Overcoming adversity

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Minneapolis Heart Institute Foundation
Creating a world without heart and vascular disease

Minneapolis Heart Institute

Allina Health
ABBOTT NORTHWESTERN HOSPITAL

CARDIOVASCULAR INNOVATIONS FOUNDATION

History

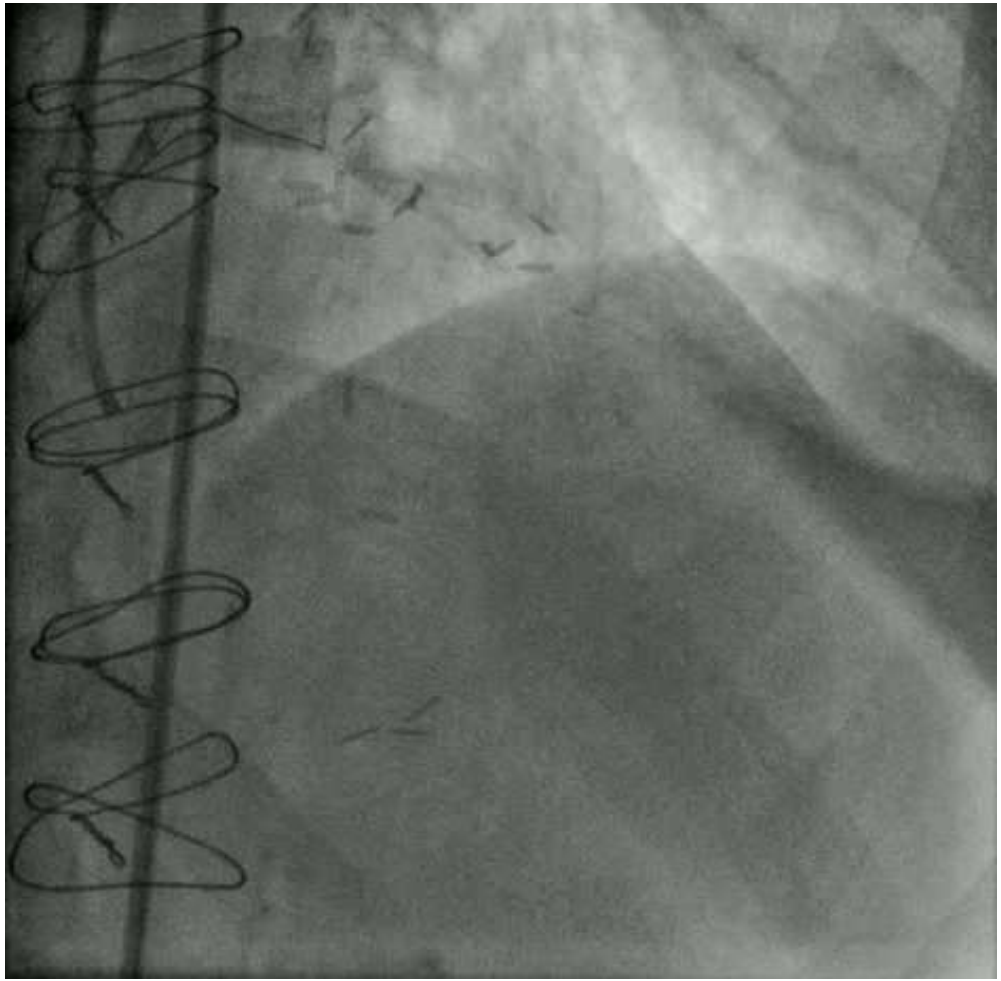
- **60-year-old man with worsening exertional dyspnea over the last several months, especially in the last 2-3 weeks, and CCS2 angina**
- **Known CAD with remote Taxus stents to LAD/Diagonal bifurcation that had acutely thrombosed necessitating emergent CABG with LIMA-diagonal and SVG-LAD, later PCI to LCx**
- **HTN, dyslipidemia, family history of early CAD**
- **Diagnostic cath had revealed occlusion of SVG-LAD with prox LAD CTO with patent LIMA-diagonal, patent LCx stent and non-critical RCA disease**
- **Referred for LAD CTO PCI**

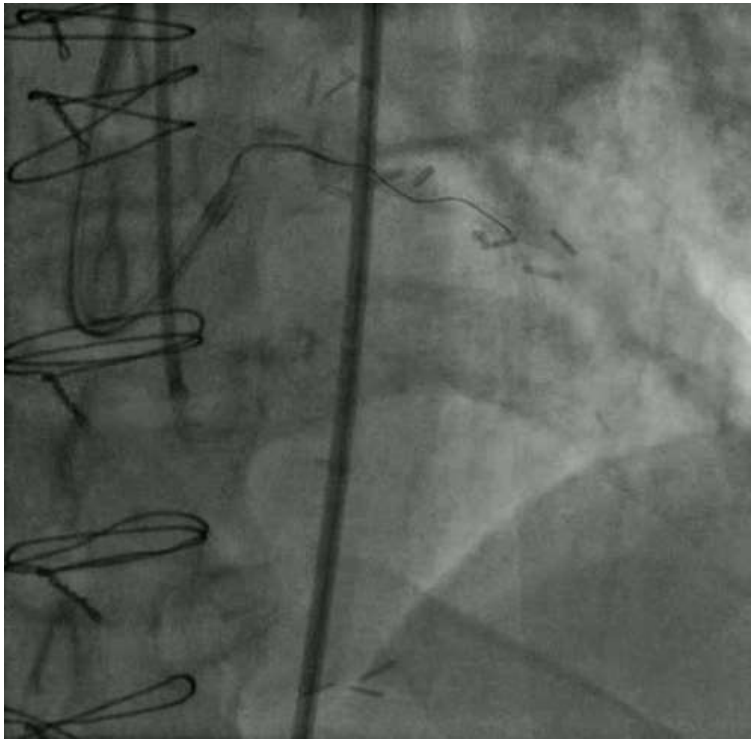
Proximal LAD CTO

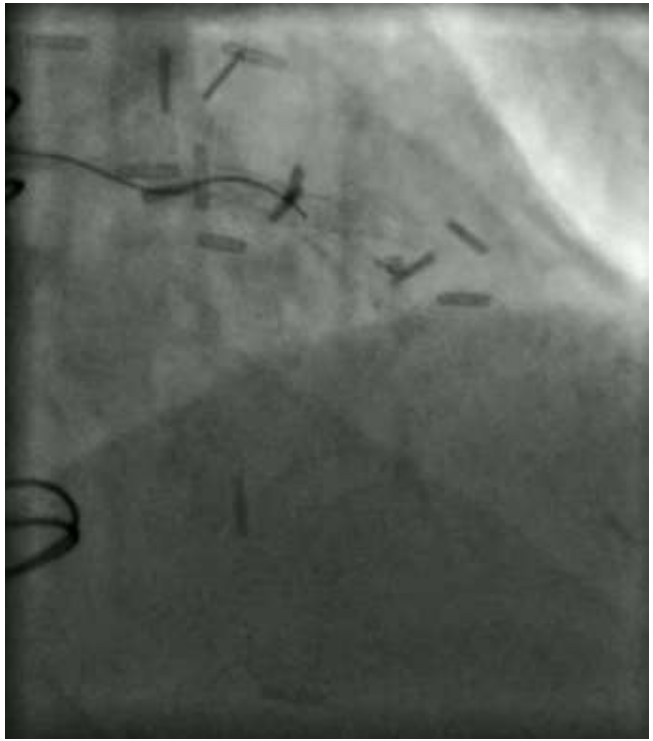
Proximal Cap:	**Tapered, calcified**
Length:	**>20mm, within previous LAD stents, includes stented diagonal bifurcation**
Distal Vessel:	**Diseased, small caliber**
Collaterals:	**Apical, tortuous epicardial from RCA**

PLAN

- **AWE**
- **ADR (limited by stents)**
- **Higher risk retrograde**



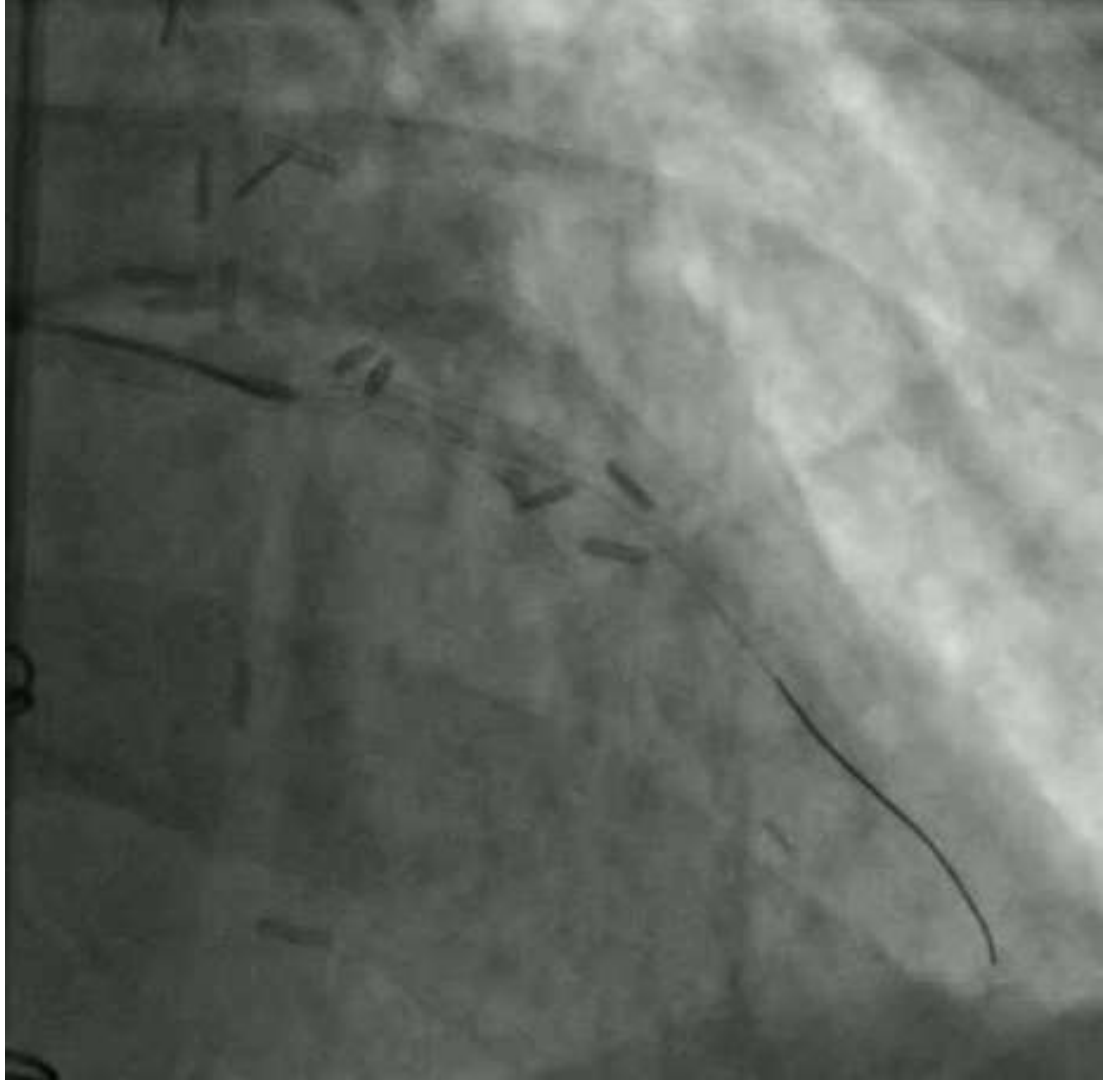




- **Pilot 200 wire advanced antegrade to LAD/diag bifurcation, but multiple different microcatheters would not advance through calcified/stented proximal segment despite extensive attempts; low profile balloons would also not pass**

- **Multiple wires would not advance further into LAD without MC backup**

- **Able to advance wire more distally into grafted diagonal**
- **Hoping to be able to advance MC further over this wire and then to re-orient towards LAD**
- **No MC would advance despite repeated attempts, nor would low profile balloons**



Approach to “balloon uncrossable” lesion

“Balloon Uncrossable” lesion

1. Small balloon
2. Rupture balloon in vessel (grenadoplasty)

1st line

3. Increase support

Guide catheter

Wire

2nd line

4. Microcatheter
5. Wire “cutting” or puncture

3rd line

9. Combinations

6. Laser
7. Atherectomy

4th line

8. Subintimal techniques

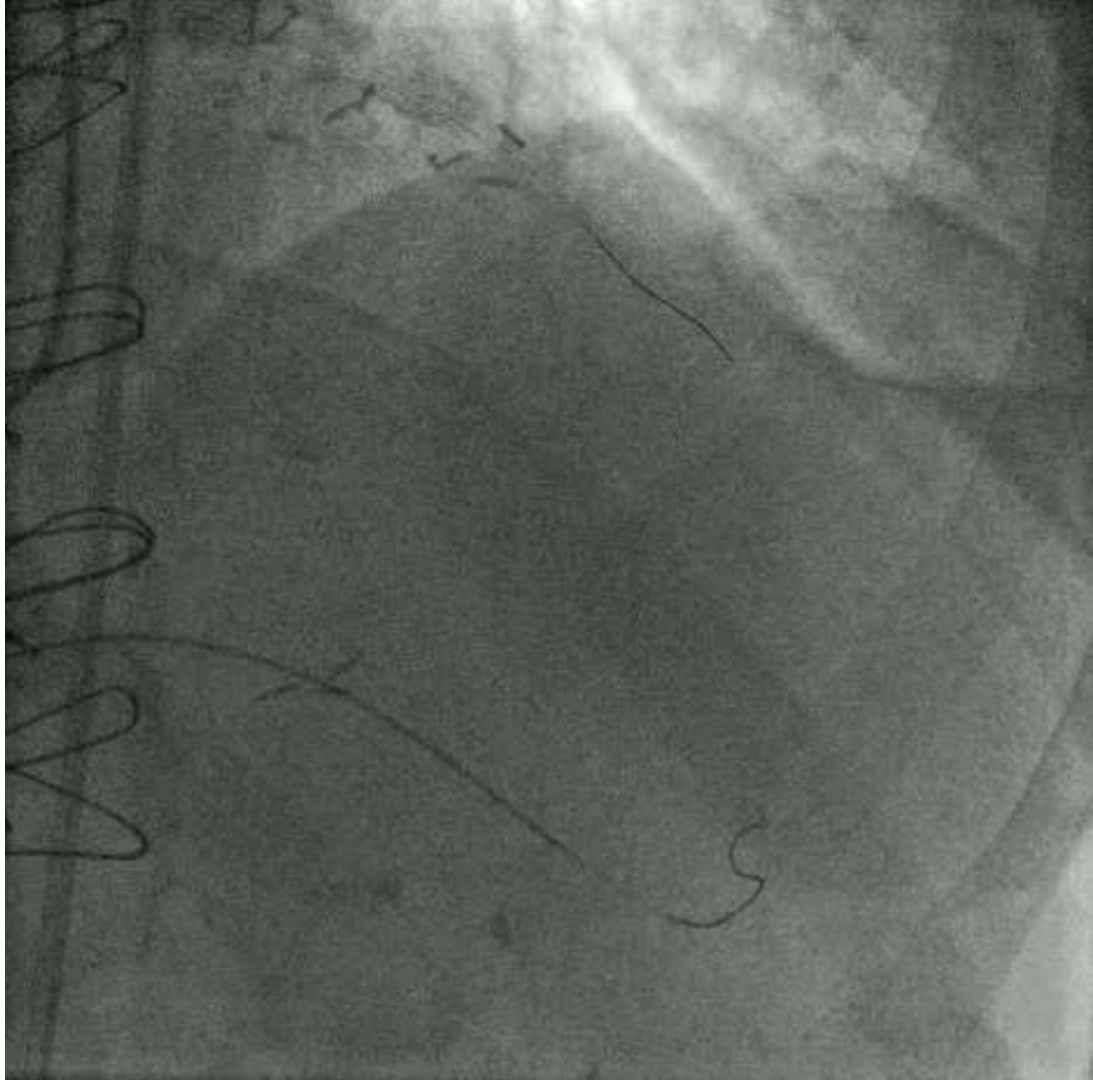
External crush

Distal anchor

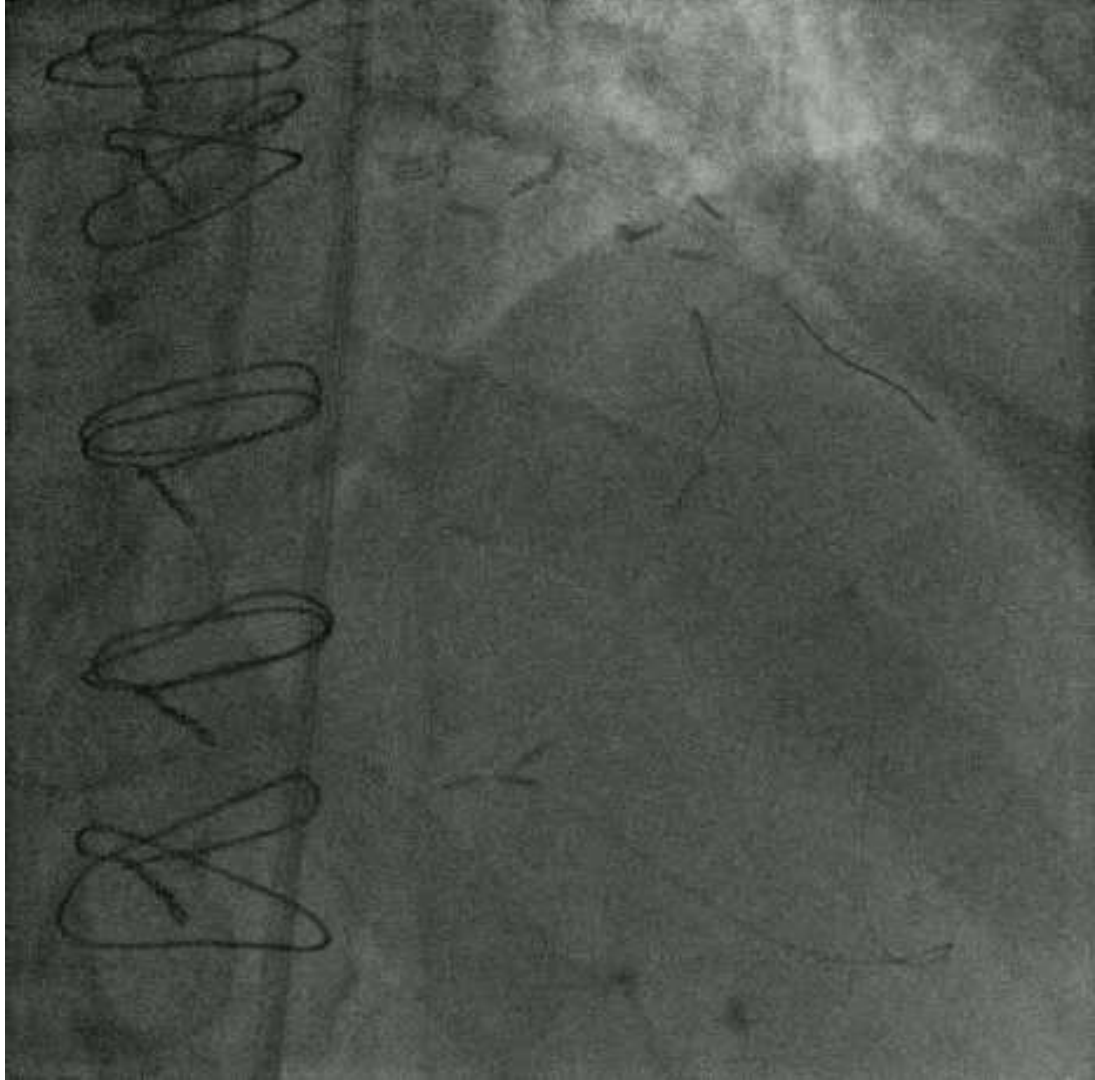
5th line

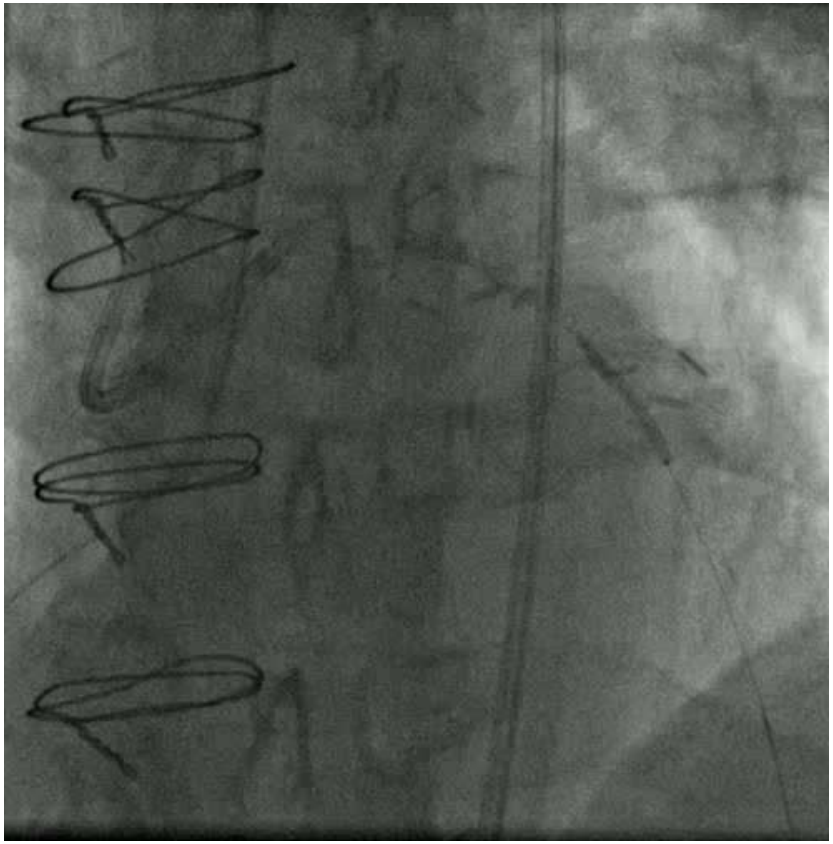
- **After multiple attempts at antegrade approach with repeated failure, decision to proceed with attempt to wire retrograde via tortuous apical epicardial collateral off RCA**

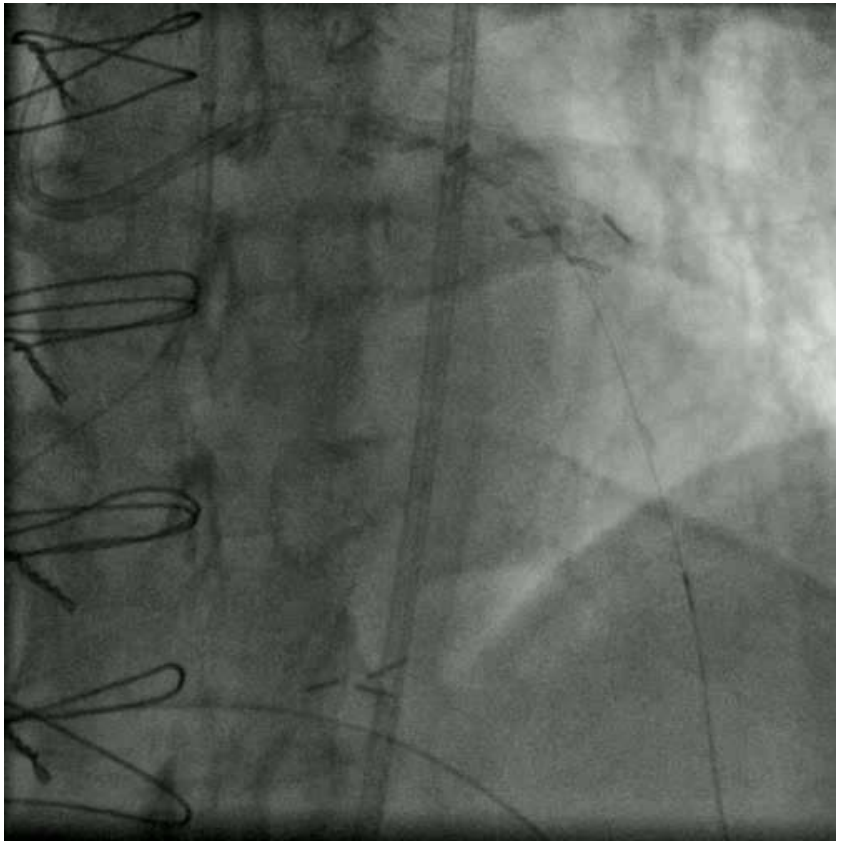
- **Corsair Pro microcatheter**
- **Suoh 03 wire**



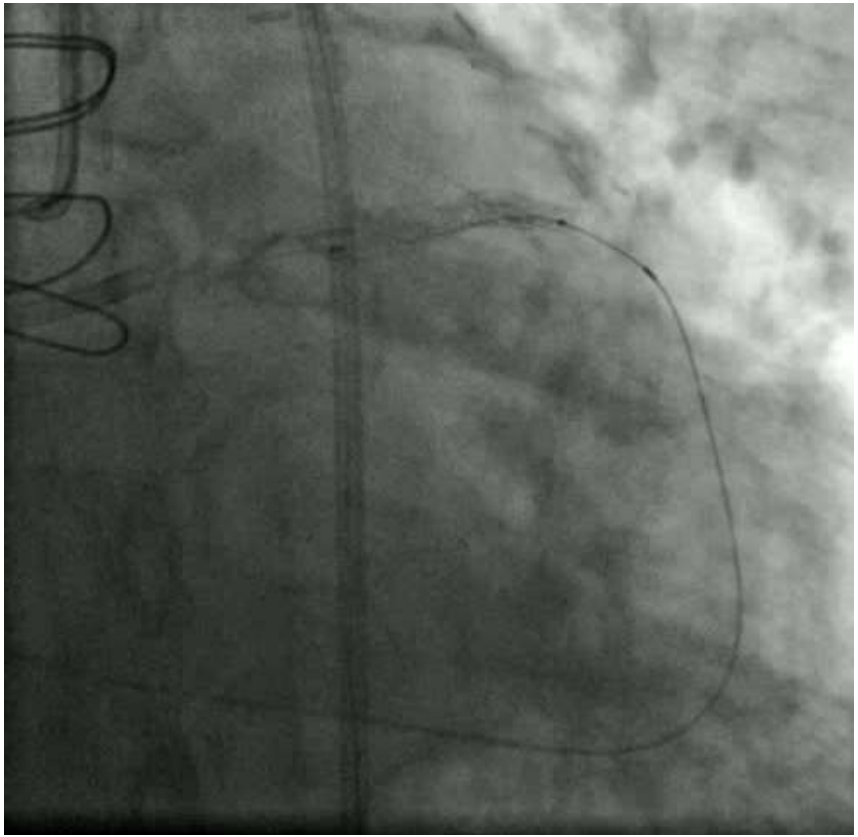
- **Corsair Pro failed to advance, but Caravel advanced retrograde**
- **Suoh 03 wire exchanged to Pilot 200 which crossed with difficulty into prox LAD/LM/guide**
- **Caravel advanced into guide and wire exchanged for R350 with externalization**

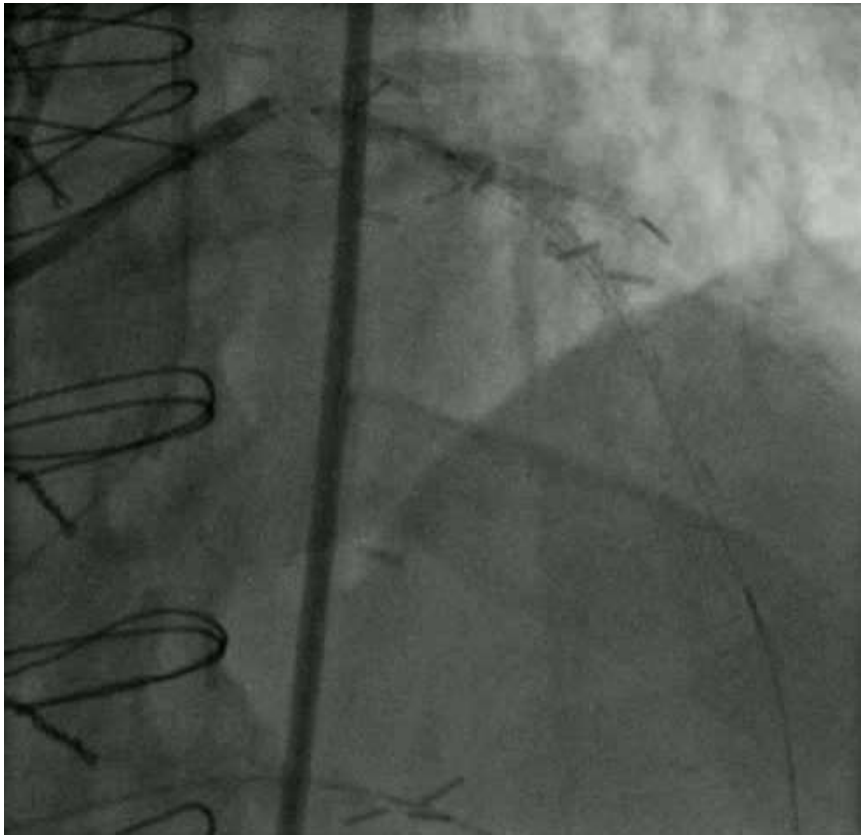






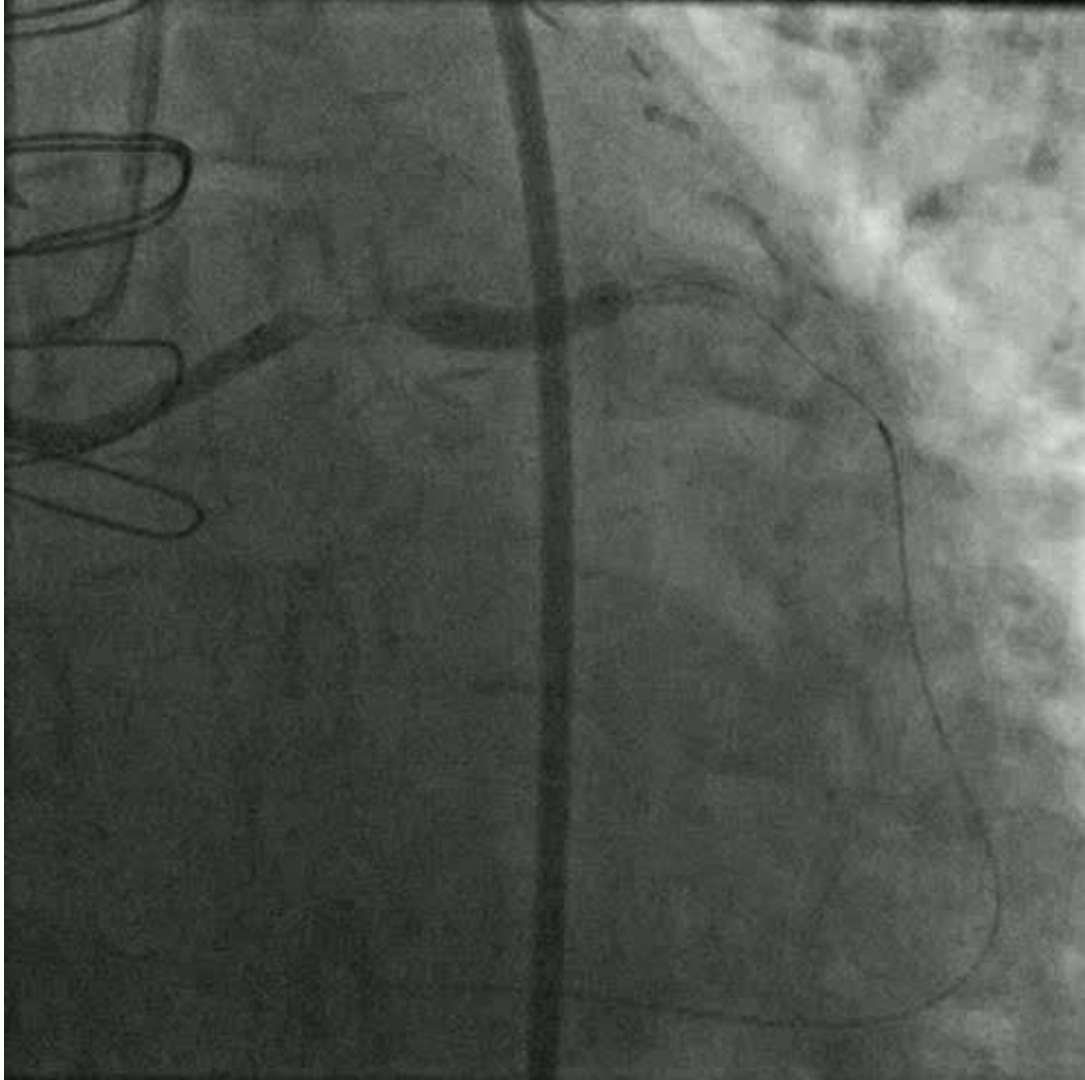
- **Multiple balloon inflations from 2.5-4.5 mm distal to proximally to permit IVUS advancement which was extremely challenging, eventually crossed**



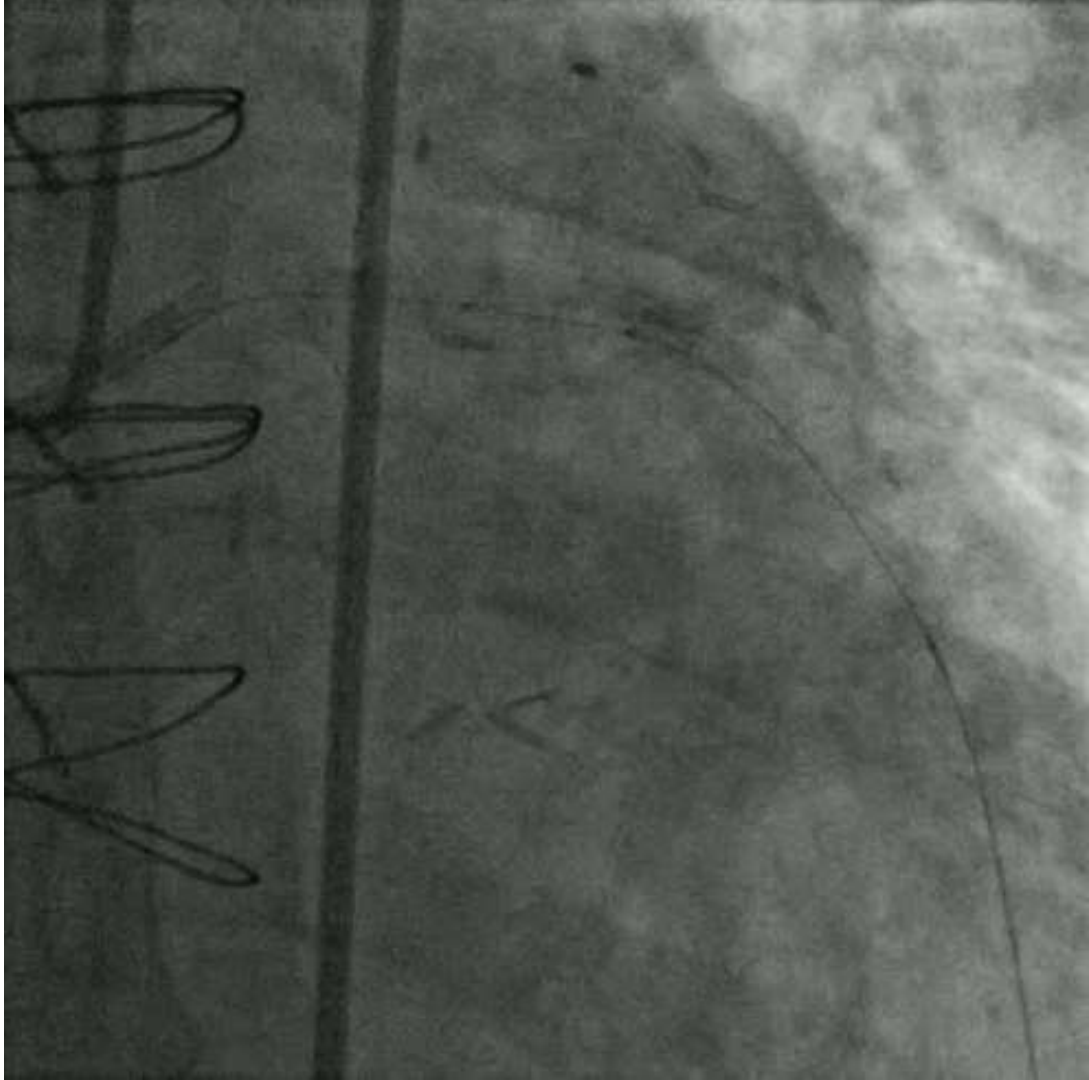


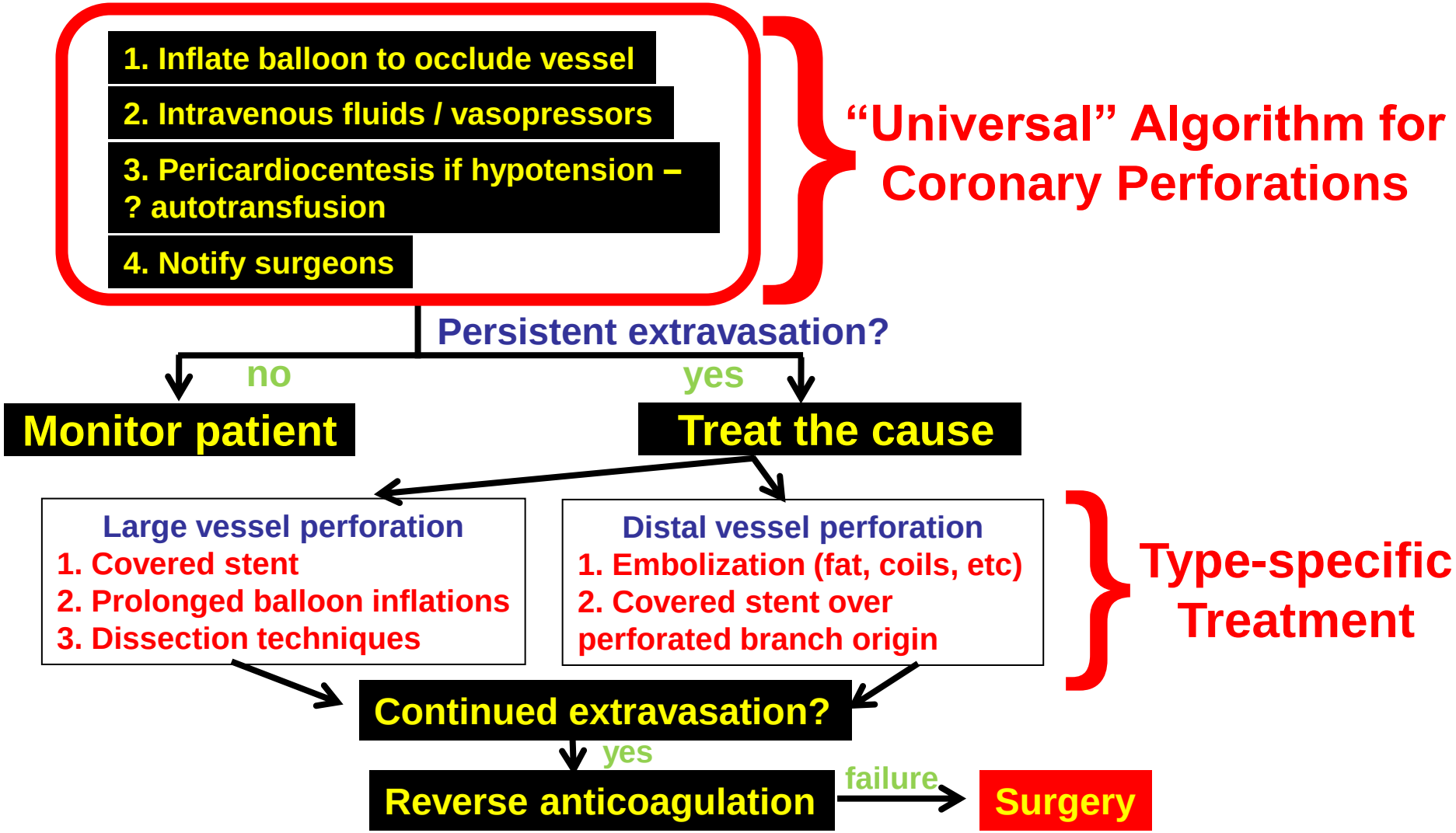
- **Lesion stented distally with 2.5 x 38 mm DES & proximally with 4.0 x 15mm DES**

Proximal 4.0mm stent postdilation



Next step?




1. Inflate balloon to occlude vessel
2. Intravenous fluids / vasopressors
3. Pericardiocentesis if hypotension – ? autotransfusion
4. Notify surgeons
"Universal" Algorithm for Coronary Perforations
Persistent extravasation?
no
yes
Monitor patient
Treat the cause
Large vessel perforation
1. Covered stent
2. Prolonged balloon inflations
3. Dissection techniques
Distal vessel perforation
1. Embolization (fat, coils, etc)
2. Covered stent over perforated branch origin
Type-specific Treatment
Continued extravasation?
yes
Reverse anticoagulation
failure
Surgery

FDA approved covered stents

PK Papyrus

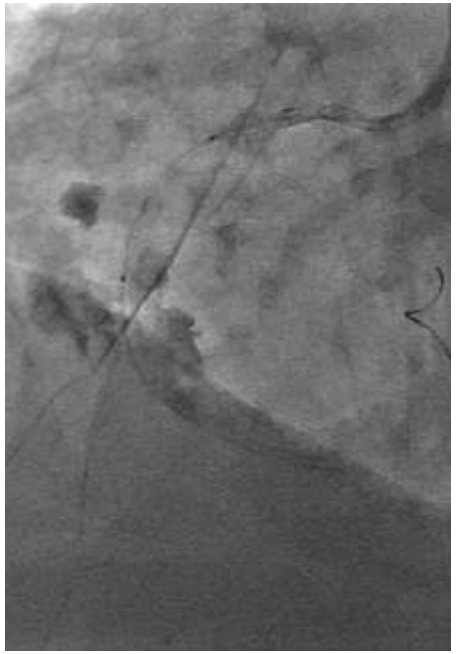
GRAFTMASTER

		Single Stent Design	Sandwich Stent Design
Cover material		Polyurethane	ePTFE
Guide catheter		5F	6F
Available sizes (mm)	Length	15, 20, 26	16, 19, 26
	Diameter	2.5, 3.0, 3.5, 4.0, 4.5, 5.0 (6 French)	2.8. 3.5, 4.0, 4.5, 4.8 (7 French)

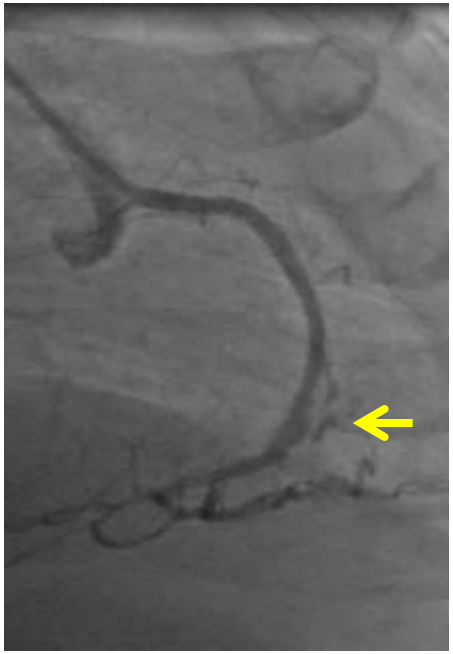
Types of coronary perforation

mechanism

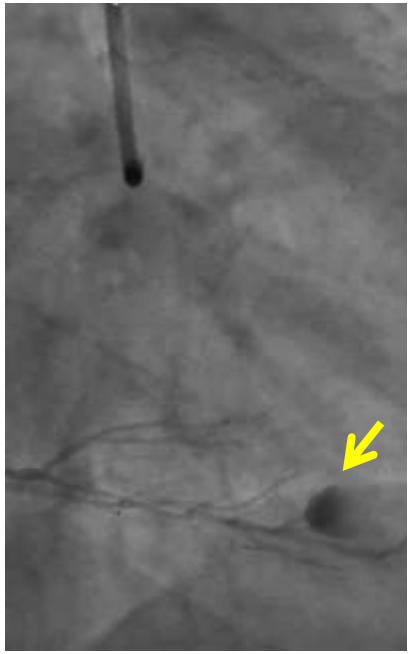
Main Vessel perforation



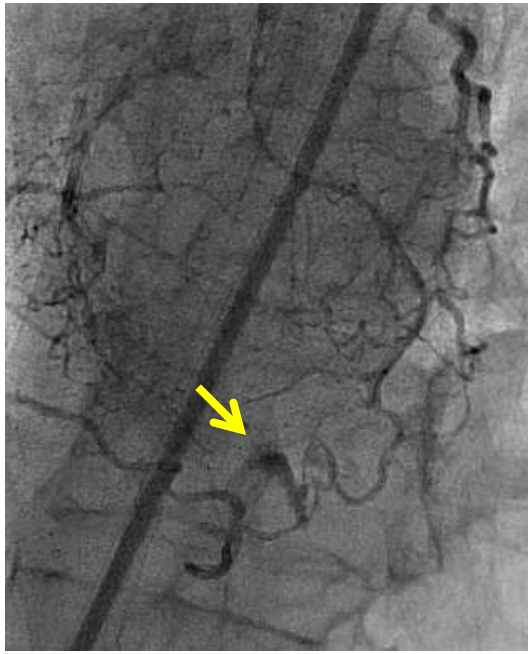
Distal Wire perforation



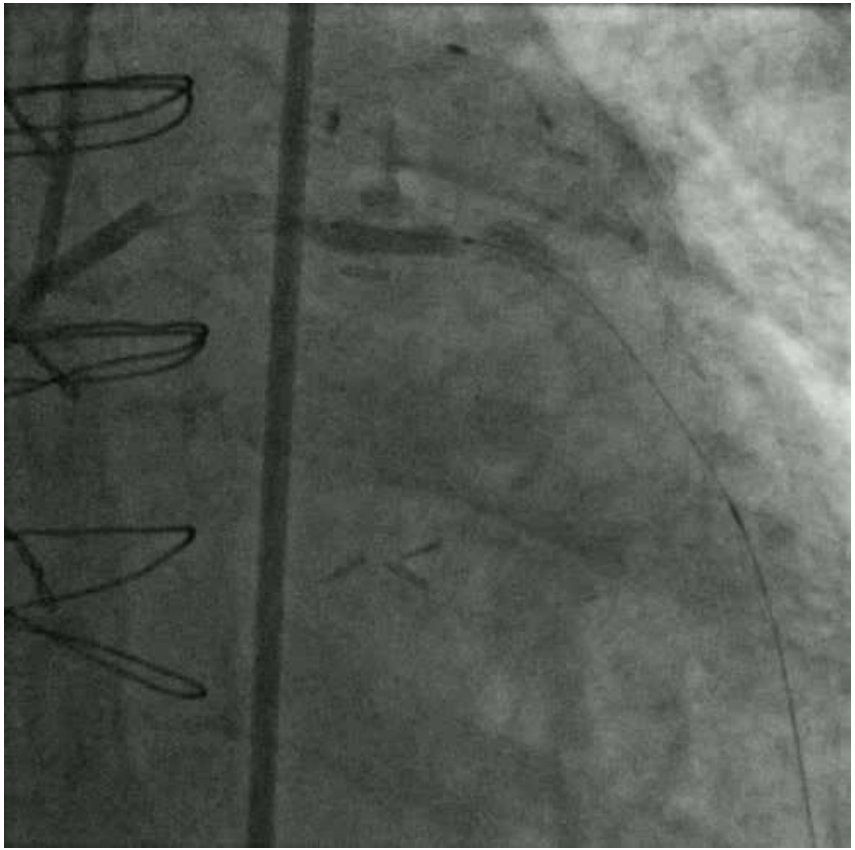
Collateral perforation - septal

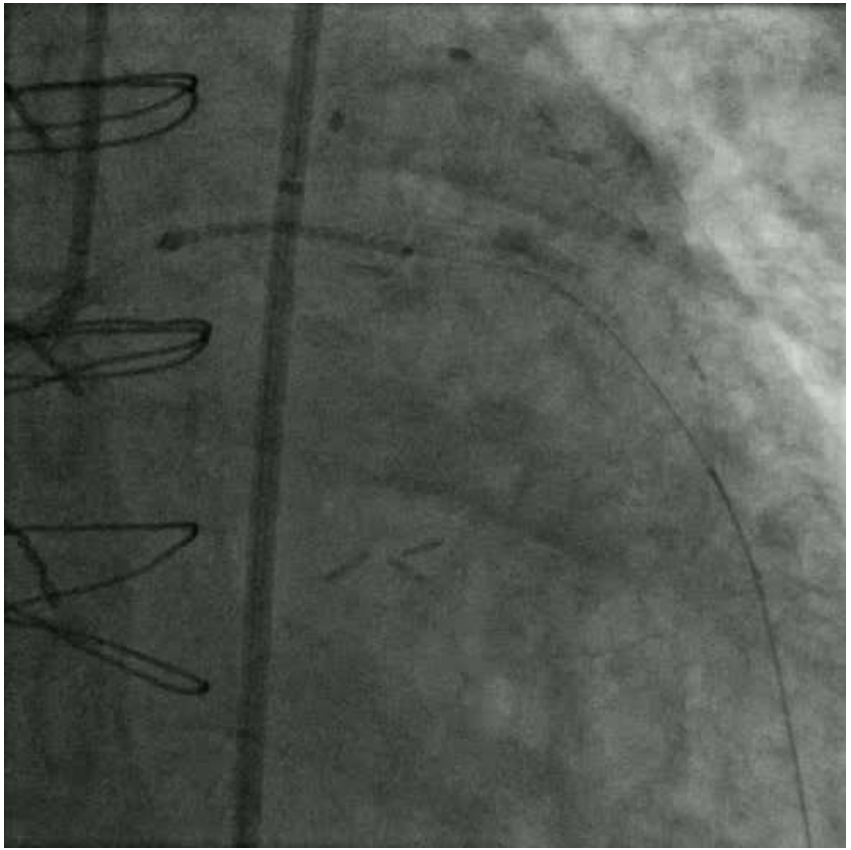


Collateral perforation - epicardial

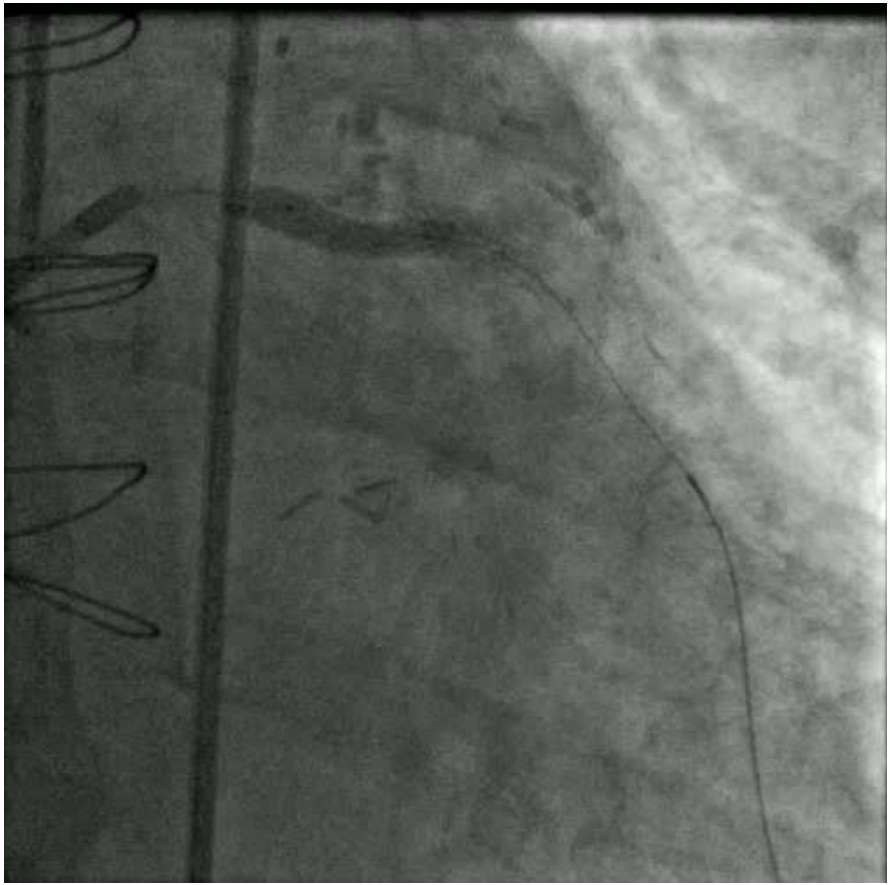


CTO-ARC Proposed classification

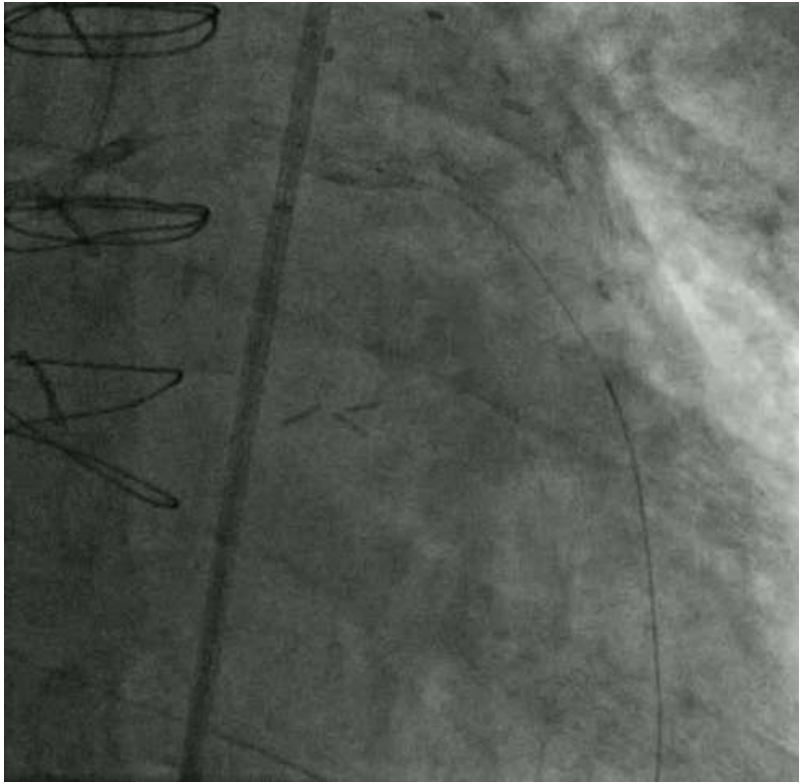


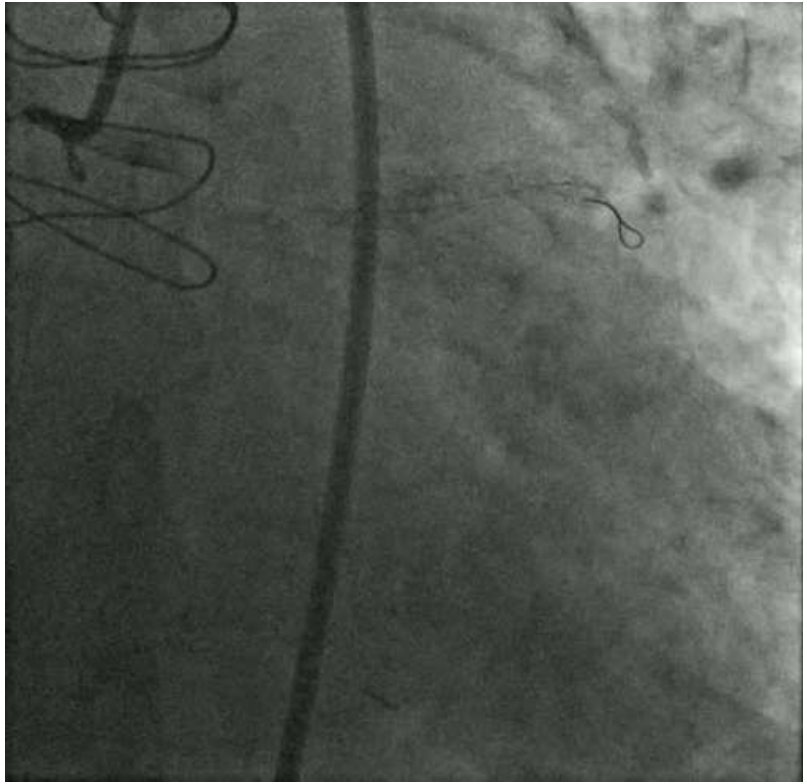


- **Prolonged balloon inflations failed to adequately seal perforation**
- **With difficulty, 4.0 x 16 mm Graftmaster advanced to site and deployed**



- **Graftmaster did not provide an immediate seal and multiple prolonged balloon inflations, intermittently for *nearly an hour* ensued…**

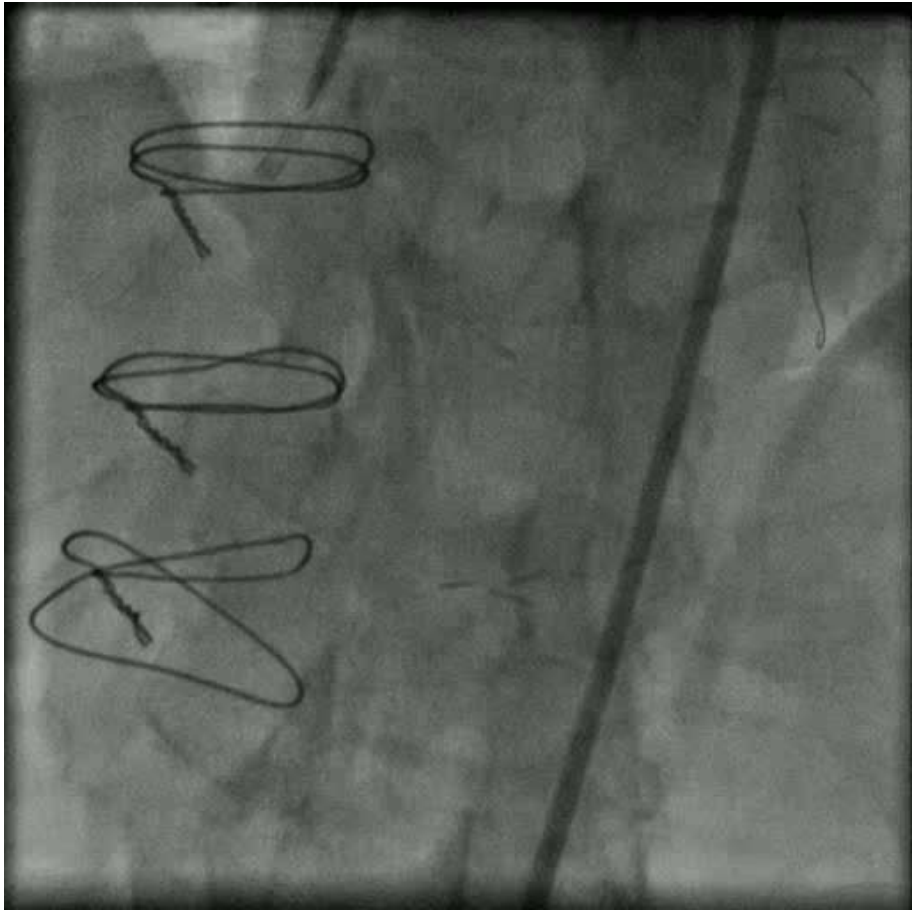




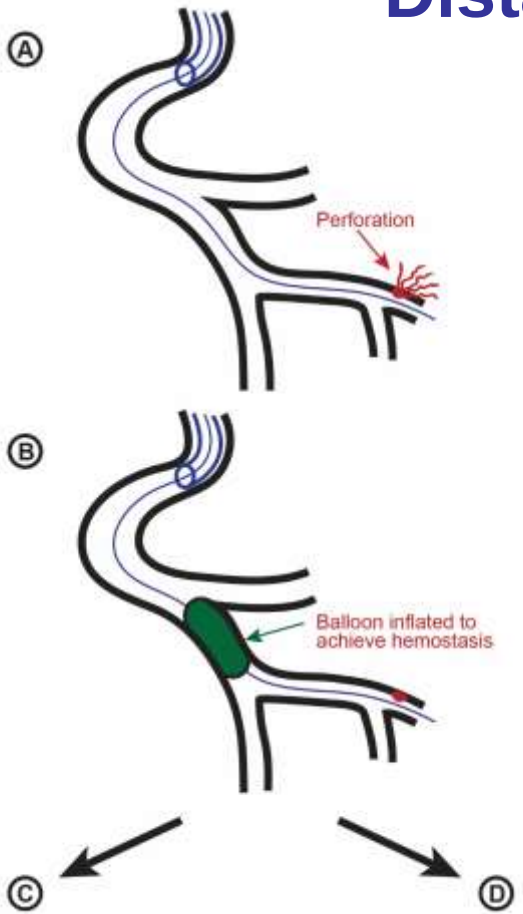
- **Eventually extravasation stopped**
- **Throughout this, echo had been performed with no significant effusion**
- **Hemodynamically stable**

- **Retrograde equipment now removed**

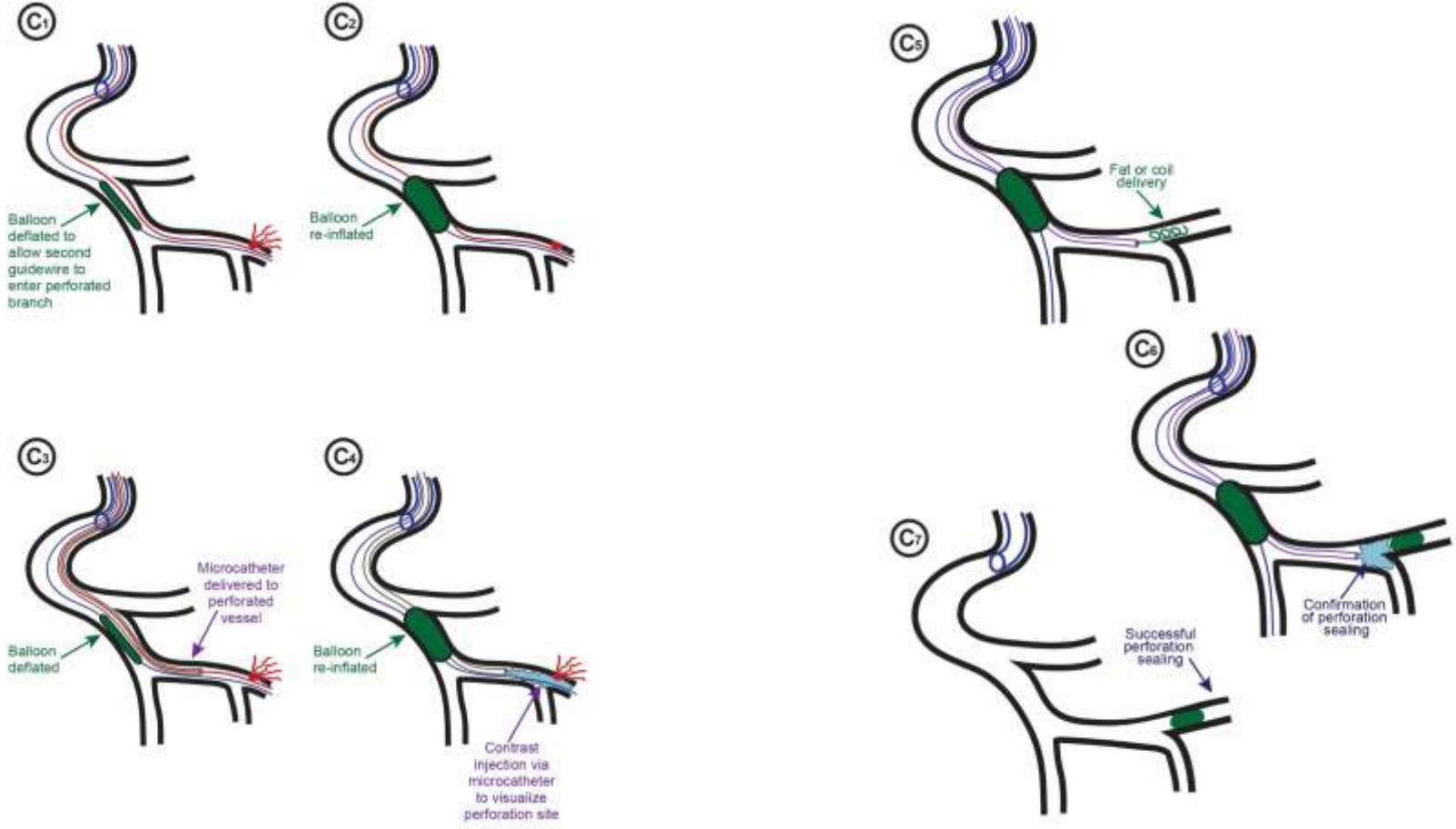
- **A new epicardial collateral perforation is revealed**



Distal vessel perforation



Brilakis ES. Manual of coronary CTO interventions 2nd edition. Elsevier 2017



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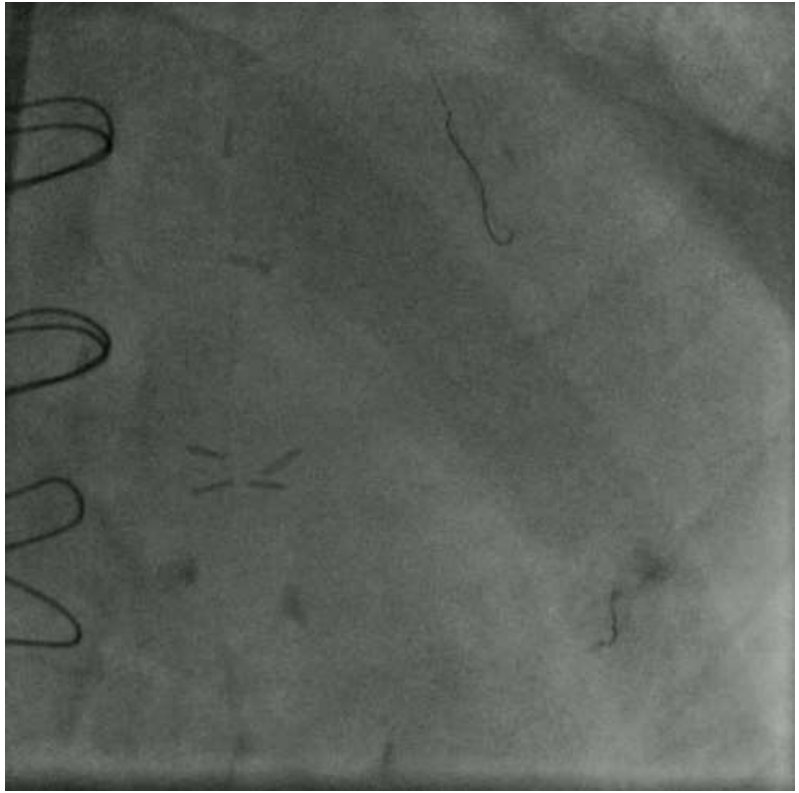
Coils

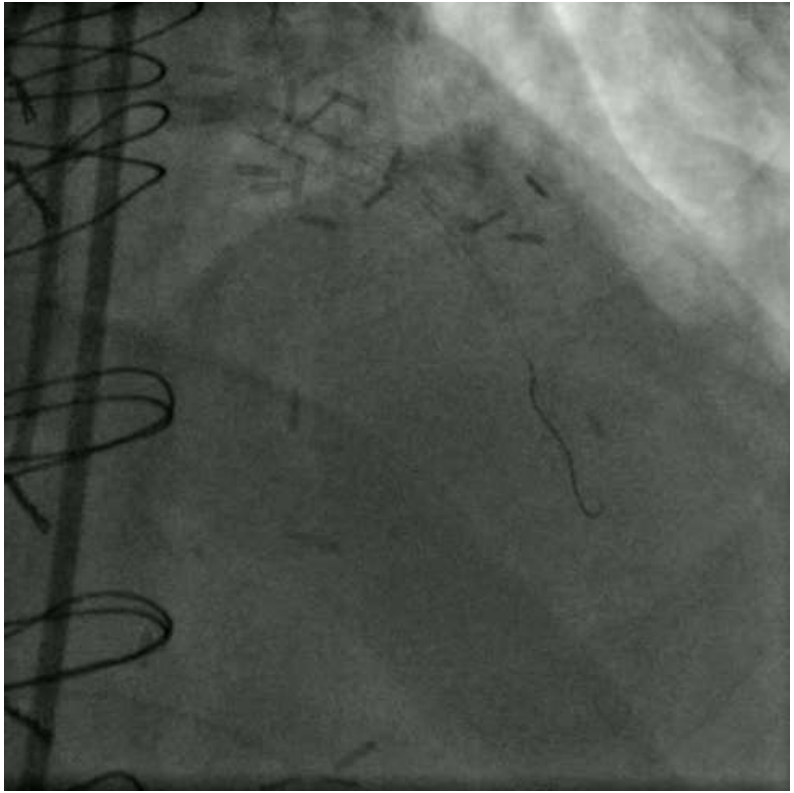
Axium – ev3

Finecross 1.8 Fr

Azur – Terumo

Progreat 2.8 Fr

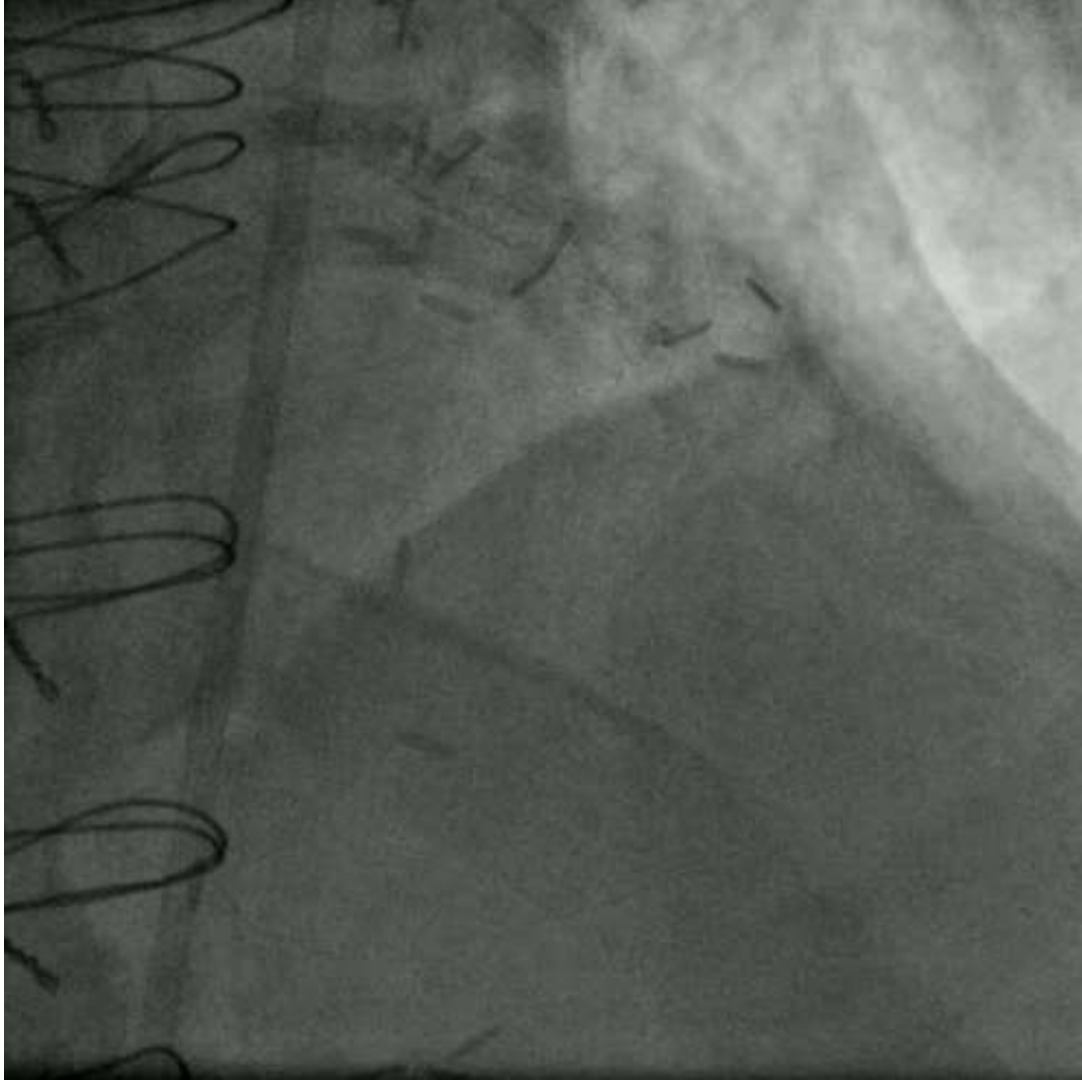




- **Caravel re-advanced into epicardial**
- **Axium ev3 1mm 3-D coil deployed**
- **Seal from RCA injection, no significant flow from LAD so bi-directional coiling not done**

Final Result

- **Patient had uneventful course post procedure except for intermittent pericardial pain x 1 day which resolved prior to discharge**



Conclusions

- Balloon uncrossable algorithm
- Retrograde via epicardial carries higher risk
- Covered stents + coils critical for perforation management