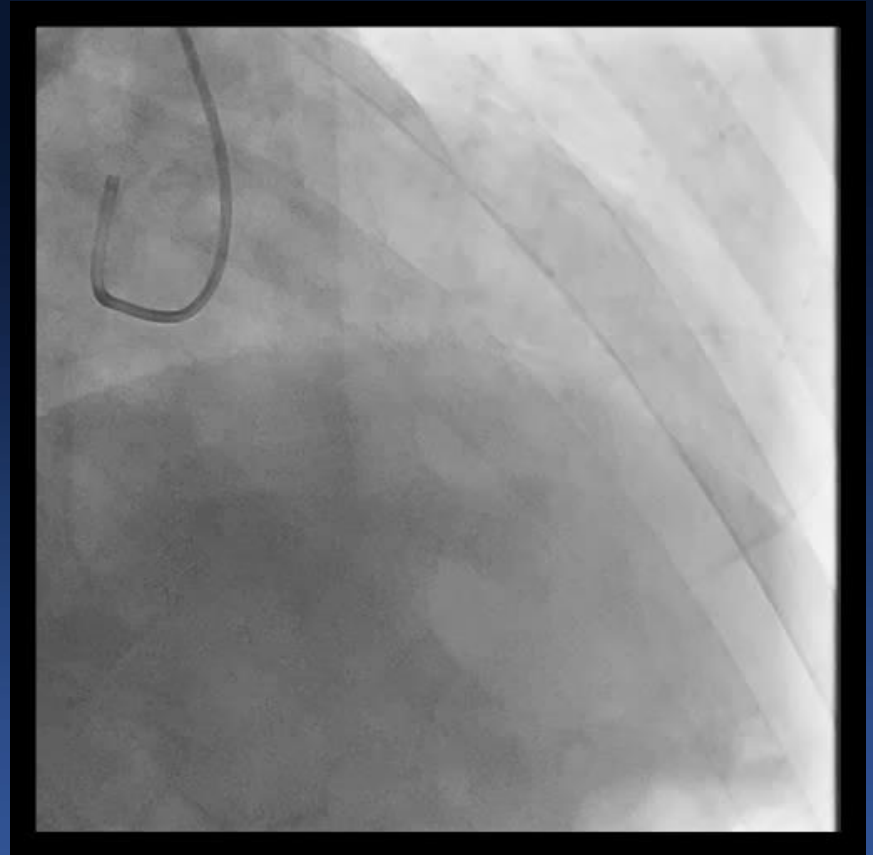
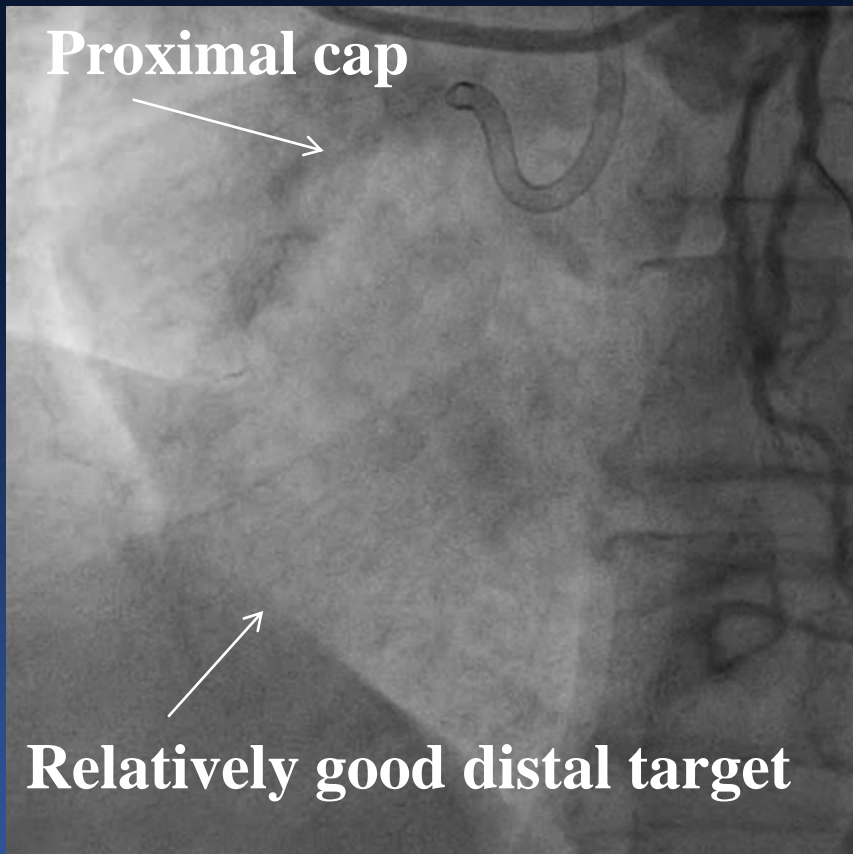
Consider stopping if >3 hours, 3.7 x eGFR ml contrast, Air Kerma > 5 Gy unless procedure well advanced

Hybrid Algorithm for CTO-PCI



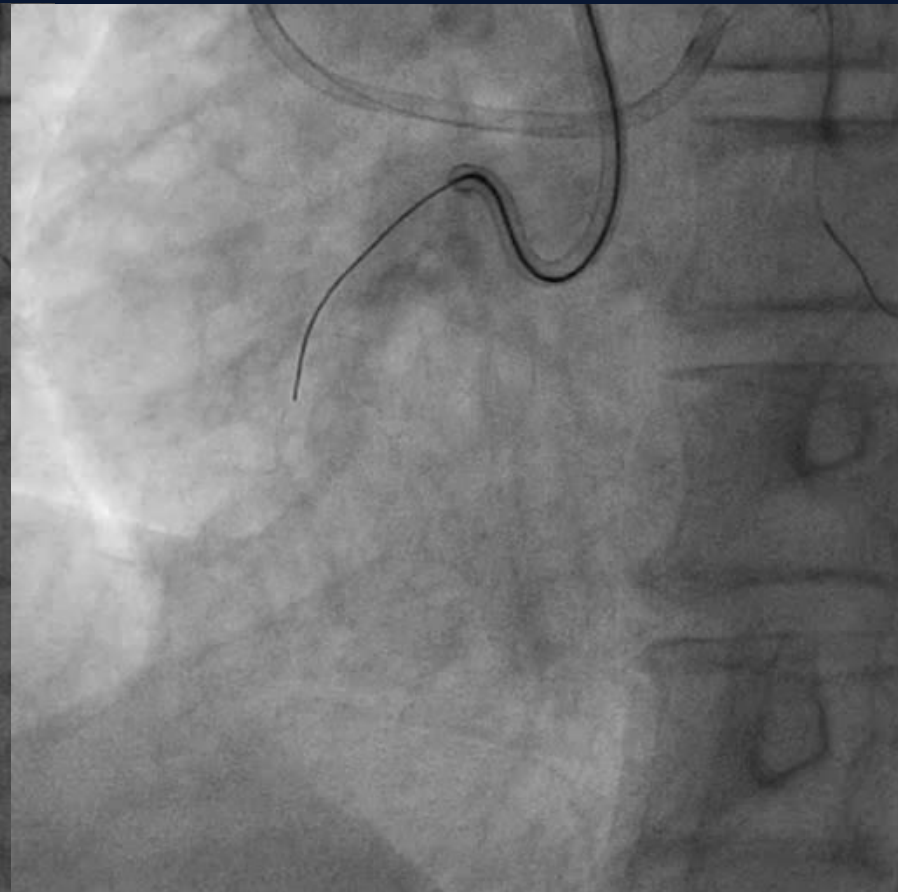
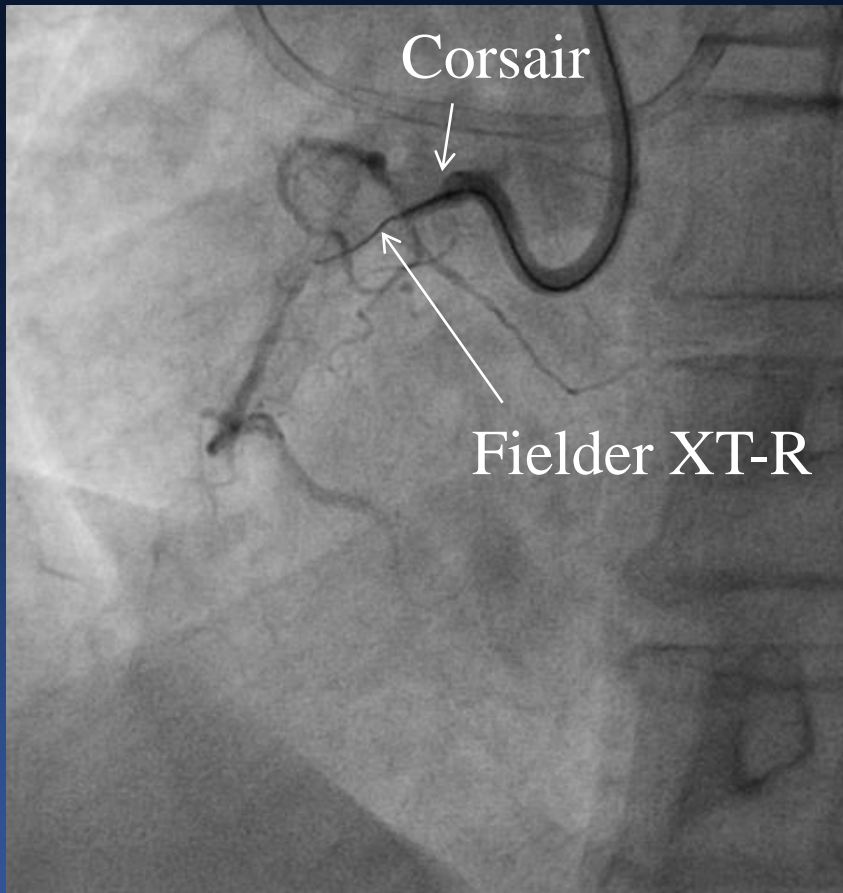
Baseline angiography

Good interventional collateral



Antegrade wire escalation

Subintimal wiring

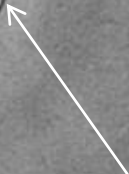


Knuckle wire and introduction of Crossboss through wire

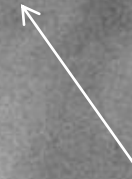
Corsair



Fielder XT-R



Crossboss



To limit subintimal hematoma

Crossboss placement

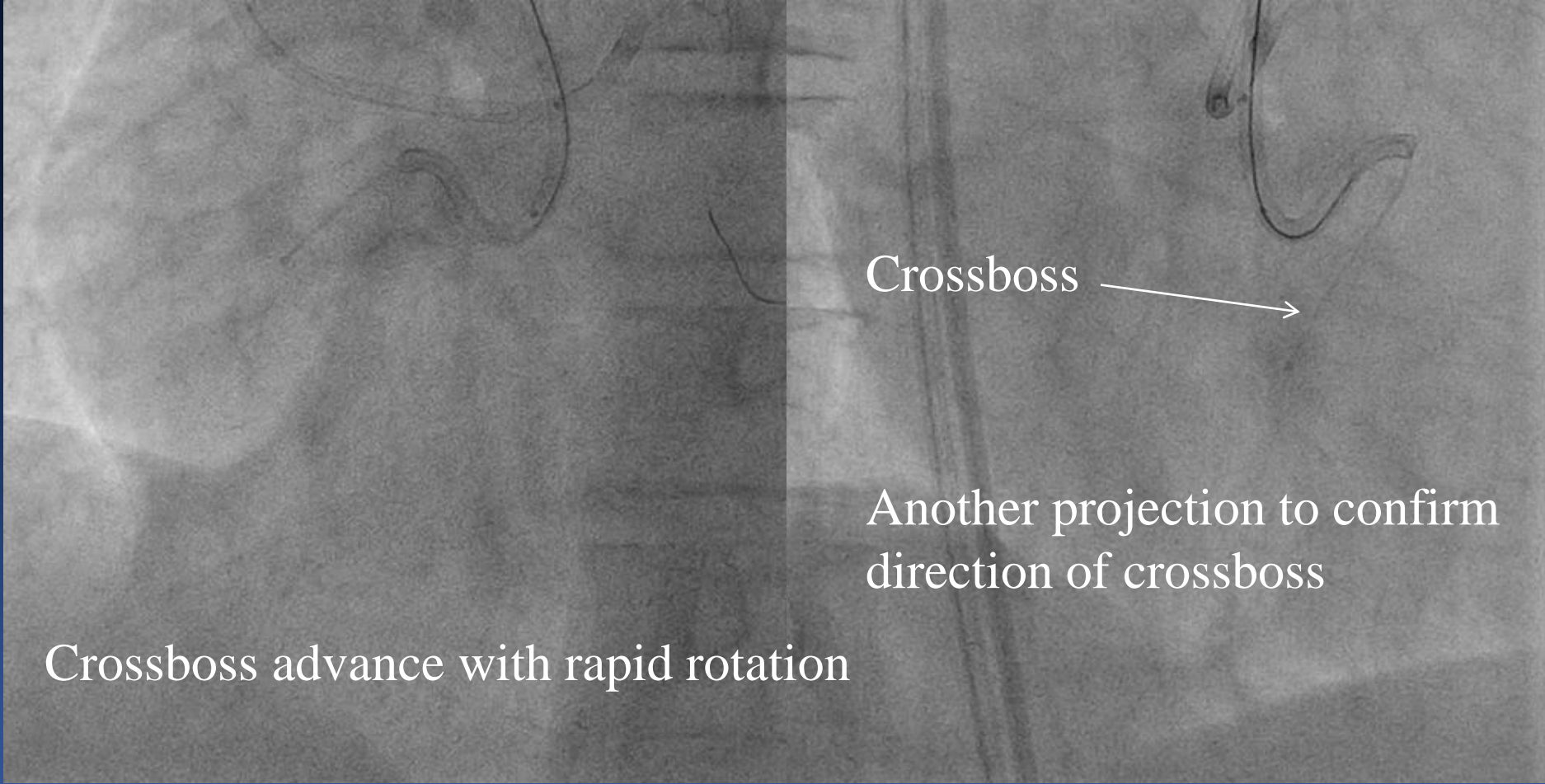
- Crossboss won't get through proximal cap
 - Knuckle wiring
 - Small balloon dilation

Crossboss direction adjustment

Crossboss is difficult to control direction

- Wire-based direction control
- Knuckle wire-based direction control

CrossBoss



Crossboss

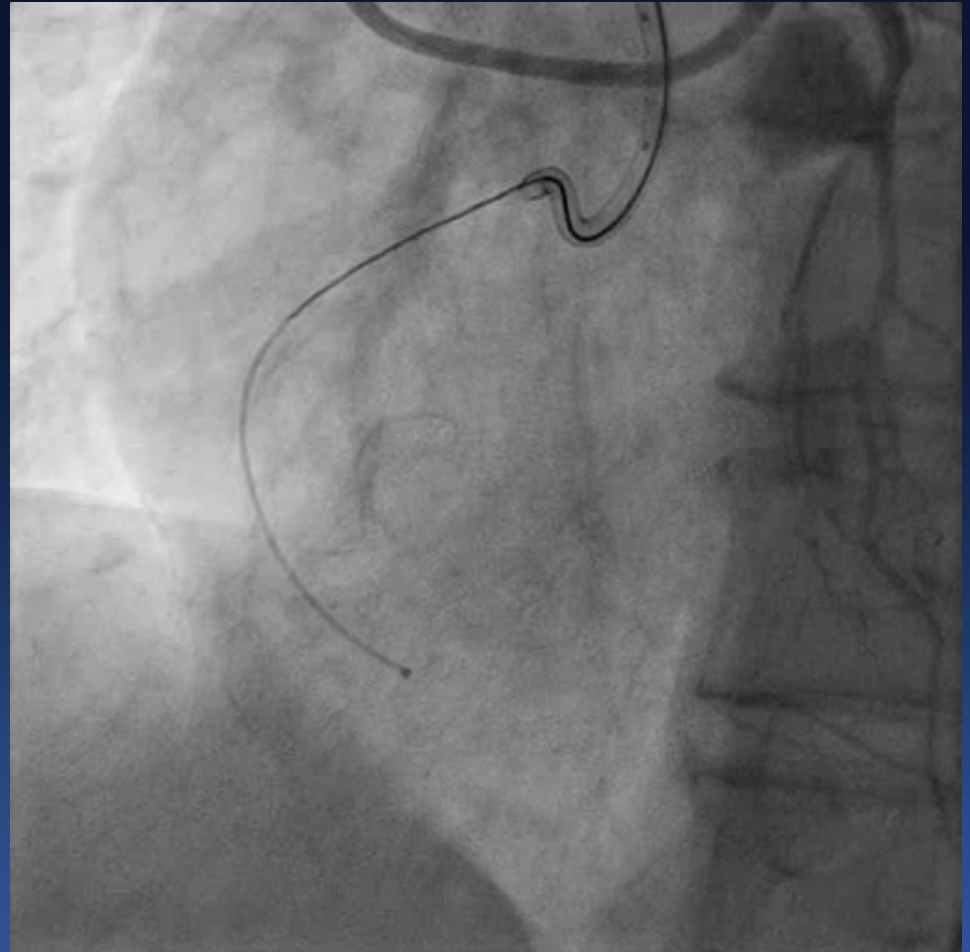
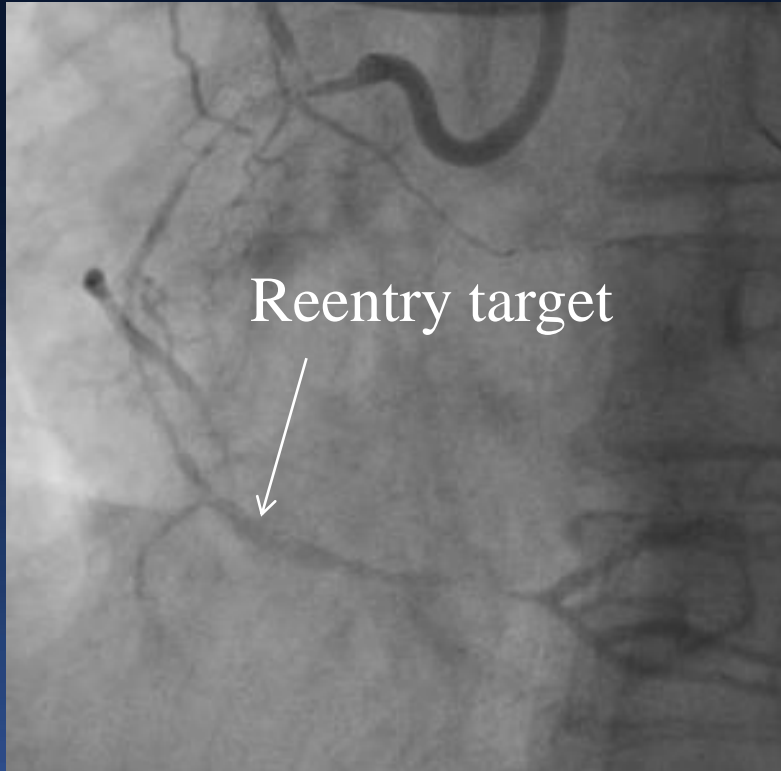


Another projection to confirm direction of crossboss

Crossboss advance with rapid rotation

CrossBoss advance

Baseline angiography



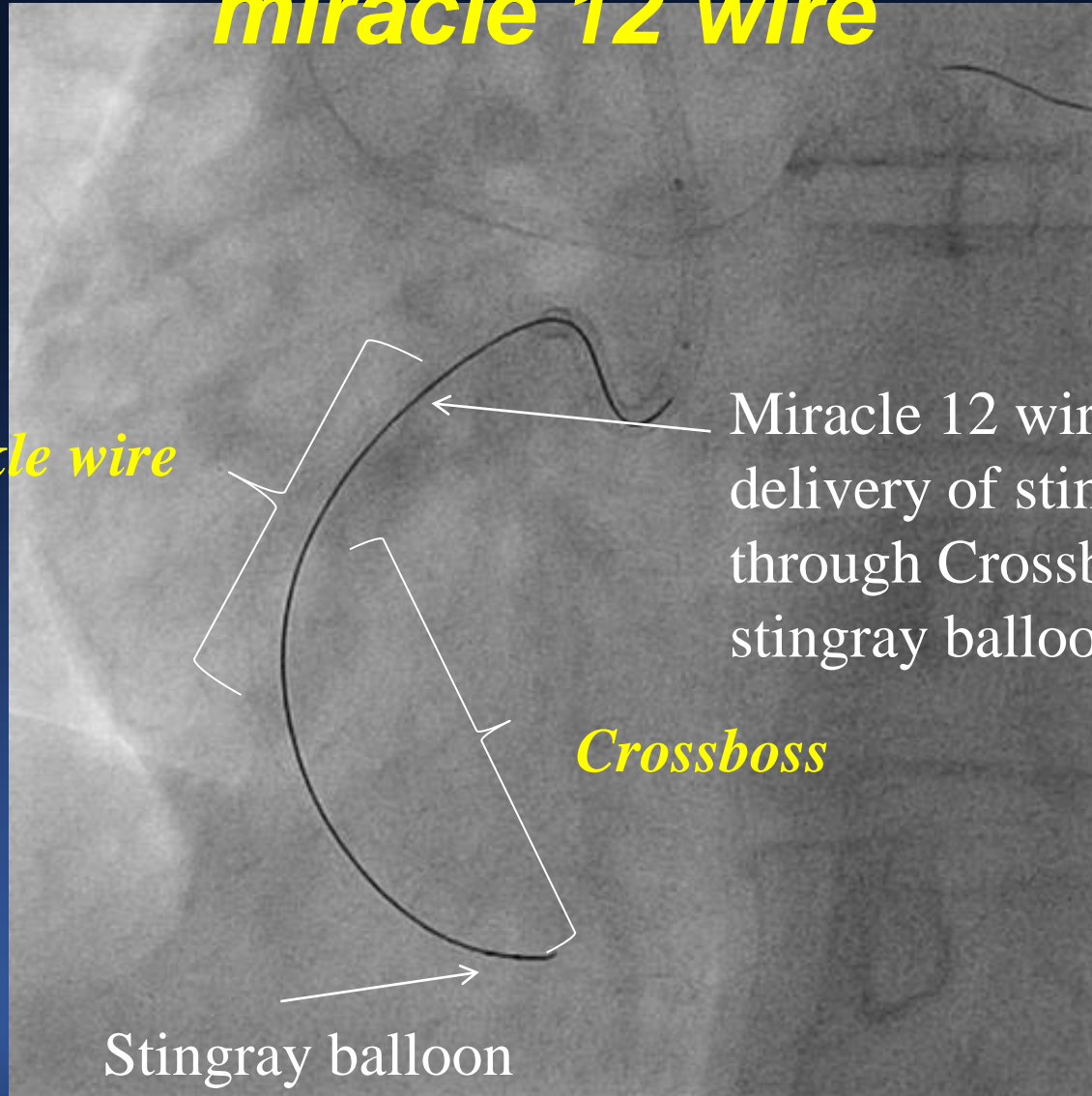
Stingray balloon advance through miracle 12 wire

Knuckle wire

Miracle 12 wire for delivery of stingray balloon through Crossboss and then stingray balloon advance

Crossboss

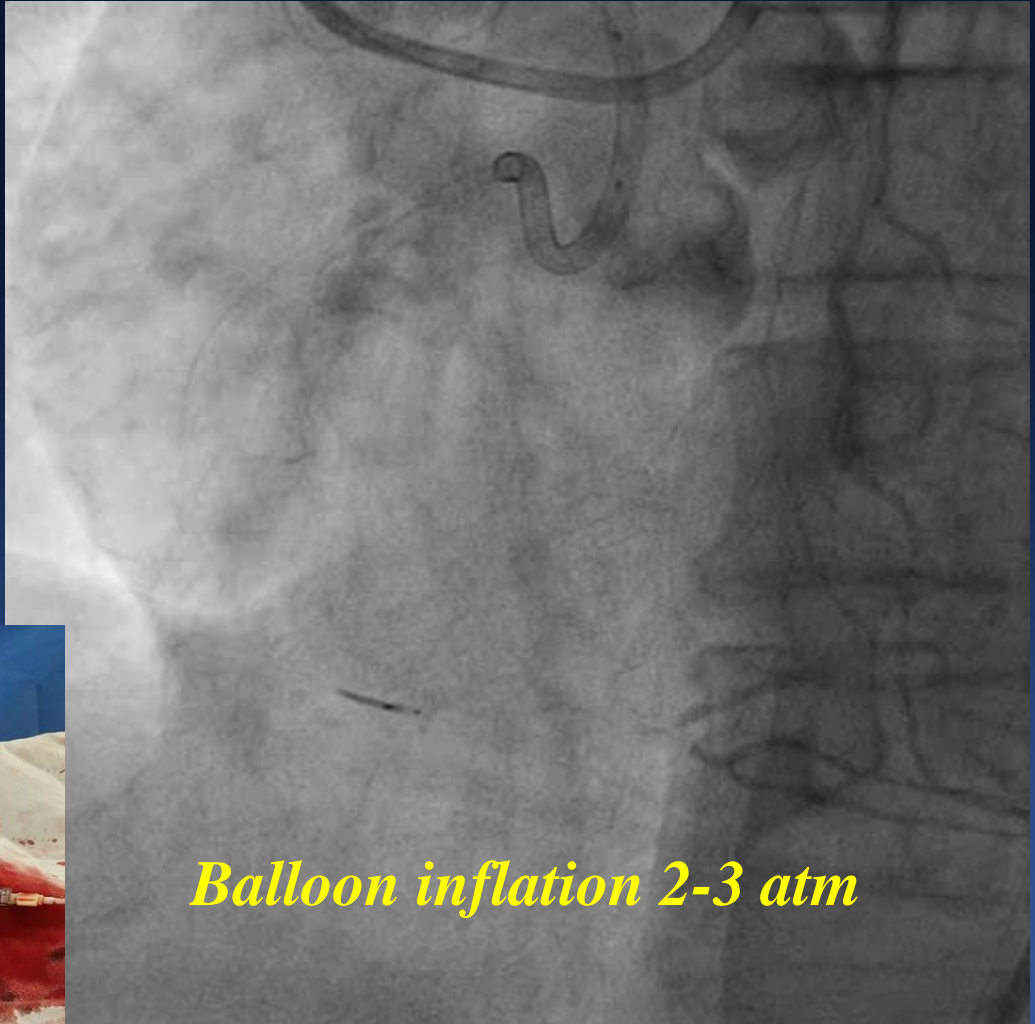
Stingray balloon



Stingray balloon position confirmed

**Straw technique
through stingray
balloon:**

Subintimal
hematoma suction
with 3 way system

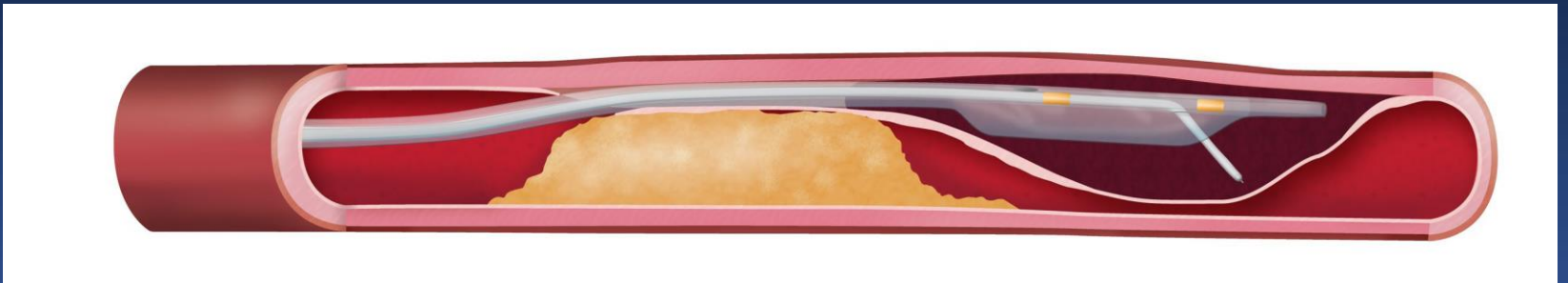


Balloon inflation 2-3 atm



Compressive hematoma

- Hematoma compression make reentry failure
- Stenting hematoma can make propagation



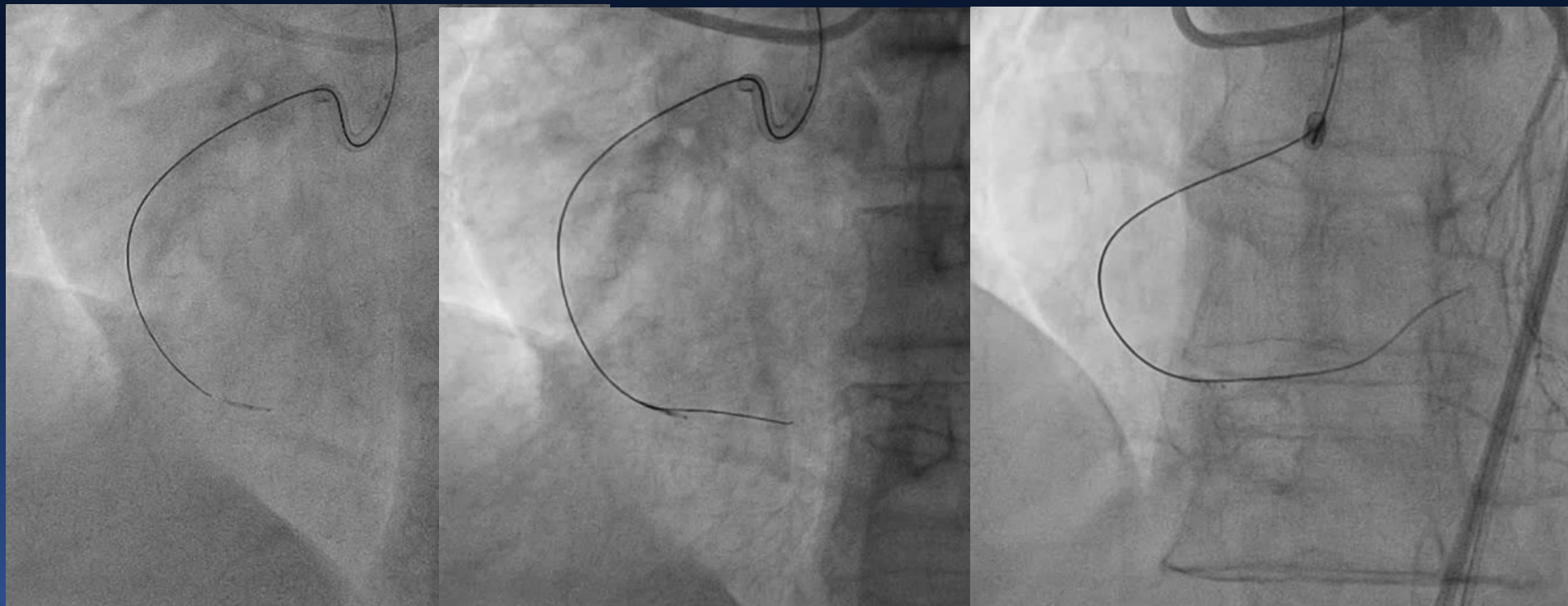
Managing the reentry zone

Minimize subintimal hematoma

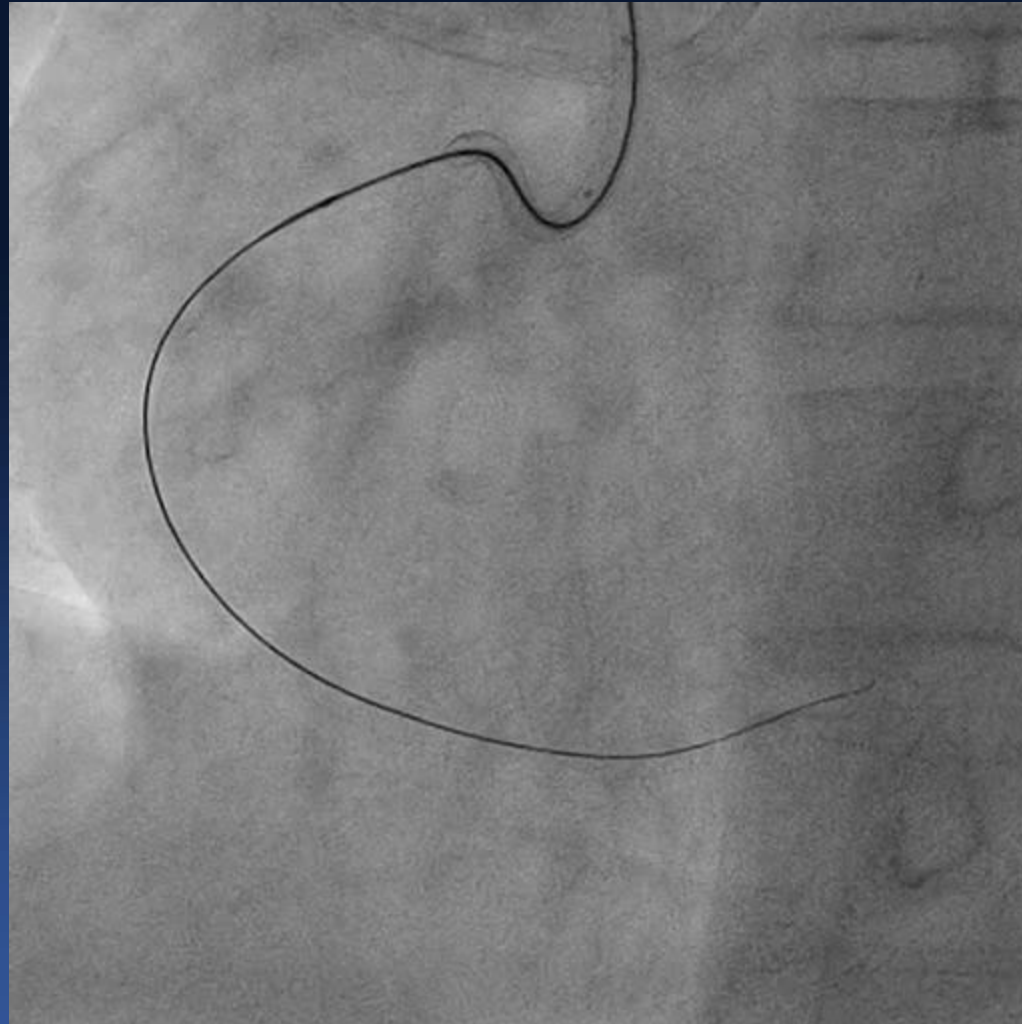
- Avoid antegrade contrast injection
- Do not use knuckled wire into the re-entry zone
- Finish with Crossboss
- Small balloon (1.5 mm or less) or corsair to allow delivery of stingray balloon via stiff wire

Stingray wire advance

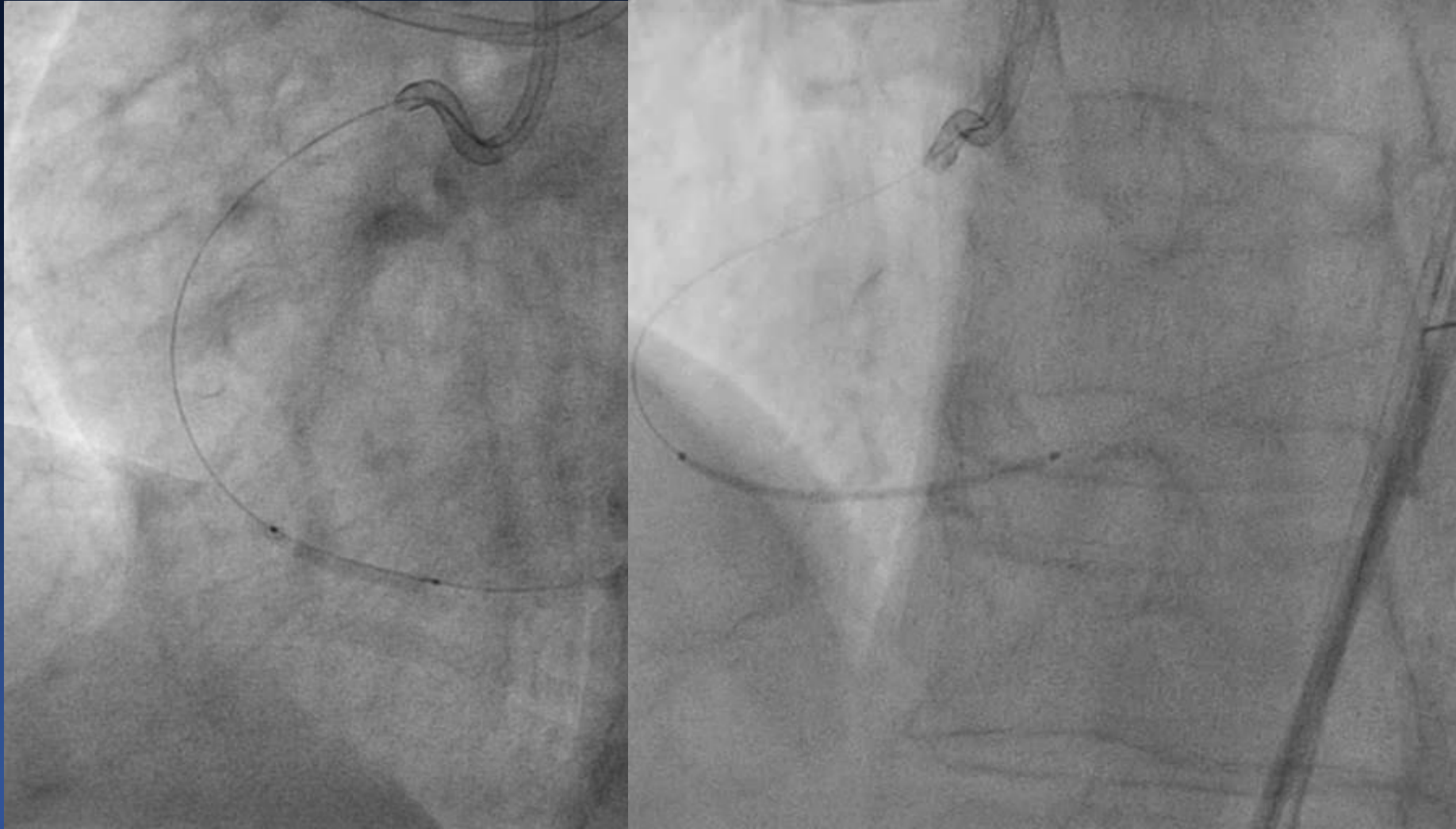
Stick and Drive



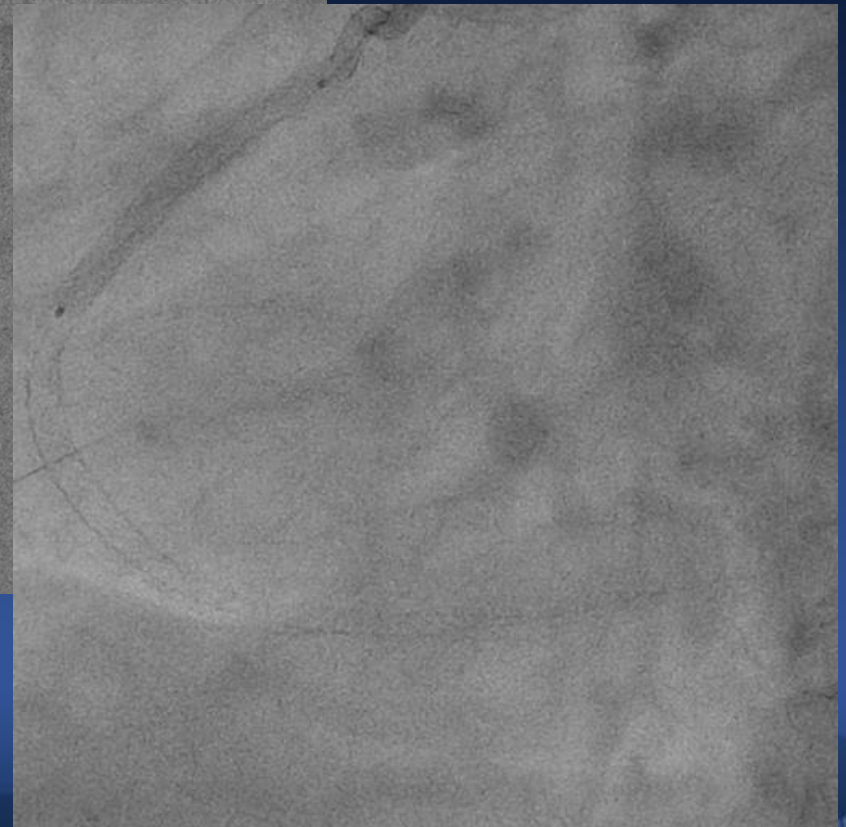
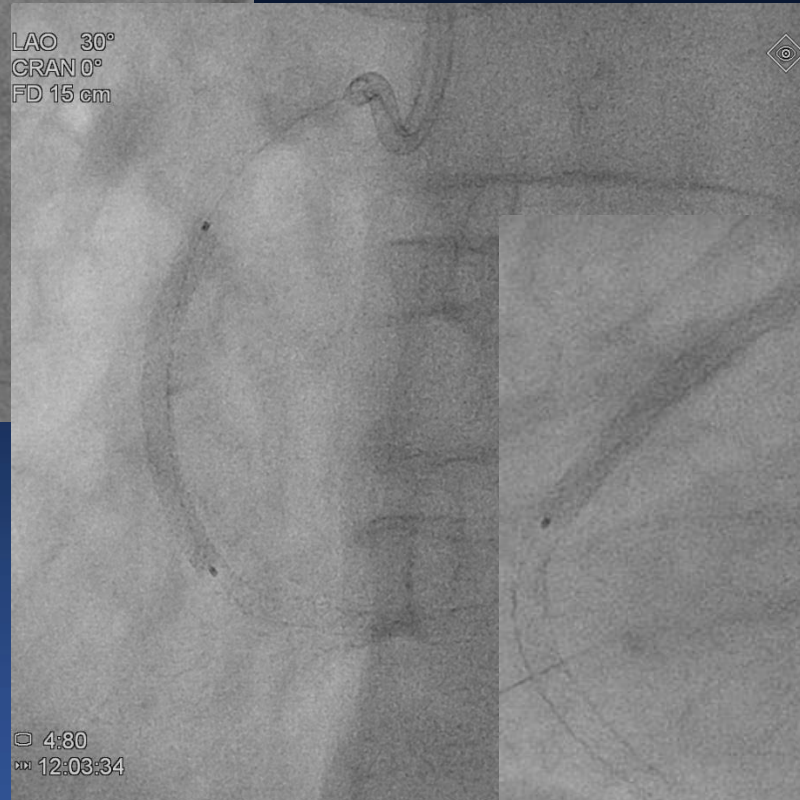
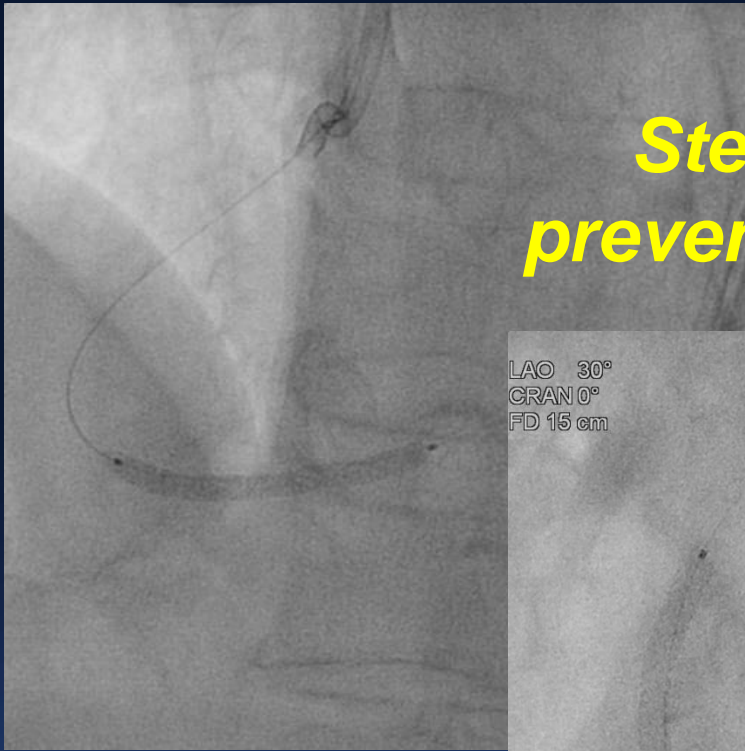
Corsair advance through stingray wire



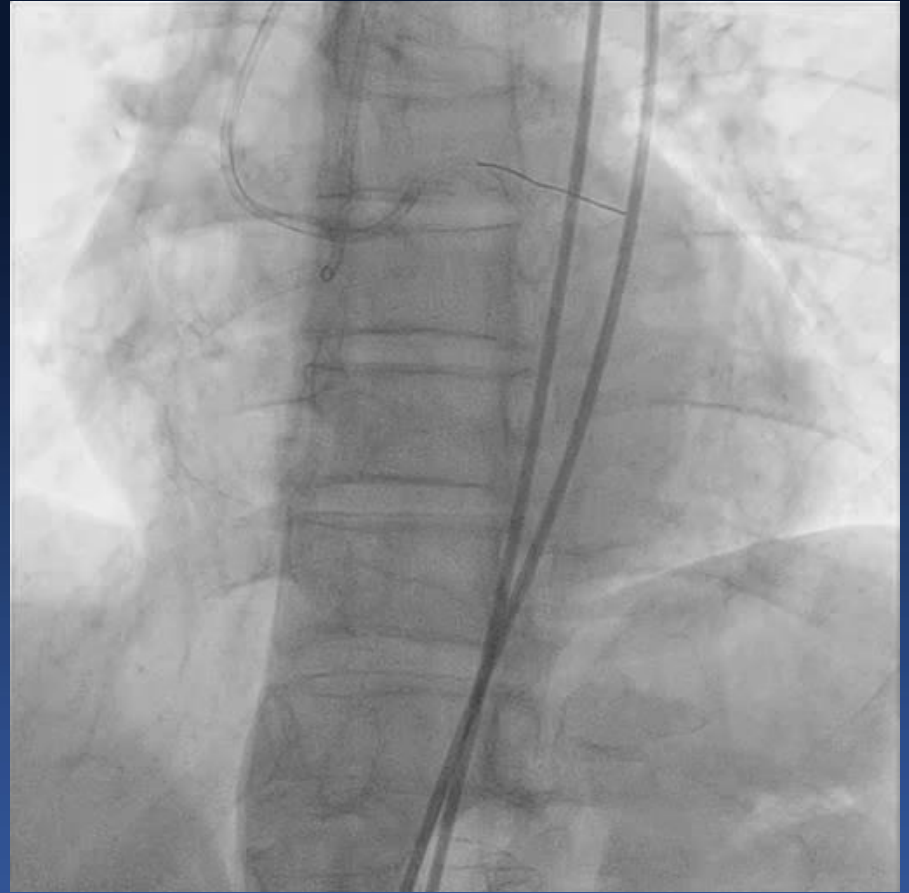
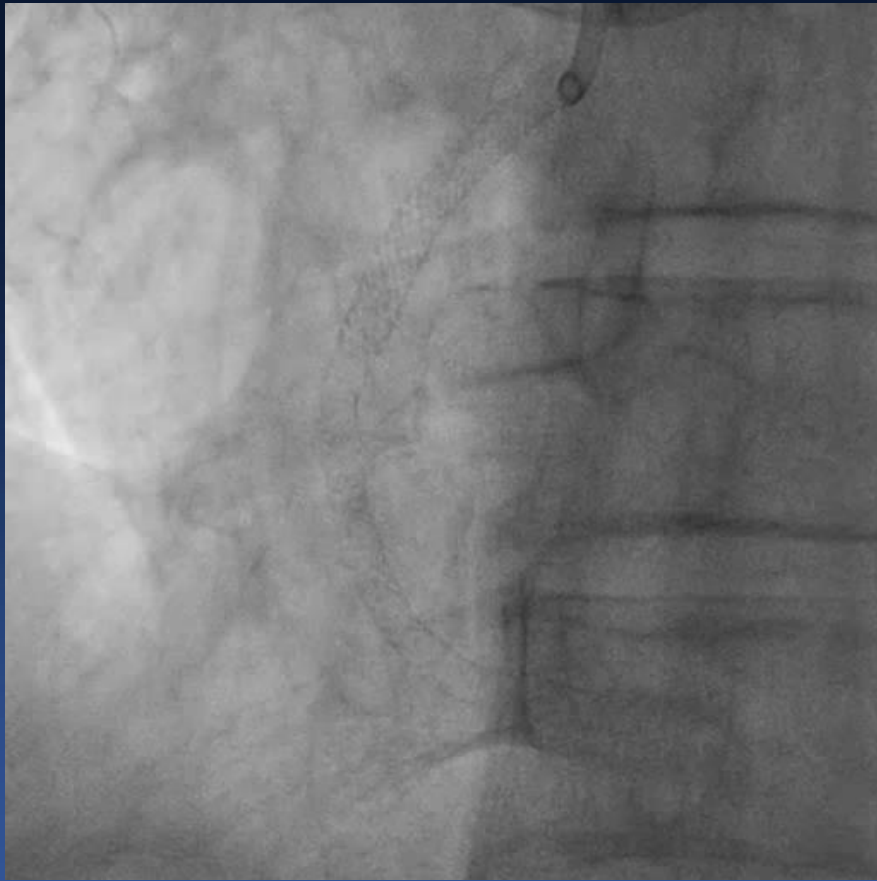
Reentry point balloon dilation And stenting position with contralateral injection



Stenting without contrast for prevention of hematoma extension

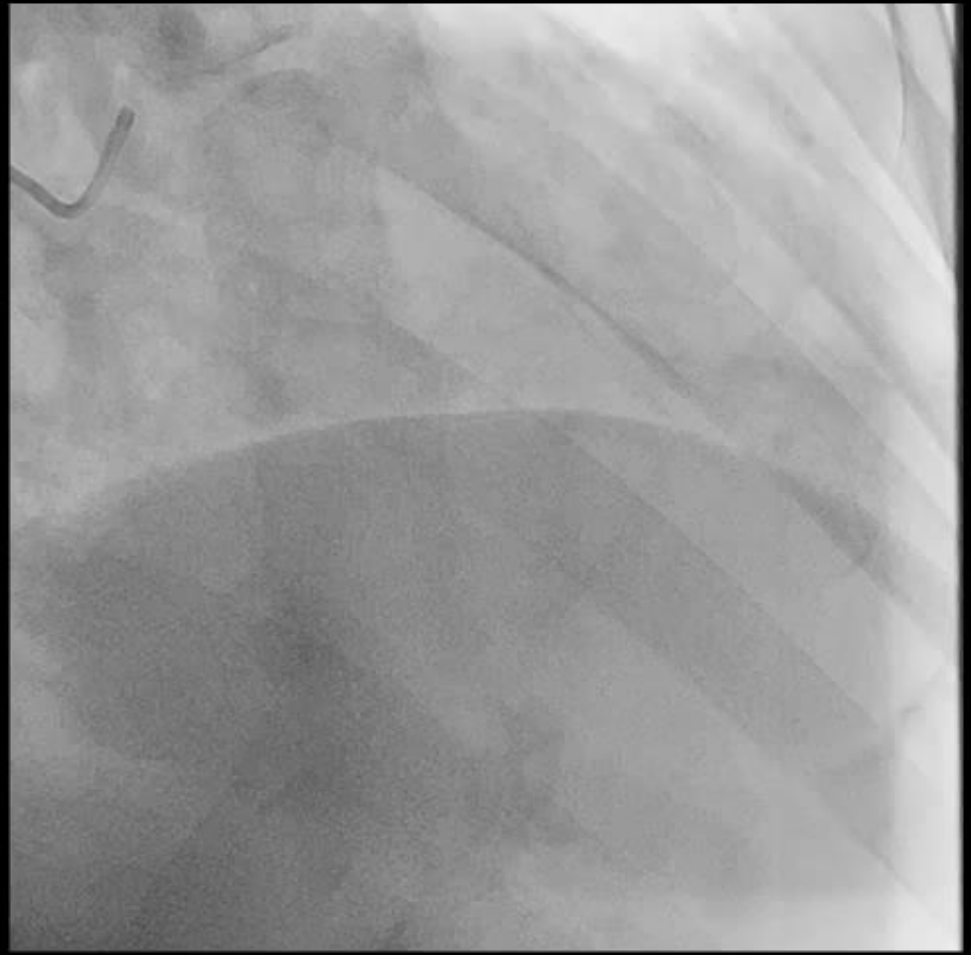


Final angiography pericardial effusion

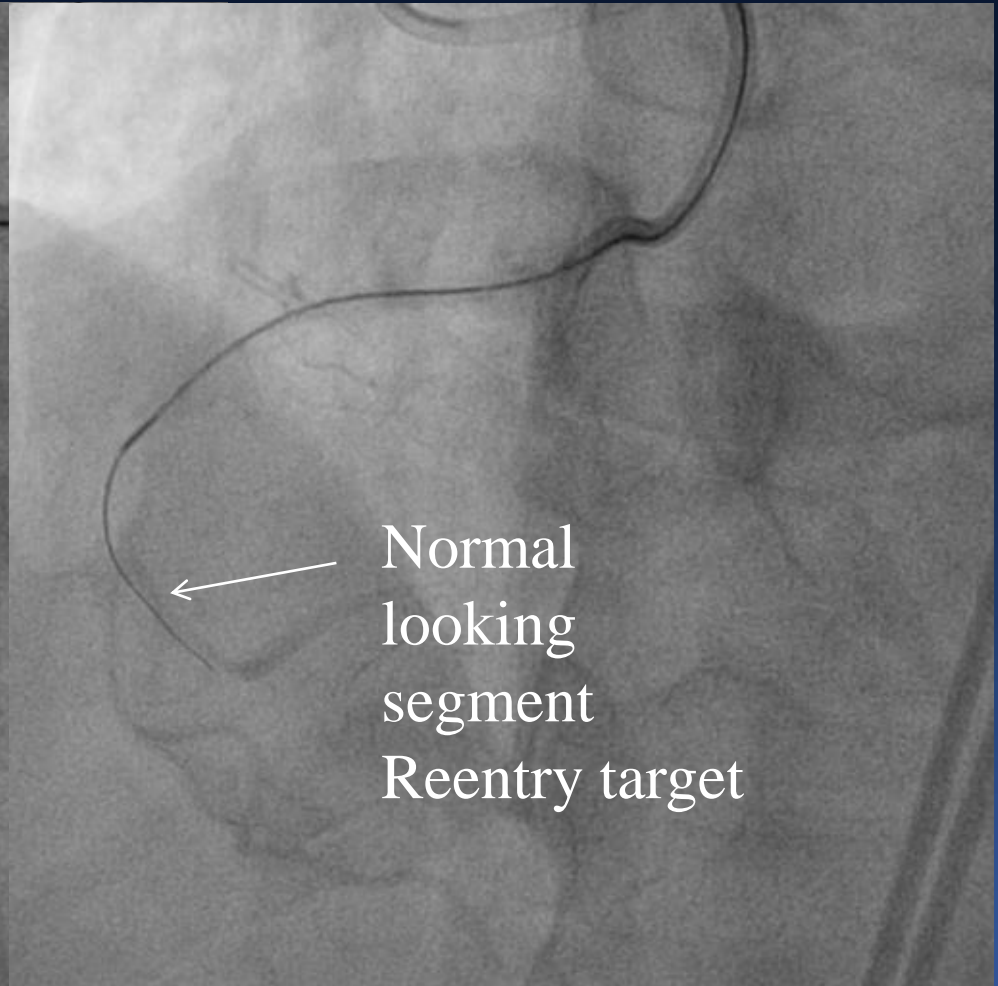
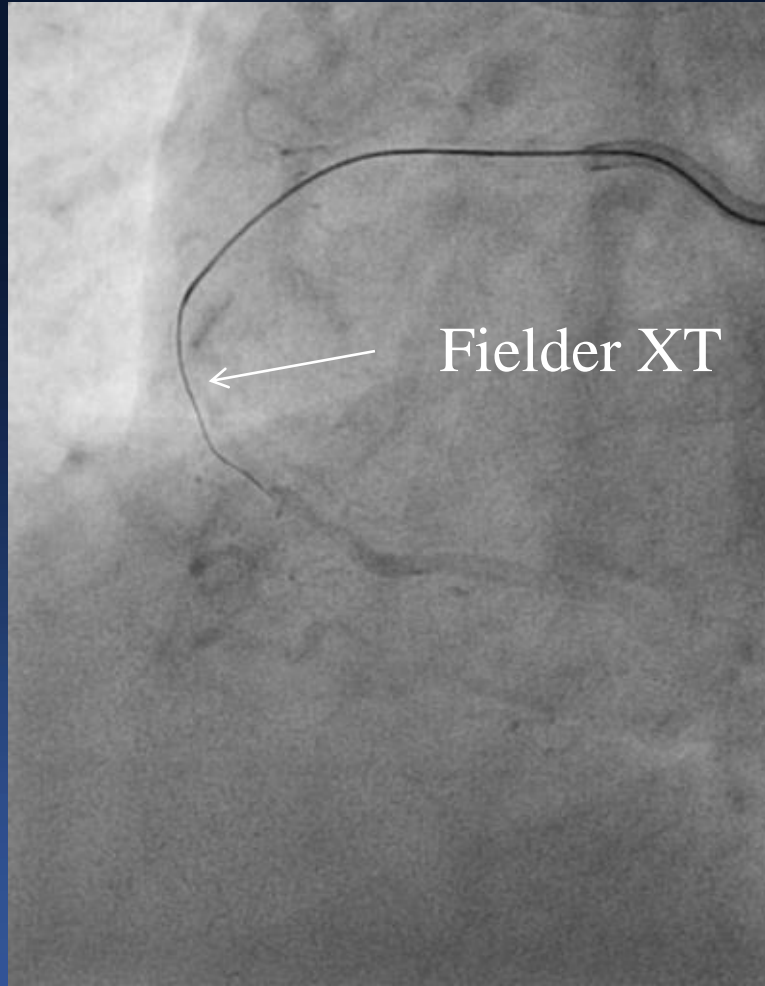


Baseline angiography

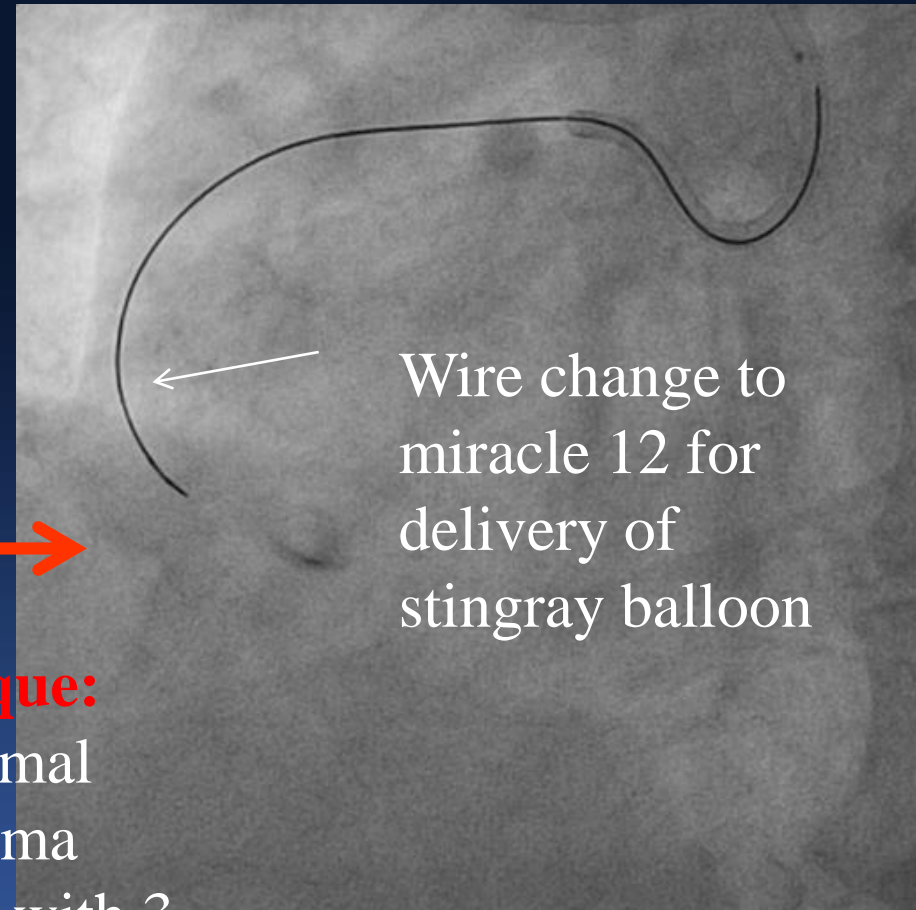
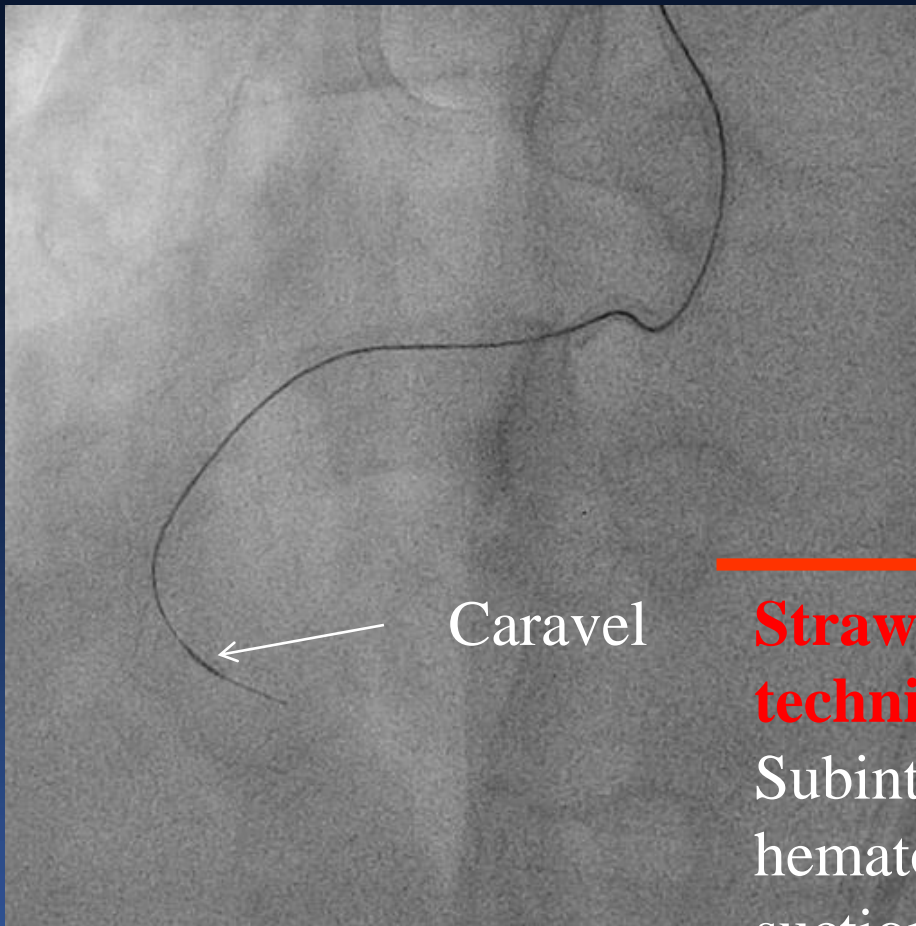
Good interventional collateral



Subintimal wiring with caravel



Microcatheter advance and wire exchange



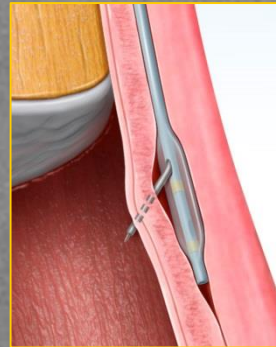
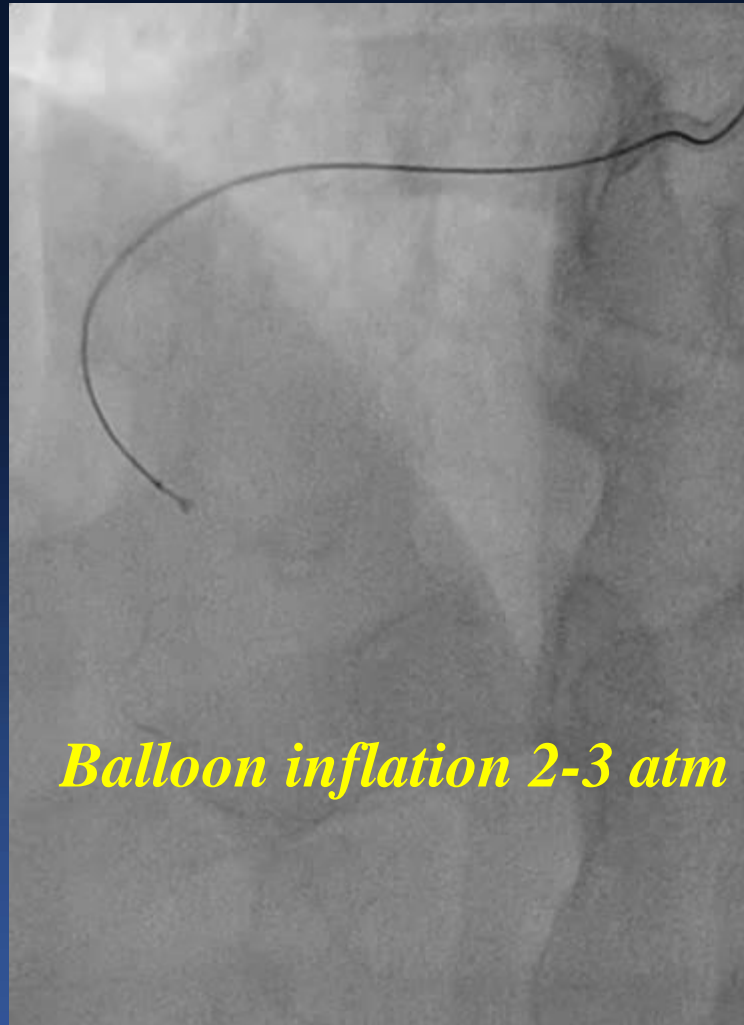
Straw technique:
Subintimal
hematoma
suction with 3
way system

Wire removal and straw technique balloon positioning by angiography

**Straw technique
again through
stingray balloon:**
Subintimal
hematoma suction
with 3 way system



Reentry using Stingray wire



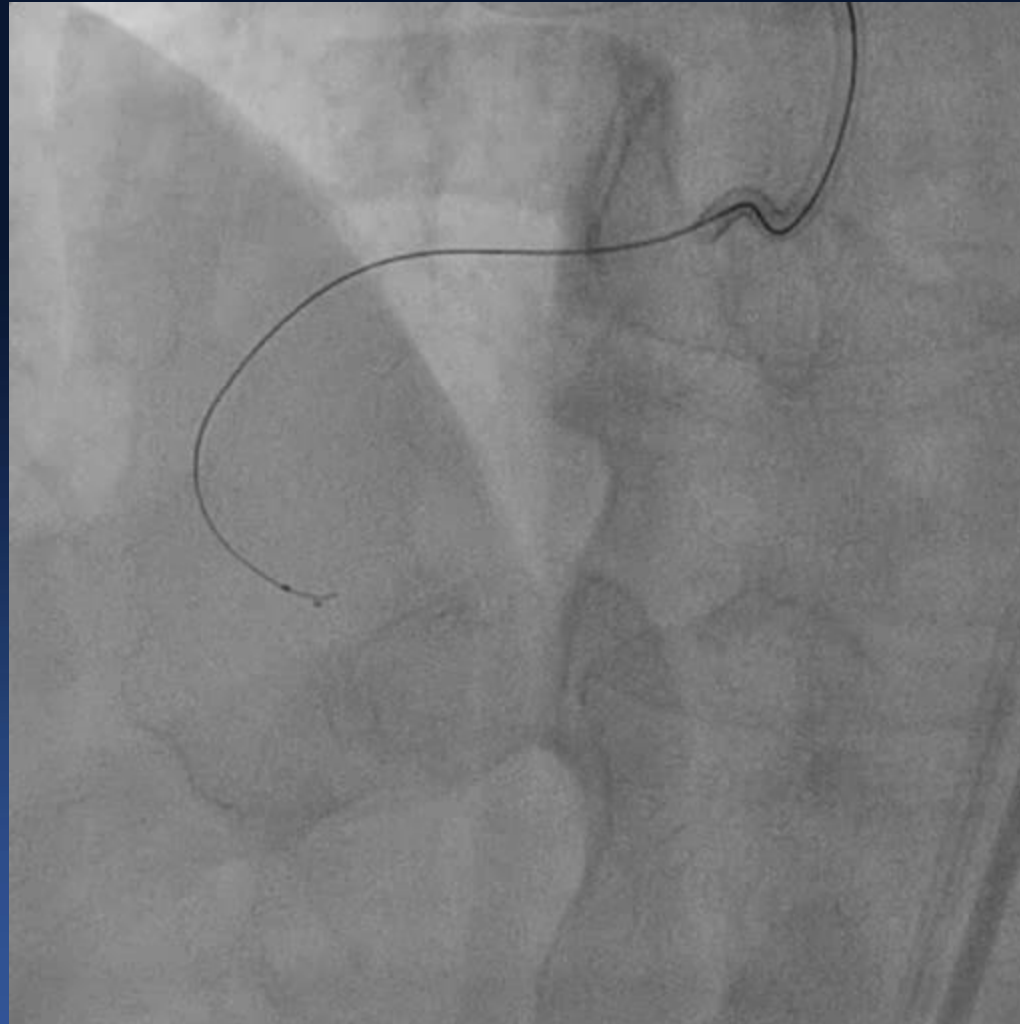
←
Angulation:
concern for vessel
damage with
stingray wire

Failure to obtain re-entry

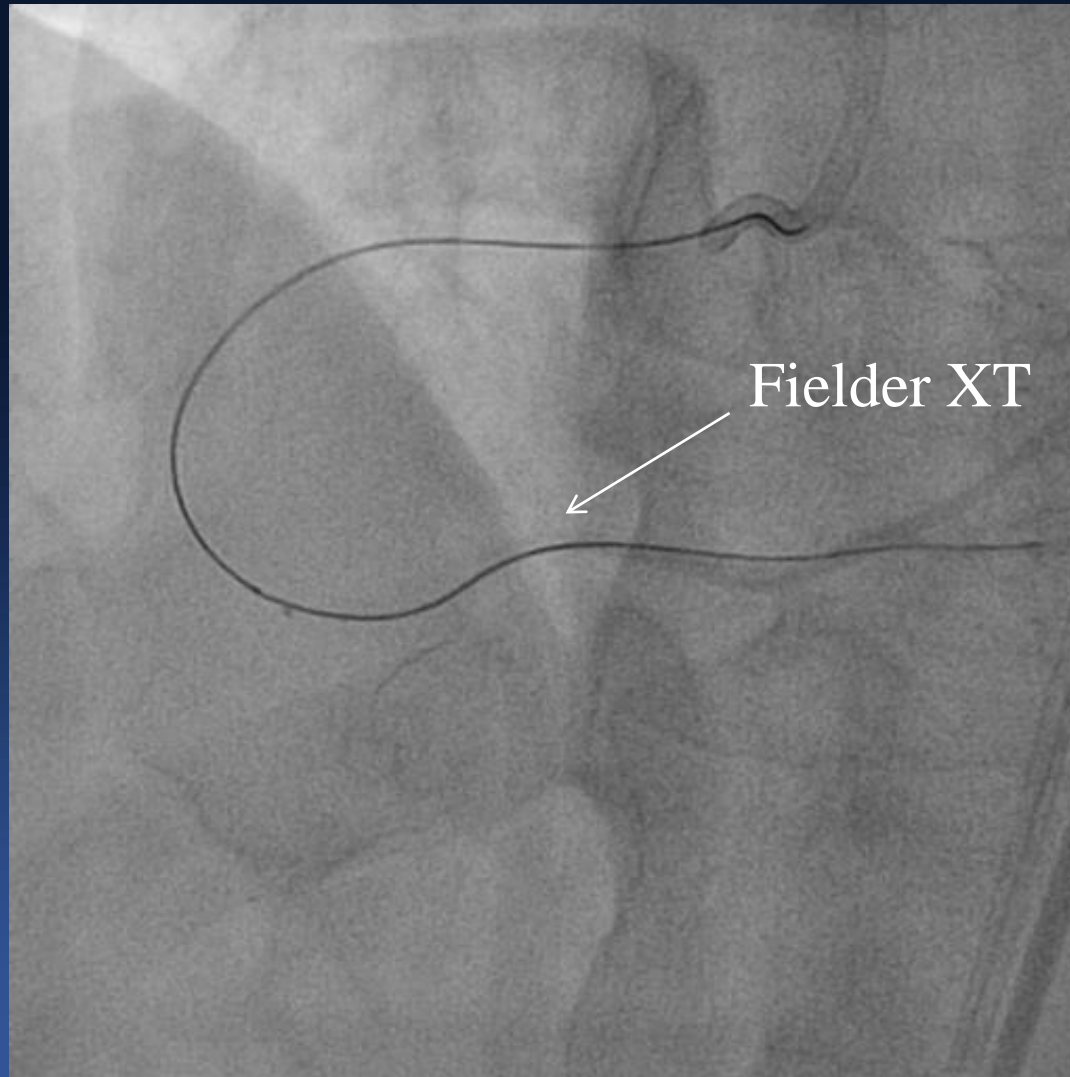
Problem solving

- Place stingray balloon to new location
- After puncture, use **soft wire (stick and swab)** to true lumen as stingray wire may make distal true lumen dissection (Pilot 200 or soft wire)

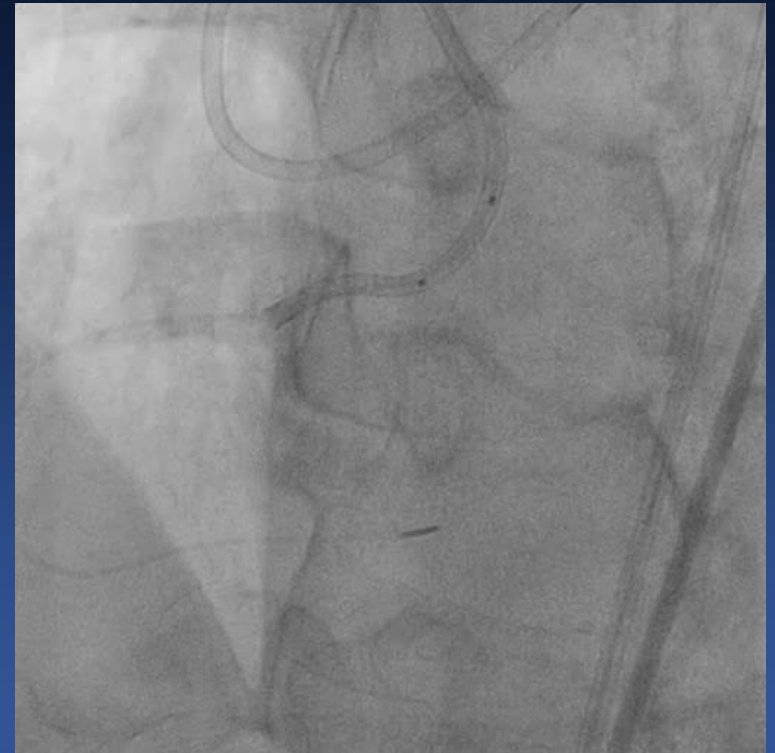
Stick and Swab using Fielder XT wire



Wire position confirmed



Stingray balloon removal and caravel advance



Post-balloon 2.0 mm

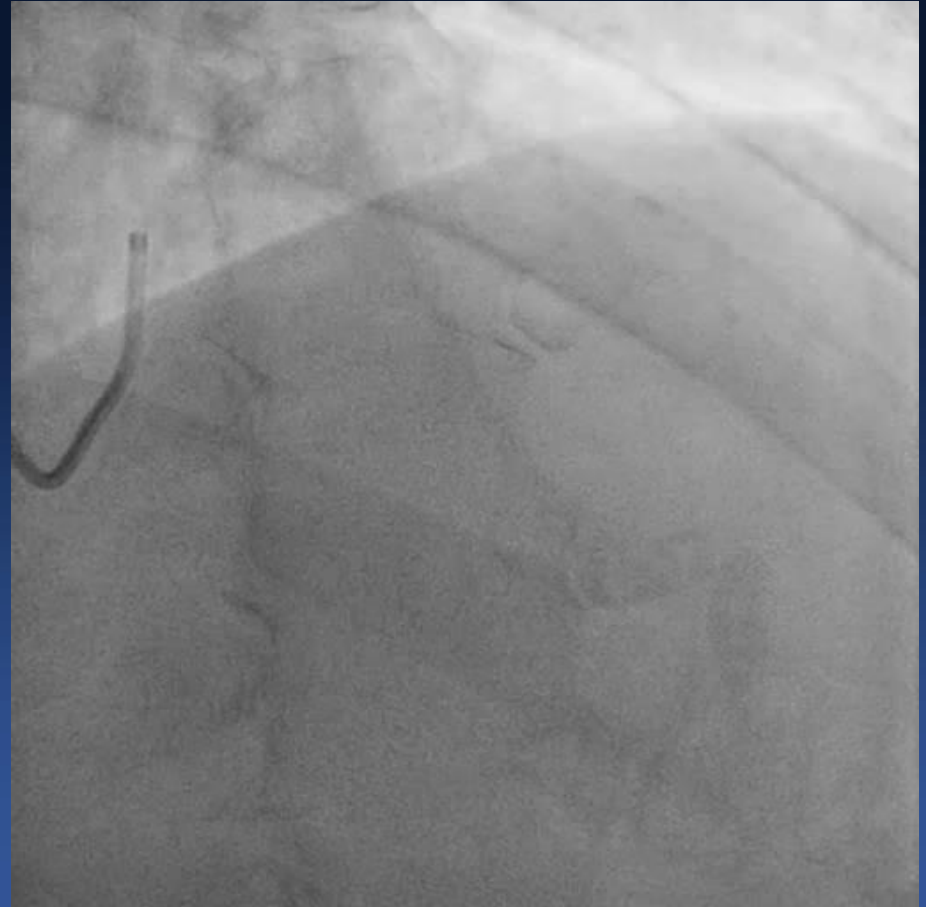


Final angiography



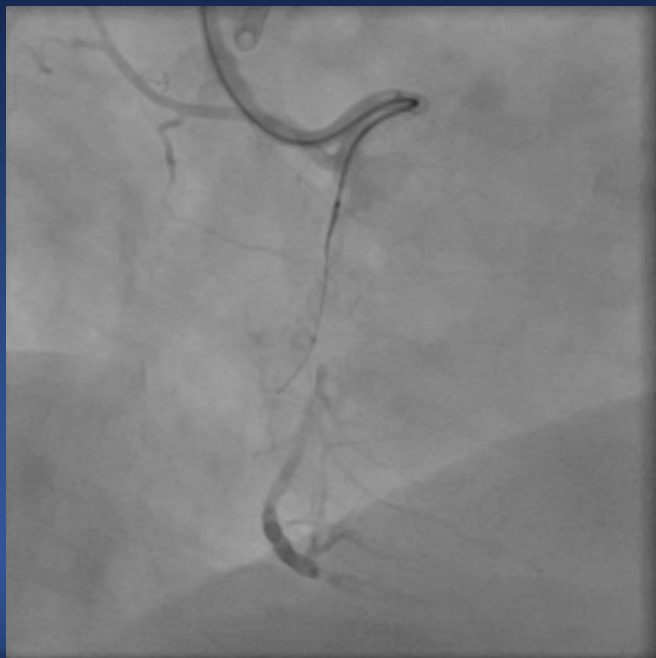
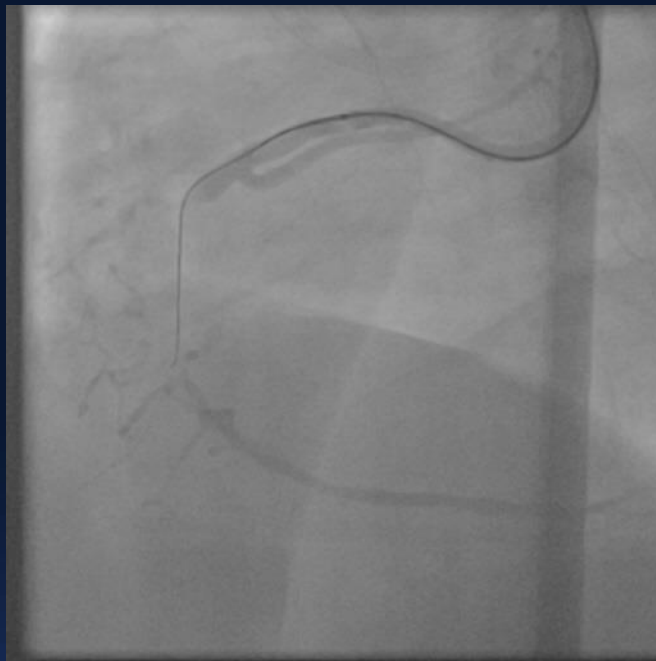
Baseline angiography

No interventional collateral



Failed previous attempt 1 month ago

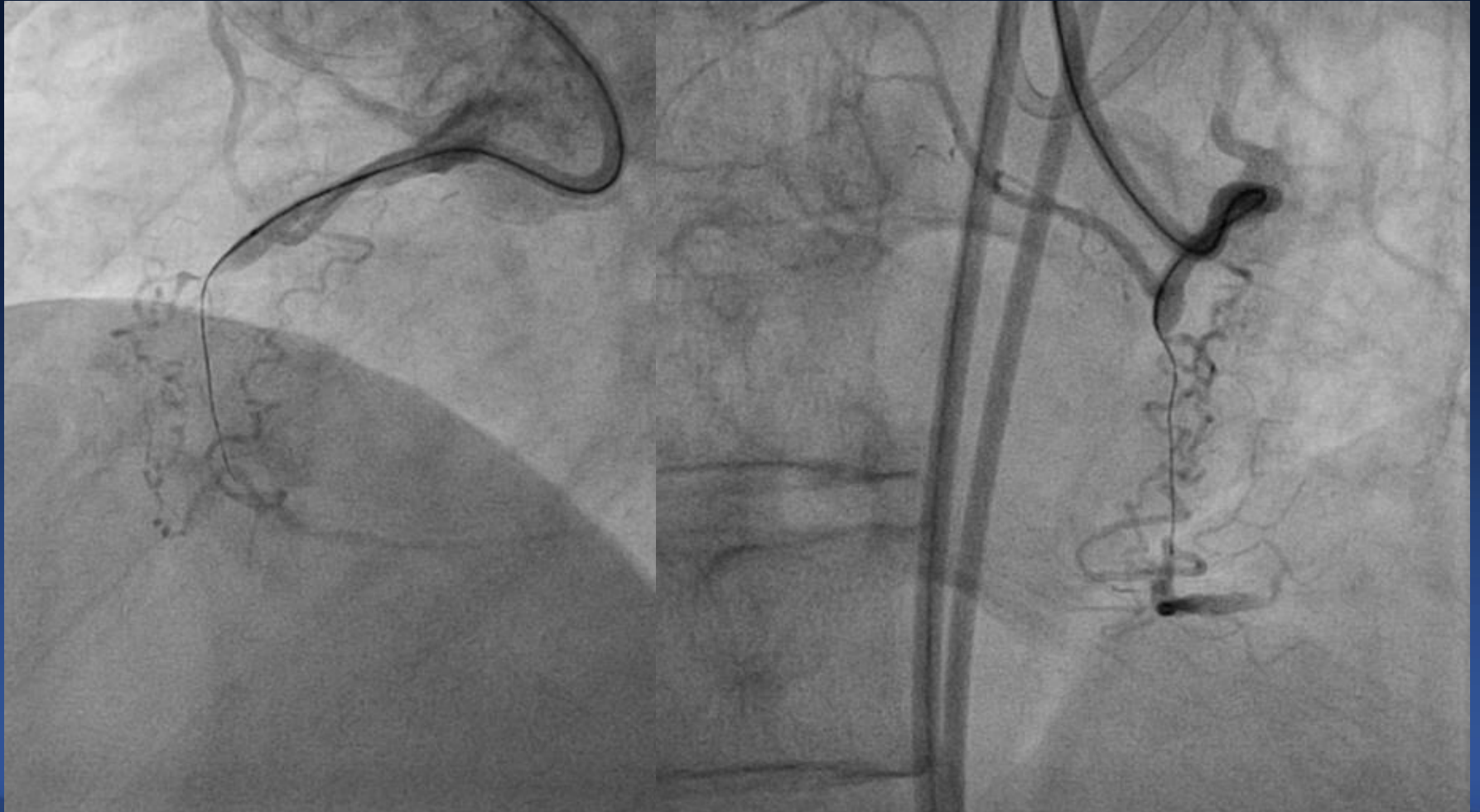
Antegrade and retrograde



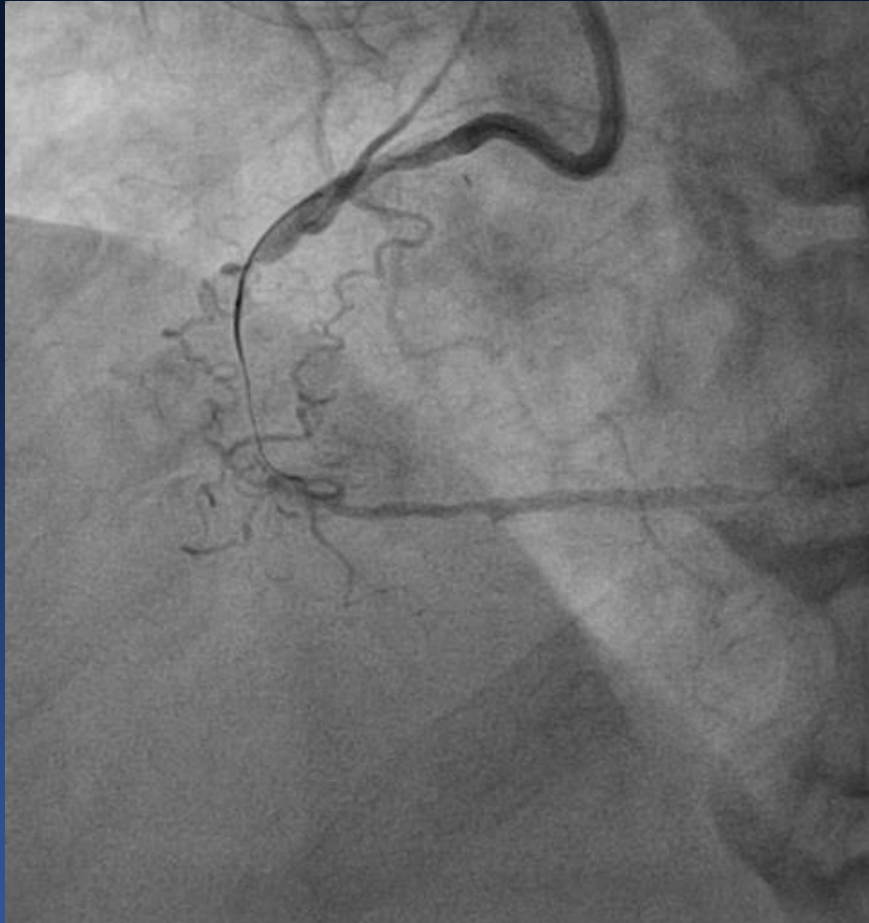
Corsair/Gaia 2 wire

True LAO

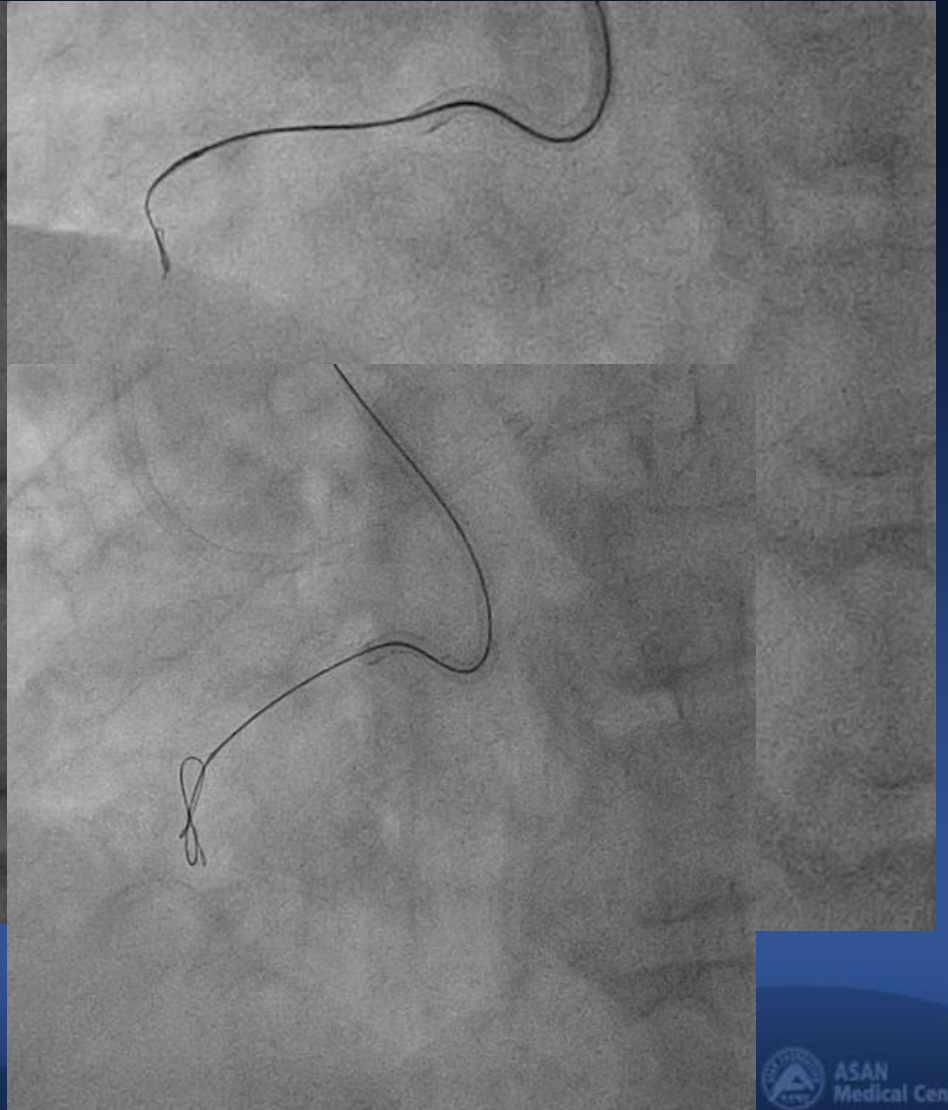
True RAO



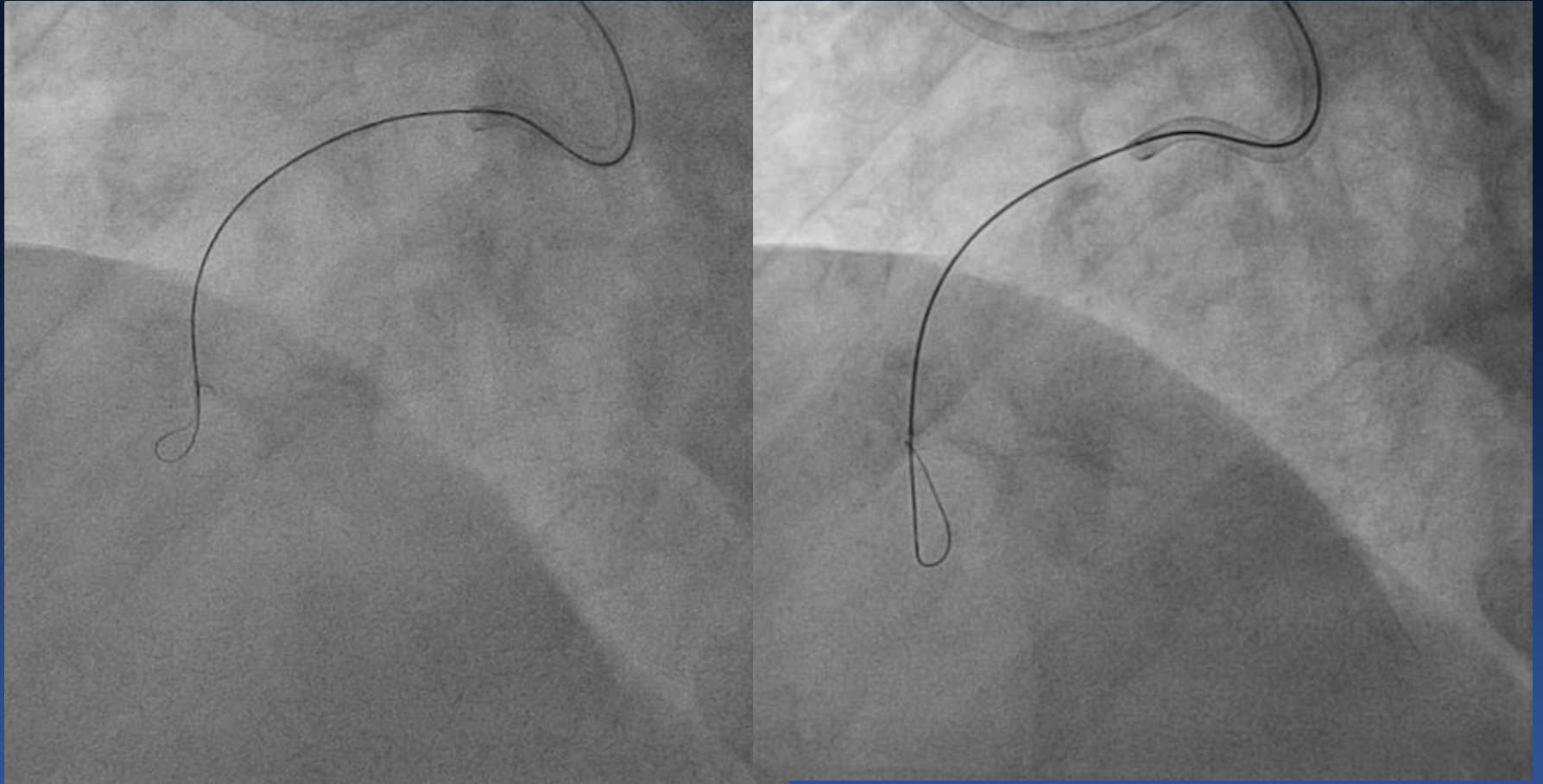
Corsair did not advance



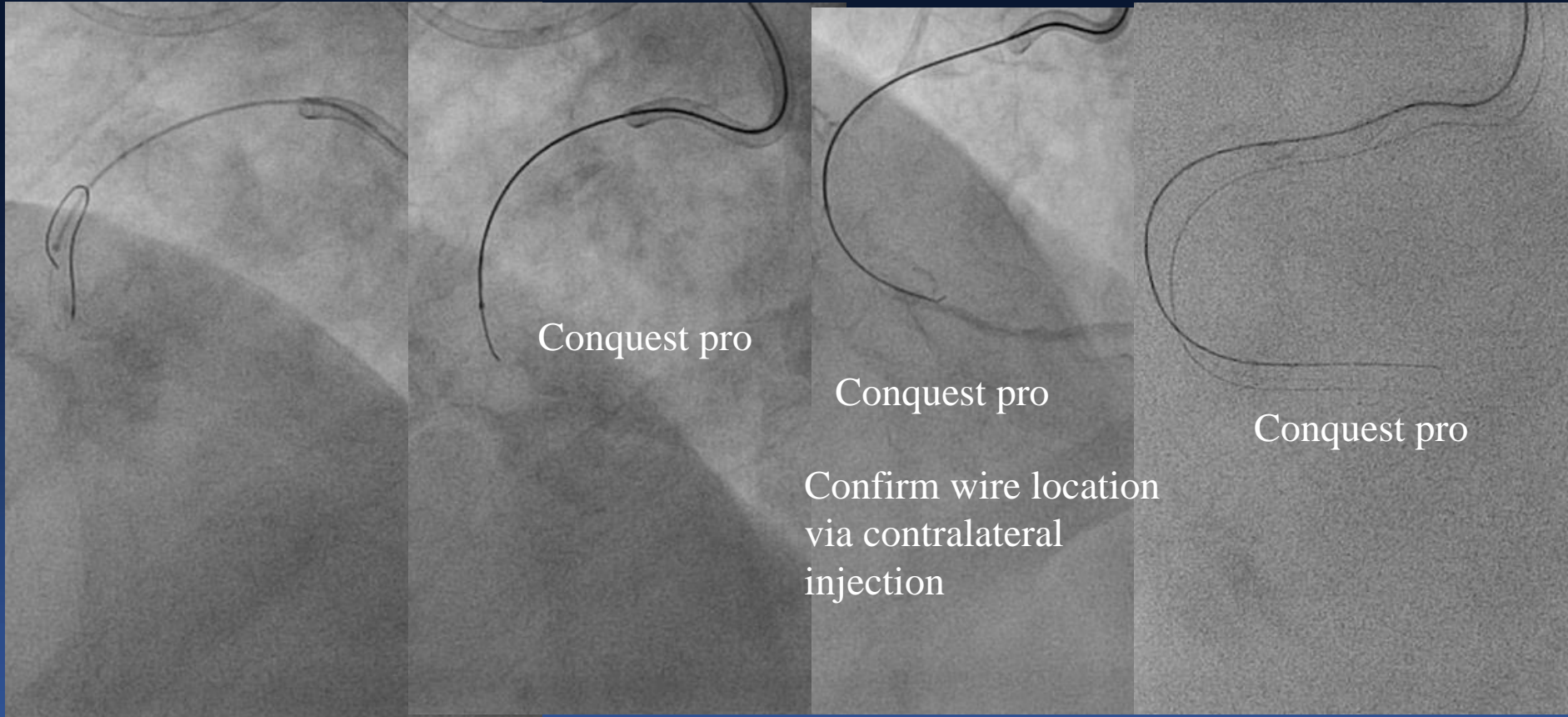
Knuckle wiring with Gladius wire



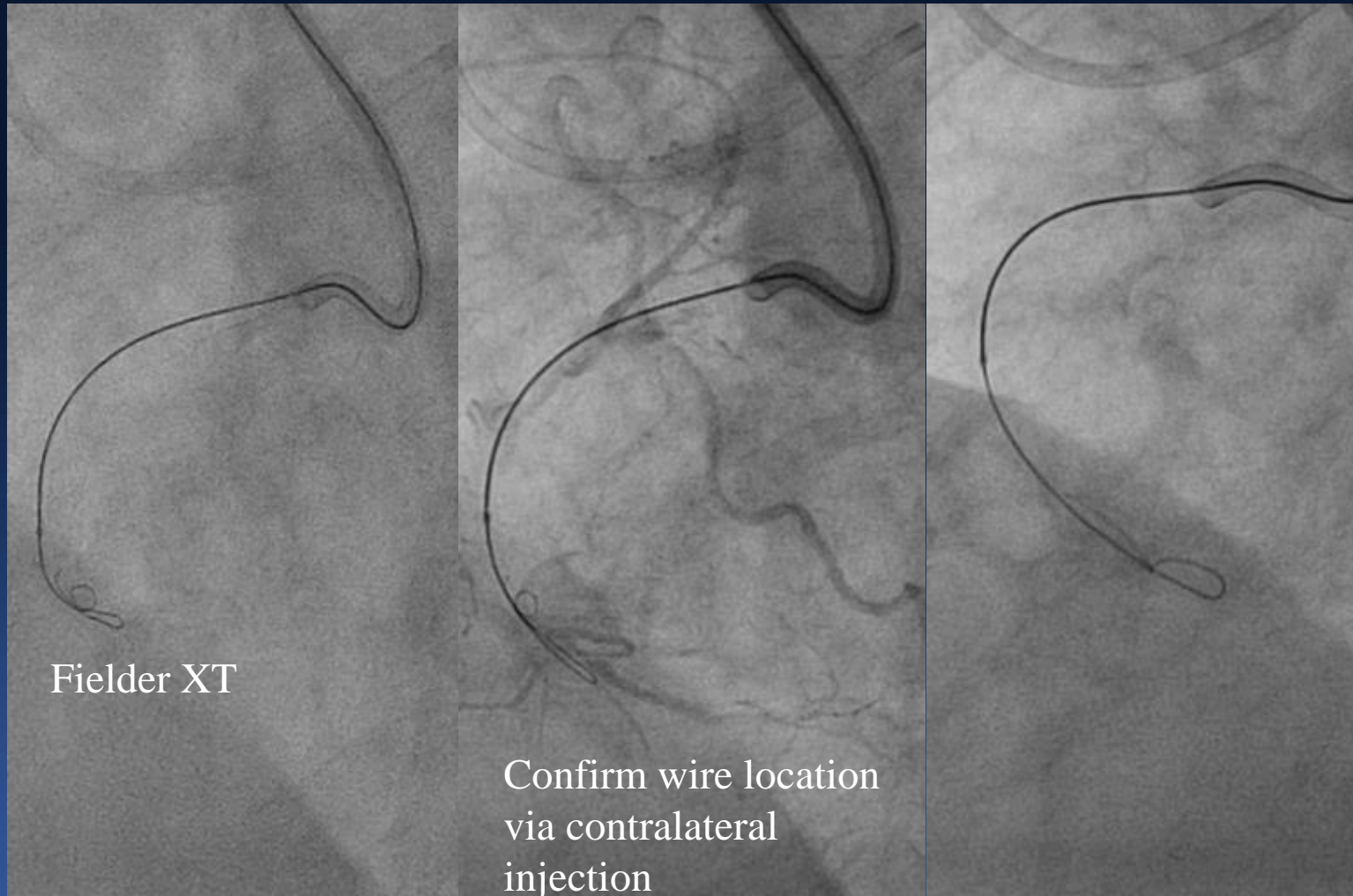
Knuckle wiring after CrossBoss insertion: wire going to RV branch



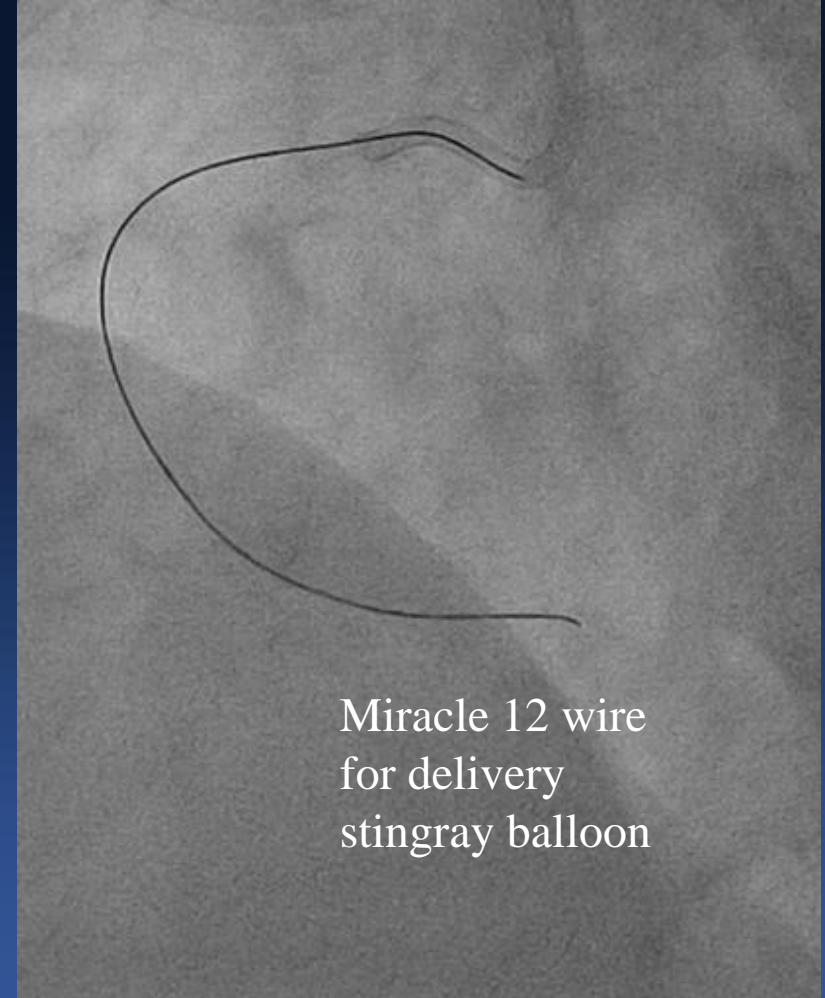
To redirect wire, pullback wire and CrossBoss, use conquest pro wire



CrossBoss cannot follow wire, so Knuckle wire again using Fielder XT



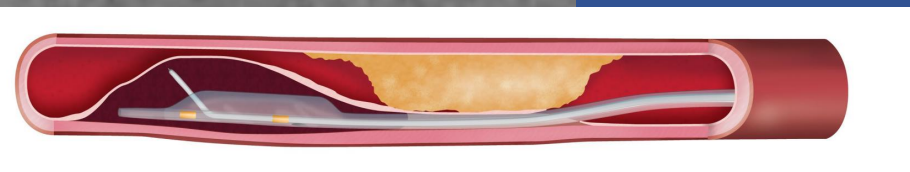
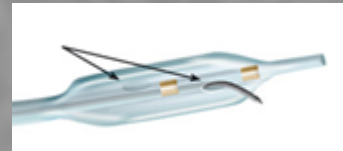
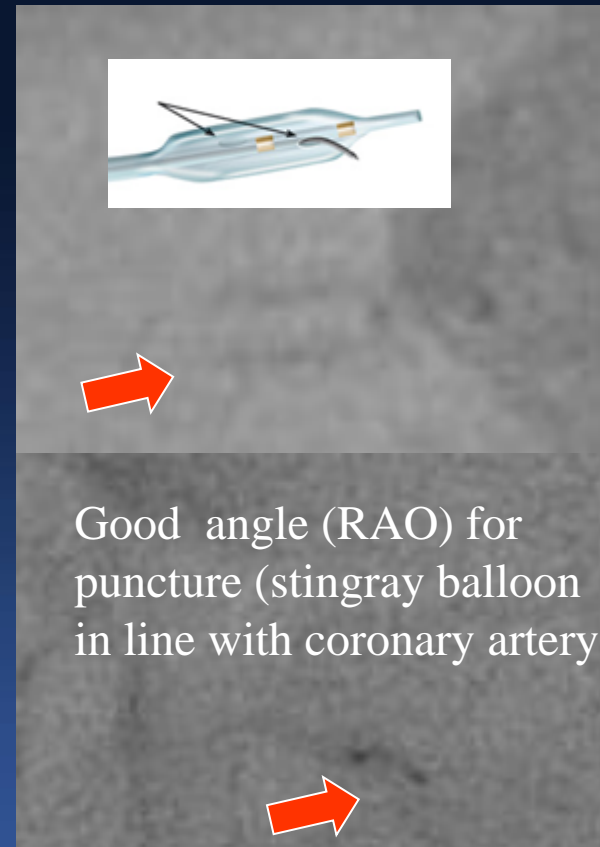
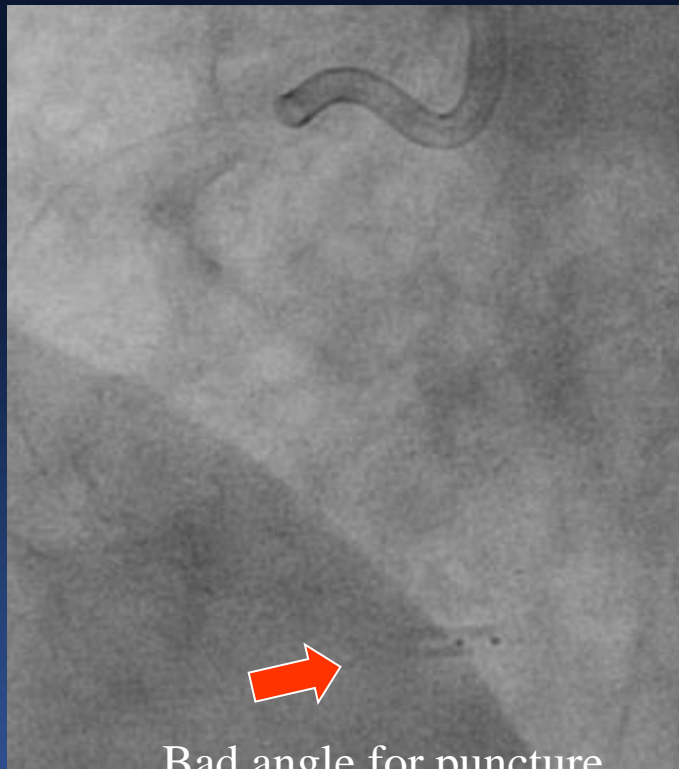
CrossBoss advance

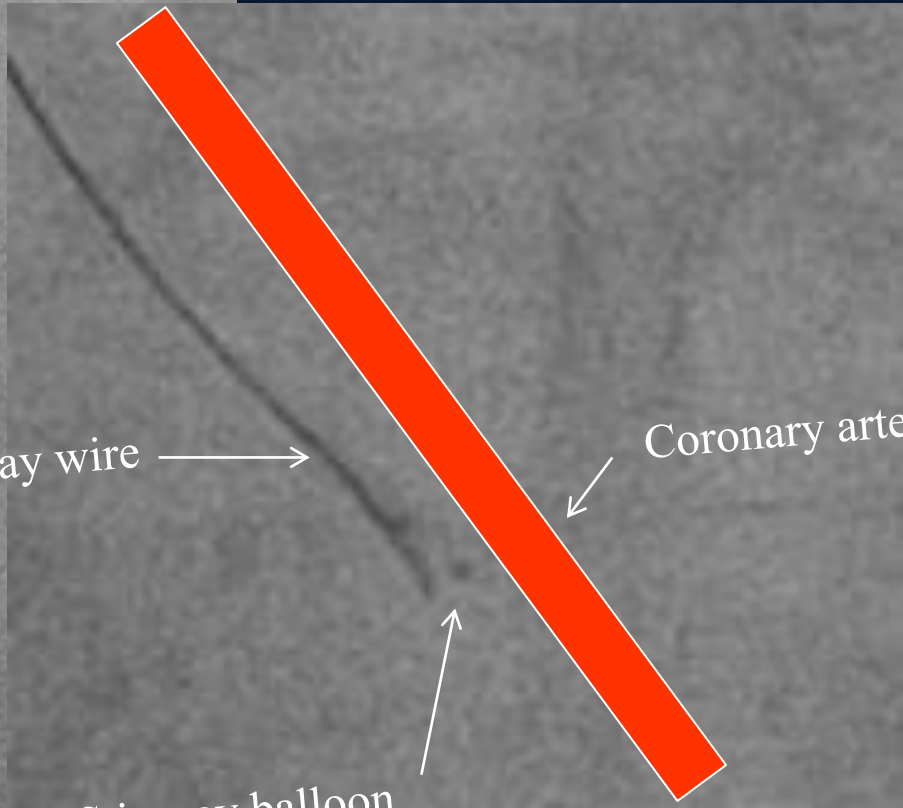
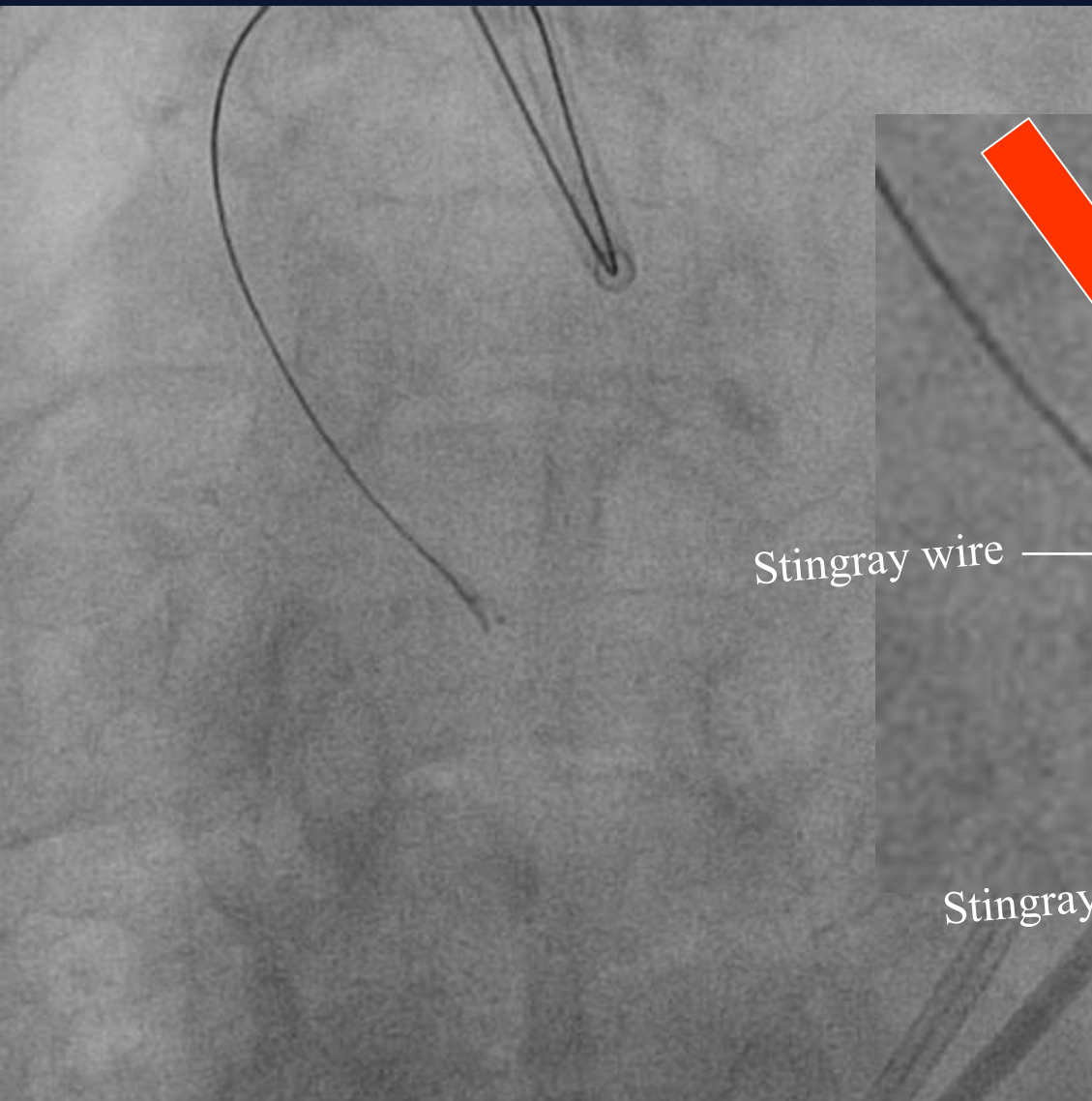


Make right projection for reentry

Stingray balloon inflation 3-4 atm

Bad angle (LAO) for puncture



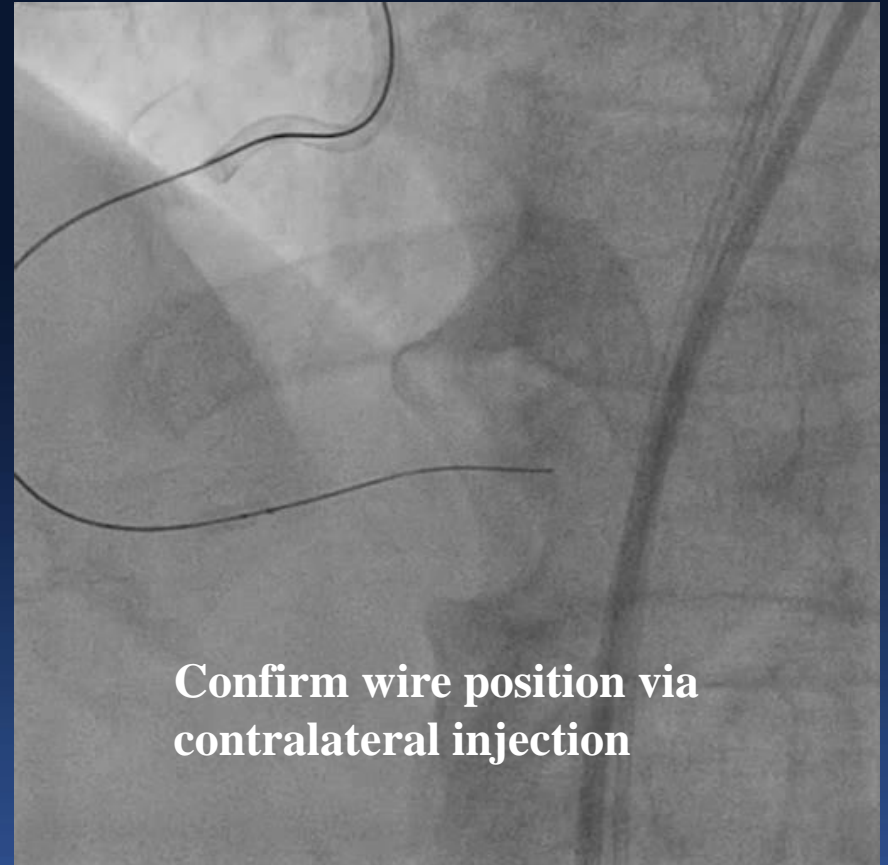
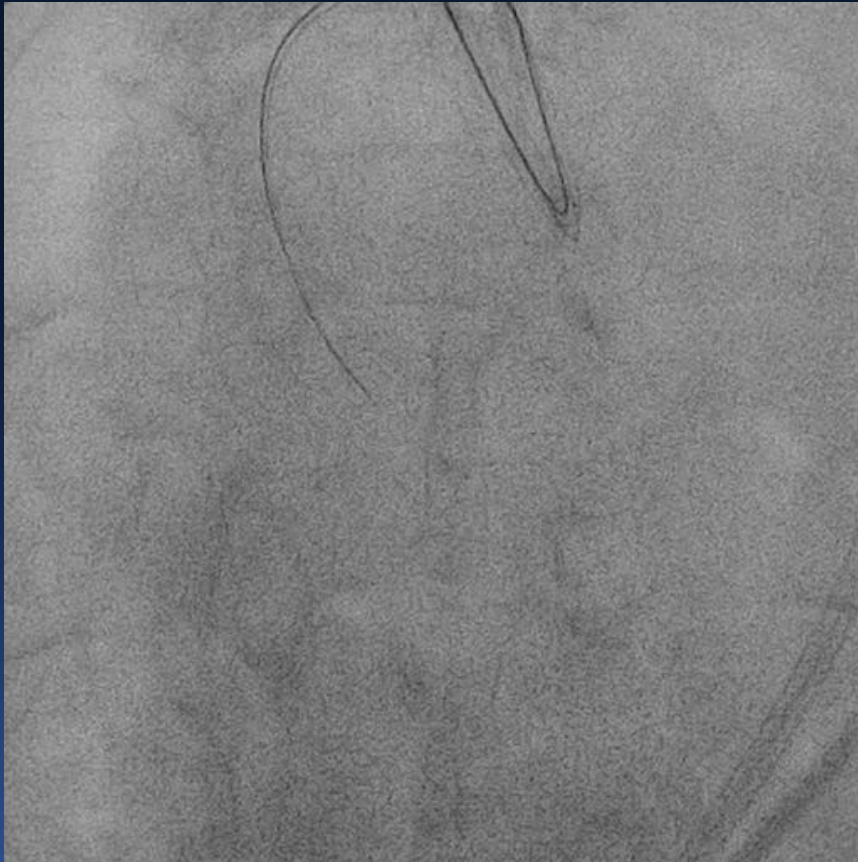


Stingray wire

Coronary artery

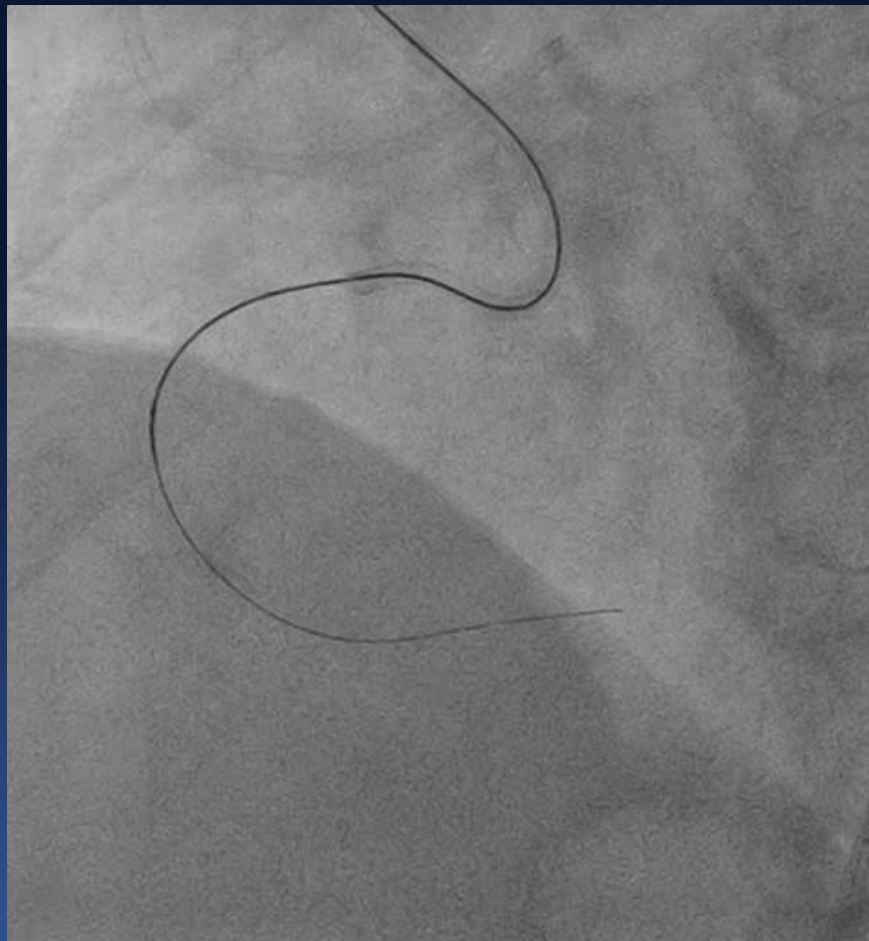
Stingray balloon

Stingray wire puncture

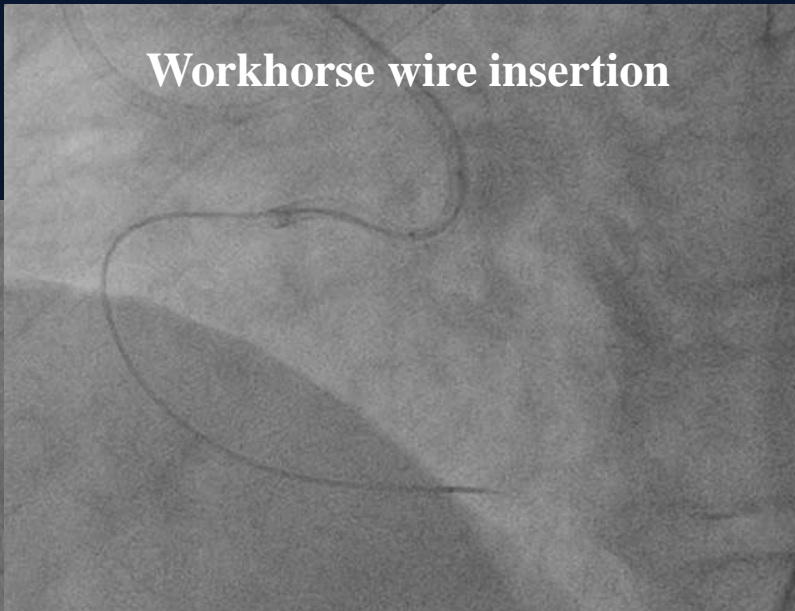


**Confirm wire position via
contralateral injection**

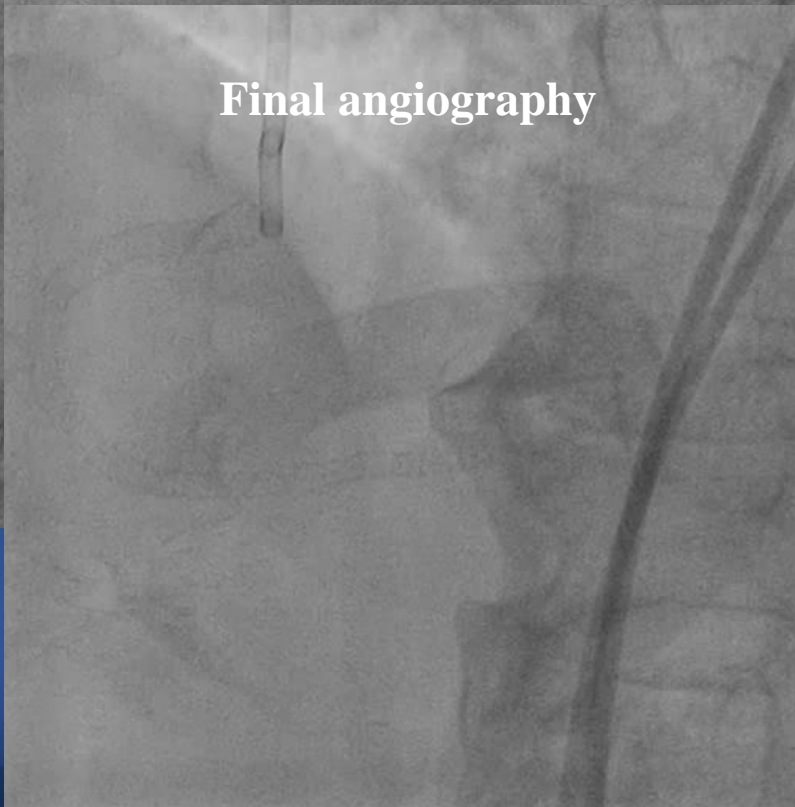
Corsair advance



Workhorse wire insertion

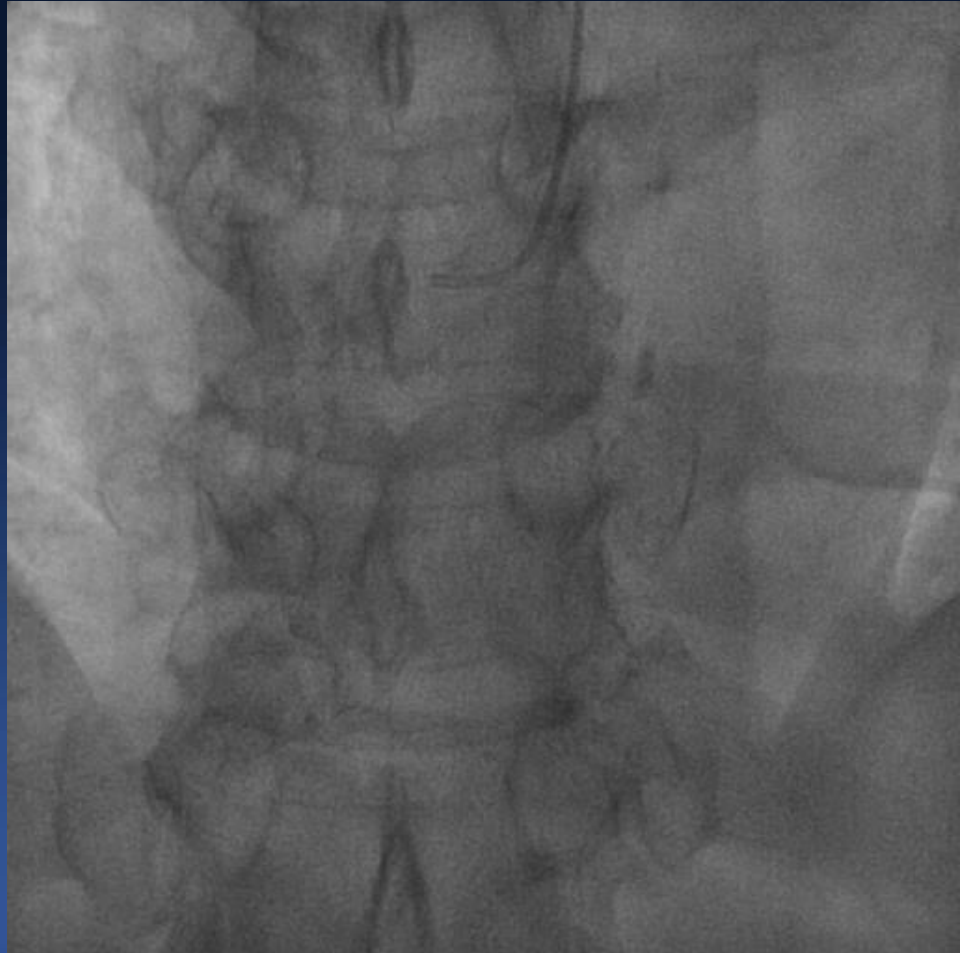


Final angiography



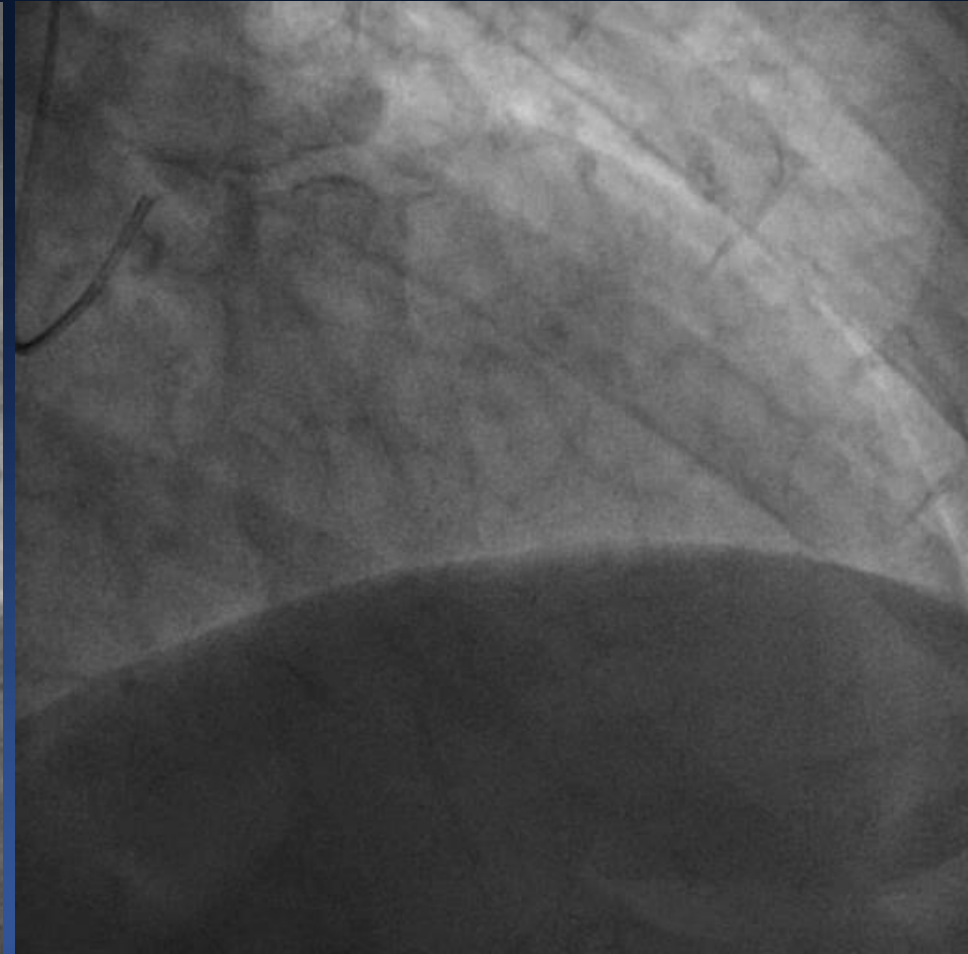
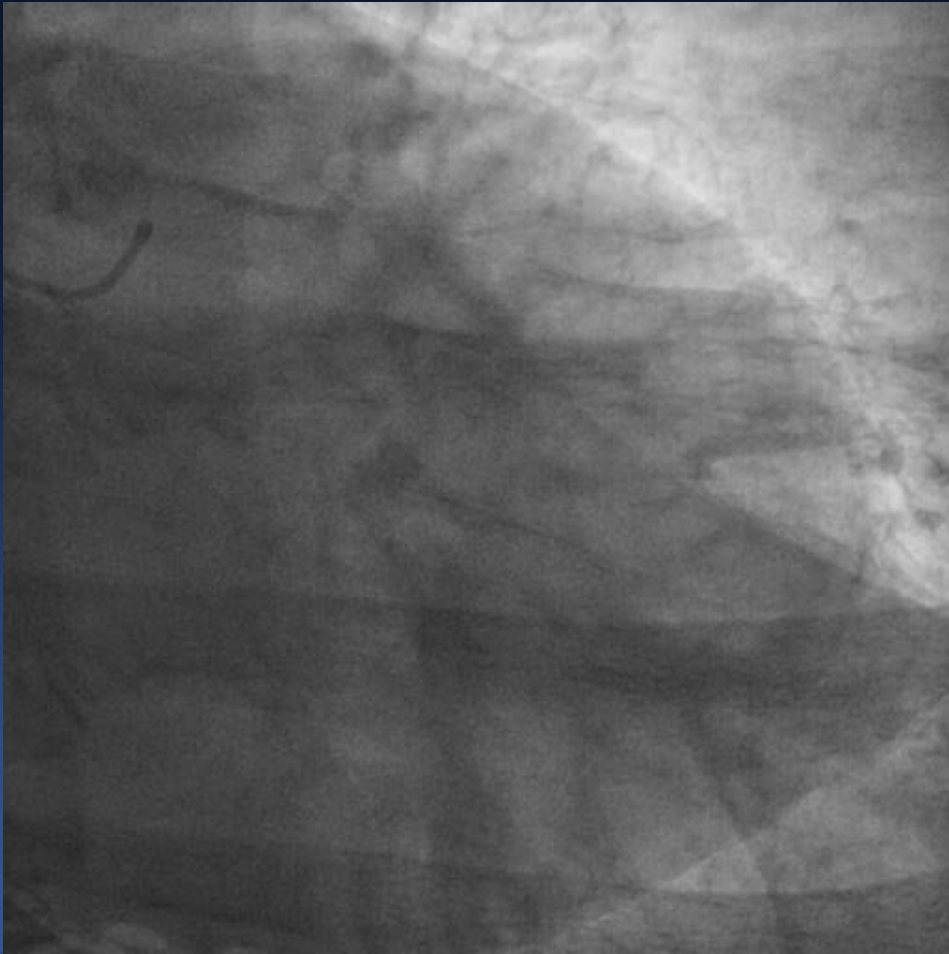
Baseline angiography

Good ipsilateral collateral



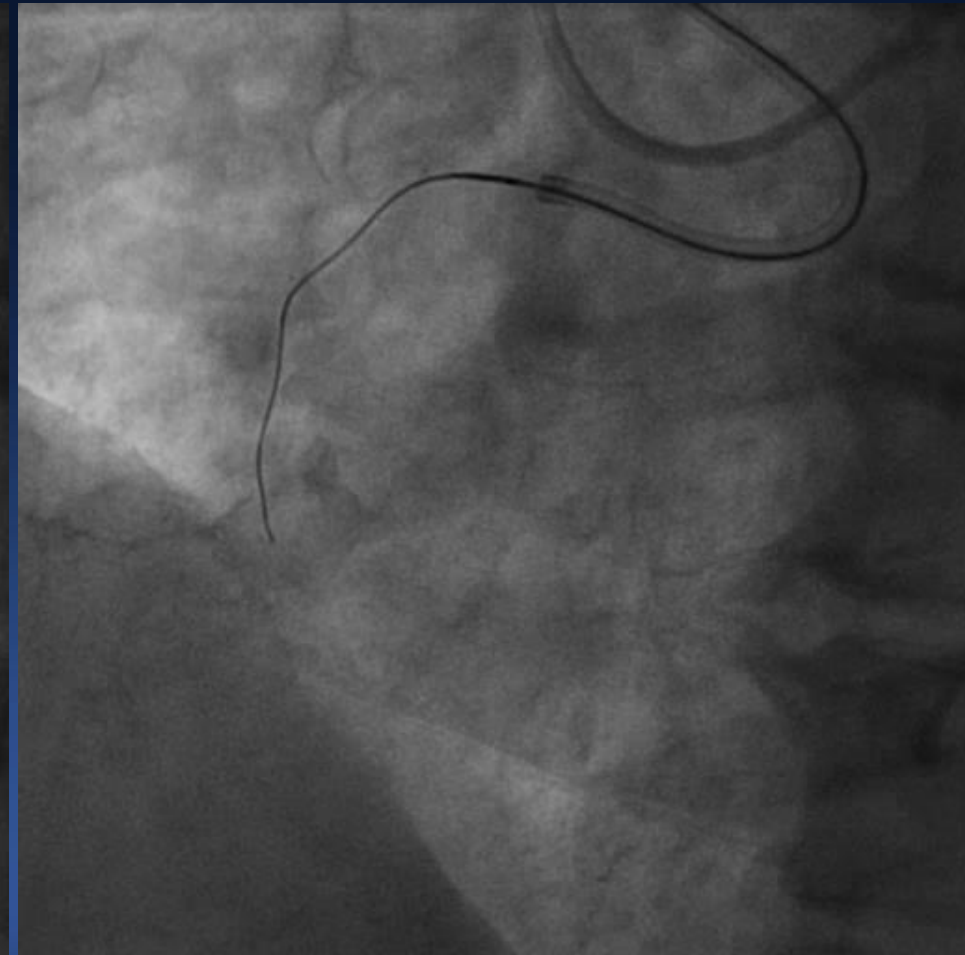
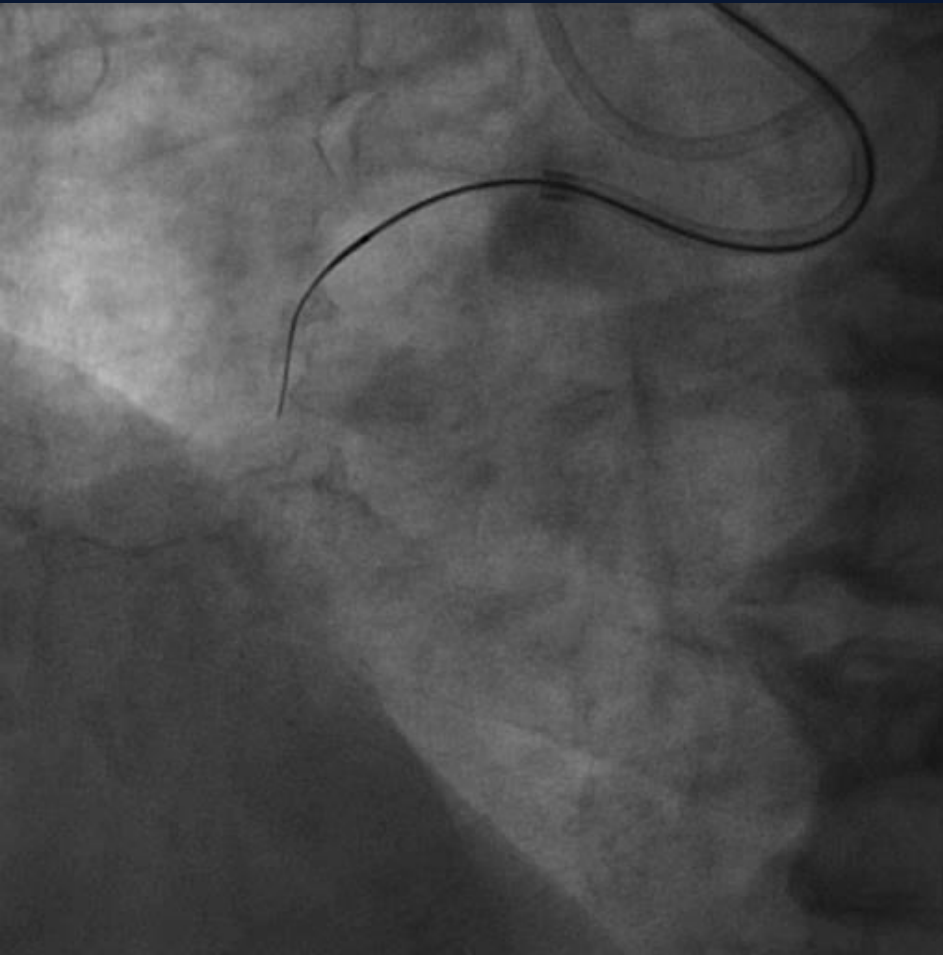
Baseline angiography

Good epicardial collateral but exit is near distal cap

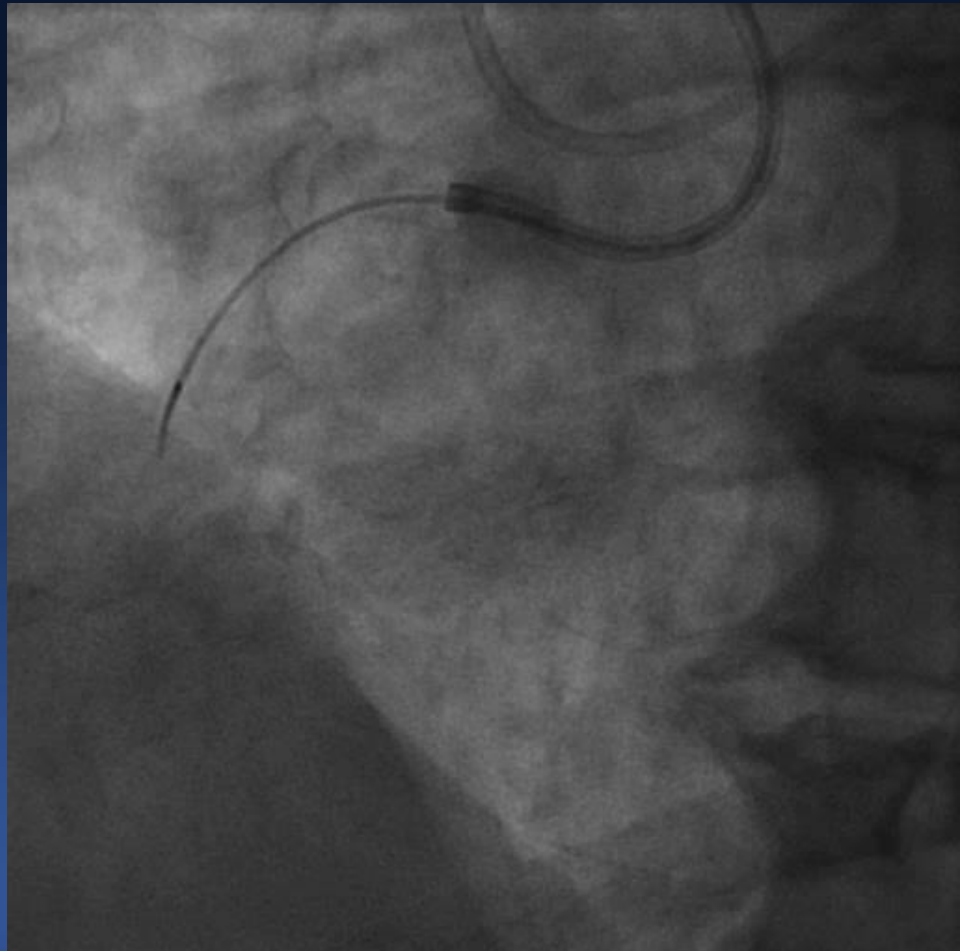
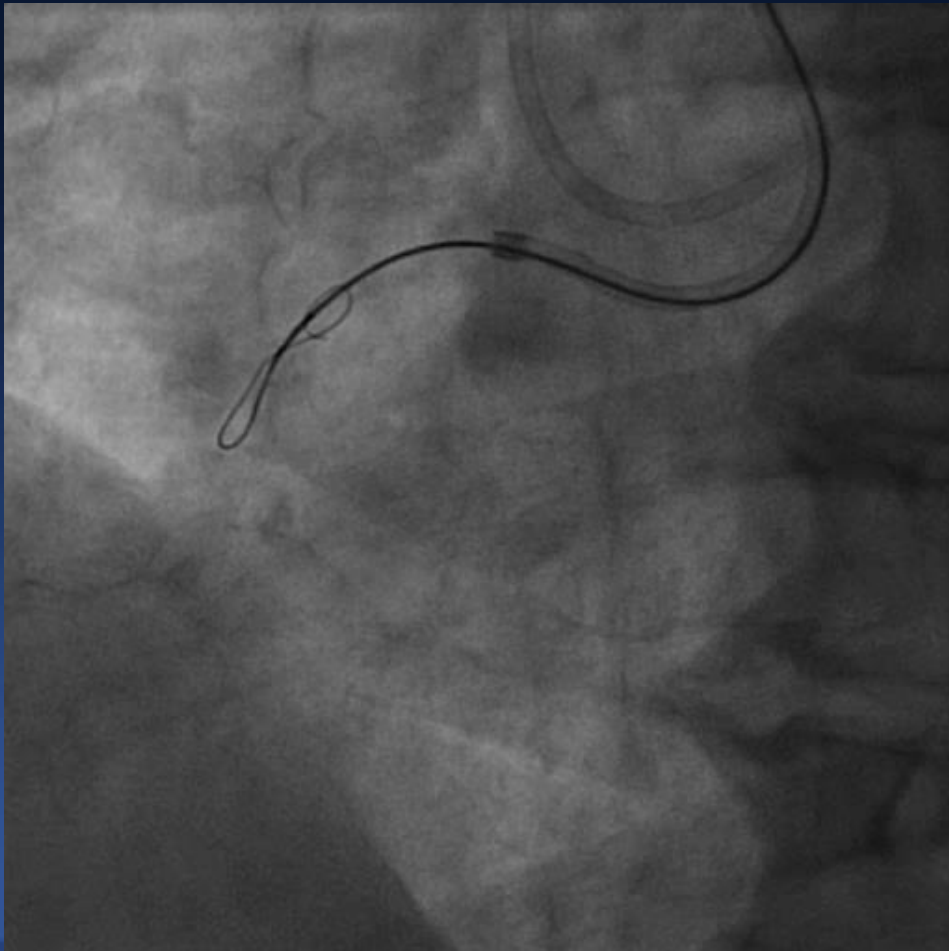


Antegrade Approach

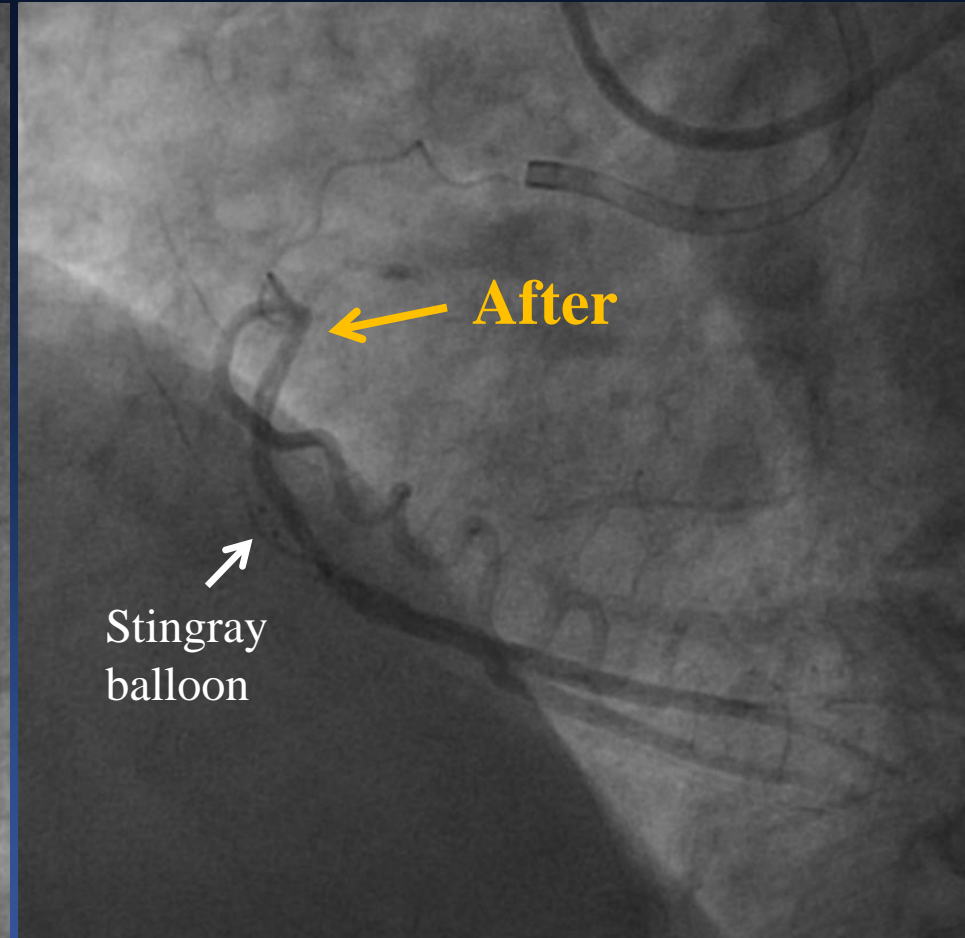
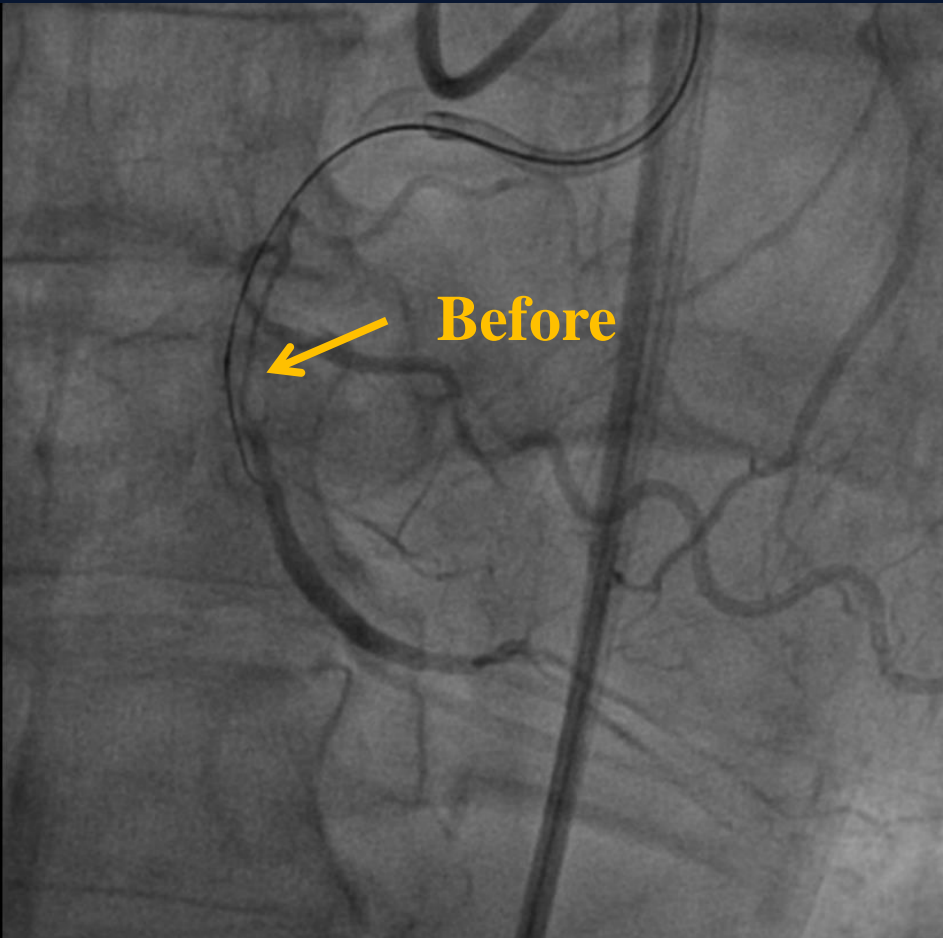
Corsair/Fielder XT failed,
Corsair failed to follow wire in the subintimal



Anterior dissection “Knuckle wire technique”



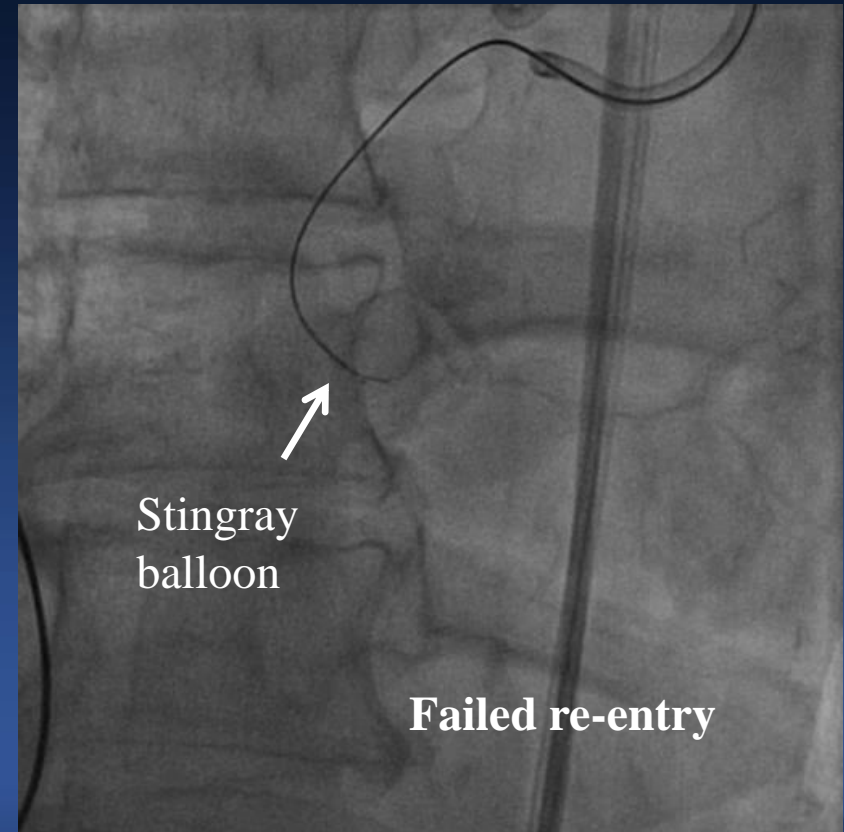
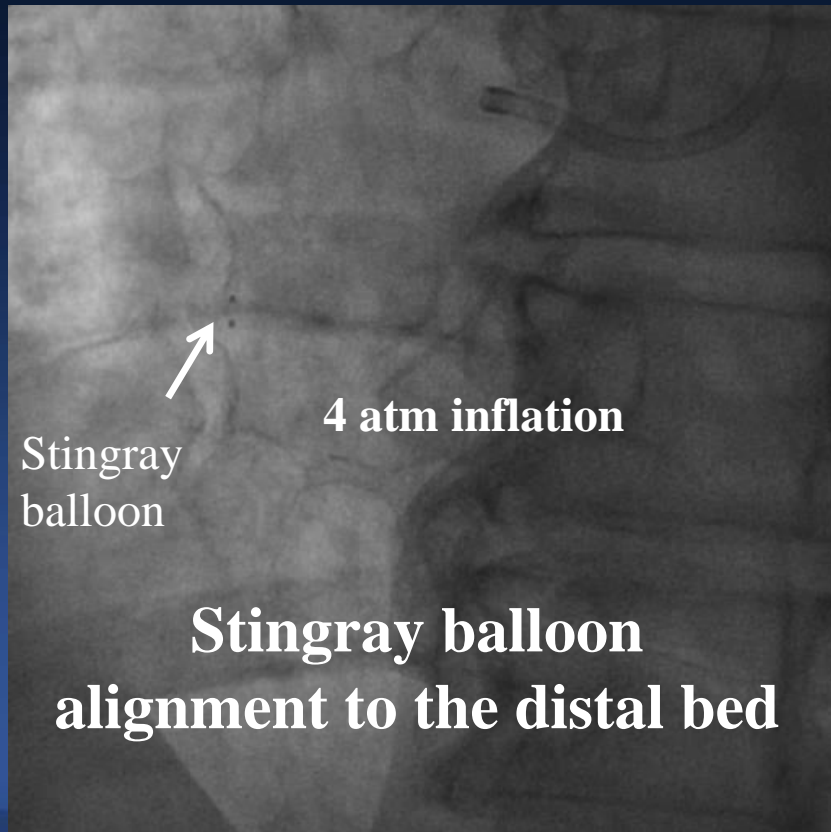
Straw Technique using corsair/stingray balloon



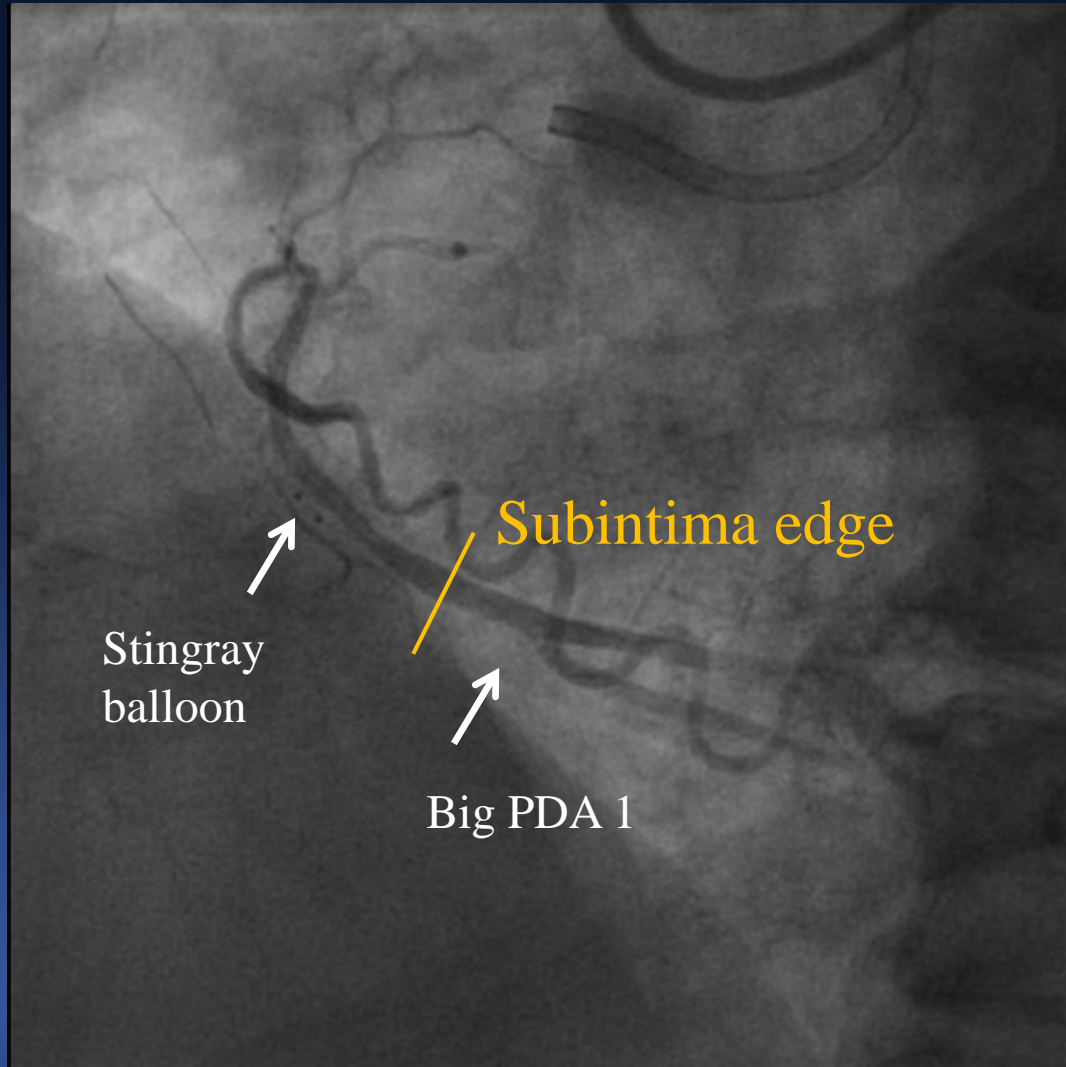
Subintima hematoma suction

Dissection Re-entry : Stingray Balloon and wire

Failed Reentry
due to large subintimal space despite straw technique



Further Distal puncture vs. IVUS-guided rewiring



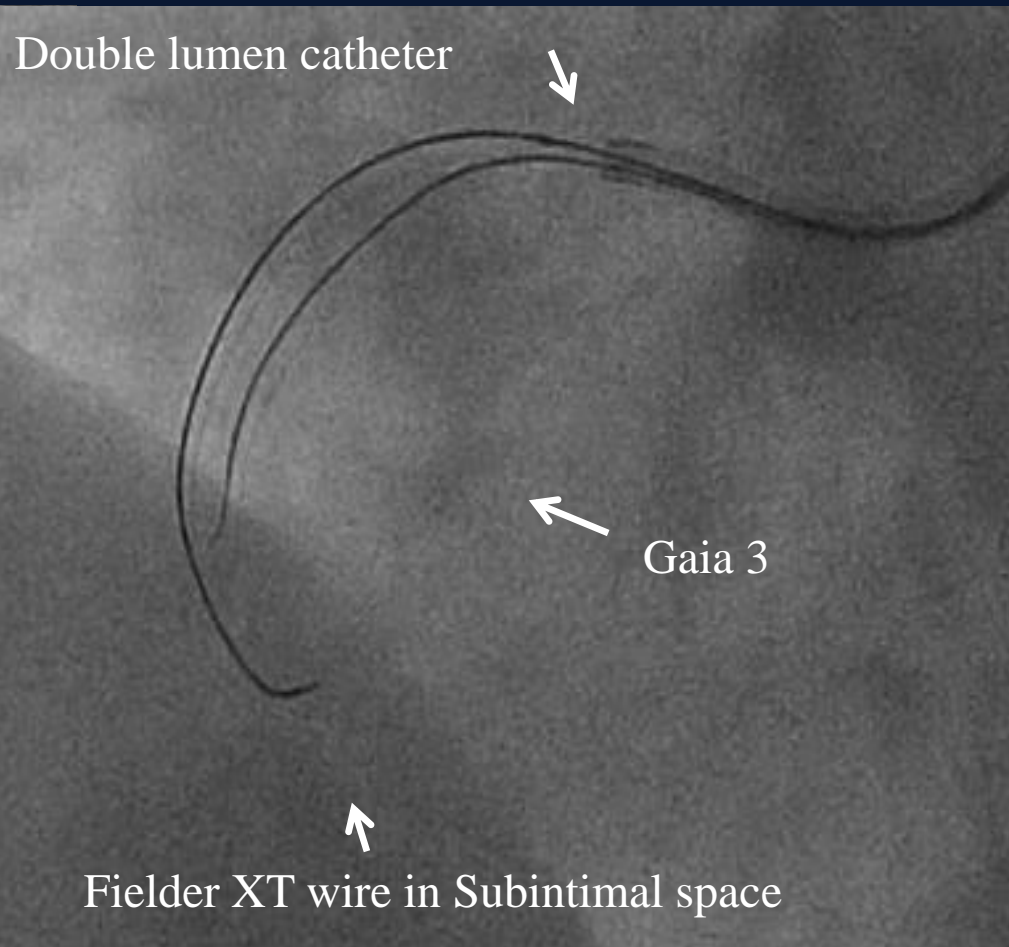
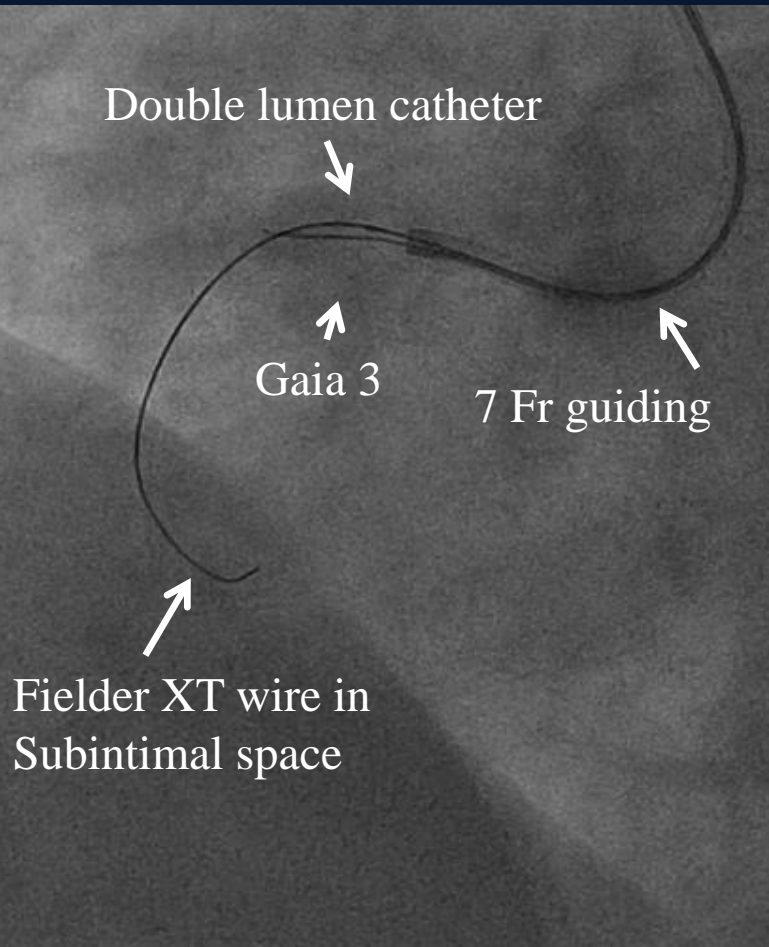
Side hole direction



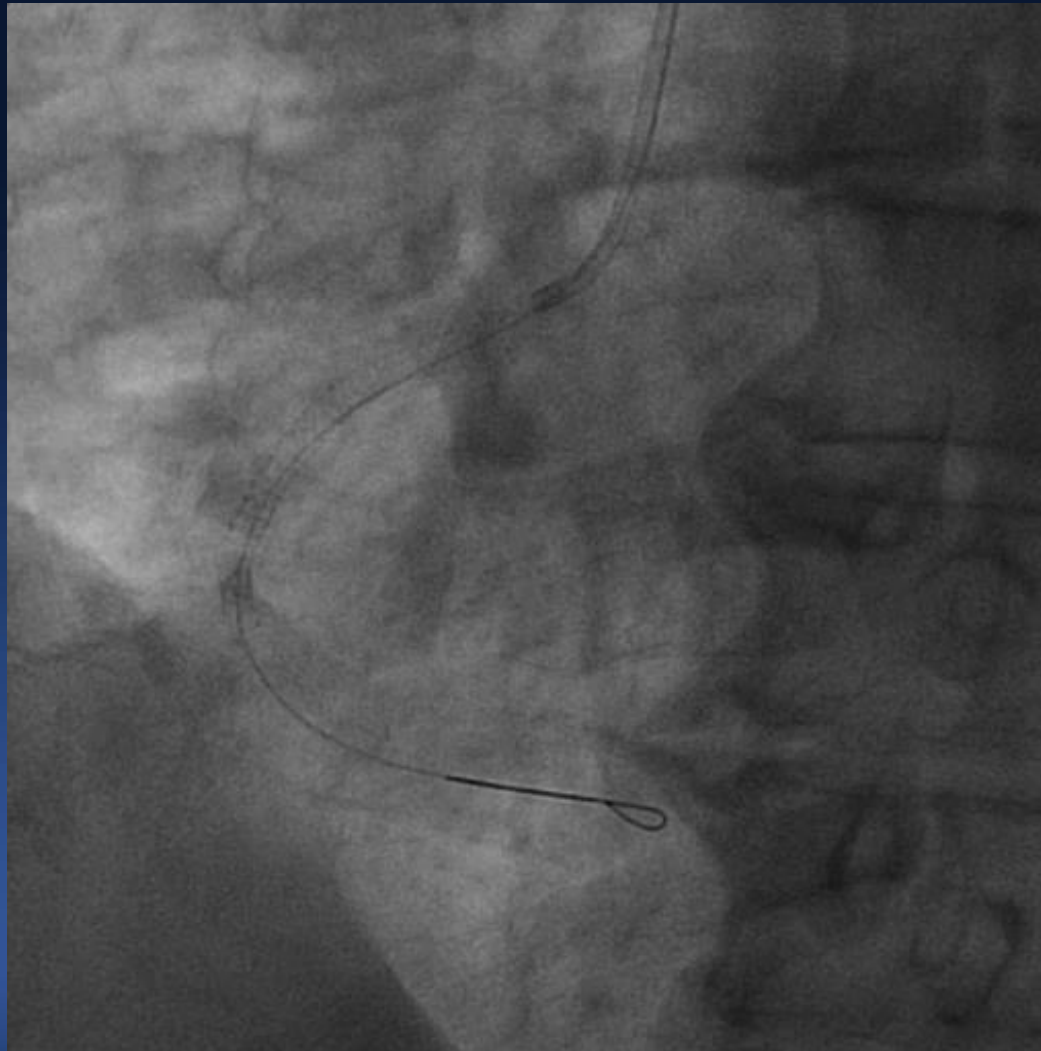
**Possible true lumen
Opposite site of side
hole of guiding**

**atheter
de hole**

IVUS-guided Re-wiring



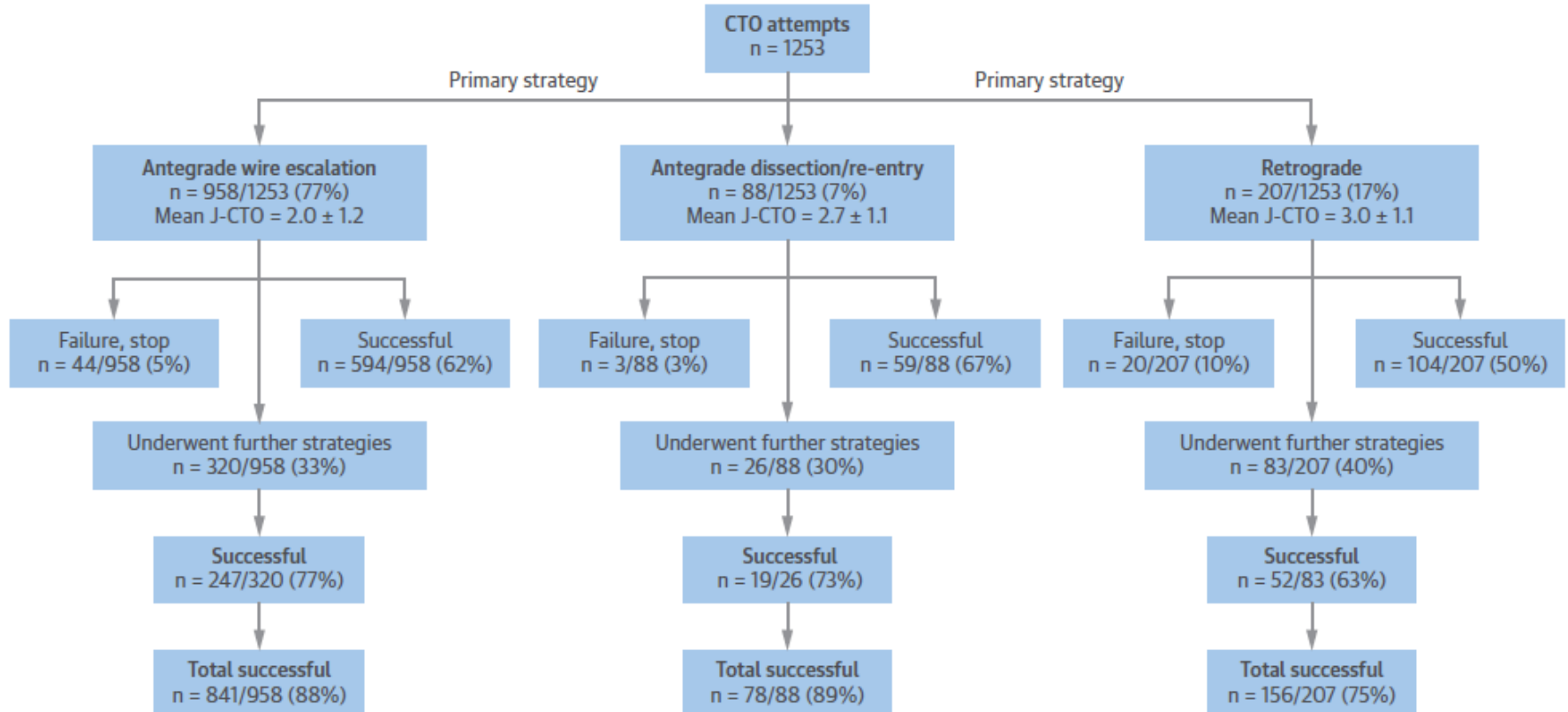
Final angiography



The Hybrid Algorithm for Treating Chronic Total Occlusions in Europe

The RECHARGE Registry

Overall procedural 86% and complications occurred in 2.6%



ADR strategy

Use of CrossBoss, Stingray, and wire-based ADR

1253 CTOs
23%

ADR technique applied	292
ADR successful	192 (66)
True-to-true lumen crossing*	36 (19)
Of which in-stent occlusion	20 (56)
Successful dissection technique	156 (81)
CrossBoss	79 (51)
Wire based	39 (25)
CrossBoss and wire based	38 (24)
Successful re-entry technique	156 (81)
Stingray system	121 (78)
STAR	13 (9)
LAST	14 (13)

6.3%

9.7%

ADR strategy

- Primary and rescue ADR strategies were successful in 67% (59 of 88) and 63% (133 of 210), respectively
- ADR was applied in **3%** (3 of 116), **13%** (33 of 249), **22%** (86 of 385), and **34%** (170 of 503) of J-CTO 0, 1, 2, and 3 respectively.
- Success was obtained in **100%** (3 of 3), **64%** (21 of 33), **72%** (62 of 86), and **62%** (106 of 170) of these cases, respectively.

Randomized Comparison of a CrossBoss First Versus Standard Wire Escalation Strategy for Crossing Coronary Chronic Total Occlusions

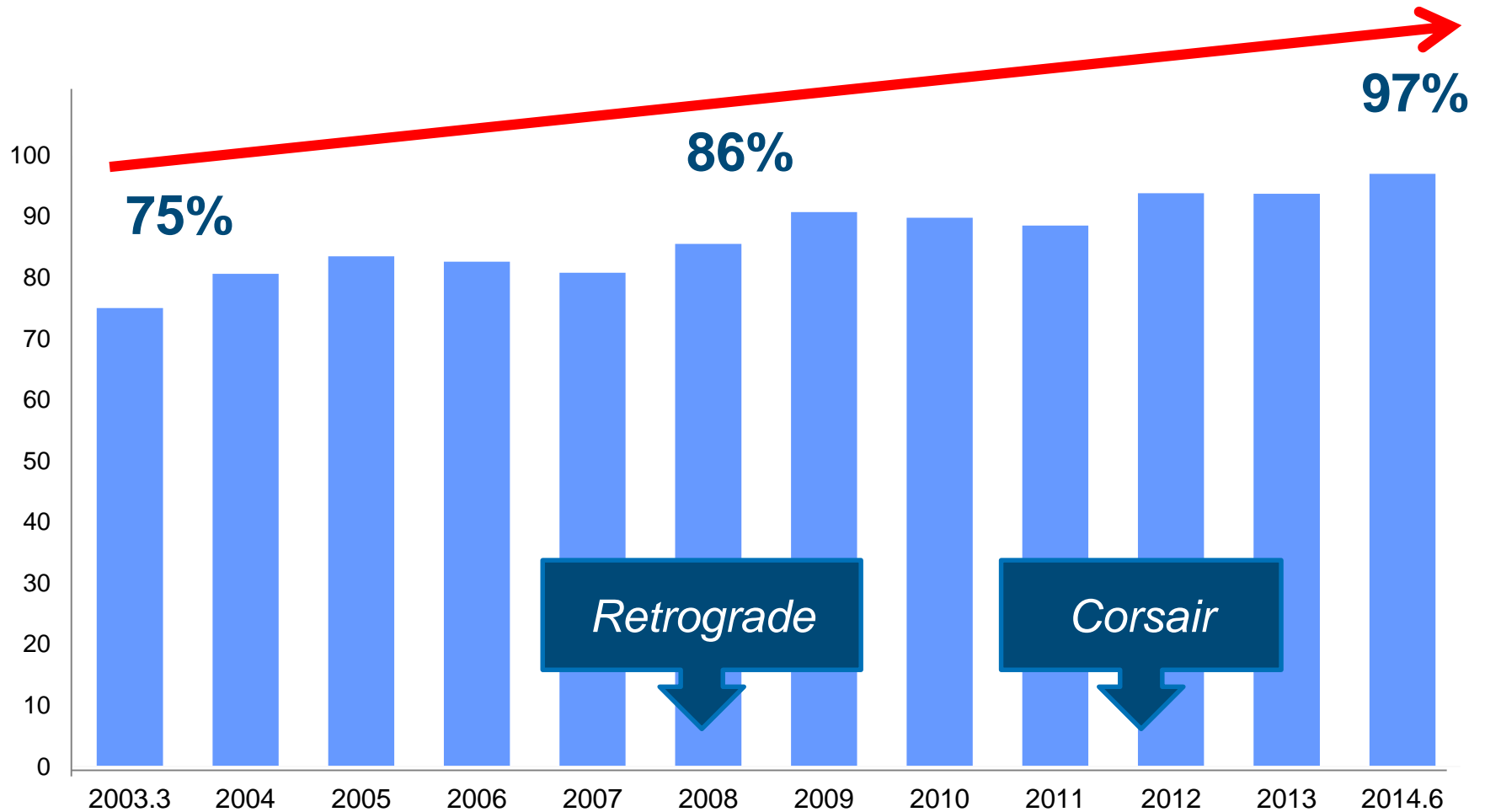
The CrossBoss First Trial

CONCLUSIONS As compared with wire escalation, upfront use of the CrossBoss catheter for antegrade crossing of coronary chronic total occlusions was associated with similar crossing time, similar success and complication rates, and similar equipment use and cost. (J Am Coll Cardiol Intv 2018;11:225-33) © 2018 the American College of Cardiology Foundation. Published by Elsevier. All rights reserved.

Technical & procedural success : 87.8% and 84.1%
Stingray success rate: 63% (51/81)

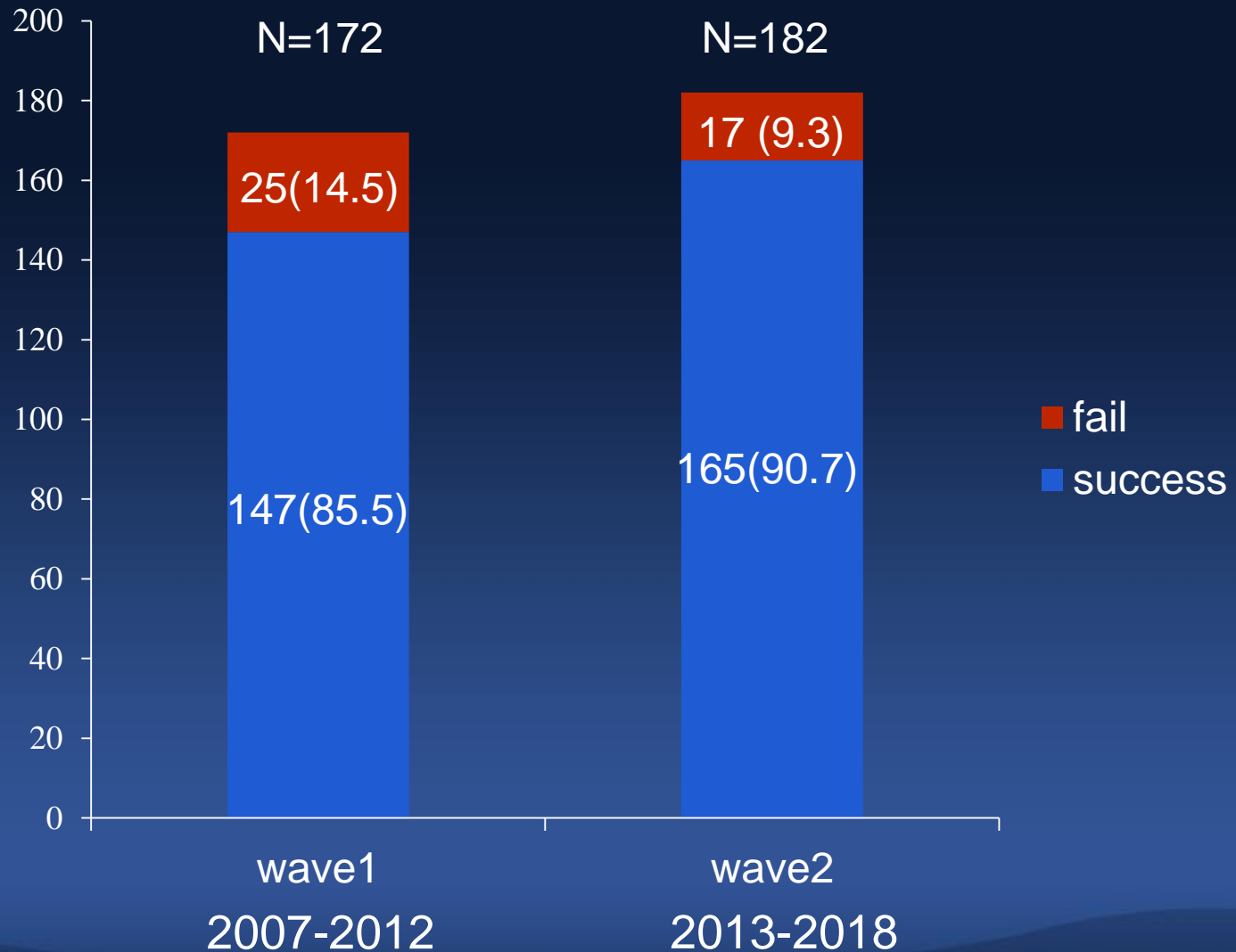
WHAT IS NEXT? New devices and crossing techniques are needed to further improve the success rates and procedural efficiency and reduce the complication rates of coronary chronic total occlusion interventions.

Wire-based strategy in AMC Procedural Success Rate



Retrograde Technical Success rate

AMC CTO Registry (Retrograde cases, n=352)



Conclusions

- Controlled Crossboss advance or wiring with or without knuckle for avoiding compressive hematoma or subintimal space widening for successful reentry using stingray device
- Introduction of stingray balloon under guidance of hard wire (miracle 12 or small balloon dilation or MC)
- After reentry, avoidance rule (small balloon inflation for stent delivery or No antegrade contrast injection)

Conclusions

- Similar success or complication with antegrade wire escalation, so if antegrade wire escalation is failed, Reentry device could be option instead of retrograde approach to reduce procedural time.
- If ADR failed, IVUS-guided rewiring could be recue approach for successful CTO-PCI.

Thank you for your attention