

Reverse CART: Situations and Solutions

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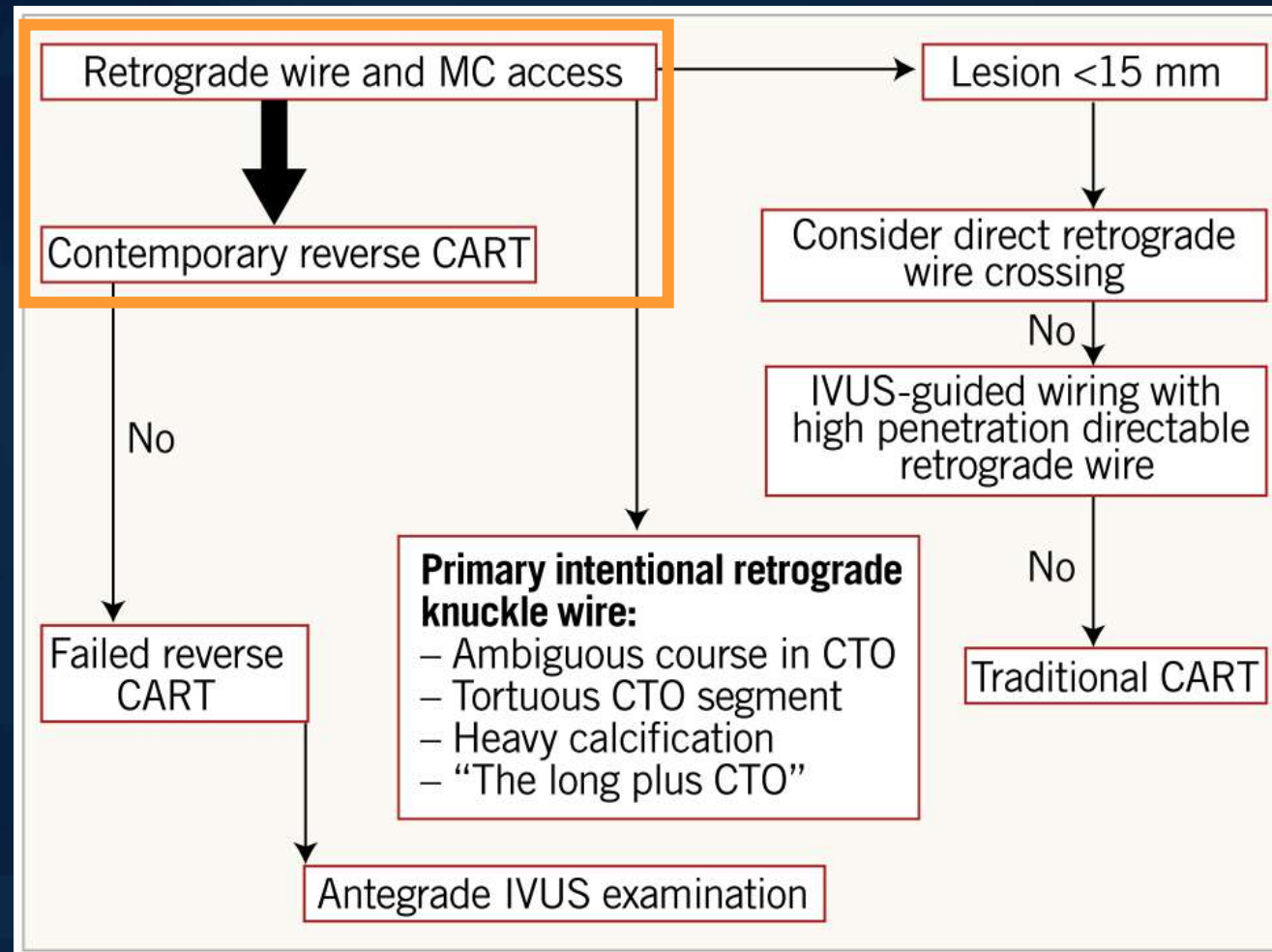
Disclosure

- I have no financial conflicts of interest to disclose concerning the presentation.

Crossing CTO remains hurdle to retrograde

- Reverse CART is now the most dominant wire crossing technique in the retrograde approach.
 - Once collateral channels are successfully crossed by a wire and a microcatheter, subsequent procedure can be quite promising.
 - However, there are still small number of cases where reverse CART fails or takes a long time.
 - Recent report from the APCTO club showed failed reverse CART accounted for 30% of failure mode in the retrograde approach.
- => There is a large need to make the reverse CART procedure quicker, more reliable and more efficient.

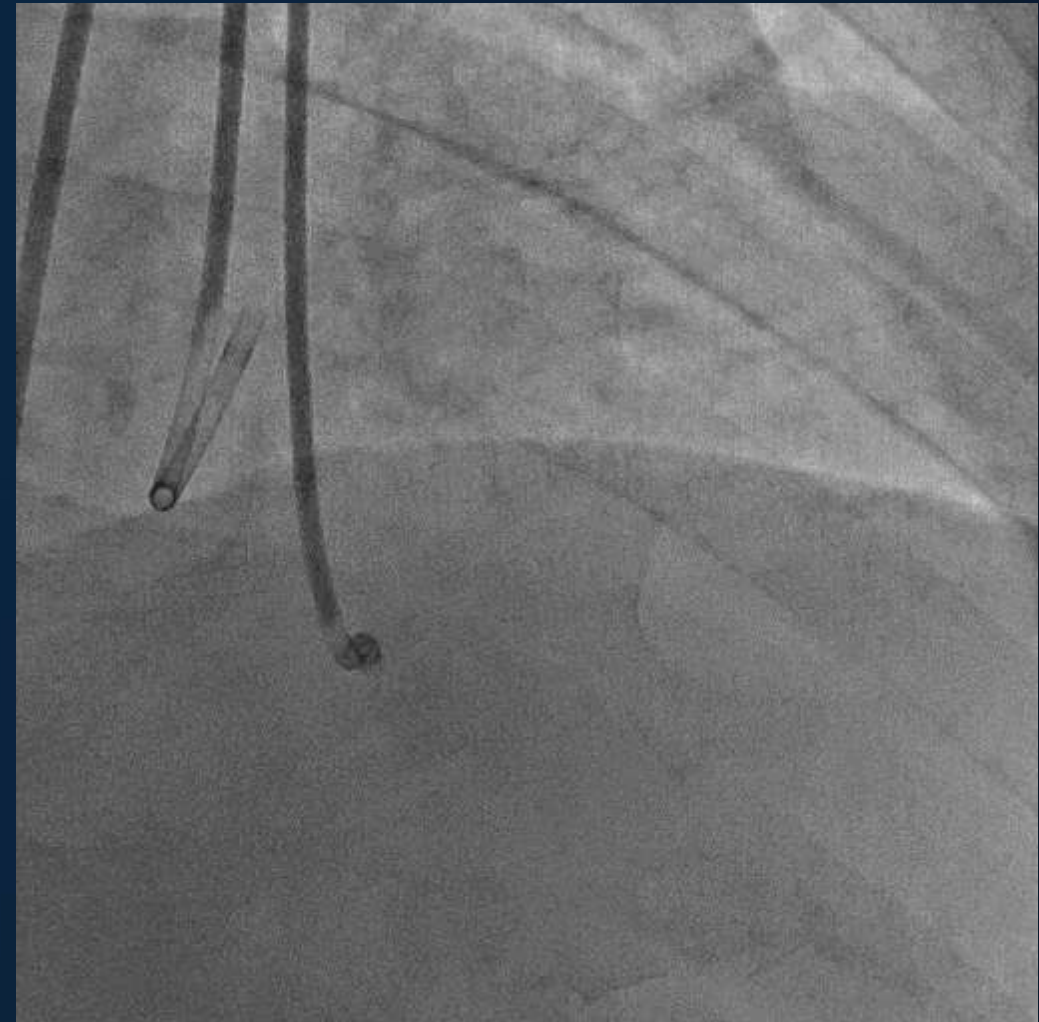
Algorithm for retrograde CTO crossing



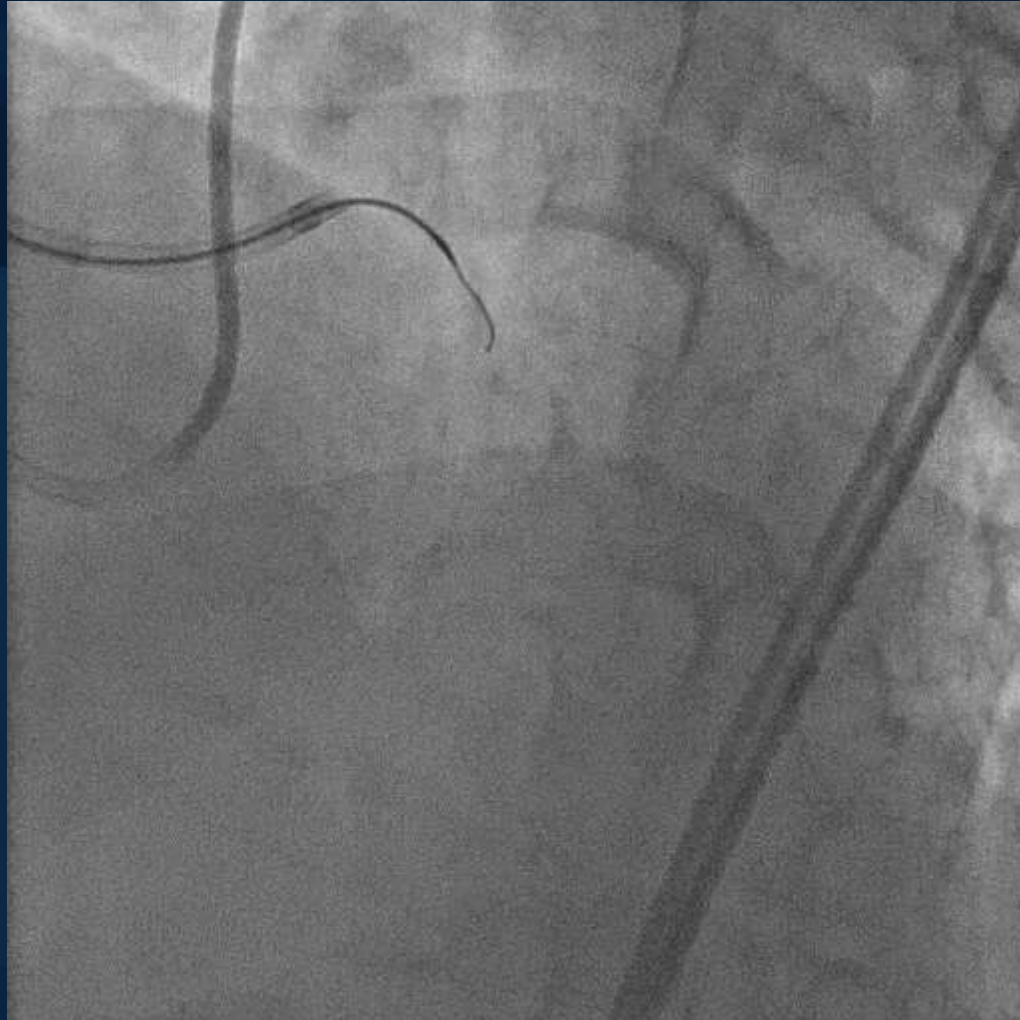
Directed reverse CART is:

- An effective and efficient technique which is characterized by the use of a small antegrade balloon and intentional vessel tracking and penetration with a directable retrograde wire.
- Recommended to be attempted first for CTOs with clear proximal cap and occlusion course and without heavy calcification and severe tortuosity.

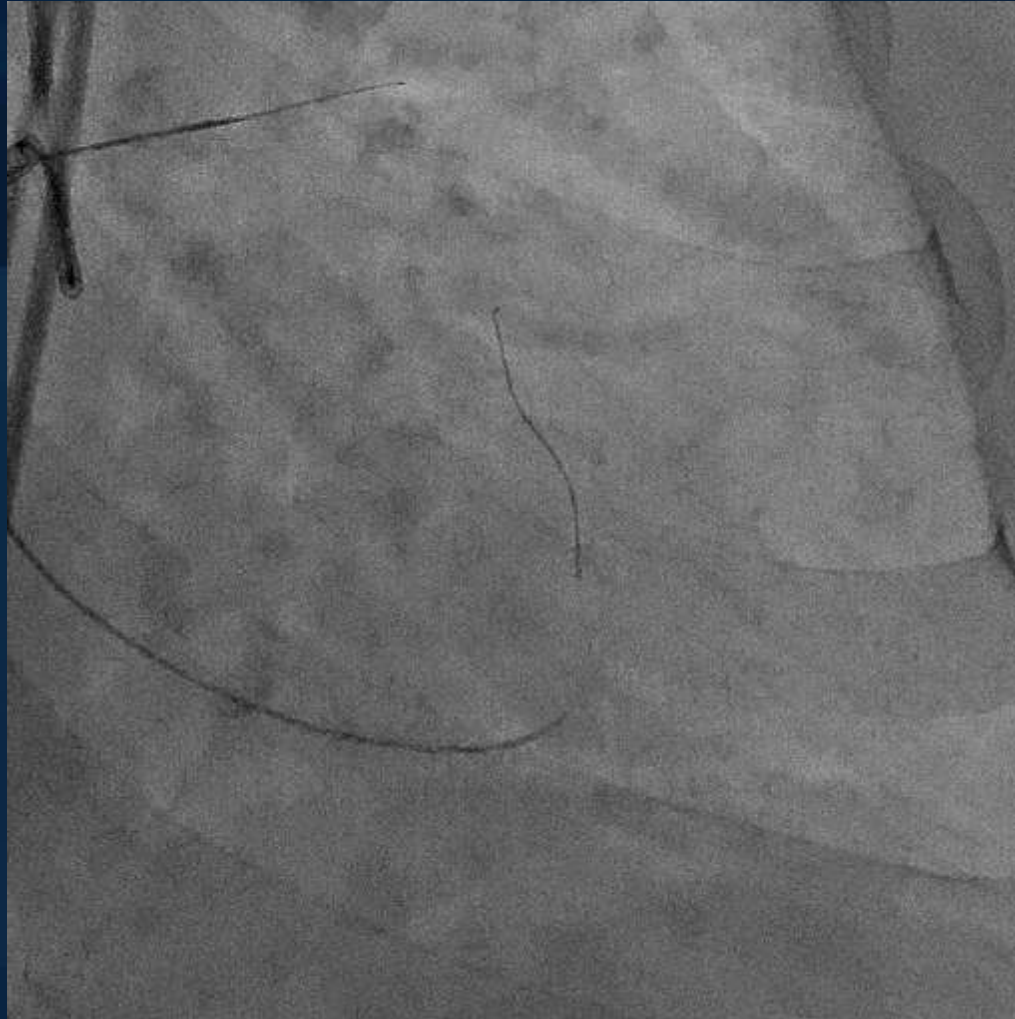
Case 1: proximal LAD CTO



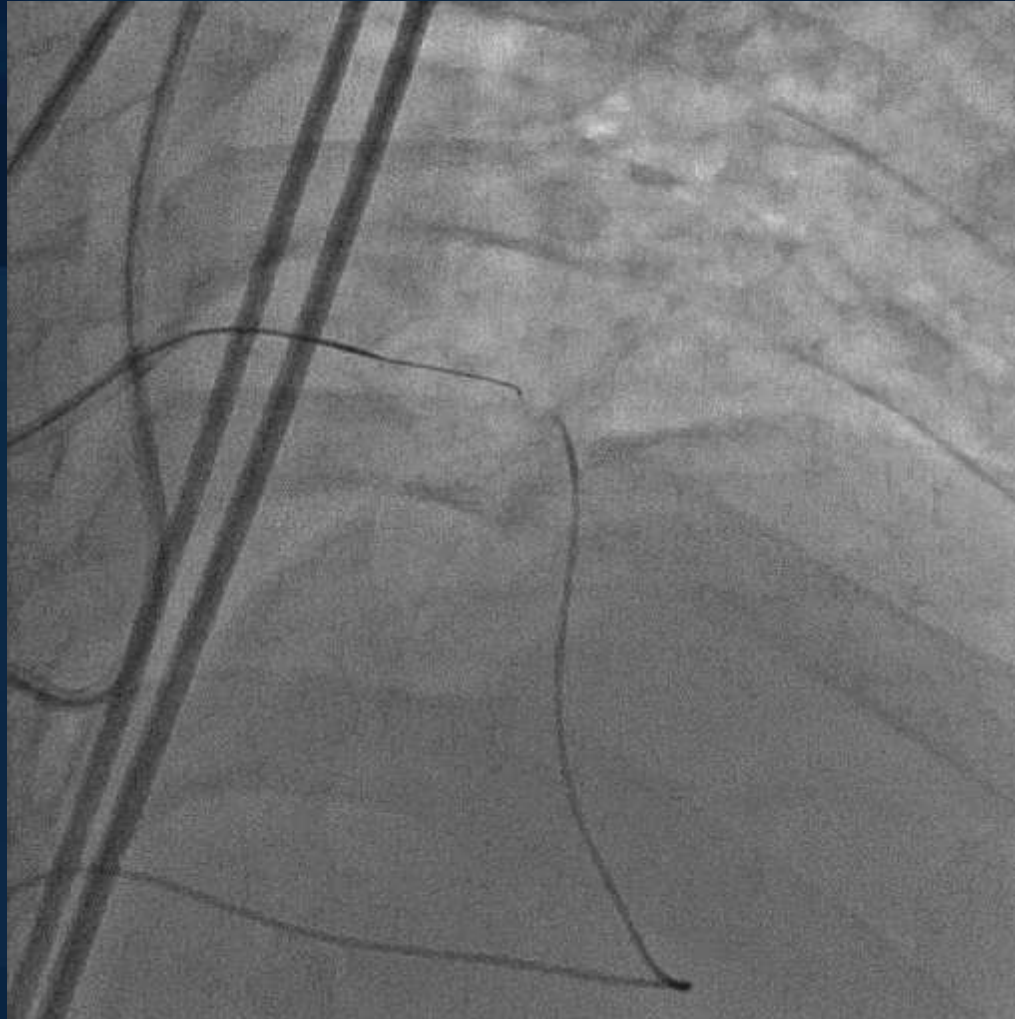
Failed antegrade wiring with GN2



Septal channel tracking with SUOH03



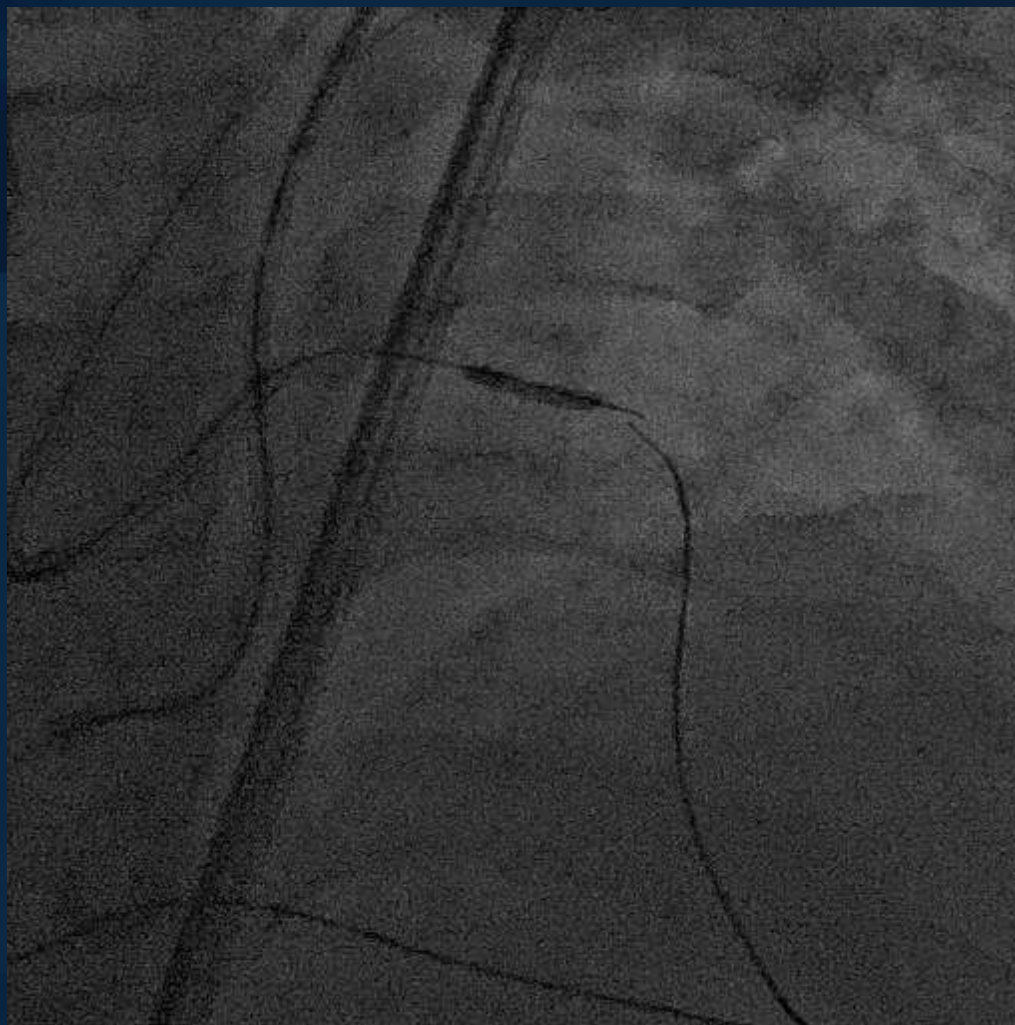
Tip injection through retrograde Corsair Pro



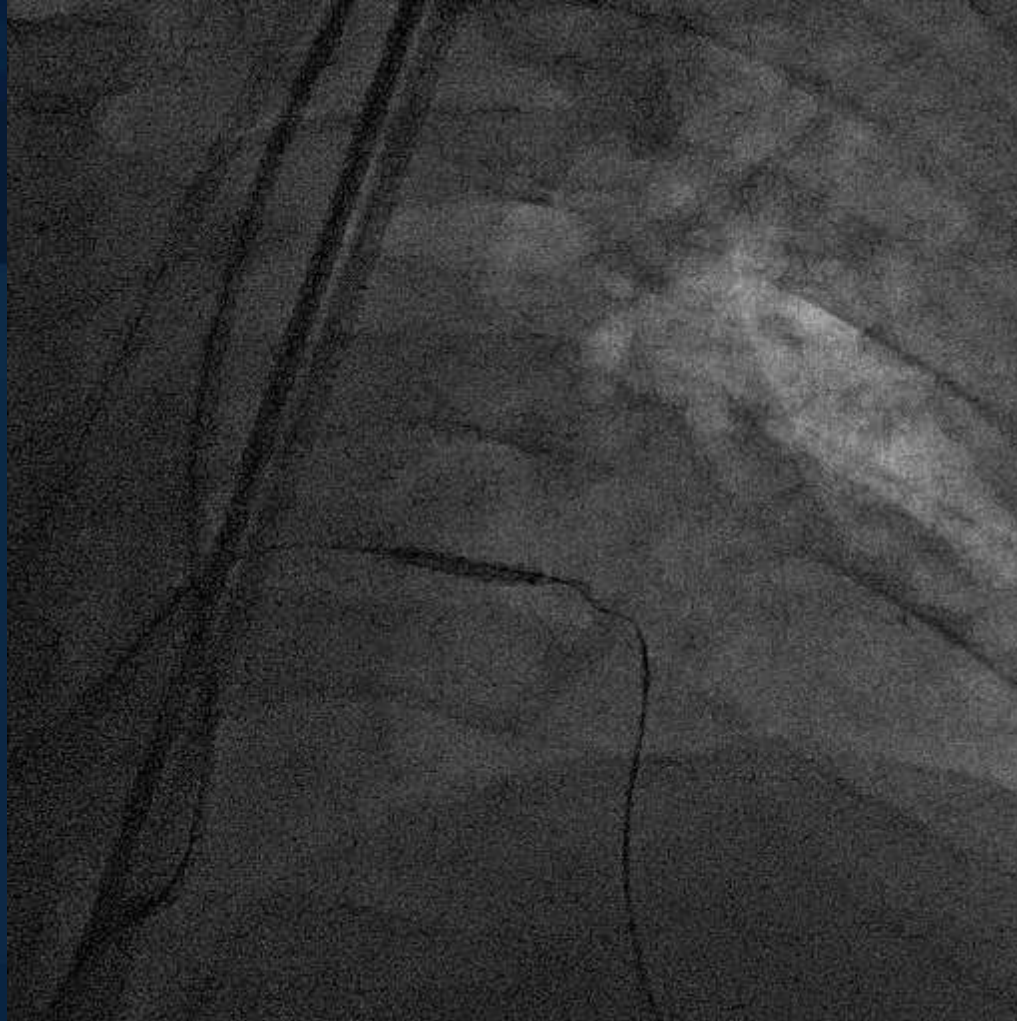
Antegrade 2.0mm balloon delivery



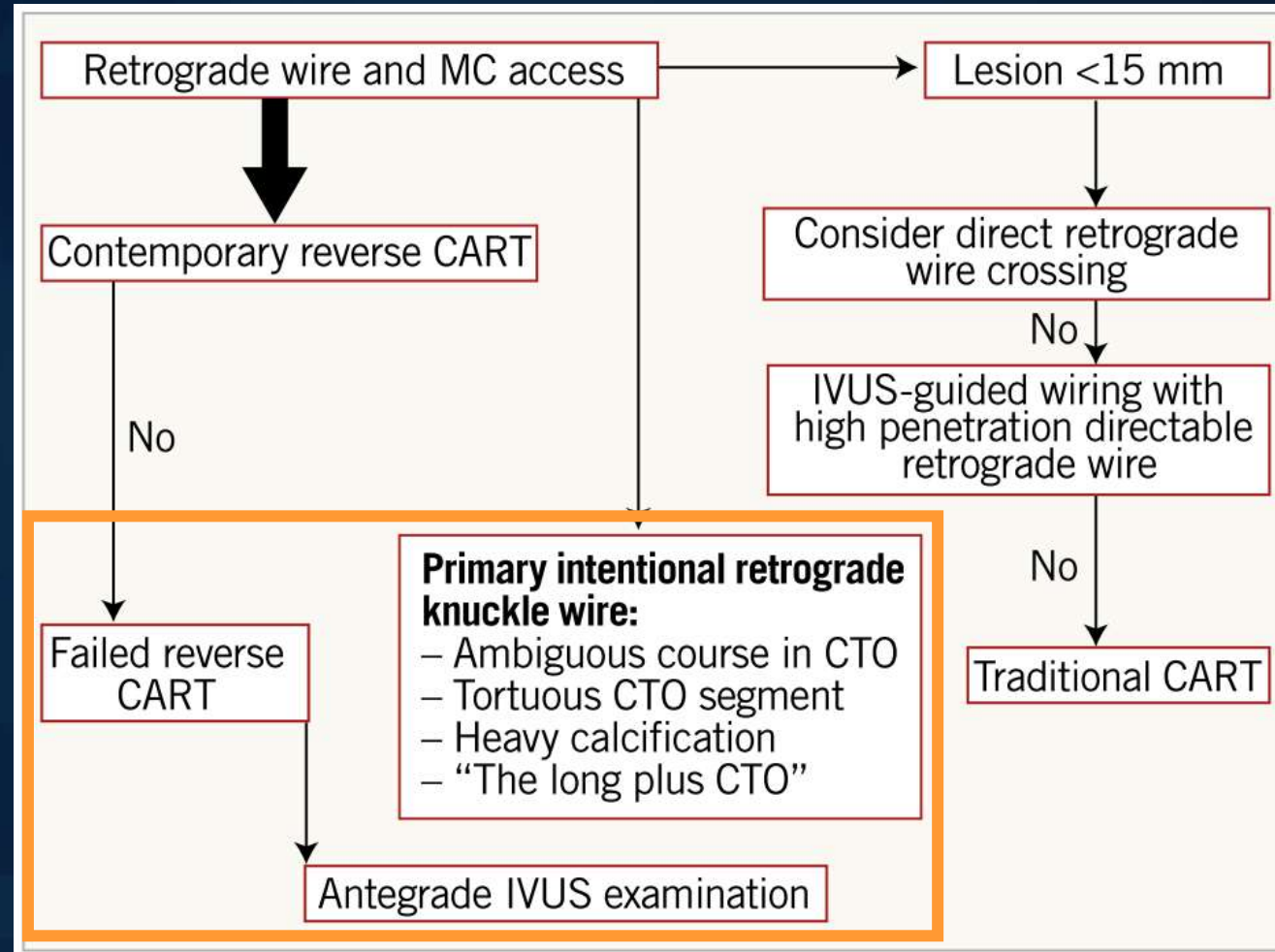
Retrograde CTO segment wiring with GN1



Successful reverse CART



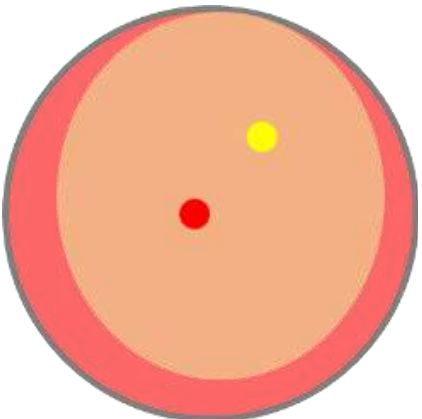
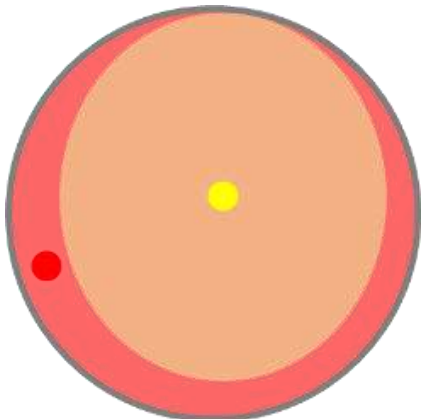
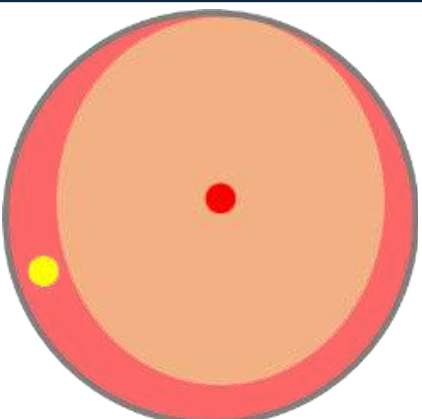
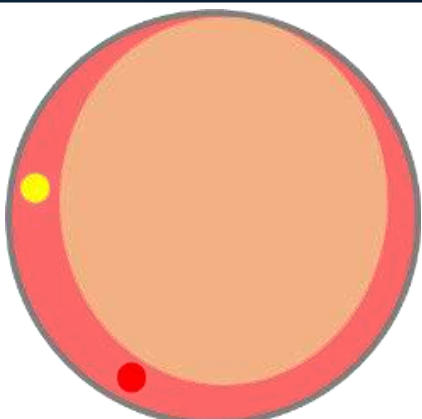
Not all CTO can be crossed with directed RC



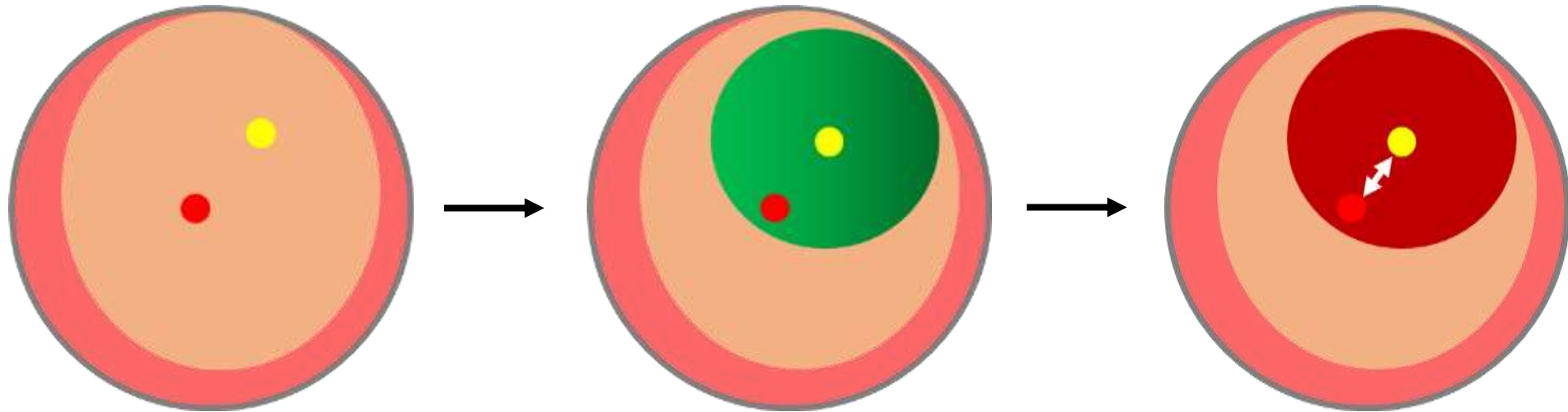
IVUS-guided reverse CART

- IVUS allows definition of the positions of the antegrade and retrograde wires in the vessel, determination of whether or not a connection has been made, and precise sizing of the vessel and the balloon, facilitating the reverse CART.

Antegrade & retrograde wire positions on IVUS

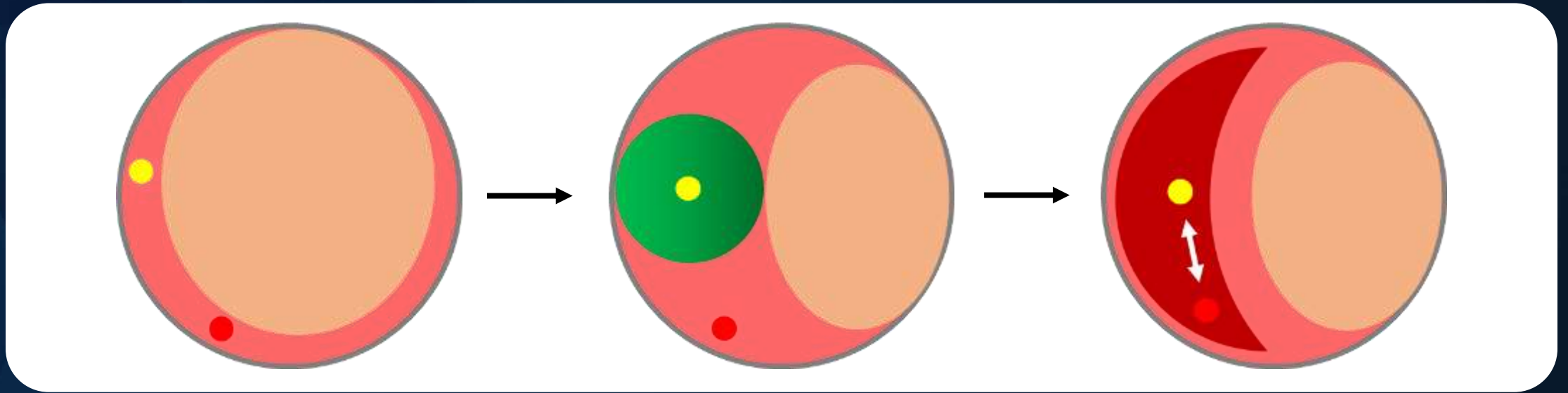
		Retrograde wire ●	
		Intraplaque	Subintimal
Antegrade wire ●	Intraplaque		
	Subintimal		

Antegrade and retrograde: intraplaque



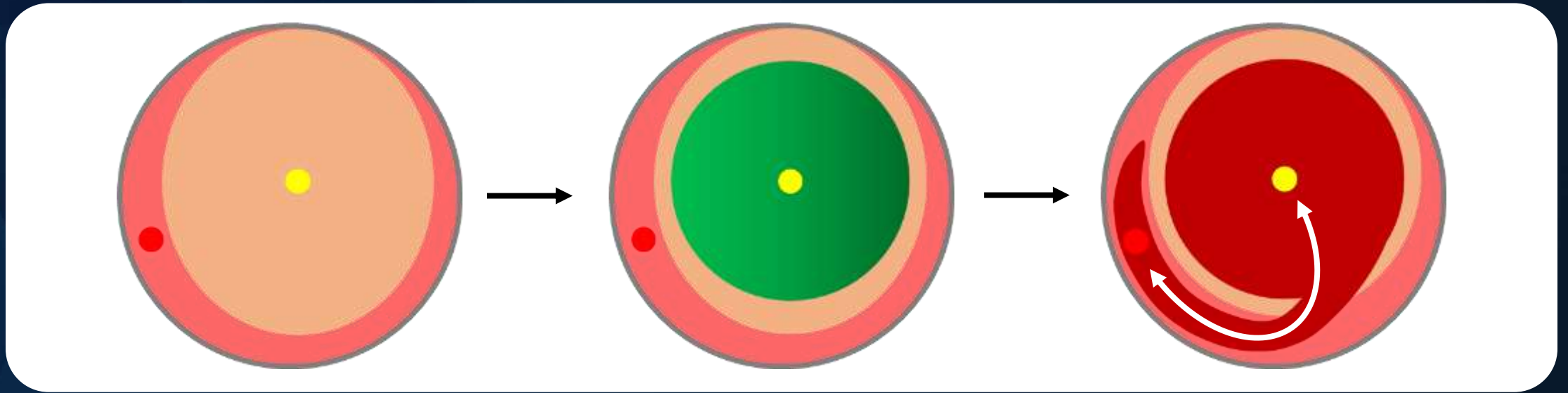
- It is easy to make a connection after antegrade balloon dilatation.
- If needed, retrograde puncture of the intimal plaque with a penetrative wire could be performed.

Antegrade and retrograde: subintimal



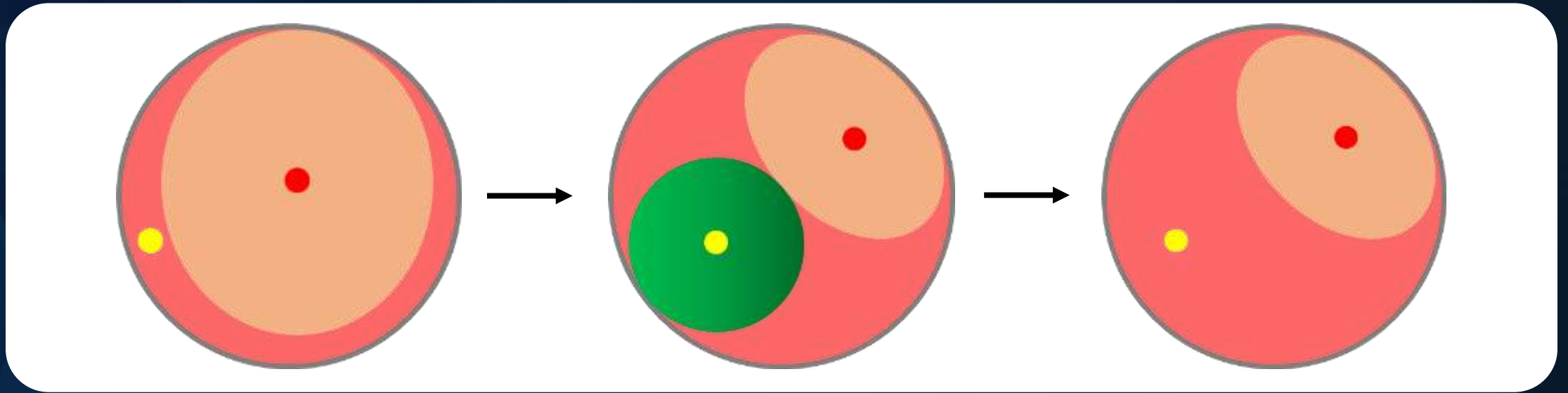
- It is easy to make a connection in the same space after antegrade balloon dilatation.

Antegrade: intraplaque, retrograde: subintimal



- It is crucial to create a medial dissection with a properly sized balloon dilatation to make a connection between antegrade and retrograde wires.
- If it fails, it may be possible to advance the antegrade wire distally to enter the subintimal space or to perform the move-the-cap techniques.

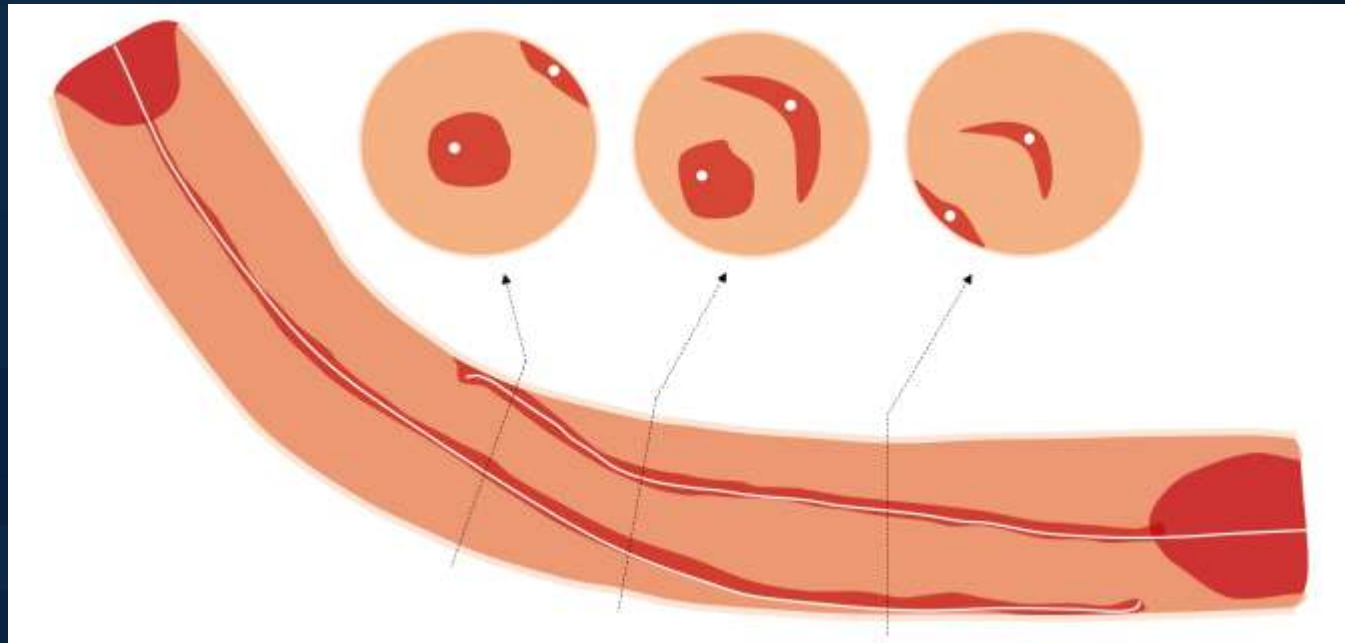
Antegrade: subintimal, retrograde: intraplaque



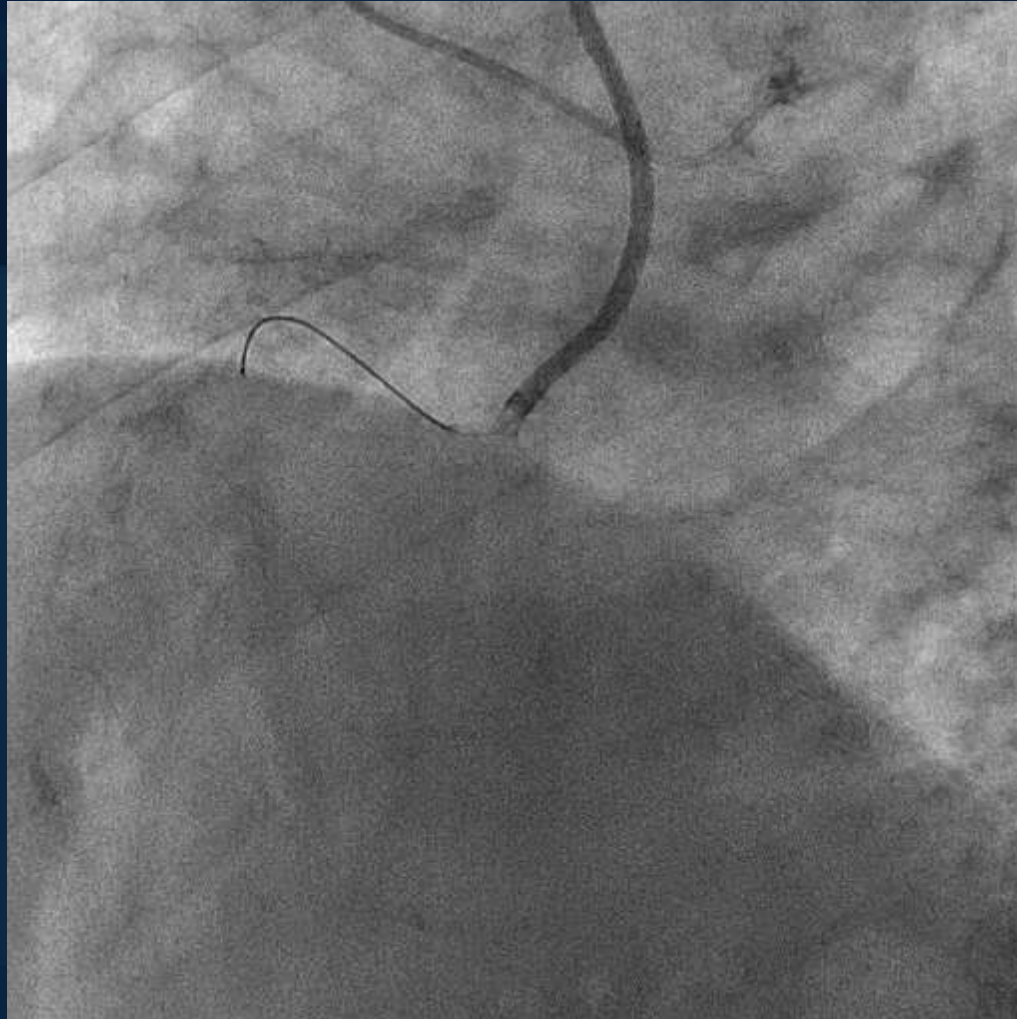
- This is the most difficult situation as antegrade balloon dilatation enlarges the subintimal space with low probability of making a connection.

Solutions for this situation

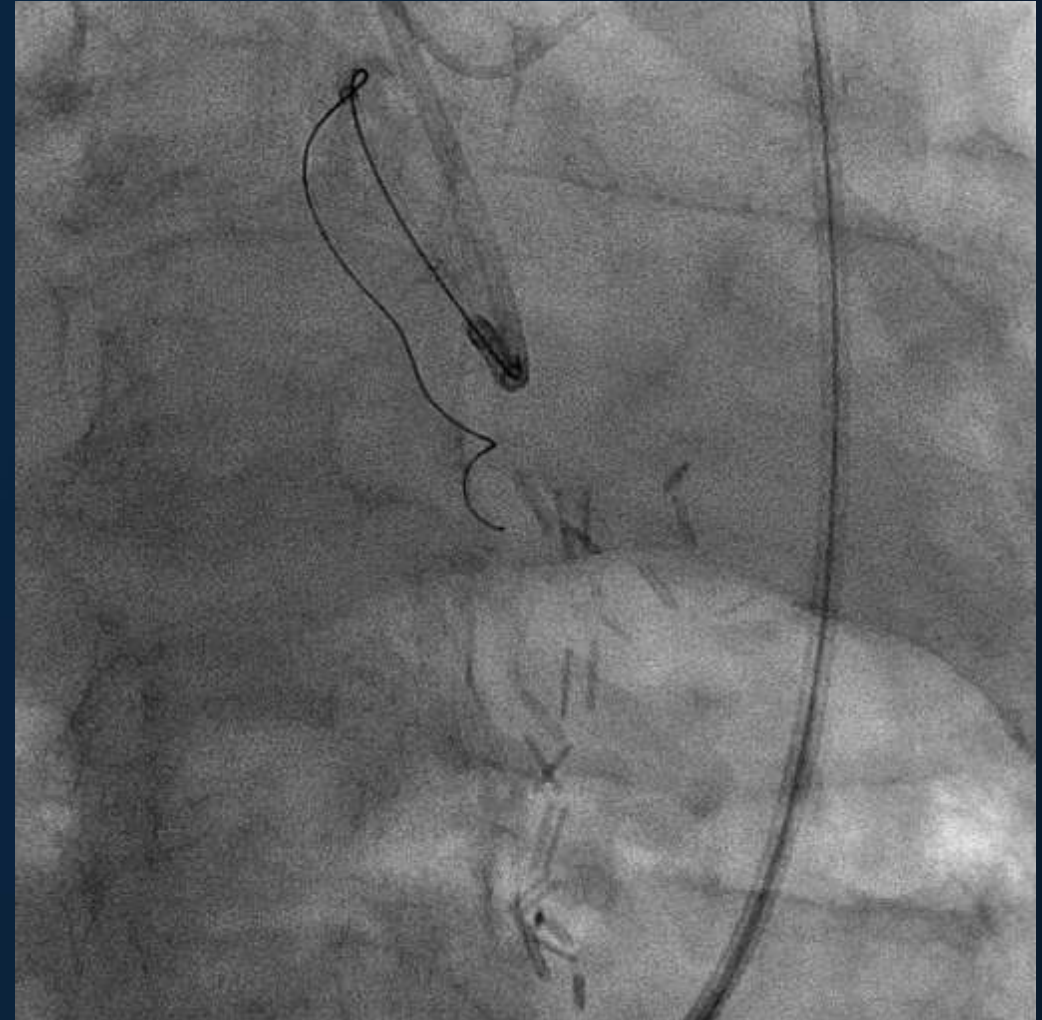
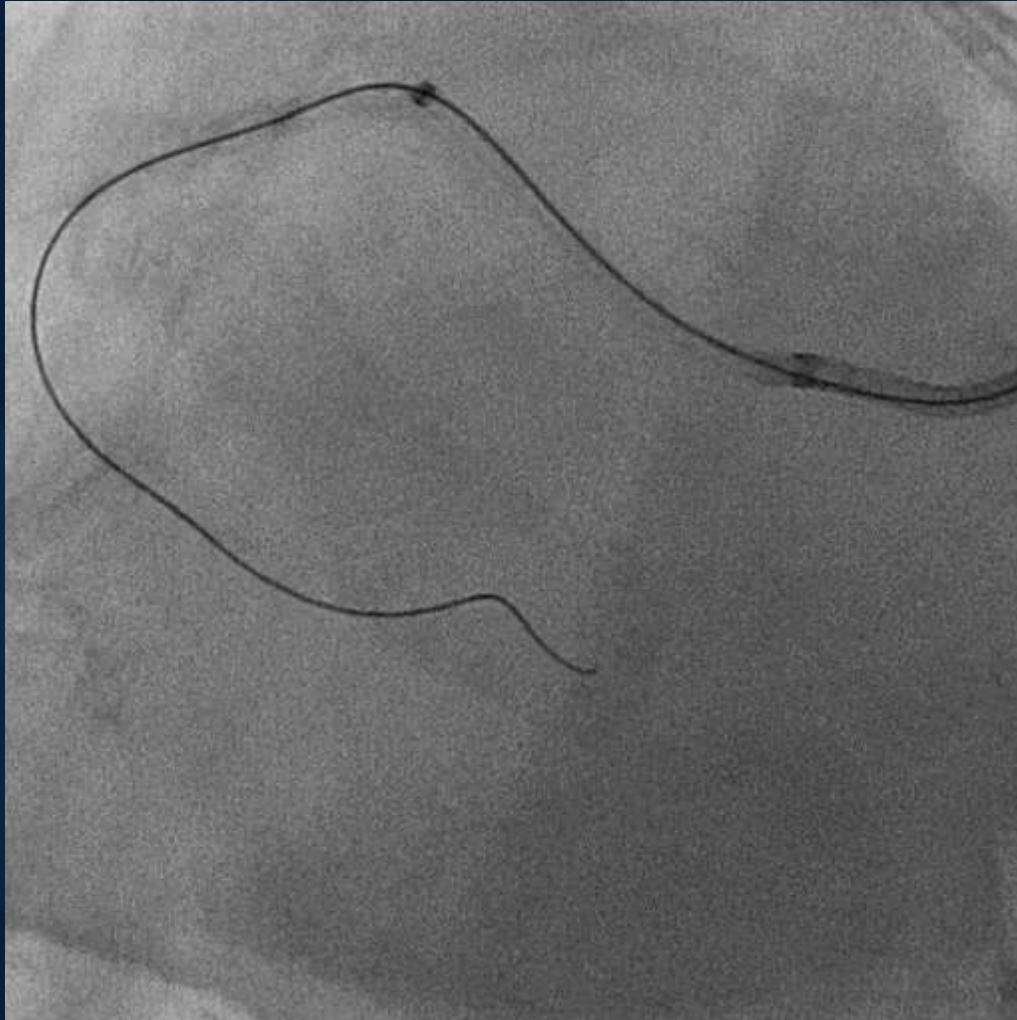
- Puncture big antegrade balloon with retrograde high penetration force wire
- Advance retrograde wire proximally to change the positional relationship between the two wires
- Perform traditional CART



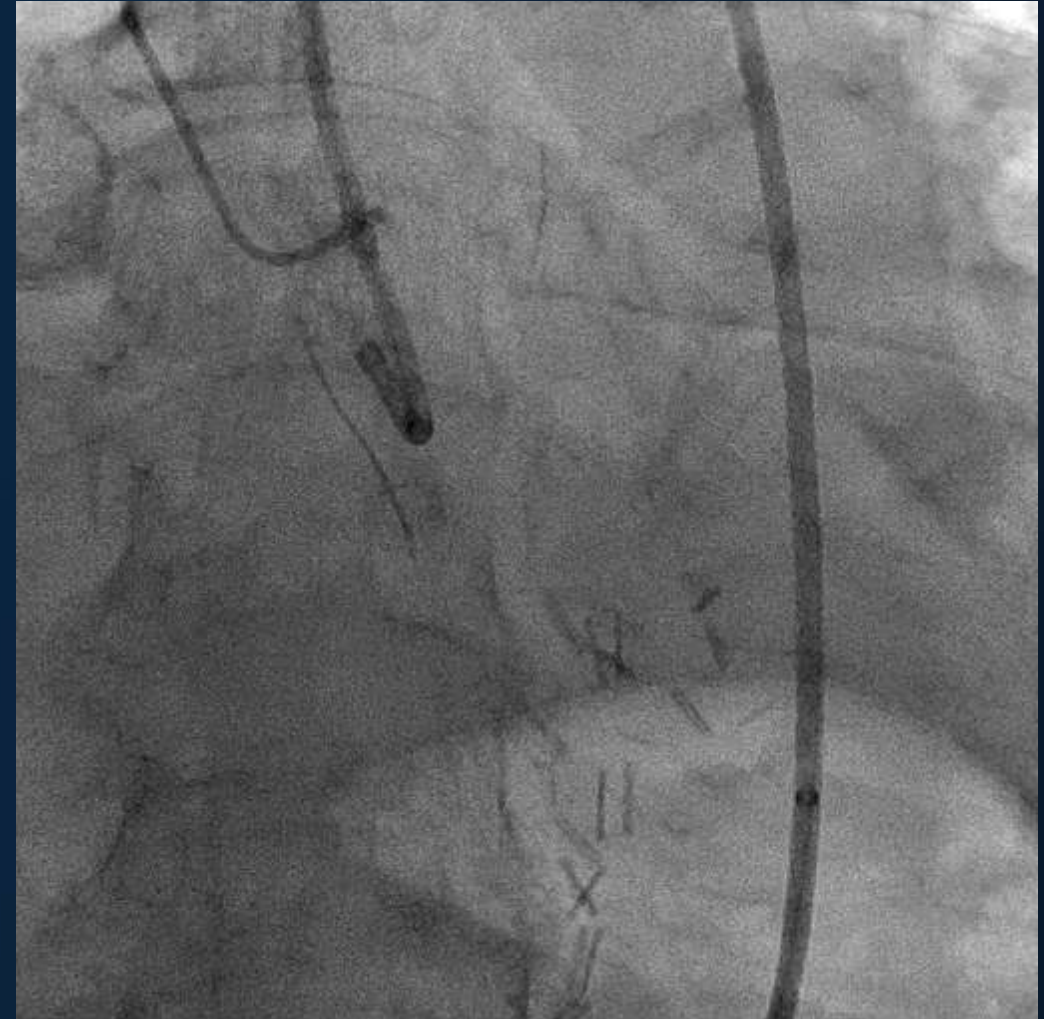
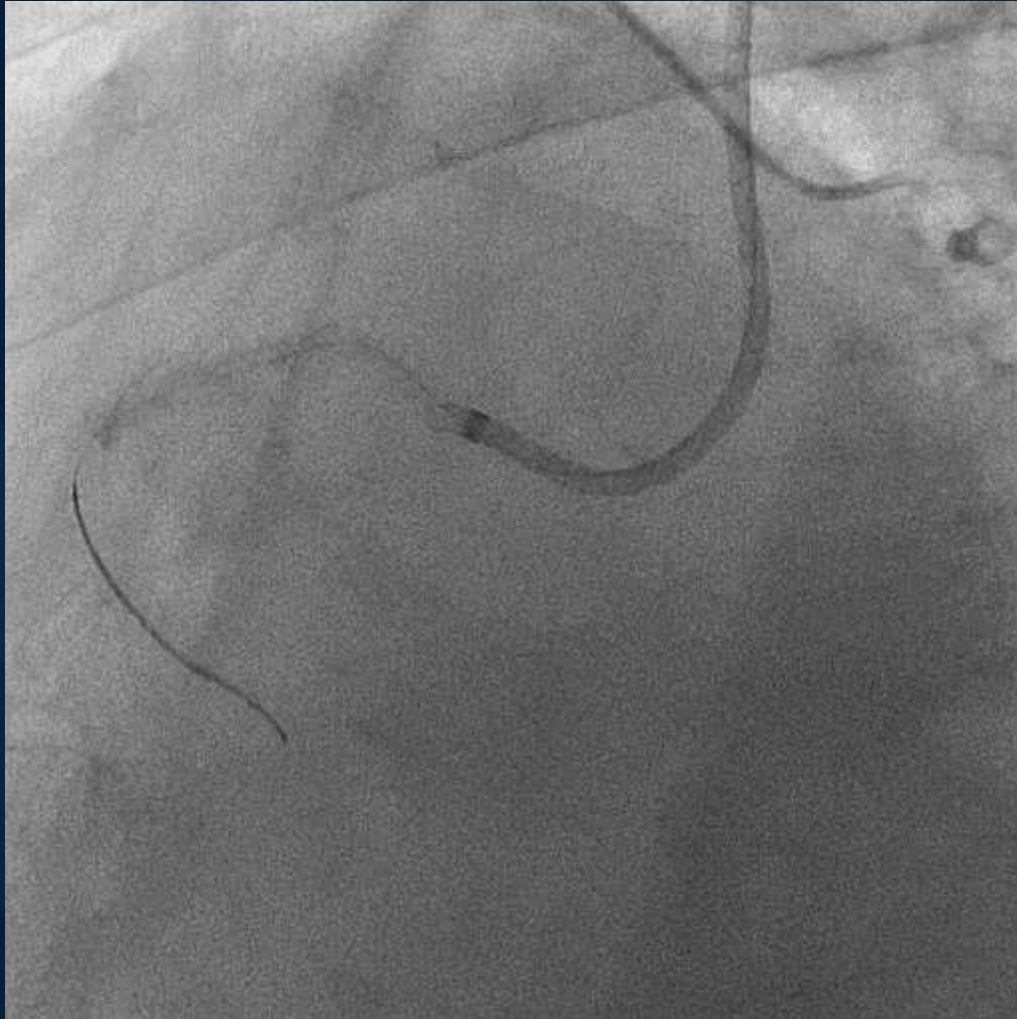
Case 2: mid RCA CTO



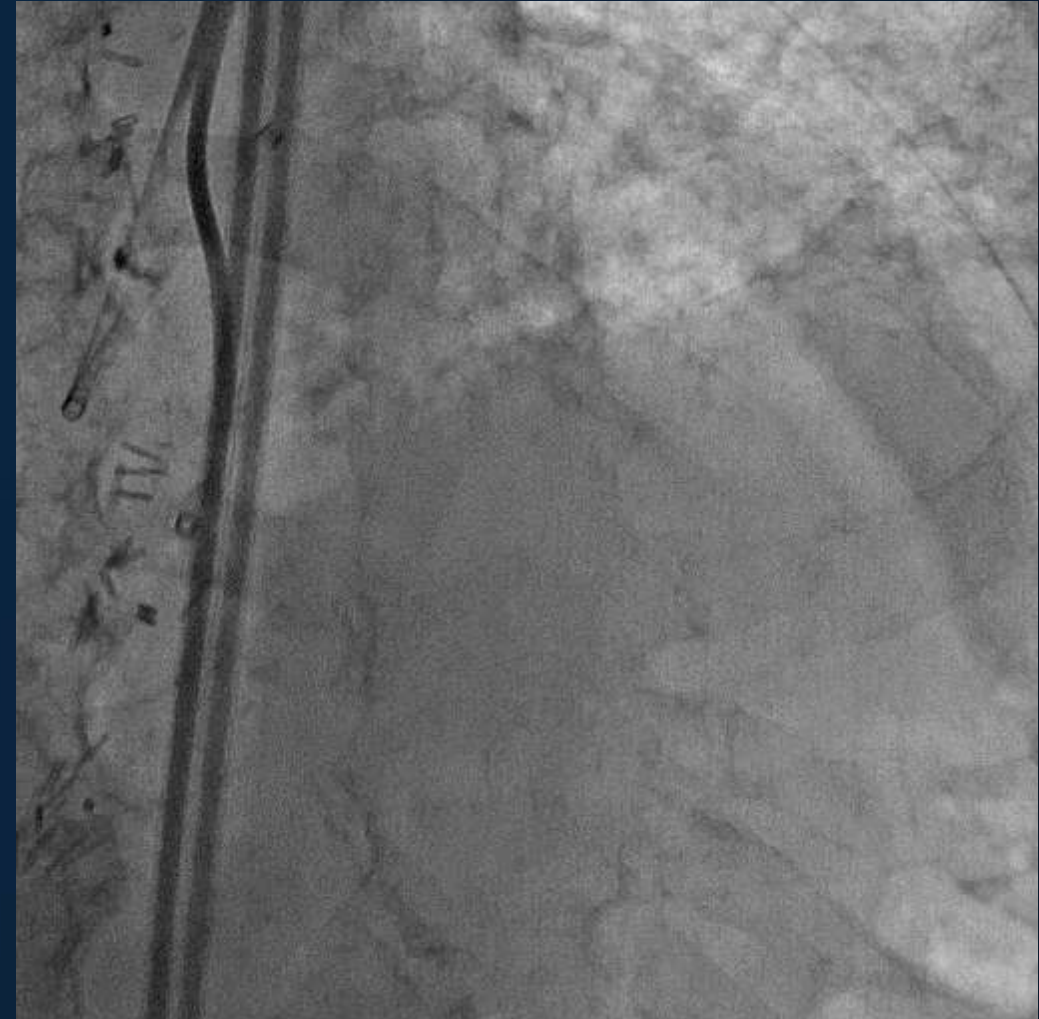
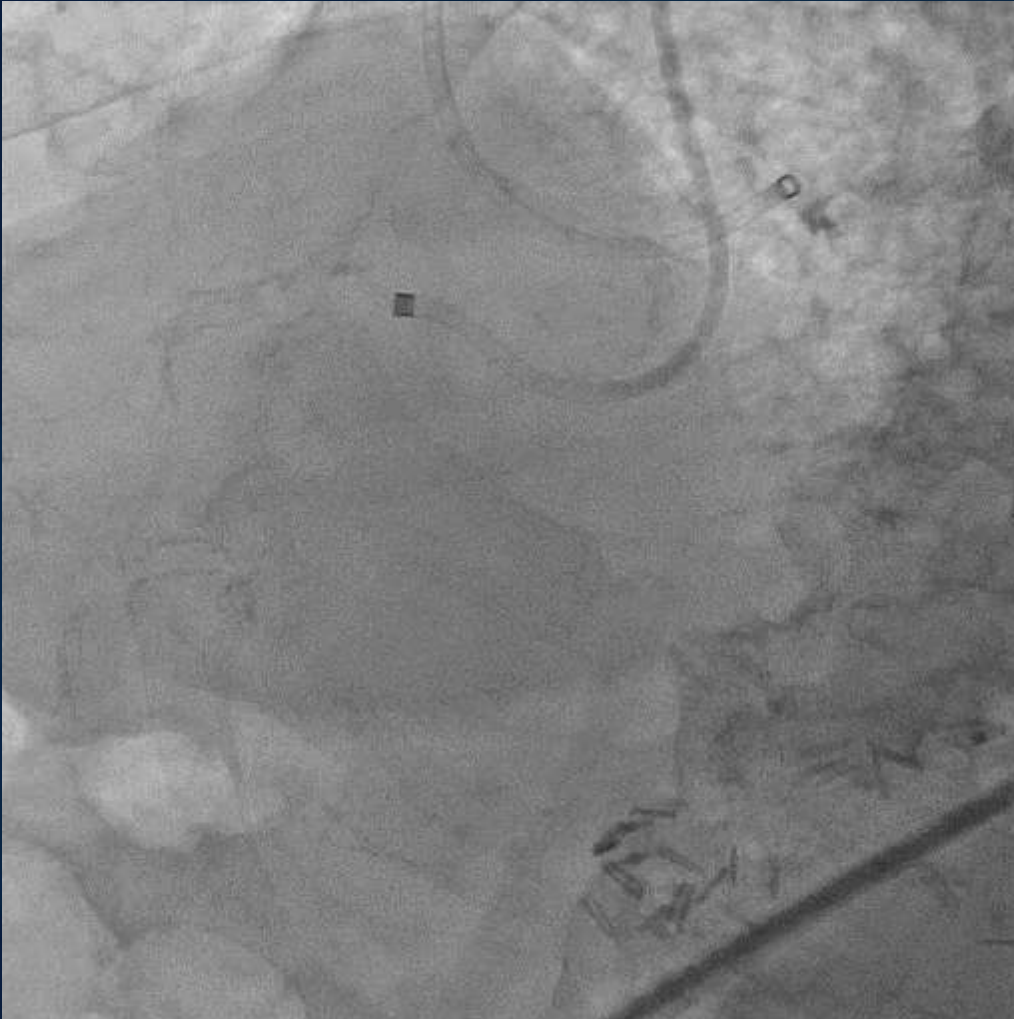
Antegrade wiring



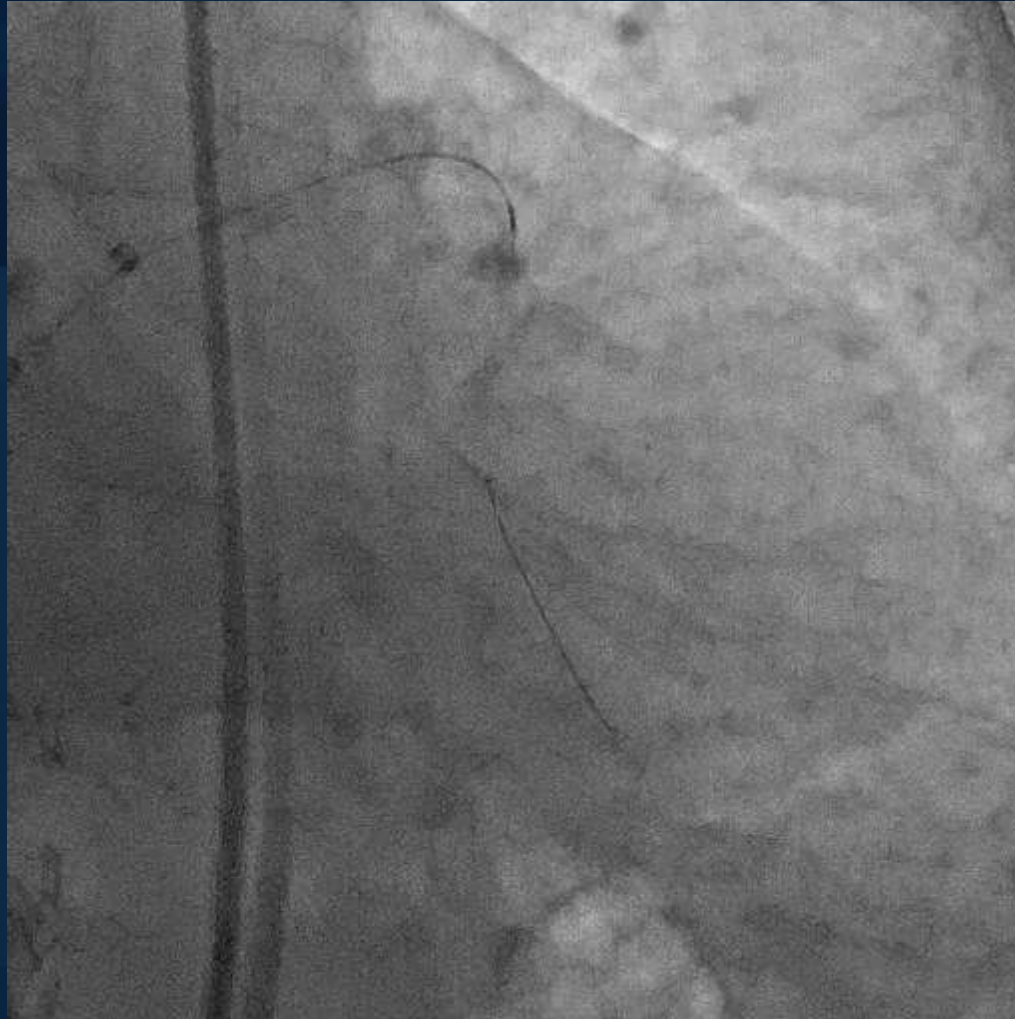
Final angiography at 1st attempt



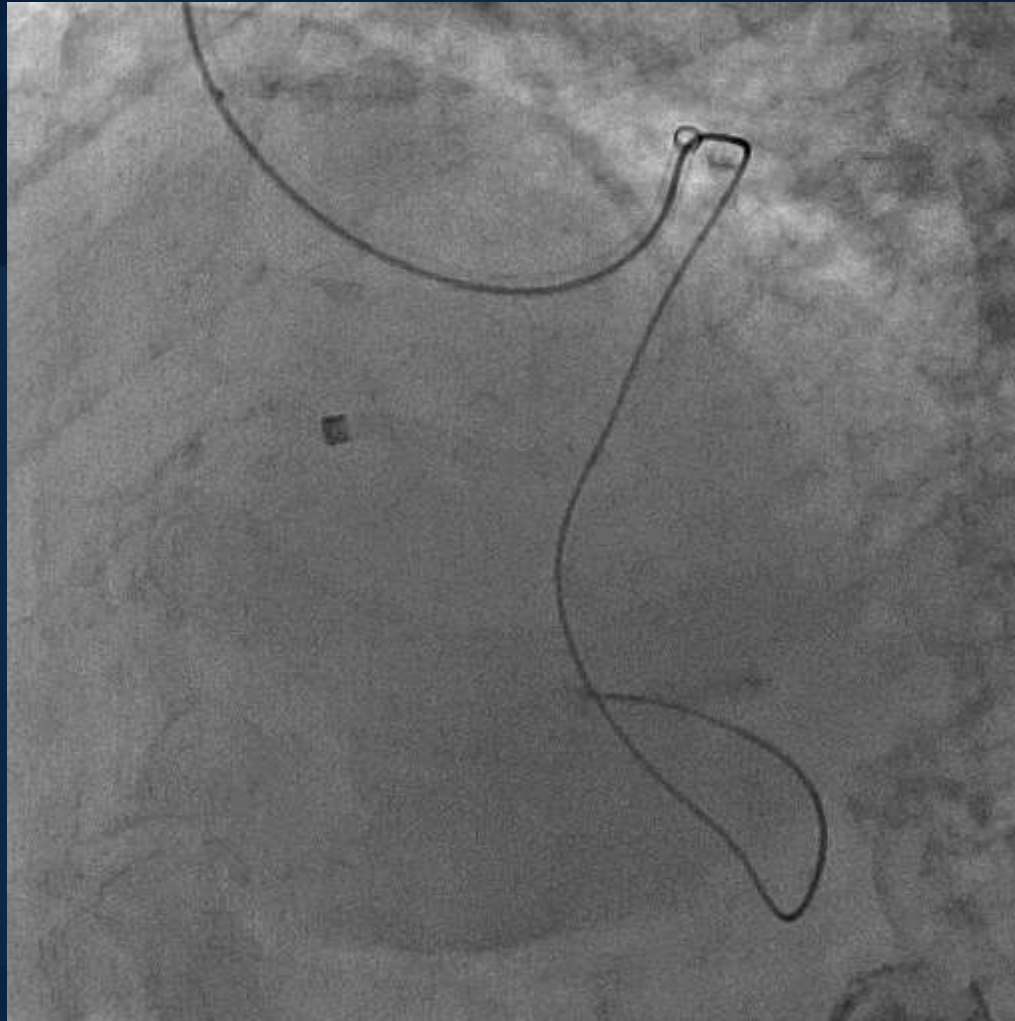
Pre-interventional angiography at 2nd attempt



Septal channel tracking with SUOH03



Tip injection through retrograde Corsair Pro



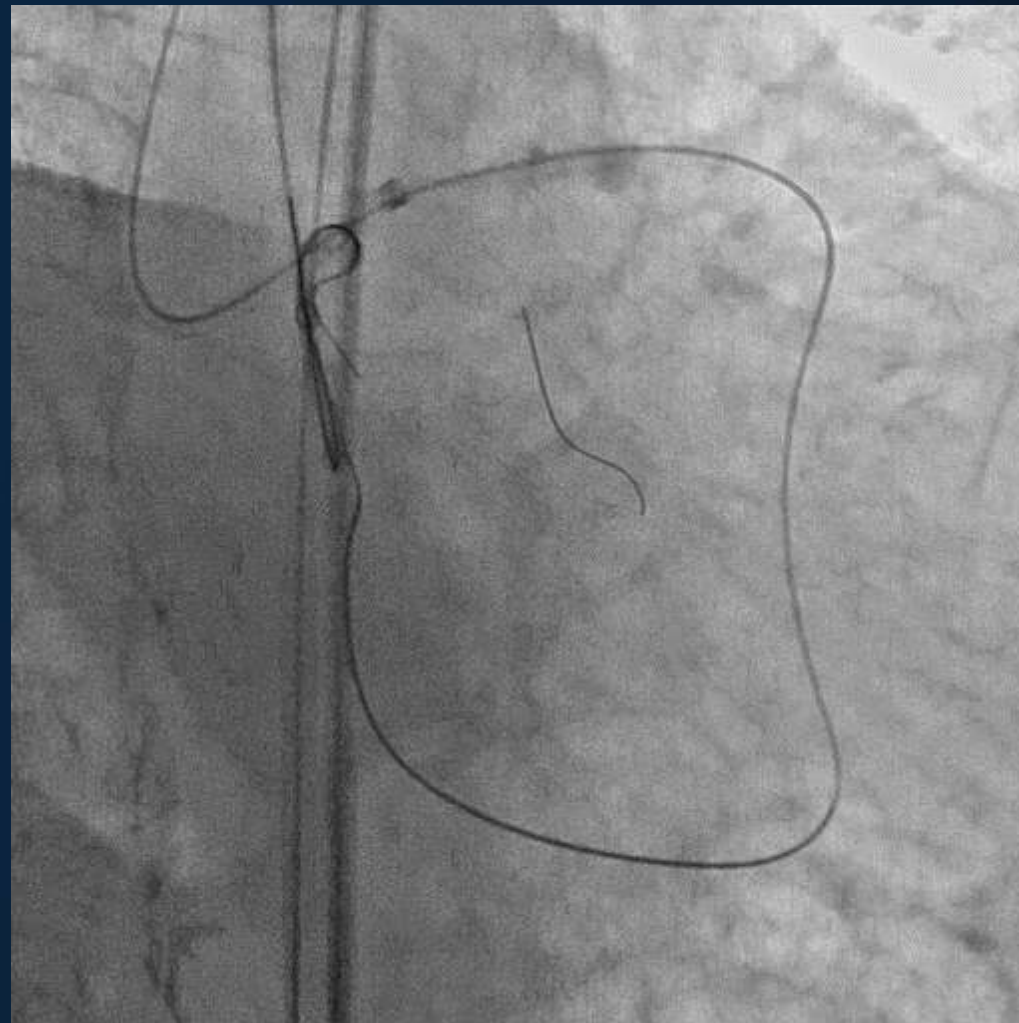
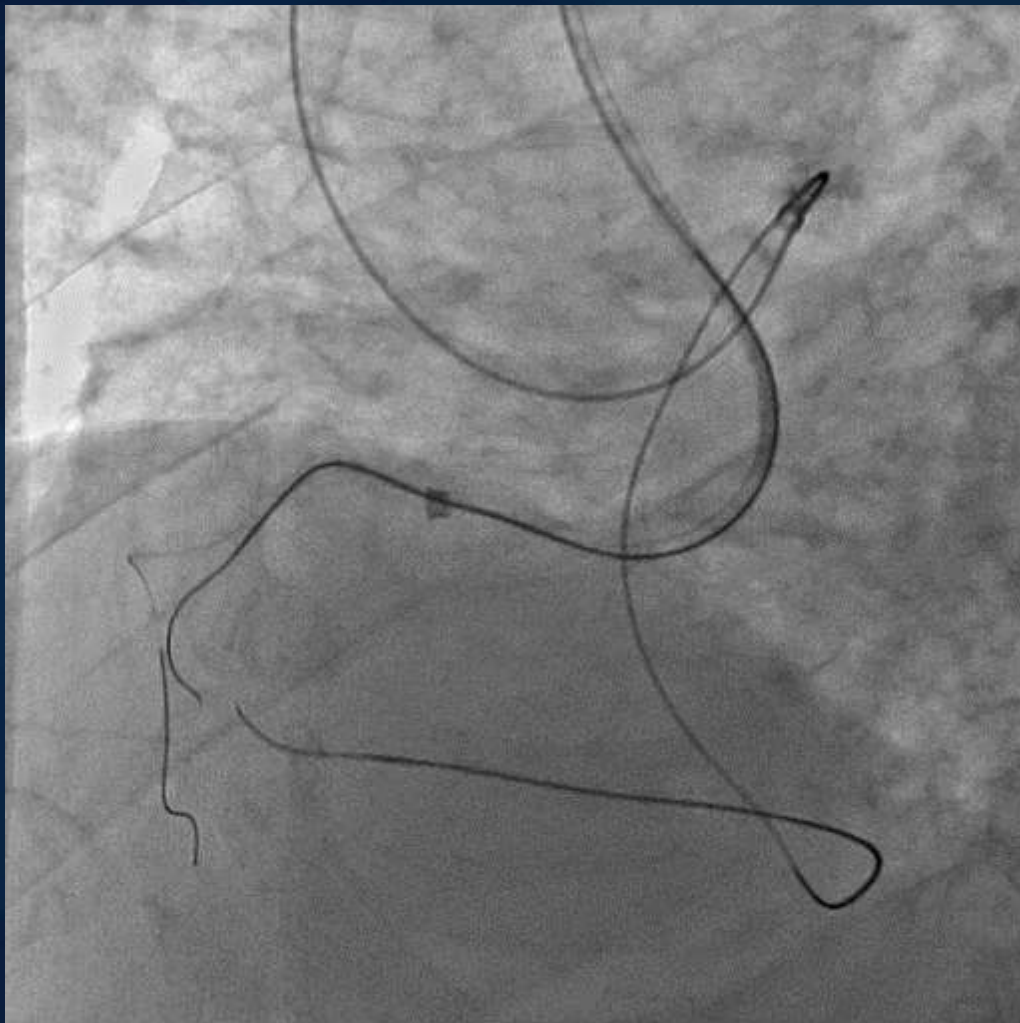
Distal cap penetration with CP12



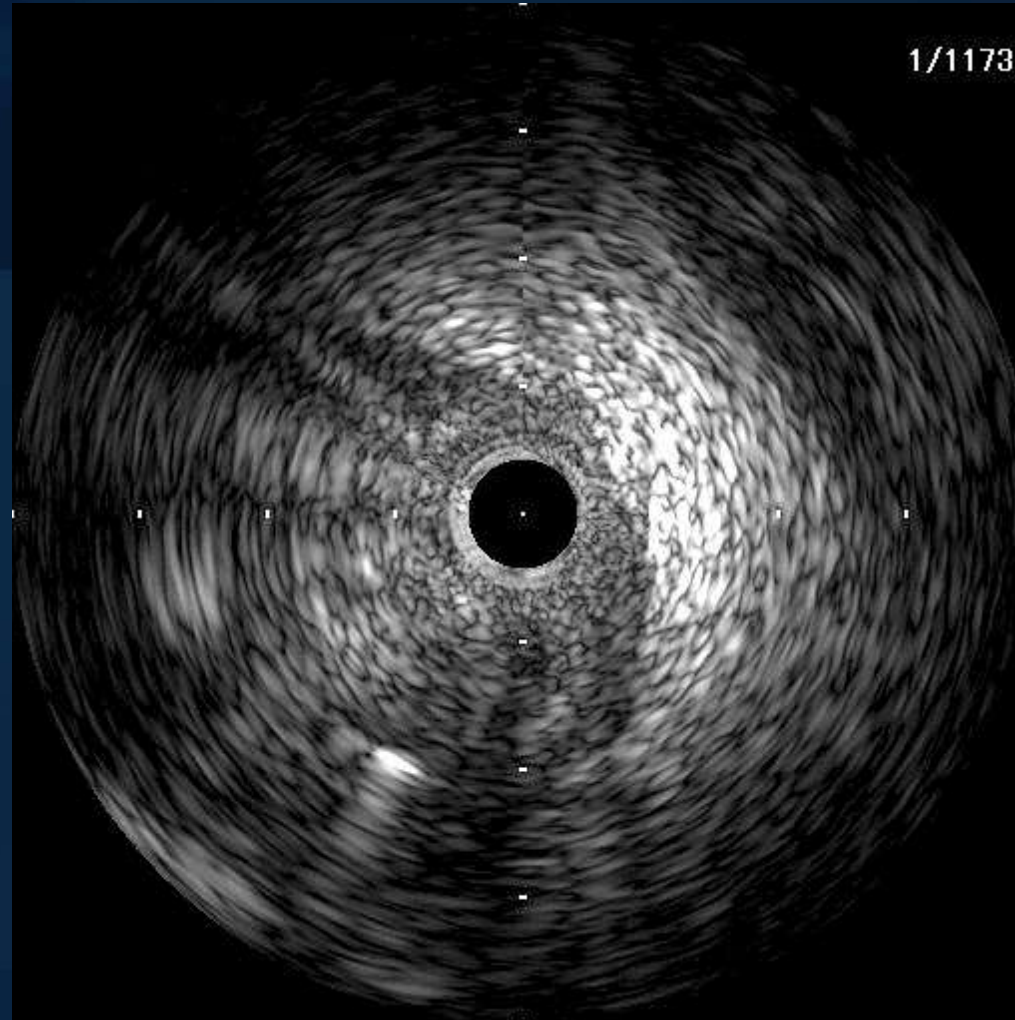
Retrograde CTO segment wiring with UB3



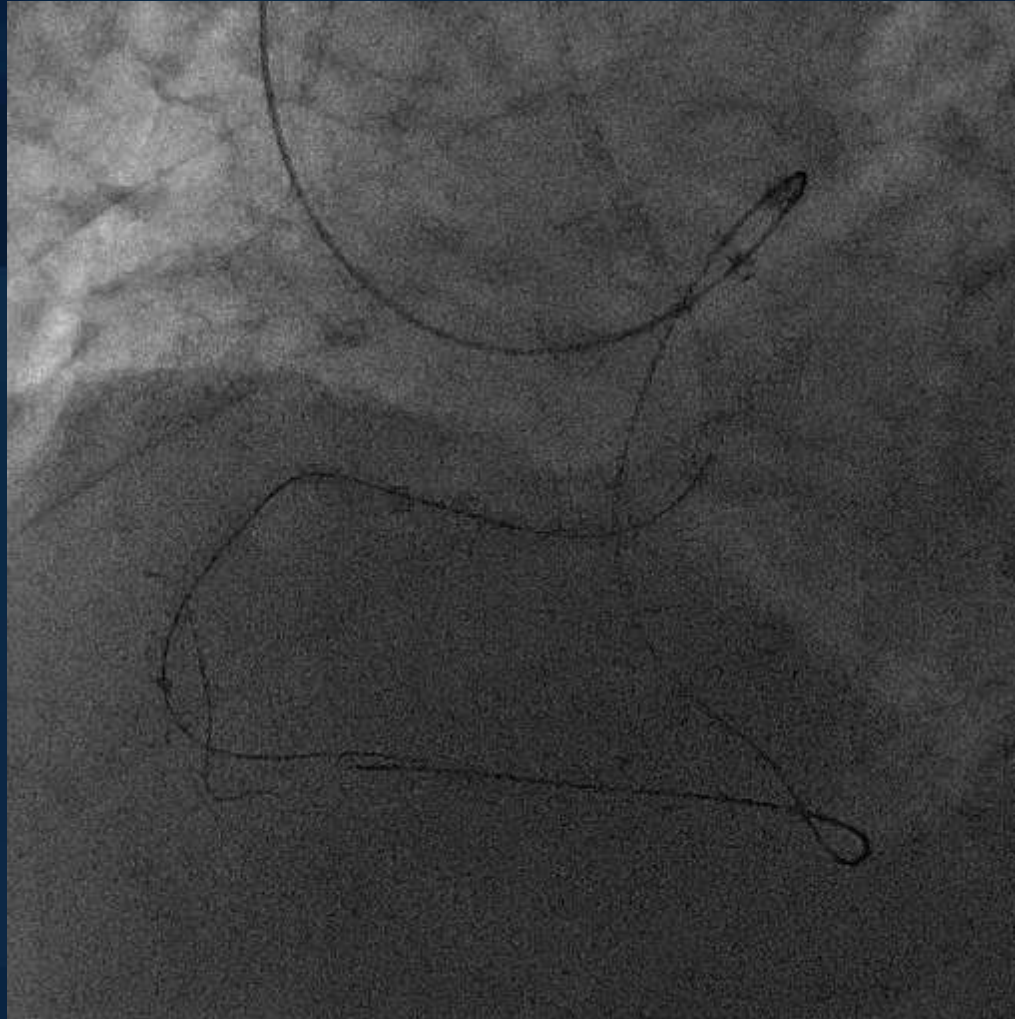
Antegrade wiring with UB3



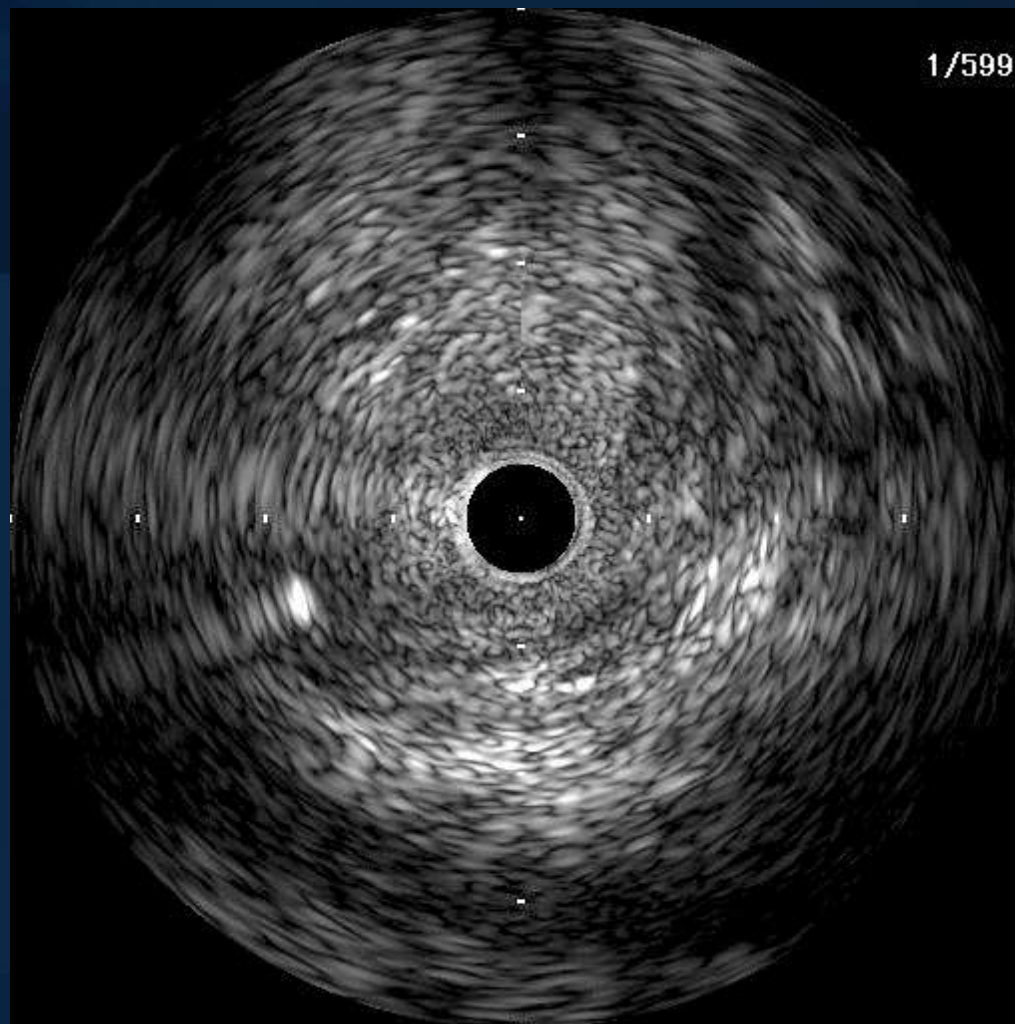
IVUS after predilatation



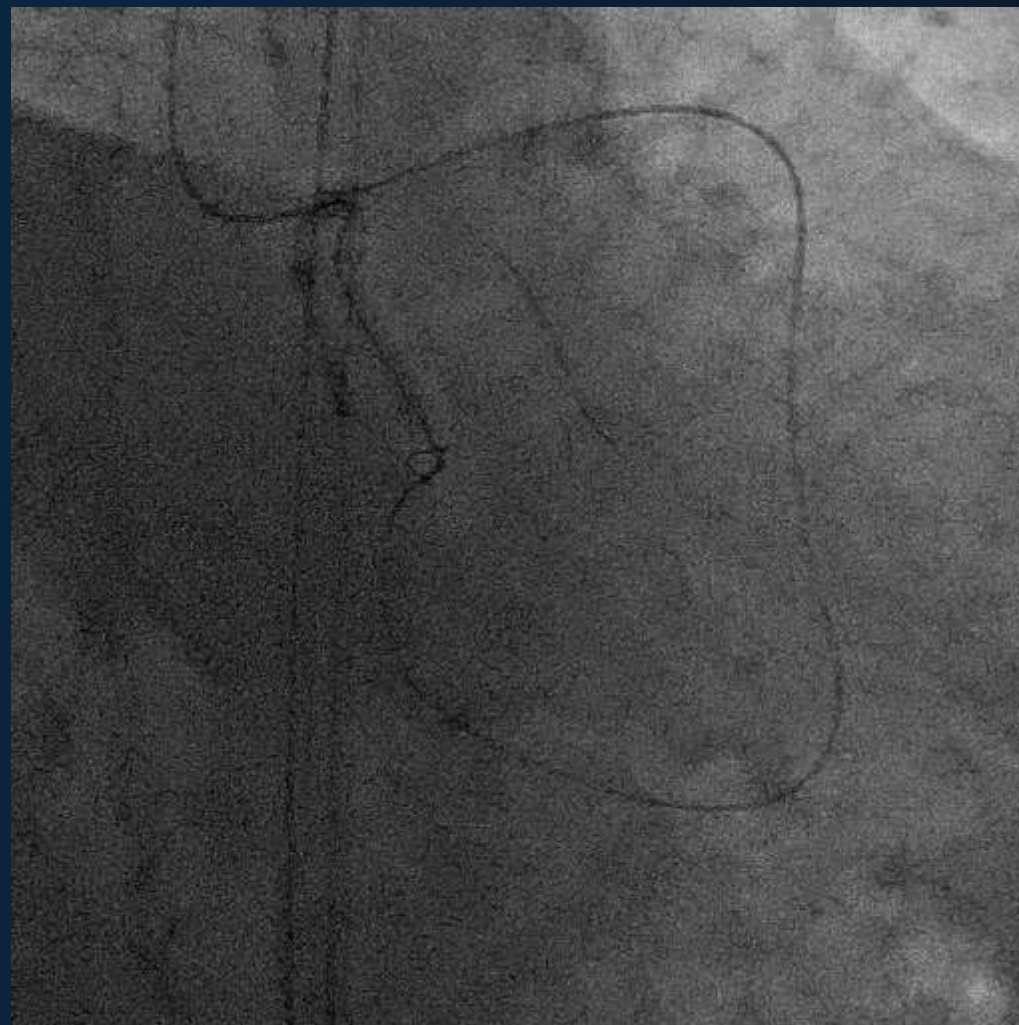
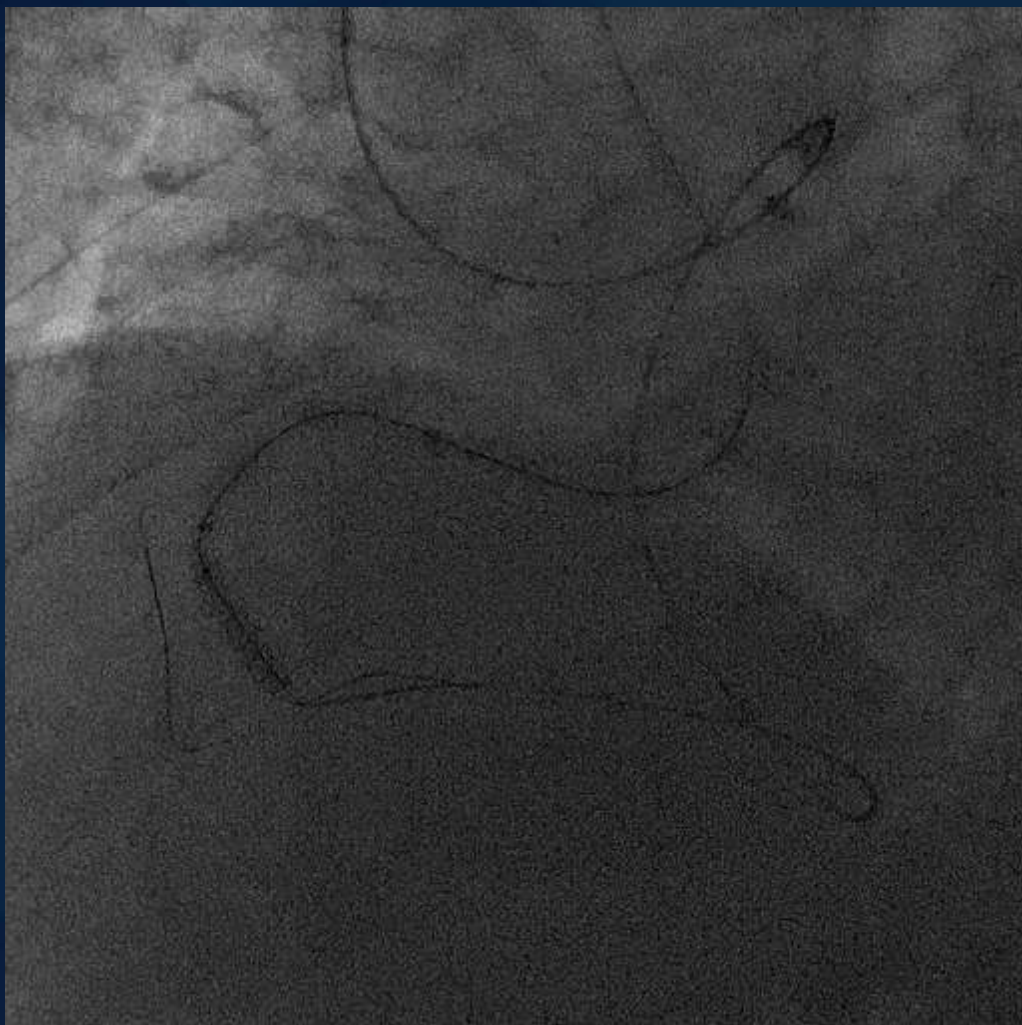
Retrograde UB3 was advanced proximally



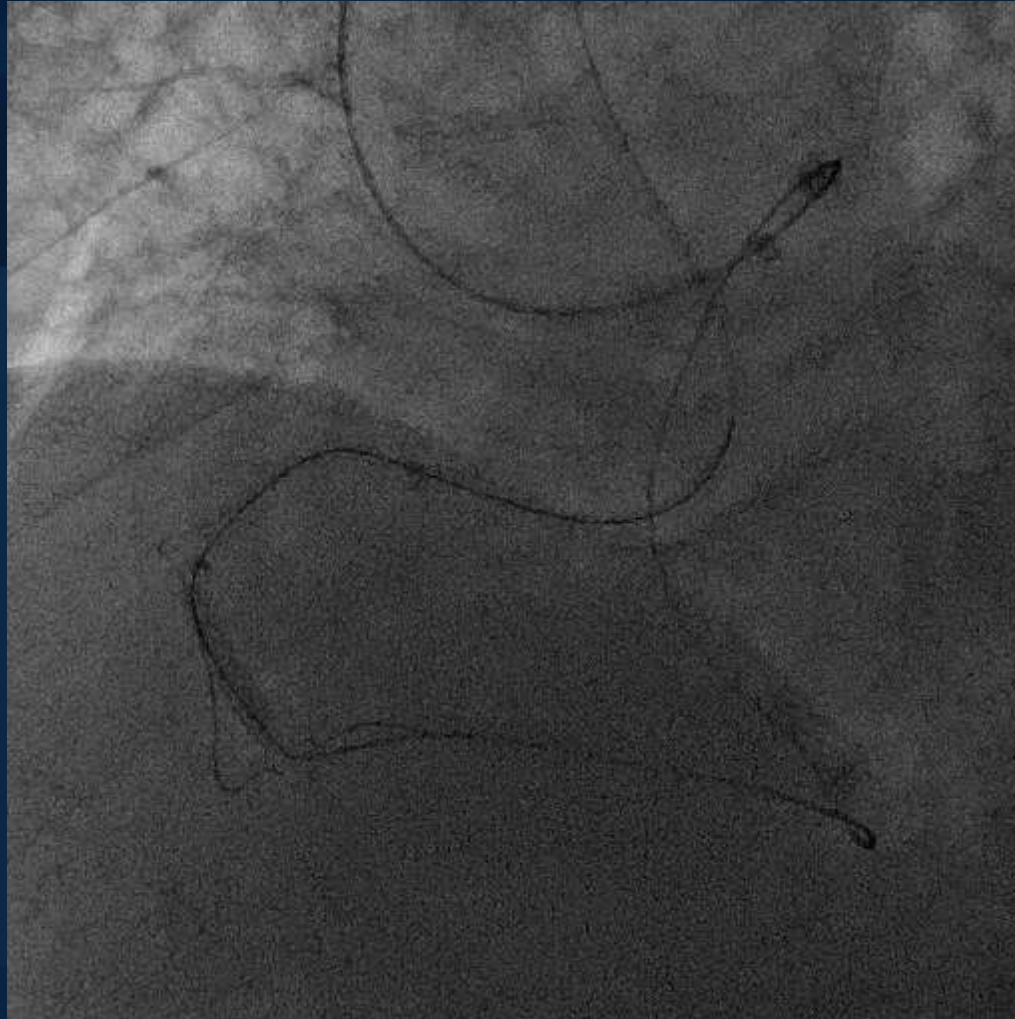
IVUS after advancing retrograde wire



Antegrade 3.5mm balloon inflation



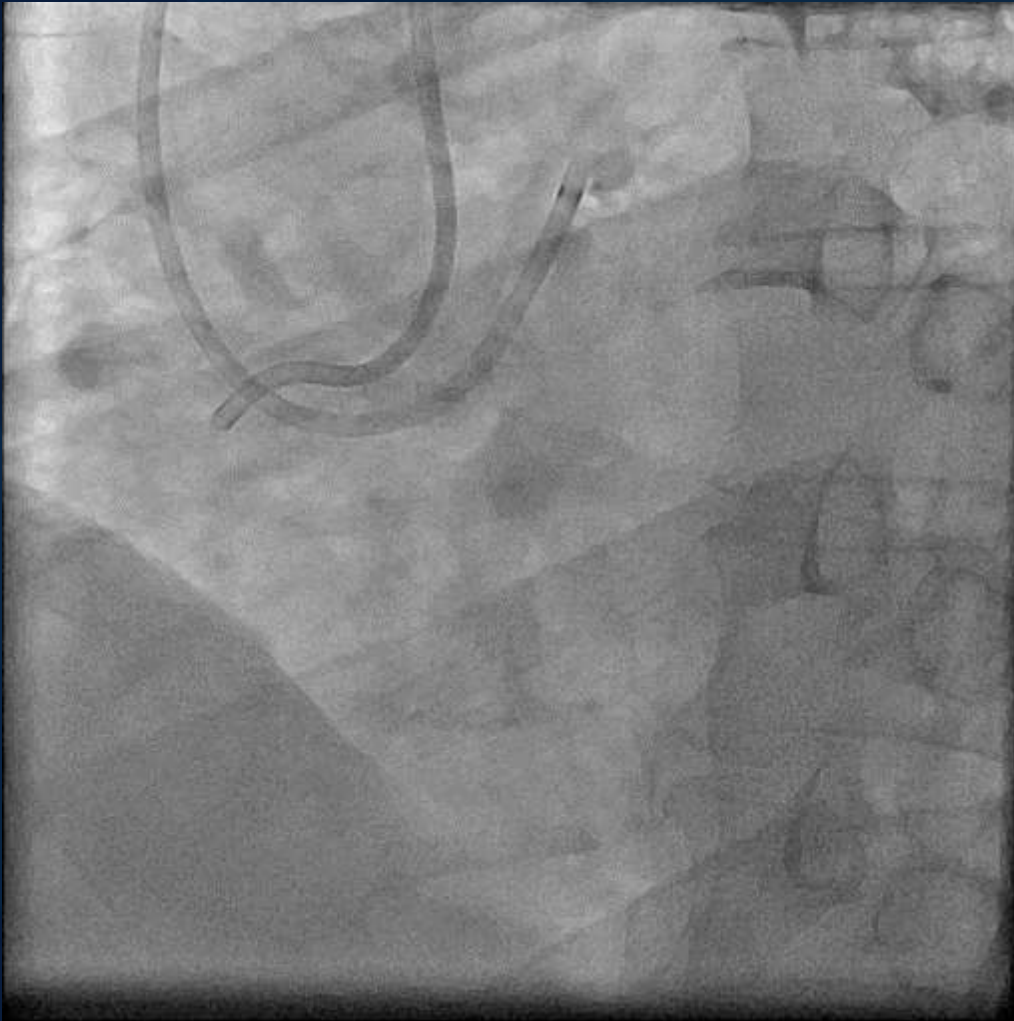
Conventional reverse CART



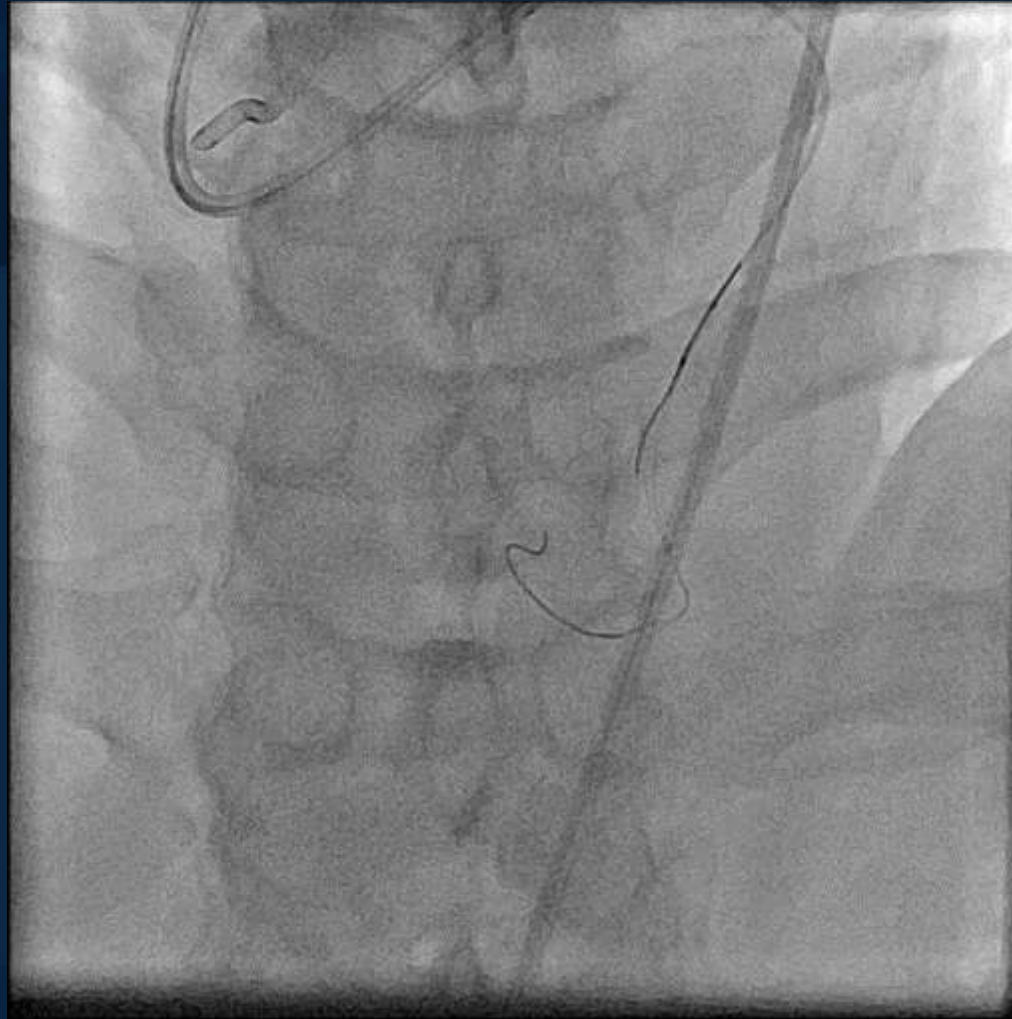
Another difficult situation in reverse CART

- Once a connection has been successfully created, the retrograde wire can be caught up in disease, dissection, recoil or tortuosity in the vessel proximal to the connection point.

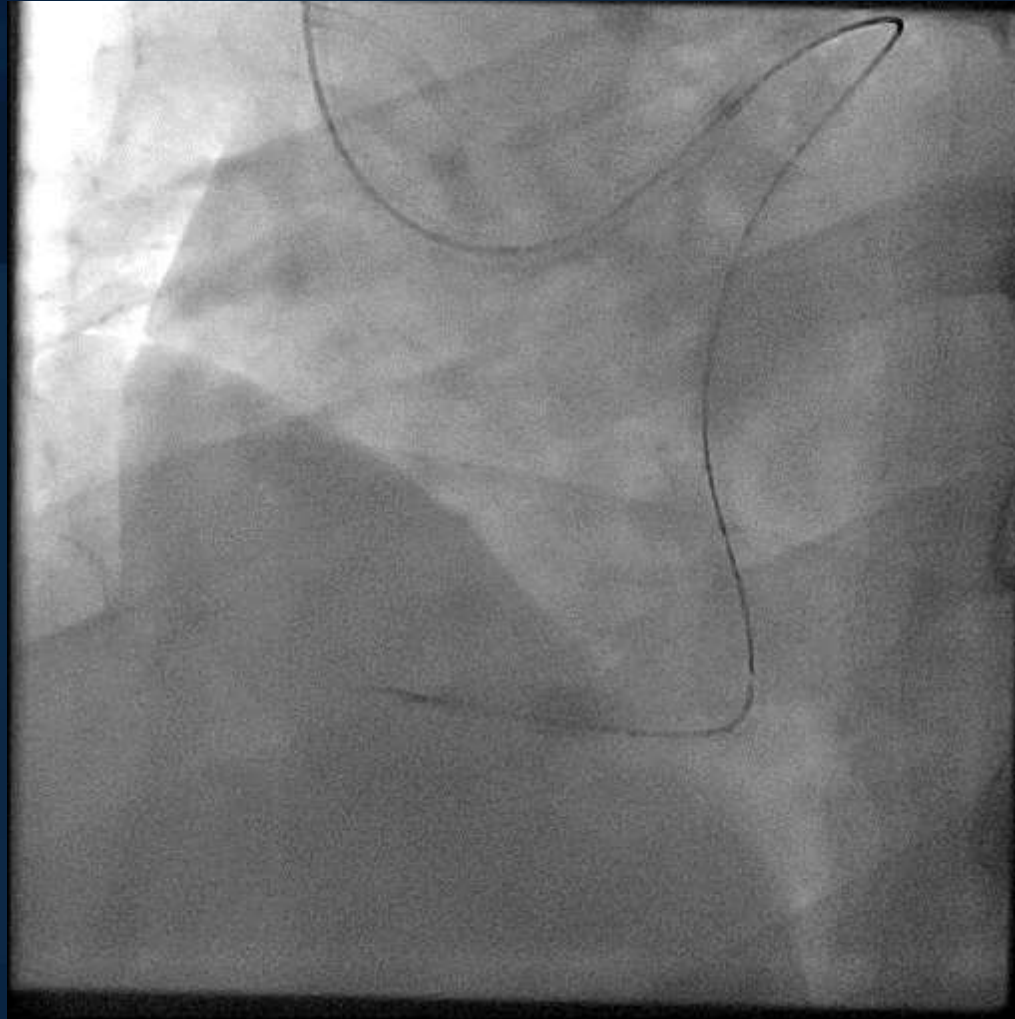
Case 3: Proximal RCA CTO



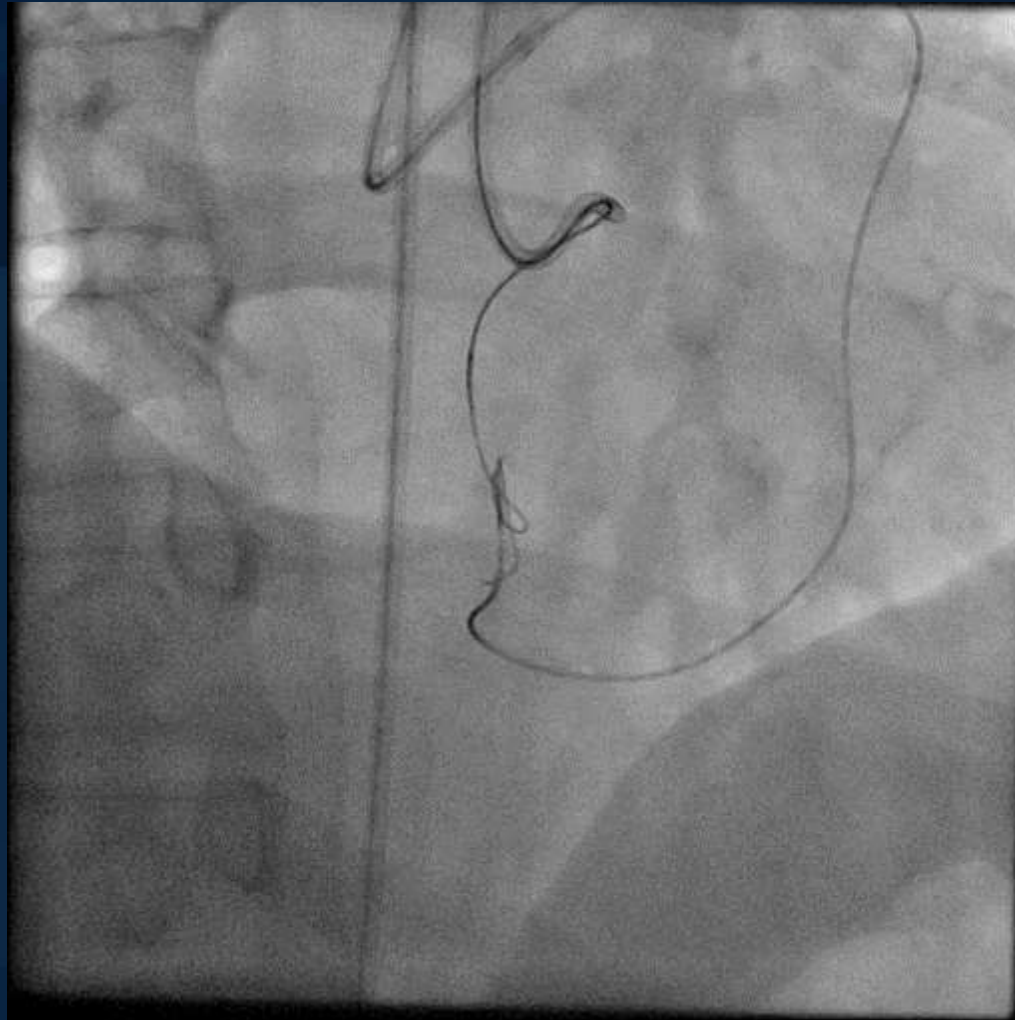
Septal channel tracking



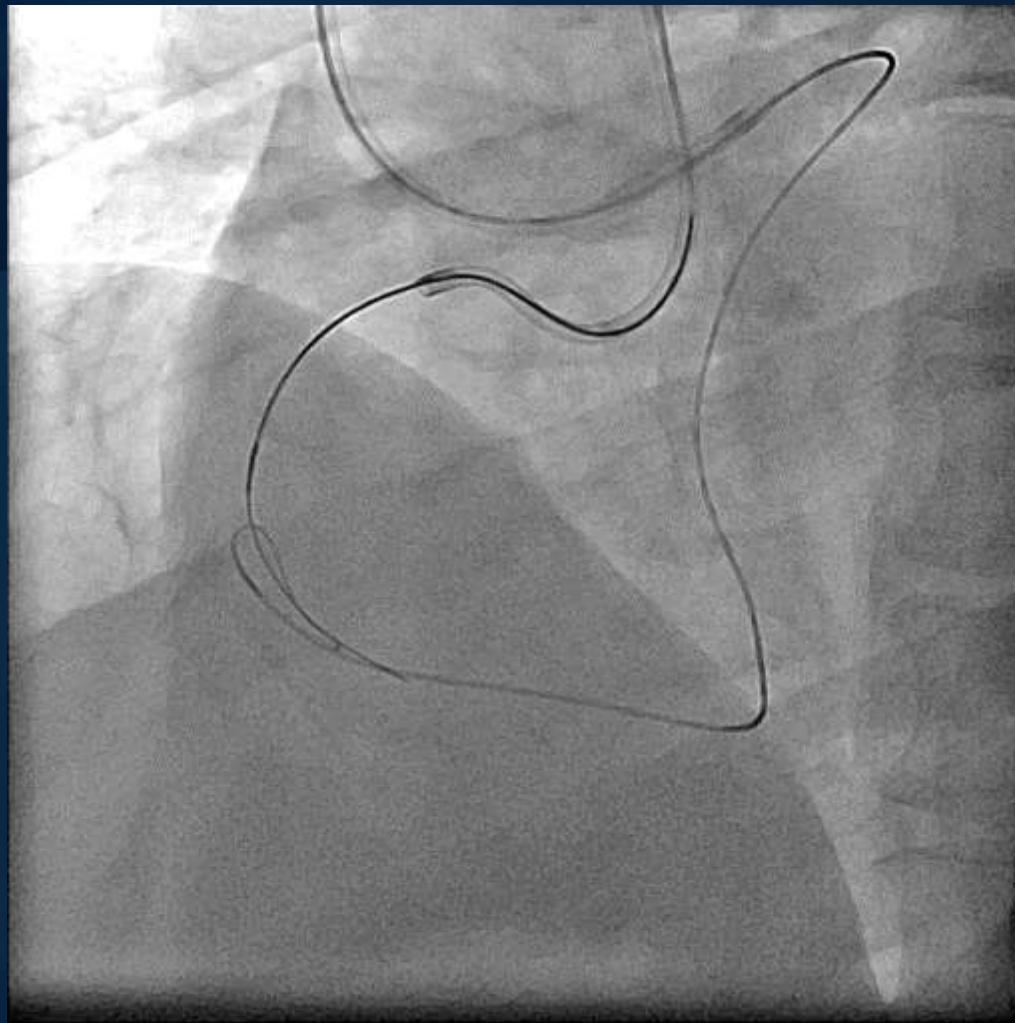
Retrograde knuckle wiring with SION black



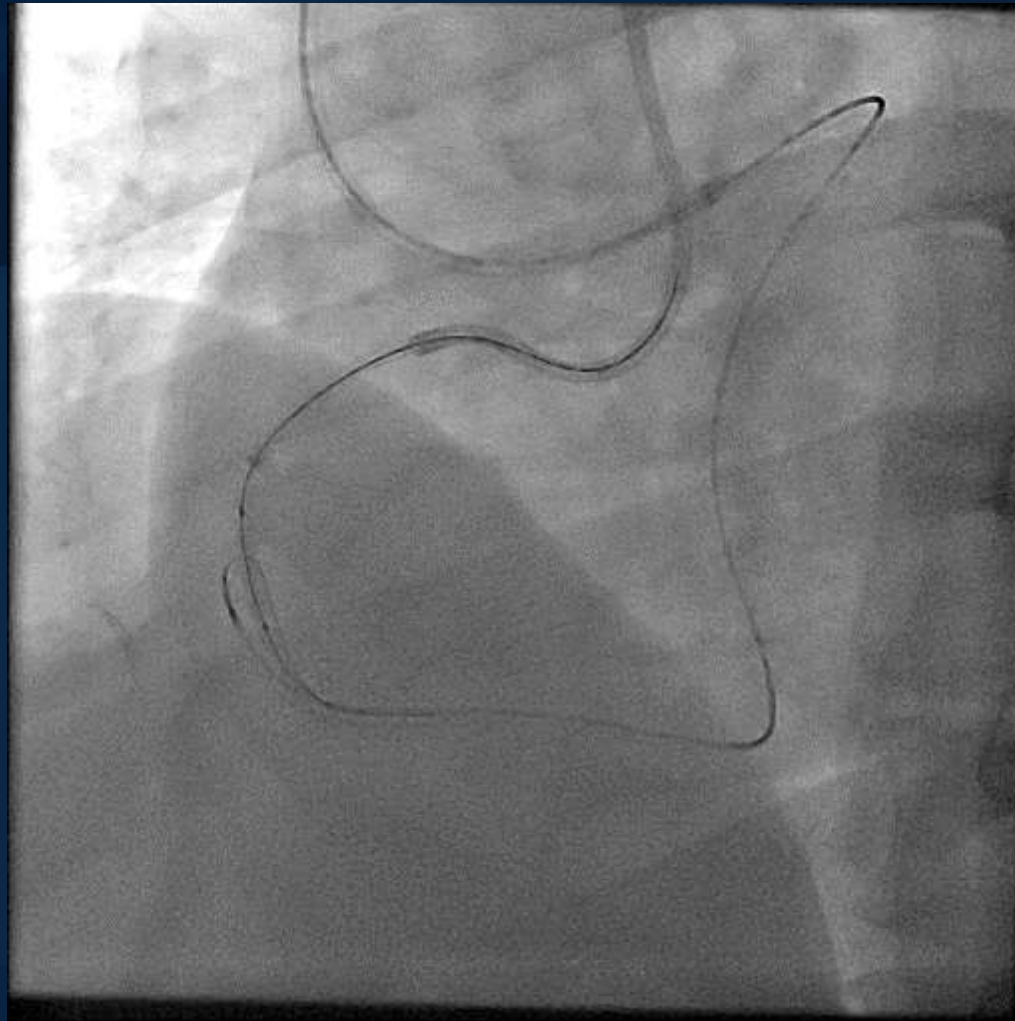
Antegrade knuckle wiring



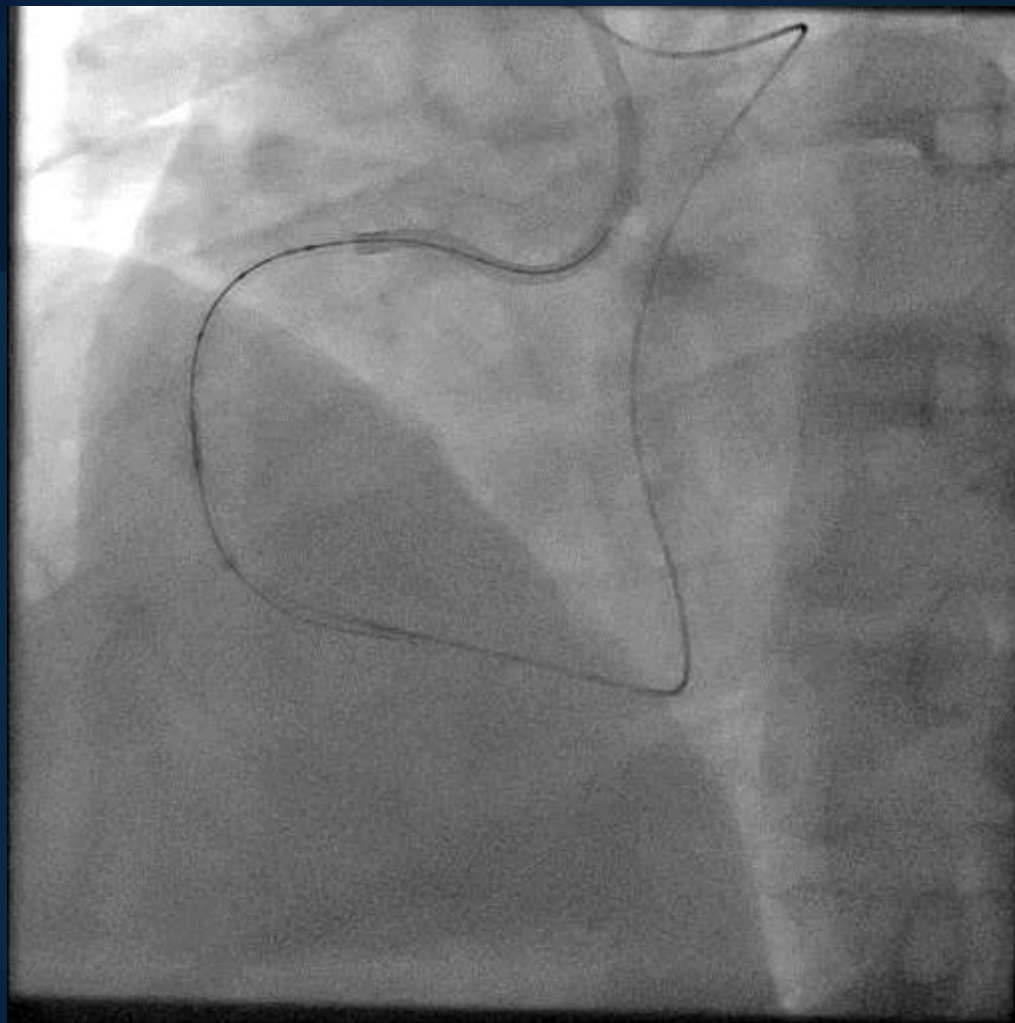
Further antegrade wiring with UB3



Guide-extension catheter advancement



Guide-extension reverse CART



Take-home Message

- **Directed reverse CART** should be attempted first for suitable CTO lesions to maximize effectiveness and efficiency.
- **IVUS-guidance** is useful to facilitate reverse CART procedure in failed directed reverse CART and conventional reverse CART cases.
- **Guide-extension catheter** is helpful when there is difficulty in retrograde wiring into the proximal true lumen once after a connection has been created.