

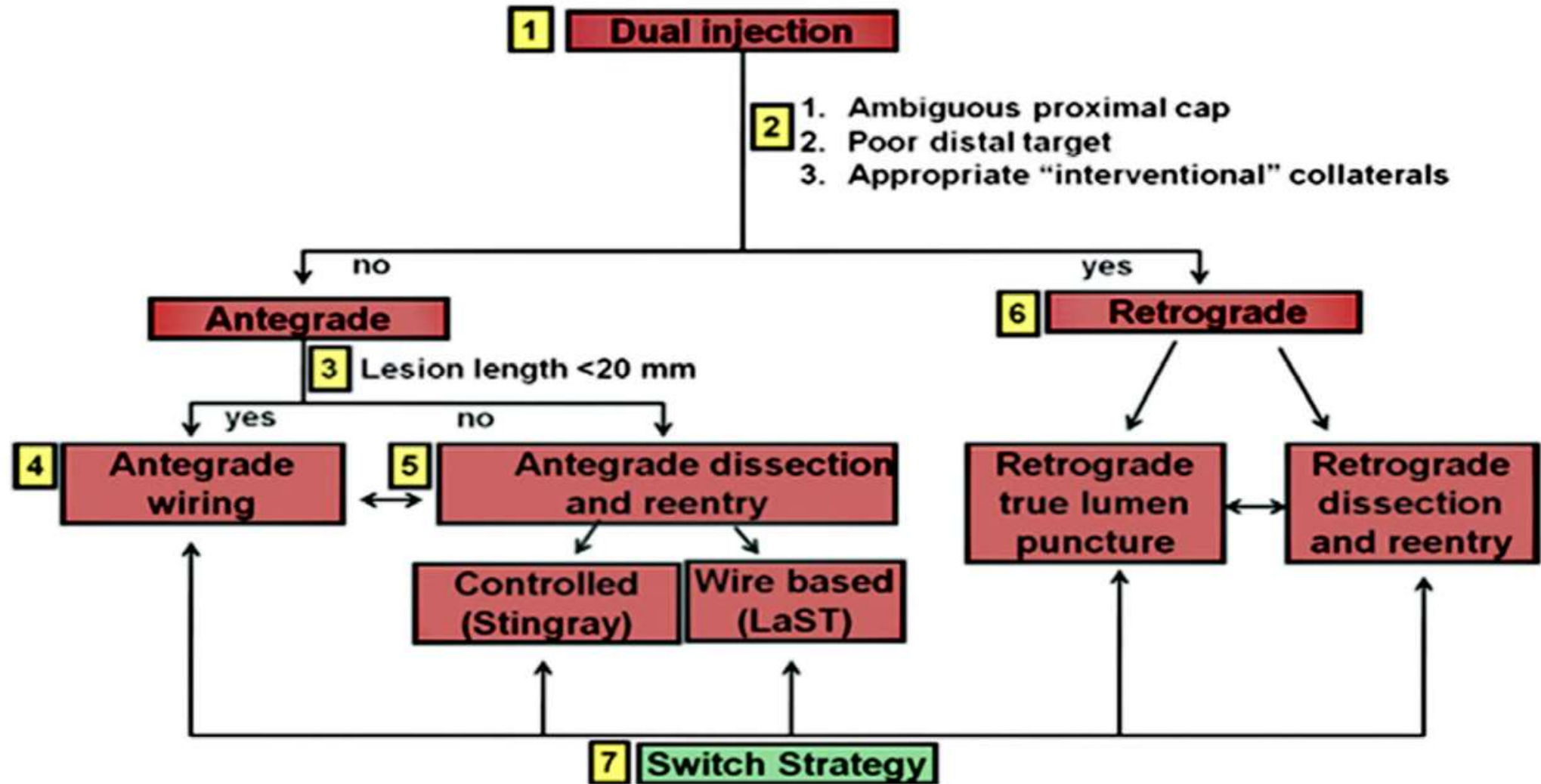
Updated Japanese Toolbox for Complex CTO-PCI

IVUS guided antegrade approach

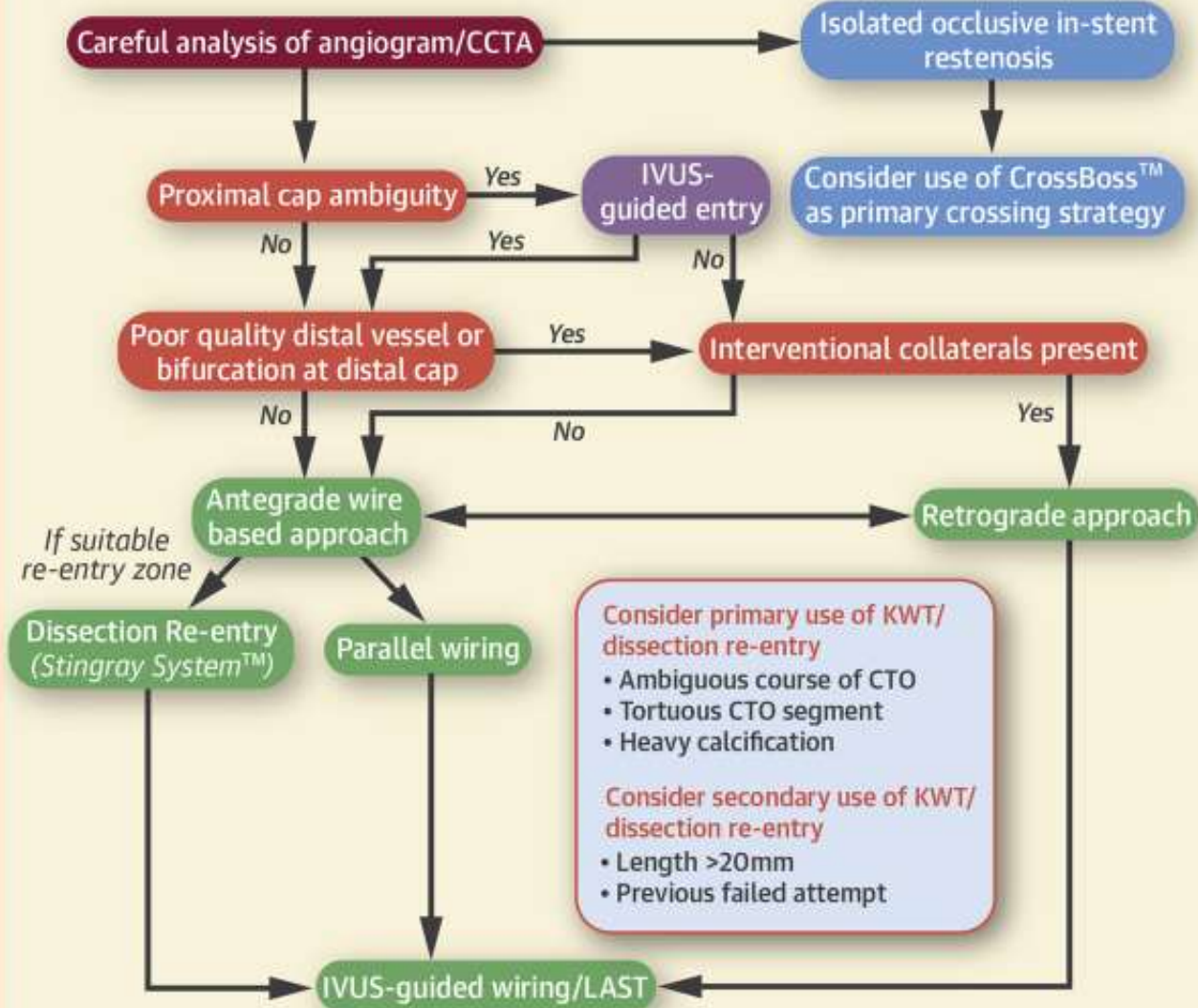
Yasumi Igarashi M.D. Ph.D.

Sapporo Kousei general hospital

Hybrid Strategy



Algorithm for CTO Crossing



Consider stopping if >3 hours, >3.7 x eGFR ml contrast, Air Kerma >5 Gy unless procedure well advanced

Difference between two strategy

Hybrid strategy

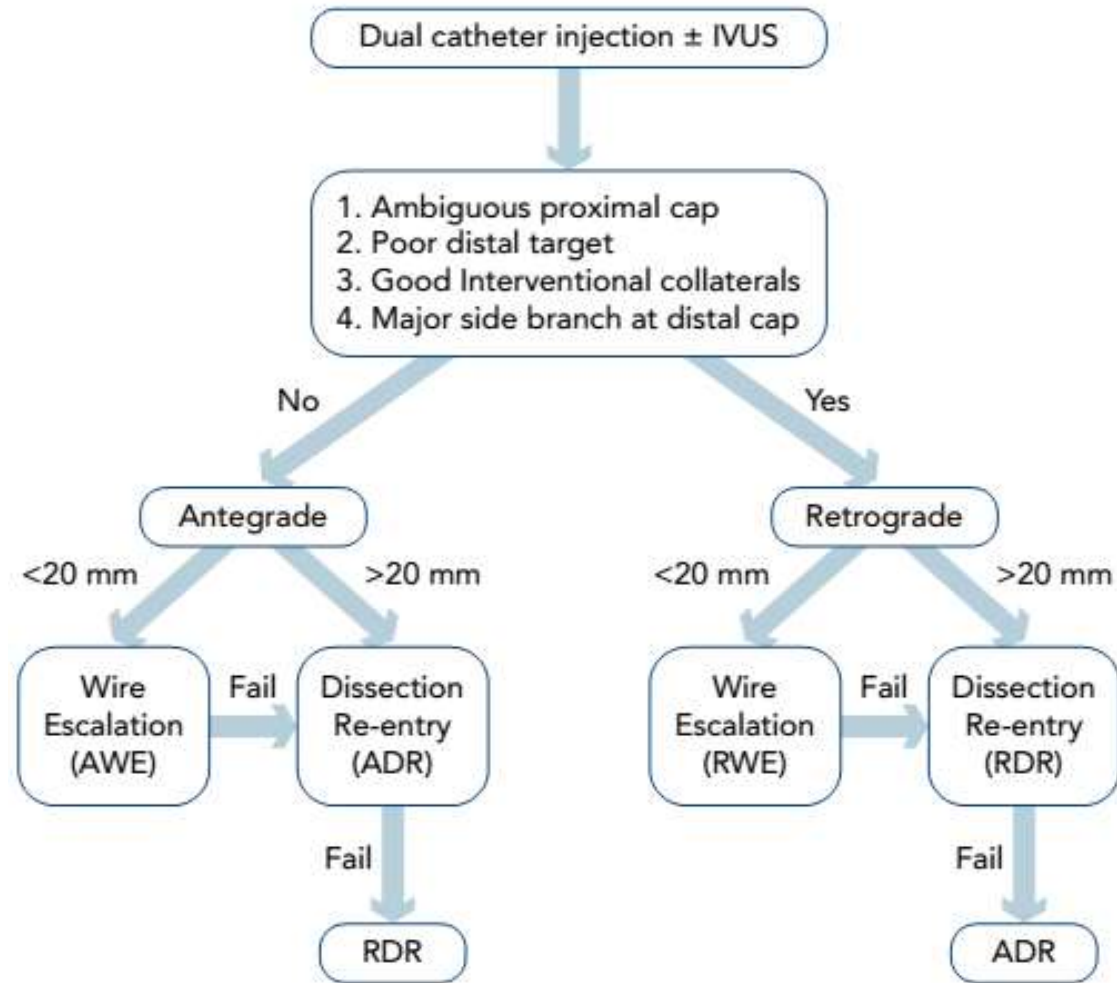
- 1) US and Maker initiative
- 2) simplified
- 3) ADR oriented

APCTO Club

- 1) Asia Pacific initiative
- 2) Procedure success oriented
- 3) IVUS guide Included
- 4) PWT

JACC: Cardiovascular Interventions
Volume 10, Issue 21, November 2017

Figure 1: Hybrid Algorithm for Chronic Total Occlusion Percutaneous Coronary Intervention

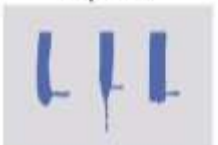

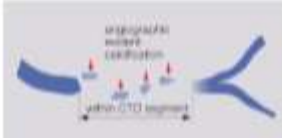
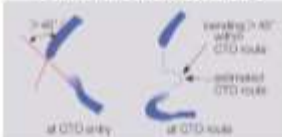
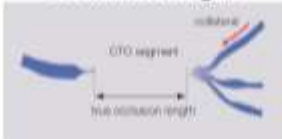



The initial approach is based on anatomical features, with a switch from a failing strategy advised at an early stage. ADR = antegrade dissection re-entry; AWE = antegrade wire escalation; IVUS = intravascular ultrasound; RDR = retrograde dissection re-entry; RWE = retrograde wire escalation.

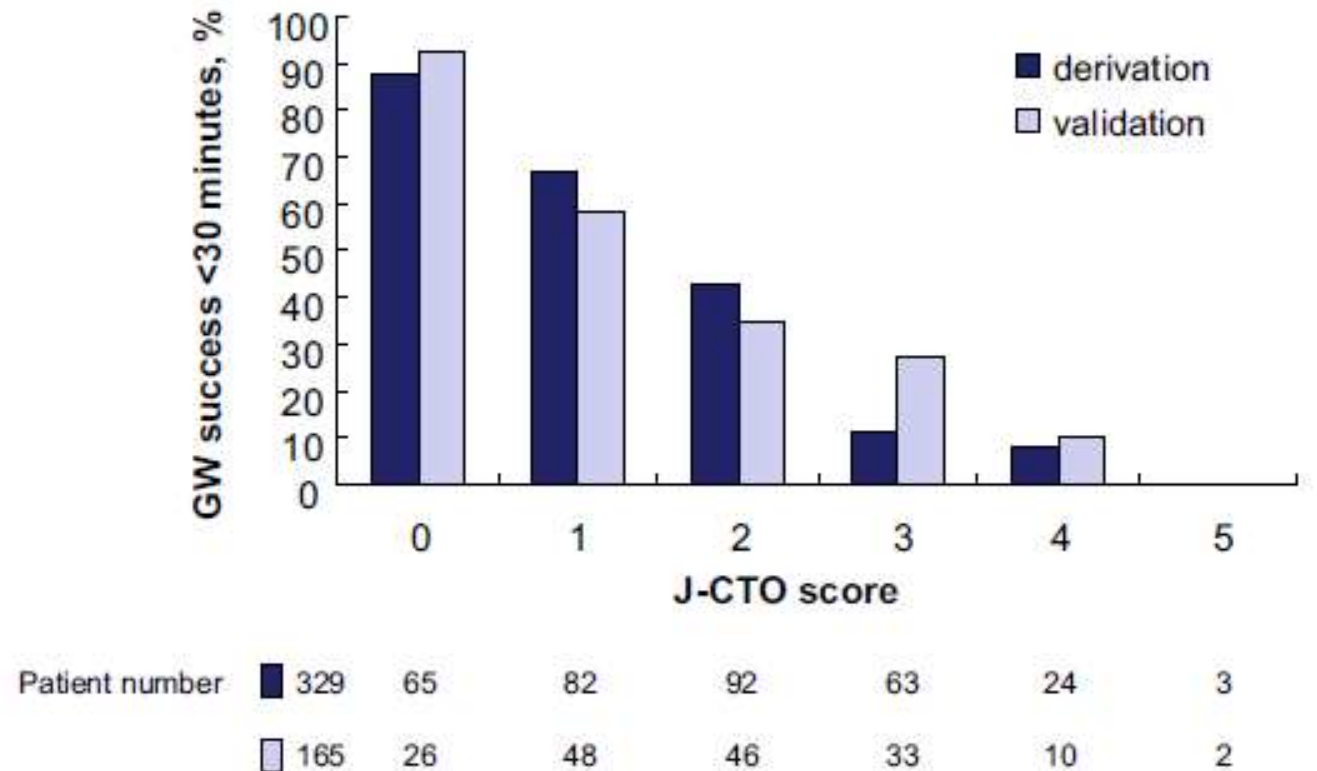
Why is IVUS necessary in CTO PCI?

J-CTO SCORE SHEET

Version 1.0

Variables and definitions		
Tapered 	Blunt 	Entry shape <input type="checkbox"/> Tapered (0) <input type="checkbox"/> Blunt (1) point
Calcification 	Regardless of severity, 1 point is assigned if any evident calcification is detected within the CTO segment.	Calcification <input type="checkbox"/> Absence (0) <input type="checkbox"/> 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° <input type="checkbox"/> Absence (0) <input type="checkbox"/> Presence (1) point
Occlusion length 	Using good collateral images, try to measure "true" distance of occlusion, which tends to be shorter than the first impression.	Occl.Length <input type="checkbox"/> <20mm (0) <input type="checkbox"/> ≥20mm (1) point
Re-try lesion Is this Re-try (2 nd attempt) lesion? (previously attempted but failed)		Re-try lesion <input type="checkbox"/> No (0) <input type="checkbox"/> Yes (1) point
Category of difficulty (total point) <input type="checkbox"/> easy (0) <input type="checkbox"/> intermediate (1) <input type="checkbox"/> difficult (2) <input type="checkbox"/> very difficult (≥3)		Total  points

Although this scoring system is usually considered as a model to predict the difficulty of CTO PCI, it is originally developed to predict successful **guidewire crossing within 30 min.**



Towards a Contemporary, Comprehensive Scoring System for Determining Technical Outcomes of Hybrid Percutaneous Chronic Total Occlusion Treatment: The RECHARGE Score

Joren Maeremans,^{1,2} MSc, James C. Spratt,³ MD, Paul Knaapen,⁴ MD, PhD, Simon Walsh,⁵ MD, Pierfrancesco Agostoni,^{6,7} MD, PhD, William Wilson,⁸ MBBS, Alexandre Avran,⁹ MD, Benjamin Faurie,¹⁰ MD, PhD, Erwan Bressollette,¹¹ MD, Peter Kayaert,¹² MD, Alan J. Bagnall,^{13,14} MD, PhD, Dave Smith,¹⁵ MD, Margaret B. McEntegart,¹⁶ MD, PhD, William H.T. Smith,¹⁷ MD, BCHIR, PhD, FRCP, Paul Kelly,¹⁸ MD, John Irving,¹⁹ MD, Elliot J. Smith,²⁰ MD, FRCP, Julian W. Strange,²¹ MD, and Jo Dens,^{1,2*} MD, PhD

Catheter Cardiovasc Interv. 2018 ; 91:192–202

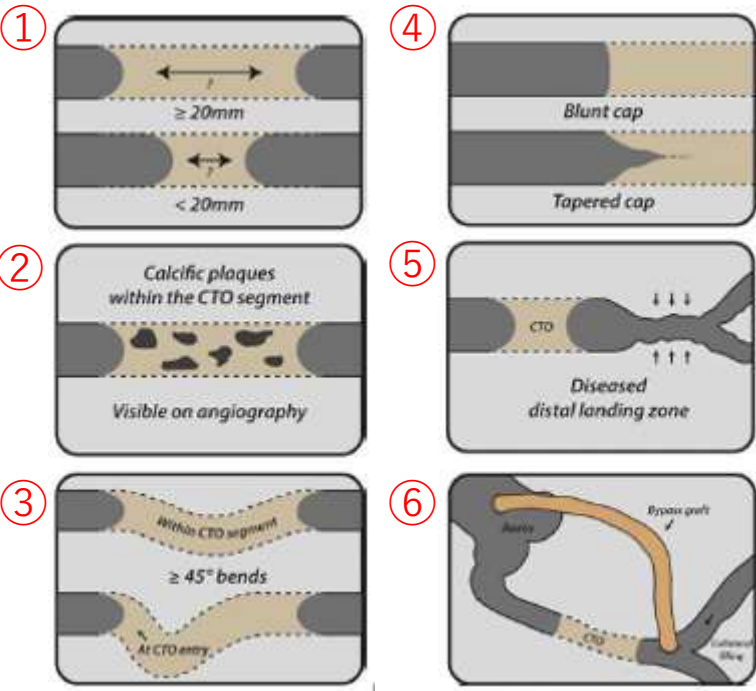
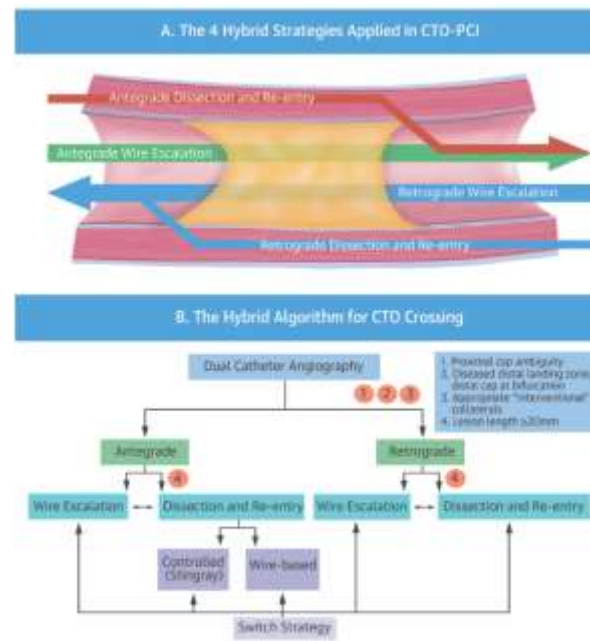
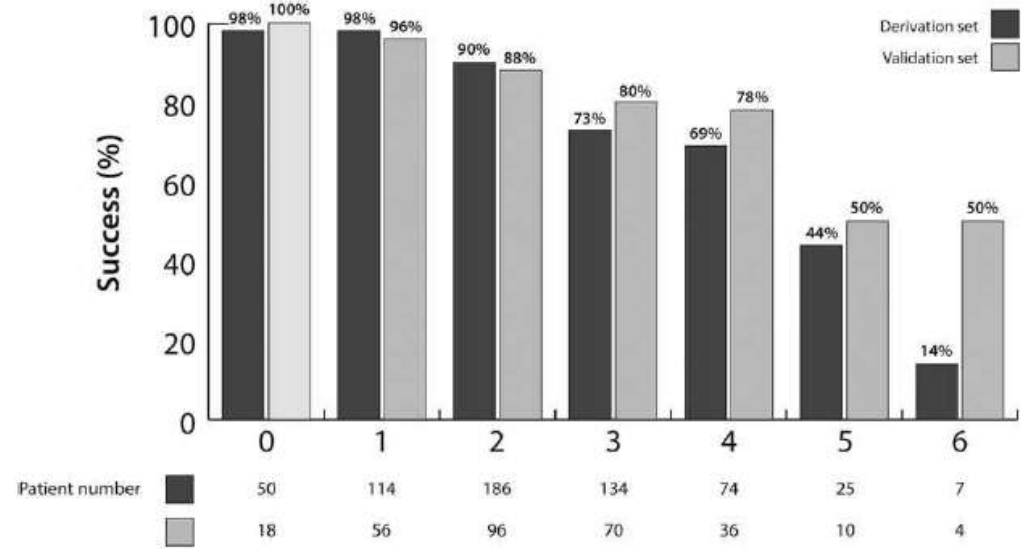


TABLE III. Multivariate Model

Previous CABG on TV
Blunt stump
Calcification
Tortuosity $\geq 45^\circ$
Lesion length ≥ 20 mm
Diseased distal landing zone



Development and Validation of a Novel Scoring System for Predicting Technical Success of Chronic Total Occlusion Percutaneous Coronary Interventions

The PROGRESS CTO (Prospective Global Registry for the Study of Chronic Total Occlusion Intervention) Score

Georgios Christopoulos, MD,* David E. Kandzari, MD,† Robert W. Yeh, MD, MBA,‡ Farouc A. Jaffer, MD, PhD,‡ Dimitri Karpaliotis, MD,§ Michael R. Wyman, MD,|| Khaldoon Alaswad, MD,¶ William Lombardi, MD,# J. Aaron Grantham, MD,** Jeffrey Moses, MD,§ Georgios Christakopoulos, MD,* Muhammad Nauman J. Tarar, MD,* Bavana V. Rangan, BDS, MPH,* Nicholas Lembo, MD,† Santiago Garcia, MD,†† Daisha Cipher, PhD,‡‡ Craig A. Thompson, MD, MMSc,§§ Subhash Banerjee, MD,* Emmanouil S. Brilakis, MD, PhD*

J Am Coll Cardiol Intv 2016;9:1-9



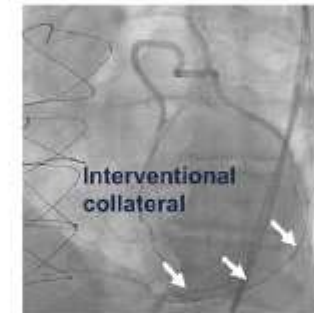
FIGURE 1 Summary of the PROGRESS CTO Score

①
Proximal cap ambiguity (1 point)

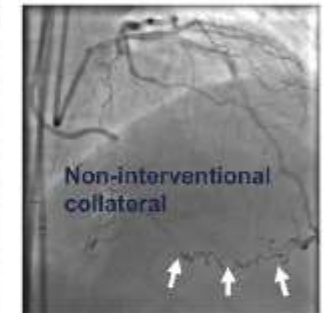


Poor cap visualization or absence of clearly tapered stump

②
Absence of “interventional” collaterals (1 point)

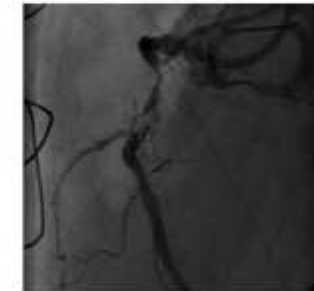


Interventional collateral



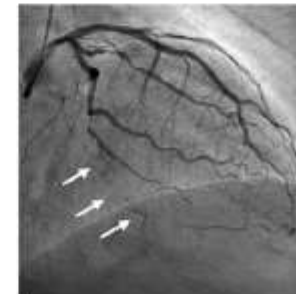
Non-interventional collateral

③
Moderate/severe tortuosity (1 point)



2 bends >70 degrees or 1 bend >90 degrees

④
Circumflex CTO (1 point)



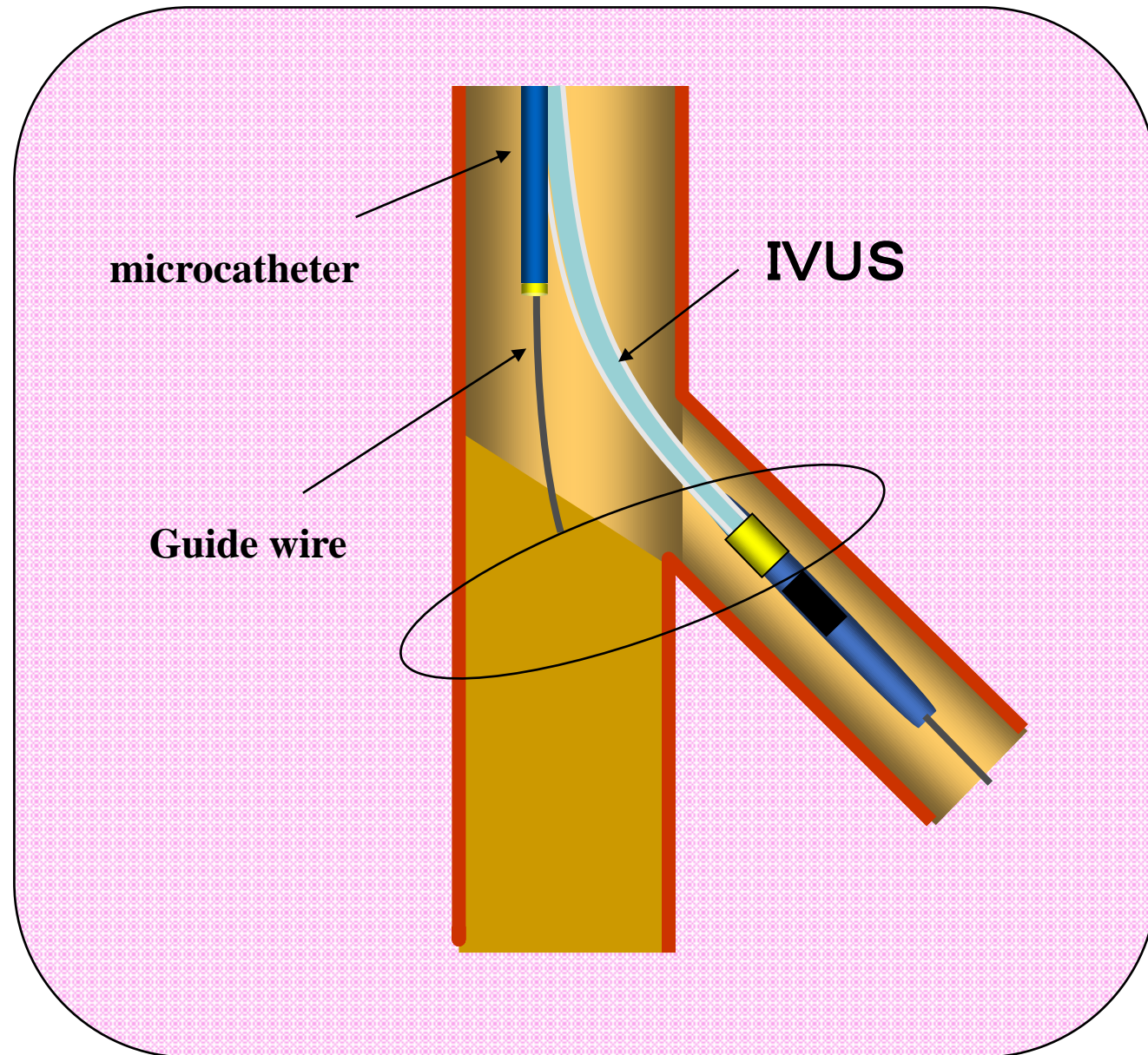
Chronic Total Occlusion Percutaneous Coronary Intervention: Evidence and Controversies

Peter Tajti, MD; Emmanouil S. Brilakis, MD, PhD

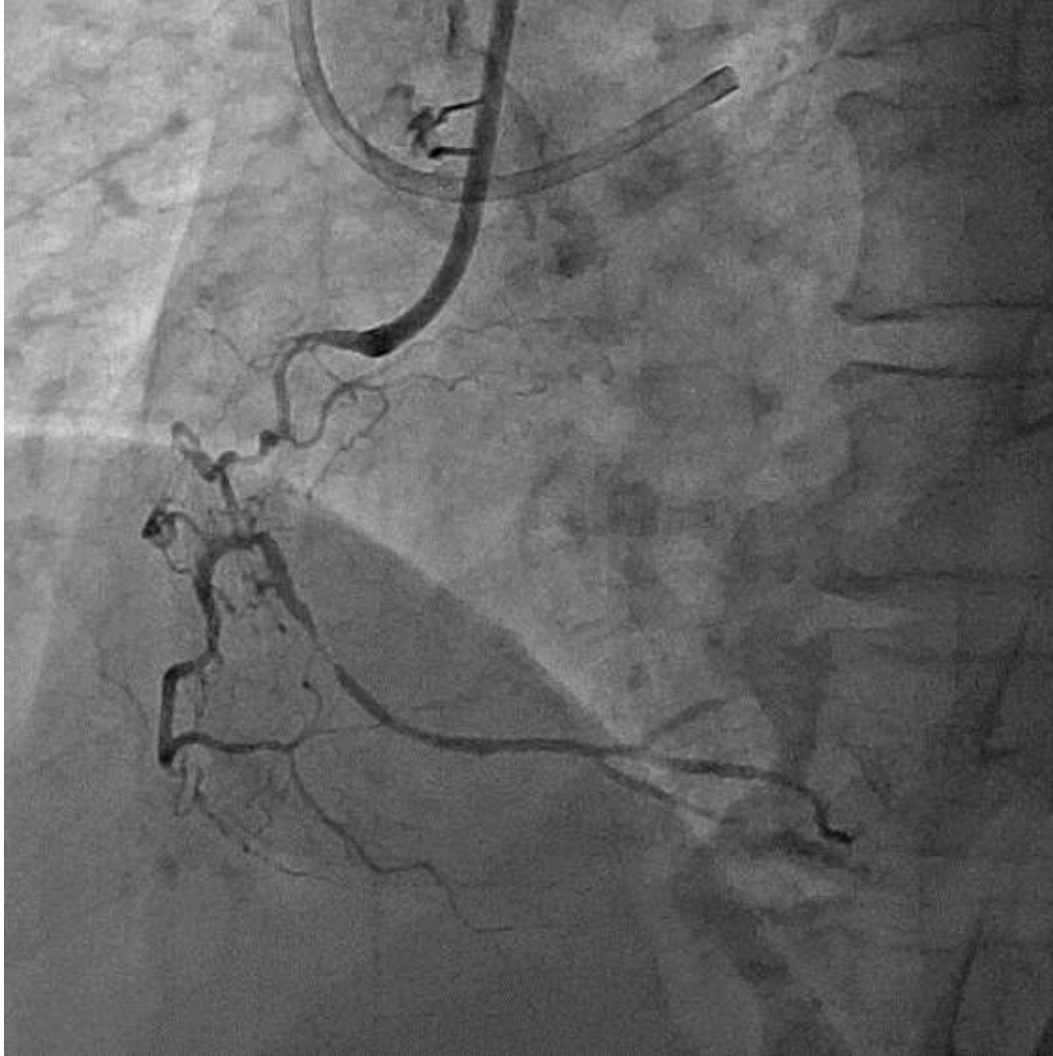
J Am Heart Assoc. 2018;7:e006732

Score Variables	J-CTO Score ³⁶	CL Score ³⁴	PROGRESS-CTO Score ³⁸	ORA Score ³⁷	RECHARGE Score ³⁹	Ellis Score ³⁵
No. of cases	494	1657	781	1073	1253	456
End point	Guidewire crossing <30 min	Technical success	Technical success	Technical success	Technical success	Technical success
Age, y	–	–	–	+ (≥75)	+ (>65)	–
Prior CABG	–	+	–	–	+	–
Prior failure	+	–	–	–	–	–
Proximal cap	+ (Blunt)	+ (Blunt)	+ (Ambiguous)	+ (Ostial)	+	+ (Ambiguous, ostial)
Tortuosity	+ (>45° in lesion)	–	+ (Moderate,* proximal)	–	+	+
Calcification	+	+ (Severe)	–	–	+	+
Lesion length	+ (≥20 mm)	+ (≥20 mm)	–	–	+	+
Target vessel	–	+ (Non-LAD)	+ (LCX)	–	–	+ (Poor distal target)
Collateral quality	–	–	+ (Interventional)	+ (Rentrop <2)	–	+†
Other	–	Prior myocardial infarction	–	–	BMI >30 kg/m ² , nonproximal location	Operator experience

To detect entry point of bifurcated CTO lesions



RCA mid CTO case in CCT2016



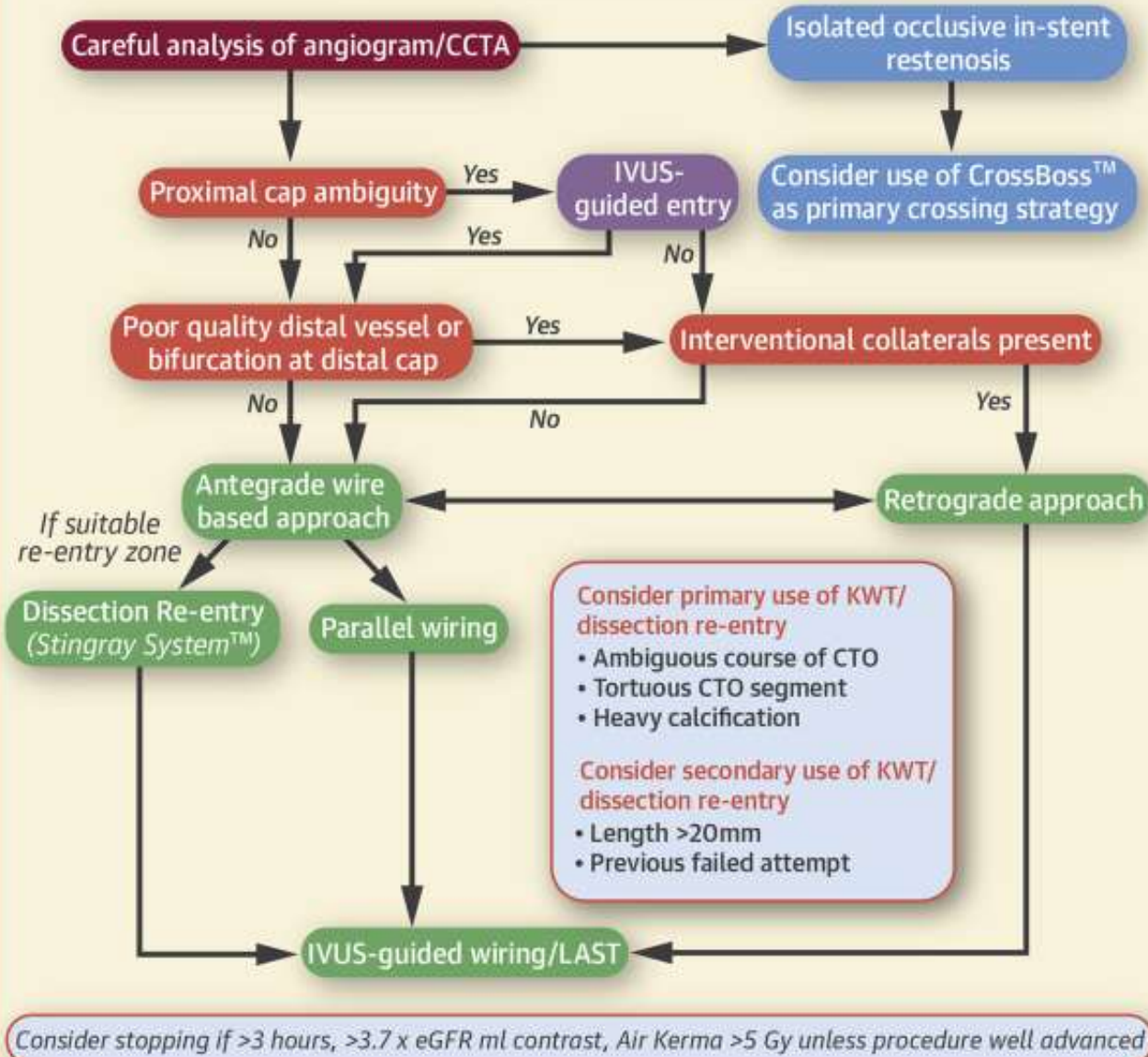
- Blunt type entry point
- proximal strong tortuosity
- Bridge collateral
- No promising interventional collateral

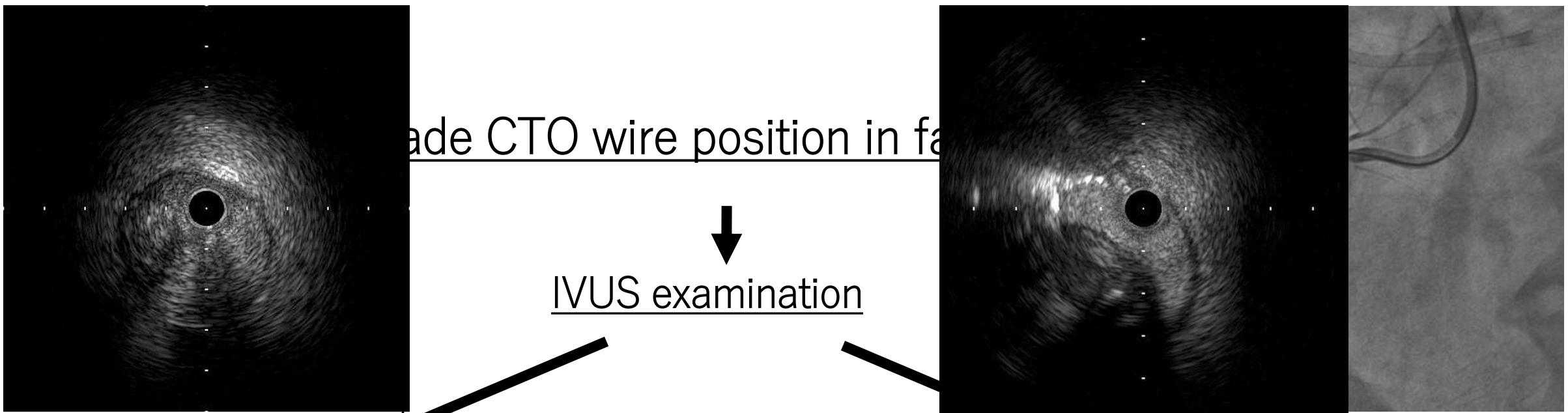
RCA mid CTO case in CCT2016



Total procedure time > 5h

Algorithm for CTO Crossing





ade CTO wire position in fa

IVUS examination

Intra-plaque

Sub-intimal space

Antegrade single wire manipulation

Interventional collateral(+)

Interventional collateral(-)

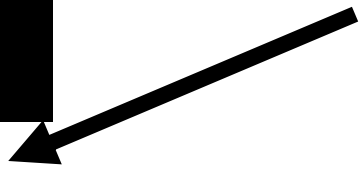
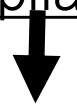
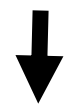
Parallel Wire Technique

Retrograde approach

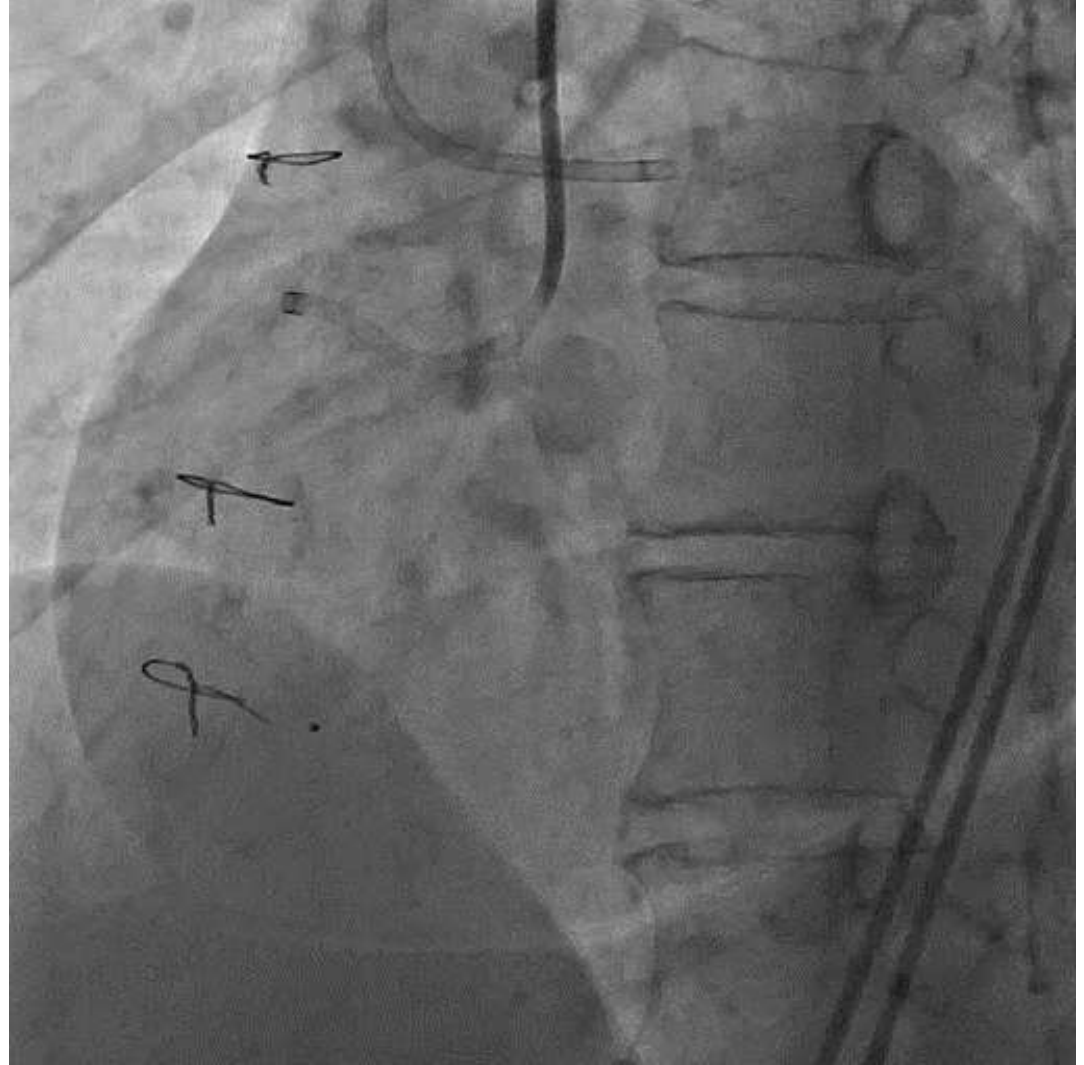
Major side branch at distal cap(-)
Good distal target (+)

ADR

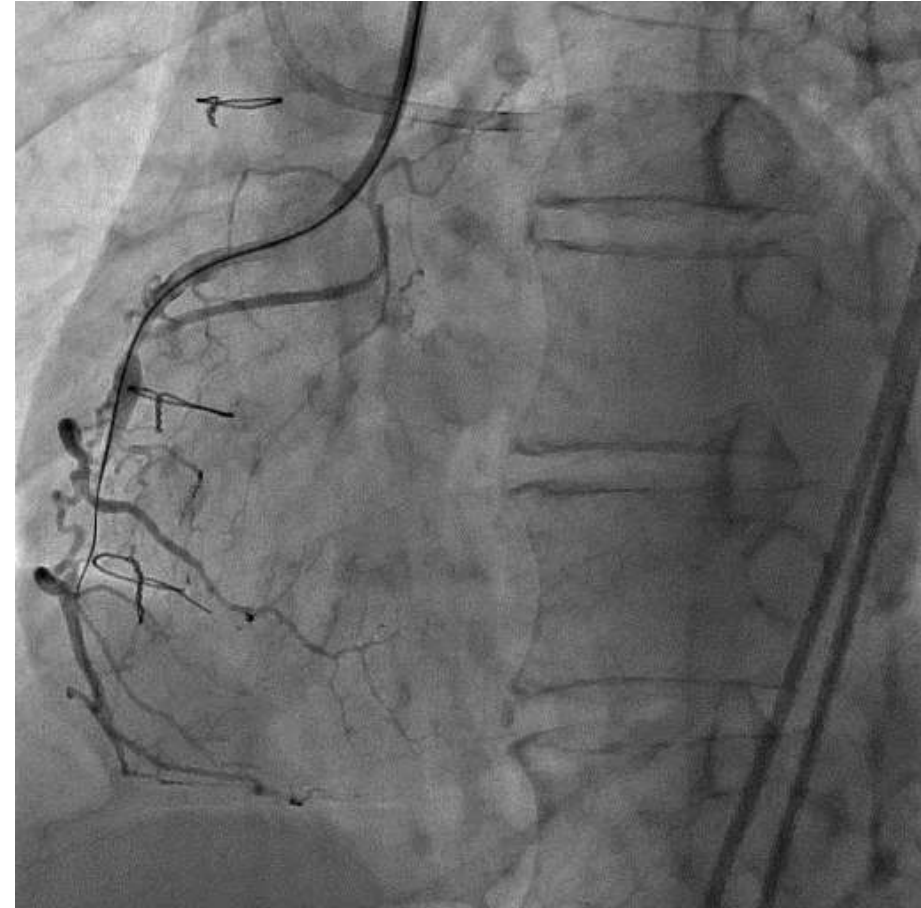
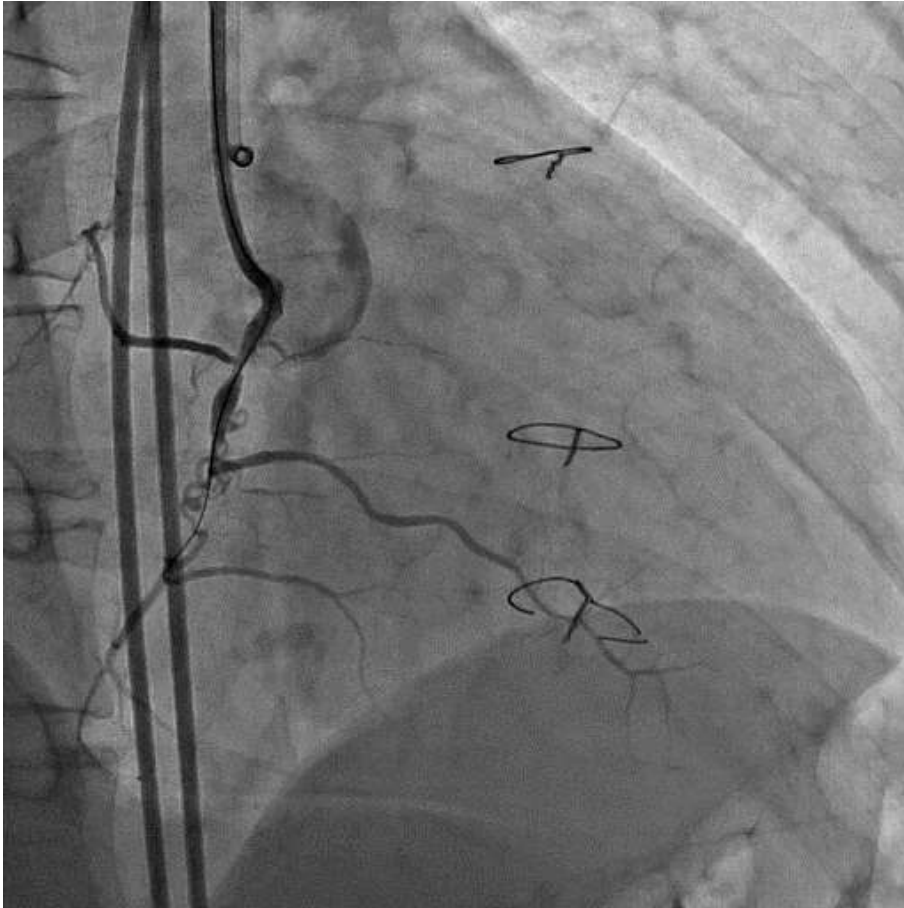
IVUS re-wiring



RCA double CTO

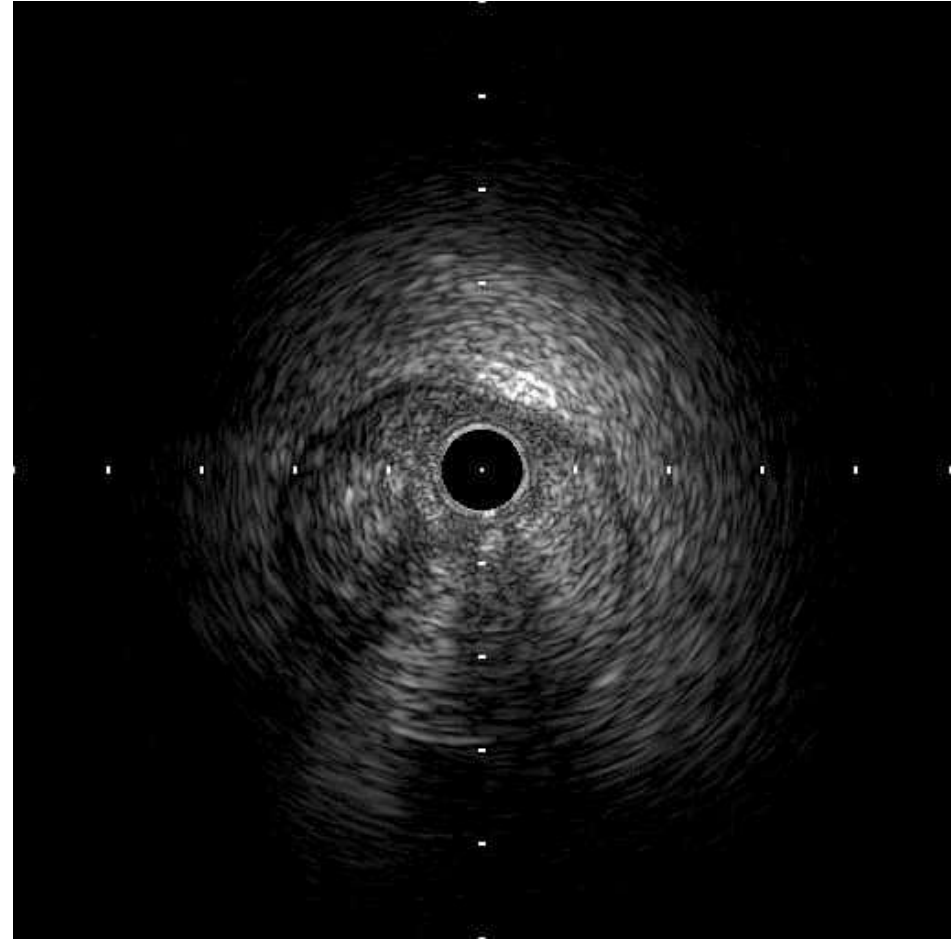
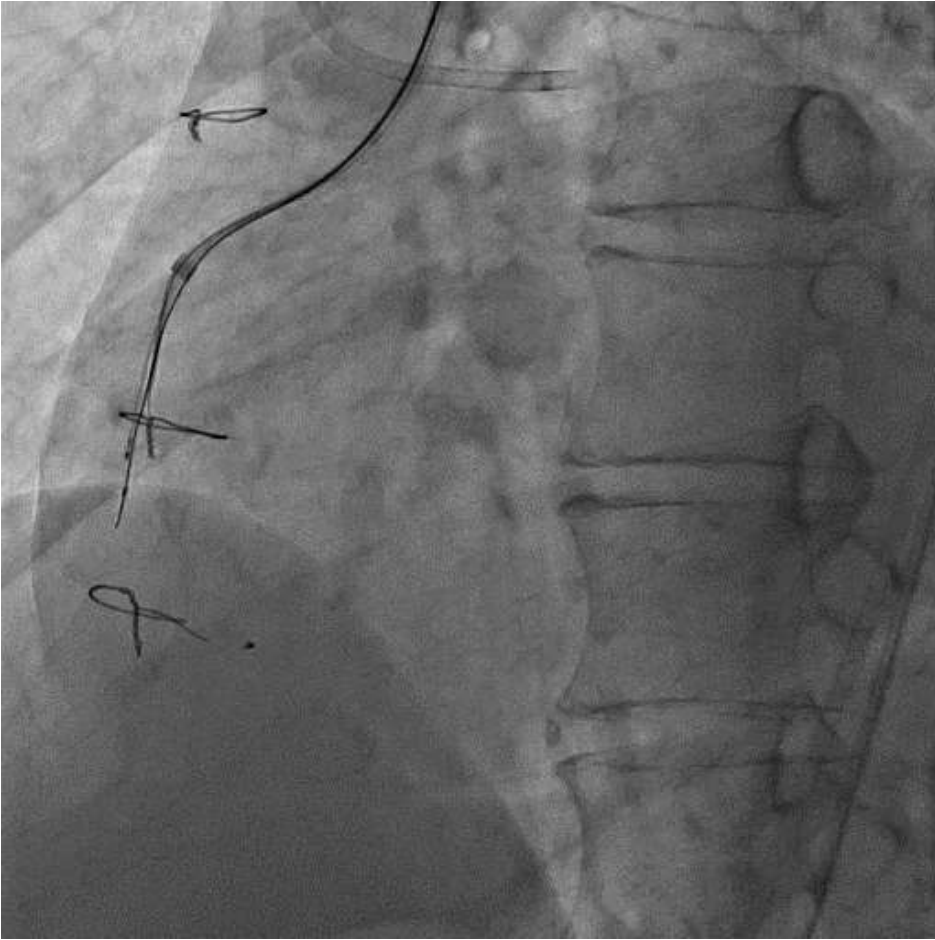


RCA double CTO



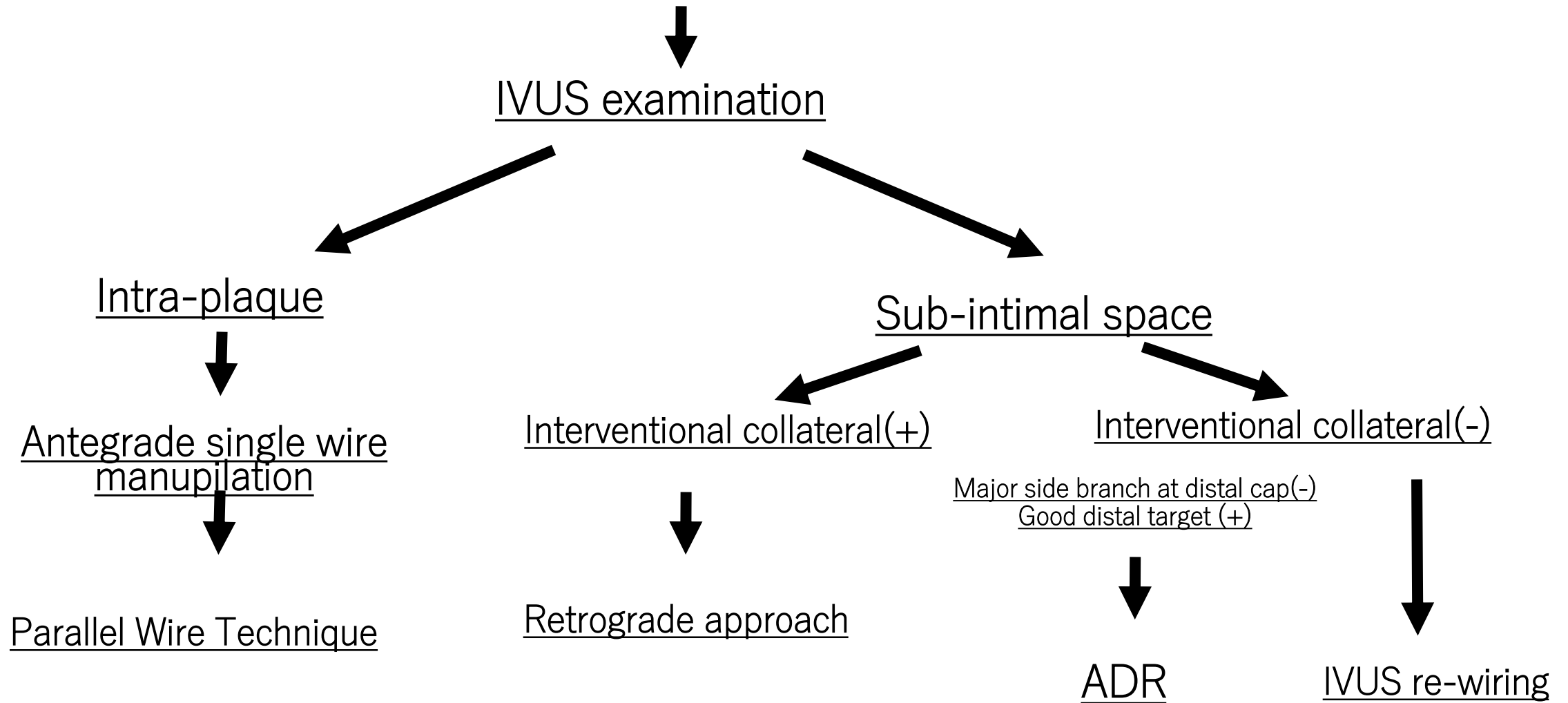
Initial wire;XTA

RCA double CTO

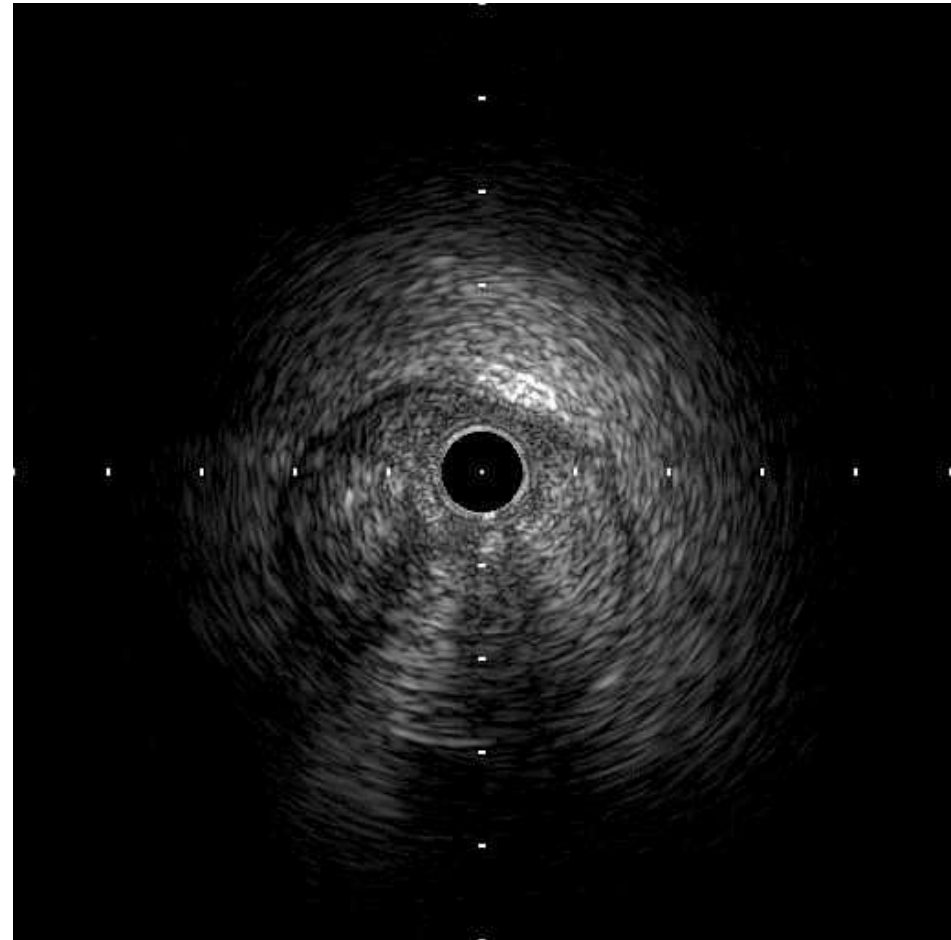
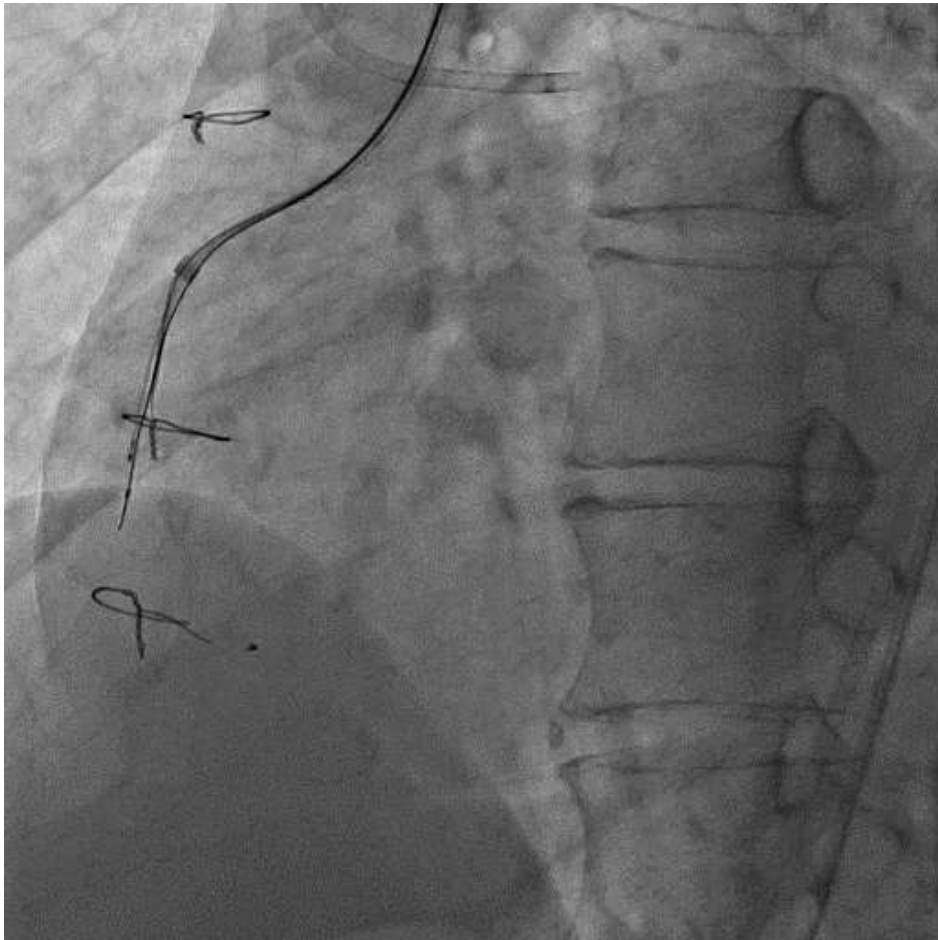


XTA→Neos3→IVUS examination

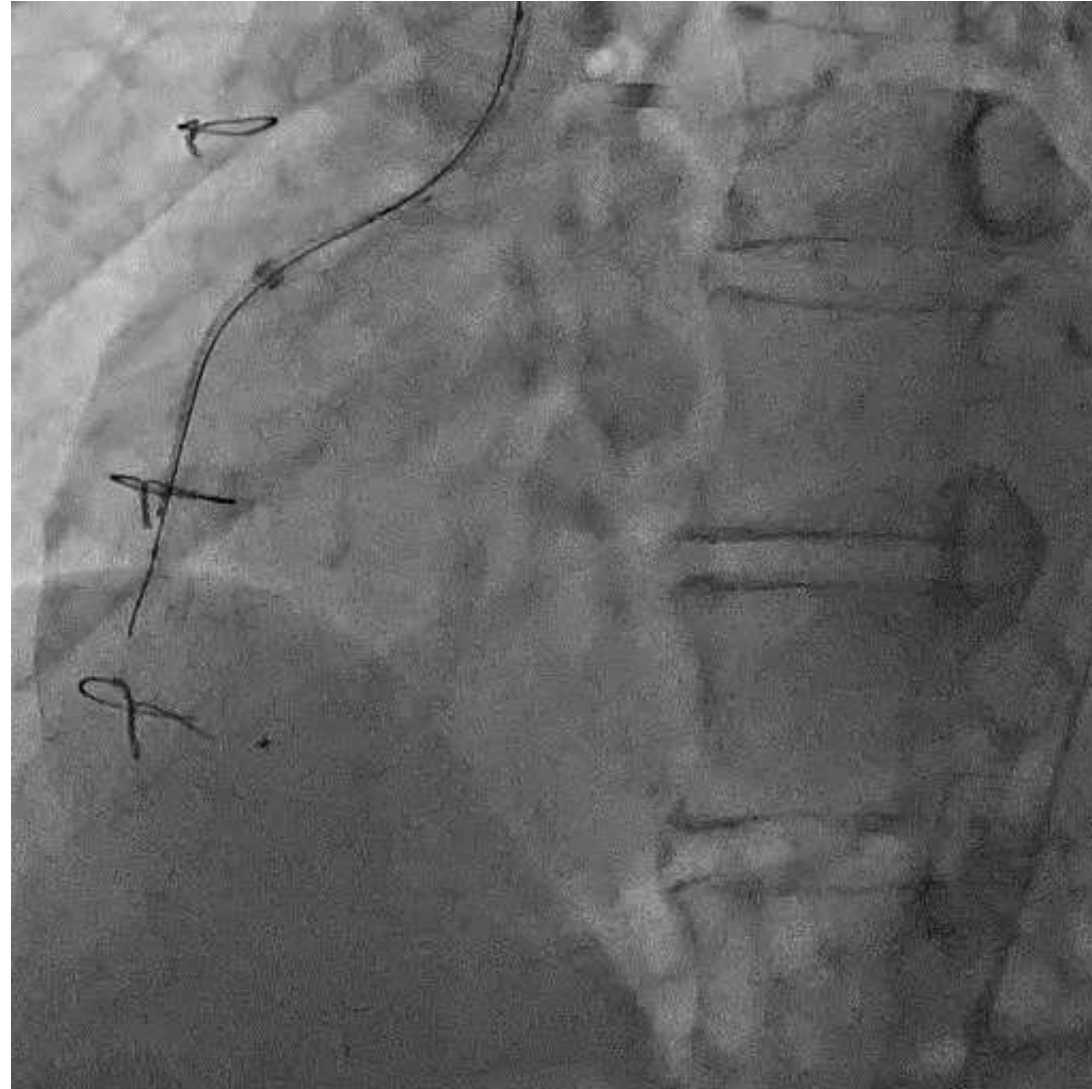
Antegrade CTO wire position in false lumen



RCA double CTO

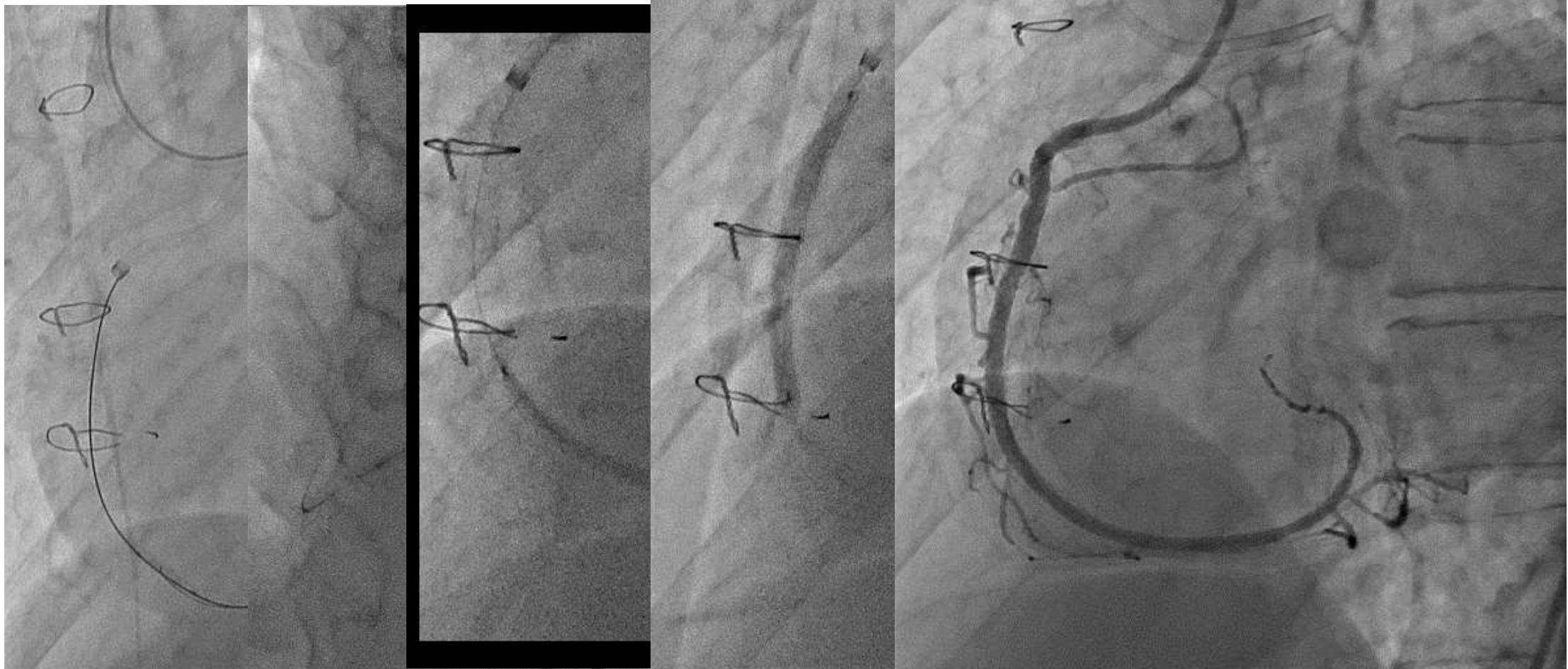


RCA double CTO

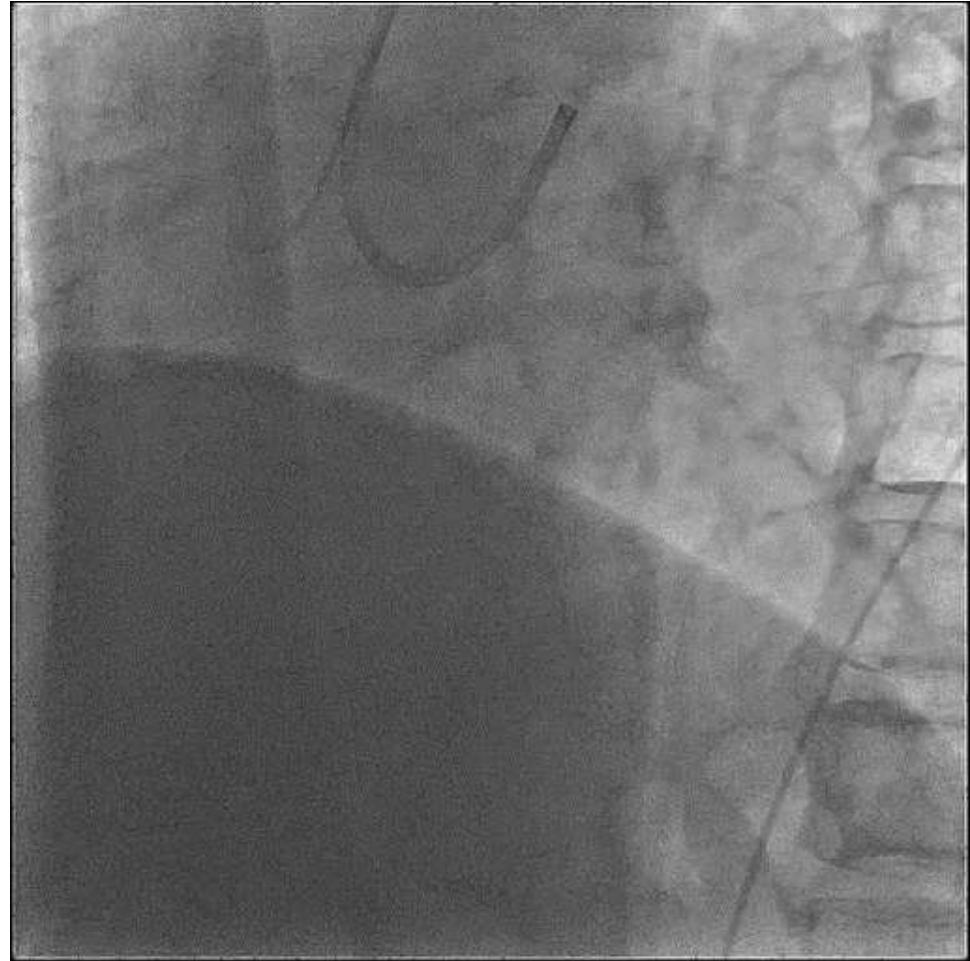


Miracle Neos 3 G

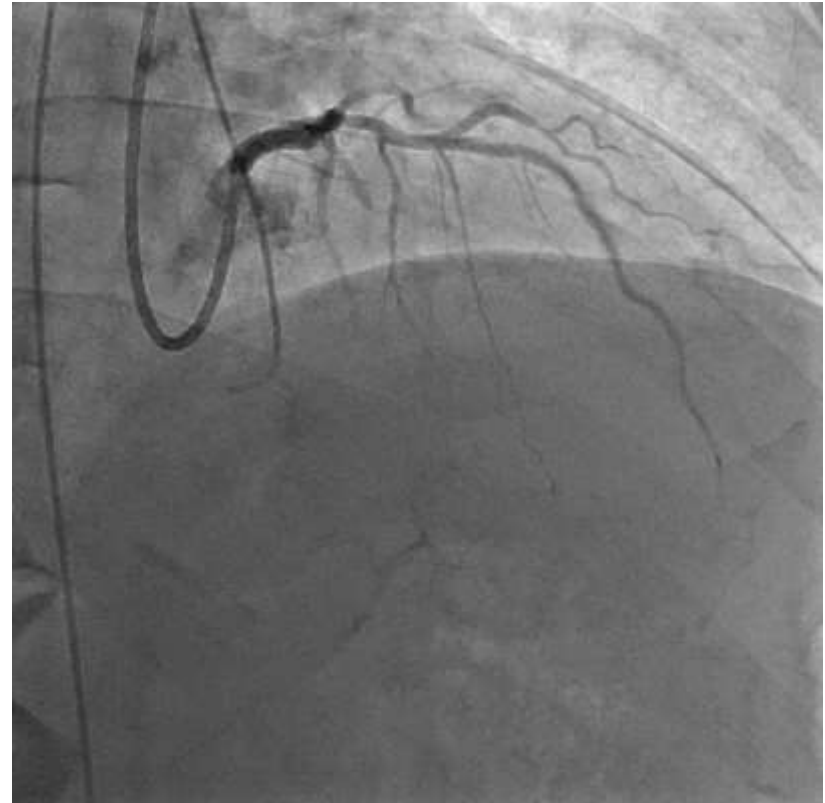
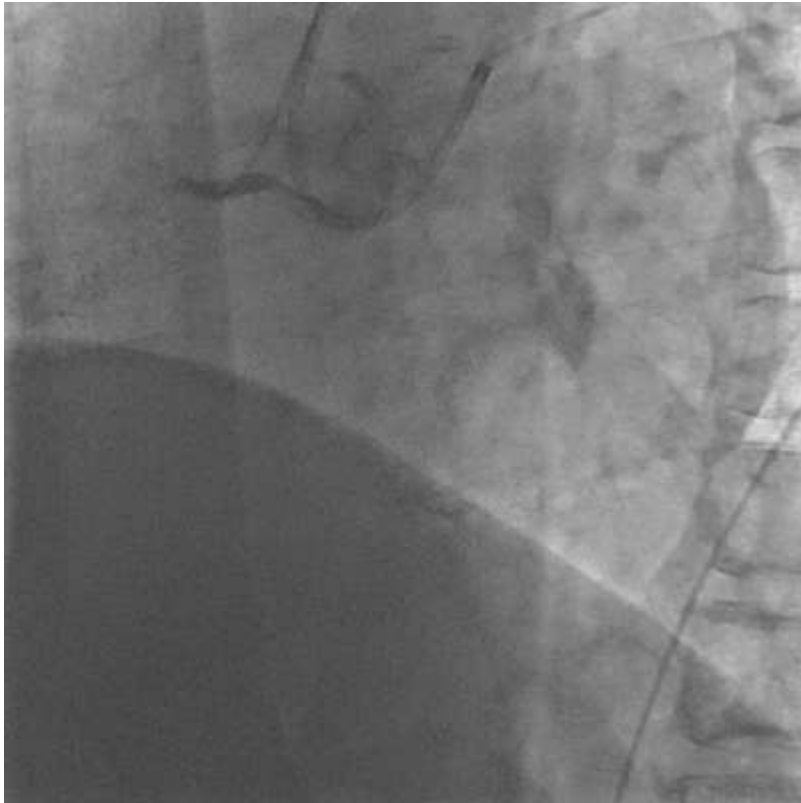
RCA double CTO



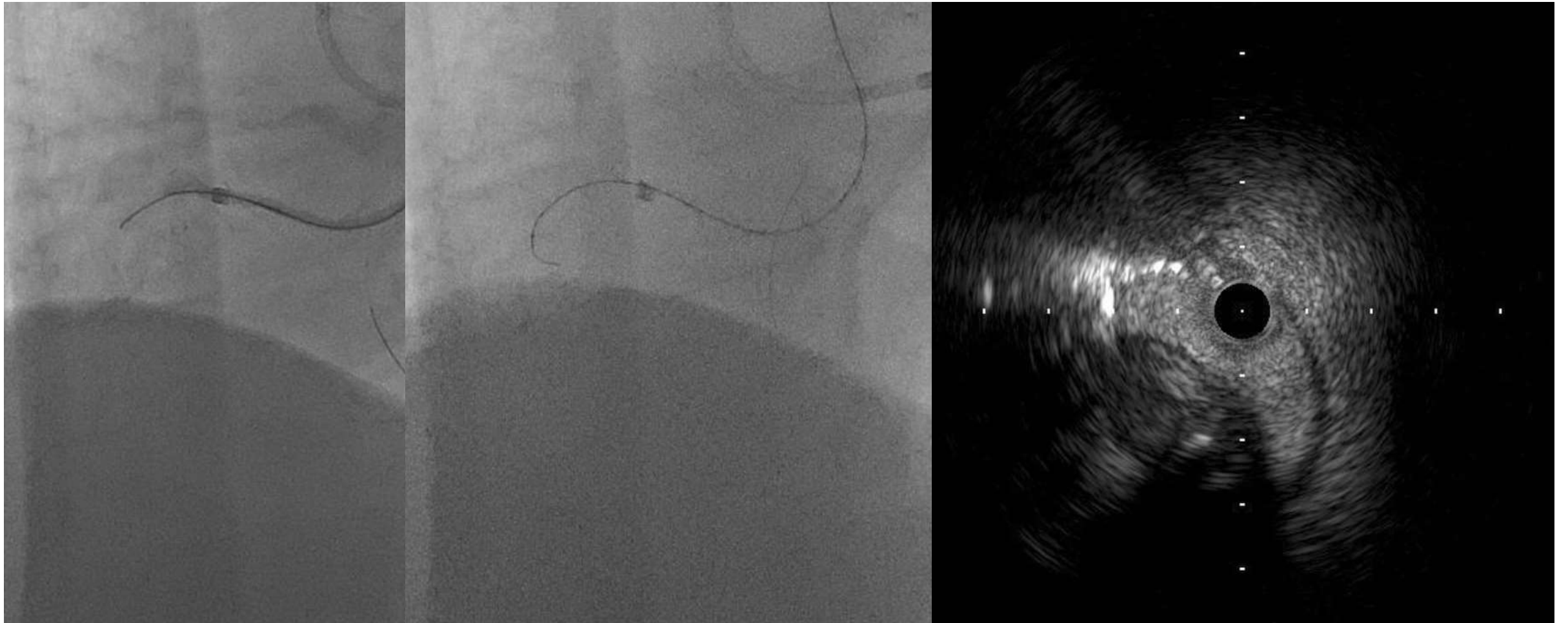
RCA proximal CTO without interventional collateral



RCA proximal CTO without interventional collateral

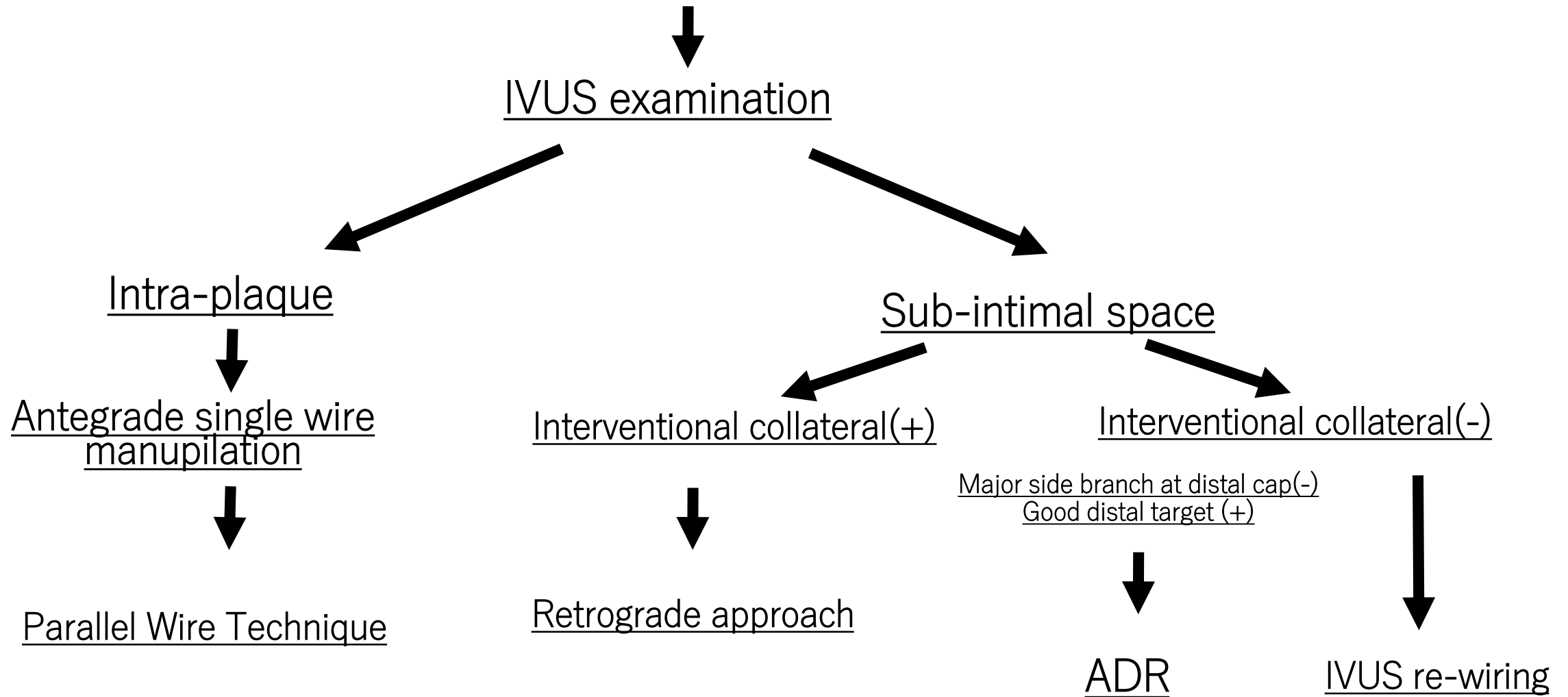


RCA proximal CTO without interventional collateral

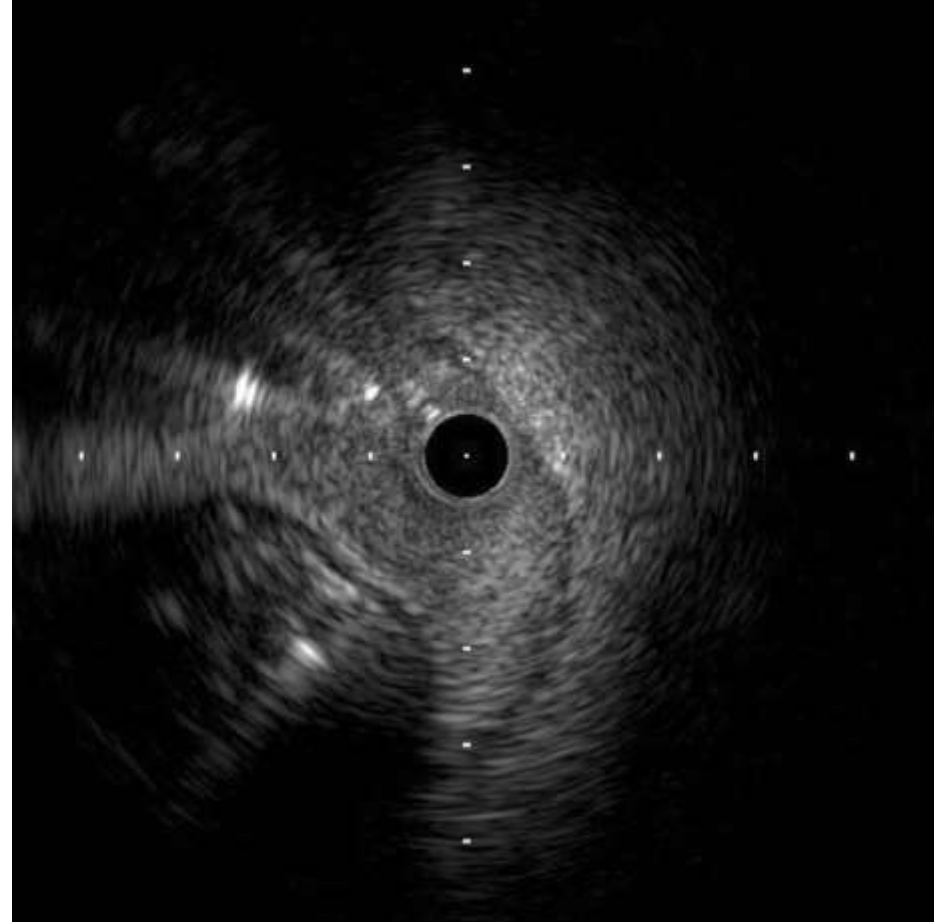
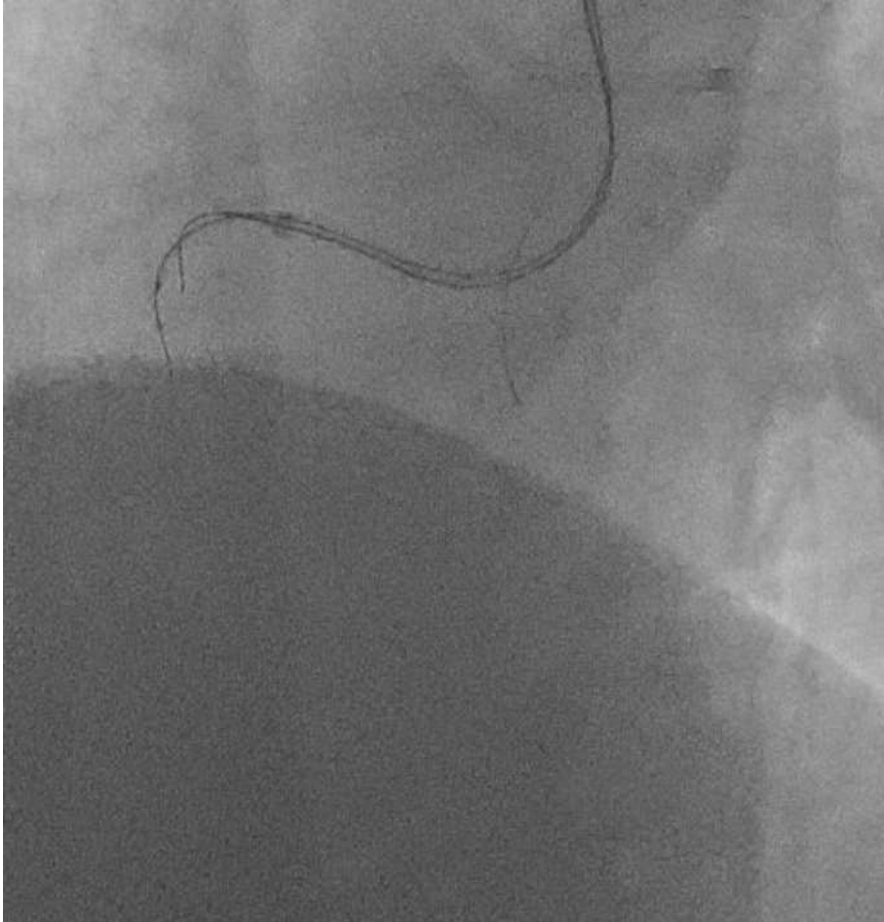


Initial wire;Miracle Neos→XT→IVUS

Antegrade CTO wire position in false lumen

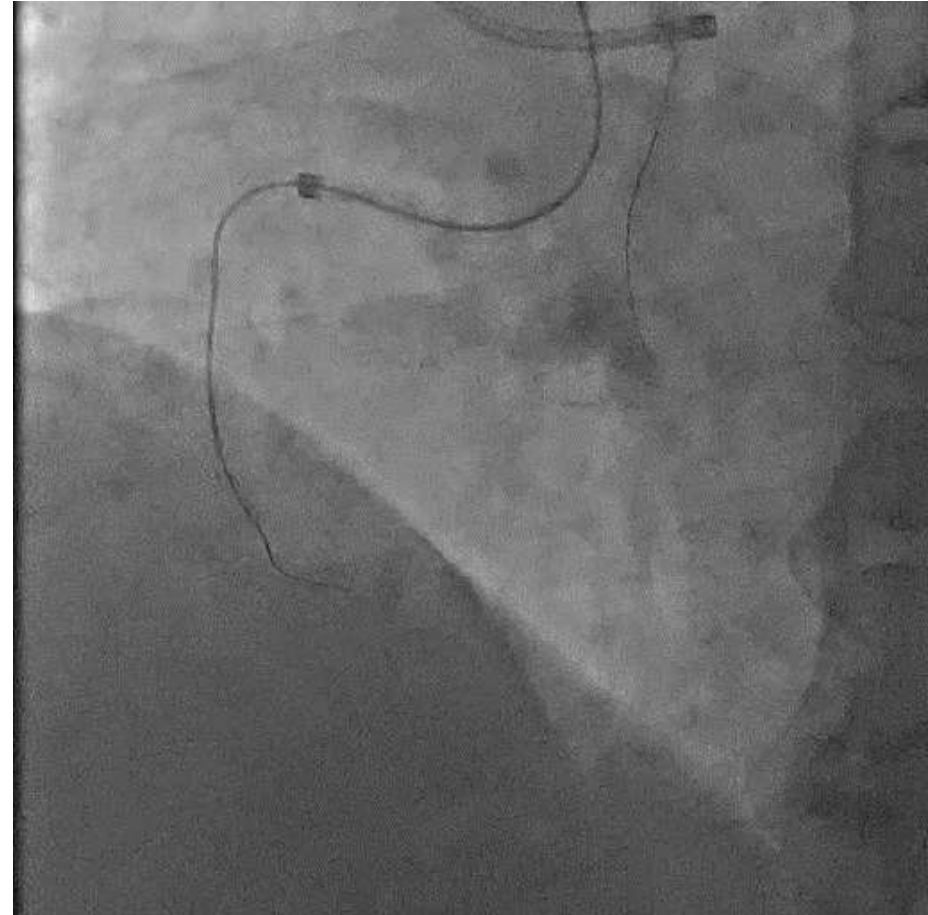
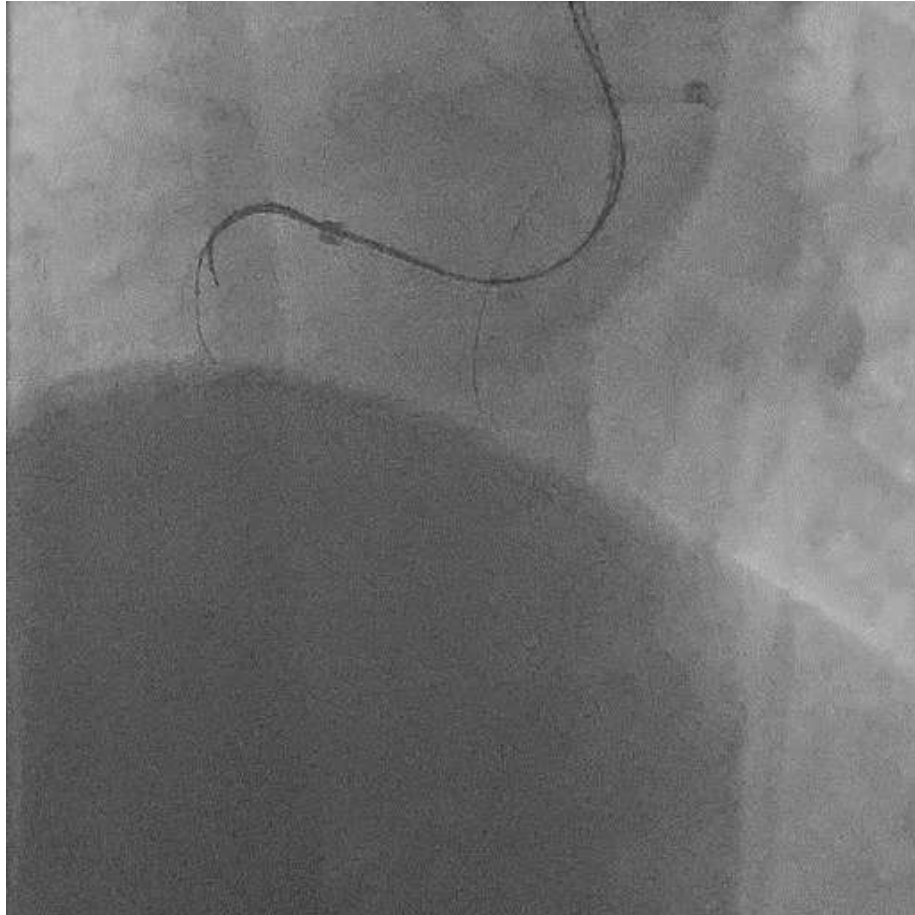


RCA proximal CTO without interventional collateral



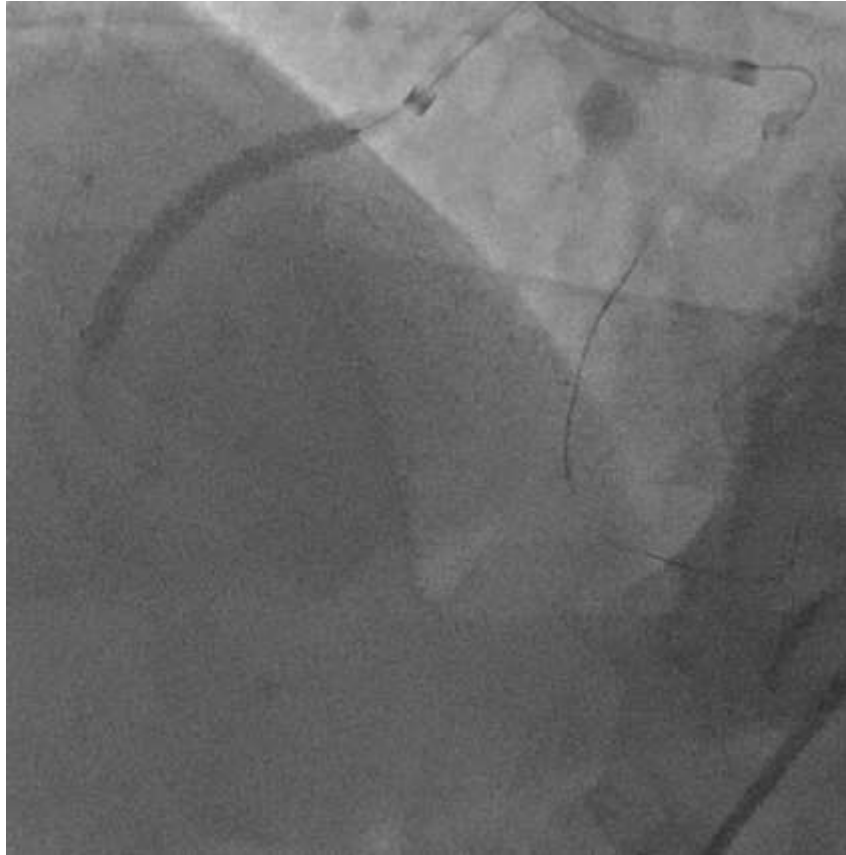
IVUS guided re-wiring: Neos3

RCA proximal CTO without interventional collateral



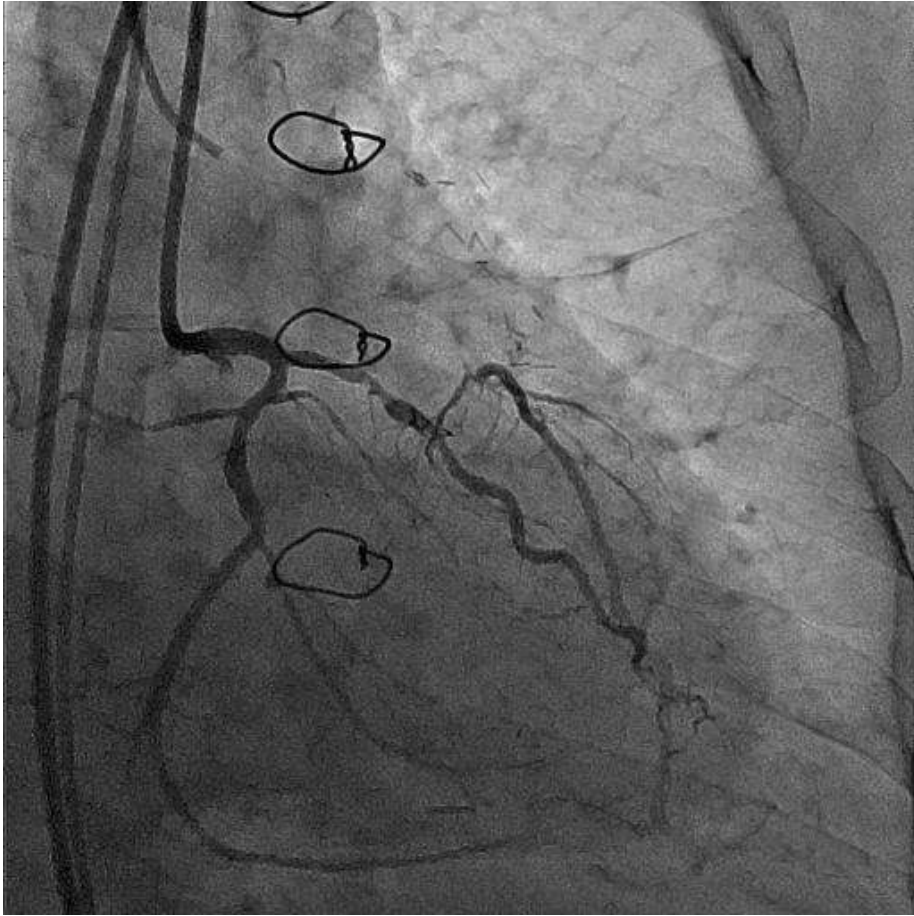
Neos 3G → Sion black

RCA proximal CTO without interventional collateral

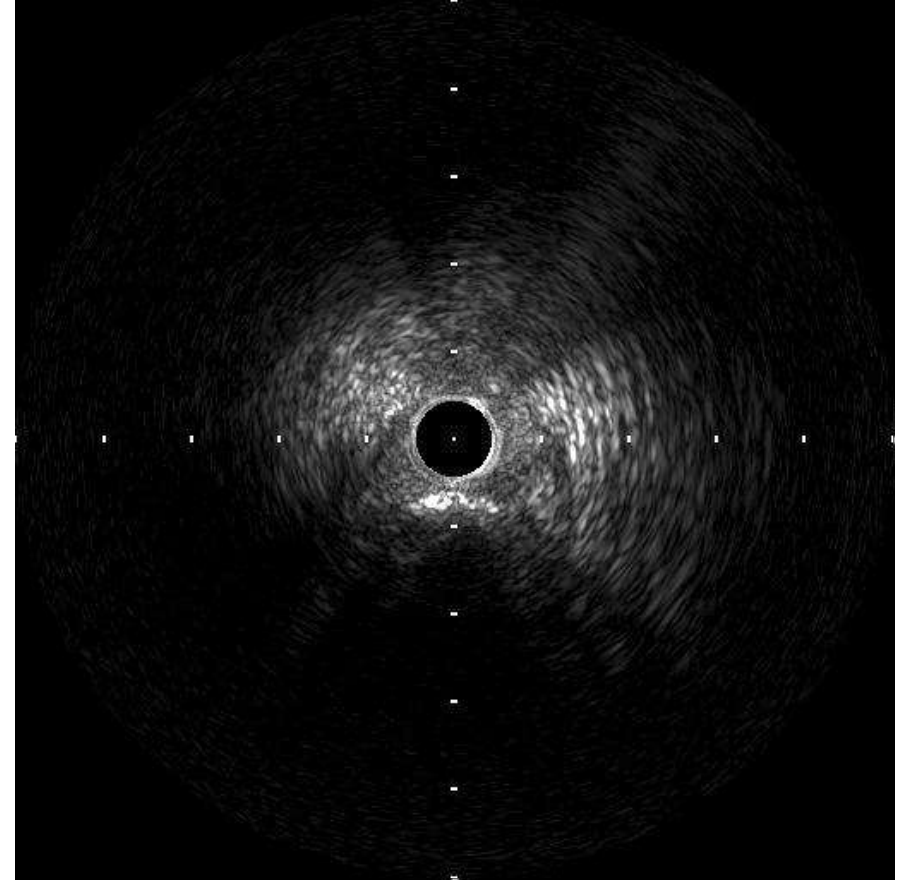
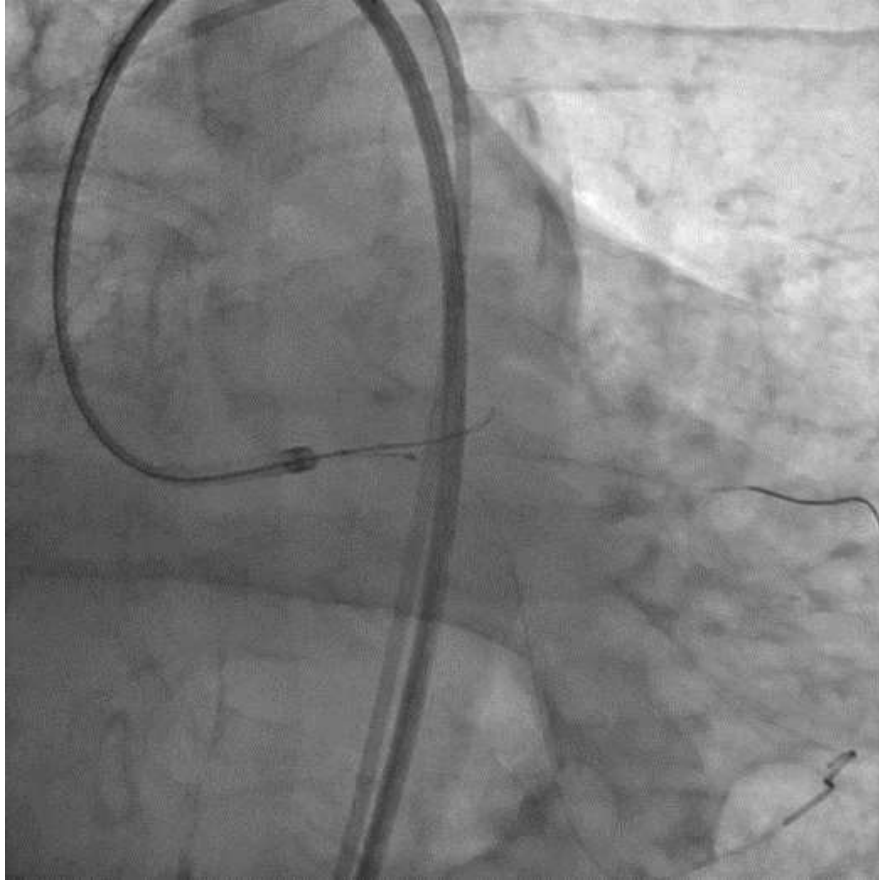


EES 3.5x48mm/5.0mm post balloon

LAD ostial CTO

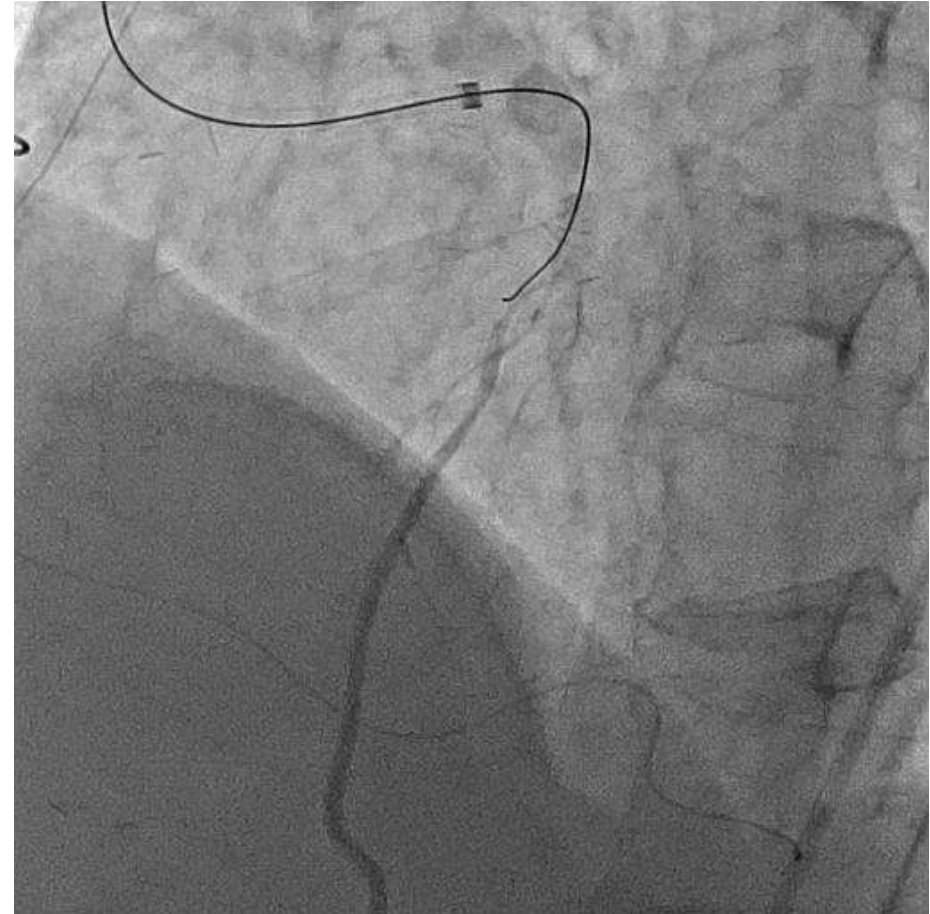
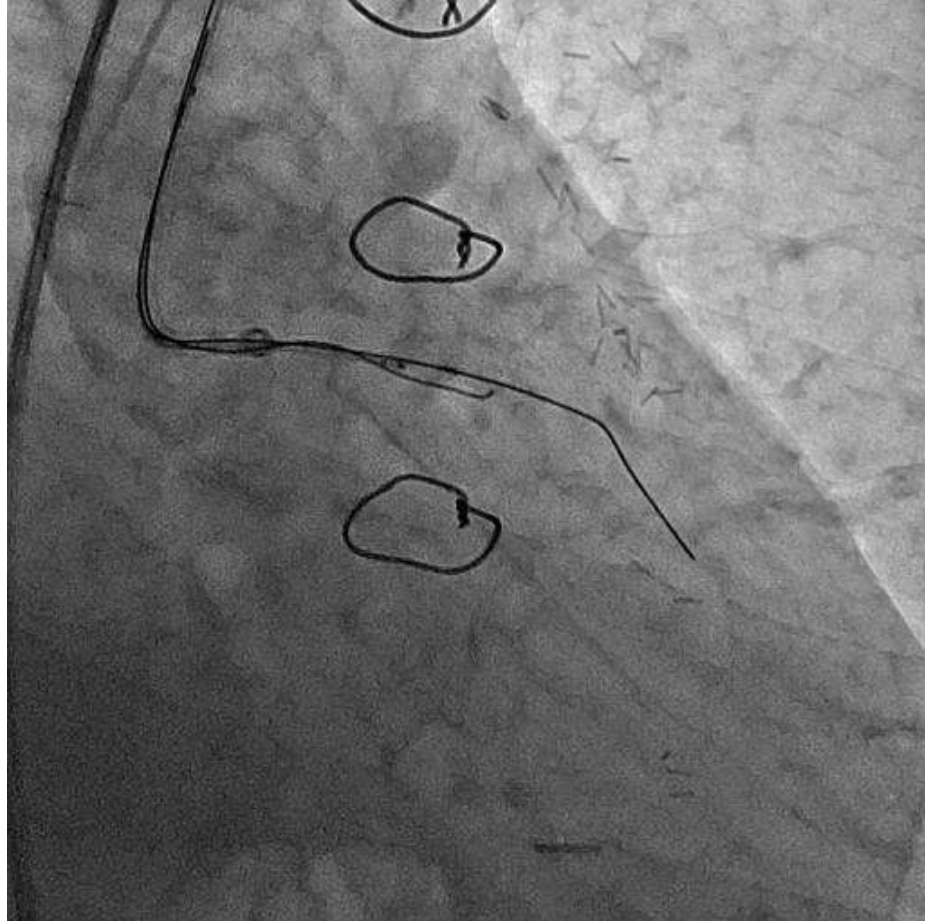


LAD ostial CTO without promising interventional collateral

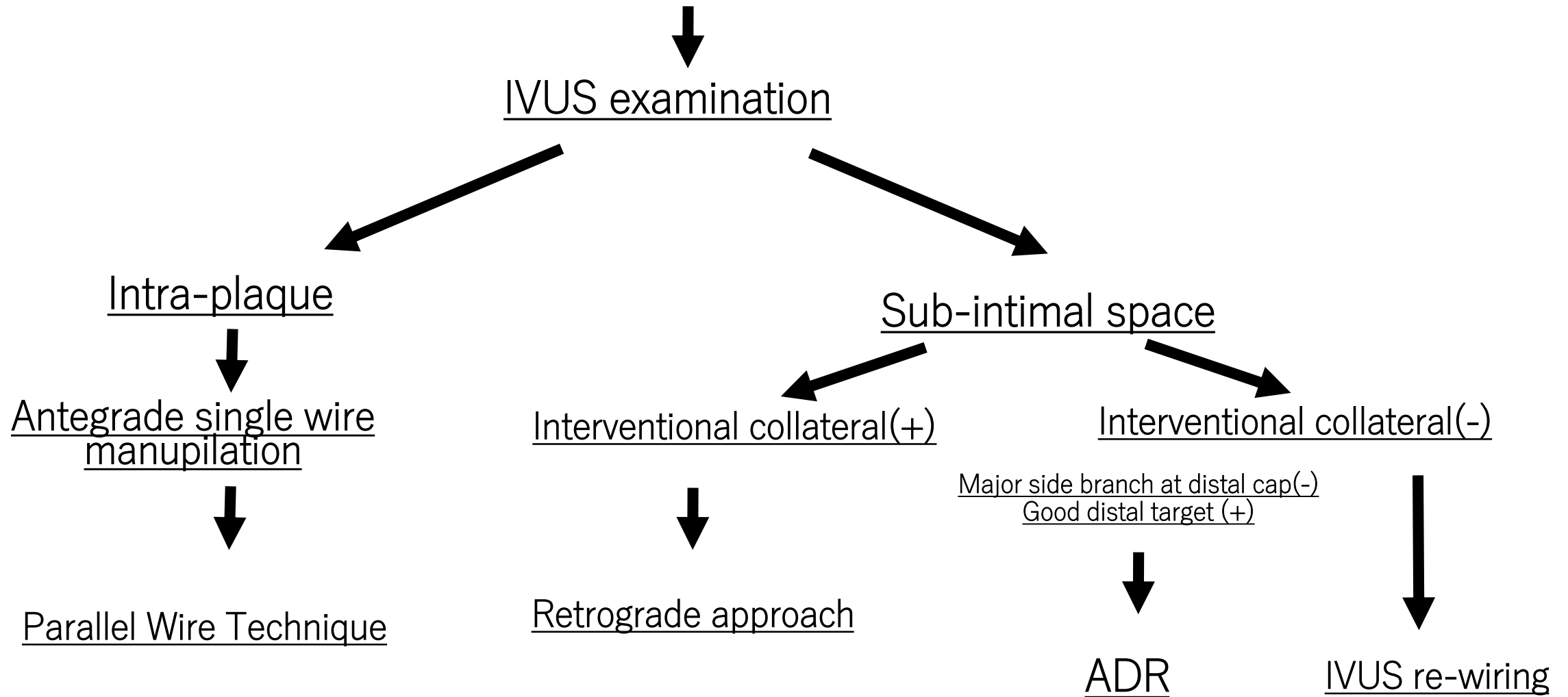


IVUS guided/DLC/Conquest8-20

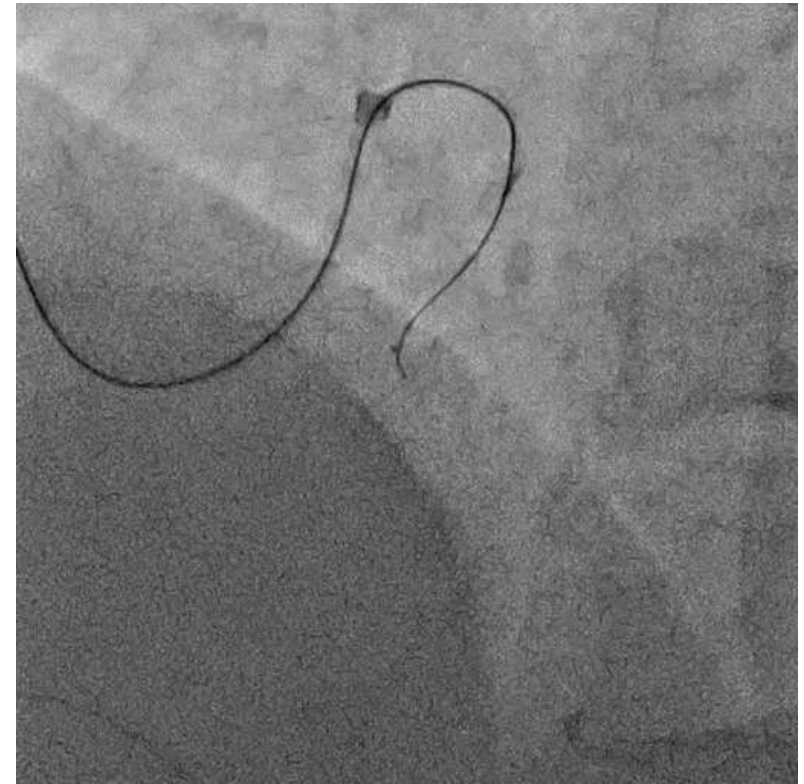
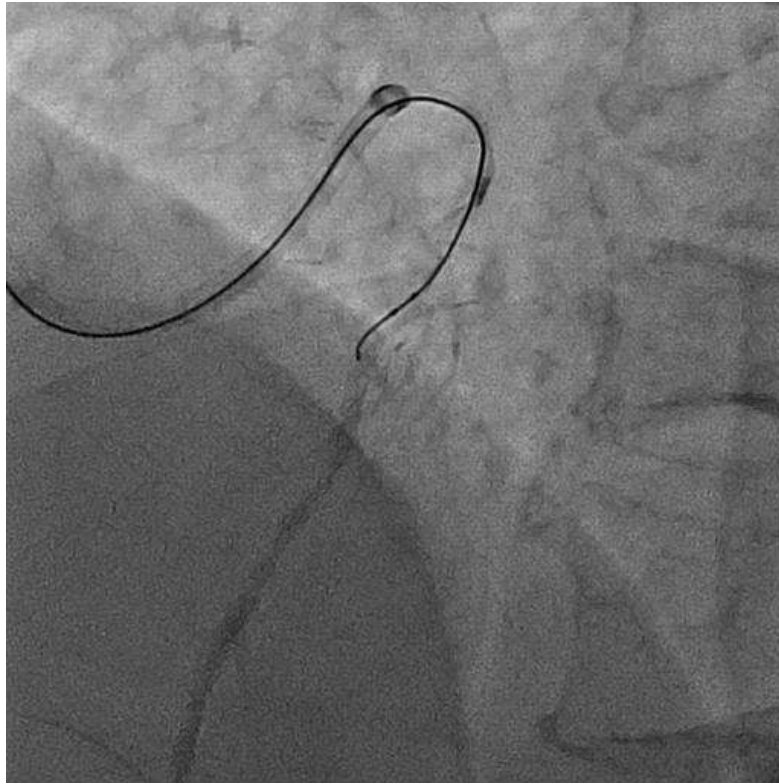
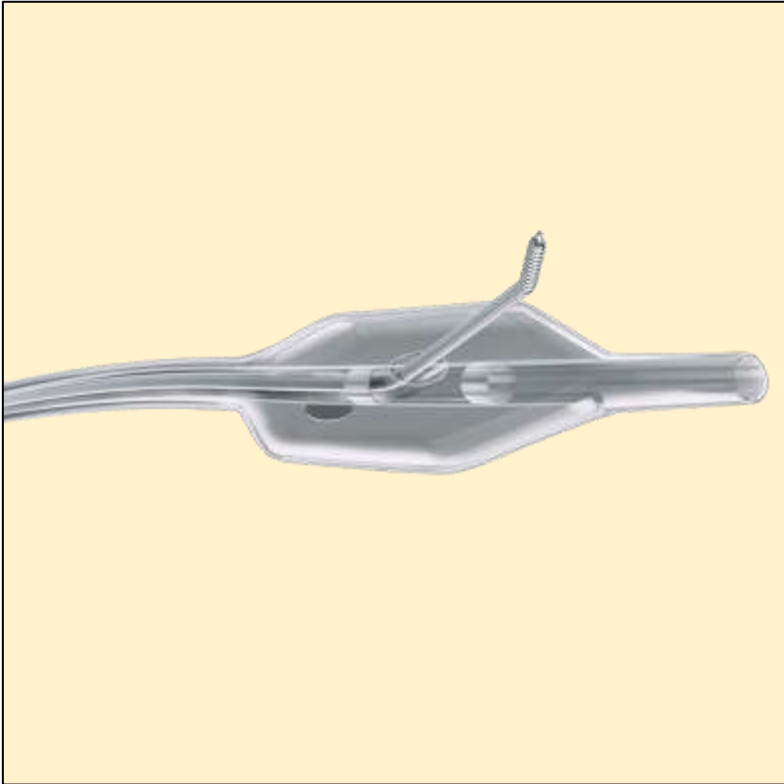
LAD ostial CTO



Antegrade CTO wire position in false lumen

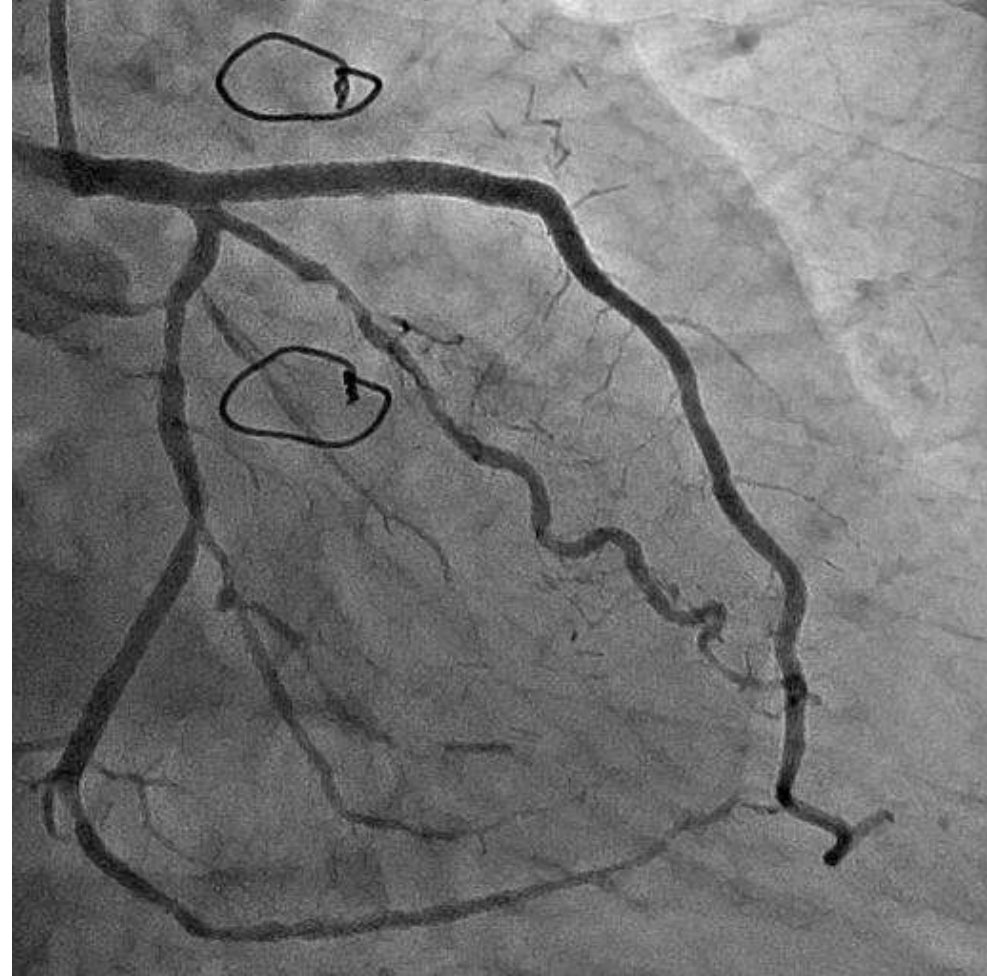
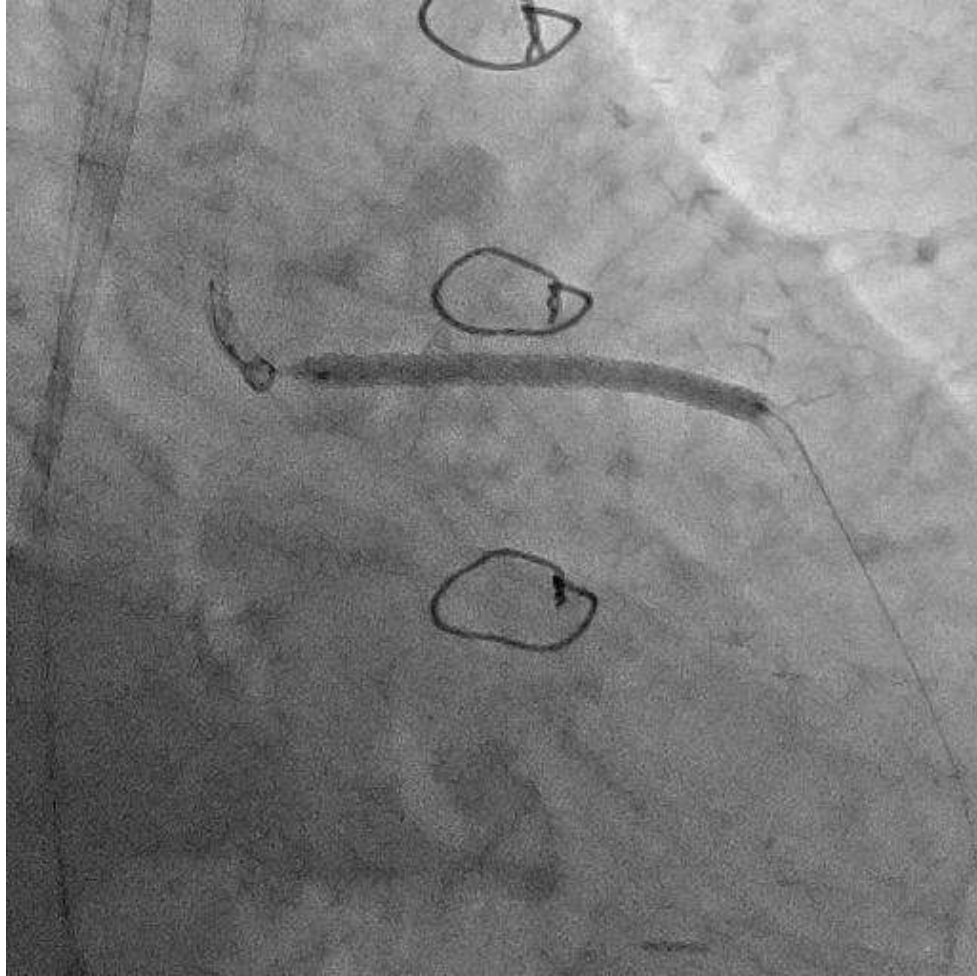


LAD ostial CTO



ADR: Stick-and-Swap Technique with straw technique

LAD ostial CTO



Why hesitate IVUS guided rewiring?

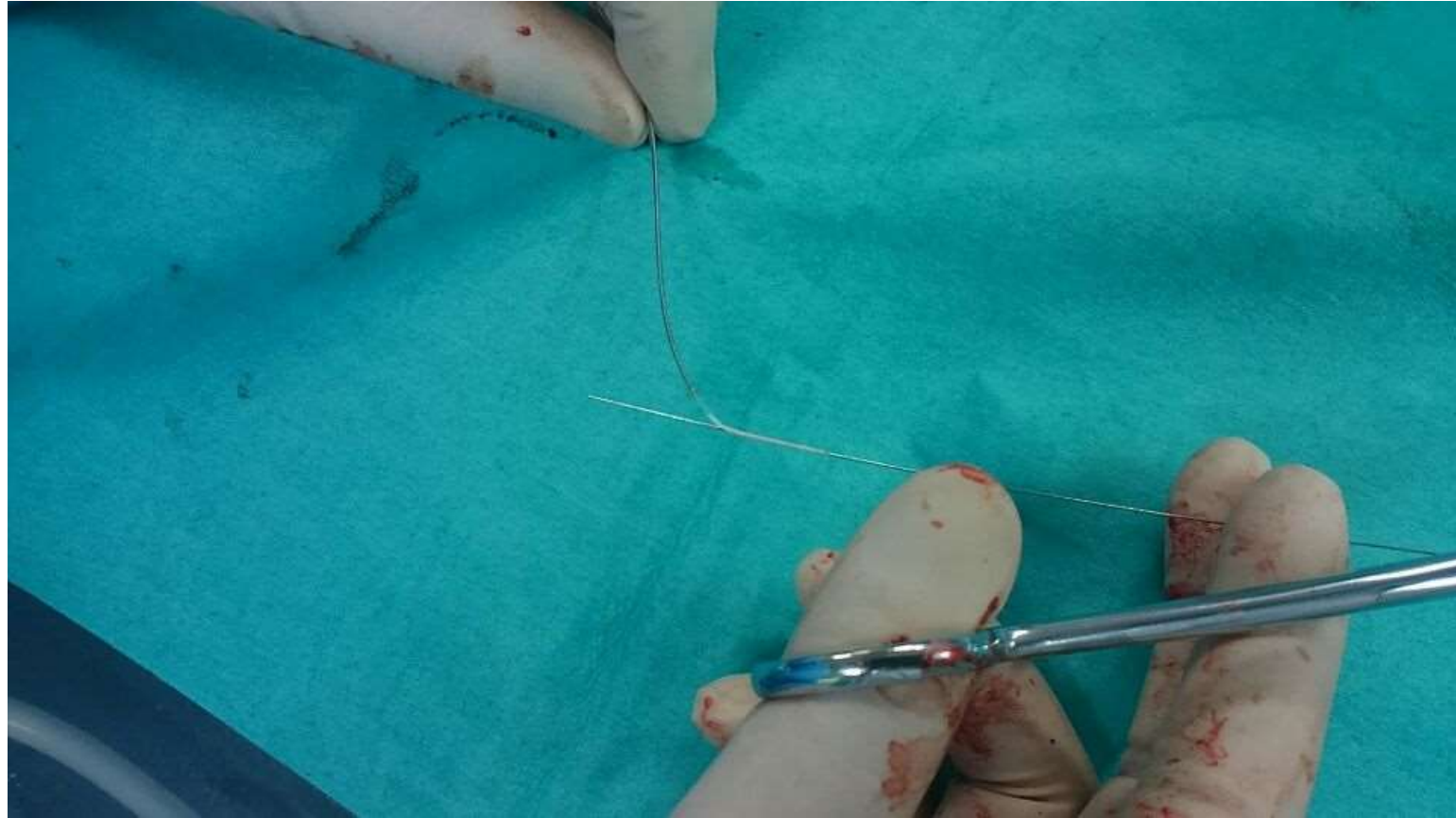
- Potential risk to induce sub-intimal hematoma progression
- Complex preparation: 8F guiding, 2mm pre-dilatation, and IVUS selection

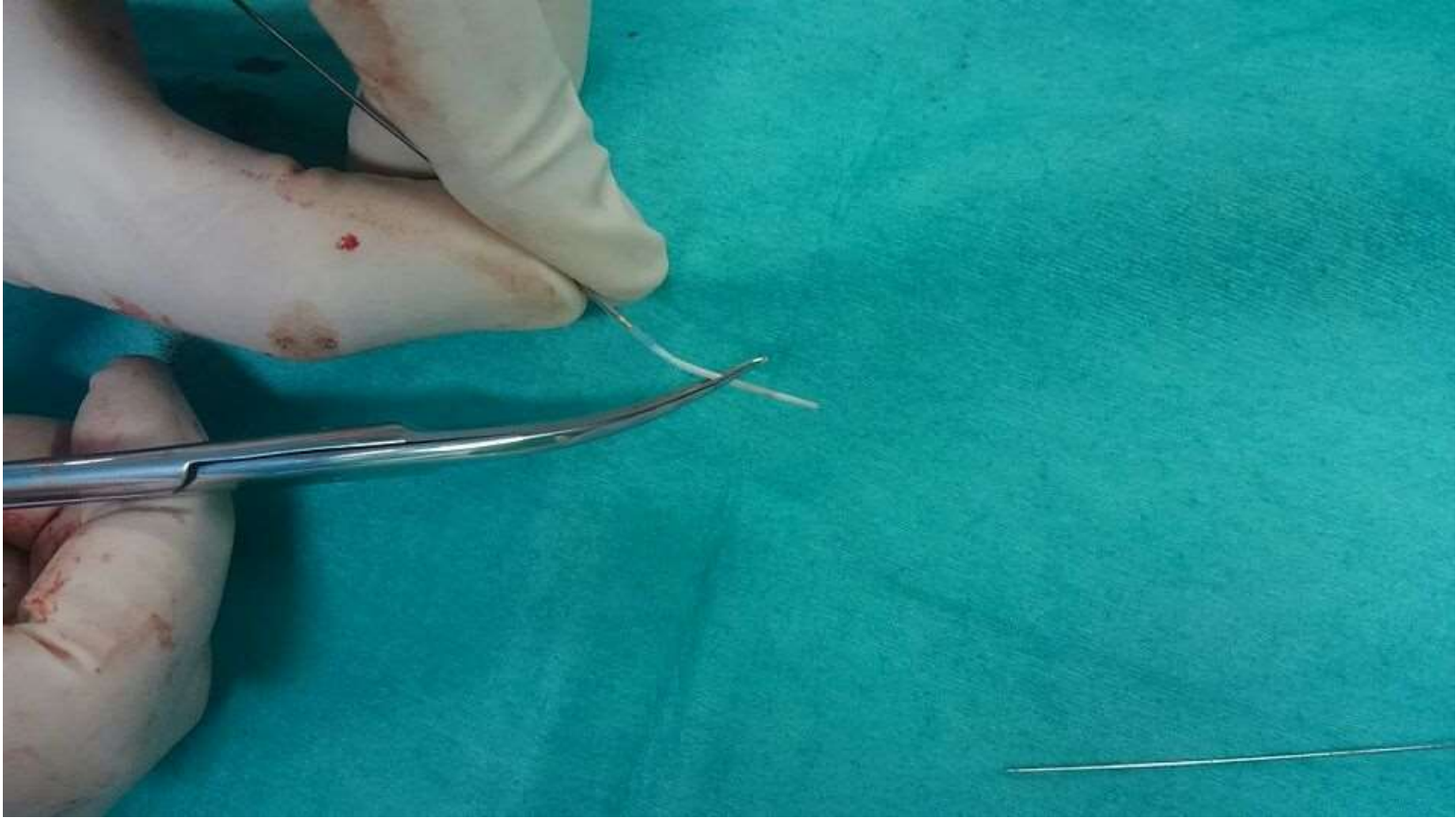
Parallel Wire Technique involves same potential risk

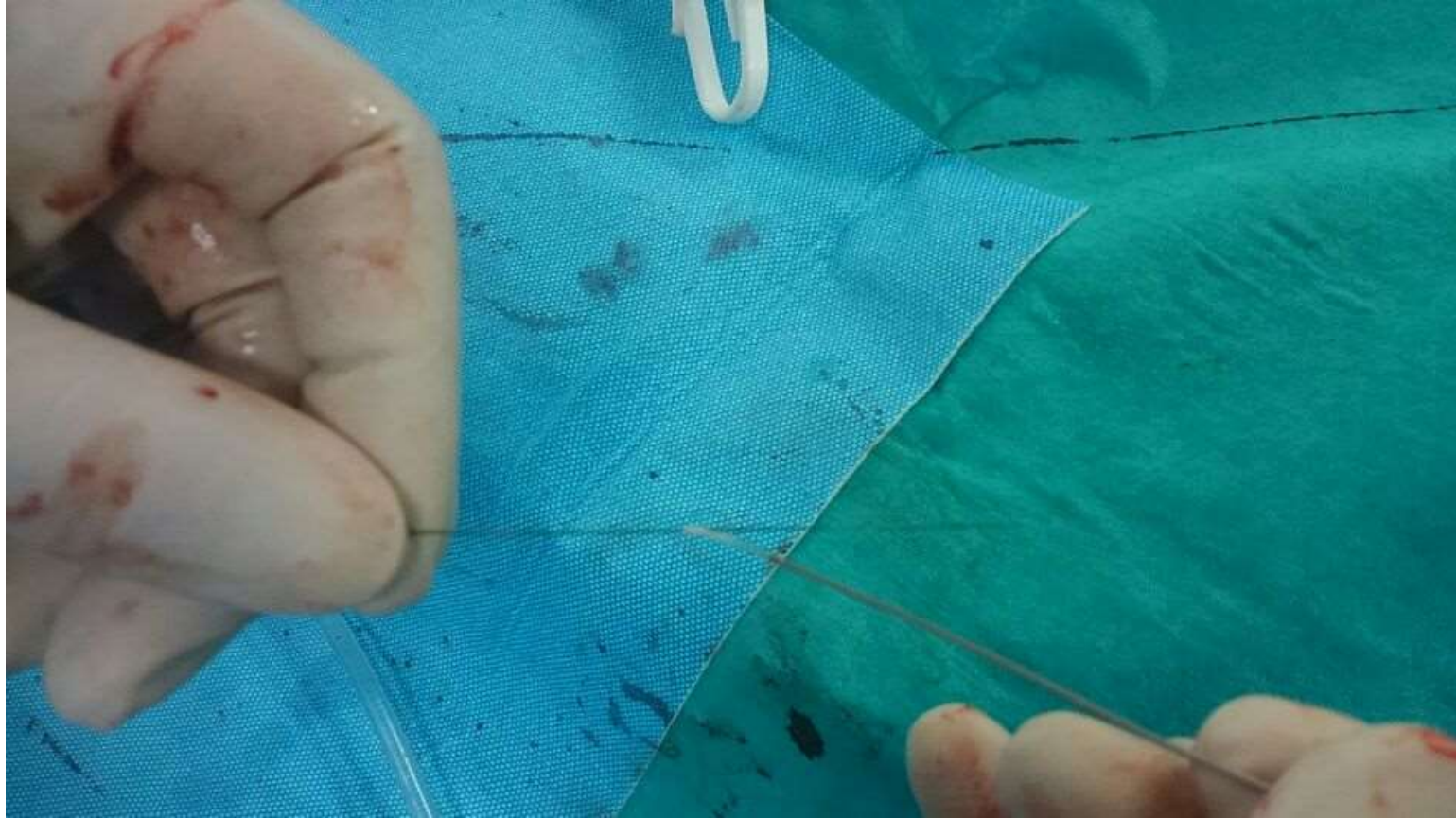
- Tapered entry
 - Short lesion(<20mm)
 - Big distal target
- Skip IVUS examination

Tip comparison of IVUS catheters

Eagle Eye ST	2.5mm	
Navi Focus WR	9mm	
Eagle Eye Volcano	11mm	
OptiCross	20mm	
Atlantis SR Pro2	26mm	
Revolution Volcano	28mm	
View IT – Terumo	30mm	



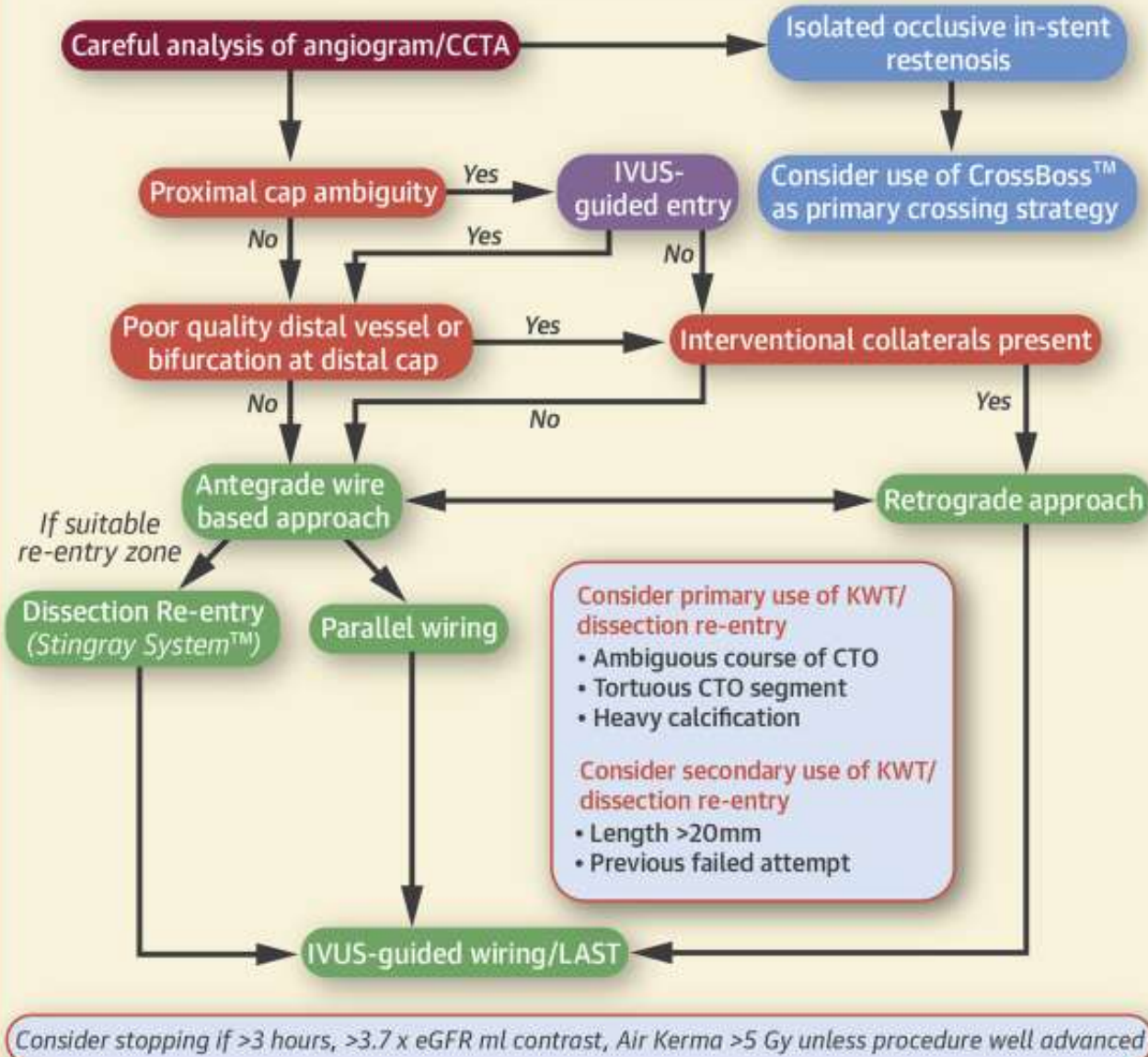




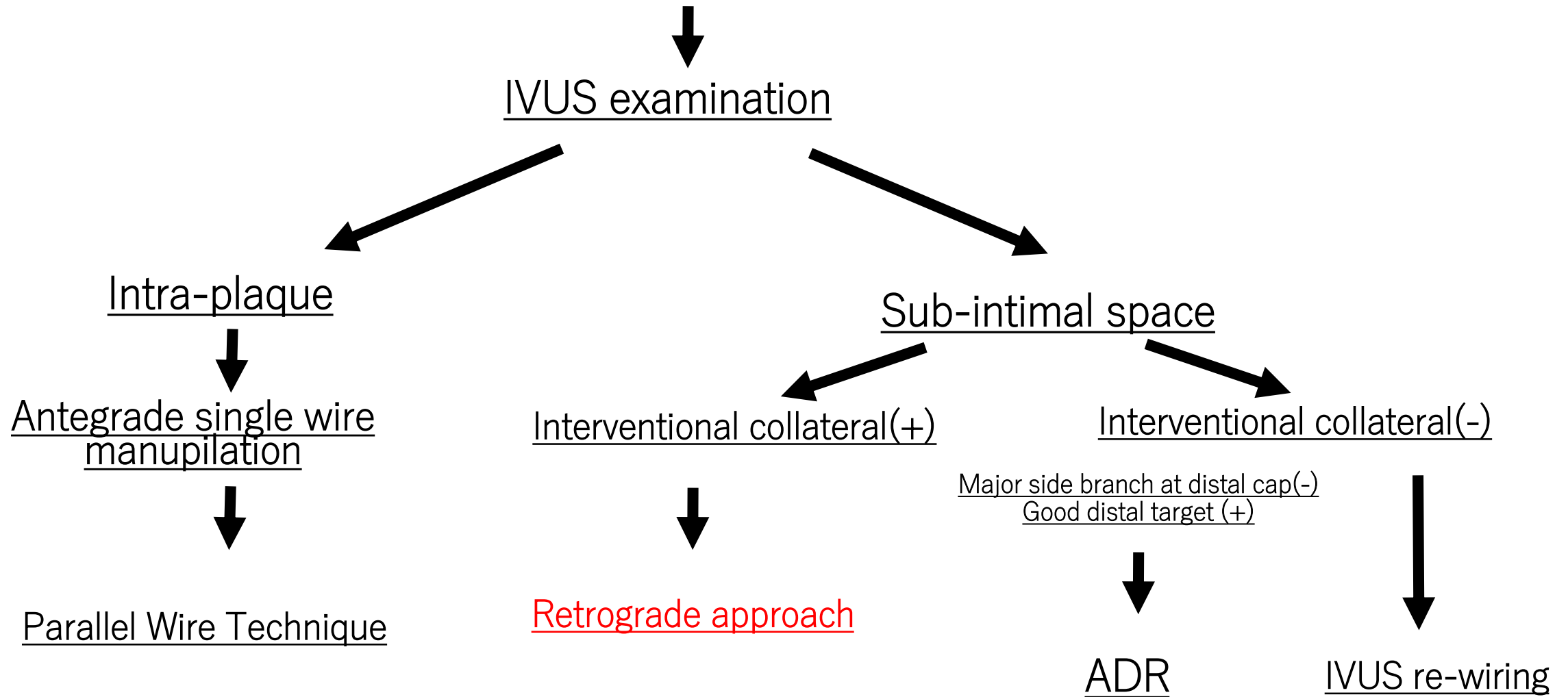
Profile comparison of IVUS catheters

Eagle Eye ST	2.5mm	
Navi Focus WR	9mm	
Eagle Eye Volcano	11mm	
OptiCross	20mm	
Atlantis SR Pro2	26mm	
Revolution Volcano	28mm	
View IT – Terumo	30mm	

Algorithm for CTO Crossing



Antegrade CTO wire position in false lumen



Conclusion(1)

- 1) IVUS guide re-wiring is not the last resort
- 2) IVUS is the only method to confirm the CTO wire position on site.
- 3) If antegrade CTO wire position detected in the false lumen,
immediate subsequent IVUS examination is helpful to determine next appropriate strategy
- 4) Early timing IVUS examination might contribute procedure time saving.