

# Selecting the Collateral and Recognizing the Risks

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# Disclosure Statement of Financial Interest

**I, (Scott Harding) DO NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.**

# The Hybrid Algorithm for CTO PCI



Dual Catheter Angiography

no

1. Ambiguous proximal cap
2. Poor Distal Target
3. Interventional collaterals

yes

Antegrade

Retrograde

yes

no

4. Length < 20mm

yes

no

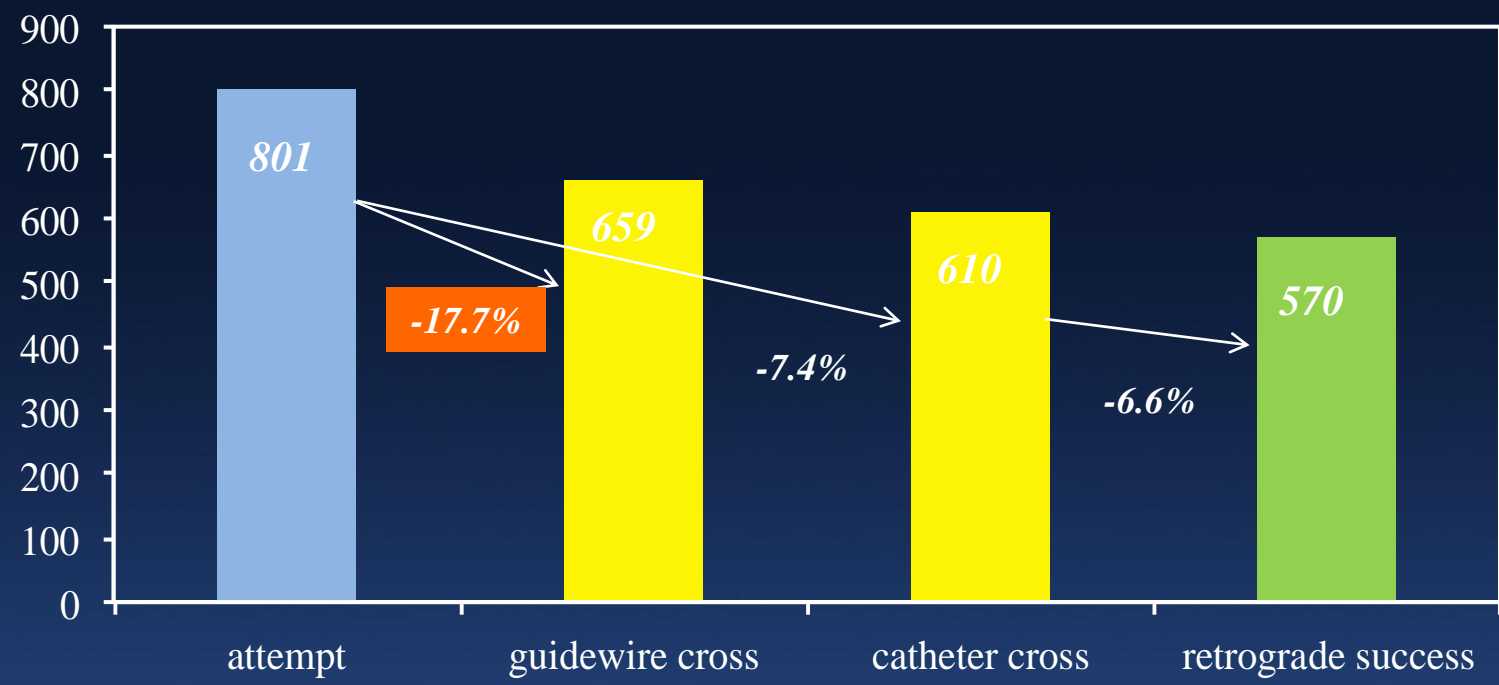
Wire escalation

Dissection Reentry  
(crossboss-stingray)

Wire escalation

Dissection Reentry  
(reverse CART)

# Collateral Crossing and Retrograde Success



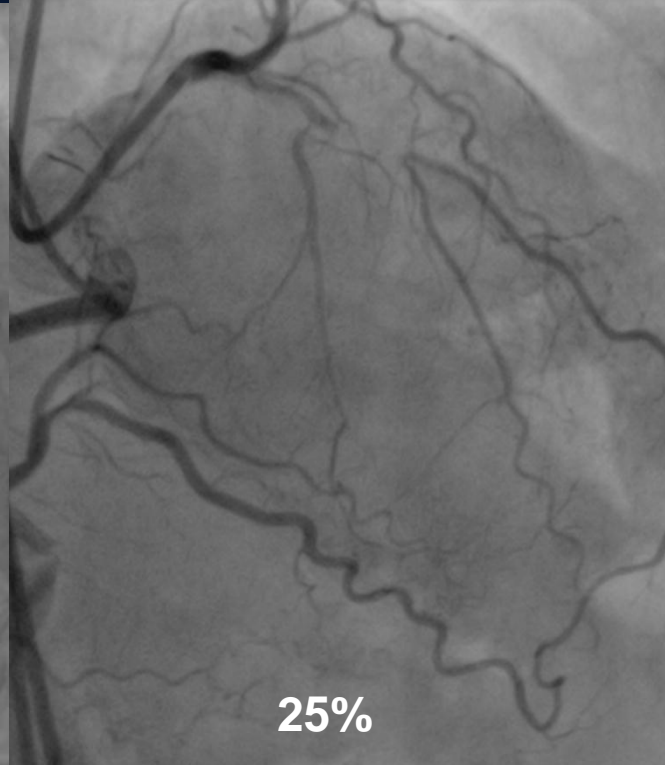
*93.4% procedural success was achieved after successful collateral cross.*

# Collateral Channels

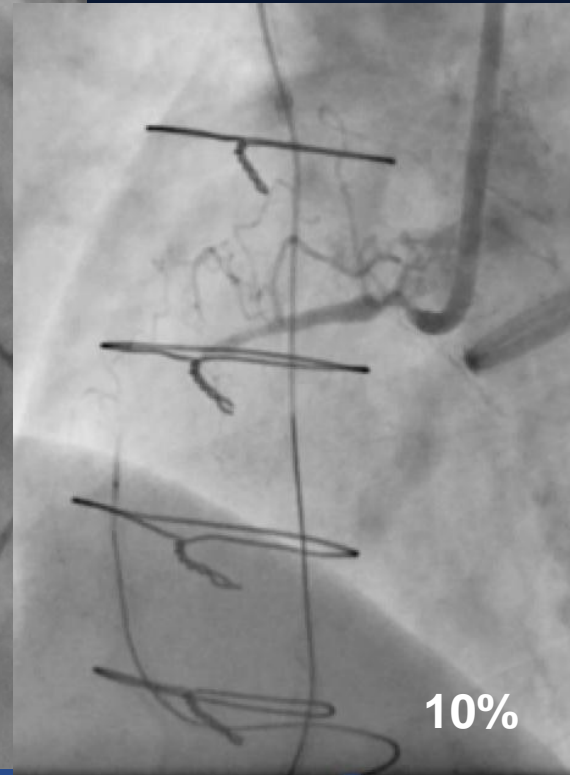
**Septal**



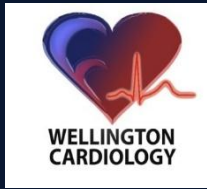
**Epicardial**



**Graft**

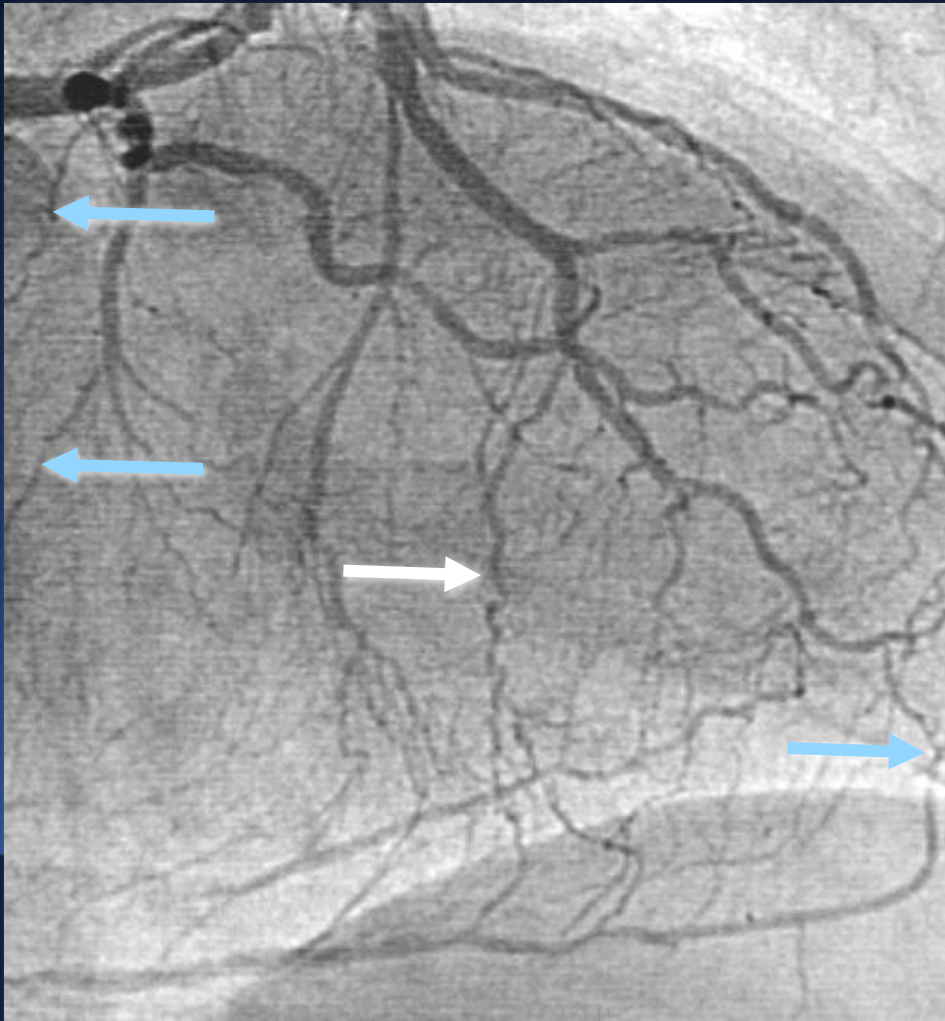


# Collateral Channels



Channel	Advantages	Disadvantages
Septal	Perforation is less likely to lead to tamponade Septal dominance is often less pronounced	Marked tortuosity can lead to failure of collateral crossing Perforation can lead to septal hematoma
Epicardial	Often only connections in lateral wall circulation Can be larger than septal collaterals	Perforation is more likely to lead to tamponade Often have a longer course
Grafts	Usually easiest to cross	Often not available

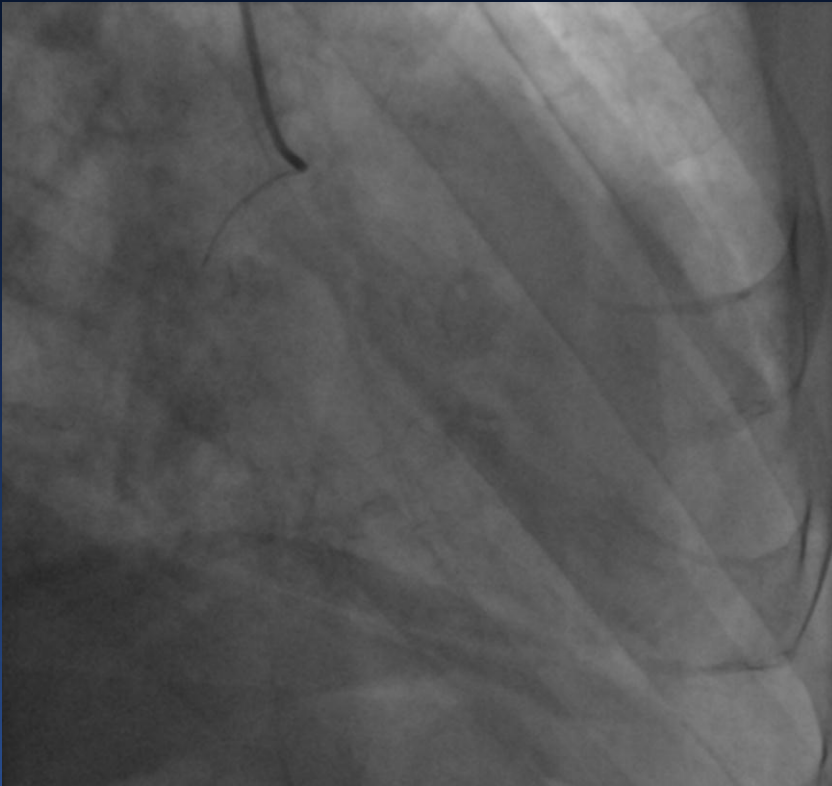
# Assessment of collaterals



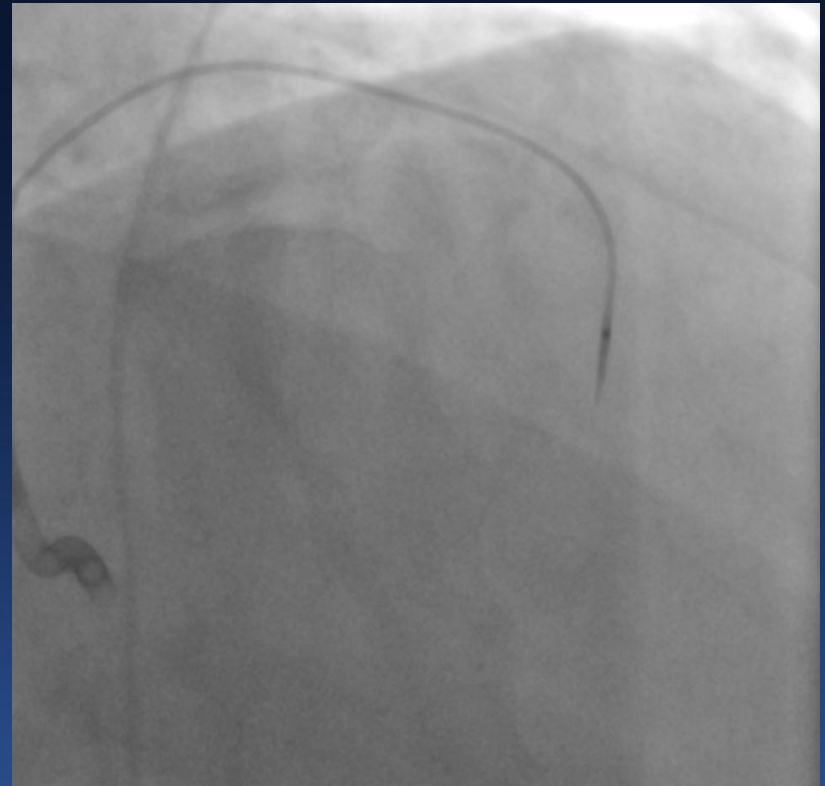
- Bilateral injections
- Have a field size large enough so you don't miss epicardial collaterals
- Don't pan
- Take optimal / multiple views
- Rotational angiography and tip injection may be required.

# Assessment of collaterals

## *Rotational angiography*



## *Selective collateral injection*



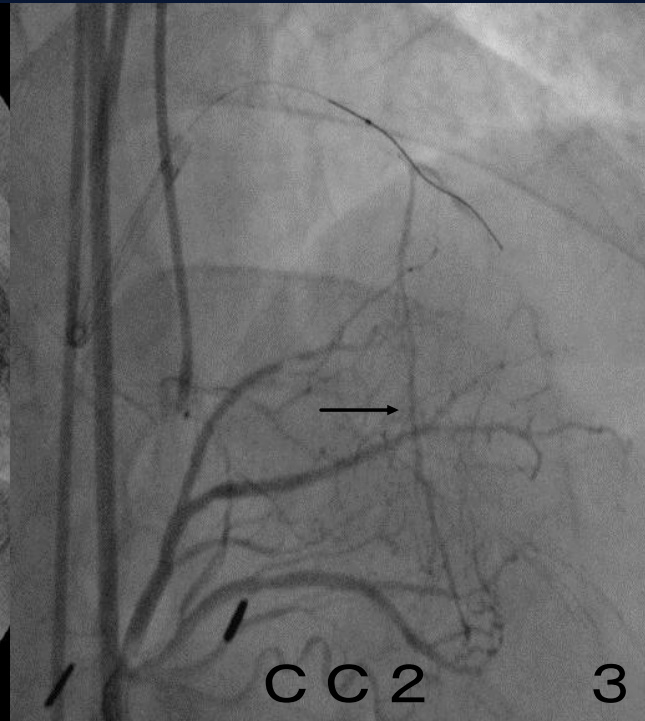
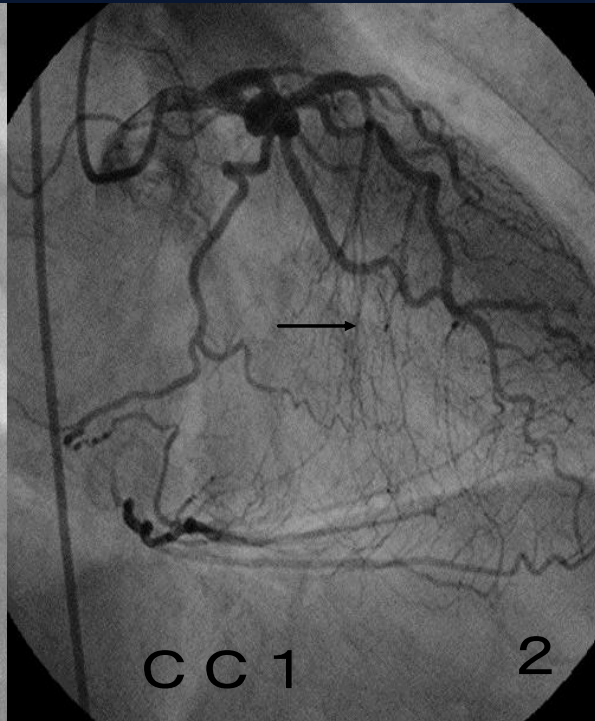
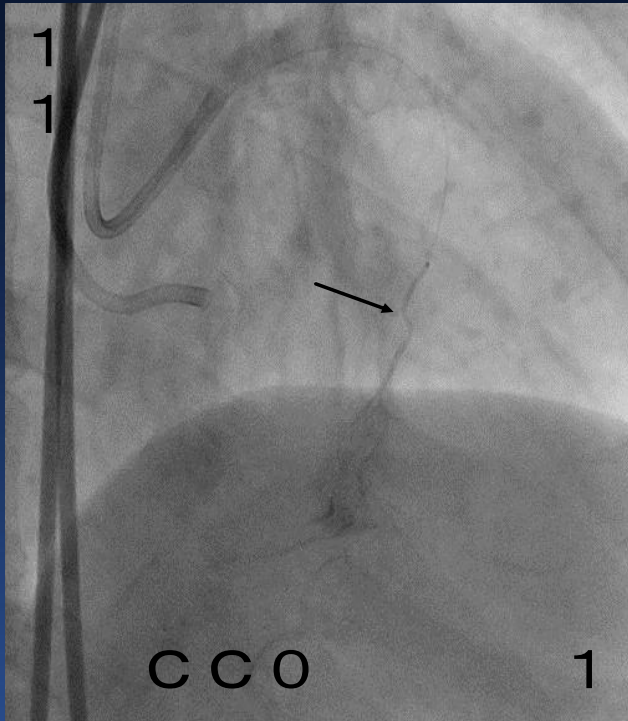


# Selection of Collateral Channels

## Size matters

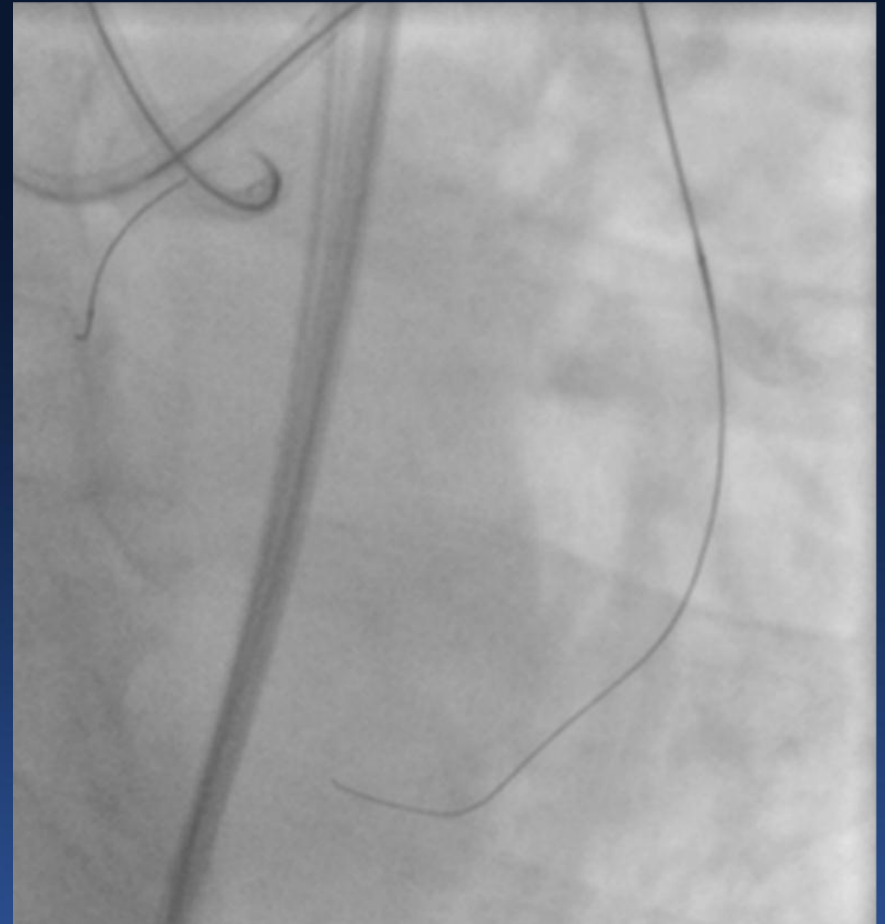
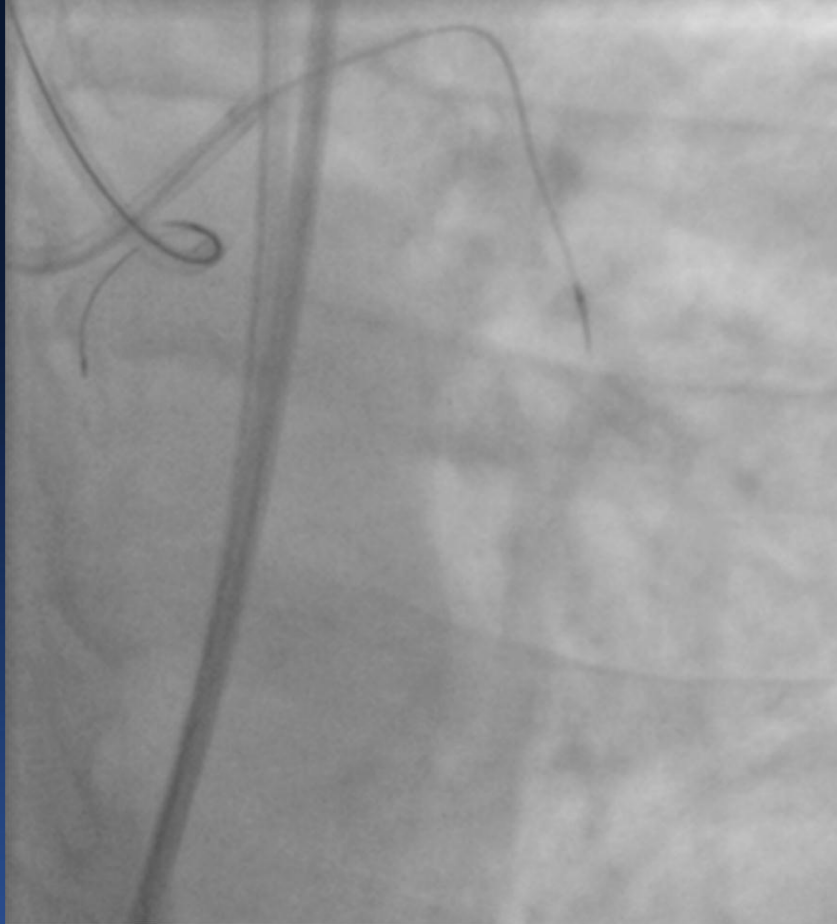
### Werner classification of septal collaterals

- **CC0** = no visible connection between donor and recipient artery
- **CC1** = continuous, thread-like connection
- **CC2** = small side branch-like size of the channel



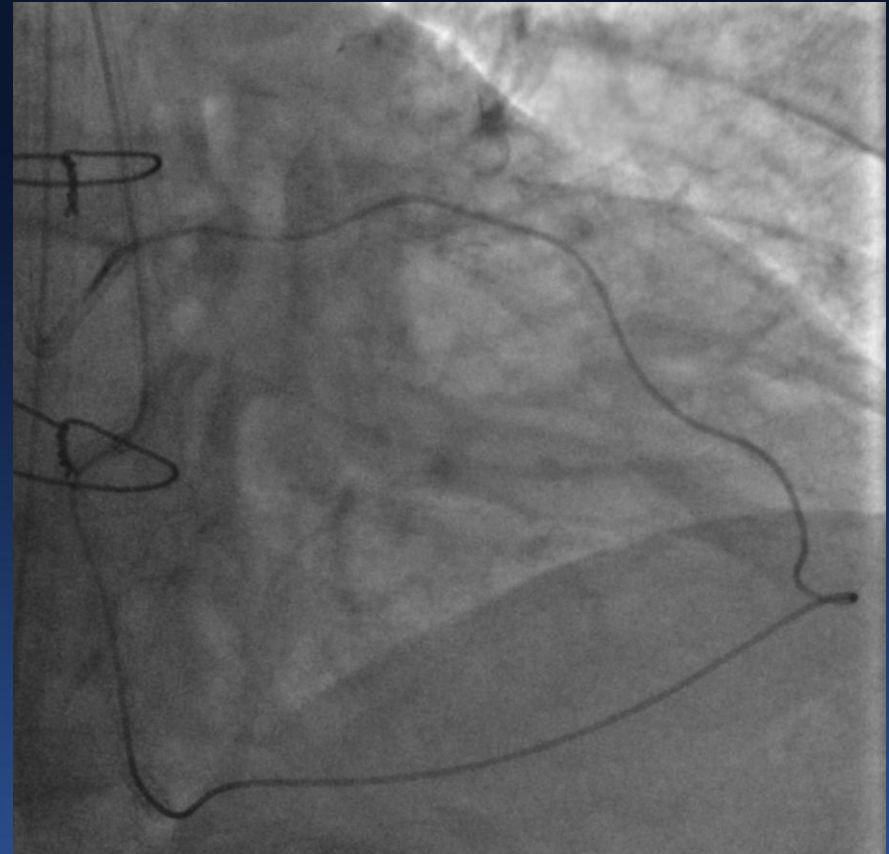
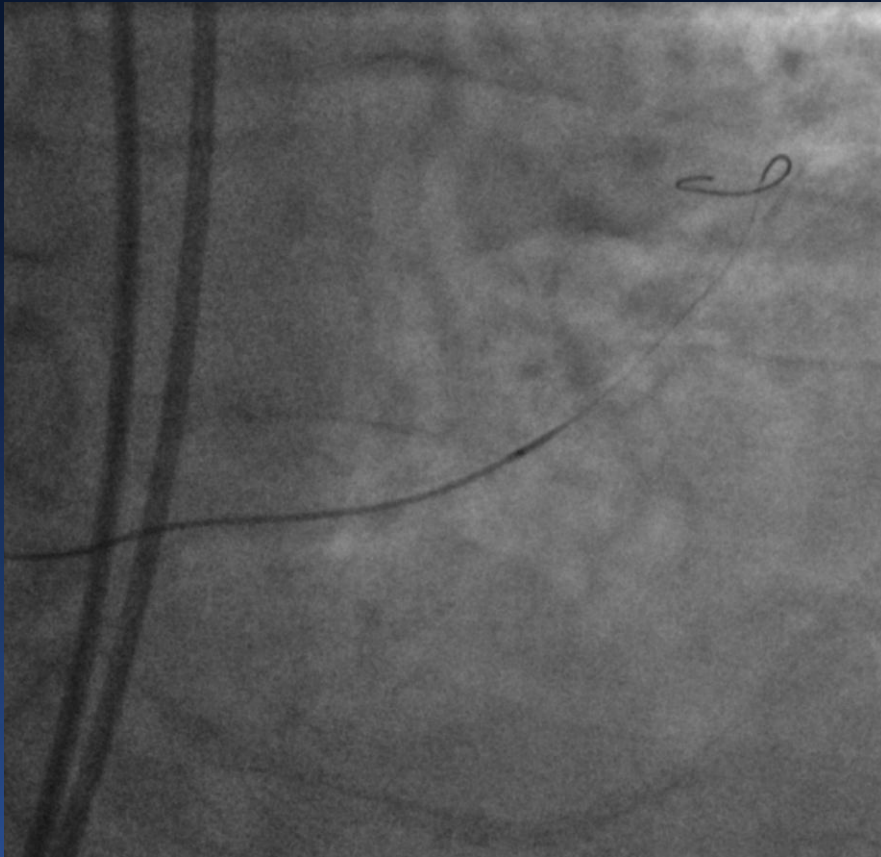
# *Selection of Collateral Channels*

*Invisible (CC0) doesn't always mean impossible*



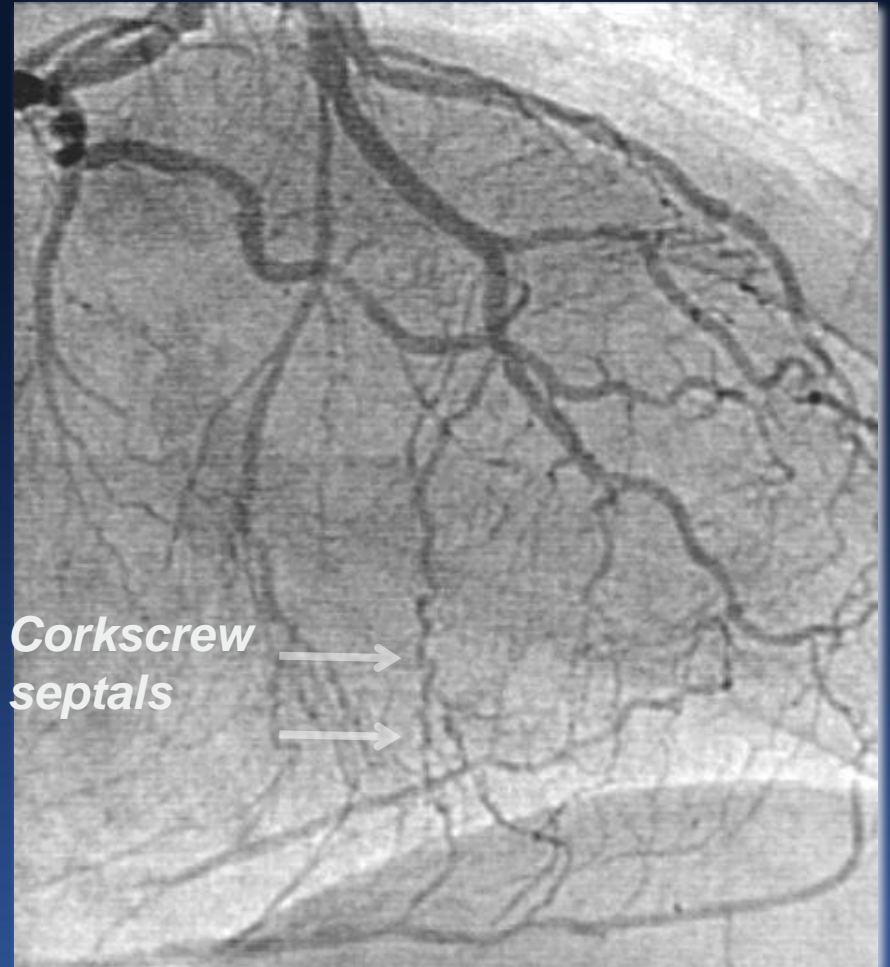
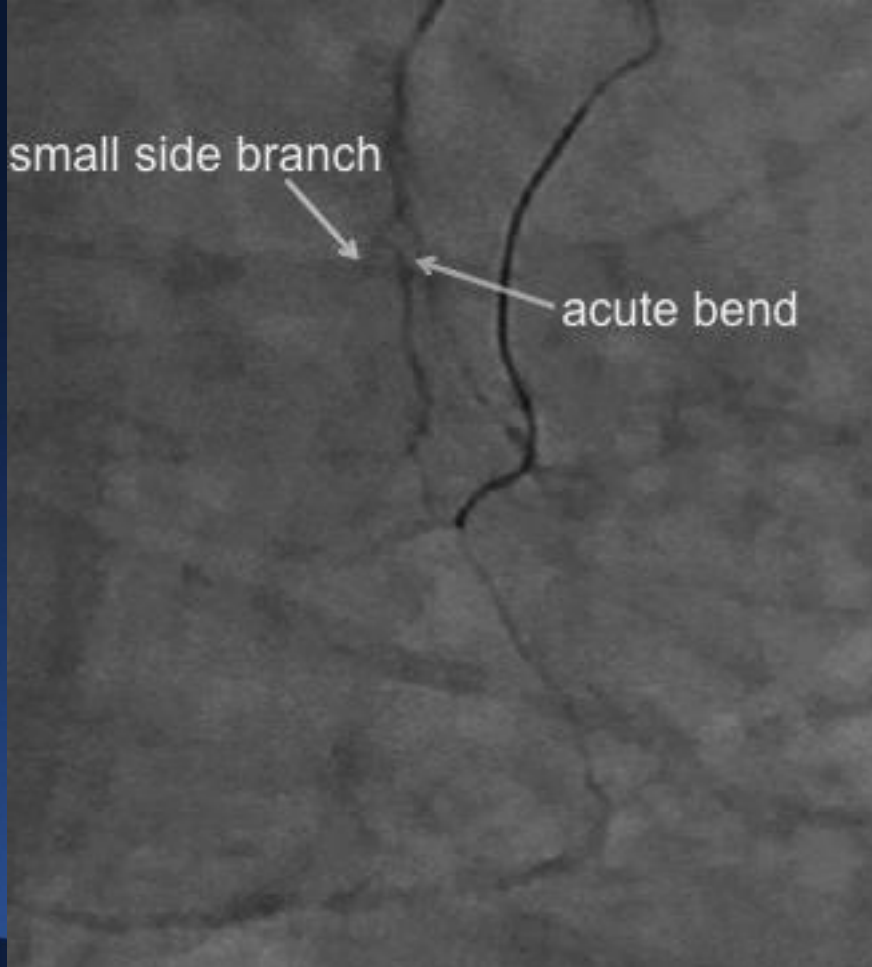
# Selection of Collateral Channels

## *Size matters*



# Selection of Collateral Channels

*Straighter is better*



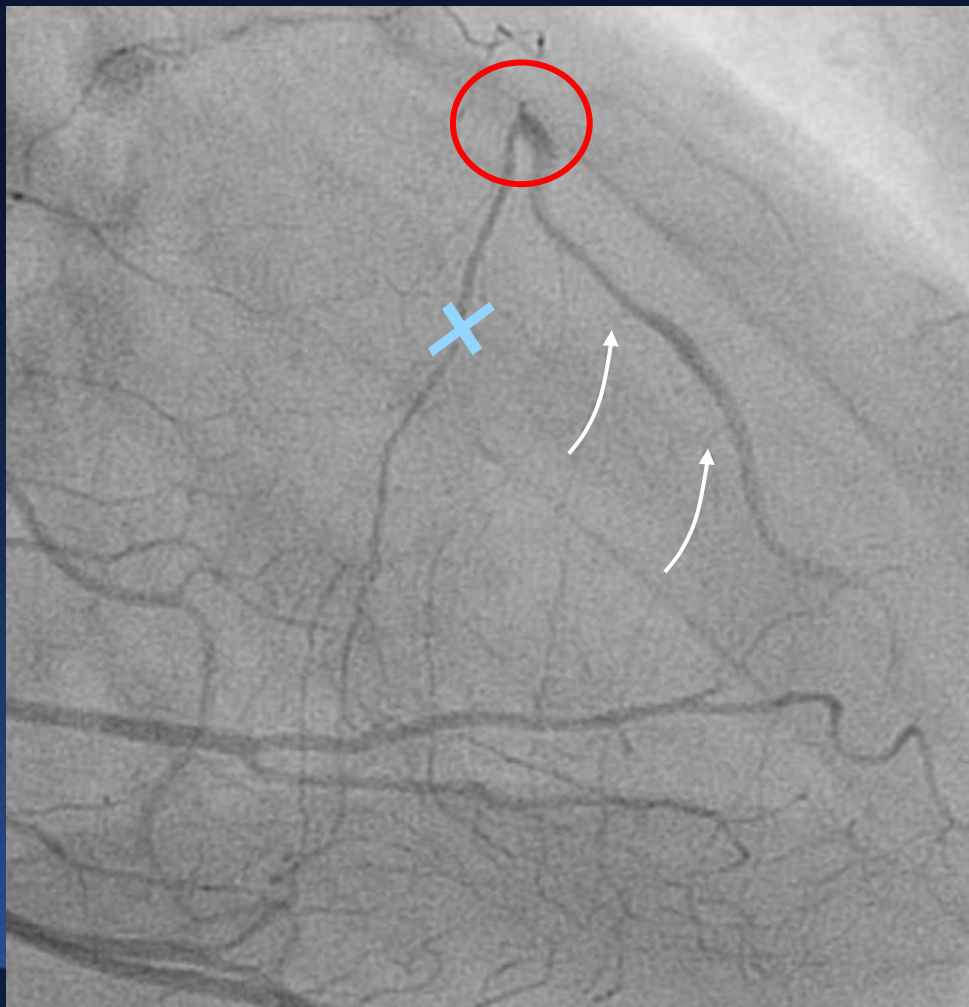
# Predictors of Retrograde Failure



Variables	Odds Ratio	95% C.I	P value
Channel used (epicardial)	0.515	0.28-9.57	0.656
CC angle with donor vessel			0.867
CC-Recipient vessel angle not visible	47.09	1.65-1340.42	0.024
Tortuosity of CC-corkscrew	8.31	1.63-42.36	0.011
CC TYPE 1	2.16	0.43-10.74	0.346
Bridging Collaterals	1.09	0.29-4.00	0.896
Significant Side Branch	1.51	0.33-6.72	0.588
Severe tortuosity	.757	0.11-4.94	0.771
Severe Calcification	2.67	0.51-13.93	0.243
CTO Length>20mm	0.971	0.93-1.01	0.138
Ostial location	1.34	0.22-7.98	0.744

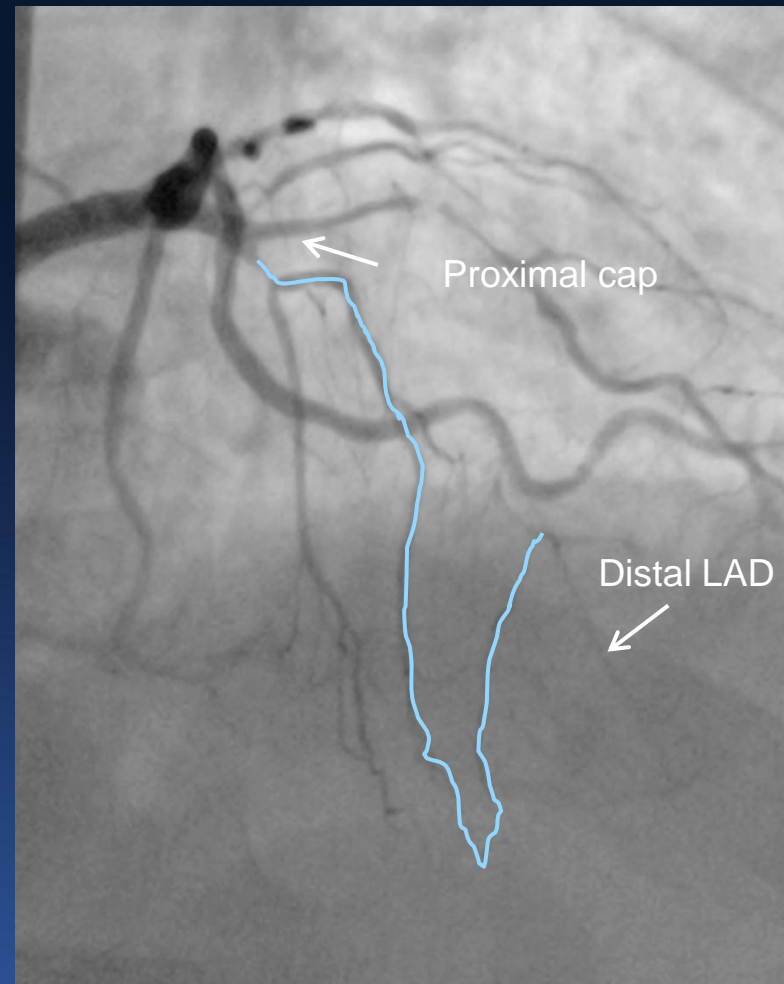
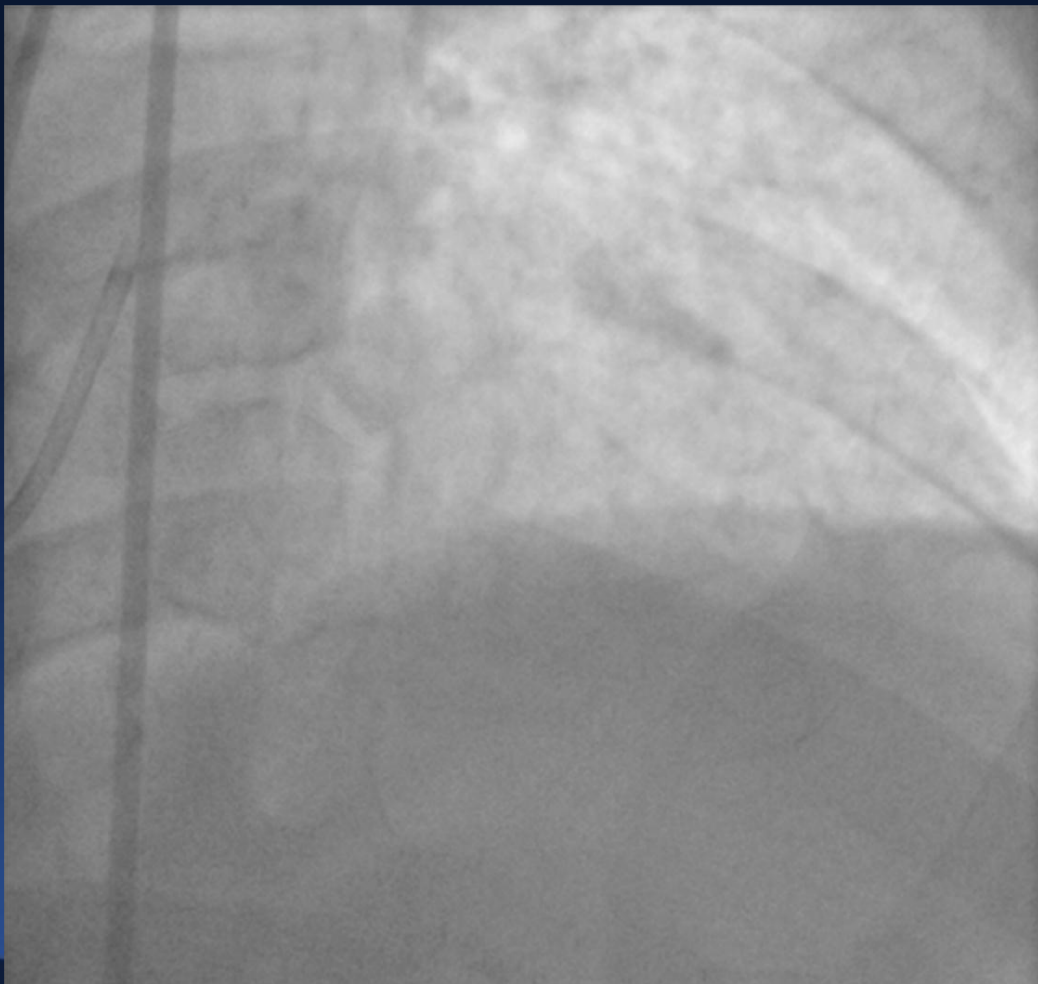
# *Selection of Collateral Channels*

## *Angle of attack is important*



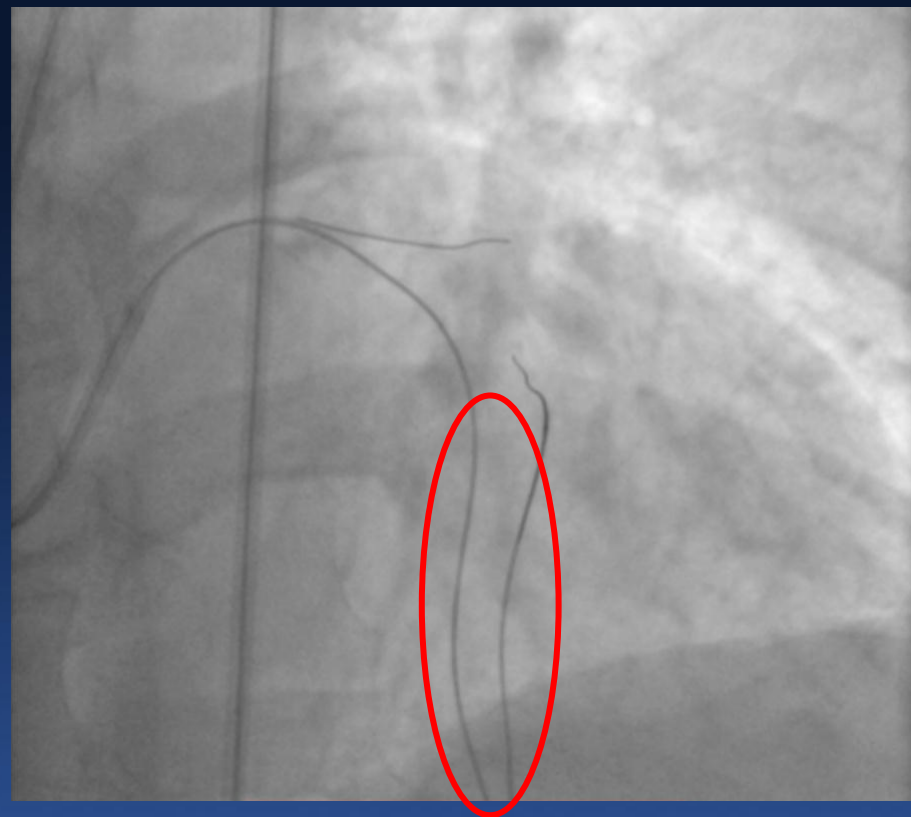
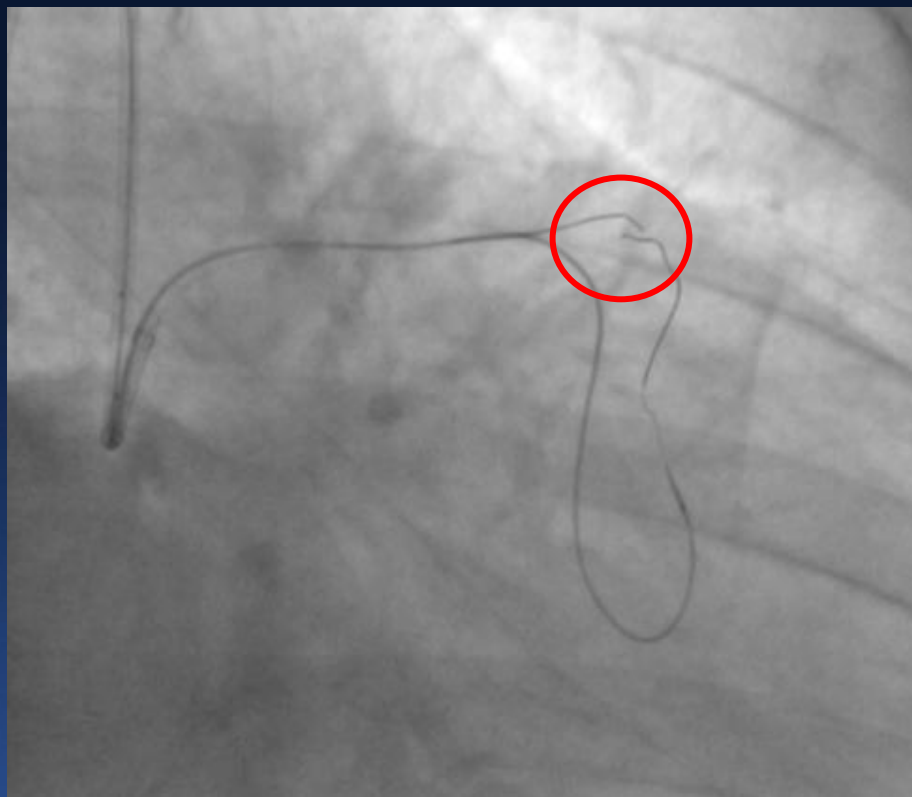
# *Selection of Collateral Channels*

## *Beware of acute angulation*



# *Selection of Collateral Channels*

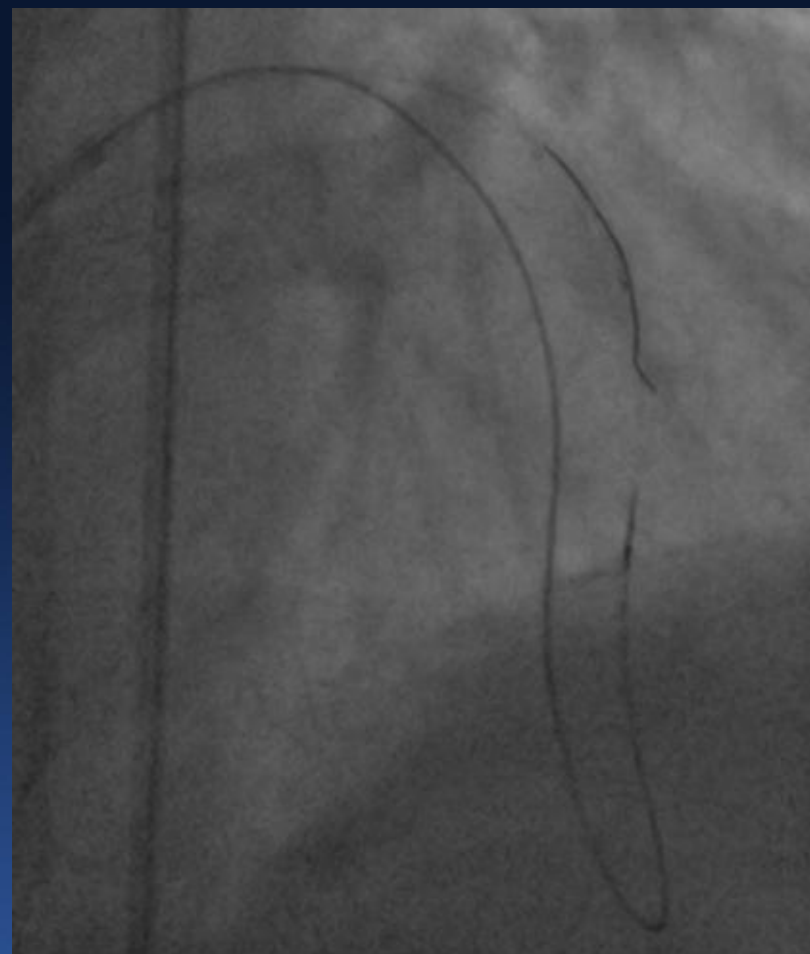
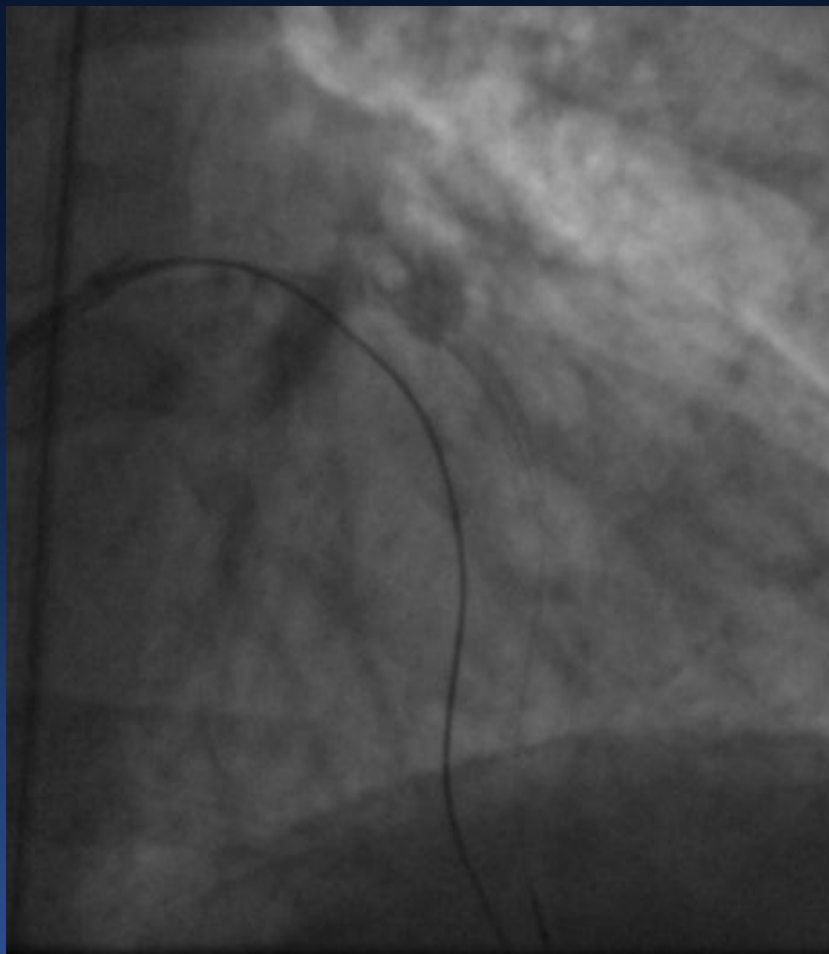
## *Beware of acute angulation*





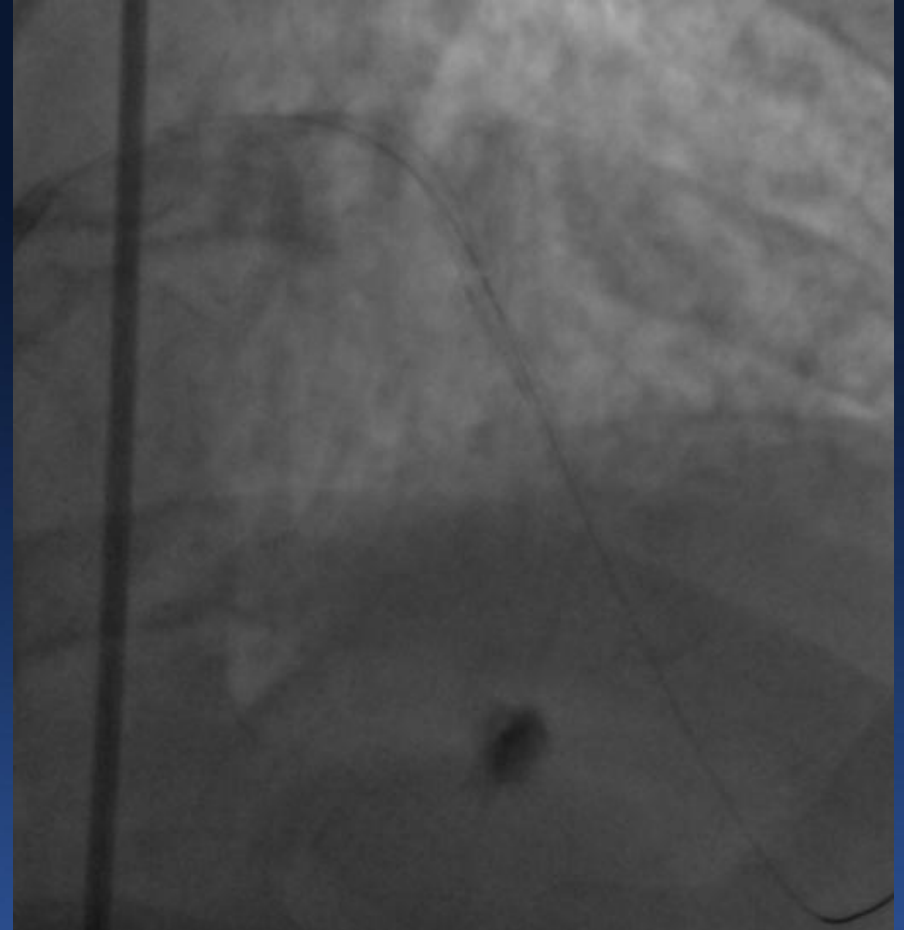
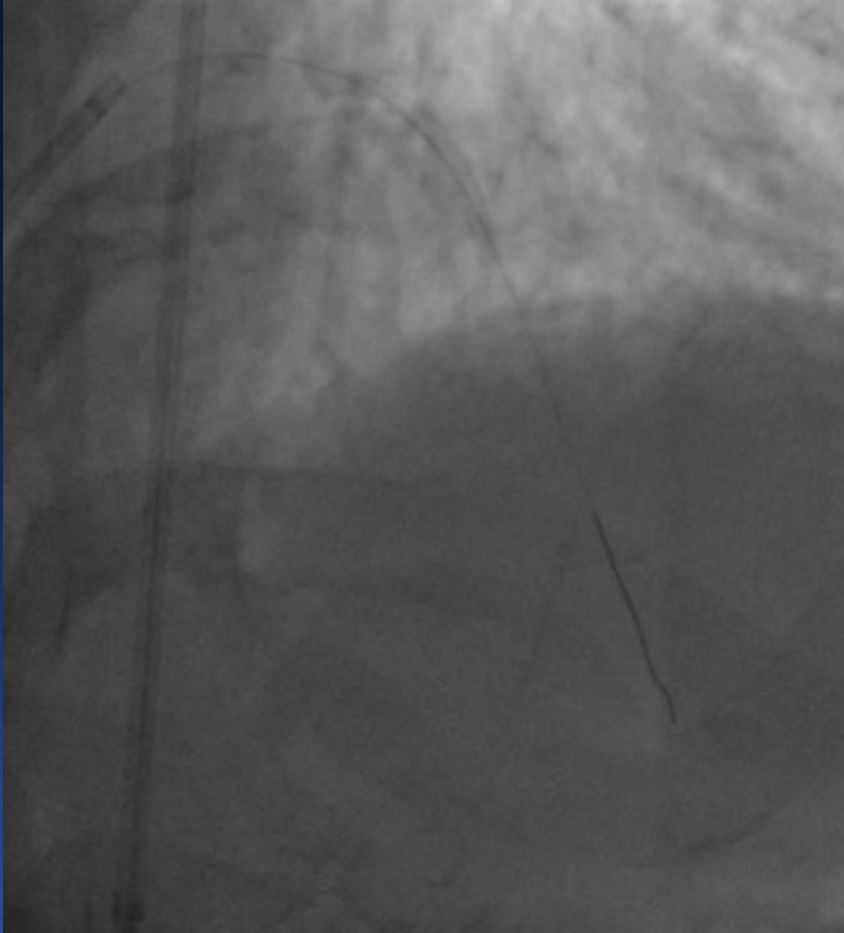
# *Selection of Collateral Channels*

## *Beware of acute angulation*



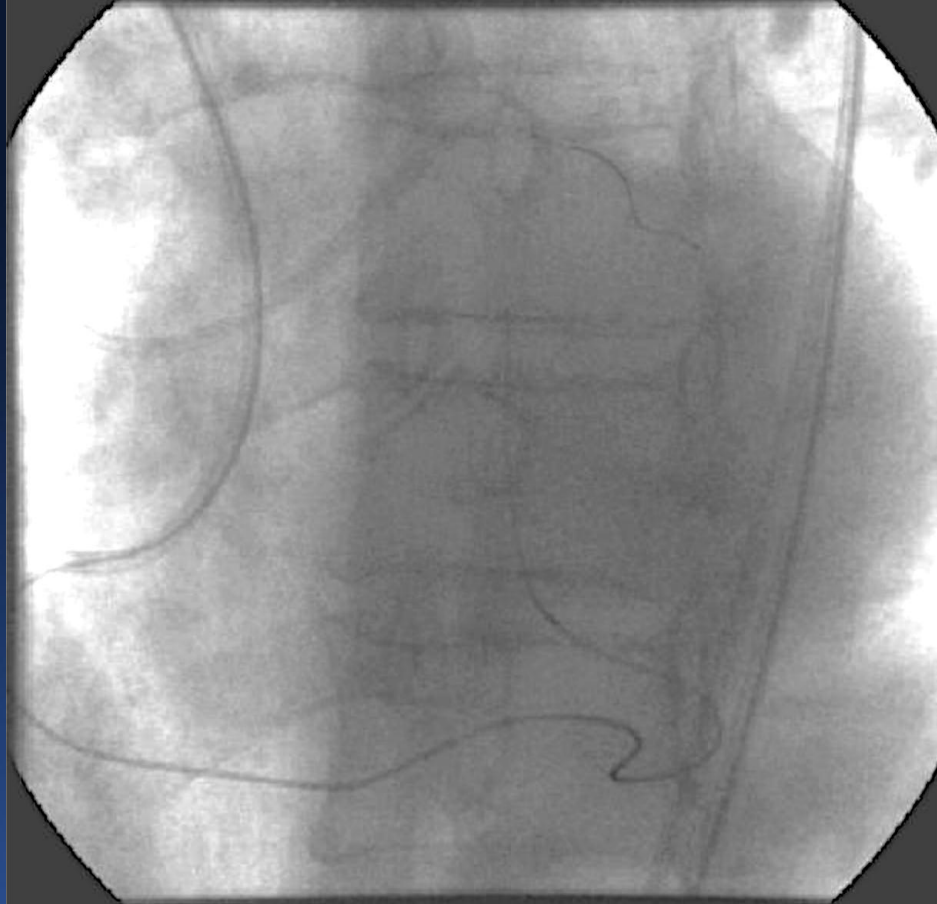
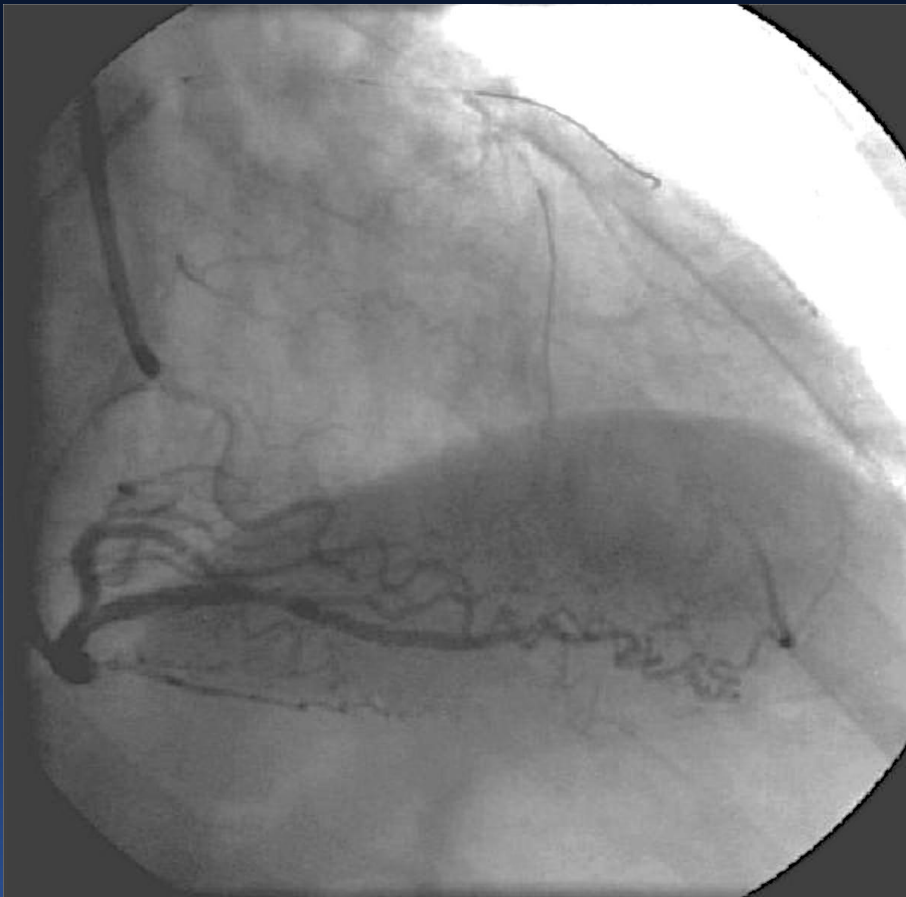
# *Selection of Collateral Channels*

## *Beware of acute angulation*



# *What are the risks?*

## *Septal perforation is not always benign*



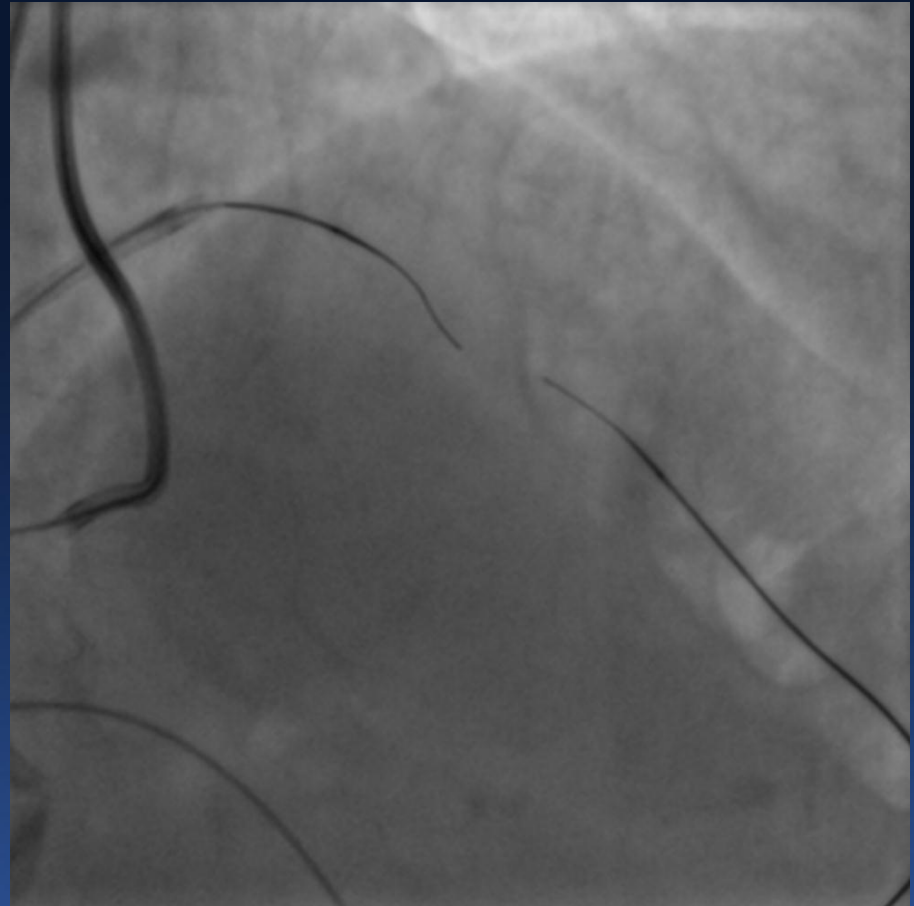
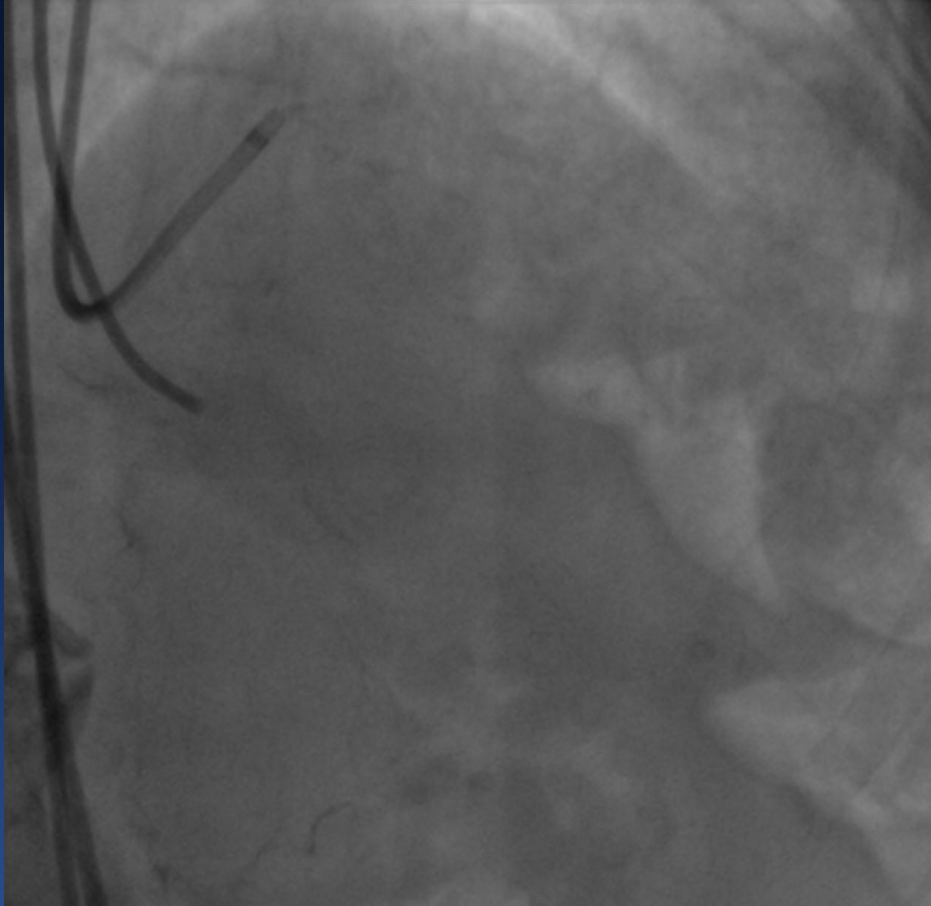
# *What are the risks?*

## *Septal perforation is not always benign*



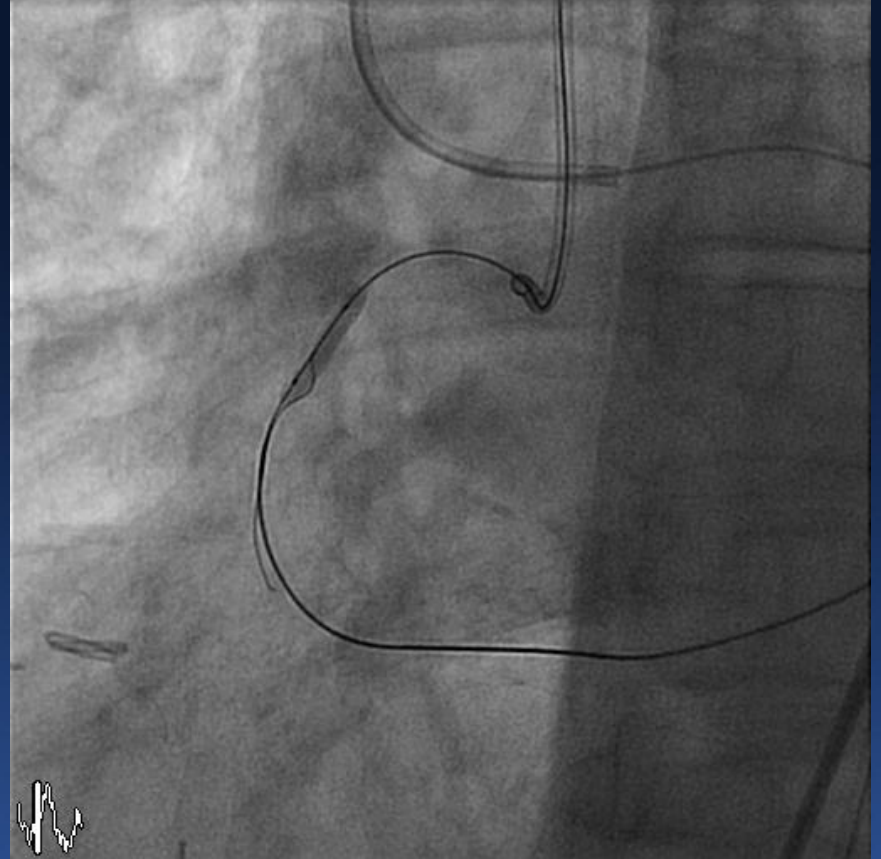
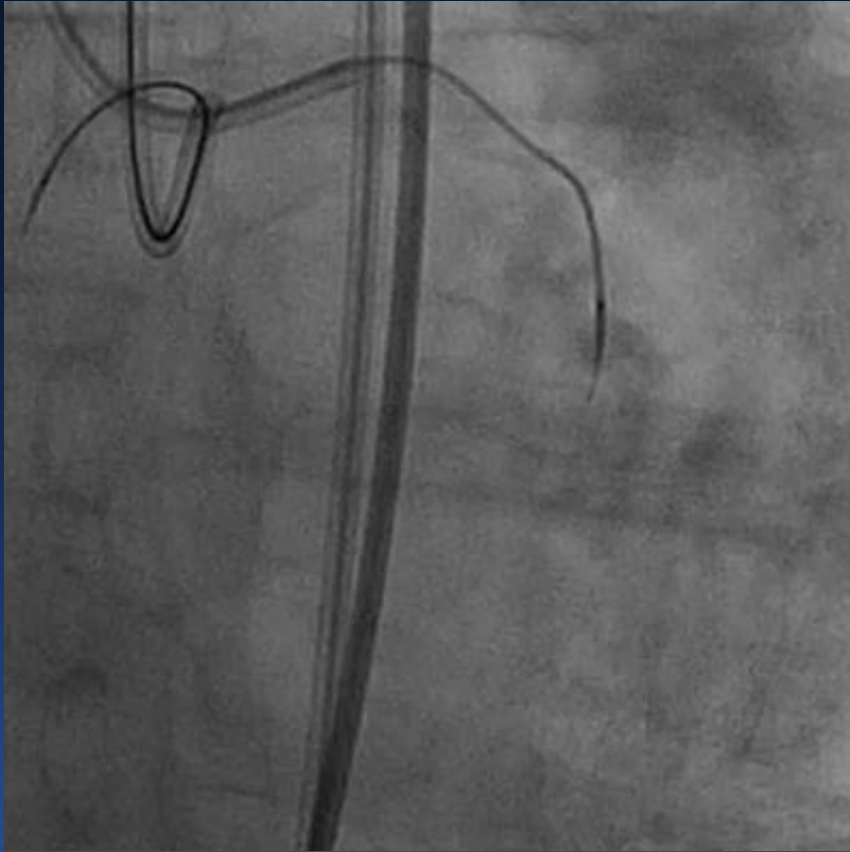
# *What are the risks?*

## *Beware of ischemia*



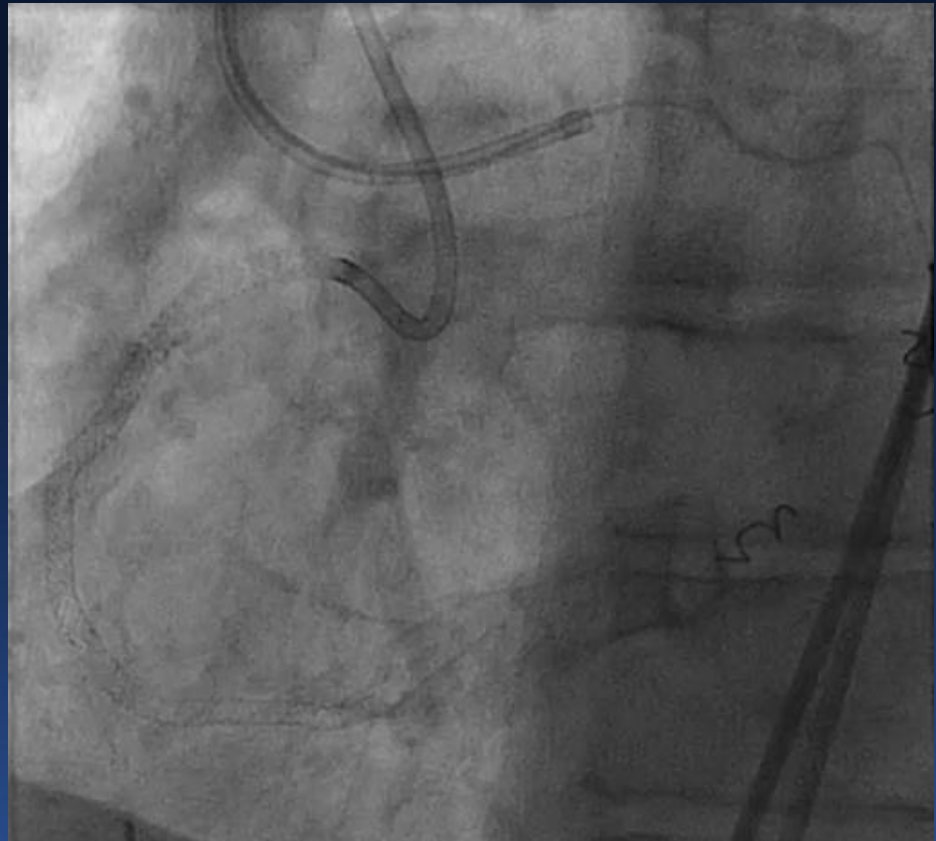
# *What are the risks?*

## *Epicardial perforation*



# *What are the risks?*

## *Epicardial perforation*



# Conclusions



- **Optimal imaging is important**
- **Septal, epicardial collaterals and grafts need to be considered as options for the retrograde approach.**
- **Size and tortuosity are the most important determinants of success**
- **The angle of attack is important**
- **Beware of acute angulation and the potential for perforation and ischemia**



