Step-by-step approach for antegrade wire escalation and antegrade dissection/re-entry techniques

Seoul National University Bundang Hospital

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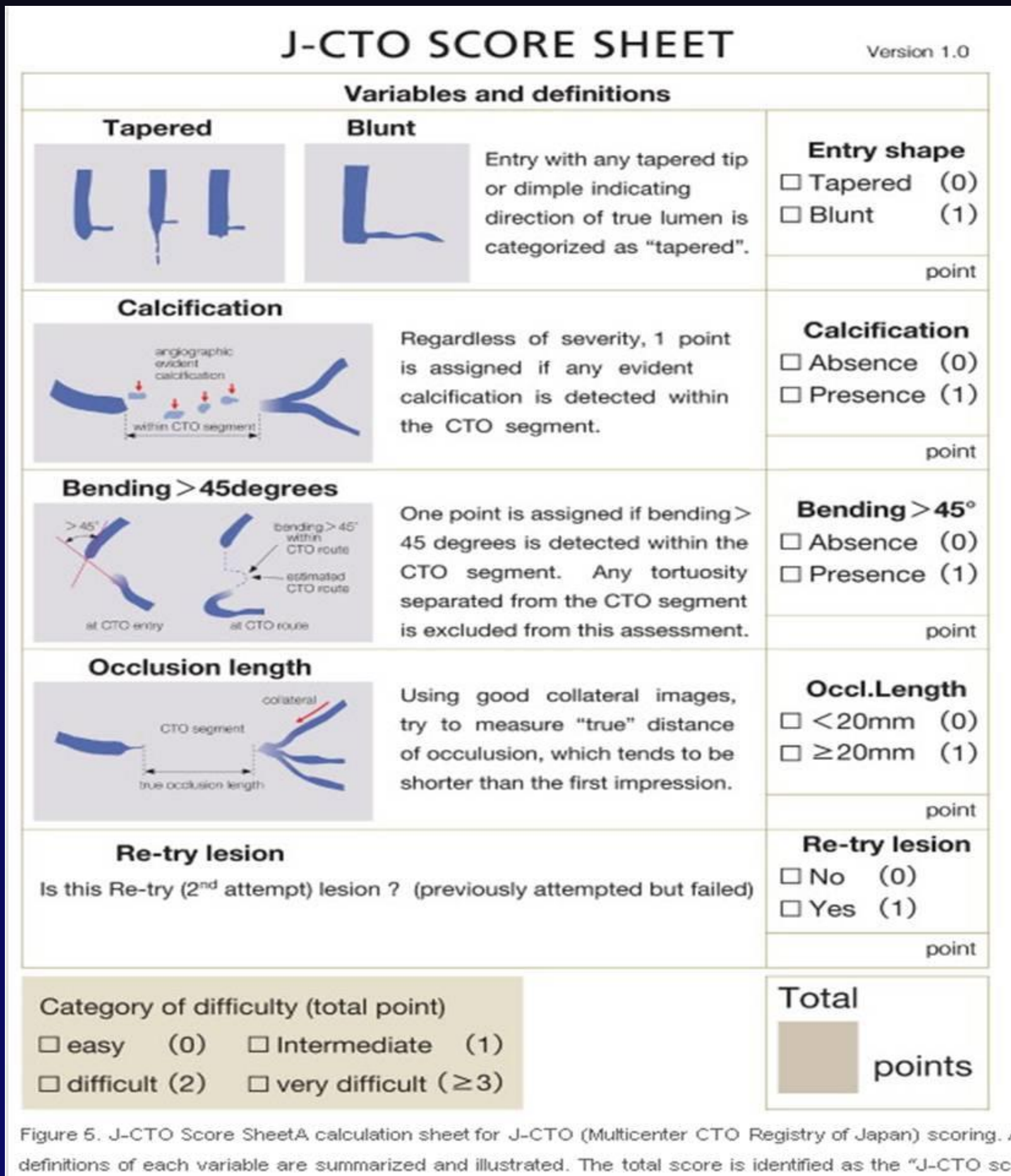
The J-CTO (Multicenter CTO Registry in Japan) Score as a Difficulty Grading and Time Assessment Tool


J-CTO SCORE SHEET Version 1.0

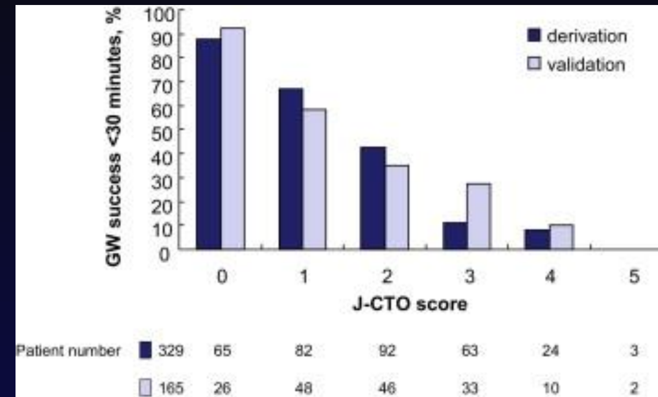
Variables and definitions

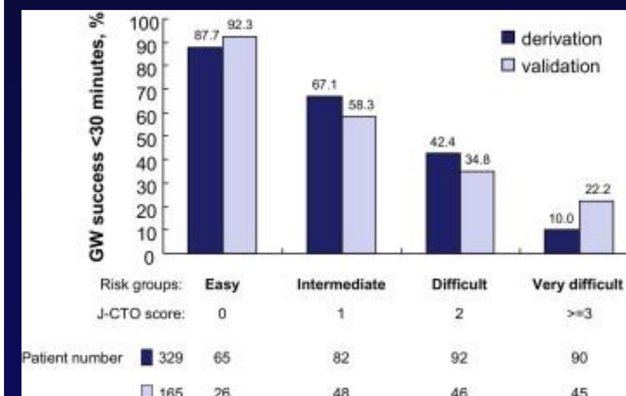
Variables	Definition	Score
Tapered / Blunt	Entry with any tapered tip or dimple indicating direction of true lumen is categorized as "tapered".	**Entry shape** ☐ Tapered (0) ☐ Blunt (1) point
Calcification	Regardless of severity, 1 point is assigned if any evident calcification is detected within the CTO segment.	**Calcification** ☐ Absence (0) ☐ Presence (1) point
Bending＞45degrees	One point is assigned if bending＞45 degrees is detected within the CTO segment. Any tortuosity separated from the CTO segment is excluded from this assessment.	**Bending＞45°** ☐ Absence (0) ☐ Presence (1) point
Occlusion length	Using good collateral images, try to measure "true" distance of occulusion, which tends to be shorter than the first impression.	**Occl.Length** ☐ ＜20mm (0) ☐ ≥20mm (1) point
Re-try lesion	Is this Re-try (2nd attempt) lesion ? (previously attempted but failed)	**Re-try lesion** ☐ No (0) ☐ Yes (1) point

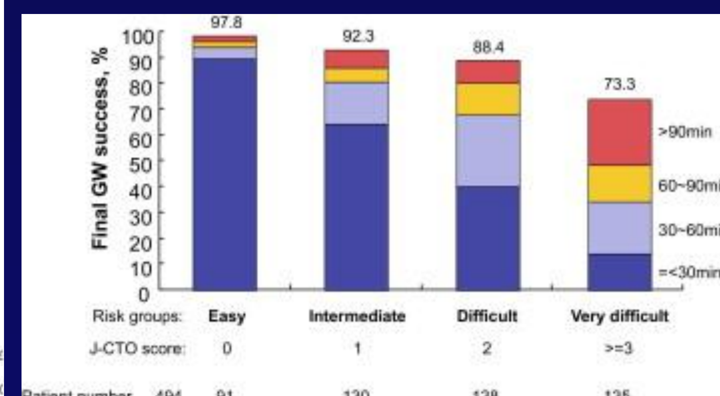
Category of difficulty (total point)
☐ easy (0) ☐ Intermediate (1)
☐ difficult (2) ☐ very difficult (≥3)

Total points

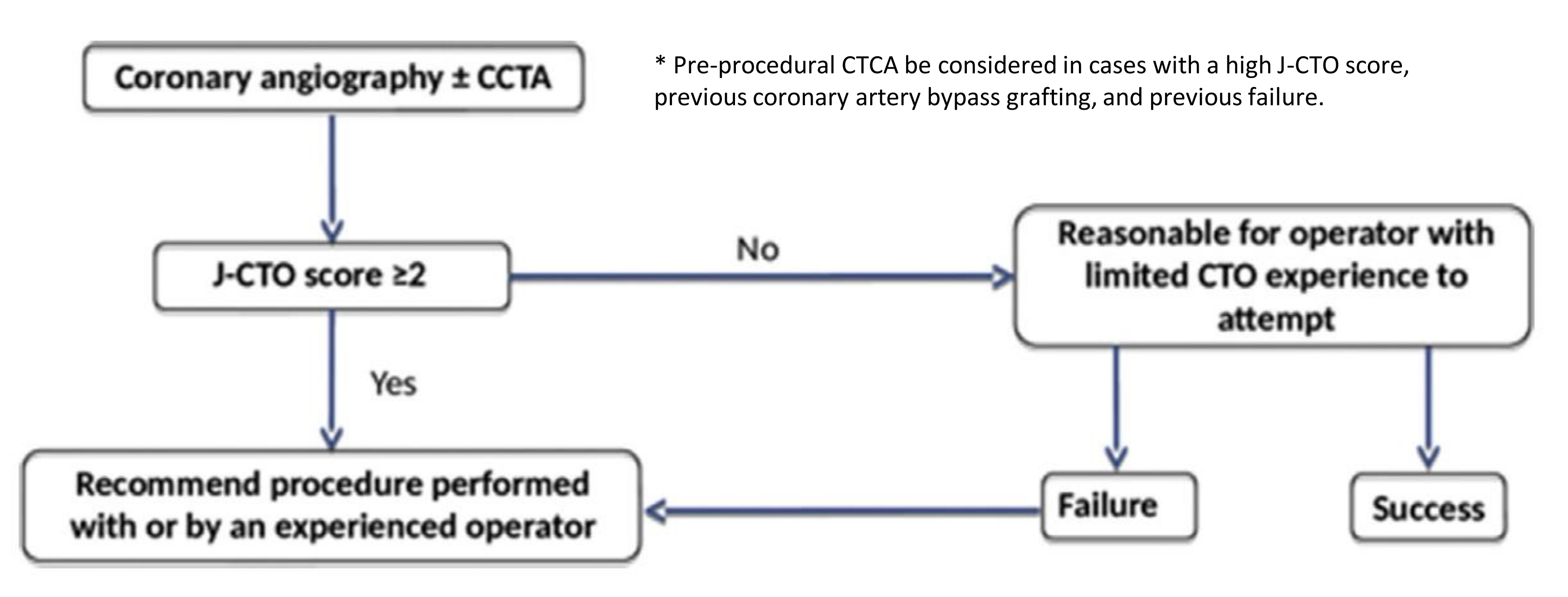
Figure 5. J-CTO Score SheetA calculation sheet for J-CTO (Multicenter CTO Registry of Japan) scoring. A definitions of each variable are summarized and illustrated. The total score is identified as the "J-CTO sc





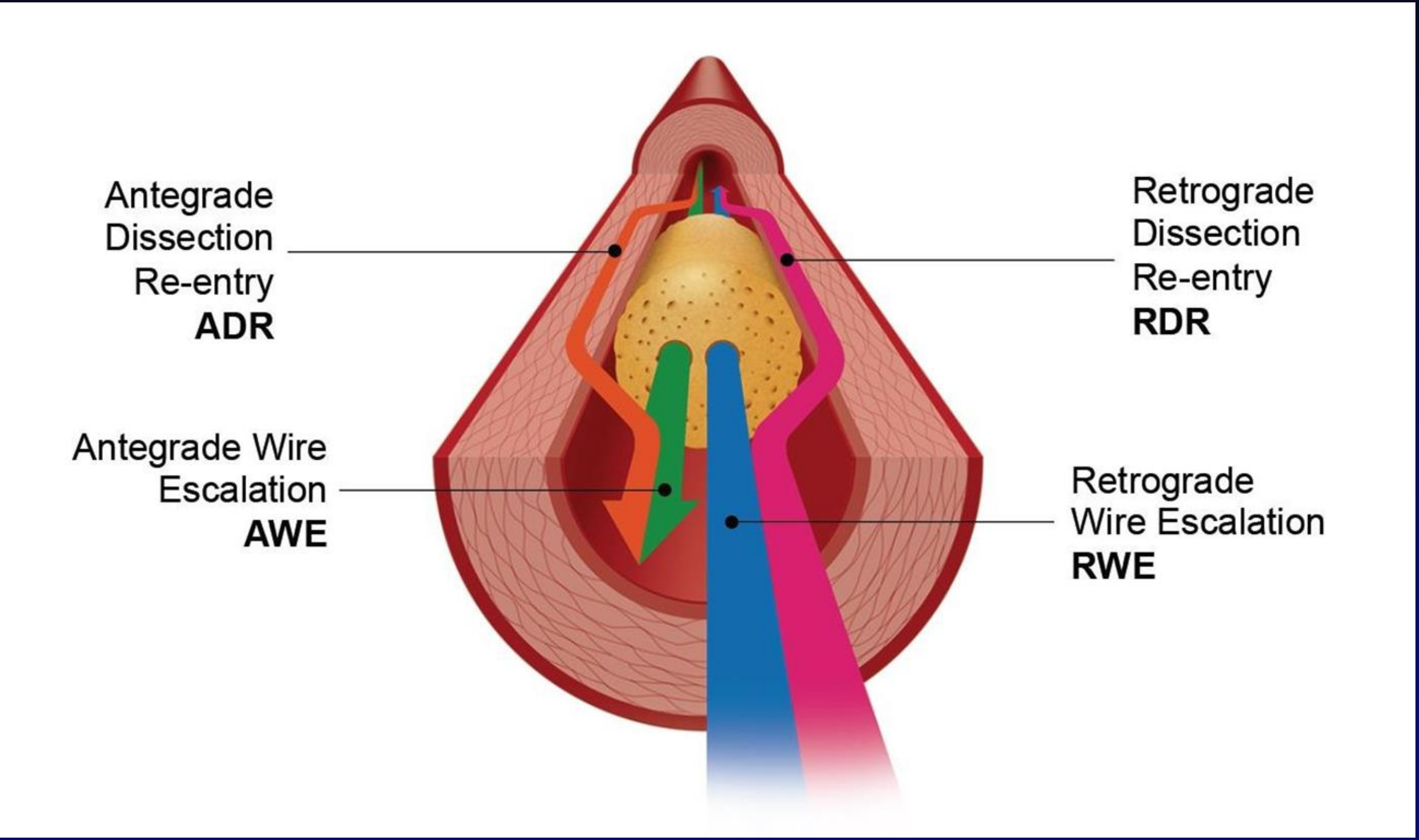


Case Selection Guided by the J-CTO Score

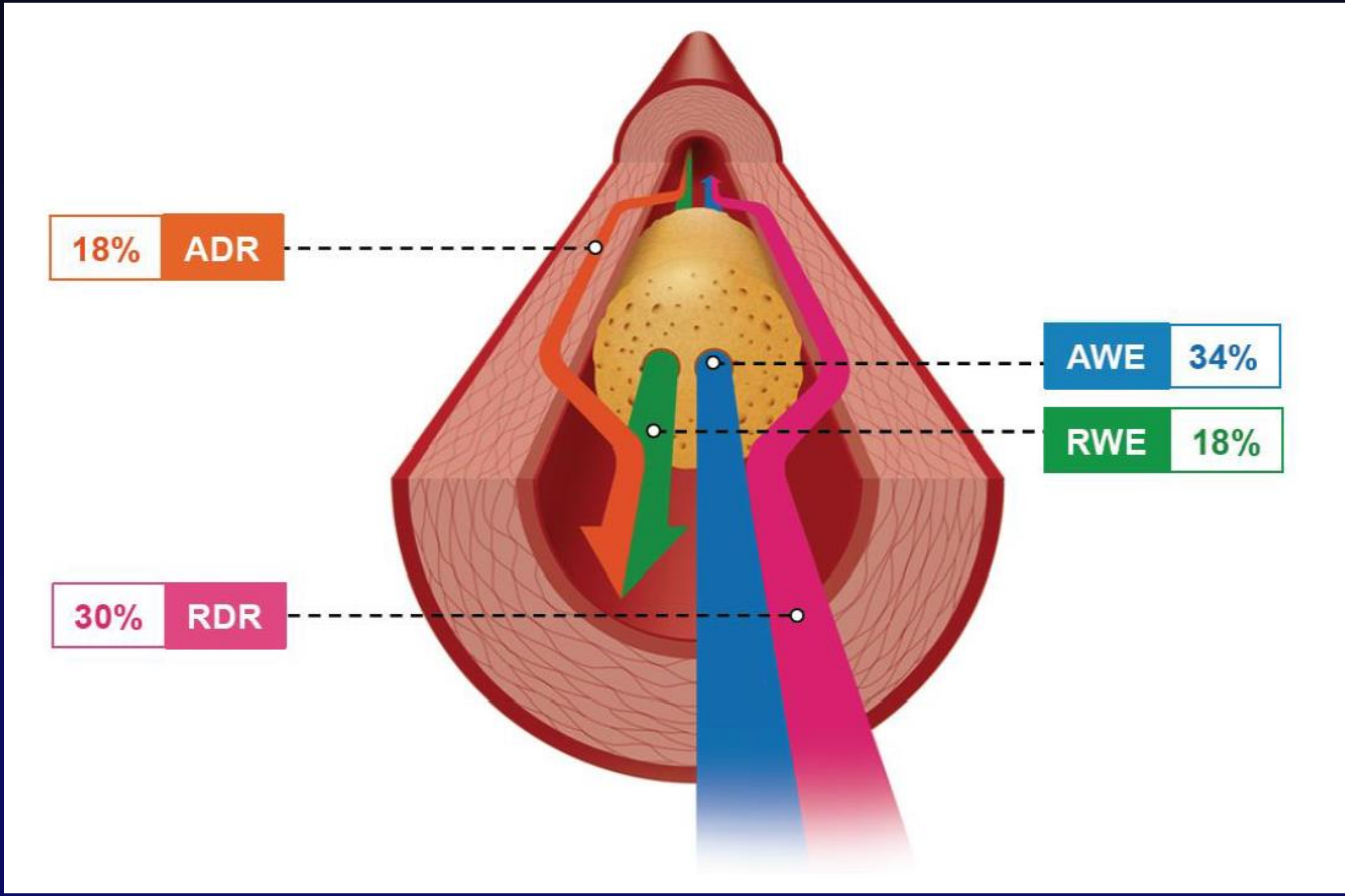


Hardingg et al., JACC CVI, 2017

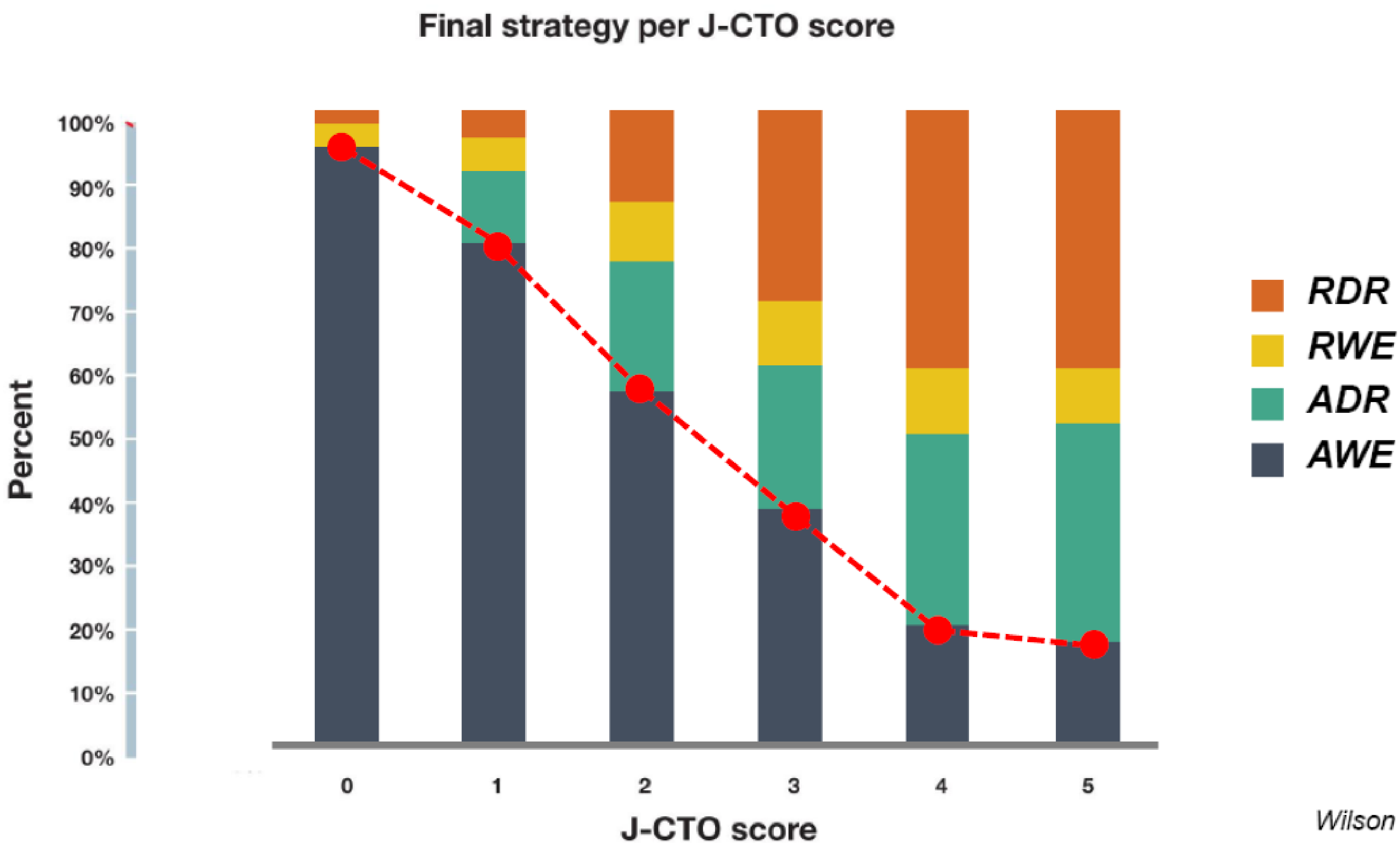
Four wire crossing strategies in CTO



Proportion of the final successful strategy

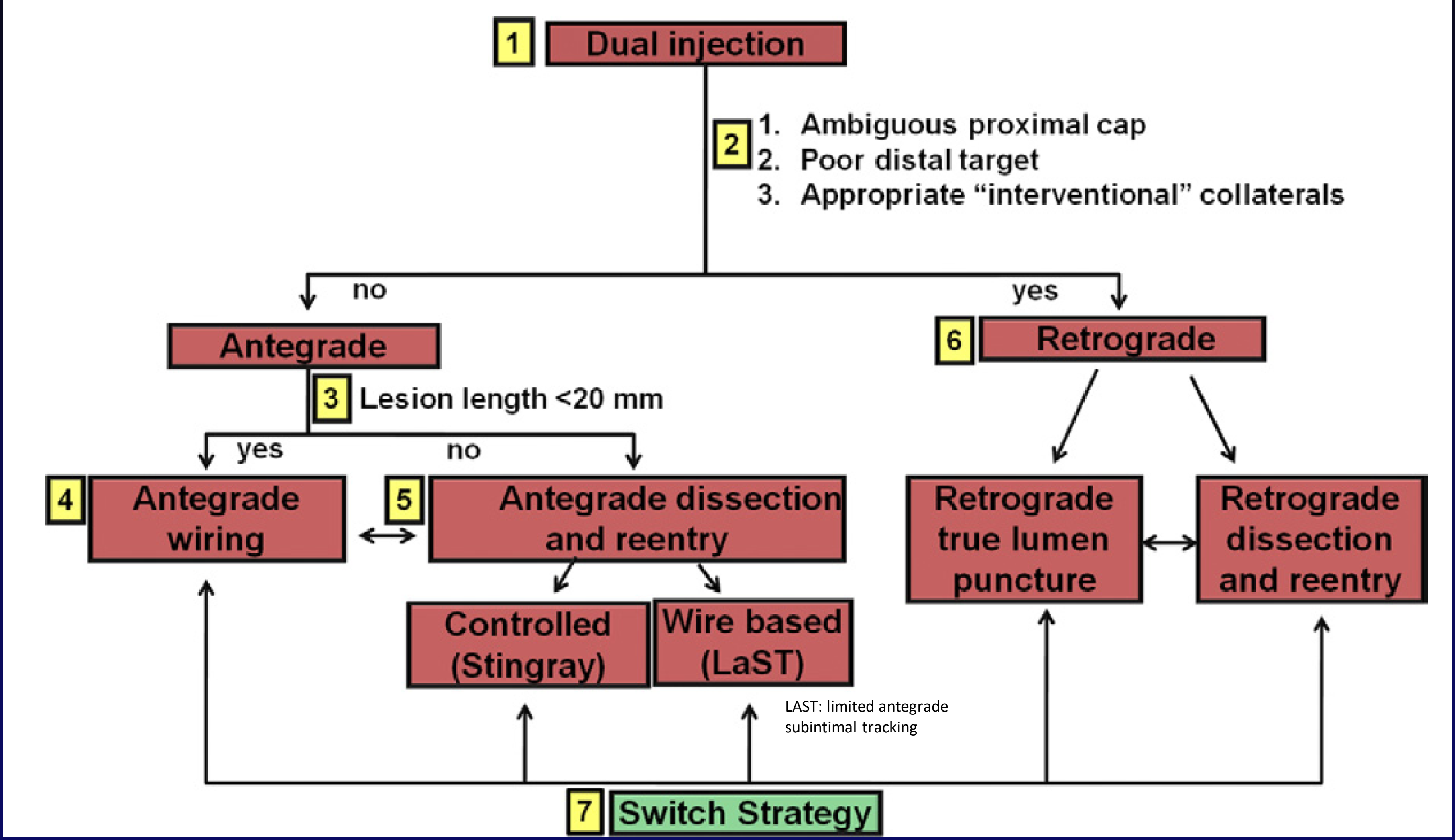


Final strategy depends on J-CTO score



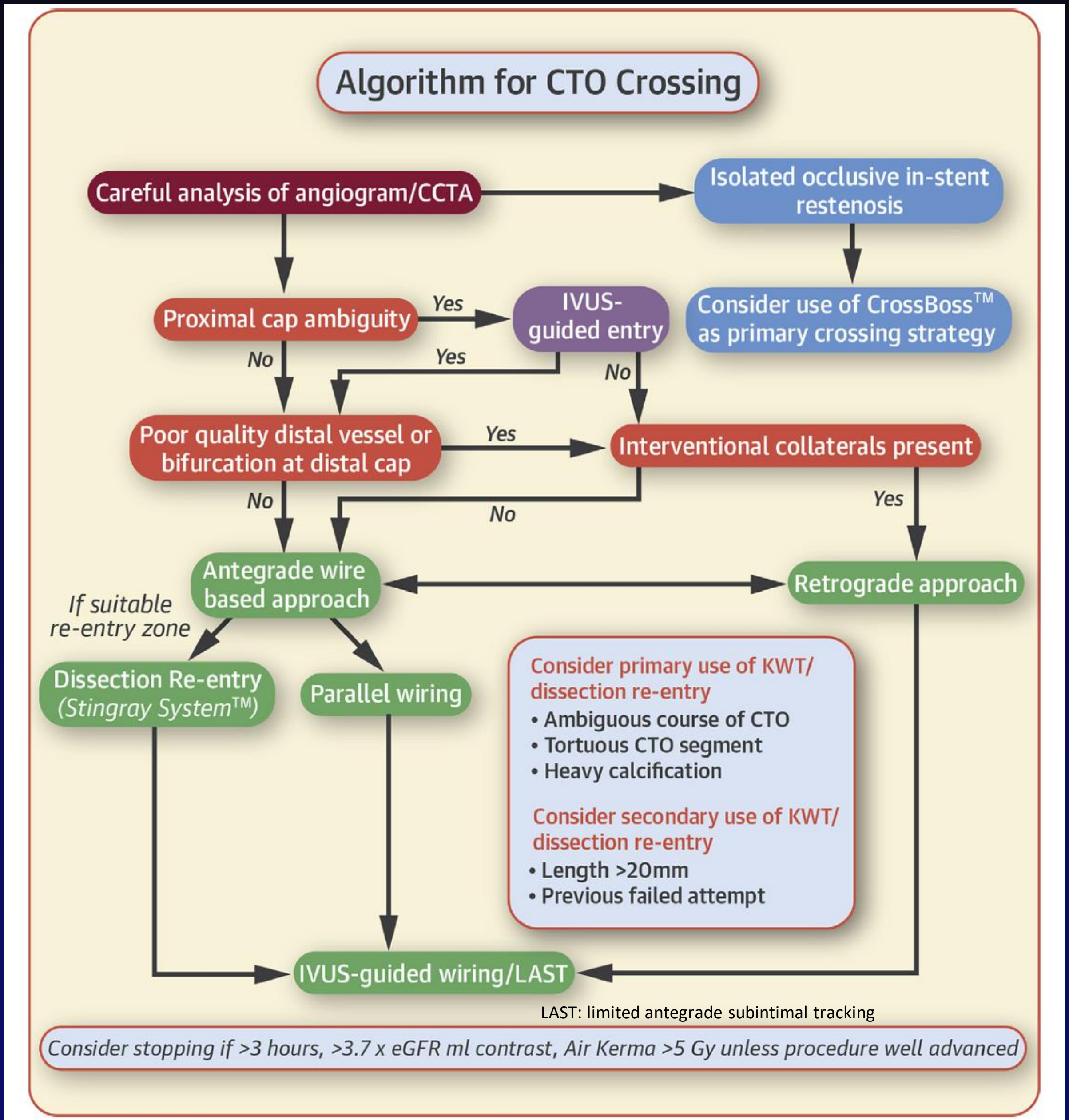
Wilson et al. Heart 2016

Algorithm for CTO crossing



Brilakis et al., JACC CVI, 2012

The Main Algorithm for CTO Crossing

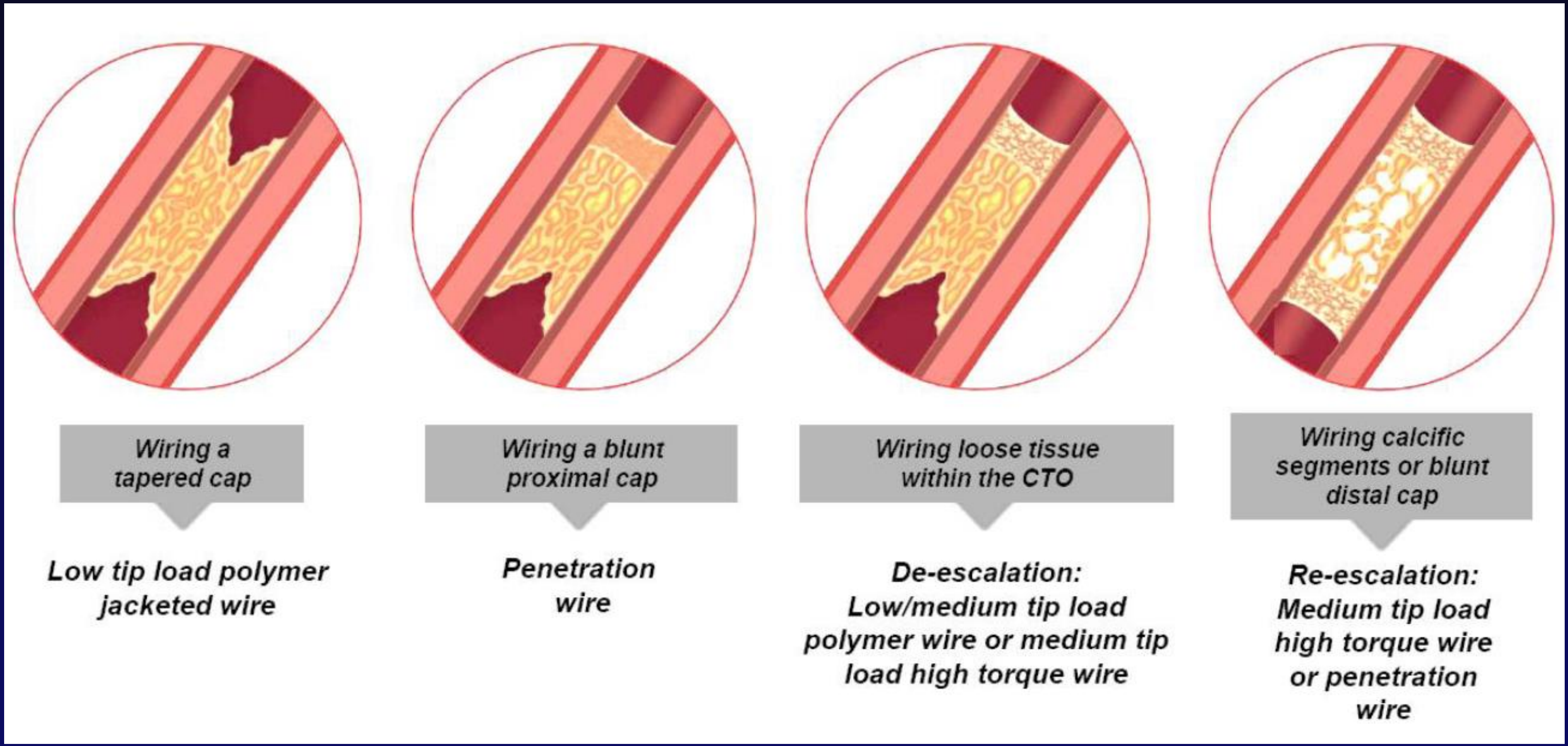


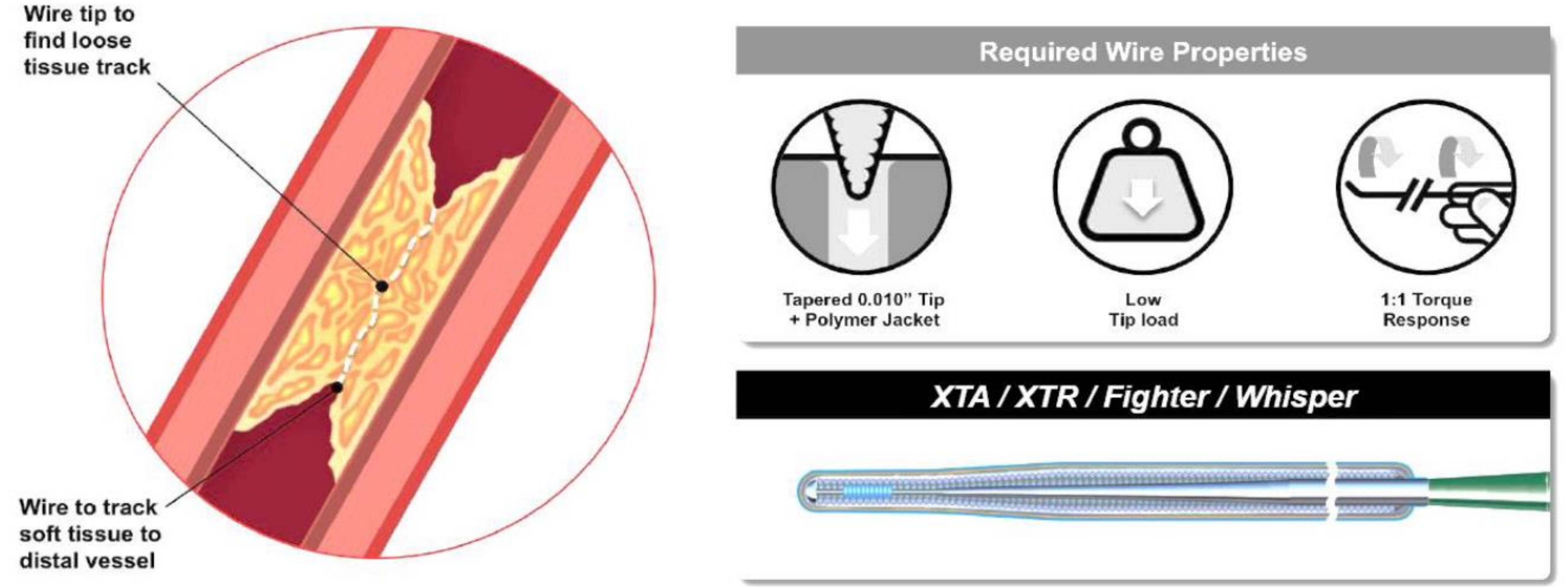
Hardingg et al.,
JACC CVI, 2017,

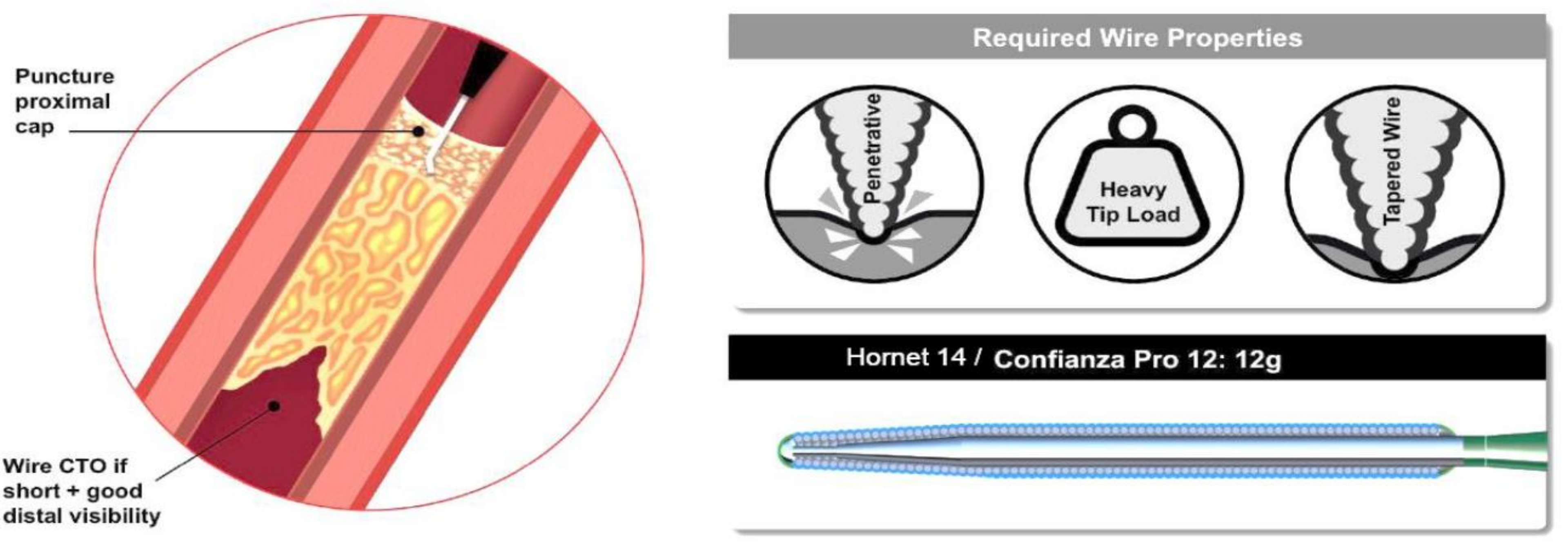
Essentials for antegrade wiring

- Anatomy: dual injection or CT angiography
- Use of microcatheter
- Wire escalation
- Multiple angle projection (to identify the wire and target vessel positions)

Various types of CTO lesions and different strategies




Wire tip to find loose tissue track
Wire to track soft tissue to distal vessel
Required Wire Properties
Tapered 0.010" Tip + Polymer Jacket
Low Tip load
1:1 Torque Response
XTA / XTR / Fighter / Whisper


Puncture proximal cap
Wire CTO if short + good distal visibility
Required Wire Properties
Penetrative
Heavy Tip Load
Tapered Wire
Hornet 14 / Confianza Pro 12: 12g

Algorithm for Antegrade Wire Escalation

	Visible channel	Tapered proximal cap	Blunt proximal cap
Proximal Cap	Low penetration force wire with polymer jacket and tapered tip ↓ Intermediate penetration force wire	Low penetration force wire ↓ Intermediate penetration force wire	Intermediate penetration force wire ↓ High penetration force wire
CTO body	If a high penetration-force wire has been used to the puncture proximal cap step down to a lower penetration-force wire unless occlusion short with unambiguous course.		
Distal Cap	Escalation from softer more steerable wire to a higher penetration-force wire may be required.		

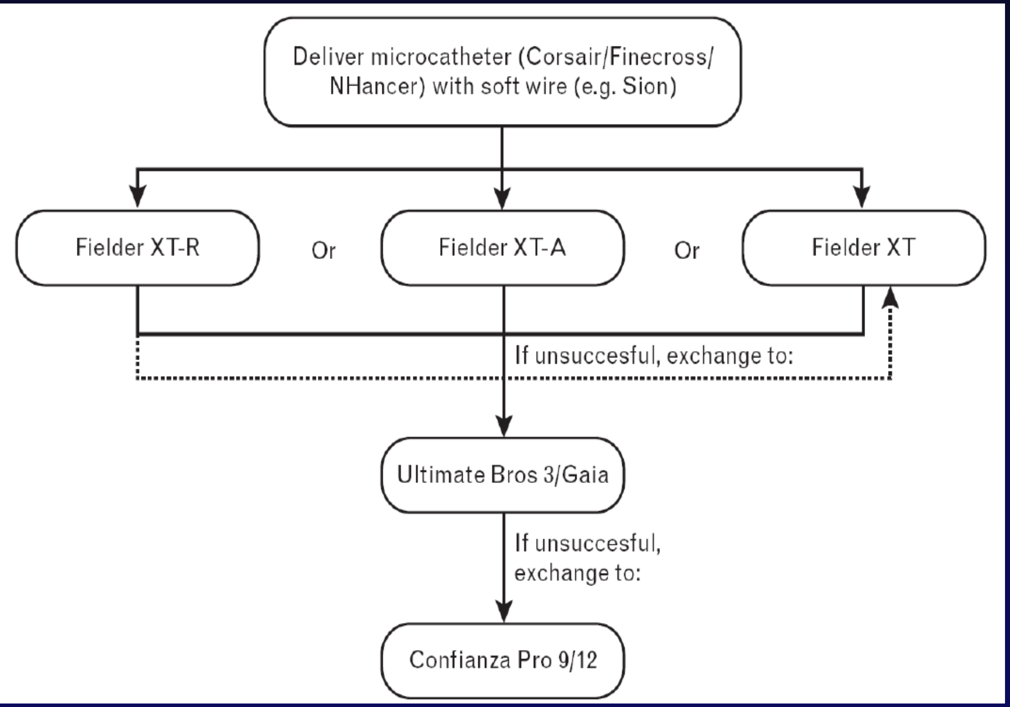
Guidewires Commonly Used for CTO Crossing

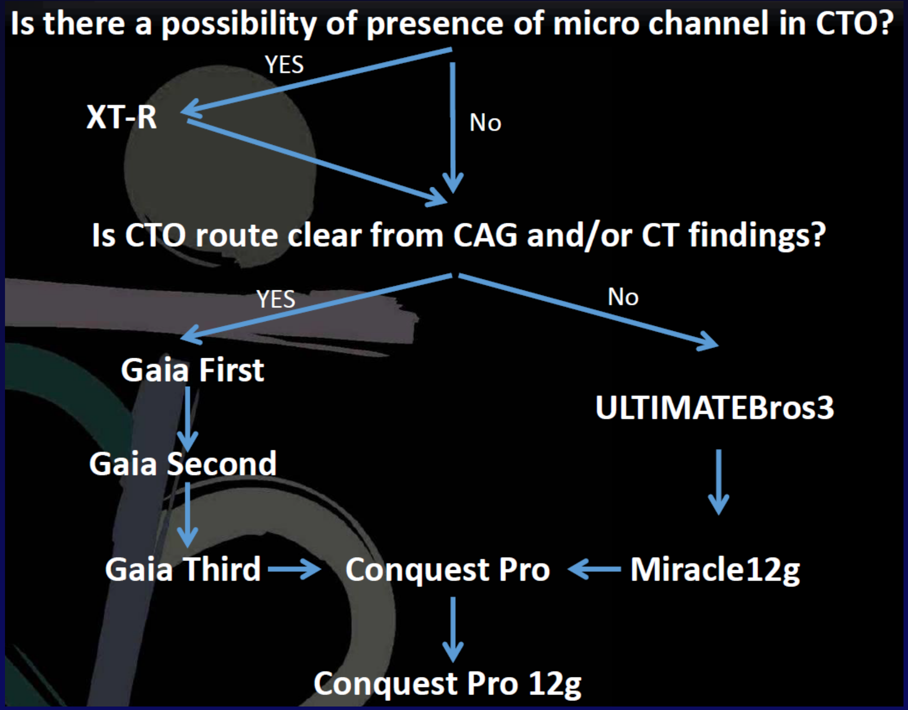
Wire Category	Wire Name	Polymer Jacket	Tapered Tip (inch)	Tip Load (gf)	Manufacturer
Low penetration force	Fielder XT*	✓	0.009	0.8	Asahi Intecc
	Fielder XT-R*	✓	0.010	0.6	Asahi Intecc
	Fielder XT-A*	✓	0.010	1.0	Asahi Intecc
	Pilot 50	✓	×	1.5	Abbott Vascular
	Fighter	✓	0.009	1.5	Boston Scientific
	Hornet	×	0.008	1.0	Boston Scientific
	Gaia 1st	×	0.010	1.7	Asahi Intecc
	Cross-it 100XT	×	0.010	2.0	Abbott Vascular
Intermediate penetration force	Pilot 150	✓	×	2.7	Abbott Vascular
	Pilot 200*	✓	×	4.1	Abbott Vascular
	Gladius	✓	×	3.0	Asahi Intecc
	Miracle 3	×	×	3.0	Asahi Intecc
	Ultimate 3*	×	×	3.0	Asahi Intecc
	Gaia 2nd*	×	0.010	3.5	Asahi Intecc
	Cross-it 200	×	0.011	3.0	Abbott Vascular
High penetration force	Conquest Pro*	✓	0.009	9.0	Asahi Intecc
	Conquest Pro 12*	✓	0.009	12.0	Asahi Intecc
	Gaia 3rd*	×	0.012	4.5	Asahi Intecc
	Hornet 10	×	0.008	10.0	Boston Scientific
	Hornet 14	×	0.008	14.0	Boston Scientific
	PROGRESS 200T	×	0.009	13.0	Abbott Vascular
	Miracle 12	×	×	12.0	Asahi Intecc

*Most commonly used guidewires

Hardingg et al., JACC CVI, 2017,

Typical antegrade wire escalation technique





IVUS catheters used for CTO intervention

Company	Catheter	Tip to Transducer	Scan Type	Image
Volcano	Eagle Eye Platinum ST	2.5mm	Electronic scan type	
Volcano	Eagle Eye Platinum	10mm	Electronic scan type	
TERUMO	Navi Focus WR	9mm	Mechanical Scan type	
Boston	OptiCross	20mm	Mechanical Scan type	

CTO dissection and Re-entry strategy

Antegrade

Dissection
- Knuckle wire
- Crossboss

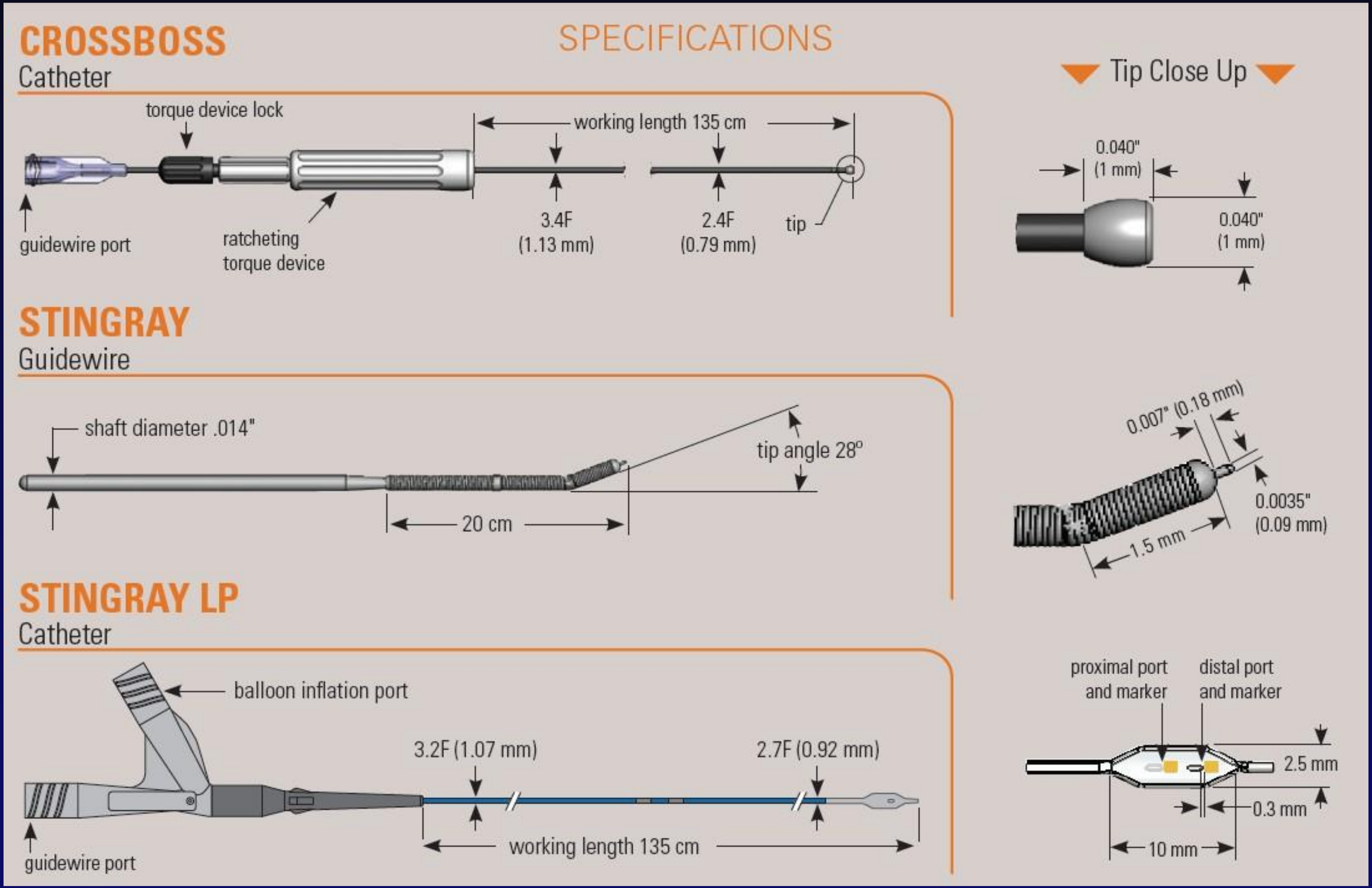
Re-entry
- STAR
- Contrast- guided STAR
- Mini-STAR
- LAST
- Stingray

Retrograde

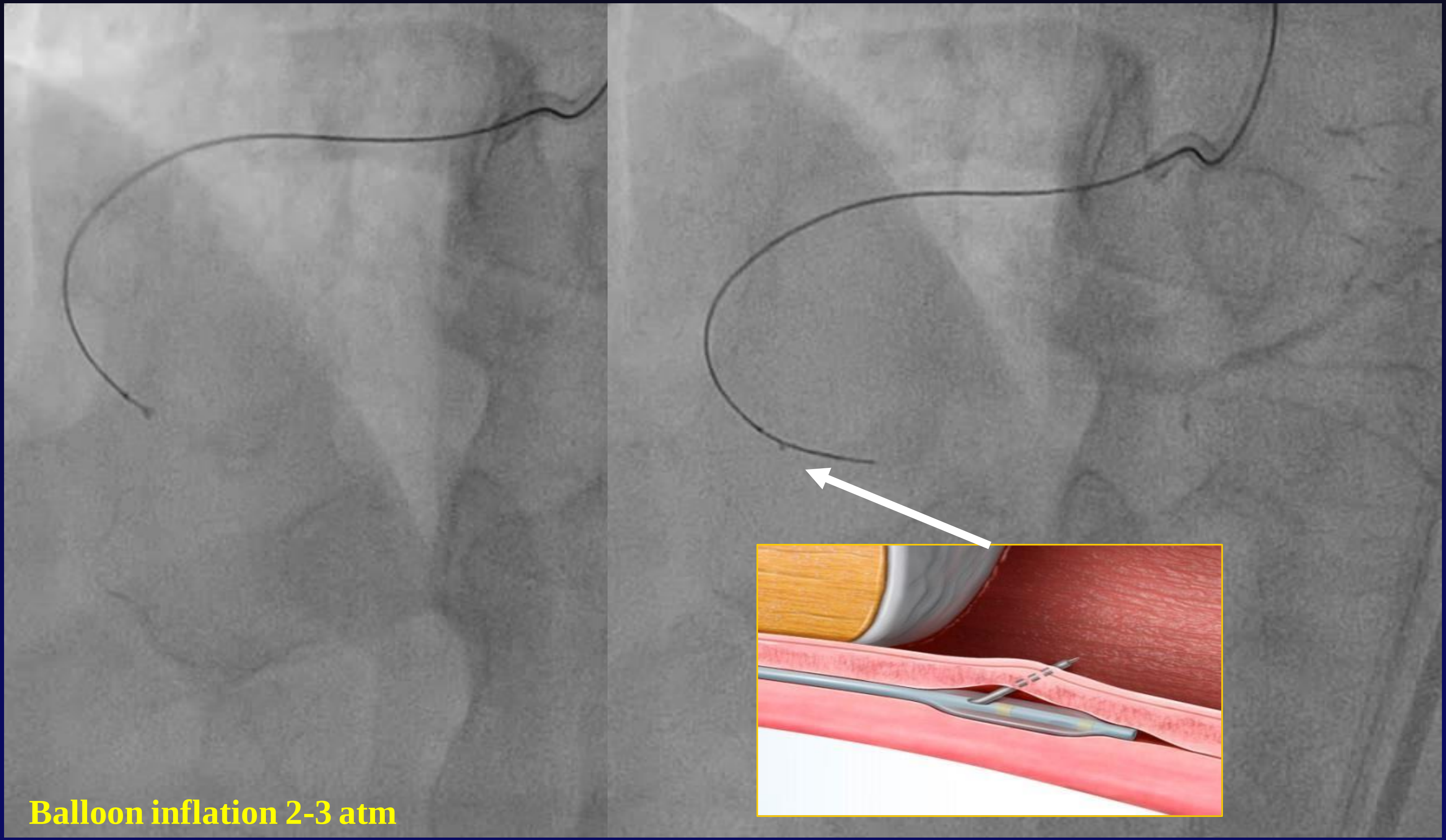
Dissection
- Knuckle wire

Re-entry
- CART
- Reverse-CART

ADR device


CROSSBOSS
Catheter
SPECIFICATIONS
Tip Close Up
torque device lock
working length 135 cm
guidewire port
ratcheting
torque device
3.4F
(1.13 mm)
2.4F
(0.79 mm)
tip
0.040"
(1 mm)
0.040"
(1 mm)
STINGRAY
Guidewire
shaft diameter .014"
tip angle 28º
20 cm
0.007" (0.18 mm)
0.0035"
(0.09 mm)
1.5 mm
STINGRAY LP
Catheter
balloon inflation port
3.2F (1.07 mm)
2.7F (0.92 mm)
working length 135 cm
guidewire port
proximal port
and marker
distal port
and marker
2.5 mm
0.3 mm
10 mm

Reentry using Stingray



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)

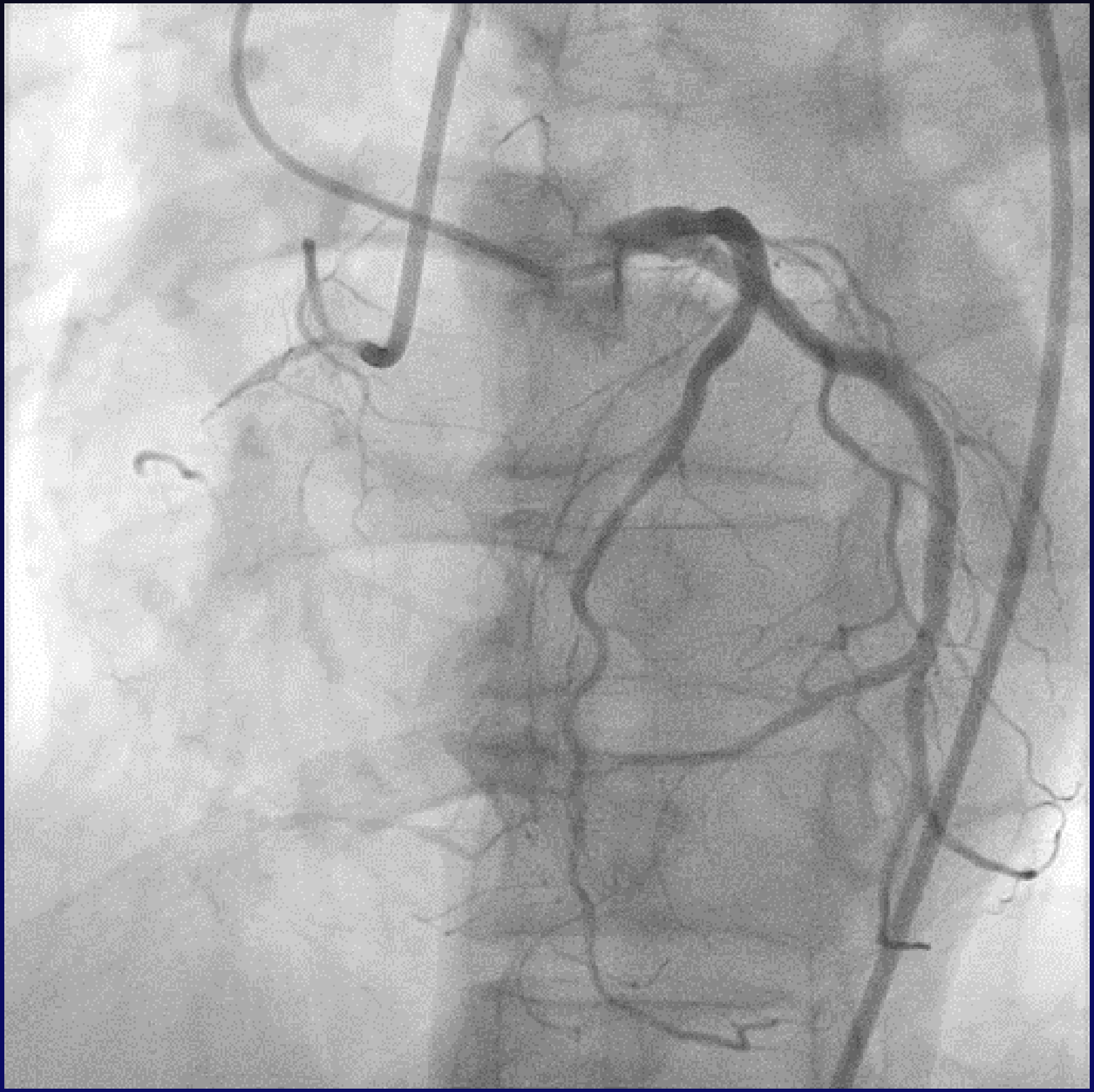
Technical procedural success : 87.8% and 84.1%

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.

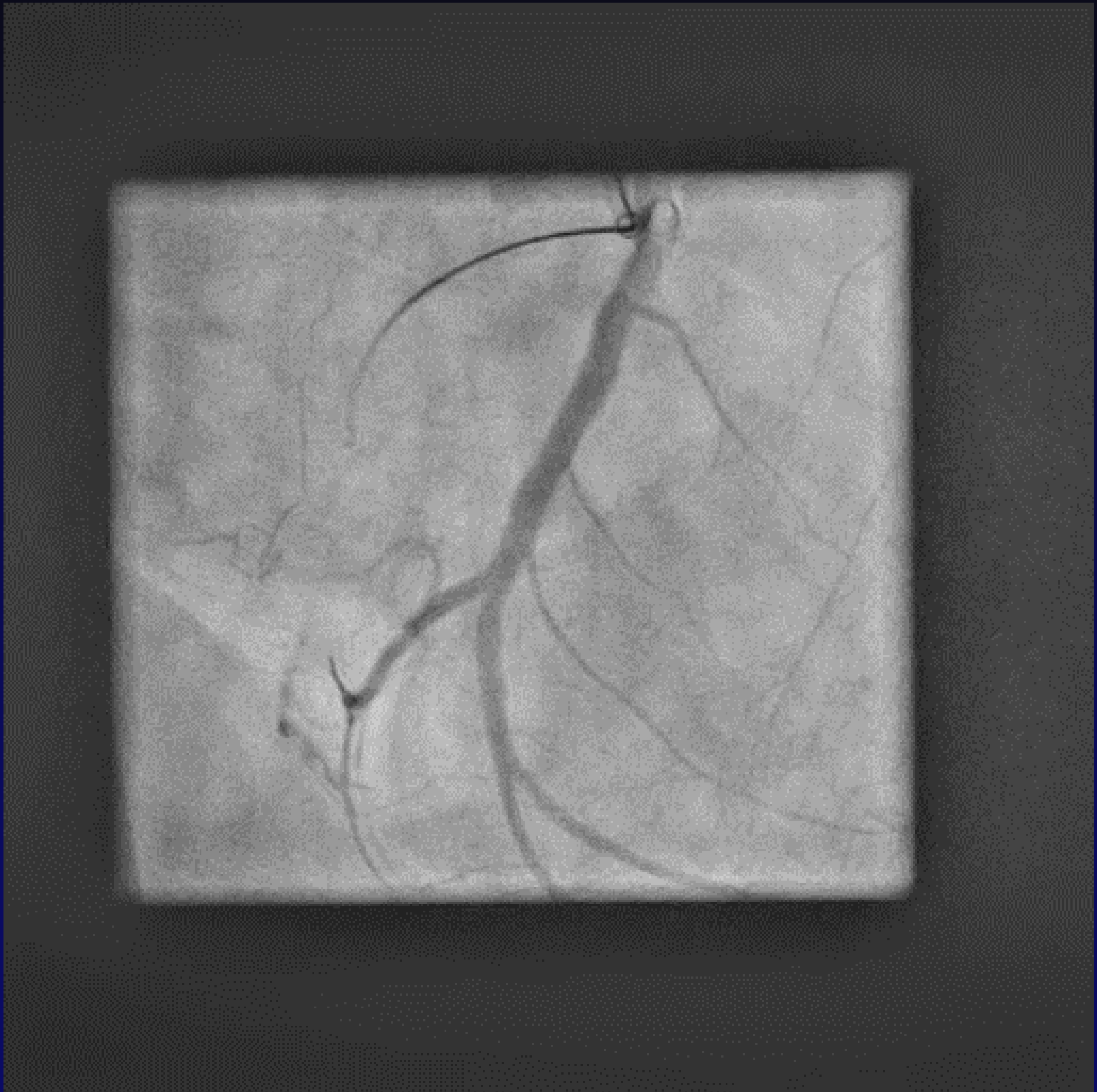
J Am Coll Cardiol Intv 2018;11:225–33

Long mRCA CTO

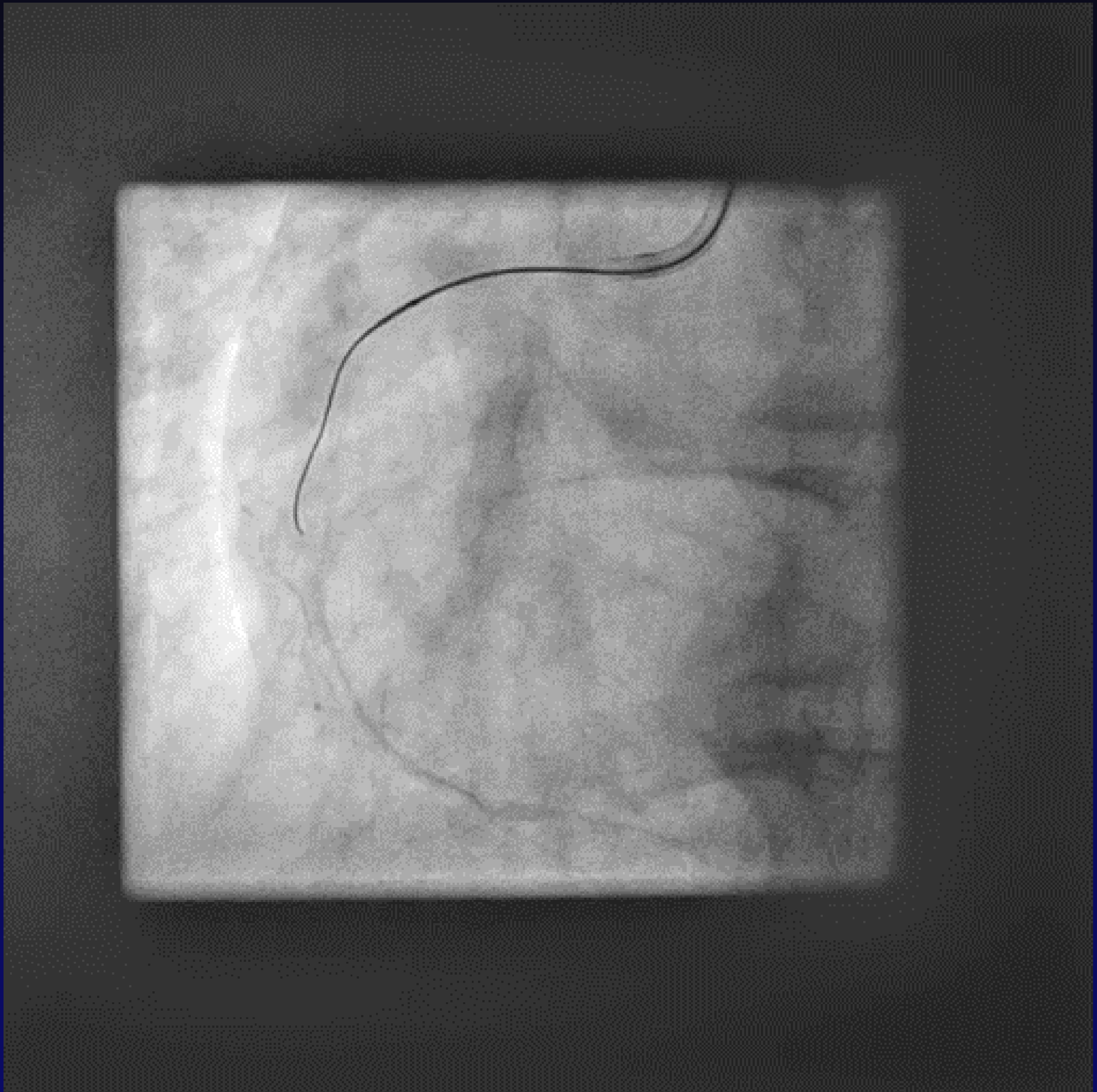


Sion wire for loose channel tracking

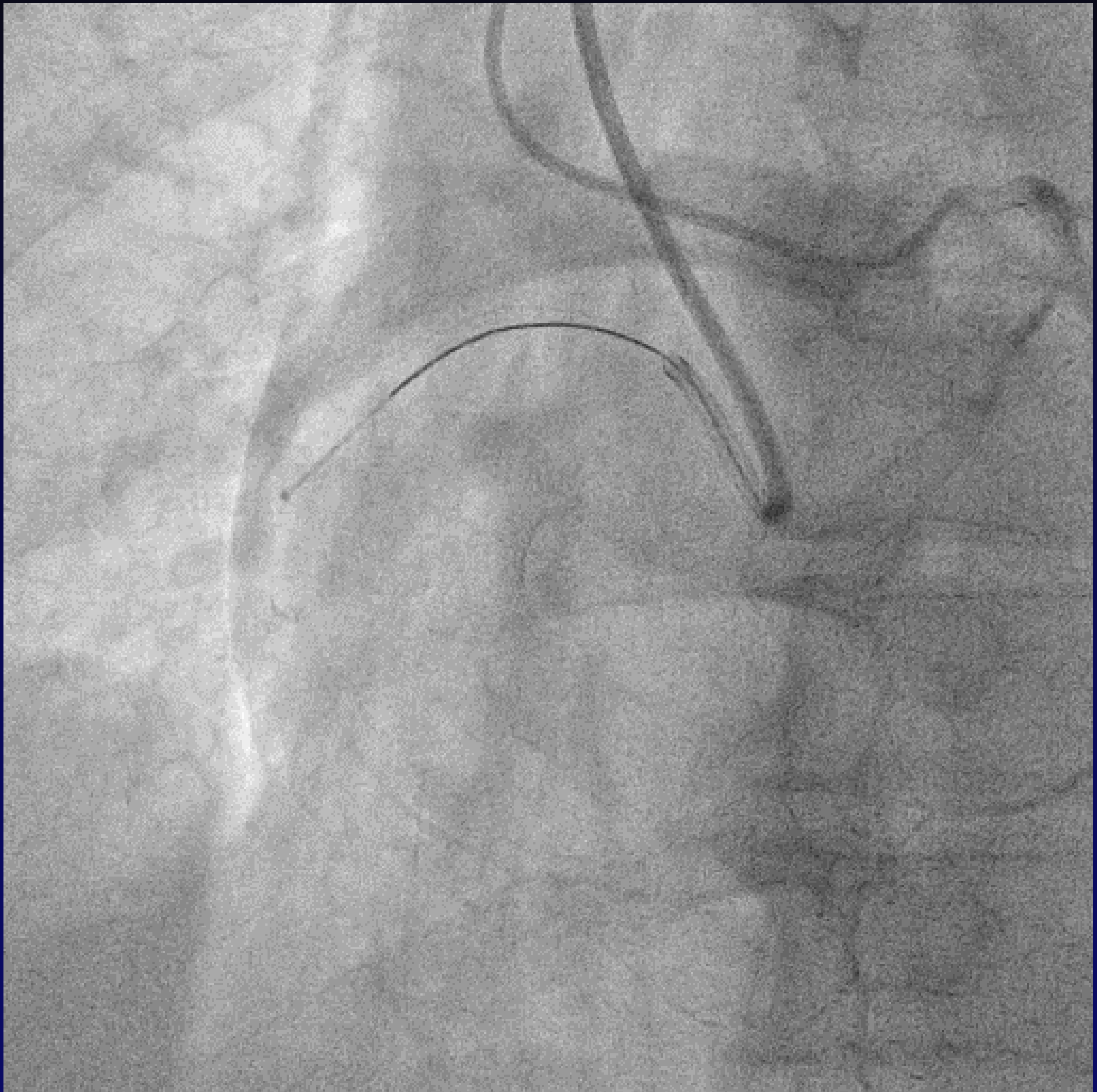
Wire escalation to Gaia 1st



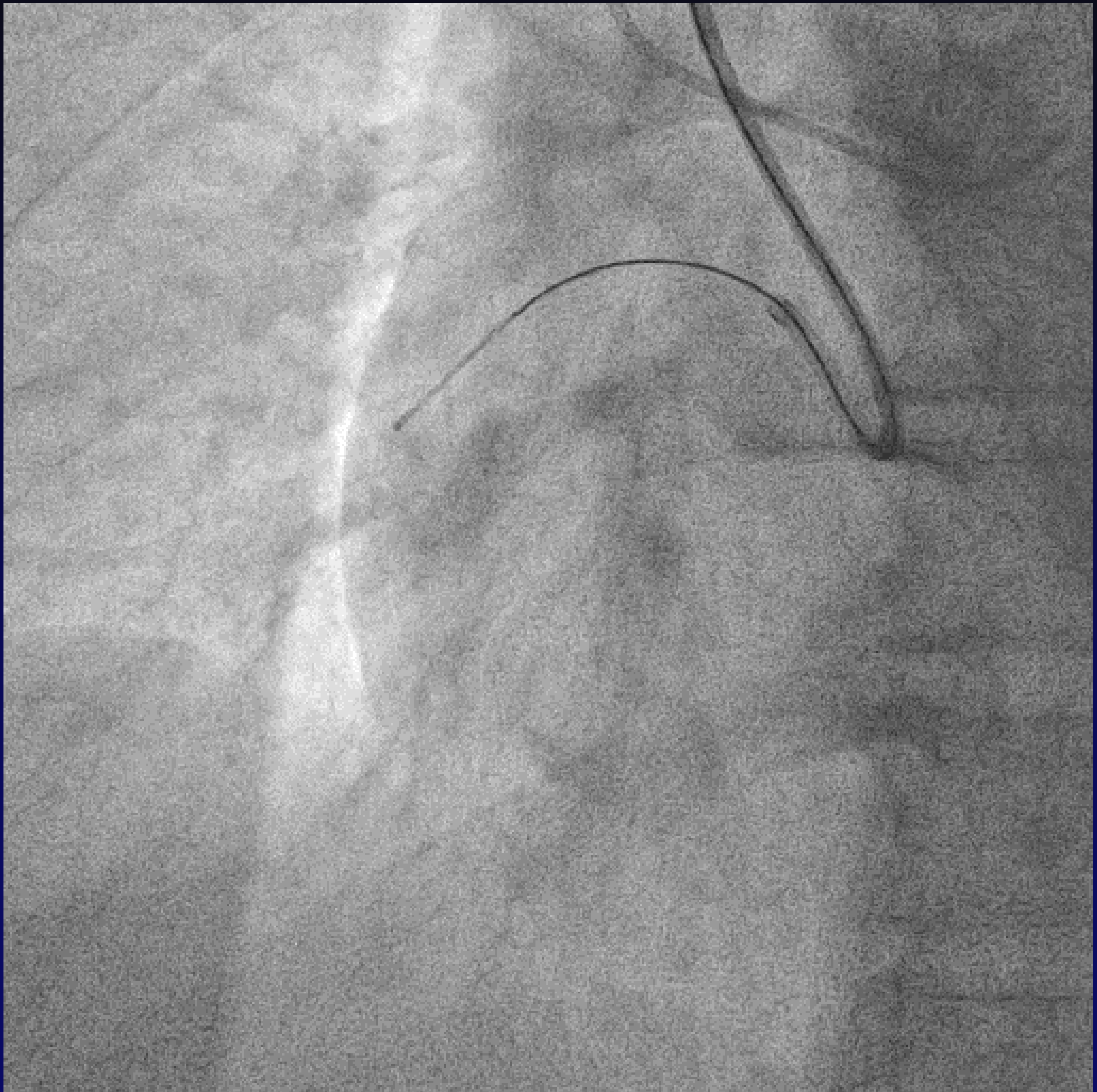
Additional escalation to Gaia 2nd



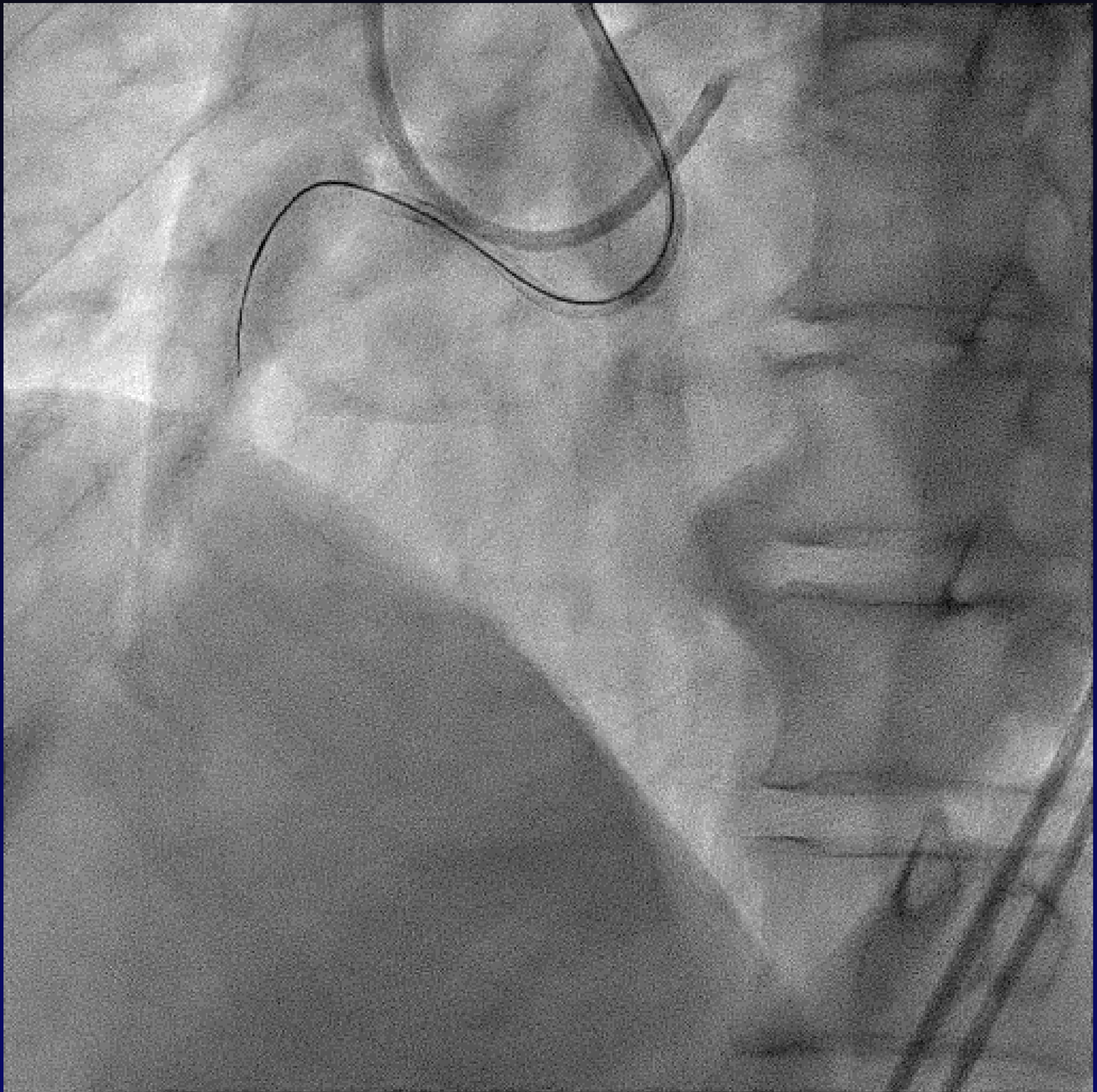
CrossBoss for controlled dissection 1



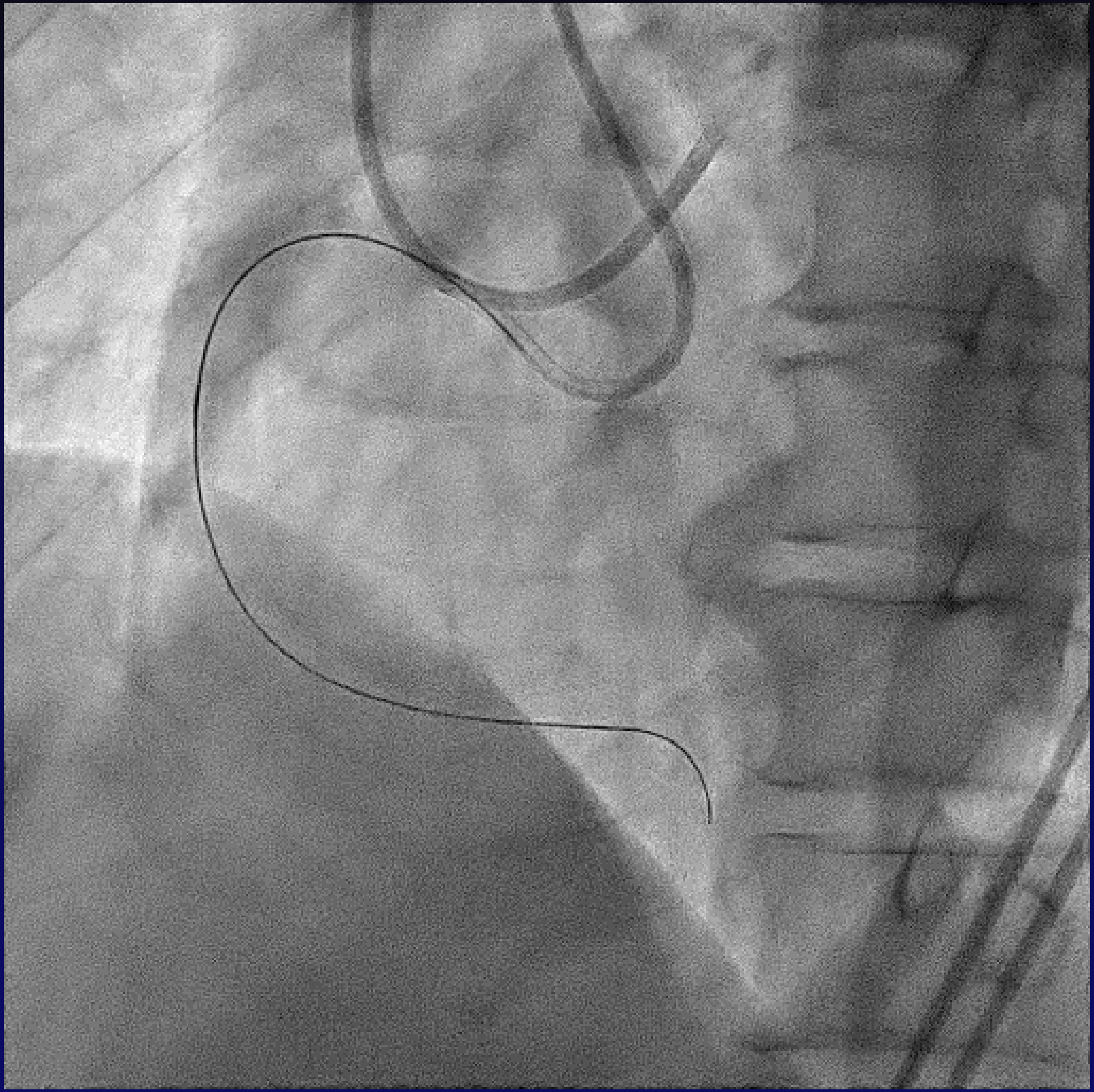
CrossBoss for controlled dissection 2



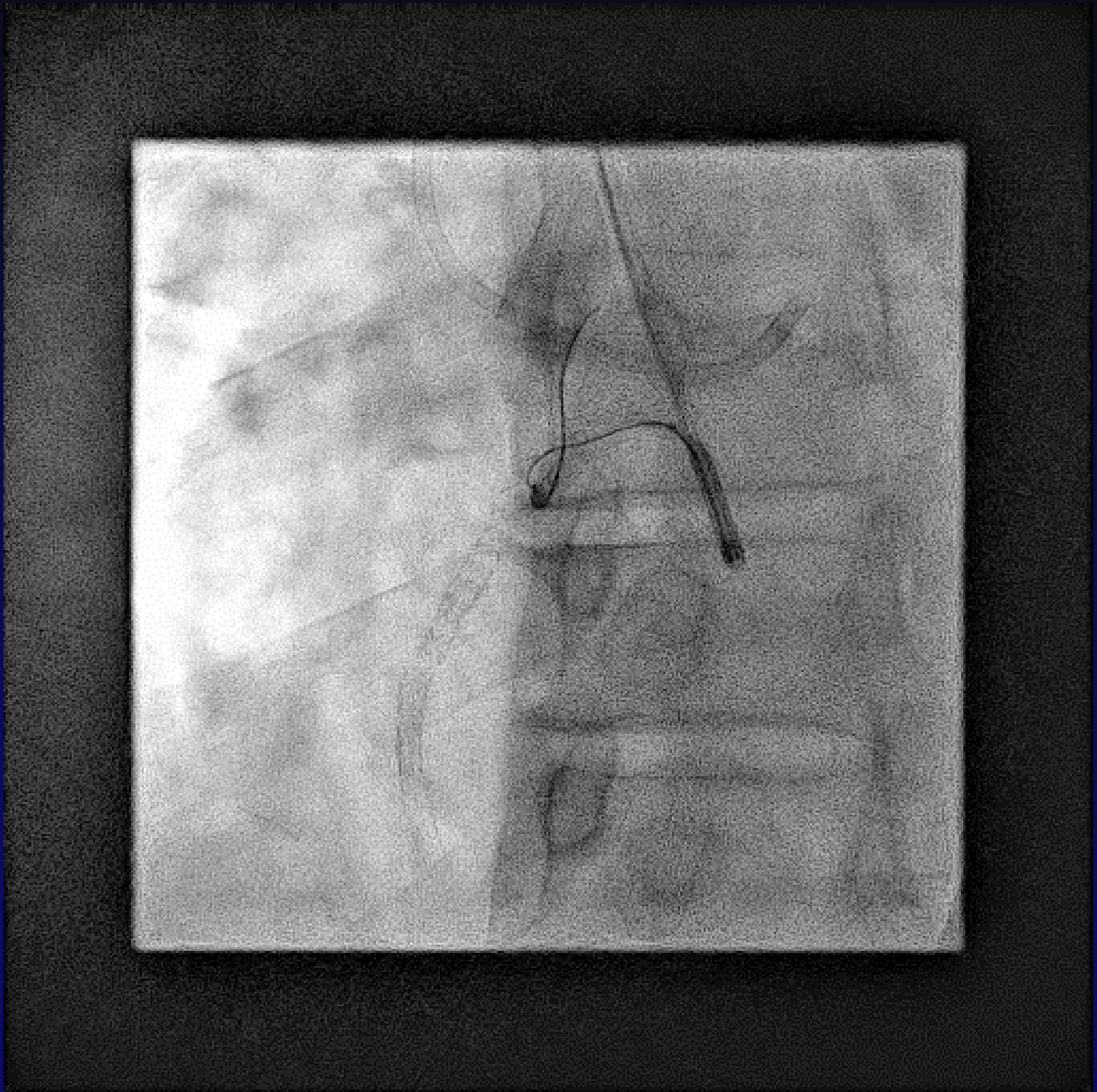
Wire escalation to Gaia 3rd



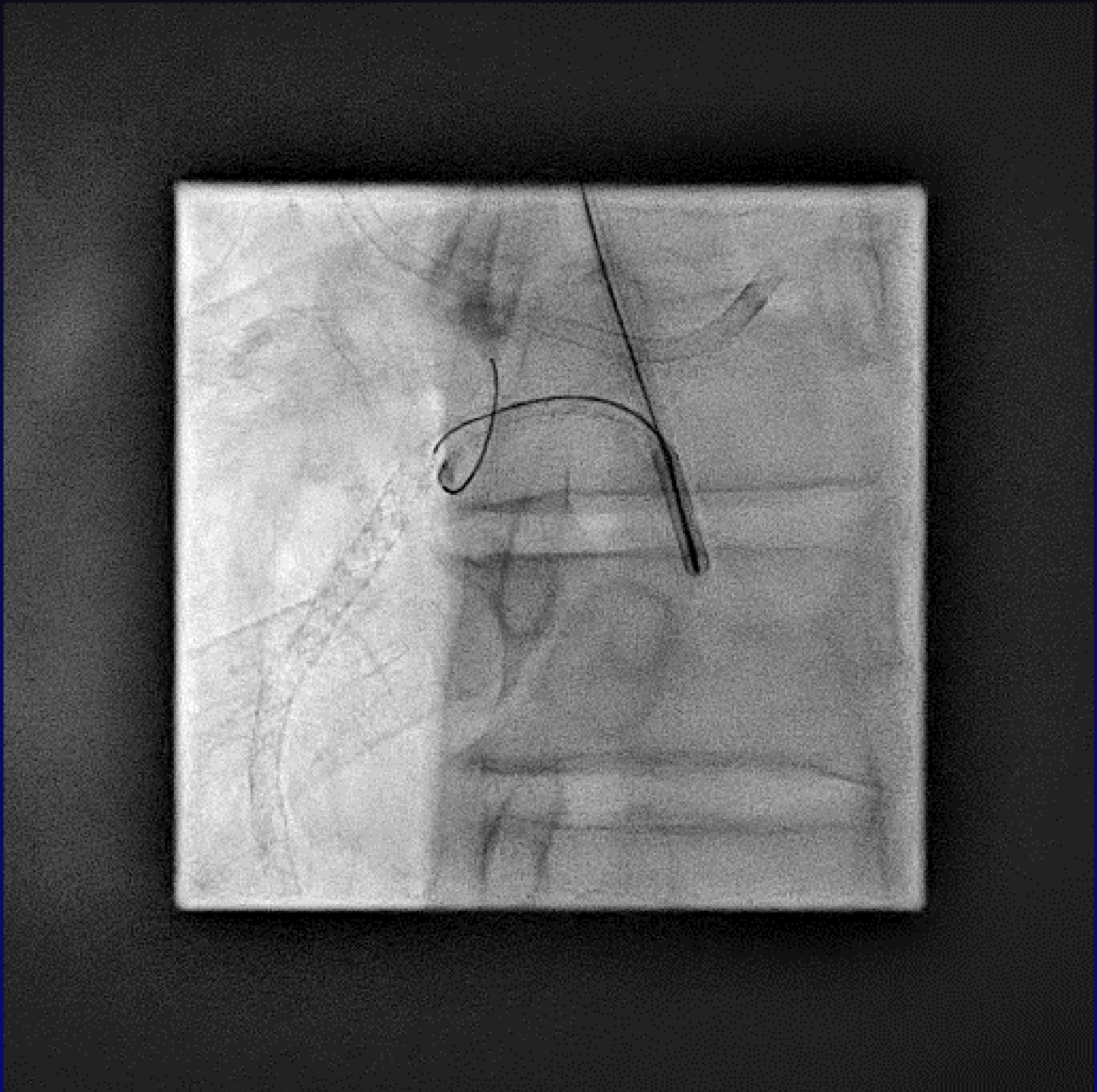
Successful guidewire and microcatheter passage



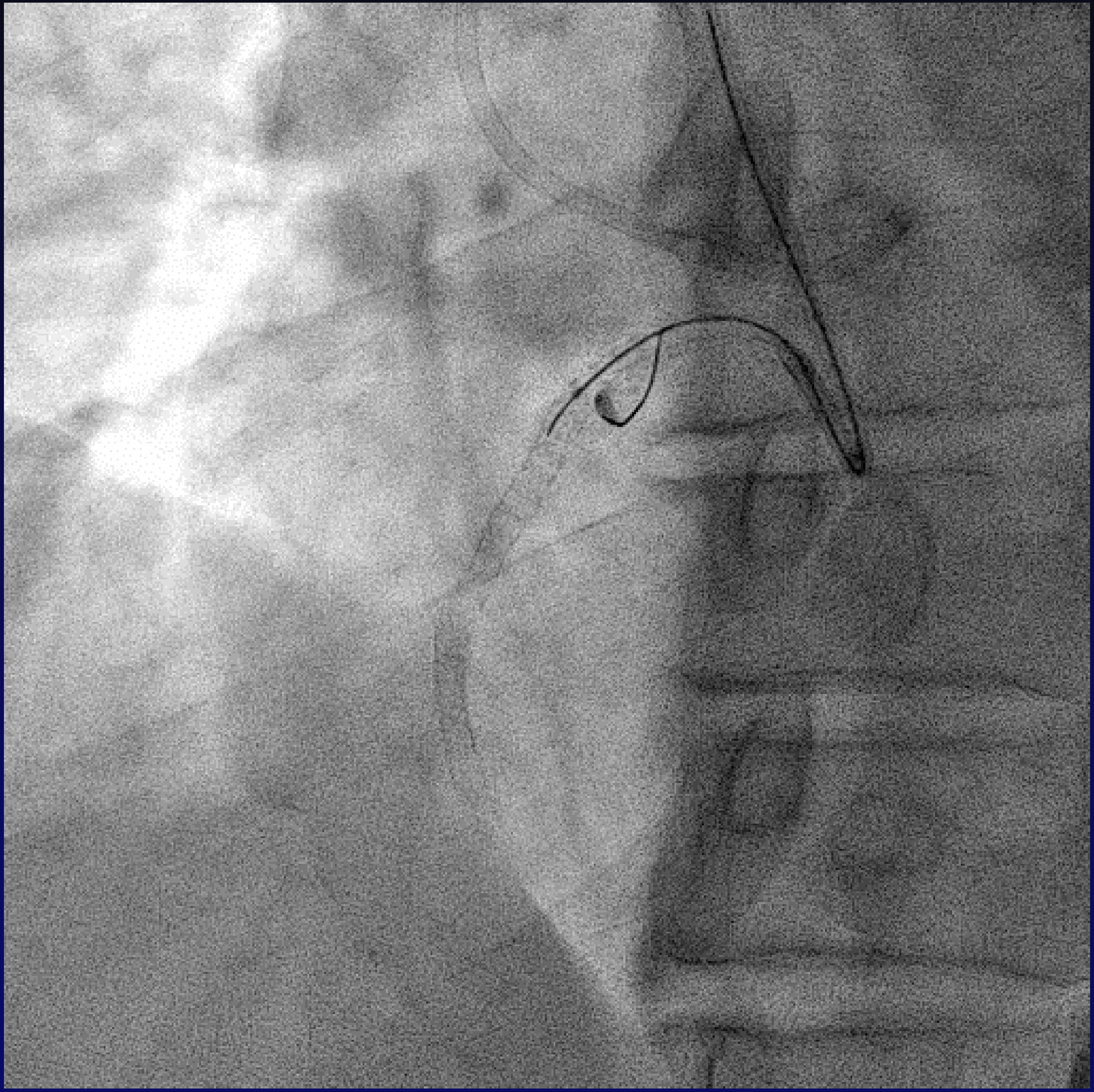
mRCA ISR CTO, very tough proximal cap



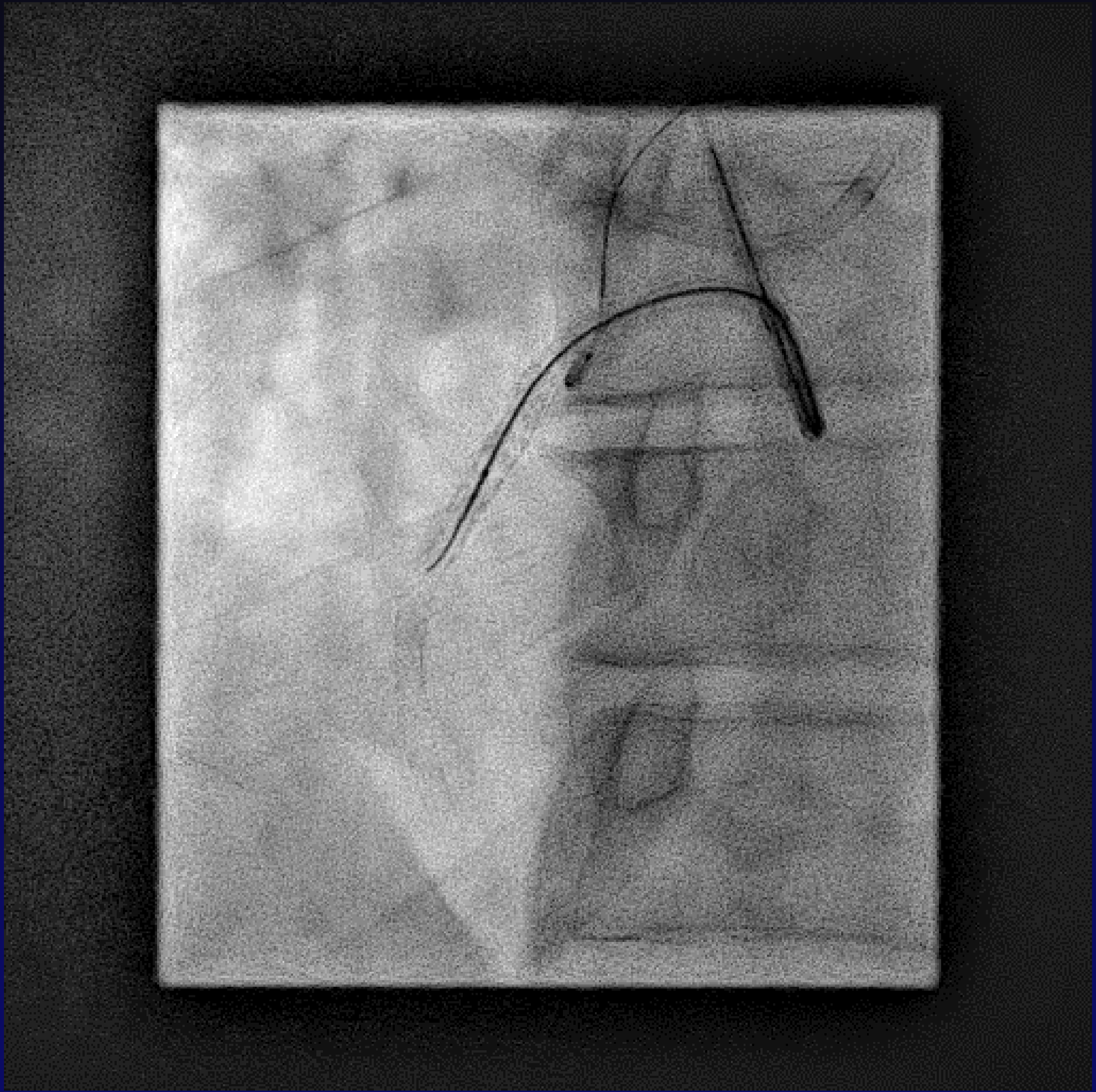
Conquest pro with CrossBoss for ADR



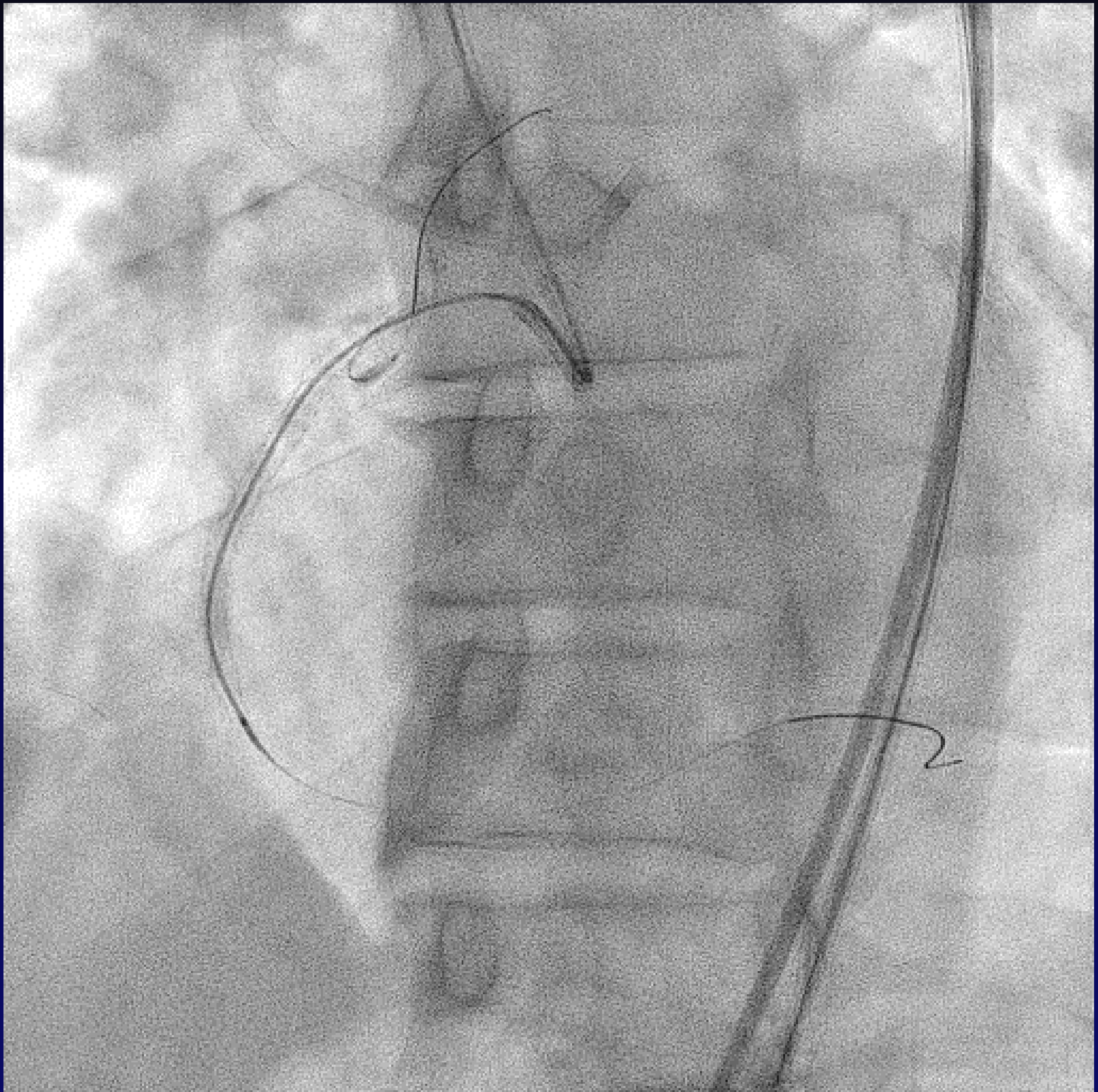
No progression of CrossBoss



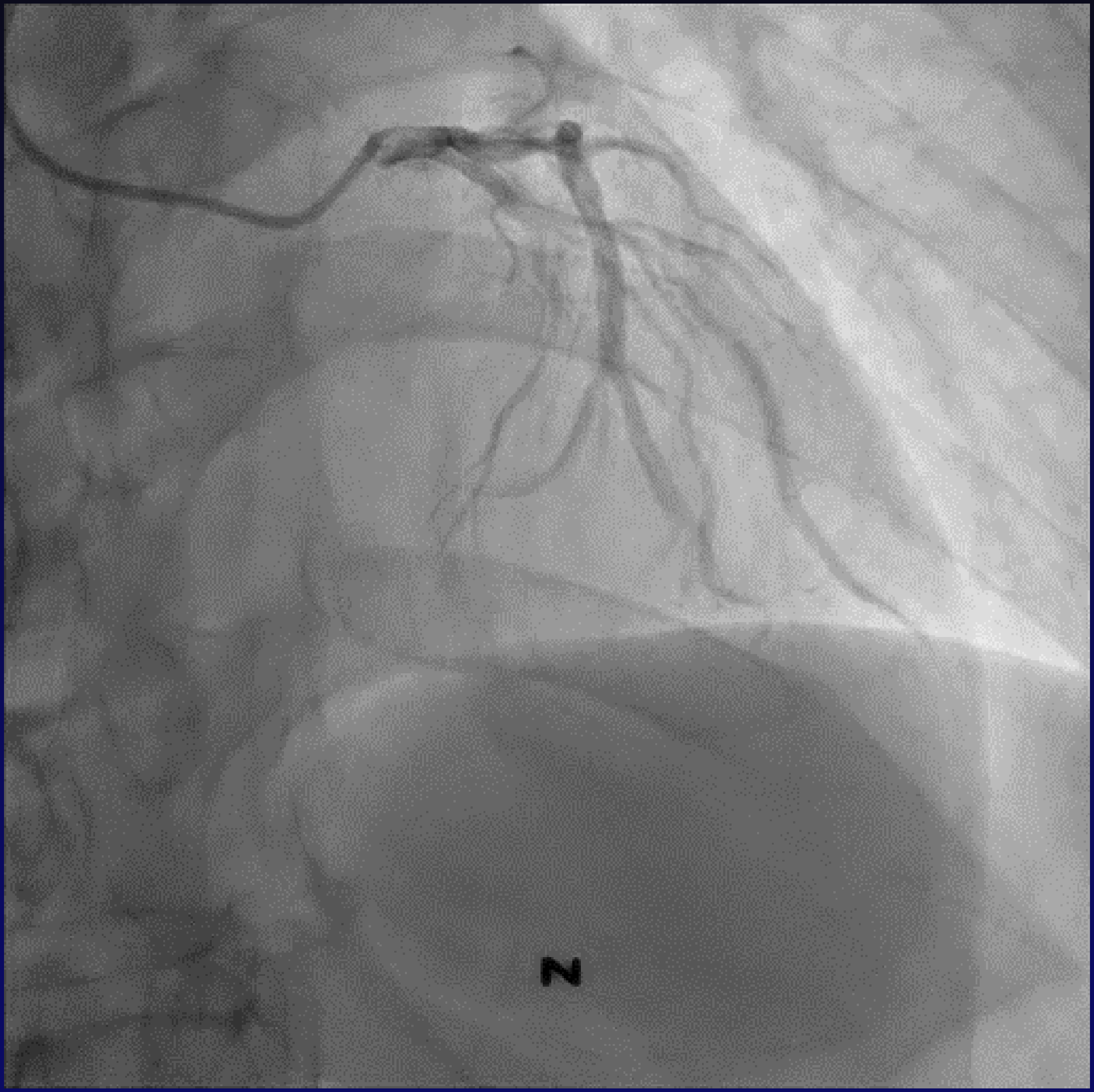
Gaia 1st and Corsair microcatheter



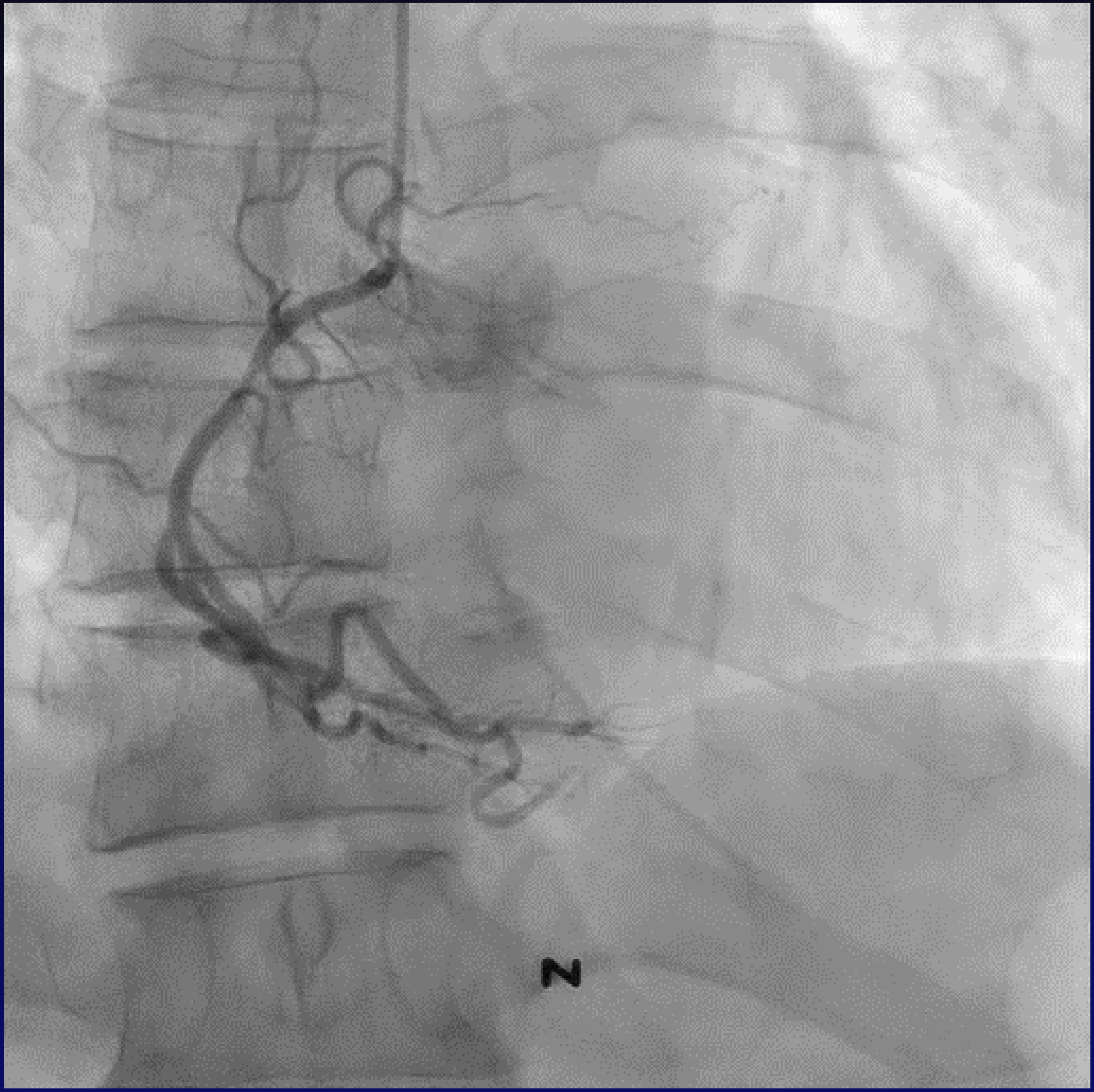
Successful guidewire and microcatheter delivery



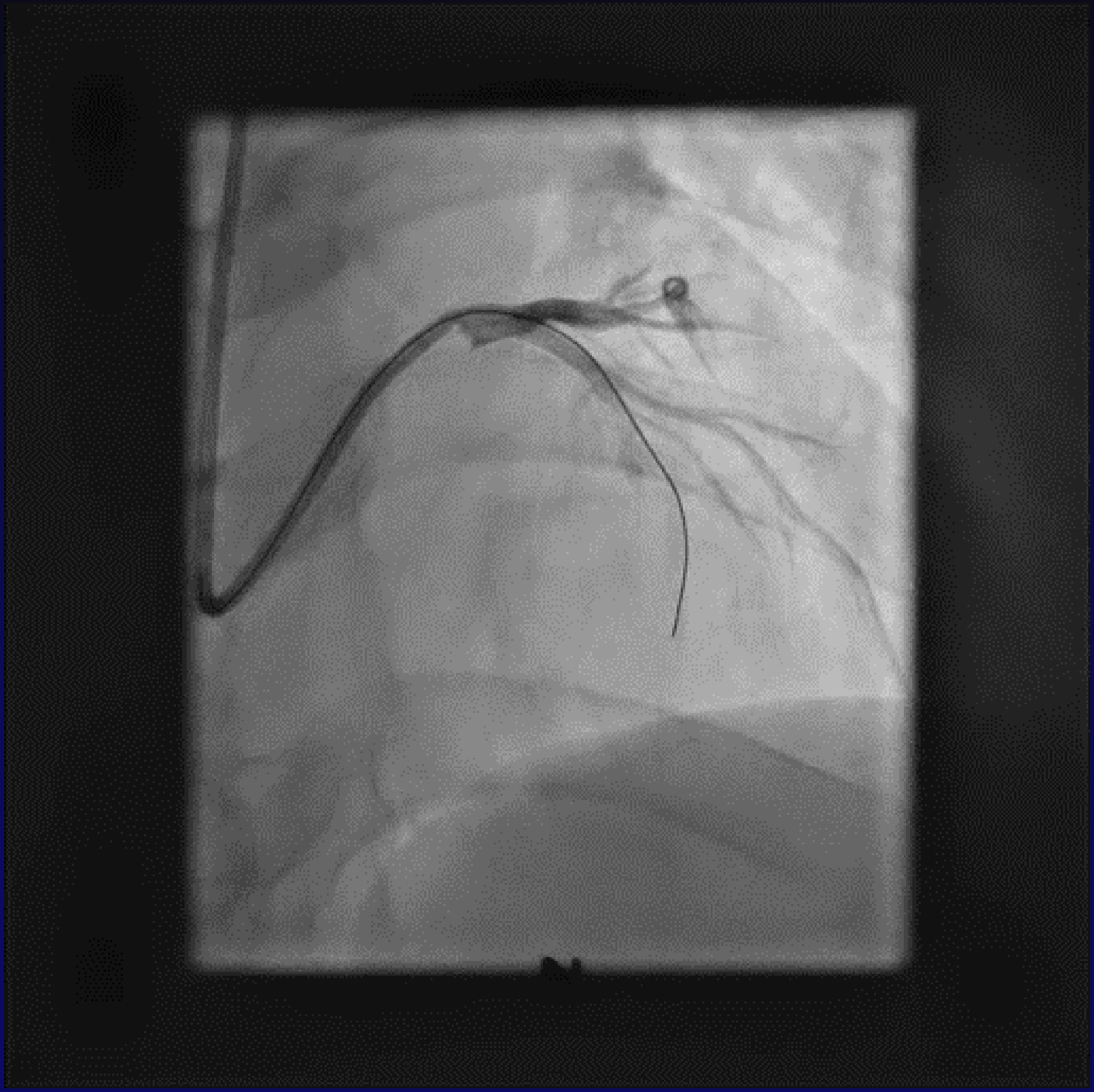
Llong LAD CTO with OM collateral to dLAD



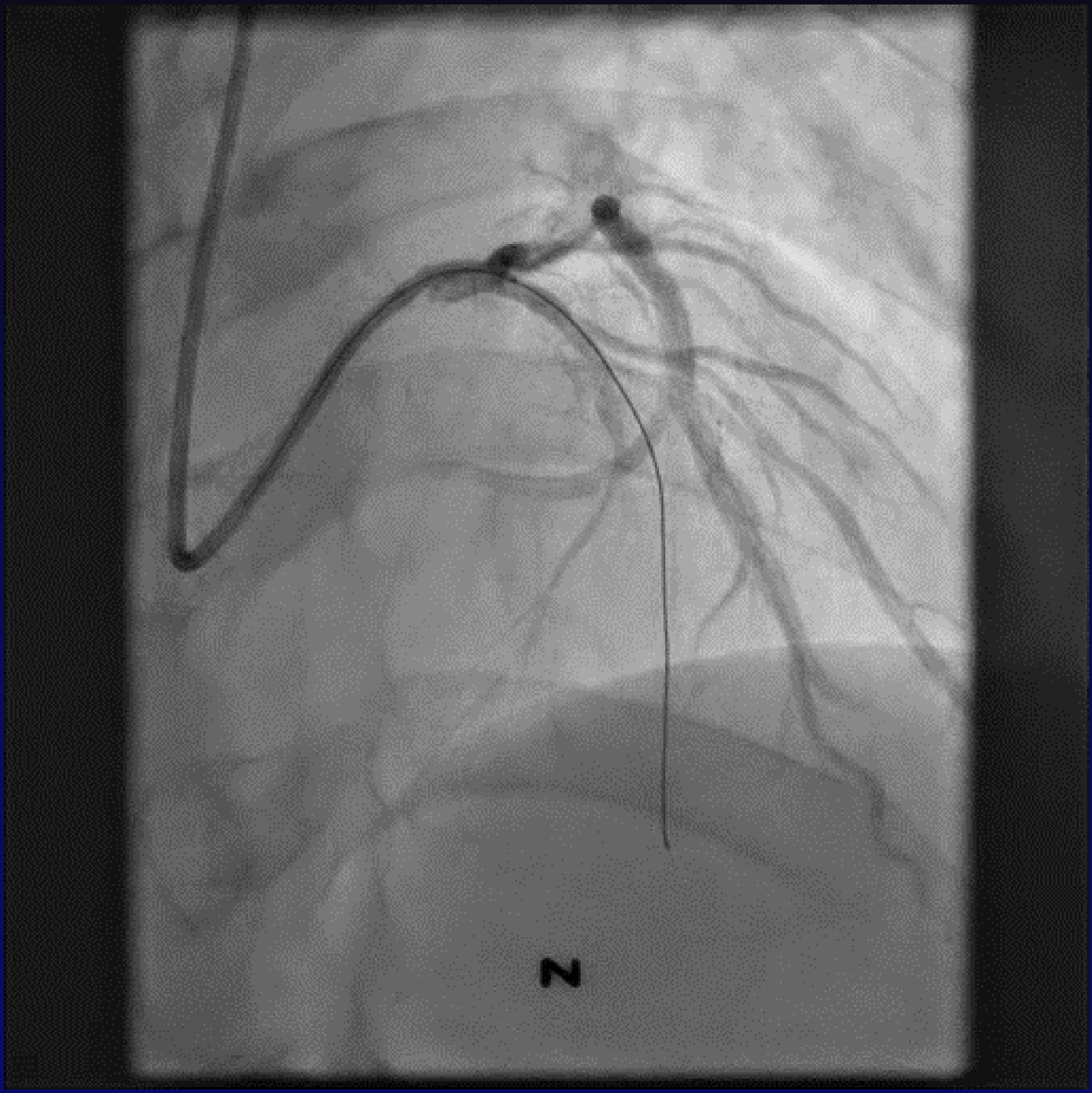
Collateral channel from RCA to mLAD



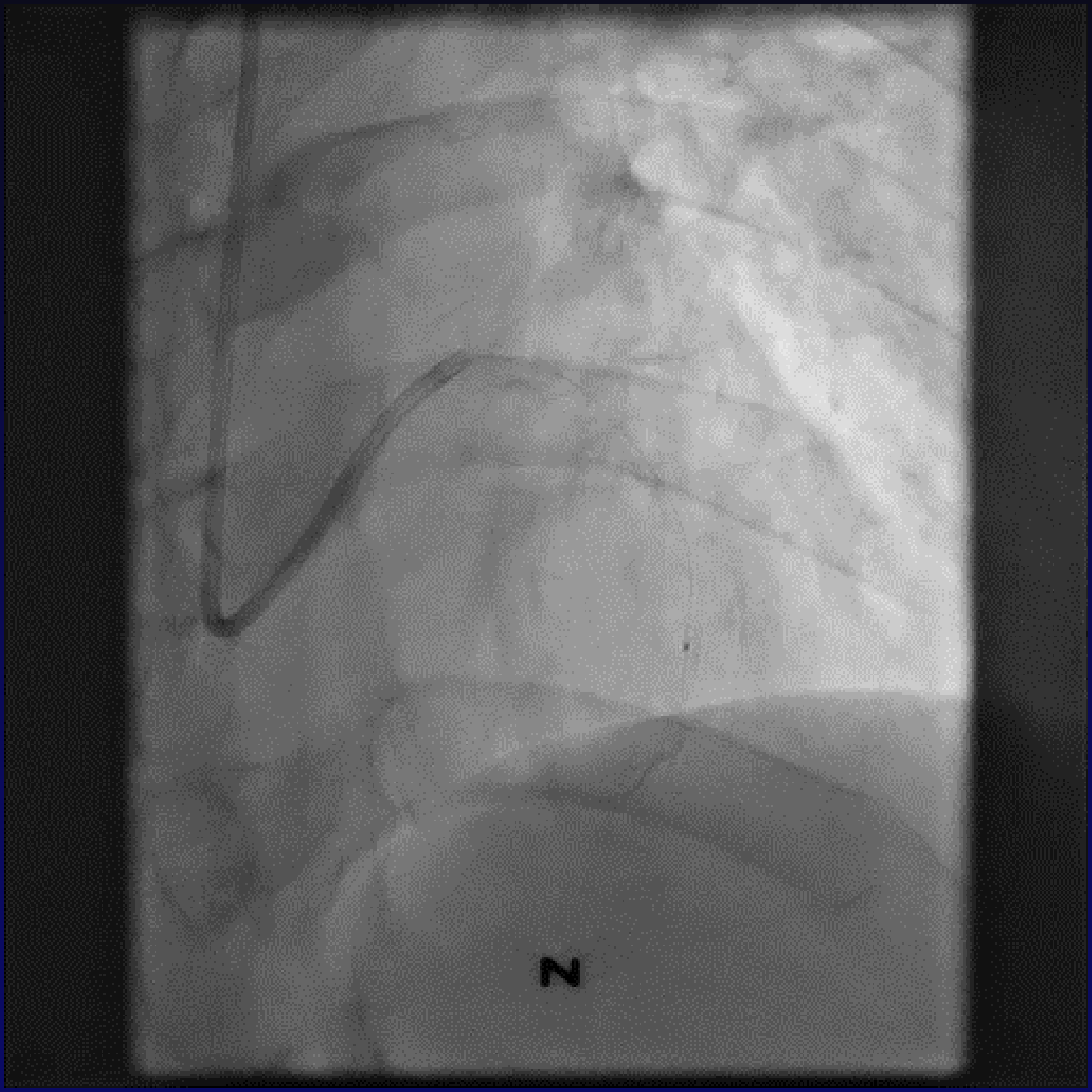
Fielder XT-A in a false lumen



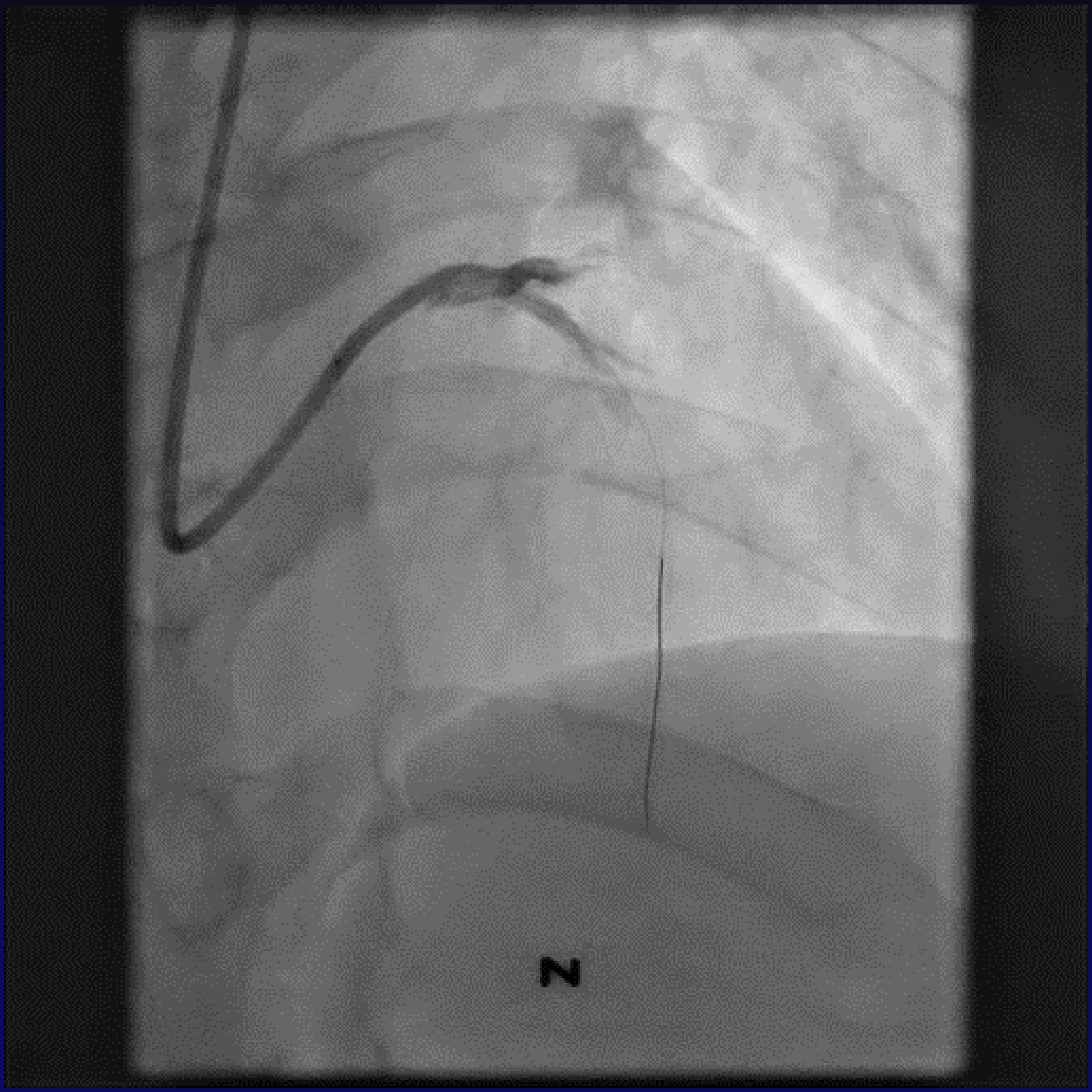
Wire escalation to Gaia 1st and Redirection, but hard to enter the dLAD



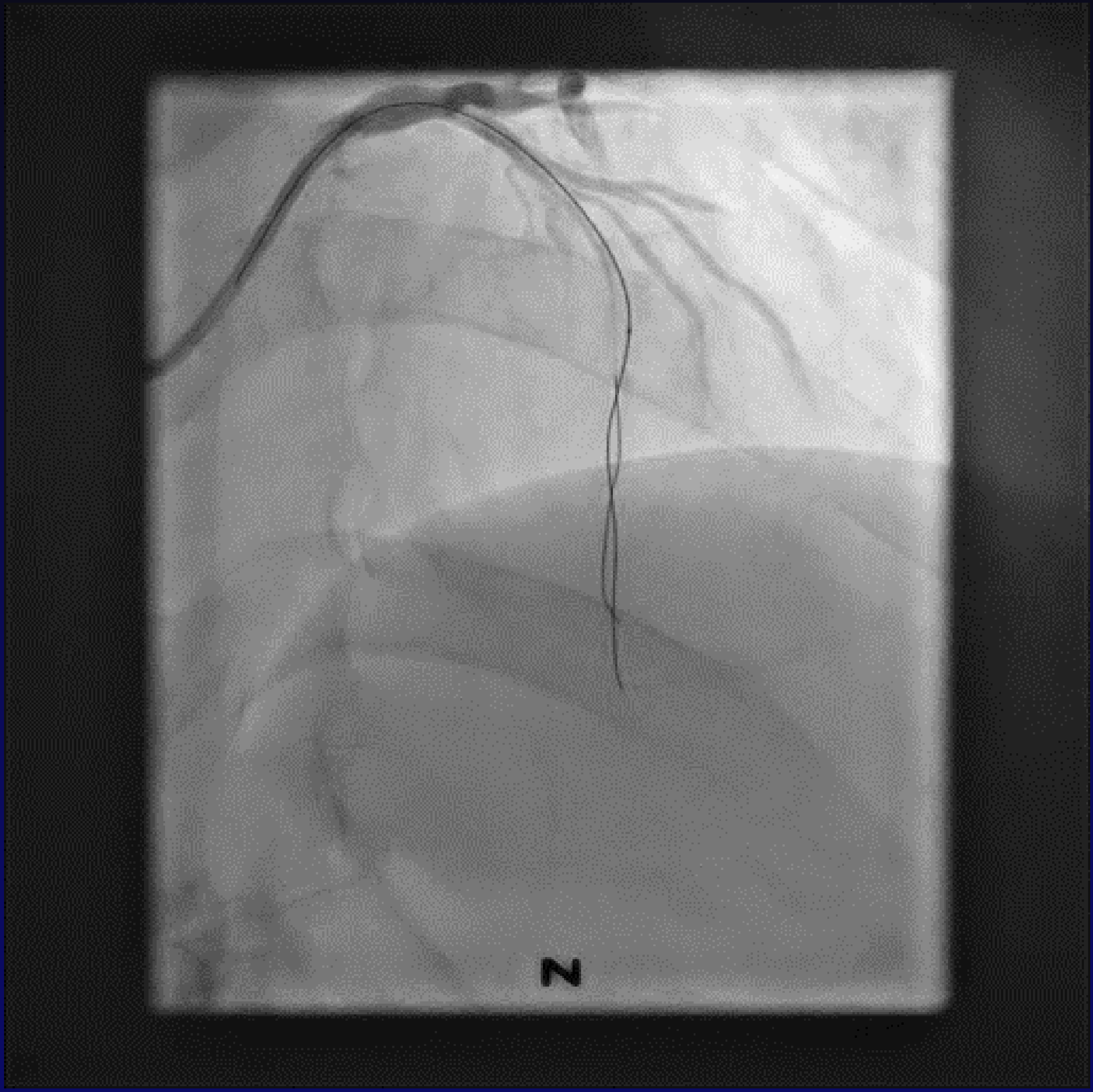
When you are sure that the wire is in the true lumen → Tip injection confirmed true lumen at mLAD



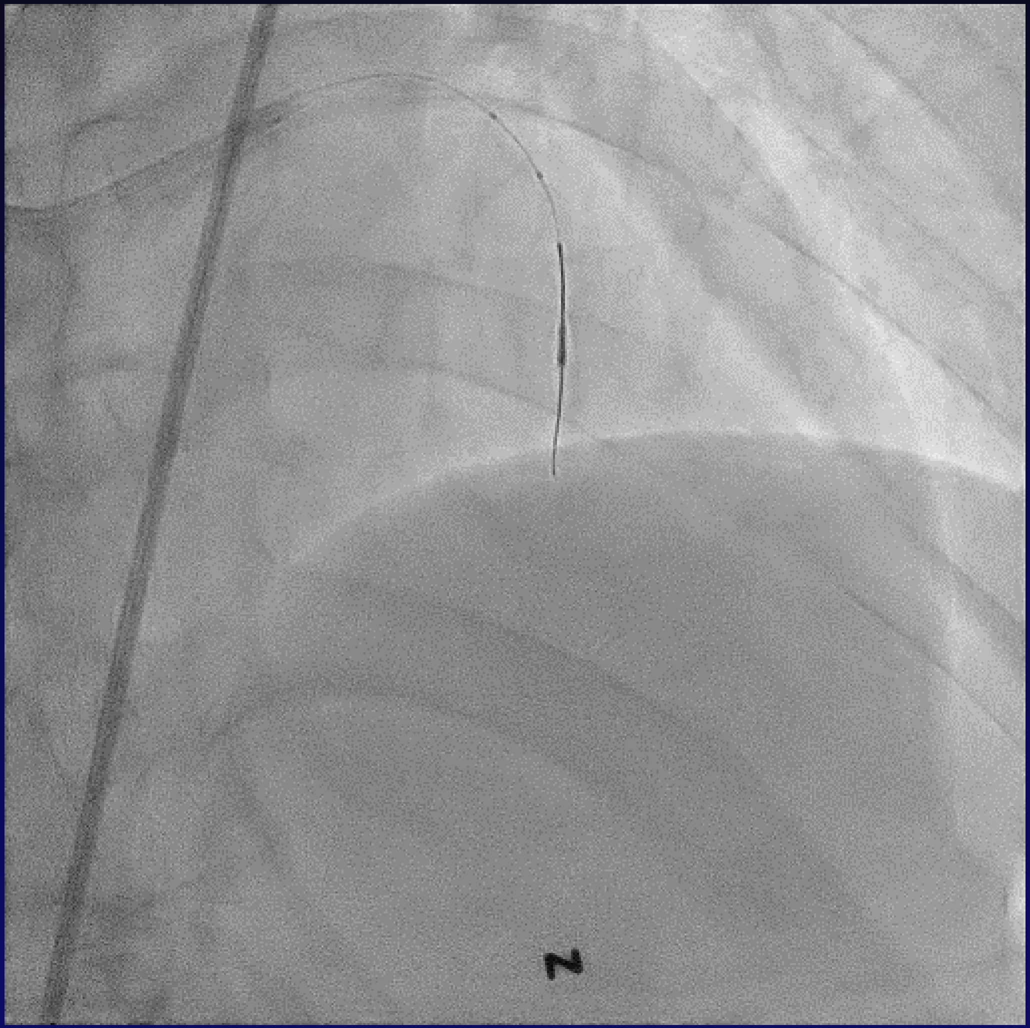
Small balloon angioplasty to mLAD



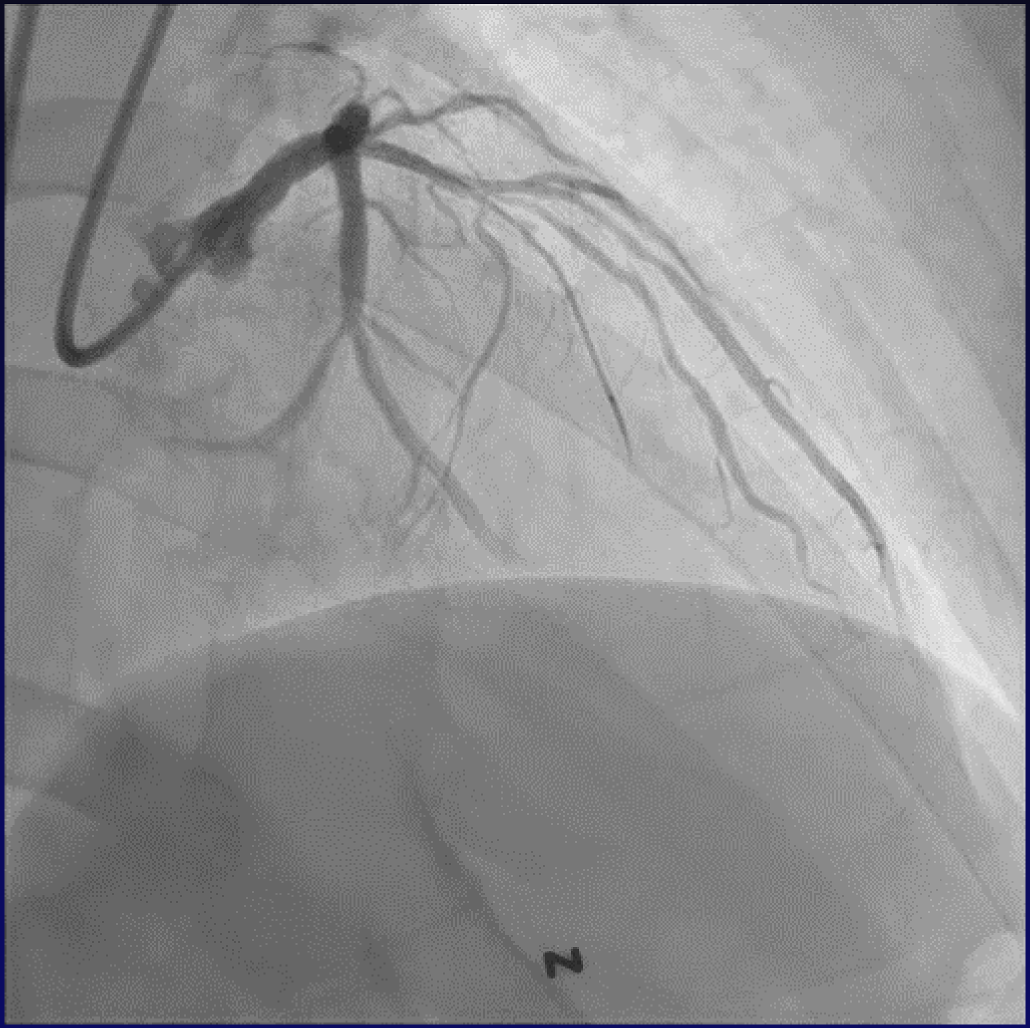
Tracking with parallel guidewires
(Runthrough in the false lumen and Gaia 1st for the tracking)



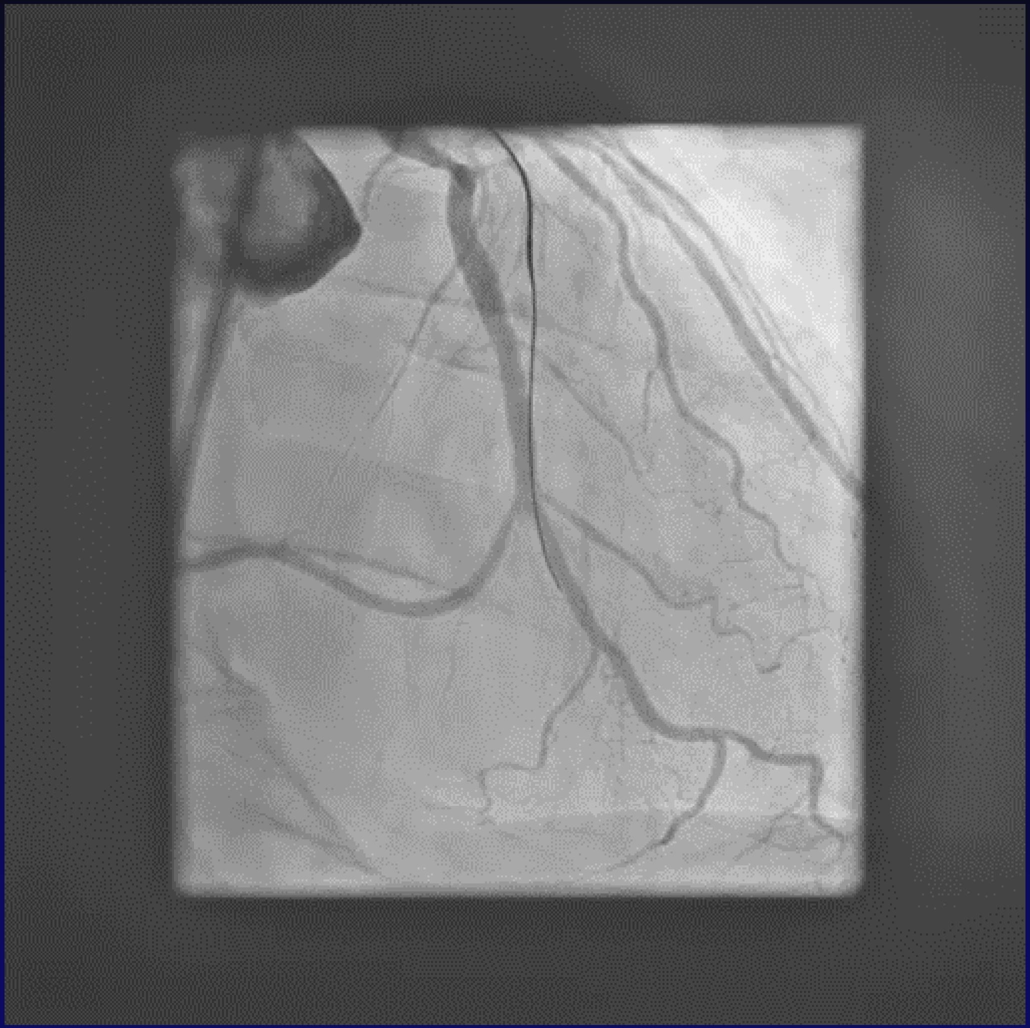
IVUS to recheck the correct pathway
(Vessel size and anatomy of septal and diagonal branches)



Dual injection to identify the target lesion anatomy

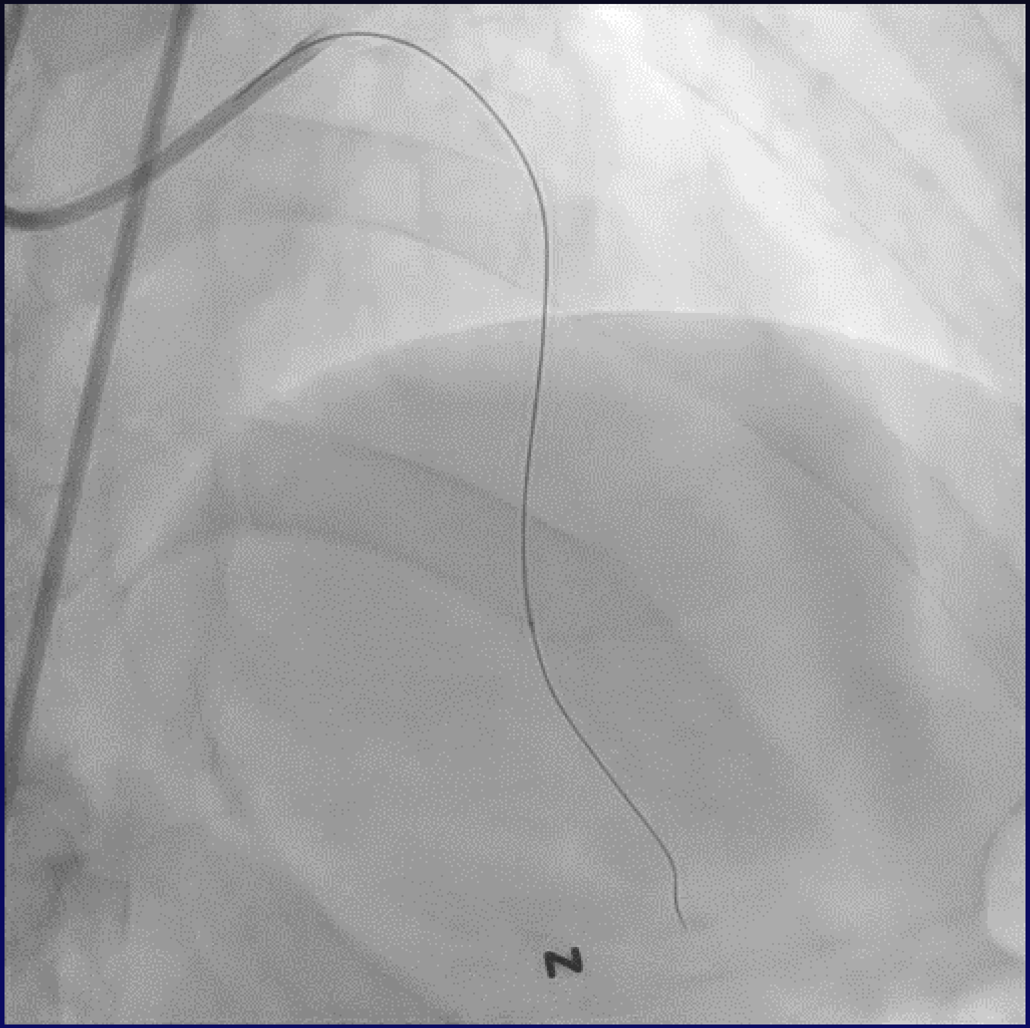


Slow advancing the Gaia 1st wire

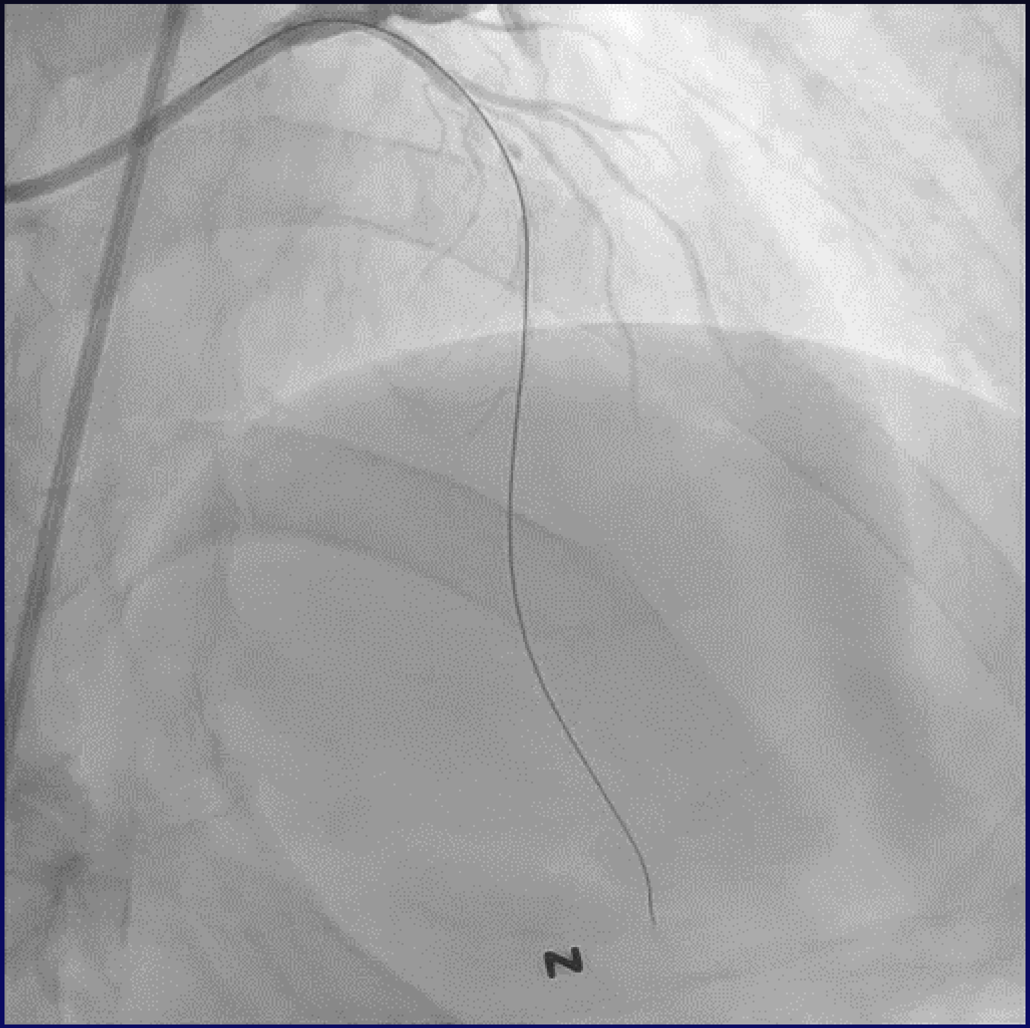


Checking the route in a different angle

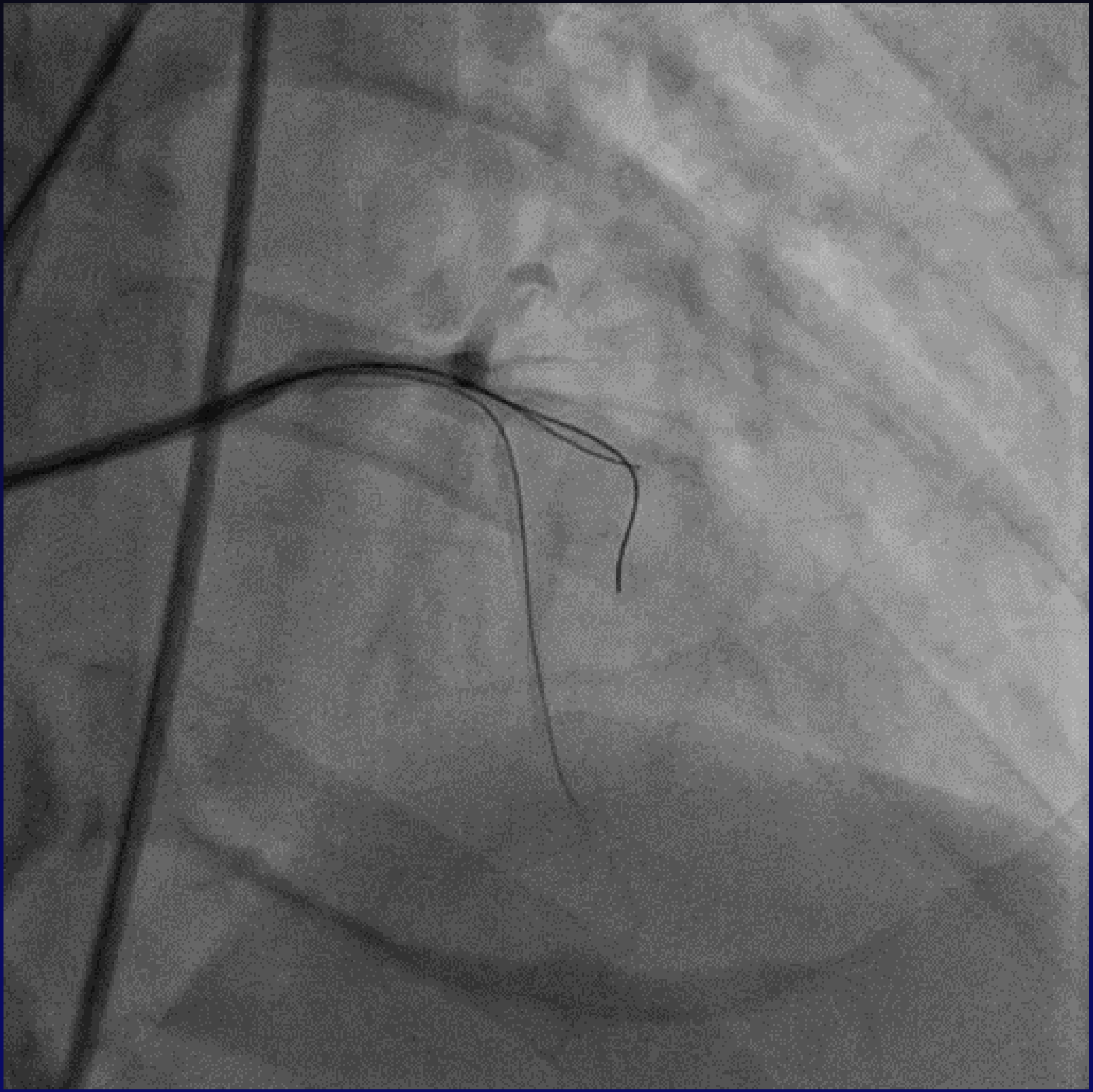
Freely moving wire to the dLAD



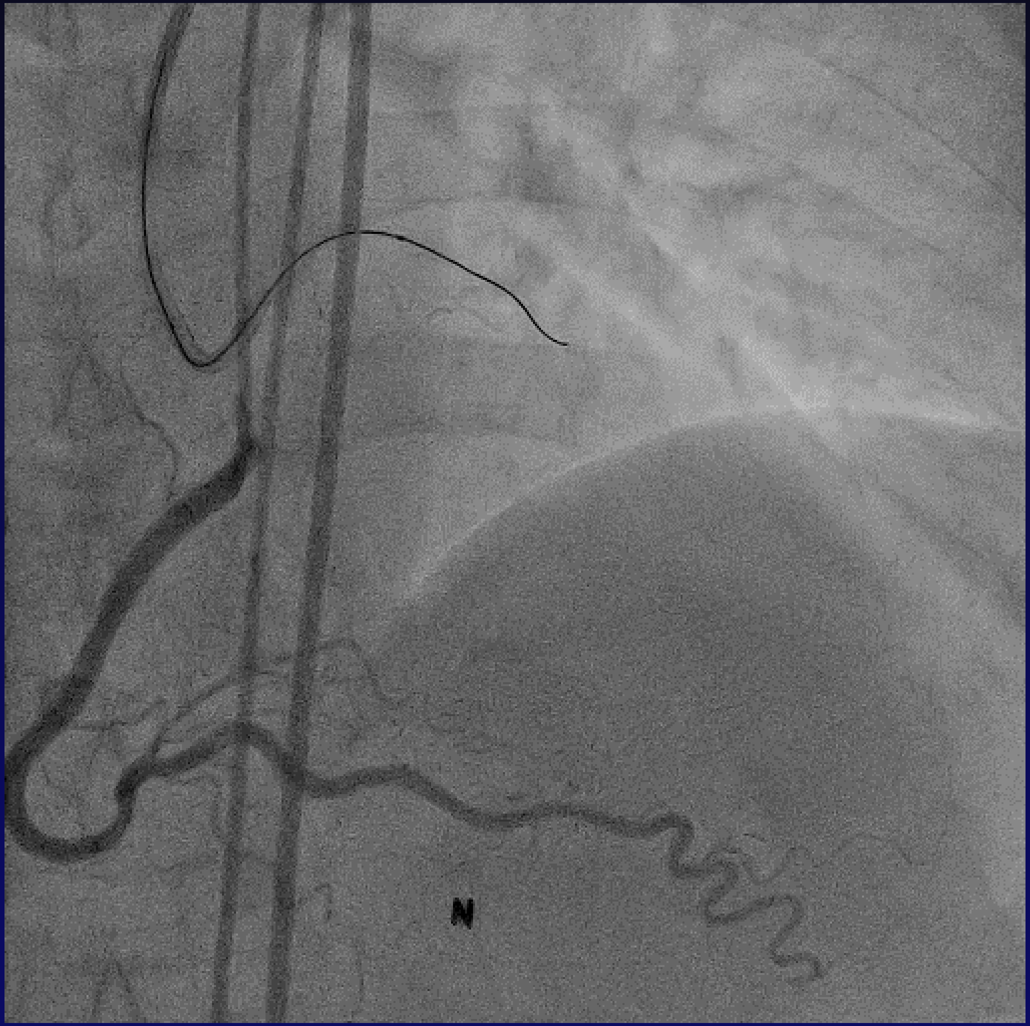
Antegrade flow to dLAD was obtained.



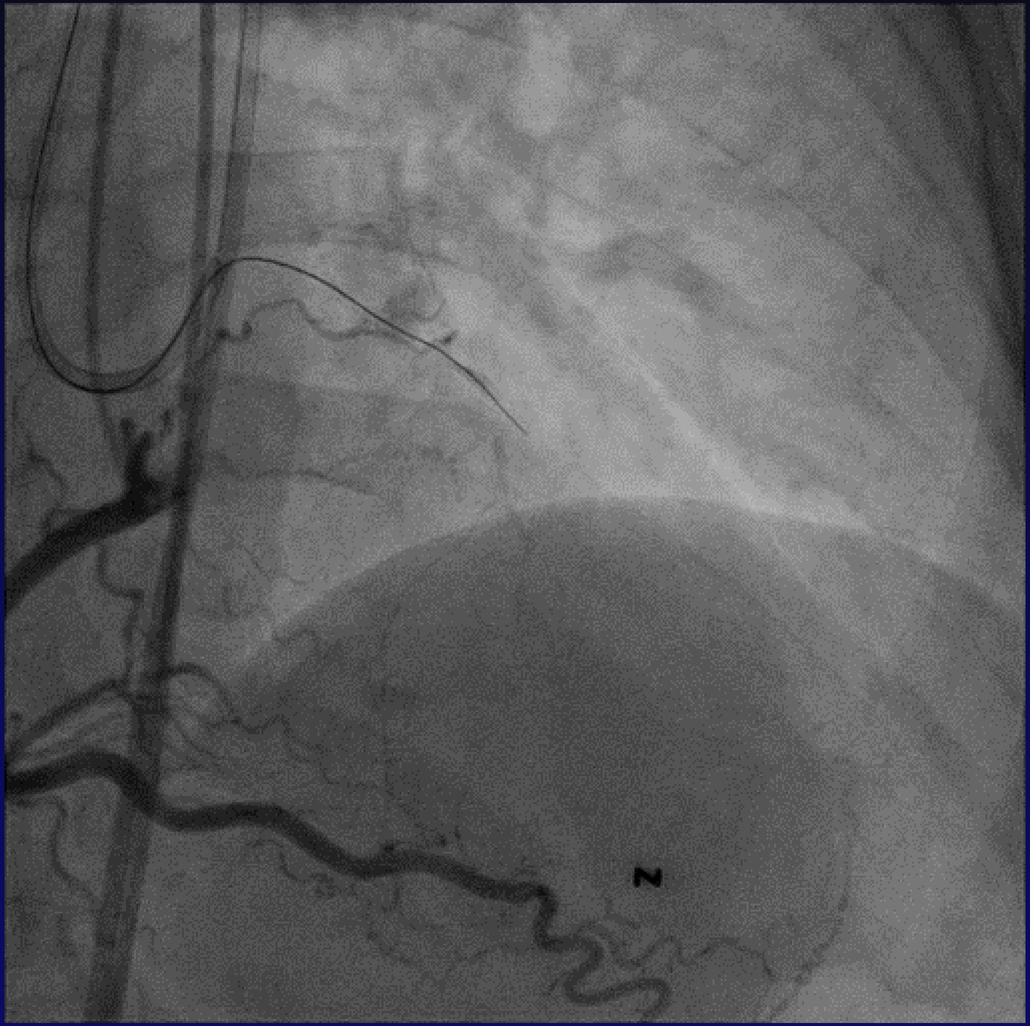
Sometimes, we need more than 3 parallel wires



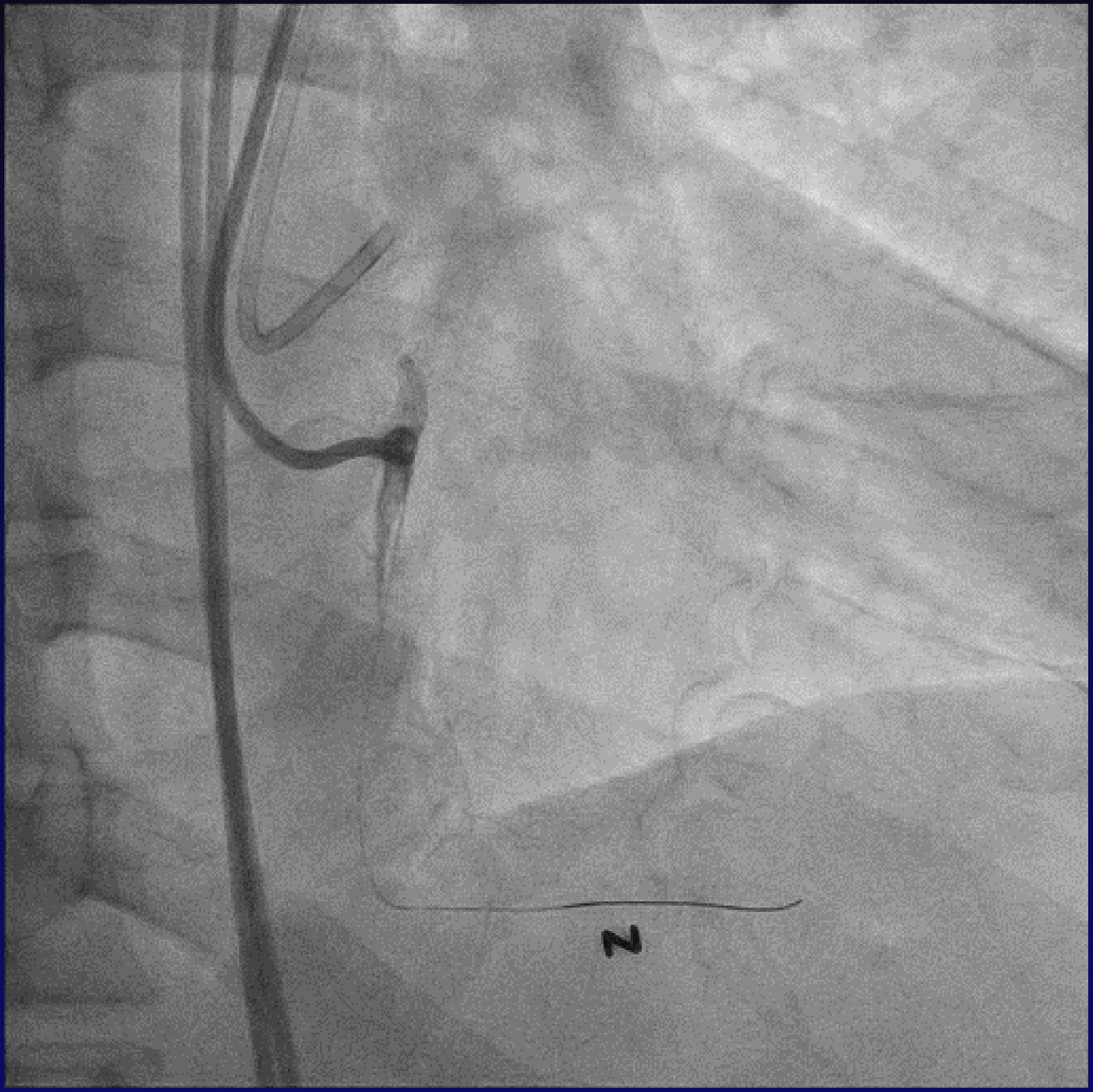
Failed to enter the true lumen



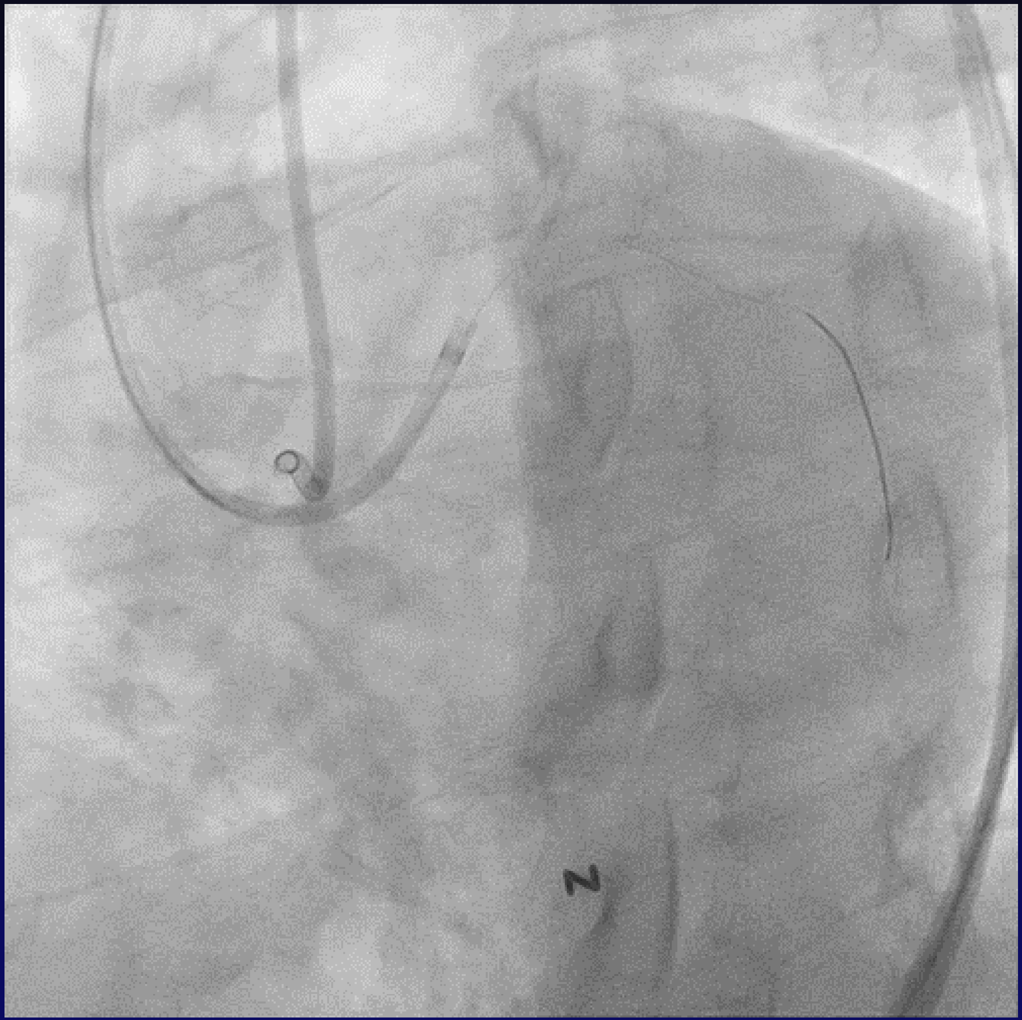
Wire escalation to Conquest pro to puncture the distal cap



Ambiguous LAD ostium on dual injection



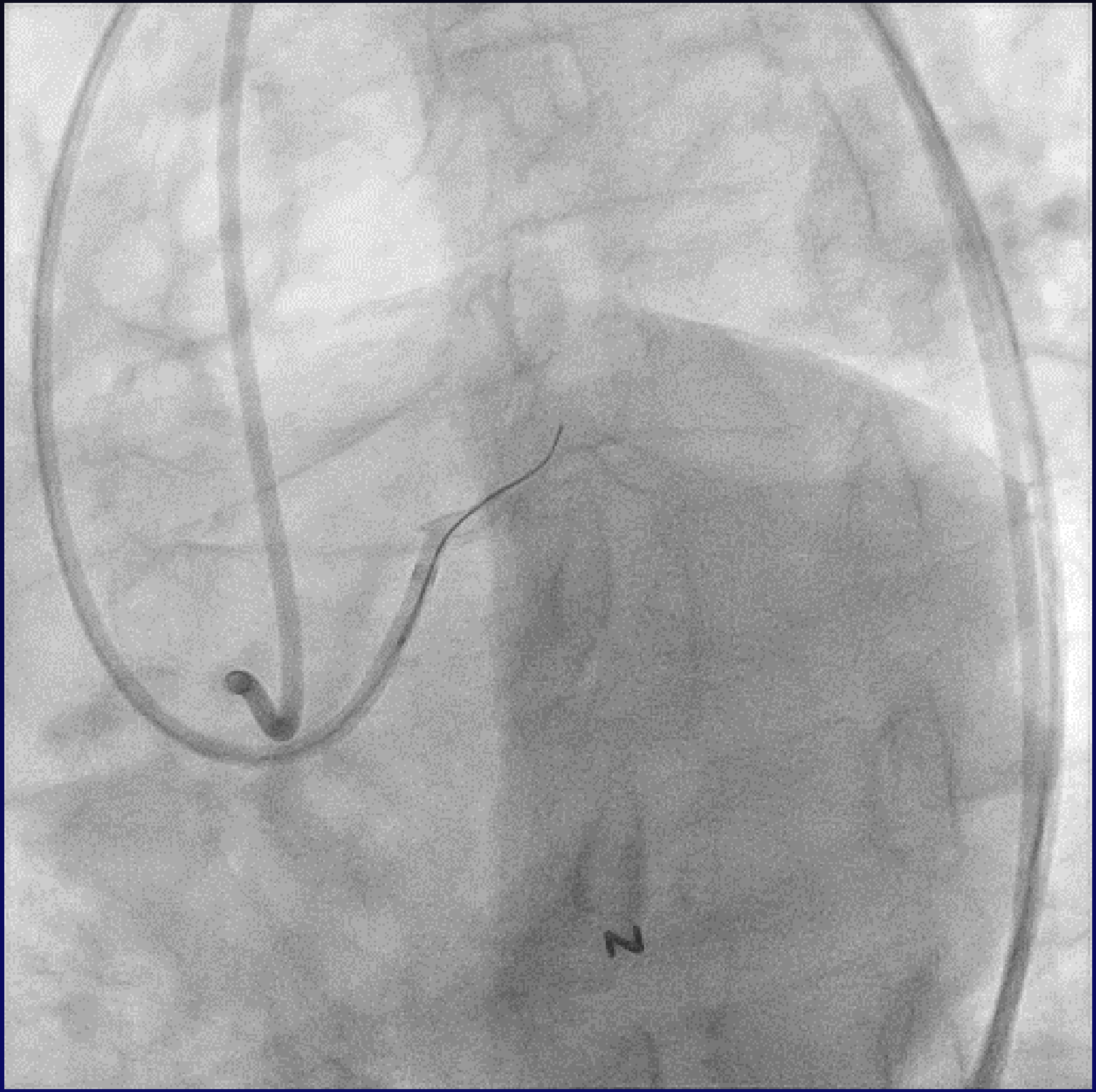
There is proximal stump on a different projection



Unstable Guiding support
→ a wire in LCX

Target entry site: small dimpling at LAD ostium

Soft wire tracking through the dimpling



After three time false lumen wiring with the soft wire, an escalated wire go into the true lumen

Summary (Chain of Success)

Anatomy
(Dual injection & CCTA)

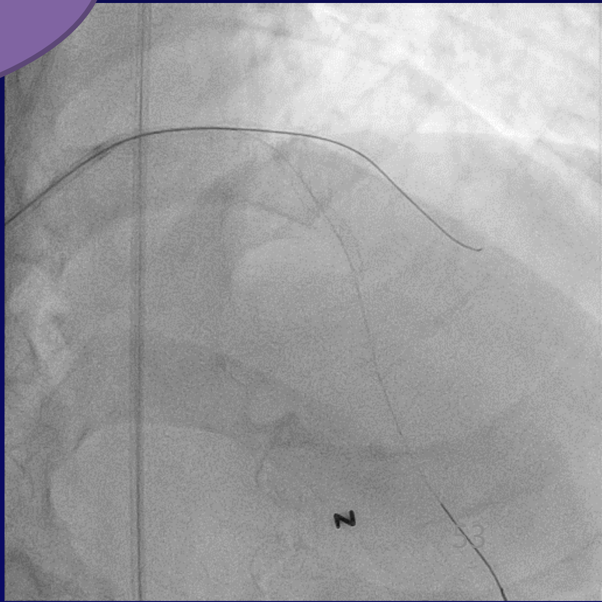
Antegrade wire & microcatheter

parallel wires

Antegrade wire escalation

IVUS & Multiple projection

ADR in Korea??



Thank you for your attention !!