

# Fundamentals of contemporary reverse CART technique

Yasumi Igarashi, M.D. Ph.D.

Division of Cardiology

Cardiovascular Center

JCHO Hokkaido Hospital

# Procedure Sequence of previous Retrograde Approach

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1st step : Connection channel related strategy

- 1) Branch selection
- 2) Wiring through collateral

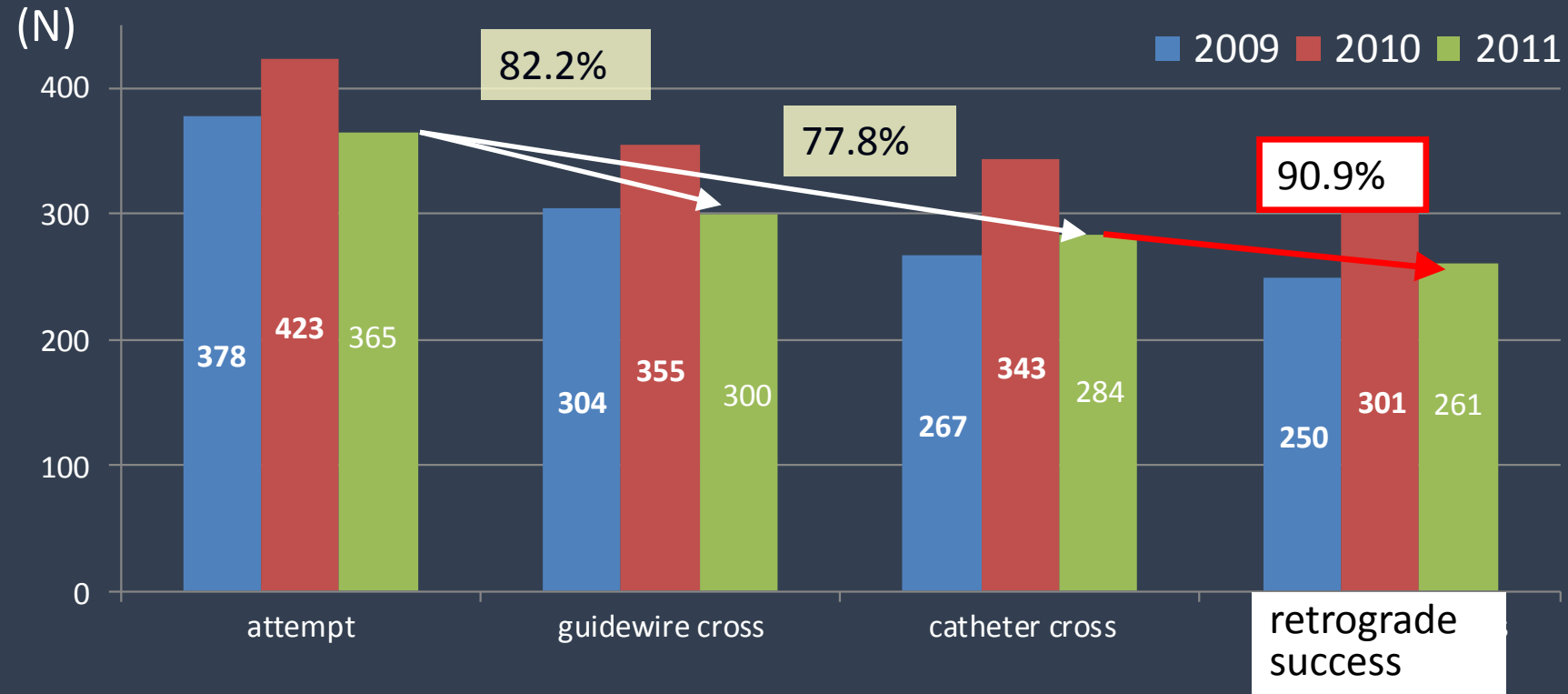
2<sup>nd</sup> Step : Micro-catheter delivery to distal CTO

3<sup>rd</sup> Step : Retrograde wiring in CTO lesion

- 1) Retrograde guide-wire crossing
- 2) Reverse CART technique
- 3) IVUS guided Reverse CART technique

# Clinical Results

## Collateral crossing and retrograde success



Successful channel crossing with both wire and catheter is very important factor in retrograde approach, as fact 90.9% of procedure success was achieved after successful collateral crossing.

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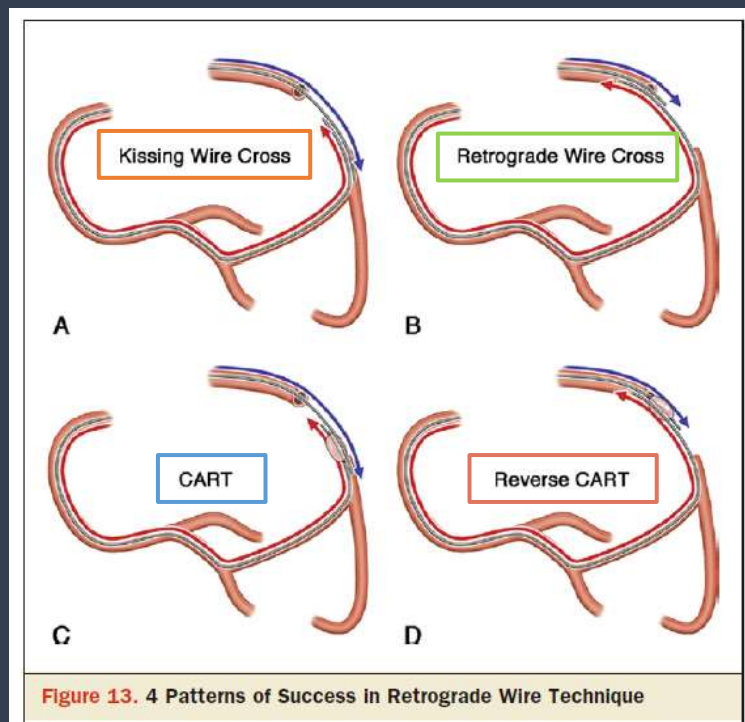
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- 1) Retrograde guide-wire crossing
- 2) Reverse CART technique
- 3) IVUS guided Reverse CART technique

# Retrograde: CTO Crossing

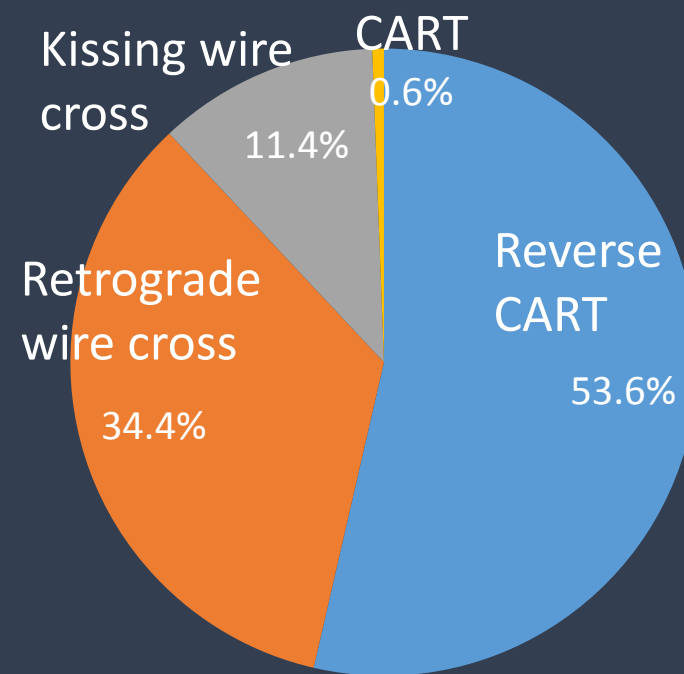
## Successful strategy

Patterns of Success in Retrograde Approach



Sumitsuji et al. JACC Cardiovasc Interv 2011

CTO cross by GW, 67.9% (326/480)

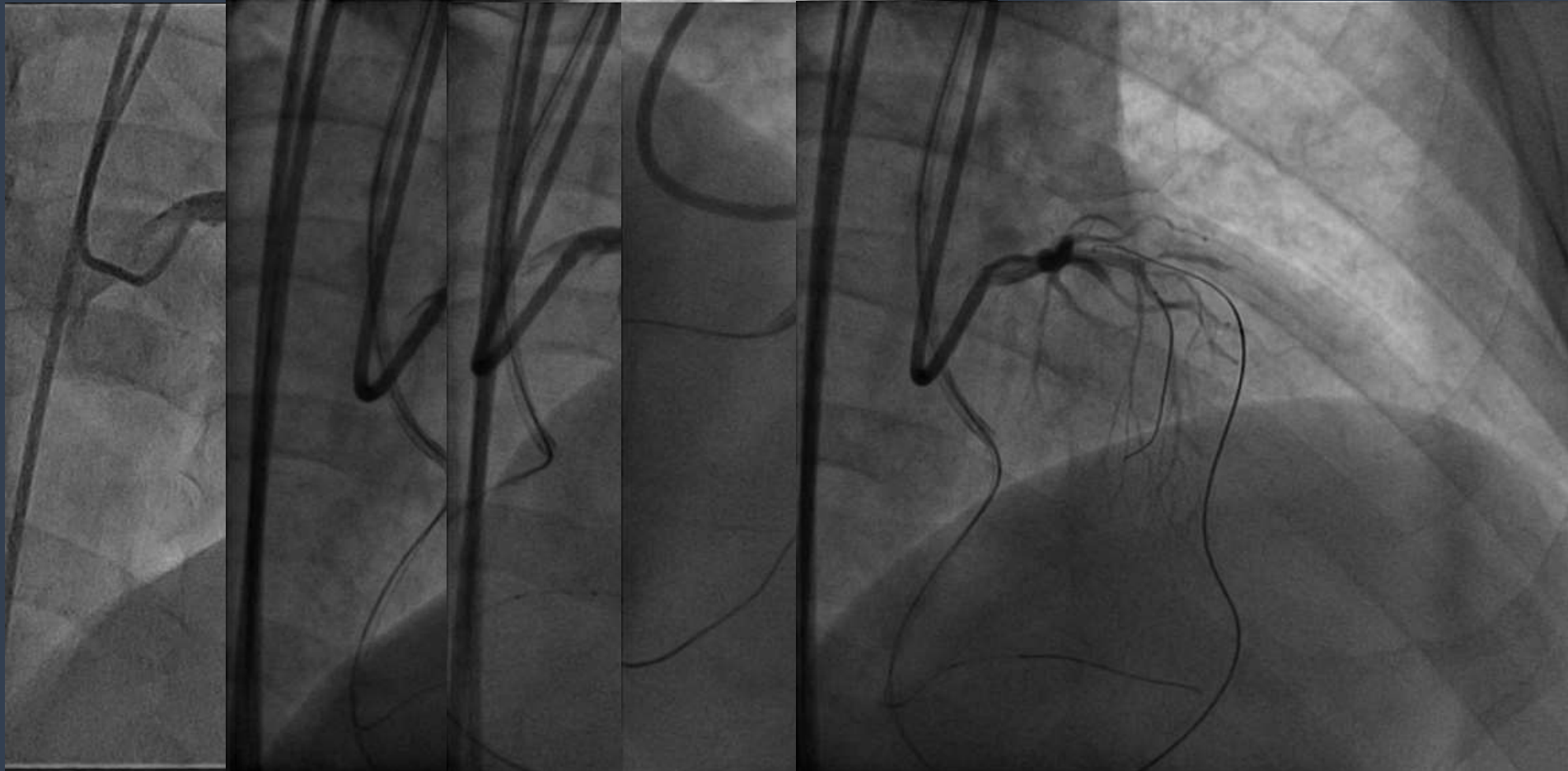


IVUS was used in 69% of Reverse CART

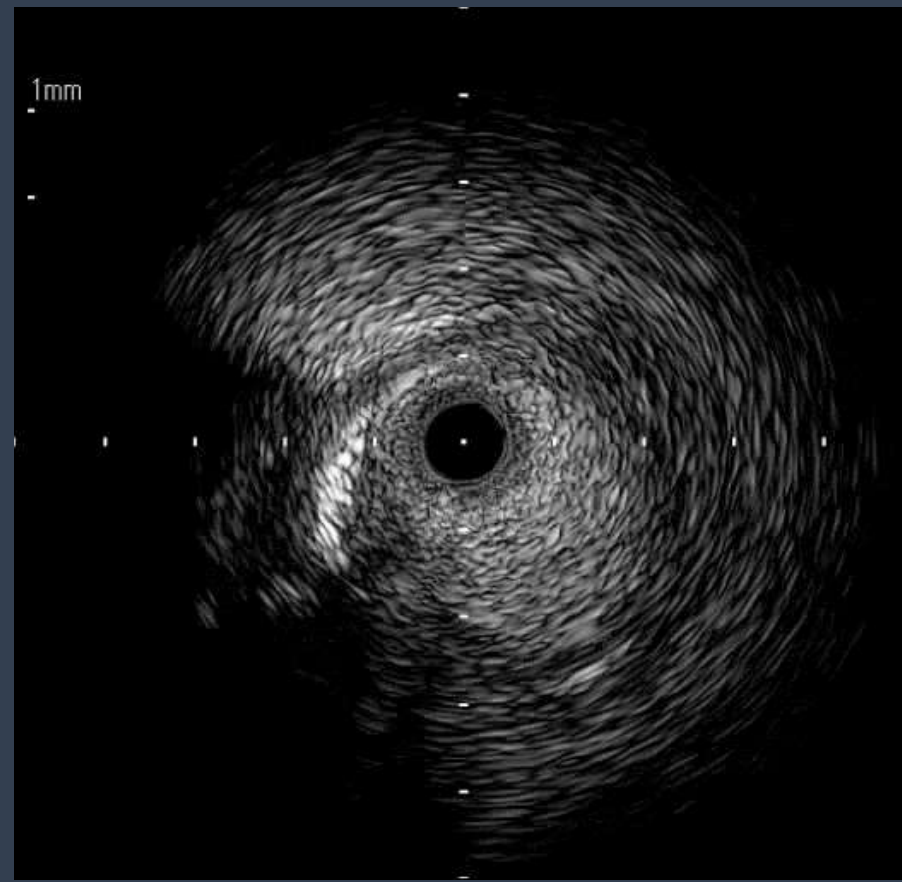
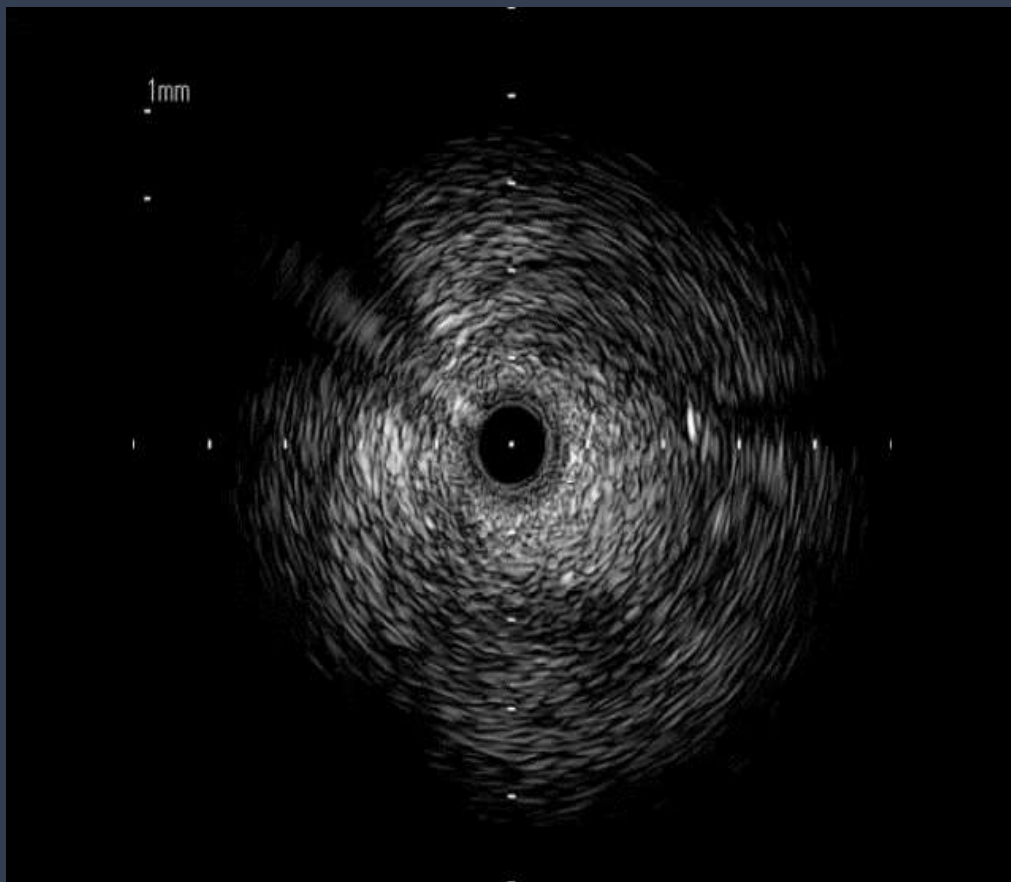
# Procedure outcome

	Total (1573)	Antegrade alone (1080)	Retrograde (493)	P value
Successful CTO crossing by GW	89.8%	92.1%	84.8%	<0.0001
Number of guidewire used for CTO approach	3.3±2.3	2.5±1.5	5.1±2.7	<0.0001
Number of micro/balloon catheter	2.9±2.2	2.5±1.7	3.9±2.7	<0.0001
Number of stent	1.7±1.2	1.5±0.9	2.2±1.5	<0.0001
<b>Procedure success</b>	<b>88.6%</b>	<b>91.1%</b>	<b>83.0%</b>	<b>&lt;0.0001</b>
Procedure time, min	141.2±87.2	112.3±67.2	202.3±92.9	<0.0001
Contrast dose, ml	227.2±107.9	207.6±95.2	268.6±120.8	<0.0001
Fluoroscopy time, min	72.6±188.0	62.0±226.0	94.5±45.8	0.0034

# Failed Retrograde direct crossing



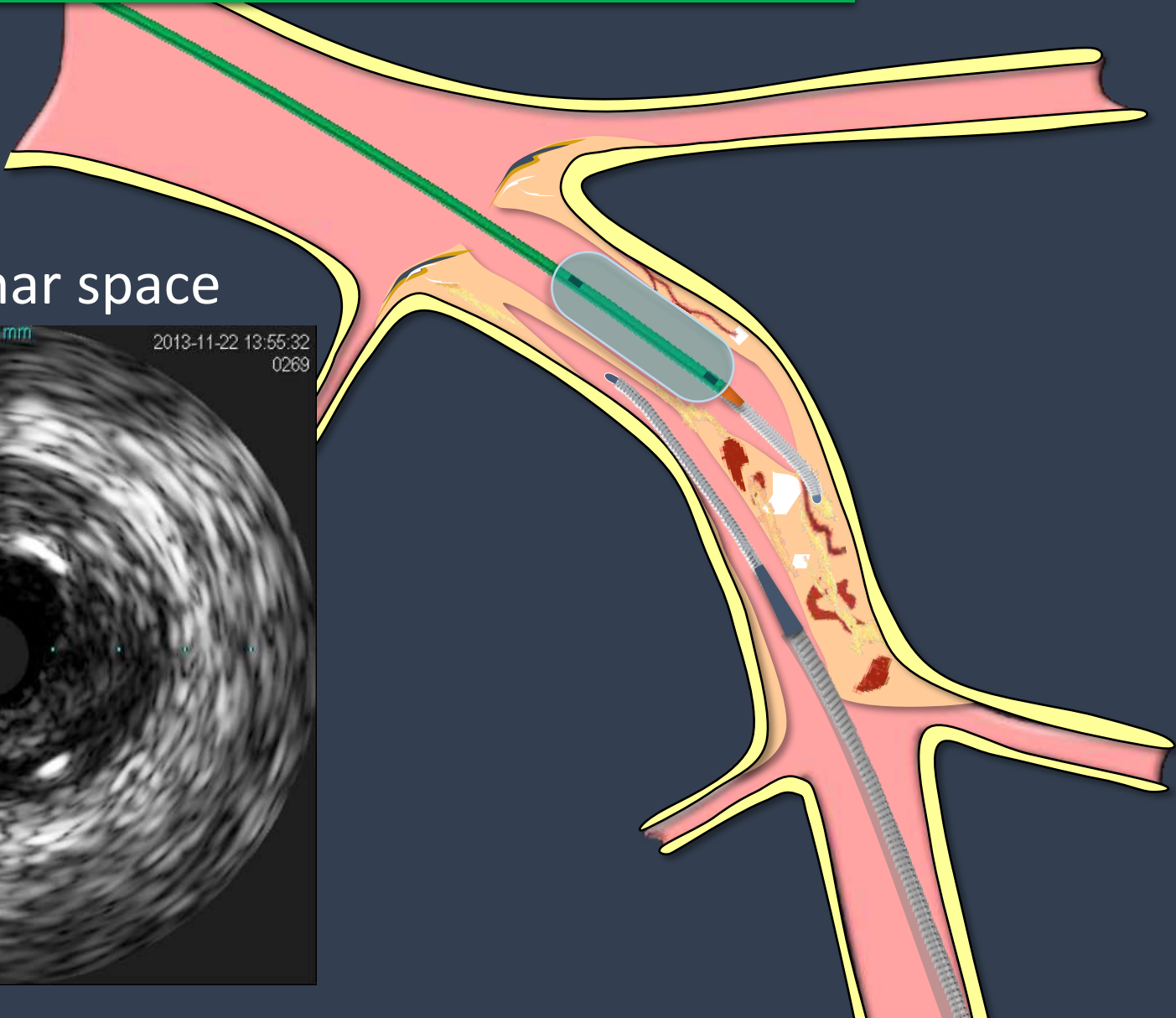
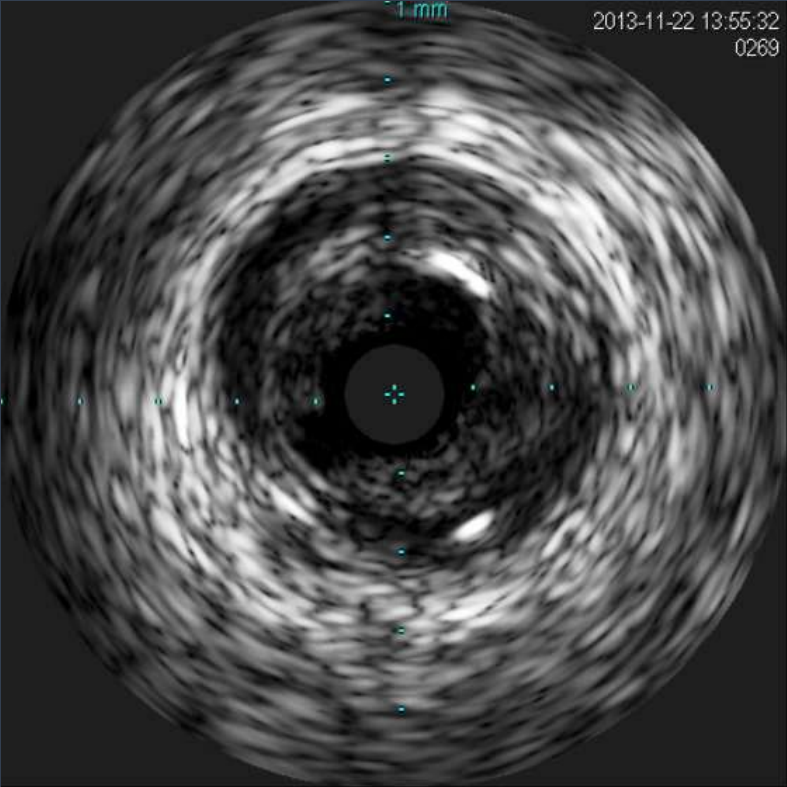
# IVUS findings of failed retrograde wiring



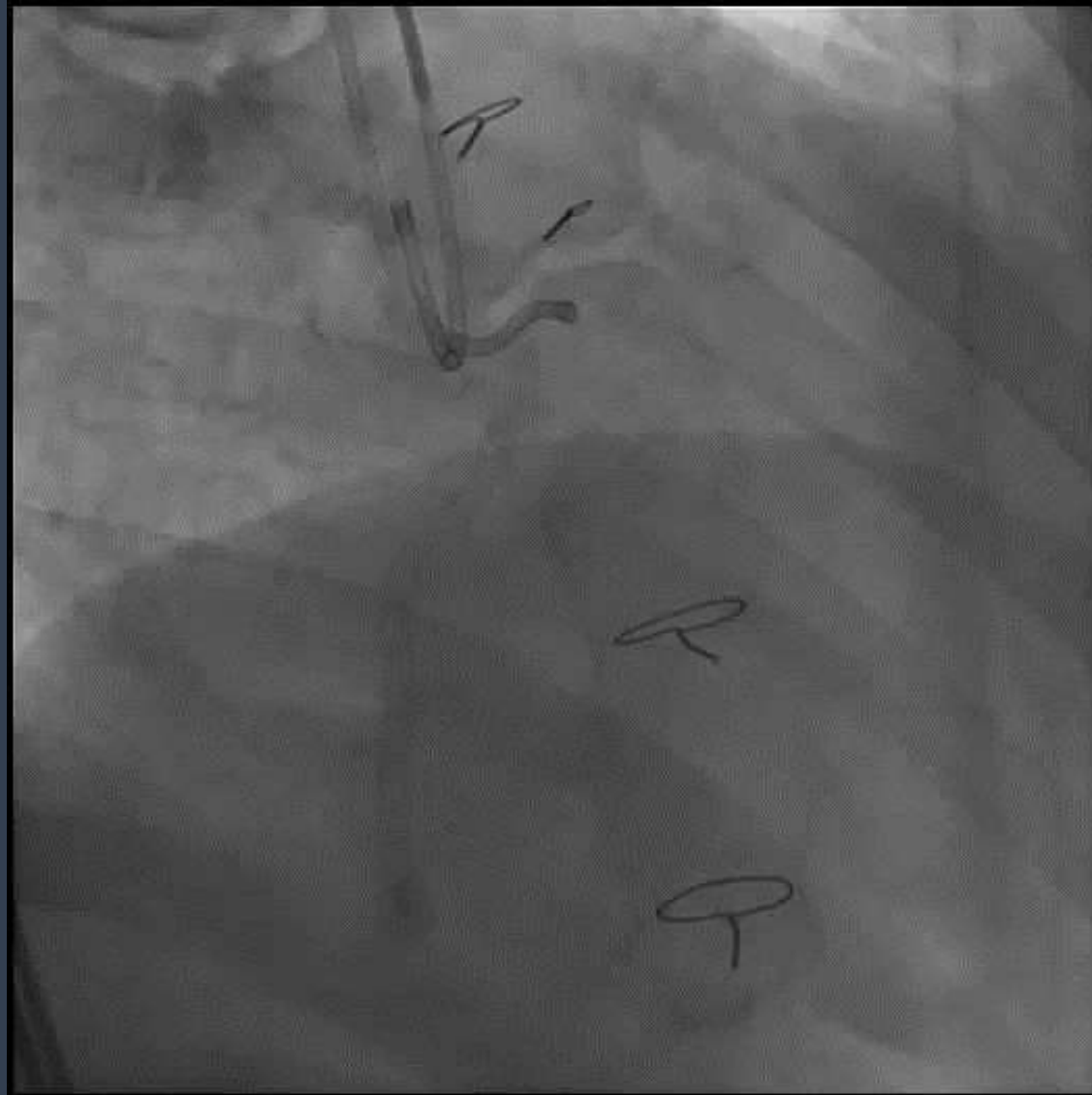


reverse CART  
subsequent to failed retrograde wiring

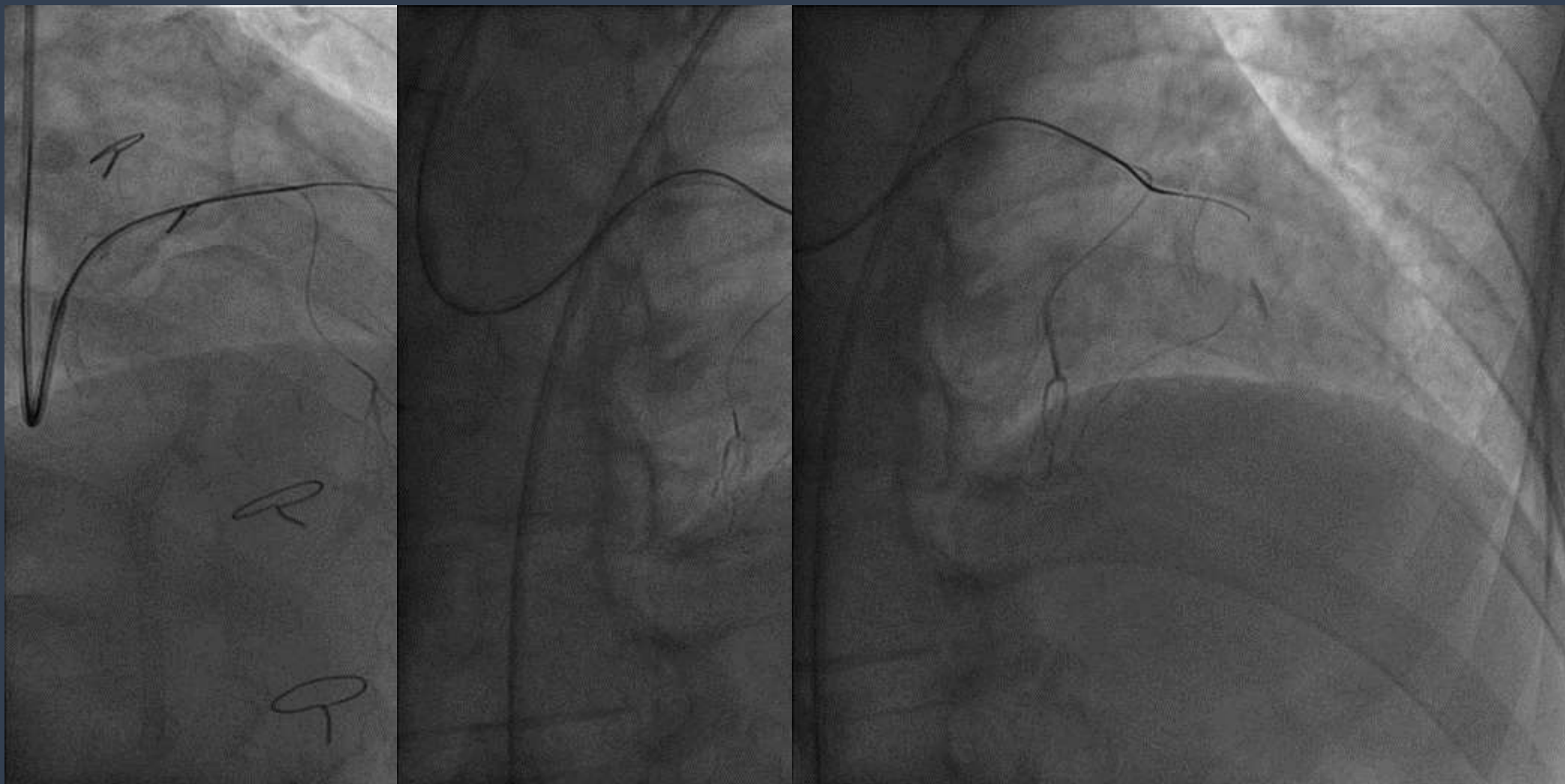
Semilunar space



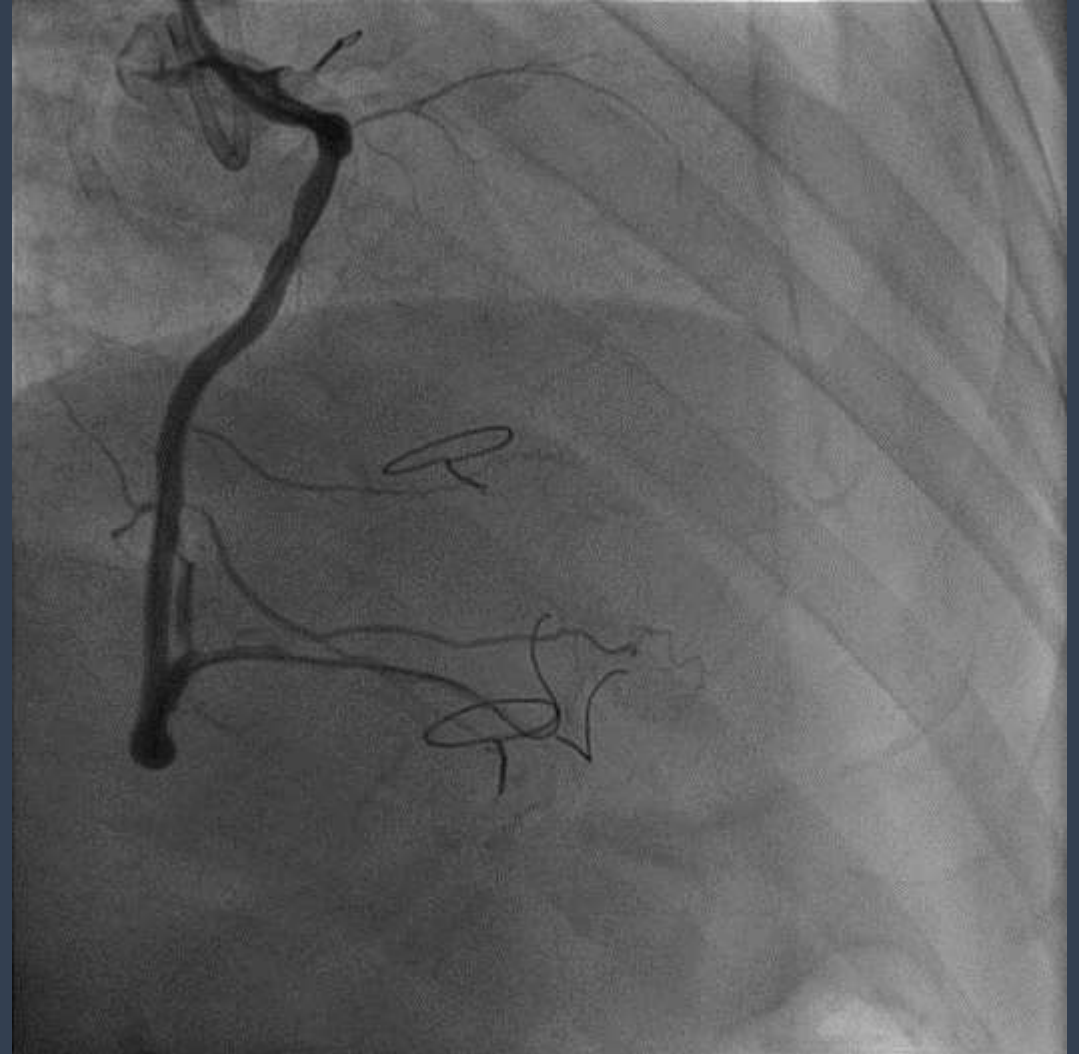
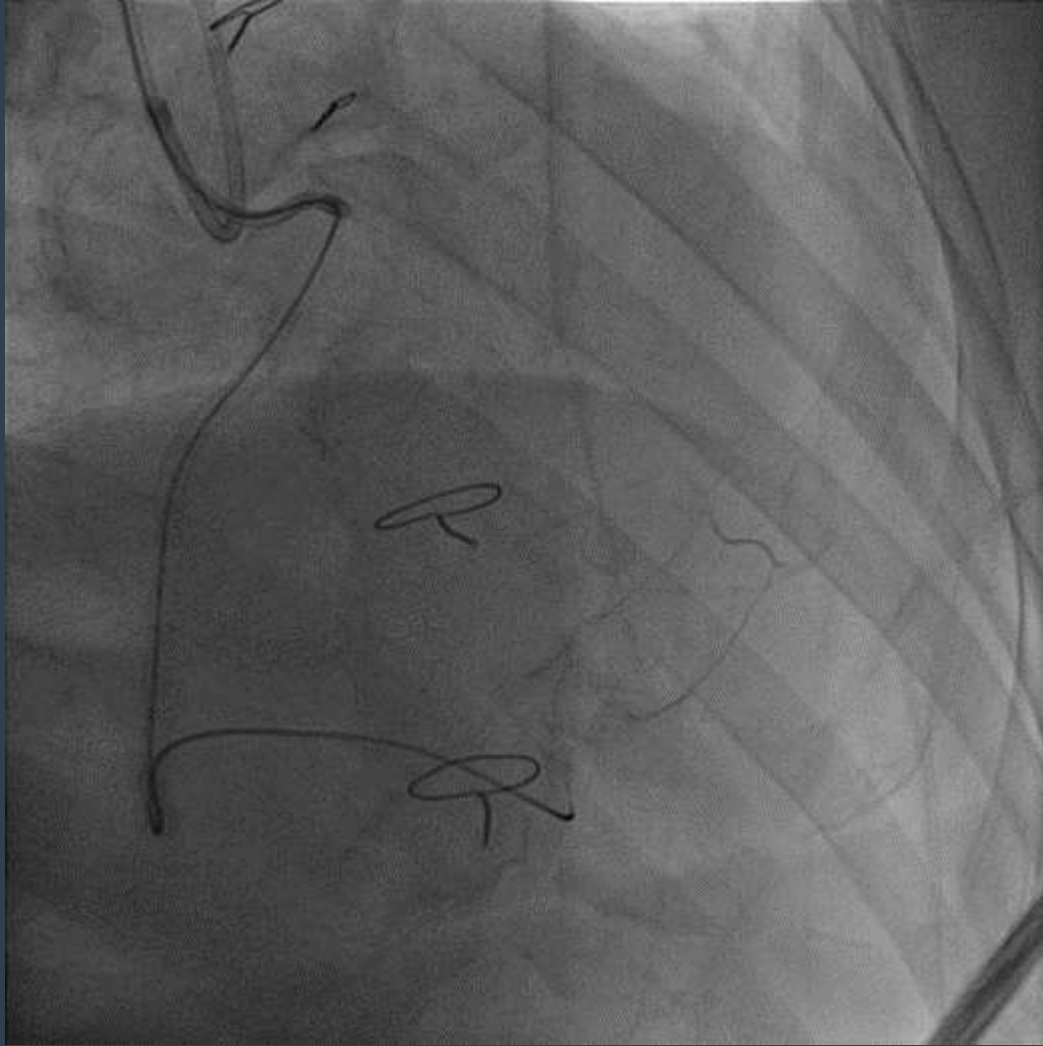
# LAD mid short CTO in Asian WS



# Antegrade wiring

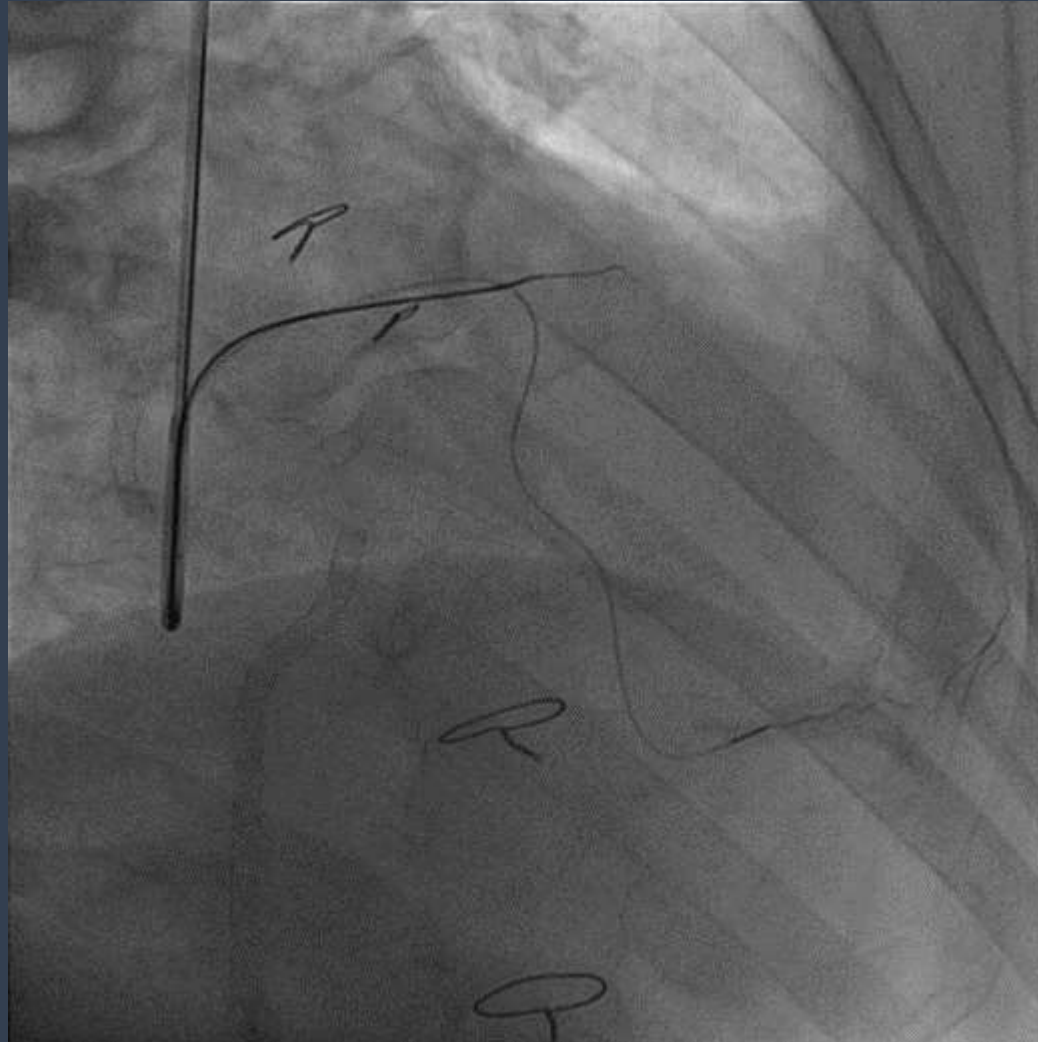


# Retrograde wiring from RCA

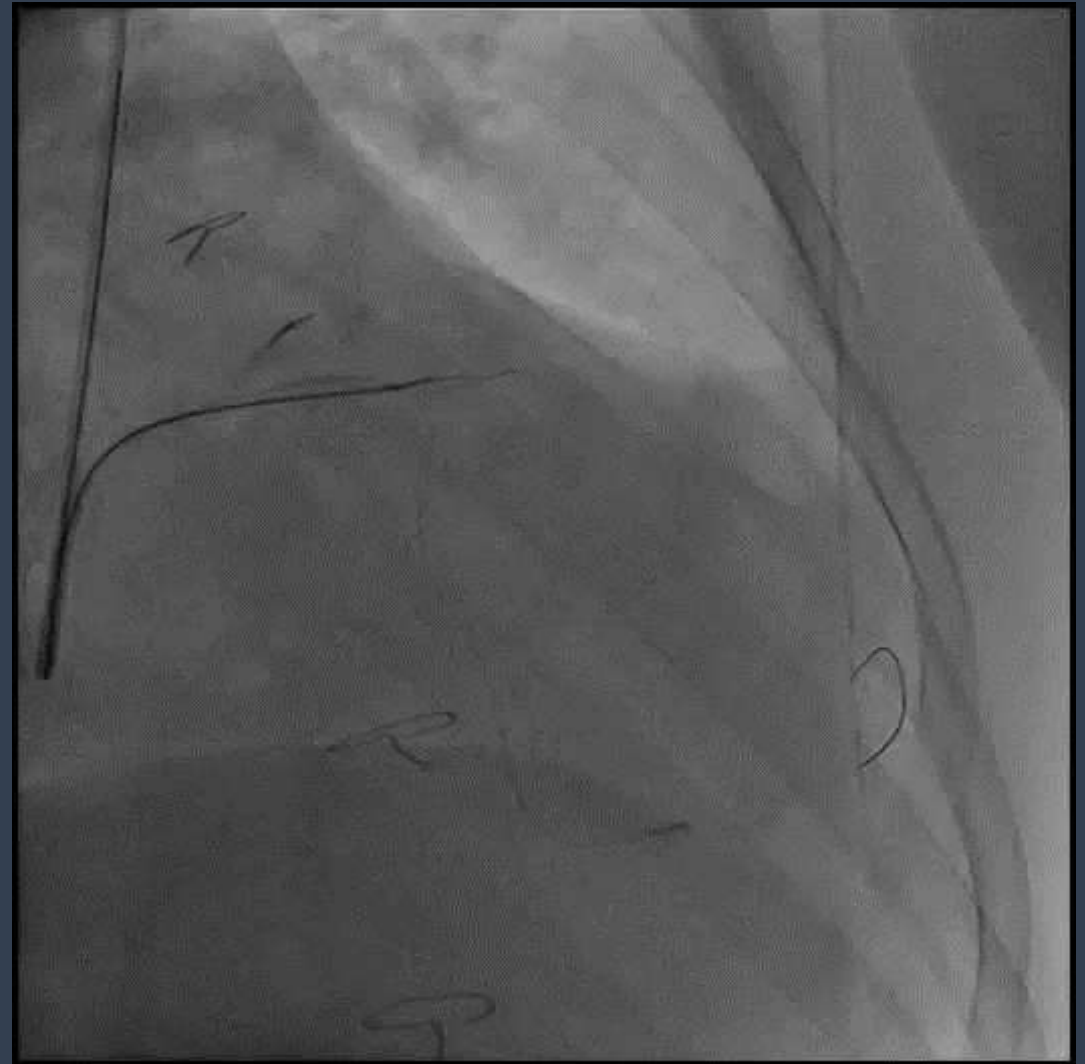
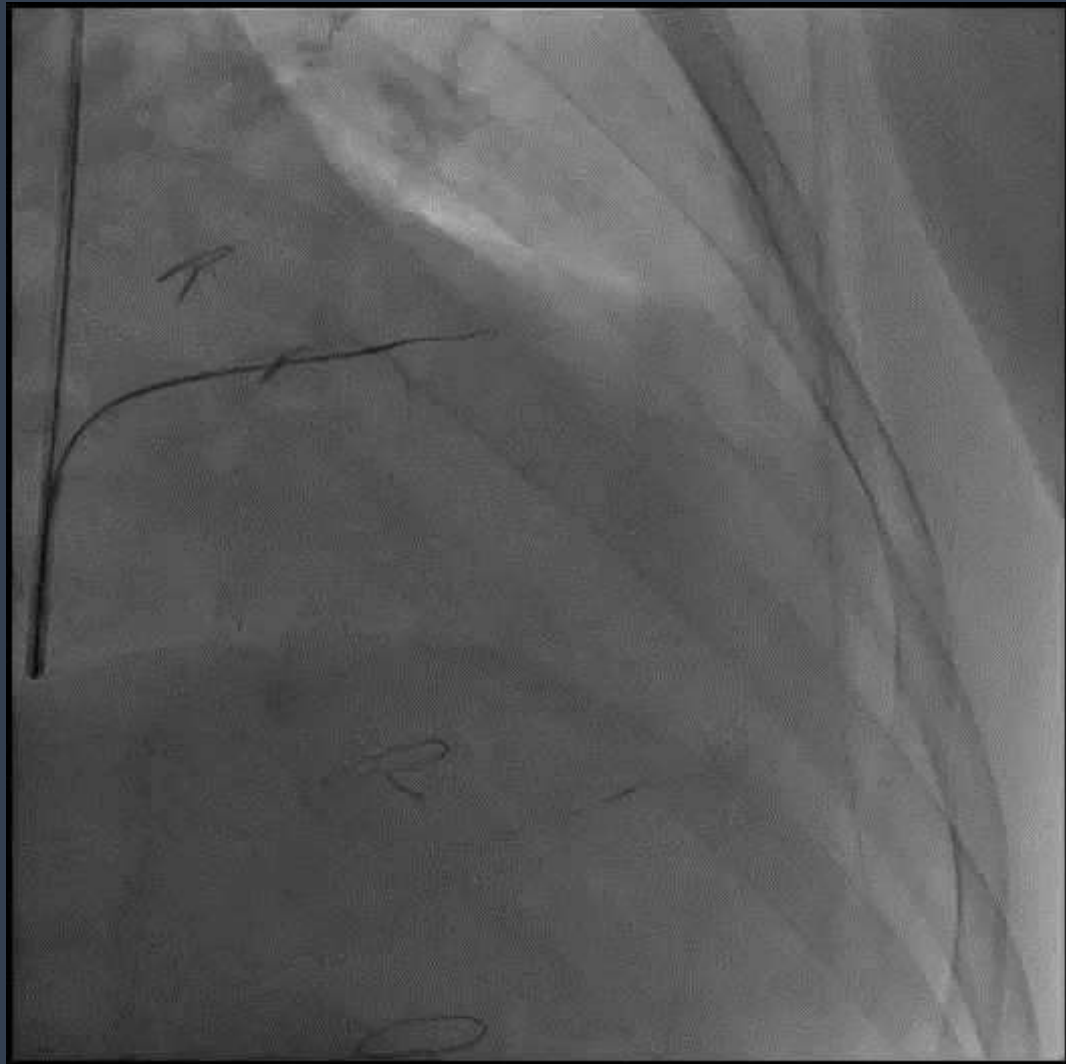




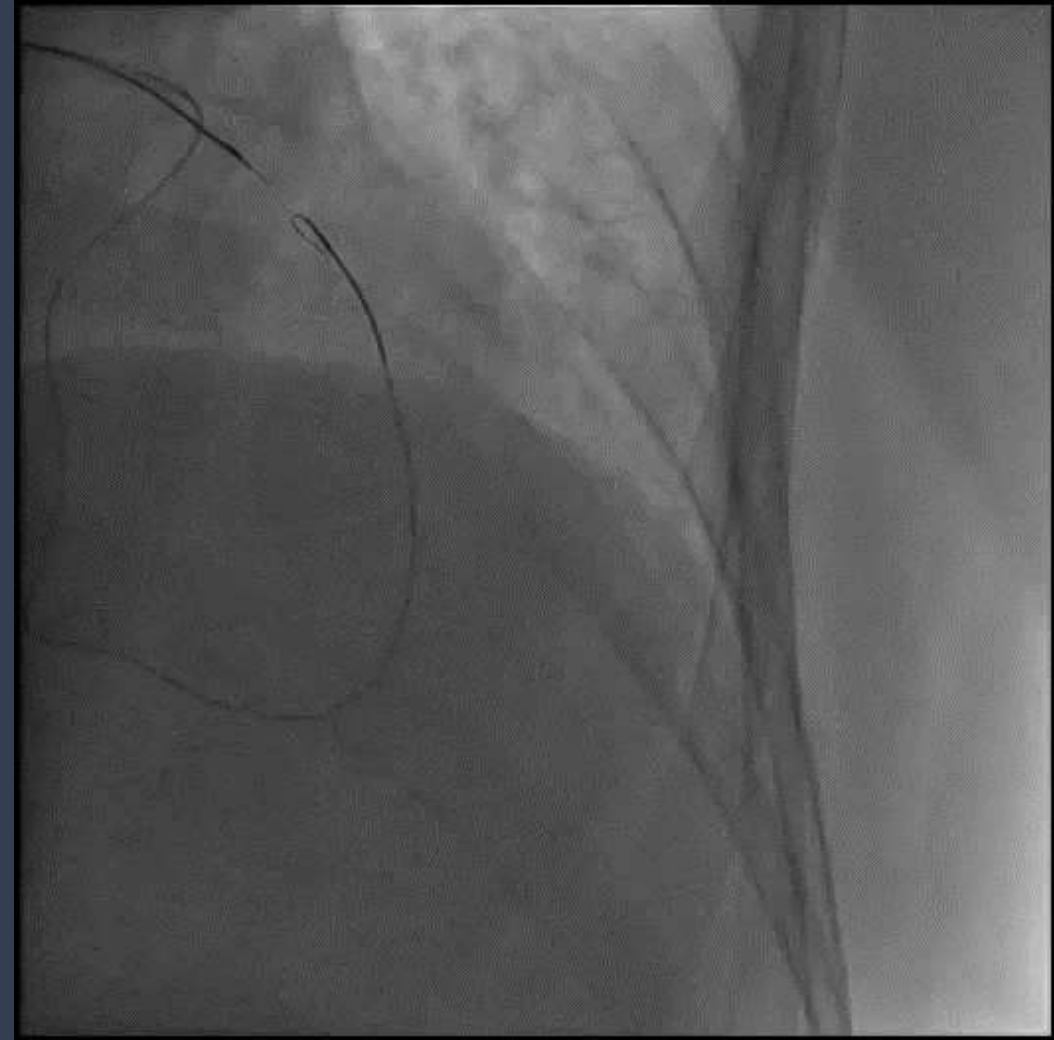
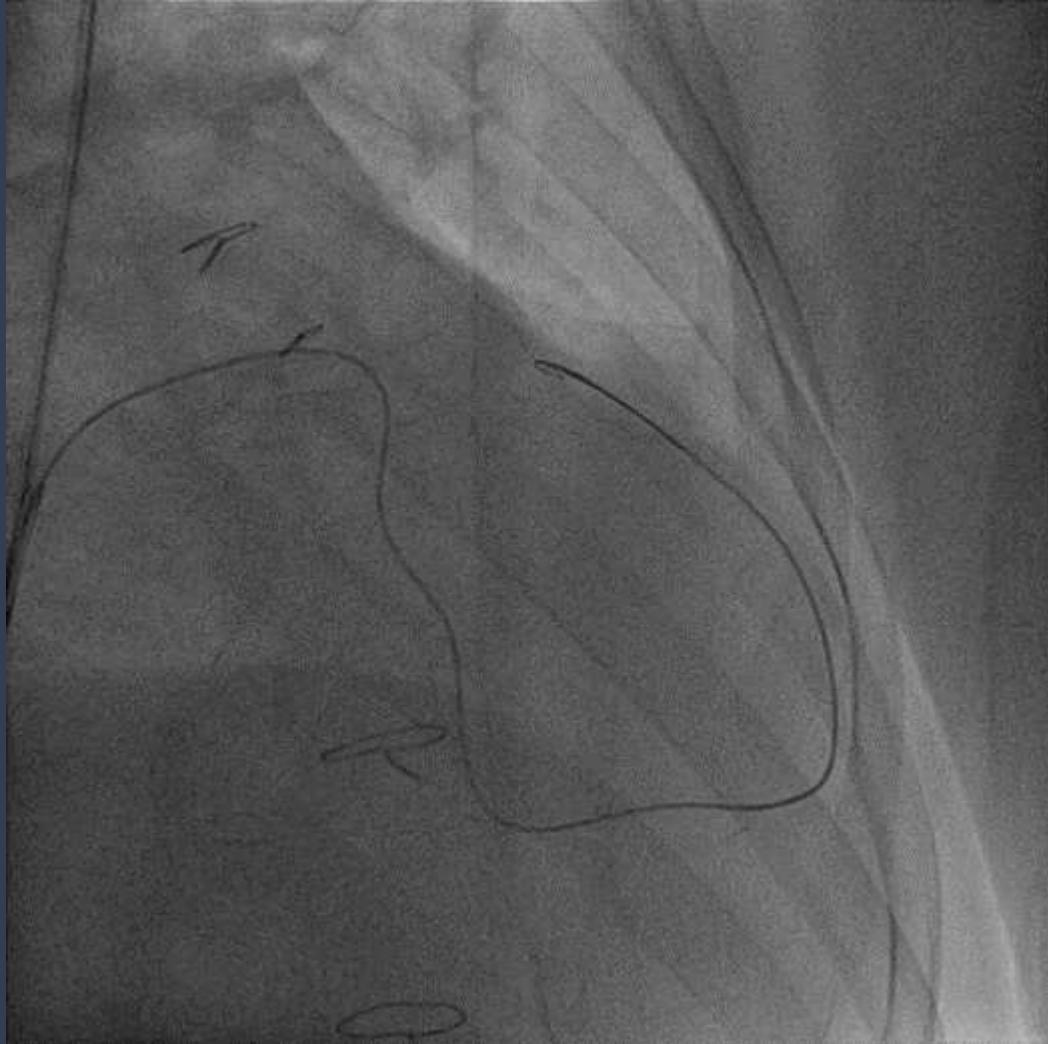
# Retrograde wiring from ipsilateral



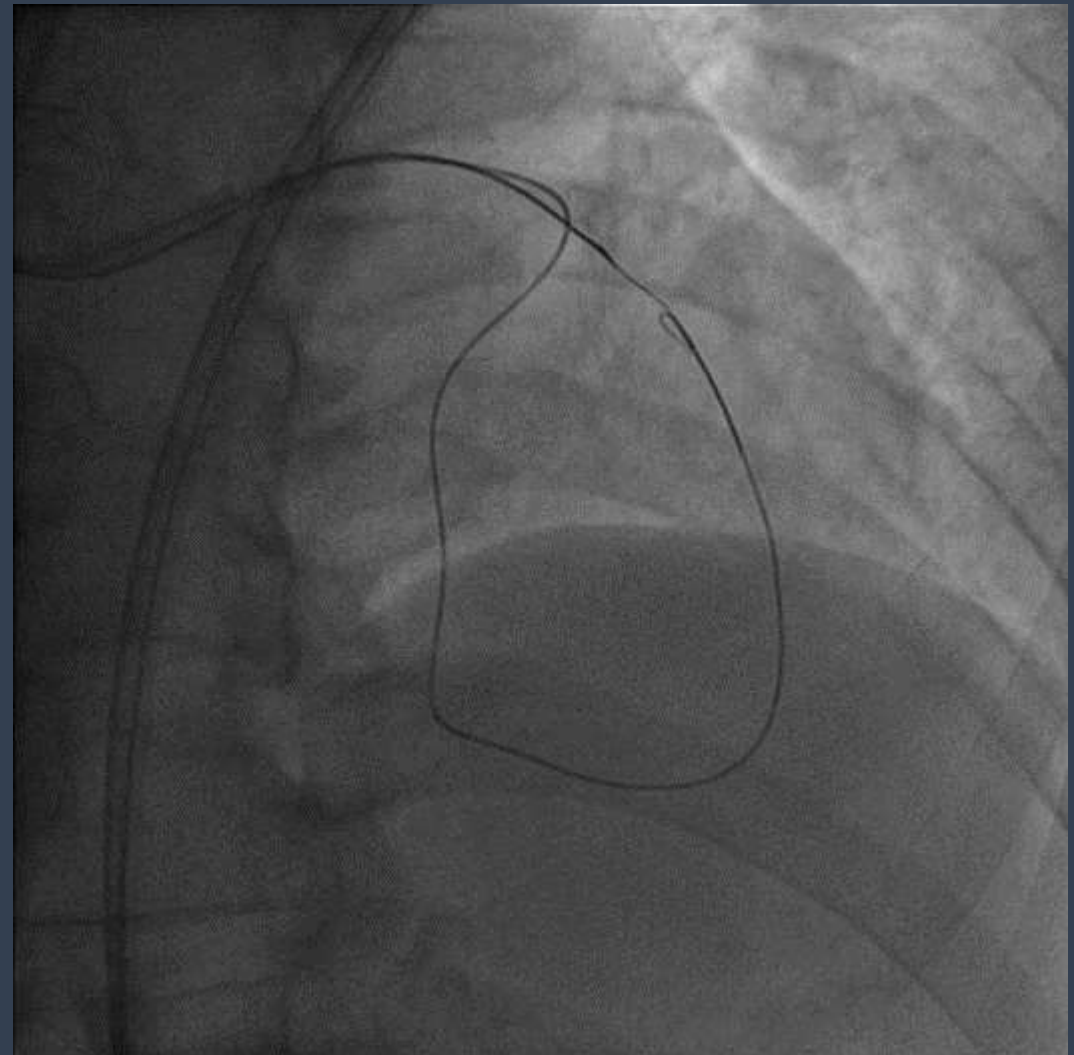
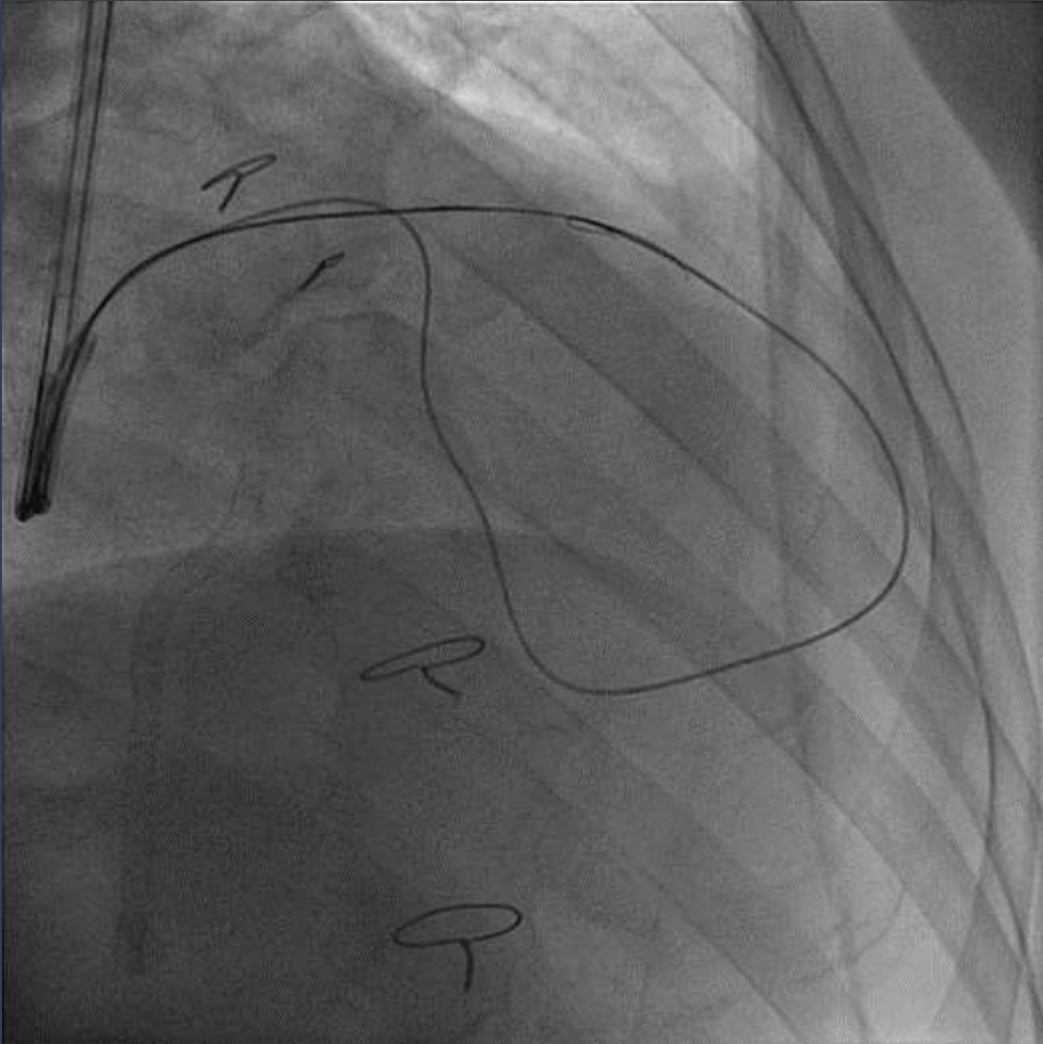
# Retrograde wiring from ipsilateral connection



# Anterograde setup for contemporary reverse CART

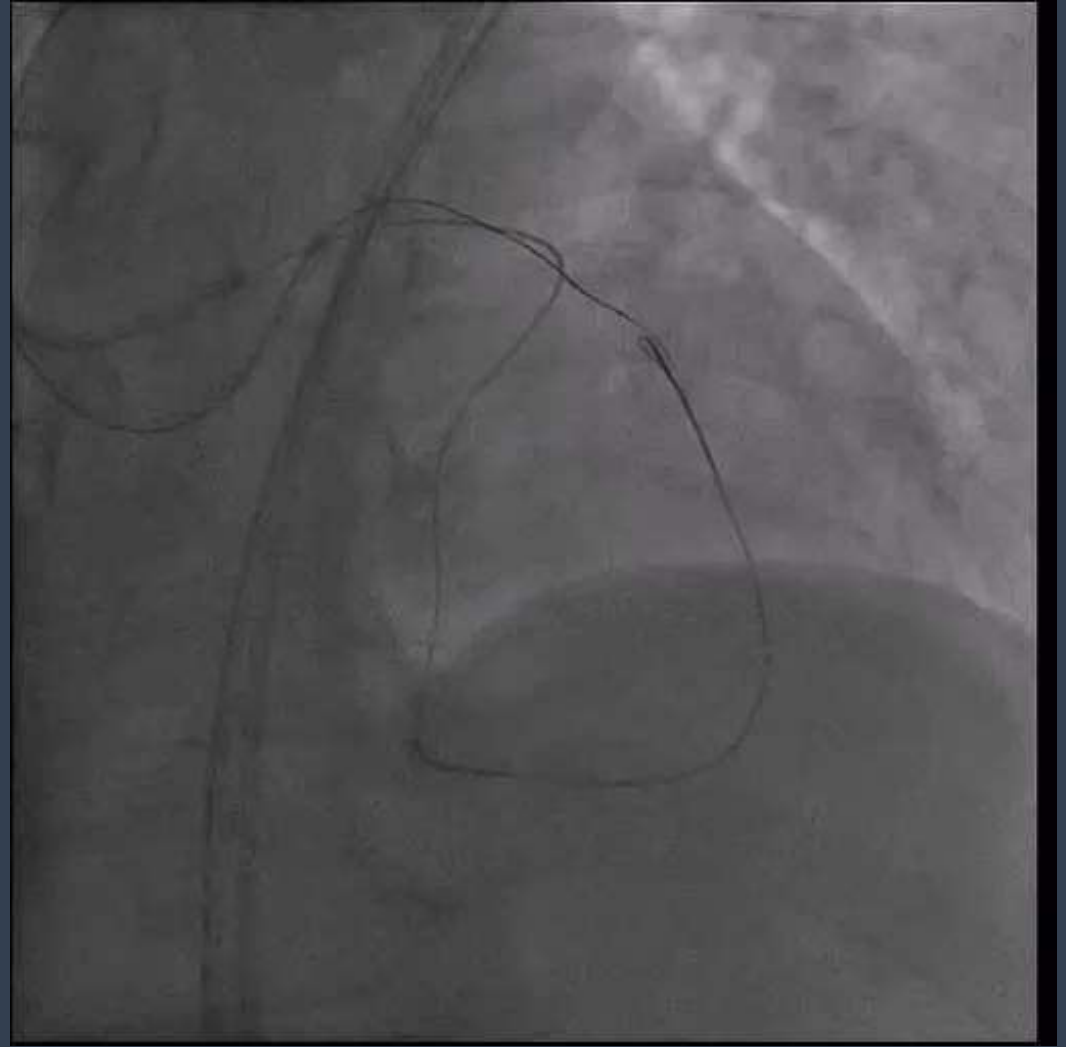
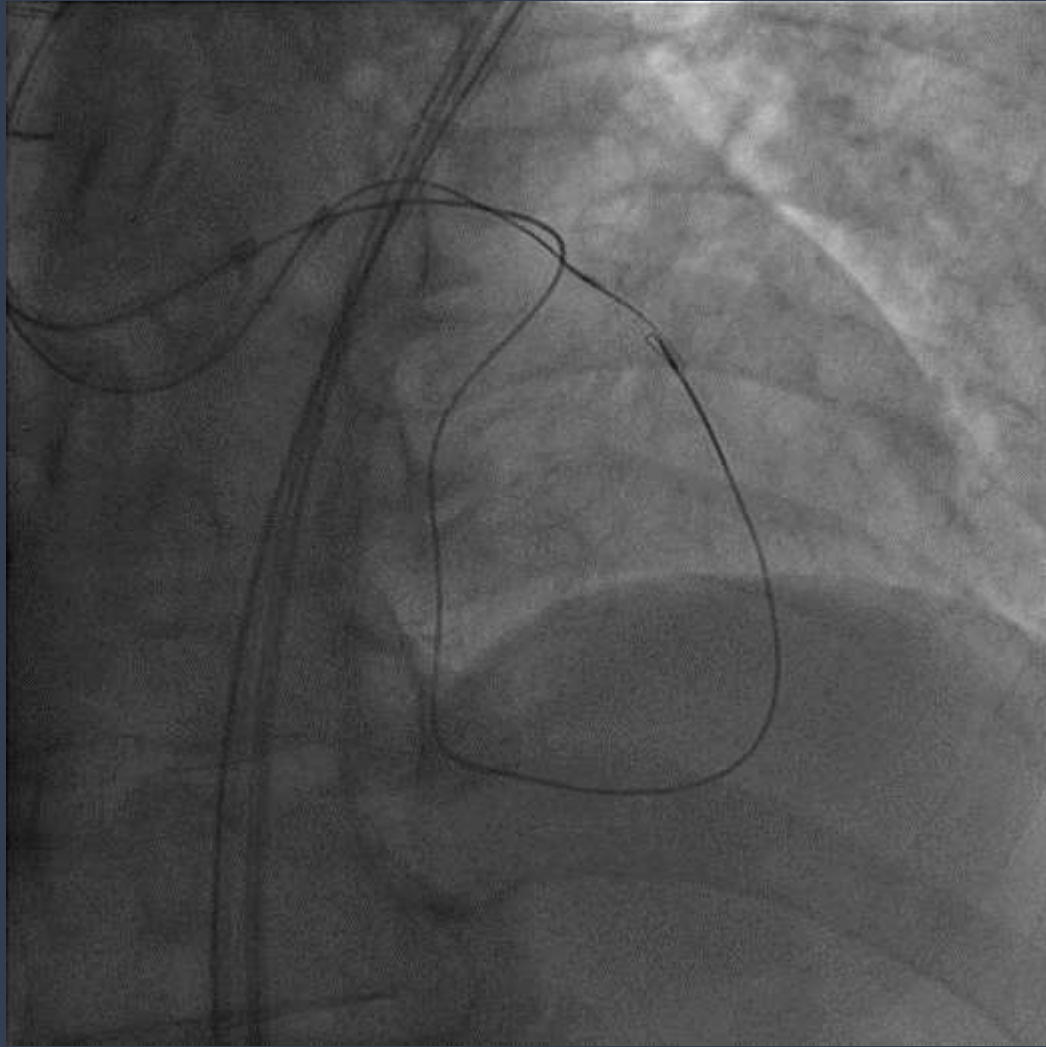


# Anterograde setup for contemporary reverse CART

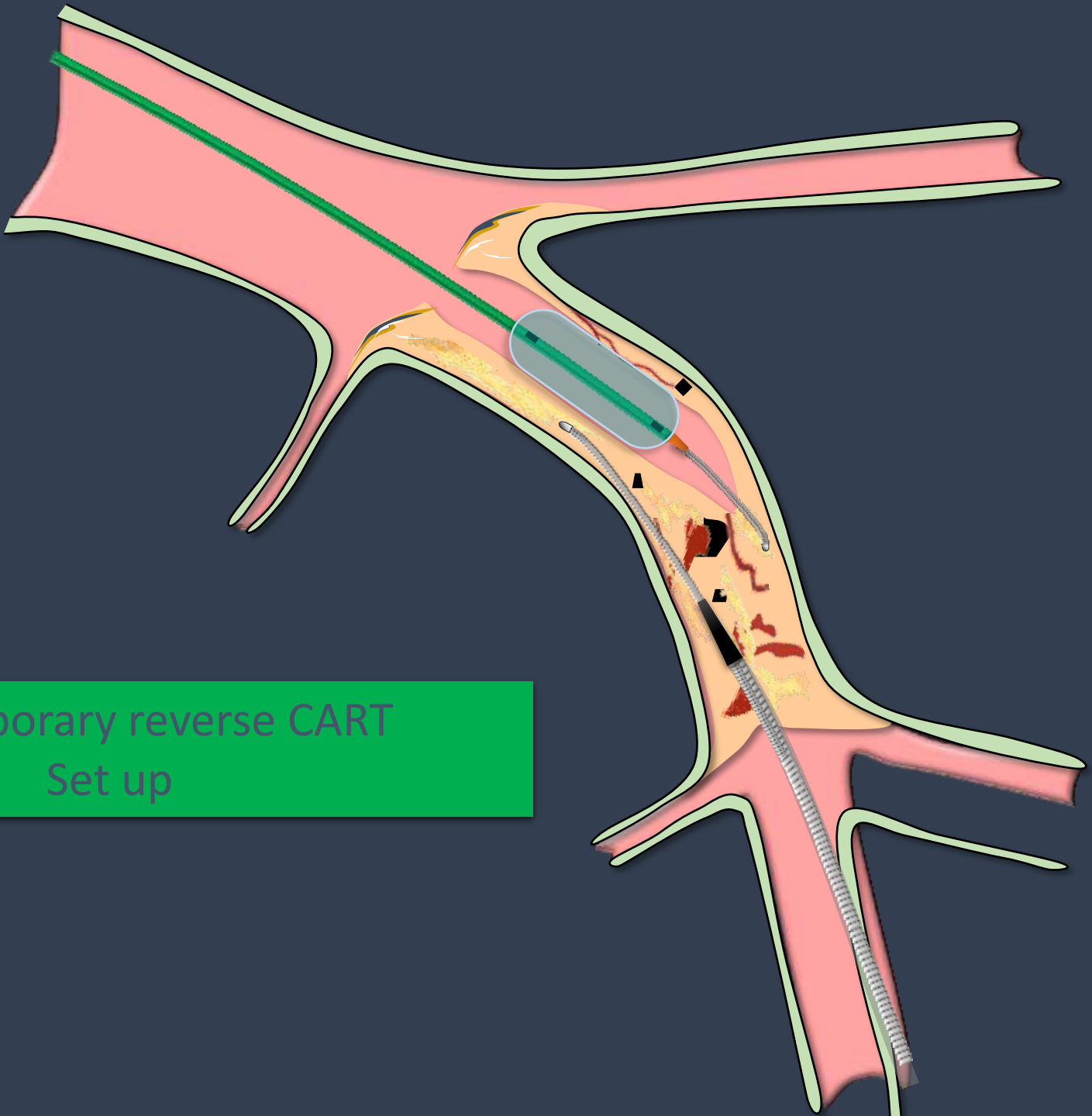




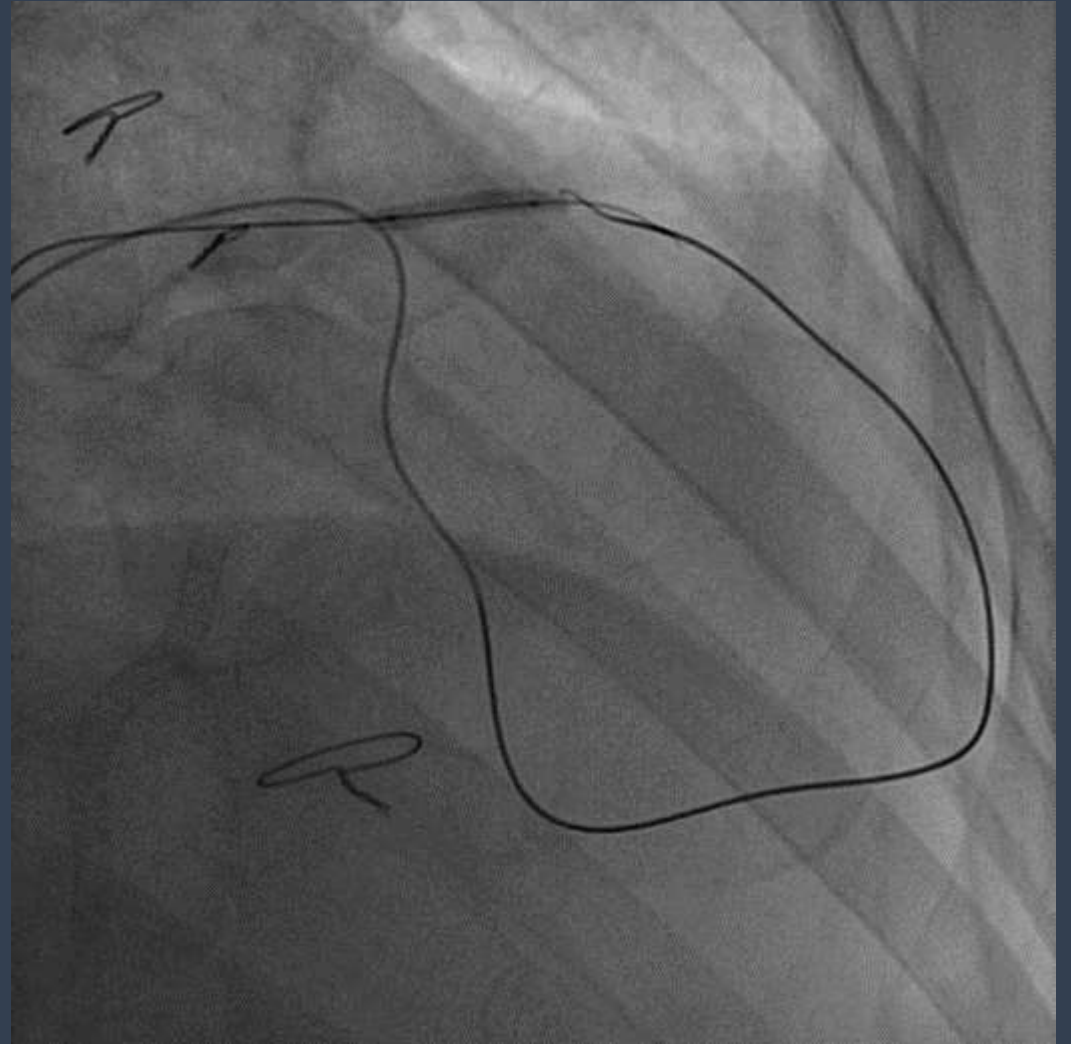
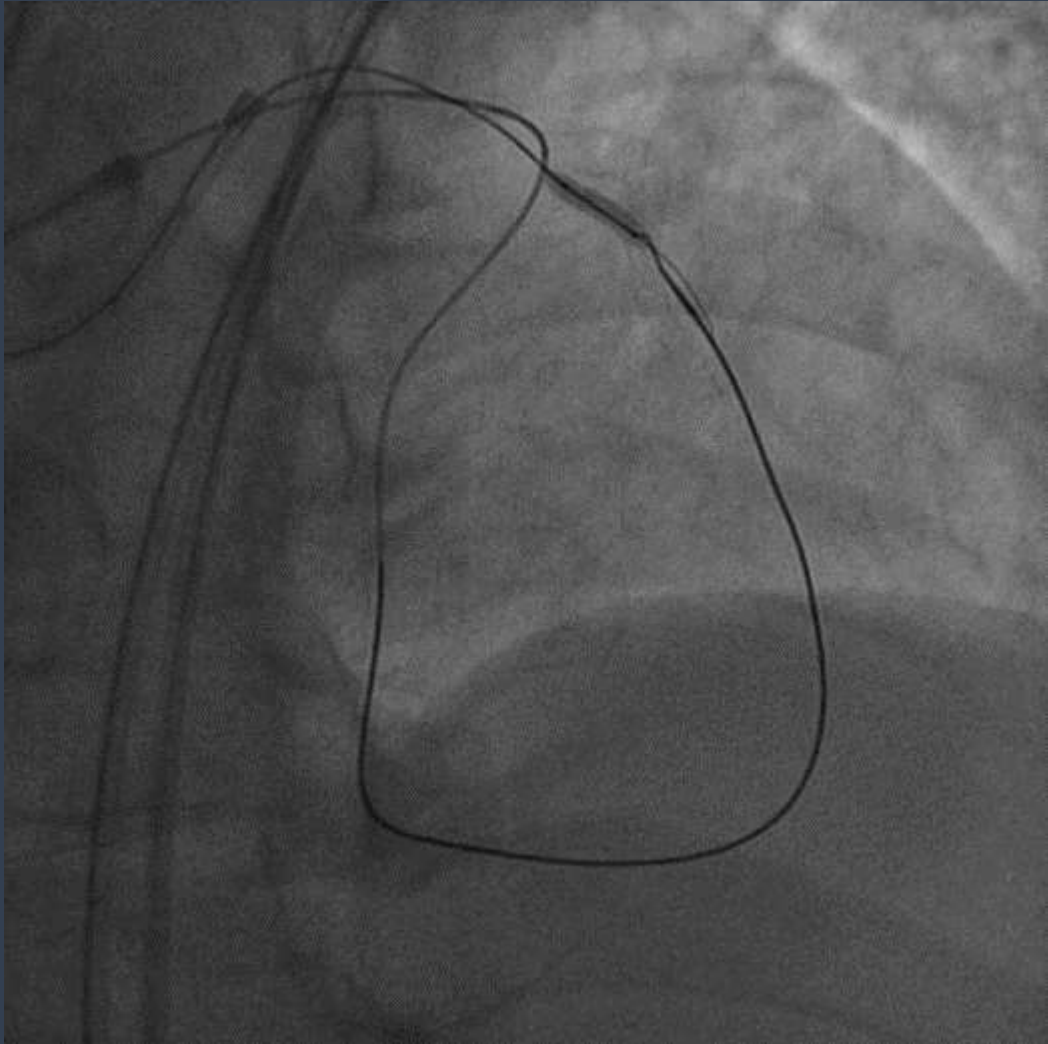
# balloon setup for contemporary reverse CART



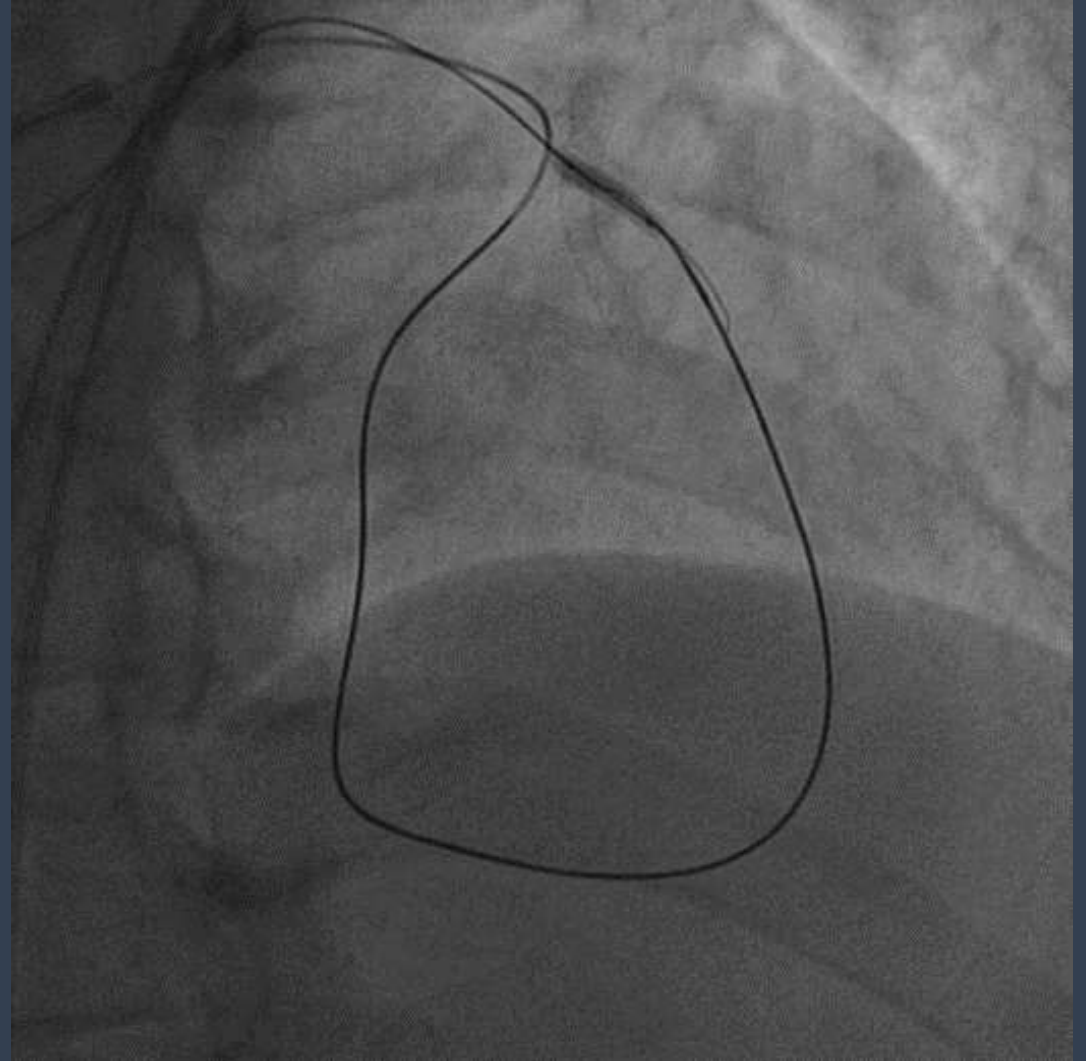
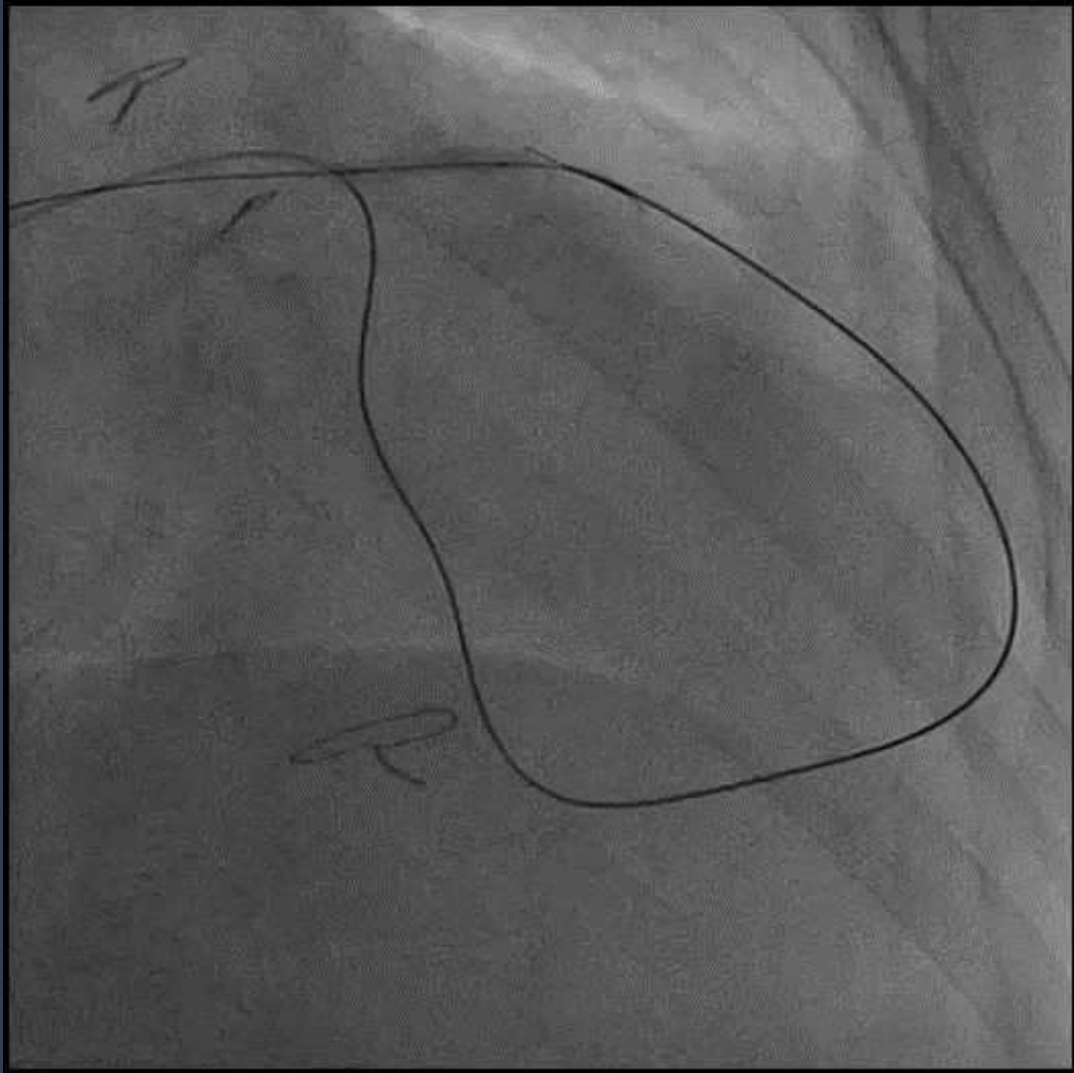
Contemporary reverse CART  
Set up



# contemporary reverse CART

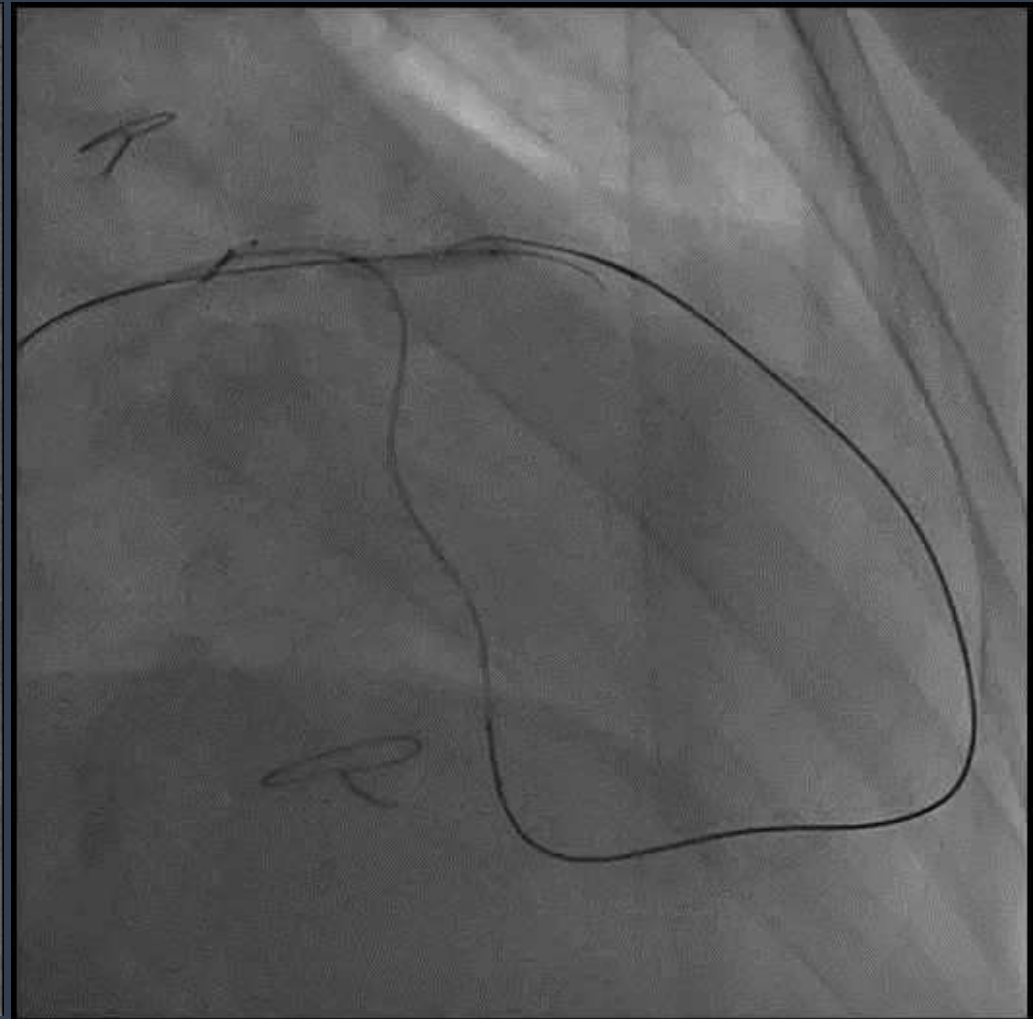
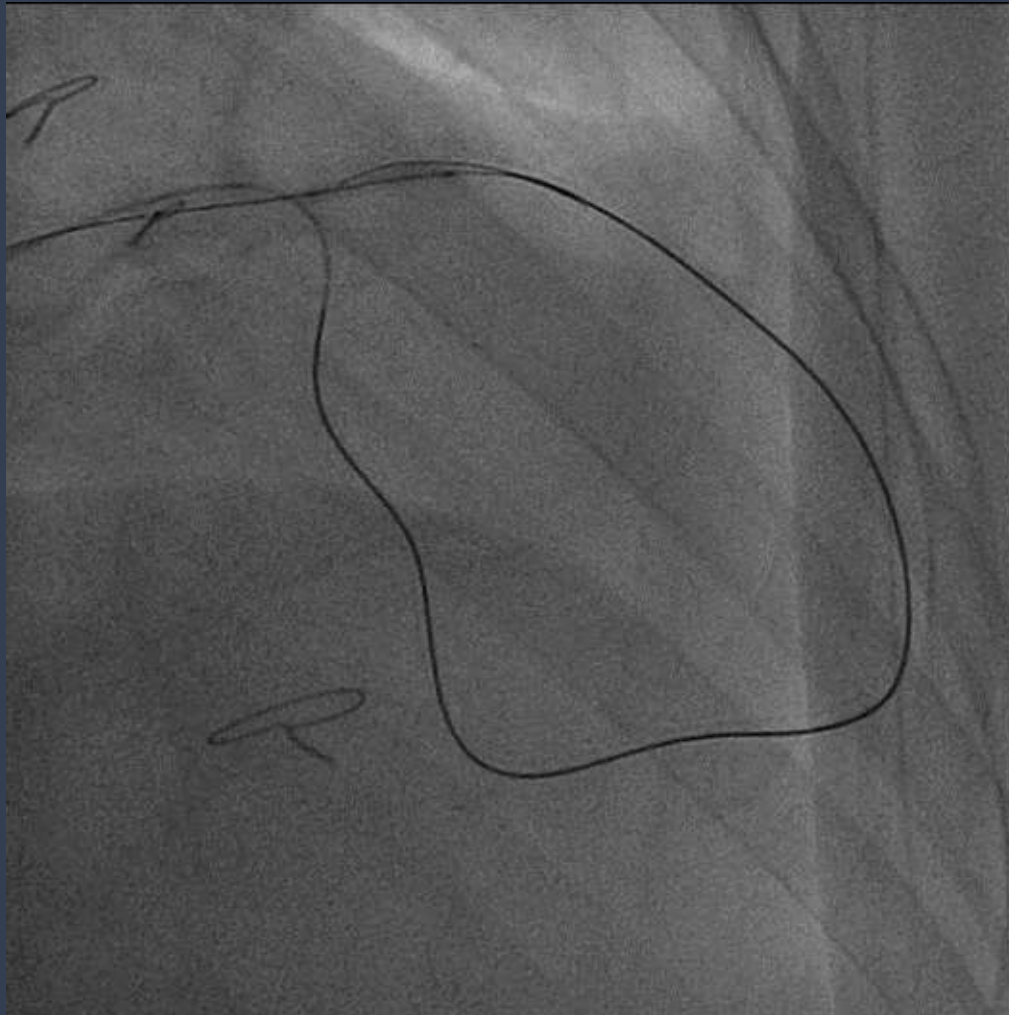


# contemporary reverse CART

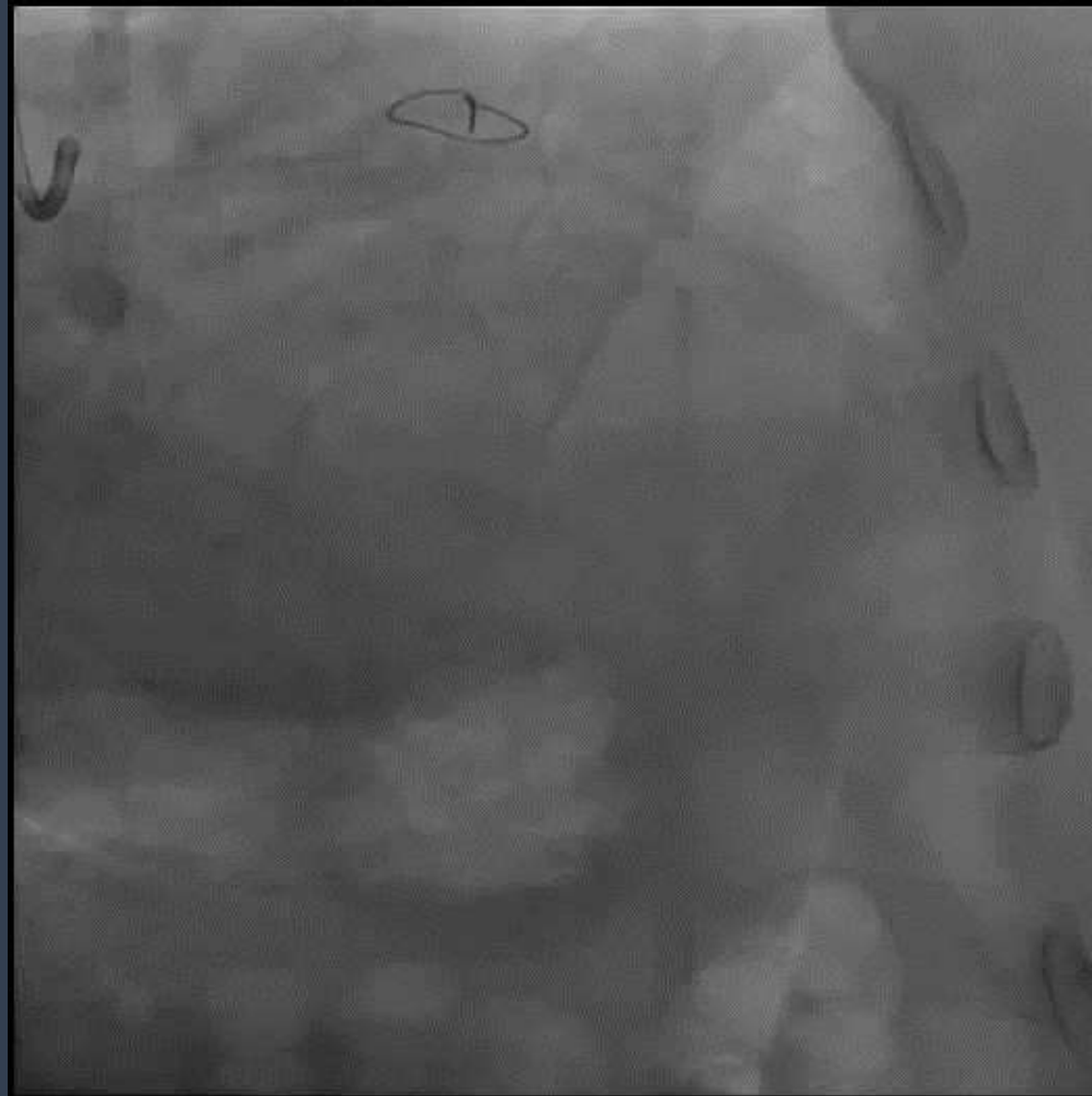




# contemporary reverse CART



# Final angiogram



## original reverse CART

## contemporary reverse CART

Subsequent to failed direct crossing

primary strategy for CTO crossing

Retro. Wire

polymer wire  $\Leftrightarrow$  stiff wire

Gaia 2<sup>nd</sup>

Balloon size

bigger the better

moderate size

IVUS use

recommended

recommended

Success rate

high

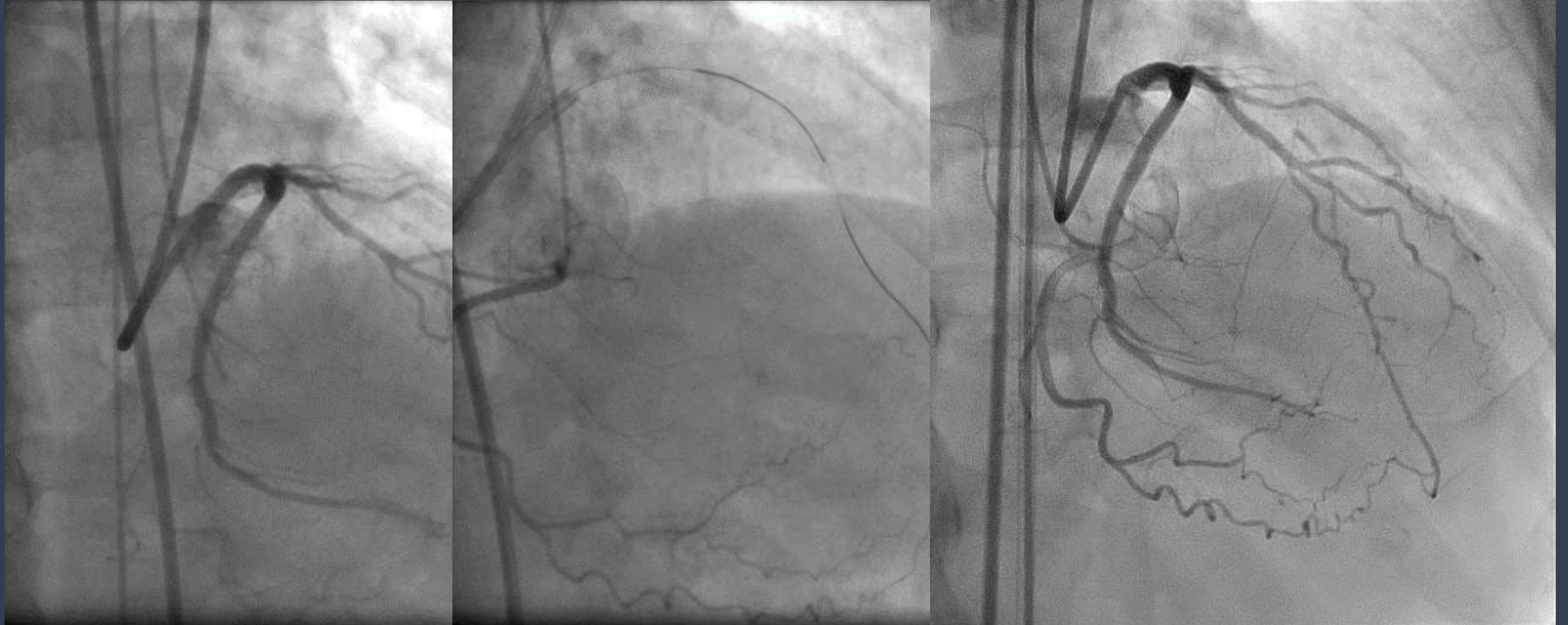
high

Procedure  
time

often very long

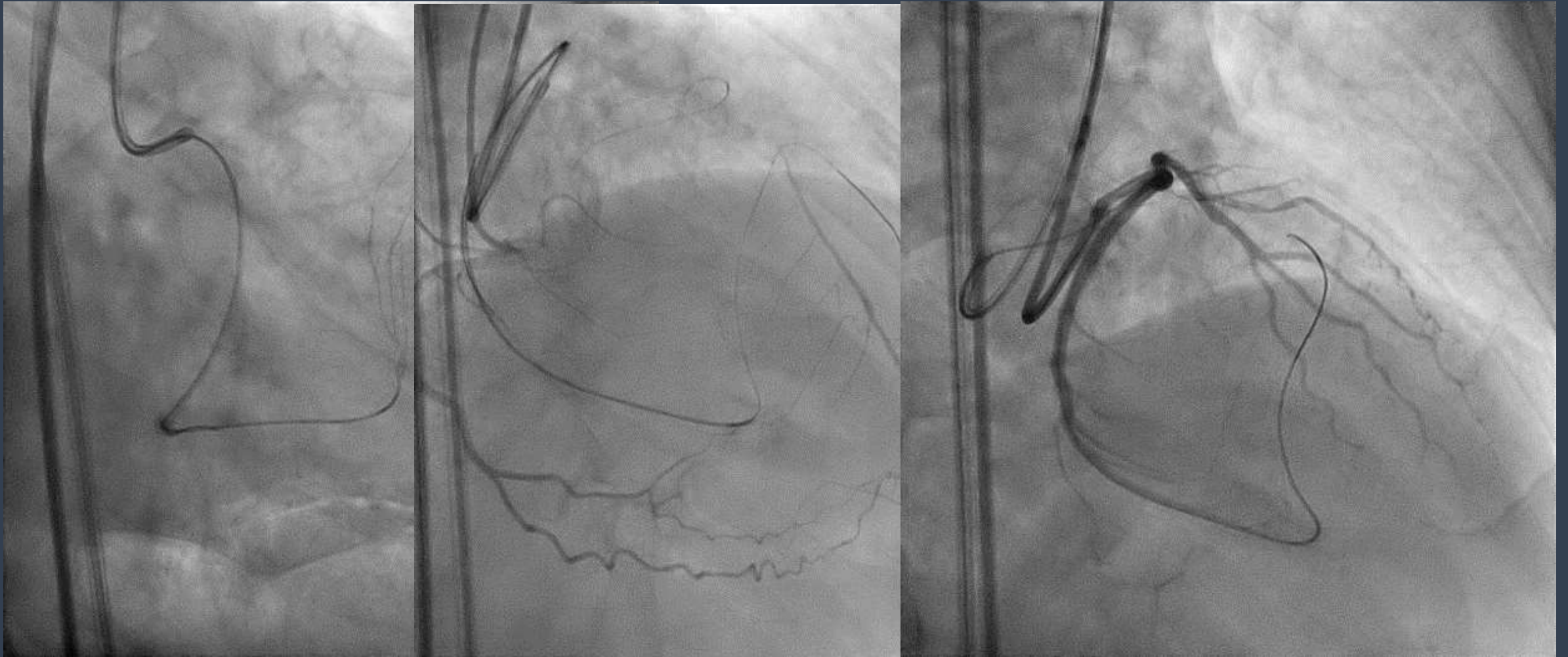
short

# LAD mid short CTO (re-attempt) in local WS

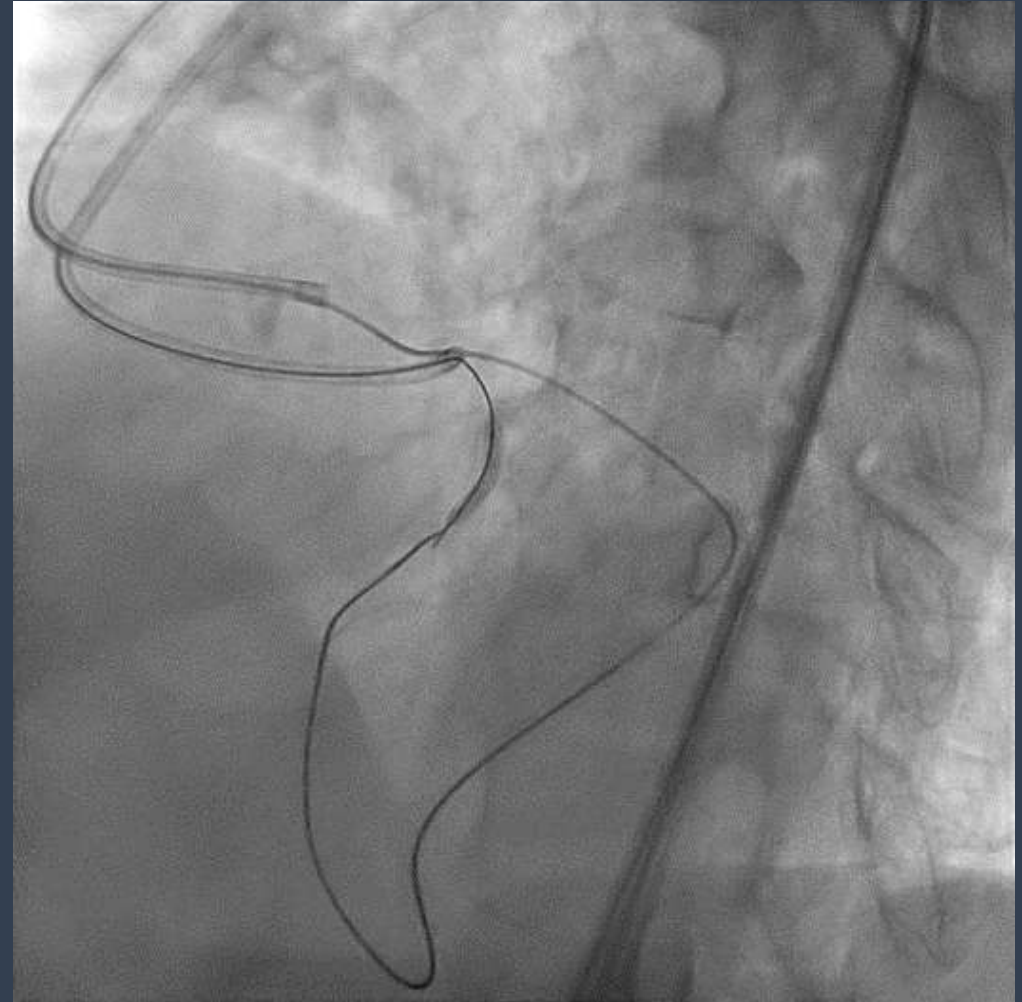
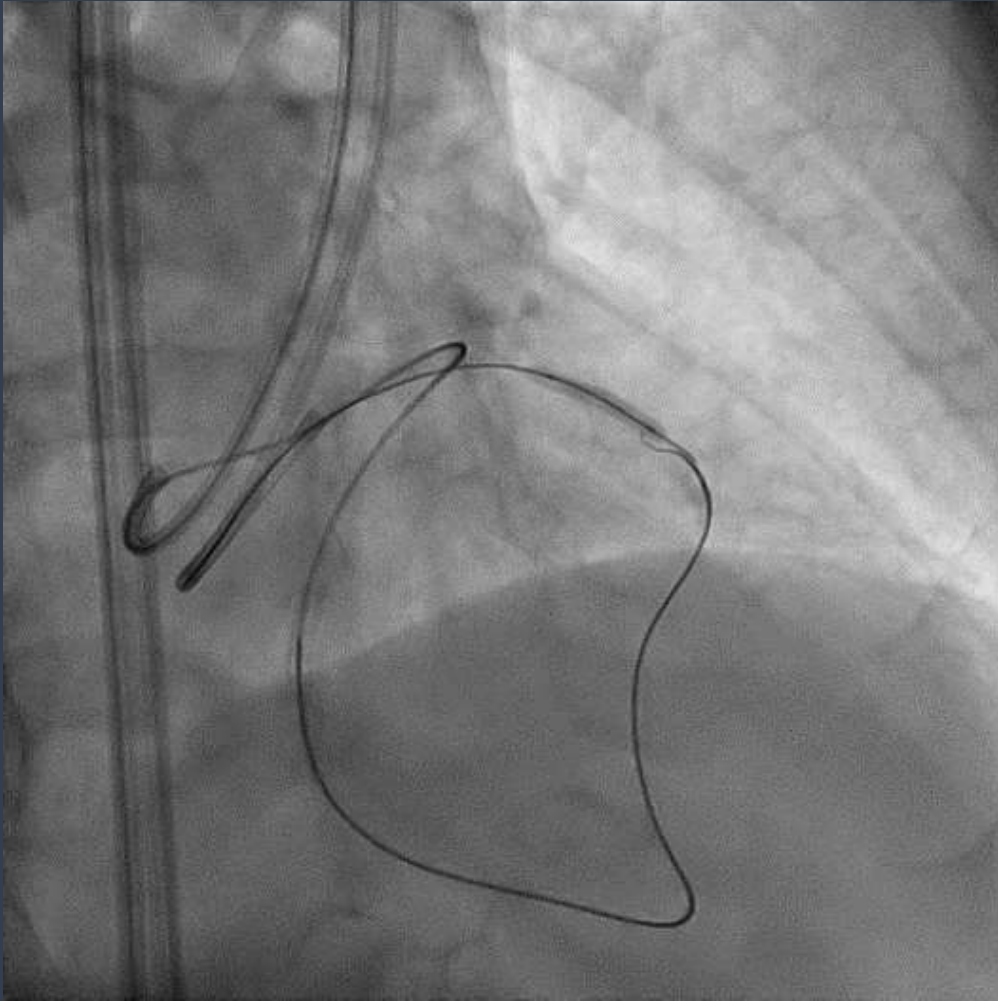




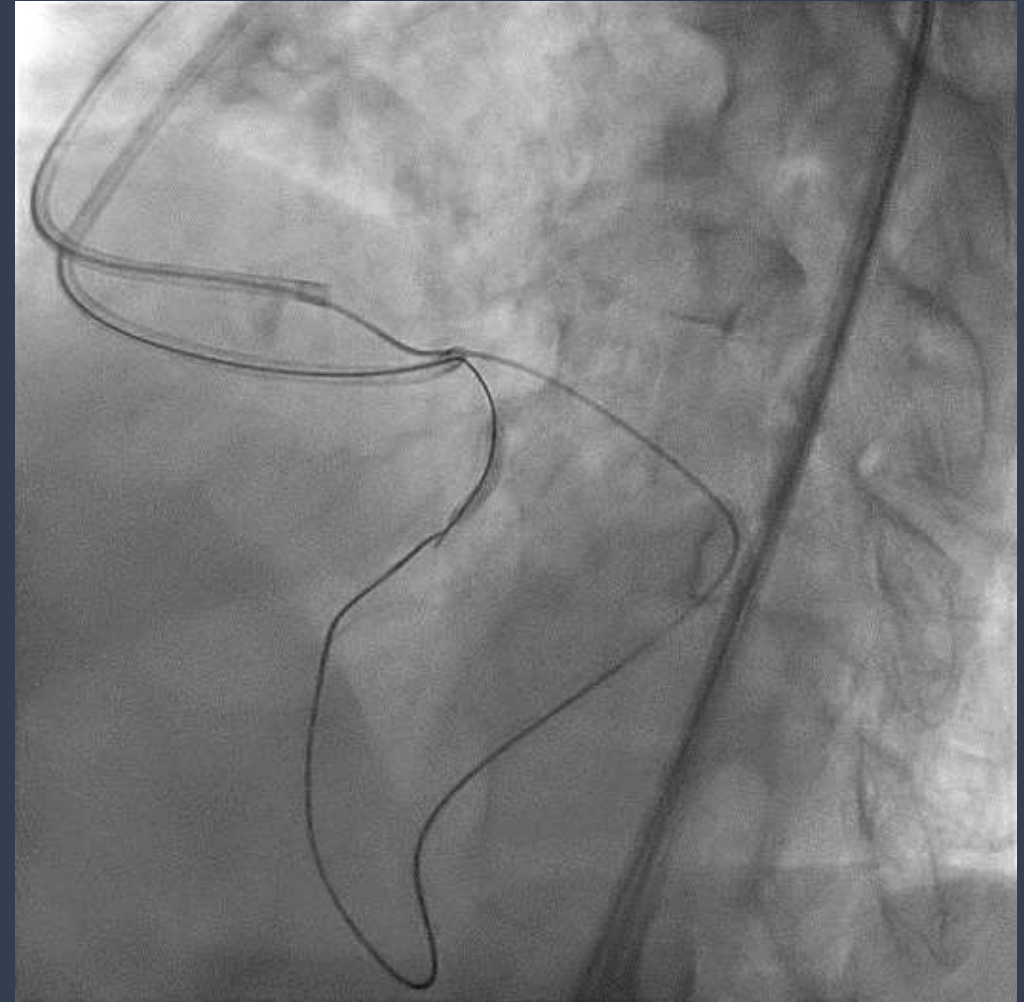
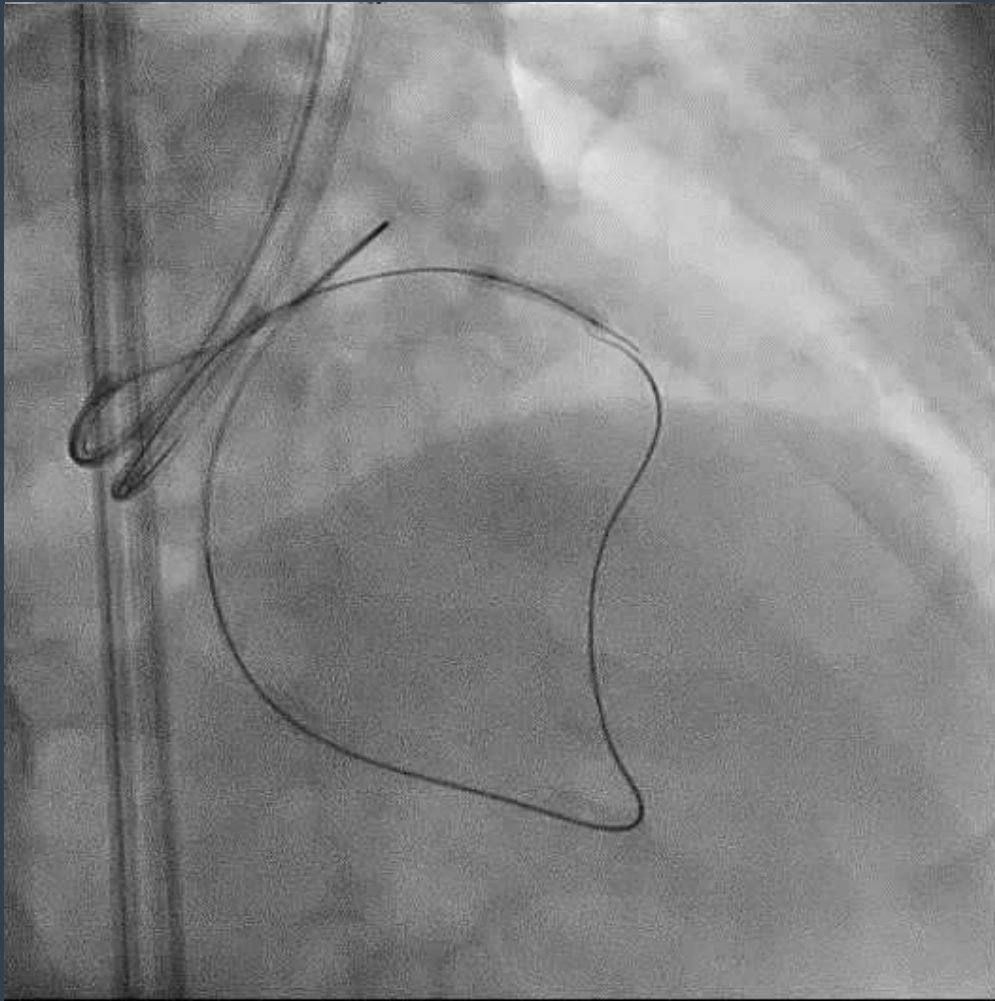
# Retrograde wiring and microcatheter delivery



# contemporary reverse CART procedure

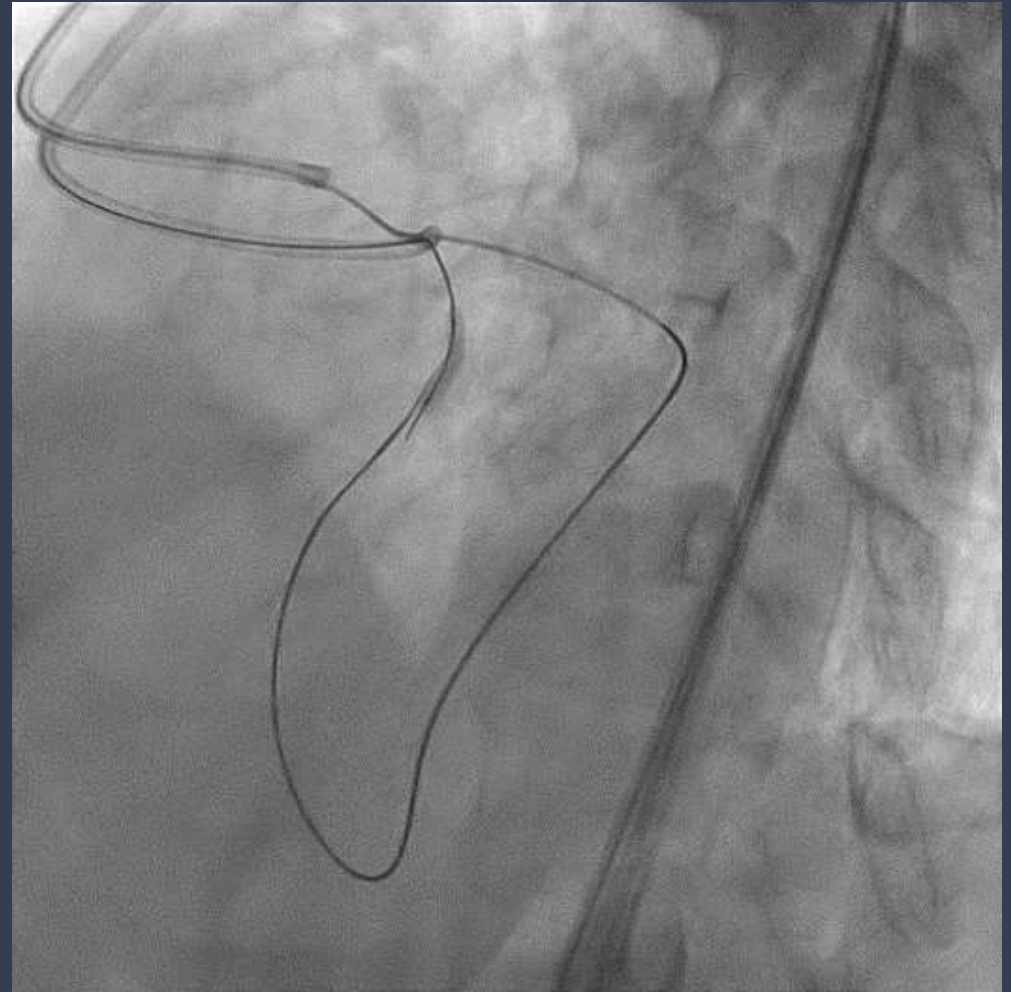
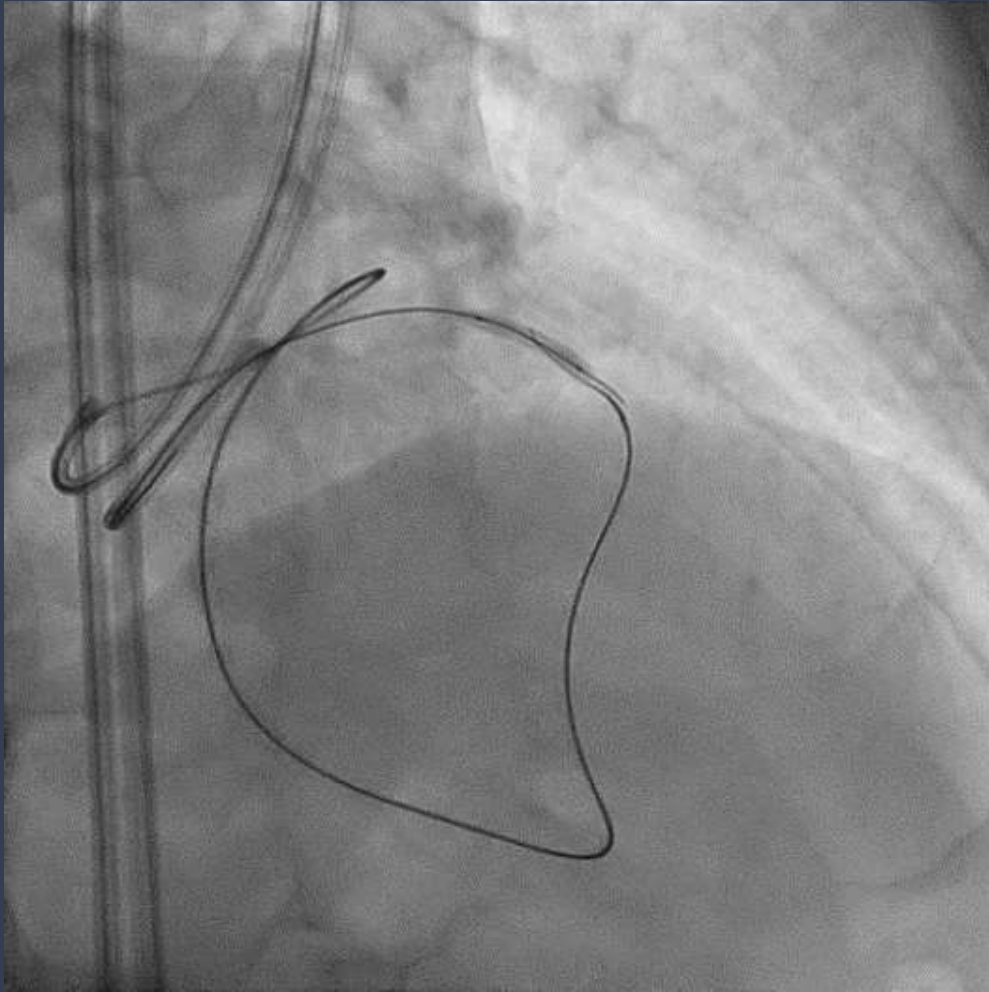


# contemporary reverse CART procedure

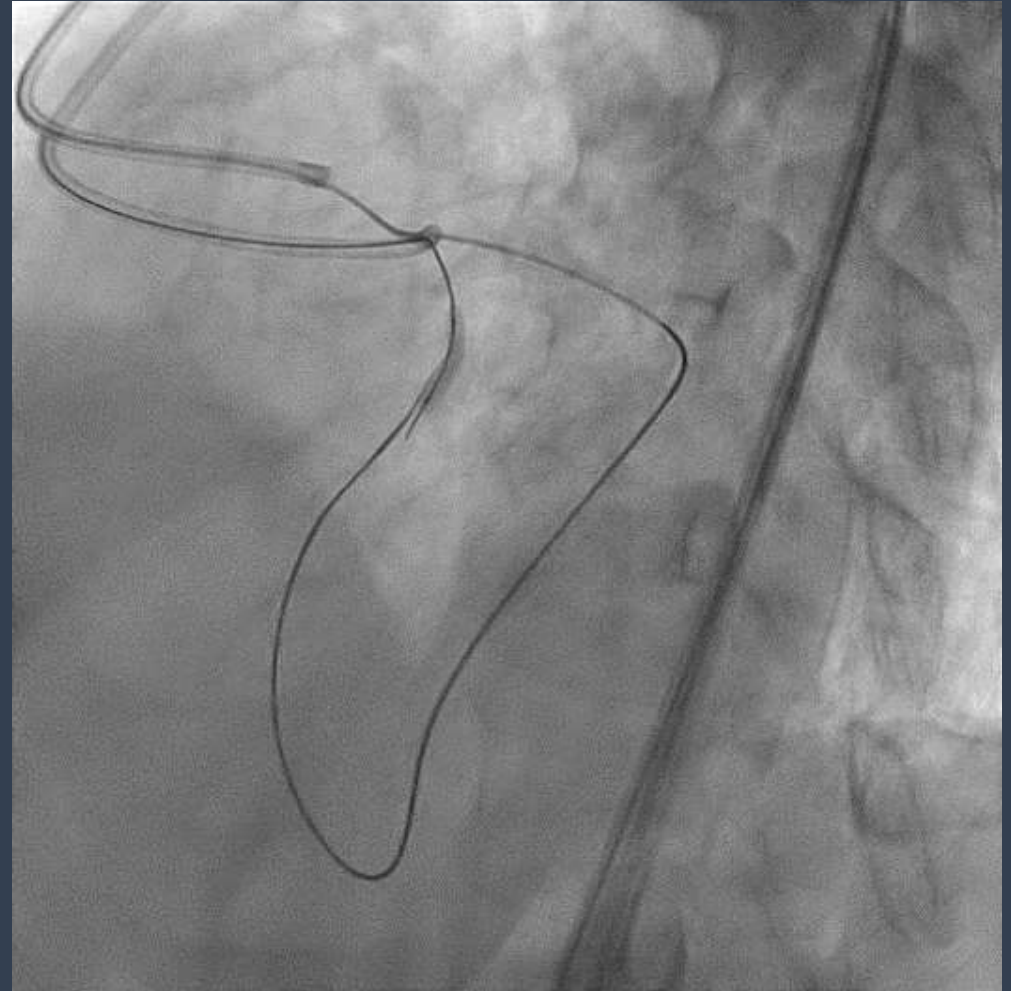
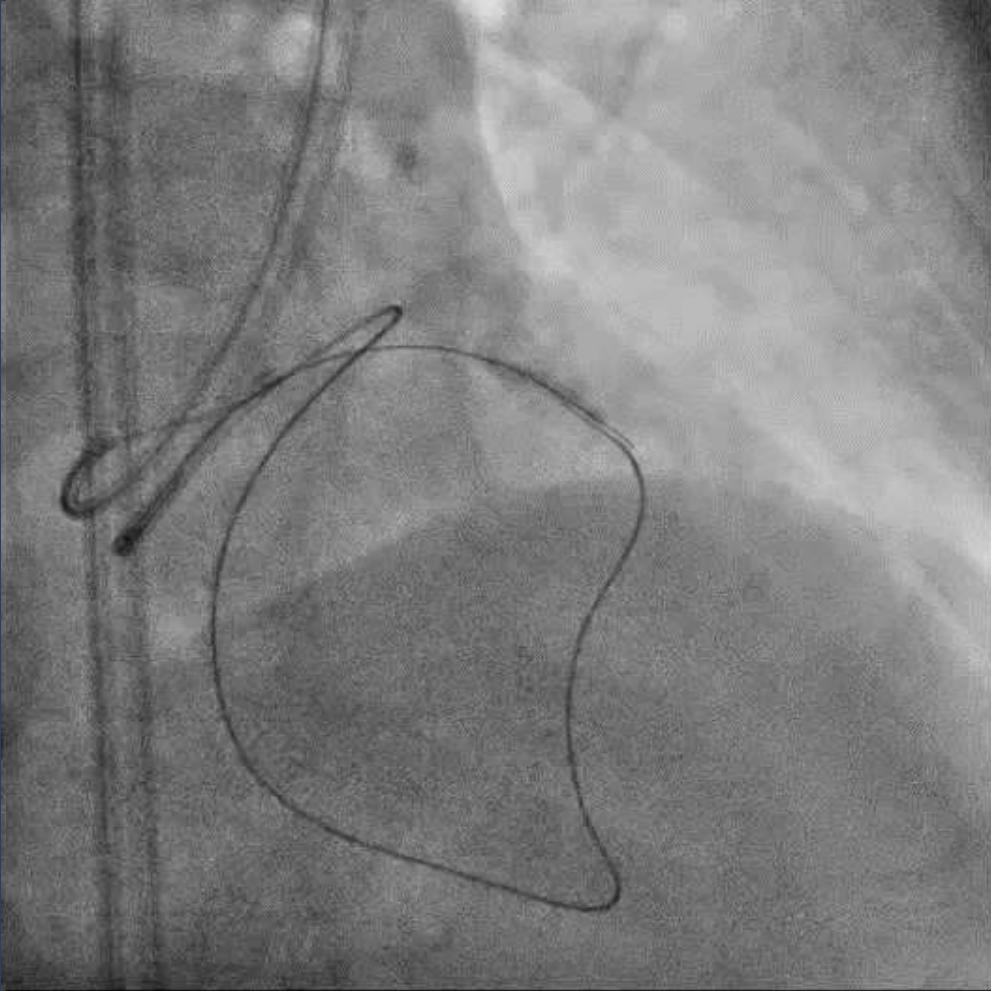


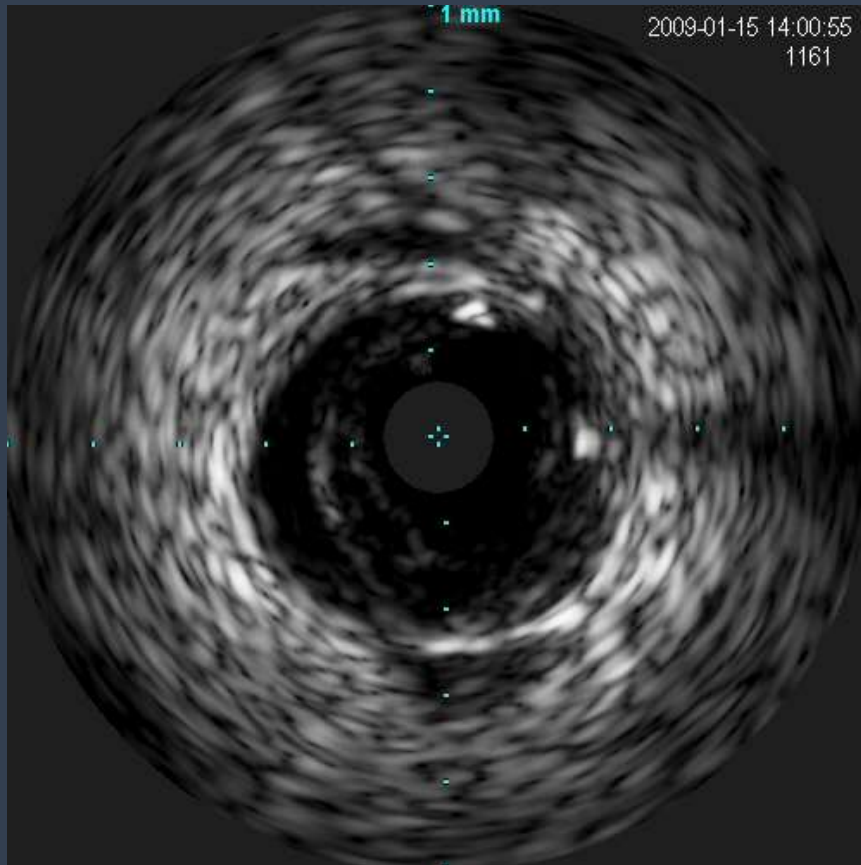


# contemporary reverse CART procedure



# contemporary reverse CART procedure





## Estimation of IVUS finding

- Position of IVUS probe
- Position of retrograde guide-wire
- Vessel size
- Assessment of dissection

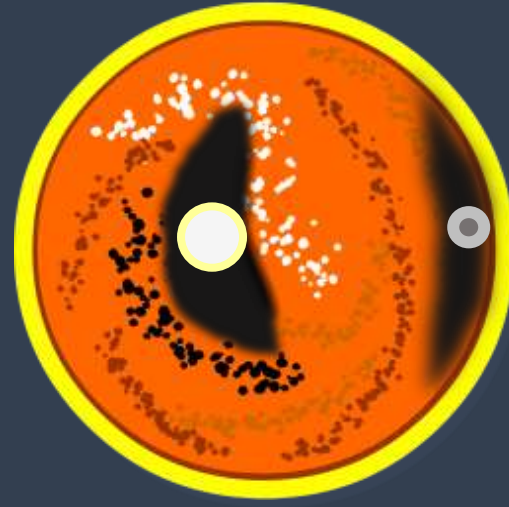
# IVUS finding classification in reverse CART procedure

		Retrograde G.W. position	
		Intra-plaque	sub-intima
IVUS position	Intra-plaque	pattern 1	pattern 2
	Sub-intima	pattern 3	pattern 4

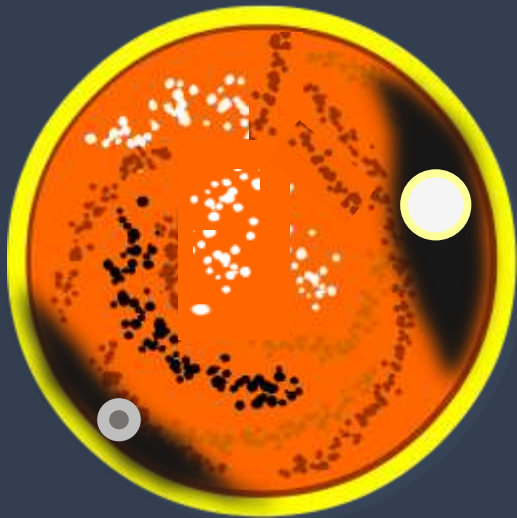
Pattern 1



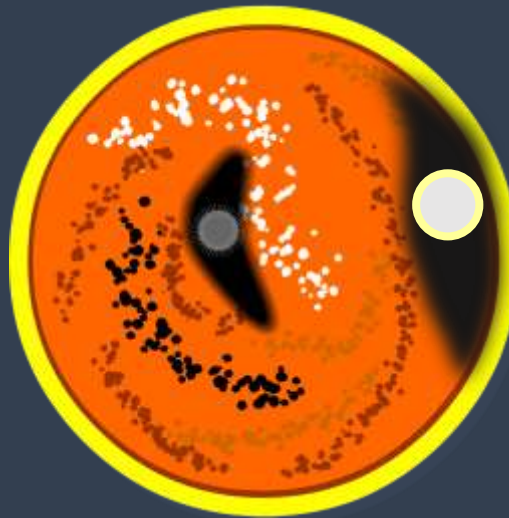
Pattern 2





Pattern 3

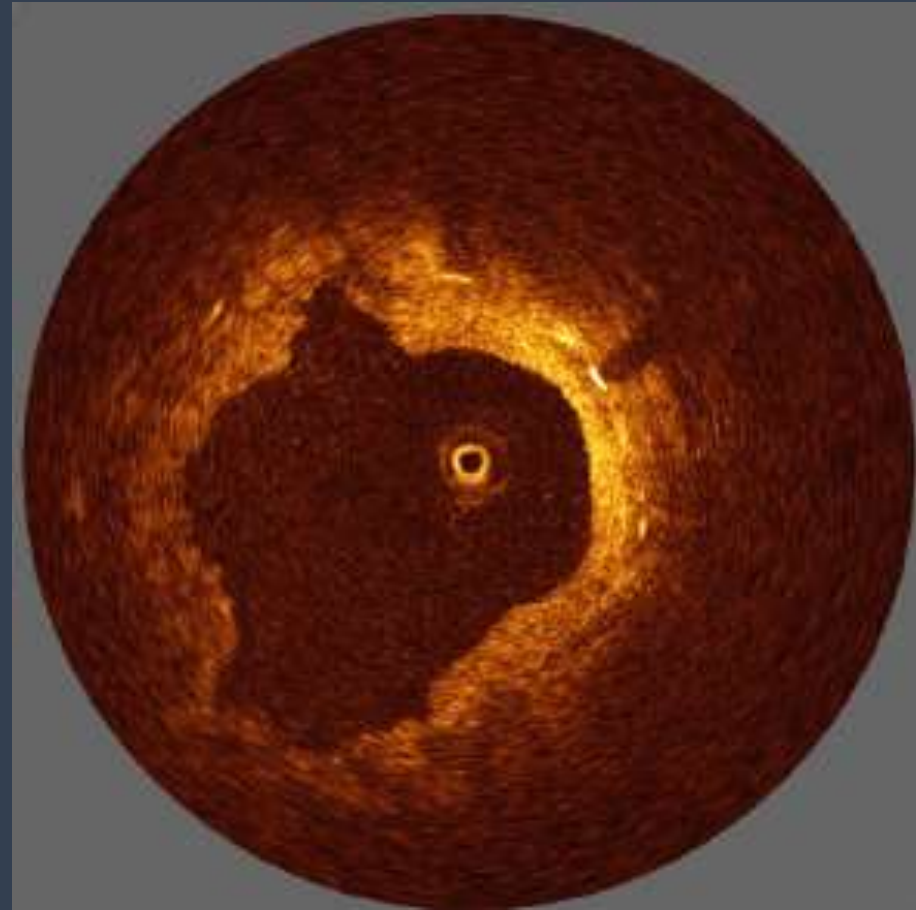
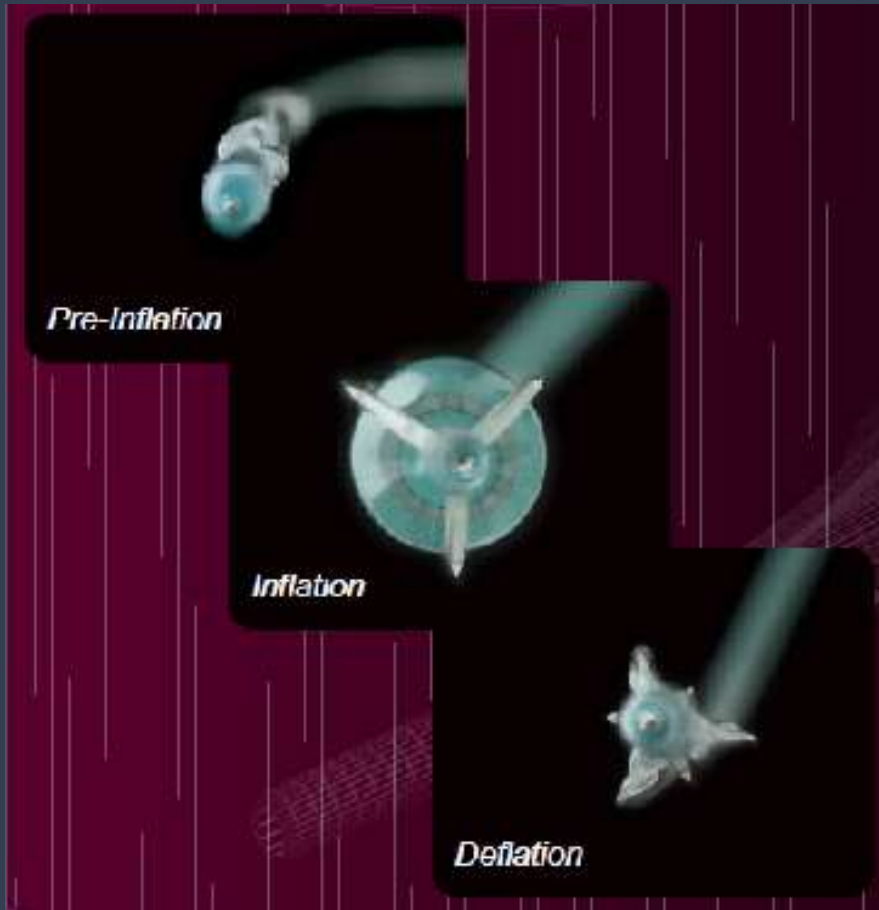


Pattern 4



-  IVUS transducer
-  Retro. G.W.





# Procedure Sequence of latest Retrograde Approach

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1st step : Connection channel related strategy

- 1) Branch selection
- 2) Wiring through collateral

2<sup>nd</sup> Step : Micro-catheter delivery to distal CTO

3<sup>rd</sup> Step : Retrograde wiring in CTO lesion

- 1) Antegrade set up for reverse CART technique
- 2) Reverse CART by retrograde guidewire: Gaia 1st /2nd
- 3) IVUS guided Reverse CART technique

# Indication of retrograde direct crossing

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- not contra-indication for CTO crossing
- floppy wire is available (< 1G tip load)
- short lesion (<10mm)
- large proximal vessel lumen
- minimum bend
- difficult antegrade wiring or balloon delivery